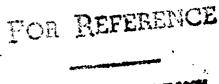
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Calculation of Water Drop Trajectories to and About Arbitrary Three-Dimensional FOR REFERENCE Bodies in Potential Airflow



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Calculation of Water Drop Trajectories to and About Arbitrary Three-Dimensional Bodies in Potential Airflow

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Scientific and Technical Information Branch

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# CALCULATION OF WATER DROP TRAJECTORIES TO AND ABOUT ARBITRARY THREE-DIMENSIONAL BODIES IN POTENTIAL AIRFLOW

#### by Hillyer G. Norment Atmospheric Science Associates

#### SUMMARY

Computer programs are described by which trajectories of water drops can be calculated to and about three-dimensional, non-lifting bodies of arbitrary shape. External potential airflow about the body is computed; flow into (but not through) inlets also can be simulated. Calculations can be done for any atmospheric conditions and for any subsonic airspeed. Experimentally derived relations between Reynolds and Davies numbers for water drops of all sizes, from the smallest cloud droplets to large raindrops, are used to represent effects of aerodynamic drag on the particles during integration of the water drop equations of motion, and effects of gravity settling are included. A variable time step numerical integration method is used.

The surface of the three-dimensional body is approximated by plane quadrilateral panels, over each of which a uniform potential source is assumed to be distributed. Source densities and the resulting potential flow field are calculated by the Hess-Smith method.

The following seven codes are described:

- 1. A code used to debug and plot the body surface data.
- 2. A modified version of the Hess-Smith code which processes the body data and yields data required to compute flow velocities at arbitrary points in space.
- 3. A code that computes flow velocities at arrays of points in three-dimensional space.

- 4. A code that computes trajectories of water drops toward the body from arrays of initial points in space.
- 5. A code that computes water drop trajectories and water drop fluxes to arbitrary target points.
- 6. A code that computes water drop trajectories tangent to the body.
- 7. A code that produces stereo pair plots that include both the body and trajectories.

Code descriptions include operating instructions, card inputs and printouts for example problems, and listings of the FORTRAN codes.

Various tests of simulation accuracy are discussed, and accuracy is found to be acceptible. Trajectory results for flow around ellipsoids are compared with prior calculations and acceptable agreement is found. Results, again for flow about ellipsoids, are compared with experimental data and are found to be superior to prior calculations.

#### INTRODUCTION

With the development of practical numerical methods by which potential flow about arbitrary three-dimensional bodies can be calculated, along with development of efficient methods for integration of particle equations of motion, it has become possible to compute trajectories of particles suspended in a fluid to or about a complex body that is in motion relative to the fluid. Past applications have been to the study of mounting sites of hydrometeor measurement instruments on cloud physics research airplanes (refs. 1 - 8). In the future the methods are to be used to study aircraft icing, an application for which they are ideally suited, and it is in preparation for such work that this code documentation is undertaken.

We distinguish two major categories of codes: flow codes and trajectory codes. The flow codes process data that describe the three-dimensional body and compute the fluid flow field around that body.\* The trajectory codes use the results of the flow codes to compute trajectories of particles to and about the body. For aircraft icing studies, the body is, of course, an aircraft, the fluid is air and the particles are water drops. Table 1 identifies and briefly describes the executive codes in the two categories, and Table 2 does the same for the subroutine and function codes.

It is immaterial whether we consider the fluid to be stationary and the body in motion, or vice versa, but it is expedient here to consider the body stationary and the fluid in motion.

# TABLE 1

# EXECUTIVE CODES

# A. FLOW CODES

Code	Description		
PBOXC	Processes and plots data which define the three-dimensional body. Used to debug and plot the body data.		
BOXC	Processes three-dimensional body data and prepares and stores data to be used by SR FLOVEL to calculate flow velocities as needed during trajectory calculations.		
FLOPNT	Computes and prints flow velocities at user-specified arrays of points in space.		
	B. TRAJECTORY CODES		
Code	Description		
ARYTRJ	Computes trajectories, which begin at user-specified arrays of points in space, to and/or about the body.		
CONFAC	Computes trajectories from the free stream to user-specified points in space. Also computes particle concentration factors at user-specified points in space. (Concentration factor is ratio of particle flux at the target point to free stream particle flux.)		
TANTRA	Computes trajectories tangent to the body which are initiated along user-specified lines in the free stream. (Tangent trajectories are those trajectories that barely miss intersection with the body.)		
STEREO	Prepares stereo-pair plots of the body along with particle trajectories.		

TABLE 2
SUBROUTINE AND FUNCTION CODES

# A. FLOW CODES

Code	Called By	Description
AFORM	BOXC	Computes the induced velocity matrix, $A_{i,j}$ (ref. 9).
ATAPES	BOXC	Reads A <sub>ij</sub> matrix from an appropriate tape.
DATPROS	INPUT	Translates, scales and rotates input body data before processing.
FLOVEL	TRAJECT CONFAC ARYTRJ FLOPNT	Returns flow velocity for a given point in space.
FLOWS	BOXC	Sets up non-uniform free stream flows.
HEADER	BOXC INPUT AFORM VFORM PRINT1	Writes a printout header.
INPUT	BOXC	Processes input body coordinate data into quadrilaterals. Produces the "first output" (ref. 9, sec. 9.4).
PATPROS	PINPUT	Translates, scales and rotates input body data before processing.  Punches the translated, scaled and rotated data if so requested.
PEADER	PINPUT	Writes a printout header.
PICTUR	PBOXC	Plots the body surface data.
PINPUT	PB0X <b>€</b>	Processes input body coordinate data into quadrilaterals. Produces the "first output" (ref. 9, sec. 9.4).
PRINT1	вохс	Computes and prints on-body velocities, and off-body velocities if so requested. Writes source strengths on unit 14 if so requested. Produces the "second output" (ref. 9., sec. 9.7).
SIGMA	вохс	Solves linear equation matrix for surface source densities by the Seidel iterative method.
SOLVIT	вохс	Solves linear equation matrix for surface source densities by the direct method.

#### TABLE 2, cont.

Code	Called By	Description
UNIFRM	FLOWS	Sets up uniform free stream flows.
VFORM	вохс	Computes velocity components induced at each quadrilateral by all other quadrilaterals.
WTAP14	вохс	Writes quadrilateral data needed for flow velocity computation onto unit 14 if so requested.
		B. TRAJECTORY CODES
_Code	Called By	Description
CDRR	PRFUN PARTCL	Given Reynolds number, returns Davies number for a sphere. Used for water drops for which Reynolds number is less than or equal to 200.
Q D V D	TRAJECT	Integrates particle equations of motion for each time step (ref. 11).
FALWAT	PARTCL	Returns still-air, terminal settling speed for a water drop. Uses equations of Beard (ref. 17).
IMPACT	TRAJECT	Used in runs under control of CONFAC to adjust trajectory initial y,z coordinates to avoid impact on the body on the next trajectory after impaction has occurred. This is a problem-specific subroutine.
МАР	CONFAC	Controls the iterative calculation of trajectories to a specified target point.
MATINV	MAP	Linear equation solver.
PARTCL	ARYTRJ CONFAC TANTRA	Reads particle specification data and returns still-air, terminal particle settling speed and other particle data as required for the particular type of particle. This is a particle type-specific code. The version provided here is for water drops.
POLYGON	CONFAC	Calculates area of a plane polygon of N vertices. Provides cross- sectional areas of particle flux tubes which are used to compute concentration factors.
PRFUN	TRAJECT	Given the particle Reynolds number, returns the factor which when multiplied by $\vec{v}_p - \vec{v}_a$ yields the first term on the right side of eq. (1). This is a particle type-specific function. The version provided here is for water drops.

TABLE 2, cont.

_Code_	Called By	Description
SETFL0	FLOPNT ARYTRJ CONFAC TANTRA	Reads BOXC output data stored on unit 14 that is required by SR FLOVEL for flow velocity calculations. If flow velocities are calculated by other than the Hess-Smith method, this code must be replaced with a dummy.
STRPNT	TANTRA	Specified a curve in three-dimensional space on which lie the initial points of all trajectories used in computing a tangent trajectory to the body. Also specified coarse and fine step sizes to be used in traversing the curve in search of the tangent trajectory, and it steps along the curve to define new initial trajectory points under control of TANTRA. The version supplied here uses straight line curves.
TRAJECT	ARYTRJ TANTRA MAP	Computes particle trajectories. (See p. 38)
TRANSFM	CONFAC MAP	Transforms coordinate system from the "flow system" to the "flux tube system", or reverse. (See pp. 44, 45.)
WCDRR	PRFUN Partcl	Given Reynolds number, returns Davies number for a water drop. Used for case where the Reynolds number is greater than 200.

#### METHODOLOGY

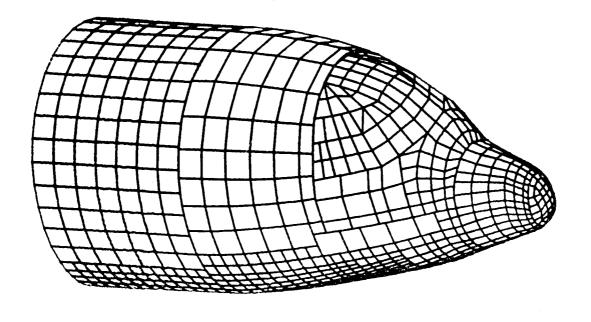
#### THREE-DIMENSIONAL FLOW

The code of Hess and Smith (refs. 9, 10) for calculation of non-lifting potential flow about arbitrary three-dimensional bodies is used. The code requires input of a digital description of the body surface. This consists of the coordinates of the corner points of a large number of quadrilaterals. (Examples of digital descriptions of portions of a C130 airplane are shown in Fig. 1.) Each quadrilateral panel is taken to be a uniform-distributed source. On the basis of the boundary condition that there be zero flux through the center of each panel, and given the direction of the free-stream flow, the code finds the source strengths of all panels by inversion of a large matrix that includes all possible panel interactions. The matrix is inverted only once for each airplane geometry, provided that the results are stored for future use.

This potential flow method works quite satisfactorily where the local Mach number does not exceed approximately one-half (ref. 10). By making simple adjustments to the calculations the method can be extended to higher Mach numbers as long as there are no supersonic regions in the real flow.

Particle trajectory calculations require flow velocities point-by-point along each trajectory. In calculating each flow velocity, contributions from all panels are summed. There are three algorithms for computing contributions: (1) for panels that are close to the calculation point, a detailed calculation is used that accounts for exact panel shape, (2) for panels at intermediate distances a multipole expansion is used, and (3) for remote panels a point source approximation is used. Mathematical details are found in references 9 and 10.

To perform these calculations, we have developed a subroutine (FLOVEL) that consists of various extracted and modified portions of the Hess-Smith code. This subroutine is generalized such that given geometrical properties, source strength and other data for every quadrilateral,



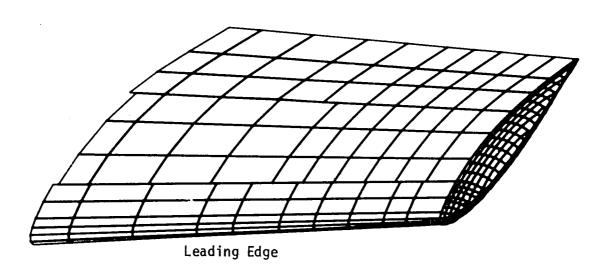


Figure 1. Digital descriptions of the forward fuselage and outer wing of a Lockheed C130E airplane.

it will provide the flow velocity for any specified point in space. It also checks each quadrilateral to determine if it has been penetrated by the particle.

Hess and Smith have evaluated the accuracy of their method for a variety of cases and have found excellent agreement with experiment (refs. 9 and 10). We have also done some evaluation studies (ref. 1), and in the Validation section below our prior work is summarized and results of some new studies of tangent trajectories to ellipsoids are presented and compared with prior work.

Of course accuracy also depends on the fineness of resolution of the panel description of the body, and naturally some compromise is called for. The smaller the panels the finer the resolution, and the fewer of them for which the most exacting of the three algorithms must be used. On the other hand, the number of panels increases inversely as the square of their linear size. In past studies on airplanes we have used the following criteria in setting up panel structures: For those parts of the airplane traversed by particle trajectories, we try to keep the panel edges between 6" to 8" in length. Where allowed by simplicity of surface shape, remote panels can be larger. Remote downstream complexities of shape are ignored. The cylindrical portion of a fuselage is extended to approximately five times the length of the nose section, as recommended by Hess and Smith (ref. 10).

For a particular computer, time required for trajectory calculation is largely dependent on the number of velocities required. On the CDC 6600 computer, one velocity calculation requires on the order of 0.15 second for a typical problem. The number of velocities required per trajectory varies from about 60 to 300. A typical number of trajectories required is 25. Thus, computing time, even on a large computer, can be considerable. Computing times required on the UNIVAC 1100 are included here for each of the test problems. (See p. 60.)

Though the flow codes retain additional capabilities, for the calculations described here we require the following:

- A unit free stream speed in the direction of the positive x axis.
- 2. All velocities are normalized and scaled to be consistent with the unit free stream speed.
- 3. All distances are normalized by dividing by a user-specified characteristic dimension of the body.

Body coordinates may be recorded in any convenient units and can be appropriately scaled and translated prior to processing via use of SR's PATPROS and DATPROS. These subroutines also allow rotation of the body about the y axis to adjust angle of attack.

#### PARTICLE TRAJECTORY CALCULATION

We assume that the bulk air flow is not perturbed by the particles. Moreover, since particle density is large compared to that of air, we can neglect buoyancy and inertial reaction of the fluid to obtain the three-dimensional, normalized equation

$$\frac{d\vec{v}_p}{d\tau} = \frac{1}{N_F} \left[ \frac{1}{v_s} (\vec{v}_a - \vec{v}_p) \frac{N_D N_{R,s}}{N_{D,s} N_R} - \vec{k} \right] \qquad (1)$$

Non-dimensional quantities are:

$\vec{v}_p$ , $\vec{v}_a$	particle and air velocities
v <sub>s</sub>	still-air, terminal settling speed of the particle
Ř	unit vector in the z (upward) direction
τ	time

$$N_D = C_D N_R^2$$
 Davies number  $N_F = V^2/(Lg)$  Froude number  $N_R = \frac{\rho \delta}{n} |\vec{v}_a - \vec{v}_p| V$  Reynolds number

Dimensioned quantities are:

- δ particle diameter
- ρ air density
- η air viscosity
- g gravity acceleration constant
- V free stream airspeed
- L a characteristic dimension of the body

Here length is normalized by dividing by L, velocity by V and time by L/V.  $N_{D.s}$  and  $N_{R.s}$  are for still-air, terminal particle settling.

We initiate the calculation far enough upstream to be essentially beyond the influence of the body where we can take  $\vec{v}_p = -\vec{k}v_s$ . We compute  $\vec{v}_a$  at the initial point, calculate  $N_R$  from these data, calculate  $N_D$  from  $N_R$  using the relations discussed in the next section, and proceed straightforwardly with a numerical integration of eq. (1). The integration is done via use of the code DVDQ of Krogh (ref. 11). This code uses an Adams-type predictor - corrector algorithm with variable time step. It also tests for computational stability and loss of accuracy via roundoff error. It was tested by Hull, et al., (ref. 12) along with a number of other codes and found to be most efficient in terms of numbers of function evaluations (flow velocities) required.

#### AERODYNAMIC DRAG OF WATER DROPS

Davies (ref. 13) shows that still-air terminal settling of spheres can be generalized in terms of the dimensionless numbers  $N_{R,s}$  and  $N_{D,s}$ . Over the range from the smallest spheres, which settle under viscous flow conditions and obey Stokes law, to spheres much larger than of interest here, and for any Newtonian fluid, a reproducible single-valued relationship between  $N_{R,s}$  and  $N_{D,s}$  exists. Furthermore,  $N_{D,s}$  is independent of settling speed, being a function of fluid and sphere properties only; thus for given sphere and fluid,  $N_{R,s}$  and hence  $V_s$  can be calculated. Polynomials by which  $N_{R,s}$  can be computed as a function of  $N_{D,s}$  were derived by Davies from a composite of many sets of experimental data.

Since the work of Davies it has been found repeatedly that this treatment is applicable to particles of other shapes, providing settling is steady and particle orientation is stable.

For the trajectory calculations required here, the problem must be turned around. In addition to gravity settling, there is a particle velocity component (relative to air) caused by the disturbance of the passing airplane. At any time step in the numerical integration of eq. (1),  $\vec{v}_a - \vec{v}_p \text{ (and hence } N_R) \text{ is known, and } N_D \text{ must be determined. For viscous motion (i.e., Stokes flow, where <math>N_R < 1)$   $N_D = 24$   $N_R$  and eq. (1) can be integrated without question. However, for larger  $N_R$  the steady-state drag data determined experimentally for terminal settling must be used to compute accelerative particle motion.

Experimental measurements by Keim (ref. 14) and a theoretical analysis by Crowe, et al. (ref. 15) indicate that if the acceleration modulus,

$$N_{A} = \delta \left| \frac{dV_{p}}{dt} \right| / V_{p}^{2} ,$$

is smaller than about  $10^{-2}$ , steady-state drag coefficients can be used without significant error to compute accelerative motion.  $N_A$  has never been found to exceed  $10^{-2}$  in our trajectory calculations.

For water drops small enough to be essentially spherical ( $N_R \ge 200$ ) we calculate  $N_D$  from a polynomial function in  $N_R$  derived from Davies data (ref. 13). (Function CDRR) For larger drops ( $N_R > 200$ ), which have a flattened, non-spherical shape, we calculate  $N_D$  from polynomials in  $N_R$  derived from the water drop data of Gunn and Kinser (ref. 16). (Function WCDRR).

Still-air, terminal settling speeds for water drops are computed via use of Beard's equations (ref. 17). (SR FALWAT)

Water drops of any size, from submicron to the breakup size at about 8000  $\mu m$  diameter, can be handled by these methods. However, the user should be aware that computation time goes up as droplet diameter goes down, and the time required for drops of diameter 1  $\mu m$  or less may be large.

We have also developed aerodynamic drag relationships from observed settling data for various forms of ice crystals and have used these to study trajectories of ice to and around various airplanes (refs. 1, 2, 5, 7), though these are not included here.

#### FLOW CODE DESCRIPTIONS

#### PROGRAM PBOXC

## General Discussion

This program is derived from the Douglas Aircraft Company code BOXC which was developed by Hess and Smith (ref. 9). It processes and produces CALCOMP plots of the three-dimensional body surface description data and is used primarily to debug these data. Processing and printing go as far as the "first output" (ref. 9, sec. 9.4). A secondary use is to store the body surface data such that it can be retrieved later and used by PGM STEREO to plot the body along with trajectories stored by one of the trajectory codes.

The surface of a general three-dimensional body is defined in terms of "rows" and "columns", the so-called m and n lines, of coordinates of points on the surface as described below. The m and n lines of points are combined by the code to form quadrilateral elements, or panels, such that when considered together they represent a reasonable approximation to the surface. (For example see Figs. 1 and 8.) Adjacent panels should be contiguous, or as nearly contiguous as possible. The data for general bodies may be scaled and translated in the three coordinate directions, and rotated about the y axis prior to processing.

The code also has the capability of generating ellipsoids of prolate, oblate or general shape with the only restriction being that their major and minor axes lie on the coordinate axes.

When the user elects to prepare plots of the body, the code automatically prepares a number of plots, each from a unique viewing angle, the number varying according to symmetry. For an asymmetric body fourteen plots are prepared. These consist of the six views from both directions along each coordinate axis, and the eight plots from 45 degree angles in each octant.

For a body with one plane of symmetry nine plots are prepared, for two symmetry planes six plots, and for three planes four plots. The user is urged to make liberal use of the plots to find errors in the body data.

## Symmetry Planes

Up to three reflection planes may be specified, though only the first two are used in PBOXC for plotting. The surface descriptions for general bodies and ellipsoids are reflected across these planes. The number of symmetry planes is specified by parameter NSYM which has allowed values of 0, 1, 2, 3. The symmetry planes, in order of their application to the data, are:

Order of Application	Symmetry Plane
1	y = 0
2	z = 0
3	x = 0

For example, if NSYM = 1, for each point with coordinates (x,y,z), another point with coordinates (x, -y, z) is created. If NSYM = 2, for each point with coordinates (x, -y, z), (x, -y, -z) and (x, y, -z) are created. If NSYM = 3, seven additional points are created.

Only the primary data points should be input. If reflected as well as primary data are input, the flow calculations will be in error.

# Surface Description Data For General Bodies (IFLAG = 0)

The user must examine the body, or drawings of it, and devise a layout plan for subdividing its surface into sections that are compatible with the requirements of m line, n line surface point input while providing panels of appropriate size which cover the surface without leaving gaps or introducing unwanted discontinuities. Also a coordinate system must be established, but this can be manipulated at processing time by use of the scaling and translation capability of the code.

The important thing is to understand the requirements of the m and n line input. Here we give a brief summary of the requirements; the user is encouraged to carefully study sec. 9.1 of reference 9 to obtain a thorough understanding of them.

Points which define the corners of the quadrilateral panels are labeled with integers m and n which identify hypothetical "rows" and "columns" on which they lie. The integers m and n are not input to the computer; they are used for data organization and sequencing only.

To ensure a proper computation, the rows and columns must be organized by the following rule: If an observer is located in the flow and is oriented so that locally he sees points on the surface with m values increasing upward, he must also see n values increasing toward the right.

A surface may be subdivided into sections, each of which must be independent. That is, all quadrilaterals in each section must be closed. Where an edge of a section is contiguous with another, the input for each section must define the common edge, though they need not use the same points on the edge.

Figure 2 illustrates a surface description that is subdivided into four sections. Note how the sectioning can be used to change resolution or to deal with structural complexities.

Coordinates are punched into cards, one point per card; also in each card is punched the integer parameter STAT which is used to identify the m,n status of each point. All points in a section are ordered in the sequence (m,n):

$$(1,1), (2,1), (3,1), \ldots, (1,2), (2,2), (3,2), \ldots (1,3), (2,3), (3,3), \ldots$$

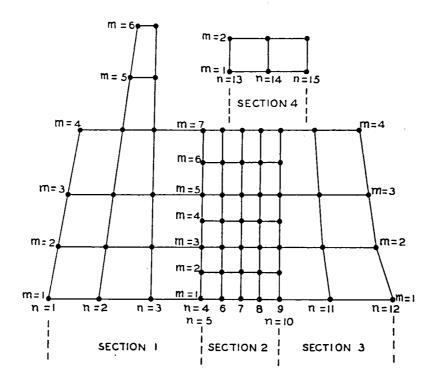


Figure 2. Plan view of the input points on a body divided into sections. (From ref. 9)

The STAT parameters are as follows for each section:

<u>(m,n)</u>	STAT
(1,1)	2
(1,n≠1)	1
all others	0 or blank

For the last card of the last section, STAT = 3.

Input order of sections is immaterial, but within sections, the data must be ordered according to the underlined rule given above.

# Surface Description Data for Ellipsoids (IFLAG = 2 or 3)

Ellipsoids are generated by specifying the semi-axis lengths B and C (A = 1 always), and by specifying the numbers of "latitudinal" and "longitudinal" element divisions (Fig. 3), NLM1 and MMIN respectively.

There are two modes for specification:

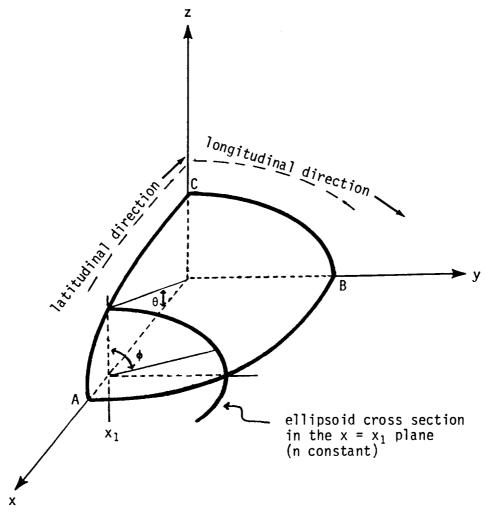
Mode 1. IFLAG = 1, NSYM = 3

All three symmetry planes are used and NLM1 and MMIN are specified for one octant only. Element increments are computed for NLM1 and MMIN equal increments in angles  $\theta$  and  $\phi$  (Fig. 3).

Mode 2. IFLAG = 2, NSYM = 2

Only two symmetry planes are used, and (x, z) values in the y = 0 plane must be input for  $-1 \le x \le 1$ , beginning at (1,0) and proceeding to (-1,0) for either all positive z or all negative z (i.e., for  $180^{\circ}$  in angle  $\theta$ ). (The code automatically ensures that the "underlined" input rule is obeyed.) Thus, NLM1 must be specified for the entire x axis, but MMIN is for one octant only as for the other option, and element increments in the "longitudinal" direction are created at equal increments of the angle  $\phi$ .

Body surface data for generated ellipsoids cannot be plotted nor can the data be translated, scaled, and rotated by subroutine PATPROS or DATPROS.



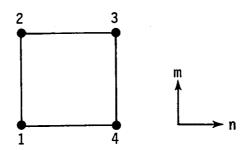
- $\theta$  is in the y = 0 plane  $\phi$  is in the x =  $x_1$  plane
- n lines run in the latitudinal direction from  $\theta$  = 0 to  $\theta$  =  $\pi$
- m lines run in the longitudinal direction from  $\varphi$  = 0 to  $\varphi$  =  $2\pi$

Figure 3. Definition of angles  $\theta$  and  $\phi$ , and m and n line directions used by PBOXC and BOXC for generation of ellipsoids.

## Printed Output

The printed output is the result of the first stage of surface data processing (ref. 9, sec. 9.4). For each quadrilateral panel on the surface it consists of:

1. Coordinates (X,Y,Z) of the four points on a quadrilateral in the order



around the quadrilateral.

- 2. Components (NX,NY,NZ) of the unit normal vector to the plane of the quadrilateral. This vector should point toward the exterior of the body rather than toward its interior. If it points in the wrong direction the data have been input in violation of the "underlined rule" on p. 17, and the data must be reordered.
- 3. Coordinates (NPX,NPY,NPZ) of the quadrilateral null point (ref. 9., sec. 9.3).
- 4. The common projection distance (D) of the four input points into the plane of the quadrilateral. (The four points from which a plane quadrilateral is formed do not in general, and need not, lie exactly in a plane.)
- 5. The maximum diagonal length (T) of the quadrilateral.
- 6. The area (A) of the quadrilateral.

Additional output appears for certain abnormal quadrilaterals. If the integer 1 or 2 appears at the far right of the page, they indicate the following conditions:

- Integer 1. The null point point was found to lie outside of the quadrilateral. The coordinates listed are for the quadrilateral centroid.
- Integer 2. The iterative procedure used to determine the null point did not converge and thus the null point is only approximate

(ref. 9, sec. 9.3).

# Subroutines Required

PINPUT, PICTURE, PEADER, PATPROS, plotting subroutines.

## External Storage Units

Units 5 and 6 are the system input and print units respectively. Unit 8 temporary storage.

Unit 9 storage for surface data to be used later for plotting by PGM STEREO.

## PBOXC Card Input

Card No.	Variables and Format		Description
1	HEDR(15), IFLAG, NSYM,	HEDR (Cols. 1-60	) Hollerith run identification
_	KMACH, KASE, (15A4, I1,	IFLAG (Col. 61)	Body surface description input control
	10X, II, 1X, II, 2X, A4)	IFLAG = 0	Input data for a general, three-dimensional body (See pp. 16 ff.)
		IFLAG = 1	Generate an ellipsoid using the mode 1 option, with three reflection planes. (See p. 19.) Be sure that NSYM = 3.
		IFLAG = 2	Generate an ellipsoid using the mode 2 option, with two reflection planes, and input x,z coordinates for the ellipsoid via cards no. 5C. (See p. 19.) Be sure that NSYM = 2.
		NSYM (Col. 72)	Number of data reflection planes. Limited to values 0,1,2,3. (See p. 16.)
		KMACH (Col. 74)	A non-zero value indicates that a Mach number is to be read via card no. 2. (See p. 26.)
		KASE (Cols. 77-8	30) Hollerith body identification.
.2	MACH, (F10.6)	Mach number	This card is input only if KMACH $\neq$ 0 on card 1. (See p. 26.)
3	IPROS, IPUNCH, IPRNT,	Logical variable	es which cause the following if true:
	IPICT, ICRT, (5L1)	la	dy surface data for a general body are to be trans- ted, scaled and rotated about the y axis before ocessing, and card 4 is to be input.
			dy surface data are copied to the system punch unit ter translating, scaling and rotating about the y axis.
		IPRNT Bo	dy surface data are processed and printed up to the irst output". (See p. 21 and ref. 9, sec. 9.4.)
		IPICT Bo	dy surface data for a general body are plotted.
			otting is via CRT. If ICRT is false, plotting is via n and ink.
4.	ANGLE, XSCALE, YSCALE,	This card is in	put only if IPROS (card 3) is true.
	ZSCALE, XTRANS, YTRANS, ZTRANS, (7F10.0)	ANGLE Angle A pos the a towar	(degrees) that the body is rotated about the y axis. itive value causes a counterclockwise rotation from spect of a viewer looking down the positive y axis d the origin. (Note: For a nose-up airplane angle tack, ANGLE is negative.)
		YSCALE, coord	factors to be applied to surface point x, y and z inates respectively after translation. Default s are unity.
		XTRANS, Trans YTRANS, coord ZTRANS	lations to be applied to surface point $\mathbf{x}$ , $\mathbf{y}$ and $\mathbf{z}$ inates before scaling.
		0 1 511	
5A	X,Y,Z,STAT, XX, YY, ZZ, STATT,		to general bodies (IFLAG = 0, see pp. 16 ff). e coordinates of points used to define the body
	(3f10.0, 12/3f10.0,12)		rface.
•	: :	STAT Ar	e point status integers. Allowed values are 0, 1, 3. The meanings of these values are: 0 This point is on the same n line as the last point 1 This point starts a new n line 2 This point starts a new section 3 This is the last point in the input.

#### PBOXC Card Input, cont.

Card No.	Variables and Formats	Description
5A cont.		Note: For the last coordinate card STAT or STATT = 3. A blank card should follow this if there is an odd number of body surface points.
5B	NLM1, MMIN, B, C, (215, 2F10.5)	Card 5B applies to generated ellipsoids (IFLAG > 0)  NLM1 Number of "latitudinal" element divisions  MMIN Number of "longitudinal" element divisions  B y semi-axis of the ellipse  C z semi-axis of the ellipse
		(See p. 19 Modes 1 and 2, and Fig. 3.)
5C	x <sub>1</sub> , z <sub>1</sub> , x <sub>2</sub> , z <sub>2</sub> , <sup>x</sup> NLM1+1 <sup>, z</sup> NLM1+1 (8F10.0)	Cards 5C apply to generated ellipsoids for which the x,z coordinates are input (IFLAG = 2, NSYM = 2).
•		$(x_1, z_1)$ are coordinates in the $y=0$ plane, beginning at $(1,0)$ and proceeding to $(-1,0)$ , that define the "latitudinal" element subdivisions. (See p. 19 Mode 2, and Fig. 3.)
6,7	LINE1, LINE2, (7A6/7A6)	Cards 6 and 7 are read only if ICRT is true (card 3). These are two lines of 42 columns each of Hollerith labeling for a microfiche film.

#### General Discussion

Program BOXC is the Hess-Smith code for calculation of potential flow about arbitrary, three-dimensional, non-lifting bodies as described in ref. 9, with the following exceptions:

- Overlay, common and subroutine argument structures have been changed to accommodate the code to the CDC 6600 and UNIVAC 1100/42 computers.
- 2. SR WTAP14 has been added to store on external unit 14 all data needed by the trajectory codes for flow velocity calculations.
- 3. A provision has been added to allow a group of surface elements to leak inward a specified fraction of the free stream flow. This is used to simulate effects on external flow of air flow into inlet aperatures.
- A provision has been added to scale, translate and rotate surface point coordinates for general bodies before they are processed. (SR DATPROS)

To understand the theory and details of the calculations, the user must study reference 9.

The code has the capability to compute flow about the body for the free stream vector along each of the three axial directions. For nonsymmetrical bodies the capability extends to any free stream direction, and for bodies with one plane of symmetry, which must be the y=0 plane, to any direction in the y=0 plane (ref. 9, sec. 9.56). However, these general capabilities have not been used in the past, and furthermore, the trajectory codes and other important features of the flow calculations which are discussed below assume that the free stream vector is in the direction of the positive x axis. Changes of body orientation and/or location relative to the flow coordinate system are accomplished via use of SR DATPRO, which in its

present form also is designed to allow for arbitrary specification of airplane angle-of-attack. In any case the free stream flow speed must be unity. The card input instructions below specify unit onset flow in the positive x direction.

Use and application of symmetry planes as well as preparation of body surface description data are the same as for PGM PBOXC.

Up to 1000 quadrilaterals can be accommodated for description of the basic body surface, before multiplication by symmetry plane reflection.

### Compressibility Effects

According to Hess and Smith (ref. 10, pp. 7 and 35) their method works satisfactorily where the local Mach number does not exceed approximately one-half. For higher Mach numbers the Gothert transformation (ref. 18) is applied as follows:

- 1. All distances in the free-stream direction, that is the x direction, are scaled by dividing by  $\beta = \sqrt{1 M^2}$ , where M is free stream Mach number.
- 2. Perturbation velocities computed at the scaled distances are themselves scaled by dividing by  $\beta$  for the y and z components, and by dividing by  $\beta^2$  for the x component.

If the Gothert transformation is to be applied, the parameter KMACH (card 1) is given a value greater than zero, and the Mach number is input via card 5.

## Flow\_Inlets

We have added a feature to the code (in SR UNIFRM) to allow simulation of flow up to the aperture of a flow inlet. The code cannot handle internal flows.

The aperture is represented by quadrilateral panels in the same manner as the body surface. To illustrate this, Fig. 4 shows the panelling of the orifice in the tip of the intake tube of a cloud water meter, the EWER, which is mounted under the wing of a C130 research airplane (ref. 7). Inlet aperture panel coordinates must be the first in the deck of surface point cards (cards 6A).

Input card no. 4 contains the number of aperature quadrilaterals and also the fraction of the free-stream flow speed that is "leaked" through the apertures. This leakage is taken to be the same for each aperture quadrilateral. If there is no flow inlet, card 4 is blank.

#### Off-Body Points

The code provides for computation of flow velocities at off-body points. If the parameter NOFF (card 1) is given a value greater than zero, coordinates of the off-body points are input following the surface points via the same format. The only status flag (STAT or STATT) required is 3 for the final point.

## Printed Output

The printed output consists of two main parts: the first is the result of preliminary processing of the surface description data which yields "the first output" (ref. 9, sec. 9.4) described above on p. 21. The second output contains the final results and consists of the following for each quadrilateral (ref. 9, sec. 9.7):

- 1. Null point coordinates (NX, NY, NZ) (ref. 9, sec. 9.3).
- 2. Velocity magnitude (VT) at the null point.

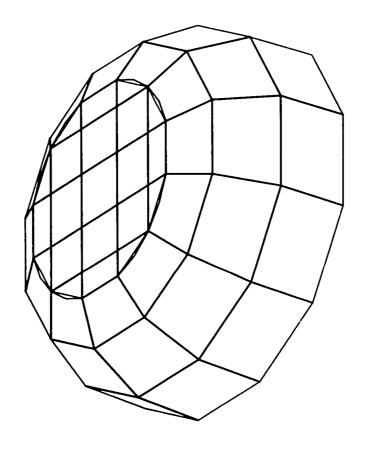


Figure 4. Computer plot of tip and orifice of a EWER cloud water content meter probe (ref. 7).

- 3. Square of the null point velocity magnitude (VTSO).
- 4. Pressure coefficient (CP) (ref. 9, eq. (137)).
- 5. Null point velocity components (VX, VY, VZ).
- 6. Direction cosines of the null point velocity (DCX, DCY, DCZ).
- 7. Unit normal vector to the plane of the quadrilateral (NX, NY, NZ).
- 8. Component of velocity normal to the quadrilateral plane at the null point (VN). (Note: VN should be essentially zero unless the quadrilateral is part of a flow inlet (see p. 26), in which case it should equal the input free-stream flow fraction.)
- 9. Source strength of the quadrilateral (SIG).

## Unit 14 Output

If parameter KTP14 is unity (card 1), the following data are stored on external unit 14 (in binary format) for use later by SR FLOVEL in calculating flow velocities at arbitrary points in space:

Body identification, KASE (see card 1), number of symmetry planes, NSYM, the number of quadrilaterals, NQUAD, in the basic body unit (i.e., before multiplication by symmetry plane reflections), free-stream Mach number, MACH, and  $(1 - \text{MACH}^2)^{-\frac{1}{2}}$ .

For each quadrilateral is stored the "twenty-eight quantities" (ref. 9, sec. 9.51), plus the distances between quadrilateral points 1 and 2, 2 and 3, 3 and 4, and 4 and 1. (See p. 21.)

# Overlay Structure and Subroutines Required

To conserve storage the program is run with the overlay structure shown in Fig. 5, which also identifies the subroutines required.

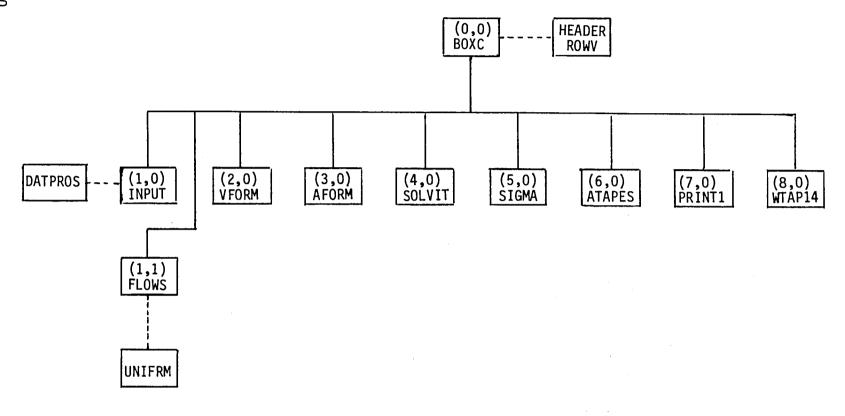


Figure 5. Overlay structure for program BOXC. The integer pairs (i,j) indicate the primary, i, and secondary, j, overlay levels.

# External Storage Units

Units 5 and 6 are the system input and print units. Unit 14 contains the data to be used by SR FLOVEL to compute flow velocities at arbitrary points in space. The following units are used for temporary storage: 1, 3, 4, 8, 9, 10, 11, 12, 13.

### BOXC Card Input

Card	Vanishing and Farmet		Descripto
<u>No.</u>	Variables and Format		Description
1	HEDR(15), IFLAG, LIST, AFLOW, BFLOW, CFLOW,	HEDR (cols. 1-60)	Hollerith run identification
	ISIG, IPRS, MPR, NCODE, NNON, NSYM, NOFF, KMACH,	IFLAG (col. 61)	Body surface description input control. Same as for card 1 of PBOXC. (See pp. 16ff.)
	KTP14, KASÉ, (15Á4, 211, 3L1, 4I1, I2, 4I1, IX, A4)	LIST (col. 62)	A value of zero (or blank) causes full execution. Otherwise, calculation is stopped after the "first output". (See p. 21.)
		AFLOW, BFLOW, CFLOW (Cols. 63, 64, 65)	Logical parameters which specify the free- stream flow axis. These parameters should be T,F,F respectively.
		ISIG (Col. 66)	Always zero or blank.
		IPRS (Col. 67)	Always zero or blank.
		MPR (Col. 68)	Normal value is zero or blank. Non-zero values cause printout of the following matrices
			(ref. 9): 1 print V <sub>ij</sub>
			2 print A <sub>i,j</sub>
			3 print $V_{ij}^{1J}$ and $A_{ij}$ (output is
			voluminous for large cases)
		NCODE (Col. 69)	Always zero or blank.
		NNON (Cols. 70,71)	Always zero or blank.
		NSYM (Col. 72)	Number of symmetry planes. Same as for card 1 of PBOXC. (See p. 16.)
		NOFF (Col. 73)	Number of off-body points for which velocity calculations are to be calculated. (See cards 7)
		KMACH (Col. 74)	A non-zero value indicates that a Mach number is to be read via card 5.
		KTP14 (Col. 75)	If given a value of one, the unit 14 output is prepared. (See p. 29)
		KASE (Cols. 77-80)	Hollerith body identification.
2	IPROS, (L1)		ace data for a general body (IFLAG = 0) are to led, and rotated about the y axis before pro- B is to be input.
3	ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, ZTRANS, (7F10.0)	This card is input of PBOXC.	only if IPROS (card 2) is true. Same as card 4
4	LEAK, FRACT, (I4, F10.0)	LEAK Number of the body.	f quadrilaterals used to define a flow inlet in
			of the free-stream air speed that passes through point of each inlet quadrilateral.
			vinlet, input a blank card. (Note: the inlet (cards 6A) must be the first body data input.)

### BOXC Card Input, cont.

Card No.	Variable and Format	Description
5	MACH, (F10.6)	Free-\$tream Mach number. This card is input only if parameter KMACH (card 1) is non-zero.
6A :	X, Y, Z, STAT, XX, YY, ZZ, STATT, (3F10.0, 12/3F10.0, 12)	Cards 6A apply to general bodies (IFLAG = 0) Coordinates and status flags for points used to describe the body surface. Same as cards 5A of PBOXC. (See pp. 16 ff)
6B	NLM1, MMIN, B, C, (215, 2F10.5)	Card 6B applies to generated ellipsoids (IFLAG > 0). Same as card 5B of PBOXC. (See p. 19)
6C	x <sub>1</sub> , z <sub>1</sub> , x <sub>2</sub> , z <sub>2</sub> ,  XNLM1+1, ZNLM1+1 (8F10.0)	Cards 6C apply to generated ellipsoids for which the x,z coordinates are input. (IFLAG = 2, NSYM = 2). Same as cards 5C of PBOXC. (See p. 19)
7	X, Y, Z, STAT, XX, YY, ZZ, STATT, (3F10.0, I2/3F10.0, I2)	Off-body points for which flow velocities are to be calculated. Cards 7 are input only if NOFF (card 1) is greater than zero. STAT or STATT for the last point must be 3. If there are an odd number of points, the deck of off-body point cards should be terminated with a blank card.

#### SUBROUTINE FLOVEL

Given the coordinates of a point in space (XNPP, YNPP, ZNPP) and the current time step, H, used in the integration of the particle equations of motion, SR FLOVEL returns the flow velocity components (VXPP, VYPP, VZPP) at that point, and an indicator, INBODY, of whether the body surface has been penetrated. INBODY = 0 if the point is exterior to the body, but INBODY = 1 if it is detected to be inside the body.

The discussion to follow assumes that a Hess-Smith (ref. 9) flow field is being considered. However, if the user wishes to compute flow by use of some other method, for example, flow about an ellipsoid via an analytical equation, he may replace FLOVEL by a subroutine of his own design.\*

SR FLOVEL is based mainly on the Hess-Smith subroutine VFORM, with modifications required to include the quadrilateral source strengths, and to set the INBODY parameter. Application of the source strengths (i.e.,  $\sigma$  values) is straightforward, as indicated by eq. (140) of reference 9, and needs no further discussion. Determination of whether or not the body has been penetrated is discussed next.

FLOVEL calculates and sums velocities induced at the specified point by each quadrilateral. Three modes of induced velocity calculation are used (ref. 9, sec. 9.52): 1. where the distance between the point and the quadrilateral is sufficiently large the quadrilateral is approximated by a simple point source, 2. for intermediate distances the quadrilateral is approximated by a point source plus a point quadrupole, and 3. for short distances an exact calculation is used. For each quadrilateral for which

In the trajectory codes a call of SR SETFLO precedes the first call of FLOVEL. SETFLO reads the data stored on unit 14 by PGM BOXC (see p. 29), which data are required by FLOVEL for calculation of a Hess-Smith flow velocity, and puts these data into COMMON storage. If a user-designed version of FLOVEL is used, SETFLO must be replaced by a dummy subroutine.

the exact calculation is required the following tests are made in sequence, and if any one is satisfied, penetration is taken not to have occurred:

- 1. The vector of separation between the point and the center of the quadrilateral is projected onto the normal vector to the quadrilateral, and the sign of the projection is checked to see if the point is on the exterior side of the quadrilateral.
- 2. If the distance of the point to the center of the quadrilateral is greater than one-half of the maximum quadrilateral diagonal, penetration of the quadrilateral has not occurred.
- 3. If the absolute value of the projection calculated in test 1 is greater than the time step, H, penetration of the quadrilateral has not occurred.

For test 3 we assume that the maximum particle speed is about unity, so that the maximum distance a particle can travel in one time step is roughly H.

These tests are applicable only during trajectory calculations when the particle is advancing by small steps such that if penetration occurs the particle will be close to the point of penetration when the tests are made. The tests will not give a penetration indication for interior points that are not close to the body surface.

#### PROGRAM FLOPNT

## General Description

This program computes flow velocities at an array of points in three-dimensional space. The array is oriented parallel with the three coordinate axes. Flow velocities are computed by SR FLOVEL, which uses data that, for example, are prepared by program BOXC for flow about an arbitrary three-dimensional body.

Initial coordinates, array increment values along the three coordinate directions and the number of increments desired along each direction (including the initial point) are input. Also input are integers M(3) which control the order of incrementing along three axes. For example, suppose M(1) = 3, M(2) = 1, M(3) = 2:

- 1. The x and z coordinates are held fixed while y is incremented over its range.
- 2. y is returned to its initial value, z is incremented once, and y is incremented over its range.
- 3. This is repeated until z covers its complete range.
- 4. z is returned to its initial value, x is incremented once, and y is incremented over its complete range.
- 5. etc.

The printed output is self-explanatory and consists of point coordinates, velocity components and speed.

If data prepared by BOXC are used, SR SETFLO reads these data from unit 14; units 5 and 6 are used for input and printing, respectively.

Subroutines called are: SETFLO, FLOVEL.

## FLOPNT Card Input

Card No.	Variables and Format	Description
1	KASE, (A4)	Body identification. Read by SR SETFLO, and must be identical to the identification on card 1 of BOXC.
2	HOLL(18), (18A4)	Run identification.
3	M(3), (312)	Coordinate incrementation sequence control. (See discussion above.)
4	X(I), D(I), N(I); I = 1 (2E10.0, I4)	X(1) initial x coordinate dimensionless) D(1) x coordinate increment N(1) number of increments desired in the x direction (including initial value).
5	X(I), D(I), N(I); I = 2	Same as card 4 but for the y axis.
6	X(I), D(I), N(I); I = 3	Same as card 4 but for the z axis.
3'	Cards 3 - 6 are repeated for another array.	
3	Blank card	A blank card 3 terminates the run.

#### TRAJECTORY CODE DESCRIPTIONS

#### GENERAL UTILITY CODES

### Subroutine PARTCL

Subroutine PARTCL is called by all three of the executive trajectory codes (Table 1B) to input particle specification data and compute still-air, terminal particle settling speed and other data depending on particle type. This is a particle type - specific code, the version used here being for water drops. It calls SR FALWAT.

### Subroutine TRAJECT

Trajectories are calculated by SR TRAJECT with the assistance of: SR DVDQ, the numerical integrator code, SR FLOVEL and the functions PRFUN and IMPACT. It also stores trajectory point coordinates at user-specified (normalized) time intervals (TPRINT) in arrays XPLOT(60), YPLOT(60), ZPLOT(60), providing logical parameter IPLOT is specified as true.

### Function PRFUN

Function PRFUN is a particle type - specific code which is called by TRAJEC to provide the N<sub>D</sub> - N<sub>R</sub> relation used in calculating the particle equations of motion (eq. (1)). Actually, through use of the pre-calculated quantity COF (= N<sub>D,s</sub>v<sub>s</sub>N<sub>F</sub>/N<sub>R,s</sub>), PRFUN returns the factor on the first term on the right side of eq. (1) which when multiplied by  $\vec{v}_a - \vec{v}_p$  yields the particle equation of motion. The version of PRFUN used here is for water drops, and it calls functions CDRR and WCDRR.

### Subroutine IMPACT

Subroutine IMPACT is called by TRAJECT following penetration of a particle into the body. When used with CONFAC, IMPACT adjusts trajectory initial y and z coordinates such as to avoid impaction by the next trajectory (see p. 44); accordingly IMPACT is a problem-specific code. No such adjustment is required for cases run under control of ARYTRJ and TANTRA\*, so that a dummy version of IMPACT is used.

### Subroutine SETFLO

Subroutine SETFLO reads data prepared by PGM BOXC from external unit 14. These data are required by SR FLOVEL for calculation of flow velocities about a Hess-Smith three-dimensional body. SETFLO reads a four-character Hollerith identification of the body and checks to see if it is identical to the identification obtained from unit 14. If not, a comment is printed and the calculation is stopped.

If flow around the body is calculated by some means other than the Hess-Smith method, SETFLO must be replaced with a dummy subroutine.

## Subroutine DVDQ

This is the variable order, ordinary differential equation integrator of Krogh (ref. 11). Operating instructions, which have proven to be quite adequate, are found in the glossary of the DVDQ card listings. The version used here automatically adapts to the word size of the computer used.

Be very sure that IMPACT does not adjust initial trajectory coordinates during tangent trajectory determination under control of TANTRA.

#### PROGRAM ARYTRJ

## General Description

SR TRAJECT is called to compute particle trajectories initiated at an array of points in three-dimensional space. Particle properties are computed by SR PARTCL and SR PRFUN. Flow velocities are computed by SR FLOVEL, which uses data that, for example, are prepared by program BOXC for flow around an arbitrary three-dimensional body. SR DVDQ integrates the particle equations of motion.

Initial coordinates of the initial point array, array increment values for the three coordinate directions and the number of increments desired along each direction (including the initial point) are input. Also input are integers M(3) which control the order of incrementing along the three axes and a skip parameter NSKIP. For example, suppose M(1) = 3, M(2) = 1, M(3) = 2:

- 1. The x and z coordinates are held fixed while y is incremented over its range.
- 2. y is returned to its initial value, z is incremented once, and y is incremented over its range.
- 3. This is repeated until z covers its complete range.
- 4. z is returned to its initial value, x is incremented once, and y is incremented over its complete range.
- 5. etc.

Trajectories are computed to the limiting x coordinate value XLIMIT or until penetration of the body is sensed.

If not every trajectory is desired, the parameter NSKIP is set greater than zero. Then, after the first trajectory, only every NSKIP + 1 th trajectory is computed.

## Subroutines Required

FLOVEL, SETFLO, PARTCL, FALWAT, TRAJECT, IMPACT (dummy), PRFUN, DVDQ, WCDRR, CDRR

## External Storage Units

Units 5 and 6 are the system input and print units, respectively. Unit 9 is used for temporary storage.

Unit 10 is used to store trajectory data for plotting by PGM STEREO. Unit 14 is used by SR SETFLO for input of data prepared by PGM BOXC.

### Printed Output

The printed output is largely self-explanatory. For each trajectory are printed at time interval TPRINT: time, point coordinates (X, Y, Z), particle velocity components (VPX, VPY, VPZ), flow velocity components (VX, VY, VZ), time step (H), Reynolds number (R), acceleration modulus (AC) and cumulative number of flow velocity computations (NEVAL). (All dimensionless)

Other quantities are: angle between the projection of the initial flow velocity vector in the z=0 plane and the x axis (ALPHAO), angle between the initial flow velocity vector and its projection in the z=0 plane (BETAO), angle between the projection of the final particle velocity vector in the z=0 plane and the x axis (ALPHAR), angle between the final particle velocity vector and its projection in the z=0 plane (BETAR), direction cosines of the drag vector at the final point, and the angle between the projection of the drag vector in the z=0 plane and the x axis (A), and the angle between the drag vector and the z axis (GAMMA). (All angles are in degrees.)

## ARYTRJ Card Input

Card No.	Variables and Format	Description
1	KASE, (A4)	Body identification. Read by SR SETFLO. Must be identical to parameter KASE on card 1 of the BOXC input.
2	HOLL (18), IPLOT,	HOLL 72 columns of Hollerith run identification
	(18A4, 7X, L1)	IPLOT Logical variable: if true, trajectory data are written (col. 80) on unit 10 for plotting by PGM STEREO.
3	V, ELL, RHO, TEMP,	V Free stream airspeed (m s <sup>-1</sup> )
	XFINAL, (8F10.5)	ELL Characteristic dimension of the body (m). Corresponds to L as defined for eq. (1).
		RHO Ambient air density (kg m <sup>-3</sup> )
		TEMP Ambient temperature (°K)
		XFINAL x coordinate for trajectory cut off (i.e., maximum x coordinate) (normalized, dimensionless)
4	TPRINT, HI, HMINI, EPSI(3), (8F10.5)	TRRINT Time interval for trajectory point print. Default value = 0.1.
		HI Initial numerical integration time step. (See SR DVDQ). Default value = 0.1
		HMINI Initial numerical integration minimum time step. (See SR DVDQ). Default value = .005.
		EPSI(3) Parameters used to control numerical integration local error. (See SR DVDQ). Default values = 1.0E-5.
		All normalized, dimensionless.
5	DIAM, (7F10.0)	Water drop diameter $(\mu m)$ . This card is read by SR PARTCL.
6	M(3), NSKIP, (4I4)	M(3) Array incrementation control
		NSKIP Array skip parameter (See discussion above.)
7	X(I), D(I), N(I); I = 1	X(1) Initial x coordinate )
	(2F10.0, 14)	D(1) x coordinate increment (dimensionless)
		N(1) Number of increments desired in the x direction (including the initial value)
8	X(I), D(I), N(I); I = 2	Same as card 7, but for the y direction.
9	X(I), D(I), N(I); I = 3	Same as card 7, but for the z direction.
5'	Cards 5 - 9 are repeated for another particle and another array	· · · · · · · · · · · · · · · · · · ·
:	:	
:	•	
 5	Blank card	A blank card 5 terminates the run.
		•

#### PROGRAM CONFAC

## General Discussion

Program CONFAC computes trajectories to user-specified target points. It operates in two modes:

- 1. Single trajectories are calculated to each target point (NW = 0).
- 2. A central trajectory is computed to the target point, and NW trajectories, evenly spaced about a circle in the target plane of radius RW about the central trajectory, are calculated such as to define a particle flux tube.

Mode 2 is used to calculate concentration factor,  $C_{\mathsf{F}}$ , which is the ratio of particle flux at the target point to the free-stream particle flux. It is easy to show that

$$C_F \simeq \frac{\text{area of flux tube cross section in the free stream}}{\text{area of flux tube cross section at the target point}}$$

The areas are those of plane polygons of NW vertices as calculated by SR POLYGON. Concentration ratio,  $C_{\rm M}$ , the ratio of particle concentration at the target point to free stream concentration, is obtained via the relation

$$C_{M} = C_{F}/|\vec{v}_{p}|$$
.

The desired trajectories are calculated by an iterative method which finds a trajectory that passes within a user-specified distance tolerance (RW\*TOL) of the desired target point. To initialize, the user may input four sets of coordinate guesses: two sets of y and z coordinates for the initial and target planes. No special care need be taken in making these guesses since convergence should be rapid as long as the coordinates are in the correct general neighborhood. On default of input, the initial coordinate guesses are supplied by the code.

The trajectory iteration procedure is described in detail in reference 1. (See pp. 13 - 16 and Appendix A.) SR MAP controls the iteration and calls SR TRAJECT to calculate trajectories. If convergence is not achieved after calculating twenty-five trajectories, the calculation proceeds to the next particle or stops. The limiting number of trajectories can be changed by changing the value of ILIM in a DATA statement in SR MAP.

SR IMPACT is a problem-specific code whose purpose is to adjust trajectory initial y and z coordinates when penetration of the body occurs such that penetration will be avoided on the next attempt. After twenty-five penetrations, the calculation proceeds to the next particle or stops. The limiting number of penetrations can be changed by changing the value of JLIM in PGM CONFAC.

## Subroutines Required

FLOVEL, MAP, PARTCL, POLYGON, DVDQ, SETFLO, FALWAT, PRFUN, IMPACT, TRAJECT, TRANSFM, MATINV, WCDRR, CDRR.

## External Storage Units

Same as for ARYTRJ.

## Printed Output

The printed output is largely self-explanatory, and contains all of the data described for PGM ARYTRJ.

Detailed trajectory data are printed only for the final trajectory which is the result of a successful convergence to the desired target point. For

other trajectories, only the initial and final y and z coordinates are printed. Except for the initial coordinate guesses, these coordinates are given in the "flux tube coordinate system", and are so identified and distinguished in the output from the "flow coordinate system". The "flow system" is the coordinate system (normalized) by use of which the body is described and the flow is computed. The "flux tube system" at any point along the trajectory has its origin at the flux tube center and its y and z axis in the plane normal to the central trajectory. Flux tube system coordinates are given in the initial and target planes in the output.

For cases where flux tubes are calculated, a summary of the initial and final coordinates of all NW + 1 trajectories are printed, the areas of the polygons with NW vertices in the initial and final planes are printed, and the concentration factor and concentration ratio are printed.

### CONFAC Card Input

Card		
No.	Variables and Format	Description
1	KASE, (A4)	Body identification. Read by SR SETFLO. Must be identical to parameter KASE on card 1 of the BOXC input.
2	HOLL(18), IPLOT,	HOLL 72 columns of Hollerith run identification.
	(18A4, 7X, L1)	IPLOT Logical variable: if true, trajectory data are written (col. 80) on unit 10 for plotting by PGM STEREO.
3	V, ELL, RHO, TEMP,	V Free stream airspeed (m s <sup>-1</sup> )
	XSTART, (8F10.5)	ELL Characteristic dimension of the body (m). Corresponds to L as defined for eq. (1).
		RHO Ambient air density (kg m <sup>-3</sup> ).
		TEMP Ambient temperature (°K).
		XSTART Initial x coordinate of trajectory. (normalized, dimensionless)
4	TPRINT, HI, HMINI, EPSI(3), (8F10.5)	Same as for ARYTRJ.
5	NW, RW, TOL, (110, 7F10.5)	NW Number of trajectories used to define flux tube peripheries for concentration factor calculation.  If NW = 0, single trajectories are calculated to target points defined by cards 9.
6	YE(I), ZE(I), YI(I), Z(I); (I = 2), (8F10.5)	YE, ZE Initial guesses of trajectory y and z coordinates in the target plane.
7	YE(I), ZE(I), YI(I), Z(I); (I = 3), (8F10.5)	YI, ZI Initial guesses of trajectory coordinates in the initial plane.
		These coordinates are in the coordinate system used to define the body and the flow field (normalized, dimensionless). The data in the two cards can be very approximate, but if not blank, the two cards should not be identical. On input of two blank cards, the code supplies default estimates based on the first target coordinates
8	DIAM, (7F10.0)	Water drop diameter ( $\mu m$ ). This card is input by SR PARTCL.
9	XW, YW, ZW, (8F10.5)	x,y,z coordinates of the target point (normalized, dimensionless).
8'	Cards 8 and 9 are repeated for as many particles as desired.*	
9'		
	•	
•	•	
·		
8	Blank card	A blank card 8 terminates the run.

<sup>\*</sup>Previous trajectory y and z coordinates are used as trajectory iteration initialization estimates for each new target point. Thus, if target points are widely spaced, separate runs should be made for each.

#### PROGRAM TANTRA

### General Discussion

The purpose of this code is to compute tangent particle trajectories to a three-dimensional body. The code is designed to be as general and as automatic as practical, but owing to the unlimited number of geometrical possibilities in three dimensions, some compromise is necessary. Since we cannot know a priori what parts of a body the tangents will touch, we do not, in general, have the option of specifying target points on the body or even target planes through the body. Therefore, we specify curves in the free stream well ahead of the body on which all trajectories are initiated for a particular tangent determination.

Given the equation of the starting-point curve and an initial point on the curve, the code computes the trajectory from this point toward the body until penetration of the body occurs or until a specified x-coordinate stop point is reached. If penetration occurs, a specified coarse step is taken along the starting-point curve in direction away from the body, and another trajectory is computed. If penetration does not occur, the coarse step is taken along the starting-point curve in direction toward the body, and another trajectory is calculated. Once penetration occurs for trajectories that initially miss the body, or the reverse for trajectories that initially impact, the initial point is backed up one step along the curve away from the body if necessary, and the process of stepping toward the body is resumed with a fine step size until the tangent trajectory is found. Thus, the tangent trajectory misses the body by no greater than the tolerance implied by the fine step size. Note that this does not imply that the tolerance is the fine step size. Separation of trajectories in the free stream will not be the same as separation of the same trajectories near the body, nor even approximately the same except for very large, heavy particles which have sufficient inertia to essentially ignore the flow around the body. In general, trajectory separations near the body will be less than in the free stream.

Specification of the starting-point curve is done via SR STRPNT, which in the version supplied uses straight line curves. The user provides the coordinates of two points on the line:

- Point 1. Initial coordinates of the initial trajectory
- Point 2. Coordinates of any other point on the line which is closer to the body than Point 1.

Point 2 must be closer to the body than Point 1 to ensure that stepping along the starting-point curve proceeds in the proper direction. Point 2 need not be, and in general will not be, the initial point of a trajectory. Note that both of these points must be sufficiently far upstream to be essentially in the free stream. Also specified are the coarse and fine stepping distances. All coordinates and distances are normalized. (See eq. (1).)

If so specified (IPLOT = true), tangent trajectory data are stored on unit 10 for plotting later by PGM STEREO.

## Subroutines Required

FLOVEL, SETFLO, PARTCL, FALWAT, STRPNT, TRAJECT, IMPACT\*, PRFUN, DVDQ, WCDRR, CDRR.

## External Storage Units

Same as for ARYTRJ.

## Printed Output

Trajectory data are as described for PGM ARYTRJ and are printed for every trajectory computed regardless of whether or not the trajectory is

Be sure that IMPACT is a dummy subroutine. Resetting of initial trajectory coordinates by SR IMPACT will ruin a tangent trajectory determination.

accepted as the tangent trajectory. Beyond that, the output is fully labeled and self-explanatory. All input data are printed: including the points used to define the starting-point line, coarse and fine increments, and starting point coordinates. The switching from coarse to fine step size is clearly identified, as are the tangent trajectory data.

## TANTRA Card Input

Card No.	Variables and Format		Data Description
1-4		Cards 1 t ARYTRJ.	through 4 are the same as for
5	DIAM, (7F10.0)		op diameter (µm). This card by SR PARTCL.
6	DCORS, DFINE, (8F10.0)	sizes to starting-	vely, the coarse and fine step be used in stepping along the point line (normalized, dimen- card 6 is read by SR STRPNT.
7	X,Y,Z,X1,Y1,Z1, (8F10.0)	X,Y,Z	Coordinates of Point 1, which specifies the initial trajectory coordinates on the starting-point line (normalized, dimensionless).
		X1,Y1,Z1	Coordinates of Point 2, which is any point on the starting-point line that is closer to the body than Point 1 (normalized, dimensionless).
		be far en essential	the starting-point line should nough upstream of the body to be ly in the free stream. Card 7 by SR STRPNT.
6' 7' •			and 7 are repeated for as many ries as desired.
6	Blank card		ard 6 signals end of calculation water drop, and another card 5
5' 6" 7"		 ·	·
6	Blank card		
5	Blank card	A blank c	ard 5 terminates the run.

### PROGRAM STEREO

## General Discussion

Program STEREO is used to plot results of the trajectory calculations. Both body and trajectories are plotted. The body data are obtained from unit 9, on which the data were stored by SR PINPUT under control of PGM PBOXC, and the trajectory data are obtained from unit 10, on which the data were stored under control of either ARYTRJ, CONFAC or TANTRA.

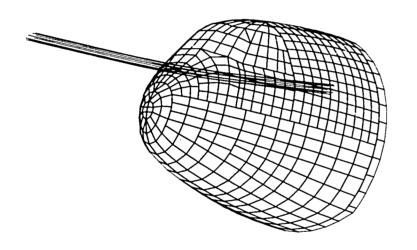
Plots are prepared in pairs, members of a pair being separated by a specified angle on each side of a specified viewing direction. Proper specification of the angles, which usually requires some trial-and-error-experimentation, may provide plots which can be used for stereo viewing as illustrated by Figure 6.

The viewing direction is defined by specifying two angles, THETA and PSI. The operation of these angles is as follows: We assume a right-handed coordinate system with its positive z axis directed upward and the free-stream flow in the direction of the positive x axis. First rotate the coordinate system about the y axis by angle THETA such that positive THETA tilts the positive x axis upward. Then rotate about the new z axis by angle PSI such that for positive PSI the rotation is clockwise when viewed from above. The view direction separation angle, DELTA is applied to angle PSI such that the members of a stereo pair are actually viewed from angles THETA, PSI-DELTA and THETA, PSI + DELTA, and are plotted in that order.

For a particular case (i.e., body and set of trajectories), the user must specify the number of trajectories and the (upstream) x coordinate at which plotting of the trajectory data is to be begun. This need not have the same value as the initial x coordinates of the data stored on unit 10.

Translating and scaling of the data such that it will properly fit into the plot area is handled automatically by the program.

Only system and plot subroutines are required.



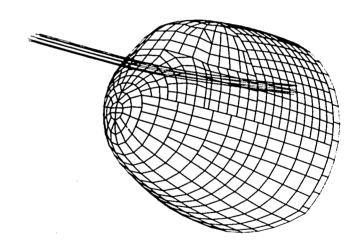


Figure 6. Stereographic plots of an eight-trajectory, 20 µm-diameter water drop flux tube to a particle replicator mounted on the forward fuselage of a Lockheed C130A airplane. The central trajectory is also shown.  $C_{\rm F}=1.15$ . (Ref. 1) Three-dimensional perspective can be attained by staring at the center of the figure and then crossing the eyes such that the two images merge.

## External Storage Units

Units 5 and 6 are the system input and print units.

Unit 9 contains the three-dimensional body surface data, plus some scaling information, as stored by SR PINPUT.

Unit 10 contains the trajectory data as stored under control of PGMS ARYTRJ, CONFAC or TANTRA.

## Printed\_Output

The printed output is simple. It consists of a run identification, the input data and some scaling information. For each trajectory is printed:

1. the coordinates (XTRAJ, YTRAJ, ZTRAJ) of each point before translation, scaling and projection onto the plot plane, and 2. the translated, scaled and projected coordinates (XPLOT, YPLOT) of each point plotted.

# STEREO Card Input

Card No.	Variables and Format		Description			
1	HOLL(18), (18A4)	72 colum	nns of Hollerith run identification.			
2	ICRT, NTRJS, XSTART, (L1, I9, F10.0)	ICRT	A logical variable which when true causes plotting to be via CRT. Otherwise, plotting is via pen and ink.			
		NTRJS	Number of trajectories to be plotted.			
		XSTART	x coordinate at which trajectory plotting is to begin. Need not correspond to the initial x coordinates of trajectories stored on unit 10.			
3,4	LINE1, LINE2, (7A6/7A6)	true (ca	and 4 are read only if ICRT is ard 2). Two lines of 42 columns Hollerith labeling for a micro- ilm.			
<b>5,</b> 6	THETA, PSI, DELTA, HLABEL(18), (3F10.2/ 18A4)	THETA PSI DELTA	Viewing angles and viewing angle separation (degrees). (See definitions above.)			
	<b>,</b>	HLABEL	72 columns of Hollerith labeling for the plots.			
5',6'	Cards 5 and 6 are repeat pairs as desired.	 ted for as	many additional plot			
<b>5,</b> 6	Blank cards	Blank c	ards 5 and 6 terminate the run.			

#### VALIDATION

### PRIOR WORK

Hess and Smith (refs. 9 and 10) present results of a wide range of studies where flow velocities and pressures calculated by their method are compared with other theory and with experiment. Outstanding agreement with the data from other sources is evident.

In reference 1 we present results of several studies that examine accuracy of the trajectory calculations. To check accuracy of the numerical integrations we computed trajectories of 1  $\mu m$  diameter water drops in axisymmetric airflow about an ellipsoid of fineness ratio 2 and found the largest deviation from the stream line flow to be 0.006%. Thus very small particles are computed to essentially follow the stream flow as they should do.

To determine differences between trajectories computed by a body constructed from Hess-Smith panels and a body with an analytically defined surface, we computed trajectories of water drops about ellipsoids of fineness ratio 2 of both types in axisymmetic air flow at 5 kft altitude in a standard atmosphere (ref. 1). The Hess-Smith ellipsoid was constructed from 1800 panels, and the length of the semi-major axes of the ellipsoids was taken to be 4.67m. Results are shown in Fig. 7 for comparison of trajectory intersections with the extended minor axis. All of the Hess-Smith points are slightly farther from the ellipsoid surface than the analytical points, but the discrepancies are not large. The largest discrepancy, for 100  $\mu m$  drops at 31 cm, is very atypical in that this point is on the edge of a shadow zone, where: trajectory distortions are near their maxima, concentration factors become very large, and we expect and find "pathlogical" computational results caused by trajectories crossing each other in this region of extremely high concentration gradients.

Also in reference 1 we compare our tangent trajectories with those calculated by Dorsch et al. (ref. 19) for axisymmetric flow about an ellipsoid

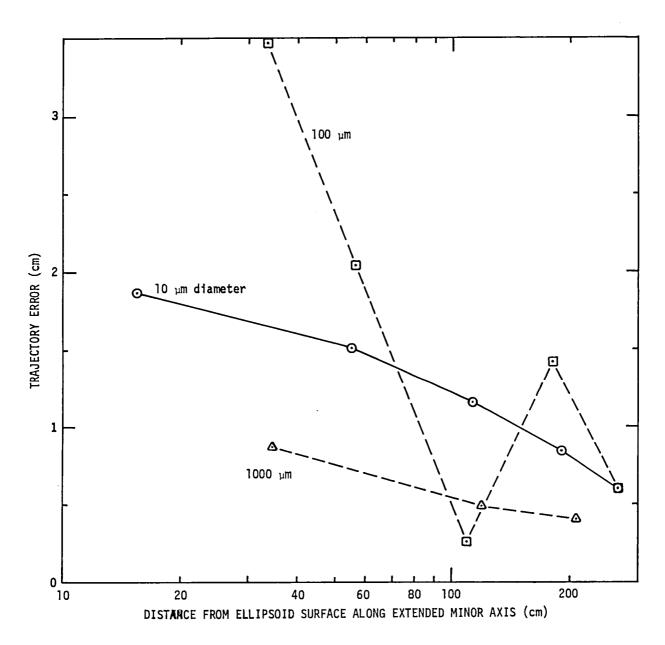


Figure 7. Comparison of water drop trajectories about an ellipsoid of fineness ratio 2 using exact and approximate potential airflow. The ellipsoid semi-minor axis is of length 2.335m. (From ref. 1)

of fineness ratio 5 for the two conditions of flow and particle size given in Figure 4 of reference 19. Particle equations of motion without gravity were used. In terms of the distance of the tangent trajectory from the symmetry axis in the free stream,  $r_0$ , we have

			r <sub>o</sub>
Stokes Number	Free Stream Reynolds Number	Dorsch, et al., ref. 19	Norment and Zalosh, ref. 1
1	4096	.077	.075
1/30	512	.020	.015

Here  ${\bf r}_0$  is a fraction of the ellipsoid semi-major axis length. Differences in our method of calculation and that of Dorsch et al. are discussed in the next section.

### ADDITIONAL VERIFICATION

The work of comparison of calculated tangent trajectories to an ellipsoid of fineness ratio 5 with those calculated by Dorsch et al. (ref. 19) was extended to include cases given in Table 1 of reference 19. Three cases were chosen for study as follows:

Altitude: 5000 ft Temperature: 20°F

Water droplet diameter: 20  $\mu m$ 

Ellipsoid semi-major axis length: 5 ft. Free stream speeds: 100, 300, 500 mph.

The Dorsch, et al. calculations were done neglecting gravity, with use of very early drag data and the equations of motion were integrated with a mechanical differential analyser. Our calculations included gravity and were done by the codes described herein. In both studies flow about an analytical ellipsoid was used. Our calculations were three-dimensional, but confined to the y=0 plane. To account for effects of gravity (i.e., droplet settling) we calculated

tangent trajectories above and below the ellipsoid and averaged the results. (If  $r_0$  values are adjusted for droplet settling between initial and impact points, the result is the same as the average  $r_0$  values obtained from the above and below tangent trajectories.) Results are:

	r <sub>o</sub>					
Free	Dorsch,		—This Study-			
Stream Speed (mph)_	et al., Ref. 19	Upper Side	Lower <u>Side</u>	Average		
100	.024	.0198	.0174	.019		
300	.041	.0373	.0365	.037		
500	.054	.0460	.0456	.045		

Lewis and Ruggeri (ref. 20) present experimental data obtained in the NACA Lewis wind tunnel used for icing studies. Data were obtained at constant free stream airspeed and atmospheric conditions for axisymmetric flow about an ellipsoid of fineness ratio 2.5. Local impingment efficiencies were measured as a function of s/R (s is the distance measured aftward along the ellipsoid surface from the nose of the ellipsoid, and R is the semiminor ellipsoid axis) for four narrow distributions of droplet sizes. The relevant datum here is the maximum s/R for each droplet distribution which is produced by the maximum droplet diameter,  $\delta_{\text{max}}$ , in its distribution.

Lewis and Ruggeri give the following flow and dimensional data:

Free stream speed: 157 kts (80.767 m  $s^{-1}$ )

Temperature: 50°F (283.16°K) Pressure: 28" Hg (94583 Pa)

Semi-minor ellipsoid axis: 15 inches (0.381m)

We calculate air density to be 1.1637 kg  $m^{-3}$ .

Lewis and Ruggeri also give theoretical s/R results. Our calculations were done as described previously in this section. x,z coordinates of limiting impingement points were converted to  $(s/R)_{max}$  values by a graphical method. Results are as follows:

	(s/R) <sub>max</sub> From Ref. 20					
<sup>δ</sup> ma x (μm)	Exp. Mean from Figs. 10,23	Theor. from Fig. 23	% Error Relative to Exp.	(s/R) <sub>max</sub> This Study	% Error Relative to Exp.	% Error Relative to Ref. 20 Theory
24	.23	.52	+160	.385	+67	-26
35	.405	.75	+ 88	.648	+60	-14
45	.525.	•9	+ 64	.847	+61	- 6
64.5	.745	1.2	+ 60	1.18	+58	-1.7

Note that in all cases our calculations are closer to the experimental values, though for the larger particles our theoretical results differ little from those reported by Lewis and Ruggeri.

### **EXAMPLE PROBLEMS**

#### GENERAL DISCUSSION

Example card input data are given below and printouts are presented in the microfiche addition included with this report for each of the seven codes listed in Table 1. A special three-dimensional test body, which is described in the next section, was used for the calculations.

All of the codes use less than 65,000 central processor storage words, and most use substantially less. Program BOXC uses the most storage and STEREO uses the least.

Total running times on the UNIVAC 1100/42 computer at NASA Lewis Research center for the example problems are:

Code	Total Running Time (minutes : seconds)
PBOXC	0:54
BOXC	4:23
FLOPNT	0:39
ARYTRJ	1:24
CONFAC	2:44
TANTRA	2:47
STERE0	0:47

### THE TEST BODY

A special asymmetric test body was designed and is described in terms of 189 Hess-Smith panels. A listing of the data cards for the body follows the PBOXC card input below, and Fig. 8 shows computer plots of the body.

The structure of the body is as follows:

 The more pointed end, which faces the free stream flow, is half of a prolate ellipsoid

$$\frac{x^2}{9} + \frac{y^2}{4} + z^2 = 1; -3 \le x \le 0.$$

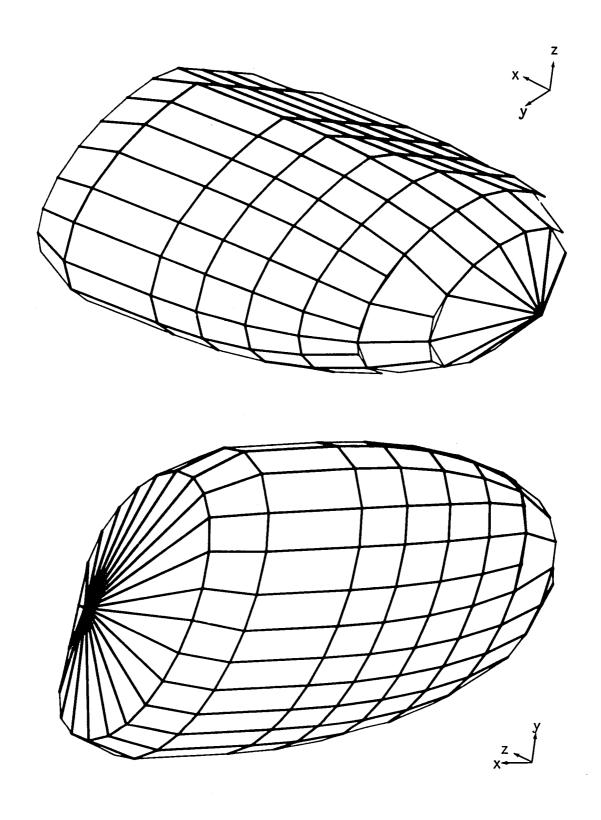


Figure 8. Asymmetric test problem body.

2. The central section is a cylinder

$$\frac{y^2}{4} + z^2 = 1$$
;  $0 \le x \le 1$ .

3. The blunt end is half of an oblate ellipsoid

$$(x - 1)^2 + \frac{y^2}{4} + z^2 = 1$$
;  $1 \le x \le 2$ .

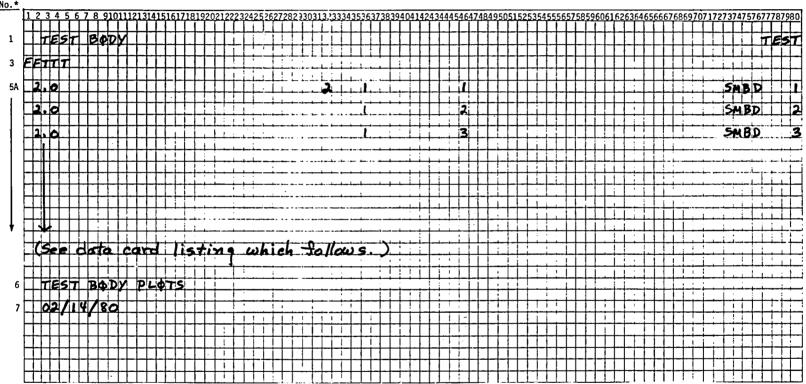
4. The body is truncated by the plane

$$y - 2z = 2.$$

EXAMPLE PROBLEM/CARD INPUT AND PRINTOUT

**PBOXC** 

Card No.\*



 $<sup>\</sup>mbox{^{\sc k}}\mbox{Card}$  numbers are the same as those given in the code description section.

### Test Problem Data Cards

Columns:	10	20	30	32				
COTUMITS:	Ţ	Ţ	1	1 2				
2.0	•			2	1	1	SMS	
2.0					1	2	SM8 SMB	
2.0					1	3	SM8	
2.0					1	<b>4</b> 5	SMB	
2.0					1 1	6	SMB	
2.0					1	7	SMB	
2.0 2.0					ī	8	SMB	8 0
2.0					ī	ğ	SMB	
2.0					1	10	SMB	
2.0					1	11	SMB	0 11
2.0					1	12	SMB	0 12
2.0					1	13	SMB	0 13
2.0					1	14	SMB	8 14
2.0					1	15	SMB	
2.0					1	16	SMB	0 16
2.0					1	17	SMB	D 17
S • 0					1	18	SMB	
2.0					1	19	SMB SMB	
2.0					1	20	SMB	D 24
2.0					1	21 22	SMB	
2.0					1	23	SMB	0 23
2.3					1	24	SMB	
2.0 1.5	1.7320	0.0		1	2	i	SMB	
1.5	1.67	0.2297		•	2	2	SMB	
1.5	1.46	0.4659			2	3	SMB	C 27
1.5	1.14	0.6520			2 2 2 2 2	4	SMB	D 28
1.5	9.8	0.7681			2	5	SMB	
1.5	0.4	0.8426			2	6	SMB	
1.5	0.0	0.8660			2	7	SMB	
1.5	-0.4	0.8			2	8	SMB	
1.5	-0.8	0.6			2	9	BM2 BH2	
1.5	-1.2	0.4			2	10	SMB	
1.5	-1.6	9 • 2			2 2	11 12	SMB	
1.5	-1.7320 -1.67	0.0 -0.2297			2	13	SMB	
1.5 1.5	-1.46	-0.4659			2	14	BMS	
1.5	-1.14	-0.6520			2	15	SMB	
1.5	-0.8	-C.7681			2 2	16	SMB	B 40
1.5	-0.4	-0.8426			2	17	SMB	
1.5	0.0	-0.8660			2 2 2	18	SMB	
1.5	0 • 4	-0.8426			2	19	SMB	
1.5	0.8	-0.7681			2	20	SMB	
1.5	1.14	-0.652 <b>0</b>			2	21	SMB	
1.5	1.46	-0.4659			2	22	SMB	
1.5	1.67	-0.2297			2	23	SM8 SMB	
1.5	1.7320	0.0			2	24	SMB	
1.7	2.9 1.87	0.0		1	2 3 3	1 2	SMB	
1.0 1.0	1.87	0.3546 0.6			3	3	SMB	
1.0	1.5	0.8			3	4	SMB	
1.0	0.8	8.9165			3	5	SMB	
1.0	0.4	0.9798			3	6	SMB	
1.0	3.3	1.0			3	7	SMB	
1.0	-0.4	0.8			3	8	SMB	0 56
-								

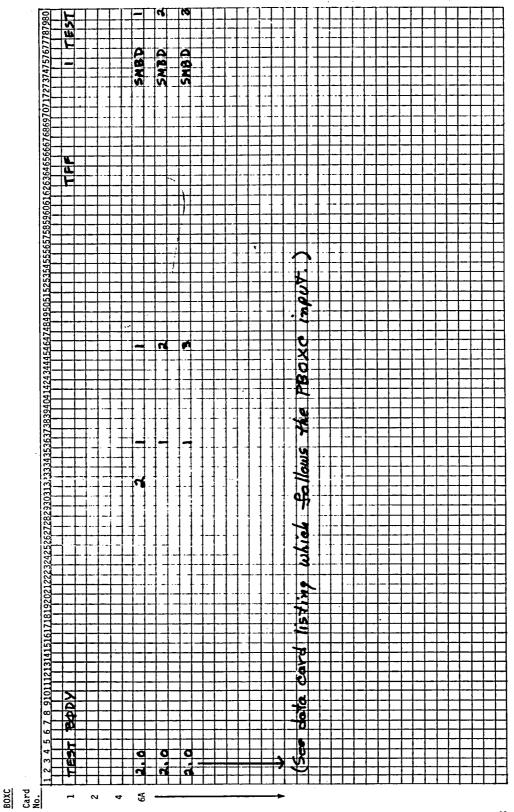
1.0	-0.8	0.6		3	9	SMBC	57.
1.0	-1.2	0.4		3	10	SMBD	58
1.0	-1.6	0.2					
				3	11	SMBD	59
1.0	-2.0	0.0		3	12	SMBC	6 G
1.0	-1.87	-0.3546		3	13	SMBD	61
1.0	-1.6	-0.6		3	14	SMBD	62
1.0	-1.2	-0.8		3	15	SIBD	63
1.0	<b>-0.</b> 8	-0.9165		3	1	SMBD	64
1.0	-0.4	-0.9798		3	1	SMBD	65
1.0	0.0	-1.0		3	18	SMBD	66
1.0	0.4	-0.9798		3	19	SMBD	67
1.0	0.8	-0.9165		3	20	SMBC	68
	1.2	-0.8		3			69
1.0				3	21	SMBD	
1.0	1.6	-0.6			22	SMBD	70
1.0	1.87	-0.3546		3	23	SMBG	71
1.0	2.0	0.0		3	24	SMBC	72
0.0	2.0	0.0	1	8	1	SMBC	73
0.0	1.87	0.3546		8	2 3	SMBD	74
0.0	1.6	0.6		8	3	SMBC	75
0.0	1.2	0.8		8	4	SMBD	76
0.0	0.8	0.9165		8	5	SMBD	77
0.0	0.4	0.9798		8	5 6	SHBC	78
0.0	0.0	1.0		8	7	SMBD	79
					,		
0.0	-0-4	0.8		8	8	SMBD	80
0.0	-0.8	0.6		8	9	SMBD	81
0.0	-1.2	0 • 4		8	10	SMBD	82
0.0	-1.6	0.2		8	11	SMBD	83
0.0	- 2.0	0.0		8	12	SMBD	84
0.0	-1.87	-0.3546		8	13	SMBC	85
0.0	-1.6	-0.6		8	14	SMBC	86
0.0	-1.2	-0.8		8	15	SMBD	87
0.0	-0.8	-0.9165		8	16	SMBD	88
0.0	-0.4	-0.9798		8	17	SMBD	89
0.0	0.0	-1.0		8	18	SMBC	90
0.0	8.4	-0.9798		8	19	SMBD	91
0.0	0.8	-0.9165		8	20	SMBD	92
0.0	1.2	-0.8		8	21	SMBO	93
0.0	1.6	-0.6		8	22	SMB C	94
0.0	1.87	-0.3546		8	23	SMBC	95
0.0	2.0	0.0		8	24	SMBC	96
-0.5	1.9720	0.0	1	9	1	SMBD	97
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-0.5	1.195	0.7844		ġ	4	SMBD	
-0.5	0.8	0.9012		9	4 5 6	SMB C	
-0.5	0.4	0.9655		g	2	SMBO	
-0.5	0.0			-	7	SMBC	
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-0.5	-0.4	0.8		9	8	SMBD	
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-0.5	-1.195	-0.7844		9	15	SM8 C	111
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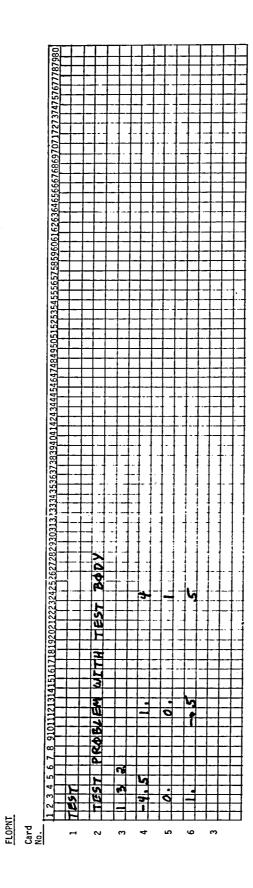
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-0.5	0.4	-0.9655		ð ð	19 20
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-0.5 -0.5	1.195 1.585	-0.5866		9	22
-0.5	1.85	-0.3415		g	23
-0.5	1.9720	0.0		ģ	24
-1.0	1.8856	0.0	1	10	1
-1.0	1.785	0.3039		10	2
-1.0	1.54	0.5440		10	3
-1.0	1.175	0.7374		10	4
-1.0	0.8	0.8538		10	5
-1.0	0 • 4	0.9214		10	6
-1.0	0.0	0.9428		10	7
-1.0	-0.4	0 • B		10	8 9
-1.0	-0.8	0.6		10 10	10
-1.0	-1.2 -1.6	0 • 4 0 • 2		18	11
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-1.0	-1.54	-0.5440		10	14
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-1.5	1.46	0.4659		11	3
-1.5	1.14	0.6520		11	4
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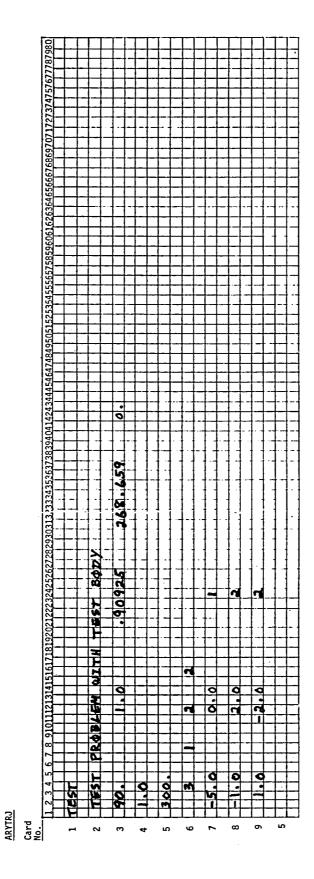
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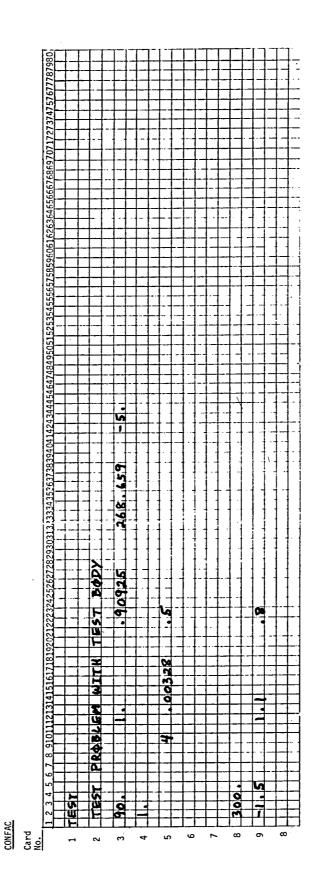
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-2.0	1.072	0.5179		12	4	SMBD	
-2.0	0.8	0.6289		12	5	SMBC	
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-2.0	0.0	0.7454		12	7	SMBO	
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-2.C	-1.2	0 • 4		12	10	SMBC	178
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-2.0	1.4907	0.0		12	24	SMBD	
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-2.5	0.8	0.3815		14	3	SMBC	212
-2.5	0.4	0.5153		14	4	SMBD	213
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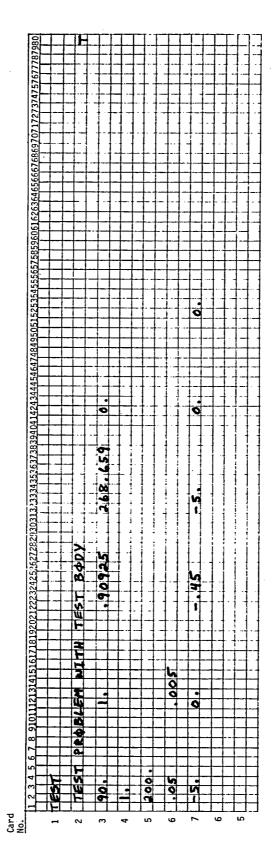
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-2.5	-0.8	0.3815		15	5 6	SMB0 232
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-2.5	0.8	-0.3815		15	12	SMBC 238
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-3.0				1 6	5	SMB0 244
-3.C				16	6	SNBC 245
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				16	10	SMBD 249
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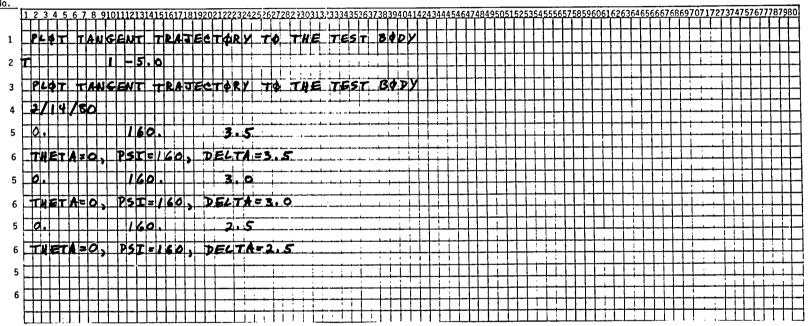






TANTRA

Card No.



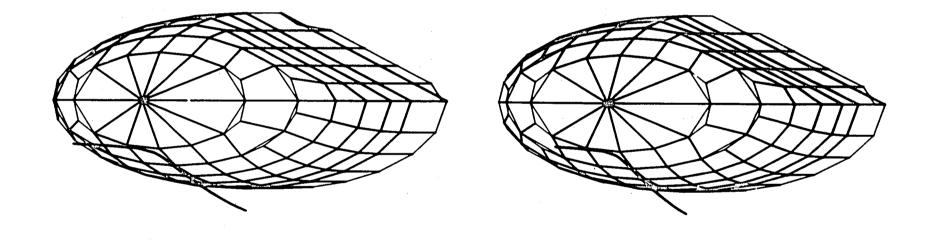


Figure 9. Stereographic plot of the tangent trajectory of a 200  $\mu m$  diameter water drop to the lower side of the test body in the y = 0 plane. Plotted from the results of the TANTRA test problem. Three-dimensional perspective can be attained by staring at the center of the figure and then crossing the eyes such that the two images merge.

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### MICROFICHE SUPPLEMENT TO NASA CR-3291

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### EXAMPLE PROBLEM PRINTOUT

**PBOXC** 

PROGRAM PBOXC

ATHOSPHERIC SCIENCE ASSOCIATES
BEDFORD, MASSACHUSETTS

PAGE 1

BODY ID. TEST

TEST BOCY

PARAMETRIC INFORMATION

NO SYMMETRY SPECIFIED
PLOTS ARE PREPARED

N

PROGRAM PBOXC
BODY ID. TEST

# ATPOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSAGHUSETTS

PAGE

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	-1.6528						
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NX	NP X	D
NY	NP Y	T
NZ	NP Z	A
•390089	1.241719	.0288E-02
•65217u	1.652830	.6561E+00
•650004	.414680	.1846E+00
• 324 553	1.241630	.6043E-02
• 447ûû 6	1.351646	.6814E+00
• 833 577	.631851	.2159E+00
.288J09	1.242990	•4216E-02
.287154	.985715	•66C0E+00
.913561	.786135	•2025E+00
.270929	1.250160	.2656E-02
.163401	.600088	.6744E+00
.948629	.876683	.21(8E+00
.261384	1.250117	.7710E-03
.052527	.201126	.6594E+00
.963805	.922194	.2075E+00
•126140	1 • 24 6 J 98	.3153E-01
••312996	- • 19 9 5 6 6	.67 (8E+40
•941341	• 36 7 1 6 7	.2125E+00
0.000000	1.250000	.3553E-14
447214	600000	.67ü8E+00
.894427	.700000	.2236E+ü0
0.00000	1.250000	.3553E-14
447214	-1.000060	.6708E+00
.894427	.500000	.2236E+00
0.050000	1.250000	.6661E-14
447214	-1.400000	.67(8E+10
.894427	.30000	.2236E+00
•159008	1.216789	.3975E-01
•593315	-1.739216	.6748E+00
•789109	.102018	.1685E+00
•435365	1.220560	.5764E-02
•855263	-1.831729	.6416E+00
•281038	149900	.1708E+00
.390089	1.241719	.8288E-02
.652170	-1.652830	.6561E+00
.650004	414680	.1846E+00

## ATMOSPHERIC SCIENCE ASSOCIATES BEOFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

TEST BODY

			TEST	RODA			
N	M	×	X	<b>X</b>	<b>X</b>	NX	NP X
		Y	Y	Υ	Y	NY	NP Y
		, <b>Z</b>	2	54 € <b>Z</b>	Z	NZ	NP Z
2	14	1.500000	1.500000	1.000000	1.000000	• 324553	1.241630
		-1.460000	-1.140000	- 1. 200000	-1.600000	447996	-1.351646
		465900	652000	800000	600000	830577	631851
	15	1.530000	1.500000	1.000000	1.000000	.286889	1.242990
		-1.140000	600000	800000	-1.200000	287154	98 5715
		652000	768100	916500	890000	913561	786135
	16	1.500000	1.500000	1.000000	1.00000	.278929	1. 250180
		800000	460000	400000	830000	163401	600088
		768100	842600	979800	91650 <b>0</b>	948629	876583
	17	1.500000	1.500000	1.000000	1.000000	.261384	1.250017
		400000	0.000000	0.000000	400000	052527	200026
		84269C	866000	-1.000000	979800	963805	922094
	18	1.500000	1.500000	1.000000	1.090000	-261384	1.250017
		0.00000	. 40 00 00	.400000	0.00000	.052527	• 200026
		866000	- 842600	979800	-1.000000	963805	922094
	19	1.500000	1.500000	1.00000	1.630660	•276 92 9	1.250180
6		•40000 G	.883000	.800000	. 400000	.163401	.600088
		842600	768100	+•9165û0	979800	948629	876683
	20	1.500000	1.500000	1.000000	1.600000	-288009	1.242990
		.800000	1.146000	1.200000	.600000	.287154	• 98 5715
		768100	652000	800000	916500	913561	78 6135
	21	1.500000	1.500000	1.000000	1.000000	•324553	1. 241630
		1.140000	1.460000	1.600000	1.200000	• 447006	1.351646
		652000	465900	600000	800000	833577	631851
	22	1.500000	1.500000	1.000000	1.000000	.390089	1.241719
		1.463000	1.670000	1.870000	1.600000	652170	1. 65 28 30
		465900	229700	354600	630000	650004	41 4680
	23	1.500000	1.500000	1.000000	1.000000	. 435365	1.220560
		1.670000	1.732000	2.000000	1.870000	.855263	1.631729
		229700	0.060000	0.000000	354600	281038	149900
3	1	1.000000	1.600900	0.00000	0.00000	0.000000	• 50 0 0 0 0
		2.000000	1.870000	1.870000	2.000000	•938893	1.935000
		0.000000	.354600	.354600	1.000000	.344208	• 177300
	2	1.000000	1.000000	0.00000	0.00000	0.000000	.500960
		1.870000	1.600000	1.600000	1.870000	.672591	1.735000
		.354600	.600000	•604000	.354600	.740014	.477300
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600000	633577	631851	•21796+00
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-1.200000	287154	985715	.6600E+00
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1.600000	.270929	1.250180	.2656E-02
810000	163401	600088	.6744E+u0
916500	948629	- 876683	.21 £8E+80
1.00000	.261384	1.250017	.7710E-03
400000	052527	200026	.6594E+00
979800	963805	922094	.20 75E+00
1.00000	. 261 38 4	1.250017	.7710E-03
0.00000	.052527	.200026	.6594E+00
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.498000	.163401	.600088	. E744E+00
979800	- 948629	876683	. 21 08 E+ 00
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800000	833577	631851	.2159E+00
1.600000	.390089	1.241719	.8288E-02
1.600000	.652170	1. 65 28 30	.65 E1E+00
610000	650004	41 468U	.1846E+00
1.00000	435365	1.220560	.5764E-02
1.670000	.855263	1.831729	.6416E+00
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2.000000	.938893	1.935000	.1069E+01
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0.000000	0.000000	.500000	.4885E-14
1.870000	.672591	1.735040	.10 E4E+01
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		Z	2	Z	Z	NZ	NP Z
3	3	1.0000000	1.000000	0.000000	<b>3.00000</b>	0.000000	• 58 u 0 0 <b>0</b>
		1.600000	1.200000	1.200000	1.600000	.447214	1.400000
		•600000	.800000	.860000	.600000	.894427	.700000
	4	1.000000	1.000000	0.00000	u • 0 0 0 0 0	0.00000	. 50 0 0 0 0
	*	1.200000	.800000	.800000	1.200000	.279631	1.000060
		.800800	.916500	.916500	.80u00 <b>0</b>	.966107	. 85 82 50
	5	1.000000	1.000000	0.00000	0.00000	0.000000	50000
	,	.800000	• 48 0000	• 400000	.80000	•156305	• 50 0 0 0 0 • 60 0 0 0 0
		.916500	.979800	979800	.916500	.987789	.948150
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		.800000	.600000	.600000	.800000	.894427	.70000
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		800000	-1.200000	-1.200000	800000	447214	-1.000000
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		-1.600000	-2.006000	-2.000000	-1.600000	447214	-1.800000
		- 500000	0.600000	0.000000	• 20000	.894427	. 10 00 00
	12	1.000000	1.000000	0.000000	J. 600 600	8.000000	• 50 00 4 0
		-2.000000	-1.870000	-1.870000	-2.000000	1938893	-1.935000
		0.000000	354600	354600	0.00000	344208	177300
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	14	1.900000	1.000000	0.00000	0.00000	0.00000	.500000
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14	N	<b>X</b>	×	X	r x i i i i	NX	NP X
		- <b>Y</b>	<b>Y</b>	Y	<b>Y</b>	NY	NP Y
		Z	Z	2	<b>Z</b>	NZ	NP Z
3	15	1.000000	1.000000	0.00000	6.00000	0.00000	-500000
		-1.200000	800000	800000	-1.200000	279631	-1.000000
		800000	916500	916500	810000	960107	858250
	16	1.000000	1.060000	0.000000	0.000000	0.00000	. 500000
		800000	400000	400000	800000	156305	600000
		916500	979800	979800	916500	987709	948150
	17	1.000000	1.000000	0.00000	0.00000	0.00000	. 50 0000
		400000	0.000000	0.000000	400000	050436	200000
		979830	-1.000000	-1.000000	979800	998727	989900
	18	1.000000	1.060000	0.000000	0.00000	0.00000	. 50 0000
		0.00000	.400000	.400000	0.00000	.050436	.200000
		-1.000000	979800	979800	-1.000000	998727	989900
	19	1.000000	1.600000	0.000000	0.00000	0.00000	.500000
		.400.000	.800000	.800000	. 400000	.156305	.600000
		979800	916500	916500	979840	987709	948150
	20	1.000000	1.000000	0.000000	9.600000	0.00000	.500000
$\infty$		.800000	1.200000	1.200000	.800000	.279631	1.000000
		916500	800000	800000	916500	960107	858250
	21	1.000000	1.060000	0.060000	0.600000	0.00000	.500000
		1.200600	1.600000	1.600000	1.200000	.447214	1.450000
		800000	600000	600000	800000	894427	700000
	22	1.000000	1.000000	0.00000	0.00000	0.00000	. 500060
		1.600000	1.870000	1.870000	1.680000	.672591	1.735000
		600000	354600	354600	600000	740014	477300
	23	1.000000	1.000000	0.000000	0.000000	0.00000	. 50 0000
		1.870000	2.083000	2.000000	1.870000	.938893	1.935000
		354600	0.000000	0.000000	354600	344208	177300
4	1	0.000000	0.000000	500000	500000	049532	248068
	~	2.000000	1.870000	1.850000	1.972000	.939127	1.923092
		0.000000	.354600	.341500	0.00000	.339988	.174052

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NZ	NP Z	A
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		1083E+01
		-4166E+00
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0.000000	. 500000	•2442E-14
·		•1079E+01
987709	948150	•4050E+00
0.00000	. 50 0000	•5551E-16
		.1077E+01
998727	989900	.4005E+00
		•3553E-14
		•1077E+01
998727	989911	.4005E+00
0.000000	. 500000	.2228E-14
		.1079E+01
the state of the s	•	.4050E+00
0.00000	.500000	.3109E-14
		•1083E+01
960107	858250	•4166E+80
0.00000	.500000	•6661E-14
		.1095E+01
		.447 2E+ 60
	:	
0.000000	. 500000	.6217E-14
•672591	1.735000	• 10 64E+01
740014	477300	• 3649E+00
0.00000		•6217E-14
		.1069E+01
		-3777E+00
049532		•7648E-03
		.6238E+00
•33998ů	.174052	.1853E+00
043145	249477	.7887E-03
675158	1.726269	.6205E+00
.736411	•470688	.1816E+00
		.6327E-03
		.6693E+00
•892614	. 69 27 74	•2213E+00
	NY NZ  0.00000279631960107  0.00000156305987709  0.000000050436998727  0.000000156305987709  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107  0.000000279631960107	NY NZ NPY NPZ  0.000000

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NX	NP X	Ö
NY	NPY	T .
NZ	NPZ	<b>A</b>
031043	249537	.4237E-03
.281449	• 998756	.6507E+00
.959674	.850538	.2072E+00
029218	250016	.2468E-03
•157442	.600001	.2026E+00
.987096	.948749	
028252	250002	.7487E-04
.050789	. 20 0 0 0 0	.6412E+00
.998 310	• 98 28 25	.2003E+00
012698	249496	.3152E-02
434526	199997	.6708E+00
.900571	.896509	.2221E+00
0.000000	250000	.3553E-14
447214	690000	.6768E+00
.894427	.700000	.2236E+00
0.000000	25 0 0 0 0	.3553E-14
447214	-1.000010	.6748E+00
.894427	.500000	.2236E+00
0.000003	250000	.6661E-14
447214	-1.400000	.6708E+00
.894427	.360300	·2236E+00
012880	247831	.3220E-02
460010	-1. 79 30 15	.6708E+00
.887820	.100024	.2174E+00
049532	248068	.7648E-03
939127	-1.923092	.6238E+00
339981	17 40 52	.1853E+00
043145	249477	.7887E-03
675158	-1.726269	.6205E+00
736411	-4470688	.1816E+00
034875	249169	.6327E-U3
449471	-1.395016	.6693E+00
892614	692774	•2213E+00
031043		.4237E-03
281449	998756	.6507E+CO
- 959074	850538	.2072E+00

### ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

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			,	TEST	BODY		:	
	N	M	X	×	X	<b>X</b>	, <b>NX</b> :	NPX
			Y			Ŷ	NY	NPY
			ż	Y Z	4 mm ia	<b>-</b>	NZ	NPZ
			<del></del>	•	i	. <b>€</b>		141 &
	4	16	0.00000	0.000000	500000	500000	029218	250016
			800000	400000	400000	- 80000	157 442	600001
			916500	979800	965500	901200	987096	940749
		17	0.000000	0.000000	_ 50000	- 50000	# 20 2E 2	050000
		11	400000	6.000000	50000	500000	028252	250002
			979800	-1.060000	0.000000	400000	050789	+ . 20 00 00
			3/3000	-1.000000	986000	965500	998 310	38 28 25
		18	0.00000	U.000000	50000¢	500000	028252	250002
			0.000000	. 480000	4.400000	0.000000	.050789	. 200000
			-1.000000	979800	965500	986000	998310	98 28 25
					•			
		19	9.000000	0.000000	500000	500000	029218	25 0 0 1 6
			. 400000	.800000	.800000	• 40000 <b>0</b>	.157442	.600001
			979800	91,5500	901200	-• 96550 <b>0</b>	987496	940749
		20	0.000000	0.000000	- 500000	500000	674667	0.0539
		20	.800000	1.200000	500000 1.195000	500000 .800000	031043 .281449	-• 249537 • 998756
			916500	600000	784400	901200	959074	850538
			<b>432</b> 020 <b>4</b>				- 6 3 2 3 0 1 4	- 6056930
		21	0.000000	0.060000	500000	500000	034875	249169
10			1.200000	1.600000	1.585000	1.195000	.449471	1.395016
_			800000	600000	586600	784400	892614	692774
						: ميدفقي		
		22	0.00000	0.000000	500000	500000	043145	249477
			1.600000 600000	1.870000	1.850000	1.585000	•675158	1.726269
		,	000000	354600	341580	586600	736411	478608
17		23	0.00000	0.000000	500000	500000	049532	248068
			1.870000	2.000000	1.972000	1.850000	.939127	1.923092
			354600	0.000000	0.00000	341500	33998u	174052
	5	1	500000	500000	-1.000000	-1.000000	153543	743334
			1.972000	1.850000	1.785000	1.885660	• 934141	1.874150
			0.000000	.341500	•303900	0.00000	•322188	• 161626
		2	500000	50000			4705)	
		2	500000 1.850000	500000 1.585000	+ :. 000000	-1.000000	132740	747309
			•341500	•586600	1.540000	1.785000	•683173	1.690281
			•34T266	• >0 0000	. 544000	• 303900	.718091	• 444215
		3	500000	500000	-1.000000	-1.600000	108809	747752
			1.585000	1.195000	1.175000	1.540000	457325	1.373892
			.586600	.784400	.737400	• 544000	.882618	663304
				<b></b>		en e		
		4	500000	50 0000	-1.000000	-1.000000	095703	747958
			1.195000	.800000	.800000	1.175000	288525	• 992572
1 . 4			.784400	.901200	.853860	.737400	.952677	• 81 9383

<b>X</b> :	NX NY	NP X	Ċ.
Ż	NZ	NPY NPZ	T A
500000	029218	250016	.2468E-U3
80000	157442	600001	.6451E+C0
901200	987096	940749	.2026E+00
500000	U28252	- 250002	•7487E-04
400000	U50789	- 200000	•6412E+00
965500	998310	- 382825	•2003E+00
50 C00 0	028252	- 250002	.7487E-04
<b>00 C</b> 00 0	.050789	- 200000	.6412E+00
98600 0	998310	- 982825	.2003E+00
500000	029218	25 u 0 1 6	.2468E-03
400000	.157442	.60 0 0 0 1	.6451E+00
965500	987196	94 0 7 4 9	.2026E+00
500000	031043	- 249537	.4237E-03
800000	.281449	998756	.6507E+00
901200	959074	- 850538	.2072E+00
500000	034875	249169	.6327E-03
195000	.449471	1.395016	.6693E+00
784400	892614	692774	.2213E+00
500000	U43145	249477	.7887E-03
585000	.675158	1. 726269	.6205E+00
586600	736411	470608	.1816E+00
500000	049532	248068	•7648E-03
850000	.939127	1. 923092	•6238E+00
341500	339980	174052	•1853E+00
000000	153543	743334	.1969E-02
885600	.934141	1.874150	.6143E+00
000000	.322188	.161626	.1727E+00
000000	132740	-•747369	.2518E-02
785000	.683173	1•690281	.6222E+00
303900	.718091	•444215	.1776E+00
000000	108809	747752	.1887E-02
540000	.457325	1.373892	.6640E+00
544000	.882618	.663304	.2139E+00
000000	095703	747958	•1347E+02
175000	-288525	.992572	•6461E+00
737400	-952677	.819383	•2021E+00

PRO	GRAM P	DUXU	ATP	OSPHERIC SCI Bedford, Mas	ENCE ASSOCIATE	:S	P
80	DY ID.	TEST		CLUI ONUS MA	JUNUIU35113		<b>F</b> ' (
	_		TEST	BODY		r en	
N	M	X	×	X	X Y	NX	NPX
		Y Z	Y Z	. <b>Y</b> . Z	Y Z	NY NZ	NP Y NP Z
		<b>£-</b> :	. •	4	<b>4</b>	NZ	14F Z
5	5	500000	500000	-1.000000	-1.600900	089915	7500
		.80 <u>9000</u>	400000	•400000	.800000	.162020	. 60 0 1
		.901200	• 9655 <b>00</b>	•921400	. 853800	.982682	.9104
	6	500000	500000	-1.000000	-1.00000	066851	7501
		.400000	0.000000	0.00000	. 400000	.05210 €	.2000
		.965500	.986000	.9428¥0	921400	• 994858	• 95 39
	7	500000	50 GO QU	- 1. 000000	-1.000000	039925	7489
	-	0.000000	400000	400000	0.00000	379842	1999
		.986000	.800000	.800000	.94280C	.924189	. 88 22
	8	500000	500000	- 1.000000	-1.000000	0.00000	7500
		400000	800000	800000	400 60 0	447214	6001
		.800000	.6C0000	.600000	. 800000	.894427	.7000
	9	500000	560000	- 1.000000	-1.030000	0.00000	75 04
	-	800000	-1.200000	-1.200000	800000	447214	-1.000
		.600000	. 400000	.400000	.600000	.894427	• 50 00
	10	500000	550000	-1.000000	-1.000000	0.000000	750
<del></del>	•	-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.4000
		• 4 0 0 0 0 0	.200000	.200000	• 400 00 0	.894427	- 36 0 8
	11	500000	500000	-1.000000	-1.000000	044855	7413
		-1.600000	-1.972000	-1.885600	-1.600000	519160	-1.7647
		. 200900	0.000000	0.00000	. 200000	.853499	. 1002
	12	500000	500000	- 1. 000008	-1.000000	153543	743
		-1.972000	-1.850000	-1.785000	-1.885630	934141	-1.8741
		0.00000	341500	303900	0.00000	322188	1616
	13	500000	500000	- 1.000000	-1.000000	132740	7473
		-1.850000	-1.585000	-1.540000	-1.785000	683173	-1.6902
		341500	586600		303900	718091	44 46
	14	500000	500000	- 1.000000	-1.000000	158869	7477
		-1.585000	-1.195000	-1.175000	-1.540000	- 457325	-1.3738
		586600	- • 784400	737400	544000	662618	66 33
	15	500000	500000	-1.000000	-1.00000 <b>0</b>	095703	7479
	*	-1.195000	600000	800000	-1.175000	288525	- 992
		784400	901200	853800	737400	952677	8193

- 1. 000000

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-.901200

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X	NX	NP X	, <b>D</b>
Y	NY	NP Y	<b>.</b> T
Z	NZ	NP Z	A
<b>G</b> 0 0 0 0 0	089915	750055	.8107E-03
800000	.162020	.600009	.6500E+00
853800	•982682	•913468	.2035E+00
00000	086851	750005	2226-07
400000	.05210 E	200003	.2238E-03
921400	994858	• 95 39 24	•20 10E+00
0.0000	039925	748551	.9981E-02
900000 942800	379842	199961	•66E8E+40
9420UU	.924189	.882279	•2164E+00
00000	0.00000	750000	.3553E-14
40000	447214	600000	.6708E+00
800000	.894427	.700000	-2236E+00
000000	0.00000	75 0 0 0 0	•3553E-14
B00000	447214	-1.0000000	•6708E+00
600000	.894427	.50000	.2236E+00
00000	0.000000	750000	.66 E1E-14
200000	447214	-1.400000	67 C8E+UO
<b>400000</b>	.894427	.300000	.2236E+00
00000	044855	741375	44.54.5-04
00000	519160	-1.764760	•1121E-01 •6545E+00
200000	.853499	.100234	•1926E+ú0
0.0000	Araria		
100000 185600	153543 934141	743334	•19 69E-02
00000	322188	-1.874150 161626	•6143E+00
	0022200	101050	•1727E+00
0000	132740	747389	-2518E-02
85000	683173	-1.690281	•6222E+00
03900	718091	44 4215	•1776E+00
0000	118809	747752	.1887E-02
40000	- 457325	-1.373892	.6640E+00
44000	882618	-• 66 33 u 4	•2139E+00
0000	095703	747958	•1347E-02
75000	288525	- 992572	•6461E+00
37400	- 952677	- 819383	.2021E+00
80000	089915	750055	•8107E-03
00000	162020	-。600009	•6500E+00
53800	982682	91 0 4 6 8	.2035E+00
<b>E</b> *		·	

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.857948

-.170981

.304683

.936981

-.159881

.172638

• 971 923

-1.245068

-1.245783

-1.250120

1.329324

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: X		-	• • • •	NP X NP Y	0 T
Y Z				NP Z	A
			_		
- 1.0000			-	, , ,	.2238E-03
0.0000				1	• 6436E+80
9428	uu9	21400	994858 -•	953924	20108+00
-1.0000	00 -1.0	00000	086851	750005	.2236E-03
.4000	0.0	00000 .	052106 .	200003	.6436E+00
9214	9	42880	994858	953924	.2010E+00
4 0000	: :0.6 = 4 b	80000	0.004.5	75 11 0 5 5	94: 75-07
+ 1.0000 8000					.8117E-03 .6516E+00
8538					2035E+00
• • • • • • • • • • • • • • • • • • • •			, 02 00 2	,	
-1.0000	00 -1.0	00000	095703	747958	1347E-02
1.1750			<del></del>		.6461E+00
7374	8	53800	952677	819383	2021E+00
- 1.0000	nn -4	00200	108809	747752	1887E-02
1.5400					66 40 E+ CO
- 5440					2139E+00
-1.0000	00 -1.0	00000	132740		2518E-02
1.7850					.6222E+00
3039	00 7.5	44000	718 191	444215	.1776E+00
-1.0000	nn -1.6	00000	153543	743334	1969E-02
1.8856			· . · · · · · · · · · · · · · · · · · ·		6143E+00
0.0000	-			161626	.1727E+00
	i i i i i i i i i i i i i i i i i i i				
-1.5000					3684E-02
1.6700					.5910E+00
• 2297	0 0 U	00000	280799	134912	•1448E+30
-1.5000	ΰ0 -1.5	00000	239065 -1.	245329	5490E-02
1.4600				£1 46 91	.6180E+00
• 4659		29700 .	670724 .	38 65 55	.1696E+00
			: 4:A. A. A	8/ 5000	*******
- 1.5000 1.1400				7, 7 . –	.3782E-02 .6494E+00
6520					1996E+00
# U549	• • • • • • • • • • • • • • • • • • •		• >1 > 7 0	GUUCE!	
1.5000	00 -1.5	0000	170981 -1.	245783	.2596E-02
.8000					6374E+00
-7681	.00 .6	52000 .	936981 .	753512	.1908E+00
		20656	4 5 0 0 0 4	350438	4,5995 85
-1.5000				**	.1677E-U2 .6584E+00
• 4000 • 8426					·2058E+00
. 0420	• •	•	J1 & JE U		
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-. 642600

-.055250

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-.280010

-.893198

-.400000

-.921400

8.800000

-.942800

ST BODY

	X	X	NX	NP X	D
	Y	Y	NY	NP Y	T
	Z	Z	NZ	NP Z	A
00	-1.500000	-1.500000	153515	-1.250012	.4933E-03
00	0.00000	.40000	.055250	.200010	.6481E+00
00	.866000	.842600	.986601	.893198	.2027E+00
00	-1.500000	-1.500000	074106	-1.248100	.1853E-01
00	40000	0.00000	251846	199835	.6560E+00
00	.800000	.866000	.964926	.852389	.2073E+00
00	- 1.50000	-1.500000	0.060000	-1.250000	.3553E+14
	80000	400000	447214	60000	.6708E+00
	.60000	.800000	.894427	.700000	.2236E+00
00 00	-1.50000 -1.20000 .40000	-1.500000 600000 .600000	0.060090 447214 .894427	-1.250000 -1.000000 .500000	.3553E-14 .6708E+00 .2236E+00
00	-1.500000	-1.500000	0.000000	-1.250000	.6661E-14
00	-1.600000	-1.200000	447214	-1.400000	.6708E+60
00	.20000	.400000	.894427	.300000	.2236E+60
00	-1.500000	-1.500000	105654	-1.225923	.2641E-01
00	-1.732000	-1.600000	687853	-1.707445	.6096E+00
00	0.000000	.200000	.718119	.100626	.1454E+00
00	-1.501000	-1.50000	268347	-1. 229655	.3684E-02
00	-1.673000	-1.732000	921489	-1. 773614	.5910E+60
00	229700	0.000000	260799	134912	.1448E+00
0 0 0 0	- 1. 500000 -1. 460000 465900	-1.500000 -1.670000 229700	- 239065 - 702123 - 67u724	-1.245329 -1.614691 386555	.5490E-02 .61 80E+00 .1696E+00
00	-1.50000	-1.500000	194936	-1.245068	.3762E-02
	-1.140000	-1.460000	475316	-1.329324	.6494E+00
	652000	465900	857948	600627	.1996E+00
10	-1.503000	-1.500000	170981	-1.245783	.2596E-02
	800000	-1.140000	304683	979044	.6374E+00
	768100	652000	936981	753512	.1908E+00
) ()	-1.500000	-1.500000	159881	-1.250120	.1677E-02
()	40000	800000	172638	600034	.6584E+00
()	842600	768100	971923	846449	.2058E+00
0 0 0	-1.500000	-1.50000	153515	-1.250012	.4933E-03
	0.000000	40000	055250	200010	.6481E+00
	866000	842600	986601	893198	.2027E+00

#### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

				TEST	BODY			: :
1	N	M	×	x	×	X	NX	NPX
			Υ	Y	11.11.1 <b>Y</b>	Y	NY	NPY
			<b>Z</b>	2	Z	<b>Z</b>	NZ	N <sub>2</sub> Z
	6 1	18	- 1. 009000	-1.000000	-:.500000	-1.500000	153515	-1.250012
			0.000000	.40000	.400000	0.00000	.055250	.200010
			942800	921400	842600	866000	986601	893198
	1	19	-1.000000	-1.000000	-1.500000	-1.500000	159881	-1.250120
			.400000	.800000	.830000	.400000	.172638	·60u034
			921490	853800	768100	842600	971923	846449
	2	20	-1.000000	-1.000000	-1.500000	-1.500000	170981	-1.245783
			.800000	1.175000	1.140000	.800000	• 304 68 3	.979004
			853800	737400	652000	766100	936981	753512
	2	21	-1.000000	-1.000000	-1.500000	-1.500000	194936	-1.245068
			1.175000	1.540000	1.460000	1.140000	.475316	1.329324
			737400	544000	465900	652000	857948	600627
	2	22	-1.330000	-1.000000	-1.500000	-1.500000	239065	-1.245329
			1.540000	1.785000	1.670000	1.460000	.792123	1. 61 46 91
L			544000	303900	229700	465900	676724	<b></b> 38 65 5 5
	2	23	-1.000006	-1.300000	-1.500000	-1.500000	268347	-1.229655
			1.785000	1.885600	1.732000	1.670300	.921489	1. 77 3614
			303900	0.000000	0.00000	229700	280799	134912
•	7	1	-1.500000	-1.500000	-2.000000	-2.000000	414479	-1. 699678
			1.732000	1.670000	1.465000	1.490700	.885202	1.611865
			0.00000	.229700	.137800	0.000000	.211244	• 096576
		2	-1.500000	-1.500000	-2.300000	-2.000000	372374	-1.733772
		-	1.673000	1.460000	1.322000	1.465000	.725701	1.434752
•			.229700	.465980	.344400	.137800	.578529	. 297994
		3	-1.503000	-1.500000	-2.000000	-2.00000	310024	-1.738932
		Ų	1.465000	1.140.000	1.072000	1.322000	-507279	1.256730
			• 465918	65 2000	•517900	.344400	•804685	• 497910
		t.	-1.500000					
		4	1.140000	-1.500000 -800000	-2.000000 80000	-2.000000 1.672000	269527	-1. 73 82 66 . 95 4 8 5 4
			1.140000 .652000	• 80 0000	.800000 .628900	1.072000 .517900	•335023 •902837	• 954 <b>0</b> 54 • 644837
				e attua				• <b>04 40 3 (</b>
		5	-1.500000	-1.500800	-2.000000	-2.600000	250229	-1.750276
			.800000	. 40 30 00	. 400000	.80000	.193980	.600104
			.768100	.842600	.718000	.628900	• 948555	.739306
		6	-1.500000	-1.500000	- 1.000000	-2.000000	237694	-1.750025
			.400000	0.000000	0.00000	. 400000	.061556	. 200030
			.842600	.866000	.745400	.718000	.969388	• 792992

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NP X

TEST BODY

	enak tak	Ŷ	NY	NPY	•
	7	Ž	NZ	NP Z	· T
	<b>4</b>	4	11/2	N- Z	•
0000	-1.500000	-1.500000	153515	-1.250012	.4933E-03
6000	• 480000	J. U 00000	.055250	200010	.6481E+00
1400	842600	866000	986601	893198	-2027E+00
	***************************************		0,00002	0000200	
0000	-1.500000	-1.500000	159881	-1.250120	-1677E-82
0000	.830000	. 400000	.172638	• 60 u 0 34	.6584E+00
8800	768100	842600	971923	846449	.2056E+00
0000	-1.500000	-1.500000	170981	-1.245783	.2596E-02
5000	1.140000	.800000	.304683	979004	.6374E+00
7400	652000	768100	936981	753512	.1908E+00
					1
0000	-1.500000	-1.500000	194936	-1.245068	.3782E-02
0000	1.460000	1.140000	• 475316	1.329324	.6494E+00
.000	465900	652000	857948	600627	.1996E+80
0000	-1.500000	-1.500000	239065	-1.245329	.5490E-02
<b>0</b> 00	1.670000	1.460000	•792123	1. 61 46 91	.6180E+08
<b>900</b>	229700	465900	- 678724	38 65 55	.1696E+00
000	-1.500000	-1.500000	268347	-1.229655	•3684E-02
600	1.732000	1.670300	.921489	1.77 3614	.5910E+00
000	0.00000	229700	280799	134912	•1448E+00
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000	-2.000000	-2.000000	- • 414479	-1. 699678	•3180E-02
000	1.465000	1.490700	.885202	1.611865	•5833E+00
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			· · · · · · · · · · · · · · · · · · ·		
000	-2.000000	-2.000000	372374	-1.733772	.7874E-02
000	1.322000	1.465000	.725701	1.434752	•6199E+80
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0 0 0	-2.000000	-2.000000	310024	-1.738932	.6345E-02
000	1.072000	1.322000	.507279	1.256730	•6350E+00
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	6 465046	2 02000	0.050	4 99 00 4	
000	-2.00000	-2.000000	269527	-1. 73 82 66	.4544E-02
	.800000	1.072000	•335023	954054	.6218E+00
100	•628900	.517900	.902837	• 64 48 37	.1695E+00
000	-2.000000	-2.600000	250229	-1.750276	-34 E2E-02
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0.00	-:.000000	-2.000000	237694	-1.750025	-9694E-13
000	0.00000	.400000	.061556	.200030	•6572E+00
000	.745400	.718000	969388	792992	.2063E+00
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PRO	GRAM	PBOXC	ATM		IENCE ASSOCIATE	<b>S</b>	especial desirabilities
80	DY I	D. TEST	Charles The Charles	BEDFORD, M	ASSACHUSETTS		PA
		_ · · · · · · · · · · · · · · · · · · ·	TEST	BODY		<i>t.</i>	()
N	M	X	×	X	<b>X</b>	NX	NPX
		Y Z	Y Z	Y Z	<b>Y Z</b>	NY NZ	NPY NPZ
7	7	-1.500000	-1.500000	-2.000000	-2.000000	197278	-1.7495
		0.000000	480000	400000	0.000000	113683	1997
		•86600D	.80000	.718000	. 745400	•973734	.7824
	8	-1.500000	-1.500000	-2.000000	-2.00000	075980	-1.7473
		400000	800000	800000	-+400000	368319	59 98
		.800000	.600000	.600000	.718000	•926589	• 67 97
	9	-1.500000	-1.500000	-2.000000	-2.00000	0.000000	-1.7500
		890000	-1.200000	-1.200000	800000	447214	-1.0000
		.600000	. 400000	.400000	.600000	.894427	. 50 0 0
	10	-1.500000	-1.500000	- 1.000000	-2.000000	050829	-1.7204
		-1.209000	-1.600000	-1.400000	-1.200000	496741	-1.3528
		. 4000 a c	. 200000	.256000	. 400000	. 866 49 9	.3141
	11	-1.500000	-1.500000	- 2.000000	-2.010000	348.626	-1.7625
		-1.600000	-1.732000	-1.498700	-1.400000	842191	-1.5505
		-200000	0.000000	0.00000	.256000	·411387	• 11 39
15	12	-1.500000	-1.500000	- 2.000000	-2.000000	414479	-1. 6996
ပၢ		-1.732000	-1.670000	-1.465000	-1.496700	885202	-1.6118
		0.000000	229700	137800	0.000000	211244	0965
	13	-1.500000	-1.500000	-2.000000	-2.00000	372374	-1.7337
		-1.670000	-1.460000	-1.322900	-1.465000	725701	-1 - 48 47
		229700	465900	344400	137800	578529	2979
	14	-1.500000	-1.500000	-2.000000	-2.00000	310024	-1.7389
		-1.460000	-1.140000	-1.072000	-1.322000	507279	-1.2507
		465900	- 65 2000	517900	344400	804085	4979
	15	-1.500000	-1.500000	- 2.000000	-2.000000	269527	-1.7362
		-1.146000	800000	800000	-1.072000	335023	9540
		652000	768100	62890Û	517900	902837	6448
	16	-1.500000	-1.500000	- 2.000000	-2.000000	250229	-1.7582
		800000	400000	400000	800000	193980	6001
		768100	842600	718000	628900	948555	73 93
	17	-1.500000	-1.500000	-2.000000	-2.000000	237694	-1.7500
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18000	.745400	.973734	.782469	.2054E+00
0000	-2.00000	07598g	-1.747311	1066564
0000	400000	368319	59 9857	•1900E-01 •6708E+00
0000	.718000	•926589	• 67 97 77	.2158E+00
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10000	-2.000000	0.00000	-1.750000	.3553E-14
30000	830000	447214	-1.000000	.6708E+00
0000	.600000	.894427	. 50 0 0 0 0	• 2236E+00
0000	-2.000000	050829	-1.720409	.1271E-01
0000	-1.200000	496741	-1.352829	.6708E+00
560u0	.490000	.866409	.314114	.1731E+00
0000	-2.630060	348626	-1.762537	.1445E-81
00700	-1.406900	842191	-1.550513	.6525E+00
0000	.256000	.411307	• 11 39 43	•1354E+00
0000	-2.000000	414479	-1. 699678	•3180E-02
5000	-1.496700	- 885202	-1.611865	•5833E+00
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10000	-2.00000	372374	-1. 733772	797/5-43
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0000	-2.000000	269527	-1.738266	.4544E-02
8000	-1.072000	335023	95 40 54	.6218E+00
8900	517900	902837	-•644837	•1695E+00
0000	-2.000000	250229	-1.750276	-34 E2E-02
0000	800000	193980	600104	.675UE+00
B000	628900	948555	739306	.2108E+00
0000	-2.000000	237694	-1.750025	.9694E-03
0000	40 00 00	061556	- 200030	.6572E+00
5400	718000	969388	792992	.2063E+00
1000	-2.000000	237694	-1.750025	• 9694E+03
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1000	745400	969388	792992	.2063E+00
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PRO	IGRAM	PBOXC	ATM	OSPHERIC SCIE BEDFORD, MAS	ENCE ASSOCIATE SSACHUSETTS	S	in the state of th
80	DY ID	. TEST	TEST	1.8		**	
N	М	<b>X</b>	<b>X</b>	. <b>X</b>	<b>X</b> .	NX	NP
		Y Z	Y	. <b>Y</b>	Υ	NY	NP
		L	<b>Z</b>	Z	<b>Z</b>	: NZ	NP
7	19	-1.500000	-1.500000	-2.000000	-2.000000	250229	-1.75
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			-9100200		4 :	• 340,77	
	20	-1.503000	-1.500000	- 2.000000	-2-000000	269527	-1.73
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		1.140000 652000	1.460000 465900	1.322000 344400	1.4720 <b>00</b> 51790 <b>0</b>	.507279 804085	1.250 497
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		465900	229700	1378ÜÜ	344400	578529	297
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	23	-1.500 <b>00</b> 0 1.670000	-1.500000 1.732000	-2.000000 1.490700	-2.000000 1.465000	414479 .885202	-1.699 1.611
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8	1	-2.000000	-2.001000	- 2.500000	-2.500000	597981	-2.218
		1.490700	1.322000	1.000000	1.055000	.747834	1.246
		0.000000	.344400	.235700	0.000000	. 288 38 2	. 149
	2	-2.000000	-2.000000	-2.500000	-2.500000	- 425912	-2.214
		1.322000 .344400	.800000 .628900	.80000 .381560	1.000000 .235700	• 463200 • 777203	990
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	3	-2.000000	-2.000000	-2.500000	-2.500000	397801	-2.250
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34441	00	.235700	0.000000	• 263 38 2	• 149617	. 1939E+88
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, 62 891	0.0	.381560	.235700	•777203	• 411267	.2322E+00
. 00000	00 °-	2.500000	-2.500000	397801	-2.250969	.9877E-02
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8000	96	0.000000	. 400000	.075569	.200101	.6805E+00
<b>74</b> 57	00	.552800	•515300	•927222	632913	•2157E+00
. <b>06</b> 00	0 a -	2.500000	-2.500000	366839	-2.250072	.2272E-62
40 00		400000	0.000000	075569	200101	.68 05E+40
71 80		.515300	•55280 <b>0</b>	.927222	.632913	.2157E+00
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5000		.381500	.515300	.885102	• 553499	.2260E+00

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	8	-2.000000	-2.000000	-2.500000	-2.500000	537231	-2.212088	
		-1.200000	-1.490700	-1.055000	-1.000000	740960	-1.209729	
		.400000	0.00000	0.00000	.235700	•402941	• 166619	
	9	-2.000000	-2.0000000	-2.500000	-2.50000	597981	-2.218024	
		-1.490700	-1.322000	-1.000000	-1.055000	747834	-1.240723	
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Y	Y	NY	NPY	: <b>T</b>
Z	Z	NZ.	NP Z	A
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		1.35433	• 41 00 33	• 1886E+ 00
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55000	-1.000000	- 740960	-1.209729	•2711E-01
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00000	-2.500000	597981	-2.218024	47405 04
00000	-1.055000	747834	-1.240723	-1342E-81
35700	0.600000	288 38 2	14 9617	•7391E+60
		7-3000	- 4 74 207 (	•1939E+00
00000	-2.500000	425912	-2.214445	
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00000	-2.500000	397841	-2.250969	00775 00
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30000	-2.500000	366578	-2.250074	
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- · • •		-+111203	411287	.2322E+00
0000	-2.500000	- 507094		
5000	1.000000	597981	-2.218024	•1342E-01
0000	235700	•747834	1.246723	•7391E+00
~ 0 0 0	-• 233/UV	288382	149617	.1939E+00
	*****	**************************************	***	*******
	1			र के के के के <b>के के कि</b> 
0000	-3.000000	868756	-2.626833	<b>O</b> • salah
0000	0.00000	•411733	. 63 7692	•11 67E+01
9000	0.00000	.275208	.149145	•2316E+00
			· - · - · - · · -	

P	R	OG	RA	M	PB	OX	C
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# ATMOSPHERIC SGIENCE ASSOCIATES EEDFORD, MASSACHUSETTS

$\sim$	<b>D</b> V	* ^	<b>+-</b> ^+
80	U T	ID.	TEST

### TEST BODY

			1531	DUUT			•
N	· M	X Y Z	2	X Y Z	X Y Z	NX NY NZ	NP X NP Y NP Z
9	2	-2.500000 -800000 -381530	-2.500000 .40000 .515300	-3.000000 0.00000 0.00000	-3.00000 0.00000 0.00000	776209 .200002 .597912	-2.629 .434 .336
	3	-2.500000 .400000 .515300	-2.500000 0.000000 .552800	-3.00000 0.0000u 0.00000	000000 000000 000000 000000	740175 .062764 .669478	-2.635 141 .369
	4	-2.500000 0.000000 .552800	-2.500000 400000 .515300	-3.00000 0.00000 0.00000	-3.00000 0.00000 0.00000	740175 062764 .669478	-2. £35 141 . 389
	5	-2.500000 400000 .515300	-2.500000 800000 .381500	-3.00000 0.00000 0.00000	-3.000000 0.00000 0.00000	776209 200002 .597912	-2. 629 43 4 . 336
	6	-2.500000 800000 .381500	-2.500000 -1.055000 0.00000	-3.00000 0.00000 0.00000	-3.000000 0.00000 u.00000	868756 411733 .275208	-2.626 687 .149
18	7	-2.500000 -1.055000 0.000000	-2.500000 800000 381500	-3.000000 0.00000 0.00000	-3.00000 0.00000 0.00000	868756 411733 275208	-2 • 62 6 - • 68 7 - • 149
	8	-2.500000 800000 381500	-2.500000 400000 515300	-3.00000 0.00000 0.00000	-3.00000 6.506000 0.60000	776209 200002 597912	-2.629 434 336
	9	-2.500000 400000 515300	-2.500000 0.000000 552800	-3.060000 0.00000 0.00000	-3.00000 9.00000 9.00000	740175 062764 669478	-2.635 141 365
	10	-2.500000 0.00000 552800	-2.500000 .400000 515300	-3.000000 0.000000 0.00000	-3.900000 0.000000 u.000u00	740175 .062764 669478	-2 • 63 • 14 - • 38
	11	-2.500000 .400000 515300	-2.500000 .800000 361500	-3.000000 0.00000 0.00000	-3.00000 0.00000 0.00000	776209 .200002 597912	- 2 · 62 • 43 - • 33
	12	-2.500000 .800000 381500	-2.500000 1.055000 0.000000	-3.000000 0.000000 0.00000	-3.000000 0.00000 0.00000	868756 .411733 275208	-2 · 62 - 68 - · 14
		****	LARRENA		****	***	

FOLDOLD FRAME

X	NX	NP X	0
Ŷ	NY	NPY	Ť
Z	NZ	NPZ	Ä
2	112	141 2	
500000	776209	-2.629150	.1332E-14
00000	200002	. 43 41 70	.1018E+01
. 0 0 0 0 0 0	597912	. 33 6248	-1672E+60
		• • • • • • • • • • • • • • • • • • • •	
60000	740175	-2.635472	• 2220E-15
000000	.062764	.141262	.8219E+00
000000	. 669478	. 38 97 79	.1494E+00
		0000110	
. 830060	740175	-2.635472	.3053E-15
000000	062764	141262	.8219E+00
.000000	669478	.389779	.1494E+00
0 0 35 0 0 0			
. 000000	776209	-2.629150	-11 10E-14
. 6 3 3 0 0 0	200002	43 41 70	.1018E+01
. 600000	597912	• 336208	.1672E+00
	• • • • • • • • • • • • • • • • • • • •	• • • • • • • • • • • • • • • • • • • •	, , , , , , , , , , , , , , , , , , , ,
. 000000	868756	-2.626833	.8882E-15
. 600000	411733	687692	.1167E+01
. 8 9 0 0 0 0	.275208	. 149145	.2316E+00
		1	
. 000000	868756	-2.626833	0.
. 0 0 0 0 0 0	411733	687692	•1167E+01
. 000000	275208	149145	.2316E+00
. 600000	776209	-2.62915U	.1332E-14
. 600000	200002	434170	•1018E+01
. 6 0 0 0 0 0	597912	336208	•1672E+00
<b>.</b> 699000	740175	-2 • 63 5472	.2220E-15
. 500000	062764	141262	.8219E+00
• 830000	669478	389779	•1494E+80
• D 0 0 0 0 0 0		-2.635472	.3053E-15
- 000000	.062764	. 141262	.8219E+00
. 000000	669478	389779	.1494E+30
-060000	776209	-2.629150	•1110E-14
• 00000	20002	. 43 41 70	•1018E+01
000000	597912	3362ú8	•1672E+00
	and the state of t		1
000000	868756	-2.626833	.8882E-15
000000	•411733	. 687692	•1167E+01
600000	275208	149145	.2316E+00

#### CRT PLOTS

```
MINIMUM AND MAXIMUM COORDINATES IN THE SCALED. TRANSLATED. RCTATED SYSTEM -
 X AXIS= -3.00000E+00 2.0000E+00
 Y AXIS= -2.00000E+00
                          2. (0000E+00
 Z AXIS= -1.00000E+00
                          1. (0000E+00
COORDINATE TRANSLATIONS USED TO CENTER THE PLCTS - DELX, DELY, DELZ -
  AFTER SCALING, TRANSLATING, ROTATING - 5.00000E-01 G.
```

0.

```
VIEW OF BODY LOOKING DOWN THE -Y AXIS TOWARD THE ORIGIN
45-DEGREE VIEW FROM THE +X -Y +Z SIDE
45-DEGREE VIEW FROM THE +X -Y -Z SIDE
45-DEGREE VIEW FROM THE -X . -Y +Z SIDE
45-DEGREE VIEW FROM THE -X -Y -Z SIGE
VIEW OF BODY LOOKING DOWN THE -Z AXIS TOWARD THE ORIGIN-
45-DEGREE VIEW FROM THE -X +Y -Z SIDE
45-DEGREE VIEW FROM THE +X +Y -Z SIDE
VIEW OF BODY LOOKING DOWN THE -X AXIS TOWARD THE ORIGIN
45-DEGREE VIEW FROM THE -X +Y +Z SIBE
VIEW OF BODY LOOKING DOWN THE +X AXIS TOWARD THE ORIGIN VIEW OF BODY LOOKING DOWN THE +Y AXIS TOWARD THE ORIGIN
VIEW OF BODY LOOKING DOWN THE +Z AXIS TOWARD THE ORIGIN
45-DEGREE VIEW FROM THE +X +Y +Z SIDE
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**BOXC** 

PROGRAM BOXC

ATMCSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE 1

BODY ID. TEST

TEST BODY

INPUT PARAMETERS -

IFLAG= 0 LIST= 0 ISIG= 0 IPRS= 0 MPR= 0

NCODE= 0 NNON= 0 NOFF= 0 KMACH= 0 KTP14= 1

NUMBER OF LEAKY QUADRALATERALS= & FRACTION OF FREE-STREAM VELOCITY LEAKED= G.

PARAMETRIC INFORMATION

GENERATED UNIFORM FLOWS

WC\_F\_DW

NO SYMMETRY SPECIFIED

•

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(

BOCY

	X	X	NX	NP X	<b>D</b>
	Y Z	¥	NY	NPY	T
		Z	NZ	NP Z	A
	1.500000	1.500000	•958186	1. 591395	0.
	1.670000	1.732000	.276584	1.389794	.18 (3E+01
	.229700	0.20000	• 674655	• 494899	.2076E+30
	1.500000	1.500000	04.70		
	1.460000	1.679360	•941794	1.598349	•8862E-15
	465900	·229700	• 251249	1.254128	•1758E+01
		• E E 57 U U	• <b>223</b> 38 0	· 28 29 2 <b>7</b>	.2356E+ (0
	1.50))00	1.500000	.915363	1.605113	.2665E-14
	1.143000	1. 460000	• 20 2 + 1 4	1.019539	•1612E+01
	• 652000	• 4659 <b>00</b>	.348052	• 445612	.2299E+L0
	1.500000	1.500000	•891771	1.609275	26655 41
	.800000	1.140000	146221	.750320	•2665E-14 •1485E+01
	.76810J	652000	.428210	. 557494	•1405E+U1
			1		119032460
	1.500000	1.500000	874522	1.620269	.9992E-15
	•400000	• 800300	• 38880 Z	· 447961	.1217E+01
	.842600	.768100	•476787	•613381	.2097E+CU
	1.580000	1.500000	.865649	1.624811	• 2220E-15
	0.000000	400000	.029238	147089	•1058E+01
	.866000	.842600	• 499797	641222	• 2001E+00
	1.500000	1.500000	•863J87	1. 62 60 41	.2228E-15
	460000	0.000000	082222	140316	.1025E+01
	.800000	• 866 <b>0</b> 00	•498318	• 62 32 24	.2007E+L0
	1.500000	1.500000	•872872	1. 627233	.8862E-15
	803060	400000	218218	-• 44 28 46	•1118E+91
	.600000	.800000	• 436436	• 52 4111	•2291E+u0
	4		***		
	1.500000	1.500000	•872872	1.618821	•1776E-14
-	1.200000	890000	218218	751160	.1366E+61
	•400000	.634368	• 436436	• 38 6778	•2291E+60
	1.500000	1.500000	.872872	1. 607148	.8882E-15
	1.600000	-1.200000	218218	-1.085976	•1688E+01
	.200000	• 40C JUO	.436436	• 242716	•2291E+00
	1.500000	1.500000	•945063	1. 58 9795	0.
	1.732000	-1.600000	272824	-1.365206	.18 G3E+31
	0.000000	. 200000	• <b>1</b> 89164	• 184464	•1833E+00
	1.586900	1.500000	•958186	1. 591395	**************************************
	1.670000	-1.732000	276584	-1.389794	.1803E+01
	229700	0.00000	074655	094899	.2076E+U0
			and the second s	- <del> • • • •</del> •	

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

2024		
BODY	TD.	TEST

### TEST BODY

			1631	9001			
N	M	X Y	X Y	X Y	X Y	NX NY	NP Y
		Z	Z	Z	<b>Z</b>	NZ	NP 2
1	13	2.000000	2.000000	1.500000	1.500000	•941794	1.598
		0.300000	0.060000	-1.460000	-1.670000	251249	-1.254
		0.00000	0.003000	465903	22978ú	223386	28 2
	14	2.300000	2.0000000	1.503030	1.530000	•915363	1.605
		0.000600	0.000000	-1.140000	-1.460000	202414	-1.019
		0.00000	0.000000	652003	465900	348352	- • 445
	15	2.300000	2.000000	1.500000	1.500000	.891771	1.609
		0.103000	6.000000	8 43 00 6	-1.140000	146221	750
		0.00000	6.603000	768180	652000	4 28 21 3	- • 55 7
	16	2.000000	2.000000	1.500000	1.500000	.874522	1.620
		0.000000	0.000000	400000	830000	088802	447
		9.007020	0.003600	842601	768100	476787	613
	17	2.003000	2.000000	1.500000	1.590000	.865649	1.624
		0.00000	0.001000	0.00000	437040	029238	147
		0.00000	<b>J.00</b> 0000	866000	842600	499797	641
	18	2.)00000	2.000000	1.500000	1.500000	.865649	1. 82 41
22		0.000000	0.000000	• 400000	4.00000	.029238	. 147
		0.303000	0.000000	842600	86600 <b>0</b>	499797	- 641
	19	2.000000	2.000000	1.500003	1.50000	.874522	1.628
		0.00000	G. 0C 0000	.800000	• 40000	.088802	. 447
		0.307000	0.000000	768180	8,42600	476787	61 3
	20	2.1000000	2.6000000	1.585000	1.500000	.891771	1 . 60 9
		0.00000	0.000000	1.149090	.800000	.146221	. 75 0
		0.00000	0.000000	65200J	768100	-•428213	557
	21	2.992000	2.000000	1.500000	1.500000	•915363	1. 665
		0.00000	0.000000	1.460000	1.140000	. 202414	1.019
		0.325000	6.00000	465900	652000	348352	4450
	22	2.333030	2.003000	1.580000	1.500000	•941794	1.598
		0.303030	0.000000	1.670000	1.460000	.251249	1.254
		0.00000	0.000000	229700	46590 <b>0</b>	223381	28 21
	23	2.003000	2.000000	1.500000	1.500000	•958086	1.591
		0.00000	0.000000	1.732000	1.670000	• 276 58 4	1.369
		0.00000	0.000000	0.000000	229700	074655	(94
2	1	1.500000	1.500000	1.000000	1.000000	• 435365	1.220
		1.732000	1.670000	1.870000	2.000000	.855263	1.831
		0.00000	.229700	.354690	0.00000	.251035	. 149

TEST	BOD	Y
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X Y	X	X	NX	A15.4	
	· Y	<b>Y</b>	NÝ	N> X	<b>D</b>
Z	Z	2		NP Y	7
		-	NZ	NP Z	A
00000	1.500000	1.500000	0.4704		
6 6000	-1.460000	-1.670000	•941794	1.598349	•8882E-15
0000	-• 465901	229700	251249	-1.25 40 20	•1758E+C1
			-•22338ti	282927	.235¢€+00
00000	1.500000	1.536990			120355160
00000	-1.140000	-1.460000	• 915363	1.605113	•2665E-14
00000	*•652000		202414	-1.019539	•1612E+J1
	0025403	465900	- • 3 48 35 2	445612	
00000	1.500000	*			•2299€+80
00000	8 40 90 6	1.500000	.891771	1.609275	20000
00000	768180	-1.146600	146221	750320	•2665E-14
	- • LOOTEN	- 652000	- 428210	557494	•1405E+01
0 0 0 0 0 0	4 59041			<b>** ** ** ** ** ** ** **</b>	•1985E+00
0 0 0 0 U	1.500000	1.500000	•874522	1 500000	
0020	400000	835000	088802	1.620269	•9992E-15
17500	-•8426 <b>0</b> g	76810n	- 476787	447901	•1217E+ü1
			4410101	613081	•2097E+00
0000	1.500000	1.50000	86561.0		
13000	0.000000	439000	• 865649 • NGC 370	1.624811	•2220E-15
00000	-•86600g	- 842600	029238	-• 1470 89	.105 EE+01
			499797	641222	.2061E+50
8000	1.500000	1.500000			
0000	• 400000	9.00000	• 865649	1. 62 48 11	•2220E-15
0000	8426 <b>00</b>		• 0 29 238	• 147089	•1058E+01
		866000	- 499797	641222	•2001E+00
0000	1.500003				• ERRTEARR
0000	• 800000	1.530000	.874522	1.620269	COO
0000	768100	• 400060	• 088802	• 447901	•9992E-15
	- * L GO TRA	842600	-•476787	61 33 61	•1217E+61
0000	4			0010001	•2097E+00
0000	1.585000	1.500000	.891771	4 - 60 00 70	
0000 0000	1.149020	.890000	•146221	1.609275	•26E5E-14
8000	652000	768100	- 428213	• 75 0 3 20	• 1405E+61
			ALCOSTO	- • 557494	•1985E+60
3000	1.500000	1.500000	•915363		
8500	1.460000	1.140000		1. 605113	•2665E-14
0000	465955	- 652000	-202414	1.019539	•1612E+01
			348052	-• 445012	.2299E+00
1000	1.5ខូបព្យព្ធ	1.500000			
000	1.670000	1.460000	•941794	1.598349	•6882E-15
000	229700		•251249	1.254020	•1758E+01
		-•46590 <b>0</b>	7.223388	282927	•2350E+GG
<b>0</b> 00	1.500000	4			• 60 50 E+ 60
000	1.732000	1.500000	•958086	1. 591395	0.
000	0.000000	1.670000	• 276584	1. 38 9794	
	ម • ម ១ ម ម ម ម ម	229700	074655	-• <b>194899</b>	•18 03E+01
000	4 000			• 474077	·2076E+00
000	1.000000	1.000000	• 435365	1 20.50	
7.80	1.870000	2.000000	• 8 5 5 2 6 3	1.220560	•5764E-02
UU	• 35460 <b>0</b>	0.000000	• 251035	1.831729	•6416E+80
			· · · · · · · · · · · · · · · · · · ·	• 149900	.1748E+ CO
<b>E</b> tronia					

PRO	GRAM B	oxc		SPHERIC SCIE	NCE ASSOCIATE	:S	PAGE
800	DY ID.	TEST		* .			
			TEST B	ODY	e de la companya de La companya de la co		
N	М ,	X	X	X	<b>X</b> :	NX	NP X
		<b>Y</b>	Y	Y Z	Y	NY NZ	NP Y NP Z
		<b>Z</b> .	Z	2	<b>Z</b>	N Z	NF Z
2	2	1.500030	1.500000	1.000000	1.090000	.398889	1.241719
	•	1.670000	1.460000	1.600000	1.870000	.652170	1. 65 28 30
		.229790	•465900	•600003	• 35460 <b>0</b>	.654604	• 41 4681
	3	1.500000	1.500000	1.000000	1.000000	•324553	1.241630
		1.460000	1.140000	1,200000	1.600000	.447006	1.351646
		•465900	• 65 20 0 0	.890000	.600000	.833577	.631851
	4	1.500000	1.560000	1.000000	1.690909	-288009	1.242990
	•	1.149000	.803000	.800000	1.200000	.287154	. 98 57 15
		.652000	.768160	.916500	.800000	.913561	. 78 61 35
	5	1.500000	1.500000	1.000000	1.000000	.270929	1. 25 6 1 8 6
	,	.800000	. 450000	. 400000	.802030	.163401	. 60 0 0 8 8
		.768100	.842600	.979800	.916500	• 948629	. 87 66 83
	6	1.533808	1.500000	1.000000	1.000000	. 261 384	1.250017
		.400000	0.000000	0.000000	.400000	.052527	. 200026
		.842600	.866000	1.900000	.979800	•963805	.922094
23	7	1.500000	1.500000	1.000000	1.000000	•126140	1.2460 98
	•	000000	400000	400000	0.000000	312996	199566
		166000	.800000	. 6 0 0 0 0 0	1.000000	.941341	.867167
	8	1,503000	1.500000	1.080000	1.009000	0.000000	1. 25 0 0 0 0
		400000	800000	800000 .600000	400000 -8600 <b>0</b> 0	-•447214 •894427	600000 -700000
		.800000	.600000	. 5 9 8 8 0 9	• 0 0 0 0 0 0	0034461	
	9	1.509000	1.500000	1.000000	1.000000	0.000000	1.250050
		800000	-1.20,000	-1.200000	800000	- • 447214	-1.000000
		.600000	.400000	.400000	.630000	.894427	. 50 0000
	19	1.500000	1.500000	1.000000	1.000000	0.000000	1.250000
		-1.200000	-1.600000	-1.600000	-1.200000	447214	1.400000
		.400600	.200000	-260000	. 400000	.894427	.300000
	11	1.500000	1.500000	1.000000	1.600000	•159008	1. 21 67 89
		-1.600000	-1.732000	-2.000000	-1.600000	593315	-1.739216
		.200000	0.000000	0.00000	. 200000	.789109	. 10 20 18
	12	1.500000	1.500000	1.000000	1.030000	435365	1.220560
	ŤŒ	-1.732000	-1.670000	-1.870000	-2.690000	- 855263	-1.831729
		0.000000	- 229700	354600	0.00000	- 281038	149900
						1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

1.000000

-.601000

1.000000

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-1.870000

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-.652170

-.650004

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- . 41 4 680

-1.652830

1.500000

-.465900

-1.460000

13

1.509000

-1.670000

-.229700

X X Y Z Z	NX	NP X	C
	NY	NP Y	T
	NZ	NP Z	A
1.00000 1.87000 1.87000 354600	.390089 .652170 .650004	1.241719 1.652830 .414660	.8288E-02 .6561E+00 .1846E+00
.000000 1.00000	•324553	1.241630	.6043E-U2
.200000 1.600000	•447006	1.351646	.6814E+10
.800000 .600000	•833577	.631851	.2159E+U0
.000000 1.60000	•288059	1.242998	.4216E-62
.800000 1.20000	•287154	.985715	.66(0E+00
.916500 .80000	•913561	.786135	.2025E+00
.000000 1.000000	•270929	1. 25 0 1 8 0	.2656E-02
.400000 .800000	•163481	. 60 0 0 8 8	.6744E+00
.979800 .916500	•948629	. 87 6 6 8 3	.21 (8E+00
.000000 1.000000	• 261384	1.250017	•7718E-03
.000000 .400000	• 052527	.200026	•6594E+00
.000000 .979800	• 963805	.922094	•2075E+00
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.400000 0.000000	••312996	199566	•6708E+00
.800000 1.000000	•941341	.867167	•2125E+00
.000000 1.00000	0.000000	1.256000	.3553E-14
.800000400000	447214	600000	.6768E+00
.600000 .800000	.894427	.700000	.2236E+00
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.200000 .400000	.894427	.300000	.2236E+0]
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.000000 -1.600000	••593315	-1. 73 92 16	.67 u8E+ 0n
.000000 .20000	•789109	. 10 20 18	.1685E+ 30
.000000 1.10000	•435365	1.220560	.5764E-02
.870000 -2.000000	••855263	-1.831729	.6416E+00
.354600 0.00000	••281038	149900	.1708E+60
.000000 1.000000	.390089	1.241719	.8288E-02
.600000 -1.570000	652170	-1.652830	.6561E+00
.600000354600	650004	414680	.1846E+00

# ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

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		<b>Y</b> : :	Y	Y	Y Y	N/Y	NPY
		2	Z	. 2	Z	NZ	NP Z
2	14	1.50000	1.500000	1.000000	1.000000	•324553	1.241630
		-1.463008	-1.149000	-1.200000	-1.600000	44700 E	-1.351646
		465900	652000	890000	600000	833577	631851
	15	1.500000	1.500000	1.000000	1.000000	.288609	1.242990
		-1.140000	800000	800000	-1.200000	287154	-• 98 57 <b>15</b>
		652001	768100	916500	890000	913561	786135
	16	1.500000	1.500000	1.800000	1. 300000	. 278 929	1.250180
		803000	400000	400000	800000	163481	600988
		768100	842600	979800	916500	948629	<b></b> 87668 <b>3</b>
	17	1.500000	1.560000	1.000000	1.000000	. 261 384	1.250017
		403019	0.000000	0.00000	400000	852527	200026
		842600	866000	-1.000000	97980 <b>0</b>	963885	922094
	18	1.500000	1.500000	1.000000	1.000000	.261384	1.250017
		0.00000	.400000	•40000	0.00000	.052527	• 20 û 0 26
		-•866 <b>0</b> 10	842600	979800	-1.690000	963805	922094
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	21	1.500000	1.500000	1.000000	1.090000	. 324553	1.241630
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		652000	465900	600000	833000	833577	<b></b> 63 18 5 <b>1</b>
	22	1.530000	1.500000	1.003000	1.000000	•390089	1.241719
		1.460000	1.679000	1.870000	1.600000	.652171	1.652830
		465900	229700	35460 <b>0</b>	600000	650004	41 4680
	23	1.500000	1.500000	1.00100	1.600000	•435365	1.220560
		1.670000	1.732000	2.0000	1.870000	.855253	1.831729
		229700	0.000000	0.00/200	3546F0	281338	149960
3	1	1.000000	1.000000	0.09-000	6.000800	0.000000	• 50 e 0 # <b>0</b>
		2.00000	1.870000	1.870000	2.000000	.938893	1.935000
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		1.8700 0	1.600000	1.600000	1.870000	.672591	1.735000
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163481	60088	•6744E+00
948629	876683	•2168E+00
•261384	1.250017	•7710E-03
-•952527	280026	•6594E+00
-•963805	922094	•2075E+00
.261384	1.250017	.77 10E-03
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963805	922094	.2075E+00
•270929	1.250180	.2656E-02
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••948629	876683	.2168E+60
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.390089	1.241719	.8288E-02
.652170	1.652830	.6561E+00
650004	414680	.1846E+00
.435365	1.220560	•5764E-02
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		1.200000	.800000		1.290000	.279631	1.00000
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	5	1.000000	1.000000		6.00000	0.060000	.5000
		.800000	.400000		.800000	-156305	. 66 000
		•91650 C	•979890	.979800	•91650 <b>0</b>	.987709	• 94815
	6	1.200000	1.000000	0.00000	0.000000	9.000000	. 50 000
		. 400000	0.600000		.400000	.050436	. 20000
		•979800	1.000000	1.000000	• 97980 <b>0</b>	• 998727	• 98 9 <b>9 0</b>
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	13	1.000000	1.000000	0.000000	0.00000	0.00000	.5000
		-1.870000	-1.600000	-1.600000	-1.876000	- 672591	-1.7350
		354600	600000	600000	354600	748014	4773
	14	1.000000	1.000000	0.00000	0.00000	0.00000	• 5 L J O
	•	-1.603300	-1.200000		-1.600000	447214	-1.4000
		600000	800000		600000	894427	7000
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Z		NZ	NP Z	A
9000 0.03300	1.600000	0.050000	.500000	•6661E-14
0000 1.23000		.447214	1.406000	•1895E+61
0000 .80900		.894427	.700960	•4472E+00
0000 0.00000	1.230000	0.000000	.500000	.2442E-14
0000 .80000		.279631	1.000000	.1083E+01
6500 .916500		.960137	.858250	.4166E+00
0000 0.00000	.800000	0.010000	.560000	.2442E-14
0000 .40000		•156305	.660060	.1079E+41
9800 .979800		•987709	.948150	.4050E+00
0.000 0.000000	.400000	0.000000	• 50 00 0 0	•5551E-16
0000 0.00000		.050436	• 20 0 0 0 0	•1077E+01
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1000 0.002000	-1.870000	0.000000	.500000	•4885E-14
1000 -1.600000		672591	-1.735030	•1644E+01
1000600000		740014	477340	•3649E+00
000 0.00000	-1.630000	0.003000	-500000	•6661E-14
000 -1.20000		447214	-1.400000	•1095E+01
000800000		894427	700000	•4472E+60

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		Y	Y	Y	Y	NY	NPY
		Z	7	· Z	Z	NZ	NP Z
3	15	1.007000	1.000000	0.00000	0.033630	0.000000	.500000
		-1.200000	800000	800000	-1.200000	279631	-1.0000000
		800000	916500	916500	800000	960107	858250
							<u>.</u>
	16	1.300038	1.000000	0.00000	3.030000	0.00000	• 50 00 00
		800000	400000	F.4 C0000	890000	156305	600000
		916500	979800	979800	-•91650 <b>0</b>	987709	948150
	17	1.000000	1.000000	0.900000	0.500000	0.00000	• 50 DOVO
		400000	0.000000	0.000000	400000	050436	- 20 0000
		979830	-1.000000	-1.080000	979800	998727	- 98 9 9 0 0
				200000	• J. J. J. G. G.	. 330121	909986
	18	1.000000	1.000000	0.000000	0.610000	0.000000	.560J00
		0.00000	400000		0.000000	.058436	.200056
		-1.300030	979800	979880	-1.606000	998727	989900
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	19	1.909000	1.000000	0.000000	0.600000	0.00000	• 50 00 00
		.405000	.80000	.800000	• 493 u 8 8	•156305	•600000
		979800	916500	916500	-•97980 <b>0</b>	987709	948150
	20	1.000000	1.000000	0.000000	0.00000	0.666399	.500000
26		.800000	1.200000	1.200000	.800000	279631	1.000000
6		916500	800000	800300	91650 <b>0</b>	960107	858250
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	21	1.096606	1.0000009	0. 030303	0.400000	0.000000	.569900
		1.200000	1.600000	1.600000	1.200000	.447214	1.460000
		800000	600000	600000	800000	894427	700000
	22	1.000000	1.080000	0.00000	9.638000	0.00000	- 500000
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. 4	1	0.000000	0.000000	500000	500000	049532	248068
		2.000000	1.870000	1.850000	1.972000	.939127	1.923092
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	2	0.00000	0.000000	500000	500680	043145	249477
		1.870000	1.607000	1.585000	1.850000	.675158	1.726269
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279631	-1.000030	.1083E+01
960107	858250	.4166E+00
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156305	•• 6 0 0 0 ú J	.1079E+01
987705	•• 94 8 1 5 0	.4050E+00
0.000000	.500000	.5551E-16
050436	200000	.1077E+01
998727	969900	.4005E+00
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.050436	.200000	.1077E+01
998727	969900	.4005E+00
0.000000	.500000	.2220E-14
.156305	.600000	.1079E+01
987709	948150	.4050E+60
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.279631	1.000000	.1083E+01
960107	858250	.4166E+00
0.090900	.507000	.6661E-14
.447214	1.40000	.1095E+u1
894427	760000	.4472E+00
0.000000	.500000	.6217E-14
.672591	1.735000	.1864E+61
740014	477300	.3649E+60
0.00000	.500000	.6217E-14
.938893	1.935000	.1069E+01
344208	177300	.3777E+00
049532	248068	.7648E-03
.939127	1.923092	.6238E+00
.339981	.174052	.1853E+00
u43145	249477	.78 67 E- C3
.675158	1.726269	.6205 E+ GU
.736411	.476688	.1816 E+ CO
034875	249169	.6327E-03
.449471	1.395016	.6693E+00
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					3!	54	6	3 0			6	0 (	O	0.0			-	, 5	8(	66	0 0	ĭ		-	٠	34	1	500	3					1				47
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	- 1	15		G.	ġ (	g n	g r	ם ו		u -	n i	D 0	n D	מו			<b>.</b>	, 5	٥	ğ Pı	0 0				۰ 🛋	51	Į į	001	)	-	·	3	1 r	) 4	3		<b>-</b>	24
				1.	2	0 9	0.0	0 0			8	<b>0</b> f	100	0 (							CO							ti d (						) <b>**</b>		. •		39
					8	ÖÖ	e c	3 0			9	16	55 (	30			٠,	9	Ũ.	12	0.0	)		-	•	78	4	40	Ĵ	-	ي .	95	91	; <b>7</b>	4			85

X	X	NX	NP X	D T
Y	Y	NY	NP Y	
Z	Z	NZ	NP Z	
00000	500000	031343	- · 249537	• 4237E-03
00000	1.195000	.281449	• 998756	•6507E+00
01200	.784400	.959874	• 850538	•2072E+00
00000	500000	029218	250016	•2468E-03
00000	.800000	.157442	.600061	•6451E+00
5500	.901200	.967096	.940749	•2026E+00
6000	500000	028252	250002	.7487E-04
6000	-430000	.050789	.200000	.6412E+00
6000	-965500	.998310	.982825	.2003E+00
00000	50000 <b>0</b>	412608	249496	.3152E-02
00000	0-0000 <b>0</b>	434526	199997	.6708E+00
00000	-98600 <b>0</b>	.900571	. 8965ú9	.2221E+00
0 0 0 0	50000	0.0000UJ	250000	.3553E-14
0 0 0 0	40000	447214	600000	.6708E+60
0 0 0 0	.800000	.894427	-700000	.2236E+60
0000	500000	0.000000	250000	.3553E-14
0000	800000	447214	-1.000000	.6708E+00
0000	.600000	.894427	.500000	.2236E+00
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	500000	0.0000n0	+.250100	.6661E-14
	-1.200000	447214	-1.400000	.6748E+40
	.400000	.894427	.30000	.2236E+60
2000 2000	50000 -1.60000 .20000	012880 460913 .887820	247831 -1.793415 .106024	.3220E-02 .6708E+00 .2174E+83
0000	500000	049532	+.248068	.7648E-03
0000	-1.972000	939127	-1.923092	.6238E+00
1500	0.00000	339980	+.174052	.1853E+00
0000	590000	043145	249477	.7887E-U3
50uJ	-1.850000	675158	-1.726269	.6205E+ 10
6600	341500	736411	470688	.1816E+30
0000	503000	034875	249169	.63276-03
5000	-1.585000	449471	-1.395016	.6693E+00
4400	586600	892614	692774	.2213E+00
0000	500090	031043	249537	.4237E-03
0000	-1.195000	281449	998756	.65(7E+00
1200	784400	959074	850538	.2072E+00

# ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

PAGÉ

-	<b></b>	T 0	
80	I Y	Tfl.	TEST

#### TEST BODY

			1E21 :	SUU T			
N	M	<b>X</b>	×	x	×	NX Property	NPX
		Y		Y	Υ Υ	NY	NPY
		Z	Z	Z	Z	NZ	NP Z
4	16	0.00000	0.000000	588300	500000	029218	25 00 16
		800000	480000	400000	80 (000	157 442	600001
		916500	979800	965500	901200	987496	- 34 u 7 49
	17	0.000000	0.000000	500000	500000	028252	250002
		400000	0.000000	0.00000	400000	050789	2000 <b>0</b>
		979810	-1.000000	986000	-•96551t	998319	-•98 28 <b>25</b>
	18	0.000000	0.000000	500000	500000	828252	- 25 0002
		0.000000	•400000	•400300	0.070000	. 050789	. 20 0 0 0 <b>0</b>
		-1.000000	979800	965500	986000	998310	- 98 28 25
	19	0.000000	0.000000	509000	506000	- · 0 2921 o	25 00 16
		• 4 00 00 0	-800000 ·	.800000	490000	. 157442	-600001
		9798#6	916500	901280	-• 9655 <b>0</b> 0	987396	- 946749
	20	0.300000	0.000000	500000	500000	031443	249537
		.800000	1.200000	1.195300	• 8 9 0 0 0 0	. 281449	998756
		916511	80000	784400	901200	959074	35ú5 <b>38</b>
28	21	9.300000	5.000000	500000	50000 <b>0</b>	034875	249169
		1.230000	1.600000	1.585000	1.195000	• 449471	1.395016
		800000	600000	586600	784480	892614	- 63 27 74
	22	0.00000	0.00000	500000	500000	043145	249477
		1.600000	1.870000	1.850000	1.585000	•675158	1.726269
		600000	354600	341500	586600	736411	- 47 û 68 <b>8</b>
	23	0.000000	0.000000	500000	530000	049532	- • 24806 <b>8</b>
		1.870000	2.000000	1.972060	1.850000	.939127	1.923392
		-4354600	0.000000	0.000000	341500	339988	17 40 52
5	1	500000	5000000	-1.000000	-1.030000	153543	743334
		1.972000	1.850000	1.785000	1.885600	.934141	1.874150
		0.000003	• 341500	.303900	0.695000	•322188	•16162 <b>6</b>
	2	500000	500000	-1.000000	-1.600600	132740	747389
		1.853000	1.585000	1.540000	1.785000	.683173	1.690281
		. 341500	• 58 6600	.544900	.333900	.718 391	444215
	3	500000	500000	-1.000000	-1.00000	108809	74775
		1.585000	1.195000	1.175000	1.540000	• 457325	1.373892
		-586600	. 784400	.737400	• 54400 <b>0</b>	•88261 €	• 66 3 <i>3</i> 84
	4	500000	500000	- 1. 000000	-1.60,000	095703	74795
		1.195000	.800000	.800040	1.175000	.288525	• 9925 <b>72</b>
		.784400	.961200	.853800	.737400	.952677	• 81 93 <b>8</b>

	X Y Z	NX NY NZ	NP X NP Y NP Z	D T A
000	50000	- 029218	250016	•2468E-03
000	80000	- 157442	600001	•6451E+00
500	901200	- 987896	940749	•2026E+00
000 000	5000 <b>00</b> 400000 965500	- 028252 - 050789 - 998310	25 0 0 6 2 20 0 0 0 98 28 25	.74 &7E-04 .6412E+00 .2003E+00
000	500000	-• 9 28 2 5 2	25 0 0 0 2	•7487E-04
000	0.070000	• u 5 u 7 8 9	20 0 0 0 0	•6412E+00
500	986000	-• 9 9 8 3 1 0	98 28 25	•2003E+00
0 0	500000	029216	250016	.2468E-03
0 0	-400000	.157442	.600031	.6451E+00
20 0	965500	987J96	946749	.2026E+00
0 0	530000	031043	-• 249537	.4237E-U3
0 0	.800000	.281449	• 998756	.6507E+00
0 0	931200	959074	-• 850538	.2072E+00
0 0	500000	034875	249169	.6327E-03
0 8	1.195000	.449471	1.395016	.6693E+00
0 0	784400	892614	632774	.2213E+00
0 0	500000	043145	-• 24 94 77	.7887E-U3
0 0	1.585000	.675158	1• 72 62 69	.6205E+00
0 0	586600	736411	-• 47 0 688	.1816E+00
18 0	5J0000	049532	248068	.7648E- £3
16 0	1.850000	.939127	1. 923092	.6238E+£0
16 0	341500	339988	174052	.1853E+60
0 0 0 0 0	-1.030000 1.885600 0.03000	153543 .934141 .322188	743334 1.874158 .161626	•1969E-02 •6143E+00 •1727E+00
0 0 0 0	-1.000000 1.785000 .333900	13274U .683173 .718 J91	747389 1.690281 .444215	•2518E-02 •6222E+00 •1776E+00
0 0	-1.00000	108809	747752	•1887E-02
0 0	1.549000	.457325	1.373892	•6640E+00
0 0	.544000	.882618	.663304	•2139E+00
0 0 0 0	-1.60J000 1.175000 .737400	095703 -288525 -952677	747958 .992572 .819363	.1347E-02 .64 (1E+00 .2021E+00

-.737400

-1.000000

-.860000

-.853890

-1.000000

-.400000

-. 921400

-. 544000

-1.000000

-1.175000

-1.000000

-.800000

-.853800

-. 737400

-.882618

- .095703

-.288525

-.952677

-.089915

-.162020

- . 982682

- 66 33 : 4

-. 747958

-.992572

- . 81 9383

-.750055

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-.914468

15

16

-. 536600

-.500000

-. 784400

-.500000

--800000

-.901200

-1.195000

-. 784400

-. 500000

-.800000

-.901200

-.500000

-. 40 0000

-.965500

D	Y	

X Y	X Y Z	NX NY ***** NZ	NP X NP Y NP Z	C' T A
-1.800000	-1.090000	089915	750055	.8107E-93
.400000	.809000	.162320	-600009	.6530E+00
.921400	.853800	.982682	-918468	.2035E+00
-1.000000	-1.000000	086851	-•7500 05	•2238E-03
6.000000	.400000	.052106	•20003	•6436E+60
.942800	.921400	.994858	•953924	•2010E+(0
-1.000060	-1. 600000	039925	-•748551	.9981E-02
400000	c. 990000	379842	-•199961	.6668E+00
.800000	. 942800	.924189	•862279	.2164E+00
-1.000000	-1.000000	0.00000	750000	.3553E-14
800000	400000	447214	600000	.6708E+00
.600000	.800000	.894427	.700000	.2236E+00
-1.000000	-1.002000	0.090 uuu	750060	.3553E-14
-1.200000	80000	447214	-1.000000	.67£8E+00
.400000	.60000	.894427	.500000	.2236E+00
-1.000005	-1.000000	0.000000	750000	.6661E-14
-1.600000	-1.200000	447214	-1.400060	.6708E+00
.200960	-400000	.894427	.30000	.2236E+00
-1.000000	-1.000000	044855	741375	•1121E-01
-1.885600	-1.600000	519160	-1.764760	•6545E+00
0.00000	.20000	.853499	.100234	•1926E+00
-1.000000	-1.00000	153543	743334	.1969E-02
-1.785000	-1.885600	934141	-1.874150	.6143E+00
303900	0.00000	322188	161626	.1727E+00
-1.300906	-1.000000	132740	747389	.2518E-02
-1.540000	-1.785000	683173	-1.690281	.6222E+00
544000	303900	718091	444215	.1776E+00
-1.000000	-1.006000	108809	747752	•1867E-02
-1.175000	-1.540000	457325	-1.373892	•6640E+00
737400	544000	882618	663314	•2139E+00
-1.000000	-1.000000	095703	747958	.1347E-02
800000	-1.175000	288525	992572	.64 E1E+00
853880	737400	952677	819383	.20 21E+00
-1.000000	-1.000000	089915	750055	.8167E-03
400000	800000	162020	600009	.6560E+00
921460	853800	982682	910468	.2035E+00
<b>F</b>				

PR	ROGRAM	BOXC	AT	MOSPHERIC SGIE BEDFORD, MAS		:5	PAG
8	ODY I	. TEST	*	CCOI ORDY MAS	SHOHOSCIIS		PAG
		æ .	TEST	B0 <b>0</b> Y			
٨	ı M	X	<b>x</b>	<b>X</b> 1 min	X	NX	NP X
		Y	·	land 👸	: : <b>Y</b>	NY	NPY
		Z	Z	<b>Z</b>	Z	NZ	NPZ
5	17	508000	500000	-1.000000	-1.000000	086851	750001
		400000	0.000000	0.00000	400000	052106	20000
	,	965500	986000	942800	921400	994858	95 39 24
	18	500010	588000	-1.000000	-1.000000	086851	750009
		0.000000	.400000	.400000	0.500000	.052106	. 200003
		985000	965500	921480	942800	994858	953924
	19	502000	508000	-1.080000	-1.638000	089915	750059
		.400800	.800000	.800000	. 480 000	.162020	- 660009
		965500	901200	853800	921400	982682	91046
	20	500008	500000	-1.000000	-1.536000	095703	747958
		.809000	1.195000	1.175000	.800000	.288525	.99257
,		901200	78 4400	737400	853800	952677	81938
	21	500000	500000	-1.000000	-1.600000	108809	747752
		1.195000	1.585000	1.54000	1.175000	•457325	1. 37 38 9
		78440 <b>0</b>	586600	544000	737400	88261 E	663304
30	22	500000	506000	-1.000000		132748	747389
		1.585000	1.850000	1.785000	+1.000000 1.540000	-663173	1.690281
		586632	341500	303900	544050	718.91	44 421
						0, 20032	
	23	500000	500000	-1.000000	-1.638000	153543	743334
		1.850000	1.972000	1.885640	1.785000	•93414±	1.87415
		341500	0.00000	0.00000	303900	322188	161626
6	1 1	-1.000000	-1.000000		-1.500000	268347	-1.22965
		1.885600	1.785000	1.670000	1.732000	•921489	1.773614
		0.060000	.303900	• 2297 ú G	0.00000	.280799	. 13 491
	2	-1.300036	-1.003000	-1.500000	-1.509060	239065	-1. 245329
		1.785000	1.540000	1.460000	1.670000	.702123	1. 61 46 91
		.303900	.544000	• 46590 U	.229700	.670724	• 38 65 55
	3	-1.000000	-1.006000	-1.500000	-1.500000	194936	-1.245068
		1.540000	1.175000	1.140000	1.460000	.475316	1.329324
		•544800	.737400	•652 <b>000</b>	.465900	.857948	• 60 0 6 27
	4	-1.000000	-1.000000	-1.500000	-1.500000	170981	-1.24578
		1.175000	.600000	.800000	1.140000	-304683	.979504
		•737400	.853800	.768100	• 652000	•936981	. 75 351
	5	-1.000000	-1.000000	-1.509000	-1.500000	159881	-1.25012
		.800000	.400000	. 480000	.800000	•172638	.60003
		.853800	.921400	.842600	.768100	•971923	. 84644

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·	X	NX	NP X	D
	Y	NY	NP Y	T
	Z	NZ	NP Z	A
00	-1.000000	086851	750005	.2238E~03
	400000	052106	200003	.6436E+00
	921400	994858	953924	.2010E+00
0	-1.000000	086851	750005	%2238E-63
	0.00000	.052106	.200003	%6436E+00
	942800	994858	953924	•2010E+00
0	-1.030000	089915	750055	.8107E-03
	.40000	.162020	.60009	.6500E+00
	921400	982682	910468	.2035E+00
COO	-1.536000	095703	747958	•1347E=02
	800000	.288525	.992572	•6461E+00
	853800	952677	819383	•2021E+00
000	-1.600000	108899	747752	•1887E-02
	1.175000	.457325	1.373892	•6640E+00
	737400	882618	663304	•2139E+00
0	-1.000000	132740	747389	•2518E-02
	1.54000	.683173	1.690281	•6222E+00
	544000	718091	444215	•1776E+00
0	-1.00000	153543	743334	•1969E-\$2
	1.78500	.934141	1.874150	•6143E+#0
	303900	322188	161626	•1727E+#0
0 0 0	-1.50000	268347	-1.229655	•3684E-02
	1.73200	.921489	1.773614	•5916E+00
	0.00000	.280799	.134912	•1448E+00
0	-1.5000L0	239065	-1.245329	•54 50E = 02
	1.670000	.702123	1.614691	•61 80E + 00
	.229700	.670724	.386555	•16 96E + 00
0 0 0	-1.500000	194936	-1.245068	•3762E-02
	1.460000	.475316	1.329324	•6494E+00
	.465900	.857948	.600627	•1996E+00
0 0	-1.500000	170981	-1.245783	.2596E-02
	1.14000	.304683	.979504	.6374E+00
	.652000	.936981	.753512	.1908E+00
000	-1.500000	159881	-1.250120	•1677E-02
	.800000	.172638	.600034	•65E4E+00
	.768190	.971923	.846449	•2658E+00

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

TEST BODY

	N	M	X Y Z	X Y Y Z Z	X Y Y Z	X Y Z	NX NY NZ	NP NP NP
!	6	6	-1.300,00	-1.060000	-1.500000	-1.500000	153515	-1.25
			.400°00 .921400	0.000000 -942800	0.000000 .866000	• 40000 <b>0</b> • 84260 <b>0</b>	• 986601	• 20 ( • 89
		7	-1.009696 0.009600 .942806	-1.000300 40000 .800000	-1.500000 400000 .800000	-1.500000 0.00000 .866000	074106 251846 964926	-1.244 199
		8	-1.000000	-1.000000	-1.500000	-1.500000	0.00000	-1.250
			400000	800000	800000	400000 .80000 <b>0</b>	- 447214 - 894427	-•60 ( • 70 <b>(</b>
		9	-1.000000 800000	-1.006200 -1.200000	-1.500000 -1.200000	-1.500000 800000	0.050505 447214	-1.25 Q -1.00 Q
		4.5	•600900	. 40,000	.400000	.600000	•894427	• 50 0
	•	10	-1.200000 -1.20000	-1.000000 -1.600000 .200000	- 1.500000 - 1.600000 - 200000	-1.500000 -1.200000 .40000	0.000000 447214 .894427	-1.250 -1.400 -300
	;	11	-1.000000	-1.000000	-1.500000	-1.506000	105654	-1.225
31			-1.600000 -200000	-1.885600 0.000000	-1.732000 0.00000	-1.600000	687853 .718119	-1 • 70 7 • 10 0
		12	-1.000000 -1.885600	-1.000000 -1.785000	- 1.500000 -1.670000	-1.500000 -1.732000	268347 921489	-1.229 -1.773
		4 7	0.000000	303900	229700	0.000000	280799	134
	•	13	-1.000000 -1.785000 303900	-1.000000 -1.540000 544000	-1.500000 -1.460000 465900	-1.500000 -1.670000 229700	23906 5 702123 670724	-1.245 -1.614 386
	;	14	-1.000000	-1.000000	-1.500000	-1.500000	194936	-1.245
			-1.540000 544000	-1.175000 737400	-1.140000	-1.460000 465900	-•475316 -•857948	-1.329 600
	:	15	-1.030000 -1.175000	-1.000000 800000	- 1.500000 800000	-1.500000 -1.146000	170981 304683	-1.245 979
		16	737400 -1. 000000	853800	768100	652000 -1.500010	936981	753
		<b>.</b> ∪	\$00000 \$53866	-1.000000 400000 921400	-1.500000 400000 842600	830000 830000	159881 172638 971923	-1.250 600 846
		17	-1.000000	-1.060000	- 1.500005	-1.500000	153515	-1.250
			400000 921400	0.000000 942800	0.00000 866000	40000 <b>0</b> 842600	055250 986601	200 893

X

X

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NPX

Ŷ	Ŷ	NY	NP Y	Ť
Z	. <b>Z</b>	NZ	NP Z	. Å
.500000	-1.500000	153515	-1.250012	.4933E-03
.000000	• 400000	.055250	.200010	.6481E+00
866000	.842600	.986601	.893198	.2027E+60
.500000	-1.500000	074106	-1.248100	.1853E-51
. 400000	0.000000	251846	199835	.6560E+00
.800000	.866000	•964926	• 85 2389	.2073E+00
.500000	-1.500000	0.00000	-1.250000	•3553E-14
800000	400000	447214	600000	.678E+00
.600000	.800000	•894427	.700000	·2236E+00
.500000	-1.500000	0.000000	-1.250000	.3553E-14
-200000	800000 .600010	447214	-1.000000	•6708E+00
• 400000	• 69000	.694427	•500000	•2236E+00
.500000	-1.500000	0.000000	-1.250000	.6661E-14
600000	-1.200000	447214	-1.400000	.67C8E+C0
.200000	. 490000	•894427	. 30 0 0 0 0	.2236E+00
.500000	-1.500000	105654	-1.225923	.2641E-81
732000	-1.600000	687853	-1 • 70 7445	.609EE+00
.000000	.200000	•718119	• 10 ú 626	•1454E+GD
500000	-1.506660	268347	-1.229655	-3684E-02
.670000 .229700	-1.732000	921489	-1.773614	.5910E+60
• 2 2 3 7 U U	0.00000	280799	-• <b>134912</b>	.1448E+00
500000	-1.500000	239065	-1.245329	.5490E-02
460000	-1.670000	762123	-1. 61 4691	6188E+60
.465900	229700	670724	38 65 55	.1696E+00
,500000	-1.500000	194936	-1 - 245068	.3782E-02
,140000	-1.460000	475316	-1.329324	.6494E+00
,652100	465900	- 857948	60 0627	.1996E+ L8
500000	-1.500000	170981	-1.245783	.2596E-02
8 00000	-1.140000	304683	97 90 04	.6374E+00
768100	652000	936981	753512	.1908E+00
500000	-1.500010	159881	-1.250120	.1677E-02
400000	830000	172638	600034	.6584E+00
842600	768160	971923	846449	.2058E+ (0
500000	-1.500800	153515	-1.250,12	.4933E-03
0 00 000	400000	055250	200010	.6481E+40
866000	842600	986601	393198	.2027E+30
<b>.</b>				

NX

	ODY I	D. TEST	••••	BEDFORD, MAS	NCE ASSOCIATES Sachusetts	PAG
U	00, 1	.U	TEST	800 Y		
· N	м	<b>X</b>	v	·	NO.	NO.
. 14	M	<b>X</b> • <b>Y</b>	X Y	X ************************************	X NX NX	NP X NP Y
		Z	Z	7 Z	Z NZ	NPZ
. 8.		<b>4-</b>	:	4	<b>4</b>	111 2
6	18	-1.000000	-1.003000	+1.500000	-1.500000153515	-1.250012
		0.000000	. 403000	. 400000	0.00000 .055253	. 260010
		942800	921400	842608	866000986601	893198
	19	-1.003000	-1.000000	-1.501909	-1.500000159881	-1.250120
	• •	.400000	.800000	.800000	.400000 .172638	.600034
		921400	853800	768100	842600971923	84 64 49
		· · · · · · · · · · · · · · · · · · ·		, , ,	the second secon	
	20	-1.000000	-1.000000	-1,500000	-1.500000170981	-1.245783
		.897999	1.175000	1.140000	.870000 .304683	979004
		853800	737400	652000	768100936981	753512
	21	-1.000000	-1.600000	-1.500000	-1.500000194936	-1.245068
		1.175000	1.540000	1.460000	1.140000 .475316	1.329324
		73749D	544000	465900	6520£0857948	60ú627
	22	-1.000000	-1.003000	- 1.500300	-1.503000239865	- 1. 245329
	<b>c</b> . c.	1.549000	1.785000	1.67,900	1.460000 .702123	1.614691
		544000	303900	229700	465900670724	38 65 55
<u>ა</u>						
10	23	-1.000000	-1.000000	-1.500000	-1.500000268347	-1.229655
		1.785000	1.885600	1.732900	1.677000 .921489	1. 77 3614
		303900	0.00000	0.000000	229700280799	13 4912
7	1	-1.500600	-1.500000	-2.000000	-2.00000414479	-1.699678
		1.732000	1.670000	1.465000	1.490700 .885202	1.611865
		0.20000	• 229700	•137863	0.000000 .211244	. 096576
	2	-1.507076	-1.500000	-2.00000	-2.64000372374	-1.733772
	_	1.679000	1.460000	-2.000000 1.322000	1.465000 .725701	1. 48 4752
		.229700	465900	344400	.137800 .578529	297994
	3	-1.500000	-1.500000	-2.000000	-2.000000316024	-1.738932
		1.463000	1.143000	1.072000	1.322000 .507279	1.250730
		• 4659 ü 🗓	652000	•517901	.344400 .864085	.497910
	4	-1.500000	-1.509600	- 2.00000	-2.030000269527	-1.738268
		1.140000	.800000	.802060	1.072000 .335023	954054
		.652000	.768100	.628900	.517900 .902837	. 644837
	5	-1.500000	-1.500000	-2.000000	-2.106000250229	_4 350076
	<b>フ</b>	-1-200000	-1.000000	-2.000000	-2.606000250229	-1.750276

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BODY

_				
X Y Z Z	X	NX	NP X	D
	Y	NY	NP Y	T
	Z	NZ	NP Z	A
-1.500000	-1.500000	153515	-1.250012	.4933E-63
.40000	0.00000	.055253	.200010	.6481E+60
842600	866000	986601	893198	.2027E+60
-1.503900	-1.500000	159881	-1.250120	.1677E-02
.800000	-40000	.172638	.600034	.6584E+00
768109	842600	971923	846449	.2058E+00
-1.500000	-1.500000	17u981	-1.245783	.2596E-02
1.140000	-801000	.304683	.979004	.6374E+00
652000	768100	936981	753512	.1908E+00
-1.530003	-1.500000	194936	-1.245068	.3782E-02
1.460000	1.140000	.475316	1.329324	.6494E+00
465900	652000	857948	600627	.1996E+00
-1.500300	-1.50J000	239065	- 1. 245329	•549 GE+ C2 •618 GE+ GO •1696E+ GO
1.670300	1.460000	.702123	1.614691	
229700	465900	670724	386555	
-1.500000	-1.500000	268347	-1.229655	•3664E+02
1.732900	1.673000	.921489	1.773614	•5910E+00
0.000000	2297u0	288799	134912	•144EE+00
-2.030343	-2.000000	-•414479	-1.699678	.3189E+u2
1.465000	1.490700	•885202	1.611865	.5833E+u0
.137860	0.60000	•211244	.096576	.1038E+06
-2.10000	-2. GJUUQQ	372374	-1.733772	.7874E-12
1.322000	1. 465000	.725701	1.484752	.6199E+00
.344400	.137800	.578529	.297994	.1525E+60
-2.00000	-2.000000	316024	-1.738932	.6345E-02
1.072000	1.322000	.507279	1.250730	.6350E+00
.517900	.344400	.664085	.497910	.1772E+00
- 2.000000	-2.030000	269527	-1.738266	.4544E-02
- 802000	1.072000	.335023	.954054	.6218E+00
- 628900	.517900	.902837	.644837	.1695E+00
-2.000000	-2.600000	250229	-1.750276	.34 62 E - 52
.40000	.800000	.193980	.600104	.67 5 C E + 5 D
.718000	.628900	.948555	.739306	.21
-2.000000	-2.00000	237694	-1.750025	.9694E-03
0.300000	.400000	.061556	.200030	.6572E+00
.745400	.718600	.969388	.792992	.2063E+00

#### ATPOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

TEST BODY	1	1
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							1
N	M	<b>X</b> ·	X	X	X	NX	NP X
		: <b>Y</b>	<b>Y</b>	Y	<b>Y</b>	NY.	NoA
		Z	7	<b>Z</b>	Z	NZ	NPZ
7	7	-1.500000	-1.500000	-2.000000	-2.000000	197278	-1.74955
		0.100000	48 2000	400000	0.20000	113683	19975
		.866000	.800000	.718000	• 745460	• 973734	. 78 2 4 6
	8	-1.500000	-1.500000	-2.000000	-2.000000	075980	-1.74731
		400000	800000	800000	400000	368319	59985
		.800000	.600000	.609900	.718900	.926589	67977
	9	-1.500006	-1.500000	- 2. 403000	-2.600000	0.000000	-1.75400
		800000	-1.200000	-1.200000	83.060	447214	-1.06000
		.600000	.468600	.400000	.600000	.894427	• 50 0 20
	10	-1.500000	-1.500000	-2.000000	-2.000000	050829	-1.72.40
		-1.200000	-1.600000	- 1.400000	-1.200000	- 496741	-1.35282
		400000	. 200000	256000	430000	866409	31411
					:	1000403	
	11	-1.500000	-1.500000	- 2. 000000	-2.000000	348626	-1.76253
		-1.600000	-1.732000	-1.493700	-1.400000	842191	-1.55051
		• 200000	0.00000	0.000000	.25 € 000	•411307	• 11 39 4
	12	-1.503000	-1.500000	-2.000000	-2.60000	414479	-1.69967
ယ္ထ		-1.732000	-1.670000	- 1.465000	-1.490700	885202	-1.61186
w		0.00000	229700	137800	0.00060	211244	19657
	13	-1.500000	-1.500000	-2.000000	-2.00000	372374	-1.73377
		-1.670000	-1.460000	-1.322000	-1.465000	725701	-1.48475
		229780	465900	344400	137800	578529	- 29799
	14	-1.503000	-1.500000	2.000gGa	-2.600000	310324	-1.73893
		-1.460030	-1.140000	-1.072000	-1.322000	507279	-1.25173
		-•4659 <b>0</b>	652000	517900	344400	804085	49791
	15	-1.500000	-1.500000	- 2. 0 0 9 0 0 0	-2.000000	2 69 52 7	-1.73826
		-1.149000	800600	850960	-1.072000	335023	95405
		652030	768100	628960	517900	902837	64483
	16	-1.500000	-1.50000	-2.762000	-2.890000	250229	-1.75027
		803000	400000	400000	890000	193980	60010
		768100	842600	718300	628900	948555	73930
	17	-1.507000	-1.500000	-2.000000	-2. 000000	237694	-1.75002
		400000	0.000000	0.000000	430000	061556	2003
		842600	866000	745400	718000	969388	79299
	18	-1.507008	-1.500000	- 2.000000	-2.030000	237 69 4	-1.75602
	10	0.000000	.400000	• 400000	0.00000	.061556	-1.75002
		366070	84 2600	718100	745400	969388	79299
				- ♦ ( To An O	ニョノランサじひ		/ 7 6 7 7

		X	NX	NP X	ξ
		<b>Y</b> Z	NY NZ	NP Y NP Z	T A
800			197278	-1.749550	.9397E-02
00 ŭ 00 0		33000 45400	113683 .973734	-•199759 •782469	.2054E+00
<b>3</b> 00			67598J	-1.747311 599857	.190UE-U1 .6708E+00
000		190 <b>00</b> 0	368319 .926589	.679777	.2158E+L0
000			0.000000	-1.750000 -1.060000	.3553E-14 .67&8E+60
000		:0000 <b>0</b>	447214 .894427	• 56 9 3 8 9	.2236E+00
0 0 0 0 0 0	, .	,	+.050829 496741	-1.72 J409 -1.35 28 29	.1271E-01 .6768E+00
000		196000	.866409	.314114	.1731E+G0
<b>0</b> 00			348626 842191	-1.762537 -1.550513	.1445E-01 .6525E+00
<b>0</b> 0		56000	.411307	• 11 39 43	•1354E+00
000			414479 885202	-1.699678 -1.611865	.3180E-02
800		99968	211244	196576	.10 38E+00
000		6500 <b>0</b>	372374 725701	-1.733772 -1.484752	.7874E-02
400		37800	578529	297994	.1525E+U0
000		322888	310324 507279	-1.738932 -1.253730	.6345E2
900		54446 G	804085	497910	.1772E+00
<b>0</b> 00		00000 72000	269527 335623	-1.738266 954054	.4544E-C2
960		517900	902837	64 48 37	.1695E+C0
<b>0</b> 000		)	250229 193980	-1.750276 600104	.3462E-62
900		28900	948555	739376	.21C8E+C0
900 900		.30000 -30000	237694 061556	-1.750025 20030	.9694E-83
400		1 6000	969388	792992	.2063E+uJ
0 U O		00000	237 69 4 .0 6155 6	-1.756025 .200030	.9694E-03
000		745400	969388	792392	.20 63 E+ u0

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

N	М	X	X	×	X	NX	NP
		Υ	Ÿ	· Y	Ÿ	NY	NP
		<b>Z</b>	Z	Z	Z	NZ	NP
7	19	-1.500000	-1.500000	-2.000000	-2.000000	250229	-1.75
		.40000n	.860000	.800000	.400000	• <b>1</b> 9398\$	- 60
		842600	768100	628990	718000	948555	73
	20	-1.500000	-1.500000	-2.000000	-2.000000	269527	-1.73
		.80000	1.146900	1.072000	020268	.335023	. 95
		768107	652000	517900	628900	902837	- • 64
	21	-1.500000	-1.500000	- 2.000000	-2.000000	310024	-1. 73 É
		1.140000	1.460000	1.322000	1.072000	•507279	1. 25 (
		652000	465900	344400	517900	864685	497
	22	-1.597680	-1.500000	-2.000000	-2.000000	372374	-1.733
		1.465000	1.670100	1.465888	1.322000	.725701	1. 48 4
		465900	229700	137800	344400	578529	- • 29 7
	23	-1.500000	-1.501000	- 2.0000000	-2.000000	4 1 4 4 7 9	-1 . 699
		1.670000	1.732300	1.490760	1.465000	.885202	1. 611
		229700	0.000000	0.00000	137800	211244	09 6
34		**** *****	****		*****	F 4F 4F	÷ .
8	1	-2.000000	-2.000000	-2.500000	-2.500000	597981	-2.218
•	•	1.490700	1.322000	1.000000	1.655000	.747834	1.240
		0.000000	.344400	.235700	6.200000	.288382	. 149
	2	-2.000000	-2.000000	- 2.500000	-2.500000	425912	- 2. 214
		1.322000	.800000	.801000	1.000000	. 463 20 u	. 990
		.34440 1	.628900	.381500	235700	.777203	• 41 1
	3	-2.000000	-2.000000	- 2.500000	-2.500000	397801	-2.250
	•	800000	.400000	•400000	.800000	246251	. 60 0
		.628900	.71 8000	.515360	.381500	.883807	• 56 0
	4	-2. 200000	-2.000000	-2.500000	-2.506000	366089	-2.250
		400000	0.00000	0.00000	. 400000	.075569	. 20 0
		713008	. 74 57 00	•5528.0	.515300	.927222	• 63 2
	5	-2.000000	-2.000000	-2.500300	-2.500000	366809	-2.250
		0.00000	40 0000	400000	0.00000	075569	200
		.745700	.718000	•515300	. 552800	.927222	632
	6	-2.000000	-2.000000	-2.500000	-2.500000	372805	- 2. 250
		400000	800000	800000	430000	278586	- 600
		.718000	.600000	-381500	.515310	.885102	• 55 3

T.	X	NX	NP X	D
	Y	NY	NP Y	T
	Z	NZ	NP Z	A
000	-2.00000	250229	-1.750276	.3462E-02
000	.40000	.193980	.600104	.6750E+00
900	718000	948555	739306	.2108E+00
000 000	-2.000000 -80000 -828900	269527 .335023 902837	-1.738266 .954054 644837	•4544E-02 •6218E+00 •1695E+10
0 0 0 0	-2.000000 1.072000 517900	310024 -507279 804085	-1.738932 1.250730 497910	.6345E-02 .6350E+00 .1772E+00
00	-2.000000	372374	-1.733772	•7874E+02
	1.322000	.725701	1.484752	•6199E+00
	344400	578529	297994	•1525E+00
00	-2.00000	414479	-1.699678	•3180E-02
	1.465000	.885202	1.611865	•5833E+00
	137800	211244	096576	•1038E+00
	*****	<b>*</b>	****	****
0 0 0 0	-2.500000 1.055000 0.00000	597981 .747834 .288382	-2.218024 1.248723 .149617	•1342E-01 •7391E+00 •1939E+00
0 0	-2.530000	425912	-2.214445	.1034E+01
0 0	1.000000	.463200	.99u269	.7238E+00
0 0	.235700	.777203	.411287	.2322E+00
0 C	-2.500000	397601	-2.250969	.9877E-02
0 D	.800000	.246251	.600392	.7233E+60
0 O	.381500	.883807	.566379	.2263E+60
0 0	-2.500000	36600 \$ .075569 .927222	-2.250072	.2272E-02
0 0	.400000		.200101	.6805E+00
0 0	.515300		.632913	.2157E+00
0 0 0 0	-2.500000 0.00000 .552800	366809 075569 .927222	200101	.2272E-02 .6805E+00 .2157E+00
	-2.530000 43000 .515300	372805 278586 .885102	600126	•3496E-02 •7233E+60 •2260E+60

#### ATPOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

### TEST BODY

N	M	X	×	X	X	NX	NP
		Y '	Y _	Y _	Y	NY	NP
		Z	Z	, , , , <b>Z</b>	<b>. Z</b>	NZ	NP
8	7	-2.000000	-2.0000000	- 2.500000	-2.500000	396212	-2.21
	, <del>-</del> ,	800000	-1.200000	-1.000080	800000	458473	95 (
	4)	.600000	. 400000	.235700	.38150 <b>0</b>	•795499	•416
	8	-2.000000	-2.000000	-2.500000	-2.500000	537231	-2.21
		-1.200000	-1.490700	-1.055000	-1.000000	740960	-1.20 \$
		.400000	0.000000	0.000000	.235700	•462941	.16
	9 .	-2.000000	-2.000000	-2.500000	-2.500000	597981	-2.21
		-1.490700	-1.322000	-1.000000	-1.055000	747834	-1.240
		0.000000	344400	235700	0.00000	288382	149
	10	-2.000000	-2.000000	- 2.500000	-2.500000	425912	-2.214
		-1.322000	800000	800000	-1.090000	463200	990
		344400	628900	381500	235700	777203	41 1
	11	-2.000000	-2.000000	-2.505000	-2.500000	397801	-2.250
		800000	400000	400000	800000	246251	600
		628900	718000	515300	381500	883807	560
(a)	12	-2.000000	-2.000000	-2.500000	-2.500000	366578	- 2 · 25 0
<b>ω</b>		400000	0.00000	0.303000	400000	075231	208
		718000	745400	552800	515300	927341	632
	13	-2.000000	-2.000000	-2.500000	-2.500060	366578	- 2. 250
		0.000000	. 400000	.400000	0.000000	.075231	. 20 0
		745400	71 8000	515360	552800	927341	632
	14	- 2. 000000	-2.0000000	-2.500000	-2.500000	397891	-2.250
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		718000	628900	381500	515300	883807	560
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		000000	1.322000	1.000000	.8000 <b>0</b>	•463200	. 990
		628910	344400	235700	381500	777203	411
	16	-2.000000	-2.000000	-2.500000	-2.500000	597981	-2.218
		1.322000	1.490700	1.055000	1.630000	.747834	1.240
		344400	0.00000	0.000000	235760	288382	149
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9	1	-2.500000	-2.500000	- 3.000000	-3.009000	_ 960756	_2 606
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• 2357		- 458473	956945	.1214E-01
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			•416859	•1886E+00
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80	DY :	ID. TEST	TEST	BOD Y			
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		<b>-</b>		-	4	19.4	1
9	2	-2.500000	-2.500000	-3.000000	-3.000000	776209	-2.629
		.800000 ,381500	. 400000	0.000000	0.00000	.200002	. 43 4
		*201200	• 51 5300	0.000000	0.600000	•597912	• 33 6
	3	-2.500000	-2.500000	-:.000000	-3.00000	740175	-2.635
		.400000	0.000000	0.00000	0.603000	.062764	. 14 1
		.515370	• 55 2800	0.000000	0.030000	•669478	• 38 9
	4	-2.500000	-2.500000	- 3. 000000	-3.650060	743175	<b>-</b> 2 <b>.</b> 63 <b>5</b>
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36	7	-2.500000	-2.500000	-3.000000	-3.000000	868756	-2.626
9		-1.055000 0.000000	800000	0.00000	0.00000	411733	687
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	9	-2.500000	-2.500000	- 3.000000	-3.000660	740175	-2.635
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	11	-2.500000 .400000	-2.500000 -600000	-3.000000 0.000000	-3.690000	7762 <b>0</b> 9	-2.629
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			70270	4 4 6 6 6 9 6 9		サンフェフエム	- • 33 0
	12	-2.500000	-2.560000	-3.000000	-3.000000	868756	- 2. 626
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# 189 BASIC ELEMENTS WERE INPUT FLOWS HAS SET UP 1 X FLOWS, G Y FLOWS, AND C Z FLOWS.

NEAR ELEMENTS = 12340

INTERMEDIATE ELEMENTS = 12849

FAR ELEMENTS = 10532

LEAVING VFORM

LEAVING AFORM

THE 189 X 189 MATRIX WITH 1 RIGHT SIDES WAS SOLVED DIRECTLY. LEAVING ATAPES

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

#### TEST BODY

1.				X-FLOW		
N	M	NPX	VT			
		NPY	VTSQ	VX	DCX	NX
		NPZ	CP	VY	DCY	NY
			O P	VZ	DCZ	ΝZ
1	1	1.591395	• 650542	496765		
		1.389794	423205	•186355	• 28 E4 60	•958086
		• 0 9 4 8 9 9	• 576795	683774	928109	.276584
			V = 1 O 1 J J	154717	237813	.074655
	2	1.598349	• 722874	24.00=		
		1.254929	• 522546	• 242954	.336094	•941794
		• 282927	• 477454	520217	719651	.251249
	_		5 <del></del>	439138	607572	.223380
i.	3	1.695113	• 827395	777490		
	2	1.019539	- 684582	•333138	• 40 25 99	•915363
		• 445612	• 31 5418	389638	47922	.202414
				-•649454	784950	-348352
	4	1.609275	• 907577	1.40000		
		• 750320	.8236 56	•410652	• 452482	.891771
		• 557494	•176304	- 257457	283676	•146221
	_			767312	8 45451	• 428210
	5	1.620269	940808	LECTION.		
		• 447981	885119	• 45 60 97	• 484793	.874522
		•613081	• 11 48 81	124538	132373	.088802
			4 4 2 10 0 2	81337s	-•864553	•476787
	6	1.624811	• 975755	/ 0.350 a		
		• 1470 89	952098	487598	• 499713	.865649
		•641222	.947902	•01 0372	•618630	.029238
			4 7 7 1 2 0 2	845127	866126	•499797
	7	1.626041	1.0225 {2	E4.6000		
		148316	1.045673	• 516020	• 504625	.863087
		• 523224	045673	185219	•181129	082222
	- :			363186	- • 8 4 4 1 2 4	•493318
	8	1.627233	1.027046	E64390		
		- • 442846	1.054824	•501079	• 487883	.872872
		• 524111	054824	• 38 5641	• 375436	218218
				899336	788023	• 436436
	9	1.618821	1.037872	505607		
		751160	1.077179	•505633	•487230	.872872
		• 386778	077179	•454951	• 436350	218218
	1			783899	755286	•43643€
1	0	1.607148	1.045350	507017		
		-1.085976	1.092756	•507243	• 485237	.872872
		• 242716	092756	• 58 4246	• 48 23 70	218218
			- 552, 50	762363	729290	• 436436
1.	1	1.589795	. 843584	27500		e e e e e e e e e e e e e e e e e e e
		-1.365206	• 711633	·275038	.326094	•945063
		. 1184464	288367	•631398	•748462	272824
			, , = <del>= = = = = =  </del>	487141	577466	.180064
12	2	1.591395	• 659238	103,35		
		-1.389794	• 4345 94	•182435	• 276812	.958086
		094899	• 565406	• 63345 · ·	960895	276584
				004927	007473	074655

38

	X-FLOW			
VT	****			
TSQ	VX	DCX	NX	VN
DP	VY	DCY	NY	SIG
<b>9</b> P	VZ	OCZ	NZ	
50542	•186355	- 28 64 60	•958086	Antaan
23205	683774	928109	• 276584	.000000
6795	154737	237813	• 97 4 6 5 5	139050
22874	• 242954	.336094	•941794	0.0003.
22546	520217	719651	251249	137437
7454	439138	607572	.223380	110/40/
73 95	•333118	• 402599	•915363	• 60 60 00
4582	389638	470922	202414	133778
5418	- • 64 94 5 4	784950	348352	1133776
7577	•410652	• 452482	.891771	• 50 50 . 0
36 96	257457	283676	•146221	130613
'£304	767312	845451	.428218	1700073
8080	• 45 60 97	• 484793	.874522	.000000
5119	124538	132373	988802	128792
4881	813378	-•864553	•476787	
<b>57</b> 55	•487598	•499713	.865649	. 800000
2098	.010372	· C10630	.029238	1276 84
7902	845127	866126	.499797	0227004
25 {2	.516020	• 504625	.863087	. 300000
5673	•185219	.181129	082222	127758
<b>5</b> 673	36 318 6	844124	•493318	<b>-11</b> , <b>-1</b>
7046	.501079	. 487683	.872872	• 85 86 20
4824	. 38 5641	• 375486	218218	134528
<b>4</b> 824	809336	788023	. 436436	10 42 20
7872	•505633	•487230	.872872	. 66666
7179	• 454951	• 436350	218218	136386
71 79	783893	755286	.43643€	120000
5350	.507243	. 485237	.872872	. 55555
2756	• 58 4246	• 48 23 70	218218	128897
2756	762363	725290	• 436436	1220031
5584	.275038	.326094	•945063	• 000000
1633	.631390	.748462	272824	146478
367	487141	577466	•180064	
238	•182435	.276812	•958086	• 400000
5 94	• 633458	960895	276584	143742
406	004927	007473	074655	The state of the s

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NPX	VT	vx '	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DGZ	NZ
1	13	1.598349	•686910	• 228418	. 332515	.941794
		-1.254020	. 471645	. 54 55 ] 3	.794140	251249
		282927	• 528155	.349431	.508700	223380
	14	1.635113	•794765	.319054	.401444	•915363
		-1.019539	•631651	•417354	• 525129	262414
		445612	-368349	•596382	.750388	348052
	15	1.609275	. 883063	.399194	. 452056	.891771
		750320	.779800	.290737	.329203	146221
		557494	.220200	.732075	.829018	428210
	16	1.620269	•918614	•445350	.484818	.874522
		447901	.843852	.170819	.185953	088802
		613981	• 156148	.785065	.854619	476787
	17	1.624811	• 938859	•469935	.500602	.865649
	<b>*</b> ′	147089	• 881457	·164633	.064581	029238
		641222	118543	.810495	.863265	499797
39	. 8	1.624811	.941987	•471601	• 50 66 45	.865649
	. 0	•147089	887340	0 .2714	045345	.029238
		641222	•112660	.814314	.864464	499797
	19	1.620269	• 928862	.450482	•464982	.874522
		.447901	.862784	15 20 9 1	163739	.088802
		613081	.137216	.797947	.859059	476787
	20	1.609275	•902372···	. 40 8274	. 452446	.891771
	2.0	.750320	814275	271614	301006	.146221
		557494	.185725	.757505	839459	428216
	21	1.605113	•824376	•331816	. 40 25 05	•915363
		1.019539	.679596	397026	481607	"202414
		445612	320404	•641767	.778488	348052
	22	1.598349	•721173	. 242312	.335997	.941794
		1.254020	.520090	523530	726026	.251249
		232927	.479910	.432699	.595994	223380
	23	1.591395	. 6499 87	.186167	.286416	.958086
		1.389794	• 422484	604720	930356	. 276584
		194899	.577516	•148793	.228917	074655
2	1	1.220560	1.298463	1.168799	. 900141	.435365
		1.831729	1.686005	543418	418509	.855263
		•149900	686005	156877	120818	.281038

DCX DCY DCZ	NX NY NZ	VN SIG
.332515 .794140 .508700	.941794 251249 223380	.000036 141206
.401444 .525129 .750388	.915363 212414 348952	.000030 136358
.452056 .329203 .829018	.891771 146221 428210	.000000 132383
.484818 .185953 .854619	.874522 088802 476787	.000000 129915
.501602 .064581 .863265	.865649 029238 499797	.000000 126441
.50645 045345 .864464	.865649 .029238 499797	- 128168
.484982 163739 .859059	.874522 .088802 476767	.000010 129054
.452446 301000 .839459	.891771 .146221 428216	.604000 130873
.402505 481607 .778488	.915363 .202414 348052	.00000u 133979
.335997 726026 .599994	.941794 .251249 223380	.300000 137551
.286416 930356 .228917	.958086 .276584 074655	.000050 139085
.90[141 418509 120818	.435365 .855263 .281036	.600000 041547

#### ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

				t .	X-FLOW		
	N	M	NPX	VT	٧x	DCX	NX
			NPY	VTSQ	VY	DCY	NY
			NPZ	СР	٧Z	DCZ	NZ
	2	2	1.241719	1.342441	1.235652	. 9204 59	.390089
			1.652830	1.802147	395679	294746	.652170
			.414680	802147	344554	256670	.650004
		3	1.241630	1.394162	1.318375	.945640	.324553
			1.351646	1.943667	240723	172665	.44700 E
			.631851	9436 87	38 4222	275593	.833577
		4	1.242993	1.422806	1.362458	. 957585	.2880 <b>0</b> 9
			• 985715	2.024378	135694	095371	.287151
			.786135	-1.024378	386876	271910	.913561
		5	1.250180	1.439029	1.385168	.962571	.270929
			.600088	2.070805	055319	038442	.163401
			.876683	-1.970805	386075	268289	• 948629
		6	1.250017	1.440042	1.388034	.963884	•261384
			.200026	2.073722	.055597	.038608	.052527
			• 9220 94	-1.073722	379465	263509	.963805
40		7	1.246098	1.454852	1.441656	•991475	•126140
			199566	2.114266	103242	.071603	312996
			.867167	-1.114266	158854	109249	.941341
		8	1.250000	1.464273	1.463954	•999782	0.030000
			600000	2.144096	.027353	.018687	447214
			.700000	-1.144096	.013631	.009344	.894427
		g	1.250000	1.45 91 10	1.458563	•999623	0.000000
			-1.000000	2.129001	.035829	.024556	447214
			.500000	-1.129001	.017915	.012278	.894427
		10	1.250000	1.413037	1.412346	.999511	0.000000
			-1.400000	1.996674	.039537	.027980	447214
			.300000	996674	.019758	.013996	.894427
		11	1.216789	1.329756	1.312795	.987245	.159008
			-1.739216	1.768252	.118463	.889886	593315
			.102018	76 8252	175453	131951	.78910 9
		12	1.220560	1.246825	1.106576	.891807	• 435365
			-1.831729	1.539647	.561339	. 452391	855263
	+		149970	539647	.005949	.004795	201038
		13	1.241719	1.307517	1.201637	.919023	.390389
			-1.652830	1.709599	.417526	.319327	652170
			414680	709599	. 30 2225	. 231144	650304

--175453

1.106576

•561339

.005949

1.201637

•417526

. 30 2225

--131951

.891807

. 452391

.004795

.919023

.319327

. 231144

.000000

-. 052420

.000036

-.039199

.78910 ¢

• 435365

-.855263

-.201038

.390389

-.652173

-.650104

X-FLOW			
VX VY	DCX DCY	NX	VN
٧Z	OCZ	N Y NZ	SIG
1.235652	• 920459	•390089	.00000
395679	294746	.652170	031945
344554	256670	•650004	
1.318375 240723	•945640	.324553	. 500635
384222	172665	•44700€	019186
	-•275593	•833577	
1.362458 135634	• 957585	·28800 S	. 400000
386876	695371	•287154	811885
*306678	271910	•913561	
1.385168	.962571	.270929	.006666
055319 386075	038442	.163401	008418
T • 30 0075	268289	•948629	
1.388034	• 963884	•261384	.000618
•055597 ••379465	• 038608	.052527	007881
	263509	•963805	
1.441656	•991475	•126140	• 6000030
103242	.871603	312996	.022592
158854	109249	• 941341	***************************************
1.463954	•999782	0.050000	. 000000
.027353	•018687	447214	• b51235
• 013631	.009344	.894427	• 0 J 1 L 1 J
1.458563	•999623	0.00000	. 000000
• 035829	024556	447214	• 649986
.017915	.012278	.894427	# C 4 3 3 0 O
1.412346	•999511	0.១៥០០៦០	
•039537	·027980	447214	• 047884
• 01 9768	•013990	894427	• • • • • • • • • • • • • • • • • • •
1.312795	• 987245	•159008	An one e
•118453	.089086	593315	.000000 .611237
175453	- 4 740 54	70040	• DITES!

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

TEST BORY

			e de la companya de l	X-FLOW		
N	М	NPX	VT	<b>vx</b>	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
2	14	1.241630	1.375733	1.306194	.945891	. 324553
		-1.351646	1.892642	•259936	·186943	44700E
		631851	892642	•36684j	.266651	833577
	15	1.242999	1.414596	1.354205	• 957309	·2880 <b>0</b> 9
		985715	2.001080	.156928	•116935	287154
		786135	-1.001080	.377630	.266931	91.561
	16	1.250180	1.43 91 88	1.385197	.962478	.270929
		600068	2.971262	.088639	.061631	163481
54,	*	876683	-1.871262	.380331	.264268	948629
	17	1.250017	1.449715	1.399232	•965212	.261384
		200026	2.101673	.030686	•621167	052527
		922994	-1.101673	.377813	. 260612	963805
	18	1.250017	1.451738	4 104000	0.5555	064704
	16	.200026		1.401258	.965235	-261384
			2.107544	022042	015183	.052527
41		922094	-1.107544	.378823	. 266944	963805
_	19	1.250180	1.445716	1.391539	.962560	.271929
		•600088	2.090095	079317	3 5 48 63	.163401
		876683	-1.090095	• 38 377 6	• 265457	948629
	20	1.242993	1.426664	1.366014	• 957488	.288009
		•985715	2.035371	146440	102645	.287154
		786135	-1.635371	•384619	.269593	913561
	21	1.241630	1.396261	1.320233	•945549	.324553
		1.351646	1.949544	245938	176183	.447006
		631851	949544	.382116	.273671	833577
	22	1.241719	1.343418	1.236477	•920396	.391089
		1.652830	1.804772	398298	296481	652170
		414680	804772	• 342426	254891	653044
	23	1.220560	1.298765	4 460575	0.0644.0	
	23	1.831729	1.686792	1.169035	900112	•435365
		149900	686792	544235	419079	.855263
		147700	000/32	•1546]3	•119039	281038
. 3	1	.500000	1.212633	1.212570	• 999948	0.0.0000
		1.935000	1.470479	004275	003526	.938893
		.177300	470479	•011662	.009617	.344208
	2	.500000	1.221463	1.221289	• 999841	0.000000
		1.735000	1.492020	016038	013179	.672591
		•477300	492020	.014632	.011979	740014
				772,700		

DCX DCY DCZ	NX N Y N Z	VN SIG
•945891 •186943 •266651	.324553 447006 833577	•000000 ••024030
.957309 .11[935 .266931	•288119 ••207154 ••91•561	•00000 -•314970
.962478 .061631 .264268	.273929 163481 948629	.000000 010137
.965212 .621167 .260612	.261384 052527 963805	.000080 607697
.965235 015183 .266944	.261384 .052527 963805	.000000 007196
• 962560 •• 054863 • 265457	.27J929 .163401 948629	• 00 00 00 •• 00 85 45
•957488 ••102645 •269593	.288009 .287154 913561	.008000 012085
.945549 176183 .273671	•324553 •447806 •833577	.000000 19350
•920396 ••296481 •254891	.390089 .652170 650004	.0000u0 032050
.900112 419079 .119039	•435365 •855263 ••281038	.0800u0 041587
.999948 003526 .009617	0.00000 .938893 .344208	.000000 .009526
•999841 -•013179 •011979	0.000000 .672591 .740014	• 000600 • 009772

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	M	NPX NPY	VT VTSQ	VX VY	DCX DCY	NX NY
		NPZ	ĊP	٧Z	DCZ	NZ
3	3	.500000	1.232356	1.232207	.999879	0.000000
		1.430990	1.518701	017153	013919	.447214
		.700000	518701	.008577	.006960	.894427
	4	.500000	1.237837	1.236932	•999955	0.000000
		1.070000	1.530261	011243	009088	.279631
		. 858250	530261	.003274	.002647	.961107
	5	.500000	1.234013	1.234011	•999998	0.080200
		•600000	1.522789	002482	002011	•156305
		•948150	5227 89	.000333	.006318	.987789
	6	.500000	1.2200 64	1.220020	• 999964	0.020000
		.200300	1.488557	.010370	.008500	.050436
		.989900	- 488557	90 0524	000429	.998727
	7	.500000	1.206541	1.206516	•999979	U.000000
		200000	1.455742	007029	905826	447214
		.936000	455742	003515	C02913	.894427
42	8	.500009	1.196347	1.196331	• 999986	0.000000
		600000	1.431247	.005573	.004659	447214
		.700000	431247	·002787	.002329	.894427
	9	.500000	1.185439	1.185352	• 999927	0.000000
		-1.300000	1.405265	. 11 28 3 6	.610828	447214
		.500000	40 5265	.006418	.005414	.894427
	10	.500000	1-175488	1.175237	• 999829	0.000000
		-1.406000	1.381772	.019439	.016537	447214
		.300000	381772	.009719	.000268	.894427
	11	.500000	1.164000	1.163439	• 9 9 9 5 1 9	0.000000
		-1.800000	1.354855	.032312	.027751	447214
		.190900	354895	• 116151	.013876	•89+427
	12	.500000	1.16 (003	1.167855	•999873	0.000000
		-1.935000	1.364231	.006398	.005477	938893
		177300	364231	017450	014940	344208
	13	.500000	1.195403	1.195120	•999763	9.000000
		-1.735000	1.42 89 89	.019253	.016106	672591
		477300	42 89 89	017439	614638	743314
	14	.530000	1.218760	1.218532	•999813	0.333000
		-1.400000	1.485377	.021030	.017296	447214
		700000	485377	010540	008648	894427

X	-F	<u>.</u>	0	W
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VX VY	DCX DCY	NX	VN
٧Z	DCZ	NY NZ	SIG
1.232207	•999879	0.000000	000300.
• 9¢ 8577	013919 -006960	•447214 •894427	.910857
1.236932	• 9 9 9 9 5 5	0.000000	• ប្រជុំដូច្
.003274	-•009088 •002647	•279631 •96J107	• 011576
1.234011 002482	• 999998	0.000200	• 000000
.000333	002011 .000318	•156305 •987709	.011895
1.220020 .010370	999964	0.060666	• ១០០១៩៦
90 0524	•008500 <b>-•00</b> 0429	•050436 •998727	.010980
1.206516 007029	999979	<b>0.000000</b>	• Ø Ø Ø G G G
003515	005826 002913	-•447214 •894427	· 811147
1.196331 .005573	• 999986	0.000000	• 6000000
•002787	• 0 0 46 5 9 • 0 0 23 2 9	-•447214 •894427	• 611654
1.185352 .012836	• 999927	0.00000	.000065
• JU 641 8	• 610828 • 605414	-•447214 •894427	• 11632
1.175237 .019439	• 999829	0.000000	.000000
009719	• 016537 • 00 62 68	-•447214 •894427	.008609
• 163439 • 032312	999519	0.000000	• 603888
016151	•027751 •013876	-•447214 •89+427	• 00 4981
167855	• 9 9 9 8 7 3	<b>u.</b> 000000	• 60 00 00
•006398 •017450	•005477 -•014940	938893 344208	• 606411
. <b>1</b> 9 5120 . <b>0</b> 1 9253	•999763	u. 000000	.000666
017499	.016106 014638	672591 74JJ14	.007340
21 853 2 0 21 8 3	•999813	0.00000	• 000000
010540	•017296 -•608648	447214	.08900

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
	N M	NPX	VT	٧x	DCX	NX"
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
	3 15	•500000	1. 234579	1.234452	•9999 <b>1</b> 5	0.00000
		-1.000000	1.524186	.016316	013216	279631
		85825U	524186	904752	- 003849	960107
	16	•500000	1.244132	1.244037	• 999964	n nanan
		600000	1.547863	.010356	008332	0.000000
		948150	547863	001643	001319	-•156305 -•987709
	17	• 590000	1.249397	1.24939j	•99994	0.000000
		200003	1.563993	•004210	• <b>60</b> 3369	
		989900	560953	000213	000170	-•050436 -•998727
	18	•500000	1.251259	1.251258	• 99999	0.00000
		• 200000	1.565650	001969	001573	• 0 5 0 4 3 6
		-•9899 <b>0</b> 6	-•56565 <b>0</b>	0000099	00ûu79	998727
	19	•59 <b>000</b> 0	1.249969	1.249942	•999979	0.050930
		• 600000	1.562422	008053	606451	•156385
		948150	562422	001276	601021	987789
43	20	.509000	1.245269	1.245135	• 999933	0.000000
		1.000000	1.550694	013854	011133	•279631
		858250	550694	004038	003242	961107
	21	• 500000	1.236471	1.236305	•999866	0.090000
		1.456900	1.528862	918128	014661	•447214
		700060	528862	009064	007331	894427
	22	•500000	1. 223413	1.223215	• 999838	0.0.0000
		1.735000	1.496738	016278	013306	•672591
		477303	496738	014795	012093	740314
	23	.500000	1.213215	1.213153	999949	0.000000
		1.935000	1.47189C	38 4223	003478	•938893
		177360	471895	011513	009487	344208
4	. 1	246968	1.156990	1.155568	• 998771	049532
		1.923092	1.338626	.053200	045981	•939127
		• 174952	338626	.021401	.018497	•33998¢
	2	249477	1.161134	1.160840	•999058	043145
		1.726269	1.348232	• 329883	.025736	
		• 470 588	34 82 32	.040558	• 434938	•67515 { •736411
	3	249169	1.165449	1.164738	• 999364	_ 87.07F
		1.395016	1.358272	.313548	.050504	034875
		.692774	- @ 35 6272	.343195	.034489	•449471 •892614

X-FLOW

Yם

VX	DCX	NX	۷N
VY	DCY	NY	
٧Z	DCZ	NZ	SIG
1.234452	00000		
	999905	0.00000	.000000
• 916316	.013216	<b>279631</b> : ··	.010302
304752	003849	960107	
1.244037	• 999964	0.000000	St. Ale in the land
.010356	.008332	156365	• 500000
001640	001319	987719	.011310
		-0901109	
1.249391	• 999994	0.000000	.000000
.004210	•003369	050436	• 011924
000213	000170	998727	9 011354
1.251258	996999		
001969	999999	0.00000	.000000
000099	001573	• 0 50 436	.012193
-• 44444	000u79	998727	
1.249942	•999979	0.050006	
008053	006451	•156305	
001276	G01021	987789	• 612128
1.245135	200033		
013854	• 999933	0.000000	.000000
004038	011133	•279631	.011740
• • • • • • • • • • • • • • • • • • • •	003242	963107	
1.236305	•999866	0.030000	.000800
918128	û14661	•447214	
009064	007331	894427	.010921
1.223215	00000		
016278	•999838	0.000000	.000010
014795	013306	•672591	· L 09813
-4014133	012093	- * • 740014.	
1.213153	• 999949	0.00000	262440
004220	003478	•938893	.000000
011510	009487	344208	• 00 95 45
4 10			
1.155568	• 998771	049532	• 6 10 10 10
.053200	•045981	•939127	.004922
.021401	.018497	.339980	4366
1.160040	•999058	- 51.741 F	
.029883	• 025736	043145	• 600000
.040558	• 034938	•67515 {	.004422
	• ¥ 3 47 30	•736411	
1.164738	999364	034875	
• 010548	005051	• 449471	. 600060
.343195	.034489	.892614	• 06 40 10
	, - <del></del>	•076014	

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

			;	X-FLOW	*****	
N	М	NPX	V I	VX	DCX	NX
		NPY	VTSQ	V.Y	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
4	4	249537	1.166421	1.165810	•999476	031043
		•998756	1.360539	000124	000106	.281445
		.850538	360539	•037770	.032381	.959074
	5	250016	1.163090	1.162575	.999497	029218
		.630001	1.352777	008797	007555	.157442
		• 940749	352777	.035812	.030790	.987096
	6	250r02	1.152040	1.151345	.999397	028252
		.200000	1.327196	021538	018722	.050769
		• 98 28 25	327196	.033683	.029235	.998310
	7	249496	1.135124	1.134850	•999714	012608
		199997	1.288507	026978	023767	43452E
		.896509	288517	•00 287 û	• 00 25 29	.900571
	8	250000	1.119936	1.119873	.999944	U.000000
		600000	1.254256	010588	009454	447214
		.700000	254256	005294	004727	.894427
44	9	250000	1.111342	1.111342	•995999	9.000000
4		-1.000000	1.2350 82	.001286	.001157	447214
		.500000	235082	• 30 36 43	.000578	.89+427
	10	250000	1.108832	1.168745	.999917	0.00000
		-1.400000	1.229508	• 01 2740	.011489	447214
		.330000	2295 [8	.006370	.00 57 45	•894427
	11	247831	1.115217	1.114799	•999625	012880
		-1.793015	1.243710	.0173+2	.015550	460010
		.100024	243710	.025159	.022559	.887820
	12	248068	1.128924	1.126893	.998201	049532
at talah		-1.923092	1.274468	0655+5	058060	939127
		174052	274468	•316879	•014951	339980
	13	249477	1.147986	1.146858	.999018	043145
		-1.726269	1.317872	042024	036607	675158
		478688	317872	028665	024969	736411
	14	249169	1.160735	1.160026	.999389	034875
		-1.395016	1.347306	020453	617620	449471
		692774	347306	035024	030174	892614
	15	249537	1.169028	1.168465	.999518	031343
		998756	1.366627	009974	008532	281449
		850538	366627	034893	029848	959074
					7 - 70 - 70	+ 3 3 3 G 1 4

DCX	NX	VN
DCY	NY	SIG
OCZ	NZ	
•999476	031043	.000000
000106	.281449	• G G 4 B 8 3
•032381	.959074	
.999497	029218	.000000
007555	.157442	004254
.030790	.987096	
•999397	028252	.000000
016722	.050789	. 684249
•029235	.998310	
.999714	012608	.000010
023767	434526	.000634
• 00 25 29	.900571	
.999944	u.000000	.000000
009454	447214	501173
004727	.894427	
•995999	0.000000	.000000
.001157	447214	001694
.006578	.894427	
.999917	0.000000	0 0 0 0 0
.011489	447214	362980
• 0 0 57 45	.894427	
•999625	012880	. 000000
.015550	460010	003264
.022559	.887820	
.998201	049532	
T.058060	939127	.007805
• 0 1 49 51	339980	
•999018	043145	.000010
036607	675158	.006628
024969	736411	
.999389	034875	.000000
017620	449471	.005602
030174	892614	
•999518	031043	. 2246.0
008532	281449	.005201
029848	959074	

## ATMOSPHERIC SCIENCE ASSOCIATES BEOFORD, MASSACHUSETTS

BODY ID. TEST

		$\frac{d^2}{dt} = \frac{1}{2} \left( \frac{dt}{dt} + \frac{dt}{dt} \right)$		X-FLOW		
N	М	NPX	VT	<b>VX</b>	OCX	NX
		NPY	VTSQ	VŸ.	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
4	16	250016	1.174210	1.173709	•999573	029218
		600001	1.378769	005058	004308	157442
		940749	378769	033935	028900	987096·
	17	250002	1.177071	1.176601	.999601	028252
		200000	1.385457	002132	001854	350789
		982825	-•3854 97	033187	028194	998310
	18	250002	1.177939	1.177467	•999680	028252
		.200000	1.387539	000154	000131	.051789
		98 28 25	387539	033330	4 28295	998310
	19	250016	1.176983	1.176476	. 999569	029218
		.600001	1.385288	.00 2234	.001940	.157442
		940749	385238	034459	029278	987096
	20	249537	1.174127	1.173553	.999511	031043
		.998756	1.378574	006152	.005248	.281449
		850538	378574	036176	030811	959074
45	24	= 2/.04.60	4 4 6 05 26	4 4 6 9 9 % 0	001701	02 025
	21	249169	1.169520	1.168850	•999384	034875
		1.395916	1.367777	.014296	.012223	.449471
		692774	367777	038458	932892	892614
	22	249477	1.163098	1.162013	•999ÿ67	643145
		1.726269	1.352797	.032273	.027748	.675158
		470688	352797	038492	633694	736411
	23	248068	1.157588	1.156167	.998772	049532
	7.5	1.923092	1.340010	.054224	. 0 4 65 42	.939127
		174052	340010	013660	016120	339980
5	1	743334	1.160425	1.146655	.988142	153543
		1.874150	1.346567	.168493	.145199	.934141
		.161626	346587	.057936	.049927	.322188
	2	747389	1.166631	1.156305	•991149	132740
		1.690281	1.361028	.104989	· 089994	.683173
		• 444215	361028	.113850	.097597	.718091
	3	747752	1.171864	1.164831	. 994042	1 [8809
		1.373892	1.373264	- 151919	•044296	•457325
		.663304	373264	. 23.5710	.099593	.882618
	4	747958	1.173024	167569	.995350	095703
	•	992572	1.375986	120130	.017212	-288525
		.819383	375986	A11176	.094777	.952677
	300				T W J 71 1 1	# J J G G F F

OCX	NX	۷N
DCY	NY	SIG
DCZ	NZ	
•999573	029218	.640030
004308	157442	• 00 50 76
028900	987096	
.999601	028252	.000000
001854	350789	. 60 4937
028194	998310	
•999600	028252	000000
000131	.051789	.004786
428295	993310	
• 999569	029218	• 609690
.001940	.157442	• • • • 4603
029278	987096	
•999511	031043	.000000
•005248 -•030811	.281449	•004347
030011	959074	
•995384	03+875	000000
.012223	• 449471	.604212
932892	892614	
999067	043145	. 600000
.027748	•675158	- 50 45 66
633694	-,736411	
•998772	049532	. 5000.0
• 0 4 68 42	.939127	.004987
016120	339980	
.988142	153543	050050
•145199	• 934141	.015792
.049927	.322188	
.991149	132740	000000
.089994	.683173	. 613445
.097597	•710091	
994042	1 [8809	004000
•044296	•457325	. 610893
.099593	•882618	
•995350	095703	000000
.017212	•288525	.009621
.094777	.952677	

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N -	М	NPX		,		
		•	NPY	VŤ	VX	n.cv	
				VTSQ	VY	DCX	NX
			NPZ	CP	VZ	DCY	NY
	5	_			٧٧	DCZ	NZ
	2	5	<b></b> 750055	1.170769	4 46 564 5		
			•6000009	1.370699	1.165817	• 995771	089915
			• 910468	370699	0 4751	60 40 67	•162ú2t
				•010099	.107457	.091784	•982682
		6	750005	4 404		- · · · ·	• 30 20 0 2
			. 200003	1.161565	1.156220	•995398	
			• 953924	1.349234	041883	036057	0 66851
			• 323924	349234	•103132		•05210E
		7	<b>-</b>			• C 8 & 7 8 7	• 99485 €
		,	748551	1.145511	1.143638		
			199961	1.312155		• 998365	039925
			882279	312195	060743	053027	379842
				4015133	• 0 2 4 4 4 0	021335	924189
	8	3	750000	4 401543			• 25410 F
			600000	1.124601	1.124251	• 999689	3 8 8 8
			700000	1.264728	125032	022312	0.0.0000
			.796869	264728	312546		-•447214
					0022340	011156	.894427
	9		750000	1.114870	4.442064		
			-1.300000	1.242934	1.114851	• 999992	0.000000
			• 500000	- 242934	064028	003613	- 447214
46				4545394	002014	001807	
	10		750000	4 4 4 4 4 4 4			•894427
			-1.400000	1.115443	1.115255	•999831	
			•300000	1.244214	·918316	.016420	0.000000
			• 24 0 0 0 0	244214	.009158		-•447214
					1003230	.008210	.894427
	11		741375	1.132611	1.130300		
			-1.764760	1.282807		•997960	-•044855
			•190234	282807	017624	·015560	519160
					• 07 0123	· 061913	.85349¢
	12		743334	1 120074			***
			-1.874150	1.132236	10115714	.985408	- 4555
			161626	1.281958	-,191336	168990	- • 153543
			• 101050	-•281958	.023044	• 0 20353	934141
	13		- 7:			• 6 5 6 9 9 9	322188
	20		-•747389	1.151358	1.140735	201515	
			-1.690281	1.325626	126978	•996816	132740
			444215	325626	- 100010	110286	683173
					090072	076231	718391
	14		- • 747752	1.165286			*******
			-1.373892	1 757004	1.158299	994004	a. A dansa
			- 663334	1.357891	069581	059712	138869
				·· 357891	1867+1	091601	457325
	15		747958			APSTOUT	882618
				1.173815	1.167615	00=3.0=	
			992572	1.375964	038301	995397	095763
			819383	375964	105695	032652	288525
					2 + 40 303 P	090106	952677
	16		750055	1.177768	e de la marcia de la composición de la		
			600009	1.387138	1.172932	• 995944	039915
			910468	- 7074	023972	C178C7	
				387138	103871	088193	162320
						4 # A O T 2 Q	982682

DCY DCZ	NX NY NZ	VN SIG
95771 84067 91784	089915 •162020 •982682	.000000 .009344
95398 36057 38787	036851 .052106 .994858	000000 .009411
98365 53027 21335	039925 379842 .924189	.000000 000416
99689 22312 L1156	0.0.0000 447214 .894427	.00000 007092
99992 3613 1807	0.003006 447214 .894427	• 000000 -•007455
9831 6420 8210	0.000000 447214 .834427	.000000 09950
7961 5560 1913	04 <u>+</u> 355 519160 .853499	.00000 005237
5408 8990 20353	153543 934141 322188	000000 .022041
0816 0286 8231	132740 683173 718091	00G0U0 .510214
9712 1601	138869 457325 882618	00CQ00 . L14426
53 97 2652 <b>01</b> 06	095703 288525 952677	090000 .012115
5944 7807 <b>61</b> 93	009915 162020 982682	.00000

## ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NPX	VT	VX:	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ :
5	17	750005	1.180390	1.175928	•996219	- 00005
		200003	1.393322	007814	006620	056851
		-• 953924	-•393322	10 2249	08 66 23	-•05210€ -•994858
	18	- 75666			1000020	
	10	750005	1.181278	1.176812	996220	G86851
		•200003 <b>-</b> •953924	1.395417	• 30 3321	.002812	.052166
		- 1 300324	395417	102552	086823	- 99+858
	19	750055	1.180608	1.175825	005010	
		•600009	1.393835	•015707	995949	089915
		910468	393835	104938	•013304	•162020
	20	7. 70 75			-•û88936	982682
	C U	-•747958 002572	1-178349	1.172939	.995409	095703
		•992572 <b>-</b> •819383	1.388506	.031346	.026601	•288525
		019393	388506	108337	091940	952677
	21	747752	1.174632	1.167657	00/067	
		1.373892	1.379760	•958416	994063	1 (8869
47		663334	379760	11368U	•049732 •096779	• 457325
7	0.3				-•096779	882618
	22	747389	1.167891	1.157552	991148	132740
		1.690281	1.363969	•10897u	.093305	•683173
		444215	363969	110314	094447	718391
	23	743334	1.160774	1.44.6000		
		1.874150	1.3473 96	1.146999	• 988133	- • 1 53 543
		161626	3473 96	•17 0110 -•053408	•146548	• 934141
c	4			•093436	046011	32218 8
6	1	-1.229655	1.132362	1.090828	•963321	268347
		1.773614	1.282243	.291159	257134	•92148g
		•134912	282243	• 386937	.076775	• 280799
	2	-1 • 245329	1.144713	4 44 4 50 1		
		1.614691	1.310369	1.111521	.971303	239465
		• 336555	310369	•197828 •189089	•172819	.7 02123
				• 10 300 3	• 165185	.670724
	3	-1.245768	1.15 8983	1.136725	•980795	- 40,026
		1.329324	1.343242	.102834	• 688779	194936
		.600627	343242	.201273	•173663	•475316 •857948
	4	-4 005707				•05/ 948
	7	-1.245783 .979864	1.165866	1.148618	.985205	170981
		• 753512	1.35 52 44	.048514	.041612	•314683
		• (232 <u>1</u> 2	359244	•193825	.166250	•936981
	5	-1.250120	1.16 95 61	1.154226	00000	
		670034	1.367873	• 00 6877	• 986888 735333	159881
		• 846449	367873	.188649	• 0 0 5880	•172638
				*100043	•161299	•971923

DCX DCY DCZ	NX NY NZ	VN SIG
•996219 ••006620 ••086623	056851 052106 994858	.000060
.996220 .002812 .086823	086851 .052106 99+858	• 600000 • 00 9850
.995949 .013304 088936	069915 -162020 982682	• 80 9 6 8 0 • 60 9 8 20
.995409 .026601 091940	095743 .288525 952677	006000 .010025
•994063 •049732 •096779	1 \$8809 .457325 882618	000000 -511212
•991148 •093305 •094447	132740 .683173 718391	000000 -013668
• 988133 • 146548 • 046011	153543 .934141 322188	CO O CO O . 015888
• 963321 • 257134 • 076775	268347 .921489 .280799	-• ชียีอีซีซี • 327232
• 971J03 • 172819 • 165185	239165 .7 02123 .670724	010000 .124419
•980795 •088779 •173663	194936 .475316 .857948	310600 •619161
985205 041612 166250	170981 .3J4683 .936981	00360B .316512
986888 005880 161299	159881 .172638 .971923	0030L0 -015703
and the second s		

## ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
				X-1-LOH		
N	М	NPX	VT	VX	DCX	NX
		NPY	VTSQ	VY .	DCY	NY
		NPZ	CP	VZ	DCZ	NZ
6	6	-1.250012	1.170850	1.155253	. 986679	153515
		.200010	1.370889	053638	- • 0 4 58 11	.055250
		.893198	370889	•102761	.156093	.986601
	7	-1.248100	1.174562	1.168731	•995078	074106
		199835	1.379597	096916	082504	251846
		.852389	379597	. 0 64470	.054888	•964926
	8	-1.250000	1.154940	1.154031	.999187	0.090000
		600000	1.3338 86	341635	036050	447214
e"		.700000	3338 86	020818	016025	.894427
	9	-1.250000	1.138016	1.137954	.999954	0.00000
		-1.000000	1.2950 61	009751	008568	447214
		.500000	295081	004875	004284	.89+427
	10	-1.250000	1.1438 92	1.143471	.999571	0.0.000
		-1.470708	1.308488	.129956	. 0 2 £1 88	447214
		.300000	308468	.01 4978	.013094	.894427
48	11	-1.225923	1.161360	1.150415	•990576	105654
		-1.707445	1.348756	011041	009507	687853
		.100626	348756	.158631	.136634	.718119
	12	-1.229655	1.118520	1.069951	. 956586	268347
		-1.773614	1.2518 [8	323609	289310	921489
		134912	251088	.039432	• 6 3 5 2 5 4	280799
	13	-1.245329	1.130909	1.097016	.970030	239065
		-1.614691	1.278956	230259	203614	7 02123
		386555	278956	149950	132601	670724
	14	-1.245068	1.151328	1.129939	.984641	194936
		-1.329324	1.325556	127799	111993	475316
		60 <b>0</b> 627	325556	185734	161321	857948
	15	-1.245783	1.162543	1.145364	• 985223	170981
		979114	1.351506	172753	062581	3 54 68 3
		753512	351506	185350	159435	936981
	16	-1.250120	1.169385	1.154316	.987114	159881
		600034	1.367462	040457	034597	172638
		846449	367462	182639	156235	971923
	17	-1.250012	1.172927	1.159016	.98814G	153515
		270013	1.375757	014301	012192	055250
	17.00	893198	375757	179542	153072	986601

X Y Z	NX NY NZ	VN SIG
679 811 093	153515 .055253 .986601	000GCO .015444
078 504 888	074106 251846 .964926	• 900000 • 000059
187 050 025	0.030000 447214 .894427	.600000 vi3633
954 568 284	0.040000 447214 .894427	.0000e0 013916
571 188 094	0.01303C 447214 .894427	.000000 016569
576 507 634	185654 687853 .718119	.00000 002403
586 310 254	268347 921489 288799	900030 .636636
030 614 601	239065 7 02123 670724	500000 .031398
641 993 <b>3</b> 21	194936 475316 857948	600000 .024287
223 581 435	170981 354683 936981	000000 .920145
114 597 235	159881 172636 971923	000000 .618139
140 192 72	153515 055250 986601	000u00 .u16626

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N M		NPX	VT	٧x	οĈΧ	NX:
			NPY	VISQ	VY	DCA	ŃΥ
			NPZ	CP	VZ	DCZ	NZ
	6 18	-1.	250012	1.173694	1.159779	.986144	153515
		•	200013	1.377557	.007630	.006552	.05525C
			893198	377557	180031	153388	986601
	19		250120	1.171902	i.156827	•987136	159881
			600034	1.373354	.032555	•027788	.172638
			846449	373354	184514	157448	971923
	20	-1.	245783	1.167332	1.150142	.985274	170981
		•	979004	1.362663	.062430	.053481	.30+683
			753512	3626 £3	189579	162403	936981
	21		245768	1.15 9668	1.137419	.988815	194936
			329324	1.344829	.111184	.095876	•475316
		-•	696627	344829	196837	169736	857948
	22		245329	1.144845	1.111627	.970984	239165
			614691	1.310671	.202859	•177193	.782123
4		· . · •	386555	310671	183853	160598	670724
49	23		229655	1.132343	1.090782	• 963296	268347
			773614	1.282201	.29310+	<ul><li>258848</li></ul>	,921489
		-•	134912	282201	083543	071127	280799
•	7 1		699678	1.071793	• 97 53 9 4	•910058	414479
			611365	1.148740	.431871	.402943	.885202
		.•	096576	148740	•104985	.097113	.2112+4
	2	-1.	733772	1.092781	1.014192	. 928083	372374
		1.	484752	1.194171	.318158	. 291155	.725701
		•	297994	194171	.253683	.232145	.578529
	3	-1.	738932	1.121965	1.066664	.950711	310024
			250730	1.25 &8 <b>0</b> 5	.179768	•160226	•507279
		•	497910	25 88 05	•297852	.265474	.864085
	4	-1.	738266	1.142165	1.099857	. 962958	269527
			954054	1.304542	• 097975	• 08 57 80	.335023
		•	644837	374542	.291988	. 255644	.932837
	5		750276	1.158627	1.121590	.968034	25022 9
			600104	1.342417	.137916	.032716	.193980
		•	739306	342417	.288124	. 248677	• 948555
	6		750025	1.174333	1.139526	.976360	237694
			200030	1.379059	034967	029776	.061556
		•	792992	379059	.281632	. 239823	.969388

DCX DCY DCZ	NX NY NZ	VN SIG
• 988144 • 006552 •• 153388	153515 .055250 986601	600830 . 61 6044
• 987136 • 0 27788 •• 157448	159881 .172638 971923	00u030 -016340
• 985274 • 053481 •• 162403	170981 .384683 936981	000030 .017048
.980815 .095876 169736	194936 .475316 857948	.00J0J0 .u19582
• 970984 • 177193 • 160598	239165 .702123 670724	-•00 Luco • G2 47 0 6
• 963296 • 258848 • <b>0</b> 71127	268347 .921489 280799	000000 .027344
•91058 •402943 •097113	-•414479 •885202 •211244	000030 .041810
• 92 80 83 • 2911 55 • 2321 45	372374 .725701 .578529	000000 .037841
•950711 •160226 •265474	319024 .507279 .804085	000000
962958 085780 255644	269527 .335023 .902837	000000 .025359
968034 032716 248677	250225 .193980 .948555	000000 .023756
976360 029776 239823	237694 .061556 .96938£	000030 .022518

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

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PAGE

TEST BODY

				X-FLOW	•		
N	M	NPX	VT	٧x	n.cv		
		NPY	VTSQ	VŶ	DCX	NX	VN
		NPZ	. CP		DCY	NY	SIG
			O,	VZ	DCZ	NZ	
7	7	-1.749550	1.205607	1.178638	•977672	197278	000.0
		199759	1.453488	11 5921	096152	113683	• u 0 0 0 d 0
		.782469	453488	.225268	.186851	•973734	.015226
	8	-1.747311	1.230972	1.225355	005		
		599857	1.515291		• 995437	075980	• ប្បីបីព្រះវិថា
		.679777	515291	100709	081813	368319	008677
			• 21 25 31	.0694*7	.049105	•92658 <b>9</b>	
	9	-1.750000	1. 2273 80	1.227221	•999871	0 0 10000	
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	10	-1.726469			770.200	******	
	<b>4</b> G		1.218753	1.215655	•997458	050829	.0006.0
		-1.352829	1.485359	.022100	.018133	496741	018933
		• 314114	-• 485359	.083939	• # 68914	8664119	610333
	11	-1.762537	4 400140				
	**	-1.550513	1.166416	1.083066	• 926542	348626	0000000
			1.360526	29 2335	250627	842191	. 634454
		•113943	<b>360</b> 526	.31 9428	. 273854	•411307	*******
	12	-1.699678	1.081512	•977211	007564		
		-1.611865	1.169668	462855	903560	414479	0.804460
		096576	169668	• 32 218 6	427970	885202	• 649582
			420.000	• A E S T 2 Q	• 0 20514	211244	
	13	-1.733772	1.086144	1.306238	• 926484	372374	1
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	14	-1.738932	1.114650	1.059335	• 950374	310024	
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	15	. 4 770000	·	English and the second		0044005	
	1. N	-1.738266	1.13 6204	1.093988	. 962844	269527	444460
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		644837	290960	- 28 0114	246534	912837	.129572
	16	-1.750276	1.151282	4 44155			
		600104	1.325451	1.114573	•968114	250229	200000
		739306	325451	071497	062102	193988	-326698
		0,00 <b>0</b> 0	325451	279403	242689	948555	
	17	-1.750025	1.158015	1.124810	•971326	0.774	
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## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

#### TEST BODY

			1631 000	•			
				X-FLOW			
N	M	NPX	VT	٧x	DCX	NX	VN
		NPY	VTSQ	VY	DCY	N.Y	SIG
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7	19	-1.750276	1.152916	aj ajakon mem	00110		1. 1 <u>.</u> .
•		•600104	1.152916	1.115233 .362952	• 96 61 83	250229	<b>0</b> 000000
		739306	1•329215 -•329215	• 36 895 2 <b>-</b> • 28 19 3 6	• 052876 • 244597	.193986	.024579
		# # U # U # U	-252512	- • COTA10	244593	948555	
	20	-1.738266	1.139416	1.097239	• 962984	269527	358000
		•954054	1.298269	•111503	.097859	•335023	•026002
		644837	298269	286136	251169	902837	
	21	-1.738932	1.120131	1.064935	. 950724	318324	
	-	1.250730	1.254694	• 188418	• 950724 • 168210	310J24 .507279	000000
		497910	254694	291729	26(442	834085	. 930634
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	22	-1.733772	1.091523	1.312998	928952	372374	000610
		1.484752	1.191423	• 32 335 5	.296251	.725701	.038158
		297994	191423	246391	225731	578529	
	23	-1.699678	1.071357	• 97 497 3	.910036	414479	600030
		1.611865	1.147806	• 433686	•40489 <b>0</b>	865282	.041913
		096576	147806	095654	089283	211244	,
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8	1	-2.218024	• 9530 89	.763560	.801143	597981	006030
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	2	-2.214445	1.078634	Q7 50 6 7	<b>AB</b> 1 <b>4 3 3 3 3 3 3 3 3 3 3</b>		2. ************************************
		•990269	1.163451	•975917	904762	425912	000000
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	3	-2.250969	1.127743	1.034668	•917468	397801	400000
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		600126	1.477407	1.127038 178891	•927273 - 1/7175	372805	000000
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PROGRAM BOXC ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS BODY ID. TEST TEST BODY X-FLOW NPX N М VT VX DCX NX NPY VTSQ VY DCY NY NPZ CP YZ DCZ NZ 8 -2.218355 7., 1.206050 1.107315 .918133 -.396212 -.956945 1.454557 -.246493 -.204380 \*\* 458473 .416059 -- 454557 .409454 .339500 .795499 -2.212888 1.083768 8 . 91 2254 .841752 -.537231 -1.209729 1.174554 - . 477735 --448855 -.744960 .166619 -- 174554 .337711 .311608 .402941 -2.318024 .772784 9 . 965398 .800483 -.597981 -1.243723 .931993 -.555522 -.575433 -.747834 -. 149617 - 06 8007 ... 161641 -. 167642 -.288382 10 -2.214445 1.074426 .971432 .904113 -. 425912 -.990269 1.154391 -. 269128 -.250485 -.463230 -. 411287 -- 154391 -.371939 -.346175 -.777203 -2.256969 1.117305 1.024831 .917209 -.397801 11 1.248370 --145033 -.129804 -.246251 -.600392 -.560379 -. 249370 -- 420854 -.883807 -.376669 12 -2.250074 1.138957 1.059640 .930360 -.366578 -.200104 1.297223 - 042453 -.075231 -.037274 -.632837 - 297223 -- 415432 --364748 --927341 13 -2.250074 1.139033 1.059741 . 930387 -.366578 .032406 .075231 .200104 1.297395 .028451 -- 297395 -.632837 - . 41 6287 -.365474 - 927341 1-11 74 86 .917498 397891 14 -2.250969 1.325191 .600392 1.248774 .131954 .118082 .246251 -- 248774 -.560379 -.883807 -- 424672 -.380025 15 -2.214445 1.073381 .971068 . 904682 -.425912 990269

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ATMOSPHERIC SCIENCE ASSOCIATES PROGRAM BOXC BEDFORD, MASSACHUSETTS BODY ID. TEST TEST BODY X-FLOW NPX VT N М VX DCX NX NPY VTSQ VY DCY NY NPZ CP ٧Z DCZ NZ 2 9 -2.629150 .835434 .526675 .63(421 -.776209 . 4341 70 .697949 .195323 .233798 . 288042 .336208 .302051 .618394 .740208 .597912 3 -2.635472 .672319 -.740175 .875817 .591517 .774078 .052329 .062764 .141262 .046040 .389779 . 225922 .649655 .738410 .669478 .8907 €6 -2.635472 .598838 · 672273 -.743175 -.141262 .793463 -. 179632 -. 489465 -.062764 .389779 .206537 . 654634 .734878 .669478 5 -2.629151 .869668 .548218 .630376 -.776209 -. 434170 .756323 -.228735 -. 263014 -.200302 . 243677 .597912 .336208 .635135 .730376 -2.626833 .703717 . 495047 -.868756 6 .348373 -.687692 .495218 -.497144 -.706454 -.411733 .149145 .584782 .355953 .505818 .275208 7 -2.626333 .664268 .328750 • 494906 -.868756 -.411733 -.687692 . 441252 -.493026 -. 742209 -.149145 .558748 -.300168 -.451879 -.27520 E .820631 .517237 . 630352 -.776209 8 -2.629150 .673435 -. 434170 -.217408 -. 264928 -.20002 -. 336208 . 326565 -.598819 -.729705 -.597912

. 606040 · 690273 -2.635472 -.743175 -.0000000 .857280 .576419 . 672381 . 187213 .734930 -. 462764 -. 141262 -- 067574 -.078941 -.389779 . 265070 -.630944 -. 735984 -.66947E -2.635472 .856967 .576233 .672410 -.740175 -- 000000

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.653104 12 -2.626833 .323443 . 495240 -.868756 . 6376 92 . 426545 •471156 .721410 .411733 . 104895 -.27520 E -.149145 .573455 -.316135 - . 484050

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LEAVING FRINT1

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FLOPNT

BODY IDENTIFIER IS TEST

NUMBER CF SYMMETRY PLANES = 0

NUMBER OF QUADRALA

NUMBER OF QUADRALATERALS= 189

MACH NUMBER= 0.

FIRE BOILT FRAM.

### FLOPNT RUN ID -TEST PROBLEM WITH TEST BCDY

#### INPUT DATA -

INITIAL X=-4.5000E+00 INCREMENT= 1.000JE+00 NUMBER OF VALUES= 4
INITIAL Y= 0. INCREMENT= 0. NUMBER OF VALUES= 1
INITIAL Z= 1.0000E+00 INCREMENT=-5.000JE-01 NUMBER OF VALUES= 5

X AXIS IS INCREMENTED FIRST Y AXIS IS INCREMENTED THIRD Z AXIS IS INCREMENTED SECOND

## \* INDICATES THE POINT IS INSIDE THE BODY

	. <b>X</b>	Y	VX	VY	٧Z
	-4.5000000	0.0000000 1.000000	9.4274E-01	-1.8463E-83	3.1225E-02
	-3.5000000	2.0000000 1.0000000	8.9363E-01	-5.2865E-03	1.0830E-01
		~ ~ ~			
	-2.5000000	0.0000000 1.0000000		-2.1047E-02	2.8638E-01
	-1.5000000	0.9000000 1.090000	1.1528E+00	-7.7206E-02	1.6956E-01
			A Commence of the Commence of		
	1				
	i in falson 🗙	Y	VX	<b>V Y</b>	٧Z
	-4.5000000	0.3000000 .5000000	9.2695E-01	-1.8687E-03	2.0175E-U2
	-3.5000000	0.000000 .5000000	8.0239E-01	-5.3770E-03	1.0116E-01
		QUAD 179 I 2= 1			
56		SQ.TSQ.H= -6.9149E-82	2.2821E-31 1	.0355E+00 1	.0000E-01
	INSIDE			190736.44	
		SQ.TSQ.H= -3.5348E-02	6.6282E-12 6.	.7553E-01 1	.0000E-01
	<del>-</del>		9. 05955-15 P	• LDDOE-AT T	**************************************
	INSIDE			75575.44	00000 04
	_	SQ,TSQ,H= -3.5348E-02	6.6282E-12 6.	.7553E-01 1	.0000E-01
		QUAD 182 I2= 1			
		SQ, TSQ, H= -8.9149E-02			0000E-01
		-0.000000 .500000	1.4449E+00		
	-1.5000000	0.000000 .5000600	1.2122E+00	-6.2494E-02	3.9898E-02
					900 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	X	Y	VX	VY	٧Z
	-4.5000000	0.000000 2.000000	9.1975E-01	-1.7342E-03	1.5068E-03
	-3.5000000	0.000000 0.000000	7.3093E-01	-4.4575E-03	4.6059E-03
	-2.5000000	0.000000 C.00000CO	1.2744E+00	-1.3880E-02	1.8615E-02
	-1.5000000	0.0000000 0.000000	1.2164E+00		3.3288E-02
	-71300000	***************************************	1161646400	-34460 96-02	3135005-45
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	X	Y Z	VX	4 40545 03	VZ
	-4.5000000	0.00000005600000	9.2565E-01	-1.4964E-03	-1.7501E-02
	-3.5000000	0.0000005000000	7.9717E-01	-3.3034E-03	-9.4089E-02
	INSIDE				
	ZNP,ROS	SQ.TSQ.H= -8.9149E-02	2.2821E-01 1	.0355E+00 1	.0000E-01
	INSIDE	QUAD 186 I2= 1			
	ZNP.ROS	SQ.TSQ. H= -3.5348E-02	6.6282E-02 6	.7553E-01 1	. 0000E-01
	INSIDE				
		SQ, TSQ, H= +3.5348E-02	6.6282E-12 6	.7553E-01 1	.0000E-01
		QUAD 188 I2= 1			
		SQ.TSQ.H= -8.9149E-02	2.2821E-01 1	.0355E+00 1	.0800E-01
	-2.5000000	0.000000500000	1.4261E+00	-4.1937E-03	
			·		
	-1.5000000	0.000000500000	1.2105E+00	-1.1531E-02	1.9700E-02

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+00
     NUMBER OF VALUES=
     NUMBER OF VALUES=
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E THE BODY
          VY
                        ٧Z
-01
    -1.8463E-03
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}

THE BOUT FRAME

X -4.5000000 -3.5000000 -2.5000000 -1.5000000	0.0000000	Z -1.0000000 -1.0000000 -1.0000000	8.8645E-U1	-2.3480E-03 -3.3361E-03	VZ -2.9389E-02 -1.0521E-01 -2.8834E-01 -2.8899E-81	V 9.4098E-01 8.9268E-01 1.0048E+00
-1.5000000	0.000000	-1.0000000				1.1550

<sup>\*</sup> INDICATES THE POINT IS INSIDE THE BODY

ARYTRJ

BODY IDENTIFIER IS TEST

NUMBER OF SYMMETRY PLANES = 0 NUMBER OF QUADRAL

PLANES= (

NUMBER OF QUADRALATERALS= 189

MACH NUMBER= 0.

FIRE BOLLY FRAME

ARYTRJ RUN ID -TEST PROBLEM WITH TEST BOCY

PHYSICAL INPUT DATA -AIR SPEED= 9.000000E+01 CHARACTERISTIC DIMENSION OF THE BODY= 1.000000E+00 DENSITY AND TEMPERATURE OF AIR ARE 9.092500E-01 AND 2.686590E+02 AIR VISCOS

NUMERICAL INTEGRATOR INPUTS -TIME STEP= 1.0000E-01 MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTERVAL = 1. LOCAL ERROR TOLERANCES FOR DVDQ -1.000) E-05 1.0000E-05

1.0000E-05

NENSION OF THE BODY= 1.000000E+00 0E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

5.0000E-03 PRINT TIME INTERVAL= 1.0000E+00 X CCORD. OF FINAL FLANE= 0.

E-05 1.0000E-05 1.0000E-05

```
WATER DROP DIAMETER = 3.00 (00E+02 MICROMETERS
              PARTICLE SETTLING SPEED= 1.27827E+00 M/SEC
    INITIAL X=-5.0000E+00
                           INCREMENT= 0.
                                                  NUMBER OF VALUES=
    INITIAL Y = - 1.0000E+00
                           INCREMENT= 2.000DE+UD
                                                 NUPBER OF VALUES=
                                                 NUMBER OF VALUES=
    INITIAL Z= 1.0000E+00
                           INCREMENT=-2.0000E+00
                                                                     2
    X AXIS IS INCREMENTED THIRD
    Y AXIS IS INCREMENTED FIRST
    Z AXIS IS INCREMENTED SECOND
          Z= 1.00000
IFLAG= 7 FOR KSTEP=
                      27 NEVAL=
                                    49
                                                 HMIN IS SET TO 3.1250E-03
                                                     VPX
                                                                 VPY
       T
                                      1.0037E+00
  0.
             -5.0000E+30 -1.000CE+CO
                                                 9.6596E-91 -1.4267E-02
    H= 1.0000E-01 R= 2.0586E+01 AC= 0.
                                                 NEVAL=
   1.00CJE+00 -4.0344E+00 -1.0145E+00
                                      1.0021E+00
                                                  9.6478E-01 -1.5232E-02
    H= 1.0000E-01 R= 6.8363E+01 AC= 7.6445E-04
                                                  NEVAL=
                                                           12
   1.0000E+00 -4.0344E+00 -1.0145E+00
                                      1.0321E+00
                                                  9.6478E-01 -1.5232E-02
    H= 1.0000E-01 R= 7.6138E+01 AC= 6.1633E-04
                                                  NEVAL=
                                                           13
   2.0000E+00 -3.0718E+00 -1.0325E+00
                                                  9.5991E-01 -2.2680E-02
                                      1. U 694E+00
    H= 1.0000E-01 R= 1.8029E+02 AC= 5.1923E-04
                                                  NEVAL=
                                                           31
   2.3125E+00 -2.7720E+00 -1.[404E+00
                                                  9.5930E-01 -2.7841E-02
                                      1.0151E+00
     H= 3.1250E-03 R= 2.0134E+02
                                 AC= 5.1575E-04
                                                  NEVAL=
                                                           57
                                      1.01727+00
   2.4000E+00 -2.6881E+00 -1.0429E+00
                                                  9.5956E-01 -2.9385E-02
    H= 1.2500E-02 R= 2.0860E+02 AC= 5.0905U-04
                                                  NEVAL=
                                                           77
```

1

3

3

16

24

24

3.

4

4

4

4

4

3

9.6448E-01 -3.6556E-02

97

9.6916E-01 -3.9522E-02

9.7641E-01 -4.2069E-02

184

NEVAL=

NEVAL=

H= 1.2500E-02 R= 1.9778E+02 AC= 5.6993E-04 NEVAL= 130 74 3.50 DDE+ 00 -1.6219E+00 -1. (846E+00 1.0613E+00 9.8411E-01 -4.3370E-02 H= 5.0000E-02 R= 1.7680E+02 AC= 5.9854E-04 NEVAL= 150 4.0000E+00 -1.1265E+00 -1.1064E+00 9.9693E-01 -4.3131E-02 81 1.0867E+00

1.0293 E+00

1.0373E+00

1.0492E+00

2.80 COE+ 00 -2.3035E+00 -1.05 61E+00

3.0000E+00 -2.1101E+00 -1.0637E+00

3.2500E+00 -1.6670E+00 -1.0739E+00

H= 1.0 000E-01 R= 2.2229E+02 AC= 4.9923E-04

H= 1.0000E-01 R= 2.0962E+02 AC= 5.373]E-04

H= 2.0000E-01 R= 1.4402E+02 AC= 6.9847E-04 NEVAL= 1.64 5.0000E+00 -1.1968E-01 -1.1471E+00 1.1313 E+00 1.0160E+00 -3.7496E-02 H= 2.0000E-01 R= 1.5173E+02 AC= 6.0353E-04 NEVAL= 175

-1.1515E+80 1.1361E+80 5.1177E+00 0. 1.0161E+00 -3.6517E-02 86 H= 2.0000E-01 R= 1.5173E+02 AC= 6.2904E-04 175 NEVAL=

> INITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -ALPHAD= -.8 462 BETAQ = . 0988 -2.0542 BET AR= ALPHAR= 2.2413

DRAG VECTOR AT FINAL POINT -DIRECTION COSINES-8.2179E-01 3.8626E-01 -4.1888E-01 ANGLES A AND GAI AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.10221E+00 1.01954E+0

```
INITIAL COORDINATES X=-5.00000E+00
                                                  Y= 1.00000 E+00
                                                                   Z=-1.00000
IFLAG = 7 FOR KSTEP=
                                                    HPIN IS SET TO 3.1250E-03
                       28 NEVAL=
                                     60
```

1

₹

ť

4

ľ

KSTEP

C

10

11

21

31

41

51

54

## ROYETERS

```
27827E+00 M/SEC

NUMBER OF VALUES= 1

000E+00 NUMBER OF VALUES= 2

000E+00 NUMBER OF VALUES= 2
```

#### E+J0 Y=-1.00000E+60 Z= 1.00000E+00 HMIN IS SET TO 3.1250E-03

VP X

VPY

```
9.6596E-01 -1.4267E-02
003E+00
                                                                     1.5870E-02
                                 1.6667E-03
                                              9.6596E-41 -1.4267E-02
        NEVAL=
021 E+00
        9.6478E-01 -1.5232E-02
                                 3.1541E-33
                                              9.43 !2E-01 -3.440 3E-02 4.0864E-02
445E-04
        NEVAL=
        9.6478E-01 -1.5232E-02
                                  3. 1541E-03
                                              9.4151E-01 -3.7761E-02 4.5294E-02
021 E+00
63] E-ü4
        NEVAL=
                   13
894E+08
         9.5991E-01 -2.2680E-02
                                 1.4476E-J2
                                              9.4637E-01 -8.7974E-02 1.2281E-01
923E-64
        NEVAL=
                   31
        9.5930E-01 -2.7841E-02
                                  2. 2740E-J2
                                              9.6591E-01 -9.7990E-02 1.4245E-01
151E+00
                   57
575E-04
        NEVAL=
172E+00
        9.5956E-01 -2.9385E-02
                                  2.5288£-G2
                                              9.7691E-01 -1.0088E-01
                                                                     1.4898E-01
905E-34
                   77
        NEVAL=
        9.6448E-01 -3.6556E-02
                                              1.0420E+00 -9.9754E-02
293 E+00
                                  3. 7613E-12
                                                                       1.5379E-01
9232-04
        NEVAL=
                   97
        9.6916E-01 -3.9522E-02
373E+00
                                  4. 2861 E- u2
                                              1.4858E+00 -8.3119E-02 1.2343E-01
7315-04
        NEVAL=
                  184
        9.7641E-01 -4.2069E-02
                                  4.7262E-#2
                                              1.0977E+00 -7.2147E-02 1.0213E-01
192E+00
393E-04
                  130
        NEVAL=
513E+CO
        9.8411E-01 -4.3370E-02
                                 4.93202-62
                                             1.1037E+00 -5.4774E-02 7.0318E-02
354E-04
        NEVAL=
                  150
163E+00
        9.9693E-01 -4.3131E-02
                                 4.8716E-92
                                              1.0997E+00 -2.2761E-02 2.4140E-02
347E-04
        NEVAL=
                  164
        1.0160E+00 -3.7496E-02
                                              1.1046E+00 5.6844E-03 -6.0732E-03
113 E+00
                                  4.1378E-32
153E-04
        NEVAL=
                  175
161 E+00
         1.0161E+00 -3.6517E-02
                                  3.9872E-32
                                              1.1046E+00 5.6844E-03 -6.0732E-03
104E-04
        NEVAL=
                 1 75
```

VPZ

ANGLES (DEGREES) -0= .0988 R= 2.2413

01 -4.1888E-01 ANGLES A AND GAMMA- 2.5175E+(1 1.1476E+02 ARE 1.10221E+00 1.01954E+30

HPIN IS SET TO 3.125GE-03

FIRE BOUT FRAME 2

VY

V Z

VX.

```
KSTEP
                        X
                                                 Z
                                                            VPX
                                                                        VPY
                  -5.0000E+00 1.0000E+00 -1.0000E+00
       G.
                                                        9.6340 E-01
                                                                   1.2975E-02 -24
         H= 1.0000E-01 R= 1.5173E+02 AC= 0.
                                                        NEVAL=
                                                                   1
                               1.0132E+C0 -1.0295E+60
   10
       1.0000E+00 -4.0369E+00
                                                        9.6232E-01
                                                                    1.3738E-02
         H= 1.0000E-01 R= 4.5689E+01 AC= 1.2573E-03
                                                        NEVAL=
                                                                  16
                                                        9.6232E-01 1.3708E-02 -3
   11
       1.0000E+00 -4.0369E+00 1.(132E+00 -1.0295E+00
         H= 1.0 CODE-01 R= 5.2997E+01 AC= 9.3450E-04
                                                        NEVAL=
                                                                  18
       2.0000E+00 -3.0769E+00 1.0291E+00 -1.0623E+00
   21
                                                        9.5692E- 81
                                                                    1.9735E-02 - 3
         H= 1.0 000E-01 R= 1.5349E+02 AC= 5.8890E-04
                                                                  38
                                                        NEVAL=
                                                                    3.1574E-02 -5.
       2.7656E+00 -2.3454E+00 1.0485E+00 -1.0985E+00
                                                        9.5602E-01
   31
         H= 3.125UE-03 R= 2.0016E+02 AC= 5.4973E-04
                                                        NEVAL=
                                                                  66
                                                                    3.3578E-02 -6.
   41
       2.90 0GE+00 -2.2168E+00 1.0529E+00 -1.1066E+00
                                                        9.5733E- 61
         H= 5.0000E-02 R= 2.0280E+02 AC= 5.4600E-04
                                                        NEVAL=
                                                                  86
       3.0000E+00 -2.1210E+00 1.0563E+00 -1.1130E+00
                                                        9.5864E-01 3.4974E-02 -6.
         H= 5.0000E-02 R= 2.0340E+02 AC= 5.4493E-04
                                                        NEVAL=
                                                                  92
       3.3875E+00 -1.7482E+00
                               1.0707E+00 -1.1405E+00
   54
                                                        9.6613E-01
                                                                    3.9311E-62 -7.
         H= 6.2500E-03 R= 1.9948E+02 AC= 5.8877E-04
                                                        NEVAL=
                                                                 117
       3.5500E+ 00 -1.5909E+00 1.0772E+00 -1.1532E+60
                                                        9.7046E-01
                                                                    4.0630E-02 -8.
   64
         H= 5.0000E-02 R= 1.9617E+02 AC= 5.9103E-04
                                                                 137
                                                        NEVAL=
       4.00 00E+00 -1.1512E+00 1.6960E+60 -1.1910E+00
   71
                                                        9.8418E-01 4.2377E-02 -8.
         H= 1.0000E-01 R= 1.8893E+02 AC= 5.9535E-04
                                                                 1 52
                                                        NEVAL=
       5.C000E+00 -1.5051E-01 1.1371E+00 -1.2785E+00
                                                                   3.8245E-02 -85
   80
                                                        1.8170E+00
         H= 5.0 COOE-O2 R= 2.0139E+02 AC= 5.5777E-04
                                                                 172
                                                        NEVAL=
   84
       5.1477E+00 1.3878E-17 1.1427E+00 -1.2909E+00
                                                        1.0214E+ 50
                                                                    3.6966E-02 -8.
         H= 2.5 100E-02 R= 2.0627E+02
                                       AC= 5.1777E-04
                                                        NEVAL=
                                                                 181
```

ORAG VECTOR AT FINAL POINT DIRECTION COSINES- 8.4447E-01 -2.5705E-01 4.6989E-01 ANGLES A AND GAM
AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.14163E+00 1.02538E+00

```
VPX
                        VPY
                                    VPZ
                                                  ٧X
       9.6340E-01 1.2975E-02 -2.9207E-02 9.6340E-01
00 E+00
                                                         1.2975E-C2 -1.5004E-02
       NEVAL=
                  1
5E+60
       9.6232E-01
                   1.3708E-02 -3.0100E-02
                                            9.3841E-81
                                                         3.1623E-02 -4.0163E-02
73E-03
       NEVAL=
                16
5E+00
       9.6232E-01 1.3708E-02 -3.6100E-62
                                            9.3552E-01
                                                         3.4700E-02 -4.4642E-02
50E-04
       NEVAL=
                 18
3E+00
       9.5692E-01 1.9735E-02 -3.8095E-02
                                            9.2806E-01
                                                        7.9368E-02 -1.2368E-01
0E-04
       NEVAL=
                 38
13 E+00
       9.5602E-01
                   3.1574E-02 -5.8414E-02 9. 8771E-01
                                                        9.4036E-02 -1.7743E-01
19E-84
       NEVAL=
                 66
5E+00
       9.5733E-01 3.3578E-02 -6.2513E-02
                                            1.0045E+00
                                                        9.1879E-02 -1.8064E-01
DE-04
       NEVAL=
                86
0E+00
       9.5864E-01
                  3.4974E-02 -6.5529E-02
                                            1.0231E+00
                                                         8.77962-02 -1.8064E-01
9E-04
       NEVAL=
                 92
5E+00
       9.6613E-01
                   3.9311E-02 -7.6149E-02
                                            1.0615E+00
                                                         7.4554E-02 -1.6886E-01
7E-04
       NEVAL=
                117
2 E+00
       9.7046E-01 4.0630E-02 -8.0008E-02
                                            1.0775E+00
                                                        6.7191E-02 -1.5845E-01
3E-44
       NEVAL=
                137
9 E+00
       9.8418E-01 4.2377E-02 -8.7065E-02
                                            1.1159E+00
                                                         4.1874E-02 -1.1020E-01
5E-04
       NEVAL=
                1 52
5E+00
       1.0170E+00
                   3.8245E-02 -8.4P91E-02
                                            1.1389E+00
                                                        3.9491E-03 -2.2823E-02
7E-04
       NEVAL=
                172
9E+00
       1.0214E+ 80
                   3.6966E-02 -8.1971E-02
                                            1.1416E+00
                                                        3-2180E-04 -1-4954E-02
7E-04
       NEVAL=
                181
```

ANGLES (DEGREES) -

-1.7363

-4.5852

1 4.6989E-01 ANGLES A AND GAMMA- -1.6930E+61 6.1973E+01 Are 1.14163E+00 1.02538E+00 CONFAC

BODY IDENTIFIER IS TEST

NUMBER OF SYMMETRY PLANES = 0

NUMBER OF QUADRAL

NUMBER OF QUADRALATERALS= 189 MACH NUMBER= 0.

CONFAC RUN ID - TEST PROBLEM WITH TEST BOLY

PHYSICAL INPUT DATA AIR SPEED= 9.000000E+01 CHARACTERISTIC DIMENSICA OF THE BODY= 1.000000E+0
DENSITY AND TEMPERATURE OF AIR ARE 9.092500E-01 AND 2.686590E+02 AIR VI

NUMERICAL INTEGRATOR INPUTS TIME STEP= 1.0000E-0: MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTERVAL:

LOCAL ERROR TOLERANCES FOR DVDQ - 1.0003E-05 1.0000E-05 1.0000E-05

PARTICLE FLUX TUBE SPECIFICATIONS NUMBER OF TRAJECTORIES ON FLUX TUBE PERIPHERY = 4 FLUX TUBE RADIUS AT TAR

TARGET AND INITIAL COORDINATE ESTIMATES-JGUESS YT ZT YI ZI 1 0.00000 0.0000 0.60000 0.00000 2 0.00000 9.00000 U. 0 0000 0.00000 TERISTIC DIMENSION OF THE BODY= 1.00000E+00
RE 9.092500E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

TIME STEP= 5.0000E+03 PRINT TIME INTERVAL= 1.0000E+00 UPSTREAM START DISTANCE=-5.0000E

1.0 JOJE-05 1.0000E-05 1.0000E-05

UEE PERIPHERY= 4 FLUX TUBE RADIUS AT TARGET= .00328 TOLERANCE= .5000

IMATES-

ZT YI ZI • C000 0.60000 0.0000 • C000 0.0000

FIRE SOLLY FRAN.

. Ngjaran naga manga manga naga

### WATER DROP DIAMETER = 3.00000E+02 MICROYETERS

TARGET COORDINATES -

TARGET COORDINATES X=-1.50000E+00

TRAJECTORY NUMBER

FOLDOLO FRAM

#### PARTICLE SETTLING SPEED= 1.27927E+00 M/SEC

Y= 1.10000E+00

 $X^{2}STAR = -1.500000$ 

Z= 8.00000E-01

YPSTAR =

YPSTARP= 1. YFINAL ZFINAL **ITERATIONS** ERRO YINIT ZINIT .1209E+01 .8803E+C0 .8012E+0U .1352E 1 .1101E+01 2 .1 36 7E -1210E+01 .8813E+ CO .1102E+01 .8024E+00 .1097E+01 .8052E+00 3 .9795E+00 .7039E+00 .5 98 1E .1102E+01 .7993E+00 .9834E+04 .6981E+0u . 2 11 2E ·1999E+31 5 .7979E+ 00 .9830E+00 .6961E+0u .2383E .1100E+01 .4269E .7998E+00 .9811E+00 .6983E+00 KSTEP VP X VPY T Z -5.0000E+00 9.8110E-(1 6.9823E-01 9.6002E-01 1.3571E-02 -1. Ð. H= 1.0000E-01 R= 2.7725E+02 AC= 0. NEVAL= 1 10 7.0000E-01 -4.3281E+00 9.90 68E- C1 6.9725E-01 9.5929E-01 1.3983E-02 -1. H= 1.0 COOE-01 R= 5.2057E+01 AC= 8.3495E-04 NEVAL= 13 14 1.5000E+00 -4.0405E+00 9.9497E-01 6.9703E-01 9.5819E-01 1.4671E-02 -2. H= 1.0 COOE-01 R= 8.71 92E+01 AC= 5.9458E-04 NEVAL= 17 24 1.8625E+00 -3.2173E+00 1.0101E+00 6.9995E-01 9.4867E-01 2.2660E-02 9. H= 6.250JE-03 R= 2.0038E+02 AC= 5.2003E-04 NEVAL= 42 2.5388E-02 34 2.0000E+00 -3.0870E+00 1.0134E+(0 7.0151E-01 9.4620E-01 1. H= 5.0 CODE-02 R= 2.2830E+02 AC= 4.9527E-04 62 NEVAL= 35 2.0000E+00 -3.0870E+00 1. (134E+ (0 7.0151E-01 9.4620E-01 2.5388E-02 1. H= 5.0 00JE-02 R= 2.3878E+02 AC= 4.5273E-04 NEVAL= 64 2.8000E+00 -2.3352E+00 1.0437E+ CO 7.2664E-01 9.3723E-01 5.2614E-02 5. 45 H= 5.0000E-02 R= 3.3778E+02 AC= 4.3878E-04 NEVAL= 86 3.0000E+00 -2.1475E+00 49 1.0549E+00 7.3913E-01 9.4051E-01 5.9150E-02 6. H= 1.0000E-01 R= 3.2750E+02 AC= 4.4993E-04 NEVAL= 94 59 3.6804E+00 -1.5000E+00 1.0996E+00 7.9973E-01 9.6535E-01 6.9344E-02 1.1 H= 5.0 000E-02 R= 2.7658E+02 AC= 4.7412E-04 NEVAL= 117 DRAG VECTOR AT FINAL POINT -DIRECTION COSINES-8.1247E-01 4.2971E-02 5.8142E-01 ANGLES A AND GAME AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.14461E+08 9.73484E- C1 INITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -RIGINAL PAGE IS .8099 ALPHAC= BET AO = -.0973 OF POOR QUALITY ALPH AR= 4.1063 BETAR= 6.1774 TRAJECTORY NUMBER TARGET COORDINATES - XPSTAR = -1.509352 1 YPSTAR = 1.6 YPSTARF= 0. YFINAL ZFINAL **ITERATIONS** YINIT ZINIT ERROF -.30 22E-03 .3611E-02 .7256E-03 .4269E-02 1 .448 3E-KSTEP T VP X VPY Y 7 -5.0000E+00 9.8182E- (1 7.0255E-01 9.6008E-01 0 1.3563E-02 -1.5 H= 1.0000E-01 R= 2.7658E+02 AC= 0. NEVAL= 1 7.0000E-01 -4.3281E+00 9.9140E- (1 9.5935E-01 7.0157E-01 1.3974E-02 - 1. H= 1.0000E-01 R= 5.2019E+01 AC= 8.3454E-04 NEVAL= 15 1.0000E+00 -4.0404E+00 9.9568E-[1 7.0133E-01 9.5825E-01 1.4660E-02 -1.5 14

```
is
```

```
00 M/SEC
```

```
10000E+00 Z
```

Z= 8.00000E-01

```
R = -1.500000
                YPSTAR = 1.100000
                                                    .800080 (FLOW SYSTEM)
                                         ZFSTAR =
                 YPSTARP= 1.130000
                                         ZPSTARP=
                                                    .800000 (FLUX TUBE SYSTEM)
YINIT
            ZINIT
                         ERROR (FLUX TUBE SYSTEM)
.101E+01
          .8612E+00
                       .1352E+00
.192E+01
          .8024E+00
                       .1367E+00
795E+00
          .7039E+00
                       .5981E-02
834E+84
          .6981E+0u
                       .2112E-02
810E+00
          .3961E+0U
                       .2383E-02
811E+00
          .6983E+08
                       .4269E-03
                   VPY
      VP X
                               VPZ
                                                                      VZ
                                             VX
                                                          VY
  9.6002E-01 1.3571E-02 -1.6308E-03
                                        9.6002E-01
                                                    1.3571E-C2
                                                                 1.2572E-02
  NEVAL=
  9.5929E-C1 1.3983E-G2 -1.0880E-G3
                                        9. 3821E-01
                                                    2.6512E-02
                                                                 2.5151E-02
  NEVAL=
            13
  9.5819E-01 1.4671E-02 -2.03192-J4
                                        9.1998E-01
                                                    4.0543E-02
                                                                 3.9618 E-02
  NEVAL=
            17
  9.4867E-01 2.2660E-02
                           9.6867E-43
                                       8.7914E-01
                                                    9.4479E-82
                                                                 1.0518E-01
  NEVAL=
            42
  9.4620E-01 2.5388E-02
                           1.3176E-02
                                        8.7511E-01
                                                    1.0894E-01
                                                                 1.2621E-01
  NEVAL=
            62
  9.4620E-01 2.5388E-02
                           1.3176E-02
                                        8.7458E-61
                                                    1.1444E-01
                                                                 1.3473E-01
  NEVAL=
            64
  9.3723E-01 5.2614E-02
                                        9.6531E-01
                           5. 5791E-02
                                                    1.5681E-01
                                                                 2. 6234E-01
  NEVAL=
            86
  9.4051E-01 5.9150E-02
                           6.9614E-12
                                        1. L177E+80
                                                    1.4009E-01
                                                                 2.7029E-01
           94
  NEVAL=
  9.6535E-01 6.9344E-02
                                                   7.7552E-02 2.1635E-01
                           1.0475E-01
                                        1.1213E+00
  NEVAL=
           117
```

S (DEGREES) --.0973 6.1774

1.14461E+08

6.8142E-01

t = -1.509352 YPSTAR = 1.699975 ZPSTAR = .803261 (FLOW SYSTEM)
YPSTARF= 0.000000 ZPSTARP= .033280 (FLUX TUBE SYSTEM)

3.0275E+C0

5.4450E+01

ANGLES A AND GAMMA-

9.73484E-01

VP X VPY VPZ VX VY ٧Z 9.6008E-01 1.3563E-02 -1.5749E-03 9.6008E-01 1.3563E-02 1.2628E-02 NEVAL= 9.5935E-01 1.3974E-02 -1.0349E-03 9.3835E-01 2.6478E-02 2.5248E-02 NEVAL= 15 9.5825E-01 1.4660E-02 -1.5069E-04 9.2023E-01 4.0463E-02 3.9745E-02 Ţ

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AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                                         9.735206
                                                          1.14496E+00
 TRAJECTORY NUMBER
                   2
                           TARGET COORDINATES - XPSTAR = -1.500235
                                                                        YPSTAR =
                                                                        YPSTARF=
               YFINAL
                            ZFINAL
                                        ITERATIONS
                                                        YINIT
                                                                    ZINIT
              .3951E-32
                        -. 1236E-02
                                                      .4128E-82
                                                                -.3891E-03
                                            1
                                                                               .14
 KSTEP
                                                              VPX
                                                                          VPY
                          X
                                                  Z
     0
                    -5.0001E+00
                                 9.8523E-(1
                                             6.9791E-01
                                                          9.6007E-01
        0.
                                                                      1.3617E-02
          H= 1.0000E-01 R= 2.7205E+02 AC= 0.
                                                          NEVAL=
    10
        7.0000E-01 -4.3282E+00 9.9484E-(1
                                             6.9685E-U1
                                                          9.5934E-81
                                                                      1.4030E-02
          H= 1.0 000E-01 R= 5.1988E+01 AC= 8.3522E-04
                                                          NEVAL=
                                                                    15
                                                                      1. 4719E-02
    14
        1.0000E+00 -4.0405E+60 9.9914E-[1
                                             6.9664E-01
                                                          9.5824E-01
          H= 1.0000E-01 R= 8.7042E+01 AC= 5.9501E-04
                                                          NEVAL=
                                                                    23
    24
        1.8688E+00 -3.2113E+00
                                1.0145E+68
                                             6.9955E-01
                                                          9.4866E-01
                                                                      2.2828E-02
65
          H= 6.2500E-03 R= 2.0108E+02 AC= 5.1932E-04
                                                          NEVAL=
                                                                    48
    34
        1.9750E+00 -3.1106E+00
                                                          9.4677E-01
                                 1. 01 70 E+ 00
                                             7.0074E-01
                                                                      2.4981E-02
          H= 2.5000E-02 R= 2.2250E+02 AC= 4.9985E-04
                                                          NEVAL=
                                                                    68
        2.0000E+00 -3.0870E+00
                                             7.0105E-01
                                                          9.4630E- C1
    36
                                 1.0176E+00
                                                                      2.5444E-G2
          H= 2.5000E-02 R= 2.3288E+02 AC= 4.7383E-04
                                                          NEVAL=
                                                                    72
                                 1.0393E+00
        2.6250E+00 -2.4990E+00
    46
                                             7.1739E-01
                                                          9.3677E-01
                                                                      4.6008E-02
          H= 5.0000E-02 R= 3.3341E+02
                                         AC= 4.4043E-04
                                                          NEVAL=
                                                                    93
    52
        3.0000 E+00 -2.1473E+00 1.0592E+ 00
                                             7.3850E-01
                                                          9.4862E-01
                                                                      5.92145-02
          H= 1.0000E-01 R= 3.2871E+02 AC= 4.4545E-04
                                                                   105
                                                          NEVAL=
    62
        3.6250E+00 -1.5532E+00
                               1.1801E+ (0
                                                          9.6281E-01
                                                                      6.9236E-02
                                             7.93032-01
          H= 5.0000E-02 R= 2.8409E+02 AC= 4.6253E-04
                                                          NEVAL=
                                                                   128
        3.6800E+00 -1.5002E+00
                                 1.1039E+00
                                             7.9877E-01
                                                          9.6534E-01
                                                                      6.9463E-02
          H= 5.0000E-02 R= 2.7313E+02 AC= 4.8587E-04
                                                          NEVAL=
                                                                   132
     DRAG VECTOR AT FINAL POINT -
                                                                    ANGLES A AND I
      DIRECTION COSINES-
                            8.2653E-01
                                         3.2372E-02
                                                       5.6197E-01
     AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                          1.14547E+00
                                                                         9.73446E
 TRAJECTORY NUMBER
                                                                        YPSTAR =
                    3
                           TARGET COORDINATES -
                                                XPSTAR = -1.499648
                                                                        YPSTARP=
               YFINAL
                            ZFINAL
                                        ITERATIONS
                                                        YINIT
                                                                    ZINIT
                                                                                 Ε
             .3971E-03
                         -. 2 022E-02
                                                      .4452E-03
                                            1
                                                                 --1895E-02
                                                                               .13
 KSTEP
             T
                          X
                                                              VP X
                                                                           VPY
                                                   Z
                                                          9.6000E-01
                    -5.0000E+00
                                 9.8154E- (1
        0.
                                             6.9640E-01
                                                                     1.3583E-02
          H= 1.0000E-01 R= 2.7313E+02 AC= 0.
                                                          NEVAL=
                                                                     1
        7.0000E-01 -4.3282E+00
                                9.9114E-[1
                                             6.9535E-01
                                                          9.5927E-01
                                                                      1.3995E-02
    10
          H= 1.0000E-01 R= 5.2060E+01 AC= 8.3513E-04
                                                          NEVAL=
                                                                    13
        1.0000E+00 -4.0405E+00 9.9542E-(1
                                                          9.5817E-01
                                              6.9513E-01
                                                                      1.4684E-02
             1 DANGE AL D. B. TARRELIA LO. E. OLEGE AL
```

M= 7.0 NAME-AT K= 0.1800048T WP= 0.2484F-84

H= 2.5000E-02 R= 2.2224E+02 AC= 5.0001E-04

H= 2.5 CODE-02 R= 2.3257E+02 AC= 4.7405E-04

H= 5.0000E-02 R= 3.1803E+02 AC= 4.4628E-04

H= 2.0000E-01 R= 3.2760E+02 AC= 4.4565E-04

H= 5.0000E-02 R= 2.8288E+02 AC= 4.6314E-04

H= 5.0000E-02 R= 2.7205E+02 AC= 4.8639E-04

8.2736E-01

1.0110E+ (0

1. C293E+C0

1. 05 54E+ 00

1.0959E+ (0

1.8688E+03 -3.2112E+00

2.4750E+00 -2.6395E+00

3.0000E+00 -2.1471E+00

3.6250E+00 -1.5528E+00

DRAG VECTOR AT FINAL POINT -

DIRECTION COSINES-

H= 6.2500E-03 R= 2.0090E+02

1.9750E+00 -3.1105E+00 1.0135E+00

2.0000E+00 -3.0869E+00 1.0141E+00

3.67 94E+ 00 -1.5004E+00 1.0997E+ (0

24

34

36

46

53

63

65

FOLDOUT FRAME

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

5.6078E-01

7.0439E-01

7.0557E-L1

7.0590E-01

7.1651E-01

7.4345E-01

7.9793E-01

8.0359E-01

3.1554E-02

AC= 5.1944E-84

9.4870E-01

9.4682E-01

9.4636E-01

9.38 (3 E- 01

9.4086 E-01

9.6301E-01

48

68

72

92

106

129

133

9.6549E-01 6.8798E-02

2.2724E-02

2.4783E-02

2.5322E-02

3.98 67E-02

5.8707E-02

6.8579E-02

ANGLES A AND

```
23
'DE-01 2.2724E-02 9,8992E-03 8.7962E-01 9.4692E-02 1.0612E-01
,=
   48
2E-01 2.4783E-02 1.2530E-02 8.7645E-G1 1.0571E-01 1.2211E-01
.=
   68
6E-01 2.5322E-02 1.3231E-02 8.7562E-01 1.1110E-01 1.3036E-01
Œ
   72
=
   92
6E-01
      5.8707E-02 6.9232E-02 1.0128E+00 1.4126E-01 2.6912E-01
,=
   106
1E-01 6.8579E-02 1.0215E-01 1.1111E+00 8.4626E-02 2.2827E-01
  129
=
9E-01 6.8798E-02 1.0407E-01 1.1229E+00 7.4802E-02 2.1077E-01
= 133
01 ANGLES A AND GAMMA- 2.1841E+00 5.5890E+01
96E+00
        9.73520E-01
00235
       YPSTAR = 1.103272
                           ZPSTAR = .800000 (FLOW SYSTEM)
       YPSTARF= .003280
                           ZPSTARP= -.000000 (FLUX TUBE SYSTEM)
    ZINIT
             ERROR (FLUX TUBE SYSTEM)
-.3891E-03
            .1406E-02
PX
         VPY
                    VPZ
                               V X
                                                    ٧Z
7E-01 1.3617E-02 -1.6521E-03 9.6007E-01 1.3617E-02 1.2551E-02
    1
4E-01 1.4030E-02 -1.1109E-03 9.3831E-01
                                     2.65 ESE-02 2.50 95E-02
=
   15
                                                                     Ĵ
%E-U1 1.4719E-D2 -2.3501E-04 9.2016E-D1 4.0642E-D2 3.9509E-D2
=
    23
6E-01 2.2828E-02 9.7640E-03 8.7928E-01 9.5240E-02 1.0563E-01
   48
7E-01 2.4901E-02 1.2396E-02
                           8.7602E-01 1.8636E-01 1.2160E-01
    68
DE- (1 2.5444E-02 1.3095E-02 8.7515E-01
                                     1.1181E-01 1.2984E-01
    72
7E-01 4.6008E-02 4.3395E-02 9.2909E-01 1.6091E-01 2.4252E-01
   93
=
2E-01 5.9214E-02 6.9218E-02 1.0123E+00 1.4274E-01 2.6969E-01
=
   105
                                                                     1E-01 6.9236E-02 1.0236E-01 1.1112E+00 8.5586E-02 2.2938E-01
=
  128
%E-01 6.9463E-02 1.0433E-01 1.1232E+00 7.5645E-02 2.1166E-01
                                                                     7
= 132
   ANGLES A AND GAMMA- 2.2429E+C0 5.5808E+01
B 1
                                                                     3
47E+00
       9.73446E-01
                                                                     ZFSTAR = .796739 (FLOW SYSTEM)
99648
       YPSTAR = 1.100025
       YPSTARP= -.000000
                           ZPSTARP= -. CC3280 (FLUX TUBE SYSTEM)
                                                                     1
    ZINIT
             ERROR (FLUX TUBE SYSTEM)
-.1895E-02 .1319E-02
X
         VPY
                   VPZ
                               VX
                                          VV
                                                    ٧Z
}E-01 1.3583E-02 -1.6586E-d3 9.6000E-01 1.3583E-02 1.2544E-02
    1
PE-01 1.3995E-02 -1.1167E-03 9.3816E-01 2.6541E-02 2.5099E-02
                                                                  FIN SCALT ERAL. -
```

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「ガー・1.リ ひひじにっせん 「ベー・ロ・ノとととにすり」 「Aしー・ブ・ソサブフにつりサ
                                                       NEVAL
       1.8625E+00 -3.2174E+00 1.0106E+00 6.980DE-01
                                                        9.4863E- $1 2.2692E-$2
   24
         H= 6.2500E-03 R= 2.0058E+02 AC= 5.1985E-04
                                                       NEVAL=
                                                                  42
   34
       2.00 00E+00 -3.0871E+00
                               1. 01 39E+ CD
                                           6.9955E-01
                                                        9.4614E-01 2.5428E-02
         H= 5.0 000E-02 R= 2.2856E+02 AC= 4.9509E-04
                                                       NEVAL=
                                                                  62
   35
       2.0000E+00 -3.0871E+00
                               1.0139E+00
                                          6.9955E-01
                                                       9.4614E-01 2.5428E-02
         H= 5.0000E-02 R= 2.3908E+02 AC= 4.5250E-04
                                                       NEVAL=
                                                                  64
   45
       2.8000E+00 -2.3354E+00 1.0443E+(0
                                          7.2465E-01
                                                       9.3711E-01
                                                                   5.2784E-02
         H= 5.0000E-02 R= 3.3842E+02 AC= 4.3855E-04
                                                       NEVAL=
                                                                 86
   49
       3.00 00E+00 -2.1477E+00 1.(555E+00
                                                        9.4038E-01
                                                                   5.9353E-02
                                          7.3724E-01
         H= 1.0 CODE-01 R= 3.2808E+02 AC= 4.4975E-04
                                                       NEVAL=
                                                                  94
   59
       3.6500E+00 -1.5296E+00
                              1.0983E+00
                                          7.9477E-01
                                                       9.6385E-81 6.9443E-82
         H= 5.0000E-02 R= 2.8269E+02 AC= 4.6343E-04
                                                       NEVAL=
                                                                 117
       3.6808E+00 -1.4998E+00
                               1.1004E+00
                                                        9.6528E-01 6.9554E-02
   60
                                           7.9793E-01
         H= 5.0 000E-02 R= 2.7710E+02 AC= 4.7361E-04
                                                       NEVAL=
                                                                119
    DRAG VECTOR AT FINAL POINT +
     DIRECTION COSINES-
                          8.1238E-01
                                       4.2836E-02
                                                    5.8156E-01
                                                                  ANGLES A AND G
                                                       1.14489E+00
    AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                                       9.73459E4
TRAJECTORY NUMBER
                         TARGET COORDINATES - XPSTAR = -1.499765
                                                                      YPSTAR =
                                                                      YPSTARP=
              YFINAL
                          ZFINAL
                                      ITERATIONS
                                                      YINIT
                                                                  ZINIT
                                                                              ER
                                                                            .103
           -. 43 10E-02
                        .7579E-04
                                          1
                                                  -.3891E-02 -.3977E-03
```

KSTEP VP X VPY -4.9999E+00 9.7721E-C1 6.9790E-01 9.59962-01 1.3530E-02 -H= 1.0000E-01 R= 2.7710E+02 AC= 0. NEVAL= 1 6.9687E-G1 7.0000E-01 -4.3281E+00 9.5923E-01 10 9.8676E-01 1.3941E-02 H= 1.0000E-01 R= 5.2125E+01 AC= 8.3479E-04 NEVAL= 13 8 14 1.0000E+00 -4.0405E+00 9.9104E-(1 6.9667E-01 9.5813E-01 1.4628E-02 H= 1.0000E-01 R= 8.7353E+01 AC= 5.9414E-04 NEVAL= 17 1.86 25E+00 -3.2174E+00 24 1. (0 £1E+ (0 6.9953E-01 9.4856E-01 2.2624E-02 H= 6.2500E-03 R= 2.0095E+02 AC= 5.1945E-04 NEVAL= 42 34 2.0000E+00 -3.0871E+00 1.0094E+ (0 7.0115E-01 9.4606E-01 2.5356E-02 H= 5.0000E-02 R= 2.2900E+02 AC= 4.9474E-04 NEVAL= 62 35 2.0000E+00 -3.0871E+00 1.0094E+00 7.0115E-01 9.4666E-01 2.5356E-02 H= 5.0 000E-02 R= 2.3953E+02 AC= 4.5213E-04 NEVAL= 64 2.8000E+00 -2.3355E+00 1.03 98E+00 45 7.2645E-01 9.3704E-01 5.2642E-02 H= 5.0000E-02 R= 3.3867E+02 AC= 4.3847E-04 NEVAL= 86 49 3.0000E+00 -2.1478E+00 1.0510E+00 7.3908E-01 9.4034E-01 5.9173E-02 H= 1.0000E-01 R= 3.2816E+02 AC= 4.4983E-04 NEVAL= 94 59 3.65 00 E+00 -1.5297 E+00 1.09 35 E+00 7.9682E-01 9.6387E-01 6.9148E-02 H= 5.0000E-02 R= 2.8240E+02 AC= 4.6359E-04 NEVAL= 116 3.6811E+00 -1.4997E+00 1.0957E+00 8.0003E-01 60 9.6531E-01 6.9255E-02 H= 5.0 000E-02 R= 2.7685E+02 AC= 4.7364E-04 NEVAL= 118 DRAG VECTOR AT FINAL POINT -DIRECTION COSINES-ANGLES A AND G 8.1378E-01 4.0887E-02 5.7973E-01

1-14496E+00

9.73502E-

AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE

```
E-01 9.4614E-01 2.5428E-02 1.3140E-02 8.7412E-01 1.0920E-01 1.2612E-01
    NEVAL= 62
E-04
E-D1 9.4614E-01 2.5428E-D2 1.314DE-J2 8.7418E-D1 1.1472E-D1 1.3465E-D1
E-04 NEVAL= 64
:E-U1 9.3711E-01 5.2784E-02 5.5842E-U2 9.6504E-Û1 1.5739E-Û1 2.6271E-Û1
E-04 NEVAL= 86
E-01 9.4038E-01 5.9353E-02 6.9706E-02 1.0176E+00 1.4059E-01 2.7074E-01
E-04 NEVAL= 94
'E-D1 9.6385E-01 6.9443E-U2 1.0389E-U1 1.1154E+00 -8.2845E-02 2.2593E-01
BE-04 NEVAL= 117
E-01 9.6528E-01 6.9554E-02 1.0497E-01 1.1215E+00 7.7790E-02 2.1679E-01
.E-04 NEVAL=
            119
 5.8156E-01 ANGLES A AND GAMMA- 3.0184E+88 5.4440E+01
RE 1.14489E+00 9.73459E-01
STAR = -1.499765
                                     ZPSTAR = .800000 (FLON SYSTEM)
                YPSTAR = 1. 496728
                 YPSTARP= -. 003280 ZPSTARP= .CO0000 (FLUX TUBE SYSTEM)
   YINIT ZINIT
                       ERROR (FLUX TUBE SYSTEM)
-.3891E-02 -.3977E-03 .1033E-02
                  VPY
                             VP Z
                                         V X
                                                    VY
        VP X
                                                              ٧Z
E-01 9.5996E-01 1.3530E-02 -1.6213E-03 9.5996E-01 1.3530E-02 1.2582E-02
    NEVAL= 1
'E-01 9.5923E-01 1.3941E-02 -1.0773E-C3 9.3808E-G1 2.6448E-02 2.5186E-02
E-04 NEVAL= 13
'E-01 9.5813E-01 1.4628E-02 -1.9607E-04 9.1978E-01 4.0466E-02 3.9694E-02
E-04 NEVAL= 17
|E-01 9.4856E-01 2.2624E-02 9.7440E-03 8.7866E-01 9.4430E-02 1.0556E-01
E-04 NEVAL= 42
E-01 9.4606E-01 2.5356E-02 1.3253E-02 8.7459E-01 1.0891E-01 1.2671E-01
E-04 NEVAL= 62
E-01 9.4666E-01 2.5356E-02 1.3253E-02 8.7396E-01 1.1442E-01 1.3528E-01
E-04 NEVAL= 64
E-01 9.3704E-01 5.2642E-02 5.6158E-02 9.6537E-01 1.5667E-01 2.6346E-01
E-04 NEVAL= 86
E-U1 9.4034E-01 5.9173E-02 7.0049E-02 1.0180E+00 1.3981E-01 2.7122E-01
E-04 NEVAL= 94
E-01 9.6387E-01 6.9148E-02 1.0418E-01 1.1156E+00 8.2154E-02 2.2576E-01
E-04 NEVAL= 116
E-U1 9.6531E-U1 6.9255E-U2 1.0526E-U1 1.1216E+UU 7.7109E-U2 2.1662E-U1
E-04 NEVAL= 118
  5.7973E-01 ANGLES A AND GAMMA- 2.8763E+00 5.4568E+01
```

E-U1 9.4863E-01 2.2692E-U2 9.6505E-03 8.7850E-01 9.4679E-02 1.0508E-01

E-04 MEVAL

E-U4 NEVAL= 42

ξE

1.14496E+00 9.73502E-01

FIR BOUT FRAM

# FLUX TUBE CROSS SECTION COORDINATES IN THE -

	INITIAL PLANE				TARGET PLAN	
IP CENTER 1 2 3 4	XP -5.0000E+00 1.5884E-14 1.1492E-14 2.8054E-14 9.7370E-15	YP 9.8110E-01 7.2555E-04 4.1278E-03 4.4517E-04 -3.8913E-03	ZP 6.9829E-01 4.2635E-03 -3.8912E-04 -1.8950E-03 -3.9756E-04	XP -1.5000E+00 -5.2934E-15 -1.0963E-15 -2.9064E-15 1.6757E-15	YP 1.100 0E+00 -3.0 21 5E -0 4 3.950 6E -0 3 3.971 0E -0 4	

FLUX TUBE CROSS SECTION AREA IN THE INITIAL PLANE = 2.47114E-85

CONCENTRATION FACTOR= 1.08337

AT THE POINT (X,Y,Z) = -1.50000 1.1000 .80000 FOR A PARTICLE OF DIAMETER = 300.00000 WITH DIAMETER TO LENGTH RATIO = 1 NORMALIZED AIR SPEED AT FINAL FOINT = 1.14339 PARTICLE CONCENTRATION FATIO = 1.11288

## ROSS SECTION COORCINATES IN THE -

## TARGET PLANE

79	ΧР	YP	ZP		
9829E-01	-1.5000E+00	1.100 GE+00	8.00 C 0 E- 01		
263 5E - 0 3	-5.2934E-15	-3.0 21 5E -0 4			TUBE SYSTEM)
8912E-84	-1.0963E-15	3.950 6E-03			TUBE SYSTEM
8950E-03	-2.9064E-15	3.9710E-04			TUBE SYSTEM)
9756E-84	1.6757E-15	-4.310 OE-03	7.5786E-05	(FLUX	TUBE SYSTEM)

THE INITIAL PLANE = 2.47114E-05

IN THE TARGET PLANE= 2.28097E-05

1.1000 .80000 00 WITH DIAMETER TO LENGTH RATIO= 1.00000E+00 AND DENSITY= 1.00000E+03 1.14339 1288 **TANTRA** 

BODY IDENTIFIER IS TEST

NUMBER OF SYMMETRY PLANES=

NUMBER OF QUADRAL

MMETRY PLANES = 0 NUMBER OF QUADRALATERALS = 189 MACH NUMBER = 0.

TANGENT TRAJECTORY CODE RUN ID -TEST PROBLEM WITH TEST BOLY

PHYSICAL INPUT DATA AIR SPEED= 9.000000E+01 CHARACTERISTIC DIMENSION OF THE BODY= 1.000000
DENSITY AND TEMPERATURE OF AIR ARE 9.092500E-01 AND 2.686590E+02 AIR

NUMERICAL INTEGRATOR INPUTS TIME STEP= 1.0000E-01 MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTER
LOCAL ERROR TOLERANCES FOR DVDQ - 1.0000E-05 1.0000E-05 1.0000E

TRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTTING

C DIMENSION OF THE BODY= 1.000000E+00 92500E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

EP= 5.0000E-03 PRINT TIME INTERVAL= 1.0000E+00 X COORD. OF FINAL PLANE= 0.

000E-05 1.0000E-05 1.0000E-05

R PLOTTING

#### WATER DROP DIAMETER = 2.00000E+02 MICROMETERS

#### PARTICLE SETTLING SPEED= 7.69093E-01 M/SEC

```
TRAJECTORIES ARE TO BEGIN ALONG A LINE DEFINED BY THE POINTS (X1.Y1.Z1.) AND
           -5.00000E+00
                            8.
                                           -4.50000E-01)
                                                            AND
                                                                        -5.00000E
                                                                   WITH DIRECTION COSINES - (COS(ALPHA), COS(BETA), COS(GAMMA)) -
   STARTING POINT INCREMENTS ARE - COARSE INCREMENT= 5.00000E-02
                                                                    FINE INCREMEN
                                                     Y = 0.
               INITIAL COORDINATES X=-5.00000E+00
                                                                       Z=-4.50000E
   IFLAG = 7 FOR KSTEP=
                                                       HMIN IS SET TO 3.1250E-03
                           27
                               NEVAL=
                                         58
    IFLAG = 7 FOR KSTEP=
                               NEVAL=
                                         59
                                                       HNIN IS SET TO 1.5625E-03
                           27
         INSIDE QUAD 185
                              I 2=
                                                                  2.500 JE-02
         ZNP.ROSQ.TSQ.H= -5.4665E-03
                                                     1.0355E+00
                                        2.4343E-01
         INSIDE QUAD 188
                              I 2=
                                   1
         ZNP.ROSQ.TSQ.H=
                          -7.1977E-03
                                        2.5035E-01
                                                      1.0355E+00
                                                                   2.500 DE-02
         THE BODY SURFACE IS PENETRATED. PARTICLE COORDINATES ARE (X,Y,Z)-2.5528
         TRIAL INITIAL COORDINATES ARE (YINIT, ZINIT)
                                                                 -4.530 UE-01
                                                      ٥.
            - AFTER - 0 ATTEMPTS FARTICLE STILL PENETRATES THE BODY.
KSTEP
                                                           VPX
                                                                        VPY
                  -5.0000E+00 0.
                                          -4.5000E-01
                                                       9.4971E-01 -1.0353E-03 -1.
         H= 1.0 COOE-01 R= 8.2573E+00 AC= 1.9004E-17
                                                       NEVAL=
       5. CO CO E- 01 -4.5253E+00 -5.2030E-04 -4.5857E-01
   10
                                                        9.4886E-01 -1.0526E-03 *1.
         H= 5.0000E-02 R= 2.1823E+01 AC= 1.6453E-03
                                                       NEVAL=
                                                                 17
   19
       1.0000E+00 -4.0517E+00 -1.0637E-03 -4.6742E-01.
                                                       9.4439E-01 -1.1384E-03 -1.
         H= 1.0 000E-01 R= 6.8350E+01 AC= 6.6054E-04
                                                       NEVAL=
                                                                 35
       1.8406E+00 -3.2695E+00 -2.2201E-(3 -4.8800E-01
                                                        9.0566E-01 -1.7706E-03 -3.
         H= 1.5625E-03 R= 2.0070E+02 AC= 4.9963E-04
                                                       NEVAL=
                                                                  63
   39
       1.8750E+00 -3.2385E+00 -2.2817E-(3 -4.8936E-01
                                                       9.0255E-01 -1.8174E-03 -4.
         H= 1.2500E-02 R= 2.1011E+02 AC= 4.9003E-04
                                                       NEVAL=
                                                                 83
   47
       2.0000E+00 -3.1264E+00 -2.5204E-03 -4.9505E-01
                                                       8.8980E-01 -2.0074E-03 -5
         H= 5.8000E-02 R= 2.6029E+02 AC= 4.1124E-04
                                                       NEVAL=
                                                                  99
   57
       2.5750E+00 -2.6346E+00 -3.9985E-03 -5.5196E-01
                                                       8.2481E-01 -3.1898E-03 -1
```

```
28
   IFLAG= 7 FOR KSTEP=
                               NEVAL=
                                      ···· 60
                                                       HMIN IS SET TO 3.125CE-03
   IFLAG= 7 FOR KSTEP=
                           29
                               NEVAL=
                                                       HPIN IS SET TO 1.5625E-03
                                         63
   IFLAG= 7 FOR KSTEP=
                               NEVAL=
                                                       HNIN IS SET TO 7.8125E-04
                          108
                                        235
KSTEP
            T
                                                                       VPY
                                                Z
                                                           VP X
                  -5.0000E+00 0.
                                          -5.0000E-01
                                                       9.5022E-01 -1.0211E-03 -1.
         H= 1.0000E-01 R= 3.9701E+02 AC= 8.2203E-21
                                                       NEVAL=
   10
       5.0000E-01 -4.5250E+00 -5.1313E-04 -5.0905E-01
                                                       9.4939E-01 -1.0379E-03 -1.
         H= 5.0000E-02 R= 2.1255E+01 AC= 1.6923E-03
                                                       NEVAL=
                                                                 17
   20
                                                       9.4510E-01 -1.12J4E-03 -1.
       1.00C0E+00 -4.0512E+00 -1.0485E-03 -5.1842E-01
         H= 1.0 000E-01 R= 6.6581E+01 AC= 6.7263E-04
                                                       NEVAL=
                                                                 37
       1.8797E+00 -3.2321E+00 -2.2468E-13 -5.4173E-01
   30
                                                       9.0617E-01 -1.7668E-03 -4.
         H= 1.5625E-03 R= 1.9997E+02 AC= 5.3975E-04
                                                       NEVAL=
                                                                65
         CACACHAR TARREST OF TOTAL
```

INITIAL COORDINATES X=-5.00000E+00 Y= 0.

H= 2.5000E-02 R= 3.9701E+02 AC= 3.9795E-04

121

Z=-5.000000E

NEVAL=

```
FINE INCREMENT= 5.0 CO COE- C3
     Z=-4.50000E-01
                       FOR TRAJECTORY NUMBER
ET TO 3.1250E-03
ET TO 1.5625E-03"
 2.500 JE-02
 2.5000E-02
RE (X,Y,Z)-2.55232E+00-4.32804E-03-5.70585E-01
-4.500 02-01
                ATTEMPT NUMBER
DY.
      VPY
                  VPZ
                                V X
                                            VY
L -1.0353E-03 -1.7077E-02 9.4971E-01 -1.0353E-03 -8.5312E-03
-1.0526E-03 -1.7267E-02
                          9.2635E-01 -1.5046E-03 -1.5595E-02
17
1 -1.1384E-03 -1.8462E-02
                          8.7433E-01 -2.4196E-03 -3.7486E-02
35
-1.7706E-03 -3.8358E-02
                         7.3501E-01 -4.3441E-03 -1.5675E-01
63
-1.8174E-03 -4.0613E-82
                          7.2694E-01 -4.4526E-03 -1.6882E-01
83
. -2.00,74E-03 -5.1080E-02
                          6. $105E-01 -4.9664E-03 -2.4430E-01
99
-3.1898E-03 -1.6851E-01 7.4570E-01 -6.1109E-03 -5.7168E-01
                                                          RIGINAL PAGE IS
                                                          OF POOR QUALITY
    Z=-5.00000E-01
                      FOR TRAJECTORY NUMBER
T TO 3.125CE-03
T TO 1.5625E-03
T TO 7.812 9E-04
     VPY
                  VP Z
                               VX
                                                       ٧Z
-1.0211E-03 -1.8037E-02
                         9.5022E-01 -1.0211E-03 -9.4917E-03
-1.0379E-03 - 1.8253E-02
                         9.2743E-01 -1.4781E-03 -1.7214E-02
17
-1.12J4E-03 -1.9572E-C2 8.7764E-01 -2.3594E-03 -4.0720E-02
37
-1.7668E-03 -4.2684E-02
                         7.45 (3E-01 -4.2808E-03 -1.7362E-01
```

0. 1.00008E+08

(X1,Y1,Z1,) AND (X2,Y2,Z2) -

( -5.00000E+00

THE BOILT FRAME 2

```
FOLDOLI FRAME
```

```
1.70000000 -3.6001000 -6.67460-03 -5.46940-01
                                                      Y.U373E-U1 -1.0U10E-U3
       H= 6.2500E-03 R= 2.0666E+02 AC= 4.9383E-04
                                                      NEVAL=
                                                                85
     2.8000E+00 -3.1237E+00 -2.4692E-03 -5.4747E-01
 49
                                                      8.9545E-01 -1.9350E-03
       H= 2.5000E-02
                      R= 2.3735E+02 AC= 4.4684E-04
                                                      NEVAL=
                                                               103
 59
     2.5250E+00 -2.6674E+00 -3.7260E-13 -5.9541E-01
                                                      8.46L7E-81 -2.8998E-03
       H= 5.0000E-02 R= 3.5235E+02 AC= 4.1138E-04
                                                      NEVAL=
                                                               124
 69
     2. 7125E+00 -2.5091E+00 -4.3054E-03 -6.2775E-01
                                                      8.46925-01 -3.2768E-03
                                                               147
       H= 1.2500E-02 R= 3.6565E+02
                                      AC= 4.0703E-04
                                                      NEVAL=
 79
     2.8750E+00 -2.3701E+00 -4.8572E-03 -6.6323E-01
                                                      8.6379E-01 -3.4910E-03
       H= 2.5 000E-02 R= 2.7019E+02 AC= 4.4649E-04
                                                      NEVAL=
                                                               1 67
 84
     3.0000E+00 -2.2614E+00 -5.30(4E-03 -6.9338E-01
                                                      8.7616E-01 -3.5962E-03
       H= 2.5000E-02 R= 2.2479E+02 AC= 4.9517E-04
                                                               178
                                                      NEVAL=
 94
     3.2687E+00 -2.0226E+00 -6.292CE-03 -7.6277E-01
                                                      9.0165E-01 -3.7829E-03
       H= 6.2500E-03 R= 2.2802E+02 AC= 4.7372E-04
                                                      NEVAL=
                                                               202
104
     3.3750E+00 -1.9261E+00 -6.6963E-03 -7.9143E-01
                                                      9.1405E-01 -3.8160E-03 -
       H= 2.5 000E-02 R= 2.0274E+02 AC= 4.9543E-04
                                                      NEVAL=
                                                               222
     3.3937E+00 -1.9089E+00 -6.7679E-03 -7.9658E-01
114
                                                      9.1608E-01 -3.8177E-03 -
       H= 1.56255-03 R= 1.9867E+02
                                     AC= 5.3852E-04
                                                      NEVAL=
                                                               247
124
     3. 45 00E+ 00 -1 e 3 57 2E+00 -6.98 27E-03 -8.1193E-ù1
                                                      9.2214E-01 -3.8205E-03 -
       H= 1.2500E-02 R= 1.8939E+02 AC= 5.4795E-04
                                                      NEVAL=
                                                               267
     3.8000E+00 -1.5285E+00 -8.3154E-(3 -9.0780E-01
134
                                                      9.5632E-01 -3.7791E-03 -
       H= 5.0000E-02 R= 1.9086E+02 AC= 5.4461E-04
                                                      NEVAL=
                                                               288
144
     4. 90 00E+ 00 -1.3352E+00 -9.0641E-03 -9.6181E-01
                                                      9.7643E-01 -3.7025E-03 -
       H= 5.0000E-02 R= 1.8499E+02 AC= 5.4933E-04
                                                      NEVAL=
                                                               311
145
     4.0000E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01
                                                      9.7643E- [1 -3.7025E- [3 -
       H= 2.5000E-02 R= 1.8398E+02 AC= 5.5533E-04
                                                      NEVAL=
                                                               314
155
     4.3500E+00 -9.8803E-01 -1.0328E-C2 -1.0523E+û0
                                                      1.0069E+00 -3.5092E-03 -1
       H= 2.5000E-02 R= 1.9043E+02 AC= 5.4239E-04
                                                      NEVAL=
                                                               335
     4.7750E+00 -5.5306E-01 -1.1753E-02 -1.1520E+00
165
                                                      1.0387E+ 00 -3.1772E-03 -
       H= 5.0000E-02 R= 1.8739E+02 AC= 5.4448E-84
                                                      NEVAL=
                                                               356
     5.0000E+00 -3.1772E-C1 -1.2444E-(2 -1.1993E+00
170
                                                      1.0528E+00 -2.9619E-03 -
       H= 5.0000E-02 R= 1.8378E+02 AC= 5.5173E-04
                                                      NEVAL=
                                                               367
175
     5.2995E+88
                 1.1102E-16 -1.3284E-02 -1.2559E+00
                                                      1.0682E+40 -2.6446E-03 -
       H= 1.0000E-01 R= 1.7534E+02 AC= 5.5777E-04
                                                      NEVAL=
                                                               377
                                                   SWITCH TO FINE STEPSIZE
```

INITIAL COORDINATES X=-5.00000E+00 Y= 0. Z=-4.95000 IFLAG= 7 FOR KSTEP= 30 NEVAL= 57 HMIN IS SET TO 3.1250E-03 IFLAG= 7 FOR KSTEP= NE VAL= 30 58 HMIN IS SET TO 1.5625E-03 INSIDE QUAD 187 I 2= ZNF, ROSQ, TSQ, H= -3.2026E-04 1.67372-01 6.7553E-01 2.5003E-02 THE BODY SURFACE IS PENETRATED. PARTICLE COORDINATES ARE (X,Y,Z)-2.41 TRIAL INITIAL COORDINATES ARE (YINIT, ZIVIT) 0. -4.9500E-01

AFTER O ATTEMPTS PARTICLE STILL PENETRATES THE BODY.

```
KSTEP
                                                             VPX
                                                                          VPY
                                                  Z
                   -5.0000E+00
                                                         9.5017E-01 -1.0226E-03 -:
                                C.
                                           -4.9503E-41
         H= 1.0000E-01
                        R= 1.7534E+02 AC= 4.2147E-20
                                                         NEVAL=
   10
       5. 00 00E-01 -4.5250E+00 -5.1385E-(4 -5.0401E-01
                                                         9.4934E-01 -1.0394E-03 -
         H= 5.0000E-02 R= 2.1313E+01 AC= 1.6874E-03
                                                         NEVAL=
                                                                   13
       1.0000E+00 -4.0512E+00 -1.0501E-(3 -5.1333E-01
   20
                                                         9.4502E-01 -1.1222E-03 -
         H= 1.0 CODE-01
                        R= 5.6799E+01 AC= 9.2763E-04
                                                         NEVAL=
                                                                    31
       1.0000E+00 -4.0512E+00 -1.0501E-03 -5.1333E-01
   21
                                                         9.4502E-01 -1.1222E-03 -:
         H= 1.0000E-01
                        R= 6.6762E+01
                                        AC= 6.7141E-04
                                                         NEVAL=
                                                                   33
   31
       1.8766E+00 -3.2352E+00 -2.2457E-(3 -5.3643E-01
                                                         9.0602E-01 -1.7688E-03 -4
         H= 1.5625E-03
                        R= 2.0029E+02 AC= 5.0045E-04
                                                         NEVAL=
                                                                    60
       1.9063E+00 -3.2083E+00 -2.2988E-03 -5.3772E-01
                                                         9.0350E-01 -1.8081E-03 -
   41
         H= 6.2500E-03 R= 2.0786E+02 AC= 4.926JE-04
                                                         NEVAL=
                                                                    80
         ANA 12 LAG # 1 01 05-100 - 0 - 12 155 12 15 1901 5 02
```

```
RE-U1 -1.0010E-03 -4.4579E-02
                                / · 41622-01 • 4 · 3561E • 03 • 1 · 0313E • 01
                                                                                 0
₿E-01 -1.9350E-03 -5.2476E-02
                                7.2203E-01 -4.6783E-03 -2.3124E-01
   103
PE-01 -2.8990E-03 -1.4541E-01
                                7.75C3E-01 -5.6161E-03 -5.0306E-01
                                                                                 Ü
PE-01 -3.2768E-03 -2.0033E-01
                                9.5347E-01 -5.6300E-03 -5.6342E-01
   147
                                                                                 ()
9E-01 -3.4910E-03 -2.3312E-01
                                1.4317E+GD -5.0500E-03 -4.5671E-01
   167
E- 01 -3.5962E-03 -2.4746E-01
                                1.0474E+00 -4.9247E-03 -4.0973E-01
                                                                                 Ü
   178
5E-01 -3.7829E-03 -2.6766E-(1
                                1.1074E+00 -5.0931E-03 -3.8329E-01
    202
                                                                                 Ü
5E-01 -3.8160E-{3 -2.7199E-01
                                1.1195E+00 -4.0114E-03 -3.1470E-01
   222
BE-G1 -3.8177E-03 -2.7241E-01
                                1.1183E+00 -3.9671E-03 -3.0931E-01
                                                                                 247
6E-01 -3.8205E-03 -2.7338E-01
                                1.1168E+00 -3.8600E-03 -2.9616E-01
   267
                                                                                 0
2E-01 -3.7791E-03 -2.7288E-01
                                1.1511E+00 -3.2909E-03 -2.4028E-01
   288
$E-01 -3.7025E-03 -2.6648E-J1
                                1.15C7E+00 -2.854CE-03 -1.872CE-01
                                                                                  .)
   311
SE- C1 -3.7025E- C3 -2.6648E-01
                                1.1506E+00 -2.8140E-03 -1.8361E-01
E
   314
                                                                                  )
9E+00 -3.5092E-03 -2.4919E-01
                                1.1656E+00 -2.2839E-03 -1.3240E-01
   335
7E+00 -3.1772E-03 -2.1923E-01
                                1.1649E+00 -1.4849E-03 -7.1961E-02
                                                                                  1
   356
BE+00 -2.9619E-03 -2.0115E-01
                                1.16(3E+00 -1.0059E-03 -4.1299E-02
   367
                                                                                  1
2E+00 -2.6446E-03 -1.7707E-01
                                1.1631E+40 -4.1830E-04 -1.9720E-02
   377
                                                                                  .
O FINE STEPSIZE * *
          Z=-4.95000E-01
                            FOR TRAJECTORY NUMBER
                                                                ORIGINAL PAGE IS
IS SET TO 3.1250E-03
                                                                OF POOR QUALITY
IS SET TO 1.5625E-03
     2.500 BE-02
                                                                                  €,
                     ATTEMPT NUMBER
     -4.9500E-01
                                                                                  3
HE BODY.
                                                                                  3
```

-01 ES ARE (X,Y,Z)-2.41459Ē+00-4.70245E-03-6.47195E-**8**1

VPZ

80

VPY

COLOREADS - F. OTTT. "C

PX

7E-01 -1.ŭ226E-ŭ3 -1.7943E-02 9.5017E-01 -1.0226E-03 -9.3971E-03 4E-01 -1.0394E-03 -1.8156E-02 9.2731E-U1 -1.4808E-03 -1.7056E-02 13 2E-01 -1.1222E-03 -1.9463E-02 8.8821E-01 -2.1833E-03 -3.45U0E-02 31 2E-01 -1.1222E-03 -1.9463E-02 8.7730E-01 -2.3654E-03 -4.0409E-02 33 2E-01 -1.7688E-03 -4.2313E-(2 7.4457E-01 -4.2901E-03 -1.7230E-01 60 0E-01 -1.8081E-03 -4.4423E-02 7.3895E-01 -4.3748E-03 -1.8295E-01

VY

VZ.

ALO E

1

```
2.4750E+00 -2.7105E+00 -3.5943E-13 -5.8330E-01
   58
                                                         8.4764E-01 -2.8141E-03 -
         H= 5.0 COOE-02 R= 3.4415E+02 AC= 4.1415E-04
                                                         NEVAL=
                                                                  115
   68
       2.7125E+00 -2.5103E+00 -4.3208E-03 -6.2285E-01
                                                         8.4491E-01 -3.3024E-03 -
         H= 1.2500E-02 R= 3.7292E+02 AC= 4.0480E-04
                                                         NEVAL=
                                                                  137
                                                   TANGENT TRAJECTORY IS AS FOLL
               INITIAL COORDINATES X=-5.00000E+00
                                                       Y= 0.
                                                                        Z=-5.0000
    IFLAG = 7 FOR KSTEP=
                            28
                                                         HMIN IS SET TO 3.1250E-0
                                NEVAL=
                                          60
    IFLAG= 7 FOR KSTEP=
                            29
                                NEVAL=
                                          63
                                                         HMIN IS SET TO 1.5625E-0
    IFLAG = 7 FOR KSTEP=
                           108
                                NEVAL=
                                         235
                                                         HMIN IS SET TO 7.8125E-0
KSTEP
            T
                        X
                                     Y
                                                 Z
                                                             VP X
                                                                         VPY
    0
       O.
                  -5.0000E+00
                                0.
                                           -5.0003E-01
                                                         9.5022E-01 -1.0211E-03 -
         H= 1.0000E-01
                        R= 3.7292E+02
                                        AC= 9.3174E-21
                                                         NEVAL=
   10
       5.0000E-01 -4.5250E+00 -5.1313E-04 -5.0905E-01
                                                         9.4939E-01 -1.6379E-03 -
         H= 5.0000E-02 R= 2.1255E+01
                                        AC= 1.6923E-03
                                                         NEVAL=
                                                                   17
   26
       1.0000E+00 -4.0512E+00 -1.0485E-(3 -5.1842E-01
                                                         9.4510E-01 -1.1204E-03 -:
         H= 1.0 (00E-01 R= 6.6581E+01
                                       AC= 6.7263E-04
                                                         NEVAL=
                                                                   37
       1.8797E+00 -3.2321E+00 -2.2468E-(3 -5.4178E-01
   30
                                                         9.0617E-01 -1.7668E-03 -
         H= 1.5625E-03 R= 1.9997E+02 AC= 5.3975E-04
                                                         NEVAL=
                                                                   65
       1.9063E+00 -3.2081E+00 -2.2942E-03 +5.4294E-01
   40
                                                         9.0393E-01 -1.8018E-03 -
         H= 6.2500E-03 R= 2.0666E+02 AC= 4.9383E-04
                                                         NEVAL=
                                                                   85
       2.0000E+00 -3.1237E+00 -2.4692E-03 -5.4747E-01
   49
                                                         8.9545E-01 -1.9358E-03 -
         H= 2.5800E-02
                       R= 2.3735E+02 AC= 4.4684E-04
                                                         NEVAL=
                                                                  103
   59
       2.5250E+00 -2.6674E+00 -3.7260E-03 -5.9541E-01
                                                         8.4607E-01 -2.899UE-03 -
         H= 5.0 000E-02 R= 3.5235E+02 AC= 4.1138E-44
                                                         NEVAL=
                                                                  124
   69
       2.7125E+00 -2.5091E+00 -4.3054E-03 -6.2775E-01
                                                         8.4692E-01 -3.2768E-03 -2
         H= 1.2500E-02 R= 3.6565E+02
                                        AC= 4.0703E-04
                                                         NEVAL=
                                                                  147
   79
       2.8750E+00 -2.3701E+00 -4.8572E-03 -6.6323E-01
                                                         8.6379E-81 -3.4918E-83 -2
         H= 2.5000E-02 R= 2.7019E+02 AC= 4.4643E-04
                                                         NEVAL=
                                                                  167
       3.0000E+00 -2.2614E+00 -5.3004E-03 -6.9338E-01
   84
                                                         8.7616E-01 -3.5962E-03 -8
         H= 2.5000E-02 R= 2.2479E+02 AC= 4.9517E-04
                                                         NEVAL=
                                                                  178
  94
       3.2687E+00 -2.0226E+00 -6.2920E-03 -7.6277E-01
                                                         9.0165E-01 -3.7829E-(3 -2
         H= 6.2500E-03 R= 2.2802E+02 AC= 4.7372E-04
                                                                  202
                                                         NEVAL=
 104
       3.3750E+00 -1.9261E+00 -6.6963E-03 -7.9148E-01
                                                         9.1405E-01 -3.8160E-13 -
         H= 2.5 000E-02
                       R= 2.0274E+02
                                        AC= 4.9543E-04
                                                         NEVAL=
                                                                  222
 114
       3.3937E+00 -1.9089E+00 -6.7679E-03 -7.9658E-01
                                                         9.1688E-01 -3.8177E-03 -:
                                        AC= 5.3852E-04
         H= 1.5625E-03 R= 1.9867E+02
                                                         NEVAL=
                                                                  247
       3.4500E+00 -1.8572E+00 -6.9827E-(3 -8.1193E-01
 124
                                                         9.2214E-01 -3.8205E-03 -2
         H= 1.2500E-02 R= 1.8939E+02 AC= 5.4795E-04
                                                         NEVAL=
                                                                  267
 134
       3.8000E+00 -1.5285E+00 -8.3154E-03 -9.0780E-01
                                                         9.5632E-01 -3.7791E-03 -
         H= 5.0000E-02 R= 1.9086E+02 AC= 5.4461E-04
                                                         NEVAL=
                                                                  288
       4.0000E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01
 144
                                                         9.7643E-01 -3.7025E-03 -:
         H= 5.0 000E-02 R= 1.8499E+02 AC= 5.4930E-04
                                                         NEVAL=
                                                                  311
 145
       4. 90 0 0 E + 00 -1.3352 E + 00 -9. 0641 E - 03 -9.6181 E - 01
                                                         9.7643E-01 -3.7025E-03 -
         H= 2.5000E-02 R= 1.6398E+02 AC= 5.5533E-04
                                                         NEVAL=
                                                                  314
 155
       4.3500E+00 -9.8803E-01 -1.0328E-02 -1.0523E+00
                                                         1.0069E+00 -3.5092E-03 -7
         H= 2.5000E-02 R= 1.9043E+02
                                        AC= 5.4233E-04
                                                         NEVAL=
                                                                  335
       4.7750E+00 -5.5306E-01 -1.1753E-02 -1.1520E+00
 165
                                                         1.0387E+00 -3.1772E-03 -
         H= 5.0000E-02 R= 1.8739E+02 AC= 5.4448E-04
                                                         NEVAL=
                                                                  356
 170
       5.0000E+00 -3.1772E-01 -1.2444E-02 -1.1993E+00
                                                         1.0528E+00 -2.9619E-03 -
         H= 5.0000E-02 R= 1.8378E+02 AC= 5.5173E-04
                                                         NEVAL=
                                                                  367
 175
                   1.1102E-16 -1.3284E-02 -1.2559E+00
       5.2995E+00
                                                         1.0682E+00 -2.6446E-03 -
         H= 1.0 CODE-01
                        R= 1.7534E+02 AC= 5.5777E-04
                                                         NEVAL=
                                                                  377
```

2.0000ETU0 -3.1240E+00 -2.4747E-63 -3.4224E-01

€,

1

72

H= 2.5000E-02 R= 2.3887E+02 AC= 4.4563E-04

びょうサンロヒーロン ーン・メルとうヒーリン

94

NEVAL=

```
94
.15
.37
ORY IS AS FOLLOWS * *
    Z=-5.00000E-01 FOR TRAJECTORY NUMBER
T TO 3.1250E-03
T TO 1.5625E-03
T TO 7.8125E-04
     VPY
               VP Z
                          VX
                                              V 7
-1.0211E-03 -1.8037E-02 9.5022E-01 -1.0211E-03 -9.4917E-03
-1.0379E-03 -1.8253E-C2 9.2743E-01 -1.4781E-03 -1.7214E-02
17
37
. -1.8018E-03 -4.4579E-û2 7.41C2E-ü1 -4.3561E-03 -1.8313E-01
85
: -1.935UE-03 -5.2476E-02 7.2203E-01 -4.6783E-03 -2.3124E-01
03
-2.899 0E-03 - 1.4541E-01
                     7.7503E-01 -5.6161E-03 -5.0306E-01
24
-3.2768E-03 -2.0033E-01 9.5347E-01 -5.6300E-03 -5.6342E-D1
47
-3.4910E-03 -2.3312E-01 1.0317E+00 -5.0500E-03 -4.5671E-01
67
-3.5962E-E3 -2.4746E-E1 1.0474E+DU -4.9247E-03 -4.0973E-01
78
-3.7829E-[3 +2.6766E-01 1.1074E+00 -5.0931E-03 -3.8329E-01
02
-3.8160E-u3 -2.7199E-01 1.1195E+00 -4.0114E-03 -3.1470E-01
22
-3.8177E-03 -2.7241E-01 1.11{3E+00 -3.9671E-03 -3.0931E-01
47
-3.8205E-03 -2.7338E-01 1.1168E+00 -3.8600E+(3 -2.9616E-01
67
-3.7791E-03 -2.7286E-01 1.1511E+00 -3.2909E-03 -2.4028E-01
88
-3.7025E-63 -2.6648E-01 1.1567E+00 -2.8540E-03 -1.8720E-01
11
-3.7025E-03 -2.6648E-01 1.1506E+00 -2.8140E-03 -1.8361E-01
14
-3.5092E-C3 -2.4919E-61
                     1.1656E+00 -2.2839E-03 -1.3240E+01
35
:-3.1772E-03 -2.1923E-01 1.1649E+00 -1.4809E-03 -7.1961E-02
56
-2.9619E-03 -2.0115E-01 1.1603E+00 -1.0059E-03 -4.1299E-02
57
-2.6446E-03 -1.7707E-01 1.1631E+00 -4.1830E-04 -1.9720E-02
```

T'674475=83 =5643536=84 =7617466=81 =4667766=83 =63746=81

\*

X

## PLOT TANGENT TRAJECTORY TO THE TEST BODY

NUMBER OF SYMMETRY PLANES= 0 NUMBER OF TRAJECTORIES= 1

MINIMUM AND MAXIMUM COORDINATES 
X AXIS= -5.0 COOOE+00 2.00000E+00

Y AXIS= -5.0 CQ O O E + 0 O CO O C E + 0 O CO C E + 0 O C C E +

COORDINATE TRANSLATIONS USED TO CENTER THE PLOTS - DELX, DELY, DELZ -1.50000E+00 3. -1.27964E-01

CRT PLOTS

-.4051E+01

-.3232E+01

-.3208E+01

-.3124E+01

-.2667E+01

-.1049E-02

-.2247E-02

-.2294E-02

-.2469E-02

-.3726E-02

THETA = 0.00 PSI = 160.00 DELTA = 3.50 PLOT LABEL - THETA=0, PSI=160, DELTA=3.5

PEMSF = 1.5466E+00

TRAJ. NO. 1 OF 22 POINTS

IRAJ. NO. 1 UF	SS POTUIS			
XTRAJ	YTRAJ	ZTRAJ	XFLCT	YPLOT
50005104	:	5245.00	64.505.84	
5000E+01	0.	5000E+00	2158E+01	5754E+00
5000E+01	0.	5000E+00	21 58E+01	5754E+00
4525E+01	5131E-03	5091E+00	1865E+01	5894E+00
4051E+01	1049E-02	518 4E+00	1572E+01	6039E+00
3232E+01	2247E-02	541 &E+00	10 E5E+01	6400E+00
3208E+01	2294E-02	542 SE+00	10 50E+01	6418E+00
3124E+01	2469E-02	547 5E+00	9978E+00	6488E+00
2667E+01	3726E-02	5954E+00	7146E+00	7229E+00
2509E+01	4305E-02	-•6277E+00	6162E+00	7729E+00
2370E+01	4857E-02	6633E+00	5297E+00	8279E+00
2261E+01	5300E-02	6934E+00	4620E+00	8744E+00
2023E+01	6292E-02	762 EE+09	3133E+00	9818E+00
1926E+01	6696E-02	7915E+00	2533E+00	1026E+01
1909E+01	6768E-02	7966E+00	2426E+00	1034E+01
1857E+01	6983E-02	8119E+00	2104E+00	1058E+01
1528E+01	8315E-02	907£E+60	5772E-02	1206E+01
1335E+01	9064E-02	961 EE+00	• 1145E+00	1290E+01
1335E+01	9064E-02	961 EE+00	•1145E+80	1290E+01
9880E+00	1033E-01	1052E+01	.3304E+G0	1429E+01
5531E+00	1175E-01	1152E+01	.6006E+00	1584E+01
=.3177E+0 C	1244E-01	1199E+01	.7468E+80	1657E+01
.1110E-15	1328E-01	125 EE+81	.9439E+00	1744E+01
TRAJ. NO. 1 OF	22 POINTS			
XTRAJ	YTRAJ	ZTRAJ	XPLOT	YPLOT
5000E+01	0.	5000E+00	1537E+01	5754E+80
500CE+01	: 0 •	500 0E+00	1537E+01	5754E+00
4525E+01	5131E-03	5091E+00	1328E+01	5894E+00

-.5184E+00

-.5418E+00

-.5429E+00

-.5475E+00

-. 5954E+00

-.1119E+01

-.7575E+00

-. 7469E+00

-.7096E+00

-.5073E+00

-.6039E+00

- . 640UE+00

-.6418E+00

-.6488E+00

-.7229E+00

## YPLOT

```
-.5754E+00
```

-.5754E+00 -.5894E+00

-.6039E+00

-.6408E+00

-.6418E+00

-.6488E+00

-.7229E+00 -.7729E+00

-.8279E+00

-.8744E4JQ

-.9818E+00

-.1026E+01

-.1634E+81

-.1058E+01

-.1206E+01 -.1290E+01

-.1290E+01

-.1429E+01

-.1584E+01

-.1657E+01

-.1744E+01

YPLOT

- -.5754E+00
- -.5754E+00
- -.5894E+00
- -.6039E+00
- -.640UE+00
- -.6418E+00
- -.6488E+00
- -.7229E+00

FITE BOLLT FRAM

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2

```
-. 2370E+01
                     -.4857E-02
                                                                        -.8279E+00
                                      -.6633E+00
                                                       -. 37 50E+00
     -.2261E+01
                     -.5300E-02
                                      -.6934E+00
                                                       -.3266E+00
                                                                        -.8744E+00
     -.2023E+01
                     -. 6292E-02
                                                       -. 220 2E+00
                                      -.7 E28E+00
                                                                        --9818E+00
     -.1926E+01
                     -.6696E-02
                                      -.7915E+00
                                                       -. 1772E+00
                                                                        -.1026E+01
     --1909E+01
                                      -.7966E+00
                     --6768E-02
                                                       -.1696E+00
                                                                        --1034E+01
     -.1857E+01
                     -.6983E-02
                                      -.8 119E+00
                                                       -.1466E+00
                                                                        -.1058E+01
     -.1528E+01
                      -.8315E-02
                                      -.907 8E+00
                                                       -. 1849E-03
                                                                        -.1206E+01
     -.1335E+01
                      -. 9064E-02
                                                        .8585E-01
                                                                        -.129DE+01
                                      -.961 EE+00
     -.1335E+01
                                      -.9 £1 8E+00
                     -.9064E-02
                                                        .8585E-01
                                                                        -.1290E+01
     -.9880E+00
                                                        .240 2E+00
                     -.1033E-01
                                      -.105 2E+U1
                                                                        -.1429E+01
     -.5531E+00
                      -.1175E-01
                                      -.1152E+01
                                                        .4334E+08
                                                                         -.1584E+01
     -. 3177E+00
                      -.1244E-01
                                      -.1199E+01
                                                        .5378E+00
                                                                        -.1657E+01
      .111 0E-15
                     -.1328E-01
                                      -.1256E+01
                                                         .6786E+00
                                                                        -.1744E+01
 THETA =
              0.0 C
                             PSI =
                                     160.00
                                                       DELTA =
                                                                    3.00
 PLOT LABEL - THETA=0, PSI=160, DELTA=3.0
          PEMSF =
                    1.5568E+00
                     22 POINTS
 TRAJ. NO.
             1 0F
        XTRAJ
                         YTRAJ
                                          ZTRAJ
                                                          X PL OT
                                                                            YPLOT
    -. 5000E+01
                     0.
                                      -. 50 0 CE+00
                                                       -. 2129E+01
                                                                        -.5792E+30
     -.500 0E+01
                     0.
                                      -.5000E+00
                                                       -. 2129E+01
                                                                        -.5792E+00
     -. 4525E+01
                     -.5131E-83
                                      -.5091E+00
                                                                        -.5933E+00
                                                       -.1839E+01
     -. 4051E+D1
                     -. 1049E-02
                                      -.5184E+80
                                                       -. 1550E+01
                                                                        -.6079E+00
     -. 3232E+01
                     -.2247E-02
                                      -.541 8E+00
                                                       -. 1050E+01
                                                                        -.6442E+00
     -.3208E+01
                      -.2294E-02
                                      -.5429E+00
                                                       -. 1036E+01
                                                                        -.6460E+00
     -. 3124E+01
                     -.2469E-02
                                      -.547 5E+88
                                                       -. 9841E+00
                                                                        -.6531E+00
     -. 2667E+01
                     -.3726E-02
                                      -.5954E+80
                                                       -.7048E+00
                                                                        -. 7277E+00
74
                      -.4305E-02
     -. 2509E+01
                                      -.6277E+00
                                                       -. 60 76E+00
                                                                        -. 7780E+00
     -. 2370E+01
                      -.4857E-D2
                                      -.6633E+00
                                                       -.5223E+00
                                                                        -.8334E+00
     -. 2261E+01
                      -.5300E-02
                                      -.6934E+00
                                                       -. 4555E+00
                                                                        -.8802E+00
     -. 2023E+01
                     -.6292E-02
                                      -.7626E+00
                                                       -.3088E+00
                                                                        -.9882E+00
     -.1926E+01
                     -.6696E-02
                                      -. 791 5E+ 00
                                                       -. 2496E+00
                                                                        -.1033E+01
                                      -.7966E+00
     -. 1909E+01
                      - • 6 768 E-02
                                                       -. 239 GE+00
                                                                        -- 1041E+81
     -- 1857E+01
                      -.6983E-02
                                      -.8119E+00
                                                       --2073E+00
                                                                        -.1065E+01
     -. 1528E+01
                      -.8315E-02
                                      -.9078E+GU
                                                       -.5410E-02
                                                                        -.1214E+01
     -.1335E+01
                     --9064E-02
                                      -.9618E+DD
                                                        .1133E+00
                                                                        -.1298E+81
     -.1335E+81
                     -.9064E-02
                                      -.961 EE+ 00
                                                        . 1133E+00
                                                                        -.1298E+01
     -. 9880E+00
                      -.1033E-01
                                      -.1052E+01
                                                        .3262E+00
                                                                        --1439E+01
     -.5531E+00
                      -.1175E-01
                                       -.1152E+01
                                                        .5923E+00
                                                                        --1594E+01
     -.3177E+00
                      -.1244E-01
                                       - •11 99E+ 61
                                                         .7370E+00
                                                                        -.1668E+01
      .1110E-15
                     --1328E-01
                                      -.125 EE+01
                                                        -9315E+00
                                                                        -.1756E+01
 TRAJ. NO.
             1 OF
                     22 POINTS
        XTRAJ
                         YTRAJ
                                          ZTRAJ
                                                          XPLOT
                                                                           YPLOT
     -. 5000E+01
                     9.
                                      -.5000E+00
                                                       -.1593E+01
                                                                        -.5792E+00
                                      - .500 0E+00
    -.5000E+01
                     0.
                                                                        -.579 2E+00
                                                       --1593E+01
                     -.5131E-03
     -.4525E+01
                                      -.5091E+00
                                                       -.1376E+01
                                                                        -.5933E+00
     -- 4051E+01
                      -.1049E-02
                                      -.5184E+00
                                                       -. 11 60E+01
                                                                        -.6679E+00
     -- 3232E+01
                      -.2247E-02
                                      -.5418E+00
                                                       -. 7850E+00
                                                                        -.6442E+00
     -. 3208E+01
                      -.2294E-02
                                      -.5429E+00
                                                       -. 7740E+00
                                                                        -. 646DE+00
     -.3124E+01
                                      -.5475E+00
                      -.2469E-02
                                                       -.7354E+00
                                                                        -.6531E+00
    -. 2667E+01
                     -.3726E-02
                                      -.5 954E+00
                                                       -.5258E+00
                                                                        -.7277E+00
    -. 2509E+01
                     -. 4305E-02
                                      -.6277E+0J
                                                       -. 4529E+00
                                                                        -.778üE+00
    -. 237 0E+01
                     -.4857E-02
                                      -.6633E+00
                                                       -.3868E+00
                                                                         -.8334E+00
     -. 2261E+01
                      -.5300E-02
                                      -.6934E+00
                                                       -.3387E+00
                                                                        -.8802E+00
     -.2023E+01
                      -.6292E-02
                                      -.7628E+00
                                                       -.2285E+00
                                                                        -.9882E+00
     -.1926E+01
                                      -.7915E+00
                      -.6696E-#2
                                                       -.1840E+00
                                                                         -.1033E+01
```

JOSEFELDS.

-- 6027/6+00

250 9E + 61

10005-01

\_6.7/0E\_60

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- 01/27E+UU

-145 0 7E TUV

```
~-10415+01
   +.1857E+01
                    -.6983E-02
                                     -.8119E+00
                                                     -. 1522E+00
                                                                      --1065E+01
   +.1528E+01
                    -.8315E-02
                                     -.9078E+00
                                                     -.5852E-03
                                                                      -.1214E+01
   -.1335E+01
                    -.9064E-02
                                     -.9618E+83
                                                       .8853E-01
                                                                      -.1298E+#1
   +.1335E+01
                    -.9064E-02
                                     -.9618E+00
                                                       .8853E-01
                                                                      -.1298E+01
   -. 988 CE+0 (
                    -.1033E-01
                                     -.105 2E+01
                                                      .2464E+00
                                                                      -.1439E+01
   -.5531E+00
                    -.1175E-01
                                     -.1152E+01
                                                       .4485E+00
                                                                      -.1594E+U1
   -.3177E+00
                    -.1244E-01
                                     -.1199E+01
                                                       .5566E+00
                                                                      -.1668E+81
    .1118E-15
                    -.1328E-01
                                     -.125 (E+01
                                                       .7025E+00
                                                                      -.1756E+01
THETA =
            0.0 C
                            PSI =
                                   160.00
                                                                  2.50
                                                     DELTA =
               THETA=0, PSI=160, DELTA=2.5
PLOT LABEL -
         PEMSF =
                   1.5672E+00
TRAJ. NO.
            1 OF
                    22 POINTS
      XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                         XPLOT
                                                                          YPLOT
   -. 5000E+01
                    9.
                                     -.500 DE+00
                                                     -. 20 99E+01
                                                                      -.5831E+00
                    9.
   -.5000E+01
                                     -.500 0E+00
                                                     -. 2699E+01
                                                                      -.5831E+00
   -. 452 5E+81
                    -.5131E-03
                                     -.5091E+00
                                                     -.1814E+81
                                                                      -.5973E+00
   -.4051E+01
                    -.1049E-02
                                     -.5184E+00
                                                     -.1529E+01
                                                                      -.6119E+00
   -.3232E+01
                    -.2247E-02
                                     -.5418E+00
                                                     -. 10 3 EE+01
                                                                      -.6485E+00
   -. 3208E+01
                    -.2294E-02
                                     -.542 SE+00
                                                     -.1021E+01
                                                                      -.6504E+00
   -. 3124E+01
                                                     -. 9783E+00
                    -.2469 E-82
                                     -.5475E+00
                                                                      -.6575E+ü0
   -. 2667E+01
                    -.3726E-02
                                     -.5954E+00
                                                     -.6948E+30
                                                                      -.7326E+00
   -.2509E+01
                    -.4305E-02
                                     -.6277E+00
                                                     -.5990E+0U
                                                                      -.7833E+00
                    -.4857E-02
   -.2370E+01
                                     -.6633E+00
                                                     -. 51 48E+00
                                                                      -.8398E+00
   -.2261E+01
                    -.5300E-02
                                     -.6934E+00
                                                     -.4490E+00
                                                                      -.8861E+00
   -.2023E+01
                    -.6292E-02
                                     -.762 EE+ 00
                                                     -.3043E+00
                                                                      -.9949E+88
   -.1926E+01
                    -.6696E-02
                                     - .7915E+B0
                                                     -. 2459E+00
                                                                      -.1640E+81
   -.1909E+01
                                     -.7966E+00
                    -.6768E-02
                                                     -.2355E+00
                                                                      -.1048E+01
   -.1857E+01
                    -.6983E-02
                                     -.8119E+00
                                                     -.2041E+00
                                                                      -.1072E+81
   -.1528E+01
                    -.8315E-02
                                     -.9078E+80
                                                     -.5043E-02
                                                                      -.1222E+01
   -.1335E+01
                    -. 9064E-02
                                     -.961 EE+00
                                                      • 11 29E+00
                                                                      -•1307E+D1
   -.1335E+01
                    --9064E-02
                                     -.9618E+B0
                                                       .1120E+00
                                                                      -.1307E+01
   -. 988 CE+00
                    -.1033E-01
                                     -.1052E+Q1
                                                      .3220E+00
                                                                      -.1449E+01
   -. 5531E+00
                    --1175E-01
                                     -.1152E+01
                                                      . 5849E+08
                                                                      -.1605E+01
   -.3177E+00
                    -.1244E-01
                                     -.1199E+01
                                                       .7271E+00
                                                                      -.1679E+01
    .1110E-15
                    -.1328E-01
                                     -.1256E+01
                                                       .9189E+00
                                                                      -.1768E+U1
TRAJ. NO.
            1 OF
                    22 POINTS
      XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                        XPLOT
                                                                         YPLOT
   -.5000E+01
                    0.
                                     -.5000E+00
                                                     -.1649E+81
                                                                      -.5831E+33
   -.5000E+01
                                     -.5000E+00
                                                     -. 1649E+B1
                                                                      -.5831E+J0
                                     - .5091E+00
   -- 4525E+01
                    -.5131E-03
                                                     -.1425E+01
                                                                      -.5973E+30
   -.4051E+01
                    -.1049E-02
                                     -.5184E+00
                                                     -.1201E+01
                                                                      -.6119E+00
   -.3232E+01
                    -. 2247E-02
                                     -.541 EE+ 80
                                                     - 28129E+00
                                                                      -.6485E+00
   -.3208E+01
                    -.2294E-02
                                     -.5429E+00
                                                     -.8015E+00
                                                                      -.6504E+00
                    -. 2469E-02
   -.3124E+01
                                     -.5475E+00
                                                     -.7615E+00
                                                                      -.6575E+00
   -. 266 7E+01
                    -.3726E-02
                                     -.5954E+00
                                                                      -.7326E+80
                                                     -.5446E+00
   -. 25 09E+01
                    -.4305E-02
                                     -.6277E+00
                                                     -. 4691E+00
                                                                      -.7833E+00
   -. 237 0E+01
                    -.4857E-02
                                     -.6633E+00
                                                     -- 40 28E+00
                                                                      -.8390E+00
   -. 2261E+01
                    -.5390E-02
                                     -.6934E+09
                                                     -.3509E+00
                                                                      -.8861E+00
   -.2023E+01
                    -.6292E-02
                                     -.762 8E+00
                                                     -. 2369E+00
                                                                      -.9949E+88
   -.1926E+01
                    -.6696E-02
                                     -. 791 5E+00
                                                     -.1968E+60
                                                                      -.1040E+01
   -.1989E+01
                    --6768E-02
                                     -.7966E+00
                                                     -.1826E+00
                                                                      -.1048E+01
   -.1857E+01
                    -.6983E-02
                                     -.8119E+00
                                                     -.1579E+00
                                                                      -.1072E+01
   -.1528E+01
                    -.8315E-02
                                     -.9078E+00
                                                     -.9949E-03
                                                                      -.1222E+01
                                     -.9618E+00
   -.1335E+01
                    -.9064E-02
                                                       .9124E-01
                                                                      -.1307E+01
   -.1335E+01
                    -.9864E-82
                                     -. 9618E+00
                                                       •9124E-01
                                                                      -.1307E+01
```

- 48ECE4 A

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-61/ CIETUN

ORIGINAL

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CARDELAC

4027C

- . 6 / OC E-UC

- · 700UE + UU	_ • T A 3 2 C _ A 1	~ ~ 1072にナロ1	• Z>C/C+UU	
			I ESCIETUU	~・1447にてひ1
5531E+00	1175E-01	1152E+01	.4638E+00	1605E+01
3177E+00	- 40666-04	44.005.04		
- 0 2 7 1 1 E 4 D A	1244E-01	1199E+01	•5758E+QQ	1679E+01
•1110E-15	1328E-01	1256E+01	.7268E+00	
	1-11-	**********	# 1 E DOE TH H	1768E+01

## CODE LISTINGS

```
PROGRAF PRUXC (INPUT. TAPES. TAPES=INPUT. OUTPUT.
     1 TAPES , TAPES, TAPESS, PUNCH, TAPEL=PUNCH)
C
                                                                            PBOXC
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
C
                                                                            PBOXC
                                                                            PBOXC
      THIS CODE HAS THREE PRINCIPAL USES -
C
                                                                            PBCXC
           1. DEBUG HESS-SHITT CODE INPUT DATA.
                                                                            PBOXC
           2. PLCT 3-DIMENSICNAL BODY SURFACE DESCRIPTION.
                                                                            PBCXC
           3. TRANSFER QUADRA_ATERAL ELEMENT DATA TO UNIT 9 FOR LATER
                                                                            PBCXC
C
               USE BY PROGRAM STEREO.
                                                                            PBOXC
                                                                            FBCXC 10
C
      PERFORMS FRELIMINARY PROCESSING (IPROS=TRUE) (SCALING.
                                                                            PBOXC 11
      TRANSLATING, R (TATING) OF INFUT DATA FOR THE HESS-SMITH
                                                                            PBCXC 12
      NON-LIFTING COCE (RPT. E.S. 40622). PRELIMINARY PROCESSEU DATA PBCXC 14
C
                                                                            PBOXC 13
      MAY BE PUNCHED (IPUNCH=TRUE). AFTER PRELIMINARY PROCESSING, DATAPBOXC 15
C
      ALSO MAY BE PPCCESSED INTO QUADRALATERAL ELEMENTS AND THE HESS-
C
      SMITH FIRST OUTPUT (E.S. 41622 SEC. 9.4) MAY BE PRINTED (IPRNT=
                                                                           PBOXC 16
             DATA ALSO MAY BE PLOTTED (IPICT=TRUE). IN ANY CASE THE PROXC 18
C
      DATA ARE HRITTEN ON TO UNIT 9, WHICH MAY BE SAVED FOR USE LATER
      BY SR STEREO WHICH PLOTS THE BODY ALONG WITH TRAJECTORIES.
                                                                           PECXC 19
                                                                           PBOXC 20
     COMMON HEDRE 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, PBCXC 22
    1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, FBCXC 23
     REAL MACH
                                                                           FBCXC 24
     LOGICAL IPROS, IPUNCH, IPRNT, IFICT, ICRT
                                                                           FBCXC 25
     COMMON /F/ MACH, BETA, RBETA
                                                                           PBCXC 26
     READ IN CONTROL DATA
                                                                           FBCXC 27
   1 READ ( 5. 9000 ) (HEDR (I) . I=1, 15) . IFLAG , NSYM. KMACH. KASE
                                                                           PBCXC 28
9000 FORMAT ( 15 44, II, 10x, II, 1x, 11, 2x, 44)
                                                                           PBCXC 29
     MACH = C.O
                                                                           FBOXC 30
     IF(KMACH .NE. () READ(5,6) MACH
                                                                           FBCXC 31
   6 FORMAT (F10.E)
                                                                           FBOXC 32
     BETA = SCRT(1.0 - MACH + MACH)
                                                                           PBOXC 33
     RBETA = 1.0 / BETA
                                                                           PBCXC 34
     READ(5,8000) IPROS, IPUNCH, IPRNT, IPICT, ICRT
                                                                          PBCX( 35
8000 FORMAT (5L1)
                                                                          FBCXC 36
     IF( IPRO : ) READ(5,7000) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                           FBOXC 37
    1 TRANS. ZTRANS
                                                                          FBCXC 38
7000 FORMAT ( 7F 10.0)
                                                                          PBCX( 39
     IF(.NOT. IFROS) GC TO 53
                                                                          PBOXC 40
     IF(XSCALE .EQ. 0.0) XSCALE=1.0
                                                                          FBOXC 41
     IF(YSCALE .EQ. U.D) YSCALE=1.0
                                                                          PBOXC 42
     IF(ZSCALE .EQ. 0.0) ZSCALE=1.0
                                                                          FBCXC 43
    COSA = COS( 0.0174533 * ANGLE)
                                                                          PBOXC 44
     SINA = SIN( 0.0174533 * ANGLE)
                                                                          PBCXC 45
    REHIND &
                                                                          PBCXC 46
    RENIND 9
                                                                          P60X( 47
    CALL PINPUT
                                                                          FBCXC 48
    IFTIPICT | CALL PICTUR
                                                                          PBOXC 49
    IFI ICRT ) CALL FRAME (0.5, 0.5)
                                                                          PBCXC 50
    IF(IPICT .AND. .NOT. IRT) CALL PLOT(15.8. 8.0.-3)
IF(IPICT .AND. .NOT. IRT) CALL ENDCC
                                                                          FBCX( 51
                                                                          PBOXC51A
    IF(IPICT .. AND. ICRT) CALL ENDPLY
                                                                          FBCXC 52
    REHIND 9
                                                                         PBCXC 53
    STOP
                                                                         PBCX ( 54
    È IO
                                                                         FBCXC 55
                                    78
                                                                         PBOXC 56
```

```
*DECK. PEADER
                                                                            PEAD
      SUBROUTINE PEADER
                                                                           PEAD
                                                                                   2
      COMMON HEDR ( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IPRNT, PEAD
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, PEAD
     2 ZTRANS
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT
                                                                           PEAD
                                                                                   6
      DATA IPAGE/0/
                                                                           PEAD
                                                                                   7
    1 FORMAT ( 141, 4X, 14H PROGRAM PBCXC, 15X, 30HATMOSPHERIC SCIENCE ASPEAD
     1SOCIATES/
                           38X, 22HBEDFORD, MASSACHUSETTS, 22X, 4HP &GEI5/PEAD
                                                                                   9
     2 7X, 8HBODY ID., 2X, A4/ 30X, 15A4)
   10 IPAGE = IPAGE + 1
                                                                           PEAD
                                                                                  11
      WRITE (6,1) IPAGE, KASE, (HEDR(I), I=1,15)
                                                                           PEAD
                                                                                  12
      RETURN
                                                                           PEAD
                                                                                  13
      END
                                                                           PEAD
                                                                                  14
```

```
*DECK, PATPROS
                                                                            PATP
      SUBROUTINE PATPROS( X, Y, Z, XX, YY, ZZ )
                                                                            PATP
C
                                                                            PATP
C
      THIS IS A SIMPLE SCALING AND ORIGIN TRANSLATION CODE FOR THE
                                                                            PATP
C
      DOUGLAS BOXC POTENTIAL FLOW CODE DATA INPUT
                                                                            PATP
C
         XTRANS, YTRANS, ZTRANS ARE ORIGIN TRANSLATIONS
                                                                            PATP
         XSCALE, YSCALE, ZSCALE ARE SCALE FACTORS
C
                                                                            PATP
Ć
      THE CODE ALSO ALLOWS FOR ROTATION IN THE X - Z PLANE TO ADJUST
                                                                            PATP
C
      FOR ARBITRARY ANGLE OF ATTACK
                                                                            PATP
                                                                                    9
         SINA, COSA ARE SINE AND COSINE OF ANGLE
                                                                            PATP
                                                                                  10
         ANGLE IS THE ANGLE (INPUT IN DEGREES) THAT THE AIRPLANE AXIS
                                                                            PATP
                                                                                   11
         MAKES WITH THE NEGATIVE X AXIS (POSITIVE COUNTERCLOCKWISE
                                                                            PATP
C
         FROM THE-X AXIS) AFTER SCALING ( NOTE - AFTER SCALING THE
                                                                            PATP
                                                                                   13
C
         AIRPLANE NOSE POINTS DOWN THE NEGATIVE X AXIS)
                                                                            PATP
                                                                                   14
C
                                                                            PATP
                                                                                  15
C
      THIS VERSION FOR USE WITH PROXC
                                                                            PATP
                                                                                   16
C
                                                                            PATP
                                                                                  17
C
                                                                            PATP
                                                                                  18
      LOGICAL IPROS, IPUNCH, IPRNT, IPICT, ICRT
                                                                            PATP
                                                                                  19
      COMMON HEDR( 15), NQLAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IPRNT, PATP
                                                                                  20
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, PATP
     2 ZTRANS
                                                                            PATP
                                                                                  22
      X = (X - XTRANS) + XSCALE
                                                                            PATP
                                                                                   23
      Y = (Y - YTRANS) +
                            YSCALE
                                                                            PATP
                                                                                   24
      Z' = (Z - ZTRANS) +
                            ZSCALE
                                                                            PATP
                                                                                   25
      XX= ( XX- XTRANS ) * XSCALE
                                                                            PATP
                                                                                  26
      YY= ( YY- Y TRANS ) + YSCALE
                                                                            PATP
                                                                                  27
      ZZ= ( ZZ- ZTRANS ) * ZSCALE
                                                                            PATP
                                                                                   28
      XP = X
                                                                            PATP
                                                                                   29
      X = XP + COSA - Z + SINA
                                                                            PATP
                                                                                  30
      Z = XP + SINA + Z + COSA
                                                                            PATP
                                                                                   31
      XP = XX
                                                                            PATP
                                                                                  32
      XX = XP + COSA - ZZ+ SINA
                                                                            PATP
                                                                                  33
      ZZ= XP + SINA + ZZ+ COSA
                                                                            PATP
                                                                                  34
      RETURN
                                                                            PATP
                                                                                  35
      END
                                                                            PATP
                                                                                  36
```

```
PINP
*DECK, PINPUT
      SUBROUTINE PINPUT
                                                                            PINP
                                                                                   3
                                                                            PINP
C
      PROCESSES THE HESS-SMITH CODE INPUT DATA
                                                                            PINP
                                                                                   5
                                                                            PINP
      REAL NX, NY, NZ , MACH
                                                                            PINP
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT, RFLAG, AFLAG, BFLAG
                                                                            PINP
      INTEGER STAT, STATT, CCNV
                                                                            PINP
      COMMON HEDR ( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, PINP
                                                                                   9
                                                                                  10
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, PINP
     2 ZTRANS
      COMMON /M/ MACH, BETA, REETA
                                                                            PINP
                                                                                  12
      DIMENSION SPH ( 200 ), CPH ( 203 ), XINP ( 200 ), ZINP ( 200 )
                                                                            PINP
                                                                                  13
      DIMENSION LAXIS(8), RAXIS(6), L45(6), L(5)
                                                                            PINP
                                                                                  14
                                                                                  15
      DIMENSION XA ( 500 ), XE ( 500 ), YA ( 500 ), YB ( 500 ),
                                                                            PINP
        ZA ( 500 ), ZB ( 500 ), NLINE(500 ), NLT ( 500 ), CFLAG(3),
                                                                            PINP
                                                                                  16
                                                                            PINP
                                                                                  17
        XI (4), ETA (4), XIN (4), YIN (4), ZIN (4),
                                        RX (4), R (4), RY (4)
                                                                            PINP
                                                                                  18
      EQUIVALENCE (NULL, NQUAD)
                                                                            PINP
                                                                                  19
                                       / 2H 1, 2H 2, 2H
                                                                            PINP
                                                                                  20
      DATA
             CFLAG
      DATA PI/3.141593E0/, HAFPI/1.570736E0/, EPS/.0001/
                                                                            PINP
                                                                                  21
                                                                            PINP
                                                                                  22
      DATA LAXIS / 4HVIEW, 4H CF , 4HBODY, 4H LOO, 4HKING, 4H DOW,
                                                                            PINP
                                                                                  23
     1 4HN TH, 1HE/
                                                                                  24
      DATA RAXIS/ 4H AXI, 4HS TO, 4HWARD, 4H THE, 4H ORI, 4HGIN /
                                                                            PINP
      DATA L45/ 4H45-D, 4HEGRE, 4HE VI, 4HEW F, 4HROM, 4HTHE /
                                                                            PINP
                                                                                  25
                                                                                  26
      DATA R45/ 4HSIDE/, L/5+4H
                                                                            PINP
      DATA PLUSX, MINUSX, FLUSY, MINUSY, PLUSZ, MINUSZ
                                                                            PINP
                                                                                  27
                                                                            PINP
                                                                                  28
       / 4H +X , 4H -X , 4H +Y , 4H -Y , 4H +Z , 4H -Z /
                    3E10.0, I2 / 3F10.0, I2)
                                                                            PINP
                                                                                  29
    1 FORMAT (
 4002 FORMAT ( 1HO, 6x 5HN M, 7X, 4 ( 1HX, 11X ), 2HNX, 11X, 3HNFX,
                                                                            PINP
                                                                                  30
        11X, 1HD / 19X, 4 ( 1HY, 11X ), 2HNY, 11X, 3HNPY, 11X, 1HT /
                                                                            PINP
                                                                                  31
                                                                            PINP
                                                                                  32
        19X, 4(1HZ, 11X), 2HNZ, 11X, 3HNPZ, 11X, 1HA
                                                              1
 4005 FORMAT ( 1H0, 7X, I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                            PINP
                                                                                  33
                                                                            PINP
                                                                                  34
        2F13.6, E14.4 ) )
                                                                                  35
 4010 FORMAT ( 1H0, 3X, 2I4, 4F12.6, 2F13.6, E14.4,A2/(12X, 4F12.6,
                                                                            PINP
     1 2F13.6. E14.4
                                                                            PINP
                                                                                  36
                        1
 4015 FORMAT ( 1H0, 3 ( 20 X, 12H********* ))
                                                                            PINP
                                                                                  37
                                                                            PINP
                                                                                  38
                                                                            PINP
                                                                                  39
   INPUT -- SECTION 9.1 INPUT SCHEME
                                                                                  40
      KLCT = 0
                                                                            PINP
                                                                            PINP
                                                                                  41
      NULL = 0
      NPRT = 13
                                                                                  42
                                                                            PINP
      CALL PEADER
                                                                                  43
                                                                            PINP
                                                                            PINP
                                                                                  44
      WRITE (6, 40)
   40 FORMAT (1H0,16X,44HP A R A M E T R I C
                                                  INFORMATION//)PINP
                                                                                  45
                                                                            PINP
                                                                                  46
      IF (NSYM - 1) 54, 56, 58
   54 WRITE (6, 55)
                                                                            PINP
                                                                                  47
   55 FORMAT (1H0,16X,21HNC SYMMETRY SPECIFIED)
                                                                            PINP
                                                                                  48
      GO TO 61
                                                                            PINP
                                                                                  49
   56 WRITE (6, 57)
                                                                            PINP
                                                                                  50
   57 FORMAT (1HO 16X, 30HTHERE IS ONE PLANE OF SYMMETRY)
                                                                            PINP
                                                                                  51
                                                                            PINP
      GO TO 61
                                                                                  52
   58 WRITE (6, 59) NSYM
                                                                            PINP
                                                                                  53
   5'9" FORMAT (1H0,16X,9HTHERE ARE,12, 19H PLANES OF SYMMETRY)
                                                                            PINP
                                                                                  54
                                                                            PINP
                                                                                   55
   61 IF ( MACH .NE. 0.0 ) WRITE (6, 21) MACH
                                                                            PINP
   21 FORMAT (1H0,16X,13HNACH NUMBER =,F10.5)
                                                                                  56
      IF (IFLAG .EQ. 0) GO TO 29
                                                                            PINP
                                                                                   57
      READ (5, 20) NLM1, MMIN, B, C
                                                                            PI NP
                                                                                  58
      IF (8 \cdot EQ \cdot 0.0) B = 1.0
                                                                            PINP
                                                                                  59
                                                                            PINP
      IF (C \cdot EQ \cdot O \cdot O) \cdot C = 1 \cdot O
                                                                                  60
                                    80
```

```
20 FORMAT ( 215, 2F10.5 )
                                                                     PINP 61
4 FORMAT ( 8F18.8 )
                                                                     PINP
   WRITE (6, 62) NLM1, MMIN, B. C
                                                                     PINP
                                                                           63
62 FORMAT (1H0,16X,10HGENERATE A,13, 2H X,13, 12H SPHERE. B =,F10.5, PINP
                                                                           64
 1 4X.3HC =.F10.5 )
                                                                     PINP
                                                                           65
  MLINES = MMIN + 1
                                                                           66
                                                                     PINP
   NLINES = NLM1 + 1
                                                                     PINP
                                                                           67
  N = 0
                                                                     PINP
                                                                           68
  IF ( NSYM .EQ. 8 ) GO TO 2
                                                                     PINP
                                                                           69
  IF ( NSYM - 2 ) 3, 5, 6
                                                                     PINP
                                                                           70
2 PITH = PI
                                                                     PINP
                                                                           71
  PIPHI = PI + PI
                                                                     PINP
                                                                           72
  GO TO 7
                                                                     PINP
                                                                           73
3 PITH = PI
                                                                     PINP
                                                                           74
  PIPHI = PI
                                                                     PINP
                                                                           75
   GO TO 7
                                                                     PINP
                                                                           76
 5 PITH = PI
                                                                     PINP
                                                                           77
  PIPHI = HAFPI
                                                                     PINP
                                                                           78
  GO TO 7
                                                                     PINP
                                                                           79
 6 PITH = HAFPI
                                                                     PINP
                                                                           80
  PIPHI = PITH
                                                                     PINP
                                                                           81
 7 SPH ( MLINES ) = SIN ( PIPHI )
                                                                     PINP
                                                                           82
   SPH(1) = 0.0
                                                                     PINP
                                                                           83
  CPH ( NLINES ) = COS ( PIPHI )
                                                                     PINP
                                                                           84
  CPH (1) = 1.0
                                                                     PINP
                                                                           85
   EKM = MMIN
                                                                     PINP
                                                                           86
  EKN = NLM1
                                                                     PINP
                                                                           87
   EMM = 0.0
                                                                     PINP
                                                                           88
   DO 8 I = 2, MMIN
                                                                     PINP
                                                                           89
  EMM = EMM + 1.0
                                                                     PINP
                                                                           90
  PHI = EMM / EKM * PIFHI
                                                                     PINP
                                                                           91
   SPH (I) = SIN (PHI)
                                                                     PINP
                                                                           92
8 CPH (I) = COS (PHI)
                                                                     PINP
                                                                           93
   IF ( IFLAG .EQ. 2 ) GO TO 10
                                                                     PINP
                                                                           94
   ENN = 1.0
                                                                     PINP
                                                                           95
   DO 9 I = 1, MLINES
                                                                     PINP
                                                                           96
  XA (I) = 1.0
                                                                     PINP
                                                                           97
  YA (I) = 0.0
                                                                     PINP
                                                                           98
9 ZA ( I ) = 0.0
                                                                     PINP
                                                                          99
                                                                     PINP 100
   GO TO 18
10 READ ( 5, 4 ) ( XINP ( I ), ZINP ( I ), I = 1, NLINES )
                                                                    PINP 101
  DO 11 I = 1, MLINES
                                                                    PINP 102
   XA (I) = XINP (1)
                                                                     PINP 103
  YA (I) = B + ZINP (1) + SPH (I)
                                                                     PINP 104
  ZA (I) = -C + ZINP (1) + GPH (I)
                                                                     PINP 105
  XB (I) = XINP (2)
                                                                     PINP 106
   YB (I) = B + ZINP (2) + SPH (I)
                                                                     PINP 107
11 ZB ( I ) = - C + ZINF ( 2 ) + CPH ( I )
                                                                     PINP 108
                                                                     PINP 109
   NLCT = 2
   GO TO 250
                                                                     PINP 110
12 DO 14 I = 1. MLINES
                                                                     PINP 111
   XA (I) = XB (I)
                                                                     PINP 112
   YA (I) = YB (I)
                                                                     PINP 113
                                                                     PINP 114
14 ZA (I) = ZB (I)
  IF ( IFLAG .EQ. 1 ) GO TO 16
                                                                     PINP 115
   NLCT = NLCT + 1
                                                                     PINP 116
   DO 15 I = 1, MLINES
                                                                     PINP 117
   XB (I) = XINP (NLCT)
                                                                     PINP 118
   YB (I) = B + ZINP (NLCT) + SPH (I)
                                                                     PINP 119
15 ZB ( I ) = - C + ZINP ( NLCT ) + CPH ( I )
                                                                     PINP 120
```

```
GO TO 250
                                                                          PINP 121
   16 ENN = ENN + 1.0
                                                                          PINP 122
   18 THETA = ENN / EKN * PITH
                                                                          PINP 123
      STH = SIN ( THETA )
                                                                          PINP 124
      CTH = COS ( THETA )
                                                                          PINP 125
      DO 17
             I = 1. MLINES
                                                                          PINP 126
      XB (I) = CTH
                                                                          PINP 127
      YB (I) = B + STH + SPH (I)
                                                                          PINP 128
   17 ZB ( I ) = - C + STH + CPH ( I )
                                                                          PINP 129
                                                                          PINP 130
      GO TO 250
                                                                          PINP 131
   29 N = -1
     IF (IPROS) WRITE (6, 101)
                                                                          PINP 132
      IF(IPROS) WRITE(6,102) XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS,
                                                                          PINP 133
     1 ZTRANS, COSA, SINA
                                                                          PINP 134
      IF(IPICT) WRITE(6,103)
                                                                          PINP 135
                                                                          PINP 136
      IF(IPUNCH) WRITE(6,104)
C
                                                                          PINP 137
  101 FORMAT( 1HO, 16x, 61HINPLT DATA ARE PROCESSED BY SCALING, ROTATING PINP 138
                                                                          PINP 139
     1 AND TRANSLATING)
  102 FORMAT ( 18X, 58HXSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, ZZANS, COPINP 140
     1SA, SINA/ 15X, 8 (1PE 14.4))
                                                                          PINP 141
  103 FORMAT( 1HO, 16X, 18HFLOTS ARE PREPARED)
                                                                          PINP 142
                                                                          PINP 143
  104 FORMAT( 1HO, 16X, 16HDATA ARE PUNCHED)
      XMIN = 1.0E6
                                                                          PINP 144
      XMAX = -1.0E6
                                                                          PINP 145
      YMIN = 1.0E6
                                                                          PINP 146
      YMAX = -1.0E6
                                                                          PINP 147
      ZMIN = 1.0E6
                                                                          PINP 148
      ZMAX = -1.0E6
                                                                          PINP 149
      GO TO 50
                                                                          PINP 150
   30 IF ( RFLAG ) GO TO 50
                                                                          PINP 151
      RFLAG = .TRUE.
                                                                          PINP 152
      X = XX
                                                                          PINP 153
      Y = YY
                                                                          PINP 154
      Z = ZZ
                                                                          PINP 155
      STAT = STATT
                                                                          PINP 156
      GO TO 66
                                                                          PINP 157
   50 RFLAG = .FALSE.
                                                                          PINP 158
   51 READ ( 5, 1 ) X, Y, Z, STAT, XX, YY, ZZ, STATT
                                                                          PINP 159
      IF ( IPROS ) CALL PATPROS( X, Y, Z, XX, YY, ZZ )
                                                                          PINP 160
      IF(IPUNCH) WRITE(1,5100) X, Y, Z, STAT, XX, YY, ZZ, STATT
                                                                          PINP 161
 5100 FORMAT( 3( F10.7), I2/3( F10.7), I2)
                                                                          PINP 162
      WRITE (9) X,Y,Z,STAT,XX,YY,ZZ,STATT
                                                                          PINP 1E3
                                                                          PINP 164
   64 XMIN = AMIN1(XMIN, X + RBETA)
                                                                          PINP 165
      YMIN = AMIN1(YMIN,Y)
                                                                          PINP 166
      ZMIN = AMIN1(ZMIN,Z)
                                                                          PINP 167
      XMAX = AMAX1(XMAX, X + REETA)
                                                                          PINP 168
      YMAX = AMAX1(YMAX,Y)
                                                                          PINP 169
      ZMAX = AMAX1(ZMAX,Z)
                                                                          PINP 170
      IF(STAT .EQ. 3) GO TO 164
                                                                          PINP 171
      XMIN = AMIN1(XMIN, XX* REETA)
                                                                          PINP 172
      YMIN = AMIN1(YMIN, YY)
                                                                          PINP 173
      ZMIN = AMIN1(ZMIN,ZZ)
                                                                          PINP 174
      XMAX = AMAX1(XMAX, XX* RBETA)
                                                                          PINP 175
      YMAX = AMAX1(YMAX, YY)
                                                                          PINP 176
      ZMAX = AMAX1(ZMAX,ZZ)
                                                                          PINP 177
  164 IF ( NSYM . EQ. 0 ) GO TO 65
                                                                          PINP 178
      YMIN = AMIN1(YMIN, -Y)
                                                                          PINP 179
      YMAX = AMAX1(YMAX, -Y)
                                                                          PINP 180
```

```
IF(STAT .EQ. 3) GO TO 165
                                                                         PINP 181
    YMIN = AMIN1(YMIN, -YY)
                                                                         PINP 182
    YMAX = AMAX1(YMAX, -YY)
                                                                         PINP 163
165 IF( NSYM .EQ. 1 ) GO TO 65
                                                                        PINP 184
    ZMIN = AMIN1(ZMIN, -Z)
                                                                         PINP 185
    ZMAX = AMAX1(ZMAX, -Z)
                                                                         PINP 186
    IF (STAT .EQ. 3) GO TO 65
                                                                         PINP 187
    ZMIN = AMIN1(ZMIN - ZZ)
                                                                         PINP 188
    ZMAX = AMAX1(ZMAX, -ZZ)
                                                                         PINP 189
65 IF (N .EQ. (-1))GO TO 80
                                                                         PINP 190
66 IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180
                                                                         PINP 191
    IF ( STAT .EQ. 2 ) GO TO 200
                                                                         PINP 192
    IF ( .NOT. AFLAG ) GC TO 200
                                                                         PINP 193
    MC = M
                                                                         PINP 194
80 M = 1
                                                                        PINP 195
    IF ( STAT .EQ. 2 ) GO TO 150
                                                                        PINP 196
    IF ( .NOT. BFLAG ) GO TO 84
                                                                        PINP 197
75 DO 81 J = 1. MC
                                                                         PINP 198
    XA (J) = XB (J)
                                                                         PINP 199
    YA (J) = YB (J)
                                                                         PINP 200
81\ ZA\ (J) = ZB\ (J)
                                                                         PINP 201
83 \times B (1) = X
                                                                         PINP 202
    YB (1) = Y
                                                                         PINP 203
    Z8 (1) = Z
                                                                        PINP 204
    GO TO 30
                                                                         PINP 205
84 IF ( AFLAG ) GO TO 85
                                                                         PINP 206
    BFLAG = . TRUE.
                                                                         PINP 207
    GO TO 75
                                                                         PINP 208
85 AFLAG = .FALSE.
                                                                         PINP 209
    GO TO 83
                                                                         PINP 210
150 AFLAG = .TRUE.
                                                                         PINP 211
    BFLAG = .FALSE.
                                                                        PINP 212
    IF (N \cdot EQ \cdot (-1))N = 0
                                                                        PINP 213
160 \times A ( M ) = X
                                                                        PINP 214
    YA (M) = Y
                                                                        PINP 215
    ZA(M)=Z
                                                                        PINP 216
    GO TO 30
                                                                        PINP 217
180 M = M + 1
                                                                         PINP 218
    IF ( AFLAG ) GO TO 160
                                                                        PINP 219
    XB(M) = X
                                                                        PINP 220
    YB (M) = Y
                                                                         PINP 221
                                                                        PINP 222
    ZB (M) = Z
    IF ( STAT .NE. 3 ) GO TO 30
                                                                         PINP 223
200 MMIN = MINO(H, MC) - 1
                                                                         PINP 224
    MC = M
                                                                        PINP 225
250 N = N + 1
                                                                        PINP 226
    KLCT = KLCT + 1
                                                                         PINP 227
    IF( .NOT. IPRNT) GO TO 2100
                                                                         PINP 228
                                                                         PINP 229
BEGIN COMPUTATION OF NULL PCINTS AND 28 QUANTITIES
                                                                        PINP 230
                                                                         PINP 231
    DO 2000 I = 1, MMIN
                                                                         PINP 232
    NULL = NULL + 1
                                                                         PINP 233
    XIN(1) = XA(I) + RBETA
                                                                         PINP 234
    XIN(2) = XA(I+1) + RBETA
                                                                         PINP 235
    XIN(3) = XB(I+1) + RBETA
                                                                         PINP 236
    XIN(4) = XB(I) + RBETA
                                                                         PINP 237
    YIN(1) = YA(I)
                                                                        PINP 236
    YIN(2) = YA(I+1)
                                                                         PINP 239
    YIN(3) = YB(I+1)
```

PINP 240

```
YIN(4) = YB(I)
                                                                         PINP 241
      ZIN(1) = ZA(I)
                                                                         PINP 242
      ZIN(2) = ZA(I+1)
                                                                         PINP 243
      ZIN(3) = ZB(I+1)
                                                                         PINP 244
      ZIN(4) = ZB(I)
                                                                         PINP 245
                                                                         PINP 246
  FORM DIAGONAL VECTORS
                                                                         PINP 247
  EQUATION (64)
                                                                         PINP 248
                                                                         PINP 249
      T1X = XIN(3) - XIN(1)
                                                                         PINP 250
      T2X = XIN(4) - XIN(2)
                                                                         PINP 251
      T1Y = YIN(3) - YIN(1)
                                                                         PINP 252
      T2Y = YIN(4) - YIN(2)
                                                                         PINP 253
      T1Z = ZIN(3) - ZIN(1)
                                                                         PINP 254
      T2Z = ZIN(4) - ZIN(2)
                                                                         PINP 255
                                                                         PINP 256
  FORM CROSS PRODUCT N = T2 X T1
                                                                         PINP 257
  EQUATION (65)
                                                                         PINP 258
                                                                         PINP 259
      NX = T2Y+T1Z - T1Y+T2Z
                                                                         PINP 260
      NY = T1X+T2Z - T2X+T1Z
                                                                         PINP 261
      NZ = T2X+T1Y - T1X+T2Y
                                                                         PINP 262
      VN = SQRT ( NX + NX + NY + NY + NZ )
                                                                         PINP 263
                                                                         PINP 264
  FORM UNIT NORMAL VECTOR
                                                                         PINP 265
   EQUATION (66)
                                                                         PINP 266
                                                                         PINP 267
      NX = NX / VN
                                                                         PINP 268
      NY = NY / VN
                                                                         PINP 269
      NZ = NZ / VN
                                                                         PINP 270
                                                                         PINP 271
  COMPUTE AVERAGE POINT
                                                                         PINP 272
   EQUATION (68)
                                                                         PINP 273
                                                                         PINP 274
      AVX = .25 + (XIN(1) + XIN(2) + XIN(3) + XIN(4) )
                                                                         PINP 275
      AVY = .25 * (YIN(1) + YIN(2) + YIN(3) + YIN(4) 
                                                                         PINP 276
      AVZ = .25 + (ZIN(1) + ZIN(2) + ZIN(3) + ZIN(4) 
                                                                         PINP 277
                                                                         PINP 278
  COMPUTE PROJECTION DISTANCE
                                                                         PINP 279
   EQUATIONS ( 69 ) AND ( 71 )
                                                                         PINP 280
                                                                         PINP 281
      D = NX*(AVX - XIN(1)) + NY*(AVY - YIN(1)) + NZ*(AVZ-ZIN(1)) PINP 282
      PD = ABS(D)
                                                                         PINP 283
                                                                         PINP 284
   EQUATIONS (73) AND (74)
                                                                         PINP 285
                                                                         PINP 286
      T = SQRT ( T1X+T1X + T1Y+T1Y + T1Z+T1Z )
                                                                         PINP 287
      T1X = T1X / T
                                                                         PINP 288
      T1Y = T1Y / T
                                                                         PINP 289
      T1Z = T1Z / T
                                                                         PINP 290
                                                                         PINP 291
   EQUATION
            (75)
                                                                         PINP 292
                                                                         PINP 293
      T2X = NY+T1Z - NZ+T1Y
                                                                         PINP 294
      T2Y = NZ+T1X - NX+T1Z
                                                                         PINP 295
      TZZ = NX+T1Y - NY+T1X
                                                                         PINP 296
                                                                         PINP 297
   COMPUTE COORDINATES OF CORNER POINTS IN REFERENCE COORD. SYSTEM
C
                                                                         PINP 298
   EQUATION (72)
                                                                         PINP 299
                                                                         PINP 300
```

```
00 1000 J = 1, 4
                                                                       PINP 301
     XP = XIN(J) + NX + D
                                                                       PINP 302
      YP = YIN(J) + NY + D
                                                                       PINP 303
      ZP = ZIN(J) + NZ + D
                                                                       PINP 304
      D = -D
                                                                       PINP 305
      XDIF = XP - AVX
                                                                       PINP 306
      YDIF = YP - AVY
                                                                       PINP 307
      ZDIF = ZP - AVZ
                                                                       PINP 308
                                                                       PINP 309
  TRANSFORM CORNER POINTS TO ELEMENT COORDINATE SYSTEM ( XI, ETA )
                                                                       PINP 310
  WITH AVERAGE POINT AS ORIGIN
                                                                       PINP 311
   EQUATION (80)
                                                                       PINP 312
                                                                       PINP 313
      XI(J) = T1X*XDIF + T1Y*YDIF + T1Z*ZDIF
                                                                       PINP 314
 1000 ETA(J) = T2X*XDIF + T2Y*YDIF + T2Z*ZDIF
                                                                       PINP 315
                                                                       PINP 316
C COMPUTE CENTRICID
                                                                       PINP 317
C EQUATION (81)
                                                                       PINP 318
                                                                       PINP 319
      XIO = .3333333EO * (XI (4) * (ETA (1) - ETA (2)) + XI (2)
                                                                       PINP 320
    1 * ( ETA (4) - ETA (1) ) ) / ( ETA (2 ) - ETA (4) )
                                                                       PINP 321
      ETA0 = -.3333333E0 * ETA(1)
                                                                       PINP 322
                                                                       PINP 323
                                                                       PINP 324
  OBTAIN CORNER POINTS IN SYSTEM WITH SENTROID AS ORIGIN
                                                                       PINP 325
  EQUATION (82)
                                                                     PINP 326
                                                                       PINP 327
      00\ 1620\ J = 1, 4
                                                                       PINP 328
      OIX - (U)IX = (U)IX
                                                                       PINP 329
 1020 ETA(J) = ETA(J) - ETAO
                                                                       PINP 330
                                                                       PINP 331
 COMPUTATION AIDS
                                                                       PINP 332
      ETA2M1 = ETA ( 2 ) - ETA ( 1 )
                                                                       PINP 333
      ETA3M2 = ETA (3) - ETA (2)
                                                                       PINP 334
      ETA4M3 = ETA ( 4 ) - ETA ( 3 )
                                                                       PINP 335
      ETA1M4 = ETA (1) - ETA (4)
                                                                       PINP 336
      XI1M2 = XI (1) - XI (2)
                                                                       PINP 337
     X12M3 = XI (2) - XI (3)
                                                                       PINP 338
     X13M4 = XI (3) - XI (4)
                                                                       PINP 339
     XI4M1 = XI (4) - XI (1)
                                                                       PINP 340
      ETA2P4 = ETA ( 2 ) + ETA ( 4 )
                                                                       PINP 341
     XI3M1 = XI (3) - XI (1)
                                                                       PINP 342
      XI4M2 = XI (4) - XI (2)
                                                                       PINP 343
      ETA2M4 = ETA (2) - ETA (4)
                                                                       PINP 344
      XI1234 = XI (1) + XI (2) + XI (3) + XI (4)
                                                                       PINP 345
                                                                       PINP 346
C
  TRANSFORM CENTROID TO REFERENCE COORDINATE SYSTEM
                                                                       PINP 347
  EQUATION (63)
                                                                       PINP 348
      XCENT = AVX + T1X+XIO + T2X+ETAO
                                                                      PINP 349
      YCENT = AVY + T1Y*XIO + T2Y*ETAO
                                                                       PINP 350
      ZCENT = AVZ + T1Z*XIC + T2Z*ETAC
                                                                       PINP 351
                                                                       PINP 352
  COMPUTE LARGER DIAGONAL VECTOR
                                                                       PINP 353
  EQUATION (84)
                                                                       PINP 354
     TSQ = AMAX1 ( XI3M1 ++ 2, XI4M2 ++ 2 + ETA2M4 ++ 2 )
                                                                       PINP
                                                                            355
     T = SQRT (TSQ)
                                                                       PINP 356
                                                                       PINP 357
                                                                       PINP 358
  COMPUTE AREA
C
                                                                       PINP 359
  ECUATION (85)
                                                                       PINP 360
```

```
= .5 * XI3M1 * ETA2M4
      AREA
                                                                        PINP 361
                                                                        PINP 362
   COMPUTE CONSTANTS FOR EQUATIONS ( 42 ) AND ( 43 )
C
                                                                        PINP 363
   EQUATION (45)
                                                                        PINP 364
      D12SQ = XI1M2 ** 2 + ETA2M1 ** 2
                                                                        PINP 365
      D12 = SQRT (D12SQ)
                                                                        PINP 366
      D23SQ = XI2M3 ++2 + ETA3M2 ++ 2
                                                                        PINP 367
      D23 = SQRT (D23SQ)
                                                                        PINP
                                                                             368
      D34SQ = XI3M4 ++ 2 + ETA4M3 ++ 2
                                                                        PINP 369
      D34 = SQRT (D34SQ)
                                                                        PINP 370
      D41SQ = XI4M1 ** 2 + ETA1M4 ** 2
                                                                        PINP 371
      D41 = SQRT ( D41SQ )
                                                                        PINP 372
      C1 = 0.0
                                                                        PINP 373
      C2 = 0.0
                                                                        PINP 374
      C3 = 0.0
                                                                        PINP 375
      C4 = 0.0
                                                                        PINP 376
      C5 = 0.0
                                                                        PINP 377
      C6 = 0.0
                                                                        PINP
                                                                             378
      C7 = 0.0
                                                                        PINP 379
      C8 = 0.0
                                                                        PINP 380
      XNP = 0.0
                                                                        PINP 381
      YNP = 0.0
                                                                        PINP 382
      IF ( D12 ) 1030, 1040, 1030
                                                                        PINP 383
 1030 C1 = ETA2M1 / D12
                                                                        PINP 384
      C5 = XI1M2 / D12
                                                                        PINP 385
 1040 IF ( D23 ) 1050, 1060, 1050
                                                                        PINP 386
 1050 C2 = ETA3M2 / D23
                                                                        PINP
                                                                             387
      C6 = XI2M3 / D23
                                                                        PINP 388
 1060 IF ( D34 ) 1070, 1080, 1070
                                                                        PINP 389
 1070 C3 = ETA4M3 / D34
                                                                        PINP 390
      C7 = XI3M4 / D34
                                                                        PINP 391
 1080 IF ( 041 ) 1090, 1100, 1090
                                                                        PINP 392
 1090 C4 = ETA1M4 / D41
                                                                        PINP 393
      C8 = XI4M1 / D41
                                                                        PINP 394
 1100 CONV = 3
                                                                        PINP 395
                                                                        PINP
                                                                             396
                                                                        PINP
                                                                             397
C BEGIN NULL POINT ITERATION
                                                                        PINP 398
                                                                        PINP 399
              ITR = 1, 30
      DO 1590
                                                                        PINP 400
      00 1580 K = 1.4
                                                                        PINP 401
   EQUATION (47)
                                                                        PINP 402
      R(K) = SQRT((XNP - XI(K)) + 2 + (YNP - ETA(K)) + 2)
                                                                        PINP 403
      RX(K) = (XNP - XI(K))/R(K)
                                                                        PINP 484
 1580 RY (K ) = ( YNP - ETA ( K ) ) / R ( K )
                                                                        PINP 405
                R (1)
      R1PR2
            =
                         + R ( 2 )
                                                                        PINP 406
                R (2)
      R2PR3
             =
                        + R (3)
                                                                        PINP 407
                R(3) + R(4)
      R3PR4
             =
                                                                        PINP 408
      R4PR1
             = R(4) + R(1)
                                                                        PINP
                                                                             409
      ARG1 = ALOG ( ( R1PR2 - D12 ) / ( R1PR2 + D12 ) )
                                                                        PINP
                                                                             410
      ARG2 = ALOG ( ( R2PR3 - 023 ) / ( R2PR3 + 023 ) )
                                                                        PINP 411
      ARG3 = ALOG ((R3PR4 - D34) / (R3PR4 + D34))
                                                                        PINP 412
      ARG4 = ALOG ((R4PR1 - D41) / (R4PR1 + D41))
                                                                        PINP 413
                                                                        PINP 414
                                                                        PINP 415
   COMPUTE INDUCED VELOCITY COPPONENTS
C
                                                                        PINP 416
   ECUATIONS ( 42 ) AND ( 43 )
                                                                        PINP 417
      VX = C1 + ARG1 + C2 + ARG2 + C3 + ARG3 + C4 + ARG 4
                                                                        PINP
                                                                             418
      VY = C5 + ARG1 + C6 + ARG2 + C7 + ARG 3 + C8 * ARG4
                                                                        PINP 419
                                                                        PINP 420
```

```
COMPUTE PARTIAL DERIVATIVES OF INDUCED VELOCITIES
                                                                          PINP 421
   EQUATION ( 90 ), USING EQUATIONS ( 91 ) - ( 93 )
                                                                         PINP 422
                                                                         PINP 423
                                                                         PINP
                                                                               424
      D12P=
             ( R1PR2 ** 2 - D12 SQ
                                      ) *
                                         • 5
                                                                         PINP 425
             1 R2PR3 ** 2 - D23 SQ
      D23P=
                                      ) +
                                         • 5
                                                                         PINP 426
             ( R3PR4 ** 2 - D34 SQ
      D34P=
                                          • 5
                                                                          PINP 427
             ( R4PR1 ** 2 - D41 SQ
      D41P=
                                                                          PINP 428
      C1P = ETA2M1 / D12P
                                                                          PINP 429
      C2P = ETA3M2 / D23P
                                                                         PINP 430
      C3P = ETA4M3 / D34P
                                                                          PINP 431
      C4P = ETA1M4 / D41P
                                                                          PINP 432
      C5P = XI1M2 / D12P
                                                                          PINP 433
      C6P = XI2M3 / D23P
                                                                          PINP
                                                                               434
      C7P = XI3M4 / D34P
                                                                          PINP 435
      C8P = XI4M1 / D41P
                                                                         PINP 436
      R12Y = RY (1) + RY (2)
                                                                         PINP 437
      R23Y = RY (2) + RY (3)
                                                                          PINP 438
      R34Y = RY (3) + RY (4)
                                                                         PINP 439
      R41Y = RY (4) + RY (1)
                                                                         PINP 440
      VXX = C1P^{+} (RX (1) + RX (2)) + C2P^{+} (RX (2) + RX (3)) + PINP 441
            C3P^{+} ( RX ( 3 ) + RX ( 4 ) ) + C4P^{+} ( RX ( 4 ) + RX ( 1 ) ) PINP
                                                                               442
      VXY = C1P* R12Y + C2P* R23Y + C3P* R34Y + C4P* R41Y.
                                                                          PINP 443
      VYY = C5P* R12Y + C6F* R23Y + C7P* R34Y + C8P* R41Y
                                                                         PINP
                                                                               444
                                                                         PINP
                                                                               445
                                                                         PINP 446
  COMPUTE NEW NULL POINT ( XNP, YNP )
                                                                          PINP 447
  EQUATION ( 94 )
                                                                         PINP 448
                                                                         PINP 449
      XMXP = (VY + VXY - VX + VYY) / (VXX + VYY - VXY + 2)
                                                                         PINP 450
     XNP = XMXP + XNP
                                                                         PINP 451
      YNP = YNP - (VX + VXX + XMXP) / VXY
                                                                         PINP 452
                                                                         PINP 453
      TEST NULL POINT CONVERGENCE
                                                                         PINP 454
      IF ( ABS ( VX ) .LT. EPS .AND. ABS ( VY ) .LT. EPS ) GO TO 1600
                                                                          PINP 455
1590 CONTINUE
                                                                         PINP 456
      NO CONVERGENCE . USE 30TH ITERATION
                                                                         PINP 457
      CONV = 2
                                                                         PINP 458
                                                                         PINP 459
      TEST IF THIS POINT IS OUTSIDE THE ELEMENT
                                                                         PINP 460
1600 IF ( XNP ** 2 + YNP ** 2 .LE. TSQ ) GO TO 1620
                                                                         PINP 461
                                                                         PINP 462
C
      CONVERGES TO POINT AT INFINITY
                                                                         PINP 463
      CONV = 1
                                                                         PINP 464
      XNULL
                     = XCENT
                                                                         PINP 465
      YNULL
                     = YCENT
                                                                         PINP 466
      ZNULL
                     = ZCENT
                                                                         PINP 467
      GO TO 1700
                                                                         PINP 468
                                                                         PINP 469
      TRANSFORM NULL POINT TO REFERENCE COORDINATE SYSTEM.
                                                                         PINP 470
   EQUATION ( 79 ) NOTE THAT Z - COORDINATE IS ZERO
                                                                         PINP 471
                     = XCENT + T1X + XN2 + T2X + YNP
1620 XNULL
                                                                         PINP 472
                     = YCENT + T1Y * XN3 + T2Y * YNP
      YNULL
                                                                         PINP 473
      ZNULL
                     = ZCENT + T1Z + XN3 + T2Z + YNP
                                                                         PINP 474
                                                                         PINP 475
                                                                         PINP 476
  PRINT RESULTS -- SECTION 9.4 THE FIRST OUTPUT
                                                                         PINP 477
                                                                         PINP 478
1700 IF ( NPRT .GE. 11 ) GO TO 1750
                                                                         PINP 479
      NPRT = NPRT + 1
                                                                         PINP 480
```

```
IF ( I .EQ. 1 ) GO TO 1760
                                                                           PINP 481
      WRITE (6, 4005) I, XIN, NX, XNULL , PD, CFLAG (CONV),
                                                                           PINP 482
                          , T, ZIN, YZ, ZNULL , AREA
     1 YIN, NY, YNULL
                                                                           PINP 483
      GO TO 1770
                                                                           PINP 484
 1750 NPRT = 0
                                                                           PINP 485
      CALL PEADER
                                                                           PINP 486
      WRITE ( 6, 4002 )
                                                                           PINP 487
 1 760 WRITE ( 6, 4010) N , I, XIN, NX, XNULL , PD, CFLAG (CONVPINP 488 1 ), YIN, NY, YNULL , T, ZIN, NZ, ZNULL , AREA PINP 489
 1770 CONTINUE
                                                                           PINP 490
 2000 CONTINUE
                                                                           PINP 491
 2100 NLT ( KLCT ) = MMIN
                                                                           PINP 492
      NLINE ( KLCT ) = N
                                                                           PINP 493
      IF ( IFLAG .EQ. 0 ) GO TO 2001
                                                                           PINP 494
      IF ( N .LT. NLM1 ) GC TO 12
                                                                           PINP 495
      IF( IPRNT ) WRITE(6,4015)
                                                                           PINP 496
      GO TO 2025
                                                                           PINP 497
 2001 IF ( STAT .LT. 2 ) GO TO 80
                                                                           PINP 498
      NLT(KLCT) = -NLT(KLCT)
                                                                           PINP 499
      NPRT = NPRT + 1
                                                                           PINP 500
      IF( IPRNT ) WRITE(6.4015)
                                                                           PINP 501
                                                                           PINP 502
  TIST FOR END OF CASE
                                                                           PINP 503
 2020 IF ( STAT .NE. 3 ) GO TO 80
                                                                           PINP 504
 2025 \text{ NN1} = \text{MOD} (3 + \text{NQUAD}, 255)
                                                                           PINP 505
      NQNN1 = NQUAD
                                                                           PINP 506
      IF ( NN1 -LT. 5 -AND. NN1 -GT. 0 ) NQNN1 = NQUAD + 2
                                                                           PINP 507
      DELX = -0.5 * (XMIN + XMAX)
                                                                           PINP 508
      DELY = -0.5 * (YMIN + YMAX)
                                                                           PINP 509
      DELZ = -0.5 + (ZMIN + ZMAX)
                                                                           PINP 510
      WRITE (9) XMIN, XMAX, YMIN, YMAX, ZMIN, ZMAX, DELX, DELY, DELZ,
                                                                           PINP 511
     1 NSYM
                                                                           PINP 512
      ENDFILE 9
                                                                           PINP 513
      REWIND 9
                                                                           PINP 514
      IF ( .NOT. IPICT ) GO TO 8500
                                                                           PINP 515
      SET UP PERSPECTIVE ANGLES FOR PLOTS
                                                                           PINP 516
      WRITE (8) XMIN, XMAX, YMIN, YMAX, ZMIN, ZMAX, DELX, DELY, DELZ
                                                                           PINP 517
      LAST = 6
                                                                           PINP 518
      PHI = 0.0
                                                                           PINP 519
      THE OPERATION OF ANGLES THETA AND PSI ARE AS FOLLOWS FOR A RIGHT
                                                                           PINP 520
C
      HANDED COORDINATE SYSTEM WITH THE Z AXIS DIRECTED UPWARD. FIRST PINP 521
C
      ROTATE THE COORDINATE SYSTEM BY ANGLE THETA ABOUT THE Y AXIS SUCH PINP 522
C
      THAT FOR POSITIVE THETA THE POSITIVE X AXIS TILTS UPWARD. THEN PINP 523
      ROTATE BY ANGLE PSI ABOUT THE NEW Z AXIS SUCH THAT FCR POSITIVE
                                                                           PINP 524
      PSI THE ROTATION IS CLOCKWISE WHEN VIEWED FROM ABOVE.
                                                                           PINP 525
      IF (NSYM .GT. 0) IF (NSYM - 2) 2028, 2029, 2030
                                                                           PINP 526
 2027 PSI = 90.
                                                                           PINP 527
      THETA = 0.0
                                                                         PINP 528
      WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSY, RAXIS
                                                                           PINP 529
      PSI = 45.
                                                                           PINP 530
      THETA = 45.
                                                                           PINP 531
      WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSX, MINUSY, PLUSZ, R45 ,LPINP 532
      THETA = -45.
                                                                           PINP 533
      WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSX, MINUSY, MINUSZ, R45, LPINP 534
      PSI = 135.
                                                                           PINP 535
      WRITE (8) PSI, THETA, PHI, LAST, 145, MINUSX, MINUSY, PLUSZ, R45, LPINP 536
      THETA = 45
                                                                           PINP 537
      WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, MINUSY, MINUSZ, R45, LPINP 538
2028 PSI = 0.
                                                                           PINP 539
      THETA = -90.
                                                                           PINP 540
```

```
WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSZ, RAXIS
                                                                          PINP 54
     THETA= 45.
                                                                          PINP 54
      PSI=-135.
                                                                          PINP 54
     WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, PLUSY, MINUSZ, R45, L PINP 54
      THETA=-45.
                                                                          PINP 549
     PSI=-45.
                                                                          PINP 540
     WRITE (8) PSI, THETA, PHI, LAST, 145, PLUSY, PLUSY, MINUSZ, R45, L PINP 54
2029 PSI = 180.
                                                                          PINP 548
     THETA = G.
                                                                          PINP 549
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSX, RAXIS
                                                                          PINP 550
     PSI = -135.
                                                                          PINP 551
     THETA =-45.
                                                                          PINP 552
     WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, PLUSY, PLUSZ, R45, L PINP 553
2030 THETA = 0.0
                                                                          PINP 554
     PSI = 0.
                                                                          PINP 555
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, PLUSX, RAXIS
                                                                          PINP 556
     THETA = 0.0
                                                                          PINP 557
     PSI = -90.
                                                                          PINP 556
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, PLUSY, RAXIS
                                                                          PINP 559
     THETA = 90.
                                                                          PINP 560
                                                                         PINP 561
     HRITE (6) PSI, THETA, PHI, LAST, LAXIS, PLUSZ, RAXIS
                                                                          PINP 562
     THETA = 45.
                                                                          PINP 563
     PSI =-45.
                                                                          PINP 564
     LAST = 1
                                                                          PINP 565
     WRITE (8) PSI, THETA, PHI, LAST, 145, PLUSY, PLUSY, PLUSZ, R45, L PINP 566
8 500 REWIND 8
                                                                          PINP 567
                                                                          PINP 568
     IF(IPRNT) WRITE(6,9999) NQUAD
                                                                          PINP 569
9999 FORMAT ( 140, 16X, 15, 26H BASIC ELEMENTS HERE INPUT)
                                                                          PINP 570
     RETURN
                                                                          PINP 571
     END
                                                                          PINP 572
```

```
*DECK, PICTURE
                                                                             PICT
      SUBROUTINE PICTUR
                                                                             PICT
                                                                            PICT
C
      PLOTS SURFACE ELEMENTS ON A 3-DIMENSIONAL BODY
                                                                            PICT
                                                                                    5
                                                                             PICT
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT, RFLAG, AFLAG, BFLAG
                                                                            PICT
      COMMON HEDR( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, PICT
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, PICT
                                                                                    8
     2 ZTRANS
                                                                            PICT
                                                                                    9
      DIMENSION
                  XA(250),X8(250),YA(250),YB(250),ZA(250),ZB(250),
                                                                            PICT
                                                                                   10
                     XIN(4), YIN(4), ZIN(4), HLABEL(15), PROGID(3),
                                                                            PICT
     2 YIN2(4), ZIN2(4),
                                   YPLTSC( 4), ZFLTSC( 4), HLINE2(7),
                                                                            PICT
                                                                                   12
     3 HLINE1(7), XM(2), YM(2), ZM(2)
                                                                            PICT
                                                                                   13
      REAL
            NX, NY, NZ, NXO
                                                                            PICT
      INTEGER STAT.STATT
                                                                            PICT
                                                                                   15
      DATA PROGID/ 7HNORMENT, 4H3840, 3HLYC/
                                                                            PICT
                                                                                   16
                   ISHAD, IFRAME/0,0/ , XSC, YSC, ZSC/3*1.0/
                                                                            PICT
                                                                                   17
                                                                            PICT
                                                                                   18
      FIRST(QX,QY,QZ,Q1,Q2,Q3) = QX+Q1 + QY+Q2 + QZ+Q3
                                                                            PICT
                                                                                   19
                                                                            PICT
                                                                                   20
      THIRD(QX,QY,QZ,QPSI,QTHETA,QPHI) = QX*(COS(QTHETA)*COS(QPSI)) +
                                                                            PICT
                                                                                   21
     1 QY*(-SIN(QPSI)*COS(QPHI)+SIN(QTHETA)*COS(QPSI)*SIN(QPHI)) +
                                                                            PICT
        QZ*(SIN(QPSI)*SIN(QPHI)+SIN(QTHETA)*COS(QPSI)*COS(QPHI))
                                                                            PICT
                                                                            PICT
                                                                                   24
      IREFL = NSYM
                                                                            PICT
                                                                                   25
      IF( IREFL .GT. 2 ) IREFL = 2
                                                                            PICT
                                                                                   26
      IPIC = 1
                                                                            PICT
                                                                                   27
      IF( ICRT ) GO TO 750
                                                                            PICT
                                                                                   28
      CALL PLOTID
                                                                            PICT
                                                                                   29
      CALL PLTID3 ( PROGID, 200.0, 11.0, 1.0)
C
                                                                            PICT
                                                                                   30
      CALL PLOT ( 5.0, 0.0, -3 )
                                                                            PICT
                                                                                   31
      GO TO 2
                                                                            PICT
                                                                                   32
  750 CALL MICRO(PROGID, 1.8, 14.8)
                                                                            PICT
                                                                                   33
      READ(5,3000) HLINE1, HLINE2
                                                                            PICT
                                                                                   34
 3000 FORMAT (7A6/7A6)
                                                                            PICT
                                                                                   35
      CALL TITL(HLINE1, HLINE2)
                                                                            PICT
                                                                                   36
      WRITE( 6, 5201 )
                                                                            PICT
                                                                                   37
 5201 FORMAT( 1H-, 12H
                          CRT PLOTS)
                                                                            PICT
                                                                                   38
      REWIND 9
                                                                            PICT
                                                                                   39
  301 READ (8) XM(1),XM(2),YM(1),YM(2),ZM(1),ZM(2),DELX,DELY,DELZ
                                                                            PICT
                                                                                   40
                                                                            PICT
      WRITE(6,7400) XM(1), XM(2), YM(1), YM(2), ZM(1), ZM(2)
                                                                                   41
      WRITE(6,7500)
                                                                            PICT
                                                                                   42
      WRITE(6,7700) DELX,DELY,DELZ
                                                                            PICT
                                                                                   43
 7400 FORMAT( 1H0, 9X, 81HMINIMUM AND MAXIMUM COORDINATES IN THE
                                                                       SCALEPICT
                                                                                   44
           TRANSLATED.
                          ROTATED SYSTEM -/12X.
                                                    7HX AXIS=2(1PE15.5)/
                                                                            PICT
                                                                                   45
     2 12X, 7HY AXIS=2(1PE15.5)/ 12X, 7HZ AXIS=2(1PE15.5))
                                                                            PICT
                                                                                   46
 7500 FORMAT(1HO, 9X, 69HCCORDINATE TRANSLATIONS USED TO CENTER THE FLOTPICT
                                                                                   47
     1S - DELX, DELY, DELZ -)
                                                                            PICT
                                                                                   48
 7700 FORMAT(12X,39H AFTER SCALING, TRANSLATING, ROTATING -3(1PE15.5)/) PICT
                                                                                   49
    4 IPIC = IPIC + 1
                                                                            PICT
                                                                                   50
                                                                            PICT
                                                                                   51
   READ PLOTTING INSTRUCTIONS
                                                                            PICT
                                                                                   52
      READ ( 8 ) PSI, THETA, PHI, LAST, HLABEL
                                                                            PICT
                                                                                   53
      WRITE(6,5205)HLAGEL
                                                                            PICT
                                                                                   54
 5205 FORMAT(5X, 15A4)
                                                                             PICT
                                                                                   55
                                                                            PICT
                                                                                   56
    8 IF( IPIC .GT. 2 .AND.
                               .NOT. ICRT ) CALL FLOT ( 10.0, -5.5, -3 )
                                                                                   57
                                                                            PICT
      IF( IPIC .GT. 2 .AND.
                                      ICRT ) CALL FRAME( 0.5. 0.5 )
                                                                            PICT
                                                                                   58
                                                                                   59
                                                                            PICT
C
      SET UP STARTING CONSTANTS
                                                                             PICT
```

		, i	
	IFADV = 1	PICT	61
	PSI = PSI / 57.29578E0	_	
		PICT	62
	THETA = THETA / 57.29578E0	PICT	63
	PHI = PHI / 57.29578E0	PICT	64
	SINTH = SIN(THETA)	PICT	65
	COSTH = COS(THETA)	PICT	66
	SINPSI= SIN(PSI)	PICT	67
	COSPSI= COS(PSI)	PICT	68
	SINPHI= SIN(PHI)	PICT	6 <b>9</b>
	COSPHI= COS(PHI)	PICT	70
	A1 = COSTH * SINFSI	PICT	71
	A2 = COSPSI*COSPHI + SINTH*SINPSI*SINPHI	PICT	72
	A3 =-COSPSI*SINPHI + SINTH*SINPSI*COSPHI	PICT	73
	A4 =-SINTH	PICT	74
	A5 = COSTH+SINPHI	PICT	75
	A6 = COSTH*COSPHI	PICT	76
	A7 = COSTH*COSPSI	PICT	77
	A8 =-SINPSI*COSPHI + SINTH*COSPSI*SINPHI	PICT	78
	A9 = SINPSI*SINPHI + SINTH*COSPSI*COSPHI	PICT	79
C	SET SCALE FACTOR FOR THE PLOT	PICT	80
U	YSM = 1. E50	PICT	81
	ZSN= 1. E50	PICT	
	YLG=-1.E50		82
		PICT	83
	ZLG=+1.E50	PICT	84
	00 20 I=1,2	PICT	85
	X=XM(I)+DELX	PICT	86
	DO 20 J=1,2	PICT	87
	Y=YM(J)+DELY	PICT	88
	DO 20 K=1, 2	PICT	89
	Z=ZM(K)+DELZ	PICT	90
	YNR=FIRST(X,Y,Z,A1,A2,A3)	PICT	91
	ZNR=FIRST(X,Y,Z,A4,A5,A6)	PICT	92
	YSM=AMIN1(YSM, YNR)	PICT	93
	ZSM=AMIN1(ZSM,ZNR)	PICT	94
	YLG=AMAX1(YLG,YNR)	PICT	95
20	ZLG=AMAX1(ZLG,ZNR)	PICT	96
, Francisco	PENSF=9.99/AMAX1 (YLG-YSM,ZLG-ZSM)	PICT	97
	N = -1	PICT	
	NN = - 1	PICT	
	en de la composition de la composition La composition de la	PICT	
		PICT	
С	READ IN SURFACE DATA	PICT	
29	READ (9) X,Y,Z,STAT, XX,YY,ZZ,STATT	PICT	
	IF (STAT .EQ. 3 .CR. STATT .EQ. 3) REWIND 9	PICT	
	RFLAG = .FALSE.	PICT	-
	GO TO 80	PICT	-
30	IF (RFLAG) GO TO 50	PICT	_
	RFLAG = .TRUE.	PICT	
	X = XX	PICT	
	$\hat{\mathbf{Y}} = \hat{\mathbf{Y}}\hat{\mathbf{Y}}$		_
		PICT :	
	Z = ZZ	PICT :	
	STAT = STATT	PICT :	
	GO TO 60	PICT :	
50	RFLAG = .FALSE.	PICT :	
	READ (9) X,Y,Z,STAT, XX,YY,ZZ,STATT	PICT :	
: . _ <u>-</u>	IF (STAT .EQ. 3 .OR. STATT .EQ. 3) REWIND 9	PICT :	
60	IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180	PICT :	
	IF (STAT .EQ. 2) GO TO 200	PICT :	
70	IF (.NOT. AFLAG) GO TO 200	- PICT :	
	MC = M To a grant of the control of	PICT :	120
		with the second second second	<del>- Diskeria</del> vera:

```
80
     M = 1
                                                                           PICT 121
      IF (STAT .EQ. 2) GO TO 150
                                                                           PICT 122
      IF (.NOT. BFLAG) GO TO 84
                                                                           PICT 123
     DO 81 J =1.MC
 75
                                                                           PICT 124
       XA(J) = XB(J)
                                                                           PICT 125
       YA(J) = YB(J)
                                                                           PICT 126
 81
       ZA(J) = ZB(J)
                                                                           PICT 127
 83
     XB(1) = X
                                                                           PICT 128
     YB(1) = Y
                                                                           PICT 129
     ZB(1) = Z
                                                                           PICT 130
     GO TO 30
                                                                           PICT 131
     IF (AFLAG) GO TO 85
 84
                                                                           PICT 132
      BFLAG = .TRUE.
                                                                           PICT 133
      GO TO 75
                                                                           PICT 134
 85
     AFLAG = .FALSE.
                                                                           PICT 135
      GO TO 83
                                                                           PICT 136
150
     AFLAG = .TRUE.
                                                                           PICT 137
      BFLAG = .FALSE.
                                                                           PICT 138
      N = N+1
                                                                           PICT 139
160
     XA(M) = X
                                                                           PICT 140
     YA(N) = Y
                                                                           PICT 141
     ZA(M) = Z
                                                                           PICT 142
     GO TO 30
                                                                           PICT 143
     M = M + 1
180
                                                                           PICT 144
     IF (AFLAG) GO TO 160
                                                                           PICT 145
      XB(M) = X
                                                                           PICT 146
      YB(M) = Y
                                                                           PICT 147
      ZB(M) = Z
                                                                           PICT 148
     IF (STAT .NE. 3) GO TO 30
                                                                           PICT 149
200
     MMIN = MINQ (M,MC) - 1
                                                                           PICT 150
      MC = M
                                                                           PICT 151
250
     N = N + 1
                                                                           PICT 152
     NN = NN + 1
                                                                           PICT 153
                                                                           PICT 154
                                                                           PICT 155
  BEGIN COMPUTATION OF SURFACE ELEMENT CHARACTERISTICS
                                                                           PICT 156
                                                                           PICT 157
450
     00 2000 I= 1.NMIN
                                                                           PICT 158
       XIN(1) = XA(I) + XSC + DELX
                                                                           PICT 159
       XIN(2) = XA(I+1) + XSC + DELX
                                                                           PICT 160
       XIN(3) = XB(I+1) + XSC + DELX
                                                                           PICT 161
       XIN(4) = XB(I) + XSC + DELX
                                                                           PICT 162
       YIN(1) = YA(I) * YSC + DELY
                                                                           PICT 163
       YIN(2) = YA(I+1) + YSC + DELY
                                                                           PICT 164
       YIN(3) = YB(I+1) + YSC + BELY
                                                                           PICT 165
       YIN(4) = YB(I) * YSC + DELY
                                                                           PICT 166
       ZIN(1) = ZA(I) * ZSC + DELZ
                                                                           PICT 167
       ZIN(2) = ZA(I+1) * ZSC + DELZ
                                                                           PICT 168
       ZIN(3) = ZB(I+1) + ZSC + DELZ
                                                                           PICT 169
       ZIN(4) = ZB(I) + ZSC + DELZ
                                                                           PICT 170
       IRFLG = 0
                                                                           PICT 171
                                                                           PICT 172
  FORM DIAGONAL VECTORS - EQUATION (64)
                                                                           PICT 173
      T1X = XIN(3) - XIN(1)
                                                                           PICT 174
      T2X = XIN(4) - XIN(2)
                                                                           PICT 175
      T1Y = YIN(3)
                   - YIN(1)
                                                                           PICT 176
      T2Y = YIN(4)
                   - YIN(2)
                                                                           PICT 177
      T1Z = ZIN(3)
                   - ZIN(1)
                                                                           PICT 178
      T2Z = ZIN(4) - ZIN(2)
                                                                           PICT 179
```

```
FORM CROSS PRODUCT N=T2 X T1 - EQUATION (65)
                                                                            PICT 181
       NX = T2Y^*T1Z - T1Y^*T2Z
                                                                            PICT 182
       NY = T1X+T2Z - T2X+T1Z
                                                                             PICT 183
       NZ = T2X*T1Y - T1X*T2Y
                                                                            PICT 184
       VN = SQRT (NXTNX + NYTRY + NZTNZ)
                                                                            PICT 185
                                                                            PICT 186
   FORM UNIT NORMAL VECTOR - EQUATION (56)
                                                                            PICT 187
       NX = NX / VN
                                                                            PICT 188
                                                                            PICT 189
PICT 190
       NY = NY / VN
       NZ = NZ / VN
                                                                             PICT 191
      IF (IFADV .EQ. 0) GO TO 471
                                                                             PICT 192
                                                                            PICT 193
C
      A NEW VIEW OF THE BODY IS TO BE PLOTTED. FLOT THE LEGEND AND
                                                                            PICT 194
C
      INITIALIZE FOR THE BODY PLOT.
                                                                             PICT 195
      IF( ICRT ) GO TO 524
                                                                            PICT 196
      CALL PLOT( 2.5, 0.0, 3 )
                                                                            PICT 197
      CALL SYMBOL ( 2.5, 0.0, 0.150, HLABEL, 0.0, 60)
                                                                            PICT 198
                                                                            PICT 199
      CALL PLOT( 7.5, 5.5, -3)
      GO TO 525
                                                                            PICT 200
  524 CALL STBEAM(24)
                                                                            PICT 201
      CALL SYMBOL ( 3.0, 0.0, 0.150, HLABEL, 0.0, 60)
                                                                            PICT 202
                                                                            PICT 203
      CALL STBEAM(18)
                                                                            PICT 204
      CALL PLOT( 8.0, 5.5, -3)
 525
      IFADV = 0
                                                                            PICT 205
                                                                            PICT 206
 471
      NXO = THIRD(NX,NY,NZ,PSI,THETA,PHI)
                                                                            PICT 207
                                                                            PICT 208
      IF (NXO.LE.O.O .AN (. ISHAD.EQ.O) 30 TO 571
                                                                            PICT 209
                                                                            PICT 210
  CALCULATE POINTS TO BE PLOTTED
                                                                            PICT 211
      YO1 = FIRST(XIN(1), YIN(1), ZIN(1), A1, A2, A3)
 530
                                                                            PICT 212
                                                                            PICT 213
PICT 214
      YO2 = FIRST(XIN(2), YIN(2), ZIN(2), 41, 42, 43)
      YO3 = FIRST(XIN(3), YIN(3), ZIN(3), A1, A2, A3)
      YO4 = FIRST(XIN(4), YIN(4), ZIN(4), A1, A2, A3)
                                                                            PICT 215
      ZO1 = FIRST(XIN(1), YIN(1), ZIN(1), A4, A5, A6)
                                                                            PICT 216
      ZO2 = FIRST(XIN(2), YIN(2), ZIN(2), A4, A5, A6)
                                                                            PICT 217
      ZO3 = FIRST(XIN(3), YIN(3), ZIN(3), 44, 45, 46)
                                                                            PICT 218
      ZO4 = FIRST(XIN(4),YIN(4),ZIN(4),A4,A5,A6)
                                                                            PICT 219
                                                                            PICT 220
      YIN2(1) = Y01
                                                                            PICT 221
                                                                            PICT 222
      YIN2(2) = Y02
      YIN2(3) = Y03
                                                                             PICT 223
      YIN2(4) = YC4
                                                                             PICT 224
      ZIN2(1) = Z01
                                                                            PICT 225
      ZINZ(2) = Z02
                                                                            PICT 226
                                                                             PICT 227
      ZIN2(3) = Z03
      ZIN2(4) = Z04
                                                                             PICT 228
                                                                            PICT 229
C
      SCALE AND PLOT A SINGLE QUADRALATERAL
                                                                             PICT 230
                                                                             PICT 231
      DO 540 II=1,4
      YPLTSC(II) = YINZ(II) * PENSF
                                                                             PICT 232
      ZPLTSC(II) = ZIN2(II) * PENSF
                                                                            PICT 233
      IF(
                                      ABS(ZPLTSC(II)) .LE. 5.000)
                                                                             PICT 234
                         GO TO 540
                                                                             PICT 235
                                                                             PICT 236
      WRITE(6,5000) N. M
 5000 FORMAT( 1H0, 10x, 21HSCALE TROUBLE FOR N =14, 3x, 3HM =14)
                                                                             PICT 237
      GO TO 2000
                                                                            PICT 238
  540 CONTINUE
                                                                             PICT 239
      CALL PLOTE YPLTSCE 1), ZPLTSCE 1), 3)
                                                                             PICT 240
```

```
DO 550 II=2,4
   550 CALL PLOT( YPLTSC(II), ZPLTSC(II), 2)
                                                                            PICT 241
       CALL PLOT( YPLTSC( 1), ZFLTSC( 1), 2)
                                                                            PICT 242
                                                                            PICT 243
 571
       IF (IREFL .EQ. 0 .OR. IRFLG .EQ. 3) GO TO 2000
                                                                            PICT 244
       IF (IREFL .EQ. 2 .ANC. IRFLG .EQ. 1) GO TO 600
                                                                            PICT 245
       IF (IREFL .EQ. 2 .AND. IRFLG .EQ. 2) GO TO 602
                                                                            PICT 246
C
                                                                            PICT 247
      REFLECT QUADRANT I ELEMENTS TO QUADRANT II
C
                                                                            PICT 248
       DO 586 II = 1,4
                                                                            PICT 249
 580
       YIN(II) = -YIN(II)
                                                                            PICT 250
       NY = -NY
                                                                            PICT 251
       GO TO 604
                                                                            PICT 252
C
                                                                            PICT 253
      REFLECT QUADRANT II ELEMENTS TO QUADRANT IV
                                                                            PICT 254
 600
      DO 601 II = 1,4
                                                                            PICT 255
       YIN(II) = -YIN(II)
                                                                            PICT 256
 601
       ZIN(II) = -ZIN(II)
                                                                            PICT 257
       NY = -NY
                                                                           PICT 258
       NZ = -NZ
                                                                            PICT 259
                                                                           PICT 260
       GO TO 604
C
                                                                           PICT 261
      REFLECT QUADRANT IV ELEMENTS TO QUADRANT III
                                                                           PICT 262
 602
      00 603 II = 1.4
                                                                           PICT 263
 603
       YIN(II) = -YIN(II)
                                                                           PICT 264
                                                                           PICT 265
       NY = -NY
C
                                                                           PICT 266
C
                                                                           PICT 267
      IRFLG = IRFLG + 1
                                                                           PICT 268
604
      IF (IREFL .EQ. 1) IRFLG = 3
                                                                           PICT 269
      GO TO 471
                                                                           PICT 270
                                                                           PICT 271
                                                                           PICT 272
2000 CONTINUE
                                                                           PICT 273
2001 IF (STAT .LT. 2) GO TO 480
                                                                           PICT 274
     NN = NN \sim 1
                                                                           PICT 275
     N = -1
                                                                           PICT 276
     IF (IFRAME .EQ. 2) IFADV = 1
475
                                                                           PICT 277
     IF (IFRAME .EQ. 1) IFADV = 1
                                                                           PICT 278
48G
     IF (IFADV .EQ. 1) CALL PLOT (19.0,-5.5, -3)
                                                                          PICT 279
485
                                                                          PICT 280
                                                                          PICT 281
 TEST FOR END OF CASE
                                                                          PICT 282
2020 IF (STAT .NE. 3) GO TO 80
                                                                          PICT 283
PICT 284
     IF (LAST .EQ. 1) RETURN
     GO TO 4
                                                                          PICT 285
     END
                                                                          PICT 286
                                                                          PICT 287
```

```
OVERLAY(BOXC,0,0)
                                                                            BOXC
      PROGRAM MAIN( INPUT, TAPE6, TAPE5=INPUT, OUTPUT,
                                                                            BOXC
     1 TAPE1, TAPE3, TAPE8, TAPE9, TAPE11, TAPE12, TAPE13,
                                                                                    3
                     TAPE4, TAPE10, TAPE14)
                                                                            BOXC
                                                                            BOXC
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1979
                                                                            BOXC
                                                                                    6
                                                                            BOXC
                                                                                    7
      THIS IS ESSENTIALLY THE NON-LIFTING POTENTIAL FLOW CODE OF HESS
                                                                            BOXC
      AND SMITH AS DESCRIBED IN DOUGLAS AIRCRAFT CO. RPT. E.S. 40622
                                                                            BOXC
C
      (15 MARCH 1962). AD-282 255. THAT REPORT SHOULD BE CONSULTED FORBOXC
                                                                                   10
      DETAILS OF THE METHOD AND COMPUTATION.
                                                                            80 XC
                                                                                   11
                                                                            BOXC
                                                                                   12
      EIGHT OVERLAYS ARE USED.
                                   THE FINAL OVERLAY WRITES THE 28
                                                                            BOXC
                                                                                   13
      QUANTITIES ON UNIT 14 FOR USE BY SR FLOVEL IN CALCULATING FLOW
                                                                            EOXC
                                                                                   14
C
      VELOCITIES.
                                                                            BOXC
                                                                                   15
C
                                                                            BOXC
                                                                                   16
C
      ALSO REQUIRED, IN ADDITION TO THE SYSTEM INPUT, OUTPUT AND PUNCH
                                                                            BOXC
                                                                                   17
      UNITS, ARE THE FOLLOWING UNITS - 1,3,8,9,10,11,12,13.
                                                                            BOXC
                                                                                   18
                                                                            BOXC
                                                                                   19
      LOGICAL IPROS
                                                                            BOXC
                                                                                   20
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                            BOXC
                                                                                   21
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                            BOXC
      REAL MACH
                                                                            BOXC
                                                                                   23
      COMMON /SPACER/ DUMMY (14888)
                                                                            BOXC
                                                                                   24
      COMMON / ATAPE / NATAPE
                                                                            BOXC
                                                                                   25
      COMMON / MY MACH, BETA, RBETA
                                                                            BO XC
                                                                                   26
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                            BO XC
                                                                                   27
      COMMON /OFLOW/ AFLOW, BFLOW, CFLCW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW BOXC
                                                                                   28
      COMMON/SOLVE/ N1, N2, N3, CORE, NFL
                                                                            BOXC
                                                                                   29
      COMMON /INPT/ LIST, IPROS
                                                                            BOXC
                                                                                   30
      COMMON /PROS/
                          SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                            BOXC
                                                                                   31
     1 YTRANS, ZTRANS
                                                                            BOXC
                                                                                   32
      COMMON /FLOWP/ NU.NNON
                                                                            BOXC
                                                                                   33
      CONMON /SIG/ NFLCOM
                                                                            BOXC
                                                                                   34
      COMMON / TAPES/ MN
                                                                            BOXC
                                                                                   35
      COMMON /FRINTO/ KMAT, NSEQ, KTP14
                                                                            BOXC
                                                                                   36
                                                                            BOXC
      COMMON / GLEAK/ LEAK, FRACT
                                                                                   37
    6 FORMAT (F10.6)
                                                                            BOXC
                                                                                   38
 7000 FORMAT ( 7F10.0)
                                                                            BOXC
                                                                                   39
 7500 FORMAT (
                 18X, 55HANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, ZBOXC
                                                                                   40
     1TRANS = / 16X, 7(1PE13.4))
                                                                            BOXC
                                                                                   41
 8000 FORMAT ( L1)
                                                                            BOXC
                                                                                   42
 9000 FORMAT (15A4,2I1,3L1,4I1,I2,4I1,1X,A4)
                                                                            BOXC
                                                                                   43
 9300 FORMAT( 14, F10.0 )
                                                                            BO XC
                                                                                   44
 9400 FORMAT( 1H0, 17X, 31HNUMBER OF LEAKY QUADRALATERALS=14, 3X,
                                                                            BOXC
                                                                                   45
     1 40 HFRACTION OF FREE-STREAM VELOCITY LEAKED=1PE11.4)
                                                                            BOXC
                                                                                   46
 9500 FORMAT( 1H0, 17X, 61HINPUT DATA ARE PROCESSED BY SCALING, ROTATINGBOXC
                                                                                   47
     1 AND TRANSLATING)
                                                                            BOXC
                                                                                   48
                                                                            BOXC
      DATA KORE /14000/
      NSEQ = 0
                                                                            BOXC
                                                                                   50
      READ IN CONTROL DATA
                                                                            BOXC
                                                                                   51
    1 READ ( 5, 9000 ) HEDR, IFLAG, LIST, AFLOW, BFLOW, CFLOW, ISIG,
                                                                            BOXC
                                                                                   52
     1 IPRS, MPR, NCODE, NNON, NSYM, NOFF, KMACH, KTP14, KASE
                                                                            BOXC
                                                                                   53
      READ(5.8000) IPROS
                                                                            BOXC
                                                                                   54
      IF( IPROS ) READ(5,7000) ANGLE, XSCALE, YSCALE, ZSCALE,XTRANS,
                                                                                   55
                                                                            BOXC
     1 YTRANS, ZTRANS
                                                                            BOXC
                                                                                   56
      IF(.NOT. IPROS) GC TO 2
                                                                             BOXC
```

IF (XSCALE +EQ. 0.0) X SCILE=1.0		FTN 4.7+476	
IFIZSCALE .EQ. 9.07 YSCALE=1.0  2 CONTINUE READ 9300 ) LEAK, FRACT REMIND 3 READ 8,9300 ) LEAK, FRACT REMIND 6 REMIND 1 REMIND 8 REMIND 9 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 12 REMIND 12 REMIND 13 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 17 REMIND 18 REMIND 19 REMIND 10 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 18 REMIND 19 REMIND 1	TELVES		02/27/80
IFIZSCALE .EQ. 9.07 YSCALE=1.0  2 CONTINUE READ 9300 ) LEAK, FRACT REMIND 3 READ 8,9300 ) LEAK, FRACT REMIND 6 REMIND 1 REMIND 8 REMIND 9 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 12 REMIND 12 REMIND 13 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 17 REMIND 18 REMIND 19 REMIND 10 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 18 REMIND 19 REMIND 1	TEVECALE .EQ. 0.0) XSCALE=1.0		
2 CONTINUE	IFIZSCALE .EQ. 0.0) YSCALE=1.0		3040
READI S,9300 ) LEAK, FRACT  REMIND 3  REMIND 6  REMIND 6  REMIND 9  REMIND 10  REMIND 10  REMIND 11  REMIND 11  REMIND 12  REMIND 12  REMIND 12  REMIND 12  REMIND 13  REMIND 12  REMIND 13  REMIND 14  REMIND 15  REMIND 15  REMIND 15  REMIND 16  REMIND 17  REMIND 17  REMIND 18  REMIND 19  REMIND 19  REMIND 19  REMIND 19  REMIND 10  REMIND 10  REMIND 10  REMIND 10  REMIND 10  REMIND 11  REMIND 12  REMIND 12  REMIND 13  REMIND 14  REMIND 15  REMIND 15  REMIND 15  REMIND 15  REMIND 15  REMIND 16  REMIND 16  REMIND 17  REMIND 18  REMIND 18	2 CONTINUE .EQ. D. 0) ZSCALE=1.0		****
REMIND 3 REMIND 8 REMIND 9 REMIND 10 REMIND 11 REMIND 11 REMIND 12 REMIND 12 REMIND 12 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 19 REMIND 19 REMIND 10 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 15 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 18 REMIND 18 REMIND 18 REMIND 19 REMIND 19 REMIND 18 REMIND 19	READ & E. OZOO		50
REMIND 3 REMIND 8 REMIND 9 REMIND 10 REMIND 11 REMIND 11 REMIND 12 REMIND 12 REMIND 12 REMIND 12 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 19 REMIND 19 REMIND 10 REMIND 10 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 15 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 18 REMIND 18 REMIND 18 REMIND 18 REMIND 19 REMIND 19 REMIND 18 REMIND 19	RENTAD , 4300 ) LEAK, FRACT		2012
REMIND 8 REMIND 9 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 13 REMIND 13 REMIND 13 REMIND 13 REMIND 14 REMIND 15 REMIND 15 REMIND 15 REMIND 15 REMIND 16 REMIND 17 REMIND 17 REMIND 18 REMIND 18 REMIND 18 REMIND 19 REMIND 1			
REMIND 9 REMIND 10 REMIND 11 REMIND 12 REMIND 12 REMIND 13 REMIND 15 REMIND	REMIND 4		
REWIND 10 REWIND 12 REWIND 12 REWIND 12 REWIND 13 REWIND 14 REWIND 15 REWIND 15 REWIND 15 REWIND 15 REWIND 15 REWIND 16 REWIND	RENIND a		
REMIND 12 REMIND 12 REMIND 13 REMIND 15 REMIND 13 REMIND	REWIND 40		
REMIND 12 REMIND 13 IF (LIST .EQ. 0) REMIND 4  MACH = 0.0  IF (KMACH .LE. 0) GO TO 7  NNON = 0  READ (5, 6) MACH AFLOU = .TRUE.  BFLOU = .FRISE.  CFLOU = .FRIS	RENTNO 11		
REMIND 13  IF (LIST . EG. 0) REWIND 4  MACH = 0.0  IF (KMACH . LE. 0) GO TO 7  NNON = 0  READ (5, 6) MACH AFLON = . TRUE.  BOXC 75  BEFAD (5, 6) MACH AFLON = . TRUE.  BOXC 75  BEFAD (5, 6) MACH AFLON = . TRUE.  BOXC 75  BEFAD (5, 6) MACH AFLON = . TRUE.  BOXC 75  BOXC 75  BOXC 75  BOXC 75  BOXC 75  BOXC 76  CFLON = . FALSE.  CFLON = . FALSE.  CFLON = . FALSE.  CFLON = . FALSE.  BOXC 76  BOXC 77  ROETA = 1.0 / BETA  NU = 8  BOXC 78  BOXC 78  ROETA = 1.0 / BETA  NOF, KMACH, KIP14  SOXC 81  SOXC 81  1 SHLISTIZ, 5%, SHISTIG=13, 6%, SHIPRS=12, 7%, HHPR=12.7  BOXC 85  1 SX, 6HNFQHS, 15, 54, SHINNO=12, 5%, SHNOFF=13, 5%, 6MKMACH=12, 80XC 85  IF (. NOT. IPROS) GO TO 40  MRITE(6,9500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS BOXC 89  WHITE(6,9500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS BOXC 91  LIF (. NOT. IPROS) GO TO 55  LIF (. NOT. IPROS) GO TO 15  COSA = COS( 0.017+333 * ANGLE)  SINA = SINA = SIN (0.017+333 * ANGLE)  COSA = COS( 0.017+333 * ANGLE)  CALL INPIT (LIST)  CALL OVERLAY(4H80XC,1,0)  IF (LIST) - NC. LIGO TO 10  COSA = COS( 0.017+333 * ANGLE)  COSA = COS( 0.017+333 * ANG	REWIND 12		A A
IF (LIST .EQ. 0) REHIND 4  MACH = 0.0.  IF (KMACH .LE. 0) GO TO 7  NNON = 0  READ (5, 6) MACH  AFLOW = .TRUE.  BFLOW = .FALSE.  CFLOW = .FALSE.  CFLOW = .FALSE.  BOXC 77  RBETA = 1.0 / BETA  NU = 8  CALL MEADER  WITE (6,92CG) IFLAG, LIST, ISIG, JPRS, MPR, NCUOE, NNON, BOXC 60  1 NOFF, KMACH, KTP14  P2CO FORMAT (1M0, 17X, 17HINPUT PARAMETERS - // 20X, EMIFLAG = I2, 5X, BOXC 65  1 NOFF, KMACH, KTP14  P2CO FORMAT (1M0, 17X, 17HINPUT PARAMETERS - // 20X, EMIFLAG = I2, 5X, BOXC 66  1 SHLIST = 12, 5X, 5HISIG = 13, 6X, 5HIPRS = I2, 7X, "HPPR = 12// BOXC 66  2 COX, EMNCOUE = 12, 5X, 5HNOON = 12, 5X, 5HNOFF = I3, 5X, 6HKMACH = I2, BOXC 67  IF (***ACT. IPROS) GO TO 40  MRITE (6,9500) MGLE .XSCALE, YSCALE, ZSCALE, XTRANS, YIFANS, ZTRANS  NONC 93  NINI = SIN( 0.9174533 * ANGLE)  CALL INPIT (ILIST)  CALL OVERLAY (4MBD XC, 1.0)  IF (LIST, CALL OVERLAY (4MED XC, 8, 0)  IF (KIPI) ***EQ. 1) CALL OVERLAY (4MED XC, 8, 0)  COX CALL FLOMS (NU, NNON)  IF (LIST, CALL OVERLAY (4MBD XC, 2.0)  IF (NOODE = 1 GOOD > 1500 , 20U	REWIND 13		2011
IF (KMACH *LE. 0) GO TO 7  NNON = 0  NNON = 0  READ (5, 6) MACH AFLOW = .TRUE. BELOW = .FALSE. GFLOW = .FALSE.	IF (LIST SO A) and		8646
IF (KMACH *LE. 0) GO TO 7  NNON = 0  READ (5, 6) MACH  AFLOW = **.TRUE**  BFLOW = **.FALSE**  CFLOW = **.FALSE**  CALL MEADER  WITE (6, 92CC) IFL AG, LIST, ISIG, IPRS, MPR, NCUDE, NNON, BOXC 62  1 NOFF **.KMACH, KYP14**  92C3 FORMAT( 1H0, 17X, 17HINPUT PARAMETERS-*/* 20X, EMIFLAGEI2, 5X, BOXC 63  1 SMLIST=12; 5X, **.HISIG=I3, 6X, **.HIPRS=12, 7X, **.HMPR=12/*  3 SX, EMKTD1=12; 5X, **.HINDN1E, 5X, 5HNOFF=I3, 5X, 6HKMACH=I2, BOXC 65  2 COX, EMNCODE=12, 5X, 5+.HNON=12, 5X, 5HNOFF=I3, 5X, 6HKMACH=I2, BOXC 66  MRITE(6, 9500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS  40 WRITE(6, 9400) LEAK, FRACT  COSA = COS( 0.017*353 ** ANGLE)  SOXC 92  COSA = COS( 0.017*353 ** ANGLE)  COSA = COS( 0.017*353 ** ANGLE)  COSA = COS( 0.017*353 ** ANGLE)  COLL INPIT (ILST)  CALL OVERLAY(4HB) XC, 1,0)  IF (AFLOW, ORR BFLOW **.OR** CFLCW) NU = 1  CALL INPIT (ILST)  CALL OVERLAY(4HB) XC, 1,0)  IF (KNFP14, **.EQ, 1) CALL OVERLAY(4HE0XC, 8,0)  COTO 1000  COTO 1000  CONTINUE  GO TO 5000  COLL OVERLAY(4HB) XC, 2,0)  IF (MOUAD) **.COLL OVERLAY(4HE0XC, 2,0)  COLL OVERLAY(4HB) XC, 2,0)  IF (MOUAD) **.COLL OVERLAY(4HB) XC, 2,0)  COLL OVERLAY(4HB) XC, 2,0)  IF (MOUAD) **.COLL OVERLAY(4HB) XC, 2,0)  1500 KC 1000  CALL OVERLAY(4HB) XC, 2,0)  1500 KC 1000  COLL OVERLAY(4HB) XC, 2,0)  COLL OVER	MACH = n.n REWIND 4		22.
READ (5, 6) MACH  AFLOW = *TRUE.  BFLOW = *TRUE.  BFLOW = *FALSE.  GFLOW = *FALSE.  BOXC 76  RESTA = 1.0 / BETA  NU = 8  CALL MEADER  MRITE(6,92GD) IFLAG, LIST, ISIG, IPRS, MPR, NCUDE, NNON,  BOXC 61  1 NOFF, KMACH, KTP14  92C9 FORMAT (1HD, 17X, 17MINDUT PARAMETERS-// 20X, 6HIFLAGE:12, 5X,  2 20X, 6HNCODE=12, 5X, 5HIDRS=12, 7X, "MMPR=12//  3 5X, 6HKTP14=12) 5X, 5HIDRS=12, 7X, "MMPR=12//  BOXC 66  40 NRITE(6,9500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  BOXC 69  40 HRITE(6,7500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  BOXC 69  40 HRITE(6,7500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  BOXC 69  1F(.NOT. IPROS) GO TO 50  COSA = COS (0.017.533 * ANGLE)  50 IF (AFLOW .OR. 9FLOW .OR. CFLCH) NU = 1  COALL INPUT (1ST)  CALL OVERLAY(44B0XC,1.0)  IF (LIST) .NE. (1) GO TO 10  CALL INPUT (1ST)  CALL OVERLAY(44B0XC,1.1)  IF (KYP14 .EG. 1) CALL O/ERLAY(4HE0XC,8.0)  C FORM XIJ, YI., AND ZIJ MATRICES  BOXC 101  BOXC 102  GO TO 5000  C FORM XIJ, YI., AND ZIJ MATRICES  BOXC 103  BOXC 104  BOXC 105  BOXC 106  C1600 CALL VFORM  1000 CALL V	IF (KMACH - IF ON OO I		0040
READ (5, 6) MACH AFLON = .TRUE. BFLON = .FALSE. BFLON = .FALSE. BFLON = .FALSE.  CFLON = .FALSE. BFLON = .FALS	NNON = n		56.46
#FLOW = .TRUE, #FLOW = .FALSE. #FLOW = .FALSE. #FLOW = .FALSE.  GFLOW = .FALSE.  GFLOW = .FALSE.  GFLOW = .FALSE.  GFLOW = .FALSE.  FRITA = SCRT(1:C - MACH * MACH)  NU = 8  BOXC 76  BOXC 77  REFIA = 1.0 / BETA  BOXC 78  BOXC 61  BOXC 61  BOXC 62  BOXC 61  BOXC 62  BOXC 62  BOXC 62  BOXC 63  #RITE(6,92GD) IFLAG, LIST, ISIG, JPRS, MPR, NCUDE, NNON, BOXC 62  #RITE(6,92GD) IFLAG, LIST, ISIG, JPRS, MPR, NCUDE, NNON, BOXC 62  BOXC 63  #RITE(6,92GD) IFLAG, LIST, ISIG, JPRS, MPR, NCUDE, NNON, BOXC 63  #RITE(6,95GD) SOX 55 SHIPRS=12, 7X, "MMPR=127, BOXC 65  2 20X, EMNCODE=12, 5X, 5HNON=12, 5X, 5HNOFF=I3, 5X, 6MKMACH=I2, BOXC 65  #RITE(6,95GD) ANGLE,XSCALE,YSCALE, ZSCALE,XTRANS,YTFANS,ZTRANS  #RITE(6,95GD) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  #BOXC 93  #BOXC 93  #BOXC 94  #BOXC 95  GOSA = GOS( 8.017.933 * ANGLE)  SINA = SIN( 0.017.4533 * ANGLE)  CALL INPLIT (ILIST)  CALL OVERLAY(4HBOXC-1.0)  IF (4LIST, NS. 6) GO TO 10  CALL OVERLAY(4HBOXC-1.1)  IF (KIT) ** EG. 1) CO TO 10  BOXC 96  BOXC 97  CALL OVERLAY(4HBOXC-1.1)  IF (KIT) ** EG. 1) CALL OVERLAY(4HEOXC,8.9)  CONTINUE  FORM XIJ, YI, AND ZIJ MATRICES  BOXC 103  BOXC 104  BOXC 105  BOXC 105  BOXC 106  BOXC 107  BOXC 107  BOXC 107  BOXC 107  BOXC 108  BOXC 109  BOXC 110  BOXC 111  BOXC 111  BOXC 112  BOXC 111  BOXC 112  BOXC 111  BOXC 111  BOXC 111  BOXC 112  BOXC 111  BOXC 111  BOXC 111  BOXC 111  BOXC 111  BOXC 111  BOXC 112  BOXC 111	READ (5. 6) MACH		
### ### #### #########################	MFLUM = .TDIIE		
### CFLUM = .FALSE.  ### SETA = SCRT[11.C - MACH * MACH)  ### RETA = 1.8 / BETA  **NOTE THAT	BPLOW = .FAICE		80×C 2=
BOXC 78   BOXC 77   BOXC 78   BOXC 77   RRETA = 1.0 / BETA   BOXC 78   BOXC 79   BOXC 80   BOX	UPLUM = _EALOR		0000
NU = 8 CALL MEADER WRITE(6,92GG) IFLAG, LIST, ISIG, JPRS, MFR, NGUDE, NNON, 900C 81 NOFF, KMACH, KIP14 920 FORMAT (180,17X, 17HINPUT PARAMETERS-// 20X, 6HIFLAG=12, 5X, 80XC 83 1 SHLIST=12, 5X, 5HISIG=13, 6X, 5HIPRS=12, 7X, "HMPR=12// 80XC 85 2 20X, 6HNCODE=12, 5X, 54NNON=12, 5X, 5HNOFF=13, 5X, 6MKMACH=12, 80XC 86 3 5X, 6HKF14=12) IF( .NCT. IPROS) GO TO 40 WRITE(6,9500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS 80XC 89 WRITE(6,9500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS 80XC 90 HRITE(6,9500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS 80XC 91 COSA = COS ( 0.017*333 * ANGLE) SINA = SIN( 0.017*333 * ANGLE) SINA = SIN( 0.017*333 * ANGLE) COSA = COS ( 0.017*333 * ANGLE) SOXC 93 SINA = SIN( 0.017*333 * ANGLE) CCALL INP(T (LIST) CALL OVERLAY(4H80XC,1*0) IF (AFLOH .OR. 9FLOH .OR. CFLCH) NU = 1  CALL OVERLAY(4H80XC,1*0) IF (LIST .NE. () GO TO 10 CALL OVERLAY(4H80XC,1*1) IF(KTP14 .EQ. 1) CALL O/ERLAY(4H80XC,8,9)  CFORM XIJ , YI , AND ZIJ MATRICES  CONTINUE GO TO 5000  CONTINUE GO TO 5000 TIF (NCODE) 5000, 1590, 20UU TIF (NOUAD .GT. 500 ) NCODE = 2  BOXC 111 BOXC 112 BOXC 112 BOXC 111 BOXC 111 BOXC 111 BOXC 111	PEIA = SCRT(4 A MAG)		
CALL MEADER MRITE(6,92CG) JFLAG, LIST, ISIG, JPRS, MPR, NCUGE, NNON,  1 NOFF, KMACH, KTP14  92C9 FORMATI (1M0, 17x, 17hINPUT PARAMETERS-// 20x, EHIFLAG=I2, 5x, 80xC 83  1 SHLIST=I2, 5x, 5HISIG=I3, 6x, SHIPRS=I2, 7x, +HMPR=I2// 80xC 83  2 ZUX, EHNCODE=I2, 5x, 54NNON=I2, 5x, 5HNGFF=I3, 5x, 6HKMACH=I2, 80xC 83  HRITE(6,9500) MRITE(6,9500)	RBETA = 1.8 / RETA MACH)		00
CALL MEADER  WRITE (6,92CG) IFLAG, LIST, ISIG, IPRS, MPR, NCUDE, NNON,  1 NOFF, KMACH, KTP14  9209 FORMAT (1H0,17x,17HINPUT PARAMETERS-// 20x, 6HIFLAG=12,5x,  1 SHLIST=12,5x,5HISIG=13,6x,5HIPRS=12,7x,4HMPR=12//  3 SX,6HNCODE=12,5x,5HNON=12,5x,5HNOFF=13,5x,6HKMACH=12,80xC 86  3 SX,6HNCODE=12,5x,5HNON=12,5x,5HNOFF=13,5x,6HKMACH=12,80xC 86  MRITE (6,9500)  MRITE (6,9	14U = g		
MRITE(6,92CG) IFLAG, LIST, ISIG, IPRS, MFR, NCUDE, NNON, BOXC 81  1 NOFF, KMACH, KTP14  2203 FORMAT (1HD, 17X, 17HINPUT PARAMETERS-// 20X, 6HIFLAG=12, 5X, 80XC 83  1 SHLIST=12, 5X, 5HISIG=13, 6X, 5HIPRS=12, 7X, 4HMPR=12// 80XC 85  2 2X, 6HKTP14=12)  IF( NCT. IPROS) GO TO 40  MRITE(6,9500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  BOXC 89  HRITE(6,7500) ANGLE,XSCALE,YSCALE,ZSCALE,XTRANS,YTFANS,ZTRANS  BOXC 91  IF( NOT. IFROS) GO TO 5)  COSA = COS( 0.0174533 * ANGLE)  SINA = SIN( 0.0174533 * ANGLE)  SINA = SIN( 0.0174533 * ANGLE)  CALL INPUT (LIST)  CALL OVERLAY(4HB0XC-1,0)  IF (LIST NE. (1) GO TO 10  CALL OVERLAY(4HB0XC-1,1)  IF(KTP14 * EG. 1) CALL O/ERLAY(4HE0XC,8,0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  GO TO 5000  COLALL VFORM  1000 CALL VFORM  1000 CALL VFORM  1000 CALL VFORM  1000 CALL OVERLAY(4HB0XC,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NCODE) 5000, 1500, 2000  BOXC 111	CALL HEADER		
1 5HLIST=12, 5x, 5HISIG=13, 6x, 5HIPRS=12, 7x, "HMPR=12," 5x, 80xC 84 2 20x, 6HNCODE=12, 5x, 5HNON=12, 5x, 5HNOFF=13, 5x, 6HKHAG=12, 80xC 85 3 5x, 6HKTP14=12)  If (.NCT. IPROS) GO TO 40  HRITE(6,9500)  HRITE(6,7500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS  HRITE(6,7500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS  80xC 89  80xC 89  80xC 89  80xC 91  1F (.NOT. IFROS) GO TO 5)  COSA = COS ( 0.0174333 * ANGLE)  SINA = SIN ( 0.0174533 * ANGLE)  COSA = COS ( 0.0174533 * ANGLE)  SINA = SIN ( 0.0174533 * ANGLE)  COLL INPIT (LIST)  CALL INPIT (LIST)  CALL OVERLAY (4HBUXC, 1,0)  IF (LIST .NE. () GO TO 10  COLL OVERLAY (4HBUXC, 1,1)  IF (KTP14 .EQ. 1) CALL O/ERLAY (4HE0XC, 8,0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  GO TO 5000  COLL VFORM  1000 CALL VFORM  1000 CALL VFORM  11000 CALL VFORM  11000 CALL OVERLAY (4HBOXC, 2,0)  IF (NCODE) 5000, 1500, 2000  150 NCODE = 1  IF (NOUAD .GT. 500) NCODE = 2  80xC 111  80xC 112  80xC 112  80xC 111	WRITE (6,9200) IFLAGA LIST TOTAL		80 XC 81
1 5HLIST=12, 5x, 5HISIG=13, 6x, 5HIPRS=12, 7x, "HMPR=12," 5x, 80xC 84 2 20x, 6HNCODE=12, 5x, 5HNON=12, 5x, 5HNOFF=13, 5x, 6HKHAG=12, 80xC 85 3 5x, 6HKTP14=12)  If (.NCT. IPROS) GO TO 40  HRITE(6,9500)  HRITE(6,7500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS  HRITE(6,7500) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, ZTRANS  80xC 89  80xC 89  80xC 89  80xC 91  1F (.NOT. IFROS) GO TO 5)  COSA = COS ( 0.0174333 * ANGLE)  SINA = SIN ( 0.0174533 * ANGLE)  COSA = COS ( 0.0174533 * ANGLE)  SINA = SIN ( 0.0174533 * ANGLE)  COLL INPIT (LIST)  CALL INPIT (LIST)  CALL OVERLAY (4HBUXC, 1,0)  IF (LIST .NE. () GO TO 10  COLL OVERLAY (4HBUXC, 1,1)  IF (KTP14 .EQ. 1) CALL O/ERLAY (4HE0XC, 8,0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  GO TO 5000  COLL VFORM  1000 CALL VFORM  1000 CALL VFORM  11000 CALL VFORM  11000 CALL OVERLAY (4HBOXC, 2,0)  IF (NCODE) 5000, 1500, 2000  150 NCODE = 1  IF (NOUAD .GT. 500) NCODE = 2  80xC 111  80xC 112  80xC 112  80xC 111	1 NOFF, KMACH, KTP14 1516, IPRS, M	IFR. NCUDE. NNON	BOXC 82
TF( .NCT. IPROS) GO TO 40	PELS FORMAT ( 1HD, 17X, 17HINDUT DARROWS		BOXC 83
TF( .NCT. IPROS) GO TO 40	1 SHLIST=12, 5x, 5HISIG=13, 6WAMETERS-//	20X, 6HIFLAGETS SU	BOXC 84
TF( .NCT. IPROS) GO TO 40	E ZOX, EHNCODE=12, 5X. 54NNON-15	, 7X, 4HMPR=1244	80 XC 85
## ## ## ## ## ## ## ## ## ## ## ## ##	5 5X 6 6HKTP14=I2) 5X, 5HN	OFF=13, 5X. 6HKMACH-13	BOXC 86
### ##################################	UPTTER ( IPROS) GO TO 40	A AUGUSTS,	
COSA = COS( 0.0174533 * ANGLE)  SINA = SIN( 0.0174533 * ANGLE)  FOR COLL INPUT (LIST)  CALL OVERLAY(4HBDXC.1.0)  IF (LIST · NE. () GO TO 10  CALL FLOWS (NU, NNON)  CALL OVERLAY(4HB0XC.1.1)  IF (KTP14 · EQ. 1) CALL OFERLAY(4HE0XC.8.0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  COLL FORM XIJ , YI. , AND ZIJ MATRICES  COLL OVERLAY(4HB0XC.2.0)  IF (NCODE) 5000 · 1500 · 2000  IF (NCODE) 5000 · 1500 · 2000  1500 NCODE = 1  1500 NCODE = 1  1500 NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2	WOTTE (6. 9500)		BO XC 88
COSA = COS( 0.0174533 * ANGLE)  SINA = SIN( 0.0174533 * ANGLE)  FOR COLL INPUT (LIST)  CALL OVERLAY(4HBDXC.1.0)  IF (LIST · NE. () GO TO 10  CALL FLOWS (NU, NNON)  CALL OVERLAY(4HB0XC.1.1)  IF (KTP14 · EQ. 1) CALL OFERLAY(4HE0XC.8.0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  COLL FORM XIJ , YI. , AND ZIJ MATRICES  COLL OVERLAY(4HB0XC.2.0)  IF (NCODE) 5000 · 1500 · 2000  IF (NCODE) 5000 · 1500 · 2000  1500 NCODE = 1  1500 NCODE = 1  1500 NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2	40 MOTTE ( 6, 7500) ANGLE, XSCALE, YSCALE 750015		BOXC 89
COSA = COS( 0.0174533 * ANGLE)  SINA = SIN( 0.0174533 * ANGLE)  FOR COLL INPUT (LIST)  CALL OVERLAY(4HBDXC.1.0)  IF (LIST · NE. () GO TO 10  CALL FLOWS (NU, NNON)  CALL OVERLAY(4HB0XC.1.1)  IF (KTP14 · EQ. 1) CALL OFERLAY(4HE0XC.8.0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  CONTINUE  COLL FORM XIJ , YI. , AND ZIJ MATRICES  COLL OVERLAY(4HB0XC.2.0)  IF (NCODE) 5000 · 1500 · 2000  IF (NCODE) 5000 · 1500 · 2000  1500 NCODE = 1  1500 NCODE = 1  1500 NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2  2000 IF (NMAT · EQ. 3) NCODE = 2	TECHNOT TOOM LEAK, FRACT	XTRANS, YTEANS . ZTRANS	BOXC 98
SINA = SIN( 0.0174533 * ANGLE)  50 IF (AFLOH .OR. 0FLOH .OR. CFLCH) NU = 1  CALL INPIT (LIST)  CALL OVERLAY(4H00XC.1.0)  IF (LIST .NE. C) GO TO 10  CALL OVERLAY(4H00XC.1.1)  IF (KTP14 .EQ. 1) CALL OVERLAY(4H00XC.8.0)  CONTINUE  GO TO 1000  CONTINUE  GO TO 5000  C  FORM XIJ , YI. , AND ZIJ MATRICES  C1000 CALL VFORM  1000 CALL VFORM  1000 CALL OVERLAY(4H00XC.2.0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  2000 IF (NMAT .EQ. 3) NCODE = 2  2000 IF (NMAT .EQ. 3) NCODE = 2  2000 IF (NMAT .EQ. 3) NCODE = 2	COSA = COS( COS) GO TO 5)	W= 1- 1-44443	BUXE 91
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	SINA = STN4 0.0174333 * ANGLE)		80XC 92
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	50 IF (AFLOW OD -0174533 + ANGLE)		BOXC 5
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	C CALL THOSE SELON OR CELCHI NIL -		BOXE 94
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	CALL OVERLANGUE		BOXC 95
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	IF (LTST NE AND XC. 1.0)		80 VC 95
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	C CALL FLOWS (NIL ALGO TO 10		BOXC 64
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	CALL OVERLAY(AUDANA)		BOXC 90
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	IF(KTP14 .EQ. 1) CALL		BOXC 100
GO TO 5000  C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XG,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 112  80XC 113  80XC 114	GO TO 1000 TO CALL OVERLAY (4HEOXC.8.0)		80XC 101
C FORM XIJ, YI, AND ZIJ MATRICES  C FORM XIJ, YI, AND ZIJ MATRICES  C 1000 CALL VFORM  1000 CALL OVERLAY(4HB0XC,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NGODE = 1  IF (NQUAD .GT. 500) NCDDE = 2  80XC 103  80XC 106  80XC 107  80XC 108  80XC 110  80XC 111  80XC 111  80XC 111  80XC 111			BOXC 142
G FORM XIJ, YIL, AND ZIJ MATRICES  C1000 CALL VFORM  1000 CALL OVERLAY(4H80XC,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 104  80XC 107  80XC 108  80XC 110  80XC 111  80XC 111  80XC 111  80XC 111  80XC 112  80XC 113  60 > C 114	GO TO SOCO		80XC 103
FORM XIJ, YIL, AND ZIJ MATRICES  C1000 CALL VFORM  1000 CALL OVERLAY(4HB0XC, 2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 105  80XC 106  80XC 107  80XC 108  80XC 110  80XC 110  80XC 111  80XC 112  80XC 113  80XC 114	· ·		30XC 104
C1000 CALL VFORM  1000 CALL OVERLAY(4HB0XC,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 110  80XC 111  80XC 111  80XC 112  80XC 113  60 XC 114	FORM XIJ, YIL AND ZIL MARKET		80XC 105
1000 CALL VFORM  1000 CALL OVERLAY(4HB0XC,2,0)  IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 110  80XC 111  80XC 112  80XC 113  80XC 114	CARAN AND LID MATRICES		80 XC 166
IF (NCODE) 5000, 1500, 2000  1500 NCODE = 1  IF (NQUAD .GT. 500) NCODE = 2  80XC 108  80XC 109  80XC 110  80XC 111  80XC 112  80XC 113  80XC 114	TOO CALL VEORM		80 XC 1C7
1500 NGODE = 1  IF (NQUAD .GT. 500) NCDDE = 2  80XC 110  80XC 110  80XC 111	TOUS CALL OVERLAY(4HB0XC.2.n)		80XC 108
IF (NQUAD .GT. 500 ) NCDDE = 2  8000 IF (NMAT .EQ. 3) NCODE = 2  8000 IF (NMAT .EQ. 3) NCODE = 2  8000 IF (NMAT .EQ. 3) NCODE = 2	1500 NOODE) 5000, 1500, 2000		80xC 169
BOXC 113 60 %C 114	ADOU NCODE = 1		BOXC 110
BOXC 113 60 %C 114	2000 TE ANNUAD GT. 500 ) NCODE = 2		BOXC 111
60 xC 114	INMAT .EQ. 3) NCODE = 2		BOXC 112
			EUXC 113
			BU 3C 114

17.14.35

PROGRAM MAIN

74/74

CPT=2

AM MAIN	74/74 OPT=2	FIN 4.7+476	02/27/80 17.14.35	
	N3 = 8		80XC 172	
	MN = 2		BOXC 172	
C **	POSITION THE TAPE FOR THE SIGNAS.		BOXC 173	
	JJ = 2			
	IF (ISIG .NE. C) J# = 3		EOXC 175	
	JJ = NFLOW + JJ + NFL		BOXC 176	
	DO 3750 J = 1, JJ		80XC 177	
3750	READ (3)		80 XC 178	
T	NFL = NFLOW - NFL		30XC 179	
	(KMAT - 2) 3830, 3933, 5000		80 XC 180	
3800	IF (NBFLOW) 3900, 3900, 3850		BOXC 181	
3850	KMAT = 2		BOXC 182	
9,02,4	GO TO 2450		BOXC 183	
3900	KMAT = 3		80 XC 164	
9,00	GO TO 2450		BOXC 185	
5000	CONTINUE		BOXC 186	
2000	WRITE (6, 5100)		BOXC 187	
5400	FORMATIANA ANY ARM CRATIC MATERIA		80XC 188	
2136	FORMAT(1HO. 10X. 12HLEA/ING MAIN)		BOXC 189	
			BOXC 190	
			50XC 191	
			BOXC 192	
•	CALL EXIT		BOXC 193	
С	IF (LIST .NE. C) STOP		BOXC 194	
	GO TO 1		90XC 195	
	E NO		EOXC 196	

```
1 KASE, NOFF, NSYM, IFLAG, IFLOW, NGODE
                                                                                   5
      DATA IPAGE/0/
                                                                           HEAD
                                                                                   6
    1 FORMAT( 1H1, 5X, 13HPROGRAM BOXC . 15X, 30HATMOSPHERIC SCIENCE ASSHEAD
                                                                                   7
     10CIATES/ 38X, 22HBEOFCRD, MASSACHUSETTS, 22X, 4HPAGE, 15/
                                                                           HE AD
     2 7X, 8HBODY ID., 2X, A4/ 30X, 15A4)
                                                                                   8
                                                                           HEAD
   10 IPAGE = IPAGE + 1
                                                                           HEAD
                                                                                  9
      WRITE (6.1) IPAGE, KASE, HEDR
                                                                                  10
                                                                           HEAD
      RETURN
                                                                           HEAD
                                                                                  11
      END
                                                                                  12
                                                                           HEAD
TO ECK, ROWV
                                                                           ROWV
      SUBROUTINE ROWY( XIJ, YIL, ZIJ, III, KSKIP )
                                                                           RO WV
                                                                                   3
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL OW, NQUAD,
                                                                           ROWV
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                           ROWV
      LOGICAL AFLOW. BFLOW. CFLOW
                                                                           ROWV
      COMMON /DFLOW/ AFLCW.BFLOW.CFLOW.NHAT.NMATM1.NAFLOW.NBFLOW.NCFLOW ROWV
                                                                                  7
       DIMENSION XIJ(1), YIJ(1), ZIJ(1)
                                                                           ROWV
      INTEGER CKFLG
                                                                           ROWV
                                                                                  8
                                                                                   9
      DIMENSION NT(3)
                                                                           ROWV
      DATA NT
                             / 1, 11, 12 /
                                                                           ROWV
                                                                                  10
    5 CKFLG = 0
                                                                           ROWV
                                                                                  11
      N1 = 1
                                                                           ROWV
                                                                                  12
      N2 = NQUAD/ 3
                                                                           ROWV
                                                                                  13
      N3 = NQUAD - N2 - N2
                                                                           ROWV
                                                                                  14
      NN = N2
                                                                           ROWV
                                                                                  15
C
        READ IN ONE ROW OF THE VX, VY, VZ
                                                                           ROWV
                                                                                  16
      00 50 I1 = 1, 3
                                                                           ROWV
                                                                                  17
      NTAPE = NT(I1)
                                                                           ROWV
                                                                                  18
   10 READ(NTAPE)
                          (XIJ(I2) , YIJ(I2) , ZIJ(I2) , I2 = N1 , NN )
                                                                           ROWV
                                                                                  19
                                                                           ROWV
      N1 = NN + 1
                                                                                  20
      IF( I1 .EQ. 2 ) GO TO 35
                                                                           ROWV
                                                                                  21
                                                                           ROWV
      NN = NN + N2
                                                                                  22
                                                                           ROWV
      GO TO 50
                                                                                  23
   35 NN = NN + N3
                                                                           ROWV
                                                                                  24
   50 CONTINUE
                                                                           ROHV
                                                                                  25
      NER = 0
                                                                           ROWV
                                                                                  26
      ROWV
                                                                                  27
      REWIND 1
                                                                           ROWV
                                                                                  28
                                                                           ROWV
                                                                                  29
      REWIND 11
      REWIND 12
                                                                           ROWV
                                                                                  30
   80 RETURN
                                                                           ROWV
                                                                                  31
  100 IF ( NMATM1 .EQ. 0 ) RETURN
                                                                           ROWV
                                                                                  32
      DO 118 N1 = 1, NMATM1
                                                                           ROWV
                                                                                  33
      READ ( 1 )
                                                                           ROWV
                                                                                  34
      READ ( 11 )
                                                                           ROWV
                                                                                  35
  110 READ ( 12 )
                                                                           ROWY
                                                                                  36
      RETURN
                                                                           ROWV
                                                                                  37
      END
                                                                           ROWV
                                                                                  38
```

COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL ON, NQUAD,

HEAD

HEAD

HEAD

HEAD

2 3

4

\*DECK, HEADER

SUBROUTINE HEADER

```
*DECK, INPUT
                                                                            INPU
                                                                                   1
      SUBROUTINE INPUT
                                                                            INPU
C
      SUBROUTINE INPUT (LIST)
                                                                                   3
                                                                            INPU
      LOGICAL IPROS
                                                                            INPU
                                                                                   4
      COMMON /INPT/ LIST, IPROS
                                                                                   5
                                                                            INPU
      REAL NX, NY, NZ , IXX, IXY, IYY, MACH
                                                                            INPU
                                                                                   6
      LOGICAL AFLOW, BFLOW, CFLOW, RFLAG, AFLAG, BFLAG
                                                                            INPU
                                                                                   7
      INTEGER STAT, STATT, CONV
                                                                            INPU
                                                                                   8
      DIMENSION SPH ( 200'), CPH ( 200 ), XINP ( 200 ), ZINP ( 200 )
                                                                                   9
                                                                            INPU
      DIMENSION XOFF(1000), YOFF (1000), ZOFF (1000)
                                                                            INPU
                                                                                  10
      DIMENSION XA ( 500 ), XB ( 500 ), YA ( 500 ), YB ( 500 ),
                                                                            INPU
                                                                                  11
        ZA ( 500 ), ZB ( 500 ), NLINE(500 ), NLT ( 500 ), CFLAG(3),
                                                                            INPU
                                                                                  12
        XI (4), ETA (4), XIN (4), YIN (4), ZIN (4), XNULL (1888),
                                                                            INPU
                                                                                  13
        YNULL (1000), ZNULL (1000),
                                              XNORM(1000),
                                                                            INPU
                                                                                  14
        YNORM ( 1 100), ZNORM (1000), RX (4), R (4), RY (4)
                                                                                  15
                                                                            INPU
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                            INPU
                                                                                  16
     1 KASE, NOFF, NSYM, IFLA G, IFLOW, NCODE
                                                                                  17
                                                                            INPU
      COMMON /M/ MACH, BETA, RBETA
                                                                            INPU
                                                                                  18
       COMMON /NORMS/ XNORM, YNORM, ZNORM
                                                                            INPU
                                                                                  19
      EQUIVALENCE (XNULL.
                                  XOFF), ( YNULL,
                                                          YOFF).
                                                                            INPU
                                                                                  20
     1 (ZNULL, ZOFF), (NULL, NGUAD)
                                                                            INPU
                                                                                  21
      COMMON /DFLOW/ AFLCW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW INPU
                                                                                  22
             CFLAG
                                       / 2H 1, 2H 2, 2H
                                                                            INPU
                                                                                  23
      DATA PI/3.141593EO/, HAFFI/1.570796EO/, EPS/.0001/
                                                                            INPU
                                                                                  24
 3030 FORMAT (1H1)
                                                                                  25
                                                                            INPU
    1 FORMAT (
                    3E10.0, I2 / 3Fig.0, I2)
                                                                                  26
                                                                            INPU
 4002 FORMAT ( 1H0, 6X,5HN M, 7X, 4 ( 1HX, 11X ), 2HNX, 11X, 3HNPX,
                                                                            INPU
                                                                                  27
        11X, 1HD / 19X, 4 ( 1HY, 11X ), 2HNY, 11X, 3HNPY, 11X, 1HT /
                                                                            INPU
                                                                                  28
        19X, 4(1HZ, 11X ), 2HNZ, 11X, 3HNPZ, 11X, 1HA
                                                                            INPU
                                                                                  29
 4005 FORMAT ( 1H0, 7X, I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                            INPU
                                                                                  30
     1 2F13.6, E14.4 ) )
                                                                            INPU
                                                                                  31
 4&10 FORMAT ( 1H0, 3X, 2I4, 4F12.6, 2F13.6, E14.4,A2/(12X, 4F12.6,
                                                                            INPU
                                                                                  32
        2F13.6, E14.4 ) )
                                                                            INPU
                                                                                  33
 4015 FORMAT (1HC, 3 (20), 12H***************))
                                                                            INPU
                                                                                  34
                                                                            INPU
                                                                                  35
   INPUT -- SECTION 9.1 INPUT SCHEME
                                                                            INPU
                                                                                  36
      KLCT = 0
                                                                                  37
                                                                            INPU
      NULL = 0
                                                                            INPU
                                                                                  38
      NPRT = 13
                                                                            INPU
                                                                                  39
      WRITE (6, 40)
                                                                            INPU
                                                                                  40
   40 FORMAT (1H0,16X,44HP A R A M E T R I C I N F O R M A T I O N
                                                                            INPU
                                                                                  41
     1 /// 38x,23HGENERATED UNIFORM FLOWS //)
                                                                            INPU
                                                                                  42
      IF ( AFLOW ) WRITE (6, 41)
                                                                            INPU
                                                                                  43
   41 FORMAT (46X,6HX-FLOW)
                                                                            INPU
                                                                                  44
      IF ( BFLOW ) WRITE (6, 42)
                                                                            INPU
                                                                                  45
   42 FORMAT (46X,6HY-FLOW)
                                                                            INPU
                                                                                  46
      IF ( CFLOW ) WRITE (6, 43)
                                                                            INPU
                                                                                  47
   43 FORMAT (46X,6HZ-FLOW)
                                                                            INPU
                                                                                  48
      IF (IPRS .NE. 0) WRITE (6. 44)
                                                                            INPU
                                                                                  49
   44 FORMAT (1H0,16X, 22HPRINT SIGMA ITERATIONS )
                                                                            INPU
                                                                                  50
      IF (MPR .EQ. 0) GO TO 52
                                                                            INPU
                                                                                  51
      IF (MPR - 2) 45, 47, 49
                                                                            INPU
                                                                                  52
   45 WRITE (6, 46)
                                                                            INPU
                                                                                  53
   46 FORMAT (1H0,16X,18+PRINT VIJ MATRICES)
                                                                            INPU
                                                                                  54
    . GO TO 52
                                                                            INPU
                                                                                  55
   47 WRITE (6. 48)
                                                                                  56
                                                                            INPU
   48 FORMAT (1HO: 16X, 18HP FINT AIJ MATRICES )
                                                                            INPU
                                                                                  57
      GO TO 52
                                                                            INPU
                                                                                  58
   49 WRITE (6, 51)
                                                                            INPU
                                                                                  59
   51 FORMAT (1H0,16X,31+PRINT BOTH VIJ AND AIJ MATRICES )
                                                                            INPU
                                                                                  60
```

```
52 IF (ISIG .NE. 0) WRITE (6, 53)
                                                                          INPU
                                                                                61
53 FORMAT (1H0,16X,19HINPUT SIGNA GUESSES )
                                                                          INPU
                                                                                62
   IF (NSYM - 1) 54, 56, 58
                                                                          INPU
                                                                                63
  WRITE (6, 55)
                                                                          INPU
                                                                                64
55 FORMAT (1H0,16X,21HNC SYMMETRY SPECIFIED )
                                                                          INPU
                                                                                65
   GO TO 61
                                                                          INPU
                                                                                66
56 WRITE (6, 57)
                                                                          INPU
                                                                                67
57 FORMAT (1H0,16X, 30HTHERE IS ONE PLANE OF SYMMETRY )
                                                                          INPU
                                                                                68
   GO TO 61
                                                                          INPU
                                                                                69
58 WRITE (6, 59) NSYM
                                                                          INPU
                                                                                70
59 FORMAT (1H0,16X,9HTHERE ARE,12, 19H PLANES OF SYMMETRY )
                                                                          INPU
                                                                                71
61 IF ( MACH .NE. 0.0 ) WRITE (6, 21) MACH
                                                                          INPU
                                                                                72
21 FORMAT (1H0,16X,13HMACH NUMBER =,F10.5)
                                                                          INPU
                                                                                73
   IF (IFLAG .EQ. 0) GO TO 29
                                                                          INPU
                                                                                74
   READ (5, 20) NLM1, MMIN, 8, C
                                                                          INPU
                                                                                75
   IF (B \cdot EQ \cdot O \cdot O) B = 1.0
                                                                          INPU
                                                                                76
   IF (C \cdot EQ \cdot 0.0) C = 1.0
                                                                          INPU
                                                                                77
20 FORMAT ( 215, 2F10.5 )
                                                                          INPU
                                                                                78
 4 FORMAT ( 8F10.0 )
                                                                          INPU
                                                                                79
   WRITE (6, 62) NLM1, PMIN, B, C
                                                                          INPU
                                                                                80
62 FORMAT (1H0,16X,10HGENERATE A,13, 2H X,13, 12H SPHERE. 8 =,F10.5, INPU
                                                                                81
  1 4X.3HC = F10.5 )
                                                                          INPU
                                                                                82
   MLINES = MMIN + 1
                                                                          INPU
                                                                                83
   NLINES = NLM1 + 1
                                                                          INPU
                                                                                84
   N = 0
                                                                          INPU
                                                                                85
   IF ( NSYM .EQ. 0 ) GO TO 2
                                                                          INPU
                                                                                86
   IF ( NSYM - 2 ) 3, 5, 6
                                                                          INPU
                                                                                87
 2 PITH = PI
                                                                          INPU
                                                                                88
   PIPHI = PI + PI
                                                                          INPU
                                                                                89
   GO TO 7
                                                                          INPU
                                                                                90
 3 PITH = PI
                                                                          INPU
                                                                                91
   PIPHI = PI
                                                                          INPU
                                                                                92
   GO TO 7
                                                                          INPU
                                                                                93
 5 PITH = PI
                                                                          INPU
                                                                                94
   PIPHI = HAFPI
                                                                          INPU
                                                                                95
   GO TO 7
                                                                          INPU
                                                                                96
 6 PITH = HAFPI
                                                                          INPU
                                                                                97
   PIPHI = PITH
                                                                                98
                                                                          INPU
 7 \text{ SPH ( MLINES ) = SIN ( PIPHI )}
                                                                          INPU
                                                                                99
   SPH (1) = 0.0
                                                                          INPU 100
                                                                          INPU 101
   CPH ( MLINES ) = CCS ( PIPHI )
   CPH (1) = 1.0
                                                                          INPU 182
   EKH = MMIN
                                                                          INPU 103
   EKN = NLM1
                                                                          INPU 104
   EMM = 0.0
                                                                          INPU 105
   DO B I = 2, MMIN
                                                                          INPU 106
   EMM = EMM + 1.8
                                                                          INPU 107
   PHI = EMM / EKM * PIFHI
                                                                          INPU 108
   SPH (I) = SIN (PHI)
                                                                          INPU 109
 8 CPH ( I ) = COS ( PHI )
                                                                          INPU 110
   IF ( IFLAG .EQ. 2 ) GO TO 10
                                                                          INPU 111
   ENN = 1.0
                                                                          INPU 112
   009 I = 1, MLINES
                                                                          INPU 113
   XA (I) = 1.0
                                                                          INPU 114
   YA (I) = 0.0
                                                                          INPU 115
 9 ZA ( I ) = 0.0
                                                                          INPU 116
   GO TO 18
                                                                          INPU 117
10 READ ( 5, 4 ) ( XINP ( I ), ZINP ( I ), I = 1, NLINES )
                                                                          INPU 118
   DO 11 I = 1, MLINES
                                                                          INPU 119
   XA (I) = XINP (1)
                                                                          INPU 120
```

```
YA (I) = B * ZINP (1) * SPH (I)
                                                                     INPU 121
   ZA (I) = -C + ZINF (1) + CPH (I)
                                                                     INPU 122
   XB (I) = XINP (2)
                                                                     INPU 123
   YB (I) = B * ZINP (2) * SPH (I)
                                                                     INPU 124
11 ZB ( I ) = - C + ZINF ( 2 ) + CPH ( I )
                                                                     INPU 125
   NLCT = 2
                                                                     INPU 126
   GO TO 250
                                                                     INPU 127
12 DO 14 I = 1, MLINES
                                                                     INPU 128
   XA (I) = XB (I)
                                                                     INPU 129
   YA (I) = YB (I)
                                                                     INPU 130
14 ZA (I) = ZB (I)
                                                                     INPU 131
   IF ( IFLAG .EQ. 1 ) GO TO 16
                                                                     INPU 132
   NLCT = NLCT + 1
                                                                     INPU 133
   DO 15 I = 1, MLINES
                                                                     INPU 134
   XB (I) = XINP (NLCT)
                                                                     INPU 135
   YB (I) = B * ZINP (NLCT) * SPH (I)
                                                                     INPU 136
15 ZB ( I ) = - C * ZI P ( NLCT ) * CPH ( I )
                                                                     INPU 137
  GO TO 250
                                                                     INPU 138
16 ENN = ENN + 1.0
                                                                     INPU 139
18 THETA = ENN / EKN * FITH
                                                                     INPU 140
   STH = SIN ( THETA )
                                                                     INPU 141
   CTH = COS ( THETA )
                                                                     INPU 142
   DO 17 I = 1, MLINES
                                                                     INPU 143
   XB (I) = CTH
                                                                     INPU 144
   YB(I) = B * STH * SPH(I)
                                                                     INPU 145
17 ZB ( I ) = - C * STH * CPH ( I )
                                                                     INPU 146
   GO TO 250
                                                                     INPU 147
29 N = -1
                                                                     INPU 148
   IF (LIST .EQ. 0) GO TO 50
                                                                     INPU 149
  WRITE (6, 19)
                                                                     INPU 150
19 FORMAT (1HO 16X 28HBASIC DATA CALCULATIONS ONLY)
                                                                     INPU 151
   GO TO 50
                                                                     INPU 152
39 IF ( RFLAG ) GO TO 50
                                                                     INPU 153
   RFLAG = .TRUE.
                                                                     INPU 154
   X = XX
                                                                     INPU 155
   Y = YY
                                                                     INPU 156
   Z = ZZ
                                                                     INPU 157
   STAT = STATT
                                                                     INPU 1:8
   IF (LIST) 66, 66, 65
                                                                     INPU 159
50 RFLAG = .FALSE.
                                                                     INPU 168
   READ ( 5, 1 ) X, Y, Z, STAT, XX, YY, ZZ, STATT
                                                                     INPU 161
                                                                    INPU 162
   IF ( IPROS ) CALL DATPROS( X, Y, Z, XX, YY, ZZ )
65 IF (N .EQ. (-1))GO TO 80
                                                                     INPU 163
66 IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180
                                                                     INPU 164
   IF ( STAT .EQ. 2 ) GC TO 200
                                                                     INPU 165
   IF ( .NOT. AFLAG ) GO TO 200
                                                                     INPU 166
  MC = M
                                                                     INPU 167
80 M = 1
                                                                     INPU 168
   IF ( STAT .EQ. 2 ) GO TC 150
                                                                     INPU 169
                                                                     INPU 170
   IF ( .NOT. BFLAG ) GO TO 84
75 DO 81 J = 1, MC
                                                                     INPU 171
   XA (J) = XB (J)
                                                                     INPU 172
   YA (J) = YB (J)
                                                                     INPU 173
81 \ ZA \ (J) = ZB \ (J)
                                                                     INPU 174
83 XB ( 1 ) = X
                                                                     INPU 175
   YB (1) = Y
                                                                     INPU 176
   ZB (1) = Z
                                                                     INPU 177
   GO TO 30
                                                                     INPU 178
84 IF ( AFLAG ) GO TO 85
                                                                     INPU 179
   BFLAG = .TRUE.
                                                                     INPU 160.
```

```
GO TO 75
                                                                         INPU 181
 85 AFLAG = .FALSE.
                                                                         INPU 182
    GO TO 83
                                                                         INPU 183
150 AFLAG = .TRUE.
                                                                         INPU 184
    BFLAG = .FALSE.
                                                                         INPU 185
    IF (N \cdot EQ \cdot (-1))N = 0
                                                                         INPU 186
160 \times A ( M ) = \times
                                                                         INPU 187
    YA (M) = Y
                                                                         INPU 188
    ZA(M)=Z
                                                                         INPU 189
    GO TO 30
                                                                         INPU 190
180 M = M + 1
                                                                         INPU 191
    IF ( AFLAG ) GO TO 160
                                                                         INPU 192
    XB (M) = X
                                                                         INPU 193
    YB (H) = Y
                                                                         INPU 194
    ZB (M) = Z
                                                                         INPU 195
    IF ( STAT .NE. 3 ) GO TO 30
                                                                         INPU 196
200 MMIN = MIND(M, MC) - 1
                                                                         INPU 197
    MC = M
                                                                         INPU 198
250 N = N + 1
                                                                         INPU 199
    KLCT = KLCT + 1
                                                                         INPU 200
                                                                         INPU 201
BEGIN COMPUTATION OF NULL PCINTS AND 28 QUANTITIES
                                                                         INPU 202
                                                                         INPU 203
    DO 2000 I = 1, MNIN
                                                                         INPU 204
    NULL = NULL + 1
                                                                         INPU 205
    XIN(1) = XA(I) + RBETA
                                                                         INPU 206
    XIN(2) = XA(I+1) + RPETA
                                                                         INPU 207
    XIN(3) = XB(I+1) + RBETA
                                                                         INPU 208
    XIN(4) = XB(I) + REETA
                                                                         INPU 209
    YIN(1) = YA(I)
                                                                         INPU 210
    YIN(2) = YA(I+1)
                                                                         INPU 211
    YIN(3) = YB(I+1)
                                                                         INPU 212
    YIN(4) = YB(I)
                                                                         INPU 213
    ZIN(1) = ZA(I)
                                                                         INPU 214
    ZIN(2) = ZA(I+1)
                                                                         INPU 215
    ZIN(3) = ZB(I+1)
                                                                         INPU 216
    ZIN(4) = ZB(I)
                                                                         INPU 217
                                                                         INPU 218
FORM DIAGONAL VECTORS
                                                                         INPU 219
EQUATION (64)
                                                                         INPU 220
                                                                         INPU 221
    T1X = XIN(3) - XIN(1)
                                                                         INPU 222
    T2X = XIN(4) - XIN(2)
                                                                         INPU 223
    T1Y = YIN(3) - YIN(1)
                                                                         INPU 224
    T2Y = YIN(4) - YIN(2)
                                                                         INPU 225
    T1Z = ZIN(3) - ZIN(1)
                                                                         INPU 226
    T2Z = ZIN(4) - ZIN(2)
                                                                         INPU 227
                                                                         INPU 228
 FORM CROSS PRODUCT N = T2 \times T1
                                                                         INPU 229
ECUATION (65)
                                                                         INPU 230
                                                                         INPU 231
    NX = T2Y+T1Z - T1Y+T2Z
                                                                         INPU 232
    NY = T1X+T2Z - T2X+T1Z
                                                                         INPU 233
    NZ = T2X+T1Y - T1X+T2Y
                                                                         INPU 234
    VN = SQRT ( NX + NX + NY + NZ + NZ )
                                                                         INPU 235
                                                                         INPU 236
FORM UNIT NORMAL VECTOR
                                                                         INPU 237
 ECUATION (66)
                                                                         INPU 238
                                                                         INPU 239
    NX = NX / VN
                                                                         INPU 240
```

```
NY = NY / VN
                                                                         INPU 241
      NZ = NZ / VN
                                                                         INPU 242
                                                                         INPU 243
  COMPUTE AVERAGE POINT
                                                                         INPU 244
   EQUATION (68)
                                                                         INPU 245
                                                                         INPU 246
      AVX = .25 + (XIN(1) + XIN(2) + XIN(3) + XIN(4) )
                                                                         INPU 247
      AVY = .25 + (YIN(1) + YIN(2) + YIN(3) + YIN(4) )
                                                                         INPU 248
      AVZ = .25 + (ZIN(1) + ZIN(2) + ZIN(3) + ZIN(4))
                                                                         INPU 249
                                                                         INPU 250
   COMPUTE PROJECTION DISTANCE
                                                                         INPU 251
   EQUATIONS ( 69 ) AND ( 71 )
                                                                         INPU 252
                                                                         INPU 253
      D = NX + (AVX - XIN(1)) + NY + (AVY - YIN(1)) + NZ + (AVZ - ZIN(1)) INPU 254
      PD = ABS( D )
                                                                         INPU 255
                                                                         INPU 256
   EQUATIONS ( 73 ) AND ( 74 )
                                                                         INPU 257
                                                                         INPU 258
      T = SQRT (T1X*T1X + T1Y*T1Y + T1Z*T1Z)
                                                                         INPU 259
      T1X = T1X / T
                                                                         INPU 260
      T1Y = T1Y / T
                                                                         INPU 261
      T1Z = T1Z / T
                                                                         INPU 262
                                                                         INPU 263
   EQUATION (75)
                                                                         INPU 2E4
                                                                         INPU 265
      T2X = NY+T1Z - NZ+T1Y
                                                                         INPU 266
      T2Y = NZ*T1X - NX*T1Z
                                                                         INPU 267
      T2Z = NX+T1Y - NY+T1X
                                                                         INPU 2E8
                                                                         INPU 269
  COMPUTE COORDINATES OF CORNER POINTS IN REFERENCE COORD. SYSTEM
                                                                         INPU 278
  EQUATION (72)
                                                                         INPU 271
                                                                         INPU 272
      DO 1000 J = 1, 4
                                                                         INPU 273
      XP = XIN(J) + NX + D
                                                                         INPU 274
      Q + YN + (U)NIY = QY
                                                                         INPU 275
      ZP = ZIN(J) + NZ + D
                                                                         INPU 276
      D = -D
                                                                         INPU 277
      XDIF = XP - AVX
                                                                         INPU 278
      YDIF = YP - AVY
                                                                         INPU 279
      ZDIF = ZP - AVZ
                                                                         INPU 280
                                                                         INPU 281
  TRANSFORM CORNER POINTS TO ELEMENT COORDINATE SYSTEM ( XI. ETA )
                                                                       INPU 282
   WITH AVERAGE P (INT AS ORIGIN
                                                                         INPU 283
  EGUATION (80)
                                                                         INPU 284
                                                                         INPU 285
      XI(J) = T1X+XDIF + T1Y+YDIF + T1Z+ZDIF
                                                                         INPU 286
1000 ETA(J) = T2X*XDIF + T2Y*YDIF + T2Z*ZDIF
                                                                         INPU 287
                                                                         INPU 288
  COMPUTE CENTROID
                                                                         INPU 289
  EQUATION (81)
                                                                         INPU 290
                                                                         INPU 291
      XIO = .3333333EO + (XI (4) + (ETA (1) - ETA (2)) + XI (2)
                                                                         INPU 292
     1 + ( ETA (4) - ETA (1) ) / ( ETA (2 ) - ETA (4) )
                                                                         INPU 293
      ETAO = -.3333333EO + ETA(1)
                                                                         INPU 294
                                                                         INPU 295
                                                                         INPU 296
   OBTAIN CORNER POINTS IN SYSTEM WITH CENTROID AS ORIGIN
C
                                                                         INPU 297
   EQUATION (82)
                                                                         INPU 298
                                                                         INPU 299
      D0 1020 J = 1.4
                                                                         INPU 300
```

```
XI(J) = XI(J) - XII
                                                                       INPU 301
 1026 ETA(J) = ETA(J) - ETAO
                                                                       INPU 302
                                                                       INPU 363
  COMPUTATION AIDS
                                                                       INPU 304
      ETA2M1 = ETA (2) - ETA (1)
                                                                       INPU 305
      ETA3M2 = ETA (3) - ETA (2)
                                                                       INPU 366
      ETA4M3 = ETA (4) - ETA (3)
                                                                       INPU 307
      ETA1M4 = ETA (1) - ETA (4)
                                                                       INPU 308
     XI1M2 = XI (1) - XI (2)
                                                                       INPU 309
     XI2M3 = XI (2) - XI (3)
                                                                       INPU 310
     XI3M4 = XI (3) - XI (4)
                                                                       INPU 311
     XI4M1 = XI (4) - XI (1)
                                                                       INPU 312
      ETA2P4 = ETA (2) + ETA (4)
                                                                       INPU 313
     XI3M1 = XI (3) - XI (1)
                                                                       INPU 314
     XI4M2 = XI (4) - XI (2)
                                                                       INPU 315
      ETA2M4 = ETA (2) - ETA (4)
                                                                       INPU 316
     XI1234 = XI (1) + XI (2) + XI (3) + XI (4)
                                                                       INPU 317
                                                                       INPU 318
  TRANSFORM CENTROLD TO REFERENCE COORDINATE SYSTEM
                                                                       INPU 319
C
  EGUATION (83)
                                                                      INPU 320
     XCENT = AVX + T1X*XIQ + T2X*ETAD
                                                                       INPU 321
      YCENT = AVY + T1Y*XIO + T2Y*ETAO
                                                                       INPU 322
      ZCENT = AVZ + T1Z*XIO + T2Z*ETAG
                                                                       INPU 323
                                                                       INPU 324
C
  COMPUTE LARGER DIAGONAL VECTOR
                                                                       INPU 325
  EQUATION (84)
                                                                      INPU 326
     TSQ = AMAX1 ( XI3M1 + 2, XI4M2 + 2 + ETA2M4 + 2 )
                                                                      INPU 327
     T = SQRT (TSQ)
                                                                      INPU 328
                                                                      INPU 329
                                                                       INPU 330
  COMPUTE AREA
C
                                                                       INPU 331
  EQUATION (85)
                                                                      INPU 332
      AREA
                     = .5 * XI3M1 * ET42M4
                                                                       INPU 333
                                                                      INPU 334
C
  COMPUTE 2ND HOMENTS IXX, IXY, IYY
                                                                       INPU 335
  EQUATIONS ( 86 ) - ( 88 )
                                                                       INPU 336
     IXX =
                      8.333333E-2 * XI3M1 * ( ETA ( 1 ) * XI4M2 *
                                                                       INPU 337
       XI1234 + ETA2M4 + (XI(1) + (XI(1) + XI(3)) +
                                                                       INPU 338
       XI (3) + 2) + XI (2) + ETA (2) + (XII.234 - XI (4))
                                                                       INPU 339
       - XI (4) * ETA (4) * (XI1234 - XI (2))
                                                                       INPU 340
                      4.166667E-2 * XI3M1 * ( 2. * XI ( 4 ) * ( ETA (1)INPU 341
     IXY =
        ** 2 - ETA ( 4 ) ** 2 ) - 2. * XI ( 2 ) * ( ETA ( 1 ) ** 2 -
                                                                       INPU 342
        ETA ( 2 ) ** 2 ) + ( XI ( 1 ) + XI ( 3 ) ) * ETA2M4 * ( 2. *
                                                                       INPU 343
       ETA ( 1 ) + ETA2P4 ) )
                                                                      INPU 344
                      8.333333E-2 * XI3M1 * ETA2M4 * ((ETA ( 1 ) +
     IYY =
                                                                      INPU 345
      ETA2P4 ) ** 2 - ETA ( 1 ) * ETA2P4 - ETA ( 2 ) * ETA ( 4 ) )
                                                                      INPU 346
                                                                       INPU 347
  COMPUTE CONSTANTS FOR EQUATIONS ( 42 ) AND ( 43 )
                                                                      INPU 348
C
  EQUATION (45)
                                                                       INPU 349
     D12SQ = XI1M2 ** 2 + ET #2M1 ** 2
                                                                       INPU 350
     D12 = SQRT (D12SQ)
                                                                       INPU 351
     D23SQ = XI2M3 **2 + ETA3M2 ** 2
                                                                       INPU 352
     D23 = SQRT (D23SQ)
                                                                       INPU 353
     D34SQ = XI3M4 ** 2 + ETA4M3 ** 2
                                                                       INPU 354
     D34 = SQRT (D34SQ)
                                                                       INPU 355
     D41SQ = XI4M1 ** 2 + ETA1M4 ** 2
                                                                       INPU 356
     D41 = SQRT (D41SQ)
                                                                       INPU 357
     C1 = 0.0
                                                                       INPU 358
     C2 = 0.0
                                                                       INPU 359
     03 = 0.0
                                                                       INPU 360
```

```
C4 = 6.6
                                                                         INPU 361
       C5 = 0.0
                                                                         INPU 362
       C6 = 0.0
       C7 = 0.0
                                                                         INPU 363
                                                                         INPU 364
       C8 = 0.0
                                                                         INPU 365
       XNP = 0.0
       YNP = 0.0
                                                                         INPU 366
       IF ( 012 ) 1038, 1040, 1030
                                                                         INPU 367
  1030 C1 = ETA2M1 / D12
                                                                         INPU 368
                                                                         INPU 369
       C5 = XI1M2 / D12
  1040 IF ( D23 ) 1050, 1060, 1050
                                                                         INPU 370
  1050 C2 = ETA3M2 / D23
                                                                         INPU 371
       C6 = XI2M3 / D23
                                                                         INPU 372
  1060 IF ( D34 ) 1070, 1080, 1070
                                                                         INPU 373
                                                                         INPU 374
  1070 C3 = ETA4M3 / D34
       C7 = XI3M4 / D34
                                                                         INPU 375
  1080 IF ( D41 ) 1090, 1100, 1090
                                                                        INPU 376
                                                                        INPU 377
  1090 C4 = ETA1M4 / D41
      C8 = XI4M1 / D41
                                                                        INPU 378
                                                                        INPU 379
  1100 \text{ CONV} = 3
                                                                        INPU 388
                                                                        INPU 381
                                                                        INPU 362
C BEGIN NULL POINT ITERATION
                                                                        INPU 383
                                                                        INPU 384
      DO 1591 ITR = 1, 30
                                                                        INPU 385
      D0 1580 K = 1.4
                                                                        INPU 386
   EQUATION (47)
      R ( K ) = SQRT ( ( XNP - XI ( K ) ) ** 2 + ( YNP - ETA(K)) ** 2 )
                                                                        INPU 387
      RX (K) = (XNP - XI (K)) / R (K)
                                                                        INPU 3E8
 1580 RY (K ) = ( YNP - ETA ( K ) ) / R ( K )
                                                                        INPU 389
                                                                        INPU 390
      R1PR2 = R(1) + R(2)
                                                                        INPU 391
      R2PR3 = R(2) + R(3)
                                                                        INPU 392
      R3PR4 = R(3) + R(4)
                                                                        INPU 393
      R_4PR1 = R(4) + R(1)
      ARG1 = ALOG ( ( R1PR2 - 812 ) / ( R1PR2 + 812 ) )
                                                                        INPU 394
                                                                       INPU 395
      R4PR1 = R(4) + R(1)
      ARG1 = ALOG ( ( R1PR2 - 012 ) / ( R1PR2 + 012 ) )
                                                                       INPU 396
      ARG2 = ALOG ( ( R2PR3 - E23 ) / ( R2PR3 + E23 ) )
                                                                       INPU 397
      ARG3 = ALOG ((R3PR4 - D34 ) / ( R3PR4 + D34 ) )
                                                                       INPU 398
      ARG4 = ALOG ((R4PR1 - D41) / (R4PR1 + D41))
                                                                       INPU 399
                                                                       INPU 400
                                                                        INPU 401
  COMPUTE INDUCED VELOCITY COPPONENTS
                                                                        INPU 442
                                                                        INPU 403
 EQUATIONS ( 42 ) AND ( 43 )
      VX = C1 * ARG1 + C2 * ARG2 + C3 * ARG3 + C4 * ARG 4
                                                                       INPU 494
      VY = C5 + ARG1 + C6 + ARG2 + C7 + ARG 3 + C8 + ARG4
                                                                       INPU 405
                                                                       INPU 406
C COMPUTE PARTIAL DERIVATIVES OF INDUCED VELOCITIES
                                                                       INPU 407
C EQUATION ( 98 ), USING EQUATIONS ( 91 ) - ( 93 )
                                                                       INPU 468
                                                                       INPU 409
                                                                       INPU 410
      D12P= ( 泉1PR2 ** 2 - D12 SQ
                                                                        INPU 411
                                    ) * .5
      D23P= ( R2PR3 ** 2 - D23 SQ
                                                                        INPU 412
                                    ) * .5
           ( R3PR4 ** 2 - D34 SQ
                                                                       INPU 413
     D34P=
                                    ) + .5
           ( R4PR1 ** 2 - D41 SQ ) * .5
                                                                       INPU 414
     D41P=
                                                                       INPU 415
     C1P = ETA2H1 / D12P
     CZP = ETA3H2 / D23P
                                                                       INPU 416
                                                                       INPU 417
     C3P = ETA4M3 / D34P
                                                                       INPU 418
     C4P = ETA1M4 / D41P
                                                                       INPU 419
     C5P = XI1M2 / D12P
                                                                       INPU 420
```

```
C EQUATION ( 94 )
                                                                          INPU 435
                                                                          INPU
                                                                               436
      XMXP = { VY + VXY - VX + VYY } / { VXX + VYY - VXY +* 2 }
                                                                          INPU 437
      XNP = XMXP + XNP
                                                                          INPU 438
      YNP = YNP + (VX + VXX * XMXP) / VXY
                                                                          INPU
                                                                               439
                                                                          INPU 440
      TEST NULL POINT CONVERGENCE
                                                                          INPU
                                                                               441
1590 IF ( ABS ( VX ) .LT. EPS .AND. ABS ( VY ) .LT. EPS ) GO TO 1600
                                                                          INPU 442
1591 CONTINUE
                                                                          INPU
                                                                               443
      NO CONVERGENCE . USE 30TH ITERATION
                                                                          INPU
                                                                               444
      CONV = 2
                                                                          INPU
                                                                               445
                                                                          INPU
                                                                               446
      TEST IF THIS POINT IS OUTSIDE THE ELEMENT
                                                                          INPU 447
1600 IF ( XNP ** 2 + YNP ** 2 .LE. TSQ ) GO TO 1620
                                                                          INPU 448
                                                                          INPU 449
C
      CONVERGES TO POINT AT INFINITY
                                                                          INPU 450
      CONV = 1
                                                                          INPU 451
      XNULL ( NULL ) = XCENT
                                                                          INPU 452
      YNULL ( NULL ) = YCENT
                                                                          INPU 453
      ZNULL (NULL) = ZCENT
                                                                          INPU 454
      GO TO 1700
                                                                          INPU 455
                                                                          INPU 456
      TRANSFORM NULL POINT TO REFERENCE COORDINATE SYSTEM
                                                                          INPU 457
 EQUATION ( 79 ) NOTE THAT Z - COORDINATE IS ZERO
                                                                          INPU 458
1620 XNULL ( NULL ) = XCENT + T1X + XNP + T2X + YNP
                                                                          INPU 459
      YNULL ( NULL ) = YCENT + T1Y + XNP + T2Y + YNP
                                                                          INPU 460
      ZNULL ( NULL ) = ZCENT + T1Z + XNP + T2Z + YNP
                                                                          INPU 461
                                                                          INPU 462
                                                                          INPU 463
  PRINT RESULTS -- SECTION 9.4 THE FIRST OUTPUT
                                                                          INPU 464
                                                                          INPU 465
1700 IF ( NPRT .GE. 11 ) GO TO 1750
                                                                          INPU 466
      NPRT = NPRT + 1
                                                                          INPU 467
      IF ( I .EQ. 1 ) GO TO 1760
                                                                          INPU 468
      WRITE (6, 4005) I, XIN, NX, XNULL ( NULL), PD, CFLAG (CONV),
                                                                          INPU 469
       YIN, NY, YNULL (NULL), T, ZIN, NZ, ZNULL ( NULL ), AREA
                                                                          INPU 470
      60 TO 1770
                                                                          INPU 471
 1750 NPRT = 0
                                                                          INPU 472
      CALL HEADER
                                                                          INPU 473
      WRITE ( 6, 4002 )
                                                                          INPU
                                                                               474
 1760 WRITE ( 6, 4010) N
                            . I. XIN. NX. XNULL ( NULL ). PD. CFLAG (CONVINPU 475
         ), YIN, NY, YNULL (NULL), T, ZIN, NZ, ZNULL ( NULL ), AREA
                                                                          INPU 476
 1770 \times NORM (NULL) = NX
                                                                          INPU 477
      YNORM ( NULL ) = NY
                                                                          INFU 478
      ZNORM ( NULL ) = NZ
                                                                          INPU 479
                                                                          INPU 480
                                      107
```

 $VXX = C1P^{+} (RX (1) + RX (2)) + C2P^{+} (RX (2) + RX (3)) + INPU 42$   $C3P^{+} (RX (3) + RX (4)) + C4P^{+} (RX (4) + RX (1)) INPU 42$ 

VXY = C1P\* R12Y + C2F\* R23Y + C3P\* R34Y + C4P\* R41Y

YYY = C5P\* R12Y + C6P\* R23Y + C7P\* R34Y + C8P\* R41Y

INPU 42

INPU 42

INPU 42

INPU 42

INPU 42

INPU 42

INPU 43

INPU 431 INPU 431 INPU 433

INPU 434

INPU

C6P = XI2M3 / D23P

C7P = XI3M4 / D34P

C8P = XI4M1 / D41P

R12Y = RY (1) + RY (2)

R23Y = RY (2) + RY (3)

R34Y = RY (3) + RY (4)

R41Y = RY (4) + RY (1)

C COMPUTE NEW NULL POINT ( XNP, YNP )

```
C WRITE 28 QUANTITIES ON TAPE 4 AS ONE LOGICAL RECORD
                                                                             INPU 481
                                                                             INPU 482
 2000 IF (LIST .EQ. 0) WRITE (4) XCENT, YCENT, ZCENT, T1X, T1Y, T1Z, INPU 483 1 T2X, T2Y, T2Z, NX, NY, NZ, XI(1), ETA(1), XI(2), ETA(2), XI(3), INPU 484
     2 XI(4), ETA(4), TSQ, AREA, IXX, IXY, IYY, D12, D23, D34, D41 INPU 485
      NLT ( KLCT ) = MMIN
                                                                             INPU 486
      NLINE (KLCT) = N
                                                                             INPU 487
      IF ( IFLAG .EQ. 0 ) GO TO 2001
                                                                             INPU 488
      IF ( N .LT. NLM1 ) GO TO 12
                                                                              INPU 489
      WRITE ( 6, 4015 )
                                                                              INPU 490
      GO TO 2025
                                                                             INPU 491
 2001 IF ( STAT .LT. 2 ) GO TO 80
                                                                             INPU 492
      NLT(KLCT) = -NLT(KLCT)
                                                                             INPU 493
      NPRT = NPRT + 1
                                                                             INPU 494
      WRITE ( 6. 4015 )
                                                                             INPU 495
                                                                             INPU 496
C TEST FOR END OF CASE
                                                                             INPU 497
 2020 IF ( STAT .NE. 3 ) GC TO 80
                                                                             INPU 498
 2025 \text{ NN1} = \text{MOD} (3 + \text{NQUAO}, 255)
                                                                             INPU 499
      NONN1 = NOUAD
                                                                            INPU 500
      IF ( NN1 .LT. 5 .AND. NN1 .GT. 0 ) NQNN1 = NQUAD + 2
                                                                            INPU 501
      IF (LIST.NE. 0) GO TO 8500
                                                                            INPU 502
      WRITE UNIT NORMALS ON TAPE 4 AS ONE LOGICAL RECORD
                                                                            INPU 503
 WRITE ONLY NORMALS ON TAPE 4 AS UNE EUGLCAE RECORD

2031 WRITE (4) (XNORM(J), YNORM(J), ZNORM(J), J = 1, NQNN1)
                                                                            INPU 504
C WRITE CONTROL TABLES ON TAPE 4 AS ONE LOGICAL RECORD WRITE ( 4 ) KLCT, ( NLINE (J), NLI(J), J = 1, KLCT )
                                                                            INPU 505
                                                                            INPU 506
C ** WRITE NULL POINTS AND NORMALS (1 RECORD)
                                                                             INPU 507
 3632 WRITE (4)(XNULL(J), YNULL(J), ZNULL(J), XNGRH(J), YNORH(J), ZNCRH(J)INPU 568
     1 \cdot J = 1 \cdot NQUAD
                                                                             INPU 509
      WRITE ( 6, 3030 )
                                                                             INPU 510
 WRITE ALL NULL POINTS ON TAPE 8 (1 LOGICAL RECORD / POINT)
                                                                             INPU 511
      DO 2058 I = 1, NQUAD
                                                                             INPU 512
 2058 WRITE (8) XNULL (I), YNULL(I), ZNULL(I)
                                                                             INPU 513
                                                                             INPU 514
C
      READ IN OFF-BODY POINTS
                                                                             INPU 515
                                                                             INPU 516
      IF ( NOFF .LE. 0 ) GC TO 8000
                                                                             INPU 517
      NOFF = 0
                                                                             INPU 518
 5000 NOFF = NOFF + 1
                                                                             INPU 519
      READ (5, 1) XOFF (NCFF), YOFF (NOFF), ZOFF (NCFF), STAT, X,Y,Z, STATT
                                                                             INPU 520
      IF (STAT .EQ. 3) GO TO 5100
                                                                             INPU 521
      NOFF = NOFF + 1
                                                                             INPU 522
      XOFF(NOFF) = X
                                                                             INPU 523
      YOFF(NOFF) = Y
                                                                             INPU 524
      ZOFF(NOFF) = Z
                                                                             INPU 525
                                                                            INPU 526
      IF (STATT .NE. 3) GO TO 5000
                                                                             INPU 527
      WRITE OFF-BODY POINTS ON 8 ( 1 RECORD / POINT )
                                                                            INPU 528
                                                                           INPU 529
 5100 DO 7020 I = 1, NOFF
                                                                             INPU 530
      XOFF(I) = XOFF(I) + RBETA
                                                                            INPU 531
 7020 WRITE ( 8) XOFF(I), YOFF(I), ZOFF(I)
                                                                             INPU 532
                                                                             INPU 533
      WRITE OFF-BODY POINTS ON 4 (1 RECORD)
                                                                             INPU 534
                                                                             INPU 535
      WRITE (4)(XOFF(I), YCFF(I), ZOFF(I), I = 1, NOFF)
                                                                             INPU 536
                                                                            INPU 537
      WRITE (6, 63) NOFF
                                                                             INPU 538
   63 FORMAT (1H0,16X,9HTHERE ARE,14, 15H OFF-BODY POINTS )
                                                                             INPU 539
 8000 REWIND 4
                                                                              INPU 540
```

```
8500 REWIND 8

C

WRITE(6, 9999) NQUAD

9999 FORMAT( 1H0 , 5X, I5, 2 €H BASIC ELEMENTS WERE INPUT)

C RETURN
END

INPU 545
INPU 546
```

```
*DECK, DATPR
                                                                             DATP
      SUBROUTINE DATPROS( X, Y, Z, XX, YY, ZZ )
                                                                             DATP
                                                                                     2
                                                                             DATP
C
                                                                                     3
      THIS IS A SIMPLE SCALING AND ORIGIN TRANSLATION CODE FOR THE
C
                                                                             DATP
                                                                                     4
                                                                                     5
C
      DOUGLAS BOXC POTENTIAL FLOW CODE DATA INPUT
                                                                             DATP
C
         XTRANS, YTRANS, ZTRANS ARE ORIGIN TRANSLATIONS
                                                                             DATP
                                                                                     6
C
          XSCALE, YSCALE, ZSCALE ARE SCALE FACTORS
                                                                             DATP
                                                                                     7
C
      THE CODE ALSO ALLOWS FOR ROTATION IN THE X - Z PLANE TO ADJUST
                                                                                     8
                                                                             DATP
C
      FOR ARBITRARY ANGLE OF ATTACK
                                                                                     9
                                                                             DATP
                                                                                   10
C
         SINA, COSA ARE SINE AND COSINE OF ANGLE
                                                                             DATP
C
          ANGLE IS THE ANGLE (INPUT IN DEGREES) THAT THE AIRPLANE AXIS
                                                                             DATP
                                                                                    11
C
         MAKES WITH THE NEGATIVE X AXIS (POSITIVE COUNTERCLOCKWISE
                                                                             DATP
                                                                                    12
C
          FROM THE-X AXIS) AFTER SCALING ( NOTE - AFTER SCALING THE
                                                                             DATP
                                                                                    13
C
          AIRPLANE NOSE POINTS DOWN THE NEGATIVE X AXIS)
                                                                             DATP
                                                                                    14
C
                                                                                    15
                                                                             DATP
C
      THIS VERSION FOR USE WITH BOXC
                                                                                    16
                                                                             DATP
C
                                                                             DATP
                                                                                    17
C
                                                                             DATP
                                                                                    18
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                             DATP
                                                                                    19
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                             DATP
                                                                                    20
      COMMON /PROS/
                          SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                             DATP
                                                                                    21
     1 YTRANS, ZTRANS
                                                                             DATP
                                                                                    22
      X = (X - XTRANS) + XSCALE
                                                                             DATP
                                                                                    23
      Y = (Y - Y TRANS) + YSCALE
                                                                             DATP
                                                                                    24
      Z = (Z - ZTRANS) + ZSCALE
                                                                                    25
                                                                             DATP
      XX= ( XX- X TRANS ) * XSCALE
                                                                             DATP
                                                                                    26
      YY= ( YY- YTRANS ) * YSCALE
                                                                                    27
                                                                             DATP
      ZZ= ( ZZ- ZTRANS ) + ZSCALE
                                                                             DATP
                                                                                    28
      XP = X
                                                                             DATP
                                                                                    29
      X = XP + COSA - Z + SINA
                                                                             DATP
                                                                                    30
      Z = XP + SINA + Z + COSA
                                                                             DATP
                                                                                    31
      XP = XX
                                                                             DATP
                                                                                    32
      XX= XP + COSA - ZZ+ SINA
                                                                             DATP
                                                                                    33
      ZZ= XP + SINA + ZZ+ COSA
                                                                             DATP
                                                                                    34
                                                                                    35
      RETURN
                                                                             DATP
      END
                                                                             DATP
                                                                                    36
```

```
*DECK, FLOWS
                                                                               FLOW
                                                                                       1
      SUBROUTINE FLOWS
                                                                               FLOW
                                                                                       2
C
      SUBROUTINE FLOWS (NU, NNON )
                                                                               FLOW
                                                                                       3
      COMMON /FLOWP/ NU, ANCH
                                                                               FLOW
                                                                                       4

    COMMON HEDR (15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFL CW, NQUAD,

                                                                                       5
                                                                               FLOW
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                               FLOW
                                                                                       6
      LOGICAL AFLOW, BFLOY, CFLOW
                                                                                       7
                                                                               FLOW
      COMMON /DFLOW/ AFLCW.BFLCW.CFLOW.NMAT.NMATM1.NAFLOW.NBFLOW.NCFLOW FLOW
                                                                                       8
      COMMON / FLOW / NQ, NL, KFLOW, VX(2000), VY(2000), VZ(2000),
                                                                               FLOW
                                                                                       9
                                                  VNC (1000)
                                                                               FLOW
                                                                                      10
       COMMON /NORMS/ XNCRM(1000), YNORM(1000), ZNORM(1000)
                                                                               FLOW
                                                                                      11
   31 FORMAT ( 311 )
                                                                               FLOW
                                                                                      12
   40 FORMAT( 6F10.8 )
                                                                               FLOW
                                                                                      13
 9999 FORMAT (1H0,5X 16HFLOWS HAS SET UP.
                                                                               FLOW
                                                                                      14
     1 I3, 11H X FLOWS, I3, 15H Y FLOWS, AND I3, 11H Z FLOWS.)
                                                                               FLOW
                                                                                      15
      NAFLOW = 0
                                                                               FLOW
                                                                                      16
      NBFLOW = 0
                                                                               FLOW
                                                                                      17
      NCFLOW = 0
                                                                               FLCW
                                                                                      18
      NMAT = 0
                                                                               FLOW
                                                                                      19
      NQ = NQUAD + NOFF
                                                                               FLOW
                                                                                      20
      NL = NQUAD
                                                                               FLOW
                                                                                      21
      NN = MOD(3 + NQ)
                         • 255)
                                                                               FLOW
                                                                                      22
      IF ( NN .LT. 5 .ANC. NN .GT. 0 ) NQ = NQ + 5
                                                                               FLOW
                                                                                      23
      KFLOW = 0
                                                                                      24
                                                                               FLOW
      NN = MOD(NQUAD, 255)
                                                                                      25
                                                                               FLOW
      IF ( NN \cdotLT \cdot 5 \cdotAND \cdot NN \cdotGT \cdot 0) NL = NL + 5
                                                                                      26
                                                                               FLOW
      IF (NNON .GT. 0) GC TO 140
                                                                               FLOW
                                                                                      27
      IF (NU .GT. 0) GO TO 50
                                                                               FLOW
                                                                                      28
      WRITE (6, 115)
                                                                               FLOW
                                                                                      29
  115 FORNAT (1H1,6X,24HNO ONSET FLOWS SPECIFIED )
                                                                               FLOW
                                                                                      30
      STOP
                                                                               FLOW
                                                                                      31
   50 IF ( .NOT. AFLOW ) GC TO 60
                                                                               FLOW
                                                                                      32
      KFLOW = 1
                                                                               FLOW
                                                                                      33
      GO TO 100
                                                                               FLOW
                                                                                      34
   60 IF ( .NCT. BFLOW ) GC TO 70
                                                                               FLOW
                                                                                      35
      KFLOW = 2
                                                                               FLOW
                                                                                      36
      GO TO 100
                                                                               FLOW
                                                                                      37
   70 IF ( CFLOW ) GO TO 90
                                                                               FLOW
                                                                                      38
       IF (KFLOW .NE. 0) GO TO 4000
                                                                               FLOW
                                                                                      39
      WRITE ( 6, 80 )
                                                                               FLOW
                                                                                      40
   80 FORMAT ( 1H1,6X,12HINPUT ERROR..5X.25HNO FLOW MATRIX SPECIFIED. ) FLOW
                                                                                      41
      STOP
                                                                               FLOW
                                                                                      42
   90 KFLOW = 3
                                                                               FLOW
                                                                                      43
  100 CALL UNIFRM
                                                                               FLOW
                                                                                      44
      IF (KFLOW - 2) 60, 70, 4000
                                                                                      45
                                                                               FLOW
                                                                                      46
                                                                               FLOW
      THIS SECTION SETS UP THE NON-UNIFORM ONSET FLOWS
C
                                                                               FLOW
                                                                                      47
                                                                               FLOW
                                                                                      48
  140 DO 3000 N = 1, NNON
                                                                               FLOW
                                                                                      49
       IERR = 0
                                                                               FLOW
                                                                                      50
C
                                                                               FLOW
                                                                                      51
      THE FEAGS READ IN HERE HAVE THE FOLLOWING VALUES ...
                                                                               FLOW
                                                                                      52
C
                                                                               FLOW
                                                                                      53
C
           FLAG
                                      MEANING
                                                                                      54
                                                                               FLOW
C
                                                                                      55
                                                                               FLOW
C
                                                                               FLOW
                                                                                      56
C
           KFL
                                     FLOW MATRIX-ASSOCIATION FLAG
                                                                               FLOW
                                                                                      57
C
                                     1 X=FLOW, 2 Y-FLCW, 3 Z-FLOW
                                                                               FLOW
                                                                                      58
C
                                                                                      59
                                                                               FLOW
           KUN
                                     O NON-UNIFORM FLOW, 1 UNIFORM FLOW
                                                                               FLOW
                                                                                      60
```

```
C
                                                                            FLOW
                                                                                   61
C
          KTYPE
                                    O INPUT FLOW VELOCITY COMPONENTS.
                                                                                   62
                                                                            FLOW
C
                                    1 INPUT FLOW NORMAL VELOCITY
                                                                            FLOW
                                                                                   63
                                                                            FLOW
                                                                                   64
      READ ( 5, 31 ) KFL, KUN, KTYPE
                                                                            FLOW
                                                                                   65
      KTEST = KFL - KFLOW
                                                                            FLOW
                                                                                   66
      IF (KTEST) 145, 220, 150
                                                                            FLOW
                                                                                   67
  145 WRITE (6, 146) KFLOW, FFL
                                                                            FLOW
                                                                                   68
  146 FORMAT (15H1+++++NOTE+++++ / 25HDAN INFUT FLOW FOR MATRIX. I3.
                                                                            FLOW
                                                                                   69
     1 38H PHYSICALLY PRECEDED A FLOW FOR MATRIX, 13 /
                                                                            FLOW
                                                                                   70
     2 26HOTHIS FLOW MUST BE SKIPPED //)
                                                                            FLOW
                                                                                   71
      IERR = 1
                                                                            FLOW
                                                                                   72
      GO TO 220
                                                                            FLOW
                                                                                   73
  150 IF (NU) 155, 155, 152
                                                                            FLOW
                                                                                   74
  152 IF (KTEST - 2) 170, 153, 160
                                                                                   75
                                                                            FLOW
  153 IF (KFL - 2) 145, 160, 161
                                                                            FLOW
                                                                                   76
  155 KFLOW = KFL
                                                                            FLOW
                                                                                   77
  156 IF (KFLOW - 2) 157, 158, 159
                                                                            FLOW
                                                                                   78
  157 AFLOW = .TRUE.
                                                                            FLOW
                                                                                   79
      GO TO 220
                                                                            FLOW
                                                                                   80
  158 BFLOW = .TRUE.
                                                                            FLOW
                                                                                   81
      GO TO 220
                                                                            FLOW
                                                                                   82
  159 CFLOW = .TRUE.
                                                                            FLOW
                                                                                   83
      GO TO 220
                                                                            FLOW
                                                                                   84
  160 IF (.NOT. AFLOW) GC TO 161
                                                                            FLOW
                                                                                   85
      KFLOW = 1
                                                                            FLOW
                                                                                   86
      CALL UNIFRM
                                                                            FLOW
                                                                                   87
  161 IF (.NOT. BFLOW) GO TO 162
                                                                            FLOW
                                                                                   88
      KFLOW = 2
                                                                            FLOW
                                                                                   89
      CALL UNIFRM
                                                                            FLOW
                                                                                   90
  162 KFLOW = KFL
                                                                            FLOW
                                                                                   91
      IF (KFLOW .EQ. 2) GO TO 158
                                                                            FLOW
                                                                                   92
      IF (CFLOW) GO TO 200
                                                                                   93
                                                                            FLOW
      GO TO 159
                                                                            FLOW
                                                                                   94
  170 KFLOW = KFL
                                                                            FLOW
                                                                                   95
      IF (NU .EQ. 0) GO TO 156
                                                                            FLOW
                                                                                   96
      IF (KFLOW - 2) 175, 180, 185
                                                                            FLOW
                                                                                   97
  175 IF (AFLOW) GO TO 200
                                                                            FLOW
                                                                                   98
      GO TO 157
                                                                            FLOW
                                                                                   99
  180 IF (BFLOW) GO TO 200
                                                                            FLOW 100
      GO TO 158
                                                                            FLOW 101
  185 IF (CFLOW) GO TO 200
                                                                            FLOW 102
      GO TO 159
                                                                            FLOW 103
  200 CALL UNIFRM
                                                                            FLOW 104
  220 NVREAD = NQUAD
                                                                            FLOW 105
      IF (KUN .GT. 0) NVREAD = 1
                                                                            FLOW 106
      IF ( KTYPE .NE. 0 ) GO TO 222
                                                                            FLOW 107
      READ ( 5, 40 ) ( VX(I), VY(I), VZ(I), I = 1, NVREAD )
                                                                            FLOW 108
      GO TO 224
                                                                            FLOW 109
  222 READ ( 5, 40 ) ( VNC(I), I = 1, NVREAD )
                                                                            FLOW 110
      DO 223 I = 1, NQUAD
                                                                            FLOW 111
      VX(I) = 0.0
                                                                            FLOW 112
      VY(I) = 0.0
                                                                            FLOW 113
  223 \ VZ(I) = 0.0
                                                                            FLOW 114
  224 IF ( IERR .NE. 0 ) GO TO 1200
                                                                            FLOW 115
      NVREAD = NQUAD + NCFF
                                                                            FLOW 116
      IF (KUN .LE. 0) IF (NOFF) 240, 240, 230
                                                                            FLOW 117
      00 225 NV = 2, NVREAD
                                                                            FLOW 118
      VX(NV) = VX(1)
                                                                            FLOW 119
      VY(NV) = VY(1)
                                                                            FLOW 120
```

```
225 VZ(NV) = VZ(1)
                                                                          FLOW 121
     GO TO 240
                                                                          FLOW 122
 230 \text{ NQP1} = \text{NQUAD} + 1
                                                                          FLOW 123
     DO 235 NV = NQP1, NVREAD
                                                                          FLOW 124
     VX(NV) = 0.0
                                                                          FLOW 125
     VY(NV) = 0.0
                                                                          FLOW 126
 235 \ VZ(NV) = 0.0
                                                                          FLOW 127
 240 IF ( KFLOW - 2 ) 600, 700, 800
                                                                          FLOW 128
 600 NAFLOW = NAFLOW + 1
                                                                          FLOW 129
     GO TO 900
                                                                          FLOW 130
 700 NBFLOW = NBFLOW + 1
                                                                          FLOW 131
     GO TO 988
                                                                          FLOW 132
 800 NCFLOW = NCFLOW + 1
                                                                          FLOW 133
 900 IF ( KTYPE .NE. 0 ) GO TO 1075
                                                                          FLOW 134
     DO 1050 J = 1, NQUAD
                                                                          FLOW 135
1050 VNC (J) = VX(J) + XNORM(J) + VY(J) + YNORM(J) + VZ(J) + ZNCRM(J)
                                                                          FLOW 136
1075 HRITE ( 3 ) KFLOW, (VX(K), VY(K), VZ(K), K = 1, NQ)
                                                                         FLOW 137
1100 WRITE (3) ( VNC(K), K = 1, NL )
                                                                         FLOW 138
                                                                         FLOW 139
     READ IN FIRST GUESSES FOR THE SIGNAS
                                                                         FLOW 148
1200 IF ( ISIG ) 3000, 3000, 1600
                                                                         FLOW 141
1600 READ (5, 40) ( VNC(K), K = 1, NQUAD )
                                                                         FLOW 142
                                                                         FLOW 143
     WRITE SIGNA GUESSES ON TAPE 3 AS DNE LOGICAL RECORD
                                                                         FLOW 144
                                                                         FLOW 145
     IF (IERR .EQ. 0) WRITE (3) (VNC(J), J = 1, NL)
                                                                         FLOW 146
3000 CONTINUE
                                                                         FLOW 147
     IF (NU .NE. 0) IF (KFLOW - 2) 60, 78, 4000
                                                                         FLOW 148
4000 REWIND 3
                                                                         FLOW 149
     IF ( AFLOW ) NMAT = 1
                                                                         FLOW 150
     IF ( BFLOW ) NMAT = NMAT + 1
                                                                         FLOW 151
     IF ( CFLOW ) NMAT = NMAT + 1
                                                                         FLOW 152
     NMATM1 = NMAT - 1
                                                                         FLOW 153
     NFLOW = NAFLOW + NBFLOW + NCFLOW
                                                                         FLOW 154
     WRITE(6, 9999) NAFLOW, NBFLOW, NCFLOW
                                                                         FLOW 155
     RETURN
                                                                         FLOW 156
     END
                                                                         FLOW 157
```

```
*DECK, UNIFRM
                                                                              UNIF
      SUBROUTINE UNIFRM
                                                                              UNIF
                                                                                      2
                                                                                      3
                                                                              UNIF
          SPECIAL FOR LEAKY QUADS
                                                                              UNIF
                                                                                      4
                                                                              UNIF
                                                                                      5
      COMMON / FLOW / NG, NL, KFLOW, VX(2000), VY(2000), VZ(2000),
                                                                                      6
                                                                              UNIF
     1 VNC(1000)
                                                                                      7
                                                                              UNIF
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                                      8
                                                                              UNIF
      COMMON /DFLOW/ AFLOW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW UNIF
                                                                                      9
      COMMON /NORMS/ XNORM(1800), YNORM(1800), ZNORM(1800)
                                                                              UNIF
                                                                                     10
      CONMON HEDR (15), MPR, PER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                              UNIF
                                                                                     11
     1 KASE,NOFF,NSYM, IFLAG,IFLOW,NCODE
                                                                              UNIF
                                                                                     12
      COMMON /QLEAK/ LEAK, FRACT
                                                                                     13
                                                                              UNIF
                                                                              UNIF
                                                                                     14
C
      THIS ROUTINE SETS UP THE UNIFORM DNSET FLOWS. FOR THESE FLOWS IT UNIF
                                                                                     15
C
      IS ONLY NECESSARY TO HAVE THO VELOCITY MATRICES. ONE ALL ZERCES
                                                                              UNIF
                                                                                     16
      AND THE OTHER ALL ONES. WE SHALL FILL VX WITH 0°S AND VY WITH 1°S. UNIF
                                                                                     17
                                                                              UNIF
                                                                                     18
      00 10 I = 1, NQ
                                                                              UNIF
                                                                                     19
      Q_{\circ}0 = (I)XV
                                                                                     20
                                                                              UNIF
   10 \text{ VY(I)} = 1.0
                                                                              UNIF
                                                                                     21
                                                                                     22
                                                                              UNIF
C
      NOW WE'LL TEST "KFLOW" TO DETERMINE WHAT FLOW TO SET UP FOR.
                                                                              UNIF
                                                                                     23
                                                                              UNIF
                                                                                     24
      IF ( KFLOW - 2 ) 20, 30, 40
                                                                              UNIF
                                                                                     25
                                                                              UNIF
                                                                                     26
C
      THIS PORTION SETS UP FOR "A" FLOW.
                                                                              UNIF
                                                                                     27
                                                                              UNIF
                                                                                     28
   20 NAFLOW = 1
                                                                              UNIF
                                                                                     29
      WRITE ( 3 ) KFLOW, ( VY(I), VX(I), VX(I), I = 1, NQ)
                                                                              UNIF
                                                                                     30
                                                                              UNIF
                                                                                     31
C.
      THIS IS A PATCH TO PROVICE FOR LEAKY QUADS. THESE MUST BE THE
                                                                              UNIF
                                                                                     32
C
      FIRST QUADS IN THE TABLE. THEY LEAK AT A FRACTION FRACT OF THE
                                                                              UNIF
                                                                                     33
C
      FREE-STREAM RATE.
                          ONLY THE A FLOW IS PROVIDED FOR HERE.
                                                                              UNIF
                                                                                     34
C
                                                                              UNIF
                                                                                     35
C
      LEAK = NO. OF LEAKY QUADS
                                                                              UNIF
                                                                                     36
                                                                              UNIF
                                                                                     37
      IF( LEAK .GT. 0 ) GO TO 21
                                                                              UNIF
                                                                                     38
      WRITE( 3) ( XNORM(I), I=1,NL)
                                                                              UNIF
                                                                                     39
      GO TO 50
                                                                                     40
                                                                              UNIF
   21 DO 22 I=1, LEAK
                                                                              UNIF
                                                                                     41
   22 VZ(I) = XNORM(I) + FRACT
                                                                              UNIF
                                                                                     42
      IF( LEAK .GE. NL ) GO TO 25
                                                                              UNIF
                                                                                     43
      LEAKP = LEAK + 1
                                                                              UNIF
                                                                                     44
      DO 24 I=LEAKP.NL
                                                                              UNIF
                                                                                     45
   24 VZ(I) = XNORM(I)
                                                                              UNIF
                                                                                     46
   25 WRITE( 3 ) ( VZ(I), I=1,NL )
                                                                              UNIF
                                                                                     47
      DO 26 I=1,NL
                                                                                     48
                                                                              UNIF
   26 \ VZ(I) = 0.0
                                                                              UNIF
                                                                                     49
      GO TO 50
                                                                              UNIF
                                                                                     50
                                                                              UNIF
                                                                                     51
C
      THIS PORTION SETS UP FOR *B FLOW.
                                                                              UNIF
                                                                                     52
                                                                              UNIF
                                                                                     53
   30 NBFLOW = 1
                                                                              UNIF
                                                                                     54
      WRITE ( 3 ) KFLCH, ( VX(I), VY(I), VX(I), I = 1, NQ)
                                                                              UNIF
                                                                                     55
      WRITE (3) ( YNORH(I), I = 1, NL)
                                                                              UNIF
                                                                                     56
      GO TO 50
                                                                              UNIF
                                                                                     57
                                                                              UNIF
                                                                                     58
C
      THIS PORTION SETS UP FOR "C" FLOW.
                                                                              UNIF
                                                                                     59
```

UNIF

60

```
WRITE ( 3 ) KFLOH, ( VX(I), VX(I), VY(I), I = 1, NQ )
                                                                            UNIF
                                                                                  62
      WRITE (3) ( ZNORM(I), I = 1, NL )
                                                                            UNIF
                                                                                  63
                                                                            UNIF
                                                                                  64
C
      CHECK FOR INPUT SIGMAS.
                                                                            UNIF
                                                                                  65
                                                                            UNIF
                                                                                  66
      IF ( ISIG .EQ. 0 ) RETURN
                                                                            UNIF
                                                                                  67
                                                                            UNIF
                                                                                  68
      READ THE SIGNA GUESSES INTO VZ.
                                                                            UNIF
                                                                                  69
                                                                            UNIF
                                                                                  70
      READ ( 5. 60 ) ( VZ(I), I = 1, NQUAD )
                                                                            UNIF
                                                                                  71
   60 FORMAT ( 6F10.8 )
                                                                            UNIF
                                                                                  72
                                                                            UNIF
                                                                                  73
C
      WRITE SIGHAS ON TAPE 3 AS ONE LOGICAL RECORD AND HANG IT UP. *TMR*UNIF
                                                                                  74
                                                                            UNIF
                                                                                  75
      WRITE ( 3 ) ( VZ(I), I = 1, NL )
                                                                            UNIF
                                                                                  76
      RETURN
                                                                            UNIF
                                                                                  77
      END
                                                                            UNIF
                                                                                  78
*DECK, VFORM
                                                                            VF OR
      SUBROUTINE VFORM
                                                                            VFOR
      REAL M12, M23, M34, M41 , IXX, IXY, IYY
                                                                            VFOR
                                                                            VFOR
      INTEGER TAPES
C
                                                                            VF OR
      LOGICAL
               AFLOW, BFLOW, CFLOW
                                                                            VFOR
      DIMENSION NTAPE(3), C41(335),
                                                                            VF OR
                                                                                   7
     1 XIJ1 (335), XIJ2 (335), XIJ3 (335), YIJ1 (335), YIJ2 (335),
                                                                            VFOR
                                                                                   9
     2 YIJ3 (335), ZIJ1 (335), ZIJ2 (335), ZIJ3 (335), XX1 ( 1340),
                                                                            VFOR
     3 XX2 (1340), XX3(1340), YY1(1340),YY2(1340),YY3(1340),ZZ1(1340),
                                                                            VF OR
                                                                                  10
     4 ZZ2(1340), ZZ3(1340), X(8),Y(8),Z(8), XC(335), YC(335), ZC(335), VFOR
                                                                                  11
     5 A11(335), A12 (335), A13 (335), A21(335), A22(335), A23(335),
                                                                            VFOR
                                                                                  12
     6 A31(335), A32 (335), A33 (335), XI1(335), XI2(335), XI3(335),
                                                                            VFOR
                                                                                  13
     7 XI4(335), ETA1(335), ETA2 (335), ETA4(335), TSQ(335), A (335),
                                                                            VF OR
                                                                                  14
     8 IXX(335), IXY (335), IYY (335), D12 (335), D23(335), D34(335)
                                                                            VFOR
                                                                                  15
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                            VFOR
                                                                                  16
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCOBE
                                                                            VFOR
                                                                                  17
      EQUIVALENCE ( XIJ1, YY1 (1) ), ( XC, YY1 (336) ), ( YC, YY1 (671)), VFOR
                                                                                  18
        ( ZC, YY1(1006) ), ( ETA4, XX1 ( 1 ) ), ( YIJ1, XX1 ( 336 ) ),
                                                                                  19
                                                                            VFOR
        ( XIJ2, YY2 (1) ), ( YIJ2, YY2 ( 336 )), ( A11, YY2 ( 671)),
                                                                            VFOR
                                                                                  20
     3
       ( A12 , YY2 (1006)), ( A13, XX1 (671)), ( TSQ, XX1 ( 1006 )),
                                                                            VFOR
                                                                                  21
                                                                            VFOR
        ( A21, YY3 (1) )
                               ( A22, YY3 ( 336)), ( A23, YY3 ( 671)),
                                                                                  22
                YY3 (100 E)),
                                (XIJ3, XX2 ( 1)), ( YIJ3, XX2 ( 336) ),
        CA
                                                                            VFOR
                                                                                  23
                                (A31 , ZZ1 (336 1), (A32 , ZZ1 ( 671)),
        (ZIJ1,
                 ZZ1 (1) ) ,
                                                                            VFOR
                                                                                  24
        ( A33,
                                ( IXX, XX2 ( 671)), ( D12, XX2 (1906) ), VFOR
     7
                 ZZ1 (180 ()).
                                                                                  25
                 ZZ2 (1) ) ,
                                                                            VF OR
        (ZIJ2,
                                ( XI1, ZZ2 (336 )), ( XI2, ZZ2 ( 671)),
                                                                                  26
                 ZZ2 (100 E)),
        (XI3.
                                (IXY, XX3 (1)), (D23, XX3 (336)),
                                                                            VFOR
                                                                                  27
               223 (1)),
                               ( ZIJ3, ZZ3(336 )), (XI4, ZZ3 ( 67.1)),
                                                                            VF OR
        (D34,
                                                                                  28
                               ( ETA2, XX3 (671)), ( IYY, XX3 ( 1006))
        ( ETA1, ZZ3 ( 1006)),
                                                                            VF OR
                                                                                  29
      COMMON /DFLOW/ AFLOW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLCW, NCFLO + VFOR
                                                                                  3 G
            RH01SQ, RH02SQ / 6.0, 16.0 /
                                                                            VF OR
      DATA
                                                                                  31
                                                                            VF OR
       DATA
              NTAPE
                                                                                  32
                                          / 1 , 11 , 12 /
 4004 FORMAT ( 1HO, 3HROW, 15,5), 6HX-FLOW)
                                                                            VFOR
                                                                                  33
 4005 FORMAT ( 1HO, 3HROW, I5, 5X, 6HY-FLOW)
                                                                            VFOR
                                                                                  34
 4006 FORMAT ( 1H0, 3MRON, 15,5X, 6HZ-FLOW)
                                                                                  35
                                                                            VFOR
      INEAR = 0
                                                                            VFOR
                                                                                  36
      INTERM = 0
                                                                            VF OR
                                                                                  37
```

UNIF

61

40 NCFLOW = 1

```
IFAR = 0
                                                                          VFOR
                                                                                 38
  10 IF ( NSYM - 1 ) 58, 52, 54
                                                                          VF OR
                                                                                 39
                                                                          VF OR
  52 ASSIGN 2100 TO 129
                                                                                40
     ASSIGN 910 TO I19
                                                                          VF OR
                                                                                 41
     GO TO 68
                                                                          VFOR
                                                                                 42
  54 ASSIGN 2200 TO 129
                                                                          VFOR
                                                                                 43
     IF ( NSYM .EQ. 3 ) GO TO 56
                                                                          VF OR
                                                                                 44
     ASSIGN 920 TO 119
                                                                          VFOR
                                                                                 45
     GO TO 60
                                                                          VF OR
                                                                                 46
  56 ASSIGN 930 TO I19
                                                                          VFOR
                                                                                 47
     GO TO 60
                                                                          VFOR
                                                                                 48
                                                                          VF'OR
  58 ASSIGN 2000 TO I19
                                                                                49
  60 LOOP = 2 ** NSYM + 1
                                                                          VFOR
                                                                                 50
     NEL = NGUAD / 3
                                                                          VFOR
                                                                                51
     NELL = NEL
                                                                          VFOR
                                                                                52
     NELP = NEL
                                                                          VFOR
                                                                                53
                                                                          VFOR
     NREM = MOD ( 3 * NEL + 1, 255 )
                                                                                 54
     IF ( NREM .LT. 5 .ANC. NREM .GT. ) NELP = NEL + 5
                                                                          VFOR
                                                                                55
     NON = NQUAD + NOFF
                                                                          VFOR
                                                                                56
     DO 8000 M = 1.3
                                                                          VFOR
                                                                                 57
     KROW = 0
                                                                          VFOR
                                                                                 58
 201 NT = NTAPE ( M )
                                                                          VFOR
                                                                                 59
 202 IF (M .NE, 3) GO TO 300
                                                                          VFOR
                                                                                60
     NEL = NOUAD - 2 * NEL
                                                                          VFOR
                                                                                61
     NELP = NEL
                                                                          VFOR
                                                                                 62
     NREM = MOD (3 + NEL + 1 , 255)
                                                                          VFOR
                                                                                 63
     IF ( NREM .LT. 5 .AND. NREM .GT. 1) NELP = NEL + 5
                                                                          VFOR
                                                                                 64
                                                                          VFOR
                                                                                 65
  READ 28 QUANTITIES
                                                                          VFOR
                                                                                 66
                                                                          VF OR
                                                                                 67
 300 DO 500 J = 1, NEL
                                                                          VFOR
                                                                                68
 500 READ (4) XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                          VF OR
                                                                                 69
    1 A22(J), A23(J), A31(J), A32(J), A33(J), XI1(J), ETA1(J), XI2( VFOR
                                                                                70
    2 J), ETA2(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                          VF OR
                                                                                71
    3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J)
                                                                          VFOR
                                                                                 72
 800 \text{ KROW} = \text{KROW} + 1
                                                                          VF OR
                                                                                 73
     READ ( 8 ) XNPP, YNPP, ZNPP
                                                                          VFOR
                                                                                74
     DO 2300 I1 = 1, NEL
                                                                                75
                                                                          VF OR
     00 1700 I2 = 1, LOOF
                                                                                 76
                                                                          VFOR
     IF ( I2 .EQ. LOOP ) GO TO I19, ( 2300, 910, 920, 930 )
                                                                          VFOR
                                                                                 77
     GO TO (1000, 910, 920, 910, 930, 910, 920, 910 ), I2
                                                                          VFOR
                                                                                 78
 910 YC ( I1 ) = - YC ( I1 )
                                                                          VFOR
                                                                                 79
     A12 (I1) = -A12 (I1)
                                                                          VFOR
                                                                                 80
     A22 (I1) = -A22 (I1)
                                                                          VFOR
                                                                                 81
     A31 (I1) = -A31 (I1)
                                                                          VFOR
                                                                                 82
     A33 (I1) = -A33 (I1)
                                                                          VFOR
                                                                                83
     GO TO 932
                                                                          VF OR
                                                                                 84
 920 \ ZC \ (I1) = - ZC \ (I1)
                                                                          VFOR
                                                                                 85
     A13 ( I1 ) = - A13 ( I1 )
                                                                          VF UR
                                                                                 86
     A23 (I1) = -A23 (I1)
                                                                          VFOR
                                                                                87
     A31 (I1) = - A31 (I1)
                                                                          VFOR
                                                                                 88
     A32 (I1) = -A32 (I1)
                                                                          VF OR
                                                                                 89
     GO TO 932
                                                                          VF OR
                                                                                 90
 930 \times (I1) = - \times (I1)
                                                                          VFOR
                                                                                 91
     A11 (I1) = -A11 (I1)
                                                                          VFOR
                                                                                 92
     A21 (I1) = - A21 (I1)
                                                                          VFOR
                                                                                 93
     A32 (I1) = -A32 (I1)
                                                                          VF OR
                                                                                 94
     A33 (I1) = -A33 (I1)
                                                                          VF OR
                                                                                 95
 932 IF ( 12 .EQ . LOOP ) GO TO 129, (
                                            2100. 2200
                                                                          VF OR
                                                                                 96
1000 XDIF = XNPP- XC ( I1 )
                                                                          VFOR
                                                                                 97
```

```
YDIF = YNPP- YC ( I1 )
                                                                         VF OR
       ZDIF = ZNPP- ZC ( I1 )
                                                                               98
                                                                         VFOR
                                                                              99
   COMPUTE DISTANCE FROM NULL FOINT TO DRIGIN OF J-TH ELEMENT COORDINATEVFOR 101
      SYSTEM ( J CORRESPONDS TO THE INDEX I1 )
                                                                         VF OR 112
   INEQUALITY ( 98 )
                                                                         VF OR 183
                                                                         VFOR 104
      ROSQ = XDIF ** 2 + YDIF ** 2 + ZDIF ** 2
                                                                         VFOR 185
      IF ( ROSQ .LT. RHO2SQ + TSQ ( I1 ) ) GO TO 1400
                                                                         VF OR 106
                                                                         VFOR 107
   COMPUTE INDUCED VELOCITY COPPONENTS
                                                                         VFOR 198
   EQUATION (97)
                                                                         VFOR 189
                                                                         VFOR 110
      IFAR = IFAR + 1
                                                                        VFOR 111
      ARG1 = A ( I1) / SQRT ( ROSQ ) ** 3
                                                                        VF OR 112
                                                                        VFOR 113
          (I2) = ARG1 * XDIF
                                                                        VFOR 114
          ( I2 ) = ARG1 + YDIF
                                                                        VFOR 115
         ( I2 ) = ARG1 * ZDIF
      Ζ
                                                                        VFOR 116
      GO TO 1700
                                                                        VFOR 117
  TRANSFORM NULL POINT TO J - ELEMENT COORDINATE SYSTEM
                                                                        VFOR 118
                                                                        VFOR 119
C EQUATION (78)
                                                                        VFOR 120
                                                                        VFOR 121
1400 XNP = A11 ( I1 ) * XDIF + A12 ( I1 ) * YDIF + A13 ( I1 ) * ZCIF
                                                                        VF OR 122
     YNP = A21 ( I1 ) * XDIF + A22 ( I1) * YDIF + A23 (I1) * ZDIF
                                                                        VFOR 123
     ZNP = A31 ( I1 ) * XBIF + A32 (I1) * YDIF + A33 (I1) * ZDIF
                                                                        VFOR 124
                                                                       VFOR 125
  INEQUALITIES ( 99) AND ( 100 )
                                                                        VF OR 126
     IF ( ROSQ .LT. RH01SQ * TSQ ( I1 ) ) GO TO 1410
                                                                        VFOR 127
                                                                        VFOR 128
 COMPUTE INDUCED VELOCITY COPPONENTS
                                                                        VFOR 129
  EQUATIONS (57) - (62)
                                                                       VFOR 130
                                                                       VFOR 131
                                                                       VFOR 132
     INTERM = INTERM + 1
     P = YNP ++2 + ZNP ++ 2 - 4.0 + XNP ++ 2
                                                                       VFOR 133
     QP= XNP **2 + ZNP ** 2 - 4.0 * YNP ** 2
                                                                       VFOR 134
     RO = SQRT ( ROSQ )
                                                                       VFOR 135
     ROP = RO ** (-7)
                                                                       VFOR 136
     WXXX = XNP + ( 9.0 + P + 30.0 + XVP ++ 2 ) + ROP
                                                                       VFOR 137
     WXXY = 3.0 + P + RCP + YNP
                                                                       VFOR 138
     WXYY = 3.0 * XNP * QP * ROP
                                                                       VFOR 139
     W YYY = YNP * ( 9.6 * QP + 38.8 * YNP ** 2 ) * ROP
                                                                       VFOR 148
     HXXZ = 3.0 + ZNP + P + ROP
                                                                       VFOR 141
             = - 15.8 * XNP * YNP * ZNP * ROP
                                                                       VFOR 142
     WXY7
     WYYZ = 3.0 + ZNP + QP + ROP
                                                                       VFOR 143
                                                                       VFOR 144
     ROP = -RO ** ( - 3)
                                                                       VFOR 145
     WX = ROP * XNP
                                                                       VFOR 146
     WY = ROP + YNP
     WZ = ROP * ZNP
                                                                       VFOR 147
     HIXX = .5 + IXX ( I1 )
                                                                       VFOR 148
     HIYY = .5 * IYY ( I1 )
                                                                       VFOR 149
     VX = - WXYY*HIYY - WXXY*IXY( I1) - WXXX*HIXX - WX*A( I1)
                                                                       VFOR 150
     VY = - WYYY*HIYY - WXYY*IXY( I1) - WXXY*HIXX - WY*A( I1)
                                                                       VFOR 151
     VZ = - WYYZ*HIYY - WXYZ*IXY( I1) - WXXZ*HIXX - WZ*A( I1)
                                                                       VFOR 152
                                                                       VFOR 153
     GO TO 1600
                                                                       VFOR 154
 COMPUTE INDUCED VELOCITY COMPONENTS
                                                                       VFOR 155
 EQUATIONS ( 42 ) - ( 49 )
                                                                       VFOR 156
                                                                       VFOR 157
```

```
VFOR 158
1410 \text{ ETA} 4M3 = \text{ET} 64 ( I1) - \text{ETA} ( I1 )
                                                                           VF OR 159
     INEAR = INEAR + 1
                                                                          VFOR 160
     RO = SQRT ( ROSQ )
                                                                          VFOR 161
     ETA2M1 = ETA2 ( I1 ) - ETA1 ( I1 )
                                                                          VF OR 162
     XI4M3 = XI4 (I1) - XI 3 (I1)
                                                                          VFOR 163
     XI2M1 = XI2 (I1 ) - XI1 (I1 )
                                                                          VFOR 164
     XI3M2 = XI3 (I1) - XI2 (I1)
                                                                          VFOR 165
     XI1M4 = XI1 ( I1 ) - XI4 ( I1 )
                                                                          VFOR 166
     XMXI 1 = XNP - XI1 ( I1 )
                                                                          VFOR 167
     XMXI2 = XNP - XI2 ( I1 )
                                                                          VFOR 168
     XMXI3 = XNP - XI3 ( I1 )
                                                                          VFOR 169
     XMXI4 = XNP - XI4 ( I1 )
                                                                          VFOR 170
     YMETA1= YNP - ETA1 ( I1 )
                                                                          VFOR 171
     YMETA 2 = YNP - ETA2 ( I1 )
                                                                          VFOR 172
     YMETA 4 = YNP - ETA4 ( I1 )
                                                                          VFOR 173
     ZNPSQ = ZNP + ZNP
                                                                          VFOR 174
     IF ( ZNPSQ .LT. TSQ ( I1 ) + 1.0E-6 ) ZNPSQ = 0.0
                                                                          VFOR 175
     E1 = ZNPSQ + XMXI1 ++2
                                                                          VFOR 176
     E2 = ZNPSQ + XMXI2 **2
                                                                          VFOR 177
     E3 = ZNPSQ + XMXI3 + 2
                                                                          VFOR 178
     E4 = ZNPSQ + XMXI4 + 2
                                                                          VFOR 179
     H1 = YMETA1 * XM XI1
                                                                          VFOR 180
     H2 = YMETA2 * XMXI2
                                                                          VFOR 181
     H3 = YMETA1 * XMXI3
                                                                          VFOR 182
     H4 = YMETA4 * XMXI4
                                                                          VFOR 183
     M12 = 0.0
                                                                          VFOR 184
     IF ( XI2M1 \cdotNE \cdot 0 \cdot 0) M12 = ETA2M1 / XI2M1
                                                                          VFOR 185
     M23 = 0.0
                                                                          VFOR 186
                                                                          VF OR 167
     IF ( X 13M2 \cdot NE \cdot 0 \cdot 0) M23 = - ETA2M1 / XI3M2
     M34 = 0.0
                                                                          VFOR 188
     IF ( XI4M3 •NE• 0.0) M34 = ETA4M3 / XI4M3
                                                                          VFOR 189
     M41 = 0.0
                                                                          VFOR 190
     IF ( XI1M4 _{3}NE_{4} C_{4}C) M41 = - ETA4M3 / XI1M4
                                                                          VF OR 191
     ANUM1 = M12 * E1 - H1
                                                                          VFOR 192
     ANUM2 = M12 + E2 + H2
                                                                          VFOR 193
     ANUM3 = M23 * E2 - H2
                                                                          VFOR 194
     ANUM4 = M23 * E3 - H3
                                                                          VFOR 195
     ANUM5 = M34 * E3 - H3
                                                                          VFOR 196
     ANUM6 = M34 * E4 - H4
                                                                          VFOR 197
     ANUM7 = M41 * E4 - H4
                                                                          VFOR 198
     ANUM8 = M41 * E1 - H1
                                                                          VFOR 199
     R 1 = SQRT (XMXI1 ++ 2 + YMETA1 ++ 2 + ZNPSQ)
                                                                          VFOR 200
     R2 = SGRT (XMXI2 ++ 2 + YMETA2 ++ 2 + ZNPSQ)
                                                                          VFOR 201
     R3 = SQRT ( XMXI3 ++ 2 + YMETA1 ++ 2 + ZNPSQ)
                                                                          VFOR 202
     R4 = SQRT ( XMXI4 ** 2 + YMETA4 ** 2 + ZNPSQ)
                                                                          VFOR 203
     Q25 = D12 (I1)
                                                                          VFOR 204
     Q26 = D23 (I1)
                                                                          VFOR 205
     Q27 = D34 (I1)
                                                                          VFOR 216
     Q28 = D41 ( I1 )
                                                                          VFOR 207
     VX = 0.0
                                                                          VFOR 208
     VY = 0.0
                                                                          VFOR 209
     VZ = 0.0
                                                                          VFOR 210
     IF ( Q25 ) 1420, 1430, 1420
                                                                          VFOR 211
1420 TEMP = R1 + R2
                                                                          VFOR 212
     TEMP1 = TEMP - Q25
                                                                          VFOR 213
     TEMP2 = TEMP + Q25
                                                                          VFOR 214
     ARG1 = 1.0
                                                                          VFOR 215
     IF I TEMP1 .NE. U.C. AND. TEMP2 .NE. U.U ) ARG1=ALOG(TEMP1/TEMP2) VFOR 216
     TEMP = ARG1 / Q25
                                                                          VFOR 217
```

```
VX = ETA2M1 + TEMP
                                                                           VFOR 218
                                                                           VFOR 219
      VY = - XI2M1 + TEMP
 1430 IF ( Q26 ) 1435, 1440, 1435
                                                                           VFOR 220
 1435 \text{ TEMP} = R2 + R3
                                                                           VFOR 221
      TEMP1 = TEMP - Q26
                                                                           VFOR 222
      TEMP2 = TEMP + Q26
                                                                           VFOR 223
      ARG2 = 1.0
                                                                           VFOR 224
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG2=ALOG(TEMP1/TEMP2) VFOR 225
      TEMP = ARG2 / Q26
                                                                           VFOR 226
      VX = VX - ETA2M1 * TEMP
                                                                           VFOR 227
      VY = VY - XI3H2 + TEMP
                                                                           VFOR 228
 1440 IF ( Q27 ) 1450, 1460, 1450
                                                                           VFOR 229
 1450 TEMP = R3 + R4
                                                                           VFOR 230
      TEMP1 = TEMP - Q27
                                                                           VFOR 231
      TEMP2 = TEMP + Q27
                                                                           VFOR 232
      ARG3 = 1.0
                                                                           VFOR 233
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG3=ALOG(TEMP1/TEMP2) VFOR 234
      TEMP = ARG3 / Q27
                                                                           VFOR 235
      VX = VX + ETA4M3 * TEMP
                                                                           VFOR 236
      VY = VY - XI4M3 * TEMP
                                                                           VFOR 237
 1460 IF ( Q28 ) 1470, 1480, 1470
                                                                           VFOR 238
 1470 TEMP = R4 + R1
                                                                           VFOR 239
      TEMP1 = TEMP - Q28
                                                                           VFOR 240
      TEMP2 = TEMP + Q28
                                                                           VFOR 241
      ARG4 = 1.0
                                                                           VFOR 242
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG4=ALOG(TEMP1/TEMP2) VFOR 243
      TEMP = ARG4 / Q28
                                                                           VFOR 244
      VX = VX - ETA4M3 * TEMP
                                                                           VFOR 245
      VY = VY - XI1M4 + TEMP
                                                                           VFOR 246
 1480 IF ( ZNPSQ .NE. 0.0 ) GO TO 1510
                                                                           VFOR 247
      TEST = SQRT(TSQ(I1) + 1.0E-3)
                                                                           VFOR 248
      IF(Q25.GT.TEST) IF((XMXI1*ETA2M1-YMETA1*XI2M1)/Q25) 1600,1502,1502 VFOR 249
 1502 IF(Q26.GT.TEST) IF((-XMXI2*ETA2M1-YMETA2*XI3M2)/Q26)1600.1504.1504VFOR 250
 1504 IF(Q27.GT.TEST) IF((XMXI3+ETA4M3-YMETA1+X14M3)/Q27) 1600,1506,1506VFOR 251
 1506 IF(Q28.GT.TEST) IF((-XMXI4+ETA4M3-YMETA4+XI1M4)/Q28)1600,1508,1508VFOR 252
 1508 VZ = 6.28318531E0
                                                                           VFOR 253
      GO TO 1600
                                                                           VFOR 254
 1510 IF (XI2M1 .NE. 0.0) VZ = ATAN(ANUM1/(ZNP*R1))-ATAN(ANUM2/(ZNP*R2)) VFOR 255
      IF (XI3M2 \cdot NE \cdot 0 \cdot 0) VZ = VZ + ATAN(ANUM3/(ZNP+R2)) - ATAN(ANUM4/(ZNF+R3)) VFOR 256
      IF (XI4M3 .NE. 0.0) VZ=VZ+ATAN(ANUM5/(ZNP*R3))-ATAN(ANUM6/(ZNP*R4)) VFOR 257
      ·IF (XI1M4 •NE• G•0)VZ=VZ+ATAN(ANUM7/(ZNP+R4))-ATAN(ANUM8/(ZNP+R1))VFOR 258
C
                                                                           VFOR 259
C
   TRANSFORM INDUCED VELOCITY COMPONENTS TO REFERENCE COORDINATE SISTEM VFOR 264
   EQUATION
              (79)
                                                                           VFOR 261
                                                                           VFOR 262
          ( 12) = A11 (11) + VX + A21 (11) + VY + A31 (11) + VZ
                                                                           VFOR 263
          (12) = A12 (I1) + VX + A22 (I1) + VY + A32 (I1) + VZ
                                                                           VEOR 264
      Y
          (I2) = A13 (I1) * VX + A23 (I1) * VY + A33 (I1) * VZ
                                                                           VFOR 265
 1700 CONTINUE
                                                                           VFOR 266
                                                                           VFOR 267
 2000 IF (.NOT. AFLOW) GC TO 2016
                                                                           VF OR 268
                                                                           VF OR 269
      XIJ1(I1) = X(1)
      YIJ1(I1) = Y(1)
                                                                           VFOR 270
      ZIJ1(I1) = Z(1)
                                                                           VFOR 271
 2010 IF (.NOT. BFLOW) GO TO 2020
                                                                           VFOR 272
      XIJ2(I1) = X(1)
                                                                           VFOR 273
      YIJ2(I1) = Y(1)
                                                                           VFOR 274
      ZIJ2(I1) = Z(1)
                                                                           VFOR 275
 2020 IF (.NOT. CFLOW) GO TO 2300
                                                                           VFOR 276
      XIJ3(I1) = X(1)
                                                                           VFOR 277
```

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YIJ3(I1) = Y(1)
                                                                   VFOR 278
    ZIJ3(I1) = Z(1)
                                                                   VFOR 279
    GO TO 2300
                                                                   VFOR 280
2100 IF ( .NOT. AFLOW) GO TO 2101
                                                                   VFOR 281
    XIJ1 (I1) = X (1) + X (2)
                                                                   VFOR 282
    YIJ1 (I1) = Y (1) + Y (2)
                                                                  VFOR 283
    ZIJ1 (I1) = Z (1) + Z (2)
                                                                   VFOR 284
2101 IF (.NOT. BFLOW) GO TO 2102
                                                                   VFOR 285
    XIJ2 (I1) = X (1) - X (2)
                                                                   VFOR 286
    YIJ2(I1) = Y(1) - Y(2)
                                                                   VFOR 287
    ZIJ2 (I1) = Z (1) - Z (2)
                                                                  VFOR 288
2102 IF (.NOT. CFLOW) GO TO 2300
                                                                  VFOR 289
    XIJ3 (I1) = X (1) + X (2)
                                                                   VFOR 290
    YIJ3 (I1) = Y (1) + Y (2)
                                                                  VFOR 291
    ZIJ3 (I1) = Z (1) + Z (2)
                                                                  VFOR 292
    GO TO 2300
                                                                  VFOR 293
2200 IF (.NOT. AFLOW ) GO TO 2201
                                                                  VFOR 294
    XIJ1 (I1) = X (1) + X (2) + X (3) + X (4)
                                                                  VFOR 295
    YIJ1 (I1) = Y (1) + Y (2) + Y (3) + Y (4)
                                                                  VF OR 296
    ZIJ1 (I1) = Z (1) + Z (2) + Z (3) + Z (4)
                                                                  VF OR 297
2201 IF (.NOT. BFLOW ) GO TO 2202
                                                                  VF.OR 298
    XIJ2(I1) = X(1) - X(2) - X(3) + X(4)
                                                                  VFOR 299
    YIJ2 (I1) = Y (1) - Y (2) - Y (3) + Y (4)
                                                                  VF OR 300
    ZIJ2(I1) = Z(1) - Z(2) - Z(3) + Z(4)
                                                                  VFOR 301
2202 IF (.NOT. CFLOW ) GO TO 2204
                                                                  VFOR 302
    XIJ3 (I1) = X (1) + X (2) - X (3) - X (4)
                                                                  VFOR 393
    YIJ3 (I1) = Y (1) + Y (2) - Y (3) - Y (4)
                                                                 VFOR 304
    ZIJ3(I1) = Z(1) + Z(2) - Z(3) - Z(4)
                                                                  VFOR 305
2204 IF ( NSYM .EQ. 2 ) GC TC 2300
                                                                  VFUR 306
    IF (.NOT. AFLOW ) GO TO 2205
                                                                  VF OR 307
    XIJ1 (I1) = XIJ1 (I1) - X (5) - X (6) - X (7) - X (8)
                                                                  VFOR 308
    YIJ1 (I1) = YIJ1 (I1) - Y (5) - Y (6) - Y (7) - Y (8)
                                                                  VFOR 389
    ZIJ1 (I1) = ZIJ1 (I1) - Z (5) - Z (6) - Z (7) - Z (8)
                                                                  VFOR 310
2205 IF (.NOT. BFLOW ) GO TO 2206
                                                                  VFOR 311
    XIJ2(I1) = XIJ2(I1) + X(5) - X(6) - X(7) + X(8)
                                                                  VFOR 312
    YIJ2 ( I1 ) = YIJ2 (I1) + Y ( 5 ) - Y ( 6 ) - Y ( 7 ) + Y ( 8 )
                                                                  VFOR 313
    ZIJ2 (I1) = ZIJ2 (I1) + Z (5) - Z (6) - Z (7) + Z (8)
                                                                  VFOR 314
2206 IF ( .NOT. CFLOW ) GO TO 2380
                                                                  VFOR 315
    XIJ3 (I1) = XIJ3 (I1) - X (5) - X (6) + X (7) + X (8)
                                                                  VFOR 316
    YIJ3 (I1) = YIJ3 (I1) - Y (5) - Y (6) + Y (7) + Y (8)
                                                                  WFOR 317
    ZIJ3(I1) = ZIJ3(I1) - Z(5) - Z(6) + Z(7) + Z(8)
                                                                  VFOR 318
2300 CONTINUE
                                                                  VFOR 319
 WRITE ONE ROW ON TAPE
                                                                  VFOR 320
                                                                  VFOR 321
    IF(AFLOW) WRITE(NT) (XIJ1(J), YIJ1(J), ZIJ1(J), J=1, NELP)
                                                                  VFOR 322
    IF(BFLOW) WRITE(NT) (XIJ2(J), YIJ2(J), ZIJ2(J), J=1, NELP)
                                                                  VF OR 323
    IF(CFLOW)WRITE(NT)
                           (XIJ3(J), YIJ3(J), ZIJ3(J), J=1, NELP)
                                                                  VFOR 324
                                                                  VF OR 325
    IF ( KROW .LT. NON ) GC TO 800
                                                                  VFOR 326
    REWIND 8
                                                                  VF OR 327
                                                                  VFOR 328
8000 REWIND NT
  42 FORMAT ( 1HO, 5X, 13FXIJ COMPONENT / ( 1H ; "F15.8))
                                                                  VFOR 329
  43 FORMAT ( 1H0, 5X, 13HYIJ COMPONENT / ( 1H & 1995 $ 8))
                                                                  VFOR 330
  44 FORMAT ( 1H0, 5X, 13HZIJ COMPONENT / ( 1H ) 3.8))
                                                                  VFOR 331
    IF ( MPR .EQ. 0 .OR. MPR .EQ. 2 ) GO TO 907.
                                                                  VFOR 332
    CALL HEADER
                                                                  VFOR 333
    DO 9060 K = 1, KRCW
                                                                  VFOR 334
    IND1 = 1 - NELL
                                                                  VFOR 335
    IND2 = 0
                                                                  VFOR 336
    I = 0
                                                                   VFOR 337
```

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VFOR 338
9003 IND1 = IND1 + NELL
                                                                          VFOR 339
     IND2 = IND2 + NELL
                                                                          VFOR 340
9002 I = I + 1
                                                                          VFOR 341
     NT = NTAPE ( I )
                                                                          VFOR 342
                              (XX1(J), YY1(J), ZZ1(J), J = IND1, INC2)
004 IF (AFLOW) READ(NT)
                                                                          VFOR 343
                                 (XX2(J),YY2(J),ZZ2(J),J=IND1,IND2)
     IF(BFLOW) READ(NT)
                                                                          VFOR 344
                                 (XX3(J), YY3(J), ZZ3(J), J=IND1, IN(2)
     IF (CFLOW) READ (NT)
                                                                          VFOR 345
     IF ( I - 2 ) 9003, 9008, 9050
                                                                          VFOR 346
9008 IND1 = IND2 + 1
                                                                          VFOR 347
     IND2 = IND2 + NEL
                                                                          VFOR 348
     GO TO 9002
                                                                          VFOR 349
9050 IF (.NOT. AFLOW) GO TO 9051
                                                                          VFOR 350
     WRITE ( 6, 4004 ) K
                                                                          VFOR 351
     WRITE ( 6, 42 )
                     ( XX1 (J), J = 1, NQUAD)
                                                                          VFOR 352
     WRITE ( 6, 43 )
                      ( YY1 (J), J = 1, NQUAD)
                                                                          VFOR 353
                     (ZZ1 (J), J = 1, NQUAD)
     WRITE ( 6, 44 )
                                                                          VFOR 354
9051 IF (.NOT. BFLOW ) GO TO 9052
                                                                          VFOR 355
     WRITE ( 6, 4005 ) K
                                                                          VFOR 356
     WRITE ( 6, 42 ) ( XX2 (J), J = 1, NQUAD )
                                                                          VFOR 357
     WRITE ( 6, 43 ) ( YY : (J), J = 1, NQUAD )
                                                                          VFOR 358
     WRITE ( 6, 44 ) ( ZZ2 (J), J = 1, NQUAD )
9052 IF ( .NOT. CFLOW ) GO TO 9060
                                                                          VFOR 359
                                                                          VFOR 360
     WRITE ( 6, 4006 ) K
                                                                          VFOR 361
     WRITE ( 6, 42 ) ( XX3 (J), J = 1, NQUAD )
                                                                          VFOR 362
     WRITE ( 6, 43 ) 1 \text{ YY3 (J)}, J = 1, NQUAC )
                                                                          VFOR 363
     WRITE ( 6. 44 ) ( ZZ3 (J), J = 1, NQUAD )
                                                                          VFOR 364
9868 CONTINUE
                                                                          VFOR 365
9070 REWIND 1
                                                                          VFOR 366
     REWIND 11
                                                                          VFOR 367
     REWIND 12
                                                                          VFOR 368
9075 WRITE ( 6, 4999 ) INEAR, INTERM, IFAR
4999 FORMAT ( 1HO, //16HONEAR ELEMENTS =, 17/ 24HOINTERMEDIATE ELEMENTS = VFOR 369
                                                                          VF OR 370
            / 15HOFAR ELEMENTS = , I7 )
    1 • I7
                                                                          VFOR 371
     WRITE(6, 9999)
                                                                          VFOR 372
9999 FORMAT( 1HO , 5X, 13 LEAVING VEORY)
                                                                          VFOR 373
     RETURN
                                                                          VFUR 374
     END
```

```
*DECK, AFORM
                                                                                AFOR
      SUBROUTINE AFORM
                                                                                AF OR
                                                                                        2
      REAL NX , NY , NZ
                                                                                AF OR
                                                                                        3
       LOGICAL
                         AFLCW, BFLOW, GFLOW
      COMMON /DFLOW/ AFLCW, BFLCW, CFLOW, NMAT, NMATW1, NAFLOW, NBFLOW, NCFLOW AFOR
                                                                                AFOR
                                                                                        4
                                                                                        5
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                                AFOR
      DIMENSION C(6000)
                                                                                       7
      DIMENSION NX( 1000), NY( 1000), NZ( 1000), NTAPE(3)
                                                                               AFOR
                                                                                       8
                                                                                AFOR
                                                                                       9
      DIMENSION A( 1000), XIJ( 1000), YIJ( 1000), ZIJ( 1000)
                                                                               AFOR
                                                                                      10
      DATA NTAPE
                                   / 9, 10, 13 /
  42 FORMAT ( 1H0, 5X, 13HXIJ COMPONENT / ( 1H , 7F15.8))
43 FORMAT ( 1H0, 5X, 13HYIJ COMPONENT / ( 1H , 7F15.8))
                                                                               AF OR
                                                                                      11
                                                                               AF OR
                                                                                      12
  44 FORMAT ( 1H0, 5x, 13HZIJ COMPONENT / ( 1H , 7F15.8))
                                                                               AFOR
                                                                                      13
  45 FORMAT ( 1H0, 3HROW, 16 )
                                                                               AFOR
                                                                                      14
  46 FORMAT(1H0, 5X, 3HAIJ / (1H, 7F15.8 ))
                                                                               AF OR
                                                                                      15
                                                                               AFOR
                                                                                      16
     IF (MPR .NE. 0) CALL HEADER
                                                                               AF OR
     NQNN1 = NQUAD + 2
                                                                                      17
     NQNN = MOD (NQNN1, 255)
                                                                               AFOR
                                                                                      18
                                                                               AFOR
                                                                                      19
     IF (NQNN .LT. 5 .AND. NGNN
                                      .GT. 0) NQNN1 = NQUAD + 5
     IF (NCODE .NE. 1) GO TO 20
                                                                               AFOR
                                                                                      20
     IF (NAFLOW) 2, 2, 1
                                                                               AF OR
                                                                                      21
                                                                               AFOR
   1 NF1 = NAFLOW
                                                                                      22
                                                                               AFOR
                                                                                      23
     GO TO 5
   2 IF (NBFLOW) 4, 4, 3
                                                                               AFOR
                                                                                      24
   3 NF1 = NBFLOW
                                                                               AFOR
                                                                                      25
                                                                               AFOR
                                                                                      26
     GO TO 5
                                                                               AF OR
   4 NF1 = NCFLOW
                                                                                      27
                                                                               AF OR
   5 NF2 = NFLOW - NF1
                                                                                      28
                                                                               AFOR
                                                                                     29
     L2 = 0
     DO 6 KK = 1, NF1
                                                                               AFOR
                                                                                     30
                                                                               AFOR
     L1 = L2 + 1
                                                                                     31
                                                                               AF OR
     L2 = L2 + NQUAD
                                                                                     32
                                                                               AFOR
                                                                                     33
     READ (3)
  6 READ (3) (C(K), K = L1, L2)
                                                                               AFOR
                                                                                     34
                                                                               AFOR
                                                                                     35
     LAST1 = L2
                                                                              AF OR
                                                                                     36
     IF (NF2 .EQ. D) GO TO 8
                                                                              AFOR
                                                                                     37
     DO 7 KK = 1, NF2
                                                                              AFOR
                                                                                     38
     L1 = L2 + 1
                                                                              AFOR
     L2 = L2 + NQUAD
                                                                                     39
                                                                              AFOR
                                                                                     40
     READ (3)
  7 READ (3) (C(K), K = L1, L2)
                                                                              AFOR
                                                                                     41
                                                                              AFOR
  8 DO 10 KK = 1, L2
                                                                                     42
                                                                              AFOR
                                                                                     43
 10 C(KK) = -C(KK)
                                                                              AFOR
     READ IN UNIT NORMAL VECTORS
                                                                                     44
 20 READ(4) (NX(I), NY(I), NZ(I), I = 1, NQUAD)
                                                                              AFOR
                                                                                     45
                                                                              AFOR
 FORM NORMAL VELOCITIES - EQUATION 102
                                                                                     46
                                                                              AFOR
 30 DO 1000 KK = 1, NQUAD
                                                                                     4.7
                                                                              AF OR
                                                                                     48
    00 1000 NM = 1. NMAT
    CALL ROWY (XIJ, YIJ, ZIJ, (KK * NM) / NMAT + NOFF, 0)
                                                                              AFOR
                                                                                     49
                                                                              AFOR
    DO 60 K= 1, NQUAD
                                                                                     50
 60 A (K) = NX(KK) + XIJ(K) + NY(KK) + YIJ(K) + NZ(KK) + ZIJ(K)
                                                                              AFOR
                                                                                     51
                                                                              AFOR
                                                                                     52
    IF( MPR.EQ. 0 ) GO TO 70
                                                                              AFOR
                                                                                     53
    WRITE(6,45) KK
                                                                              AFOR
    IF ( MPR .EQ. 2 ) GO TO 65
                                                                                     54
    WRITE(6,42) ( XIJ(14), 14 = 1, NQUAD ?
                                                                              AFOR
                                                                                     55
                                                                              AFOR
    WRITE (6,43) ( YIJ(I4), I4 = 1,NQUAD )
                                                                                     56
                                                                              AFOR
                                                                                     57
    WRITE (6,44) ( ZIJ(I4), I4 = 1,NQUAD )
                                                                              AFOR
                                                                                     58
    IF ( MPR - 2 ) 70, 65, 65
65 WRITE (6, 46) (A(I4), I4 = 1, NQUAD)
                                                                              AFOR
                                                                                    59
                                                                              AF OR
                                                                                    60
```

```
(A(I), I=1, NQUAD), (C(I), I=NT, L2, NQUAD)
                                                                                    AFOR
                                                                                           66
       GO TO 1000
                                                                                    AF OR
                                                                                           67
   500 \text{ NT} = \text{NTAPE(NM)}
                                                                                    AF OR
                                                                                           68
       IF (NM .EQ. 1) WRITE (8) NQNN1,
                                                      (A(I), I = 1, NQNN1)
                                                                                    AF OR
                                                                                           69
       WRITE ( NT ) NQNN1,
                                        (A(I), I = 1, NQNN1)
                                                                                    AFOR
                                                                                           76
 1886 CONTINUE
                                                                                   AFOR
                                                                                           71
       REWIND 8
                                                                                   AFOR
                                                                                          72
       REWIND 9
                                                                                   AFOR
                                                                                          73
       REWIND 10
                                                                                   AF OR
                                                                                           74
       REWIND 13
                                                                                   AF OR
                                                                                          75
       WRITE(6, 9999)
                                                                                   AFOR
                                                                                          76
 9999 FORMAT( 1HO , 5X, 13HLEAVING AFOR4)
                                                                                   AFOR
                                                                                           77
C
       RETURN
                                                                                   AF OR
                                                                                          78
       END
                                                                                   AFOR
                                                                                          79
*DECK. SOLVT
                                                                                   SOLV
                                                                                           1
       SUBROUTINE SOLVIT
                                                                                           2
                                                                                   SOLV
C
       SUBROUTINE SOLVIT (A, NI, MD, KD, NI, MM, NG, NW, *)
                                                                                            3
                                                                                   SOLV
       COMMON/SOLVE/ NI, MM, NO, KD, MB
                                                                                   SOLV
                                                                                            4
       COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NOFLG, NFLOW, ND,
                                                                                   SOLV
                                                                                            5
      1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                                   SOLV
                                                                                            6
       COMMON /SPACER/ A(14000)
                                                                                   SOLV
                                                                                           7
C
                                                                                           8
                                                                                   SOLV
C
                                                                                   SOLV
                                                                                           9
C
                                                                                   SOLV
                                                                                          10
Ċ
                                                                                   SOLV
                                                                                          11
C
                                        ***
                                                                                   SOLV
                                                                                          12
C
                                                                                   SOLV
                                                                                          13
C
                                                                                   SOLV
                                                                                          14
C
                                                                                   SOLV
                                                                                          15
C
                DIRECT
                                PATRIX
                                                SOLUTION
                                                                                   SOLV
                                                                                          16
C
                                                                                   SOLV
                                                                                          17
       HRITTEN BY J. L. HESS * PROGRAMMED BY T. M. RIDDELL
C
                                                                                   SOLV
                                                                                          18
C**** LANGUAGE
                                                                                   SOLV
                                                                                          19
C
                                                                                   SOLV
                                                                                          20
C
           FORTRAN IV
                                                                                   SOLV
                                                                                          21
C
                                                                                   SOLV
                                                                                          22
  ++++FUNCTIONAL DESCRIPTION
                                                                                   SOLV
                                                                                          23
C
                                                                                   SOLV
                                                                                          24
C
           THIS ROUTINE SOLVES THE REAL MATRIX EQUATION
                                                                                          25
                                                                                   SOLV
C
                                                                                   SOLV
                                                                                          26
C
                                                                                   SOLV
                                                                                          27
C
                     I
                            I
                                  I
                                          I
                                                I
                                                       I
                                                                                   SOLV
                                                                                          28
C
                     İ
                            I
                                   I
                                      8
                                         1
                                                I
                                                    C
                                                       I
                                                                                   SOLV
                                                                                          29
C
                     I
                            I
                                   I
                                         I
                                                I
                                                       I
                                                                                   SOLV
                                                                                          30
Ç
                                                                                   SOLV
                                                                                          31
C
                                                                                   SOLV
                                                                                          32
C
                                                                                   SOLV
                                                                                          33
C
                                     IF "A" IS THE REAL COEFFICIENT MATRIX
                                                                                   SOLV
                                                                                          34
C
                                                                                   SOLV
                                                                                          35
C
       FOR A SET OF SIMULTANEOUS EQUATIONS AND "C" IS THE MATRIX OF
                                                                                   SOLV
                                                                                          36
```

(A(I), I=1, NQUAD), (C(I), I=KK, LAST1, NQUAD)

AF OR

AF OR

AF OR

AFOR

AFOR

61

62

63

64

65

70 IF (NCODE .NE. 1) GO TO 500

IF (NM .NE. 1) GO TO 100

WRITE(8)

GO TO 1500

WRITE (10)

100 NT = KK + LAST1

```
SOLV
                                                                                     37
C
       CONSTANTS ( RIGHT-SICES ), THEN "3" WILL BE THE SOLUTIONS OF THE
                                                                              SOLV
                                                                                     38
C
                                                                              SOLV
                                                                                     39
C
       SET OF SIMULTANEOUS EQUATIONS. NOTE THAT IF "C" IS A UNIT MATRIX, SOLV
                                                                                     40
C
                                                                              SOLV
                                                                                     41
C
       "B" WILL BE THE INVERSE OF "A".
                                                                              SOLV
                                                                                     42
C
                                                                              SOLV
                                                                                     43
C*** ** CALL STATEMENT
                                                                              SOLV
                                                                                     44
C
                                                                              SOLV
                                                                                     45
C
           CALL SOLVIT ( AREA, N, M, KORE, NT1, NT2, NT3, NOUT, &NNN )
                                                                              SOLV
                                                                                     46
C
                                                                              SOLV
                                                                                     47
C
       WHERE
                                                                              SOLV
                                                                                     48
C
                                                                              SOLV
                                                                                     49
C
        "AREA" IS AN ARRAY ( DIMENSIONED FOR AT LEAST "KORE" WORDS )
                                                                              SOLV
                                                                                     50
C
                THAT IS USED BY "SOLVIT" FOR SCRATCH PURPOSES.
                                                                              SOLV
                                                                                     51
C
                AFTER A NORMAL RETURN FROM "SOLVIT", THIS ARRAY WILL
                                                                              SOLV
                                                                                     52
C
                CONTAIN THE 'B' MATRIX STORED IN COLUMNAR ORDER.
                                                                              SOLV
                                                                                     53
Ċ
                                                                              SOLV
                                                                                     54
C
         NI
                IS THE ORDER OF THE "A" MATRIX
                                                                              SOLV
                                                                                     55
C
                                                                              SOLV
                                                                                     56
C
                IS THE NUMBER OF COLUMNS IN "B" AND "C"
                                                                              SOLV
                                                                                     57
C
                                                                              SOLV
                                                                                     58
C
        *KORE * IS THE DIMENSIONED SIZE OF 'AREA' IN WORDS
                                                                              SOLV
                                                                                     59
C
                                                                              SOLV
                                                                                     60
C
        "NT1"
                IS THE LOGICAL FILE NUMBER OF THE INPUT DATA SET
                                                                              SOLV
                                                                                     61
C
                (THIS UNIT IS ALSO USED BY 'SOLVIT' AS A SCRATCH TAPLE)
                                                                              SOLV
                                                                                     62
C
                SEE BELOW FOR THE DESCRIPTION OF THE INPUT FORMAT
                                                                              SOLV
                                                                                     63
C
                                                                              SOLV
                                                                                     64
C
         *NT2*
                IS THE LOGICAL FILE NUMBER OF AN AVAILABLE SCRATCH UNIT
                                                                              SOLV
                                                                                     €5
C
                                                                              SOLV
                                                                                     66
         'NT3'
C
                IS THE LOGICAL FILE NUMBER OF AN AVAILABLE SCRATCH UNIT
                                                                              SOLV
                                                                                     67
C
                (NT1, NT2, AND NT3 MUST ALL HAVE DIFFERENT VALUES)
                                                                              SOLV
                                                                                     68
C
                                                                              SOLV
                                                                                     69
C
         "NOUT" IS THE LOGICAL FILE NUMBER OF THE OUTPUT DATA SET
                                                                              SOLV
                                                                                     70
C
                THE 'B" MATRIX IS WRITTEN ON 'NOUT' IN COLUMNAR ORDER,
                                                                              SOLV
                                                                                     71
C
                ONE LOGICAL RECORD PER COLUMN
                                                                              SOLV
                                                                                     72
C
                (*NOUT* MAY EQUAL NT1, NT2, OR NT3)
                                                                              SOLV
                                                                                    73
C
                                                                              SOLV
                                                                                    74
C
        "ANNN" IS THE FORTRAN STATEMENT NUMBER WHERE CONTROL IS TO BE
                                                                              SOLV
                                                                                    75
C
                TRANSFERRED IF "SOLVIT" JETERMINES THAT THE VALUE OF
                                                                              SOLV
                                                                                    76
C
                *KORE" IS TOO SHALL TO ALLOW THE COMPUTATION TO CONTINUE SOLV
                                                                                     77
C
                (A FORTRAN VARIABLE RETURN)
                                                                              SOLV
                                                                                    78
C
                                                                              SOLV
                                                                                    79
C+++++OUTPUT
                                                                              SULV
                                                                                    80
C
                                                                              SOLV
                                                                                    81
C
                           WRITTEN IN COLUMNAR ORDER COME LOGICAL RECORD
                                                                              SOLV
                                                                                    82
C
                           PER COLUMN) ON 'NOUT' AND STORED IN 'AREA'
                                                                              SOLV
                                                                                     83
                                                                              SOLV
                                                                                    84
C++++ STORAGE REQUIRED
                                                                              SOLV
                                                                                    65
C
                                                                              SOLV
                                                                                    86
C
          FSE HEXADECIMAL BYTES
                                                                              SOLV
                                                                                    87
C
                                                                              SOLV
                                                                                    88
C**** METHOD
                                                                              SOLV
                                                                                    89
C
                                                                              SOLV
                                                                                    90
C
          GAUSSIAN ELIMINATION
                                                                              SOLV
                                                                                     91
C
                NOTE ... THE ROWS ARE NOT NORMALIZED
                                                                              SOLV
                                                                                    92
C
                        THE PIVOT IS ASSUMED TO BE THE DIAGONAL ELEMENT
                                                                              SOLV
                                                                                    93
C
                                                                              SOLV
                                                                                    94
C****GENERAL NOTES
                                                                              SOLV
                                                                                    95
                                                                              SOLV
                                                                                    96
```

```
C
          THE VALUE OF "KORE" MUST BE SJFFICIENT TO STORE
                                                                          SOLV
                                                                               97
C
               MAXO ( 3 * (N + M) , N * M ) REAL VALUES
                                                                          SOLV
                                                                                98
                                                                          SOLV
                                                                                99
          THE "A" AND "C" MATRICES MUST BE INPUT IN ROW ORDER . . . .
                                                                          SOLV 100
C
               ONE LOGICAL RECORD PER ROW OF THE "A" AND "C" MATRICES
                                                                          SOLV 101
C
               I.E.,
                                                                          SOLV 102
C
                                                                          SOLV 103
C
                                                                          SOLV 104
C
            1 ROW OF THE "A" MATRIX . 1 ROW OF THE "C" MATRIX .
                                                                          SOLV 105
C
                                                                          SOLV 106
C
                ("N" REAL VALUES) .
                                            ("M" REAL VALUES)
                                                                          SOLV 197
C
                                                                          SOLV 108
C
                                                                          SOLV 109
C
                              ONE LOGICAL RECORD
                                                                          SOLV 110
C
                            ("N" + "M" REAL VALUES)
                                                                          SOLV 111
                                                                          SOLV 112
C
                                                                          SOLV 113
C
          'NOUT' IS NOT POSITIONED PRICE TO THE WRITING OF 'B'
                                                                          SOLV 114
                                                                          SOLV 115
                                                                          SOLV 116
      DIMENSION A ( KD )
                                                                          SOLV 117
C
                                                                          SOLV 118
      LOGICAL LAST
                                                                          SOLV 119
C
                                                                          SOLV 120
      NW = 3
                                                                          SOLV 121
     N = ND
                                                                          SOLV 122
      M = MD
                                                                          SOLV 123
      KORE = KD
                                                                          SOLV 124
      NPM = N + M
                                                                          SOLV 125
      IF (MAXO(3 + NPM, M + N) .LE. KORE) GO TO 5
                                                                          SOLV 126
2475 WRITE (6, 2480) NQUAG, MD , KORE
                                                                          SOLV 127
 2480 FORMAT (4H1THE, 14, 2H X, 13, 15H NATRIX EXCEEDS, 16, 7H WORDS.)
                                                                          SOLV 128
      CALL EXIT
                                                                          SOLV 129
   5 MT = MM
                                                                          SOLV 130
      REWIND MT
                                                                          SOLV 131
      NIN = NI
                                                                          SOLV 132
      REWIND NIN
                                                                          SOLV 133
      NOUT = NO
                                                                          SOLV 134
      REWIND NOUT
                                                                          SOLV 135
      MP1 = M + 1
                                                                          SOLV 136
      NN = N
                                                                          SOLV 137
      NEL = NPM
                                                                          SOLV 138
                                                                          SOLV 139
C - - CALCULATE THE MAXIMUM NO. OF ROWS, *K*
                                                                          SOLV 140
                                                                          SOLV 141
  10 K = (KORE - NEL) / NEL
                                                                          SOLV 142
                                                                          SOLV 143
 - - TEST TO SEE IF THE REST OF THE MATRIX WILL FIT IN CORE
                                                                          SOLV 144
C
                                                                          SOLV 145
     LAST = K .GE. NN
                                                                          SOLV 146
      IF (LAST) K = NN
                                                                          SOLV 147
                                                                          SOLV 148
  - - READ *K* ROWS OF THE AUGHENTED *A* MATRIX
                                                                          SOLV 149
                                                                          SOLV 150
   30 \text{ NT} = 0
                                                                          SOLV 151
      00 49 IB = 1, K
                                                                          SOLV 152
      NS = NT + 1
                                                                          SOLV 153
      NT = NT + NEL
                                                                          SOLV 154
   40 READ (NIN) (A(IO), IO = NS, NT)
                                                                          SOLV 155
                                                                          SOLV 156
```

```
- CHECK TO SEE IF WE WERE UNLUCKY ENOUGH TO END UP WITH ONLY ONE ROWSOLV 157
                                                                              SOLV 158
      IF (K .EQ. 1) GO TO 90
                                                                              SOLV 159
C
                                                                              SOLV 160
C
      *K" IS GREATER THAN *1" SO WE CAN START THE TRIANGULARIZATION
                                                                              SOLV 161
                                                                              SOLV 162
      NELP1 = NEL + 1
                                                                              SOLV 163
      NS = - NEL
                                                                              SOLV 164
      NELP2 = NELP1 + 1
                                                                              SOLV 165
C
                                                                              SOLV 166
C
   - FORM THE "TRAPEZOICAL" AFRAY
                                       (8)
                                                                              SOLV 167
                                                                              SOLV 168
      00 50 IB = 2, K
                                                                              SOLV 169
      NP = NELP2 - IB
                                                                              SOLV 170
      NS = NS + NELP1
                                                                              SOLV 171
      NT = NS
                                                                              SOLV 172
      00 50 I0 = IB, K
                                                                              SOLV 173
      NT = NT + NEL
                                                                              SOLV 174
      MN = NT
                                                                              SOLV 175
      NB = NS
                                                                              SOLV 176
      A(NT) = (-A(NT)) / A(NS)
                                                                              SOLV 177
      DO 50 NF = 2, NP
                                                                              SOLV 178
      MN = MN + 1
                                                                              SOLV 179
      NB = NB + 1
                                                                              SOLV 180
   50^{\circ} A(MN) = A(MN) + A(NT) + A(NB)
                                                                              SOLV 181
      IF (LAST) GO TO 98
                                                                              SOLV 182
                                                                              SOLV 183
C
      WRITE THE "TRAPEZOIDAL" MATRIX ON TAPE
                                                                              SOLV 184
C
                                                                              SOLV 185
      NT = 0
                                                                              SOLV 166
      NP = NEL
                                                                              SGLV 187
      NS = - NEL
                                                                              SOLV 188
      DO 60 IO = 1, K
                                                                              SOLV 189
      NS = NS + NELP1
                                                                              SOLV 190
      NT = NT + NEL
                                                                              SOLV 191
      WRITE (MT) NP, (A(IB), IB = NS, NT)
                                                                              SOLV 192
   60 NP = NP - 1
                                                                              SOLV 193
      NP = NP - M
                                                                              SOLV 194
      NS = KORE - NEL + 1
                                                                              SOLV 195
C
                                                                              SOLV 196
C
      READ ANOTHER ROW
                                                                              SOLV 197
                                                                              SOLV 198
      DO 80 IO = 1, NP
                                                                              SOLV 199
      READ (NIN) (A(IB), IB = NS, KORE)
                                                                              SOLV 230
                                                                              SOLV 201
C
    - MODIFY THIS ROW BY THE 'TRAPEZOIDAL' ARRAY
                                                                              SOLV 202
                                                                              SOLV 203
      NT = 1
                                                                              SOLV 204
      MN = NS
                                                                              SOLV 205
      DO 70 IB = 1, K
                                                                              SOLV 206
      NB = NT
                                                                              SOLV 207
      NF = MN + 1
                                                                              SOLV 208
      A(MN) = (-A(MN)) / A(NT)
                                                                              SOLV 209
      DO 65 NN = NF, KORE
                                                                              SOLV 210
      NB = NB + 1
                                                                              SOLV 211
   65 \text{ A(NN)} = \text{A(NN)} + \text{A(MN)} + \text{A(NB)}
                                                                              SOLV 212
      MN = NF
                                                                              SOLV 213
   70 NT = NT + NELP1
                                                                              SOLV 214
                                                                              SOLV 215
 -- WRITE THE MODIFIED RCW ON TAPE
                                                                              SOLV 216
```

```
C
                                                                                 SOLV 217
    80 WRITE (NOUT)
                          (A(NT), NT = MN, KORE)
                                                                                 SOLV 218
       REWIND NOUT
                                                                                 SOLV 219
       REWIND NIN
                                                                                SOLV 220
 C
                                                                                 SOLV 221
 C
    - SWITCH THE TAPES
                                                                                SOLV 222
                                                                                SOLV 223
       NT = NIN
                                                                                SOLV 224
       NIN = NOUT
                                                                                SOLV 225
       NOUT = NT
                                                                                SOLV 226
C
                                                                                SOLV 227
       RE-GALCULATE ROM LENGTH AND LOOF BACK
                                                                                SOLV 228
                                                                                SOLV 229
       NEL = NEL - K
                                                                                SOLV 230
       NN = NEL - M
                                                                                SOLV 231
       GO TO 10
                                                                                SOLV 232
C
                                                                                SOLV 233
C
       REWIND ALL TAPES
                                                                                SOLV 234
C
                                                                                SOLV 235
    90 REWIND MT
                                                                                SOLV 236
       REWIND NIN
                                                                                SOLV 237
       REWIND NOUT
                                                                                SOLV 238
C
                                                                                SOLV 239
C
   - - CONDENSE THE MATRIX
                                                                                SOLV 240
                                                                                SOLV 241
       NN = NEL
                                                                                SOLV 242
       NL = NELP1
                                                                                SOLV 243
       IF (K . EQ. 1) GO TO 105
                                                                                SOLV 244
       NS = 1
                                                                                SOLV 245
       NT = NEL
                                                                                SOLV 246
       DO 100 IB = 2, K
                                                                                SOLV 247
       NS = NS + NELP1
                                                                                SOLV 248
      NT = NT + NEL
                                                                                SOLV 249
       00 100 IO = NS. NT
                                                                                SOLV 250
       A(NL) = A(IO)
                                                                                SOLV 251
  100 NL = NL + 1
                                                                                SOLV 252
  105 \text{ N1} = \text{KORE} - \text{K} + \text{M} + \text{1}
                                                                                SOLV 253
                                                                                SOLV 254
 - - THERE, NOW WE CAN START THE BACK-SOLUTION
C
                                                                                SOLV 255
 * * NOTE .. THE FIRST AVAILABLE LOCATION FOR THE SCLUTIONS IS A(N1)
                                                                                SOLV 256
                                                                                SOLV 257
      NREM = N
                                                                               SOLV 258
      NEL = NPM
                                                                               SOLV 259
      LAST = K .EQ. N
                                                                                SOLV 260
      NPASS = 0
                                                                               SOLV 261
                                                                               SOLV ZEZ
 - - SOLVE FOR THE ANSWERS COFRESPONDING TO "K" ROWS
C
                                                                               SOLV 263
                                                                               SOLV 264
  110 \text{ KM1} = \text{K} - 1
                                                                               SOLV 265
      KP1 = K + 1
                                                                               SOLV 266
      NS = NL - MP1
                                                                               SOLV 267
      NPASS = NPASS + 1
                                                                               SOLV 268
      00 139 MN = 1, M
                                                                               SOLV 269
      NF = NS + MN
                                                                               SOLV 278
      A(NF) = A(NF) / A(NS)
                                                                               SOLV 271
      NT = NS
                                                                               SOLV 272
      IF (KM1 .EQ. 0) GO
                           TO 130
                                                                               SOLV 273
      00 125 IB = 1, KM1
                                                                               SOLV 274
      NF = NF - IB - M
                                                                               SOLV 275
      NT = NT - MP1 - IB
                                                                               SOLV 276
```

```
SOLV 277
      SUM = 0.0
                                                                           SOLV 278
      NP = NF
      N2 = MP1 + IB
                                                                           SOLV 279
                                                                           SOLV 280
      00 120 I0 = 1, IB
                                                                           SOLV 281
      NN = NT + IO
      NP = NP + N2 - I0
                                                                           SOLV 282
  120 SUM = SUM + A(NN) + A(NP)
                                                                           SOLV 283
  125 A(NF) = (A(NF) - SUM) / A(NT)
                                                                           SOLV 284
                                                                           SOLV 285
  130 CONTINUE
                                                                           SOLV 286
C - - MOVE THE SOLUTIONS TO CONTIGUOUS LOCATIONS STARTING AT A (N1)
                                                                           SOLV 287
                                                                           SOLV 288
      N1 = KORE + 1
                                                                           SOLV 289
                                                                           SOLV 290
      DO 149 NN = 1. K
      DO 135 MN = 1, M
                                                                           SOLV 291
                                                                           SOLV 292
      NL = NL - 1
      N1 = N1 - 1
                                                                           SOLV 293
                                                                           SOLV 294
  135 A(N1) = A(NL)
  140 NL = NL - NA
                                                                           SOLV 295
C
                                                                           SOLV 296
C - - WRITE THE SOLUTIONS ON TAPE
                                                                           SOLV 297
                                                                           SOLV 298
                                                                           SOLV 299
      WRITE (NIN) K
      NS = N1 - 1
                                                                           SOLV 300
      DO 145 MN = 1, M
                                                                           SOLV 301
      NT = NS + MN
                                                                           SOLV 302
                                                                           SOLV 303
  145 WRITE ( NIN ) (A(I(), IO = NT, KORE, M)
                                                                           SOLV 304
C - - TEST IF THIS IS THE LAST PASS
                                                                           SOLV 305
                                                                           SOLV 306
C
      IF (LAST) GO TO 200
                                                                           SOLV 307
                                                                           SOLV 308
C
 - - WE MUST NOW MODIFY THE TRIANGULAR MATRIX TO REFLECT THE EFFECT OF SOLV 339
      THE SOLUTIONS OBTAINED SC FAR (EQ 21)
                                                                           SOLV 310
    * NOTE..LOCATIONS A(1) TO A(N1-1) ARE NOW FREE TO USE
                                                                           SOLV 311
                                                                           SOLV 312
 - - CALCULATE THE NEXT VALUES OF "NEL" AND "NREM"
                                                                           SOLV 313
                                                                           SOLV 314
      NELOLD = NEL
                                                                           SOLV 315
      KOLD = K
                                                                           SOLV 316
                                                                           SOLV 317
      NEL = NEL - K
                                                                           SOLV 318
      NREM = NREM - K
                                                                           SOLV 319
C
C - - NOW APPLY THE INCREDIBLE FORMULA FOR THE NEW *K*
                                                                           SOLV 320
                                                                           SOLV 321
      K = (-4 + M - 1) / 2 + IFIX(SQRT().25 + FLOAT((4 + M + 2) + M + 4))
                                                                           SOLV 322
     1 2 * (KORE - NELOLC))))
                                                                           SOLV 323
      NROW = NREM - K + 1
                                                                           SOLV 324
      IF (K .LT. NREM) GO TO 150
                                                                           SOLV 325
                                                                           SOLV 326
      LAST = .TRUE.
      NROW = 1
                                                                           SOLV: 327
                                                                           SOLV 328
      K = NREM
                                                                           SOLV 329
  150 NS = 1
      NT = NELOLD + 1
                                                                           SOLV 330
                                                                           SOLV 331
 - - READ IN THE ROWS TO BE MODIFIED
                                                                           SOLV 332
                                                                           SOLV 333
      DO 190 IB = 1, NREM
                                                                           SOLV 334
      NT = NT - 1
                                                                           SOLV 335
      IF (IB .LE. NROW) GO TO 160
                                                                           SOLV 336
```

```
NS = NS + NN
                                                                              SOLV 337
      NT = NT + NN
                                                                              SOLV 338
  160 READ ( MT ) NN, (A(IC), IO = NS, NT)
                                                                              SOLV 339
      NP = N1 - 1
                                                                              SOLV 340
      NF = NT - M - KM1
                                                                              SOLV 341
      NN = NN - KOLD
                                                                              SOLV 342
      DO 170 MN = 1, M
                                                                              SOLV 343
      N2 = NF
                                                                              SOLV 344
      NA = NP + MN
                                                                              SOLV 345
      NB = NA
                                                                              SOLV
                                                                                   346
      SUM = 9.0
                                                                              SOLV 347
      00 165 IO = 1, KOLC
                                                                              SOLV 348
      SUM = SUM + A(N2) + A(NA)
                                                                              SOLV 349
      N2 = N2 + 1
                                                                              SOLV 350
  165 NA = NA + M
                                                                              SOLV 351
      N2 = N2 + MN - 1
                                                                              SOLV 352
  170 \text{ A(N2)} = \text{A(N2)} - \text{SUM}
                                                                              SOLV 353
                                                                              SOLV 354
                                                                              SQLV 355
C - - WRITE THE MODIFIED ROW ON TAPE OR CONDENSE THE ROW
                                                                              SOLV 356
      NL = NT - M + 1
                                                                              SOLV 357
      IF (IB .GE. NROW) GO TO 175
                                                                              SOLV 358
      NF = NL - KP1
                                                                              SOLV 359
      WRITE (NOUT) NN, (A(IO), IO = NS, NF), (A(IO), IO = NL, NT)
                                                                              SOLV 360
      GO TO 190
                                                                              SOLV 361
  175 NF = NL - KOLD
                                                                              SOLV 362
      DO 180 MN = NL. NT
                                                                              SOLV 363
      A(NF) = A(MN)
                                                                              SOLV 364
  180 \text{ NF} = \text{NF} + 1
                                                                              SOLV 365
  190 CONTINUE
                                                                              SOLV 366
      REWIND MT
                                                                              SOLV 367
      REWIND NOUT
                                                                              SOLV 368
                                                                              SOLV 369
   - SWITCH THE TAPES
                                                                              SOLV 370
C
C
                                                                              SOLV 371
      NT = MT
                                                                              SOLV 372
      MT = NOUT
                                                                              SOLV 373
      NOUT = NT
                                                                              SOLV 374
C
                                                                              SOLV 375
C
    - LOOP BACK THRU THE SOLUTION
                                                                              SOLV 376
C
                                                                              SOLV 377
      NL = NF
                                                                              SOLV 378
      GO TO 110
                                                                              SOLV 379
                                                                              SOLV 380
   - START TO WRAP IT UP
                                                                              SOLV 381
                                                                              SOLV 382
  200 REWIND NIN
                                                                              SOLV 363
      N2 = N
                                                                              SOLV 384
                                                                              SOLV 385
C + + NOTE.. AT THIS POINT ALL LOCATIONS A(1) THRU A(KORE) ARE FREE
                                                                              SOLV 386
C
                                                                              SOLV 387
      DO 220 IB = 1. NPASS
                                                                              SOLV 368
      READ (NIN) K
                                                                              SOLV 389
      N1 = N2 - K + 1
                                                                              SOLV 390
      NS = N1
                                                                              SOLV 391
      NT = N2
                                                                              SOLV 392
C
                                                                              SOLV 393
C
    - READ IN THE SOLUTIONS
                                                                              SOLV 394
                                                                              SOLV 395
      00 210 I0 = 1, M
                                                                              SOLV 396
```

```
READ (NIN) (A(NN), NN = NS, NT)
                                                                            SOLV 397
      NT = NT + N
                                                                            SOLV 398
  210 NS = NS + N
                                                                            SOLV 399
  220 N2 = N1 - 1
                                                                            SOLV 400
                                                                            SOLV 401
  - - WRITE THE SOLUTIONS ON TAPE
                                                                            SOLV 402
                                                                            SOLV 403
      NT = 0
                                                                            SOLV 484
      00 230 I0 = 1, M
                                                                            SOL 4 405
      NS = NT + 1
                                                                            SOLV 406
      NT = NT + N
                                                                            SOLV 407
  230 WRITE (NW) (A(NN), NN = NS, NT)
                                                                            SOLV 488
                                                                            SOLV 409
      WRITE (6, 300) N, N, M
                                                                            SOLV 410
  300 FORMAT (4HOTHE, 15, 2H X, 15, 12H MATRIX WITH, 14, 33H RIGHT SICES WASOLV 411
     1S SOLVED DIRECTLY.)
                                                                            SOLV 412
C
      RETURN
                                                                            SOLV 413
      END
                                                                            SOLV 414
```

```
*DECK, SIGMA
                                                                              SIGH
                                                                                      1
      SUBROUTINE SIGMA
                                                                              SIGM
C
      SUBROUTINE SIGMA ( NSKIP )
                                                                              SIGH
                                                                                      3
      COMMON /SIG/ NSKIP
                                                                              SIGM
      DIMENSION L (100), C( 6000), DSIG1(100)
                                                                              SIGM
      DIMENSION A (1988)
                                                                              SIGM
      DIMENSION SIG(6000)
                                                                              SIGN
                                                                                      7
      COMMON HEDR(15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFL OW, NQUAD,
                                                                              SIGM
     1 KASE, NOFF, NSYM, IFLAG, I FLOW, NCODE
                                                                              SIGM
                                                                                     9
      COMMON / ATAPE / NCOPY
                                                                              SIGM
                                                                                    10
       NT = NCOPY + 8
                                                                              SIGM
      NTAPE = NCOPY
                                                                              SIGM
                                                                                    12
      IF ( ISIG .NE. 0 ) GO TO 1
                                                                              SIGM
                                                                                    13
      M = 2
                                                                              SIGM
      GO TO 2
                                                                              SIGM
                                                                                    15
    1 M = 3
                                                                              SIGM
                                                                                    16
    2 IF (NSKIP .EQ. 0) GO TO 11
                                                                              SIGM
                                                                                    17
      N = M + NSKIP
                                                                              SIGM
                                                                                    18
      DO 3 K = 1, N
                                                                                    19
                                                                              SIGM
    3 READ(3)
                                                                             SIGH
                                                                                    20
   11 N1 = 1
                                                                             SIGM
                                                                                    21
      N2 = NQUAD
                                                                             SIGM
                                                                                    22
      DO 5 I = 1, NCFLG
                                                                             SIGM
                                                                                    23
      READ (3)
                                                                             SIGM
                                                                                    24
      READ(3) ( C(K), K = N1, N2)
                                                                             SIGM
                                                                                    25
      IF( ISIG .NE. 6) READ (3) (SIG(K), K = N1, N2)
                                                                              SIGM
                                                                                    26
      N1 = N2 + 1
                                                                             SIGM
                                                                                    27
   5 N2 = N2 + NQUAD
                                                                             SIGM
                                                                                    28
      N = (NFLOW - NSKIP - NCFLG) * N + NSKIP
                                                                             SIGM
                                                                                    29
      IF ( N .EQ. 0 ) GO TO 67
                                                                             SIGH
                                                                                    30
      00 66 K = 1, N
                                                                             SIGM
                                                                                    31
  66 READ (3)
                                                                             SIGM
                                                                                    32
  67 ITER = 0
                                                                             SIGM
                                                                                    33
      NCONV = 0
                                                                             SIGM
                                                                                    34
      DO 12 J = 1, NCFLG
                                                                             SIGM
                                                                                    35
     L(J) = 0
                                                                             SIGM
                                                                                    36
      JN = NQUAD + (J - 1)
                                                                             SIGH
                                                                                    37
```

```
DO 12 I = 1, NQUAD
                                                                                38
                                                                         SIGN
     K1 = I + JN
                                                                          SIGM
                                                                               39
 12 IF( ISIG .EQ. 0) SIG(K1) = 0.0
                                                                         SIGM
                                                                                40
  20 DO 22 I = 1, NCFLG
                                                                         SIGM
                                                                                41
  22 DSIG1 (I) = 0.6
                                                                         SIGN
                                                                                42
     DO 80 I= 1, NQUAC
                                                                         SIGM
                                                                                43
     READ ( NTAPE ) NQ, ( A(J), J = 1, NQUAD )
                                                                         SIGM
                                                                                44
     DO 80 J = 1, NCFLG
                                                                         SIGM
                                                                                45
     IF( L(J) .NE. 5) GO TO 80
                                                                         SIGM
                                                                                46
     SUM = 0.0
                                                                         SIGM
                                                                                47
     JN = NQUAD + (J - 1)
                                                                         SIGM
                                                                                48
     DO 60 K = 1, NQUAD
                                                                         SIGM
                                                                                49
     K2 = K + JN
                                                                         SIGM
                                                                                50
 60 SUM = SUM + A(K) + SIG(K2)
                                                                         SIGN
                                                                                51
     K1 = I + JN
                                                                         SIGM
                                                                                52
     DSIG2 = (-C(K1) - SUM) / A(I)
                                                                         SIGM
                                                                                53
     SIG(K1) = SIG(K1) + CSIG2
                                                                         SIGM
                                                                                54
     DSIG1(J) = AMAX1(ABS(DSIG2), DSIG1(J))
                                                                                55
                                                                         SIGM
 80 CONTINUE
                                                                         SIGM
                                                                                56
      ITER = ITER + 1
                                                                         SIGM
                                                                                57
     REWIND NTAPE
                                                                         SIGM
                                                                                58
     IF( IPRS .EQ. 0) GO TO 85
                                                                         SIGM
                                                                                59
     WRITE(6,9998) ITER
                                                                         SIGM
                                                                                6 C
9998 FORMAT(1H , 5X, 17H ITERATION NOS. , I3)
                                                                         SIGM
                                                                                61
     DO 82 K = 1, NCFLG
                                                                         SIGM
                                                                                62
     K1 = NQUAD + (K-1) + 1
                                                                         SIGM
                                                                                63
     K2 = K1 + NQUAD
                                                                         SIGM
                                                                                64
  82 WRITE(6, 10) K , ( SIG(I), I = K1, K2)
                                                                         SIGM
                                                                                65
  10 FORMAT ( 1H , 5X, 12H FLCW NUMBER , 14 / ( 5X, 6F15.8))
                                                                         SIGM
                                                                                66
  85 DO 400 J = 1 , NCFLG
                                                                         SIGM
                                                                                67
     IF( L(J) .NE. 8) GO TO 400
                                                                         SIGM
                                                                                68
     IF(DSIG1(J) .GE. 1.GE-4) GO TO 400
                                                                         SIGM
                                                                                69
     L(J) = ITER
                                                                         SIGM
                                                                                70
     NCONV = NCONV + 1
                                                                         SIGM
                                                                                71
     IF ( NCONV .EQ. NCFLG ) GO TO 501
                                                                                72
                                                                         SIGM
 400 CONTINUE
                                                                         SIGM
                                                                                73
     NTAPE = NT - NTAPE
                                                                         SIGM
                                                                                74
     IF ( ITER - 100) 20, 500, 20
                                                                         SIGM
                                                                                75
 500 DO 650 J = 1, NCFLG
                                                                         SIGM
                                                                                76
     IF ( L ( J ) .EQ. 0 ) GC TC 550
                                                                         SIGM
                                                                                77
     WRITE ( 6, 6 ) L ( J )
                                                                         SIGM
                                                                                78
   6 FORMAT (1H0, 5x, I5, 2x, 35HITERATIONS REQUIRED FOR CONVERGENCE ) SIGN
                                                                                79
     GO TO 650
                                                                                80
 550 WRITE ( 6, 7 )
                                                                         SIGM
                                                                                81
   7 FORMAT (1H0, 8X, 35HNO CONVERGENCE AFTER 180 ITERATIONS )
                                                                         SIGM
                                                                                82
     K1 = NQUAD + (J-1) + 1
                                                                         SIGM
                                                                                83
     K2 = K1 + NQUAD
                                                                         SIGM
                                                                                84
     WRITE(6,8) \quad (SIG(I), I = K1, K2)
                                                                         SIGM
                                                                                85
   8 FORMAT( 1H , 5X, 8F12.7)
                                                                         SIGM
                                                                                86
 650 CONTINUE
                                                                         SIGM
                                                                                87
     NN = NQUAD
                                                                         SIGM
                                                                                88
     M = MOD(NN, 255)
                                                                         SIGM
                                                                                89
     IF (M .LT. 5 .AND. M .GT. 0) NN = NN + 5
                                                                         SIGM
                                                                                90
     N1 = 1
                                                                         SIGM
                                                                                91
     DO 675 J = 1, NCFLG
                                                                         SIGM
                                                                                92
     WRITE (3) (SIG(K), K = N1, NN)
                                                                         SIGM
                                                                                93
     N1 = N1 + NQUAD
                                                                         SIGM
                                                                                94
675 NN = NN + NQUAD
                                                                         SIGM
                                                                                95
     REWIND 3
                                                                         SIGM
                                                                                96
     WRITE(6, 9999)
                                                                         SIGM
                                                                                97
```

```
*DECK, ATAPS
                                                                                ATAP
       SUBROUTINE ATAPES
                                                                                ATAP
                                                                                        2
C
       SUBROUTINE ATAPES ( KFLOW )
                                                                                ATAP
       COMMON /TAPES/ KFLOW
                                                                                ATAP
                                                                                AT AP
                                                                                        5
   - - DEFINITION OF ARGUMENTS
                                                                                ATAP
                                                                                ATAP
                                                                                        7
C
       NQ
                     NUMBER OF VALUES OF "A" PER RECORD
                                                                                ATAP
C
       KFLOW
                     FLOW-FLAG, 1 = A-FLOW, 2 = 8-FLCW, 3 = C-FLCW
                                                                                ATAP
                                                                                        9
       NCOPY
                     TAPE NUMBER TO BE USED BY PROMAP
                                                                                ATAP
                                                                                       10
                                                                                ATAP
                                                                                       11
       COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                                ATAP
                                                                                       12
      1 KASE, NOFF, NSYH, IFLAG, IFLOW, NCODE
                                                                                ATAP
                                                                                       13
       COMMON / ATAPE / NCOPY
                                                                                ATAP
                                                                                       14
       DIMENSION A (1008), NLINE (500), NLT (500), XNULL (1800), YNULL (1006),
                                                                                ATAP
                                                                                       15
     1 ZNULL(1900), XNORM(1000), YNORM(1000), ZNORM(1000), XOFF(1000),
                                                                                ATAP
                                                                                       16
      2 YOFF (1000), ZOFF (1008)
                                                                                ATAP
                                                                                       17
       IF ( KFLOW - 2 ) 100, 200, 300
                                                                                ATAP
                                                                                       18
  100 NCOPY = 9
                                                                                ATAP
                                                                                       19
       GO TO 1000
                                                                                ATAP
                                                                                      20
  200 NCOPY = 10
                                                                                AT AP
                                                                                       21
       GO TO 400
                                                                               ATAP
                                                                                      22
  300 \text{ NCOPY} = 13
                                                                                AT AP
                                                                                      23
                                                                               ATAP
                                                                                      24
C- - - START OF LOOP
                                                                               AT AP
                                                                                      25
                                                                               ATAP
                                                                                      26
  400 DO 900 N = 1, NQUAD
                                                                               ATAP
                                                                                      27
       NTRY = 0
                                                                               ATAP
                                                                                      28
  500 CKSUM = 0.0
                                                                               ATAP
                                                                                      29
                                                                               ATAP
                                                                                      30
C+ - - READ THE #A# MATRIX FROM THE APPROPRIATE TAPE
                                                                               ATAP
                                                                                      31
                                                                               AT AP
                                                                                      32
      READ ( NCOPY ) NQ,
                                    (A(I), I = 1, NQ)
                                                                               ATAP
                                                                                      33
                                                                               AT AP
                                                                                      34
  900 WRITE ( 8 ) NQ,
                                 (A(I)_0 I = 1, NQ)
                                                                               ATAP
                                                                                      35
      GO TO 1400
                                                                               ATAP
                                                                                      36
C- -- THE PURPOSE OF THE FULLOWING "MICKEY MOUSE" IS TO RE-POSITION THE ATAP
                                                                                      37
      CONTROL TABLES, NULL POINTS, AND UNIT NORMALS AT THE BEGINNING OF ATAP
                                                                                      38
      THE TAPE. THIS ELIMINATES SKIPPING THE '28 QUANTITIES' EACH TIME. ATAP
                                                                                      39
 1800 READ (4) KLCT, (NLINE(J), NLT(J), J = 1, KLCT)
                                                                               ATAP
                                                                                      40
      READ (4) (XNULL(J), YNULL(J), ZNULL(J), XNORM(J), YNORM(J), ZNORM(J),
                                                                               ATAP
                                                                                      41
     1 J = 1, NQUAD)
                                                                               ATAP
                                                                                      42
      IF (NOFF . GT. B) READ (4) (XOFF(J), YOFF(J), ZOFF(J), J=1, NOFF)
                                                                               ATAP
                                                                                      43
      REWIND 4
                                                                               AT AP
                                                                                      44
      WRITE (4) KLCT, (NLINE(J), NLT(J), J = 1, KLCT)
                                                                               ATAP
                                                                                      45
      D0 1188 J = 1, NQUAD
                                                                               ATAP
                                                                                      46
 1100 WRITE (4) XNULL(J), YNULL(J), ZNULL(J), XNORM(J), YNORM(J), ZNORM(J)
                                                                               ATAP
                                                                                      47
      IF (NOFF .EQ. 0) GO TO 1300
                                                                               ATAP
                                                                                      48
      DO 1200 J = 1, NOFF
                                                                               ATAP
                                                                                      49
1201 WRITE (4) XOFF(J), YOFF(J), ZOFF(J), XOFF(J), YOFF(J), ZOFF(J)
                                                                               ATAP
                                                                                      50
 1300 REWIND 4
                                                                               ATAP
                                                                                      51
 1400 REWIND 8
                                                                               AT AP
                                                                                      52
```

SIGM

SIGM

SIGM 100

98

99

9999 FORMAT ( 1HO , 5X, 13HLEAVING SIGMA)

RETURN

END

```
*DECK, PRINT
                                                                             PRIN
                                                                                    1
      SUBROUTINE PRINT1
                                                                             PRIN
                                                                                    2
C
      SUBROUTINE PRINT1 ( NSKIP, MN, KMAT, NSEQ)
                                                                             PRIN
                                                                                    3
      COMMON /PRINTO/ KMAT, NSEQ, KTP14
                                                                            PRIN
                                                                                    4
      COMMON /TAPES/ MN
                                                                             PRIN
                                                                                    5
      COMMON /SIG/ NSKIP
                                                                            PRIN
                                                                                    б
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL OW, NQUAD,
                                                                                    7
                                                                            PRIN
     1 KASE, NOFF, NSY M, IFLAG, IFLOW, NCODE
                                                                             PRIN
                                                                                    8
      REAL NX , NY , NZ, MACH
                                                                             PRIN
                                                                                    9
      LOGICAL PUNCHY
                                                                             PRIN
                                                                                   10
      COMMON ZMZ MACH. BETA. REETA
                                                                             PRIN
                                                                                   11
                            FLOWID(3),
      DIMENSION
                                                                            PRIN
                                                                                   12
     1 VX(2000), VY(2000), VZ(2000),
                                                                             PRIN
                                                                                   13
     4 NST(500), NCL(500)
                                                                             PRIN
                                                                                   14
      DIMENSION SIG(1000), XIJ(1000), YIJ(1000), ZIJ(1000)
                                                                             PRIN
                                                                                   15
      DATA FLOWID / 2HX-, 2HY-, 2HZ- /, PROG / 4HBEXC /
                                                                             PRIN
                                                                                   16
      PUNCHV = .FALSE.
                                                                             PRIN
                                                                                   17
      NTIME = NQUAD + NOFF
                                                                            PRIN
                                                                                   18
      LCMAX = 12
                                                                            PRIN
                                                                                   19
C
      READ IN IDENTIFYING INTEGERS
                                                                                   Zû
                                                                             PRIN
C
                                                                            PRIN
                                                                                   21
      READ(4) INSECT, ( NS I(J) , NCL(J) , J = 1, INSECT)
                                                                             PRIN
                                                                                   22
      DO 2000 L = 1, NCFLG
                                                                             PRIN
                                                                                   23
      IF( ISIG .NE. 8) GO TO 1
                                                                             PRIN
                                                                                   24
      M = 2
                                                                             PRIN
                                                                                   25
      GO TO 2
                                                                             PRIN
                                                                                   26
    1 M = 3
                                                                             PRIN
                                                                                   27
    2 \cdot N = M + (NSKIP + L - 1)
                                                                             PRIN
                                                                                   28
      IF (N .EQ. 0) GO TO 4
                                                                             PRIN
                                                                                   29
      00 3 J = 1, N
                                                                                   30
                                                                             PRIN
    3 READ (3)
                                                                             PRIN
                                                                                   31
    4 READ ( 3) KFLOW, (VX(IJ), VY(IJ), VZ(IJ), IJ = 1. NTIME )
                                                                             PRIN
                                                                                   32
      IF ( KFLOW .EQ. KMAT ) GO TO 9
                                                                             PRIN
                                                                                   33
      CALL HEADER
                                                                             PRIN
                                                                                   34
      WRITE (6, 8) KFLOW, KMAT
                                                                             PRIN
                                                                                   35
    8 FORMAT ( 1H0,6X,48HAN APPARENT FLOW MIS-MATCH HAS OCCURRED. KFLOW PRIN
                                                                                   36
   · 1=, I2, 7H KMAT =, I2 )
                                                                             PRIN
                                                                                   37
      CALL EXIT
                                                                             PRIN
                                                                                   38
    9 N = (NFLOW - NSKIP - L + 1) + M + NSKIP + L - 2
                                                                             PRIN
                                                                                   39
      D0 5 J = 1, N
                                                                             PRIN
                                                                                   40
    5 READ (3)
                                                                             PRIN
                                                                                   41
      READ (3) (SIG(J), J = 1, NQUAD)
                                                                             PRIN
                                                                                   42
      REWIND 3
                                                                             PRIN
                                                                                   43
      IF(KTP14 .EQ. 1) WRITE(14) (SIG(J), J=1, NQUAD)
                                                                             PRIN
                                                                                   44
      IF (KTP14 .EQ. 1) ENDFILE 14
                                                                             PRIN
                                                                                   45
      REWIND 14
                                                                             PRIN
                                                                                   46
      IF (MN .EQ. 1) GO TO 15
                                                                             PRIN
                                                                                   47
      NRSKIP = MN - 1
                                                                             PRIN
                                                                                   48
      DO 10 JM = 1, NRSKIP
                                                                             PRIN
                                                                                   49
      READ (1)
                                                                             PRIN
                                                                                   50
```

ATAP

ATAP

ATAP

ATAP

ATAP

53

54

55

56

57

REWIND NCOPY

RETURN

END

WRITE (6, 1508)

1500 FORMAT (1HO, 5X, 14HLEAVING ATAPES)

```
M = 0
                                                                           PRIN
      IF (L .GT. 1) READ (4)
                                                                           PRIN
      00 1000 IS = 1, NTIME
                                                                           PRIN
      READ(4) XN, YN, ZN, AX, AY, NZ
                                                                           PRIN
                                                                                 5
      IF ( MACH .EQ. 0.0 ) GO TO 17
                                                                           PRIN
      CORR = 1.0 / SQRT(NX + NX + BETA + BETA + (NY + NY + NZ + NZ))
                                                                           PRIN
                                                                                 61
      NX = NX * CORR
                                                                           PRIN
      NY = NY + BETA + CCRR
                                                                           PRIN
                                                                                 6
      NZ = NZ + BETA + CORR
                                                                           PRIN
                                                                                 63
      XN = XN + BETA
                                                                           PRIN
                                                                                 6
   17 VIX = 0.0
                                                                           PRIN
                                                                                 65
      VIY = G.0
                                                                           PRIN
                                                                                 66
      VIZ = 0.0
                                                                           PRIN
                                                                                 67
      CALL ROWV(XIJ, YIJ, ZIJ, IS, 1)
                                                                           PRIN
      DO 20 I1 = 1, NQUAD
                                                                           PRIN
                                                                           PRIN
                                                                                 7(
C
      VELOCITY COMPONENTS
                           EQ. (135) OR EQ. (140)
                                                                           PRIN
                                                                                 71
                                                                           PRIN
                                                                                 72
          = VIX + XIJ( I1 ) *
                                                                           PRIN
                                  SIG(I1)
                                                                                 7
          = VIY + YIJ(I1) +
                                  SIG(I1)
                                                                           PRIN
                                                                                 74
   20 VIZ = VIZ + ZIJ( I1 ) * SIG(I1)
                                                                           PRIN
                                                                                 75
      VIX = VIX * RBETA * RBETA + VX(IS)
                                                                           PRIN
      VIY = VIY * RBETA + VY(IS)
                                                                           PRIN
                                                                                 77
      VIZ = VIZ * RBETA + VZ(IS)
                                                                           PRIN
      IF ( PUNCHV ) GO TO 26
                                                                           PRIN
                                                                                 79
      IF ( IS .EQ. NGUAD .OR. IS .EQ. NTIME ) GO TO 22
                                                                           PRIN
      VIXT = VIX
                                                                           PRIN
                                                                                 81
      VIYT = VIY
                                                                           PRIN
                                                                                 82
      VIZT = VIZ
                                                                           PRIN
                                                                                 83
C
      PUNCHY = .TRUE.
                                                                           PRIN
                                                                                 84
      GO TO 30
                                                                           PRIN
                                                                                 85
   22 NSEQ = NSEQ + 1
                                                                           PRIN
                                                                                 86
      IF (PUNCHV)
                                                                           PRIN
                                                                                 87
     INRITE ( 7, 24 ) VIX, VIY, VIZ, KASE, PROG. NSEQ
                                                                           PRIN
                                                                                 88
   24 FORMAT ( 3F10.7, 36x, A4, 2x, A4, I4)
                                                                           PRIN
                                                                                 89
      GO TO 28
                                                                           PRIN
                                                                                 90
   26 NSEQ = NSEQ + 1
                                                                           PRIN
                                                                                 91
      WRITE ( 7, 27 ) VIXT, VIYT, VIZT, VIX, VIY, VIZ, KASE, PROG, NSEQ PRIN
                                                                                 92
   27 FORMAT ( 6F10.7, 6X, A4, 2X, A4, I4)
                                                                           PRIN
                                                                                 93
   28 PUNCHY = .FALSE.
                                                                           PRIN
                                                                                 94
C
            TOTAL VELOCITY MAGNITUDE EQ. ( 136 )
                                                                           PRIN
                                                                                 95
C
                                                                           PRIN
                                                                                 96
   30 VTSQ = VIX * VIX + VIY * VIY + VIZ * VIZ
                                                                           PRIN
                                                                                 97
      VT = SQRT ( VTSQ)
                                                                           PRIN
                                                                                 98
                                                                           PRIN
                                                                                 99
C
      PRESSURE COEFFICIENT EQ. (137)
                                                                           PRIN 100
                                                                           PRIN 101
      CPI = 1:0 - VTSQ
                                                                           PRIN 102
                                                                           PRIN 103
      DIRECTION COSINES OF THE TOTAL VELOCITY VECTOR EQ. (138)
                                                                           PRIN 104
      GIX = VIX / VT
                                                                           PRIN 105
      GIY = VIY / VT
                                                                           PRIN 106
      GIZ = VIZ / VT
                                                                           PRIN 107
      LC = LC +1
                                                                           PRIN 108
      IF (IS .GT. NQUAD) GO TO 50
                                                                           PRIN 189
      TOTAL NORMAL VELOCITY
                             EQ.
                                    (139)
                                                                           PRIN 110
                                       133
```

PRIN

PRIN

PRIN

PRIN

**READ (11)** 

INSECT = 1

10 READ (12)

15 LC = LCMAX

```
C
                                                                          PRIN 111
      VNI = VIX * NX * VIY * NY + VIZ * NZ
                                                                          PRIN 112
      N = NST ( INSECT )
                                                                          PRIN 113
                                                                          PRIN 114
      MMAX = IABS ( NCL ( INSECT ) )
      M = M + 1
                                                                          PRIN 115
      IF( LC .LT. LGMAX) IF (M - 1) 40. 35. 49
                                                                          PRIN 116
      WRITE (6, 3000)
                                                                          PRIN 117
 3000 FORMAT ( 1H0, 4X,1H.,84X,1H.)
                                                                          PRIN 118
      CALL HEADER
                                                                          PRIN 119
      LC = 0
                                                                          PRIN 120
      WRITE (6, 4030) FLOWID(KFLOW)
                                                                          PRIN 121
 4030 FORMAT (1H0, 45X, A2, 4HFLOW)
                                                                          PRIN 122
      WRITE(6.4000)
                                                                          PRIN 123
   35 WRITE(6, 4005) N, M, XN, VT, VIX, GIX, NX, VNI
                                                                          PRIN 124
      GO TO 45
                                                                          PRIN 125
 4015 FORMAT(1H0, 3(17X , 2(6H++++++ ) ) )
                                                                          PRIN 126
 4000 FORMAT(1HC. 6X .5HN M.8X, 3HNPX,10X, 2HVT , 12X, 2HVX , 10X .
                                                                          PRIN 127
     1 3HDCX, 11X, 2HNX ,10X, 2HVN /
                                                                          PRIN 128
     21H ,19X, 3HNPY , 9X, 4HV TSQ ,11X, 2HWY ,10X, 3HDCY,11X, 2HNY,10X, PRIN 129
                                                                          PRIN 130
     41H ,19X, 3HNPZ ,10X, 4HCF , 10X, 2HVZ ,10X, 3HDCZ,11X, 2HNZ
                                                                         PRIN 131
 4005 FORMAT(1H0,3X, 214 , 6F13.6)
                                                                          PRIN 132
 4010 FORMAT(1H0,7X, I4 , 6F13.6)
                                                                          PRIN 133
 4020 FORMAT( 1H , 11X, 6F13.6)
                                                                          PRIN 134
   40 HRITE(6,4010) M. XN, VT, VIX, GIX, NX, VNI
                                                                          PRIN 135
   45 WRITE(6, 4020) YN, VTSQ, VIY, GIY, NY, SIG(IS), ZN,
                                                                          PRIN 136
     1 CPI , VIZ, GIZ, NZ
                                                                          PRIN 137
      IFC M .LT. MMAX) GC TO 1800
                                                                          PRIN 138
      IF (NCL (INSECT) .GT. 4) GO TO 48
                                                                          PRIN 139
      WRITE (6. 4015)
                                                                          PRIN 140
      LC = LC + 1
                                                                          PRIN 141
   48 M = 0
                                                                          PRIN 142
      INSECT = INSECT + 1
                                                                          PRIN 143
      GO TO 1000
                                                                          PRIN 144
   50 IF ( LC .LT. LCMAX .AND. IS .NE. (NQUAD + 1)) GO TO 60
                                                                          PRIN 145
      WRITE (6. 3000)
                                                                          PRIN 146
      CALL HEADER
                                                                          PRIN 147
      LC = 0
                                                                          PRIN 148
      WRITE (6. 4030) FLOWID(KFLOW)
                                                                          PRIN 149
      WRITE (6, 55)
                                                                          PRIN 150
   55 FORMAT (1H0,6x,5HPCINT,13x,2Hx ,15x,2HVT,16x,2HVX,17x,3HDCx, /,
                                                                          PRIN 151
     125X,2HV ,17),4HVTSQ,17X,2HVY,17X,3HUCY, /,
                                                                          PRIN 152
     225X,2HZ ,18X,2HCP,18X,2HVZ,17X,3HDCZ, // )
                                                                          PRIN 153
C
                                                                          PRIN 154
C
      WRITE THE OFF-BODY ANSWERS
                                                                          PRIN 155
                                                                          PRIN 156
   60 N = IS - NQUAD
                                                                          PRIN 157
      HRITE (6,65) N,XN,VT, VIX,GIX,YN,VTSQ,VIY,GIY,ZN, CPI, VIZ,GIZ
                                                                          PRIN 158
   65 FORMAT (1H0, I9, 4F20.6, / (10X, 4F20.6))
                                                                          PRIN 159
                                                                          PRIN 160
 1000 CONTINUE
                                                                          PRIN 161
      REWIND 4
                                                                          PRIN 162
      IF (NOFF .GT. 0) WRITE (6. 4015)
                                                                          PRIN 163
 2000 CONTINUE
                                                                          PRIN 164
      WRITE(6, 9999)
                                                                          PRIN 165
 9999 FORMATI 1H1 , 5X, 14HLEAVING PRINT1)
                                                                          PRIN 166
      RETURN
                                                                          PRIN 167
      END
                                                                          PRIN 168
```

```
TDECK.WTAP14
                                                                          HTAP
      SUBRCUTINE HTAP14
                                                                         WTAP
                                                                                 2
C
                                                                          HTAP
                                                                                 3
C
      WRITES 28 QUANTITIES ON TAPE14 FOR USE BY THE PARTICLE TRAJECTORY WIAP
                                                                                 4
C
      CODES. REVISED 3/22/77.
                                                                                 5
                                                                         WTAP
C
                                                                          HTAP
                                                                                 6
      COMMON HEDR (15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFL ON, NQUAD,
                                                                         WTAP
                                                                                 7
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                          WTAP
                                                                                 8
      COMMON /SPACER/ DUMMY (14000)
                                                                          HTAP
                                                                                 9
                                                                         HTAP
      REAL IXX, IXY, IYY, MACH
                                                                                10
      COMMON /M/ MACH, BETA, RBETA
                                                                          WTAP
                                                                                11
      DIMENSION
                               041(1000),
                                             XC(1000), YC(100L), ZC(1000), WT AP
                                                                                12
     1 A11(1000),A12 (1000),A13 (1000),A21(1000),A22(1000),A23(1000),
                                                                                13
     2 A31(1000), A32 (1000), A33 (1000), XI1(1000), XI2(1000), XI3(1000),
                                                                          HT AP
                                                                                14
     3 XI4(1900), ETA1(1000), ETA2(1000), ETA4(1000), TSQ(1000), A(2000).
                                                                          WTAP
                                                                                15
     WTAP
                                                                                16
      EQUIVALENCE (DUMMY(1), D41), (DUMMY(1001), XC), (DUMMY(2001), YC), WTAP
                                                                                17
        (DUMMY(3001), ZC), (DUMMY(4J01), A11), (DUMMY(5001), A12),
                                                                                18
        (DUMMY(6001), A13), (CUMMY(7001), A21), (DUMMY(8001), A22),
                                                                          HT AP
                                                                                19
        (DUMMY(9001), A23), (DUMMY(10001), A31), (DUMMY(11001), A32),
                                                                          WT AP
                                                                                20
        (NUMMY(12001), A33), (DUMMY(13031), XI1)
                                                                          WTAP
                                                                                21
C
                                                                         WT AP
                                                                                22
      REWIND 14
                                                                          WTAP
                                                                                23
      WRITE (14) KASE, NSYM, NQUAD, RBETA, MACH
                                                                          WTAP
                                                                                24
      00 100 J=1 NQUAD
                                                                          WTAP
                                                                                25
  100 READ (4) XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                          HTAP
                                                                                26
     1 A22(J), A23(J), A31(J), A32(J), A33(J), XI1(J), ETA1(J), XI2( WTAP
                                                                                27
     2 J), ETA2(J), XI3(J), >I4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                          HTAP
                                                                                28
     3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J)
                                                                          WTAP
                                                                                29
      WRITE(14)(XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                          WTAP
                                                                                30
     1 A22(J), A23(J), A31(J), A32(J), A33(J), XI1(J), ETA1(J), XI2( WTAP
                                                                                31
     2 U), ETAZ(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                          WTAP
                                                                                32
     3 IXY (J), IYY(J), C12(J), O23(J), D34(J), D41(J) ,J=1,NQUAD)
                                                                          WTAP
                                                                                33
      REWIND 4
                                                                         WTAP
                                                                                34
      END
                                                                         HT AP
                                                                                35
```

C

C

C

C

C

C

C

C

C

C

C

C

C

IN THE PRINTOUT.

1 SXI(3), SEQ(6)

N1=NS(1) N2=NS (2)

N3=NS(3)

SX(1) = SXI(1)

DO 500 I=1.N1

SX(2) = SXI(2)

SX(3) = SXI(3)

DO 500 K=1.N3

00 500 J=1.N2

WILTE( 6,1900)

SX(1) = SX(1) + SD(1)

SX(2) = SX(2) + SD(2)

DATA SEQ/ 4HFIRS, 4HT

PROGRAP FLOPNT ( INPUT, TAPE6, TAPE5=INPUT, TAPE14, OUTPUT)

INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3.

INCREMENTED SECOND AND Z IS INCREMENTED LAST.

DESIRED (INCLUTING THE INITIAL COORDINATE VALUE).

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CALLS FLOVEL TO COMPUTE AND PRINT FLOW VELOCITIES AT SPECIFIED

OTHER INFUI DATA ARE (IN ORDER OF X AXIS FIRST, Y AXIS SECOND,

, 4HSECO, 4HND

, 4HTHIR, 4HD

```
DATA STAF, BLNK / 3H +, 3H
  READ( 5, 2600) KASE
  CALL SETFLO( KASE )
   READ ( 5, 1300 ) HOLL
   WRITE( 6, 1400) HCLL
5 READ(5,1100)M
  IF(IABS(M(1))+IABS(M(2))+IABS(M(3)).EQ. E) STOP
   IF(M(1)+M(2)+M(3) .EQ. 5) GO TO 10
   WRITE (6.1200)
  STOP
10 DO 20 L=1,3
20 READ(5,1000) X(L), D(L), N(L)
  WRITE( 6, 1700)
  WRITE(6,2000) X(1), D(1), N(1)
  WRITE(6,30(0) X(2), D(2), N(2)
  WRITE(6,4000) X(3), D(3), N(3)
  WRITE(6.9000)
  WRITE(6,5000) SEQ(2*M(1)-1), SEQ(2*M(1))
  WRITE(6,60(0) SEQ(2*M(2)-1), SEQ(2*M(2))
  HRITE(6,7000) SEQ(2*M(3)-1), SEQ(2*M(3))
  WRITE( 6, 1600 )
  00 40 L=1,3
  LL=4-M(L)
  SD(LL)=D(L)
   SXI(LL)=X(L)-D(L)
40 NS(LL)=N(L)
```

FLCFT FLCFT FLOFT FLOPT POINTS IN SPACE. INPUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH FLCFT FOR EXAMPLEFLEPT SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS FLOPT FL CF 1 FLOPT Z'AXIS THIRD) - INITIAL COORDINATE, INCREMENT, NUMBER OF INCREMENT SFLCFT FLOPT FLOPT NOTE - POINTS THAT ARE INSIDE THE BODY ARE MARKED WITH AN ASTERIX FLOPT FLCFT FLCPT DIMENSION HOLL(18), X(3), D(3), N(3), M(3), SX(3), SD(3), NS(3), FLOPT FLOFT S FLOPT FLOPT FLOPT FLOPT FLOFT 2 FLCPT 2 FL CP 1 FLOPT 2 FLOPT 2 FLUFT 2 FLOPT FLOFT FLOPT 3 FLOP: 3 FLOPT 3 FLOFT 3 FLOPT 3 FLGPT 3 FLCFT 3 FLOPT 3 FLOPT 3 FLOPT 4 FLOPT 4 FLOFT 4 FLOFT 4 FLOPT 4 FLOPT 4 FLOFT 4 FLOPT 4 FLOPT 4 FLOPT 4 FLOPT 5 FLOFT 5 FLOPT 5

FLOP 1 5

FLOFT 5

FLCPT 5

FLOPT 5

FLOFT 5

```
THORK FIRE
```

```
PROGRAP FLOPNT ( INPUT, TAPE6, TAPE5=INPUT, TAPE14, OUTPUT)
                                                                     FLCF1 2
H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                     FLCPT
                                                                     FLOFT
CALLS FLOVEL TO COMPUTE AND PRINT FLOW VELOCITIES AT SPECIFIED
                                                                     FLOPT
                                                                            5
POINTS IN SPACE. INPUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH
                                                                     FLCFT
INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3. FOR EXAMPLEFL CPT
SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS FLOPT
INCREMENTED SECOND AND Z IS INCREMENTED LAST.
                                                                     FLCF1 9
                                                                     FLOPT 10
DTHER INPUT DATA ARE (IN ORDER OF X AXIS FIRST, Y AXIS SÉCOND,
Z AXIS THIRD) - INITIAL COORDINATE, INCREMENT, NUMBER OF INCREMENT SFLCFT 11
DESIRED (INCLUTING THE INITIAL COORDINATE VALUE).
                                                                     FLOPT 13
NOTE - POINTS THAT ARE INSIDE THE BODY ARE MARKED WITH AN ASTERIX FLOPT 14
IN THE PRINTOUT.
                                                                     FLOFT 15
                                                                     FLCPT 16
DIMENSION HOLL(18), X(3), D(3), N(3), M(3), SX(3), SD(3), NS(3),
                                                                     FLOPT 17
SXI(3), SEQ(6)
                                                                     FLOFT 18
DATA SEQ/ 4HFIRS, 4HT , 4HSECO, 4HND , 4HTHIR, 4HD DATA STAF, BLNK / 3H +, 3H /
                                                                     FLOP1 19
                                                                     FLOPT 20
READ( 5, 2600) KASE
                                                                     FLOPT 21
CALL SETFLO( KASE )
                                                                     FLOPT 22
READ( 5, 1300 ) HOLL
                                                                     FLOFT 23
WRITE( 6, 1400) HCLL
                                                                     FLCPT 24
READ(5,1100)M
                                                                     FLOP1 25
FF(IABS(M(1)) + IABS(M(2)) + IABS(M(3)).EQ. D) STOP
                                                                     FLOPT 26
IF(H(1)+H(2)+H(3) .EQ. 6) GO TO 10
                                                                     FLOPT 27
WRITE (6, 1200)
                                                                     FLOPT 28
STOP
                                                                     FLCPT 29
00 20 L=1.3
                                                                     FLOFT 30
READ(5,1000) X(L), D(L), N(L)
                                                                     FLOPT 31
WRITE( 6, 1700)
                                                                     FLOP: 32
#RITE(6,2000) X(1), D(1), N(1)
                                                                     FLOPT 33
PRITE(6,30(0) X(2), D(2), N(2)
                                                                     FLOFT 34
WRITE(6,4000) X(3), D(3), N(3)
                                                                     FLOPT 35
IRITE(6,9000)
                                                                     FLGPT 36
RITE(6,5000) SEQ(2*M(1)-1), SEQ(2*M(1))
                                                                     FLCFT 37
IRITE(6,60(0) SEQ(2*M(2)-1), SEQ(2*M(2))
                                                                     FLOPT 38
!RITE(6,7000) SEQ(2*M(3)-1), SEQ(2*M(3))
                                                                     FLOPT 39
RITE( 6, 1600 )
                                                                     FLOPT 40
10 40 L=1,3
                                                                     FLOPT 41
L=4-H(L)
                                                                     FLOFT 42
10(LL)=0(L)
                                                                     FLOFT 43
XI(LL)=X(L)-D(L)
                                                                     FLOPT 44
IS(LL)=N(L)
                                                                     FLOPT 45
11=NS(1)
                                                                     FLOFT 46
2=NS (2)
                                                                     FLOPT 47
3=NS(3)
                                                                     FLGPT 48
X(1)=SXI(1)
                                                                     FLOPT 49
0 500 I=1.N1
                                                                     FLOPT 50
X(1)=SX(1)+SD(1)
                                                                     FLOPT 51
                                                                     FLOPT 52
X(2) = SXI(2)
0 500 J=1.N2
                                                                     FLOP 1 53
SITE( 6,1900)
                                                                     FLCFT 54
X(2)=SX(2)+SD(2)
                                                                     FLCPT 55
                                                                     FLOPT 56
X(3) = SXI(3)
0 500 K=1,N3
                                                                     FLOP 1 57
```

FLCPT 92

*0E	74/74 OPT=2 FIN 4.7+476 CK.PRFUN	02/28/80	18.34.09
00000000000	FUNCTION PRFUN(R, DLR, 30F)  H. G. NCRMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979  RETURNS THE COEFFICIENT WHICH WHEN MULTIPLIED BY FLUID WELOCIT  RELATIVE TO THE PARTICLE YIELDS THE PARTICLE AGGELERATION.  FOR MATER CROPS IN AIR  FOR REYNCLES NUMBERS LARGER THAN SEG USE CORR WS R DATA OF GUN  AND KINZER FOR WATER DROPS IN AIR. FOR SMALLER REYNOLDS NUMBERS  USE DATA FOR RIGID SPHERES.  IF( R .LE. 200. 3 GO TO 100  FRETURN  PRETURN  PRETURN  CORR(R)/R/COF  RETURN  END	PRFUN 5 PRFUN 6 PRFUN 7 PRFUN 8 FRFUN 9 PRFUN 10	

	*DECK,IMPACT SUBROUTINE IMPACT(VI,ZI)		
	C H. G. NORMENT, ATMGSPHERIC SCIENCE ASSOCIATES APRIL 1979	IMPAC IMFAC IMPAC IMFAC	2 3
	· · · · · · · · · · · · · · · · · · ·	IMFAC *IMFAC IMFAC LIMPAC TIMFAC IMPAC	5 6 7 8 9
0.3	RETURN END	IMFAC IMFAC IMFAC IMFAC IMFAC IMFAC IMFAC	12 13 14 15

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```
*DECK.PAPTCL
                                                                            FAFTC
                                                                                   1
      SUBROUTINE PARTCL (V, ELL, RHC, VIS, TEMP, DIAM, GLR, RHOP, VT, RF, PT, ACC, N) PARTC
C
                                                                            PARTC
                                                                                   2
C
      H. G. NORMENT. ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                            FAFTC
C
                                                                            PARTO
C
      CALLED BY CONFAC, ARYTRI OR TANTRA TO READ PARTICLE SPECS. AND
                                                                            FAFTC
Ċ
      CONPUTE GRAVITY SETTLING SPEEC AND OTHER PARAMETERS. SEE CONFAC
                                                                            PARTE
C
                                                                            PÁSTC
C
      FOR WATER DROPS IN AIR
                                                                            PASTC
                                                                                   A
C
                                                                            PARTC
                                                                                   a
C
      CALLS FALMAT TO COMPUTE SETTLING SPEED VIA BEARDS EQUATIONS.
                                                                            PARTC 13
C
                                                                            PARTC 11
C
      REYNOLDS NUMBER(R)-DAVIES NUMBER(CORR) RELATIONS ARE AS FOLIOWS -
                                                                            PARTC 12
C
      FOR REYNCLES NUMBERS LARGER THAN 200 USE CORN VS R DATA OF GUNN
                                                                            PAFTC 13
C
      AND KINZER FOR WATER DROPS IN AIR. FOR SMALLER REYNOLDS NUMBERS PARTO 14
                                                                            PARTC 15
C
      USE DATA FOR RIGID SPHERES.
C
                                                                            PARTC 16
C
                          GLCSSARY
                                                                            PARTC 17
              DIAM/ELL - USED TO COMPUTE ACCELERATION MOCULUS
C
      ACC
                                                                            PARTC 18
                                                                            PARTC 19
Ċ
              DIAMETER OF A WATER DROP
      DIAM
C
      DLR
               NOT RELEVANT TO WATER DROPS
                                                                            PARTC 20
C
               CHARA (TERISTIC DIMENSION OF THE BODY ( METERS )
                                                                            PARTC 21
      ELL
C
      PT
              DRAG COEFFICIENT+ABSIREYNOLDS NUMBER) FOR GRAVITY SETTLINGFARTC 22
               CF PARTICLES
                                                                            PARTC 23
      RF
C
              FACTIR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                            PAFTC 24
                                                                            PARTC 25
C
      RHO
               AIR DENSITY (SI)
C
      RHOP
              PARTICLE DENSITY (SI)
                                                                            PARTC 26
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                            FARTC 27
C
              AIR SPEED (SI)
                                                                            PAFTC 28
              AIF VISCOSITY (31)
C
      VIS
                                                                            PAFTC 29
                                                                            PARTC 36
C
      VT
               GRAVITY SETTLING SPEED OF FARTICLE
~
                                                                            PARTC 31
      READ (5, 11 (0) DIAM
                                                                            PAFTC 32
      IFIDIAM .NE. 8.8) GO TO 6
                                                                            PARTC 33
                                                                            FARTC 34
      N = 1
      RETURN
                                                                            PAFTC 35
    6 WRITE (6,2500) DIAM
                                                                            PARTC 36
      RIOP = 1.0E3
                                                                            PAFTC 37
      DLR=1.0
                                                                            PARTC 36
      RF = DIA ++RHO /VIS + 1.3E-6
                                                                            PAFTC 39
                                                                            PAFTC 40
      ACG = DIAM/ELL * 1.0E-6
      COMPUTE GRAVITY SETTLING SPEED OF FART. AND PARAMETERS DERIVED
                                                                            PAFTC 41
      FROM IT
                                                                            PAFTC 42
      CALL FALHATIDIAM* 1.3E-6, RHO, VIS, TEMP, 287.04*RHG*TEMP, VI
                                                                            PARTC 43
      R = RF*VT
                                                                            PARTC 44
      PT = CCRR(R)/R
                                                                            PARTO 45
      IF(R .GT. 200.) PT = MCDRR( R )/R
                                                                            FARTC 46
    7 HRITE(6, 3500) VT
                                                                            PARTC 47
      VT = VT/V
                                                                            PARTC 48
                                                                            PARTC 49
      RF = RF*V
      RETURN
                                                                            PARTO 50
1100 FORMAT (7F10.0)
                                                                            PARTC 51
 2500 FORMATI 1H1, 9X, 21HHATER GROP DIAMETER =1FE12.5,12H MIGROMETERS/)PARTO 52
                   28X. 24HPARTICLE SETTLING SPEED=1PE12.5, 6H M/SEC)
                                                                            FARTC 53
 3500 FORMATI
      END
                                                                            PAFTC 54
```

```
*DECK . CONFAC
                                                                             CONF
                                                                                     1
      SUBROUTINE CONFAC
                                                                             CONF
                                                                                     2
C
                                                                             CONF
                                                                                     3
C
      H. G. NORMENT. ATMCSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                             CONF
                                                                                     4
C
                                                                                     5
                                                                             CONF
C
      EXECUTIVE FOR COMPUTATION OF CONCENTRATION FACTORS FOR PARTICLES
                                                                             CONF
                                                                                     6
C
      IN A FLOW ABOUT A 3-CIMENSIONAL BODY. CROSS SECTIONAL AREAS OF A CONF
                                                                                     7
C
      PARTICLE FLUX TUBE ARE CALCULATED ABOUT THE FCINT OF INTEREST AND CONF
                                                                                     8
C
      ABOUT A POINT FAR UPSTREAM. CONCENTRATION FACTOR IS THE RATIO OF CONF
                                                                                     9
C
      THESE AREAS.
                                                                             CONF
                                                                                    10
C
      SINGLE TRAJECTORIES TO A TARGET POINT MAY BE COMPUTED (NW=D)
                                                                             CONF
                                                                                    11
C
      FLOW DATA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14
                                                                             CONF
                                                                                    12
C
      VIA SR SETF 10.
                                                                             CONF
                                                                                    13
C
      UNIT 9 IS A SCRATCH UNIT USED FOR TRAJECTORY DATA STORAGE.
                                                                             CONF
                                                                                    14
C
      UNIT 10 IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.
                                                                                    15
                                                                             CONF
C
      SR PARTCL IS CALLED TO READ, PROCESS AND PRINT PARTICLE DATA.
                                                                             CONF
                                                                                    16
C
      THIS SR CAN BE ONE OF SEVERAL THAT TREATS WATER DROPS OR ONE OF
                                                                             CONF
                                                                                    17
      VARIOUS TYPES OF ICE CRYSTALS.
C
                                                                             CONF
                                                                                    18
C
                                                                             CONF
                                                                                    19
C
      GLOSSARY
                                                                             CONF
                                                                                    20
                                                                             CONF
                                                                                    21
   DISTINGUISH TWO COORDINATE SYSTEMS - 1. THE FLOW SYSTEM IS THE SYSTEMCONF
C
                                                                                    22
C
   IN WHICH THE AIRCRAFT AND FLOW ARE DEFINED, AND 2. THE FLUX TUB!
                                                                             CONF
                                                                                    23
C
   SYSTEM WHICH HAS ITS Y-Z PLANE IN THE PLANE OF A FLUX TUBE CROSS
                                                                             CONF
                                                                                    24
C
   SECTION WITH CRIGIN AT THE FLUX TUBE CENTER.
                                                                                    25
                                                                             CONF
C
                                                                             CONF
                                                                                    26
      ALL COORDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)
C
                                                                             CONF
                                                                                    27
C
                                                                             CONF
                                                                                    28
C
      ACC
               DIAM/ELL - USED TO COMPUTE ACCELERATION MODULUS
                                                                             CONF
                                                                                    29
C
      ALPHAD
               AMÉLE BETWEEN PROJECTION OF INITIAL VELOCITY VECTOR IN
                                                                             CONF
                                                                                    30
C
               X-Y PLANE AND X AXIS
                                                                             CONF
                                                                                    31
C
      ALPHAR
               ANGLE BETWEEN PRCJECTION OF FINAL VELOCITY VECTOR IN X-Y
                                                                             CONF
                                                                                    32
C
               PLANE AND X AXIS
                                                                             CONF
                                                                                    33
C
      BETAO
               ANGLE BETWEEN INITIAL VELDCITY VECTOR AND ITS PROJECTION
                                                                             CONF
                                                                                    34
C
               IN THE X-Y PLANE
                                                                                    35
                                                                             CONF
C
      BETAR
               ANGLE BETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION
                                                                                    36
                                                                             CONF
C
               IN THE X-Y PLANE
                                                                             CONF
                                                                                    37
C
               RATIO OF PARTICLE CONCENTRATION AT TARGET POINT TO CONC.
      CONRTO
                                                                             CONF
                                                                                    38
C
               AT INITIAL PCINT
                                                                             CONF
                                                                                    39
               DIAMETER OF A WATER DROP OR ICE AGGREGATE
C
      DIAM
                                                                             CONF
                                                                                    40
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                             CONF
                                                                                    41
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
C
      DLR
                                                                             CONF
                                                                                    42
C
               RATIO
                                                                             CONF
                                                                                    43
C
      ELL
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
                                                                             CONF
                                                                                    44
C
      EPSI() PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
                                                                                    45
                                                                             CONF
C
               INTEGRATION (SEE DVDQ GLUSSARY)
                                                                             CONF
                                                                                    46
C
      FN
               FROUDE NUMBER
                                                                             CONF
                                                                                    47
C
      FNR
               RECIPROCAL OF THE FROUDE NUMBER
                                                                             CONF
                                                                                    48
C
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDQ)
      HI
                                                                             CONF
                                                                                    49
C
      HMAX
               MAXINUM TIME STEP (SEE DVDQ)
                                                                             CONF
                                                                                    50
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
C
      HMIN
                                                                             CONF
                                                                                    51
C
      IPL OT
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 10 FOR PLOTTINGCONF
                                                                                    52
C
               NUMBER OF TRAJECTORIES USED TO DEFINE THE FLUX TUBE
      NW
                                                                                    53
                                                                             CONF
               PERIPHERY.
C
                            IF(NW .EQ. 0) SINGLE TRAJECTORIES ARE COMPUTED CONF
                                                                                    54
C
      P( )
               CURRENT VALUES OF INCEPENDENT VARIABLES -
                                                                                    55
                                                                             CONF
C
                  P(1) = X
                                                                             CONF
                                                                                    56
C
                  P(2) = CX/DT
                                                                             CONF
                                                                                    57
C
                  P(3) = Y
                                                                             CONF
                                                                                    58
C
                  P(4) = DY/DT
                                                                             CONF
                                                                                    59
                  P(5) = Z
                                                                             CONF
                                                                                    68
```

```
C
                  P(6) = 0Z/0T
                                                                              CONF
                                                                                    61
C
      PACT
               (SPARE)
                                                                              CONF
                                                                                    62
C
      PT
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGCONF
                                                                                    63
C
               OF PARTICLES
                                                                              CONF
                                                                                    64
C
      RF
                                                                              CONF
                                                                                    65
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
C
      RHO
               AIR DENSITY (KC/M++3)
                                                                              CONF
                                                                                    66
C
      RHUP
               PARTICLE DENSITY (KG/M++3)
                                                                              CONF
                                                                                    67
C
      RH
               RADIUS OF PARTICLE FLUX TUBE IN TARGET PLANE (NORMALIZED) CONF
                                                                                    68
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                                    69
                                                                              CONF
C
      TOL
               TOLERANCE FOR REACHING A POINT ON TARGET PLANE WINDO >
                                                                              CONF
                                                                                    70
C
               (FRACTION OF RW)
                                                                              CONF
                                                                                    71
C
      TPRINT
               OUTPUT TIME INTERVAL
                                                                              CONF
                                                                                    72
C
      ٧
               AIR SPEED (M/SEC)
                                                                                    73
                                                                              CONF
               AIR VISCOSITY (KG/(M-SEC))
C
      VIS
                                                                              CONF
                                                                                    74
C
      VPGT
               PARTICLE SPEED AT TARGET POINT
                                                                              CONF
                                                                                    75
C
      VT
               GRAVITY SETTLING SPEED OF PARTICLE
                                                                              CONF
                                                                                    76
C
               AIR SPEED AT TARGET POINT
      VIGI
                                                                              CONF
                                                                                    77
C
      XI3P.YI3PsZI3P
                         INITIAL PLANE FLUX TUBE CENTER COORDINATES IN
                                                                              CONF
                                                                                    78
C
                         THE FLOW SYSTEM
                                                                                    79
                                                                              CONF
C
               TRAJECTORY INITIAL X COORDINATE
                                                                              CONF
                                                                                    80
C
                 TARGET POINT CCORDINATES IN THE FLUX TUBE SYSTEM
      XP, YP, ZP
                                                                              CONF
                                                                                    81
C
                 COORDINATES OF CENTER OF FLUX TUBE AT THE TARGET PLANE
      XW, YW, ZW
                                                                              CONF
                                                                                    82
C
                 IN THE FLOW SYSTEM
                                                                              CONF
                                                                                    83
C
                    TARGET FOINT COORDINATES OF THE LAST THREE GUESSES
      YE(), ZE()
                                                                              CONF
                                                                                    84
C
                    (FLOW SYSTEM)
                                                                              CONF
                                                                                    85
C
      YI(),ZI()
                    INITIAL POINT COORDINATES OF THE LAST THREE GUESSES
                                                                              CONF
                                                                                    86
C
                     (FLCW SYSTEM)
                                                                              CONF
                                                                                    87
C
      YPSTAR, ZPSTAR
                         TARGET POINT COORDINATES (FLOW SYSTEM)
                                                                              CONF
                                                                                    88
C
                           TARGET POINT COORDINATES (FLUX TUBE SYSTEM)
                                                                                    89
      YPSTARP. ZPSTARP
                                                                              CONF
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                              CONF
                                                                                    90
     1RF,REO,R,XPSTAR,YPSTAR,ZPSTAR,P(6),TPRINT,IT,ALPHAO,BETAO,IREC,
                                                                              CONF
                                                                                    91
     2IPLOT,IPLT;XPLOT(60),YPLOT(60),ZPLOT(60),ALPHAR,BETAR,YPSTARF,
                                                                              CONF
                                                                                    92
     3ZPSTARP, XI3P, ZI3F, XP, YP, ZP, XWP, XP, ACC, DLR, JLIM
                                                                              CONF
                                                                                    93
      DIMENSION HOLL (18), XINIT (180), XEXIT (180)
                                                                              CONF
                                                                                    94
      DIMENSION YINIT(100), ZINIT(100), YEXIT(100), ZEXIT(100)
                                                                              CONF
                                                                                    95
       DIMENSION YI(3), ZI(3), YE(3), ZE(3)
                                                                              CONF
                                                                                    96
      LOGICAL
                      IPLOT
                                                                              CONF
                                                                                    97
      DATA PI/3.1415926536/
                                                                              CONF
                                                                                    98
      NFIN=0
                                                                              CONF
                                                                                    99
C
                          READ AND WRITE DATA
                                                                              CONF
                                                                                   100
      READ (5,2600) KASE
                                                                              CONF 101
      CALL SETFLO(KASE)
                                                                              CONF
                                                                                   102
                                                                              CONF 103
      READ(5, 1000) HOLL,
                                  IPLOT
      READ(5,1100)V, ELL, RHO, TEMP, XSTART
                                                                              CONF 104
      READ(5,1100) TPRINT, HI, HMINI, EPSZ
                                                                              CONF
                                                                                   105
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS CONF
C
                                                                                   106
      IF(TPRINT .EQ. 0.0) TPRINT=0.1
                                                                              CONF
                                                                                  107
      IF (HI . EQ. 0.0) HI=0.1
                                                                              CONF 108
      IF(HMINI .EQ. 0.0) HMINI=0.005
                                                                              CONF 119
      IF(EPSI(1) .EQ. G. 0) EPSI(1)=1.0E-5
                                                                              CONF 110
      IF(EPSI(2) .EQ. 0.() EFSI(2)=1.0E-5
                                                                              CONF
                                                                                   111
      IF(EPSI(3) .EQ. 0.() EPSI(3)=1.0E-5
                                                                              CONF
                                                                                   112
      READ (5,1150) NW, RW, TOL
                                                                              CONF 113
       JLIM=25
                                                                              CONF 114
      IF(NW .EQ. 0) JLIM=0
                                                                              CONF 115
      D0 3 J=2.3
                                                                              CONF
                                                                                   116
      READ (5,1100) YE(J), ZE(J), YI(J), ZI(J)
                                                                              CONF 117
      VIS = 145.8E-8 * TEMP**(3.0/2.0)/(110.4 + TEMP)
                                                                              CONF 118
      WRITE (6,1200) HOLL
                                                                              CONF 119
      WRITE(6,1300) V, ELL, RHC, TEMP, VIS
                                                                              CONF 120
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WRITE(6,1400) HI, HPINI, TFRINT, XSTART
                                                                             CONF 121
       WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                             CONF 122
       WRITE (6,1520) NW, RM, TGL
                                                                             CONF 123
      WRITE (6,1540)
                                                                             CONF 124
       DO 4 J=2,3
                                                                             CONF 125
       I=J-1
                                                                             CONF 126
      WRITE (6,1550) I, YE(J), ZE(J), YI(J) ,ZI(J)
                                                                             CONF
                                                                                  127
C
       INITIALIZE
                                                                             CONF
                                                                                  128
      FN = V**2/(9.8*ELL)
                                                                             CONF 129
       FNR = 1.0/FN
                                                                             CONF 130
       IF (.NOT. IPLOT) GO TO 5
                                                                             CONF 131
      REWIND 10
                                                                             CONF
                                                                                  132
       WRITE (6,1800)
                                                                             CONF
                                                                                  133
C
      ENTER TRAJECTORY CALCULATION LOOP
                                                                             CONF 134
    5 CALL PARTCL(V, ELL, RHC, VIS, TEMP, DIAM, DLK, RHOP, VT, RF, PT, ACC, NFIN)
                                                                             CONF 135
      IF(NFIN .EQ. 0) GO TO 6
                                                                             CONF
                                                                                  136
      IF( .NOT. IPLOT) RETURN
                                                                             CONF 137
      ENDFILE 10
                                                                             CONF 138
      REWIND 10
                                                                             CONF 139
      RETURN
                                                                             CONF 140
    6 READ(5,1108) XW, YW, ZW
                                                                             CONF 141
      WRITE(6,3500) XM. YH. ZW
                                                                             CONF 142
      IF NECESSARY SET DEFAULT VALUES FOR INITIAL AND FINAL TRAJECTORY
C
                                                                             CONF 143
C
      POINT GUESSES
                                                                             CONF 144
      IF (ABS (YE(2))+ABS (YE(3))+ABS (ZE(3))+ABS (ZE(3))+ABS (YI(2))+
                                                                             CONF 145
     4 ABS(YI(3)) +ABS(ZI(2))+AES(ZI(3)) .NE. G.O) GO TO 7
                                                                             CONF 146
      YE(2) = YM + SIGN(1.5*RW*TOL, YW)
                                                                             CONF
                                                                                  147
      ZE(2) = ZW + SIGN(1.5*RW*TOL, ZW)
                                                                             CONF 148
      YE(3) = YW - SIGN(1.5*RW*TOL, YW)
                                                                             CONF 149
      ZE(3) = ZW - SIGN(1.5*RW*TOL, ZW)
                                                                             CONF 150
      YI(2) = YW
                                                                             CONF 151
      ZI(2) = ZW
                                                                             CONF 152
      YI(3) = YE(2)
                                                                             CONF 153
      ZI(3) = ZE(2)
                                                                             CONF 154
    7 COF = PT*VT*FN
                                                                             CONF 155
      R = RF + VT
                                                                             CONF 156
      XPSTAR = XW
                                                                             CONF 157
      YPSTAR = YW
                                                                             CONF 158
      ZPSTAR = ZW
                                                                             CONF 159
      YPSTARP=YW
                                                                             CONF 160
      ZPSTARP=ZW
                                                                             CONF 161
      XI3P = 0.0
                                                                             CONF 162
      Y13P = 0.0
                                                                             CONF 163
      ZI3P = 0.6
                                                                             CONF 1E4
      XWP=XSTART
                                                                             CONF 165
      XPP = XW
                                                                             CONF 166
      XP = 0.0
                                                                             CONF 167
      YP = 0.0
                                                                             CONF 168
      ZP = 0.0
                                                                             CONF 169
      IP = 0
                                                                             CONF 170
C
                                                                             CONF 171
C
      COMPUTE TRAJECTORY THAT PASSES THROUGH THE CENTER OF THE FLUX TUBECONF 172
C
                                                                             CONF 173
      ALPHAO = 0.0
                                                                             CONF 174
      BETAO = 0.0
                                                                             CONF 175
      ALPHAR=0.7
                                                                             CONF 176
      BETAR=0.0
                                                                             CONF 177
      WRITE (6,2805) IP, XPSTAR, YPSTAR, ZPSTAR, YPSTARP, ZPSTARP
                                                                             CONF 178
      CALL MAP (YI, ZI, TCL, FW, YE, ZE)
                                                                             CONF 179
      IF( IT .LT. 0 ) GO TO 5
```

CONF 180

```
C
              COMPUTE INITIAL AND FINAL TRAJECTORY ANGLES
                                                                          CONF 181
      CALL FLCVEL(XI3, YI3, ZI3, VX, VY, VZ, HI, INBODY)
                                                                          CONF 182
      ALPHAG = ATAN(VY/VX) + 180./PI
                                                                          CONF 183
      BETAO = ATAN((VZ-VT)/SQRT(VX++2 + VY++2)) + 180./PI
                                                                          CONF 184
      ALPHAR = ATANCPC41/PC219#180./PI
                                                                          CONF 185
      BETAR = ATAN(P(6)/SQFT(P(2)*+2+P(4)*+2))*180./PI
                                                                          CONF 186
      WRITE (6,2000) ALPHAD, BETAN, ALPHAR, BETAR
                                                                          CONF 187
      IF(NW .IQ. C) GO TO 5
                                                                          CONF 188
      ALPHAD = ALPHAD*PI/180.
                                                                          CONF 189
      BETAG = BETAG PI/180.
                                                                          CONF 190
      ALPHAR = ALPHAR*PI/18G.
                                                                          CONF 191
      BETAR = BETAR*PI/180.
                                                                          CONF 192
      COMPUTE AIR AND PARTICLE SPEEDS AT FINAL PCINT OF TRAJECTORY
                                                                          CONF 193
      CALL FLOVEL( P(1), P(3), P(5), VX, VY, VZ, HI, INBODY)
                                                                          CONF 194
      VTGT = SQRT(VX^{++}2 + VY^{++}2 + VZ^{++}2)
                                                                          CONF 195
      VPGT = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
                                                                          CONF 196
      XI3P = XI3
                                                                          CONF 197
      YI3P = YI3
                                                                          CONF 198
      ZI3P = ZI3
                                                                          CONF 199
      CALL TRANSFM( 0.0, VI(2) - YI3, ZI(2) - ZI3, ALPHAU, BETAJ,
                                                                          CONF 2uù
     1 XP, YP, ZP, 1)
                                                                          CONF 201
      YI(2) = YP
                                                                          CONF 202
      ZI(2) = ZP
                                                                          CONF 263
      CALL TRANSFM(P(1) - XPSTAR, YE(2) - YPSTAR, ZE(2) - ZPSTAR,
                                                                          CONF 204
     1 ALPHAR, BETAR, XP, YP, ZP, 1)
                                                                          CONF 205
      YE(2) = YP
                                                                          CONF 206
      ZE(2) = ZP
                                                                          CONF 207
      YI(3) = 0.0
                                                                          CONF 208
      ZI(3) = 0.8
                                                                          CONF 209
      CALL TRANSFM(P(1) - XPSTAR, YE(3) - YPSTAR, ZE(3) - ZPSTAR,
                                                                          CONF 210
     1 ALPHAR, BETAR, XP, YP, ZP, 1)
                                                                          CONF 211
      YE(3) = YP
                                                                          CONF 212
      ZE(3) = ZP
                                                                          CONF 213
      XP = XW
                                                                          CONF 214
      YP = YH
                                                                          CONF 215
      ZP = ZW
                                                                          CONF 216
      XWP = 0 . B
                                                                          CONF 217
C
                   LOOP FOR EACH POINT ON FLUX TUBE PERIPHERY
                                                                          CONF 218
      DO 500 IP=1,NW
                                                                          CONF 219
      THETA = FLOAT(IP-1)/FLOAT(NW) +3.1415926536 +2.
                                                                          CONF 220
C
               CALCULATE TARGET COORDINATES IN FLUX TUBE SYSTEM
                                                                          CONF 221
      YPSTARP = RW + SIN(THETA)
                                                                          CONF 222
      ZPSTARP = RW + COS(THETA)
                                                                          CONF 223
        IPSTAR = IP
                                                                          CONF 224
C
              TRANSFORM TARGET COCRDINATES TO FLOW SYSTEM
                                                                          CONF 225
      CALL TRANSFMID.G.YPSTARP, ZPSTARP, ALPHAR, BETAR, XPSTAR, YPSTAR,
                                                                          CONF 226
     1 ZPSTAR.-1)
                                                                          CONF 227
      XPSTAR = XW + XPSTAR
                                                                          CONF 228
      YPSTAR = YW + YPSTAR
                                                                           CONF 229
      ZPSTAR = ZW + ZPSTAR
                                                                           CONF 230
C
              GUESS INITIAL COORDINATES AND COMPUTE TRAJECTORY
                                                                           CONF 231
      WRITE (6,2800) IP, XPSTAR, YPSTAR, ZPSTAR, YPSTARP, ZPSTARP
                                                                           CONF 232
      CALL MAP (YI.ZI.TOL.RW, YE.ZE)
                                                                           CONF 233
      IF( IT .LT. 0 ) GO TC 5
                                                                           CONF 234
              TRANSFORM FINAL AND INITIAL COORDINATES TO FLUX TUBE SYS. CONF 235
C
                                                                           CONF 236
      CALL TRANSFM (P(1) - XW , P(3) - YW ,P(5) - ZW ,ALPHAR, BETAR,
     1XEXIT(IP), YEXIT(IP), ZEXIT(IP),1)
                                                                           CONF 237
      CALL TRANSFM (XI3-XI3P, YI3-YI3P, ZI3-ZI3P, ALPHAO, BETAO, XINIT(IP),
                                                                           CONF 238
     1 YINIT (IP), ZINIT (IP), 1)
                                                                           CONF 239
      IF ( ABS(XINIT(IP)) . LE . RH + TOL ) GO TO 500
                                                                           CONF 240
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WRITE (6, 2900) XINIT(IP), XI3P
                                                                           CONF 241
  500 CONTINUE
                                                                           CONF 242
      COMPUTE FLUX TUBE CROSS SECTION AREAS IN THE INITIAL AND TARGET
                                                                           CONF 243
C
      PLANES, AND COMPUTE CONCENTRATION FACTOR, ETC.
                                                                           CONF 244
                                                                           CONF 245
      WRITE (6,2200) XI3P, YI3P, ZI3P, XW, YW, ZW
      DO 600 IP=1,NW
                                                                           CONF 246
  600 WRITE (6.2300) IP, XIMIT(IP), YIMIT(IP), ZIMIT(IP), XEXIT(IP),
                                                                           CONF 247
     1 YEXIT(IP), ZEXIT(IP)
                                                                           CONF 248
      CALL POLYGON (YINIT, ZIMIT, NH, AREA)
                                                                           CONF 249
      CALL POLYGON (YEXIT, ZEXIT, NW. DENOY)
                                                                           CONF 250
      CONFAK = AREA/DENOM
                                                                           CONF 251
      CONRTO = CG FAK / VPGT
                                                                           CONF 252
      WRITE (6,3000) AREA, DENCM, COMFAC, XW, YW, ZW, DIAM
                                                                           CONF 253
      WRITE (6,3400) DLR, RHOF
                                                                           CONF 254
      WRITE( 6, 3200 ) VIGT, CONRTO
                                                                           CONF 255
C
                                                                           CONF 256
C
                                                                           CONF 257
C
                                                                           CONF 258
C
      SET UP TRIAL COORDINATES FOR NEXT PARTICLE
                                                                           CONF 259
C
                                                                           CONF 260
      YI(3) = YI3
                                                                           CONF 261
      ZI(3) = ZI3
                                                                           CONF 262
      YE(3) = P(3)
                                                                           CONF 263
      2E(3) = P(5)
                                                                           CONF 2 E4
      CALL TRANSFM( G.G. YI(2), ZI(2), ALPHAU, BETAD, XI3, YI3, ZI2, -1)CONF 265
      YI(2) = YI3 + YI3P
                                                                           CONF 266
      ZI(2) = ZI3 + ZI3P
                                                                           CONF 267
      CALL TRANSFM( 0.0, YE(2), ZE(2), ALPHAR, BETAR, XI3, YI3, ZI3, -1) CONF 268
      YE(2) = YI3 + YH
                                                                           CONF 2E9
      ZE(2) = ZI3 + ZW
                                                                           CONF 270
      GO TO 5
                                                                           CONF 271
 1003 FORMAT(18A4, 7X,L1)
                                                                           CONF 272
 1100 FORMAT(8F18.5)
                                                                           CONF 273
 1150 FORMAT (110,7F10.5)
                                                                           CONF 274
1200 FORMAT (-1H1, 5X, 15HC CNF AC RUN ID -/ 8X, 18A4)
                                                                           CONF 275
1300 FORMAT(1H0, 5X, 21HPFYSICAL INPUT DATA -/7X,10HAIR SPEED=1PE13.6, CONF 276 1 3X, 37HCHARACTERISTIC DIMENSION OF THE BODY=1PE13.6/ 7X,35HEENSICONF 277
     2Y AND TEMPERATURE CF AIR ARE 1PE13.6, 5H AND 1PE13.6,20H AIR VISCONF 278
     3COSITY IS 1PE13.6)
                                                                           CONF 279
 1400 FORMAT( 1HO, 5X, 29H NUMERICAL INTEGRATOR INPUTS -/ 7X, 10HTIME STECONF 260
     1P=1PE11.4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRINT TIME INTCONF 281
     ZERVAL=1PE11.4, 3x, 24HUPSTREAM START DISTANCE=1PE11.4)
                                                                           CONF 282
 1500 FORMAT( 1H0, 6X, 33HLOCAL ERROR TOLERANGES FOR DVDQ -, 3(1PE14.4)) CONF 283
 1520 FORMAT( 1H0, 5X, 35HFARTICLE FLUX TUBE SPECIFICATIONS -/
                                                                           CONF 284
                 7X, 46HNUMBER OF TRAJECTORIES ON FLUX TUBE PERIPHERY=13, CONF 285
     1
     2 3X, 27HFLUX TUBE RADIUS AT TARGET=F9.5, 3X, 10HTOLERANCE=F8.4) CONF 286
 1540 FORMAT( 1HG, 5%, 40HTARGET AND INITIAL CCORDINATE ESTIMATES-/ 10%,CONF 287
     1 6HJGUESS, 9X, 2HYT, 13X, 2HZT, 13X, 2HYI, 13X, 2HZI)
                                                                           CONF 288
 1550 FORMAT( I14, 4(5X, F10.5))
                                                                           CONF 289
 1800 FORMAT( ///6x, 51HTRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTICONF 290
     1 ING//)
                                                                           CONF 291
 2000 FORMAT( ///20X, 47HINITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -CONF 292
              7HALPHA0=F10.4, 5X, 6HBETA0=F10.4/ 22X, 7HALPHAR=F10.4. 5XCONF 293
     1/ 22X,
         6HBETAR=F10.4)
                                                                            CONF 294
 2200 FORMAT( 1H1, 35X, 44HFLUX TUBE CROSS SECTION COORDINATES IN THE -/CONF 295
                                                                           CONF 296
     1/ 28X.
               13HINITIAL PLANE, 33X, 12HTARGET PLANE//
           8X, 2HIP, 2(9X, 2HXP, 13X, 2HYP, 13X, 2HZP, 4X)/ 4X, 6HCENTECONF 297
     3R6(1PE15.4),14H (FLO) SYSTEM))
                                                                           CONF 298
                                                                           CONF 299
 2300 FORMAT (110,6(1PE15.4),19H (FLUX TUBE SYSTEM))
 2600 FORMAT (A4)
                                                                           CONF 300
```

```
2800 FORMAT( ///
                   18H TRAJECTORY NUMBER: 13,5X,20HTARGET COORDINATES -CONF 301
          XPSTAR =F10.6, 4X, 8HYPSTAR =F10.6,5X, 8HZPSTAR =F10.6,
                                                                        CONF 302
   2 14H (FLOW SYSTEM)/
                          70X, 8HYPSTARP=F10.6, 5X, 8HZPSTARP=F10.6, CONF 303
   3 19H (FLUX TUBE SYSTEM)//
                                                                        CONF 384
                                                                        CONF 305
        15X, 6HY FINAL, 6X, 6HZFINAL, 6X, 10 HITERATIONS, 5X, 5HYINIT, 7X,
   5 SHZINIT, 7X, 25HERRCR (FLUX TUBE SYSTEM))
                                                                        CONF 356
2900 FORMAT(// 36x,49HINITIAL POINT IS NOT IN CORRECT TRANSFORMED PLANECONF 36%
    1/ 32X, 6HXINIT=1PE 12.5, 5X, 5HXI3P=1PE12.5)
                                                                        CONF 3#8
3000 FORMAT(// 15x, 50HFLUX TUBE CROSS SECTION AREA IN THE INITIAL PLANCONF
                                                                             309
                 8X, 20HIN THE TARGET PLANE=1FE12.5// 15X, 21HGONCENTRACONF 310
   1E=1PE12.5,
   2TION FACTOR=GPF11.5//
    3 10X, 21HAT THE PCINT (X,Y,Z)=,3F12.5/10X,27HFOR A PARTICLE (F DIACONT 312
   4METER=, F12.5)
                                                                        CONF 313
                                                                        CONF 314
3200 FORMAT( 10x, 36HNORMALIZED AIR SPEED AT FINAL POINT=F12.5/
       10X, 29HPARTICLE CONCENTRATION RATIO=F12.5)
                                                                        CONF 315
3400 FORMAT( 1H+, 52X, 30HWITH DIAMETER TO LENGTH RATIO=1PE12.5, 3X,
                                                                        CONF 316
   1 12HAND DENSITY=1PE12.5)
                                                                        CONF 317
3500 FORMAT( 1H0, 9X, 22HTARGET COORDINATES X=1PE12.5, 5X, 2HY=1PE12.CONF 318
   15. 5X. 2HZ=1PE12.5)
                                                                        CONF 319
     END
                                                                        CONF 320
```

```
*DECK . MAP
                                                                             MAP
                                                                                     1
      SUBROUTINE
                                                                             MAP
                                                                                     2
                 MAP (YI, ZI, TOL, RW, YE, ZE)
                                                                             MAP
                                                                                     3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1975
                                                                             MAP
                                                                                     4
C
                                                                                     5
                                                                             MAP
C
         MAP GUESSES THE INITIAL COORDINATES OF A TRAJECTORY THAT IS
                                                                             MAP
                                                                                     6
                                                                             MAP
C
         AIMING FOR A POINT IN THE TARGET PLANE. AFTER THE TRAJECTORY
                                                                                     7
C
         IS COMPUTED, THE DISTANCE FROM THE TARGET IS COMPARED TO
                                                                             MAP
                                                                                     8
C
         THE ALLOWABLE TOLERANCE. THE PROCESS IS REPEATED UNTIL DISTANCHAP
                                                                                     9
C
         FROM THE TARGET IS BELOW THE TOLERANCE.
                                                                             MAP
                                                                                    10
C
         ONCE A HISTORY OF GREATER THAN THREE TRAJECTORIES HAS BEEN
                                                                             MAP
                                                                                    11
C
         COMPUTED, LEAST SQUARES IS USED TO DETERMINE TRIAL INITIAL
                                                                             MAP
                                                                                    12
C
         COORDINATES
                                                                             MAP
                                                                                    13
C
               GLOSSARY
                                                                             MAP
                                                                                    14
C
               MATRIX OF COEFFICIENTS INVERTED IN MATINV
                                                                             MAP
                                                                                    15
      Δ
C
               INTERMEDIATE STURAGE FOR LEAST SQUARES NORMAL MATRIX TERMSMAP
      AA, C
                                                                                    16
C
      AC
               ACCELERATION MODULUS
                                                                             MAP
                                                                                    17
C
      ANG
               ANGLE OF DRAG VECTOR PROJECTED IN THE X-Y PLANE RELATIVE
                                                                             MAP
                                                                                    18
C
               TO THE X AXIS
                                                                             MAP
                                                                                    19
C
      В
               ENTERS MATINV AS CONSTANT MATRIX AND RETURNS AS SOLUTION MMAP
                                                                                    20
C
      COSA, COSB, COSC DIRECTION COSINES OF DRAG VECTOR
                                                                             MAP
                                                                                    21
C
      CNG
               ANGLE OF DRAG VECTOR RELATIVE TO Z AXIS
                                                                              MAP
                                                                                    22
C
      DIST
               DISTANCE BETWEEN END OF TRAJECTORY AND TARGET POINT
                                                                             MAP
                                                                                    23
C
               VELOCITY OF FARTICLE RELATIVE TO AIR
      DV
                                                                              MAP
                                                                                    24
C
               ITERATION NUMBER
      IT
                                                                              MAP
                                                                                    25
C
      VΔ
               AIR SPEED AT TARGET POINT
                                                                                    26
                                                                              MAP
C
      VP
               PARTICLE SPEED AT TARGET POINT
                                                                              MAP
                                                                                    27
C
      H
               LEAST SQUARES SUMMAND HEIGHT
                                                                                    28
                                                                              MAP
C
      YE
               ARRAY OF FINAL
                                 Y COORD FOR LAST
                                                                             MAP
                                                                                    29
                                                     3 GUESSES
C
               ARRAY OF INITIAL Y COORD FOR LAST
      YI
                                                     3 GUESSES
                                                                              MAP
                                                                                    30
C
      YI3
               NEXT GUESS FOR INITIAL Y COORD (FLCH SYSTEM)
                                                                              MAP
                                                                                    31
C
      ZE
               ARRAY OF FINAL
                                 Z COORD FOR LAST
                                                                             MAP
                                                                                    32
                                                     3 GUESSES
               ARRAY OF INITIAL Z COORD FOR LAST
C
      ZI
                                                                             MAP
                                                                                    33
                                                     3 GUESSES
C
      ZI3
               NEXT GUESS FOR INITIAL Z COORD
                                                                              MAP
                                                 (FLOW SYSTEM)
                                                                                    34
      LOGICAL IPLOT
                                                                              MAP
                                                                                    35
```

```
COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                                 MAP
       1RF, REO, R, XPSTAR, YFSTAR, ZFSTAR, P(6), TPRINT, IT, ALPHAU, BETAU, IREC,
                                                                                        36
                                                                                 MAP
       2 IPLOT, IPLT, XPLOT (60), YPLCT (60), ZPLOT (60), ALPHAR, BETAR, YPSTARP,
                                                                                        37
       3ZPSTARP,XI3P,ZI3F,XP,YF,ZP,XHP,XPP,ACC,BLR,JLIM
                                                                                 MAP
                                                                                        38
        DIMENSION Y183), ZI(3), A(4,4), B(4), YE(3), ZE(3), DY(3), DZ(3), MAP
                                                                                 MAP
                                                                                        39
                                                                                        40
       1AA( 6), C(3), PSTR(3)
        DATA ILIN/ 25/
                                                                                        41
        DO 50 J=2.3
                                                                                 MAP
                                                                                        42
                                                                                 MAP
        DY(J) = YE(J) - YPSTARP
                                                                                        43
                                                                                 MAP
    50 DZ(J) = ZE(J) - ZPSTARP
                                                                                        44
                                                                                 MAP
                                                                                        45
        IT = 0
                                                                                 MAP
        N = 4
                                                                                        46
 C
                                                                                 MAP
                                                                                        47
                      GENERAL ITERATION CALCULATION OF NEXT GUESS
                                                                                 MAP
                                                                                        48
                GENERATE CONSTANT ARRAY (B) FOR PATING IF IT . LE . 3
                                                                                 MAP
                                                                                       49
   100 DO 120 J=2,3
        I = J - 1
                                                                                 MAP
                                                                                        50
                                                                                 MAP
                                                                                       51
        B(2*I-1) = YI(J)
                                                                                 MAP
                                                                                       52
        B(2*I) = ZI(J)
   120 CONTINUE
                                                                                 MAP
                                                                                       53
 C
                                                                                MAP
                                                                                       54
                GENERATE COEFFICIENT ARRAY (A) FOR MATINY
                                                                                MAP
       DO 140 J=2,3
                                                                                       55
                                                                                MAP
                                                                                       56
       I = J - 1
                                                                                MAP
                                                                                       57
        JROW = 2*I-1
                                                                                MAP
                                                                                       58
       JROW2 = 2*I
                                                                                MAP
                                                                                       59
       A(JROH,1) = 1.
                                                                                MAP
       A(JROW, 2) = 0.
                                                                                       60
                                                                                MAP
                                                                                       61
       A(JROW,3) = DY(J)
                                                                                MAP
       A(JROW,4) = -DZ(J)
                                                                                       62
                                                                                MAP
                                                                                       63
       A(JROW2,1) = 6.
                                                                                MAP
       A(JROW2,2) = 1.
                                                                                       64
                                                                                MAP
       A(JROH2,3) = DZ(J)
                                                                                       65
                                                                                MAP
       A(JROH2.4) = DY(J)
                                                                                       66
   140 CONTINUE
                                                                                MAP
                                                                                       67
                                                                                MAP
                                                                                       68
       GO TO 280
C
       IF IT . GE . 3 SOLVE FOR THE NEXT INITIAL COORDINATES GUESS BY
                                                                                MAP
                                                                                       69
                                                                                MAP
C
       LEAST SQUARES
                                                                                       70
                                                                                       71
   200 CONTINUE
                                                                                MAP
C
                                                                                MAP
                                                                                       72
C
       INCREMENT LEAST SQUARES NORMAL EQUATIONS
                                                                                MAP
                                                                                       73
C
                                                                                MAP
                                                                                       74
                                                                                MAP
       W = 1.0
                                                                                       75
                                                                                MAP
       G = DY(3) / DIST**2
                                                                                       76
       Q = DZ(3) / DIST**2
                                                                                MAP
                                                                                       77
       S = G * YI(3) + Q * ZI(3)
                                                                                MAP
                                                                                       78
                                                                                MAP
                                                                                       79
       AA(1) = AA(1) + G**2 * H
       AA(2) = AA(2) + G * G * W
                                                                                MAP
                                                                                      80
                                                                                MAP
                                                                                      81
       AA(3) = AA(3) + G * H
                                                                                MAP
       AA(4) = AA(4) + 0**2 * H
                                                                                      82
       AA(5) = AA(5) +
                                                                                MAP
                                                                                      83
                        Q * W
       AA(6) = AA(6)
                                                                                MAP
                                                                                      84
                                                                                MAP
      C(1) = C(1) + G + S + H
                                                                                      95
                                                                                MAP
                                                                                      86
      C(5) = C(5) + 6 + 8 + M
                                                                               MAP
                                                                                      87
      C(3) = C(3) + S * H
                                                                               MAP
C
                                                                                      88
C
      SET-UP LEAST SQUARES NORMAL EQUATIONS
                                                                               MAP
                                                                                      89
                                                                               MAP
                                                                                      90
                                                                               MAP
  220 A(1,1) = AA(1)
                                                                                      91
                                                                               MAP
      A(1,2) = AA(2)
                                                                                      92
                                                                               MAP
                                                                                      93.
      A(1,3) = AA(3)
                                                                               MÁP
      A12,2) = AA (4)
                                                                                      94
                                                                               MAP
```

95

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A(2,3) = AA(5)
                                                                              MAP
                                                                                     96
      A(3,3) = AA(6)
                                                                              MAP
                                                                                     97
      DO 258 I=2,3
                                                                              MAP
                                                                                     98
      K = I-1
                                                                              MAP
                                                                                     99
      00 250 J=1,3
                                                                              MAP
                                                                                    100
  250 A(J,K) = A(K,J)
                                                                              MAP
                                                                                    151
      DO 268 I=1.3
                                                                                    102
                                                                              MAP
  260 B(I) = C(I)
                                                                              MAP
                                                                                    103
      DO 265 I=1.3
                                                                              MAP
                                                                                    104
      A(4.I) = 0.0
                                                                              MAP
                                                                                    105
  265 A(I.4) = 0.0
                                                                              MAP
                                                                                    1 ú 6
      A(4.4) = 1.0
                                                                              MAP
                                                                                    107
      8(4) = 0.0
                                                                              MAP
                                                                                    108
C
               SOLVE MATRIX EQNS TO GET NEXT GUESS
                                                                              HAP
                                                                                    109
  280 CALL MATINY (A, N, B, 1, DETERM)
                                                                              MAP
                                                                                    110
      CALL'TRANSFM(XWP,B(1),B(2),ALPHAQ,BETAG,XI3,YI3,ZI3,-1)
                                                                              MAP
                                                                                    111
      XI3 = XI3 + XI3P
                                                                              MAP
                                                                                    112
      YI3 = YI3 + YI3P
                                                                              MAP
                                                                                    113
      ZI3 = ZI3 + ZI3P
                                                                              MAP
                                                                                    114
      CALL TRAJECT
                                                                              MAP
                                                                                    115
      IF (IT .LT. D) RETURN
                                                                              MAP
                                                                                    116
      IT = IT + 1
                                                                              MAP
                                                                                    117
C
      IF (IT . GT . 3) GO TO 305
                                                                              MAP
                                                                                    118
               UPDATE ARRAYS OF INITIAL AND FINAL COORDS.
                                                                              MAP
                                                                                    119
  290 00 300 J=1,2
                                                                              MAP
                                                                                    120
      YI(J) = YI(J+1)
                                                                              MAP
                                                                                    121
      ZI(J) = ZI(J+1)
                                                                              MAP
                                                                                    122
      DY(J) = DY(J+1)
                                                                              MAP
                                                                                    123
      DZ(J) = DZ(J+1)
                                                                              MAP
                                                                                    124
      YE(J) = YE(J+1)
                                                                              MAP
                                                                                    125
      ZE(J) = ZE(J+1)
                                                                              MAP
                                                                                    126
      PSTR(J) = PSTR(J+1)
                                                                              MAP
                                                                                    127
  300 CONTINUE
                                                                              MAP
                                                                                    128
  305 CONTINUE
                                                                              MAP
                                                                                    129
      YI(3) = B(1)
                                                                                    130
                                                                              MAP
      ZI(3) = B(2)
                                                                              MAP
                                                                                    131
      CALL TRANSFM(P(1) - XP , P(3) - YP , P(5) - ZP , ALPHAR, BETAR,
                                                                              MAP
                                                                                    132
     1XDUM, YE (3), ZE (3),1)
                                                                              MAP
                                                                                    133
                                                                              MAP
      IF ( ABS(XP) . EQ . 0.0 ) XDUM = KDUM - XPP
                                                                                    134
      IF (ABS (XDUM) . GT . RW + TOL ) WRITE(6, 3000 )
                                                                              MAP
                                                                                    135
      DY(3) = YE(3) - YPSTARP
                                                                              MAP
                                                                                    136
      DZ(3) = ZE(3) - ZPSTARP
                                                                              MAP
                                                                                    137
      DIST = SQRT(DY(3)**2 + DZ(3)**2)
                                                                              MAP
                                                                                    138
      PSTR(3) = DIST
                                                                              MAP
                                                                                    139
C
                GUESS AGAIN OR GO ON TO VEXT POINT ON WINDOW?
                                                                              MAP
                                                                                    140
      WRITE (6,2700) YE(3), ZE(3), IT, YI(3), ZI(3), DIST
                                                                                    141
                                                                              MAP
      IF (DIST .LE. RN+TOL ) GO TO 490
                                                                              MAP
                                                                                    142
      IF( IT .LE. ILIM) IF( IT - 3) 100,310,200
                                                                              MAP
                                                                                    143
      WRITE (6,2900) ILIM
                                                                              MAP
                                                                                    144
      IT = -ILIM
                                                                              MAP
                                                                                    145
      RETURN
                                                                              MAP
                                                                                    146
C
                                                                              MAP
                                                                                    147
C
      INITIALIZE FOR LEAST SQUARES
                                                                              MAP
                                                                                    148
                                                                              MAP
                                                                                    149
  310 DO 320 I=1.3
                                                                              MAP
                                                                                    150
  320 C(I) = 0.0
                                                                                    151
                                                                              MAP
      00 325 I=1,6
                                                                              MAP
                                                                                    152
  325 \text{ AA(I)} = 0.0
                                                                              MAP
                                                                                    153
      DO 330 I = 1,3
                                                                              MAP
                                                                                    154
      W = 1.0
                                                                              MAP
                                                                                    155
```

```
MAP
      G = DY(I) / PSTR(I)**2
                                                                                 156
      Q = DZ(I) / PSTR(I) + +2
                                                                            MAP
                                                                                 157
      S = G * YI(I) + Q * ZI(I)
                                                                            MAP
                                                                                 158
      AA(1) \approx AA(1) + G^{++}2 + W
                                                                            MAP
                                                                                 159
      AA(2) = AA(2) + G + Q +
                                                                            MAP
                                                                                 160
      AA(3) = AA(3) + G + W
                                                                            MAP
                                                                                 161
      AA(4) = AA(4) + Q**2 * W
                                                                            MAP
                                                                                 162
      AA(5) = AA(5) + Q + W
                                                                                 163
                                                                            MAP
      AA(6) = AA(6) + W
                                                                            MAP
                                                                                 164
      C(1) = C(1) + G + S + W
                                                                           MAP
                                                                                 165
      C(2) = C(2) + Q + S + W
                                                                            MAP
                                                                                 166
  330 C(3) = C(3) + S + W
                                                                            MAP
                                                                                 167
      GO TO 100
                                                                            MAP
                                                                                 168
C
                       PRINT TRAJECTORY DUTPUT
                                                                            MAP
                                                                                 169
  490 REWIND 9
                                                                            MAP
                                                                                 170
      WRITE (6.1700)
                                                                                 171
                                                                            MAP
      DO 494 IWRITE = 1, IREC
                                                                                 172
                                                                            MAP
      READ (9) NEVAL. KSTEP. T. P(1), P(3), P(5), P(2), P(4), P(6), VX. VY. MAP
                                                                                 173
     2 VZ, H, R.AC
                                                                            MAP
                                                                                 174
      WRITE(6,1600) KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, MAP
                                                                                 175
     2 VZ, H, R, AC, NEVAL
                                                                                 176
                                                                            MAP
  494 CONTINUE
                                                                            MAP
                                                                                 177
      COMPUTE AND PRINT DRAG VECTOR AT TARGET POINT
                                                                                 178
                                                                            MAP
      DV = SQRT( (VX - P(2))**2 + (VY - P(4))**2 + (VZ - P(6))**2 )
                                                                            MAP
                                                                                 179
      COSA = (YX - P(2))/DV
                                                                            MAP
                                                                                 180
      COSB = (VY - P(4))/UV
                                                                            MAP
                                                                                 181
      COSC = (VZ - P(6))/DV
                                                                            MAP
                                                                                 182
      ANG = ATAN( COSB/COSA ) + 57.29577951
                                                                            MAP
                                                                                 183
      CNS = ACOS ( COSC ) + 57. 29577951
                                                                            MAP
                                                                                 184
      WRITE( 6, 3100 ) COSA, COSB, COSC, ANG, CNG
                                                                            MAP
                                                                                 185
      COMPUTE AND PRINT AIR AND PARTICLE SPEEDS AT TARGET POINT
                                                                                 186
                                                                            MAP
           = SQRT( VX++2 + VY+*2 * VZ++2 )
      VΔ
                                                                            MAP
                                                                                 187
           = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
      VP
                                                                            MAP
                                                                                 188
      WRITE(6, 3200) VA, VP
                                                                                 189
      IF (IPLOT) WRITE (10) IFLT, (XPLOT(J),YPLOT(J),ZPLOT(J),J=1,IPLT)MAP
                                                                                 190
       RETURN
                                                                            MAP
                                                                                 191
1600 FORMAT(I6, 10(1X,1PE11.4)/10X, 24H=1PE11.4,4H R=1PE11.4,5H
                                                                        AC=MAP
                                                                                 192
     11PE11.4, 8H NEVAL=16)
                                                                            MAP
                                                                                 193
 1700 FORMAT( 6H0KSTEP, 7X, 1HT, 11%, 1HX, 11X, 1HY, 11X, 1HZ, 19X,
                                                                            MAP
                                                                                 194
     1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X, 2HVZ)
                                                                            MAP
                                                                                 195
 2700 FORMAT (10X, 2E12.4,7X,13,5X,3E12.4)
                                                                            MAP
                                                                                 196
 2900 FORMAT(///20x, 28HTOLERANCE NOT SATISIFIED IN 14, 58H TRAJECTORY IMAP
                                                                                 197
     ITERATIONS. GIVE UP AND TRY THE NEXT PARTICLE)
                                                                            MAP
                                                                                 198
 3000 FORMATI///20x, 57HFINAL FARTICLE POSITION IS NOT IN THE ROTATED TAMA>
                                                                                 199
     1 GET PLANE)
                                                                                 200
                                                                            MAP
 3100 FORMAT( 5%, 28HDRAG VECTOR AT FINAL POINT -/ 6%, 18HDIRECTION COSMAP
                                                                                 201
     1 INES-3(1PE13.4), 77 19HANGLES A AND GAMMA-2(1PE13.4))
                                                                                 202
 3200 FORMAT(5X, 47HAIR AND FARTICLE SPEEDS AT THE FINAL FOINT ARE2(1PEMAP
                                                                                 203
     115,511
                                                                            MAP
                                                                                 204
      END
                                                                            MAP
                                                                                 205
```

```
*DECK, TRAJECT
                                                                               TRAJ
                                                                                       1
      SUBROUTINE TRAJECT
                                                                                       2
                                                                               TRAJ
Ċ
                                                                               TRAJ
                                                                                       3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1975
                                                                               TRAJ
                                                                                       4
¢
                                                                                       5
                                                                               TRAJ
Ċ
               TRAJECT CALCULATES 3-D PARTICLE TRAJECTORIES
                                                                               TRAJ
                                                                                       6
Ç
               EMBEDDED IN A FLOW FIELD DETERMINED BY FLOVEL.
                                                                                       7
                                                                               TR AJ
CCC
               THE PREDICTOR-CORRECTOR SJBROUTINE DVDQ IS USED
                                                                                       8
                                                                               TRAJ
               TO INTEGRATE THE EQUATIONS OF MOTION. OUTPUT AT TIME
                                                                               TRAJ
                                                                                       9
               INTERVAL TPRINT IS WRITTEN ON UNIT 9.
                                                                               TRAJ
                                                                                     10
Ċ
      DRAG PARAMETERS ARE CALCULATED BY FUNCTION PRFUN WHICH IS PARTICLETRAJ
                                                                                     11
C
      TYPE-SPECIFIC.
                         S.R.IMPACT IS A PROBLEM-SPECIFIC CODE THAT. AFTERTRAJ
                                                                                     12
C
      PARTICLE IMPACT ON THE BODY, ADJUSTS INITIAL PARTICLE COORDINATES TRAJ
                                                                                     13
C
      SUCH THAT ON THE NEXT TRIAL IMPACTION SHOULD NOT OCCUR.
                                                                               TRAJ
                                                                                     14
C
                                                                               TRAJ
                                                                                     15
C
               GLOSSARY
                                                                               TRAJ
                                                                                     16
C
      AC
               ACCELERATION MODULUS
                                                                               TRAJ
                                                                                     17
C
      DT()
               STOFAGE FOR CVDQ
                                                                               TRAJ
                                                                                     18
C
      EPS()
               LOCAL ERROR TOLERANCE FOR THE NUMERICAL INTEGRATION
                                                                               TRAJ
                                                                                     19
C
      F( )
               EQUATION OF MOTION OF THE PARTICLE -
                                                                               TRAJ
                                                                                     20
C
                  F(1) - X DIFECTION
                                                                                     21
                                                                               TRAJ
C
                  F(2) - Y DIRECTION
                                                                               TRAJ
                                                                                     22
C
                  F(3) - Z DIRECTION
                                                                               TRAJ
                                                                                     23
C
      G
               GSTOP FUNCTION (SEE DVDQ GLOSSARY)
                                                                               TRAJ
                                                                                     24
C
               TIME STEP
      H
                                                                               TRAJ
                                                                                     25
C
      IFLAG
               DVDC STATUS FLAG (SEE DVD2 GLOSSARY)
                                                                               TRAJ
                                                                                     26
C
      INBODY
               FLAG TO INCICATE WHEN TRAJECTORY HAS
                                                                               TRAJ
                                                                                     27
C
               PENETRATED THE BODY
                                                                               TRAJ
                                                                                     28
C
      KD(I)
               ORDER OF THE ITH DIFFERENTIAL EQUATION
                                                                               TRAJ
                                                                                     29
C
      KO(I)
               THE HIGHEST ORDER DIFFERENCE USED IN THE INTEGRATION OF
                                                                               TRAJ
                                                                                     30
C
               THE ITH EQUATION
                                                                               TRAJ
                                                                                     31
Ċ
      NEQ
               NUMBER OF EQUATIONS
                                                                               TRAJ
                                                                                     32
C
               NUMBER OF GSTOP FUNCTIONS (SEE DVDQ GLOSSARY)
      NG
                                                                               TRAJ
                                                                                     33
C
      NGE
               SEE DVDQ GLOSSARY
                                                                               TRAJ
                                                                                     34
C
      P()
               CURRENT VALUE OF THE DEPENDENT VARIABLES (SEE CONFAC)
                                                                               TRAJ
                                                                                     35
C
      PN()
               STORAGE FOR DVDQ
                                                                               TRAJ
                                                                                     36
C
      P
               REYNOLDS NIMEER
                                                                               TRAJ
                                                                                     37
C
      Ť
               TIME
                                                                               TRAJ
                                                                                     38
C
               INTEGRATION CUT-OFF TIME
      TFINAL
                                                                               TRAJ
                                                                                     39
C
      VX.
               AIR VELOCITY IN X DIRECTION
                                                                               TRAJ
                                                                                     40
C
      VY
               AIR VELOCITY IN Y DIRECTION
                                                                               TRAJ
                                                                                     41
      VZ
               AIR WELOCITY IN Z DIRECTION
                                                                               TRAJ
                                                                                     42
      DIMENSION F(3), EPS(3), KD(3), PN(6), KQ(3), DT(20,3)
                                                                               TRAJ
                                                                                     43
      LOGICAL IPLOT
                                                                               TRAJ
                                                                                     44
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PAGT,
                                                                               TRAJ
                                                                                     45
     1RF,REO,R,XPSTAR,YPSTAR,ZPSTAR,P(6),TPRINT,IT,ALPHAO,BETAU,IREC,
                                                                               TRAJ
                                                                                     46
     ZIPLOT, IPLT, XPLOT (60), YPLCT (60), ZPLOT (60), ALPHAR, BETAR, YPSTARP,
                                                                               TRAJ
                                                                                     47
     3ZPSTARP, XI3P, ZI3 F, XP, YP, ZP, XWP, XPP, ACC, DLR, JLIN
                                                                               TRAJ
                                                                                     48
      DATA MXSTEP, NEQ, NG, NGE/16,3,1,0/, KD/3+2/
                                                                               TRAJ
                                                                                     49
C
      INITIALIZE FOR THE NUMERICAL INTEGRATOR
                                                                               TRAJ
                                                                                     50
      JT = 0
                                                                               TRAJ
                                                                                      51
  100 IFLAG = 0
                                                                               TRAJ
                                                                                     52
      TFINAL = (XPSTAR-XI3)+ 2. 6
                                                                               TRAJ
                                                                                     53
      HMAX = TFINAL
                                                                               TRAJ
                                                                                      54
      A11 = COS( ALPHAR ) + COS( BETAR )
                                                                               TRAJ
                                                                                     55
      A12 = SIN( ALPHAR ) + COS( BETAR )
                                                                               TRAJ
                                                                                     56
      A13 = SIN( BETAR )
                                                                               TRAJ
                                                                                     57
      T = 0.0
                                                                               TRAJ
                                                                                     58
      EPS(1) = EPSI(1)
                                                                               TRAJ
                                                                                     59
      EPS(2) = EPSI(2)
                                                                               TRAJ
                                                                                     60
```

```
EPS(3) = EPSI(3)
                                                                             TRAJ
                                                                                    61
      H = HI
                                                                             TRAJ
                                                                                    62
      HMIN = HMINI
                                                                             TRAJ
                                                                                    63
      XPLOT(1) = XI3
                                                                             TRAJ
                                                                                    64
      YPLOT(1) = YI3
                                                                             TRAJ
                                                                                    65
      ZPLOT(1) = ZI3
                                                                             TRAJ
                                                                                    66
      IPLT = 1
                                                                             TRAJ
                                                                                    67
      COMPUTE INITIAL AIR FLOW VELOCITIES
                                                                             TRAJ
                                                                                    68
  110 CALL FLOVEL(XI3, YI3, ZI3, VX, VY, VZ, H, INBODY)
                                                                             TRAJ
                                                                                    69
      P(1) = XI3
                                                                             TRAJ
                                                                                    70
      P(2) = VX
                                                                             TRAJ
                                                                                    71
      P(3) = YI3
                                                                             TRAJ
                                                                                    72
      P(4) = VY
                                                                             TRAJ
                                                                                    73
      P(5) = ZI3
                                                                             TRAJ
                                                                                    74
      P(6) = VZ - VT
                                                                             TRAJ
                                                                                    75
  120 F(1) = 0.0
                                                                             TRAJ
                                                                                    76
      F(2) = 0.0
                                                                             TRAJ
                                                                                    77
      F(3) = VT*PT/COF - FNR
                                                                             TRAJ
                                                                                    78
      G = A11*(P(1) - XPP) + A12 * (P(3) - YP) + A13 * (P(5) - ZP)
                                                                             TRAJ
                                                                                    79
      CALL
                  DVDQ(NEQ, T, P, F, KD, EPS, IFLAG, H, HMIN,
                                                                             TRAJ
                                                                                    80
     * HMAX, TPRINT, TFINAL, PXSTEP, KSTEP, KEMAX, EMAX,
                                                                             TRAJ
                                                                                    81
     * KQ,PN,DT, NEVAL, NG, NGE, NSTOP, G, GT)
                                                                             TRAJ
                                                                                    82
C
      COMPUTE THE TRAJECTORY
                                                                             TRAJ
                                                                                    83
      REWIND 9
                                                                             TRAJ
                                                                                    84
      IREC = 0
                                                                             TRAJ
                                                                                    85
      GO TO 200
                                                                             TRAJ
                                                                                    86
  150 AC = ACC + SQRT( F(1)++2 + F(2)++2 + F(3)++2 ) + (RF/R)++2
                                                                             TRAJ
                                                                                    87
      WRITE(9)NEVAL, KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, TRAJ
                                                                                    88
     2 VZ, H, R, AC
      IREC = IREC + 1
                                                                             TRAJ
                                                                                    90
      IF (.NOT. IPLOT .ANC. IFLAG .LE. 10 ) GO TO 200
                                                                             TRAJ
                                                                                    91
      IPLT = IPLT + 1
                                                                             TRAJ
                                                                                    92
      XPLOT(IPLT) = P(1)
                                                                             TRAJ
                                                                                    93
      YPLOT(IPLT) = P(3)
                                                                             TRAJ
                                                                                    94
      ZPLOT(IPLT) = P(5)
                                                                             TRAJ
                                                                                    95
      IF( IFLAG .GT. 10 ) RETURN
                                                                             TRAJ
                                                                                    96
                  DVDQ (NEQ, T, P, F, KB, EPS, IFLAG, H, HMIN.
                                                                             TRAJ
                                                                                    97
     * HMAX, TPRINT, TFINAL, MXST EP, KSTEP, KEMAX, EMAX,
                                                                             TRAJ
                                                                                    98
     * KQ,PN,DT, NEVAL,NG,NGE,NSTOP,G,GT)
                                                                             TRAJ
      GO TO( 210, 219, 150, 250, 150, 220, 230, 250, 260, 260, 150,
                                                                             TRAJ 100
     1 150 ), IFLAG
                                                                             TRAJ 101
  210 CALL FLOVEL(P(1),P(3),P(5),VX,VY,VZ,H,IN80DY)
                                                                             TRAJ 102
       IF (INBODY .EQ. 0) GO TO 215
                                                                             TRAJ 103
      WRITE (6,2200) P(1), P(3), P(5), YI3, ZI3, JT
                                                                             TRAJ 144
      CALL IMPACT (YI3, ZI3)
                                                                             TRAJ 1J5
      JT = JT + 1
                                                                             TRAJ 106
      IF(JT.LT. JLIM) GO TO 100
                                                                             TRAJ 107
      WRITE (6.2500) JLIM
                                                                             TRAJ 108
      IT=-JLIM
                                                                             TRAJ 109
      RETURN
                                                                             TRAJ 110
  215 R = RF+SQRT((VX - P(2))++2 + (VY - P(4))++2 + (VZ - P(6))++2 )
                                                                             TRAJ &11
      PR = PRFUN(R, DLR, COF)
                                                                             TRAJ 1112
      F(1) = (VX - P(2))*PR
                                                                             TRAJ 113
      F(2) = (VY - P(4)) *PR
                                                                             TRAJ 114
      F(3) \approx (VZ - P(6)) + PR - FNR
                                                                             TRAJ 115
      GO TO 200
                                                                             TRAJ 116
  221 EPS (KEMAX) = 32. FEMAX FEPS (KEMAX)
                                                                             TRAJ 117
      WRITE(6,1900) IFLAG, KSTEP, NEVAL
                                                                             TRAJ 118
      WRITE(6.2000) EPS(KEMAX), KEMAX
                                                                             TRAJ 119
```

TRAJ 120

GO TO 210

```
230 \text{ HMIN} = H
                                                                          TRAJ 121
      WRITE(6,1900) IFLAG, KSTEP, NEVAL
                                                                          TRAJ 122
                                                                          TRAJ 123
      WRITE(6.2100) HMIN
                                                                          TRAJ 124
      GO TO 200
  260 G = A11*(P(1) - XPP) + A12 * (P(3) - YP) + A13 * (P(5) - ZP)
                                                                          TRAJ 125
      GO TO 200
                                                                          TRAJ 126
  250 WRITE(6,1900) IFLAG, KSTEP, NEVAL
                                                                          TRAJ 127
      AC = ACC + SQRT( F(1)++2 + F(2)++2 + F(3)++2 ) + (RF/R)++2
                                                                          TRAJ 128
      WRITE(6,1600) KSTEP, T. F(1), P(3), P(5), F(2), P(4), P(6), VX, VY, TRAJ 129
                                                                          TRAJ 130
     1 VZ, H, R, AC
      RETURN
                                                                          TRAJ 131
C
                                                                          TRAJ 132
                                                                          TRAJ 133
                                                                        ACTRAJ 134
 1600 FORMAT(I6, 10(1x,1PE11.4)/ 10x, 24H=1PE11.4, 4H R=1FE11.4, 5H
                                                                          TRAJ 135
     1=1PE11.4)
 1900 FORMAT( 5x, 6HIFLAG=12, 11H FOR KSTEP=16, 6H NEVAL=16)
                                                                          TRAJ 136
 2000 FORMAT( 1H+, 55%, 23HEPS HAS BEEN CHANGED TO1PE11.4, 11H FOR KEMAXTRAJ 137
     1=I2}
                                                                          TRAJ 138
 2100 FORMAT( 1H+. 55X. 14HHMIN IS SET T01PE11.4)
                                                                          TRAJ 139
 2200 FORMAT( 10x, 65HTHE BODY SURFACE IS PENETRATED. PARTICLE COCRDINATRAJ 140
     TTES ARE (X,Y,Z),3(1PE12.5)/ 10X, 43HTRIAL INITIAL COORDINATES ARE TRAJ 141
     2(YINIT, ZINIT)2(1PE12.4), 5X, 14HATTEMPT NUMBER14)
 2500 FORMAT( / 15%, SHAFTERI4, 45H ATTEMPTS PARTICLE STILL PENETRATESTRAJ 143
     1 THE BODY.)
                                                                          TRAJ 144
      END
                                                                          TRAJ 145
```

```
POLY
*DECK, POLYGON
      SUBROUTINE POLYGON(XIN.YIN.N.AREA)
                                                                              POLY
C
                                                                              POLY
C
      COMPUTES AREA OF A PLANE POLYGON WITH N VERTICES
                                                                              POLY
C
                                                                                      5
                                                                              POLY
      DIMENSION XIN(N), YIN(N)
                                                                              POLY
      DIMENSION X (100), Y (100)
                                                                              POLY
                                                                                      7
      DATA PI/3.1415926536/
                                                                              POLY
                                                                                     8
                    CALCULATE CENTER OF POLYGON
                                                                              POLY
                                                                                     9
      XSUM = 0.
                                                                                    10
                                                                              POLY
      YSUM = 0.
                                                                              POLY
                                                                                    11
      DO 2 I=1.N
                                                                              POLY
                                                                                    12
                                                                              POLY
      XSUM
            = XSUM + XIA(I)
                                                                                    13
      YSUM = YSUM + YIN(I)
                                                                              POLY
                                                                                    14
    2 CONTINUE
                                                                              POLY
                                                                                    15
      XCEN = XSUM/FLOAT(N)
                                                                              POLY
                                                                                    16
                                                                              POLY
      YCEN = YSUM/FLOAT(N)
                                                                                    17
                                                                              POLY
                 REORDER FOINTS IN ASCENDING VALUES OF THETA
                                                                                    18
      TPIM1 = 0.
                                                                              POLY
                                                                                     19
      DO 8 IP=1.N
                                                                              POLY
                                                                                     20
      THETAP = 2. *PI
                                                                              POLY
                                                                                     21
                                                                              POLY
      DO 4 I=1.N
                                                                                    22
      THETA = ATAN2( YIN(I)-YCEN, XIN(I)-XCEN)
                                                                              POLY
                                                                                     23
      IF (THETA .LT. O.) THETA = 2.*PI + THETA
                                                                              POLY
                                                                                     24
                                                                              POLY
      IF (THETA .LE. TPIM1 . OR. THETA . ST. THETAP) GO TO 4
                                                                                     25
                                                                              POLY
                                                                                     26
      THETAP = THETA
      X(IP) = XIN(I)
                                                                              POLY
                                                                                     27
      Y(IP) = YIN(I)
                                                                              POLY
                                                                                     28
    4 CONTINUE
                                                                              POLY
                                                                                     29
      TPINE = THETAP
                                                                              POLY
                                                                                     30
```

```
CONTINUE
                                                                           POLY
                                                                                  31
    ASUM = 0.
                                                                           POLY
                                                                                  32
    DO 40 IN=1.N
                                                                           POLY
                                                                                  33
    INM1 = IN - 1
                                                                           POLY
                                                                                  34
    IF (IN.EQ.1) INM1 = N
                                                                           POLY
                                                                                  35
    BASE = SQFT((X(IN)-X(INM1))++2+(Y(IN)-Y(INM1))++2)
                                                                           POLY
                                                                                  36
    DENOM = X(IN) - X(INM1)
                                                                           POLY
                                                                                  37
    IF (ABS(DENOM) .GT. 1.E-10) GO TO 31
                                                                           POLY
                                                                                  38
    ALT = ABS(XCEN-X(INM1))
                                                                           POLY
                                                                                  39
    GO TO 32
                                                                           POLY
                                                                                  40
 31 SLOPE = (Y(IN)-Y(INM1))/(X(IN)-X(INM1))
                                                                           POLY
                                                                                  41
    ALT = ABS(YCEN-Y(INM1)-SLOPE*(XCEN-X(INM1)))/SQRT(1.+SLOPE*+2)
                                                                           POLY
                                                                                  42
 32 ASUM = ASUM + ALT+BASE/2.
                                                                           POLY
                                                                                  43
49 CONTINUE
                                                                           POLY
                                                                                  44
200 AREA = ASUM
                                                                           POLY
                                                                                  45
    RETURN
                                                                           POLY
                                                                                  46
    END
                                                                           POLY
                                                                                 47
```

```
*DECK, TRANSFM
                                                                              TRAN
      SUBROUTINE TRANSFM (X,Y,Z,ALPHA,BETA,XT,YT,ZT,IGO)
                                                                              TRAN
C
                                                                              TRAN
C
      TRANSFORMS COORDINATES FROM THE FLOW SYSTEM TO THE PARTICLE FLUX
                                                                              TRAN
C
      TUBE CROSS SECTION SYSTEM, OR VISE VERSA.
                                                                              TRAN
C
      IF ( IGO .GT. 0) TRANSFORM FROM FLOW TO FLUX TUBE SYSTEM
                                                                              TRAN
C
      IF( IGO .LT. 0) TRANSFORM FROM FLUX TUBE TO FLOW SYSTEM
                                                                              TRAN
                                                                              TRAN
                                                                                      8
      COSA = COS(ALPHA)
                                                                              TRAN
                                                                                      9
      SINA = SIN(ALPHA)
                                                                              TRAN
                                                                                     10
       COS9 = COS(BETA)
                                                                              TRAN
                                                                                     11
      SINB = SIN(BETA)
                                                                              TRAN
                                                                                     12
      IF (IGO .LT. 0) GO TO 20
                                                                              TRAN
                                                                                     13
      A11 = COSA*COSB
                                                                              TRAN
                                                                                     14
      A12 = SINA+COSB
                                                                              TRAN
                                                                                     15
      A13 = SINB
                                                                              TRAN
                                                                                     16
      A21 = -SINA
                                                                              TRAN
                                                                                     17
      A22 = COSA
                                                                              TRAN
                                                                                     18
      A23 = 0.
                                                                              TRAN
                                                                                     19
      A31 = -COSA*SINB
                                                                              TRAN
                                                                                     20
      A32 = -SINB*SINA
                                                                              TRAN
                                                                                     21
      A33 = COSB
                                                                              TRAN
                                                                                     22
      GO TO 30
                                                                              TRAN
                                                                                     23
               GOING THE OTHER WAY
                                                                              TRAN
                                                                                     24
  20
      A11= COSA+COSB
                                                                              TRAN
                                                                                     25
       A12 = -SINA
                                                                              TRAN
                                                                                     26
       A13 = -COSA+SINE
                                                                              TRAN
                                                                                     27
      A21 = SINA+COSB
                                                                              TRAN
                                                                                     28
      A22 = COSA
                                                                              TRAN
                                                                                     29
      A23 = -SINA+SINB
                                                                              TRAN
                                                                                     30
      A31 = SINB
                                                                              TRAN
                                                                                     31
      A32 = 0.
                                                                              TRAN
                                                                                     32
      A33=COSB
                                                                              TRAN
                                                                                     33
      XT = A11+X + A12+Y + A13+Z
                                                                              TRAN
                                                                                     34
      YT = A21*X + A22*Y + A23*Z
                                                                              TRAN
                                                                                     35
        ZT = A31*X + A32*Y + A33*Z
                                                                                     36
                                                                              TRAN
      RETURN
                                                                              TRAN
                                                                                     37
      END
                                                                              TRAN
                                                                                     38
```

```
*DECK, MATINV
                                                                              CTAM.
       SUBROUTINE MATINV(A,N,B,M,DETERM)
                                                                              MATI
                                                                              MATI
C
       MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
                                                                               MATI
C
                                                                              MATI
C
       THIS CODE SOLVES THE MATRIX EQUATION
                                                                              MATI
C
               A*X=B
                                                                              MATI
C
       FOR X.
                  A IS AN N+ P INFUT MATRIX.
                                                BIS
                                                      AN N+1 INPUT VECTOR.
                                                                              MATI
C
       A IS REPLACED BY ITS INVERSE. B IS REPLACED BY THE VECTOR X.
                                                                              MATI
C
       THE CODE CAN BE USED FOR MATRIX INVERSION ALONE. IN THIS MCDE
                                                                              MATI
C
       SET M=0 IN THE INPUT. FOR MATRIX INVERSION PLUS LINEAR EQUATIONMATI
                                                                                     11
C
       SOLUTION, SET M=1 IN THE INPUT.
                                           THE VALUE OF THE DETERMINANT
                                                                              MATI
C
       OF A, DETERM, IS RETURNED FROM BOTH MODES.
                                                                              MATI
                                                                                     13
C
                                                                              MATI
                                                                                     14
       DIMENSION IPIVOT (30), A( N, N), B( N,1), INDEX (30,2), PIVOT (30)
                                                                              MATI
                                                                                     15
       EQUIVALENCE (IROW, JRGW), (ICOLUM, JCOLUM), (AMAX, T, SWAP)
                                                                              MATI
                                                                                     16
C
                                                                              MATI
                                                                                     17
C
       INITIALIZATION
                                                                              MATI
                                                                                     18
                                                                              MATI
                                                                                     19
   10 DETERM=1.0
                                                                              MATI
                                                                                     20
   15 DO 20 J=1.N
                                                                              MATI
                                                                                     21
   29 IPIVOT(J)=0
                                                                                     22
                                                                              MATI
   30 DO 550 I=1,N
                                                                              MATI
                                                                                     23
C
                                                                              MATI
                                                                                     24
C
      SEARCH FOR PIVOT ELEMENT
                                                                              MATI
                                                                                     25
                                                                              MATI
                                                                                     26
   40 AMAX=0.0
                                                                                     27
                                                                              MATI
   45 DO 105 J=1.N
                                                                              MATI
                                                                                     28
   50 IF (IPIVOT(J)-1) 60, 105, 60
                                                                              MATI
                                                                                     29
   60 DO 100 K=1.N
                                                                              MATI
                                                                                     30
   70 IF (IPIVOT(K)-1) 80, 100, 740
                                                                              MATI
                                                                                     31
   80 IF (ABS (AMAX)-ABS (A(J,K))) 852 200, 100
                                                                                     32
                                                                              MATI
   85 IROW=J
                                                                              MATI
                                                                                     33
   90 ICOLUM=K
                                                                              MATI
                                                                                     34
   95 AMAX=A(J,K)
                                                                              MATI
                                                                                     35
  100 CONTINUE
                                                                              MATI
                                                                                     36
  105 CONTINUE
                                                                                     37
                                                                              MATI
  110 IPIVOT (ICOLUM) = IPIVOT (ICOLUM) +1
                                                                              MATI
                                                                                     38
C
                                                                              MATI
                                                                                     39
C
       INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
                                                                                     40
                                                                              MATI
                                                                              MATI
                                                                                     41
  130 IF (IROW-ICOLUM) 140, 260, 140
                                                                              MATI
                                                                                     42
  140 DETERM =- DETERM
                                                                              MATI
                                                                                     43
  150 DO 200 L=1.N
                                                                              MATI
                                                                                     44
  160 SWAP=A(IROW,L)
                                                                              MATI
                                                                                     45
  178 A(IROW, L) = A(ICCLUM, L)
                                                                              MATI
                                                                                     46
  200 A(ICOLUM, L)=SNAP
                                                                                     47
                                                                              MATI
  205 IF(M) 260, 260, 210
                                                                              MATI
                                                                                     48
  210 DO 250 L=1. M
                                                                              MATI
                                                                                     49
  220 SWAP=B(IROW:1)
                                                                              MATI
                                                                                     50
  230 B(IROW, L)≈B (ICOLUM, L)
                                                                              MATI
                                                                                     51
  250 B(ICOLUM, L) =SWAP
                                                                              MATI
                                                                                     52
  260 INDEX(I,1)=1次0W
                                                                                     53
                                                                              MATI
  270 INDEX(I,2) = TOOLUM
                                                                              MATI
                                                                                     54
  310 PIVOT (I)=A(1CO).UM, ICCLUM)
                                                                              MATI
                                                                                     55
  320 DETERM=DETERM*PIVOT(I)
                                                                              MATI
                                                                                     56
                                                                              MATI
                                                                                     57
C
      DIVIDE FIVOT ROW BY FIVOT ELEMENT
                                                                              MATI
                                                                                     58
                                                                              MATI
                                                                                     59
  330 A(ICOLUM.ICOLUM) = 1.0
                                                                              MATI
                                                                                     60
```

```
340 DO 350 L=1,N
                                                                                MATI
                                                                                       61
  350 A(ICOLUM, L) = A(ICOLUM, L)/PIVOT(I)
                                                                                MATI
                                                                                       62
  355 IF(M) 380, 380, 360
                                                                                MATI
                                                                                       63
  360 DO 378 L=1, M
                                                                                MATI
                                                                                       64
  370 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(I)
                                                                                MATI
                                                                                       65
                                                                                MATI
                                                                                       66
C
       REDUCE NON-PIVOT RCHS
                                                                                MATI
                                                                                       67
                                                                                MATI
                                                                                       68
  380 DO 550 L1=1,N
                                                                                MATI
                                                                                       69
  390 IF(L1-ICOLUM) 400, 550, 400
                                                                                MATI
                                                                                       70
  400 T=A(L1, ICOLUM)
                                                                                MATI
                                                                                       71
  420 A(L1, ICOLUM) = 0.0
                                                                                MATI
                                                                                       72
  430 DO 450 L=1,N
                                                                                MATI
                                                                                       73
  450 A(L1,L) = A(L1,L) - A(ICOLUM,L) + T
                                                                                MATI
                                                                                       74
  455 IF(M) 550, 550, 460
                                                                                MATI
                                                                                       75
  450 DO 500 L=1,M
                                                                                MATI
                                                                                       76
  500 B(L1,L)=B(L1,L)-B(ICCLUM,L)+T
                                                                                MATI
                                                                                       77
  550 CONTINUE
                                                                                MATI
                                                                                       78
C
                                                                                MATI
                                                                                       79
C
      INTERCHANGE COLUMNS
                                                                                MATI
                                                                                       80
C
                                                                                MATI
                                                                                       81
  600 DO 710 I=1,N
                                                                                MATI
                                                                                       82
  610 L=N+1-I
                                                                                MATI
                                                                                       83
  620 IF (INDEX(L,1)-INDEX(L,2)) 630, 710, 630
                                                                                MATI
                                                                                       84
  630 JROW=INDEX(L,1)
                                                                                MATI
                                                                                       85
  646 JCOLUM=INDEX(L,2)
                                                                                MATI
                                                                                       86
  650 DO 705 K=1.N
                                                                                MATI
                                                                                       87
  660 SWAP=A(K, JROW)
                                                                                MATI
                                                                                       88
  E70 A(K, JROW) = A(K, JCOLUM)
                                                                                MATI
                                                                                       89
  700 A(K, JCOLUM) = SWAP
                                                                                MATI
                                                                                       90
  705 CONTINUE
                                                                                MATI
                                                                                       91
  710 CONTINUE
                                                                                MATI
                                                                                       92
  740 RETURN
                                                                                MATI
                                                                                       93
      END
                                                                                MATI
                                                                                       94
```

```
*DECK, SETFLO
                                                                             SETF
                                                                                    2
      SUBROUTINE SETFLO( KASE )
                                                                             SETF
                                                                                    3
C
      INITIALIZES FOR FLOVEL CALCULATION BY READING IN DATA PREPARED
                                                                             SETF
      REAL IXX, IXY, IYY, MACH
                                                                             SETF
                                                                                    4
      COMMON /VELDAT/ NSYM. NGUAD. 119. 129. LOOP.
                                                                                    5
                                                                             SETF
      COMMON/COM29/ SIG(1000), D41(1000),
                                                XC(1000), YC(1000), ZC(1000), SETF
                                                                                    6
     1 A11(1000),A12 {1000),A13 {1000),A21(1000),A22(1000),A23(1000),
                                                                             SETF
     2 A31(1000), A32 (1000), A33 (1000), XI1(1000), XI2(1000), XI3(1000),
                                                                             SETF
                                                                                    9
     3 XI4(1090),ETA1(1000),ETA2(1000),ETA4(1900),TSQ(1000),A(1000),
                                                                             SETF
     4 IXX(1000),IXY (1000),IYY (1000),D12 (1000),D23(1000),D34(1000)
                                                                             SETF
                                                                                   18
      REWIND 14
                                                                             SETF
                                                                                   11
      RÉAD(14) KASETP, NSYM, NQUAD, RBETA, MACH
                                                                             SETF
                                                                                   12
      WRITE (6,3000)
                          KASE , NSYM. NQUAD, MACH
                                                                             SETF
                                                                                   13
      IF ( KASE . EQ. KASETP) GO TO 100
                                                                             SETF
                                                                                   14
                                                                                   15
      REWIND 14
                                                                             SETF
      WRITE(6,2000) KASE, KASETP
                                                                             SETF
                                                                                   16
      STOP
                                                                             SETF
                                                                                   17
  100 READ (14)(XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                             SETF
                                                                                   18
                                                                                   19
     1 A22(J), A23(J), A31(J), A32(J), A33(J), XI1(J),ETA1(J),XI2(
                                                                             SETF
     2 J), ETA2(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                             SETF
                                                                                   20
     3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J) ,J=1,NQUAD)
                                                                             SETF
                                                                                   21
      READ(14)(SIG(I), I=1, NQUAD)
                                                                             SETF
                                                                                   22
      REWIND 14
                                                                             SETF
                                                                                   23
   10 IF ( NSYM - 1 ) 58, 52, 54
                                                                             SETF
                                                                                   24
   52
                       129 = 1
                                                                                   25
                                                                             SETF
                       I19 = 2
                                                                                   26
                                                                             SETF
      GO TO 60
                                                                             SETF
                                                                                   27
   54
                      129
                           = 2
                                                                             SETF
                                                                                   28
      IF ( NSYM .EQ. 3 ) GO TO 56
                                                                                   29
                                                                             SETF
                                                                                   30
                      I19
                                                                             SETF
      GO TO 60
                                                                             SETF
                                                                                   31
   56
                      I19
                           = 4
                                                                             SETF
                                                                                   32
                                                                             SETF
      GO TO 60
                                                                                   33
   58
                      I19
                           = 1
                                                                             SETF
                                                                                   34
   68 LOOP = 2 ** NSYM + 1
                                                                             SETF
                                                                                   35
                                                                                   36
      RETURN
                                                                             SETF
 2000 FORMAT ( 1H-, 5X, 50HTAPE AND CARD IDENTIFIERS DO NOT MATCH.
                                                                                   37
                                                                       TRY ASETF
     1GAIN/ 16X, 9HCARD ID= A4, 5X,9HTAPE ID= A4)
                                                                             SETF
                                                                                   38
 3000 FORMAT ( 1H1,
                         19HBODY IDENTIFIER IS A4, 5X, 26HNUMBER OF SYMMESETF
                                                                                   39
     1TRY PLANES=13, 5X, 25HNUMBER OF QJADRALATERALS=15, 5X, 12HMACH NUMSETF
                                                                                   40
     28ER=E12.5)
                                                                                   41
      END
                                                                             SETF
                                                                                   42
```

```
*DECK, FLOVEL
      SUBROUTINE FLOVELS XNPP, YNPP, ZNPP, VXPP, VXPP。 日, INBODY) FLOV
C
      REVISED 5/11/79
                                                                          FLOV
C
                                                                          FLOV
      GIVEN SPACE COORDINATES, XNPP, YMPP, ZNPP, POTENTIAL FLOW VELOCITY
C
                                                                          FLOV
C
      COMPONENTS, VXPP, VYPP, VZPP, ARE COMPUTED AND RETURNED.
                                                                          FLOV
C
      THE HESS-SMITH METHOD IS USED. THE 28 QUANTITIES PLUS THE
                                                                          FLOV
                                                                                  7
C
      SOURCE STRENGTHS, SIG(), ARE STORED IN CCMMON/COM29/.
                                                                          FLOV
C
      CONTRIBUTIONS FROM NGUAD SURFACE ELEMENTS ARE SUMMED.
                                                                          FLOV
                                                                                  9
C
      UP TO THREE PLANES OF SYMMETRY CAN BE ACCOMODATED.
                                                                          FLOV
C
                                                                          FLOV
                                                                                 11
      REAL M12, M23, M34, M41 , TXX, IXY, IYY
                                                                          FLOV
                                                                                 12
      COMMON /VELDAT/ NSYM, NQUAD. I19, I29, LOOP, RBETA
                                                                          FLOV
                                                                                 13
                                                                          FLOV
      DIMENSION
                             X(8),Y(8),Z(8)
                                                                                 14
      COMMON/COM29/ SIG(1000), D41(1000),
                                              XC(1000), YC(1000), ZC(1000), FLOV
                                                                                 15
     1 A11(1000), A12 (1000), A13 (1000), A21(1000), A22(1000), A23(1000),
                                                                          FLOV
                                                                                 16
     2 A31(1000), A32 (1000), A33 {1000}, XI1(1000), XI2(1000), XI3(1000),
                                                                          FLOV
                                                                                 17
     3 X14(1000), ETA1(1000), ETA2(1000), ETA4(1000), TSQ(1000), A(1000),
                                                                          FLOV
                                                                                 18
     4 IXX(1000),IXY (1000),IYY (1000),D12 (1000),D23(1000),D34(1000)
                                                                          FLOV
                                                                                 19
      DATA RH01SQ, RH02SQ/ 6.0, 16.0 /
                                                                          FLOV
                                                                                 20
      VXPP=0.0
                                                                          FLOV
                                                                                 21
      VYPP=0.0
                                                                          FLOV
                                                                                 22
      VZPP=0.0
                                                                          FLOV
                                                                                 23
       INBODY = 0
                                                                          FLOV
                                                                                 24
      DO 2300 I1 = 1, NQUAD
                                                                          FLOV
                                                                                 25
      00 1700 I2 = 1, LOOP
                                                                          FLOV
                                                                                 26
      IF ( I2 9EQ. LOOP ) GO TO ( 2000, 910, 920, 930 ), I19
                                                                          FLOV
                                                                                 27
      GO TO (1000, 910, 920, 910, 930, 910, 920, 910), I2
                                                                          FLOV
                                                                                 28
  910 YC ( I1 ) = - YC ( I1 )
                                                                          FLOV
                                                                                 29
      A12 (I1) = -A12 (I1)
                                                                          FLOV
                                                                                 30
      A22 (I1) = - A22 (I1)
                                                                          FLOV
                                                                                 31
      A31 (I1) = -A31 (I1)
                                                                          FLOV
                                                                                 32
      A33 (I1) = -A33 (I1)
                                                                          FLOV
                                                                                 33
      GO TO 932
                                                                          FLOV
                                                                                 34
  920 \ ZC \ (I1) = - ZC \ (I1)
                                                                          FLOV
                                                                                 35
      A13 (I1) = -A13 (I1)
                                                                          FLOV
                                                                                 36
      A23 (I1) = - A23 (I1)
                                                                          FLOV
                                                                                 37
      A31 (I1) = -A31 (I1)
                                                                          FLOV
                                                                                 38
      A32 (I1) = -A32 (I1)
                                                                          FLOV
                                                                                 39
      GO TO 932
                                                                          FLOV
                                                                                 40
  930 \times C (I1) = - \times C (I1)
                                                                          FLOV
                                                                                 41
      A11 ( I1 ) = - A11 ( I1 )
                                                                          FLOV
                                                                                 42
      A21 (I1) = -A21 (I1)
                                                                          FLOV
                                                                                 43
      A32 (I1) = -A32 (I1)
                                                                          FLOV
                                                                                 44
      A33 (I1) = -A33 (I1)
                                                                          FL.OV
                                                                                 45
  932 IF ( I2 .EQ. LOOP ) GO TO
                                              2100, 2200
                                                               ,129
                                                                          FL OV
                                                                                 46
 1000 \times DIF = \times NPP - \times C (I1)
                                                                          FLOV
                                                                                 47
      YDIF = YNPP- YC ( I1 )
                                                                          FLOV
                                                                                 48
      ZDIF = ZNPP - ZC ( I1 )
                                                                          FLOV
                                                                                 49
                                                                          FLOV
  COMPUTE DISTANCE FROM NULL POINT TO ORIGIN OF J-TH ELEMENT COORDINATEFLOV
C
      SYSTEM ( J CORRESPONDS TO THE INDEX I1 )
                                                                          FLOV
                                                                                 52
                                                                          FLOV
                                                                                 53
   INEQUALITY ( 98 )
                                                                          FLOV
                                                                                 54
                                                                          FLOV
                                                                                 55
      ROSQ = XDIF ** 2 + YDIF ** 2 + ZDIF ** 2
                                                                          FLOV
                                                                                 56
      IF ( ROSQ .LT. RHO2SQ * TSQ ( I1 ) ) GO TO 1400
                                                                                 57
                                                                          FLOV
                                                                          FLOV.
                                                                                 58
  COMPUTE INDUCED VELOCITY COPPONENTS
                                                                          FLOV
                                                                                 59
   EQUATION (97)
                                                                          FLOV
                                                                                 60
```

```
FLOV
                                                                                61
      ARG1 = A ( I1) / SGRT ( ROSQ:) ++ 3
                                                                         FLOV
                                                                                62
          (12) = ARG1 * XDIF
                                                                         FLOV
                                                                                63
          (I2) = ARG1 + YDIF
                                                                         FLOV
                                                                                64
          (I2) = ARG1 + ZDIF
                                                                         FLOV
                                                                                65
      GO TO 1700
                                                                         FLOV
                                                                                66
                                                                         FLUV
                                                                                67
C TRANSFORM NULL POINT TO J - ELEMENT COORDINATE SYSTEM
                                                                         FLOV
                                                                                68
   EQUATION (78)
                                                                         FLOV
                                                                                69
                                                                         FLOV
                                                                                70
                                                                         FLOV
                                                                                71
 1400 XNP = A11 ( I1 ) * XCIF + A12 ( I1 ) * YOIF + A13 ( I1 ) * ZCIF
                                                                         FLOV
                                                                                72
      YNP = A21 ( I1 ) * XDIF + A22 ( I1) * YDIF + A23 (I1)*ZDIF
                                                                         FLOV
                                                                                73
      ZNP = A31 ( I1 ) * XDIF + A32 (I1) * YDIF + A33 (I1) * ZDIF
                                                                         FLOV
                                                                                74
                                                                         FLOV
                                                                                75
C
   INEQUALITIES ( 99) AND ( 100 )
                                                                         FLOV
                                                                                76
      IF ( ROSQ .LT. RHO1SQ * TSQ ( I1 ) ) GO TO 1410
                                                                                77
                                                                         FLOV
                                                                         FLOV
                                                                                78
C
  COMPUTE INDUCED VELOCITY COPPONENTS
                                                                         FLOV
                                                                                79
  EQUATIONS (57) - (62)
                                                                         FLOV
                                                                                80
                                                                         FLOV
                                                                                81
                     + ZNP ** 2 - 4.0 * XNP ** 2
      P = YNP **2
                                                                         FLOV
                                                                                82
      QP= XNP **2 + ZNP ** 2 - 4.0 * YNP ** 2
                                                                         FLOV
                                                                                83
      RO = SQRT (ROSQ)
                                                                         FLOV
                                                                                84
      ROP = RO ** (- 7)
                                                                         FLOV
                                                                                85
      WXXX = XNP + (9.0 + P + 30.0 + XVP + 2) + ROP
                                                                         FLOV
                                                                                86
      HXXY = 3.0 * P * ROP * YNP
                                                                         FLOV
                                                                                87
      WXYY = 3.0 + XNP + QP + FOP
                                                                         FLOV
                                                                                88
      W YYY = YNP + ( 9.0 + QP + 30.0 + YNP + 2 ) + ROP
                                                                         FLOV
                                                                                89
      WXXZ = 3.0 * ZNP * P * FCP
                                                                         FLOV
                                                                                90
             = - 15.0 * XNP * YNP * ZNP * ROP
      WXYZ
                                                                         FLOV
                                                                                91
      WYYZ = 3.0 * ZNP * QP * FOP
                                                                         FLOV
                                                                                92
      ROP = -RO ** ( - 3)
                                                                         FLOV
                                                                                93
      WX = ROP * XNP
                                                                         FLOV
                                                                               .94
      WY = ROP * YNP
                                                                         FLOV
                                                                                95
      WZ = ROP + ZNP
                                                                         FLOV
                                                                                96
      HIXX = .5 * IXX ( I1 )
                                                                         FLOV
                                                                                97
      HIYY = .5 * IYY ( I1 )
                                                                         FLOV
                                                                                98
      VX = -WXYYYIYY - WXXYYIXY(I1) - WXXXYHIXX - WXYA(I1)
                                                                         FLOV
                                                                                99
      VY = -WYYY^*HIYY - WXYY^*IXY(I1) - WXXY^*HIXX - WY*A(I1)
                                                                         FLOV 100
      VZ = -WYYZ*HIYY - WXYZ*IXY(I1) - WXXZ*HIXX - WZ*A(I1)
                                                                         FLOV 101
      GO TO 1600
                                                                         FLOV 102
                                                                         FLOV 183
  COMPUTE INDUCED VELOCITY COMPONENTS
                                                                         FLOV 104
   EQUATIONS ( 42 ) - ( 49 )
                                                                         FLOV 105
                                                                          FLOV 106
                CHECK TO SEE IF POINT IS INSIDE BODY
                                                                         FLOV 197
 1410 GO TO ( 1306, 1310, 1300, 1310, 1300, 1310, 1300, 1316 ), I2
                                                                         FLOV 108
 1300 IF(ZNP .GT. 0.0 .OR. ROSQ .GT. 0.25*TSQ(I1) .OR. ABS(ZNP) .GT. H) FLOV 189
     1 GO TO 1411
                                                                         FLOV 110
      WRITE (6,5000) I1, I2, ZNP, ROSQ, TSQ(I1), H
                                                                          FLOV 111
 5000 FORMAT(19X,11HINSIDE QUADI5,5X,3HI2=I3/10X,15HZNP,ROSQ,TSQ,H=4(1PEFLOV 112
     113.4))
                                                                         FLOV 113
      INBODY = 1
                                                                          FLOV 114
      GO TO 1411
                                                                         FLOV 115
 1310 IF(ZNP .LT. 0.0 .OR. ROSQ .GT. 0.25*TSQ(I1) .OR. ABS(ZNP) .GT. H) FLOV 116
                                                                         FLOV 117
     1 GO TO 1411
      WRITE (6,5000) I1, I2, ZNP, ROSQ, TSQ(I1), H
                                                                          FLOV 118
      INBODY = 1
                                                                          FLOV 119
 1411 ETA4M3 = ETA4 ( I1) - ETA1 ( I1 )
                                                                         FLOV 120
```

```
RO = SQRT ( ROSQ )
                                                                       FLOV 121
     ETA2M1 = ETA2 ( I1 ) - ETA1 ( I1 )
                                                                       FLOV 122
     XI4N3 = XI4 (I1) - XI 3 (I1)
                                                                       FLOV 123
     XI2M1 = XI2 (I1 ) - XI1 ( I1 )
                                                                       FLOV 124
     XI3M2 = XI3 (I1) - XI2 (I1)
                                                                       FLOV 125
     XI1M4 = XI1 ( I1 ) - XI4 ( I1 )
                                                                       FLOV 126
     XMXI 1 = XNP - XI1 ( I1 )
                                                                       FLOV 127
     XMXI2 = XNP - XI2 ( I1 )
                                                                       FLOV 128
     XMXI3 = XNP - XI3 ( I1 )
                                                                       FLOV 129
     XMXI4 = XNP - XI4 ( I1 )
                                                                       FLOV 130
     YMETA1= YNP - ETA1 ( I1 )
                                                                       FLOV 131
     YMETA 2 = YNP - ETA2 (I1)
                                                                       FLOV 132
     YMETA 4 = YNP - ETA4 (I1)
                                                                       FLOV 133
       ZNPSQ = ZNP + ZNP
                                                                       FLOV 134
     IF ( ZNPSQ .LT. TSQ ( I1 ) * 1.0E-6 ) ZNPSQ = 0.0
                                                                       FLOV 135
     E1 = ZNPSQ + XMXI1 ++2
                                                                      FLOV 136
     E2 = ZNPSQ + XMXI2 ++2
                                                                      FLOV 137
     E3 = ZNPSQ + XMXI3 **2
                                                                      FLOV 138
     \dot{E}4 = ZNPSQ + XMXI4 + +2
                                                                       FLOV 139
     H1 = YMETA1 + XMXI1
                                                                       FLOV 140
     H2 = YMETA2 * XMXI2
                                                                       FLOV 141
     H3 = YMETA1 * XMXI3
                                                                       FLOV 142
     H4 = YMETA4 * XMXI4
                                                                       FLOV 143
     M12 = 0.0
                                                                       FLOV 144
     IF ( XI2M1 .NE. 0. () M12 = ETA2M1 / XI2M1
                                                                       FLOV 145
     M23 = 0.0
                                                                       FLOV 146
     IF ( XI3M2 •NE•9 • 0) M23 = - ETA2M1 / XI3M2
                                                                       FLOV 147
     M34 = 0.0
                                                                       FLOV 148
     IF ( XI4M3 .NE. 0.1) M34 = ETA4M3 / XI4M3
                                                                     FLOV 149
     M41 = 0.0
                                                                      FLOV 150
     IF ( XI1M4 .NE. 9.6) M41 = - ETA4N3 / XI1M4
                                                                      FLOV 151
     ANUM1 = M12 * E1 - H1
                                                                      FLOV 152
     ANUM2 = M12 * E2 - H2
                                                                      FLOV 153
     ANUM3 = M23 * E2 - H2
                                                                     FLOV 154
     ANUM4 = M23 * E3 - H3
                                                                      FLOV 155
     ANUM5 = M34 + E3 + H3
                                                                    FLOV 156
             M34 + E4 - H4
     ANUM6 =
                                                                      FLOV 157
     ANUM7 = M41 * E4 - H4
                                                                      FLOV 158
     ANUM8 = M41 + E1 - H1
                                                                   FLOV 159
     R 1 = SQRT (XMXII) + 2 + YMETA1 + 2 + ZNPSQ)
                                                                      FLOV 160
    R2 = SQRT ( XMXI2 ** 2 + YMETA2 ** 2 + ZNPSQ)
                                                                     FLOV 161
    R3 = SQRT ( XMXI3 ** 2 + YMETA1 ** 2 + ZNPSQ)
                                                                     FLOV 162
     R4 = SQRT (XMXI4 ++ 2 + YMETA4 ++ 2 + ZNPSQ)
                                                                     FLOV 163
     Q25 = D12 ( I1 )
                                                                      FLOV 164
     Q26 = D23 (I1)
                                                                      FLOV 165
     Q27 = D34 (I1)
                                                                       FLOV 166
     Q28 = D41 (I1)
                                                                       FLOV 167
     0.0 = XV
                                                                      FLOV 168
     VY = 0.0
                                                                      FLOV 169
     VZ = G \cdot G
                                                                       FLOV 170
     IF ( Q25 ) 1420, 1430, 1420
                                                                       FLOV 171
1420 \text{ TEMP} = R1 + R2
                                                                       FLOV 172
     TEMP1 = TEMP - Q25
                                                                       FLOV 173
     TEMP2 = TEMP + Q25
                                                                       FLOV 174
     ARG1 = 1.0
                                                                       FLOV 175
     IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG1=ALOG(TEMP1/TEMP2) FLOV 176
     TEMP = ARG1 / Q25
                                                                       FLOV 177
     VX = ETA2M1 * TEMP
                                                                       FLOV 178
     VY = - XI 2M1 * TEMP
                                                                       FLOV 179
1430 IF ( Q26 ) 1435, 1440, 1435
                                                                       FLOV 180
```

```
1435 \text{ TEMP} = R2 + R3
                                                                         FLOV 181
     TEMP1 = TEMP - 026
                                                                         FLOV 182
     TEMP2 = TEMP + 026
                                                                         FLOV 183
     ARG2 = 1.0
                                                                         FLOV 184
     IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG2=ALOG(TEMP1/TEMP2) FLOV 185
     TEMP = ARG2 / Q26
                                                                         FLOV 186
     VX = VX - ETA2M1 * TEMP
                                                                         FLOV 187
     VY = VY - XI3N2 * TEMP
                                                                         FLOV 188
1440 IF ( Q27 ) 1450, 1460, 1450
                                                                         FLOV 189
1450 TEMP = 83 + 84
                                                                         FLOV 190
     TEMP1 = TEMP - Q27
                                                                         FLOV 191
     TEMP2 = TEMP + Q27
                                                                         FLOV 192
     ARG3 = 1.0
                                                                         FLOV 193
     IF ( TEMP1 .NE. 8.0 .AND. TEMP2 .NE. 0.0 ) ARG3=ALOG(TEMP1/TEMP2) FLOW 194
     TEMP = ARG3 / Q27
                                                                         FLOV 195
     VX = VX + ETA4M3 * TEMP
                                                                         FLOV 196
     VY = VY - XI4H3 * TEMP
                                                                         FLOV 197
1460 IF ( Q28 ) 1470, 1480, 1470
                                                                         FLOV 198
1470 TEMP = R4 + R1
                                                                         FLOV 199
     TEMP1 = TEMP - Q28
                                                                         FLOV 200
     TEMP2 = TEMF + Q28
                                                                         FLOV 291
     ARG4 = 1.0
                                                                         FLOV 202
     IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG4=ALOG(TEMP1/TEMP2) FLOV 203
     TEMP = ARG4 / Q28
                                                                         FLOV 204
     VX = VX - ETA4M3 * TEMP
                                                                         FLOV 205
     VY = VY - XI1M4 + TEMP
                                                                         FLOV 206
1480 IF ( ZNPSQ .NE. 0.0 ) GO TO 1510
                                                                         FLOV 207
     TEST = SQRT(TSQ(I1)* 1.0E-3)
                                                                         FLOV 208
     IF(Q25.GT.TEST) IF((XMXI1*ETA2N1-YMETA1*XI2M1)/Q25) 1600,1502,1502FLOV 209
1502 IF(Q26.GT.TEST) IF((-XMXI2+ETA2M1-YMETA2+XI3M2)/Q26)160G,1504,1504FLOV 210
1504 IF(Q27.GT.TEST) IF((XMXI3*ETA4M3-YMETA1*XI4M3)/Q27) 1600,1506,1506FLOW 211
1506 IF(Q28.GT.TEST) IF((-XMXI4*ETA4M3-YMETA4*XI1M4)/Q28)16G0,1508,1508FLOV 212
1508 VZ = 6.28318531E0
                                                                         FLOV 213
     GO TO 1600
                                                                         FLOV 214
1510 IF (XI2M1 .NE. 0.0) VZ = ATAN(ANUM1/(ZNP*R1))-ATAN(ANUM2/(ZNF*R2))FLOV 215
     IF (XI3M2 .NE. 5.0) VZ=VZ+ATAN(ANUM3/(ZNP*R2))-ATAN(ANUM4/(ZNP*R3)) FLOV 216
     IF (XI4M3 •NE• 0.0) VZ=VZ+ATAN(ANUM5/(ZNP*R3))-ATAN(ANUM6/(ZNF*R4)) FLOV 217
     IF (XI1M4 .NE. 0.0 VZ=VZ+ATAN(ANUM7/(ZNP*R4))-ATAN(ANUM8/(ZNP*R1))FLOV 218
                                                                         FLOV 219
  TRANSFORM INDUCED VELOCITY COMPONENTS TO REFERENCE COORDINATE SYSTEM FLOW 220
  EQUATION
             (79)
                                                                         FLOV 221
                                                                         FLOV 222
         (I2) = A11 (I1) + VX + A21 (I1) + VY + A31 (I1) + VZ
1600 X
                                                                         FLOV 223
         (I2) = A12 (I1) + VX + A22 (I1) + VY + A32 (I1) + VZ
     Y
                                                                         FLOV 224
         (I2) = A13 (I1) + VX + A23 (I1) + VY + A33 (I1) + VZ
                                                                         FLOV 225
1700 CONTINUE
                                                                         FLOV 226
                                                                         FLOV 227
2000 VXPP = VXPP + SIG(I1) + \chi(1)
                                                                         FLOV 228
     VYPP = VYPP + SIG(I1) + Y(1)
                                                                         FLOV 229
     VZPP = VZPP + SIG(I1) * 7(1)
                                                                         FLOV 230
     GO TO 2300
                                                                         FLOV 231
2100 VXPP = VXPP + SIG(I1) * (X(1) + X(2))
                                                                         FLOV 232
     VYPP = VYPP + SIG(I1) + (Y(1) + Y(2))
                                                                         FLOV 233
     VZPP = VZPP + SIG(I1) * (Z(1) + Z(2))
                                                                         FLOV 23%
     60 TO 2300
                                                                         FLOV 235
2209 \forall XPP = VXPP + SIG(I1) + (X(1) + X(2) + X(3) + X(4))
                                                                         FLOV 236
     VYPP = VYPP + SIG(I1) * (Y(1) + Y(2) + Y(3) + Y(4))
                                                                         FLOV 237
     VZPP = VZPP + SIG(I1) + (Z(1) + Z(2) + Z(3) + Z(4))
                                                                         FLOV 238
2204 IF ( NSYM .EQ. 2 ) GO TO 2300
                                                                         FLOV 239
     VXPP = VXPP - SIG(I1) + (X(5) + X(6) + X(7) + X(8))
                                                                         FLOV 240
```

```
VYPP = VYPP - SIG(I1) * (Y(5) + Y(6) + Y(7) + Y(8))

VZPP = VZPP - SIG(I1) * (Z(5) + Z(6) + Z(7) + Z(8))

2300 CONTINUE

VXPP = VXPP * RBETA**2 + 1.0

VYPP = VYPP * RBETA

VZPP = VZPP * RBETA

RETURN
END
```

FLOV 241 FLOV 242

FLOV 243

FLOV 244

FLOV 245 FLOV 246

FLOV 247

FLOV 248

FLOA

27

```
*DECK, FLOAIR
                                                                           FLOA
      SUBROUTINE FLOAIR( X, Z, ECC, VX, VZ, PSI, IFLAG)
                                                                           FLOA
      THIS CODE RETURNS AIRFLOW VELOCITY (VX, VZ) FOR A GIVEN POINT
      (X. Z) EXTERIOR TO AN ELLIPSOID OF REVOLUTION IN AN AIRSTREAM.
                                                                           FLOA
                                                                                   3
C
                                                                           FLOA
      THE ELLIPSOID IS PROLATE WITH MAJOR AXIS PARALLEL WITH THE FREE
                                                                                   4
                                                                           FLOA
      STREAM FLOW. FLOW IS TOWARD THE POSITIVE X AXIS. PSI IS THE
C
      STREAM FUNCTION VALUE AT X.Z. ECC IS THE ELLIPSOID ECCENTRICITY. FLOA
C
                                                                                   6
      IF(IFLAG)100,100,200
                                                                                   7
                                                                           FLOA
                                                                                   8
C
      INITIALIZE
                                                                           FLOA
                                                                                   9
  100 E2 = ECC**2
      OME2 = 1.0 - E2
                                                                           FLOA
                                                                                  10
                                                                           FLOA
      TEC = 2.0 * ECC
                                                                                  11
      CX =-ECC/( ALOG((1.0 + ECC)/(1.0 - ECC)) - TEC/OME2)
                                                                           FLOA
                                                                                  12
                                                                           FLOA
                                                                                  13
      CZ = TEC+CX
                                                                           FLOA
                                                                                 14
      CPSI = ECC+CX
      COMPUTE FLOW VELOCITIES AND STREAMFUNCTION VALUE
                                                                           FLOA
                                                                                 15
                                                                           FLOA
 200 SQRM = SQRT((X + ECC)**2 + Z**2)
                                                                                  16
                                                                           FLOA
                                                                                 17
      SQRN = SQRT((X - ECC)**2 + Z**2)
      VX =CX+(ALOG( | SGRM + SGRN + TEC) / (SQRM + SGRN - TEC) )/EGC
                                                                           FLOA
                                                                                 18
                                                                           FLOA
                                                                                 19
    1 - 1.0/SQRM - 1.0/SQRN) + 1.0
                                                                           FLOA
             CZ+Z+( 1.0/SQRM - 1.0/SQRN)/ (X++2 + Z++2 + SQRM+SQRN - E2)FLOA
                                                                                 20
                                                                                 21
     COSH = (SQRM + SQRN)/TEC
                                                                           FLOA
     COS = (SQRM - SQRN)/TEC
                                                                                 22
     PSI = GPSI+( COSH + 0.5*( COSH++2 - 1.0)+
                                                                           FLOA
                                                                                 23
                                                                           FLOA
       ALOG((COSH - 1.0)/( COSH + 1.0))) + ( 1.0 - COS++2) - Z++2/2.0
                                                                                 24
                                                                           FLOA
                                                                                 25
     RETURN
                                                                           FLOA
                                                                                 26
     END
```

```
*DECK, ARYTRJ
                                                                            ARYT
                                                                                    Ĵ.
                                                                                    2
      SUBROUTINE ARYTRJ
                                                                            ARYT
                                                                                    3
                                                                            ARYT
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                            ARYT
                                                                                    4
                                                                            ARYT
C
      CALLS TRAJECT TO COMPUTE TRAJECTORIES OF PARTICLES TO OR ABOUT
                                                                                    6
                                                                            ARYT
      AN ARBITRARY 3-DIMENSIONAL BODY.
                                           TRAJECTORIES BEGIN AT AN ARRAY ARYT
                                                                                    7
C
                                                                                    8
C
      OF POINTS IN SPACE. THE ARRAY PCINTS, AND CORRESPONDING
                                                                            ARYT
                                                                                    9
C
      TRAJECTORIES, ARE DEFINED BY SPECIFYING AN INITIAL POINT, INCREMENTARYT
C
      VALUES IN THE THREE COORDINATE DIRECTIONS. AND THE ORDER OF
                                                                                   10
C
      INCREMENTING.
                         INFUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH
                                                                            ARYT
                                                                                   11
      INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3. FOR EXAMPLEARYT
C
                                                                                   12
      SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS ARYT
C
                                                                                   13
C
      INCREMENTED SECOND AND Z IS INCREMENTED LAST.
                                                                                   14
C
      IF TRAJECTORIES ARE NOT CESIRED FROM ALL OF THE ARRAY POINTS, THE ARYT
                                                                                   15
      PARAMETER NSKIP CAN BE SIT GREATER THAN ZERO, AND AFTER THE FIRST ARYT
                                                                                   16
C
      TRAJECTORY ONLY EVERY NSKIP+1 TH TRAJECTORY IS COMPUTED.
                                                                                   17
                                                                            ARYT
C
      ALSO REQUIRED ARE - (IN ORDER OF X AXIS FIRST, Y AXIS SECOND,
                                                                            ARYT
                                                                                   18
C
      Z AXIS THIRD- INITIAL COORDINATE, INCREPENT, NUMBER OF INCREMENTSARYT
                                                                                   19
C
      DESIRED (INCLUDING THE INITIAL COORDINATE VALUE).
                                                                            ARYT
                                                                                   20
C
                                                                            ARYT
                                                                                   21
C
      SR PARTCL IS CALLED TO READ, PROCESS AND PRINT PARTICLE DATA.
                                                                            ARYT
                                                                                   22
C
      THIS SR CAN BE ONE OF SEVERAL THAT TREATS WATER DROPS OR ONE OF
                                                                            ARYT
                                                                                   23
C
      VARIOUS TYPES OF ICE CRYSTALS.
                                                                            ARYT
                                                                                   24
C
                                                                            ARYT
                                                                                   25
C
      UNIT 9 IS A SCRATCH UNIT USED FOR TRAJECTORY DATA STORAGE.
                                                                            ARYT
                                                                                   26
C
      UNIT 10 IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.
                                                                            ARYT
                                                                                   27
C
                                                                            ARYT
                                                                                   28
                                                                                   29
C
      FLOW DATA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14
                                                                            ARYT
                                                                            ARYT
C
                                                                                   30
      VIA SR SETFLO.
C
                                                                            ARYT
                                                                                   31
C
      ALL COORDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)
                                                                            ARYT
                                                                                   32
C
                                                                            ARYT
                                                                                   33
C
                                                                            ARYT
                                                                                   34
      GLOSSARY
               DIAM/ELL - USED TO COMPUTE ACCELERATION MODULUS
C
                                                                            ARYT
                                                                                   35
      ACC
C
      ALPHAC
               ANGLE BETWEEN PROJECTION OF INITIAL VELOCITY VECTOR IN
                                                                            ARYT
                                                                                   36
C
                                                                            ARYT
                                                                                   37
               X-Y PLANE AND X AXIS
C
      ALPHAR
               ANGLE BETWEEN FRCJECTION OF FINAL VELOCITY VECTOR IN X-Y
                                                                            ARYT
                                                                                   38
C
               PLANE AND X AXIS
                                                                            ARYT
                                                                                   39
C
      BETAG
               ANGLE BETWEEN INITIAL VELOCITY VECTOR AND ITS PROJECTION
                                                                            ARYT
                                                                                   40
C
               IN THE X-Y PLANE
                                                                            ARYT
                                                                                   41
C
                                                                            ARYT
      BETAR
               ANGLE BETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION
                                                                                   42
                                                                            ARYT
C
               IN THE X-Y PLANE
                                                                                   43
               COORDINATE INCREMENT ARRAY
C
                                                                            ARYT
                                                                                   44
C
               DIAMETER OF A WATER DROP OR ICE AGGREGATE
                                                                            ARYT
                                                                                   45
      DIAM
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                                   46
                                                                            ARYT
C
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
                                                                            ARYT
                                                                                   47
      DLR
                                                                                   48
C
                                                                            ARYT
               RATIO
C
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
                                                                            ARYT
                                                                                   49
C
      EPSI( ) PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
                                                                            ARYT
                                                                                   50
C
               INTEGRATION (SEE DVDQ GLOSSARY)
                                                                            ARYT
                                                                                   51
C
      FN
                                                                            ARYT
                                                                                   52
               FROUDE NUMBER
C
      FNR
               RECIPROCAL OF THE FROUDE NUMBER
                                                                            ARYT
                                                                                   53
C
      HI
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDQ)
                                                                            ARYT
                                                                                   54
C
               MAXIMUM TIME STEP (SEE DVDQ)
                                                                            ARYT
                                                                                   55
      HMAX
C
      HMIN
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
                                                                            ARYT
                                                                                   56
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 10 FOR PLOTTINGARYT
C
                                                                                   57
      IPLOT
C
               NUMBER OF COORDINATE INCREMENT STEPS ARRAY (INCLUDING THE APYT
                                                                                   58
C
                                                                                   59
               FIRST COORDINATE VALUE)
                                                                            AR YT
      NPOINT
               ARRAY POINT TALLY
                                                                            ARYT
                                                                                   60
```

```
NUMBER OF ARRAY FOINTS SKIPPED BETWEEN TRAJECTORIES
C
      NSKIP
                                                                              ARYT
                                                                                     61
C
      P( )
               CURRENT VALUES OF INDEPENDENT VARIABLES -
                                                                              ARYT
                                                                                     62
C
                  P(1) = X
                                                                              ARYT
                                                                                     63
C
                  P(2) = DX/DT
                                                                              ARYT
                                                                                     64
C
                  P(3) = Y
                                                                              ARYT
                                                                                     65
C
                  P(4) = DY/DT
                                                                              ARYT
                                                                                     66
C
                  P(5) = Z
                                                                              ARYT
                                                                                     67
Ċ
                  P(6) = 0Z/DT
                                                                              ARYT
                                                                                     68
C
      PT
               DRAG COEFFICIENT+ABS (REYNOLDS NUMBER) FOR GRAVITY SETTLING ARYT
                                                                                     69
C
               OF PARTICLES
                                                                                     70
                                                                              ARYT
C
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                              ARYT
                                                                                     71
C
      RHO
               AIR DENSITY (KG/M++3)
                                                                              ARYT
                                                                                     72
C
      RHOP
               PARTICLE DENSITY (KG/N**3)
                                                                              ARYT
                                                                                     73
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                              ARYT
                                                                                     74
C
      TPRINT
               OUTPUT TIME INTERVAL
                                                                              ARYT
                                                                                     75
C
      ٧
               AIR SPEED (M/SEC)
                                                                              ARYT
                                                                                     76
C
      VIS
               AIR VISCOSITY (KG/(M-SEC))
                                                                              ARYT
                                                                                     77
C
      VPGT
               PARTICLE SPEED AT TARGET POINT
                                                                              ARYT
                                                                                     78
C
      ٧T
               GRAVITY SETTLING SPEED OF PARTICLE
                                                                              ARYT
                                                                                     79
C
      VIGT
               ANR SPEED AT TARGET POINT
                                                                              ARYT
                                                                                     80
C
               INITIAL COCRCINATE ARRAY
      X
                                                                              AR YT
                                                                                     81
C
      XFINAL
               X COORDINATE OF THE FINAL PLANE
                                                                              ARYT
                                                                                     82
C
      XI3, YI3, ZI3
                    INITIAL COORDINATES PASSED TO TRAJECT
                                                                              AR YT
                                                                                     83
C
                                                                              ARYT
                                                                                     84
C
                                                                              ARYT
                                                                                     85
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                              AR YT
                                                                                     86
     irf,red,r,xpstar,ypstar,zpstar,p(6),tprint,it,alpha0,beta0,irec,
                                                                              ARYT
                                                                                     87
     ZIPLOT, IPLT, XPLOT(60), YPLCT(60), ZPLOT(60), ALPHAR, BETAR, YPSTARP.
                                                                              ARYT
                                                                                     88
     3ZPSTARP,XI3P,ZI3P,XP,YP,ZP,XWP,XPP,ACC,DLR,JLIM
                                                                              ARYT
                                                                                     89
      DIMENSION HOLL(18), x(3), D(3), N(3), M(3), SX(3), SD(3), NS(3),
                                                                              ARYT
                                                                                     90
     1 SXI(3), SEQ(6)
                                                                              ARYT
                                                                                     91
      LOGICAL
                       IPLOT
                                                                                     92
                                                                              ARYT
                                , 4HSECO, 4HND
      DATA SEQ/ 4HFIRS, 4HT
                                                  . 4HTHIR. 4HD
                                                                              ARYT
                                                                                     93
      DATA STAR, BLNK / 3H *, 3H / , PI/3.1415926536/
                                                                              ARYT
                                                                                     94
      JLIM=0
                                                                              ARYT
                                                                                     95
      NFIN=0
                                                                              ARYT
                                                                                     96
C
                          READ AND WRITE DATA
                                                                              ARYT
                                                                                     97
      READ (5,2600) KASE
                                                                              AR YT
                                                                                     98
      CALL SETFLO(KASE)
                                                                              ARYT
                                                                                     99
      READ(5,1000)HOLL,
                                  IPLOT
                                                                              ARYT
                                                                                   100
      READ(5,1100)V, ELL, RHO, TEMP, XFINAL
                                                                              ARYT 101
      READ(5,1100) TPRINT, HI, HMINI, EPSI
                                                                              ARYT 102
C
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS ARYT 103
      IF(TPRINT .EQ. 0.0) TPRINT=0.1
                                                                              ARYT 164
      IF(HI .EQ. 0.0) HI=0.1
                                                                              ARYT
                                                                                   105
      IF(HMINI «EQ. O.Q) HMINI=0.005
                                                                              ARYT 106
      IF(EPSI(1) .EQ. 0.0) EFSI(1)=1.0E-5
                                                                              ARYT 107
      IF(EPSI(2) .EQ. 0.() EFSI(2)=1.0E-5
                                                                              ARYT 108
      IF(EPSI(3) .EQ. 0.0) EPSI(3)=1.0E-5
                                                                              ARYT 109
      VIS = 145.8E-8 * TEMP** (3.0/2.0)/(110.4 + TEMP)
                                                                              AR YT
                                                                                   110
      WRITE(6,1200) HOLL
                                                                              ARYT 111
      WRITE (6,1300) V, ELL, RHC, TEMP, VIS
                                                                              ARYT 112
      WRITE(6,140G) HI, HMINI, TFRINT, XFINAL
                                                                              ARYT 113
      WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                              ARYT 114
C
      INITIALIZE
                                                                              ARYT
                                                                                   115
      FN = V**2/(9.8*ELL)
                                                                              ARYT 116
      FNR = 1.0/FN
                                                                              ARYT 117
       IF (.NOT. IPLOT) GO TO 5
                                                                              ARYT 118
      REWIND 10
                                                                              ARYT
                                                                                   119
      WRITE (6,1800)
                                                                              ARYT 120
```

```
C
       ENTER PARTICLE LCOP
                                                                               ARYT 121
    5 CALL PARTCL (V, ELL, RHG, VIS, TEMP, DIAM, DUR, RHOP, VT, RF, PT, ACC, NFIN)
                                                                               ARYT 122
       IF(NFIN .EQ. 0) GO TO 6
                                                                               ARYT 123
       IF( .NOT. IPLOT) RETURN
                                                                               ARYT 124
       ENDFILE 10
                                                                               ARYT 125
       REWIND 16
                                                                               ARYT 126
       RETURN
                                                                               ARYT 127
    6 COF = PT*VT*FN
                                                                               ARYT 128
       R = RF * VT
                                                                               ARYT 129
       READ(5,8100)H, NSKIP
                                                                               ARYT 130
       IF(H(1)+H(2)+H(3) .EQ. 6) GC TO 10
                                                                               ARYT 131
       WRITE(6,8200)
                                                                               ARYT 132
       STOP
                                                                               ARYT 133
   10 00 20 L=1,3
                                                                               ARYT 134
   20 READ(5,8000) X(L), D(L), N(L)
                                                                               ARYT 1.35
       WRITE(6,2000) X(1), 0(1), N(1)
                                                                               ARYT 136
       WRITE(6,3000) X(2), B(2), N(2)
                                                                               ARYT 137
       WRITE(6,4000) \times (3), D(3), N(3)
                                                                               ARYT 138
       WRITE(6,9000)
                                                                               ARYT 139
       WRITE(6,5000) SEG(2*M(1)-1), SEG(2*M(1))
                                                                               ARYT 140
      WRITE(6,6000) SEQ(2*M(2)-1), SEQ(2*M(2))
                                                                               ARYT 141
       HRITE(6,7000) SEQ(2+M(3)-1), SEQ(2+M(3))
                                                                               ARYT 142
       DO 49 L=1.3
                                                                               ARYT 143
      LL=4-M(L)
                                                                               ARYT 144
       SD(LL) = D(L)
                                                                               ARYT 145
       SXI(LL) = X(L) - D(L)
                                                                               ARYT 146
   40 NS(LL)=N(L)
                                                                               ARYT 147
      N1=NS(1)
                                                                               ARYT 148
      N2=NS(2)
                                                                               ARYT 149
      N3 = NS(3)
                                                                               ARYT 150
      NPOINT=0
                                                                               ARYT 151
      SX(1) = SXI(1)
                                                                               ARYT 152
      00 500 I=1,N1
                                                                               ARYT 153
      SX(1) = SX(1) + SD(1)
                                                                               ARYT 154
      SX(2) = SXI(2)
                                                                               ARYT 155
      DO 500 J=1,N2
                                                                               ARYT 156
      SX(2) = SX(2) + SD(2)
                                                                               ARYT 157
      SX(3) = SXI(3)
                                                                               ARYT 158
      00 560 K=1.N3
                                                                               ARYT 159
      SX(3) = SX(3) + SD(3)
                                                                               ARYT 160
      NPOINT=NPOINT+1
                                                                               ARYT 161
      IF (MOD (NPOINT, NSKIP+1) .NE. 1) GO TO 500
                                                                               ARYT 162
      D0 50 L=1.3
                                                                               ARYT 163
      LL=4-M(L)
                                                                               ARYT 164
   50 X(L)=SX(LL)
                                                                               ARYT 165
C
      INITIALIZE FOR TRAJECT
                                                                               ARYT 166
      XI3=X(1)
                                                                               ARYT 167
      YI3=X(2)
                                                                               ARYT 168
      213=X(3)
                                                                               ARYT 169
      XPSTAR=XFINAL
                                                                               ARYT 170
      XPP = XFINAL
                                                                               ARYT 171
      ALPHAR = 0.0
                                                                               ARYT 172
      BETAR=0.0
                                                                               ARYT 173
      YP = 0.0
                                                                               ARYT 174
      ZP = 0.0
                                                                               ARYT 175
      WRITE(6,1600) XI3, YI3, ZI3
                                                                               ARYT 176
      CALL TRAJECT
                                                                               ARYT 177
C
                        PRINT TRAJECTORY OUTPUT
                                                                               ARYT 178
      REWIND 9
                                                                               ARYT 179
      WRITE (6.8700)
                                                                               ARYT 180
```

```
DO 494 IWRITE = 1, IREC
                                                                        ARYT 181
      READ (9) NEVAL, KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, ARYT 182
     2 VZ, H, R,AC
                                                                        ARYT 183
      WRITE(6,8600) KSTEP, T, F(1), P(3), P(5), P(2), P(4), P(6), VX, VY, ARYT 184
     2 VZ, H, R, AC, NEVAL
                                                                         ARYT 185
  494 CONTINUE
                                                                        ARYT 186
              COMPUTE INITIAL AND FINAL TRAJECTORY ANGLES
                                                                        ARYT 187
      CALL FLOVEL (XI3, YI3, ZI3, VX, VY, VZ, HI, INBODY)
                                                                       ARYT 188
      ALPHAO = ATAN(VY/VX) + 1 (0./PI
                                                                        ARYT 189
      BETA0 = ATAN((VZ-VT)/SQRT(VX++2 + VY++2)) + 180./PI
                                                                       ARYT 190
      ALPHAR = ATAN(P(4)/P(2))+180./PI
                                                                       ARYT 191
      BETAR = ATAN(P(6)/SQRT(P(2)**2+P(4)**2))*180./PI
                                                                 ARYT 192
      WRITE (6,8800) ALPHAO, BETAO, ALPHAR, BETAR
                                                                       ARYT 193
C
      COMPUTE AND PRINT DRAG VECTOR AT FINAL POINT
                                                                       ARYT 194
      CALL FLOVEL (P(1), P(3), P(5), VX, VY, VZ, HI, INBOCY)
                                                                       ARYT 195
                                                                      ARYT 196
      DV = SQRT((VX - P(2))^{++}2 + (VY - P(4))^{++}2 + (VZ - P(6))^{++}2)
      COSA = (VX - P(2)) /DV
                                                                        ARYT 197
      COSB = (VY - P(4))/DV
                                                                        ARYT 198
      COSC = (VZ - P(6))/DV
                                                                        ARYT 199
                                                                      ARYT 200
      ANG = ATAN ( COSB/COSA ) * 57.29577951
      CNG = ACOS(COSC) * 57.29577951
                                                                         ARYT 201
      WRITE( 6, 3100 ) COSA, CCSB, COSC, ANG, CNG
                                                                        ARYT 202
      COMPUTE AND PRINT AIR AND PARTICLE SPEEDS AT FINAL POINT
                                                                       ARYT 203
           = SQRT(VX**2 + VY**2 + VZ**2)
      VA
                                                                        ARYT 204
      VP
           = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
                                                                        ARYT 205
      WRITE(6, 3200) VA, VP
                                                                        ARYT 206
      IF (IPLOT) WRITE (10) IFLT, (XPLOT(L), YFLOT(L), ZPLOT(L), L=1, IPLT) ARYT 207
                                                                        ARYT 208
  500 CONTINUE
                                                                        ARYT 209
                                                                        ARYT 210
      GO TO 5
 1000 FORMAT(18A4, 7X,L1)
                                                                         ARYT 211
 1100 FORMAT (8F10.5)
                                                                        ARYT 212
 $200 FORMAT(1H1,5X, 15HARYTRJ RUN ID -/ 8X, 18A4)
                                                                        ARYT 213
 1300 FORMAT(1H0, 5%, 21HPHYSICAL INPUT DATA -/7%,18HAIR SPEED=1PE13.6, ARYT 214
     1 3X, 37HCHARACTERISTIC DIMENSION OF THE BODY=1PE13.6/ 7X,35HCENSITARYT 215
     2Y AND TEMPERATURE OF AIR ARE 1PE13.6, 5H AND 1PE13.6,20H AIR VISARYT 216
     3COSITY IS 1PE13.6)
                                                                         ARYT 217
 1400 FORMAT( 1H0, 5X, 25HNUMERICAL INTEGRATOR INPUTS -/ 7X, 10HTIME STEARYT 218
     1P=1PE11:4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRINT TIME INTARYT 219
     2ERVAL=1PE11.4, 3X, 24HX COORD. OF FINAL FLANE=1PE11.4)
                                                                        ARYT 220
 1500 FORMAT( 1H0, 6X, 33HLOCAL ERROR TOLERANCES FOR DVDQ -, 3(1PE14,4)) ARYT 221
 1600 FORMAT(//1H0, 38H* * * * * * * INITIAL COORDINATES X=1PE1 2.5,
                                                                        ARYT 222
     2 3X, 2HY=1PE12.5, 3X, 2HZ=1PE12.5)
                                                                         ARYT 223
 1800 FORMAT( ///6x, 52HTRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTNARYT 224
                                                                         ARYT 225
 2000 FORMAT( 10X, 10HINITIAL X=1PE11.4, 12H INCREMENT=1PE11.4,
                                                                        ARYT 226
     1 19H NUMBER OF VALUES=14)
                                                                         ARYT 227
 2600 FORMAT (A4)
                                                                         ARYT 228
 3000 FORMAT( 10x, 10HINITIAL Y=1PE11.4, 12H INCREMENT=1PE11.4,
                                                                         ARYT 229
     1 19H NUMBER OF VALUES=14)
                                                                        ARYT 230
 3100 FORMAT(/5x, 29HDRAG VECTOR AT FINAL POINT -/ 6%, 18HDIRECTION COSARYT 231
     1 INES-3(1PE13.4), 3X, 19MANGLES A AND GAMMA-2(1PE13.4))
                                                                         ARYT 232
 3200 FORMAT(5X, 47HAIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE2(1PEARYT 233
     115.51)
                                                                        ARYT 234
 4000 FORMAT( 10X, 10HINITIAL Z=iPE11.4, 12H INGREMENT=1PE11.4,
                                                                         ARYT 235
     1 19H NUMBER OF VALUES=14
                                                                        ARYT 236
 5000 FORMAT( 10X, 22HX AXIS IS INCREMENTED 244)
                                                                        ARYT 237
 6000 FORMAT( 10X, 22HY AXIS IS INCREMENTED 2A4)
                                                                       ARYT 238
 7000 FORMAT( 10X, 22HZ AXIS IS INCREMENTED 2A4)
                                                                       ARYT 239
 8000 FORMAT( 2F10.0, 14)
                                                                        ARYT 240
```

```
8100 FORMAT(414)
                                                                       ARYT 241
8200 FORMAT(///10x, 47HINCREMENTING SEQUENCE IS ERRONIOUS. TRY AGAIN.) ARYT 242
8600 FORMAT(I6, 10(1x,1PE11.4)/10x, 2HH=1PE11.4,4H R=1PE11.4, 5F
                                                                    AC=ARYT 243
    11PE11.4, 8H NEVAL=16)
                                                                       ARYT 244
8700 FORMAT(/6H0KSTEP, 7X, 1HT, 11X, 1HX, 11X, 1HY, 11X, 1HZ, 10X,
                                                                       ARYT 245
    1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X, 2HVZ)
                                                                       ARYT 246
8800 FORMAT( /20x, 47HINITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) '-ARYT 247
    1/ 22X, THALPHA0=F10.4, 5X, 6HBETA0=F10.4/ 22X, THALPHAR=F10.4, 5XARYT 248
    2. 6HBETAR=F10.4)
                                                                       ARYT 249
9000 FORMAT(1H0)
                                                                       ARYT 250
     END
                                                                       ARYT 251
```

*DECK	,TANTRA Subroutine tantra	TANT TANT	1 2
C		TANT	
Č		TANT	3 4
	TO THE TOTAL PROPERTY OF THE PARTY OF THE PA	TANT	5
C C C C C	DETERMINES TANGENT PARTICLE TRAJECTORIES TO AN ARBITRARY	TANT	5 6
Č .	3-DIMENSIONAL BODY.	TANT	7
Č	5-binersional boots		
Č	CALLS TO A SECT TO COMPUTE TO A SECTION OF CAPTION FOR TO ON ADOLES	TANT	8
	CALLS TRAJECT TO COMPUTE TRAJECTORIES OF PARTICLES TO OR ABOUT		9
		TANT	10
U .	ON A CURVE AS SPECIFIED BY SR. STRPNT, AND THE INITIAL POINTS ARE		. 11
Ü	STEPPED TOWARD THE BODY USING FIRST A COARSE STEP SIZE UNTIL	TANT	12
Ü	IMPACTION OCCURS. THEN INITIAL COORDINATES ARE BACKED-UP ONE		13
C		TANT	14
C	THE TANGENT TRAJECTORY IS TAKEN TO BE THE ONE CALCULATED	TANT	15
C	IMMEDIATELY PRIOR TO THE SECOND IMPACTION. POINTS ON THE TANGENT	TANT	16
C	TRAJECTORY ONLY ARE STORED FOR PLOTTING LATER IF DESIRED.	TANT	17
C		TANT	18
C		TANT	19
00000000000	SR PARTCL IS CALLED TO READ, PROCESS AND PRINT PARTICLE DATA.	TANT	20
C	THIS SR CAN BE ONE OF SEVERAL THAT TREATS WATER DROPS OR ONE OF	TANT	21
C	VARIOUS TYPES OF ICE CRYSTALS.	TANT	22
00000		TANT	23
C	UNIT 9 IS A SCRATCH UNIT USED FOR TRAJECTORY DATA STORAGE.	TANT	£ }
C	UNIT 10 IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.	TANT	25
C		TANT	26
C	FLOW DATA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14	TANT	27
C	VIA SR SETFLO.	TANT	28
0000000		TANT	29
C	ALL COORDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)	TANT	30
C		TANT	31
C	GLOSSARY	TANT	32
C	ACC DIAM/ELL - USED TO COMPUTE ACCELERATION MODULUS	TANT	33
C	ALPHAR ANGLE BETWEEN PROJECTION OF FINAL VELOCITY VECTOR IN X-Y	TANT	34
C	PLANE AND X AXIS	TANT	35
C	BETAR ANGLE SETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION	TANT	36
CCC	IN THE X-Y PLANE	TANT	37
C	DCORS COARSE VALUE OF DEL USED FOR ROUGH DETERMINATION OF	TANT	38
C	TANGENT TRAJECTORY	TANT	39
C	DEL CURRENT VALUE OF STEP SIZE USED IN INCREMENTING INITIAL	TANT	i, D
C	COORDINATES TOWARD THE BODY	TANT	41
Č	DFINE FINE VALUE OF DEL USED FOR PRECISE DETERMINATION OF	TANT	42
Č	TANGENT TRAJECTORY	TANT	43
C	DIAM DIAMETER OF A HATER DROP OR ICE AGGREGATE	TANT	44

```
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                             TANT
                                                                                    45
C
      DLR
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
                                                                             TANT
                                                                                    46
C
                                                                             TANT
                                                                                    47
C
      ELL
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
                                                                             TANT
                                                                                    48
      EPSI( ) PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
C
                                                                             TANT
                                                                                    49
C
               INTEGRATION (SEE DVDQ GLOSSARY)
                                                                             TANT
                                                                                    50
C
      FN
               FROUDE NUMBER
                                                                             TANT
                                                                                    51
C
      FNR
               RECIPROCAL OF THE FROUDE NUMBER
                                                                             TANT
                                                                                    52
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDC)
C
      HI
                                                                             TANT
                                                                                    53
C
      HMAX
               MAXIMUM TIME STEP (SEE DVDQ)
                                                                             TANT
                                                                                    54
C
      HMIN
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
                                                                             TANT
                                                                                    55
C
      IPLOT
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 18 FOR PLOTINGIANT
                                                                                    56.
C
      IT
               WHEN RETURNED FROM TRAJECT
                                                                             TANT
                                                                                    57
C
               WITH A VALUE OF ZERO, INDICATES IMPACTION HAS OCCURED.
                                                                             TANT
                                                                                    58
C
      KT
               TRAJECTORY TALLY
                                                                             TANT
                                                                                    59
C
      P( )
               CURRENT VALUES OF INDEPENDENT VARIABLES -
                                                                             TANT
                                                                                    60
C
                  P(1) = X
                                                                             TANT
                                                                                    61
C
                  P(2) = DX/DT
                                                                             TANT
                                                                                    62
C
                  P(3) = Y
                                                                             TANT
                                                                                    63
C
                  P(4) = DYJDT
                                                                             TANT
                                                                                    64
C
                  P(5) = Z
                                                                             TANT
                                                                                    65
C
                  P(6) = DZ/DT
                                                                             TANT
                                                                                    66
C
      PT
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGTANT
                                                                                    67
C
               OF PARTICLES
                                                                             TANT
                                                                                    68
C
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                             TANT
                                                                                    69
C
      RHO
               AIR DENSITY (KG/M**3)
                                                                             TANT
                                                                                    70
C
      RHOP
               PARTICLE DENSITY (KG/M++3)
                                                                             TANT
                                                                                    71
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                             TANT
                                                                                    72
C
      TPRINT
               OUTPUT TIME INTERVAL
                                                                                    73
                                                                             TANT
C
      ٧
               AIR SPEED (M/SEC)
                                                                                    74
                                                                             TANT
C
      VIS
               AIR VISCOSITY (KG/(M-SEC))
                                                                             TANT
                                                                                    75
C
               GRAVITY SETTLING SPEED OF PARTICLE
      VT
                                                                             TANT
                                                                                    76
C
      XFINAL
               X COORDINATE OF THE FINAL PLANE
                                                                                    77
                                                                             TANT
C
                   INITIAL COORDINATES PASSED TO TRAJECT
      XI3, YI3, ZI3
                                                                             TANT
                                                                                    73
C
                                                                             TANT
                                                                                    79
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                             TANT
                                                                                    80
     1RF,REO,R,XPSTAR,YPSTAR,ZFSTAR,P(6),TPRINT,IT,ALPHAG,BETAG,IREC,
                                                                             TANT
                                                                                    81
     2IPLOT, IPLT, XPLOT(60), YPLOT(60), ZPLOT(60), ALPHAR, BETAR, YPSTARF.
                                                                             TANT
                                                                                    82
     3ZPSTARP,XI3P,ZI3F,XP,YP,ZP,XWP,XPP,ACC,DLR,JLIM
                                                                                    83
                                                                             TANT
      DIMENSION HOLL(18)
                                                                             TANT
                                                                                    84
      LOGICAL IPLOT
                                                                             TANT
                                                                                    85
      DATA SIGNAL/999999./, KTLIM/ 25/
                                                                             TANT
                                                                                    86
      JLIM=0
                                                                             TANT
                                                                                    87
      NFIN=0
                                                                             TANT
                                                                                    88
C
                          READ AND WRITE DATA
                                                                             TANT
                                                                                    89
      READ (5,2600) KASE
                                                                             TANT
                                                                                    90
      CALL SETFLO(KASE)
                                                                             TANT
                                                                                    91
      READ(5, 1000) HOLL,
                                  IPLOT
                                                                             TANT
                                                                                    92
      READ(5,1100) V, ELL, RHO, TEMP, XFINAL
                                                                             TANT
                                                                                    93
      READ(5,1100) TPRINT, HI, HMINI, EPSI
                                                                             TANT
                                                                                    94
C
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS TANT
                                                                                    95
      IF (TPRINT .EQ. 0.0) TPRINT=0.1
                                                                             TANT
                                                                                    96
      IF(HI .EQ. 0.0) HI=0.1
                                                                             TANT
                                                                                    97
      IF (HMINI .EQ. C. 0) HMINI=0.005
                                                                             TANT
                                                                                    98
      IF(EPSI(1) .EQ. U.() EPSI(1)=1.0E-5
                                                                             TANT
                                                                                    99
      IF(EPSI(2) .EQ. 0.0) EPSI(2)=1.0E-5
                                                                             TANT 100
      IF(EPSI(3) .EQ. 0.0) EPSI(3)=1.0E-5
                                                                             TANT 101
      VIS = 145.8E-8 * TEMP**(3.0/2.0)/(110.4 * TEMP)
                                                                             TANT 102
      WRITE (6,1200) HOLL
                                                                             TANT 103
      WRITE(6,1300) V, ELL, RHC, TEMP, VIS
                                                                             TANT 104
```

```
WRITE(6,1400) HI, HMINI, TPRINT, XFINAL
                                                                           TANT 105
      WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                           TANT 106
C
      INITIALIZE
                                                                           TANT 107
      FN = V**2/(9.8*ELL)
                                                                           TANT 108
      FNR = 1.0/FN
                                                                           TANT 109
      IF (.NOT. IPLOT) GO TO 5
                                                                           TANT 110
      REWIND 10
                                                                           TANT 111
      WRITE (6,1800)
                                                                           TANT 112
      ENTER PARTICLE LCOP
                                                                           TANT 113
    5 CALL PARTCL(V,ELL,RHO,VIS,TEMP,DIAM,DLR,RHOP,VT,RF,PT,ACC,NFIN)
                                                                           TANT 114
      IF(NFIN .EQ. 0) GO TC 6
                                                                           TANT 115
      IF ( .NOT. IPLOT) RETURN
                                                                           TANT 116
      ENDFILE 10
                                                                           TANT 117
                                                                           TANT 118
      REWIND 10
      RETURN
                                                                           TANT 119
    6 COF = PT*VT*FN
                                                                           TANT 120
      R = RF + VT
                                                                           TANT 121
      MFIN=0
                                                                           TANT 122
      SET INITIAL COORDINATES
                                                                           TANT 123
   10 DFINE=SIGNAL
                                                                           TANT 124
      I7=1
                                                                           TANT 125
      KT=0
                                                                           TANT 126
                                                                           TANT 127
   20 CALL STRPNT(XI3, YI3, ZI3, DEL, DCORS, DFINE, MFIN)
      IF(MFIN .GT. 0) GO TO 5
                                                                           TANT 128
      KT=KT+1
                                                                           TANT 129
      IF(KT .GT. KTLIM) GO TO 60
                                                                           TANT 130
      XPSTAR=XFINAL
                                                                           TANT 131
                                                                           TANT 132
      XPP = XFINAL
      ALPHAR= 0.0
                                                                           TANT 133
      BETAR=0.0
                                                                           TANT 134
      YP = 0.0
                                                                           TANT 135
                                                                        TANT 136
      ZP = 0.0
                                                                           TANT 137
      WRITE(6.1600) XI3. YI3. ZI3. KT
      CALL TRAJECT
                                                                          TANT 138
C
                       PRINT TRAJECTORY DUTPUT
                                                                          TANT 139
      REWIND 9
                                                                           TANT 140
                                                                           TANT 141
      WRITE (6,8700)
            IWRITE = 1, IREC
                                                                           TANT 142
      READ (9) NEVAL, KSTEP, T, P(1), P(3), P(5), F(2), P(4), P(6), VX, VY, TANT 143
                                                                           TANT 144
     2 VZ, H, R,AC
      WRITE(6,8600) KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6),VX, VY,TANT 145
                                                                           TANT 146
     2 VZ, H, R, AC, NEVAL
                                                                           TANT 147
   30 CONTINUE
      CHECK FOR IMPACTION AND ADJUST DEL IF NECESSARY
                                                                        - TANT 148
      IF(IT .LE. 0) GO TO 40
                                                                           TANT 149
      IF(DEL .EQ. -DFINE) GO TO 50
                                                                          TABY 150
      IF(DEL .NE. -DCORS) GO TO 20
                                                                           TANV 151
      DEL=DFINE
                                                                           TANT 152
      WRITE(6,3000)
                                                                           TANT 153
      GO TO 20
                                                                           TANT 154
      IMPACTION HAS OCCURED
                                                                           TANT 155
   40 IT=1
                                                                           TANT 155
      IF (DEL .EQ. -DCORS) GO TO 20
                                                                           TANT 157
      IF (DEL .EQ. DFINE) WFITE (6,4000)
                                                                           TANT 158
      KT=KT-2
                                                                           TANT 159
                                                                           TANT 160
      DEL =- DEL
                                                                           TANT 161
      GO TO 20
   59 IF( .NOT. IPLOT) GO TO 10
                                                                           TANT 162
      IF (IPEOT) WRITE (10) IFLT, (XPLOT(L), YFLOT(L), ZPLOT(L), £=1, IFLT) TANT 163
      GO TO 10
                                                                           TANT 164
```

611	N WRITE(6,2000) ITLIM	TANT 169
	GO TO 10	TANT 166
		TANT 167
1000	FORMAT(18A4, 7X,L1)	TANT 168
1100	D FORMAT(8F10.5)	TANT 169
1200	FORMAT( 1H1, 5X, 32HTANGENT TRAJECTORY CODE RUN ID -/ 8	X, 184) TANT 170
1 300	) FORMAT(1H0, 5x, 21HPFYSICAL INPUT DATA -/7x,10HAIR SPEE	D=1PE13.6, TANT 171
· •	1 3X, 37HCHARACTERISTIC CIMENSION OF THE BODY=1PE13.6/ 7	X,35HDENSITTANT 178
1.	2Y AND TEMPERATURE OF AIR ARE 1PE13.6, 5H AND 1PE13.6,20	H AIR VISTANT 173
	3COSITY IS 1PE13.6)	TANT 174
1 400	FORMAT( 1HO, 5X, 29HNUMERICAL INTEGRATOR INPUTS -/ 7X,	16HTIME STETANT 179
	1P=1PE11.4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRI	NT TIME INTIANT 176
	2ERVAL=1PE11.4, 3X, 24HX COORD. OF FINAL FLANE=1PE11.4)	TANT 177
1500	FORMAT 1 140, 6%, 33HLOCAL ERROR TOLERANCES FOR DVDQ -,	3(1PE14.4)) TANT 178
1600	B FORMAT(//1HO, 38H+ + + INITIAL COORDINATES X	=1PE12.5. TANT 179
	1 3X, 2HY=1PE12.5, 3X, 2HZ=1PE12.5, 3X, 21HFOR TRAJECTO	RY NUMBER, TANT 180
:	2 14)	TANT 181
1800	FORMAT( ///6x, 51H TRAJECTORY DATA ARE WRITTEN ON UNIT 1	O FOR PLOTITANT 182
	1ING//)	TANT 183
2000	FORMAT(///5x, 14, 66H TRAJECTORIES HAVE BEEN COMPUTED.	GIVE UP ATANT 184
	IND TRY THE NEXT CASE .//)	TANT 18
2600	FORMAT (A4)	TANT 186
3600	0 FORMAT( //128HG* * * * * * * * * * * * * * * * * * *	* * * * * * TANT 187
	1 SWITCH TO FINE STEPSIZE * * * * * * * * * * * * * * * * * *	* * * * * * TANT 188
	2 * * * * */)	TANT 189
8 600	FORMAT(16, 10(1x,1PE11.4)/10x, 24H=1PE11.4,4H R=1PE11	.4, 5H AC=TANT 190
	11PE11.4, 8H NEVAL=I6)	TANT 191
8 700	D FORMAT(/6HOKSTEP, 7X, 1HT, 11X, 1HX, 11X, 1HY, 11X, 1HZ	, 10x, TANT 198
	1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X	
4000	D FORMAT( /// 129H * * * * * * * * * * * * * * * * * * *	* * * * * * TANT 194
	1 TANGENT TRAJECTORY IS AS FOLLOWS + + + + + + + + + + + + + + + + + + +	* * * * * TANT 195
	2++++++/)	TANT 196
	FND	TANT 197

```
*DECK, STRPNT
                                                                            STRP
                                                                                   1
      SUBROUTINE STRPNT( X, Y, Z, D, DCORS, DFINE, M)
                                                                                   2
                                                                            STRP
                                                                                   3
                                                                            STRP
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1975
                                                                            STRP
C
                                                                            STRP
                                                                                   5
      CALLED BY TANTRA TO CEFINE TRAJECTORY STARTING COORDINATES FOR
C
                                                                            STRP
C
      DETERMINATION OF TANGENT TRAJECTORIES OF PARTICLES TO A THREE-
                                                                            STRP
C
      DIMENSIONAL BODY.
                          THIS VERSION STARTS ALL TRAJECTORIES ON A
                                                                            STRP
                                                                                   8
C
      POINTS ARE STEPPED ALONG THE LINE TOWARD THE BODY USING
                                                                                   9
                                                                            STRP
C
      FIRST A COARSE STEP SIZE, AND AFTER IMPACTION AND BACK-UP A FINE
                                                                            STRP
C
      STEP SIZE UNTIL IMPACTION REOCCURS.
                                                                            STRP
                                                                                  11
C
                                                                            STRP
                                                                                  12
C
      GLOSSARY
                                                                            STRP
                                                                                  13
C
      COSA, COSB, COSG
                        DIRECTION COSINES OF THE STARTING POINT LINE
                                                                            STRP
                                                                                  14
              CURRENT VALUE OF STEP SIZE USED IN INCREMENTING INITIAL
C
                                                                            STRP
                                                                                  15
C
               COORDINATES TOWARD THE BODY
                                                                            STRP
                                                                                  16
C
      DCORS
               COARSE VALUE OF D USED FOR ROUGH DETERMINATION OF
                                                                            STRP
                                                                                  17
C
               TANGENT TRAJECTORY
                                                                            STRP
                                                                                  18
              FINE VALUE OF D USED FOR PRECISE DETERMINATION OF
C,
      DFINE
                                                                                  19
                                                                            STRP
               TANGENT TRAJECTORY
                                                                            STRP
                                                                                  20
              STARTING CCORDINATES
      X, Y, Z
                                                                            STRP
                                                                                  21
                POINT USED. ALONG WITH FIRST STARTING POINT. TO DEFINE
      X1, Y1, Z1
                                                                            STRP
                                                                                  22
                                                                            STRP
C
                 THE STARTING POINT LINE
                                                                                  23
C
                                                                            STRP
                                                                                  24
      DATA SIGNAL/999999./
                                                                            STRP
                                                                                  25
      IF(DFINE .LT. SIGNAL) GO TO 200
                                                                            STRP
                                                                                  26
COPY IN STEP SIZE INCREMENTS AND INITIALIZE FOR A NEW TANGENT LOCATION
                                                                            STRP
                                                                                  27
      READ(5,1100) DCORS, CFINE
                                                                            STRP
                                                                                  28
CHECK IF TRAJECTORIES FOR THIS PARTICLE SIZE ARE FINISHED
                                                                            STRP
                                                                                  29
                                                                            STRP
                                                                                  30
      IF(ABS(DCORS) + ABS(DFINE) .NE. 0.0) GO TO 100
                                                                            STRP
                                                                                  31
      M=1
                                                                                  32
                                                                            STRP
      RETURN
                                                                                  33
                                                                            STRP
COPY IN A PAIR OF POINT COCRDINATES TO DEFINE THE STARTING POINT LINE.
                                                                                  34
                                                                            STRP
      THE FIRST COORDINATES SPECIFY THE START POINT FOR THE FIRST
                                                                            STRP
                                                                                  35
      TRAJECTORY, AND THE SECOND COORDINATES ARE FOR ANY POINT ON THE
                                                                            STRP
                                                                                  36
      LINE WHICH IS CLOSER TOWARD THE BODY.
                                                                            STRP
                                                                                  37
  100 READ(5,1100) X, Y, Z, X1, Y1, Z1
                                                                            STRP
                                                                                  38
COMPUTE DIRECTION COSINES OF THE STARTING POINT LINE
                                                                                  39
                                                                            STRP
      R = SQRT((X1-X)+2+(Y1-Y)+2+(Z1-Z)+2)
                                                                            STRP
                                                                                  40
      COSA = (X1-X)/R
                                                                            STRP
                                                                                  41
      COSB = (Y1-Y)/R
                                                                                  42
                                                                            STRP
      COSG = (Z1-Z)/R
                                                                                  43
                                                                            STRP
      D = DCORS
                                                                            STRP
                                                                                  44
      WRITE(6,1000) X, Y, Z, X1, Y1, Z1
                                                                            STRP
                                                                                  45
      WRITE(6,1200) COSA, COSB, COSG
                                                                            STRP
                                                                                  46
      WRITE(6,1300) DCORS, DFINE
                                                                            STRP
                                                                                  47
      RETURN
                                                                                  48
                                                                            STRP
COMPUTE NEXT SET OF STARTING COORDINATES
                                                                            STRP
                                                                                  49
  200 X = X + D*COSA
                                                                            STRP
                                                                                  50
      Y = Y + D*COSB
                                                                            STRP
                                                                                  51
      Z = Z + D*COSG
                                                                            STRP
                                                                                  52
      RETURN
                                                                                  53
                                                                            STRP
 1000 FORMAT(/////5x,89HTRAJECTORIES ARE TO BEGIN ALONG A LINE DEFINED BSTRP
                                                                                  54
     IY THE POINTS (X1, Y1, Z1, ) AND (X2, Y2, Z2) -/ 9X, 2H( ,3(1PE15.5),
                                                                            STRP
                                                                                  55
                      ( , 3(1PE 15.5), 2H ))
     2 13H )
               AND
                                                                            STRP
                                                                                  56
 1100 FORMAT(3F10.0)
                                                                            STRP
                                                                                  57
 1200 FORMAT(5%, 68HWITH DIRECTION COSINES -(COS(ALPHA),COS(BETA),COS(GASTRP
                                                                                  58
     1MMA)) - 3(1PE15.5)/)
                                                                                  59
 1300 FORMAT( 5x, 49HSTARTING POINT INCREMENTS ARE - COARSE INCREMENT=1PSTRP
                                                                                  60
```

```
*DECK, FALWAT
                                                                             FALW
      SUBROUTINE FALWATIO, RHO, ETA, T, P, V)
                                                                             FALW
                                                                             FALW
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1979
                                                                             FALH
C
                                                                             FALW
C
      COMPUTES STILL-AIR, TERMINAL SETTLING SPEED OF WATER DROPS
                                                                             FALW
      ACCORDING TO THE EQUATIONS OF BEARD (JAS 33, 852 (1976))
C
                                                                             FALW
C
                                                                             FALW
C
      GLOSSARY (SI UNITS)
                                                                             FALW
C
               4. D*G/3.0
                           WHERE G IS ACCELERATION OF GRAVITY (9.8)
      C
                                                                             FALW
                                                                                   10
C
      CDRR
               DAVIES NUMBER
                                                                             FALW
                                                                                   11
C
      D
               DROP DIAMETER
                                                                             FALM
                                                                                   12
C
      ETA
               VISCOSITY
                                                                             FALH
                                                                                   13
      P
               PRESSURE
                                                                             FALW
                                                                                   14
C
      PN
               PHYSICAL PROFERTY NUMBER TO 1/6 PONER
                                                                             FALW
                                                                                   15
C
               FLUID DENSITY
      RHO
                                                                             FALW
                                                                                   16
C
      RHOP
               WATER DENSITY
                                                                             FALW
                                                                                   17
¢
      SIG
               WATER SURFACE TENSION
                                                                             FALH
                                                                                   18
Ċ
               TEMPERATURE
      T
                                                                             FALW
                                                                                   19
               SETTLING SPEED
                                                                             FALH
                                                                                   20
Ċ
                                                                             FALW
                                                                                   21
      DATA C/13.066667/, RHOP/1000./, EX/D.1666666667/
                                                                             FALW
                                                                                   22
                                                                                   23
                                                                             FALH
COMPUTE DAVIES NUMBER
                                                                             FALK
                                                                                   24
      CDRR = C*(RHOP-RHO)*RHO*[**3/ETA**2
                                                                             FALW
                                                                                   25
CHECK DAVIES NUMBER VALUE FOR ROUTING
                                                                             FALW
                                                                                   26
      IF(CDRR .GT. 0.3261) IF(CDRR-58243.) 100.100.200
                                                                             FALH
                                                                                   27
COMPUTE VIA STOKES-LAW EQUATION
                                                                             FALW
                                                                                   28
      V = CDRR*ETA/(24.0*RHO*D)
                                                                             FALW
                                                                                   29
      GO TO 300
                                                                             FALW
                                                                                   31
COMPUTE VIA BEARDS EQUATION FOR MEDIUM SIZE DROPS
                                                                             FALH
                                                                                   31
 100 Y = ALOG(CDRR)
                                                                             FALM
                                                                                   32
      V = ETA/(RHO+D)*EXP(-3.18657 + Y+(0.992696 + Y+(-0.153193E-2))
                                                                             FALW
                                                                                   33
     1+Y*(-0.987059E-3 + Y*(-0.57887&E-3 + Y*(0.855176E-4
                                                                             FALW
                                                                                   34
     2-Y*0.327815E-5))))))
                                                                                   35
                                                                             FALW
      GO TO 300
                                                                             FALW
                                                                                   36
COMPLTE VIA BEARDS EQUATION FOR LARGE DROPS
                                                                             FALH
                                                                                   37
     SIG = 7.570E-2 - 1.535E-4+(T - 273.0)
                                                                             FALW
                                                                                   38
      PN = (SIG**3 * RHO**2/(9.8 * (RHOP-RHO) * ETA**4))**EX
                                                                                   39
                                                                             FALW
      Y = ALOG(PN+C+(RHOP-RHC) + D++2/SIG)
                                                                             FALW
                                                                                   40
      V = ETA+PN/(RHO+D) + EXP(-5.00015 + Y+15.23778 + Y+1-2.04914 +
                                                                             FALW
                                                                                   41
     1 Y+(0.475294 + Y+(-0.0542819 + Y+0.00238449)))))
                                                                             FALH
                                                                                   42
      RETURN
                                                                             FALW
                                                                                   43
CORRECT SETTLING SPEED FOR SLIF
                                                                             FALW
                                                                                   44
 300 V = V + (1.0 + 54.088 + ETA + SQRT(T)/P/D)
                                                                             FALH
                                                                                   45
      RETURN
                                                                             FALH
                                                                                   46
      END
                                                                             FALH
                                                                                   47
```

```
WCDR
*DECK, WCDRR
                                                                                    1
                                                                             WCDR
      FUNCTION WCDRR( R )
                                                                                    2
                                                                             WCDR
                                                                                     3
C
      GIVEN THE REYNOLDS NUMBER, R. THE PRODUCT OF THE DRAG COEFFICIENTWOOR
                                                                                     4
C
      AND THE THE SQUARE OF THE REYNOLDS NUMBER IS RETURNED FOR A WATER WODR
C
      DROP IN AIR. THIS FUNCTION SHOULD BE USED ONLY FOR R .GT. 200.
                                                                             WCDR
                                                                                     6
                                                                                     7
C
                                                                             WC DR
      ( SEE BEARD AND PRUPPACHER, JAS 25, 1066(1969)).
C
      THE DATA OF GUNN AND KINZER, J. METEOR. 6, 243(1949), ARE USED.
                                                                             WCDR
                                                                                     8
                                                                                     9
                                                                             WCDR
      IF( R .GT. 200. ) GO TO 100
                                                                             WCDR
                                                                                   10
      WCDRR = -1.0E26
                                                                             WCDR
                                                                                   11
      RETURN
                                                                             WCDR
                                                                                   12
  100 \text{ ALGR} = \text{ALOG10}(R)
                                                                             WCDR
                                                                                    13
      WCDRR = 10.0**( 21.38446 + ALGR * ( -28.81265 + ALGR * (
                                                                             WCDR
                                                                                    14
     1 16.83269 + ALGR * ( -4.152207 + ALGR * 0.3672735 ))))
                                                                             WCDR
                                                                                   15
      RETURN
                                                                             WCDR
                                                                                   16
      END
                                                                                   17
                                                                             WCDR
```

```
*DECK.CDRR
                                                                            CDRR
                                                                            CDRR
                                                                                    2
      FUNCTION CORR(R)
                                                                             CORR
                                                                                    3
C
      GIVEN THE REYNOLDS NUMBER, R. THE PRODUCT OF THE DRAG COEFFICIENT CORR
C
                                                                                    4
C
      AND THE SQUARE OF R IS RETURNED FOR A SPHERE. SEE NCRMENT, TO-B
                                                                            CORR
C
      64-102 (1 NOV. 1964).
                                                                            CORR
                                                                                    6
                                                                            CORR
                                                                                    7
      IF(R .GT. 0.05) IF(R-3.) 100,100,200
                                                                            CORR
                                                                            CORR
                                                                                    9
      CDRR = 24. * R
                                                                            CDRR
      RETURN
                                                                                   10
  100 CDRR = R*( 24.167 + R*( 3.254 - R*0.23564))
                                                                            CDRR
                                                                                   11
                                                                            CDRR
                                                                                   12
      RETURN
  200 IF(R .GT. 330.) GO TO 300
                                                                            CDRR
                                                                                   13
      CDRR = -28.339 + R*( 38.969 + R * (0.73204 - R * 0.56084E-3))
                                                                             CDRR
                                                                                   14
      RETURN
                                                                             CORR
                                                                                   15
  300 CDRR = R * ( 93.462 + F * 0.37576)
                                                                            CORR
                                                                                   16
      RETURN
                                                                             CORR
                                                                                   17
      END
                                                                             CD RR
                                                                                   18
```

, DVDQ	DUDQ	
SUBROUTINE DVDQ(NEQ,T,Y,F,KD,EPS,IFLAG,H,HMIN,	DVDQ	
+ HMAX, TPRINT, TFINAL, MXSTEP, KSTEP, KEMAX, EMAX,	DVDQ	
* KQ,YN,DT, NEWAL, NG,NGE, NSTOP,G,GT)	DVDQ	
	DVDQ	
	DVDQ	
VARIABLE ORDER INTEGRATION SUBROUTINE	DVDQ	
FOR THE SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS.	DVDQ	
	DVDQ	
ANALYSIS AND CODING BY FRED T. KROGH, JET PROPULSION	DVDQ	
LABORATORY, PASADENA, CALIF. APRIL 1, 1969.	DVDQ	
MODIFIED BY CLEVE MOLER, UNIV. NEW MEXICO, OCT. 1972	DVDQ	
	DVDQ	٠.
VARIABLES IN THE CALLING SEQUENCE HAVE THE FOLLOWING	DVDQ	
DIMENSIONS WHERE N=NEQ AND K=KD(1)+KD(2)++KD(N)	DVDQ	
Y(K),F(N),KD(N),EPS(N),KQ(N),YN(K),	DVDQ	
DT(20, N), G(NG), GT(NG)	DADO	
·	DVDQ	
PARAMETERS WHICH MUST BE ASSIGNED VALUES BEFORE THE INITIAL	DVDQ	
ENTRY ARE IFLAG, NG, NEC, T, Y, KD, H, HMIN, HMAX,	DVDQ	
TPRINT, TFINAL, MXSTEP, AND (USUALLY) EPS.	DVDQ	
INCLUSION TO THE TOTAL T	DVDQ	
THE USER MUST ALSO PROVIDE CODE WHICH ASSIGNS	DVDQ	
VALUES TO F (ONCE PER STEP INITIALLY, AND TWICE PER STEP	DVDQ	
AFTER GETTING STARTED) AND EPS (EITHER INITIALLY, OR DURING	DVDQ	
THE INTEGRATION IF A RELATIVE ERROR TEST IS USED).	DVDQ	
INTERNATION IF A RECALL VE ENROR IEST 13 OBENIA	DVDQ	
THE FOLLOWING PARAMETERS GIVE ADDITIONAL INFORMATION ABOUT THE	DVDQ	
INTEGRATION AND ARE USED FOR STORAGE. THEY SHOULD NOT BE	DVDQ	
	DVDQ	
CHANGED BY THE USER. IFLAG, KSTEP, KEMAX, EMAX, KQ, YN, AND DT.	DVDQ	
	DVDQ	
	DVDQ	
THE USAGE OF THE VARIABLES IS GIVEN BELON.	DVDQ	
THE USAGE OF THE VARIABLES IS GIVEN BELON.	1 1 1	
MEG-NUMBER OF FOUNTTONG ATMOUTE	DVDQ	
NEQ=NUMBER OF EQUATIONS (INPUT)	DVDQ	
W-THOROGUNGHO MADRADIR ATHERTAL MALLE CHODITED DM THE HOEST	DVDQ	
T=INDEPENDENT VARIABLE (INITIAL VALUE SUPPLIED BY THE USER)	DVDQ	
	DVDQ	
Y(J)=CURRENT VALUE OF A CEPENDENT VARIABLE OR DERIVATIVE.	DVDQ	
THE INITIAL VALUE MUST BE SPECIFIED BY THE USER BEFORE	DVDQ	
THE FIRST ENTRY. THE DIMENSION OF Y MUST BE	DVDQ	
AT LEAST AS GREAT AS THE SUM OF THE ORCERS OF	DVDQ	

```
THE DIFFERENTIAL EGUATIONS WHICH ARE BEING
                                                                       DVDQ
                                                                             44
                                                                       DVDQ
                                                                             45
        THE J-TH DERIVATIVE OF THE I-TH DEPENDENT VARIABLE IS
                                                                       DVDQ
                                                                             46
        STORED IN Y(K+J+1) WHERE K=KJ(1)+...+KD(I-1),
                                                                       DVDQ
                                                                             47
        I=1,..., NEQ, J=0,..., KD(I)-1 .
                                                                       DONDQ
                                                                             46
        (FOR EXAMPLE, FOR THE SYSTEM F(1)=UPP, F(2)=VPP, WHERE P
                                                                       DVDQ
                                                                             49
        DENOTES A PRIME, Y(1)=U, Y(2)=UP, Y(3)=V, Y(4)=VP.)
                                                                       DVDQ
                                                                             50
                                                                       DVDQ
                                                                             51
      F(I)=KD(I)-TH DERIVATIVE OF THE I-TH COMPONENT WITH RESPECT
                                                                       DVDQ
                                                                             52
       TO T, I=1,2,..., NEQ. THE USER HUST PROVIDE
                                                                       DVDQ
                                                                             53
        THE CODE WHICH COMPUTES F GIVEN Y AND T.
                                                                       DVDQ
                                                                             54
                                                                       DVDQ
                                                                             55
      KD(I)=THE ORDER OF THE I-TH DIFFERENTIAL EQUATION IN
                                                                       DVDQ
                                                                             56
         THE SYSTEM. KD(I) MUST BE LESS THAN OR EQUAL TO 4.
                                                                       DVDQ
                                                                             57
                                                                      DVDQ
                                                                             58
      EPS(I) IS A PARAMETER USED TO CONTROL THE LOCAL ERROR.
                                                                       DVDQ
                                                                             59
         THE ESTIMATED LOCAL ERROR IS KEPT LESS THAN EPS(I) IN
                                                                      DVDQ
                                                                             60
         THE (KD(I)-1)-ST DERIVATIVE OF THE I-TH COMPONENT. THUS
                                                                       DVDQ
                                                                             61
         FOR EQUATIONS WITH ORDER GREATER THAN ONE, THE ERROR
                                                                       DVDQ
                                                                             62
         IN A DERIVATIVE IS ESTIMATED. IN THIS CASE THE VALUE OF
                                                                      DVDQ
                                                                             63
         EPS(I) REQUIRED TO OBTAIN A GIVEN ACCURACY IN THE DEPENDENT
                                                                      DVDQ
                                                                             64
        VARIABLE DEPENDS ON THE SCALING.
                                                                       DVDQ
                                                                             65
        IF ONE WANTS A RELATIVE ERROR TEST THEN ONE SHOULD SET EPS(I)
                                                                       DVDQ
                                                                             66
        WHEN IFLAG=1 .
                                                                       DVDQ
                                                                             67
         IF EPS(I)=0 AND HMAX.NE.O, IFLAG IS SET EQUAL 8.
                                                                       DVDQ
                                                                             68
        IF EFS(I)=0 AND HMAX=0, NO ERROR TESTS ARE PERFORMED
                                                                       DVDQ
                                                                             69
         AND THE ORDER(S) AND STEPSIZE ARE NOT CHANGED.
                                                                       DVDQ
                                                                             70
         THIS OPTION SHOULE NOT BE USED IF KQ(I)=1 FOR ANY I.
                                                                       DVDQ
                                                                             71
                                                                       DVDQ
                                                                             72
   IFLAG IS USED FOR COMMUNICATION BETWEEN THE INTEGRATOR
                                                                       DVDQ
                                                                             73
         AND THE FROGRAM WHICH CALLS IT. TO BEGIN THE INTEGRATION THE DVDQ
                                                                             74
         USER SHOULD SET I FLAG=0 AND CALL DVDQ. THIS WILL CAUSE
                                                                       DVDQ
                                                                             75
         INITIALIZATION OF INTERNAL VARIABLES AND A RETURN WITH
                                                                       DVDQ
                                                                             76
         IFLAG=1. AFTER THIS INITIAL ENTRY THE VALUE OF IFLAG
                                                                       DVDQ
                                                                             77
         SHOULD NOT BE CHANGED BY THE USER.
                                                                       DVDQ
                                                                             78
                                                                       DVDQ
                                                                             79
         THE FOLLOWING VALUES OF IFLAG HAVE THE FOLLOWING MEANINGS.
                                                                       DVDQ
                                                                             80
     #0 USED TO INITIALIZE THE INTEGRATOR.
                                                                       DVDQ
                                                                             81
     #1 THE VALUE OF Y FOR THE CURRENT STEP HAS BEEN
                                                                       DVDQ
                                                                             82
          PREDICTED. THE USER SHOULD COMPUTE F AND CALL DVDQ AGAIN.
                                                                      DVDQ
                                                                             83
          IF A RELATIVE ERROR TEST IS USED THE NEW VALUE
                                                                       DVDQ
                                                                             84
          OF EPS SHOULD ALSO BE COMPUTED HERE.
                                                                       DVDQ
                                                                             85
          THE VALUE OF Y FOR THE CURRENT STEP HAS BEEN
                                                                      DVDQ
                                                                             86
          CORRECTED. THE USER SHOULD COMPUTE F AND CALL DVDQ.
                                                                      DVDQ
                                                                             87
     =3 AN OUTPUT POINT HAS BEEN REACHED (SEE DESCRIPTION
                                                                      DVDQ
                                                                             8 9
          OF TPRINT), PRINT RESULTS AND CALL DVDQ.
                                                                       DVDQ
                                                                             89
          T=TFINAL
                      IF DVDQ IS CALLED WITH T=TFINAL AND
                                                                       DVDQ
                                                                             90
          IFLAG=4, IFLAG IS SET EQUAL TO 8. IF THE VALUE OF
                                                                      DVDQ
                                                                             91
          TFINAL IS CHANGED THE INTEGRATION WILL CONTINUE.
                                                                      DVDQ
                                                                             92
    =5
          KSTEP=KSOUT
                        (SEE THE DESCRIPTION OF MXSTEP).
                                                                      DVDQ
                                                                             93
          EMAX.GT... AND IT APPEARS TO THE SUBROUTING THAT
                                                                      DVDQ
                                                                             94
          REDUCING H WILL NOT HELP BECAJE OF ROUND OFF ERROR.

IF THIS OCCURS A LARGER MALLS OF
                                                                      DVDQ
                                                                             95
          IF THIS OCCURS A LARGER VALUE OF EPS(KEMAX)
                                                        SHOULD
                                                                      DVDQ
                                                                             96
          PROBABLY BE USED. IF EPS(KEMAX) IS NOT INCREASED. TOO
                                                                      DVDQ
                                                                             97
          SMALL A STEPSIZE IS LIABLE TO BE USED. (WE HAVE FOUND THAT
                                                                      DVDQ
                                                                             98
C
          REPLACING EPS(KEMAX) WITH 32. *ENAX *EPS(KEMAX) WORKS WELL.)
                                                                      DVDQ
                                                                             99
          INCREASING EPS IN THIS WAY WILL NOT DEGRADE THE ACCURACY,
                                                                       DVDQ 100
C
          HOWEVER IF THE NATURE OF THE PROBLEM CHANGES IT MAY PAY TO
                                                                     DVDQ 101
C USE A SHALLER VALUE UP EFS LATER TO CONTINUE WITH THE CURRENT
          USE A SHALLER VALUE OF EPS LATER IN THE INTEGRATION.
                                                                DVDQ 102
                                                                      DVDQ 193
```

C

C

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VALUE OF H. SET HMIN.LE.ABS(H) AND CALL CVDQ.
                                                                             DVDQ 184
          IF THE INTEGRATOR HAS JUST HALVED H ONE MAY CONTINUE
                                                                             DVDQ 185
          WITH TWICE THE STEPSIZE BY SIMPLY CALLING DVDQ. (SUCH
                                                                             DVDQ 106
          AN ACTION IS RISKY WITHOUT A CAREFUL ANALYSIS OF THE
                                                                         DVDQ 168
          SITUATION.) IF THE STEPSIZE HAS NOT JUST BEEN HALVED
          (ABS(H) .LT . HMIN MAY BE DUE TO THE USER INCREASING THE
                                                                            DVDQ 189
          VALUE OF HMIN OR TO HAVING TOO SMALL AN H AT THE END OF THE STARTING PHASE.) THE INTEGRATION WILL CONTINUE
                                                                             DVDQ 110
                                                                             DVDQ 111
          WITH THE CURRENT VALUE OF H AND A RETURN TO THE USER WITH
                                                                             DVDQ 112
C
          IFLAG=7 WILL BE HADE ON EVERY STEP UNTIL ABS (H).GE.HMIN.
                                                                             DV0Q 113
C
      =8 ILLEGAL PARAMETER IN THE CALLING SEQUENCE. IF DVDQ
                                                                             DVCQ 114
          IS CALLED WITH IFLAG=8 THE PROGRAM IS STOPPED.
                                                                             DVDQ 115
                                                                             DVDQ 116
C
      H=CURRENT VALUE OF THE STEPSIZE: IN SELECTING THE INITIAL
                                                                             DVDQ 117
        VALUE FOR H, THE USER SHOULD REMEMBER THE FOLLOWING--
                                                                             DVDQ 118
C
       1. THE INTEGRATOR IS CAPABLE OF CHANGING H QUITE QUICKLY ANG
                                                                             DVDQ 119
          THUS THE INITIAL CHOICE IS NOT CRITICAL.
                                                                             DVDQ 120
       2. IF IT DOES NOT LEAD TO PROBLEMS IN COMPUTING THE DERIVATIVES:
                                                                             DVDQ 121
          (E.G. BECAUSE OF OVERFLOW OR TRYING TO EXTRACT THE SQUARE.
                                                                             DVDQ 122
          ROOT OF A NEGATIVE NUMBER), IT IS BETTER TO CHOOSE H MUCH
                                                                             DVDQ 123
C
          TOO LARGE THAN MUCH TOO SMALL.
                                                                             DVDQ 124
C
       3. IF H+TPRINT.LE.O INITIALLY, AN IMMEDIATE RETURN IS MADE
                                                                             0 VDQ 125
C
          WITH IFLAG=8. THE SIGN OF H IS WHAT DETERMINES THE
                                                                             DVDQ 126
C
          DIRECTION OF INTEGRATION.
                                                                             DVDQ 127
       4. IF TPRINT=H*(2**K) K A NCNNEGATIVE INTEGER THEN OUTPUT
                                                                             DVDQ 128
          VALUES WILL BE OBTAINED WITHOUT DOING AN INTERPOLATION.
                                                                             DVDQ 129
                                                                             DVDQ 130
C
      HMIN
              AFTER GETTING STARTED, AND WHENEVER H
                                                                             DVDQ 131
C
               IS HALVED. ABS(H) IS COMPARED WITH HMIN.
                                                                             DVDQ 132
C
               IF ABS(H).LT.HMIN CONTROL IS RETURNED TO
                                                                             DVDQ 133
C
               THE USER WITH IFLAG=7.
                                                                             DVDQ 134
C
                                                                             DVDQ 135
             THE STEPSIZE IS NCT DOUBLED IF
      HMAX
                                                                             DVDQ 136
               DOING SO WOULD MAKE ABS (H) .GT. HMAX
                                                                             DVDQ 137
                                                                             DVDQ 138
      TPRINT ENABLES THE USER TO SPECIFY THE PCINTS WHERE
                                                                             DVDQ 139
        OUTPUT IS DESIRED. LET TOUT=TPRINT + THE VALUE OF T THE LAST
                                                                             DVDQ 140
        TIME CONTROL WAS RETURNED TO THE USER WITH IFLAG=3. (INITIALLY
                                                                             DVDQ 141
        TOUT=THE INITIAL VALUE OF 1.1 CUNIKUL 13 RESURTED TO USER WITH IFLAG=3 WHENEVER T=TOUT. IF TOUT DOES NOT FALL
        TOUT=THE INITIAL VALUE OF T.) CONTROL IS RETURNED TO THE
        USER WITH IFLAGES WHENEVER TETOUT. IF TOUT DUES NO.

ON AN INTEGRATION STEP, OUTPUT VALUES ARE OBTAINED BY

THE FIRST STEP THAT (TETOUT)*H.GT.O.
                                                                             DVDQ 142
                                                                             DVDQ 143
                                                                             DVDQ 144
C
                                                                             DVDQ 145
        INTERPOLATED VALUES FOR BOTH Y AND F ARE COMPUTED.
                                                                             DVDQ 146
        (NOTE THAT A RETURN WITH IFLAG=3 IS ALWAYS MADE
                                                                             DVDQ 147
        BEFORE TAKING THE FIRST STEP.)
                                                                             DVDQ 148
                                                                             DVDQ 149
               CONTROL IS RETURNED TO THE USER WITH IFLAG=4 WHEN
      TFINAL
                                                                             DVDQ 150
T REACHES TFINAL. IF TFINAL DCES NOT FALL ON AN INTEGRATION
                                                                             DVDQ 151
        STEP VALUES AT TFINAL ARE OBTAINED BY EXTRAPOLATION.
                                                                             DVDQ 152
                                                                             DVDQ 153
C
               ON THE INITIAL ENTRY, AND ON ENTRIES
      MXSTEP
                                                                             DVDQ 154
        WITH 2.LT.IFLAG.LT.6 KSOUT IS SET EQUAL TO
KSTEP+MXSTEP. AT THE END OF EACH STEP KSTEP IS INCREMENTED DVDQ 156
DVDQ 157
        AND COMPARED WITH KSOUT. IF KSTEP.GE.KSOUT CONTROL IS RETURNED TO THE USER WITH IFLAG=5. (THUS IF TPRINT IS
                                                                           DV 0Q 158
        SUFFICIENTLY LARGE, CONTROL WILL BE RETURNED TO THE USER
                                                                             DVDQ 159
        WITH IFLAG=5 EVERY MXSTEP STEPS.)
                                                                             DVDQ 160
C
                                                                             DVDQ 161
      KSTEP=NUMBER OF INTEGRATION STEPS TAKEN (COMPUTED
                                                                             DVDQ 162
        BY THE INTEGRATOR.)
                                                                             DVDQ 163
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DVDQ 164
 KEMAX=INDEX OF COMPONENT RESPONSIBLE FOR THE
                                                                     DVDQ 165
       VALUE OF EMAX (SEE BELOW) .
                                                                     DVDQ 166
                                                                     DVDQ 167
 ENAX=LARGEST VALUE IN ANY COMPONENT OF (ESTIMATED ERROR)/EPS(I)
                                                                     DVDQ 168
   ORDINARILY THE STEFSIZE IS HALVED IF EMAX.GT..1. WITH A
                                                                     DVDQ 169
   RECENT HISTORY OF LOCAL ROUND-OFF PROBLEMS VALUES OF EMAX AS
                                                                     DVDQ 170
   LARGE AS 1 ARE PERMITTED. THE STEPSIZE IS NOT HALVED ON ANY
                                                                     DVDQ 171
   STEP THAT ROUND OFF ERROR APPEARS TO BE LIMITING THE PRECISION.
                                                                     DVDQ 172
                                                                     DVDQ 173
 KQ(I)=HIGHEST ORDER DIFFERENCE USED IN INTEGRATING
                                                                     DVDQ 174
   THE I-TH EQUATION. (COMPUTED BY THE INTEGRATOR)
                                                                     DVDQ 175
                                                                     DVDQ 176
 YN=A VECTOR WITH THE DIMENSION OF Y USED TO STORE
                                                                     DVDQ 177
   THE VALUE OF Y AT THE END OF EACH INTEGRATION STEP.
                                                                     DVDQ 178
                                                                     DVDQ 179
 DT=AN ARRAY WITH DIMENSICH DT(20.NEQ) USED TO
                                                                     DVDQ 180
   STORE THE DIFFERENCE TABLE.
                                                                     DVDQ 181
                                                                     DVDQ 182
NEVAL=NUMBER OF TIMES F IS EVALUATED (= NUMBER OF
                                                                     DVDQ 183
   RETURNS MADE WITH IFLAG=1 OR 2). (COMPUTED BY DVDQ.)
                                                                     DVDQ 184
                                                                     DVDQ 185
 NG MUST BE SET = 0 BY THE USER IF THE GSTOP FEATURE IS
                                                                     DVDQ 186
  NOT USED. OTHERWISE SEE BELOW.
                                                                     DVDQ 187
                                                                     DVDQ 188
                                                                     DVDQ 189
 A GSTOP IS DEFINED AS A RETURN WHICH IS MADE TO THE USER WHEN A
                                                                     DVDQ 190
 USER SPECIFIED FUNCTION & PASSES THROUGH ZERC. THE USER MAY
                                                                     DVDQ 191
 SPECIFY ANY NUMBER OF FUNCTIONS G OF TWO TYPES. ZEROS OF THE FIRSTDVDQ 192
 TYPE ARE LOCATED WITHOUT REQUIRING A DERIVATIVE EVALUATION
                                                                     DVDQ 193
 BEYOND THE ZERO. THIS TYPE OF GSTOP REQUIRES THAT G BE EVALUATED
                                                                     DVDQ 194
 BEFORE EACH DERIVATIVE EVALUATION. ZEROS OF THE SECOND TYPE ARE
                                                                     DVDQ 195
 LOCATED USING INTERPOLATION. WHICH IS MORE ACCURATE THAN THE
                                                                     DVDQ 196
EXTRAPOLATION USED IN THE PRECEDING CASE AND ONLY REQUIRES ONE
                                                                     DVDQ 197
EVALUATION OF G PER STEP. THUS ONE SHOULD USE THE SECOND TYPE OF
                                                                     DVDQ 198
 GSTOP IF POSSIBLE. USERS NOT USING THE GSTOP FEATURE NEED READ
                                                                     DVDQ 199
 NO FURTHER.
                                                                     DVDQ 200
                                                                     DV DQ 201
 THE GSTOP FEATURE IS INVCKED BY USING A NONZERO VALUE OF
                                                            NG .
                                                                     DVDQ 202
 IT IS TURNED OFF BY SETTING NG=0 . IT IS NOT NECESSARY TO
                                                                     DVDQ 203
 MAKE SEPARATE CALLS TO DVDQ TO DO THIS.
                                                                     DVDQ 204
                                                                     DVDQ 215
       THE NUMBER OF COMPONENTS IN G TO BE EXAMINED FOR A ZERO.
 NG=
                                                                     DVDQ 206
                                                                     DV DQ 207
                                                                     DVDQ 298
 NGE=THE NUMBER OF COMPONENTS OF G THAT MUST BE EXAMINED FOR
       A ZERO BEFORE COMPUTING THE DERIVATIVES (FIRST TYPE OF
                                                                     DVDQ 219
       GSTOP). IF NGE.LT.0 OR NGE.ST.NG. IFLAG IS SET
                                                                     DVDQ 210
                                                                     DVDQ 211
       EQUAL 8 AND AN IMPEDIATE RETURN IS MADE. IF NGE.GT.D.
       G(1),G(2),...,G(NGE) ARE EXAMINED FOR A ZERO BEFORE EACH
                                                                     DVDQ 212
       DERIVATIVE EVALUATION, THE REMAINING COMPONENTS (IF ANY)
                                                                     OVDQ 213
       ARE EXAMINED AT THE END OF EACH STEP.
                                                                     DVDQ 214.
                                                                     DV DQ 215
 NSTOP= THE COMPONENT OF G RESPONSIBLE FOR A GSTOP (COMPUTED BY
                                                                     DVDQ 216
        THE INTEGRATOR).
                                                                     DVDQ 217
                                                                     DVDQ 218
       A VECTOR CONTAINING THE CURRENT VALUES OF THE FUNCTIONS
 G=
                                                                     DVDQ 219
       WHOSE ZEROS ARE TO BE DETERMINED.
                                                                     DVDQ 220
                                                                     DVDQ 221
 GT=
       A VECTOR WITH THE SAME DIMENSION AS G USED BY THE
                                                                     DVDQ 222
       SUBROUTINE FOR TEMPORARY STORAGE.
```

C

C

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DVDQ 223

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CCC
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DVDQ 224
   RETURNS FROM CALLING DVDQ WITH IFLAG.GT.8 SHOULD BE INTERPETED
                                                                         DVDQ 225
   AS FOLLOWS.
                                                                         DVDQ 226
                                                                         DVDQ 227
   = 9 COMPUTE G(NGE+1),...,G(NG) (THE COMPONENTS OF G WITH
                                                                         DVDQ 228
       ZEROS TO BE LOCATED USING INTERPOLATION). THEN CALL DVDQ.
                                                                         DVDQ 229
       NO RETURN IS MADE WITH IFLAG=9 IF NGE=NG.
                                                                         DVDQ 230
   ≒10 COMPUTE G(1),G(2),...,G(NGE) (THE COMPONENTS OF G WITH
                                                                         DVDQ 231
       ZEROS TO BE LOCATED USING EXTRAPOLATION). THEN CALL DVDQ.
                                                                         DVDQ 232
       NO RETURN IS MADE WITH IFLAG=10 IF NGE=0.
                                                                         DVDQ 233
   =11 A GSTOP HAS BEEN FOUND.
                                 G(NSTOP)=0. FRINT RESULTS. IF THEIR DVDQ 234
       ARE NO DISCONTINUITIES CALL DVDQ TO CONTINUE THE INTEGRATION. DVDQ 235
   ≒12 G(NSTOP) CHANGES SIGN, BUT THERE IS DIFFICULTY IN CONVERGING
                                                                         DVDQ 236
       TO A ZERO. THE USER MAY WISH TO MAKE A SPECIAL CHECK TO BE
                                                                         DVDQ 237
       CERTAIN THAT EVERYTHING IS ALL RIGHT. TO CONTINUE THE
                                                                         DVDQ 238
       INTEGRATION CALL DVDG.
                                                                         DVDQ 239
                                                                         DVDQ 240
                                                                         DVDQ 241
   SUBROUTINE DVDQ(NEQ,T,Y,F,KD,EPS,IFLAG,H,HMIN,
                                                                         DVDQ 242
  * HMAX, TPRINT, TFINAL, MXSTEP, KSTEP, KEMAX, EMAX,
                                                                         DVDQ 243
  * KQ,YN,DT,NEWAL,NG,NEE,NSTOP,G,GT)
                                                                         BVDQ 244
   INTEGER NEQ, KD. IFLAG, MXSTEP, KSTEP, KEMAX, KQ, NEVAL, NG, NGE, NSTOP
                                                                         DVDQ 245
   REAL T, Y, F, EPS, H, HMIN, HMAX, TPRINT, TFINAL, EMAX,
                                                                         DVDQ 246
       YN, DT, G, GT
                                                                         DVDQ 247
   DIMENSION Y(1), F(1), YN(1), DT(20,1), KD(1), KQ(1), EPS(1), G(1), G(1)
                                                                         DVDQ 248
   INTEGER IB, IFL, IFLG, IFLS, IFLGS, IGK, IGKM, KBIT2, KDMAX, KDD, KDC,
                                                                         DVDQ 249
       LDOUB, LFD, LGSS, LGSC, LGSE, NE, NGA, IM1, KK, JM2, KMAXO, KM, KMD, KM1,
                                                                         OVDQ 250
  3
       KQMAX, KQM, KQQ, KQ1, KQQ2, LRND, J3, KSOUT, LSC, LSTC, NV, I, J, K, L
                                                                         DVDQ 251
         FAC, GAM, GAS, DD, EIGHTH, GI, HK, EPSGS, ERRMX, ER ND,
                                                                         DVDQ 252
  2
       TWO,FRNO,RG,ETA,TG,ONEP1,RND,RNDC,RQMAX,TL,E2HAVE,
                                                                         DVDQ 253
       E2HMAX, E2HFAC, E2+, TOLT, PT, TP, PTS1, PTS2, PTS3, PTS4, PTS5, TPS1,
  3
                                                                         DVDQ 254
       TPD,TP01,TPS3,TPS5,TPS4,TPS2,TPS6,TPD2,D,P01,P075,E,P1,
                                                                         DVDQ 255
       P25, P5, P75, S, ABS, AMCC, AMIN1, AMAX1, SIGN
                                                                         DVDQ 256
   DIMENSION GAM(20,4), GAS(20), ETA(13,18)
                                                                         DVDQ 257
   DIMENSION DD(26),D(25),PT(21),FAC(3),GI(2),RG(3)
                                                                         DVDQ 258
   EQUIVALENCE (DD(2),D(1))
                                                                         DVDQ 259
   DATA KBIT2 /U/
                                                                         DVDQ 260
                                                                         DVDQ 261
                                                                         DVDQ 2E2
   CHECK IFLAG
                                                                         DVDQ 263
                                                                         DVDQ 264
   IF (IFLAG) 1198, 10, 60
                                                                         DVDQ 265
                                                                         DVDQ 266
   CHECK TO INITIALIZE CONSTANTS
                                                                         DVDQ 267
                                                                         DVDQ 268
10 IF (KBIT2) 50,12,50
                                                                         DVDQ 269
                                                                         DVDQ 278
   DETERMINE MACHINE PRECISION
                                                                         DVDQ 271
                                                                         DVDQ 272
12 RND=1.
                                                                         DVDQ 273
14 RND=RND/2.
                                                                         DVDQ 274
   KBIT2=KBIT2+1
                                                                         DVDQ 275
   IF(1.+RND .GT. 1.) GQ TO 14
                                                                         DVDQ 276
   RND=8. * RND
                                                                         DVDQ 277
   DVDQ 278
   IF(KQMAX.GT.19) KQMAX=19
                                                                         DVDQ 279
   KBIT2=2*KBIT2+2
                                                                         DVDQ 280
                                                                         DVDQ 281
   KOMAX GIVES THE MAXIPUM CRDER OF POLYNOMIAL APPROXIMATION USED.
                                                                         DVDQ 282
   THERE IS LITTLE POINT IN HAVING KAMAX MUCH BIGGER THAN THE NUMBER DVDQ 283
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C
      OF DECIMAL DIGITS IN THE MANTISSA.
                                                                             DVDQ 284
C
                                                                             DVDQ 285
C
      RND IS APPROXIMATELY 2++(3-B) WHERE B IS
                                                                             DVDQ 286
C
      THE NUMBER OF BITS IN THE MANTISSA.
                                                                             DVDQ 287
C
      KBIT2=2*8+2 WHERE B IS THE NUMBER OF BITS IN THE MANTISSA.
                                                                             DVDQ 288
      IF THE DERIVATIVES ARE NOT COMPUTED TO THE ACCURACY EXPECTED
                                                                             DVDQ 289
C
      FROM THE WORD LENGTH OF THE COMPUTER (FOR EXAMPLE BECAUSE OF
                                                                             DVDQ 290
C
      CANCELLATION PROBLEMS OR TABULAR DATA), THEN THESE CONSTANTS
                                                                             DVDQ 291
C
      CAN BE CHANGED TO REFLECT THE NUMBER OF BITS WHICH ARE
                                                                             DVDQ 292
C
      SIGNIFICANT IN THE COMPUTED DERIVATIVES. (THIS IS NOT NECESSARY, DVDQ 293
C
      BUT IS WISE IF THE ACCURACY REQUESTED IS DIFFICULT TO OBTAIN
                                                                             DVDQ 294
C
      BECAUSE THE DERIVATIVES HAVE SO FEW SIGNIFICANT DIGITS.)
                                                                             DV DQ 295
C
                                                                             DVDQ 296
C
      ON IBM360, KQMAX WILL = 16, RND = 8.880-16, KBIT2 = 108
ON CDC6600, KQMAX WILL = 14, RND = 2.84E-14, KBIT2 = 98
                                                                           DVDQ 297
C
                                                                             DVDQ 298
C
      ON UNIVAC 1108, KQMAX WILL = 18, RND = 6.94D-18, KBIT2 = 122
                                                                             DVDQ 299
C
                                                                             DVDQ 300
C
                                                                             DVDQ 301
      KMAX0=4
                                                                             DVDQ 382
C
      KMAXO IS THE MAXIMUM ORDER DIFFERENTIAL EQUATION THIS
                                                                             DVDQ 303
C
      IMPLEMENTATION WILL INTEGRATE.
                                                                             DVDQ 304
                                                                             DVDQ 385
      FAC(1)=1.
                                                                             DVDQ 386
      FAC(2)=FAC(1)/2.
                                                                             DVDQ 307
      FAC(3) = FAC(2)/3.
                                                                             DVDQ 308
      TW0=2.
                                                                             DVDQ 389
      P1=.1
                                                                             DVDQ 310
      P01=.01
                                                                             DVDQ 311
      P25= . 25
                                                                             DVDQ 312
      P5= .5
                                                                             DVDQ 313
      P75=.75
                                                                             DVDQ 314
      P075=.075
                                                                             DVDQ 315
                                                                             DVDQ 316
      ONE P1=1.1
      PT(1)=1.
                                                                             DVDQ 317
      KM=KQMAX+1
                                                                             DVDQ 318
      DO 16 I=1.KM
                                                                             DVDQ 319
        PT(I+1)=2.*PT(I)
                                                                             DVDQ 320
   16 CONTINUE
                                                                             DVDQ 321
C
                                                                             DVDQ 322
C
      COMPUTE GAS AND GAM
                                                                             OVOQ 323
C
                                                                             DVDQ 324
C
      GAS(I) IS THE I-TH ADAMS -MOULTON CORRECTOR COEFFICIENT AND
                                                                             DV DQ 325
      GAM(I, J) IS THE I-TH ADAMS-FALKNER PREDICTOR COEFFICIENT
C
                                                                           DVDQ 326
      FOR INTEGRATING J-TH ORDER DIFFERENTIAL EQUATIONS,
                                                                             DVDQ 327
      I = 1, 2, ..., KQMAX+1, J = 1, 2, ..., KMAXO.
                                                                             DVDQ 328
                                                                             DVDQ 329
      KMD=KM+KMAXO
                                                                             DVDQ 330
      DO 20 K=1.KMD
                                                                             DVDQ 331
        S=K
                                                                             DV0Q 332
        D(K)=1./S
                                                                             DVDQ 333
   20 CONTINUE
                                                                             DVDQ 334
                                                                             DVDQ 335
      GAM (1,1)=D(1)
                                                                             DVDQ 336
      DO 22 J=2, KMAXO
        GAM(1,J)=D(J)*FAC(J-1)
                                                                             DVDQ 337
   22 CONTINUE
                                                                             DVDQ 338
      DO 26 I=2.KM
                                                                             DVDQ 339
        KK=KMD+1-I
                                                                             DVDQ 340
                                                                             DVDQ 341
        DO 24 K=1,KK
          S=I-1
                                                                             DVDQ 342
          D(K)=D(K) D(K+1)/S
                                                                             DVDQ 343
```

```
CONTINUE
                                                                              DVDQ 344
   24
        GAM(I_{1}) = 0(1)
                                                                              DVDQ 345
                                                                              DVDQ 346
        DO 26 J=2,KMAXO
          GAM(I, J)=D(J)*FAC(J-1)
                                                                              DVDQ 347
   26 CONTINUE
                                                                              DVDQ 348
      GAS(1)=1.
                                                                              DVDQ 349
      DO 28 I=2,KM
                                                                              DVDQ 350
        GAS(I) = GAM(I, 1) - GAM(I-1, 1)
                                                                              DVDQ 351
                                                                              DV DQ 352
   28 CONTINUE
C
                                                                              DVDQ 353
C
                                                                              DVDQ 354
      GENERATE ETA
                                                                              DVDQ 355
C
      ETA(I, J), I=1,2,..., J IS USED IN THE FIRST MODIFICATION OF THE
                                                                              DVDQ 356
C
      I-TH DIFFERENCE CF A J-TH ORDER METHOD AFTER THE STEPSIZE IS
                                                                              DVDQ 357
C
                                                                              DVDQ 358
      HAL VED.
C
      ETA(I,J), J=1,2,...,I-1 IS USED IN THE SECOND MODIFICATION OF
                                                                              DVDQ 359
C
      THE (J+1)-S7 DIFFERENCE OF AN I-T4 ORDER METHOD
                                                                              DVDQ 360
                                                                              DVDQ 361
      K=KQMAX-1
                                                                              DVDQ 362
      EIGHTH=FAC(2)*FAC(2)*FAC(2)
                                                                              DVDQ 363
      ETA(1,1)=EIGHTH
                                                                              DVDQ 364
      ETA(2,1)=EIGHTH
                                                                              DVDQ 365
      TP=FAC(2)*FAC(2)
                                                                              DVDQ 366
      00 33 J=2.K
                                                                              DV0Q 367
        TP=TP/2.
                                                                              DVDQ 368
        ETA(J,J)=(TP+ETA(J-1,J-1))/2.
                                                                              DVDQ 369
        IF(J.EQ.2) GO TO 32
                                                                              DV DQ 370
        JM2=J-2
                                                                              DVDQ 371
        DO 30 IB=1,JM2
                                                                              DVDQ 372
          I=J-18
                                                                              DVDQ 373
                                                                              DVDQ 374
           ETA(I,J) = (ETA(I+1,J) + ETA(I-1,J-1))/2.
   30
        CONTINUE
                                                                              DV DQ 375
   32
        ETA (1, J) = ETA (2, J)/2.
                                                                              DVDQ 376
   33 CONTINUE
                                                                              DVDQ 377
      DO 34 I=1,K
                                                                              DVDQ 378
                                                                              DVDQ 379
        TP=0.
        00 34 J=1.I
                                                                              DVDQ 380
          TP=TP+ETA(J, I)
                                                                              DVDQ 381
          ETA(I+1,J)=TP
                                                                              DVDQ 382
   34 CONTINUE
                                                                              DVDQ 383
                                                                              DVDQ 384
      TP=FAC(2)
      DO 36 J=1,K
                                                                              DVDQ 385
        TP=TP/2.
                                                                              DVDQ 386
        D(J) = ETA(J+1,J)+TP
                                                                              OV DQ 387
   36 CONTINUE
                                                                              DVDQ 388
      DO 38 J=1.K
                                                                              OVDQ 389
        DO 38 I=1,J
                                                                              DV DQ 390
          ETA(I,J)=ETA(I,J)/D(J)
                                                                              DVDQ 391
   38 CONTINUE
                                                                              DVDQ 392
      KM1=K-1
                                                                              DVDQ 393
      DO 40 J=1.KM1
                                                                              DVDQ 394
        O(J) = O(J+1) / O(J)
                                                                              DVDQ 395
   40 CONTINUE
                                                                              DV DQ 396
      DO 42 I=2, KM1
                                                                              DVDQ 397
        DO 42 J=1,I
                                                                              DVDQ 398
          ETA(I+1,J)==ETA(I+2,J)+ETA(I+1,J)+D(I)
                                                                              DVDQ 399
   42 CONTINUE
                                                                              DVDQ 400
      TP=EIGHTH
                                                                              DVDQ 491
      DO 46 I=2,KM1
                                                                              DVDQ 402
        TP=TP/2.
                                                                              DVDQ 403
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S=TP
                                                                               DVDQ 404
         DO 44 J=1,I
                                                                               DVDQ 405
           S=S+ETA(I+1,J)
                                                                               DVDQ 406
        CONTINUE
                                                                               DVDQ 467
         IM1=I-1
                                                                               DVDQ 498
         DO 46 J=1, IM1
                                                                               DVDQ 429
           ETA(I, J) = ETA(I+1, J)/S
                                                                               DVDQ 410
   46 CONTINUE
                                                                               DVDQ 411
C
                                                                               DVDQ 412
C
      INITIALIZE VARIABLES
                                                                               DVDQ 413
                                                                               DVDQ 414
   50 PTS1=PT(1)
                                                                               DVDQ 415
      PTS2=PT(2)
                                                                               DVDQ 416
      PTS3=PT (3)
                                                                               DVDQ 417
      PTS4=PT (4)
                                                                               DVDQ 418
      PTS5=PT (5)
                                                                               DVDQ 419
      LGSS=0
                                                                               DVDQ 420
      LGSD=0
                                                                               DVDQ 421
      LGSE=0
                                                                               DVDQ 422
      LFD=0
                                                                               DVDQ 423
      E2HAVE=0.
                                                                               DVDQ 424
      E2HMAX=0.
                                                                               DVDQ 425
      DO 52 I=1, KMD
                                                                               DV DQ 426
        DD(I)=0.
                                                                               DVDQ 427
   52 CONTINUE
                                                                               DVDQ 428
      KSTEP=-1
                                                                               DVDQ 429
                                                                               DVDQ 430
      IF (NE.LE.0) GO TO 1190
                                                                               DVDQ 431
      HH=H
                                                                               DVDQ 432
      NV = C
                                                                               DVDQ 433
      KDMAX=0
                                                                               DVDQ 434
      DO 56 J=1, NE
                                                                               DVDQ 435
         KQ(J) = 1
                                                                               DVDQ 436
        DO 54 I=1,KQMAX
                                                                               DVDQ 437
           DT(I,J)=0.
                                                                               GVDQ 438
   54
        CONTINUE
                                                                               DVDQ 439
         KDD=KD(J)
                                                                               DVDQ 440
         IF ((KDD.EQ.0).OR.(KDD.GT.KMAXO)) HH=0.
                                                                               DVDQ 441
        IF (KDD.GT.KDMAX) KDMAX=KDD
                                                                               DVDQ 442
        NV=NV+KDD
                                                                               DVDQ 443
   56 CONTINUE
                                                                               DVDQ 444
                                                                               DVDQ 445
      IF ((TPRINT*HH).LE.O.) GO TO 1190
                                                                               DV DQ 446
      ERRMX=P1
                                                                               DVDQ 447
      ERND=0.
                                                                               DVDQ 448
      EMAX=ERNO
                                                                               DV DQ 449
      RNDC=RND*P25
                                                                               DVDQ 450
      LDOUB=0
                                                                               DVDQ 451
      E2HFAC=P25
                                                                               DVDQ 452
      LSC=8
                                                                               DVDQ 453
      LSTC=4
                                                                               DV DQ 454
      LSC AND LSTC ARE USED IN COMBINATION AS FOLLOWS
                                                                               DV DQ 455
C
        LSTC=4. LSC=4
                             FIRST TIME THROUGH THE FIRST STEP
                                                                               DVDQ 456
C
                 LSC=4
        LSTC=3.
                              SECOND TIME THROUGH THE FIRST STEP
                                                                               DVDQ 457
C
                              (NECESSARY TO CHECK STABILITY)
                                                                               DVDQ 458
C
        LSTC=2.
                  LSC=4
                              THIRD TIME THROUGH THE FIRST STEP
                                                                               DVDQ 459
                              (CNLY OCCURS IF INSTABILITY POSSIBLE)
C
                                                                               DVDQ 460
                             SECOND STEP (IF KQ(I)=2, I=1,..., NEQ) DVDQ 461
STAFTING, ONE DERIVATIVE EVAL. PER STEP. DVDQ 462
C
                 LSC=2
        LSTC=2.
C
        LSTC=1. LSC=0
        LSTC=1. LSC.GT.0 SET WHEN STARTING THO DERIV. EVAL. PER STEP DVDQ 463
```

```
C
        LSTC=-1 LSC.LT.0 SET WHEN HALVING THE STEPSIZE
                                                                            DVDQ 464
C
       IN THE LAST TWO CASES LSC IS SET EQUAL TO LSTC+ (MAXIMUM KQ(I)
                                                                            DYDQ 465
C
       +1). AT THE END OF EACH STEP IF LSC.NE.Q IT IS REPLACED BY
                                                                            DVDQ 466
C
       LSC-LSTC UNTIL LSC=0, AT WHICH TIME LSTC IS SET EQUAL TO 0.
                                                                            DVDQ 467
C
        WHEN DOUBLING H, LSTS IS SET EQUAL TO -1 AND LSC TO -3.
                                                                            DVDQ 468
C
       UNDER CERTAIN CONDITIONS WHEN KQ(I)=1. LSTG IS SET =-1 AND LSG==50VDQ 469
                                                                            DVDQ 470
      KSOUT=MXSTEP .
                                                                            DVDQ 471
      TOUT=T
                                                                            DVDQ 472
      IFL=13
                                                                            DVDQ 473
      IFLAG=1
                                                                            DVDQ 474
      NGA=0
                                                                            DVDQ 475
      NEVAL=0
                                                                            DVDQ 476
      IF(NG.NE.0) GO TO 1420
                                                                            DVDQ 477
      GO TO 315
                                                                            DVDQ 478
C
      END OF INITIALIZATION
                                                                            DVDQ 479
C
                                                                            DVDQ 480
C
                                                                            DVDQ 481
C
      ENTRY WITH IFLAG.GT. 0
                                                                            DVDQ 482
C
                                                                            DVDQ 483
C
      CHECK FOR GSTOPS
                                                                            DVDQ 484
C
                                                                            DVDQ 485
   60 IF(NG.EQ.NGA) GO TO 65
                                                                            DVDQ 486
      IF(NG.LT.0) GO TO 1190
                                                                            DVDQ 487
      NGA=NG
                                                                            DVDQ 488
      LGSS=-NGA
                                                                            DVDQ 489
      LGSD=0
                                                                            DVDQ 490
      LGSE=0
                                                                            DVDQ 491
      IFLG=-20
                                                                            OVDQ 492
C
                                                                            DVDQ 493
C
                                                                            DVDQ 494
   65 IF (IFL.LT.2) GO TO 320
                                                                            DVDQ 495
      IF (IFL.EQ.2) GO TO 80
                                                                            DVDQ 496
      IF (IFL.GT.5) GO TO 1180
                                                                            DVDQ 497
C
                                                                            DVDQ 498
C
      SET STEP STOP
                                                                            DVDQ 499
      KSOUT=KSTEP+MXSTEP
                                                                            DVDQ 500
      IF (IFL.EQ.5) GO TO 210
                                                                            DVDQ 501
      IF (IFL.EQ.4) GO TO 1210
                                                                            DVDQ 502
C
                                                                            DVDQ 583
C
      SET PRINT STOP
                                                                            DVDQ 504
   70 TOUT=T+TPRI IT
                                                                            DVDQ 505
C
                                                                            DVDQ 506
   75 TPS1=ABS(AMOD((TOUT-T)/HH,TWO)-PTS1)
                                                                            OVDQ 507
      LFD=-1
                                                                            DVDQ 508
      IF (TPS1.GE.P5) LFD=1
                                                                            DVDQ 509
C
                                                                            DVDQ 510
      LFD IS USED TO INDICATE WHETHER DJUBLING H IS PERMITTED.
C
                                                                            DVDQ 511
C
      IF LFD. LT. 0 AT THE END OF A STEP THEN DOUBLING H IS
                                                                            DVDQ 512
C
      NOT PERMITTED. THE SIGN OF LFD IS CHANGED JUST BEFORE THE
                                                                            DVDQ 513
Ċ
      END OF EACH STEP. IF TERINT = H+ (FOWER OF 2) THEN
                                                                            DVDQ 514
C
      OUTPUT VALUES WILL BE OBTAINED WITHOUT INTERPOLATION.
                                                                            DVDQ 515
C
                                                                            DVDQ 516
      GO TO 200
                                                                            DVDQ 517
                                                                            DVDQ 518
Ċ
                                                                            DVDQ 519
C
      ENTRY WITH IFLAG=2
                                                                            DVDQ 520
C
                                                                            OV DQ 521
C
      UPDATE DIFFERENCE TABLE
                                                                            DVDQ 522
C
      AND COMPUTE KQH=MAXIHUM VALUE OF (Q(I), I=1.2,...NEQ.
                                                                            DVDQ 523
```

```
C
                                                                            DVDQ 524
   80 KQM=0
                                                                            DVDQ 525
      DO 93 I=1.NE
                                                                            OVDQ 526
        KQQ=KQ(I)
                                                                            DVDQ 527
        IF (KQQ.ST.KQM) KQM≈KQQ
                                                                            DVDQ 528
        D(1)=F(I)
                                                                            DVDQ 529
        00 85 K=1 KQQ
                                                                            DVDQ 530
          D(K+1)=O(K)-DT(K,I)
                                                                            DVDQ 531
          DT(K,I)=D(K)
                                                                            DVDQ 532
   85
        CONTINUE
                                                                            OVDQ 533
        DT(KQQ+1,I)=D(KQQ+1)
                                                                            DVDQ 534
   90 CONTINUE
                                                                            DVDQ 535
C
      END OF UPDATING DIFFERENCE TABLE
                                                                            DVDQ 536
C
                                                                            DVDQ 537
C
      STORE Y (J) IN YN (J)
                                                                            DVDQ 538
      DO 95 J=1,NV
                                                                            DVDQ 539
        (U)Y = (U)NY
                                                                            DVDQ 540
   95 CONTINUE
                                                                            DVDQ 541
C
                                                                            DVDQ 542
      LFD=-LFD
                                                                            DVDQ 543
      TL=T
                                                                            DVDQ 544
      KSTEP=KSTEP+1
                                                                            DVDQ 545
C
                                                                            DVDQ 546
      IF (LGSS) 1430,110,1510
                                                                            DVDQ 547
  100 IFLAG=2
                                                                            DVDQ 548
  110 IF (LSC EQ.0) GO TO 140
                                                                            DVDQ 549
      LSC=LSC-LSTC
                                                                            DVDQ 550
                                                                            DV DQ 551
      IF (LSC.EQ.0) GO TO 130
      IF (LSTC.NE.(-1)) GO TO 140
                                                                            DVDQ 55%
      IF (LDOUS.LT.D) RNEC=RND*P1
                                                                            DVDQ 553
  120 E2HAVE=E2HM X
                                                                            DVDQ 554
      TPS1=PTS1
                                                                            DV DQ 555
                                                                            DVDQ 556
      GO TO 190
  130 IF (ABS(HH).L. HMIN) GO TO 1808
                                                                            DVDQ 557
      LSTC=0
                                                                            DVDQ 558
  140 IF (LDOUB.NE.1) GO TO 150
                                                                            DVDQ 559
      IF ((LFD.GT.0).AND.(ABS(HH+HH).LE.HMAX)) GO TO 1030
                                                                            DVDQ 560
      GO TO 200
                                                                            DVDQ 561
  150 R@MAX=PTS1/FLOAT(KQM+3)
                                                                            OVDQ 562
      IF ((LSTC.NE.0).OR.(E2HAVE.EQ.0.)) GO TO 120
                                                                            DVDQ 563
      TPS1=E2HMAX/E2HAVE
                                                                            DVDQ 564
      IF (TPS1-PTS1) 160,190,170
                                                                            DVDQ 565
  160 E2HFAC=AMIN1(P075,E2HFAC-RQMAX,E2HFAC+TPS1)
                                                                            DVDQ 566
      GO TO 180
                                                                            DVDQ 567
  170 TPS1=TPS1*TPS1
                                                                            DVDQ 568
      E2HFAC=AMIN1(PTS1,E2HFAC+TPS1)
                                                                            DVDQ 569
  180 RNDC=(ONEP1-E2HFAC)*RND
                                                                            DVDQ 570
                                                                            DVDQ 571
      E2HAVE=P5+ (E2HMAX+E2HAVE)
  19 C ERRMX=AMAX1(P1, ERRMX-RQMAX+TPS1)
                                                                            DVDQ 572
      E2HFAC IS A FACTOR WHICH IS TAKEN TIMES AN INITIAL ESTIMATE CF
                                                                            DVDQ 573
              EZH TO GE! I FINAL VALUE OF EZH. (EZH=ESTINATE OF WHAT
C
                                                                            DVDQ 574
C
                          ROR)/(REQUESTED ERROR) HOULD BE IF H WERE
              CESTIMATE.
                                                                            DVDQ 575
C
              DOUBLED.)
                                                                            DVDQ 576
      EZHNAX IS THE MAXIMA WALUE OF THE INITIAL ESTIMATE OF EZH OVER
C
                                                                            DVDQ 577
              ALL COMPONENTS WITH KQ(I).GT.1.
C
                                                                            DVDQ 578
C
      EZHAVE IS A WEIGHTED AVERAGE OF PAST VALUES OF EZHMAX.
                                                                            DVDQ 579
      THE VALUE OF EZHFAC TENDS TO BE SMALLER WHEN EZHMAX IS
C
                                                                            DVDQ 580
C
      CONSISTANTLY SMALLER THAN EZHAVE.
                                                                            DVDQ 581
C
                                                                            DVDQ 582
                                                                            DV0Q 583
```

C		CHECK FOR PRINT STCP AND FOR T REACHING TFINAL	DVDQ	584
		TPD=(TOUT-TL)/HH	DVDQ	
		TPO1=(TFINAL-TL)/HH	DODQ	
C			DUVQ	
•		IF (LGSE.LT.0) GO TO 1780	DVDQ	
		IF (TPD1.LT.FAC(1)) GO TO 1220		
		IF (TPD.LE.Q.) GO TO 1280	DVDQ	
_		TE (ILAPEC NO LO TSOR	DVDQ	
C		CUTOK TOO OTTO OTTO	DVDQ	
C		CHECK FOR STEP STOP	DVDQ	
_	1	IF (KSOUT.GT.KSTEP) GO TO 210	DADO	
C			DVDQ	
		IFL=5	DANG	
		GO TO 310	DVDQ	596
C			DVDQ	597
Ç		CHECK TO SEE IF ROUND-OFF ERROR IS PROMINENT	DOVO	598
	210	IF (EMAX.EQ.ERND) GO TO 220	DVDQ	599
C		IT IS	DOVDQ	600
		IFL=6	DOVO	601
		IF (EMAX.GE.P1) GO TO 318	DVDQ	602
		IF ((LSTC.GE.D).OR.(LDOUB.EG.1)) ERRMX=PTS1	DOVO	
C			DVDQ	
	220	IFL=1	DVDQ	
		T=TL+HH	DVDQ	
C			DVDQ	
C		START A NEW STEP	DVDQ	
č			DVDQ	
Č		PREDICT	DVDQ	
•	240	J=0	DVBQ	
	C 7 0	00 290 I=1,NE	-	
		KDD=KD(I)	DVDQ	
		KDC=KDD	DVDQ	
	250		DVDQ	
	228		DVDQ	
		TPD=Q.	DVDQ	
		K=KDC	DVDQ	
	260		DANO	
		KQQ=KQQ-1	DVDQ	
		IF (KQQ.GT.0) GO TC 260	DVDQ	
	270		DVDQ	
		IF (K.LE.C) GO TO 280	DADO	
	¥	L=J+K	DVDQ	
		TPD=YN(L+1)*FAC(K)+HH+TPD	DVDQ	624
		GO TO 270	DVDQ	625
	280		DVDQ	626
		Y(J)=YN(J)+HH+TPD	DVDQ	627
		KDC=KDC-1	DVDQ	628
		IF (KDC.GT.0) GO TO 250	DVDQ	629
	290	CONTINUE	DVDQ	
C		END OF PREDICT	DVDQ	
C			DVDQ	
		IF (IFL) 1240,320,300	DVDQ	
	300	IF (LGSD.NE.0) GO TO 1520	DVDQ	
C			DVDQ	
•	310	IFLAG=IFL	DVDQ	
		IF (IFLAG.LE.2) NEVAL=NEVAL+1	DVDQ	
C		o which was a programment of the end appropriate the state of the stat	DVDQ	
U		RETURN	DVDQ	
			i	
C			DVDQ	
0		ENTRY WITH IFL AG=1	DVDQ	
U	720		DVDQ	
	3 <b>2 U</b>	ER ND=0.	DVDQ	643

```
EMAX=0.
                                                                           DVDQ 64
      E2HMAX=0.
                                                                           DVDQ 64
      J=0
                                                                           DVDQ 641
      IF (LDOUB.GE.B) LDOUB=1
                                                                           DVDQ 64
C
                                                                           DVDQ 64
C
      LDOUB IS SET IN THE LOOP BELOW AS FOLLOWS
                                                                           DVDQ 64
C
      LDOUB=0
                HALVE
                                                                           DVDQ 65
C
                 DOUBLE
      LDOUB=1
                                                                           DVDQ 65
C
                 DO NOT DOUBLE
      LDOUB=2
                                                                           DVDQ 65
C
                                                                           DVDQ 653
C
      LDOUB.LT. G AT THE BEGINNING OF THE LOOP INDICATES THE FOLLOWING
                                                                           DVDQ 654
C
       ==3 STEPSIZE HAS JUST BEEN HALVED. IF A DISCONTINUITY IS
                                                                           DVDQ 65
C
             NOT INDICATED MCDIFY THE DIFFERENCE TABLE AND REPEAT
                                                                           DVDQ 656
C
             THE STEP.
                                                                           DVDQ 657
C
              STEP AFTER LDOUB=-3. PROCEED AS USUAL (ORDER IS NOT
                                                                           DVDQ 658
       =-2
C
             CHANGED)
                                                                           DVDQ 659
C
             STEP AFTER LDOUB =- 2. MODIFY THE DIFFERENCE TABLE ONCE
        =-1
                                                                           DVDQ 660
              AGAIN AND REPEAT THE STEP.
                                                                           DVDQ 661
C
      IF LDOUB IS SET EQUAL TO -4 THE ORDER IN AT LEAST ONE COMPONENT
                                                                           DVDQ 662
C
      HAS BEEN GREATLY REDUCED AND THE STEP IS REPEATED.
                                                                           DVDQ 663
C
                                                                           DVDQ 664
C
                                                                           DVDQ 665
C
      BEGINNING OF LOOP FOR CORRECTING, ESTIMATION HE ERROR,
                                                                           DVDQ 666
      AND ADJUSTING THE NUMBER OF DIFFERENCES USED
C
                                                                           DVDQ 667
C
                                                                           DVDQ 668
      DO 790 I=1,NE
                                                                           DVDQ 669
        KDD=KD(I)
                                                                           DVDQ 670
        KQQ=KQ(I)
                                                                           DVDQ 671
        KQQ GIVES THE ORDER OF THE PREDICTOR FORMULA AND KQQ+1 THE
C
                                                                           DVDQ 672
C
        ORDER OF THE CORRECTOR FORMULA.
                                                                           DVDQ 573
C
                                                                           DVD0 674
        KQ1=KQQ+1
                                                                           DVDQ 675
        D(1)=F(I)
                                                                           BYDQ 676
C
        FORM THE DIFFERENCE TABLE FROM PREDICTED DERIVATIVE VALUES.
                                                                           DW0Q 677
        DO 330 K=1.KQ1
                                                                           DVDQ 678
          \theta(K+1) = D(K) - DT(K,I)
                                                                           DVDQ 679
        CONTINUE
  330
                                                                           DVDQ 680
        D(K) GIVES THE (K-1)-ST DIFFERENCE FORMED FROM PREDICTED
C
                                                                           VDQ 581
C
        DERIVATIVE VALUES
                                                                           DVDQ 682
        TPS3=A8S(D(KQQ+1))
                                                                           DVDQ 683
        IF (LDOUB.LT.0) GO TO 720
                                                                           DV DQ 68%
C
                                                                           DVDQ 685
  340
        IF (KQQ.NE.1) GO TO 520
                                                                           DVDQ 686
C
                                                                           DVDQ 687
C
        KQ(I) =1 IS TREATED AS A SPECIAL CASE
                                                                           DVDQ 688
        E2H=PTS2
                                                                           DVDQ 689
        TPS5=0T(3,1)
                                                                           DVDQ 690
        IF (LSTC.LT.2) GO TO 370
                                                                           DVDQ 591
       FIRST STEP OF INTEGRATION
                                                                           DVDQ 692
        IF (LSTC.NE.4) GO TO 358
                                                                           DVDQ 693
        TPS4=0.
                                                                           DVDQ 694
        IF (KDD.GT.1) TPS3=AMAX1(TPS3,A3S(HH+D(1)))
                                                                           DVDQ 695
        TPS3=TPS3*P1
                                                                           DVDQ 696
        GO TO 510
                                                                           DVDQ 697
  350
        DT(2, I) = D(2)
                                                                           DVDQ 698
    D(2) = D(1) - DT(5,I)
                                                                           DVDQ 699
        TPS2=-D(2)
                                                                           DVDQ 700
        TPS 3= PTS 5*ABS (TP S2)
                                                                           DVDQ 701
        FIRST STEP THAT KQ(I)=1
                                                                           DVDQ 782
  360 DT(7, I)=PT(4)
                                                                           DVDQ 703
```

```
IF (LSTC-2) 420,380,380
                                                                            DVDQ 784
  370
        IF (TPS5.EQ.O.) GO TO 360
                                                                            DVDQ 705
        IF (DT(6, I). EQ.O.) GO TO 400
                                                                            DVDQ 706
        TPS2=DT(5,I)-OT(1,I)
                                                                            DVDQ 707
        TPS4=0T(4,I)
  380
                                                                            DVDQ 708
        TPS1=ABS(TPS4)
                                                                            DVDQ 709
        TPS4=TPS2*SIGN(PTS2,TPS4)-TPS5*TPS1
                                                                            DVDQ 710
        IF (TPS4.GT.(-TPS1)) GO TO 410
                                                                            DVDQ 711
  390
                                                                            DVDQ 712
        GO TO 450
                                                                            DVDQ 713
        FIRST STEP AFTER THE STEPSIZE HAS BEEN CHANGED
                                                                            DVDQ 714
  400
        DT(6,I)=PT(1)
                                                                            DVDQ 715
        TPS6=0.
                                                                            DVDQ 716
        GO TO 450
                                                                            DVDQ 717
        IF (TPS4.LT.TPS1) GO TO 440
  410
                                                                            DVDQ 718
        IF (TPS1.EQ.0.) GO TO 390
                                                                            DVDQ 719
  420
        TPS6=PTS1
                                                                            DV DQ 720
        GO TO 450
                                                                            DVDQ 721
  430
        KQ(I)=2
                                                                            DVDQ 722
        IF (2-LSTC) 510,510,520
                                                                            DVDQ 723
  440
        TPS6=TPS4/TPS1
                                                                            DVDQ 724
  450
        TPS4=TPS5+TPS6
                                                                            DVDQ 725
        IF (TPS4.LT.P25) GO TO 430
                                                                            DVDQ 726
        INCREASE EZH IF (-S).GT..25
C
                                                                            DVDQ 727
        E 2H=PTS4*TPS4
                                                                            DVDQ 728
        IF (2-LSTC) 460,470,480
                                                                            DVDQ 729
  460
        LSC=0
                                                                            DVDQ 730
        GO TO 510
                                                                            DVDQ 731
        IF (TPS5-P25) 430,460,460
  470
                                                                            DV DQ 732
  480
        IF (TPS4.GT.PTS2) GO TO 490
                                                                            DVDQ 733
        IF (TPS4.GT.P5) D(2)=D(2)+GAM(2,1)
                                                                            DVDQ 734
        GO TO 510
                                                                            DVDQ 735
        IF (TPS4.LT.PTS4) GO TO 500
  490
                                                                            DVDQ 736
        TPS4=PTS4
                                                                            DVDQ 737
        D(2) = D(2)/PT(3)
                                                                            DVDQ 738
        THE ESTIMATE OF E (AND HENCE OF E2H) IS INCREASED IF (-S).GE.8. DVDQ 739
C
        TPS3=TPS3*DT(7',I)
                                                                            DVDQ 740
        GO TO 510
                                                                            DV DQ 741
        0(2)=0(2)*(PIS2*(TFS4-PIS1)/(TPS4*TPS4))
  500
                                                                            DVDQ 742
        IF (TPS4.GE.3.) E2H=E2H+DT(7.1)
                                                                            DVDQ 743
C
        STORE D(1)=PREDICTED DERIVATIVE AND D(2)=2*(CORRECTED Y -
                                                                            DV DQ 744
C
        PREDICTED Y)/H
                           O(1) AND D(2) ARE USED TO COMPUTE (-S) ON
                                                                            DVDQ 745
C
        THE NEXT STEP.
                                                                            DVDQ 746
  510
        DT(5, I)=D(1)
                                                                            DVDQ 747
        DT(4, I)=D(2)
                                                                            BVDQ 748
        D (4) = TPS4
                                                                            DVDQ 749
      STORE D (4) = CURRENT ESTIMATE OF (-S). (-S).GT.3 IS AN INDICATION DVDQ 750
C
C
      THAT THE STEPSIZE SHOULD BE LIMITED BECAUSE OF STABILITY PROBLEMS. DVDQ 751
      S=H*(ESTIMATE OF EIGENVALUE OF F)=H*(DIFFERENCE BETWEEN PREDICTED DVDQ 752
C
C
      AND CORRECTED DERIVATIVE VALUES)/(DIFFERENCE BETWEEN PREDICTED
                                                                            DVDQ 753
      AND CORRECTED INTEGRALS OF THE DERIVATIVE VALUES)
                                                                            DVDQ 754
      THE TREATMENT OF THE CASE KQ(I)=1 COULD BE IMPROVED BY USING A
C
                                                                            DVDQ 755
      SPECIAL METHOD FOR STIFF EQUATIONS WHEN (-S).GT.3 (MAYBE).
                                                                            DVDQ 756
C
      (THE ENTIRE TREATMENT OF THE CASE KQ(I)=1 IS FAR FROM IDEAL.)
                                                                            DVDQ 757
        OT(3, I) = D(4)
                                                                            DVDQ 758
C
                                                                            DVDQ 759
        CORRECT
                                                                            DVDQ 760
  520
        KDC=0
                                                                            DVDQ 761
        TPD=D(KQ1)
                                                                            DVDQ 762
        J=J+K00
                                                                            DVDQ 763
```

		K=J	DVDQ	764
	530	TPD=HH*TPD		
	<b>730</b>		DVDQ	
		KOC=KOC+1	DVDQ	
		Y(K)=Y(K)+GAM(KQQ+1,KDC)*TPD	DADG	767
		K=K-1	DVDQ	
		IF (KOC.LT.KOD) GO TO 530	DVDQ	
^	1			
C		END OF CORRECT	DADd	
C			DADG	771
	¥	IF (EPS(I), NE. 0.) GO TO 560	DVDQ	772
	550	IF (HMAX) 1190,780,1190	DVDQ	
			1	
	560	TPS4=ABS(D(KQQ+2))	DVDQ	
		TPS2=ABS(D(KQQ))	DVDQ	775
		TPS6=HH/EPS(I)	DVDQ	776
C			DVDQ	
•		E=ABS (GAS (KQQ+1) +TPS3+TPS6)		
^			DVDQ	
C		E GIVES ABS((ESTIMATED ERROR)/EPS(I))	DODQ	
C			DVDQ	780
		LRND=1	DODQ	781
C			DVDQ	
		A DATE A MEANS NO DOUND OFF FEDOR	1	
C		LRND= 1 MEANS NO ROUND-OFF ERROR	DONDQ	
C		= 0 MEANS SCHE ROLND-OFF ERROR	DADO	784
C		=-1 MEANS EXTREME ROUND-OFF ERROR	DVDQ	785
CCC			DVDQ	
. •		FRND=RNDC*ABS(PT(KQQ+2)*D(1))	1	
_			DVDQ	
C		CHECK TO SEE IF ROUND OFF ERROR IS DOMINANT	DVDQ	788
		IF ((TPS3+TPS4).GT.FRND) GO TO 570	DVDQ	789
		LRND=0	DVDQ	
		IF ((PTS4*TPS2).LT.FRNE) LRND=-1	DOVO	
^		IF (TF134 TF327) EF1 (TRUE) ERMU-1	1	
C	1		DVDQ	
	570	IF (E.LE.ERND) GO TO 5:0	DVDQ	793
		IF (E.LE.EMAX) GO TO 580	DVDQ	794
		EMAX=E	DVDQ	
		KEMAX=I		
			DVDQ	
	58¢	IF (LRND.LE.0) GO TO 550	DVDQ	797
		ERND=E	DVDQ	798
		IF (ERND.GT.ERRMX) LDOUB=0	DOVO	799
	590	IF (LDOUB.LE.0) GO TO 780	DVDQ	
	J J G			
		TPS1=ABS(OD(KQQ))	DVDQ	
		TPS5=TPS1	DVDQ	802
		IF (KQQ-2) 600,610,620	DVDQ	803
	600	E2H=E*E2H	DVDQ	
	<b>=</b> . <b>▼</b>	IF (E2H.LT.P01) GO TO 780	DVDQ	
		IF (D(4).LT.3.) GO TO 770	DVDQ	
		LSTC=-1	סם עם	807
		LSC=-5	DVDQ	8118
		GO TO 770	DVDQ	
	610	TPS1=TPS2	DVDQ	
	076			
		IF (LSTC. NE. 2) GC TO 620	DVDQ	
		KQ(I)=3	DVDQ	812
		TPS2=0.	DVDQ	813
	, ,	TPS4=0.	DVDQ	
		LRND=0		
			DVDQ	
	620	E2H=TPS2+TPS3+TPS4	DOVO	
		E2H=ABS(GAS(KQQ-1) *PT(KQQ+1) *E2H*TPS6)	DVDQ	817
C		EZH IS USED AS AN ESTIMATE OF WHAT THE VALUE OF E WOULD BE	DVDQ	
Č		IF H WERE DOUBLED. THE ESTINATE IS CONSERVATIVELY LARGE.	DVDQ	
·				
_		IF (E2H.GT.E2HMAX) E2HMAX=E2H	DVDQ	
C			DVDQ	821
		IF (LRND) 630, 640, 660	DVDQ	822
C		EXTREME ROUND-OFF ERRORREDUCE E2H	DVDQ	
		organicate organication of the contraction of the c		

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630
        K = (KBIT2/KQQ) - 4
                                                                             DVDQ 824
        IF (K.LE.3) GO TO 640
                                                                             DVDQ 825
        IF (K.GT.KQMAX) K=KQMA)
                                                                             DVDQ 826
        E2H=E2H/PT(K+1)
                                                                             DV DQ 827
        GO TO 650
                                                                             DVDQ 828
  640
        E2H=AMIN1(E2H, E2H+3.+E2HFAC)
                                                                             DVDQ 829
  650
        E2H=E2H*P1
                                                                             DVDQ 830
        TPS6=PTS4
                                                                             DVDQ 831
        GO TO 670
                                                                             DVDQ 832
C
                                                                             DVDQ 833
  660
        E2H=E2H*E2HFAC
                                                                             DVDQ 834
        TPS6=KQQ+2
                                                                             DVDQ 835
C
        TEST TO SEE IF DIFFERENCES DECREASE MORE RAPIDLY THAN NECESSARY DVDQ 836
C
                                                                             DVDQ 837
  679
        IF (TPS5.LT.(TPS3*TPS6)) GO TO 680
                                                                             DV DQ 838
        IF (TPS2.LE.(TPS4*TPS6)) GO TO 760
                                                                             DVDQ 839
C
        THEY DO INCREASE KQ(I)
                                                                             DVDQ 840
        IF (KQQ.NE.KQMAX) KQ(I)=KQ1
                                                                             DVDQ 841
        GO TO 768
                                                                             DVDQ 842
C
                                                                             DVDQ 843
        TEST TO SEE IF DIFFERENCES DECREASE TOO SLOWLY
C
                                                                             DVDQ 844
  680
        TPS6=TPS6*P25
                                                                            DVDQ 845
        IF ((TPS1.GT.(TPS3*TPS6)).OR.(TPS2.GT.(TPS4*TPS6))) GO TO 760
                                                                            DVDQ 846
C
        THEY DO
                                                                             DVDQ 847
        IF (LSTC.LE.0) GO TO 750
                                                                             DVDQ 848
        IF (E2H.LT.P01) GO TO 750
                                                                             DVDQ 849
        IF (LSC-LSTC) 698,758,770
                                                                             DVDQ 850
        IF (KSTEP-4) 750,700,710
  698
                                                                             DVDQ 851
  700
        KQ1=LSTC
                                                                             DVDQ 852
  718
        LSC=KQ1
                                                                             DVDQ 853
C
        END OF ONE DERIVATIVE EVALUATION PER STEP
                                                                             DVDQ 854
        GO TO 770
                                                                             DVDQ 855
C
                                                                             DVDQ 856
C
        AFTER HALVING H. REDUCE KQ(I) IF A DISCONTINUITY HAS OCCURRED.
                                                                             DVDQ 857
  720
        IF (LDOUB.EQ. (-2)) GO TO 340
                                                                             DVDQ 858
        DT(KQQ+1,I)=D(KQQ+1)
                                                                             DVDQ 859
        IF (LDOUB.EQ.(-1)) DT(KQQ+1.I)=)(KQQ+2)
                                                                             DVDQ 860
        K=KQQ
                                                                             DVDQ 861
  730
        IF (K.EQ.1) GO TO 748
                                                                             DVDQ 862
        IF ((ABS(D(K-1)).GT.(PT(2)*ABS(D(K+1)))).OR.
                                                                             DVDQ 863
          (ABS(D(K)).GT.(PT(2)*ABS(D(K+2))))) GO TO 740
     1
                                                                             DVDQ 864
        K=K-1
                                                                             DVDQ 865
        GO TO 730
                                                                            DVDQ 866
  740
        IF ((K+K).GE.KQQ) GO TO 780
                                                                             DVDQ 867
        LDOUB =-4
                                                                            DVDQ 868
        E2H=0.
                                                                             DVDQ 869
        KQQ=K+1
                                                                             DVDQ 870
C
                                                                             DVDQ 871
C
                                                                             DVDQ 872
        DIFFERENCES DECREASE TOO SLOWLY REDUCE KQ(I).
                                                                             DVDQ 873
  750
        KQ(I) = KQQ-1
                                                                             DVDQ 874
        IF (KQQ.EQ.2) DT(3.I)=0.
                                                                             DVDQ 875
  760
        IF (E2H.LT.P01) GO TO 780
                                                                             DVDQ 876
  770
        LD0U8=2
                                                                             DVDQ 877
  780
        CONTINUE
                                                                             DVDQ 878
C
                                                                             DVDQ 879
C
                                                                             DVDQ 880
  790 CONTINUE
                                                                             DVDQ 881
C
                                                                            DVDQ 682
C
      END OF LOOP FOR CORRECTING, ESTIMATING THE ERROR, ETC.
                                                                            DVDQ 883
```

```
DVDQ 884
C
C
                                                                            DVDQ 885
      IF (IFL.LT.D) GO TO 1250
                                                                            DVDQ 886
C
      TEST FOR HALVING H
                                                                            DVDQ 887
                                                                            DVCQ 888
      IF (LDOUB) 800,950.870
  800 LDOUB=LDOUB+1
                                                                            DVDQ 889
      IF (LDOUB+1) 8 10,870,820
                                                                            DVDQ 890
  810 IF (LDOUB.EQ.(-2)) GC TO 820
                                                                            BVDQ 891
      ORDER IN AT LEAST ONE COMPONENT HAS BEEN GREATLY REDUCED
                                                                            DVDQ 892
                                                                            DVDQ 893
      LDOUB=Q
                                                                            DVDQ 894
      GO TO 229
  820 DO 860 I=1, NE
                                                                            DVDQ 895
                                                                            DVDQ 896
        KQQ=KQ(I)
                                                                            DVDQ 897
        TP=DT (KQQ+1,I)
        IF (KQQ.LE.3) GO TO 860
                                                                            DVDQ 898
        IF (LDOUB.NE.D) GO TO 840
                                                                            DVDQ 899
                                                                            DVDQ 986
        DO 830 K=3.KQQ
        SECOND HODIFICATION OF DIFFERENCE TABLE AFTER HALVING H
C
                                                                            DV DQ 901
          DT(K,I)=BT(K,I)+ETA(KQQ-1,K-2)+TP
                                                                            DVDQ 902
                                                                            DVDQ 993
  830
        CONTINUE
        GO TO 860
                                                                            DVDQ 984
                                                                            DVDQ 905
  840
        DO 850 K=2.KQQ
        FIRST MODIFICATION OF DIFFERENCE TABLE AFTER HALVING H
                                                                            DVDQ 906
                                                                            DVDQ 907
          DT(K,I)=DT(K,I)+ETA(K-1,KQQ-1)+TP
        CONTINUE
                                                                            DVDQ 968
  350
                                                                            DVDQ 989
  860 CONTINUE
                                                                            DVDQ 910
      IFL=0
      GO TO 240
                                                                            DVDQ 911
                                                                            DVDQ 912
C
  870 IFL=2
                                                                            DVDQ 913
      IF (LSTC.LE.0) GO TO 300
                                                                            DVDQ 914
      IF (2-LSTC) 880,900,940
                                                                            DVDQ 915
                                                                            DVDQ 916
  880 LSTC=LSTC-1
      IF (LSTG.EQ.3) GO TO 890
                                                                            DVDQ 917
     IF (LSC) 920,960,920
                                                                            DVDQ 918
                                                                            DVDQ 919
  890 IFL=1
                                                                            DVDQ 920
      GO TO 300
  900 IF (LSC-2) 910,930,920
                                                                            DVDQ 921
                                                                            OVDQ 922
  910 LSTC=0
  920 LDOUB=2
                                                                            DVDQ 923
                                                                            DVDQ 924
      GO TO 80
                                                                            DVDQ 925
  930 LSTC=1
      LSC=0
                                                                            DVDQ 926
                                                                            DV DQ 927
      GO TO 88
  940 IF (LSC) 300,80,300
                                                                            DVDQ 928
                                                                            DVDQ 929
C
C
      HALVE H
                                                                            DVDQ 930
                                                                            DVDQ 931
  950 HH=FAC(2)+HH
      IF (LSTC.LT.2) GO TO 990
                                                                            DVDQ 932
      ERND=P25*ERND
                                                                            DVDQ 933
      IN LOOP TO FIND A NEW INITIAL STEPSIZE
                                                                            DVDQ 934
C
      IF (ERND.GE.P1) GO TO 950
                                                                            DVDQ 935
      LSTC=4
                                                                            DVDQ 936
                                                                            DVDQ 937
  960 LSC=4
      DO 970 I=1.NE
                                                                            DVDQ 938
        KQ(I)=1
                                                                            DVDQ 939
  970 CONTINUE
                                                                            DVDQ 940
      IF (LSTC-3) 890,890,1170
                                                                            DVDQ 941
C
                                                                            DVDQ 942
C
      ENTRY AFTER IFLAG=7
                                                                            DVDQ 943
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980 IF (LDOUB.EQ.0) GO TO 990
                                                                             DVCQ 944
      LSC=1
                                                                             DVDQ 945
      LSTC=1
                                                                             DVDQ 946
      GO TO 140
                                                                            DVDQ 947
      TEST TO SEE IF H IS TOO SMALL FOR HALVING
                                                                             DVDQ 948
  990 IF (ABS(HH).GE.HNIN) GO TO 1048
                                                                             DVDQ 949
      IF (IFL.EQ.7) GO TO 1810
                                                                             DVDQ 958
 1000 IFL=7
                                                                             DVDQ 951
      GO TO 1020
                                                                             DVDQ 952
C
                                                                             DV DQ 953
 1010 HH=HH+HH
                                                                             DVDQ 954
      IFL=2
                                                                             DVDQ 955
 1020 H=HH
                                                                             DV DQ 956
      GO TO 310
                                                                             DVDQ 957
C.
                                                                             DVDQ 958
C
                                                                             DVDQ 959
C
      ERROR CRITERIA PERMIT DOUBLING
                                                                             DVDQ 960
 1030 HH=HH+HH
                                                                             DVDQ 961
      IF (LSTC.EQ.1) GO TO 1050
                                                                             DVDQ 962
      LSC=-3
                                                                             DVDQ 963
 1040 LSTC=-1
                                                                             DVDQ 964
C
                                                                             DVDQ 965
C
      CHANGE THE STEPSIZE
                                                                             DVDQ 966
 1050 00 1160 I=1,NE
                                                                             DV DQ 967
        KQQ=KQ(I)
                                                                             DVDQ 968
        IF (KQQ.NE.1) GO TO 1070
                                                                             DVDQ 969
        DT(6.I)=0.
                                                                             DVDQ 970
        D(3) = OT(3, I) + PT(2)
                                                                             DVDQ 971
        IF (D(3).GT.PT(3)) LSC=-6
                                                                             DVDQ 972
        IF (LDOUB.NE.D) GO TO 1060
                                                                             DVDQ 973
        KQM=8
                                                                             DVDQ 974
        IF (D(3).GE.PT(5)) OT(7,I)=DT(7,I)*PT(2)
                                                                             DV DQ 975
        D(3) = D(3)/PT(3)
                                                                             DVDQ 976
 1060
        DT(3, I)=D(3)
                                                                             DVDQ 977
        GO TO 1160
                                                                             DVDQ 978
C
                                                                             DVDQ 979
C
        BEGINNING OF LOOP FOR CHANGING DIFFERENCE TABLE TO
                                                                             DV DQ 980
C
        CORRESPOND TO NEW VALUE OF H
                                                                             DVDQ 981
 1070
        DO 1080 K=1.KQQ
                                                                             DVDQ 982
          O(K)=DT(K,I)/PT(K)
                                                                             DVDQ 983
          IF (LDOUB.EQ.0) D(K)=D(K)/PT(K)
                                                                             DVDQ 984
 1680
        CONTINUE
                                                                             DVDQ 985
        KQQ2=KQQ-2
                                                                             DVDQ 986
        IF (KQQ2) 1169,1140,1098
                                                                             DVDQ 987
 1090
        DO 1130 J=1,KQQ2
                                                                             DVDQ 988
          IF (LDOUB.NE.D) GO TO 1110
                                                                             DVDQ 989
C
                                                                             DVDQ 990
          HALVE
                                                                             DVDQ 991
          K=KQQ
                                                                             DVDQ 992
 1100
          D(K-1) = D(K-1) + D(K)
                                                                             DVDQ 993
          K=K-1
                                                                             DVDQ 994
          IF (K+J-KQQ) 1130,1130,1100
                                                                             DVDQ 995
C
                                                                             DVDQ 996
C
          DOUBLE
                                                                             DVDQ 997
 1110
          DO 1120 K= J. KQQ2
                                                                             DVDQ 998
             D(K+1)=D(K+1)-D(K+2)
                                                                             DVDQ 999
 1120
          CONTINUE
                                                                             DVDQ1036
 1130
        CONTINUE
                                                                             DVDQ 1001
                                                                             DVDQ1002
 1140
        DO 1150 K=2.KQQ
                                                                             DV DQ 1003
```

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IF (LDOUB.NE.O) D(K)=D(K)*PT(<)
                                                                             DVDQ 1004
          DT(K,I)=D(K)*PT(K)
                                                                             DV DQ 1005
 1150
        CONTINUE
                                                                             DVDQ1006
C
        DIFFERENCE TABLE NOW CORRESPONDS TO NEW VALUE OF H
                                                                             DV DQ 1687
C
                                                                             DVDQ 1008
 1160 CONTINUE
                                                                             DVDQ1009
 1170 H=HH
                                                                             DVDQ1U10
      IF (LDOUB.NE.0) GO TO 75
                                                                             DVDQ1011
      LFD=1
                                                                             DVDQ1012
      IF (LSTC.GE.O) GO TO 220
                                                                             DVDQ1013
      LDOUB=-3
                                                                             DVDQ1014
      LSC=LSTC-KQM
                                                                             DVDQ1015
      GO TO 220
                                                                             DVDQ1616
      END OF CHANGING STEPSIZE
C
                                                                             DVDQ1017
                                                                             DVDQ1018
C
                                                                             DVDQ1819
 1180 K=IFL-5
                                                                             DV DQ 16 20
      GO TO (220,980,1200,1570,1570,1720,1720,80,1480,1450,1630,1570), KDVDQ1021
C
                                                                             DV DQ 1022
      ILLEGAL VALUE OF PARAMETER
                                     INTEGRATION CAN NOT PROCEED
                                                                             DV DQ 10 23
 1190 IFL=8
                                                                             DVDQ1024
      GO TO 310
                                                                             DVDQ1025
 1200 WRITE (6,4000)
                                                                             DVDQ1026
 4000 FORMAT (26HOIFLAG=8 IN CALL TO DVJQ1.)
                                                                             DVDQ1027
      STOP
                                                                             DVDQ1028
C
                                                                             DVDQ1029
                                                                             DVDQ1030
 1210 IF (T-TFINAL) 200,1190,200
                                                                             DVDQ1831
                                                                             DVDQ1032
C
                                                                             OV DQ 1033
 1220 IFL=4
                                                                             DVDQ1034
      IF (KSTEP.NE.0) GO TO 1270
                                                                             DVDQ1035
      TPD2=TPD
                                                                             DVDQ1036
      ESTIMATE ERROR WHEN EXTRAPOLATION FROM INITIAL POINT IS REQUESTED DVDQ1037
 1230 HH=HH+TPD1+P75
                                                                             DVDQ1038
C
                                                                             DVDQ1039
      IFLS=IFL
                                                                             DVDQ1040
      IFL=-1
                                                                             DVDQ1041
      GO TO 230
                                                                             DVDQ1042
                                                                             DVDQ1043
 1240 IF ((LGSD.EQ.0).OR.(IFLS.NE.4)) GO TO 60
                                                                             DVDQ1044
      LGSE=-1
                                                                             DVDQ1045
      TPD=FAC(1)
                                                                             DVDQ1046
      GO TO 1820
                                                                             DVDQ1047
 1250 HH=H
                                                                             DVDQ1048
      IF (EMAX.LT.P01) GO TO 1260
                                                                             DVDQ1049
C
      ERROR IS TOO LARGE, REDUCE H AND REPEAT THE FIRST STEP
                                                                             DVDQ1050
      IF (TPD1.LT.0.) GO TO 1190
                                                                             DV DQ 1 0 51
      LDOUB=1
                                                                             DVDQ10 52
      ERND=FAC(1)/TPD1
                                                                             DVDQ1053
                                                                             DV DQ10 54
      ERND=ERND*ERND*P25
      GO TC 950
                                                                             DVDQ1055
                                                                             DV DQ 10 56
 1260 IFL=IFLS
                                                                             DVDQ1057
      IF (IFL.NE.4) GO TO 1790
                                                                             DVDQ 1058
      TPD=TPD2
                                                                             DVDQ1059
      IFLAG=3
                                                                             DVDQ1060
 1270 IF (TPD1.GT.TPD) GC TO 1280
                                                                             DVDQ10 E1
      T=TFINAL
                                                                             DVDQ1062
      TPD=TPD1
                                                                             DVDQ1063
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GO TO 1290
                                                                             DVDQ10 64
 1280 T=TOUT
                                                                             DVDQ1065
      IFL≃3
                                                                             DVDQ1066
 1290 IF ((TPD.EQ.G.).ANC.(IFLAG.LE.2)) GO TO 310
                                                                             DVDQ10 67
C
                                                                             DVDQ1068
C
      INTERPOLATE FOR CUTPUT
                                                                             DVDQ1069
 1300 TP=TPD
                                                                             DVDQ1070
      D(2)=TP
                                                                             DV DQ1071
      KQQ 2= 9
                                                                             DVDQ1072
      KDC=0
                                                                             DVDQ1073
      D(1) = PT(1)
                                                                             DV0Q1074
      DD(1) = PT(1)
                                                                             DVDQ1075
      00 1310 K= 2.KQM
                                                                             DVDQ1076
        DD(1) = DD(1) + PT(1)
                                                                             DVDQ1877
        TP=TP+PT(1)
                                                                             DVDQ1078
        D(K+1) = (D(K) + TP) / DD(1)
                                                                             DVDQ1079
 1310 CONTINUE
                                                                             DVDQ1080
      GO TO 1350
                                                                             DVDQ1081
C
                                                                             DVDQ1082
      COMPUTE THE INTERPOLATING INTEGRATION COEFFICIENTS
C
                                                                             DVDQ1083
 1320 KQQ2=1
                                                                             DVDQ1884
      L=KQM-KDC
                                                                             DVDQ1085
      KDC=KDC+1
                                                                             DVDQ1086
 1330 IF (L.LE.D) GO TO 1350
                                                                             DVDQ1087
      TP=0.
                                                                             DVDQ1088
      K=L
                                                                             DVDQ1089
      J=L+KDC
                                                                             DVDQ1090
 1349 JS=J-K
                                                                             DVDQ1091
      TP=TP+GAS(K)*D(JS+1)
                                                                             DVDQ 10 92
                                                                             DVDQ1093
      IF (K.GT.0) GO TO 1340
                                                                             DVDQ1094
      D(J) = TP
                                                                             DVDQ1095
C
                                                                             DVDQ1096
C
      D(J) IS THE INTEGRATION COEFFICIENT FOR THE INTERPOLATION WHICH
                                                                             DVDQ1897
C
      CORRESPONDS TO GAM(J-KDC, KDC).
                                                                             DVDQ1098
C
                                                                             DVDQ1099
      L=L-1
                                                                             DVDQ1180
      GO TO 1330
                                                                             DYDQ1101
C
      END OF COMPUTING INTEGRATION COEFFICIENTS
                                                                             DVDQ 1102
C
                                                                             DVDQ1103
      PERFORM THE PARTIAL STEP INTEGRATION
                                                                             DVDQ 1104
 1350 J=0
                                                                             DVDQ1105
      DO 1415 I=1.NE
                                                                             DVDQ1116
      KDD=KD(I)
                                                                             DVDQ1107
      IF (KDC.GT.KDD) GO TO 1410
                                                                             DVDQ1108
      TP=0.
                                                                             DVDQ 1109
      KQQ=KQ(I)+KQQ2
                                                                             DVDQ1110
 1360 L=KQQ-KDC
                                                                             DVDQ1111
      IF (L.LE.0) GO TO 1370
                                                                             DVDQ1112
      TP=TP+0(KQQ)*DT(L.I)
                                                                             DVDQ1113
      KQQ=KQQ-1
                                                                             DVDQ1114
      IF (KQQ) 1390,1390,1360
                                                                             DVDQ1115
 1370 K=J+KDD
                                                                             DVDQ1116
                                                                              DVDQ1117
      L=KDC
                                                                             DVDQ1118
 1380 L=L-1
      IF (L.EQ.0) GO TO 1400
                                                                              DVDQ1119
      TP=TP+HH+YN(K)+FAC(L)+TPD
                                                                              DVDQ1120
      K=K-1
                                                                              DVDQ1121
      GO TO 1380
                                                                              DVDQ1122
 1390 F(I)=TP
                                                                              DVDQ1123
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	GO TO 1415	<i>3</i> 3		DVDQ1124
1400	Y(K)=YN(K)+HH*TP			DVDQ1125
1410	<b>J</b> =J+KDD			DVDQ1126
1415	CONTINUE			DVDQ1127
	IF (KDC.NE.KDMAK) GO TO 1320			DV DQ 1128
C	END OF PARTIAL STEP INTEGRATION		= -:	DVDQ1129
7.3	IF (LGSE) 1800,310,1810			DVDQ1130
C				DVDQ1131
C	INITIALIZE FOR GSTOPS			DVDQ1132
_	NGA=IABS(NG)			DVDQ1133
	LGSS=-NGA	4		DVDQ1134
	LGSD=0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		DV0Q1135
	LGSE=0			0VDQ1136
	1FLG=-20			DVDQ1137
	IF (NG) 1425,315,315			DVDQ1138
1425	IFLG=-IFL			DVDQ1139
	IFLG=-IFL			DVDQ1140
1430	LGSD=NGE			DVDQ1141
	IF (LGSD) 1190,1450,1440			DVDQ1142
1 440	IFL=15			DV DQ 1143
	GO TO 1470			DVDQ1144
C	ENTRY WITH IFL=15			UVDQ1145
_	LGSS=0			OVDQ1146
	IF (LGSD-NGA) 1460,1480,1190			DVDQ1147
1460	LGSS=LGSD+1			OV.0Q1148
7.00	IFL=14			DVDQ1149
1 470	IFLAG=IFL-5			DVDQ1150
	GO TO 315			DVDQ1151
C	ENTRY WITH IFL=14		*.	DV DQ 11 52
	DO 1490 I=1,NGA	•		DVDQ1153
	GT(I)=G(I)			DVDQ1154
1 490	CONTINUE			DVDQ1155
	GO TO 1730			DVDQ1156
C	END OF INITIALIZATION FOR GSTOPS			DV DQ 11 57
C				DVDQ1158
C	ENTRY TO EVALUATE G AT THE END OF THE S	STEP		DVDQ1159
1500	LGSE=1			DVDQ11E0
1 510	IGK=LGSS			Discourse
	IFLG=0			DVDQ1162
	IFL=9			DVDQ1163
	GO TO 319			DVDQ11E4
C	ENTRY TO EVALUATE G BEFORE EVALUATING 1	THE DERIVATIV	ES	DVDQ1165
1 520	IFLG=IFL			DVDQ1166
	IFL=10			DVDQ1167
1530	IFLAG=10			DVDQ11 68
	IGKM=LGSD			DVDQ1169
1540	IGK=1			DVDQ1170
1 550	GO TO 315		•	DVDQ1171
1560	IGK=IGK+1			DVDQ1172
	IF (IGK.GT.IGKM) GO TO 1650			BVDQ1173
C	ENTRY WITH IFL=9,10, AND 17	Year of the second		OVDQ1174
C	TEST FOR G CHANGING SIGN			DVDQ1175
1570	IF (G(IGK)*GT(IGK)) 1600,1580,1593			DVDQ1176
1580	IF (GT(IGK).NE.D.) GO TO 1600			DVDQ1177
7.75.75	IF (TL.EQ.TG) GO TO 1560			DVDQ1178
1590	IF (LGSE.GT.O) GT(IGK)=G(IGK)			DVDQ1179
	GO TO 1560			DVD01180
C	G CHANGES SIGN PREPARE FOR ITERATION	N TO FIND ZER	0	DVD01181
1600	NSTOP=IGK			DVDQ1182
	IFLG=0 IFL=9 GO TO 310 ENTRY TO EVALUATE G BEFORE EVALUATING 1 IFLG=IFL IFL=10 IFLAG=10 IGKM=LGSD IGK=1 GO TO 315 IGK=IGK+1 IF (IGK.GT.IGKM) GO TO 1650 ENTRY WITH IFL=9,10, AND 17 TEST FOR G CHANGING SIGN IF (G(IGK)*GT(IGK)) 160C,1580,159) IF (GT(IGK).NE.O.) GO TO 1600 IF (TL.EQ.TG) GO TO 1560 IF (LGSE.GT.O) GT(IGK)=G(IGK) GO TO 1560 G CHANGES SIGN PREPARE FOR ITERATION NSTOP=IGK IFLGS=IFL			DVDQ1163
	and the second of the second o	and the second second		

```
C
      COMPUTE INITIAL VALUE FOR RG (=RATIO OF FARTIAL STEPSIZE WHERE
                                                                            DV DQ1184
C
      G IS KNOWN/THE INTEGRATION STEPSIZE)
                                                                            DVDQ1185
      IF (IFLG.EQ.0) GO TO 1610
                                                                             DVDQ1186
      RG(3) = FAC(1)
                                                                            DVDQ1187
      RG(2) = 0.
                                                                             DVDQ1188
      "F ((IFLG.EQ.2).AND.(IGK.LT.LGSS)) RG(2)=FAC(1)
                                                                            DVDQ1189
      GO TO 1620
                                                                            DVDQ1190
1610 RG(3)=0.
                                                                            DVDQ1191
      RG(2) = -FAC(1)
                                                                             DVDQ1192
 1620 IF (LGSE.LT.0) RG(3)=TPD
                                                                            DVDQ1193
      LGSE=-3
                                                                            DV DQ1194
      GI(2) = GT(IGK)
                                                                            DVDQ1195
      EPSGS=RND
                                                                            DVDQ1196
      IFL=16
                                                                            DVDQ1197
      K=1
                                                                            DVDQ1198
      GO TO 1640
                                                                            DVDQ1199
C
      END OF PREPARATION TO BEGIN THE ITERATION
                                                                            DV DQ 1200
C
                                                                            DVDQ1201
C
      ENTRY WITH IFL=16
                                                                            DVDQ1202
C
      ITERATE TO FIND GSTOP
                                                                            DVDQ1203
 1630 K=1
                                                                            DV DQ 1204
      IF ((GI(2) + G(IGK)).GT.O.) K=2
                                                                            DVDQ1205
      IF (ABS(GI(K)).GT.ABS(G(IGK))) GO TO 1640
                                                                            DV DQ 1206
      CONVERGENCE PROBLEMS
C
                                                                            DVDQ1207
      LGSE=LGSE-1
                                                                            DVDQ1298
      IF (LGSE.EQ.(-5)) EPSGS=PTS1
                                                                            DVDQ1209
      EPSGS=EPSGS*PTS4
                                                                            DVDQ1210
 1640 GI(K)=G(IGK)
                                                                            DVDQ1211
      RG(K) = RG(3)
                                                                             DVDQ1212
C
      SECANT ITERATION (GIVES NEW FARTIAL STEPSIZE/H)
                                                                            DVDQ1213
      TPD=RG(1)-(GI(1)*(RG(2)-RG(1)))/(GI(2)-GI(1))
                                                                            DVDQ1214
      T=TL+TPD*HH
                                                                            DVDQ1215
      TEST FOR CONVERGENCE OF ITERATION
                                                                            DVDQ1216
      IF (ABS(TPD-RG(3)).LE.EPSGS) GO TO 1560
                                                                            DVDQ1217
      RG(3) = TPD
                                                                            DVDQ1218
      GO TO 1300
                                                                            DVDQ1219
 1650 IF (10-IFL) 1660,1700,100
                                                                             DVDQ1220
 1660 IF (IGKM.NE.NGA) GO TO 1710
                                                                             DVDQ1221
      IF (LGSE.GT.(-3)) GO TO 1690
                                                                            DVDQ1222
      IF (LSTC.NE.4) GO TO 1670
                                                                             DV DQ1223
C
      ESTIMATE ERROR -- GSTOP IS THE RESULT OF EXTRAPOLATING FROM
                                                                             DVDQ1224
C
      THE INITIAL POINT
                                                                            DVDQ1225
      TPO1=TPD
                                                                            DVDQ1226
      RG(3) = TPD
                                                                            DVDQ1227
      GO TO 1230
                                                                            DVDQ1228
 1670 IFL=11
                                                                            DVDQ1229
      IF (LGSE.LT.(-4)) IFL=12
                                                                             DVDQ1230
 1680 IFLAG=IFL
                                                                             DVDQ1231
      TEST TO SEE IF GSTOP IS PRECEDED BY ANOTHER STOP
                                                                             DVDQ1232
      IF ((HH*(T-TOUT).LE.0.).AND.(HH*(T-TFINAL).LE.0.)) GO TO 1380
                                                                             DVDQ1233
C
      IT IS
                                                                             DVDQ1234
      RG(3) = TPD
                                                                             DVDQ1235
      IFLS=IFL
                                                                            DVDQ1236
      GO TO 200
                                                                             DVDQ1237
1690 LGSE=1
                                                                            DVDQ1238
      IFL=IFLG
                                                                            DVDQ1239
      IF (IFL.LT.0) GO TO 60
                                                                            DVDQ1240
 1700 IGKM=NGA
                                                                             DVDQ1241
      IFL=IFLG
                                                                             DVDQ1242
      GO TO 310
                                                                             DV DQ1243
```

1710	IFL=17			DVDQ124
	IFLAG=9			DVDQ124
	IGKM=NGA			DVDQ124
	GO TO 315			DVDQ124
C	ENTRY WITH IFL=11 A	ND 12		DVDQ124
C	SET PARAMETERS TO I	NCICATE A GSTOP HAS BEEN FOUN	ın .	DV DQ124
1720	GT (NSTOP) = Q.	The second secon		DVDQ125
1730	LGSE=1			DVDQ125
· ·	IGKM=NGA			DVDQ125
	TG=TL			DVDQ125
	IF (IFLG) 1740,1760	,1770 . ·	•	DVDQ125
1749	IF (IFL.LT.13) GO T	0 1750		DV0Q125
	IF (IFLG.EQ.(-20))	GO TO 100		DVDQ125
	IFL=-IFLG		•	DVDQ1257
- !	GO TO 310			DVDQ125
1750	HH=H			DVDQ1259
	GO TO 200			DV DQ126
1760	TPD=0.			DVDQ126
	T=TL			DVDQ126
	LGSE=-2			DVDQ1263
	GO TO 1300		•	DVDQ1264
1770	IF (IFLG-3) 220,200	, 200		DVDQ1269
1 780	IF (LGSE.EQ. (-1)) 6	0 TO 1790		DVDQ1266
	LGSE=-1			DVDQ1267
	GO TO 1220			DVDQ1268
1790	TPD=RG(3)			OV DQ1269
	T=TL+TPD*HH			DVDQ1270
	IF (LGSE.NE.(-1)) G	0 TO 1670		DVDQ1271
	IFL=IFLS			OV DQ1272
	LGSE=-3	•		DVDQ1273
	GO TO 1680			OV0Q1274
1800	IF (LGSE+2) 1550,150	00,310		DVDQ1275
1610	IF (TPD.LE.B.) GO TO	0 310		DVDQ1276
4000	LGSE=-2			DVDQ1277
	IFLG=IFL			DVDQ1278
•	IFL=17			DVDQ1279
	IFLAG=9			DV DQ1280
	IF (LGSD .GT. 0) GO	10 1530		DVDQ1281
	GO TO 1540			DVDQ1282
	END			DVD01267

1. Report No. NASA CR-3291	2. Government Acces	sion No.	3. Recipient's Catalo	g No.		
4. Title and Subtitle CALCULATION OF WATER D	4. Title and Subtitle CALCULATION OF WATER DROP TRAJECTO					
TO AND ABOUT ARBITRARY BODIES IN POTENTIAL AIRF		SIONAL	6. Performing Organi	ization Code		
7. Author(s) Hillyer G. Norment			8. Performing Organi None	zation Report No.		
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9. Performing Organization Name and Address Atmospheric Science Associate	es					
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Washington, D.C. 20546			, ,	*		
Research Center, Cleveland, ( report contains an example pro	15. Supplementary Notes Final report. Project Manager, Robert J. Shaw, Propulsion Systems Division, NASA Lewis Research Center, Cleveland, Ohio 44135. The microfiche supplement at the back of this report contains an example problem printout and code listings.					
16. Abstract Calculations can be performed for any atmospheric conditions and for all water drop sizes, from the smallest cloud droplet to large raindrops. Any subsonic, external, non-lifting flow can be accommodated; flow into, but not through, inlets also can be simulated. Experimental water drop drag relations are used in the water drop equations of motion and effects of gravity settling are included. Seven codes are described: 1. a code used to debug and plot body surface description data, 2. a code that processes the body surface data to yield the potential flow field, 3. a code that computes flow velocities at arrays of points in space, 4. a code that computes water drop trajectories from an array of points in space, 5. a code that computes water drop trajectories and fluxes to arbitrary target points, 6. a code that computes water drop trajectories tangent to the body, 7. a code that produces stereo pair plots which include both the body and trajectories. Code descriptions include operating instructions, card inputs and printouts for example problems, and listings of the FORTRAN codes. Accuracy of the calculations is discussed, and trajectory calculation results are compared with prior calculations and with experimental data.						
17. Key Words (Suggested by Author(s))		18. Distribution Statement				
Water drop trajectories; Three	e-dimensional	Unclassified —	Unlimited			
potential flow; Computer progr	,					
trajectories; Water drop fluxes	s; Aircraft					
icing	T			ategory 02		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (c		21. No. of Pages 82	22. Price* A05		
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### MICROFICHE SUPPLEMENT TO NASA CR-3291

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#### EXAMPLE PROBLEM PRINTOUT

**PBOXC** 

PROGRAM PBOXC

ATMOSPHERIC SCIENCE ASSOCIATES
BEDFORD, MASSACHUSETTS

PAGE 1

BODY ID. TEST

TEST BODY

PARAMETRIC INFORMATION

NO SYMMETRY SPECIFIED

PLOTS ARE PREPARED

PROGRAM PBOXC			OXC	ATTOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS			PAGE	
i	BODY	ID.	TEST	TEST E	30 D Y			 
	N i	<b>M</b>	X	<b>x</b> .	X	X	NX	NP X
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			ż	ż	Ž	ż	NZ	NP Z
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			0.000000	0.000000	.768100	652000	. 428 210	• 55 7 4 9 4
		5	2.000000	2.000000	1.500000	1.500000	.874522	1.620269
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PROGRAM PBOXC

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

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	14	2.000000	2.000000	1.500000	1.500000	• 915363	1. 60 5113
		0.000000	0.000000	-1.140000	-1.460000	202414	-1.019539
		0.00000	0.00000	652000	4659 <b>00</b>	348052	44 5612
	15	2.000000	2.000000	1.500000	1.500000	.891771	1.609275
		0.00000	0.000000	800000	-1.140000	146221	750320
		0.00000	0.000000	768100	652000	428 210	55 7494
	16	2.000000	2.000000	1.500000	1.500000	.874522	1.620269
		0.000000	0.000000	480000	800000	088802	447901
		0.000000	0.000000	842600	768100	476787	613081
1 No.	17_	2.000000	2.000000	1.500000	1.500000	.865649	1.624811
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		0.00000	0.600000	842600	866000	499797	641222
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	21	2.900000	2.000000	1.500000	1.500000	•915363	1.605113
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000	1.500000	958086	1.591395	0 •
000	1.670000	.276584	1.389794	.1803E+01
000	229700	074655	094899	•2076E+00
000	1.000000	• 435365	1.220560	.5764E-02
000	2.000000	•855263	1.831729	.6416E+00
500	0.000000	.261038	• 14 9900	.1768E+00
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PROGRAM PBOXC		ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD: MASSACHUSETTS			PÂ			
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	F		•229700	• 40 2 3 0 0		. 3 2 4 6 0 0	. 650904	• 41 46
		3	1.500000	1.500000	1.000000	1.000000	.324553	1.2416
			1.460000	1.140000	1.200000	1.600000	.447006	1.3516
			•46590 <b>0</b>	. 65 20 0 0	.80000	.600000	.833577	• 63 <b>18</b>
		4	1.500000	1.500000	1.000000	1.000000	.288009	1.2429
			1.140000	.800000	.800000	1.200000	.287154	9857
			.652000	.768100	•91650 <b>0</b>	.800000	.913561	. 78 61
		5	1.500000	1.500000	1.000000	1.000000	.270929	1.2501
			.800000	.400000	.400008	.800000	.163401	• 60 0 <b>0</b>
			.768 <b>100</b>	•84260 <b>0</b>	.979800	.916500	•948629	• 87 6 <b>6</b>
		6	1.500000	1.500000	1.000000	1.000000	.261384	1. 25 0 0
			• 400000	0.000000	0.00000	. 400000	.052527	. 2000
			.842600	.865000	1.000000	.979800	.963805	• 9220
		7	1.500000	1.500000	1.900000	1.030000	.126140	1.2460
	Ω <sub>1</sub>		0.000000	400000	400000	0.00000	312996	1995
			·866000	.80000	.80000	1.000000	.941341	. 8671
		8	1.500000	1.500000	1.000000	1.000000	0.000000	1. 25 00
			400000	800000	800000	400000	447214	6000
			.800000	.600000	.600000	.800000	.894427	. 70 00
		9	1.500000	1.500000	1.000000	1.000000	0.060000	1.2500
			800000	-1.200000	-1.200000	800000	447214	-1.0000
			.600000	.400000	.460908	.6000 <b>0</b> 0	.894427	• 50 0 0
		10	1.500000	1.500000	1.000960	1.000080	0.000000	1. 2500
		•	-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.4000
			.400000	.20000	.200000	. 400000	.894427	. 3000
		11	1.500000	1.500000	1.000000	1.000000	.159008	1.2167
			-1.600000	-1.732000	-2.000000	-1.600000	593315	-1.7392
			.200000	0.000000	0.00000	. 200000	.789109	• 10 2 <b>0</b>
		12	1.500000	1.500000	1.000000	1.000000	• 435365	1.2205
			-1.732000	-1.670000	-1.870000	-2.000000	855263	-1.8317
			0.00000	229700	354600	0.00000	281938	1499
		13	1.500000	1.500000	1.000000	1.000000	.390089	1.2417
			-1.670800	-1.460000	-1.600000	-1.870000	652179	-1.6528
			229700	465900	600000	354600	650004	- • 41 46

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NX	NP X	D
NY	NP Y	T
NZ	NP Z	A
•390089	1.241719	.8288E-02
•65217J	1.652830	.6561E+00
•650004	.414680	.1846E+00
•324553	1.241630	.6043E-02
•447006	1.351646	.6814E+00
•833577	.631851	.2159E+00
.288009	1.242990	.4216E-02
.287154	.985715	.6600E+00
.913561	.786135	.2025E+00
.270929	1.250180	.2656E-02
.163401	.600088	.6744E+00
.948629	.876683	.2108E+00
•261384	1.250317	.7710E-03
•052527	.200526	.6594E+00
•963805	.922094	.2075E+00
•126149	1.246098	.31538-01
••312996	199566	.67(8E+00
•941341	.867167	.2125E+00
0.000000	1.250000	.3553E-14
447214	600000	.6708E+00
.894427	.700000	.2236E+00
0.000000	1.250060	.3553E-14
447214	-1.000060	.6708E+00
.894427	.500060	.2236E+00
0.00000	1.250000	.6661E-14
447214	-1.400000	.67(8E+00
.894427	.300000	.2236E+00
.159008	1.216789	.3975E-01
593315	-1.739216	.6708E+00
.789109	.102018	.1685E+00
•435365	1.220560	.5764E-02
••855263	-1.831729	.6416E+00
••281038	149900	.1708E+00
.390089	1.241719	.8288E-02
652179	-1.652830	.6561E+00
650004	414680	.1846E+00

#### PROGRAM PBOXC ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

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4	ᆫ	3	1	- 5	u	и	

			TEST (	BODY			
N	M	x	<b>x</b>	x	×	NX	NPX
		Y	Y	Y	Y	NY	NPY
		Z	<b>Z</b> .	Ž	Z	NZ	NP Z
2: ::	14	1.500000	1.500000	1.000000	1.000000	• 324553	1.241630
		-1.460000	-1.140000	-1.200000	-1.600000	447006	-1.351646
		465900	652000	800000	600000	833577	631851
	15	1.500000	1.500000	1.000000	1.000000	-288889	1.242990
		-1.140000	800000	800000	-1.200000	287154	985715
		652090	768100	916500	890000	913561	786135
	16	1.500000	1.500000	1.000000	1.000000	.278929	1. 250180
		800000	460000	400000	800000	163401	600088
		768100	842600	979800	916500	948629	876683
	17	1.500000	1.500000	1.000000	1.000000	.261384	1.250017
		400000	0.000000	0.000000	400000	052527	200026
		84260C	866000	-1.000000	979800	963805	922094
	18	1.500000	1.500000	1.000000	1.000000	·261384	1.250017
		0.000000	• 40 00 00	.400000	0.00000	•052527	• 200026
		866000	842600	979800	-1.000000	963805	922094
	19	1.500000	1.500000	1.000000	1.600060	.270 929	1.250180
6		.400006	.83000	.800000	.490000	.163401	.600088
		842600	768100	916500	979800	948629	876683
	20	1.500000	1.500000	1.009000	1.000000	-288009	1.242990
	•	.800000	1.140000	1.200000	.800000	.287154	. 985715
		768100	652000	800000	916500	913561	78 6135
	21	1.500000	1.500000	1.000000	1.000000	•324553	1.241630
		1.140000	1.460000	1.600000	1.200000	.447006	1.351646
		<b></b> 652 <b>000</b>	465900	600000	800000	833577	631851
	22	1.500000	1.500000	1.000000	1.000000	.390089	1.241719
		1.460000	1.670000	1.870000	1.600000	.652178	1.652830
		465900	229700	354600	690000	650004	41 4680
	23	1.500000	1.500000	1.000000	1.000000	• 435365	1.220560
		1.670000	1.732000	2.000000	1.870000	.855263	1.831729
		229700	0.060000	0.000000	354600	281038	149900
3	1	1.000000	1.000000	0.00000	0.000000	0.600000	• 50 0 0 0 <b>0</b>
		2.000000	1.870000	1.870000	2.000000	.938893	1.935000
		0.000000	.354600	.354600	0.00000	.344208	• 177300
	2	1.000000	1.000000	0.00000	0.00000	0.00000	.500000
	-	1.870000	1.600000	1.600000	1.870000	.672591	1.735000
. •		.354600	.600000	•600000	.354600	.740014	.477300

X	NX	NP X	D
Y	NY	NP Y	T
Z	NZ	NP Z	A
1.000000	• 324553	1.241630	.6043E-02
-1.600000	447906		•6814E+00
	<del>-</del> :	-1.351646	
60000 <b>0</b>	833577	631851	•2159E+00
1.000000	.288009	1.242990	.4216E-02
-1.200000	287154	985715	.6600E+00
800000	913561	786135	.2025E+00
1.000000	.270929	1. 250180	•2656E-02
800000	163401	600088	•6744E+80
916500			· ·
916986	948629	876683	.2168E+00
1.000000	-261384	1.250017	.7710E-03
400000	052527	200026	.6594E+00
9798 <b>00</b>	963805	922094	.20 75E+00
1.036000	- 261384	1. 250017	.7710E-03
0.000000	.052527	200026	.6594E+00
-1.000000	963805	922094	-2975E+00
- 14 00000	- (30000)	- 4 3220 34	\$29 / 3E+80
1.600000	.270 929	1.250180	.2656E-02
.400000	.163401	.600088	• 6744E+00
979800	948629	876683	. 21 û8 E+ 00
1.000000	-288009	1.242990	.4216E-02
.800000	.287154	• 98 5 7 1 5	.6600E+#B
916500	913561	78 6135	.2025E+00
4 3 2 6 3 6 4	•310301	•10 010	120272100
1.000000	.324553	1.241630	.6043E-02
1.200000	.447006	1.351646	.6814E+00
800000	833577	631851	.2159E+00
1.000000	.390089	1.241719	.8288E-02
1.600000	.652170	1.652830	.65 £1 E+00
	650004		
630000	650004	41 4680	.1846E+00
1.000000	.435365	1.220560	.5764E-02
1.870000	.855263	1.831729	•6416E+00
354600	281038	149900	.1708E+00
0.00000	0.00000	• 50 0 0 0 0	0 •
2.000000	•938893	1.935000	•1069E+01
0.000000	• 344208	• 177300	.3777E+00
0.000000	•344600	• 11 1 3 U G	*31115700
0.000000	0.038600	.500000	.4885E-14
1.870000	.672591	1.735000	.10 E4E+01
.354600	.740014	.477300	.3649E+00

PRO	GRA M	PBOXC	AT	MOSPHERIC SCI	ENCE ASSOCIATE	ES	PAGE
ВО	DY ID	• TEST		9	33460036113		PAGE
			TEST	BODY		•	
N	М	. <b>, X</b> ≎	X	X	X	NX	NPX
		Y	Y	Υ	Υ Υ	NY	NPY
		× <b>Z</b>	<b>Z</b>	Z	Z	NZ	NP Z
3	3	1.000000	1.000000	0.000088	0.00000	0.00000	.500000
-	-	1.600000	1.200000		1.600000	.447214	1.400000
		.600000	.800000	.800000	.600000	.894427	.700000
	4	1.000000	1.000000	0.00000	0.00000	0.00000	• 50 8 0 0 D
		1.200000	.800000		1.200000	.279631	1.000000
		.800000	.916500	.916500	.800800	.960107	.858250
	5	1.000000	1.000000	0.00000	0.000000	. 0.960000	• 50 0 0 0 0
		.800000	. 40 0000	.400000	.800000	.156305	.60000
	•	•916500	.979800	.979800	•9165 <b>00</b>	.987709	.948150
	6	1.000000	1.0000000	0.00000	0.00000	0.00000	. 50 0 0 0 0
	-	.400000	0.00000		. 480000	.050436	. 200000
		979880	1.000000	1.000000	.979800	.998727	. 98 99 00
• 1	7	1.000000	1.000000	0.00000	0.00000	0.000000	. 500000
		0.000000	40 0000	400000	0.00000	447214	200000
		1.000000	.800000	.800000	1.000000	.894427	. 90 00 00
	8	1.900000	1.000000	0.00000	0.000000	0.000000	. 50 0 0 0 0
7		400000	80 0000		400000	447214	600000
		.800000	.600000	.600000	.800000	.894427	-700000
-	9.	1.000000	1.000000		0.000000	0.000000	. 50 00 00
		800000	-1.200000		800000	447214	-1.000000
	. •	.600000	.400000	.400000	.600000	.894427	. 500000
	10	1.000860	1.060006	0.000000	0.00000	0.000000	.500000
		-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.400000
		• 400000	. 200000	.200000	. 400000	•894427	.300000
	11	1.000000	1.000000	0.00000	0.00000	0.00000	• 50 0 <b>0 0 0</b>
		-1.600000	-2.006000		-1.600000	447214	-1.800000
•		.200000	0.00000	0.00000	. 200000	•894427	- 10 00 00
	12	1.000000	1.000000	0.00000	0.000000	0.00000	- 50 0000
		-2.000000	-1.870000	-1.870000	-2.000000	938893	-1.9350G <b>0</b>
		0.000000	354600	354608	0.00000	344208	177300
	13	1.000000	1.000000	0.000000	0.00000	0.000000	• 50 0 0 0 0
		-1.870000	-1.600000	-1.600000	-1.870000	672591	-1.735000
		354600	600000	600000	354600	740014	477300
	14	1.000000	1.000000	0.00000	0.00000	0.00000	.500000
		-1.600000	-1.200000	-1.200000	-1.600000	447214	-1.480000
		600000	800000	800000	600000	894427	70000

NY NZ NPZ A  0.000000	NX	NP X	Ð
0.000000       .500000       .6661E-14         .447214       1.400000       .1095E+01         .894427       .700000       .4472E+00         0.000000       .500000       .2442E-14         .279631       1.000000       .1083E+01         .966107       .858250       .4166E+00         0.900000       .500000       .2442E-14         .156305       .600000       .1079E+01         .987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.000000       .500000       .31 C9E-14         .447214      200000       .3553E-14         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .	NY	NPY	T
.447214       1.400000       .1095E+01         .894427       .700000       .4472E+00         0.000000       .500000       .2442E-14         .279631       1.000000       .1083E+01         .968107       .858250       .4166E+00         0.000000       .500000       .2442E-14         .156305       .600000       .1079E+01         .987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.000000       .500000       .3109E-14        447214      200000       .3553E-14         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000	NZ	NP Z	A
.447214       1.400000       .1095E+01         .894427       .700000       .4472E+00         0.000000       .500000       .2442E-14         .279631       1.000000       .1083E+01         .968107       .858250       .4166E+00         0.000000       .500000       .2442E-14         .156305       .600000       .1079E+01         .987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.000000       .500000       .3109E-14        447214      200000       .3553E-14         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000			•
0.000000       .500000       .2442E-14         .279631       1.000000       .1083E+01         .960107       .858250       .4166E+00         0.000000       .500000       .2442E-14         .156305       .600000       .1079E+01         .967709       .948150       .4050E+00         0.000000       .500000       .1077E+01         .998727       .989900       .4005E+00         0.000000       .500000       .31 (9E-14        447214      200000       .31 (9E-14        894427       .900000       .3553E-14         0.000000       .500000       .3553E-14         0.000000       .500000       .3553E-14         0.447214       -600000       .1095E+01         .894427       .700000       .4472E+00         0.000000       .500000       .3553E-14         -447214       -1.00000       .1095E+01         .894427       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .44885E-14         .740014			.6661E-14
0.000000       .500000       .2442E-14         .279631       1.00000       .1083E+01         .968107       .858250       .4166E+00         0.000000       .50000       .2442E-14         .156305       .60000       .1079E+01         .987709       .948150       .4050E+00         0.00000       .50000       .1077E+01         .998727       .989900       .4005E+00         0.000000       .50000       .31 (9E-14        447214      200000       .31 (9E-14        894427       .900000       .3553E-14         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.00000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4485E-14         .894427       .100000       .4472E+00         0.000000       .500	.447214	1.400000	.1095E+01
.279631       1.000000       .4168±01         .968107       .858250       .4166±00         0.00000       .500000       .2442±-14         .156305       .600000       .1079±01         .987709       .948150       .4050±00         0.000000       .560000       .5551±-16         .050436       .200000       .1077±01         .998727       .989900       .4005±00         0.00000       .500000       .31 (9±-14         .894427       .900000       .4472±00         0.000000       .500000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .500000       .3553±-14         .894427       .500000       .3553±-14         .894427       .500000       .4472±00         0.00000       .500000       .4472±00         0.000000       .500000       .4472±00         0.000000       .500000       .1069±01         .938893       -1.935000       .1069±01         .3649±00       .1060±01	.894427	.700000	.4472E+00
.279631       1.000000       .4168±01         .968107       .858250       .4166±00         0.00000       .500000       .2442±-14         .156305       .600000       .1079±01         .987709       .948150       .4050±00         0.000000       .560000       .5551±-16         .050436       .200000       .1077±01         .998727       .989900       .4005±00         0.00000       .500000       .31 (9±-14         .894427       .900000       .4472±00         0.000000       .500000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .700000       .3553±-14         .894427       .500000       .3553±-14         .894427       .500000       .3553±-14         .894427       .500000       .4472±00         0.00000       .500000       .4472±00         0.000000       .500000       .4472±00         0.000000       .500000       .1069±01         .938893       -1.935000       .1069±01         .3649±00       .1060±01			
.966107       .858250       .4166E+00         0.00000       .500000       .2442E-14         .156305       .600000       .1079E+01         .987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.00000       .500000       .31 C9E-14        447214      200000       .1095E+01         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.00000       .500000       .4472E+00         0.000000       .5	0.00000	. 50 0 0 0 0	.24 42E-14
.966107       .858250       .4166E+00         0.00000       .500000       .2442E-14         .156305       .600000       .1079E+01         .987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.00000       .500000       .31 C9E-14        447214      200000       .1095E+01         .894427       .900000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .700000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .3553E-14         .894427       .500000       .4472E+00         0.00000       .500000       .4472E+00         0.000000       .5	.279631	1.000000	-1083E+01
.156305 .987709 .948150 .4050E+00  0.000000 .500000 .500000 .1077E+01 .998727 .989900 .4005E+00  0.000000 .500000 .500000 .3109E-14 .894427 .900000 .4472E+00  0.000000 .500000 .3553E-14 .894427 .700000 .4472E+00  0.000000 .500000 .4441E-15 .1095E+01 .894427 .100000 .4472E+00  0.000000 .500000 .4441E-15 .1095E+01 .3777E+00  0.000000 .500000 .4485E-14 .3775E+00  0.000000 .500000 .4885E-14 .3777E+00  0.000000 .500000 .4885E-14 .3777E+00  0.000000 .500000 .500000 .6661E-14 .672591 .735000 .4885E-14 .3649E+00  0.0000000 .5000000 .500000 .6661E-14 .955E+01	.969107	.858250	.41 66E+00
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.987709       .948150       .4050E+00         0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.00000       .500000       .31 C9E-14        447214      200000       .1095E+01         .894427       .900000       .4472E+00         0.000000       .500000       .3553E-14        447214      600000       .3553E-14        447214      600000       .4472E+00         0.000000       .500000       .3553E-14        447214       -1.000000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .4441E-15        447214       -1.800000       .1095E+01         .894427       .100000       .4472E+00         0.000000       .500000       .4485E-14        938893       -1.935000       .1069E+01        344208       -1.735000       .4885E-14        740014      477300       .3649E+00         0.000000       .500000       .6661E-14        7440			
0.000000       .500000       .5551E-16         .050436       .200000       .1077E+01         .998727       .989900       .4005E+00         0.00000       .500000       .31 C9E-14        447214      200000       .1095E+01         .894427       .900000       .4472E+60         0.000000       .500000       .3553E-14        447214      600000       .1095E+61         .894427       .700000       .3553E-14         0.000000       .500000       .3553E-14         0.4472E+00       .4472E+00         0.000000       .500000       .3553E-14         0.4472E+00       .4472E+00         0.000000       .500000       .44885E-14         0.000000       .500000       .4885E-14         0.000000       .500000       .4885E-14         0.000000       .500000       .6661E-14         0.000000       .500000       .6661E-14			
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.894427       .900000       .4472E+00         0.000000       .500000       .3553E-14        447214      600000       .1095E+01         .894427       .700000       .3553E-14        447214       -1.000000       .1095E+01         .894427       .500000       .4472E+00         0.00000       .500000       .6661E-14        447214       -1.400000       .1095E+01         .894427       .300000       .4472E+00         0.00000       .500000       .4441E-15        447214       -1.800000       .4472E+00         0.00000       .500000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .44885E-14        672591       -1.735000       .4885E-14        740014      477300       .3649E+00         0.000000       .500000       .6661E-14        447214       -1.400000       .1095E+01	447214	200000	.1095E#81
0.000000       .500000       .3553E-14        447214      600000       .1095%+61         .894427       .700000       .4472E+00         0.000000       .500000       .3553E-14        447214       -1.000000       .4095E+01         .894427       .500000       .4472E+00         0.00000       .500000       .6661E-14        447214       -1.400000       .4472E+00         0.000000       .500000       .4441E-15        447214       -1.800000       .4472E+00         0.000000       .500000       .4472E+00         0.000000       .500000       .3777E+00         0.000000       .500000       .4885E-14        740014      477300       .3649E+00         0.000000       .500000       .6661E-14        447214       -1.400000       .6661E-14        447214       -1.400000       .6661E-14			
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PROGRAM PBOXC

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

			TEST E	IODY			
N	M	×	X	x	×	NX	NP X
		. <b>Y</b>	γ .	* <b>Y</b>	Y	NY	NPY
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3	15	1.000000	1.000000	0.000000	0.00000	0.00000	•500000
		-1.20000G	800000	800000	-1.200000	279631	-1.0000000
		800000	916500	916500	800000	960107	858250
	16	1.000000	1.066900	0.000000	0.000000	0.000000	. 500000
		800000	400000	400000	800000	156305	600000
		916500	979800	979800	916500	987709	948150
	.17	1.000000	1.090000	0.00000	0.00000	0.000000	.500000
		400000	0.000000	0.000000	400000	050436	200000
	4.3	979800	-1.000000	-1.000000	979800	998727	989900
	18	1.000000	1.000000	0.000000	0.00000	0 • 0 0 0 0 0	. 50 0000
		0.000000	.400000	.40000	6.00000	.050436	.200000
		-1.000000	979800	979800	-1.000000	998727	98990 <b>ü</b>
	19	1.000000	1.000000	0.00000	0.00000	0.00000	.500000
		. 400000	800000	.800000	. 400000	·156305	.600000 S
		979800	916500	916500	979840	987709	948150
	20	1.000000	1.000000	0.000000	0.00000	0.000000	.500000
$\infty$		•80000C	1.200000	1.200000	.800000	.279631	1.056000
		916500	800000	800000	916500	960107	- 85 £ 2 5 <b>0</b>
•	21	1.000000	1.000000	0.000000	0.000000	0.00000	.500000
		1.200000	1.680000	1.600000	1.200000	•447214	1.400000
		800000	600000	600000	830000	894427	700000
	22	1.000000	1.000000	0.000000	0.00000	0.000000	.500000
4.1	•	1.600000	1.870000	1.870000	1.600000	672591	1.735000
		600000	354600	354600	600000	740014	477300
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	23	1.000000	1.000000	0.00000	0.000000	0.00000	• 50 0 0 D O 🦪
	•	1.870000	2.000000	2.000000	1.870000	•938893	1.935000
1.	•	354600	0.500000	0.00000	354600	344208	177300
4	1	0.000000	0.000000	500000	500000/	049532	248068
		2.000000	1.870000	1.850000	1.972000	.939127	1.923092
		0.000000	.354600	.341500	0.000000	.339980	.174052
	2	0.00000	0.000000	500000	500000	043145	249477
		1.870000	1.600000	1.585000	1.850000	.675158	1.726269
	3	.354600	.600000	-586600	.341500	.736411	.470688
	3	0.000000	0.000000	500000	500000	034875	<b></b> 24 91 69
	<b>-</b>	1.600000	1.200000	1.195000	1.585000	449471	1.395016
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1	Z	NZ	NP Z	Α
3.	00000	0.00000	•500000	.2442E-14
	200000	279631	-1.000000	.1083E+01
•	840000	960107	858250	.4166E+00
B:	000000	0.000000	.500000	•2442E-14
	800000	156305	600000	.1079E+01
•	916500	987709	948150	.40 5 BE+ 00
0.	00000	0.00000	.500000	.5551E-16
- •	400000	050436	200000	.1077E+01
•	979800	998727	989900	.4005E+00
	000000	0.00000	<ul><li>50 00 00</li></ul>	.3553E-14
t	000000	• 050436	.200000	•1077E+01
1.	000000	998727	9899 <b>0</b> ŭ	.4005E+00
	000000	0.00000	.500000	.2220E-14
	400000	.156305	.600000	.1079E+01
	979840	-:987709	948150	.4050E+00
o.	000000	0.00000	•50000 <b>0</b>	.3169E-14
	800000	.279631	1.000000	•1083E+01
٠.	916500	960107	-• 858250	.4166E+00
Ū.	000000	0.00000	.500000	•6661E-14
1.	200000	.447214	1.400000	•1095E+01
-•	800000	894427	700000	• 447 2E+ 60
O.	000000	0.00000	.500000	•6217E-14
	600000	.672591	1.735000	•10 64E+01
	600000	740014	477300	.3649E+00
0.	000000	0.00000	<ul><li>50 00 00</li></ul>	•6217E-14
	870000	•938893	1.935060	.10 6 9E+01
	354600	344208	177300	•3777E+00
	500000	049532	248068	.7648E-03
1.	972000	.939127	1.923092	.6238E+00
0.	00000	•33998ŭ	.174052	.1853E+00
	500000	043145	249477	.7887E-03
H _	a Ennana	.675158	1.726269	.6205E+00
•	341500	.736411	• 47 0 6 8 8	.1816E+û0
	500000	034875	24 91 69	.6327E-03
1.	585000	.449471	1.395016	.6693E+00
	586600	.892614	. 63 27 74	.2213E+00

PROGRAM PBOXC

## AT MOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

2001 100 1501	B	יטכ	l I I	) <b>.</b> 1	rest
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80	IDA TE	1. 1551	***	50.07			
			TEST	EODY			
N	M	X	×	X	×	NX	NPX
		Y	Y	Y	Y	NY	NPY
		Z	Z	Z	Y Z	NZ	NPZ
4	4	0.000000	0.090000	500000	599000	031043	- 24.0537
•	**	1.200000	.800000	.800000			249537
		«800000	•916500	•901200	1.195000	.281449	• 998756
		# O # # # # # #	• 31 0200	• 401500	• 7844 <b>0</b> 0	.959074	.850538
	5	0.000000	0.000000	500000	500000	029218	250016
		.800000	.400000	.400000	.800000	<ul><li>157442</li></ul>	.600001
		.916500	.979800	• 965500	.901200	.987096	• 940749
	6	0.000000	0.000000	500000	500000	028252	250002
	•	• 400000	0.000000	0.00000	. 400000	.050789	. 20 0 0 0 0
		.979800	1.000000	.986000	965500	998310	• 98 28 25
			2000000		V 303340	633002	* JU EUL J
	7"	0.00000	0.000000	500000	500000	012608	249496
		0.000000	400000	400000	0.000000	- • 434526	199997
		1.000000	.80000	.800000	•986 <b>000</b>	.900571	.896509
	8	0.000000	0.00000	500000	500000	0.00000	- 250000
	3	400000	800000	860000	400000	447214	250000 600000
		.800000	.600000	.600000	.800000	.894427	.700000
		• 5 6 6 6 6 6		. 005300	• 0 0 0 0 0	*034421	
	9	0.300000	0.000000	500000	500000	0.00000	25 0 0 0 0
9		800000	-1.200000	-1.200000	800000	447214	-1.000000
		.600000	• 40 a 0 0 0	.400000	.600000	.894427	.500000
	10	0.00000	0.000000	~.500000	500000	0.00000	250060
		-1.200000	-1.600000	-1.600300	-1.200000	447214	-1.400000
		400000	200000	.200000	. 400000	894427	.300000
		140000	• 200000	• 2 00 00 0	* 40000	*034721	• 36 8 9 6 6
	11	0.000000	0.000000	500000	500000	012880	247831
		-1.600000	-2.000000	-1.972000	-1.600000	460010	-1. 79 30 15
		.200000	8.000000	0.00000	.200000	.887820	.100024
	12	0.000000	0.00000	500000	500000	049532	248068
		-2.000000	-1.870000	-1.850000	-1.972000	939127	-1.923092
		0.000000	354600	341500	0.00000	339980	17 40 52
			002 : 000	001220			447 40 JE
	13	0.000000	0.000000	500000	500000	043145	249477
		-1.870000	-1.600000	- 1.585000	-1.850000	675158	-1.726269
		354600	600000	586600	341500	736411	470688
	14	0.300000	0.00000	500000	500000	034875	249169
	<b>.</b> T	-1.600000	-1.200000	-1.195800	-1.585000	449471	-1.395016
		600000	800000	784488	58660 <b>0</b>	892614	-1.395016 692774
			- 4 0 0 314 0	- 61 04400	500000	- 0036014	- 0 0 7 2 1 1 4
	15	0.000000	0.000000	500000	500000	031043	249537
		-1.200000	800000	800000	-1.195000	281449	998756
		800200	916500	901200	784400	959074	850538

NX NY	NP X NP Y	D T A
NZ 031943 .281449 .959074	NPZ 249537 .998756 .850538	.4237E-03 .6507E+00 .2072E+00
029218	250016	.2468E+03
.157442	.600061	.6451E+00
.987 <b>0</b> 96	.940749	.2026E+00
028252	250002	.7487E-04
.050789	.200000	.6412E+00
.998310	.982825	.2003E+00
012608	249496	.3152E-02
434526	199997	.6708E+00
.900571	.896509	.2221E+00
0.000000	250000	.3553E-14
447214	600000	.6708E+00
.894427	.700000	.2236E+00
0.000000	250000	.3553E-14
447214	-1.000000	.6788E+00
.894427	.500000	.2236E+00
0.000000	250000	.6661E-14
447214	-1.40000	.6708E+00
.894427	.300JU0	.2236E+00
012880	247831	.3220E-02
460018	-1.793015	.6708E+00
.867820	.100024	.2174E+00
049532	248068	.7648E-03
939127	-1.923092	.6238E+00
33998u	174052	.1853E+00
043145	-,249477	.7887E-03
675158	-1.726269	.6205E+00
736411	-,470688	.1816E+00
034875	249169	.6327E-03
449471	-1.395016	.6693E+00
892614	692774	.2213E+00
031043	249537	.4237E-03
281449	998756	.6507E+00
959074	850538	.2072E+00

PROGRAM PBOXC		ATM	PAGE				
80	DY ID.	TEST	TEST	BODY		•	
N	М	X	×	x	x	, NX	NPX
		Y	Y	Ÿ	Y	NY	NPY
		Z	Z	Z	Z	NZ	NP Z
4	16	0.000000	0.000000	500000	500000	029218	250016
		800000	460000	400000	806000	157 442	600001
		916500	9798 <b>00</b>	965500	901200	987096	940749
	17	0.000000	0.000000	500000	500000	028252	250002
		400000	8.000000 -1.86688	0.000000	400000	050789	~.2000¥0
		979800	-1.060000	986000	9655 <b>00</b>	998 310	98 28 25
	18	0.000000	0.000000	500000	500000	028252	250002
		0.000000	. 466000	.400200	ŭ.000000 .	.050789	. 200000
	•	-1.000000	979800	965500	986000	998310	<b></b> 98 28 25
	19	9.000000	0.000000	500000	500000	029218	250016
		.400000	.800000	.800000	.400000	.157,442	.600001
		979800	916500	981260	-•96550 <b>0</b>	987496	940749
	20	0.000000	0.000000	500000	500000	031043	249537
		.800000	1.200000	1.195000	.800000	.281449	• 998756
		916500	800000	784460	90120 <b>0</b>	959074	850538
	21	0.000000	0.060000	500000	500000	034875	249169
10		1.200000	1.600000	1.585000	1.195000	• 4 49 47 1,	1.395016
		800000	600000	5866 <b>00</b>	784400	892614	692774
	22	0.000000	0.060000	500000	500000	043145	249477
		1.600000	1.870000	1.850000	1.585000	•675158	1.726269
		600000	354600	341500	586600	736411	470668
	23	0.000000	0.000000	500000	500000	049532	248068
		1.870000	2.000000	1.972000	1.85000	•939127	1.923092
		354600	0.000000	0.000000	341500	33998 ü	174052
5	1	500000	500000	-1.000000	-1.000000	153543	743334
		1.972000	1.850000	1.785000	1.885600	• 934141	1.874150
		0.000000	.341500	.303900	3.000000	.322188	• 161626
	2	500000	500000	- 1.000000	-1.000000	132740	747389
		1.850000	1.585000	1.540000	1.785000	.683173	1.690281
		.341500	•5 <b>8</b> 66 <b>00</b>	•544000	.303900	.718091	• 44 4 2 1 5
	3	500000	583000	-1.000000	-1.000000	108809	747752
		1.585000	1.19 9000	1.175000	1.540000	.457325	1.373892
		•5866 <b>00</b>	.784400	.737400	• 544000	.882618	• 66 3304
	4	500000	500000	-1.000000	-1.000000	095703	747958
		1.195000	.800000	.800000	1.175000	.288525	. 992572
		.784400	.901200	.853800	.737400	•952677.	. 81 9383

X	NX	NPX	0
Y	NY	NPY	T
Z	NZ	NPZ	A
500000	029218	250016	.2468E-03
800000	157442	600001	.6451E+00
901200	987096	940749	.2026E+00
500000	028252	250002	•7487E-04
400000	050789	200000	•6412E+00
965500	998310	982825	•2003E+00
50 0000	028252	250002	.7487E-04
<b>00 0</b> 000	.050789	.200000	.6412E+00
986000	998310	982825	.2003E+00
5 <b>0</b> 0000	029218	250016	.2468E-03
400000	.157442	.600001	.6451E+00
965500	987096	940749	.2026E+00
500000	031043	249537	•4237E-03
800000	.281449	.998756	•6507E+00
901200	959074	850538	•2072E+00
500000	034875	249169	•6327E-03
195000	.449471	1.395016	•6693E+00
784400	892614	692774	•2213E+00
500000	043145	249477	.7887E-03
585000	.675158	1.726269	.6265E+00
586600	736411	470688	.1816E+00
500000	049532	248068	•7648E-03
850000	.939127	1.923092	•6238E+00
341500	339980	174052	•1853E+00
<b>00</b> 0000	153543	743334	.1969E-02
835600	.934141	1.874150	.6143E+00
<b>00</b> 0000	.322188	.161626	.1727E+00
000000	132740	747389	.2518E-02
785000	.683173	1.690281	.6222E+00
303900	.718091	.444215	.1776E+00
000000	108809	747752	.1887E-02
540000	.457325	1.373892	.6640E+00
544000	.882618	.663304	.2139E+00
0000000 175000 737400	095703 .288525 .952677	• 992572 • 81 9383	.6461E+00 .2021E+00

PROGRAM PBOXC			ATPOSFHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS				PA
80	DY ID	• TEST		-			
			TEST	BODY		•	
N	М	X	<b>X</b>	X	×	NX	NPX
		Y Z	Y Z	Y Z	Y Z	NY NZ	NP Y NP Z
		2	2	2	2	NZ	NF Z
5	5	500000	500000	-1.000000	-1.600000	089915	7500
		.800000 .901200	.400000 .965500	.40000 .921400	.800000 .853800	.162020 .982682	.6000 .9104
		. 301500	• 909900	• 721480	• 622080	992802	• 31 8 4
	6	500000	500000	-1.000000	-1.000000	086851	7500
		.400000	0.00000	0.00000	. 480000	.05210€	.2000
		.965500	.986000	.942800	.921400	. 994858	• 95 39
٠	7	500000	500000	- 1.000000	-1.060000	039925	7485
		0.000000	400000	400000	0.000000	379842	1999
		.986000	.800000	.800000	.94280 <b>0</b>	.924189	• 88 2 <b>2</b>
	8	500000 .	500000	-1.000000	-1.090000	0.000000	7500
		400000	800000	800000	400000	447214	6000 <b>0</b>
		.800000	.600000	.60000	. 80000 <b>0</b>	.894427	.7000
	9	500000	560000	-1.000000	-1.000000	0.060000	7500
		800000	-1.200000	-1.200000	800000	447214	-1.0000
		•600000	.480000	.400000	.600000	.894427	. 50 0 01
	10	500000	500000	-1.000000	-1.000000	0.000000	7500
11		-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.4000
		• 400000	.200000	.200000	• 40000 <b>0</b>	.894427	.3000
	11	500000	500000	-1.000000	-1.000000	044855	7413
		-1.600000	-1.972000	-1.885600	-1.600000	519160	-1.7647
		.208800	0.000000	0.00000	. 20000 <b>0</b>	.853499	.1002
	12	500000	500000	- 1. 000000	-1.000000	153543	7433
		-1.972000	-1.850000	-1.785000	-1.885630	934141	-1.8741
		0.00000	341500	303900	0.00000	322188	161 <b>6</b>
	13	500000	500000	- 1.000000	-1.000000	132740	7473
		-1.850000	-1.585000	-1.540000	-1.785000	683173	-1.6302
		341506	586600	544000	303900	718091	4442
	14	500000	500000	- 1.000000	-1.000000	198809	7477
		-1.585000	-1.19 5000	-1.175000	-1.540000	457325	-1.3738
		5866 <b>00</b>	784480	737400	544000	862618	<b></b> 66 <b>33</b>
	15	500000	500000	-1.000000	-1.000000	095703	7479
		-1.195000	800000	800000	-1.175000	288525	9925
		784400	901200	853800	737400	952677	8193
	16	500000	500000	- 1.000000	-1.000000	089915	7500
		800000	400000	400900	800000	162020	60001
		901200	965500	921400	853800	982682	- 9104

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X Y	NX NY	NP X NP Y	D T
Z	NZ	NP Z	À
800000	089915 .162020	750055 .600009	.8107E-03
85380 <b>0</b>	.982682	•912468	.2035E+00
000000 400000	086851 .052106	750005 -200003	.2238E-03
921400	•994858	• 953924	.2010E+00
0 0 0 0 0 0 0 0 0 0 0 0	039925 379842	748551 199961	.9981E-02
942800	.924189	.882279	•2164E+00
080000 4 <b>0</b> 0000	0.0 C0 000 447214	750000 600000	.3553E-14 .6708E+00
800000	.894427	.706000	•2236E+00
<b>000000</b> <b>80</b> 0000	0.060000 447214	750000 -1.000000	•3553E-14 •6708E+00
<b>60</b> 0000	.894427	. 500000	.2236E+00
<b>50</b> 0000 <b>00</b> 0000	0.000000 447214	750000 -1.400000	.66 E1E-14 .67 08E+00
400000	.894427	.300000	.2236E+00
600000 600000	044855 519160	741375 -1.764760	.1121E-01 .6545E+00
<b>50</b> 6000	.853499	.100234	•1926E+00
000000 885600	153543 934141	743334 -1.874150	.1969E-02
00000	322188	161626	•1727E+00
000000 785000	132740 683173	747389 -1.690281	.2518E-02
<b>30</b> 3900	718091	44 4215	.1776E+00
<b>900000</b> 540000	108809 457325	747752 -1.373892	•1887E-02 •6640E+00
544000	882618	66 33 04	.2139E+00
<b>00</b> 0000	095703	747958 003573	-1347E-02
175000 737400	288 525 952677	992572 819383	.6461E+00 .2021E+00
00000	089915	750055 - 600000	.8107E-03
00000 53800	162020 982682	600009 910468	•2035E+00

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1	PRO:	GRAM P	зохс	AT to	OSPHERIC SCI BEDFORD, MA	ENCE ASSOCIATE	ES	PAGE
	BODY ID. TEST			TEST	-			
	N	М	×	×	X	×	NX	NP X
			Y	Y	. Y	Y	NY	NP Y
			Z	Z	Z .	Z	NZ	NP Z
	5	17	500000	500000	-1.000000	-1.000000	086851	750005
			400000	0.000000	0.000000	400000	052106	200003
			96550 <b>0</b>	986000	942800	921400	994858	953924
		18	500000	500000	-1.000000	-1.000000	086851	750005
			0.000000	. 400000	.400000	0.00000	.052106	.200003
			986000	965500	921400	942800	994858	953924
		19	500000	500000	- 1.008000	-1.000000	089915	750055
		• -	.400000	.800000	.800000	.490000	.162020	.600009
			965500	901200	853800	921400	982682	910468
		20	500000	500000	-1.000000	-1.000000	095703	747958
			.800000	1.195000	1.175000	.800008	.288525	• 99 25 72
			901200	78 44 OC	737400	853800	952677	819383
		21	500000	500000	-1.000000	-1.000000	108809	747752
		•	1.195000	1.585000	1.540000	1.175000	• 457325	1.373892
			784400	5866 <b>00</b>	544000	737400	882618	663304
		22	500000	500000	-1.000000	-1.000000	132740	747389
12			1.585000	1.850000	1.785000	1.540000	.683173	1.690281
			586600	341500	303900	544000	718091	444215
		23	500000	500000	-1.000000	-1.000000	153543	743334
			1.850000	1.972000	1.885600	1.785000	.934141	1.874150
			341500	0.000000	0.00000	303900	322188	161626
	6	1.	-1.000000	-1.000000	-1.500000	-1.500000	268347	-1.229655
			1.885600	1.785000	1.670000	1.732000	.921489	1.773614
			0.000000,	. 36 3900	•2297 <b>00</b>	0.00000	.280799	. 13 49 12
		2	-1.000000	-1.000000	-1.500000	-1.500000	239065	-1,245329
			1.785000	1.540000	1.460000	1.670000	.702123	1. £1 46 91
			.303900	• 544000	• 46590 <b>0</b>	.229700	.670724	• <b>3</b> 8 65 55
		3	-1.000000	-1.000000	-1.500000	-1.500000	194936	-1.245068
			1.540000	1.175000	1.149000	1:460000	•475316	1.329324
			•544000	.737400	.652000	• 465900	.857948	.600627

-1.500000

-1.500000

.800000

.768100

.480000

.842600

-1.500000

-1.500000

1.140000

. 652000

.800000

.768100

-1.245783

-1.250120 .600034

. 97 90 04

.753512

.846449

-.170981

.304683

.936981

-.159881

.172638

.971923

-1.0000000

-1 . 00 0000

.800000

.853800

. 400000

.921400

-1.000000

-1.000000

1.175000

.737400

.800000

.853800

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D'	~
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°. <b>X</b>	X	. NX	NPX	<u>o</u> .
Y Z	Y Z	. NY	NP Y NP Z	T A
<b>.</b> .	<b>~</b>	NZ	NF Z	A
- 1.000000	-1.000000	086851	750005	.2238E-03
0.000000	400000	052106	200003	.6436E+00
942800	921400	994858	953924	.2010E+00
-1.000000	-1.000000	086851	750005	.2236E-03
• 400000	0.600000	.052106	. 200003	.6436E+00
921400	942800	994858	953924	.2010E+00
- 1.085000	-1.000000	089915	750055	.8107E-03
.800000	.400000	.162020	.600009	.65 0 0E+00
853800	921400	982682	910468	.2035E+00
				•
-1.000000	-1.000000	095703	747958	•1347E-02
1.175000	.800000	.288525	• 99 25 72	•6461E+00
737400	85380 <b>0</b>	952677	819383	.2021E+00
- 1.000000	-1.000000	108809	747752	.1887E-02
1.540000	1.175000	• 457325	1.373892	.66 40E+ 00
544000	737400	882618	663304	.2139E+00
	0.0.00		• • • • • • • • • • • • • • • • • • • •	
-1.000000	-1.000000	132740	747389	-2518E-02
1.785000	1.540000	.683173	1.690281	.6222E+00
303900	544000	718091	444215	.1776E+00
4 00000	4 000000	, 4 5 7 5 7	71 7771	40605 00
-1.000000 1.885600	-1.000000 1.785000	153543 .934141	743334 1.874150	•1969E-02 •6143E+00
0.000000	303900	322188	161626	.1727E+00
		***************************************		
-1.500000	-1.500000	268347	-1.229655	.3684E-02
1.670000	1.732000	•921489	1.773614	.5910E+00
•229700	0.00000	.280799	. 13 49 12	•1448E+00
4 - 222	4 -00000	070065	4 01 5700	E4 0 0 E 0 O
-1.500000	-1.500000 1.670000	239065	-1.245329	•5490E-02
# 1.400000 # 465000	.229700	•702123 •670724	1. £1 46 91 . 38 65 55	•6180E+00 •1696E+00
• 402380	8223700	4074724	• JU 0777	110301.40
1.500000	-1.500000	194936	-1.245068	.3782E-82
1.140000	1.460000	.475316	1.329324	.6494E+00
•652 <b>000</b>	. 465900	.857948	.600627	.1996E+00
1.500000	-1.500000	170981	-1.245783	.2596E-02
760400	1.140000 .652000	•3 <b>0</b> 468 <b>3</b> •936981	• 97 90 0 4 • 75 35 1 2	.6374E+00
1.460000 .465900 1.500000 1.140000 .652000 .800000 .768100 .768100 .400000 .842600	• 07 6 8 8 9	• 200 20 T	• 123277	•1908E+00
1.500000	-1.500000	159881	-1.250120	.1677E-02
.400000	.800000	.172638	.600034	.6584E+00
·842600	.768100	.971923	.846449	.2058E+00

PRO	GRAM	PBOXC	ATM	OSPHERIC SGIS	ENCE ASSOCIATE	ES	PAGE
В0	DY I	TEST		CLOI OND III.	JOHO!!OOLI (O		, 405
			TEST	B0 <b>D Y</b>	•		
N	M	X	X	X	X	NX	NPX
		Y	Y	Y Z	Y	NY	NP Y
		Z	Z	Z	Z	NZ	NP Z
6	6	-1.000000	-1.000000	-1.500000	-1.500000	153515	-1.250012
		.400000	0.000000	0.00000	. 400000	•055250	.200018
		.921400	• 942800	.866 <b>000</b>	·842600	.986601	.893198
	7	-1.000000	-1.000000	-1.500000	-1.500000	074106	-1.248100
		0.000000	400000	400000	9.090000	251846	199835
		•942800	.800000	.800000	.866000	•964926	.852389
	8	-1.000000	-1.000000	- 1.500000	-1.500000	0.00000	-1.250000
		400000	800000	800000	400000	447214	600000
		.800000	.600000	.600000	.800000	.894427	.700000
	9	-1.000000	-1.000000	-1.500000	-1.500000	0.060000	-1.250000
		800000	-1.200000	-1.200000	600000	447214	-1.000000
		.600000	.400000	.400000	.600000	•894427	• 50 G G Ü G
	13	-1.000000	-1.000000	-1.500000	-1.500000	0.000000	-1.250000
		-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.400000
		.400000	. 200000	· 20000 <b>0</b>	. 400000	.894427	.300000
	11	-1.000000	-1.000000	-1.500000	-1.500000	105654	-1.225923
13		-1.600000	-1.885600	-1.732000	-1.600000	687853	-1.707445
		·2000 <b>0</b> 0	0.000000	0.00000	.20000	.718119	. 100626
	12	-1.000000	-1.000000	-1.500000	-1.500000	268347	-1.229655
		-1.885600	-1.785000	-1.670000	-1.732000	921489	-1. 77 3614
		0.00000	-•.303900	229700	0.00000	280799	134912
	13	-1.000000	-1.060000	- 1.500000	-1.500000	239065	-1.245329
		-1.785000	-1.540000	-1.460000	-1.670000	702123	-1.614691
		303906	544000	465900	22970 <b>0</b>	670724	386555
	14	-1.000000	-1.060000	-1.500000	-1.500000	194936	-1.245068
		-1.540000	-1.175000	-1.140000	-1.460000	475316	-1.329324
		544000	737400	652000	465900	857948	600627
	15	-1.000000	~1.000000	-1.500000	-1.500000	170981	-1.245783
		-1.175000	803000	800000	-1.140000	304683	979004
		737400	853800	768100	652000	936981	753512
	16	-1.000000	-1.000000	-1.500000	-1.500000	159881	-1.250120
		800000	40 00 00	400000	800000	172638	600034
		853800	921400	842600	768100	971923	846449

-1.500000 0.000000

-.866000

-1.500000

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-. 842600

-1.250012 -.200010 -.893198

-.153515 -.055250

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-1.000000 0.000000

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-1.000000

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-.921400

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	X	X	NX	NP X	D
	Y	Y	NY	NP Y	T
	Ž	Z	NZ	NP Z	A
00	-1.500000	-1.590000	153515	-1.250012	.4933E-03
00	0.000000	.400000	-055250	.200010	.6481E+00
00	.866000	.842600	-986601	.893198	.2027E+00
100	-1.500000	-1.500000	074106	-1.248100	.1853E-01
100	400000	9.00000	251846	199835	.6560E+00
100	.800000	.866000	.964926	.852389	.2073E+00
00	- 1.500000	-1.500000	0.00000	-1.250000	.3553E+14
00	800000	400000	447214	680000	.6708E+00
00	.600000	.80000	.894427	.700000	.2236E+00
00 00	-1.500000 -1.200000 .400000	-1.500000 600000	0.000000 447214 .894427	-1.250000 -1.000000 .500000	.3553E-14 .6708E+00 .2236E+00
00	-1.500000	-1.500000	0.000000	-1.250000	.6661E-14
00	-1.600000	-1.200000	447214	-1.400000	.6708E+00
00	-200000	.400000	.894427	.300000	.2236E+00
00 00	-1.500000 -1.732000 0.000000	-1.500000 -1.600000 .200000	105654 687853 .718119	-1.225923 -1.707445 .100626	.2641E-01 .6096E+00 .1454E+00
00	-1.500000	-1.500000	268347	-1.229655	.3684E-02
00	-1.670000	-1.732000	921489	-1.773614	.5910E+00
100	229700	0.000000	280799	134912	.1448E+00
0 0 0 0 0	-1.500000 -1.460000 465900	-1.500000 -1.670000 229700	239065 702123 670724	-1.245329 -1.614691 386555	•5490E-02 •61
000	-1.500000	-1.500000	194936	-1.245063	•378 2E- 02
	-1.140000	-1.460000	475316	-1.329324	•6494E+ 00
	652000	465900	857948	600627	•1996E+ 00
0 0 0 0 0 0	-1.500000 800000 768100	-1.500000 -1.140000 652000	170981 304683 936981	-1.245783 979004 753512	.2596E-02 .6374E+00 .1908E+00
000 000 000 <b>000 000</b>	-1.500000 400000 842600	-1.500000 800000 768100	159881 172638 971923	-1.250120 600034 846449	.1677E-02 .6584E+00 .2058E+00
000	-1.500000	-1.500000	153515	-1.250012	.4933E-03
	0.00000	40000	055250	20010	.6461E+00
	866000	842600	986601	893193	.2027E+00

#### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

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				TEST 1	30 DY			
	N	М	×	×	x	X	NX	NP X
	.,	• •	Ŷ	Ŷ	Ŷ	Ŷ	NY	NP Y
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			<b>-</b>	~	_	٠,	14 4	145 4
	6	18	-1.000000	-1.080000	- 1.500000	-1.500000	153515	-1.250012
			0.000000	.400000	.480000	0.00000	.055250	-200010
			942800	921400	842600	866000	986601	893198
		19	-1.000000	-1.066000	-1.500000	-1.500000	159881	-1.250120
			.400000	.800000	.880000	. 400000	.172638	.600034
			921480	853800	768100	842600	971923	846449
		20	-1.000000	-1.000000	-1.500000	-1.500000	170981	-1.245783
			.800000	1.175000	1.140000	.800000	•304683	• 97 9 0 û 4 🖠
			853800	737400	652000	768100	936981	753512
		21	-1.000000	-1.000000	-1.500000	-1.500000	194936	-1.245068
			1.175000	1.540000	1.460000	1.140000	.475316	1.329324
			737400	544000	465900	652000	857948	600627
							7.5	
		22	-1.000000	-1.090000	-1.500000	-1.500000	239065	-1.245329
			1.540000	1.785000	1.670000	1.460000	.792123	1. 61 46 91
_			544000	303900	229700	465900	670724	<b></b> 38 65 55 ∫
14		23	-1.000000	-1.000000	-1.500000	-1.500000	268347	-1 • 229655
			1.785000	1.885600	1.732000	1.670000	.921489	1. 77 3614
			303900	0.000000	0.00000	229700	280799	134912
	7	1	-1.500000	-1.500000	-2.000000	-2.000000	414479	-1. 699678
	•	_	1.732000	1.670000	1.465000	1.490700	•8852 <b>0</b> 2	1.611865
			0.000000	229700	.137800	0.000000	.211244	.096576
		_		·	· · · · · ·			
		2	-1. *4009	-1.500000	-2.300000	-2.000000	372374	-1.733772
			1.6 800	1.460000	1.322000	1.465000	.725701	1.484752
			.229700	.465900	. 3 4440 0	.137800	• 578529	• 297994
		3	-1.500000	-1.500000	-2.000000	-2.000000	310024	-1.738932
			1.469000	1.140000	1.072000	1.322000	.507279	1.250730
			.465900	• 65 2000	.517900	.344400	.804085	• 497910
		4	-1.500000	-1.500000	-2.000000	-2.000000	269527	-1. 738266
			1.140000	.800000	.800000	1.072000	.335023	. 954054
			•652 <b>000</b>	•76 8100	•628900	•51790 <b>0</b>	.902837	. 644837
		5	-1.500000	-1.500000	-2.000000	-2.000000	250229	-1.750276
		-	.800000	.400000	.400000	.800000	193980	600104
			.768100	.842600	.718000	.628900	• 948555	.739306
		_						· · · · · · · · · · · · · · · · · · ·
		6	-1.500000	-1.500000	- 1.000000	-2.00000	237694	-1.750025
			.400000	0.000000	0.000000	.400000	.061556	.200030
			.842600	.866000	.745400	.718000	• 969388	• 792992

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	X	X	NX	NP X	O
	Y,	Y	NY	NPY	Ţ
•	Z	Z .	۶żZ	NP Z	Ä
3000	- 1.500000	-1.500000	153515	-1.250012	•4933E-03
000	.400000	0.00000	.055250	200010	.6481E+00
L400	842600	866000	986601	893198	.2027E+00
000	-1.500000	-1.500000	<u>1</u> 59881	-1.250120	•1677E-02
0000	.800000	. 400000	.172638	.600034	.6584E+00
008	768100	842600	971923	· <b></b> 846449	.2058E+00
000	-1.500000	-1.500000	170981	-1 2/5797	25065-02
5000	1.140000	.800000		-1.245783 .979004	.2596E-02
400	652000	768100	•304683 ••936981	753512	.6374E+00
		********	***********	- 190916	*120CC400
1000	-1.500000	-1.500000	194936	-1.245068	.3782E-02
000	1.460000	1.140000	• 475316	1.329324	•6494E+00
000	465900	652000	857948	600627	•1996E+80
000	-1.500000	-1.500000	239865	-1.245329	.5490E-02
000	1.670000	1.460000	.792123	1. 61 46 91	•6180E+08
900	229700	465900	670724	<del>-</del> . 38 65 55	•1696E+00
000	-1.500000	-1.500000	268347	-1.229655	-36845-82
600	1.732000	1.670000	•921489	1. 77 3614	.5910E+00
000	0.00000	229700	288799	134912	.1448E+00
000	-2.000000	-2.000000	414479	-1. 699678	.3180E-02
000	1.465000	1.490700	·8852 <b>0</b> 2	1.611865	.5833E+00
700	.137800	0.000000	.211844	.096576	.1038E+00
000	-2.000000	-2.000000	372374	-1.733772	.7874E-02
000	1.322000	1.465000	.725701	1.48 4752	.6199E+00
900	.344400	.137800	.578529	. 297994	•1525E+00
000	-2.000000	-2.000000	310024	-1.738932	.6345E-82
<b>00</b> 0	1.072000	1.322000	.507279	1.250730	.6350E+00
800	.517900	.344400	.864085	. 497910	•1772E+00
000	-2.000000	-2.000000	269527	-1. 738266	•4544E-02
000	.800000	1.072000	.335023	954054	.6218E+00
100	•628900	• 51790°O	.902837	. 644837	.1695E+00
000	-2.000000	-2.000000	250229	-1.750276	.34 E2E-02
000	.400000	.800000	.193980	.600104	.67 50 E+00
600	.718000	.628900	• 948 555	.739306	.2108E+00
000	- 2.000000	-2.000000	237694	-1.750025	•9694E-03
000	0.00000	. 400000	.061556	200030	.6572E+40
000	.745400	.718000	.969388	.792992	.2063E+00

PROGRAM PBOXC

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## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

#### TEST BODY

			TEST	BODY	•		
N	М	×	x	x	X	NX	N > X
:		Y	Y	7	Υ .	NY	NP Y
		Z	<b>Z</b> .	Z	· Z	NZ	NP Z
7	7	-1.500000	-1.500000	-2.800000	-2.000000	197278	-1.7495
		0.000000	400000	400000	0.000000	113683	1997
		.86600D	-800000	.718000	.745400	•973734	.7824
	8	-1.500000	-1.500000	-2.000000	-2.000000	075980	-1.7473
		400000	800000	800000	400000	368319	59 98
		.800000	• 60 0000	.60000	.718000	,926589	. 67 97
	9	-1.500000	-1.500000	-2.000000	-2.000000	0.660000	-1.7500
		890000	-1.200000	-1.200000	800000	447214	-1.0000
		•600000	• 400000	.400000	.600000	.894427	• 55 0 0 <b>0</b>
	10	-1.500000	-1.500000	- :.000000	-2.00000 <b>0</b>	050829	-1.72040
		-1.200000	-1.6000GB	-1.400000	-1.200000	496741	-1.35282
		.400000	. 200000	.256000	.400000	.866499	.31411
	11	-1.500000	-1.500000	- 2.000000	-2.000000	348626	-1.76253
		-1.600000	-1.732000	-1.490700	-1.400000	842191	-1.55051
		.200000	0.000000	0.00000	.256000	.411307	. 11 394
15	12	-1.500000	-1.500000	- 2.000000	-2.000000	414479	-1.69967
		-1.732000	-1.670000	-1.465000	-1.490700	885202	-1.61186
		0.000000	229700	137800	0.00000	211244	09657
	13	-1.500000	-1.500000	-2.000000	-2.000000	372374	-1.73377
•		-1.670000	-1.460000	-1.322000	-1.465000	725701	-1 - 48 47 5
		229700	<b>-•465900</b>	344400	137800	578529	29799
	14	-1.500000	-1.500000	-2.000000	-2.000000	310024	-1.73893
		-1.460000	-1.140000	-1.072000	-1.322000	507279	-1.25 <b>073</b>
		465900	- 65 2000	517900	344480	844085	49791
	15	-1.500000	-1.500000	- 2.000000	-2.000000	269527	-1.73826
		-1.146000	800000	800000	-1.072000	335023	95 40 5
		652000	768100	628900	517900	902837	64483
	16	-1.500000	-1.500000	- 2.000000	-2.000000	250229	-1.75027
		-, 800000	400000	400000	800000	193980	60010
		7681 <b>00</b>	842600	718000	628900	948555	739 <b>30</b>
	17	-1.500000	-1.500000	-2.000000	-2.000000	237694	-1.75002
		400000	0.000000	0.000000	406000	061556	20003
		842600	-,866000	745400	718000	969388	79299
	18	-1.500000	-1.500000	-2.00000	-2.000000	237694	-1.75002
		0.000000	• 400000	.400000	0.00000	.061556	. 20003
		866000	842600	718000	745400	969388	79299

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Y	Ÿ	NY	NPY	Ť
Z	Z	NZ	NP Z	Ä
00000	-2.000000	197278	-1.749550	•9397E-ú2
00000	0.000000	113683	199759	.6572E+00
18000	•745400	•973734	.782469	.2054E+Ü0
00000	-2.000000	075980	-1.747311	.1900E-01
00000	400000	368319	59 9857	•6708E+00
© 0 0 0 0	.718000	•926589	• 67 97 77	•21 58 E+00
00000	-2.000000	0.000000	-1.750000	•3553E-14
<b>00000</b>	836000	447214	-1.000006	•6708E+00
••••	•60000 <b>0</b>	•894427	• 50 0 0 0 0	•2236E+00
00000	-2.00000 <b>0</b>	050829	-1.720409	.1271E-01
00000	-1.200000	496741	-1.352829	.6708E+00
56000	. 400000	.866419	.314114	.1731E+00
<b>០</b> ០០០០	-2.600060	348626	-1.762537	•1445E-81
90700	-1.400000	842191	-1.550513	•6525E <b>+0</b> 0
00000	.256 <b>000</b>	·411307	. 11 39 43	•1354E+00
00000	-2.000000	414479	-1.699678	93180E-02
55000	-1.496700	885282	-1.611865	• 5033E+00
37800	8.000000	211244	196576	.1038E+60
00000	-2.000000	372374	-1.733772	.7874E-02
22000	-1.465000	725701	-1.484752	•6199E+00
4408	137800	578529	297994	•1525E+ (U
9000	-2.000000	310024	-1.738932	.6345E-02
2000	-1.322000	507279	-1.250730	.6350E+00
7900	344400	844985	497910	•1772E+00
0000	-2.000000	269527	-1.738266	.4544E-02
0000	-1.072000	335023	95 40 54	.6218E+00
8900	5179 <b>80</b>	902837	544837	•1695E+00
0000	-2.000000	250229	-1.758276	.34 EZE- 82
<b>5000</b> 6	800000	193980	600104	.6750E+00
8000	628900	948555	739306	•2108E+00
0000	-2.000000	237694	-1.750025	.9694E-03
0000	400000	061556	200030	.6572E+0D
5400	71800 <b>0</b>	969388	792992	.2063E+00
0000	-2.000000	237694	-1.750025	•9694E-03
0000	0.000000	.061556	.200030	.6572E+00
8000	745400	969388	792992	•2063E+00
part .				

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PROGRAM PBOXC

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#### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

TEST BODY

	N	M	X	x	X	X	NX	NP
			Y	Y	Y	Y	NY	NP
			Z	Z	Z	Z	NZ	NP
	7	19	-1.500000	-1.500000	-2.000000	-2.000000	250229	-1.75
			.40000C	.800000	.820000	.400000	.193980	• 60 <b>9</b>
			842600	768100	628900	718000	948555	739
		20	-1.500000	-1.500000	- :. 0 0 0 0 0 0	-2.000000	269527	-1.738
			.800000	1.140000	1.072000	.8000 <b>00</b>	.335023	• 95 📳
			768100	652000	517900	628900	902837	644
		21	-1.500000	-1.500000	- 2.000000	-2.000000	310024	-1.738
			1.140000	1.460000	1.322000	1.072000	.507279	1.250
			<b></b> 652 <b>00</b> 0	465900	344400	517900	804085	497
		22	-1.500000	-1.500000	-2.000000	-2.000000	372374	-1.733
			1.460000	1.670000	1.465000	1.322000	.725701	1. 48 🛂
			465900	229700	137800	~.34440 <b>0</b>	578529	297
		23	-1.500000	-1.500000	-2.000000	- 2. 000000	414479	-1.699
			1.670000	1.732000	1.490700	1.465000	.885202	1.611
			229700	0.000000	0.00000	137800	211244	096
			****	*****		*****	# * *	
16	8	1	-2.000000	-2.000000	- 2.5 00 00 0	-2.500000	597981	-2.2180
			1.490700	1.322000	1.000000	1.055000	.747834	1.2407
			0.000000	.344400	.235700	0,000000	- 288 38 2	. 149
		2	-2.000000	-2.000000	-2.560000	-2.500000	425912	-2.2144
			1.322000	.800000	.800400	1.000000	.463200	.9902
			.344400	628900	.381500	.235700	.777203	.4112
		3	-2.000000	-2.000000	-2.500000	-2.500000	397801	-2.2509
			.800000	.400000	.400008	.800000	.246251	. 6003
			.628900	.718000	•515300	.381500	.883807	• 5603
		4	-2.000000	-2.060000	- 2.500000	-2.500000	366809	-2.2500
			.400000	0.000000	0.00000	. 40000 <b>0</b>	.075569	2001
			.718000	. 745700	•55280 <b>0</b>	•515300	.927222	• 63 29
		5	-2.000000	-2.000000	-2.500000	-2.500000	366809	-2.2500
			0.000000	400000	400000	0.000000	075569	20 0 1
			.745700	.71 8000	.515300	.552800	.927222	6329
		6	-2.000000	-2.000000	-2.500000	-2.500000	372805	-2.2503
			400000	800000	800000	400000	278586	6001
			.718000	.600000	.381500	.515300	.885102	• 5534

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×	X	X	NX	NPX	Đ
A	Y	Y	NY	NP Y	Ţ
Z	Z	Z	NZ	NP Z	A
.50000n	-2.000000	-2.00000	250229	-1.750276	.34 62E-02
.800000	.820000	.490000	•19398 <b>0</b>	.600104	.6750E+00
.768100	628900	718000	948555	739306	•2188E+00
.500000	- 1.000000	-2.000000	269527	-1.738266	.4544E-02
.140000	1.072000	.8000 <b>0</b> 0	.335023	• 95 40 54	•6218E+00
.652000	517900	628900	902837	644837	•1695E+00
.500000	- 2.000000	-2.030000	310024	-1.738932	.6345E-02
• 460000	1.322000	1.072000	.507279	1.250730	.6350E+00
• 46 5900	344400	51 <b>7</b> 90 <b>0</b>	804085	497918	.1772E+00
• 5 <b>0</b> 0000	-2.000000	-2.000000	372374	-1.733772	.7874E-02
.670000	1.465000	1.322000	.725701	1. 48 4752	.6199E+00
229700	137800	344400	578529	297994	•1525E+80
-50 0000	-2.000000	-2.000000	414479	-1.699678	.3180E-02
732000	1.490700	1.465000	.885202	1.611865	• 58 33 E+ 00
• <b>00</b> 6000	0.00000	137800	211244	09 6576	.1038E+00
****		* * * * * * * * * * * * * * * * * * * *	***	***	*****
<b>. 00</b> 3000	- 2.500000	-2.50000 <b>0</b>	597981	-2.218024	.1342E-01
322000	1.000000	1.055000	•747834	1.240723	.7391E+00
344400	.235700	0.000000	· 288 38 <b>2</b>	• 149617	.1939E+00
<b>00</b> 00000	-2.560000	-2.500000	425912	-2.214445	•1834E-01
800000	.800000	1.000000	• 463200	•990269	•7238E+00
62 8900	.381500	.235700	.777203	•411287	•2322E+00
000000	-2.500000	-2.500000	397801	-2.250969	.9877E-02
400000	.400000	.800000	246251	.600392	.7233E+00
71 8000	.515300	. 38150 <b>0</b>	.883807	. 560379	.22 €3E+00
000000	- 2.500000	-2.500000	366809	-2.250072	.2272E-02
000000	0.000000	• 48000 <b>0</b>	.075569	.200101	.6805E+00
745700	•552800	•515300	.927222	.632913	.2157E+00
<b>06</b> 0000	-2.500000	-2.500000	366809	-2.250072	•2272E-02
40 0000	400000	0.00000	075569	200101	-68 05E+00
71 8000	.515300	•55280 <b>0</b>	927222	.632913	•2157E+00
000000	-2.500000	-2.500000	372805	-2.250383	•3496E-02
800000	800000	400060	278586	600126	.7233E+00
eocooó	.381500	.515300	.885102	• 553499	.2260E+00

PRO	GRAM	PB OXC	ATM	OSPHERIC SCI BEDFORD, MA	ENCE ASSOCIATE	ES -	PAGE	16
80	DY I	. TEST	TEST	•			FAGE	10
N	6.4				v	N/M	Meso	
IN	М	X	X Y	X	X	NX	NP X	ų.
		Y Z	Z	Υ Z	Y Z	NY NZ	NP Y NP Z	
8	7	-2.000000	-2.300000	-2.500000	-2.500000	396212	- 2. 21 8355	
		800000	-1.200000	-1.000000	800000	-•458473	956945	4
		•600000	• 486000	.235700	.381500	•795499	• 41 60 59	
	8	-2.000000	-2.000000	-2.500000	-2.500000	537231	-2.212088	1
		-1.200000	-1.490700	-1.055000	-1.000000	740960	-1.209729	
		.400000	0.00000	0.00000	.235700	.402941	• 166619	
	9	-2.000000	-2.0000000	-2.500000	-2.500000	597981	-2.218024	
		-1.490700	-1.322000	-1.000000	-1.055000	747834	-1.240723	
		0.00000	344400	235700	0.00000	288382	149617	, 1
	10	-2.000000	-2.000000	-2.500000	-2.500000	425912	-2.214445	<i>!</i>
		-1.322000	800000	800000	-1.800000	463200	990269	
		344400	628900	381500	235700	777203	411287	
	11	-2.000000	-2.000000	- 1.500000	-2.500000	397801	-2.250969	
		800000	400000	400000	800000	246251	600392	
		628900	718000	515300	381500	883607	560379	
	12	-2.000000	-2.000000	- 2.500000	-2.500000	366578	-2.250074	
17		490000 71000	0.000000 - 765600	0.000000	406000	075231	200104	
		718800	745400	55280 <b>0</b>	515300	927341	-• 63 28 37	
	13	-2.000000	-2.000000	-2.500000	-2.500000	366578	-2.250074	
		0.000000	.400000	.400000	0.00000	.075231	-200104	
		745400	71 8000	5153ûû	55280 <b>0</b>	927341	632837	
	14	-2.000000	-2.000000	-2.500000	-2.500000	397801	-2.250969	
		• 400 <b>0</b> 00	-800000	.800000	. 400000	.246251	.600392	
		718000	- 62 8900	381500	515300	883807	560379	
	15	-2.000000	-2.000000	-2.500000	-2.500000	425912	-2.214445	
		-83000C	1.322000	1.000000	.800000	.463200	•990269	
		-•628 <b>90</b> 0	344400	235700	381500	777203	411287	
	16	-2.000000	-2.000000	- 2.500000	-2.500000	597981	-2.218024	
		1.322000	1.490700	1.055000	1.000000	•747834	1.240723	
		344400	0.000000	0.00000	23570 <b>0</b>	288382	149617	
		****	****		****	***	***	****
9	1	-2.500000	-2.500000	-3.000000	-3.000000	868756	-2.626833	0
•		1.055000	.800000	0.000000	0.00000	.411,733	63 7692	U
		0.000000	.381500	0.000000	0.00000	.275208		

X	X	NX	NPX	D
Ÿ	Ϋ́	NY	NPY	Ť
Ż	ž	NZ	NP Z	À
7	-	112	14, =	•
00000	-2.500000	396212	- 2. 21 8355	.1214E-01
00000	800000	458473	- 956945	•6502E+00
35700	.381500	795499	• 41 60 59	•1886E+00
		• • • • • • • • • • • • • • • • • • • •	0 12 00 00	120002100
00000	-2.500000	537231	-2.212088	.2711E-01
55000	-1.000000	740960	-1.209729	.7391E+00
00000	.235700	.402941	.166619	•2145E+00
[ .				-
00000	-2.500000	597981	-2.218024	.1342E-81
00000	-1.055000	747834	-1.240723	.7391E+00
35700	0.00000	- • 288 382	-•149617	.1939E+00
	•			
00000	-2.500000	425912	-2.214445	.1034E-01
00000	-1.600000	463200	990269	.7238E+80
81500	235700	777203	411287	.2322E+00
<b>000</b> 00	-2.500000	397801	-2.250969	•9877E-02
<b>9000</b> 0	800000	246251	600392	•7233E+00
15300	381500	883807	560379	• 22 E 3 E + 10
00000	-2.500000	366578	-2.250074	•2342E-02
00000	400000	075231	200104	•68û4E+00
52800	515300	927341	- 63 28 37	.2157E+00
<b>B B B B B B B B B B</b>	-2.500000	366578	-2.250074	.2342E-02
00000	0.000000	.075231	.200104	.6804E+00
15300	55280 <b>0</b>	927341	<b>-</b> . 63 28 3 <b>7</b>	•2157E+00
		707054	-0.0560.60	00777 00
	-2.500000	397881	-2.250969	•9877E-82
<b>90</b> 000 <b>61</b> 500	. 40900 <b>0</b>	•246251	•600392 - 560339	.7233E+00
DIDUU	515300	883807	560379	•22 E3E+00
0000	-2.500000	- //2504.2	-2 24 1.7.1.5	4 7 7 1 5 - 64
0000	-2.50000 -800000	425912 .463200	-2•214445 "990269	*1034E-01 *7238E+00
	381500	777203	411287	.2322E+00
<b>8</b> 5700	• G G T D <b>G</b>	- 4/// 203	-6477501	023225700
00000	-2.500000	597981	-2.218024	•1342E-01
5000	1.000000	•747834	1.240723	•7391E+00
0000	235700	288382	149617	•1939E+00
	450714A	450000	V & T > V & F	#2303E+8U
	*****	· * *	***	******
0000	-3,000000	868756	-2.626833	0 •
0000	0.00000	.411733	. 68 7692	•11 67E+01
0000	0.00000	.275208	. 149145	.2316E+00
M				

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# ATMOSPHERIC SGIENCE ASSOCIATES EEDFORD, MASSACHUSETTS

BODY	ID.	TEST

#### TEST BODY

			1531	RUUT			
N	M	X	×	X	X	NX	NP X
		Y Z	Y Z	Y Z	Y Z	NY NZ	NP Y NP Z
9	2	-2.500000	-2.500000	-3.000000	-3.000000	776209	-2.629
		.800000 .381500	• 40 0 0 0 0 • 51 53 0 0	0.00000 0.00000	0.00000 0.00000	•200002 •597912	• 43 4: • 33 6:
	3	-2.590000	-2.500000	-3.000000	-3.00000	740175	-2.6354
		.400000 .515300	0.000000 .552800	0.00000 0.00000	0.00000	•062764 •669478	• 141 • 389
	4	-2.500000	-2.500000	-3.00000	-3.00000	740175	-2.635
		0.000000 .552800	400000 -515300	0.00000 0.00000	0.00000 0.00000	062764 .669478	-•1414 •389
	5	-2.500000	-2.500000	-3.000000	-3.000000	776209	-2.629
		400000 .515300	800000 .381500	0.00000	0.00000 0.00000	200002 .597912	43 43 • 33 6
	6	-2.500000	-2.500000	-3.000000	-3.000000	868756	-2.626
		800000 -381500	-1.055000 0.000000	0.00000	0.00000 0.00000	411733 .275208	687 .149
18	7	-2.500000	-2.500000	-3.000000	-3.000000	868756	-2 • 62 <b>6</b>
		-1.055000 0.00000	800000 381500	0.00000	0.00000 0.00000	411733 275208	687 149
	В	-2.500000	-2.500000	-3.000080	-3.000000	776209	-2.629
		800000 381500	-•400000 -•515300	0.000000	0.00000	200002 597912	- • 43 4 - • 33 6
	9	-2.500000	-2.500000	-3.000000	-3.000000	740175	-2 • 63 \$
		400000 515300	0.000000 552800	0.00000	9.00000	062764 669478	- • 141 - • 38 g
	10	-2.500000 0.00000	-2.500000 .400000	000000.5-	-3.000000	740175	-2.63
		55280 <b>0</b>	515300	0.000000	0.00000 0.00000	•062764 ••669478	• 14 •• 38
	11	-2.500000 .400000	-2.500000 .800000	000000.5- 000000.0	000000.E-	776209 .2 <b>00</b> 002	- 2 · 62 • 43
		515300	38 1500	0.00000	0.00000	597912	33
	12	-2.500000 .800000	-2.500000 1.055000	000000.0 000000.0	000000.5° 0000000	868756 .411733	≎2•6 <b>2</b> •68
		381500	0.000000	0.00000	0.00000	275208	14
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A	S	S	0	C	I	AT	ES
11	S	F	T	T	S		

PAGE 17

X	ИX	NP X	ם
Y	NY	NPY	Ŧ
Z	NZ	NP Z	A
000000	776209	-2.629150	.1332E-14
000000	.200002	. 43 41 70	.1018E+01
000000	.597912	. 336208	-1672E+00
#			
600000	740175	-2.635472	• 2220E- 15
000000	•062764	• 141262	.8219E+00
000000	• 669478	. 38 97 79	.1494E+00
F			
000000	740175	-2.635472	.3053E-15
000000	062764	141262	.8219E+00
000000	•669478	. 38 9779	.1494E+00
000000	776209	-2.629150	•11 10E-14
.000000	200002	43 41 70	.1018E+01
000000	•597912	• 336298	•1672E+00
) 			
000000	868756	-2.626833	.8882E-15
000000	411733	687692	.1167E+01
000000	·275208	• 149145	.2316E+00
.000000	868756	-2 • 62 68 33	0 •
000000	<b>411733</b>	687692	•1167E+01
.000000	275208	149145	.2316E+00
000000	776209	-2.629150	.1332E-14
600000	200002	434170	•1018E+01
600000	597912	336208	.1672E+00
600000	740175	-2.635472	.2220E-15
000000	062764	141262	.8219E+00
. 000000	669478	389779	-1494E+00
000000	740175	-2.635472	.3053E-15
-000000	.062764	• 141262	.8219E+00
.000000	669478	389779	•1494E+110
	mana mana atau at		
0 60 000	776209	-2.629150	•1110E-14
. 0 0 0 0 0 0	.20002	• 43 41 70	•1018E+01
-000000	597912	3362 <b>ù</b> 8	.1672E+00
000000	0.60 75.6	-0 606033	00005 45
000000	868756	-2.626833	.8882E-15
600000	•411733	. 687692	•1167E+01
• 6 6 6 6 6 6 6	275208	149145	.2316E+00

#### CRT PLOTS

MINIMUM AND MAXIMUM COORDINATES IN THE SCALED, TRANSLATED, RCTATED SYSTEM - X AXIS= -3.00000E+00 2.00000E+00 2.00000E+00 Z AXIS= -1.00000E+00 1.00000E+00

COORDINATE TRANSLATIONS USED TO CENTER THE PLCTS - DELX, DELY, DELZ - AFTER SCALING, TRANSLATING, ROTATING - 5.00000E-01 0.

VIEW OF BODY LOOKING DOWN THE -Y AXIS TOWARD THE ORIGIN 45-DEGREE VIEW FROM THE +X -Y +Z SIDE 45-DEGREE VIEW FROM THE +X -Y -Z SIDE 45-DEGREE VIEW FROM THE -X . -Y +Z SIDE 45-DEGREE VIEW FROM THE -X -Y -Z SIGE VIEW OF BODY LOOKING DOWN THE -Z AXIS TOWARD THE ORIGIN 45-DEGREE VIEW FROM THE -X +Y -Z SIDE 45-DEGREE VIEW FROM THE +X +Y -Z SIDE VIEW OF BODY LOOKING DOWN THE -X AXIS TOWARD THE ORIGIN 45-DEGREE VIEW FROM THE -X +Y +Z SIBE VIEW OF BODY LOOKING DOWN THE \*X AXIS TOWARD THE ORIGIN VIEW OF SODY LOOKING DOWN THE +Y AXIS TOWARD THE ORIGIN VIEW OF BODY LOOKING DOWN THE +Z AXIS TOWARD THE ORIGIN 45-DEGREE VIEW FROM THE +X +Y +Z SIDE

BOXC

PROGRAM BOXC

ATMCSPHERIC SCIENCE ASSOCIATES
BEDFORD, MASSACHUSETTS

PAGE 1

BODY ID. TEST

TEST BODY

INPUT PARAMETERS-

IFLAG= 0 LIST= 0 ISIG= 0 IPRS= 0 MPR= 0

NCODE= 0 NNON= 0 NOFF= 0 KMACH= 0 KTP14= 1

NUMBER OF LEAKY QUADRALATERALS= & FRACTION OF FREE-STREAM VELOCITY LEAKED= 0.

PARAMETRIC INFORMATION

GENERATED UNIFORM FLOWS

X-F\_OW

NO SYMMETRY SPECIFIED

 $\sim$ 

PROGRAM BOXC		ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS						
ŧ	BODY	IO.	TEST	TECT	•	33,101,10361,10		PA
				TEST 1	30 L ¥		•	
ĺ	N I	4	X	X	X	X	NX	NPX =
			<b>Y</b> Z	Y Z	Y Z	Y Z	NY	NPY
			Z	L	<b>Z</b>	<b>Z</b>	NŽ	NP Z
	1	1	2.000000	2.000000	1.500000	1.500000	958086	1, 59 1 3
			0.000000	0.000000	1.670000	1.732000	• 276584	1.3897
			0.900000	0.00000	.229700	0.00000	• <b>67</b> 4655	. 1948
	7	2	2.000000	2.000000	1.500000	1.500000	.941794	1.5983
			0.000000	0.000000	1.460000	1.670300	.251249	1.2540
			0.000000	0.000000	.465900	.229700	.223380	. 28 29
	•	3	2.000000	2.000000	1.500000	1.500000	.915363	1. 60 51
			0.700000	6.506800	1.140000	1.460000	.202414	1.0195
			0.309800	0.000000	•652000	• 4659 <b>00</b>	.348052	• 44 561
	i	4	2.000000	2.000000	1.500000	1.500000	.891771	1.60927
			0.000000	0.600000	.800 <b>00</b> 0	1.140000	•146221	. 7503
			0.000000	0.000000	.768100	.652008	.428210	• 55 74
	!	5	2.009600	2.000000	1.500000	1.500800	.874522	1. 6202
			0.00000	0.000000	.400000	.899990	.088802	. 44790
			0.000000	0.000000	.842680	.76810 <b>0</b>	•476787	.61308
	6	5	2.000000	2.000000	1.580000	1.500000	.865649	1.6248
·2			0.00000	0.00000	0.000000	.400000	.029238	. 14708
·			0.000000	0.000000	.866000	.842600	•499797	.64122
	;	7	2.000000	2.000000	1.500000	1.500000	.863087	1.62604
			8.000000	0.000000	400000	0.00000	082222	14831
			0.300000	0.000000	.800000	.866000	·498318	• 62 322
	1	8	2.000000	2.000000	1.500000	1.500000	.872872	1. 62723
			0.00000	0.0000000	800000	400000	218218	44284
			0.00000	0.000000	•600000	.800 <b>000</b>	• 436436	• 52 411
	(	9	2.000000	2.000000	1.500000	1.500000	.872872	1.6188
			0.00000	0.000000	-1.200000	800000	218218	75116
			0.000000	0.009000	• 4 6 0 9 6 9	.630300	• <b>4</b> 3 6 4 <b>3</b> 6	• 38 677
	1	0	2.303000	2.000000	1.500000	1.500000	.872872	1.60714
			0.000000	0.600660	-1.600000	-1.200000	218218	-1.08597
			0.000000	0.000000	.200000	• 400 <b>38 8</b>	.436436	• 24 271
	1:	1	2.000000	2.000000	1.500000	1.500000	•945063	1.58979
			0.000000	0.000000	-1.732000	-1.600000	272824	-1.36520
			0.000000	0.000000	-0.000000	. 200900	.180564	. 0844
	1.	2	2.000000	2.000000	1.500000	1.500000	•958U86	1.59139
			0.00000	0.000000	-1.670000	-1.732000	276584	-1.38979
			0.000000	0.000000	229700	0.000000	074655	09489

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X Y	X Y	NX NY	NPX NPY	9 T
Ž	Z	NZ	NP Z	Å
1.503000 1.670000	1.500000 1.732000	•958086 •276584	1.591395 1.389794	0. .18(3E+01
.229700	0.00000	• G74655	. 194899	.2076E+00
1.500000 1.460000	1.500000 1.670300	•941794 •251249	1.598349 1.254020	.8882E-15 .1758E+01
.465900	.229700	.223380	. 28 29 27	.2350E+ (0
1.500000 1.140000	1.500000 1.460000	•915363 •202414	1.605113 1.019539	•2665E-14 •1612E+01
•652000	• 4659 <b>00</b>	.348052	• 44 5612	.2299E+00
1.500000 .800000	1.500000 1.140000	•891771 4/6324	1.609275	.2665E-14
.768100	• 652 <b>008</b>	•146221 •428210	• 750320 • 557494	•1405E+01 •1985E+00
1.500000	1.500000	.874522	1.620269	.9992E-15
.4000U0 .842600	.800 <b>000</b> .76810 <b>0</b>	.088802 .476787	.4479#1 .613081	•1217E+01 •2097E+00
1.500000	1.500000	.865649	1.624811	.2228E-15
0.000000 .866000	•400000 •842600	•029238 •499797	• 1470 89 • 641222	.1058E+01 .2001E+00
1.500000 400000	1.590000 0.000000	•863087 - n°2222	1. 62 60 41	•2228E-15
000008.	.866000	082222 .498318	148316 .623224	.1025E+01 .2007E+00
1.500000	1.500000	.872872	1. 627233	.8882E-15
800000 000000	400000 .800000	-•218218 •436436	-•442846 •524111	•1118E+01 •2291E+00
1.500000 -1.200000	1.500000 890000	•872872 -•218218	1.618821 751160	•1776E-14
.400000	•690900	.436436	• 38 6778	.1360E+01 .2291E+u0
1.500000	1.500000	.872872	1.607148	.8882E-15
-1.600000 .200000	-1.20000 .400000	218218 .436436	-1.085976 .242716	.1688E+01 .2291E+00
1.500000	1.500000	•945063	1.589795	0.
-1.732000 0.000000	-1.600000 .200000	272824 .180164	-1.365206 .084464	•18 G3E+01 •18 33E+00
1.500900	1.500000	.958886	1.591395	<b>u</b> •
-1.670000 229700	-1.732000 0.000000	276584 074655	-1.389794 094899	.1803E+01 .2076E+00

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY	ID.	TEST
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#### TEST BODY

N	М	X	×	X	X	NX	Nax
		Y Z	Y Z	Y	Y	NY	NP
		۷	Z	Z	Z	NZ	NP 2
1	13	2.000000	2.000000	1.500000	1.500000	.941794	1.598
		0.00000	0.000000	-1.460000	-1.670000	251249	-1.25
		0.00000	0.000000	465900	229700	223380	28 2
	14	2.000000	2.000000	1.500000	1.500000	.915363	1.605
		0.000600	0.000000	-1.140000	-1.460000	202414	-1.01 <b>9</b>
		0.000000	9.00000	652000	465900	348052	445
	15	2.333000	2.000000	1.500000	1.500000	.891771	1.609
		0.00000	0.000000	80000	-1.140000	146221	75 <b>0</b>
		9.000000	0.000000	768100	652000	428210	- • 55 <b>7</b>
	16	2.000000	2.000000	1.500000	1.500000	.874522	1.620
		0.000000	0.000000	400000	800000	088802	447
		0.00000	0.000000	842600	768100	476787	613
	17	2.000000	2.000000	1.500000	1.500000	.865649	1.624
		0.000000	0.003000	0.00000	400000	029238	147
		0 0 0 0 0 0 0	0.000000	866000	842600	499797	641
	18	2.000000	2.000000	1.500000	1.500000	.865649	1. 62 4
22		0.000000	0.000000	• 400000	0.00000	<b>.02923</b> 8	• 147
		0.00000	0.000000	8426 <b>00</b>	86600 <b>0</b>	499797	641
	19	2.000000	2.000000	1.500000	1.500000	.874522	1.620
		0.00000	0.000000	.800000	• 40000 <b>0</b>	.088802	• 447
		0.00000	0.000000	768100	842600	476787	- • 61 3
	20	2.000000	2.000000	1.580000	1.500000	.891771	1. 60 9
		0.00000	0.00000	1.140000	.890000	.146221	. 75 0
		0.000000	0.000000	652000	768100	428210	557
	21	2.000000	2.000000	1.500000	1.500000	•915363	1. €05
		0.00000	0.000000	1.460000	1.140000	.202414	1.019
		0.001000	0.000000	465900	652000	348052	445
	22	2.000000	2.000000	1.500000	1.500000	•941794	1.598
		0.000000	0.000000	1.670000	1.460000	.251249	1.254
		0.00000	0.600000	229700	-•4659 <b>00</b>	223380	28 2
	23	2.000000	2.000000	1.500000	1.500000	«958086	1 - 59 1
		0.00000	0.000000	1.732000	1.670000	. 276 58 4	1.389
		0.000000	0.000000	0.00000	229700	074655	£94
2	1	1.500000	1.500000	1.000000	1.000000	• 435365	1.220
		1.732000	1.670000	1.870000	2.000000	.855263	1.831
		0.00000	.229700	.354600	0.00000	.281038	• 149

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(	X	X	NX	Nox	D
1	Y	Y	NY	NPY	T
<u> </u>	Z	Z	NZ	NP Z	A
00000	1.500000	1.500000	•941794	1.598349	.8882E-15
0000	-1.460000	-1.670000	251249	-1.254020	.1758E+01
0000	465900	229700	223380	282927	.2350E+00
0000	1.500000	1.500000	•915363	1.605113	•2665E-14
0000	-1.140000	-1.460000	202414	-1.019539	.1612E+01
0000	652000	465900	348052	445612	.2299E+00
		J . G . J . V		• • • • • • • • • • • • • • • • • • • •	
00000	1.500000	1.500000	.891771	1.609275	.2665E-14
0000	8 00000	-1.140000	146221	750320	•1405E+01
0000	768100	652000	428210	557494	e1985E+00
0000	1.500000	1.500000	.874522	1.620269	.9992E-15
0000	480000	800000	088802	447901	.1217E+01
0000	842600	768100	476787	613081	.2097E+00
0000	1.500000	1.50000	.865649	1.624811	.2220E-15
6000	0.000000	400000	029238	147089	.105 EE+01
0000	866000	842600	499797	641222	.2001E+00
10000	1.500000	1.500000	.865649	1. 62 4811	.2220E-15
0000	.400000	0.000000	.029238	• 147689	.1058E+01
0000	842600	866000	499797	641222	.2001E+00
É					
<b>DO</b> OU	1.500000	1.500000	.874522	1.620269	•9992E-15
0000	.800000	.400000	.088802	•447901	•1217E+01
<b>100</b> 00	768180	842600	476787	613081	.2097E+00
0000	1.580000	1.500000	.891771	1.609275	.26E5E-14
0000	1.140000	.800000	•146221	.75 5320	.1405E+01
0000	652000	768100	428210	557494	.1985E+60
8000	1.500000	1.500000	•915363	1. 605113	•2665E-14
0000	1.460000	1.140000	. 202414	1.019539	.1612E+01
0000	465900	652000	348052	445612	.2299E+00
0000	1.580000	1.580000	•941794	1.598349	•8882E-15
0000	1.670000	1.460000	.251249	1.254020	.1758E+01
0000	229700	465900	223380	282927	.2350E+66
		4 =====================================	0.50.50		
0000	1.500000	1.500000	958086	1.591395	0.
000	1.732000 0.00000	1.670000 229700	.276584 074655	1.389794 894899	.18 G3E+91 .20 76E+00
2000	0.000000	- 0 2 4 3 1 0 0		-• 624022	• 40 1 0E T U U
000	1.000000	1.000000	• 435365	1.220560	.5764E-02
000	1.870000	2.000000	.855263	1.831729	.6416E+80
700	• 35460 <b>0</b>	0.00000	.281838	• 149900	.1768E+60
1656					

## ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

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			120;	5001			
N	М	X	x	×	X	NX	NPX
		Y	Y	Ÿ	Y	NY	NP Y
		Ž	ż	Ž	Ž	NZ	NP Z
		<del>-</del>	_	_	_		
2	2	1.500000	1.500000	1.000000	1.000000	.390089	1.241719
	•	1.670000	1.465000	1.600000	1.870000	.652170	1. 65 28 30
		.229700	.465900	.600000	.354600	.650004	• 41 4680
	3	1.500000	1.500000	1.000000	1.000000	•324553	1.241630
		1.460000	1.140000	1.200000	1.600000	.447006	1.351646
		•465900	.652000	.890909	.600000	.833577	•631851
	i <sub>+</sub>	1.500000	1.500000	1.000000	1.000000	.288019	1.242998
		1.140000	.803000	.800000	1.200000	.287154	. 98 57 15
		.652000	.768100	.916500	.800000	•913561	. 786135
	5	1.500000	1.500000	1.000000	1.000000	.278929	1.250180
		.800000	. 460000	• 400000	.800000	.163401	.600088
		.768100	.842600	.979800	·916500	• 948629	• 87 66 83
	6	1.500000	1.500000	1.000000	1.000000	-261384	1. 25 00 17
		400000	0.000000	0.00000	.400000	.052527	.200026
		842600	.866000	1.000000	•97980 <b>0</b>	•963805	.922094
23							
ω	7	1.500000	1.500000	1.000000	1.000000	•126140	1.246098
		000000	400000	400000	0.00000	312996	-• 19 95 66
		.166000	.800000	.800000	1.000000	.941341	.867167
	•	4 560000					
	8	1,500000	1.500000	1.000000	1.000000	0.00000	1.250000
		460000	800000	800000	400000	447214	600000
		.800000	.600000	.600000	• 8000 <b>0</b>	.894427	.700000
	9	1.500000	1.500000	1.000000	1.000000	0.00000	1.250000
	,	800000	-1.200000	-1.200000	800000	447214	-1.000000
		.600000	.400000	.400000	.600000	894427	.50.0000
		0000000	U + U U U U	• + • • • • •		********	• >0 0 0 0 0
	19	1.500000	1.500000	1.000000	1.000000	0.000000	1.250000
		-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.400000
		.400000	.200000	-200000	490000	894427	.300000
					- ,	000112	
	11	1.500000	1.500000	1.000000	1.00000	.159008	1. 21 67 89
		-1.600000	-1.732000	-2.000000	-1.600000	593315	-1.739216
		.200000	9.000000	0.000000	. 200000	.789109	• 10 20 18
			· ·				
	12	1.500000	1.500000	1.000000	1.000000	• 435365	1.220560
		-1.732000	-1.670000	-1.870000	-2.690000	855263	-1.831729
		0.000000	229700	354600	0.000000	281038	1499ŭ0
				-	· -		
	13	1.500000	1.500000	1.000000	1.000000	.390089	1.241719
		-1.670000	-1.460000	-1.600000	-1.870000	652170	-1.652830
		229700	465900	600000	3546Q <b>0</b>	650004	41 4680
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X X	NX	NPX	C .
Y	NY	NP Y	Ţ
Z Z	NZ	NP Z	A
1.0000	.390089		.8288E-02
600000 1.8700			.6561E+60
600000 3546		. 414680	.1846E+00
.000000 1.0000	.324553	1.241630	.6043E-02
200000 1.6000		1.351646	.6814E+ (0
800000 .6000		.631851	.21 59 E+ ú Û
.000000 1.6900	.28800	1.242990	.4216E-62
800000 1.200		98 57 15	.66 [LE+00
916500 .800		.786135	.2025E+00
.000000 1.000	000 .27092	9 1.250180	•2656E-02
400000 .802		1 .600088	.6744E+80
979800 .916		9 .876683	.21 (8E+ü0
.000000 1.800	000 .26138	4 1.250017	.7710E-63
• 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			.6594E+00
.000000 .979			.2075E+u0
.000000 1.000	ngo .12614	o 1.246098	.3153E-U1
. 400000 0.000		6 <b></b> 19 9 5 6 6	.6708E+30
.800300 1.000		. 867167	.2125E+00
.500000 1.000	aeg 0.0000	ឮ 1. 25 ចំពុធ៌្ម	.35 53E-14
800000 - 400			.6708E+00
.600000 .800	000 .89442	7 .700000	.2236E+û0
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.200000800	00044721		.67ü8E+ü0
.400000 .600	000 .89442	.50000	.2236E+00
[.000000 1.000	000 0.0000		.6651E-14
.600000 -1.200	00044721		.67 (8E+G)
-200000 -404		.3000cu	.2236E+60
	1000 .1590	18 1.216789	.3975E- [1
2,000000 -1.60	0005933		.67 LEE+ CO
.000000 .200		)9 • 10 2 <del>1</del> 18	\$1685E\$JO
1.000000 1.60	1000 .4353		.5764E-02
1.870000 -2.69	8552		.6416E+00
.354600 0.00		38149900	.1708E+60
1.000000 1.00	0000 .3900		.8288E-02
4.600000 -1.87	00006521		.65 61 E+ ú0
600000 35		04 - 414680	.1846E+u0
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## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

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BODY ID. TEST

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N	М	X	X	X	X	NX	NP X
		Y	Y	Y	Y	NY	No A
		Z	Z	Z	Z	NZ	NP Z
2	14	1.500000	1.500000	1.000000	1.600000	•324553	1.241630
		-1.460000	-1.140000	-1.200000	-1.600000	44799 E	-1.351646
		465900	652000	890000	600000	833577	631851
	4 ***						
	15	1.500000	1.500000	1.000000	1.000000	.288009	1.242990
		-1.149500	800000	800000	-1.200000	287154	-•98 57 <b>15</b>
		652001	768100	916500	890000	913561	<b></b> 78613 <b>5</b>
	16	1.500000	1.500000	1.000000	1.000000	.270929	1.250180
		800000	460000	480000	80000	163481	600088
		768100	842600	979800	916500	948629	87668 <b>3</b>
	17	1.500000	1.500000	1.000000	1.000000	. 261 384	1.250017
	-,	400000	0.000000	0.00000	430000	52527	- 200026
		842600	866900	-1.000000	97980G	963805	- 922094
		00 12 000	***************************************	1000000	• 51 5000	• 30000	• JEEG JT
	18	1.590070	1.500000	1.063000	1.030030	.261384	1.250017
		0.00000	• 400000	。4 បិថ៌ រ៉ាប់ 0	0.00000	<ul><li>052527</li></ul>	. 20 0 0 26
		865010	842600	979800	-1.699000	963805	922094
24	19	1.590\03	1.500000	1.053000	1.000000	• 27 0 9 2 9	1. 250180
	_,	.400000	.800000	.800000	. 400000	.163401	. 60 L 0 8 <b>3</b>
		342630	768100	916500	979800	948629	876683
	20	1.509900	1.500000	1.000000	1.000000	.288009	1. 242990
		000000	1.145000	1.203900	.800000	•287154	.9857 <b>15</b>
		768103	652000	800000	91650 <b>0</b>	913561	<b></b> 78 61 3 <b>5</b>
	21	1.500000	1.500000	1.200053	1.099900	• 324 553	1.241630
		1.140000	1.460000	1.600000	1.200000	.447006	1.351646
		652000	- 465900	600000	633000	833577	631851
	22	1.530000	1.500000	1.303000	1.000000	•390489	1.241719
		1.460000	1.670000	1.870080	1.600000	·65217U	1.652830
		465900	229700	354600	600000	650034	41 4680
	23	1.500000	1.500000	1.001040	1.00000	•435365	1.220560
		1.670000	1.732000	2.3000	1.870000	.855253	1.331729
		229700	0.000000	0.40\200	354600	281338	149960
3	1	1.000000	1.090000	Ø•49•.000	6.804800	0.000000	• 50 6 9 8 <b>0</b>
-		2.00000	1.873000	1.879303	2.500000	.938893	1. 93 50 00
		0.300000	.354600	• 354500	u.000000	.344208	. 177300
	_	4 4 4 4 4 4			<b>.</b>	··	
	2	1.0000%	1.000000	0.000000	0.00000	0.060000	• 50 0 0 U <b>0</b>
		1.8700'0	1.689000	1.600000	1.870000	•672591	1.735000
		.3545,0	.600000	• 6 0 0 0 0 0	.354600	.740014	. 477300
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NX	NP X	0
NY	NP Y	Ţ
NZ	NP Z	Α
•324553	1. 241630	.6043E-02
44700 E	-1.351646	.6814E+00
833577	631851	.2159E+00
268686	4 24.2000	/ <b>0</b> / 5 F = 0 O
.288009 287154	1.242990 985715	•4216E-02 •6600E+00
913561	78 61 35	•2025E+00
.278929	1.250180	.2656E-02
163481 948629	-•600088 -•876683	•6744E+00 •2108E+00
1,4005	•010000	• 21 6 6 6 7 8 8
.261384	1.250017	.7710E-03
052527	200026	•6594E+00
963805	922094	•2075E+00
.261384	1.250017	.7710E-03
.052527	· 20 ú 0 26	.6594E+ CO
963805	922094	-2075E+00
. 270929	1. 250180	•2656E-02
.163401	• 65 • 68 8	•6744E+00
948629	- 876683	-2108E+60
.288009 .287154	1. 242990	•4216E-62
913561	•985715 ••786135	.66(0E+00
1,10,00	• 100107	12023E7 QQ
• 324 553	1.241630	. 6043E-U2
.447006	1.351646	.6814E+00
833577	63 18 51	·2159E+08
.390089	1.241719	.8288E-02
.652171	1.652830	•0561E+00
650004	41 4680	•1846E+00
•435365	1.220560	E7645 00
.855263	1.831729	•5764E-02 •6416E+00
281338	149900	•1708E+U0
0.000000 938893	•500000 • 23.5000	0.
•344208	1.935000 .177300	•1069E+01 •3777E+00
30,7200	<b>4 41 1000</b>	*SFFFETUU
0.00000	.500000	.4885E-14
672591	1.735000	.1064E+01
.740114	.477300	•3649E+00

PROGRAM BOXG ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS PAG BODY ID. TEST TEST BODY N M X X X NP X X NX Y Y Y Υ NY NPY Z Z Z Z NP Z NZ 3 3 1.000000 1.000000 0.000064 0.00000 0.000000 .50000 1.600000 1.200000 1.200000 1.6000000 .447214 1.40000 .600000 .860000 .800000 .600000 .894427 .70000 1.000000 1.060000 0.000000 0.000000 0.000000 . 50 8 0 0 1.200000 .800000 .800000 1.290000 .279631 1.00000 .880000 .916500 .916500 .899000 .960107 . 85 825 5 1.000000 1.000000 0.000000 0.000000 0.060000 . 50 000 .400000 .800000 .400000 .800000 .156305 . 60000 .916500 .979800 .979800 .916500 .987709 . 94815 6 1.000000 1.000000 0.000000 0.000000 9.060000 . 50 0 0 0 .400000 0.600000 0.000000 .400000 .050436 . 20 00 0 .979800 1.0000000 1.080000 . 97980C .998727 . 98 99 D 7 1.000000 1.000000 0.000000 0.000000 0.000000 . 50 0 0 0 0.000000 - . 48 3 8 8 6 -.400000 u. 000000 --447214 -. 20000 1.000000 .800000 .800000 1.000000 .894427 . 90 0 0 0 25 5 1. 300000 1.0000000 0.000000 0.000000 0.000000 .50000 -. 4000000 -.800000 -.800000 -. 490000 --447214 -.6088**0**0 .800000 .6000000 .600000 .70000 .830000 .894427 9 1.000000 1.000000 0.000000 0.000000 0.000000 .5000**0** -.800000 -1.200000 -1.200000 -. 806000 - . 447214 -1.00000 .600000 . 4000000 .400000 .600000 .894427 . 50 0 00 10 1.300000 1.0000000 0.000000 4.000000 0.060000 . 50 0 0 d -1.202000 -1.600000 -1.600000 -1.200000 -.447214 -1.40000 .400000 . 250000 .200000 . 400000 .894427 - 30 0 0 0 11 1.500000 1.600000 0.000000 0.000000 0.060005 .50000 -1.600000 -2.0000000 -2.000000 -1.600000 -.447214 -1.80001 .200000 0.000000 0.000000 . 200000 .894427 . 10001 12 1.000000 1.000000 0.000000 0.000000 0.000000 . 5u 001 -2.000000 -1.670000 -:.870000 -2.000000 -.938893 -1.9350 0.000000 -. 354600 -.35460 Ú 0.00000 -.344208 -. 17 73

0.000000

-.600000

0.000000

-.800000

-1.200000

-1.600000

0.000000

-.354600

0.000000

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-1.600000

-1.876000

0.000000

-.672591

-.740014

0.000000

- . 447214

-.894427

. 50 DD

-1.7350

- . 47 73

. 50 BB

-1.4000

-. 7000

13

14

1.000000

-. 354600

1.0000000

-.600000

-1.600000

-1.870000

1.0000000

-.600000

1.000000

-.8000000

-1.200000

-1.600000

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TEST BODY

	X	X	NX	NP X	D
	Y	Y	NY	NP Y	T
	Z	Z	NZ	NP Z	Α
ภองข	0.000060	o. 000000	0.000000	.500000	.66 E1E-14
0000	1.200000	1.600000	.447214	1.400000	.10 95E+01
0000	.800000	.600000	.894427	.700000	.4472E+U0
8000	0.00000	0.699000	0.000000	. 50 6 0 8 0	.2442E-14
0000	.889893	1.290000	.279631	1.000000	.1083E+01
6500	•916500	.800000	•96ŭ1 <b>07</b>	.858250	.4166E+00
0000	0.365000	0.00000	0.00000	• 50 00 00	.2442E-14
0000	• 400000	.800000	•156305	. 600000	.1079E+01
9800	.979800	•91650 <b>0</b>	.987709	948150	.4050E+00
0000	0.000000	0.000060	0.000000	. 50 00 00	•5551E-16
0000	0.000000	.400000	.050436	. 20000	.1077E+01
0000	1.000000	• 97980 <b>0</b>	•998727	• 98 9 9 0 <b>0</b>	.4005E+00
0000	0.000000	0.00000	0.000000	• 50 00 00	•3109E-14
0000	400000	u. 000000	-•447214	200060	•1095E+01
0000	.800000	1.600000	.894427	• 90 0 0 0 0	•4472E+00
0000	0.00000	0.000000	0.000000	• 500000	.3553E-14
8000	800000	490000	447214	600000	•1895E+01
0000	.60000	.830000	•894427	.700000	.4472E+00
0000	0.00000	0.000000	0.000000	.500000	•3553E-14
0 000	-1.200000	836000	447214	-1.000000	.1095E+01
6000	• 400000	.600000	•894427	• 50 0 0 0 0	.4472E+00
0000	0.000000	0.00000	0.060000	. 500000	.6661E-14
0000	-1.600000	-1.290000	447214	-1.400000	•1895E+01
<b>00</b> 00	.200000	.400600	.894427	.300000	•4472E+00
000	0.000000	0.000000	0.060006	. 500000	.4441E-15
0000	-2.000000	-1.600000	447214	-1.800000	•1095E+01
000	0.00000	. 200000	•894427	• 10 v 8 v 0	.4472E+00
000	0.000000	0.00000	0.000000	• 5u 0 0 0 0	0.
000	-: 870000	-2.00000	938893	-1.935000	.1069£+01
600 600	35460 ú	0.680000	344208	17 73 00	.3777E+00
000	0.000000	0.00000	0.00000	.500000	.4885E-14
000	-1.600000	-1.876000	672591	-1.735000	•1064E+01
2000	600000	354600	740014	- • 47 73 û U	.3649E+00
000	0.000000	0.00000	0.000000	.5.4000	.66E1E-14
្ទិលខេល	-1.200000	-1.630000	447214	-1.400000	.1095E+01
208	800000	600000	894427	70 3000	.4472E+00
<b>10</b>					

## ATPOSFHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

т.	CCT	מכי	אח (
	r	יח	3 1 1 7

			TEST	BODY			i i
N	М	x	x	X	X	NX	NPX
		Y	Y	Υ	Y	NY	NPY
		Z	7	Z	Z	NZ	NP Z
3	15	1.000000	1.000000	0.000000	0.00000	0.000000	.500000
		-1.200000	80000	800000	-1.200000	279631	-1.000000
		800000	916500	916500	800000	960107	858250
	16	1.300002	1.000000	0.000000	0.00000	0.000000	• 50 0 0 0 0
		800000	400000	400000	800000	156305	600000 🖠
		916500	979800	979800	916500	987709	948150
	17	1.000000	1.000000	0.000000	0.000000	0.000000	• 50 DO VO
		400000	0.000000	0.00000	400000	050436	200000
		379800	-1.000000	-1.000000	979800	998727	-•98990 <b>0</b>
	18	1.000000	1.000000	0.000000	0.620000	0.00000	•500000
	10	0.00000	.400000	•400000	0.000000	.050436	• 200000 £
		-1.300000	979800	979800	-1.606000	998727	989980
		2000000		• 51 30 9 9	74 0 4 5 4 6 6	• 550721	
	19	1.000000	1.000000	0.000000	0.600000	0.000009	• 50 0 0 0 0 §
		.400900	.86666	.800000	. 490000	·156305	•600000 <b>•</b>
		979800	916500	916500	9798 <b>00</b>	987709	948150
	20	1.999990	1.000000	0.00000	0.00000	0.666499	.500000
26		.800000	1.200000	1.200000	.800000	.279631	1.000000
0,		916500	800000	800000	916500	960107	858250
	21	1.096600	1.000000	0.00000	3.403000	0.00000	• 50 0 3 0 0
		1.200000	1.600000	1.600000	1.200000	.447214	1.400000
		800000	600000	600000	800000	894427	700000
	22	1.000000	1.080000	0.000000	9.638600	0.00000	•500000
		1.600000	1.870000	1.870000	1.600000	672591	1.735000
		600000	354600	354600	600000	740014	477300
	23	1.000000	1.000000	0.000000	0.00000	0.00000	•500000
		1.870000	2.000000	2.000000	1.870000	938893	1.935000
		354600	0.000000	0.000000	354600	34420à	177300
4	1	0.00000	0.00000	500000	590000	049532	- 31.9069
7	-	2.000000	1.870000	1.850000	1.972000	•939127	- · 248068 3
		0.00000	.354600	•341500	0.000000	.339980	.174052
	_						
	2	0.000000	0.000000	500000	500080	043145	249477
		1.870000	1.600000	1.585000	1.850000	.675158	1.726269
		•354600	.600000	•586600	.341500	.736411	• 470688
	3	0.00000	3.00000p	500000	500000	034875	249169
		1.600000	1.200000	1.195000	1.585000	.449471	1.395016
		.600000	.800000	.784400	.58660D	.892614	•692774

		_
NX NY NZ	NP Z NP Z	D T A
0.000000	.500000	.2442E-14
279631	-1.000000	.1083E+01
960107	858250	.4166E+00
0.000000	.500000	.2442E-14
156305	600000	.1079E+01
987705	948150	.4050E+00
0.000000	.500000	.5551E-16
050436	200000	.1077E+01
998727	989900	.4005E+00
0.000000	.500000	.3553E-14
.050436	.20000	.1077E+01
998727	989900	.4005E+00
0.000009	.500000	.2220E-14
.156305	.600000	.1079E+01
987709	948150	.4050E+00
0.000J00	.500000	.3109E-14
.279631	1.000000	.1083E+01
960107	858250	.4166E+00
0.000000	.500000	.6661E-14
.447214	1.40000	.1095E+01
894427	700000	.4472E+00
0.000000	.500000	.6217E-14
.672591	1.735000	.1064E+01
740014	477300	.3649E+00
0.000000	.500000	.6217E-14
.938893	1.935000	.1069E+01
34420ô	177300	.3777E+00
049 532	248068	.7648E-03
.939127	1.923092	.6238E+00
.339980	.174052	.1853E+00
043145	249477	.7887E-03
.675158	1.726269	.6205E+00
.736411	.470688	.1816E+00
034875 .449471 .892614		.6327E-03 .6693E+00 .2213E+00

PROG	RAM BO	xc	R R R R R R R R R R R R	PHERIC SCIENT EDFORD, MASS	CE ASSOCIATES		FJA
BOD	Y ID.	TEST	TEST BC				
		V	×	X	X	NX	NP X
N	М	X	Ŷ	Ŷ	Y	NY	NPY
		Y Z	ż	Ž	Z	NZ	NPZ
,		0.000000	0.000000	500000	500000	031043	24 <b>95</b> .998
4	4	1.200000	.800000	.800000	1.195000	•281449 •5007/	. 850
		.800000	.916500	.901200	. 784400	.959074	
	5 .	0.000000	0.00000	500000	500000	029218	25 <b>0</b>
	<b>5</b>	.800000	.400000	.400000	.800000	.157442	940
		.716500	.979800	.9655 <b>00</b>	.901200	.987096	
	6	0.000000	0.000000	500000	500000	028252	250 200
	Ö	.402000	0.000000	0.00000	.400000	.050789	982
		.979800	1.000000	.986000	.96550 <b>0</b>	.998310	
			8.060900	500000	500000	012608	249
	7	0.000000	486000	469008	0.000000	434526	199
		0.000000 1.000000	.800000	.800000	.986 <b>000</b>	.900571	.896
			ል በአጠበለሽ	500000	500000	0.000000	25 <b>0</b>
	8	0.00000	0.000000 860000	800000	400000	447214	600
		400000 .800000	.600000	.600000	.800000	.894427	. 70 0
27	_		0.000000	500000	500000	0.000000	250
•	9	0.000000	-1.250000	-1.200000	800000	447214	-1.000
		800000 -600000	.483000	.402000	.600000	.894427	• 50 <b>0</b>
		n nanan	0.00000	500000	500000	0.000000	25 <b>0</b>
	10	0.000000 -1.200000	-1.600000	-1.600000	-1.200000	447214	-1.40 <b>0</b> .30 <b>0</b>
		.400000	. 200000	.200000	. 430000	.894427	
	4.4	n.30000	c.000000	500000	500000	012880	247
	11	-1.600000	-2.000000	-1.972000	-1.690000	460910	-1.793 .100
		.200000	0.000000	0.00000	.200000	.887820	• 70.6
			c.000000	500000	500000	049532	248
	12	0.000000 -2.001000	-1.870000	-1.850000	-1.972080	939127	-1.923
		0.000000	354600	341500	0.600000	339980	174
			0.000000	500000	500000	043145	24
	13	0.000000 -1.870000	-1.600000	-1.585000	-1.850000	675158	-1.72
		354630	60 0000	586600	341500	736411	47
		8 00000	0.00000	500000	500000	034875	24
	14	0.000000 -1.600000	-1.200000	-1.195000	-1.58500 <b>0</b>	449471	-1.39
		600030	800000	784400	5866 <b>00</b>	892614	69
			0.00000	500000	500000	031043	24
	15	0.000000 -1.200000	800000	800000	-1.195000	281449	99
		800093	916500	901200	784400	959674	85

	X	NA	NP X	D
Na	Y	NX	NP Y	T
10000 10000 1200	Z -•500000 1•195000 •784400	NZ 031043 .281449 .959074	NPZ 249537 .998756 .850538	A • 4237E- 03 • 6507E+ 00 • 20 72E+ 00
0000	500000	029218	250016	.2468E-03
0000	.800000	.157442	.600061	.6451E+00
5500	.901200	.967096	.940749	.2026E+00
0000	500000	028252	250002	.7487E-04
0000	.400000	.050789	.200000	.6412E+00
6000	.965500	.998310	.982825	.2003E+00
0000	5000 <b>0</b>	u12608	249496	.3152E-02
0000	0.0000 <b>0</b>	434526	199997	.6708E+00
0000	.98600 <b>0</b>	.900571	.8965û9	.2221E+00
<b>000</b> 0 <b>00</b> 00	506000 400000 .800000	0.000003 447214 .894427	250000 600000 .700000	.3553E-14 .6708E+00 .2236E+00
0000	500000	0.000000	250000	.3553E-14
0000	800000	447214	-1.000000	.6708E+00
0000	.60000	.894427	.50000	.2236E+00
0000 0000 0000	591000 -1.200000 .490000	0.000000 447214 .894427	250100 -1.400000 .300000	.6661E-14 .67
0000	500000	012880	247831	.3220E-02
2000	-1.600000	460010	-1.793015	.6708E+00
0000	.200000	.887820	.100024	.2174E+80
0000	500000	049532	248068	.7648E-03
0000	-1.972000	939127	-1.923092	.6238E+00
1500	0.00000	339980	174052	.1853E+00
0000	500000	043145	249477	.7887E-U3
5000	-1.850000	675158	-1.726269	.6205E+ 10
16600	341500	736411	476688	.1816E+00
0000	500000	034875	249169	.6327E-03
5000	-1.585000	449471	-1.395016	.6693E+00
4400	586600	892614	692774	.2213E+00
0000	500000	031043	249537	.4237E-03
0000	-1.195000	281449	998756	.65(7E+00
1200	784400	959074	850538	.2072E+00

i	PRO	GRAM BO	oxc	ATMO	SPHERIC SCIE	ENCE ASSOCIATE	:S	PAGE
	80	DY ID.	TEST	TCCT				
				TEST E	3001			
	N	М	X	X	X	X	NX	NP X
			Y Z	Y Z	Y Z	Y Z	NY NZ	NP Y NP Z
					-	-	.,_	
	4	16	0.000000	0.000000	588000	500000	029218	250016
			800000 916500	-•400000 -•979800	400000 965500	80 <b>:</b> 00 <b>:0</b> 901200	157442 987896	6000001 940749
			- • 910233	- 6 97 9000	- 6 9 0 9 9 0 0		- 4 90 7 8 9 0	- 6 J- U / - 3
		17	0.000000	6.000000	500000	500000	028252	2500 <b>02</b>
			400000	0.000000	0.00000	400000	050789	2000 <b>0</b>
			979800	-1.000000	986000	965500	998310	- • 98 28 <b>25</b>
		18	0.000000	0.000000	500000	500000	-•B28252	- • 25 G 0 0 <b>2</b>
			0.000000	.400000	.400300	0.000000	• 659789	• 20 80 ü <b>0</b>
		•	-1.000000	979800	96550 <b>0</b>	986000	998310	9828 <b>25</b>
		19	0.000000	0.000000	500000	500000	029216	25 0 U <b>1 6</b>
			.400000	.800000	.800000	.400000	.157442	. 60 0 0 0 1
			979800	916500	901200	9655 <b>00</b>	987396	946749
		20	0.000000	0.000000	500000	500000	031843	- 。2495 <b>37</b>
			.890000	1.200000	1.195000	.800000	.281449	998756
			916500	800000	784490	901200	959074	8505 <b>38</b>
28		21	0.00000	0.000000	508000	50000 <b>0</b>	034875	-•24916 <b>9</b>
			1.200000	1.600000	1.585003	1.195000	• 449471	1.395016
			800000	600000	586600	784400	892614	692774
		22	0.000000	0.000000	500000	500000	043145	249477
		C 64	1.600000	1.870000	1.850900	1.585000	.675158	1.726269
			600090	354600	341500	586600	736411	47 U 68 <b>8</b>
		23	0.000000	0.00000	500000	53000 <b>0</b>	049532	24806 <b>8</b>
		20	1.870000	2.000000	1.972000	1.850000	•939127	1.923092
			354600	0.000000	0.000000	341500	339988	17 40 52
	5	1	500000	500000	-1.000000	_4 candoo	_ 4E3E1.7	<b></b> 7433 <b>34</b>
	9	Τ.	1.972000	1.850000	1.785000	-1.030000 1.88560 <b>0</b>	153543 -934141	1.874150
			0.000000	• 341500	.303900	0.00000	•322188	• 15162 <b>6</b>
		•	50000	<b>58555</b>	4 036663	a monadina	420.71.4	7. 7.7
		2	500000 1.859000	500000 1.585000	-1.000000 1.540000	-1.609600 1.785000	-•13274¥ •683173	74738 <b>9</b> 1.69028 <b>1</b>
			.341500	.586600	.544300	• 383900	.718391	• 44 4215
		7	= 0 0 0 0 0	<b>= 0</b> 0.000	4 000005	4 000000	4.60.000	7. 77.50
		3	500000 1.585000	500000 1.195000	-1.000000 1.175000	-1.000000 1.540000	168809 .457325	747 <b>752</b> 1.37389 <b>2</b>
			.586600	• 78 4400	.737400	• 544000	• 457325 • 88261 £	. 66 3 3 4 4
				ستشمر تصفي				7
		4	500000 1.195000	500000	-1.000000	-1.00000	095703	747958
			.784400	.8 <b>0</b> 0000 .9 <b>0</b> 1200	.800010 .853800	1.175000 .737400	•288525 •952677	• 9925 <b>72</b> • 81 93 83
			#10770#	- 20 TEAA	• 0 2309 0	• : 3	• 5 3 C O F F	• OT 20 03

	X	NX	NP X	D
	Y	NY	NP Y	T
	Z	NZ	NP Z	A
00 0	500000	029218	250016	.2468E-03
00 0	80000	157442	600901	.6451E+00
50 0	901200	987096	940749	.2026E+00
900	5000u0	028252	250002	.74 E7E-04
000	400000	050789	200000	.641 2E+00
000	965500	998310	982825	.2003 E+00
000 000 500	500000 0.090000 986000	028252 .u50789 998310	- 25 6 0 0 2	.7487E-04 .6412E+00 .2003E+00
50 0	500000	029216	25 00 16	•2468E-03
00 0	.400000	.157442	. 60 00 01	•6451E+00
00 0	965500	987096	94 0 7 49	•2026E+00
000	580000	031043	249537	.4237E-03
000	.800000	.281449	.998756	.6507E+00
400	991200	959074	850538	.2072E+00
000	500000	034875	249169	.6327E-03
003	1.195000	.449471	1.395016	.6693E+00
600	784400	892614	632774	.2213E+00
000	500000	043145	249477	.7887E-03
000	1.585000	.675158	1.726269	.6205E+00
500	586600	736411	470688	.1816E+00
000	530000	049532	248068	.7648E- û3
000	1.850000	.939127	1.923092	.6238E+ û0
000	341500	33998U	174052	.1853E+ û0
	-1.030000	153543	743334	•1969E-02
	1.885600	.934141	1.874158	•6143E+00
	0.03000	.322188	.161626	•1727E+00
	-1.000000	132748	747389	.2518E-G2
	1.785000	.683173	1.690281	.6222E+GD
	.303900	.718391	.444215	.1776E+G9
000	-1.000000	108809	747752	.1887E-02
	1.540000	.457325	1.373892	.6640E+00
	.544000	.882618	.663304	.2139E+00
00 00 00 00	-1.60J000 1.175000 .737400	095703 .288525 .952677	747958 .992572 .819383	.1347E-02 .64 £1E+ 00 .2021E+00

#### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

В.	00 V T	TEST		BEDFORD, MAS	SSACHUSETTS		PAGE
8	ODY I	. TEST	TEST	DO D V			
			1521	8001			
N	М	X	x	x	×	NX	NPX
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		Ž	ż	ż	ż	NZ	NP Z
		_	<del>-</del>	_	-	.,,	··· <del>-</del>
5	5	500000	500000	-1.000000	-1.090000	889915	<b>~.7</b> 50055
		.800990	.400000	.480000	.800000	.162820	.600009
		.901200	.965500	.921400	.853800	982682	.918468
	6	500000	500000	-1.000000	-1.000000	086851	750005
		.400000	0.000000	0.00000	. 400000	.052106	.200003
		•96550 ti	• 98 6000	•942800	.921480	•994858	• 95 39 24
	_					_	_
	7	500000	500000	-1.000000	-1.000000	039925	748551
		0.000000	400000	400000	0.00000	379842	199961
		.986000	.800000	.800000	.942800	•924189	•88 22 <b>79</b>
	•	50000	F6 0000	4 20000			
	8	500000	500000	-1.000000	-1.000000	0.00000	750060
		488878	800000	800000	400000	447214	600000
		.800000	.600000	.600000	.800000	.894427	.700000
	9	500000	500000	-1.000000	-1.000000	0.000330	750000
	-	800000	-1.200000	-1.200000	800000	447214	-1.000000
		.600000	. 400000	. 400000	.600000	894427	• 50 0 0 ú 0
N			0 10000	9 19 2 3 5 5		***********	
29	10	500000	500000	-1.000000	-1.050000	0.000000	750000
		-1.200000	-1.600000	-1.600000	-1.200000	447214	-1.400000
		.490000	.200000	.200060	. 400000	.894427	•300000
	11	503000	500000	-1.080000	-1.000000	044855	741375
		-1.600000	-1.972000	-1.885600	-1.600000	519160	-1.764760
		.200000	0.000000	0.00000	. 200000	.853499	• 100234
	12	500000	50 0000	-1.000000	-1.000000	- • 153 543	71. 7771.
	16	-1.972000	-1.850000	-1.785000	-1.885600	934141	743334 -1.874150
		0.000000	341500	303900	U.000000	322188	161626
		04 640 800		363969	0.00000	- 0352100	101050
	13	500000	500000	-1.000000	-1.000000	132740	747389
		-1.850000	-1.585000	-1.540000	-1.785080	683173	-1.690281
		341500	586600	544000	303900	718091	444215
	14	500000	500000	-1.000000	-1.000000	108809	747752
		-1.585000	-1.195000	-1.175000	-1.540000	457325	-1.373892
		586600	784400	737400	544000	882618	- 66 3304
	15	500000	500000	-1.000000	-1.000000	095703	747958
		-1.195000	800000	800000	-1.175000	288525	992572
		784400	901200	853880	737400	952677	- 81 9383
	16	500000	500000	-1.000000	-1.000000	_ 690046	_ 7E0AEE
	10	800000	400000	400000	800000	089915 162020	750055   600009
		901200	965500	921460	853860	- 982682	91 0468
		A JOILEGO	+ JU J J Q U	- 7 CT-40 0	• 0 90 0 0		51.04.00

X	X	NX	NP X	O
Y	Y	NY	NP Y	T
Z	Z	NZ	NP Z	A
-1.000000	-1.090000	089915	-•750055	.81 (7E-03
-400000	.800000	.162424	•600009	.650 GE+00
-921400	.853800	.982682	•918468	.2035E+00
-1.000000	-1.000000	086851	750005	.2238E-03
6.000000	.40000	.052106	.200003	.6436E+00
.942800	.921400	.994858	.953924	.2010E+(0
-1.000000	-1.00000	039925	748551	.9981E-02
40000	0.00000	379842	199961	.6668E+00
.800000	.942800	.924189	.882279	.2164E+00
-1.000000	-1.000000	0.000000	750008	.3553E-14
800000	400000	447214	608300	.6708E+00
.600000	.800000	.894427	.700000	.2236E+00
- 1.000000	-1.000000	0.000 300	750000	.3553E-14
- 1.200000	800000	447214	-1.006000	.6708E+00
.400000	.60000	.894427	.500000	.2236E+00
-1.000000	-1.000000	0.000000	750000	.6661E-14
-1.600000	-1.20000	447214	-1.400040	.6708E+00
.200000	-400000	.894427	.300000	.2236E+00
-1.080000 -1.885600	-1.000000 -1.600000 .20000	044855 519160 .853499	741375 -1.764760 .100234	•1121E-C1 •6545E+00 •1926E+C0
-1.000000	-1.00000	153543	743334	.1969E-02
-1.785000	-1.885600	934141	-1.874150	.6143E+00
303900	0.00000	322188	161626	.1727E+00
-1.000000	-1.000000	132740	747389	.2518E-02
-1.540000	-1.785000	683173	-1.690281	.6222E+50
544000	303900	718091	444215	.1776E+80
- 1.000000	-1.000000	108809	747752	.1887E-82
- 1.175000	-1.54000	457325	-1.373892	.6640E+80
737400	544000	882618	663304	.2139E+80
-1.000000	-1.000000	095703	747958	•1347E-02
800000	-1.175000	288525	992572	•6461E+00
853800	737400	952677	819383	•2021E+00
-1.000000	-1.000000	089915	750055	.8147E-63
400000	800000	162020	600009	.6560E+00
921400	853800	982682	910468	.2035E+00

#### ATMOSPHERIC SGIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

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			1531	0001			
N	М	X Y Z	X Y Z	X Y Z	X Y Z	NX NY NZ	NP X NP Y NP Z
		<b>4</b>	4.	2	<b></b>	142.	141 2
5	17	500000	500000	-1.000000	-1.000000	086851	75000 <b>5</b>
		-•400000 -•965500	0.000000	0.00000	405900	052106	200003
		905598	986000	942800	921400	994858	953924
	18	500000	500000	-1.000000	-1.000000	086851	750005
		0.000000	. 40 0 0 0 0	.400000	0.00000	.052106	• 20 0 0 0 <b>3</b>
		986000	965500	921400	942800	994858	·· 953924
	19	509000	500000	-1.080000	-1.000000	089915	75005 <b>5</b>
		.400800	.800000	.800000	.400000	.162020	• 60 0 0 0 <b>9</b>
		965500	901200	853800	921400	982682	91046 <b>8</b>
	20	500008	500000	-1.000000	-1.030000	095703	747958
		.809000	1.195000	1.175000	.800000	•288525	• 99 25 <b>72</b>
		901200	784400	737400	853800	952677	81938 <b>3</b>
	21	500000	500000	-1.000000	-1.600000	108809	747752
		1.195000	1.585000	1.540000	1.175000	•457325	1. 37 38 92
6.3		78440 <b>0</b>	586600	544900	737400	882618	663304
30	22	500000	500000	-1.000000	-1.000000	132740	747389
		1.585000	1.850000	1.785000	1.546000	.683173	1.690281
		586600	341500	303900	- » 544000	718091	44 4215
	23	500000	500000	-1.000000	-1.000000	153543	743334g
		1.850000	1.972000	1.885600	1.785000	•934141	1.874150
		341500	0.000000	0.000000	303900	322188	16162 <b>6</b>
6	1	-1.000000	-1.0000000	-1.580000	-1.500000	268347	-1.229655
		1.885600	1.785000	1.670000	1.732000	• 921489	1.773614
		0.00000	.303900	• 2297 <b>00</b>	0.00000	.280799	. 13 4912
	2	-1.300000	-1.0000000	-1.500000	-1.500000	239/65	-1.245329
		1.785000	1.540000	1.460000	1.670000	.70 123	1.614691
		.303900	• 544000	•46590U	.229700	.670724	• 38 65 5 <b>5</b>
	3	-1.000000	-1.000000	-1.500000	-1.500000	194936	-1.245068
		1.540000	1.175000	1.140000	1.460000	.475316	1.329324
		.544000	.737400	•652 <b>000</b>	.465900	.857948	.600627
	4	-1.000000	-1.000000	-1.500000	-1.500000	170981	-1 · 24 5 7 8 3
		1.175000	000000	.800000	1.140000	.304683	. 97 9 0 0 4
		.737400	.853800	.768100	• 65200 <b>0</b>	•936981	.753512
	5	-1.000000	-1.000000	-1.500000	-1.500000	159881	-1.25012 <b>0</b>
		.800000	. 400000	.480000	.800000	.172638	.600034
		.853800	• 921400	.842600	.768180	•971923	• 84 64 4 <b>9</b>
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	X	NX	N <sub>2</sub> X	C
	Ŷ	NY	NP Y	Ť
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00	-1.000000	086851	750005	•2238E-03
0 0	465909	052106	200003	.6436E+00
00	921400	994858	953924	.2010E+00
	4 664.666	000054	75 a a t 5	22265 67
00 00	-1.000000 0.00000	086851 .052106	-•750005 •200003	•2238E-63 •6436E+00
<b>8</b> 0	942800	994858	953924	• 29 10 E+ 00
	6342000	6334030	* JJ G J E 4	
0 C	-1.038000	089915	750055	.8107E=03
0 0	. 480000	.162020	.660009	.6500E+60
00	921400	982682	910468	.2035E+00
00	-1.236000	095703	747958	•1347E-82
00	.800100	288525	.992572	•6461E+60
00	853800	952677	819383	•2021E+00
0.0	-1.600000	168809	747752	.1887E-U2
00	1.175000	• 457325	1. 37 38 92	.6640E+60
0.0	737400	88261 &	663304	•2139E+60
	100			
00	-1.000000	132740	747389	.2518E-02
00	1.546000	.683173	1.690281	• 6222E+ 00
<b>50</b> 0	544000	718091	44 4215	.1776E+60
			<b>_</b>	
00	-1.000000	153543	743334	•1969E-52
0 0 0 0	1.785000	•934141 - 333488	1.874150	•6143E+00
UU	303900	322188	161626	•1727E+00
00	-1.500000	268347	-1.229655	.3684E-02
0 ១	1.732000	921489	1.773614	.5910E+00
00	0.00000	.280799	. 13 4912	.1448E+00
ě				
Ď O	-1.500000	239065	-1.245329	.54 90E- 02
00	1.670000	.702123	1.614691	.61 80E+00
0	• 22970 <b>0</b>	•670724	<ul><li>38 65 55</li></ul>	•1696E+00
		1010=1	4 01 75 4 5	
	-1.500000	194936	<b>-1.</b> 2450 68	-378 2E- 62
	1.460000	• 475316	1.329324	.6494E+40
U U	• 4659 <b>00</b>	.857948	.600527	•1996E+00
ត្ត ០	-1.500000	170981	-1.245783	.2596E-02
60	1.140000	• 3 6 4 68 3	979504	.6374E+ ûû
0	. 652000	.936981	.753512	.19C8E+00
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0	-1.500000	159881	-1.250120	.1677E-02
<b>6</b> 0	• 80000 <b>0</b>	•172638	·60ú034	.65 E4E+00
0	.768100	•971923	.846449	.2658E+00
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#### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

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		Y	Y	Y	Y	NY	NP
		Z	Z	Z	Z	NZ	NPZ
6	6	-1.330,00	-1.060000	-1.500000	-1.500000	153515	-1.25
		.400 * 00	0.065650	0.000000	• 40000 <b>0</b>	.055250	• 20 <b>0</b>
		.921400	•942800	.866000	.8426 <b>00</b>	.986601	. 893
	7	-1.005690	-1.000380	-1.500000	-1.500000	074106	-1.248
		0.000000	400000	400968	0.000000	251846	199
		•94280 <b>0</b>	.800000	.800000	.866000	•964926	• 85 <b>2</b>
	8	-1.300000	-1.000000	-1.500000	-1.500000	0.000000	-1.250
		400000	800000	880000	480080	447214	60 <b>0</b>
		.30000	.600,00	.600000	.892090	.894427	• 70 <b>0</b>
	9	-1.000000	-1.000-00	-1.500000	-1.500000	0.060000	-1.250
		800000	-1.200000	-1.200000	800000	447214	-1.000
		.600000	. 40 0000	.400000	.600000	• 694427	• 50 <b>0</b>
	10	-1.300000	-1.000000	-1.500000	-1.500000	0.000000	-1.250
		-1.200069	-1.600000	-1.600000	-1.200000	447214	-1.400
		. 490000	.200000	.200000	. 490000	•894427	• 30 0
	11	-1.090000	-1.000000	-1.500000	-1.500000	105654	-1.225
31		-1.600000	-1.885690	-1.732000	-1.690000	687853	-1 . 78 7
<b>—</b>		.200000	0.000000	0.000000	• 200000	•718119	• 10 0
	12	-1.000000	-1.000000	- 1.500000	-1.500000	268347	-1,229
		-1.885600	-1.785000	-1.670000	-1.732000	921489	-1.773
		0.00000	303900	229700	0.00000	280799	134
	13	-1.000000	-1.000000	- 1.500000	-1.500000	239065	-1.245
		-1.785000	-1.540000	-1.460000	-1.670000	702123	-1.614
		303900	544000	465900	229700	-•67 <b>û</b> 72 4	38 6
	14	-1.000000	-1.000000	- 1.500000	-1.500000	194936	-1.245
		-1.540000	-1.175000	-1.140000	-1.460000	475316	-1.3293
		544000	737400	652000	465900	857948	6006
	15	-1.030060	-1.0000000	-1.500000	-1.500000	170981	-1.2457
		-1.175000	800000	800000	-1.140000	304683	97 90
		737400	853800	768100	652000	936981	-• 7539
	16	-1.000000	-1.000000	-1.500000	-1.5000t0	159881	-1.2501
		800000	400000	400000	830000	172638	6000
		853800	921400	842600	768160	971923	846
	17	-1.000000	-1.0000000	- 1.500000	-1.500000	153515	-1.250
		400000	0.000000	0.000000	400000	055250	20 00
		921400	942800	866060	842600	986601	893

X	X	NX	NP X	D
Y	Y	NY	NP Y	T
Z	Z	NZ	NP Z	A
.50000	-1.500000	153515	-1.250012	.4933E-03
.00000	.40000	.055250	.20010	.6481E+00
.866000	.842600	.986601	.893198	.2027E+60
.500000	-1.500000	074106	-1.248100	•1853E-G1
.400000	0.00000	251846	199835	•6560E+00
.800000	.866000	.964926	.852389	•2073E+00
.500000	-1.500000	0.000000	-1.250000	.3553E-14
.800000	400000	447214	600000	.6708E+00
.600000	.800000	.894427	.700000	.2236E+00
.500000	-1.509000	0.00000	-1.250000	.3553E-14
.200000	800000	447214	-1.000Ju0	.6768E+00
.400000	.600000	.894427	.500000	.2236E+00
.500000	-1.500000	G.QGGGGG	-1.250000	.6661E-14
.600000	-1.290000	447214	-1.400000	.6708E+00
.200100	.490000	.894427	.300000	.2236E+00
.500000	-1.500000	105654	-1.225923	.26 41E-01
.732000	-1.690000	687853	-1.707445	.6096E+00
.000000	.200000	.718119	.100526	.1454E+00
500000	-1.500000	268347	-1.229655	.3684E-02
670000	-1.732000	921489	-1.773614	.5910E+00
229700	0.00000	280799	134912	.1448E+00
500000	-1.500000	239065	-1.245329	.5490E-02
460000	-1.670000	702123	-1.614691	.6180E+00
465900	229700	670724	386555	.1696E+00
500000 140000 652000 500000	-1.500000 -1.460000 465900	194936 475316 857948	-1.245068 -1.329324 600627	.3782E-82 .6494E+00 .1996E+00
500000	-1.500000	170981	-1.245783	.2596E-02
80000	-1.140000	304683	979004	.6374E+00
768100	652000	936981	753512	.1908E+00
500000	-1.500000	159881	-1.250120	.1677E-02
400000	800000	172638	600034	.6584E+00
842600	768100	971923	846449	.2058E+00
500000	-1.500800	153515	-1.250312	.4933E-03
000000	400000	055250	200310	.6481E+00
866000	842600	986601	893198	.2027E+00

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				1231	3001			
	N	М	X Y	X Y	X	X Y	NX N¥	NP X NP Y
			Ž	ż	Ž	Ž	NZ	NP Z
	6	18	-1.000000	-1.003000	-1.500000	-1.500000	153515	-1.250012
			0.000000 942800	• 400000 -•921400	• 400000 • • 8 42600	0.00000 866000	.05525J 9866 <b>0</b> 1	• 20 00 <b>10</b> •• 893 <b>198</b>
		19	-1.003000	-1.000000	-1.501000	-1.500000	159881	-1.250120
			•400000 ••921400	.800000 853800	.800000 768100	• 400000 ••84260 <b>0</b>	•172638 ••971923	• 60 0 0 3 <b>4</b> - • 84 64 4 <b>9</b>
		20	-1.000000	-1.000000	-1.500000	-1.500000	170981	-1.245783
			•809000 ••853800	1.175000 737400	1.140300 652000	.800000 768100	•304683 -•936981	• 97 9 0 0 4 • • 75 3 5 1 2
		21	-1.000000	-1.600000	-1.500000	-1.500000	194936	-1.245068
			1.175000 737430	1.540000 544000	1.469900 465909	1.140000 652000	•47531 6 -•857948	1.329324 60ú62 <b>7</b>
		22	-1.0000000	-1.023000	-1.500000	-1.500000	239065	- 1. 245329
			1.540000 544000	1.785000 303900	1.67000 229700	1.460000 465900	.702123 670724	1 • 61 46 91 - • 38 65 55
32		23	-1.000000	-1.000000	-1.500300	-1.500000	268347	-1,0229655
			1.785000 303900	1.88560U 0.00000	1.732900 0.00000	1.670000 229700	•921489 -•280799	1. 77 3614 13 4912
	7	1	-1.500600 1.732000	-1.500000	-2.030000	-2.000000	414479	-1.699678
			0.300000	1.670000 .229700	1.465000 .137800	1.490700 0.000000	.885202 .211244	1.611865 .096576
		2	-1.500006	-1.50 / 0 / 0	-2.000000	-2.000000	372374	-1.733772
			1.670000 .229700	1.460000 .465900	1.322000 .344400	1.465000 .137800	.725701 .578529	1. 48 4752 . 29 79 94
		3	-1.500030 1.460000	-1.500000	-2.000009	-2.000000	310024	-1.738932
			• 4659 🗓 🗓	1.140000 .652000	1.072000 .517900	1.322000 .344400	•507279 •864085	1.2507304 .497910
		4	-1.500000 1.140000	-1.509000 .809000	- 2.000000	-2.090000	269527	-1 • 738266 <sup>2</sup>
			•652000	.768100	•800 <b>0</b> 00 •628 <b>900</b>	1.072000 .517900	.335023 .902837	• 954054 • 64483 <b>7</b>
		5	-1.500000 .800000	-1.500000	- 2. 000000	-2.600000	250229	-1.750276
			.768100	• 400000 • 842600	• 409000 • 7180u 0	.800000 .628900	•19398 ¶ •948555	.600104 .739306
		6	-1.500000	-1.500000	-2.000908	-2.000000	237694	-1.750025
			•400000 •842600	0.000000 .866000	0.000000 .745460	.400000 .718000	•061556 •969388	• 20 00 30 ° • 79 29 9 2

80	D	Y

X	X	NX	NP X	D
Y	Y	NY	NP Y	T
Z	Z	NZ	NP Z	A
	//		4 050040	
-1.500000	-1.500000	153515	-1.250012	• 4933E- 63
.400060	0.00000	.05525J	. 200010	.6481E+00
8426 <b>00</b>	866000	986601	893198	.2027E+00
-1.583968	-1.500000	159881	-1.250128	.1677E-02
.800000	. 400000	•172638	.600034	.6584E+00
768100	842600	971923	- 846449	•2058E+00
-1100103	- 60 4500 1/	- 4911360	- 6040443	#20 J CC : 00
-1.500000	-1.500000	170981	-1.245783	.2596E-02
1.140360	.800000	. 3 64 68 3	.979004	.6374E+00
652000	768100	936981	753512	•1908E+00
-1.530003	-1.500000	194936	-1.245868	.3782E-02
1.460000	1.140000	.475316	1.329324	.6494E+00
465901	652000	857948	60ú627	•1996E+00
- 1.500000	-1.500000	239#65	-1.245329	.549 DE- 02
1.670900	1.460000	.702123	1.614691	.6180E+00
229700	465900	670724	38 65 55	.1696E+00
\$ 2 2 9 7 0 0	• 40000	00/4/24		110302.00
-1.580360	-1.500000	268347	-1.229655	•3664E-82
1.732900	1.670000	•921489	1. 77 3614	.5910E+00
0.000000	229700	280799	134912	.1448E+CO
C 230803	0 00000	1.41.1. <b>7</b> 0	-4 600679	74965-93
-2.000000	-2.000000	414479	-1.699678	.3180E+¥2
1.465000	1.490700	.885202	1.611865	•5833E+00
.137800	0.000000	.211244	. 196576	•1038E+00
-2.400000	-2.010000	372374	-1.733772	.7874E-ü2
1.322000	1.465000	.725701	1, 48 4752	.6199E+00
.344400	.13780 <b>0</b>	• 578529	• 297994	.1525E+G0
70 (1.,00		***************************************		
-2.000000	-2.000000	318924	-1.738932	.6345E-02
1.072000	1.322000	.507279	1.250730	.6350E+00
•51790ú	.344400	.864085	•497910	.1772E+00
				15.15.00
- 2.000000	-2.00000	269527	-1.738266	.4544E-02
.800000	1.072000	.335023	954054	. E218E+00
.6289 <b>00</b>	.5179ù0	.902837	.644837	•1695E+U0
- 2.000000	-2.600000	250229	-1.750276	.34 E2E- 02
.409900	.800000	•193980	.600104	.6750E+00
.718940	.628900	•948555	• 73 93 0 6	.2138E+£0
J. 20 9 9 9		1	-,	
-2.000000	-2.000000	237694	-1.750025	.9694E-03
0.000000	. 400000	.061556	.200030	·6572E+00
.745488	.718000	.969388	. 792992	.2063E+00

#### ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

N	М	X	X	X	X	NX	NPX
		Y Z	Y	Y	Y	NY	NP Y
		۷	Z	Z	Z	NZ	NP Z
7	7	-1.500000	-1.500000	-2.000000	-2.090000	197278	-1.74955
		0.000000	40 0000	400000	0.00000	113683	19975
		.866000	.800000	.718000	• 745480	• 973734	. 78 2 4 6
	8	-1.500000	-1.500000	-2.000000	-2.000000	075980	-1.74731
		400000	800000	800000	400000	-368319	59985
		.800000	.600000	.600000	.718900	926589	67977
	0	-1.500000	-1.500000	-5 500000	-3 282808	0.000000	_4 35 %0.0
	9			- 2. b 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-2.680000		-1.75000
		890000 -600000	-1.290000	-1.200000	800 <b>000</b>	447214	-1.00000
		• 000000	. 460000	.400000	•60000 <b>0</b>	.894427	• 50 0 0 <b>0</b>
	10	-1.500000	-1.500000	-2.000000	-2.000000	050829	-1.72:40
		-1.200000	-1.600000	-1.400000	-1.200000	496741	-1.35282
		. 400000	. 20000	• 256 <b>000</b>	. 400000	•866409	.31411
	11	-1.500000	-1.500000	-2.000000	-2.000000	348626	-1.76253
		-1.600000	-1.732000	-1.490700	-1.400000	842191	-1.55051
		•200000	0.000000	0.000000	.25 6000	.411387	• 11 39 4
	12	-1.500000	-1.500000	-2.000000	-2.000000	414479	-1.69967
ω		-1.732000	-1.670000	- 1.465000	-1.490700	885202	-1.61186
သ္သ		0.00000	229700	137800	0.000060	211244	19657
	13	-1.500000	-1.500000	- 2. 00000	-2.000000	- +372374	-1.73377
	10	-1.670000	-1.460000	-1.322000	-1.465000	725701	-1.48475
		229700	465900	344400	137800	578529	- 29799
					020,000		023,73
	14	-1.500000	-1.500000	-2.000000	-2.606000	310324	-1.73893
		-1.460000	-1.140 con	-1.072000	-1.322000	507279	-1.25973
		-•4659 <b>80</b>	- 65 2000	517900	344400	804085	49791
	15	-1.500000	-1.500000	-2.000000	-2.000000	269527	-1.73826
		-1.140000	800000	860000	-1.072000	335023	95405
		652000	768100	62890 <b>0</b>	517900	902837	64 48 3
	16	-1.500000	-1.500000	-2.900000	-2.000000	250229	-1.75027
		800000	48 0000	400000	600000	193980	60010
		768100	842600	718000	628900	948555	73930
	17	-1.500000	-1.500000	-2.000000	_2 00000	= 23760 <i>l</i> :	_4 7500 <i>0</i>
	± r	400000	0.000000	0.00000	-2.000000	237694	-1.75002 20603
		842600	866000	745400	4300 <b>00</b> 716000	061556 969388	-• 20003 -• 79299
		0072000	• • • • • • • • •	- • 1 4 5 4 6 8		- • 503300	17273
	18	-1.500008	-1.500000	- 2.000000	-2.000000	237 694	-1.75002
		0.00000	• 400000	.400000	0.00000	•061556	- 20003
		866000	842600	718000	745400	969388	79299
					•		

: : : : : : :	X Y Z	NX NY NZ	NP X NP Y NP Z	C T A
000	-2.000000	197278	-1.749550	.9397E-02
000	0.30000	113683	199759	.6572E+00
000	.745400	.973734	.782469	.2054E+00
000	-2.500000	075989	-1.747311	.1900E-01
000	400000	368319	599857	.6708E+00
000	.718000	.926589	.679777	.2158E+00
000 000	-2.600000 800000 .600000	0.000000 447214 .894427	-1.750000 -1.000000 .500000	.3553E-14 .6788E+00 .2236E+00
0 0 0	-2.000000	050829	-1.72 J409	.1271E-81
0 0 0	-1.200000	496741	-1.35 28 29	.6768E+80
0 0 0	.40000	.866409	.31 41 14	.1731E+60
000	-2.000000	348626	-1.762537	•1445E-01
700	-1.400000	842191	-1.550513	•6525E+00
<b>0</b> 00	.256000	.411387	.113943	•1354E+00
000 000 000 000	-2.00000 -1.490700 0.600000	414479 885202 211244	-1.699678 -1.611865 096576	.3180E-02 .5833E+00 .1038E+00
00 0	-2.000000	372374	-1.733772	.7874E-02
00 0	-1.465000	725701	-1.484752	.6199E+00
40 0	137800	578529	297994	.1525E+00
100 U	-2.606000	310324	-1.738932	.6345E-62
200 U	-1.322600	597279	-1.259730	.6350E+00
90 O	344466	804085	497910	.1772E+00
000	-2.000000	- • 2 69 52 7	-1.738266	.4544E-02
000	-1.072000	- • 3 3 5 û 2 3	954054	.6218E+00
900	517900	- • 9 û 2 8 3 7	644837	.1695E+00
000	-2.000000	250229	-1.750276	.3462E-02
000	600000	193980	600104	.6750E+00
900	628900	948555	739306	.2108E+00
00 0	-2.000000	237694	-1.750025	.9694E-03
00 0	490000	061556	200030	.6572E+00
40 0	716000	969388	792992	.2063E+00
000	-2.030000	237694	-1.750025	.9694E-03
000	0.000000	.061556	.200030	.6572E+00
000	745400	969388	792992	.2063E+00

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD. MASSACHUSETTS

DOOV T	D TEST		BEDFORD, MAS	SSACHUSETTS		
BODY I	D. TEST	TEST	BODY			
N M	X	X	X	X	NX	NP
	Y	Y	Y	Y	N <b>Y</b>	NP
	Z	Z	Z	Z	NZ	NP
7 19	-1.500000	-1.500000	-2.000000	-2.000000	-,250229	-1.75
	.400800	.860000	.800000	.40000	.193980	.60
	842600	768100	628900	718000	-,948555	73
20	-1.500000	-1.500000	-2.000000	-2.000000	269527	-1.738
	.800000	1.140000	1.072000	-800000	.335023	.957
	768100	652000	517900	628900	902837	644
21	-1.500000	-1.500000	-2.000000	-2.000000	310024	-1.738
	1.140000	1.460000	1.322000	1.072000	.507279	1.250
	652000	465900	344400	517960	804085	497
22	-1.590080	-1.500000	-2.000000	-2.00000	372374	-1.733
	1.469000	1.670000	1.465000	1.322000	.725701	1.484
	465900	229700	137860	344400	578529	297
23	-1.500000	-1.500000	-2.000000	-2.000000	414479	-1 • 69 <b>9</b>
	1.679000	1.732000	1.490760	1.465000	.865202	1 • 61 <b>1</b>
	229700	0.000000	0.00000	137800	211244	- • 09 <b>6</b>
34	***	*****		****	***	
8 1	-2.000000	-2.000000	-2.500000	-2.500000	597981	-2.216
	1.490700	1.322000	1.000000	1.655000	.747834	1.240
	0.000000	.344400	.235700	8.J00000	.288382	.149
2	-2.00000	-2.000000	-2.500000	-2.500000	425912	-2.214
	1.322000	.800000	.800000	1.000000	.463200	.990
	.344400	.628900	.381500	.235700	.777203	.411
3	-2.000000	-2.000000	-2.500000	-2.500000	397601	-2.250
	.80000	.400000	.400000	.800000	.246251	.600
	.628900	.718000	.515300	.381500	.883807	.560
4	-2.900000	-2.000000	-2.500000	-2.500000	36680 9	-2.250
	.400000	0.000000	0.000000	.400000	.07556 9	.200
	.718000	.745700	.552800	.515300	.927222	.632
5	-2.000000	-2.000900	-2.569000	-2.50 <b>0000</b>	366809	-2.250
	0.000000	400000	400000	0.000000	075569	200
	.745700	.718000	.515300	.5528 <b>00</b>	.927222	.632
6	-2.003000	-2.000000	-2.500000	-2.50000	372805	-2.250
	400000	800000	800000	40000	278586	600
	.718000	800000	.381500	.515360	.885102	.553

	X	NX	NP X	0
	Y	N <b>Y</b>	NF Y	T
0 0 0 0	Z -2.000000 .40000	NZ 250229 .193980	NP Z -1. 750276 .600104	A •3462E-02 •6750E+0
0 0 0 0	718000 -2.000000 .80000	948555 269527 .335023	739306 -1.738266 .954054	• 21 08E+00 • 4544E- 02 • 6218E+00
00	628900	902837	644837	.1695E+: 10
	-2.000000	310024	-1.738932	.6345E-02
00	1.072000 517900 -2.000000	•507279 ••804085 ••372374	1.250730 497910 -1.733772	.6350E+00 .1772E+00
0 0 8 0	1.322000	.725701 578529	1. 48 4752 297994	.1525E+00
00	-2.00000	414479	-1 • 69 96 78	.318GE-02
	1.465000	.885202	1 • 61 18 65	.5633E+G0
	137800	211244	- • 09 65 76	.1038E+G0
	*****	<del>* *</del>	***	*****
00	-2.500000	597981	-2.218024	•1342E-01
00	1.055000	.747834	1.240723	•7391E+00
00	0.J00000	.288382	.149617	•1939E+00
0 0	-2.500000	425912	-2.214445	.1034E-01
0 0	1.000000	.463200	.99ú269	.7238E+00
0 0	.235700	.777203	.411287	.2322E+00
9 C	-2.500000	397601	-2.250969	.9877E-02
10 D	.8000 <b>0</b> 0	.246251	.600392	.7233E+00
10 O	.38150 <b>0</b>	.883807	.560379	.2263E+00
<b>0 0</b>	-2.500000	366609	-2.250072	.2272E-02
	.400000	-075569	.200101	.6805E+00
	.515300	-927222	.632913	.2157E+60
	-2.500000	366809	-2.250072	•2272E-02
	0.000000	075569	-c200101	•6805E+00
	.552800	.927222	.632913	•2157E+00
	-2.50000	372805	-2.250383	.3496E-02
	40000	278586	600126	.7233E+00
	.515360	.885102	.553499	.2260E+00

#### ATPOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BOD	Y	ID.	. Т	EST
		10		1

#### TEST BODY

N	M	X	X	X	X	NX	NP
		Y	Y	Y	Y	NY	NP
		Z	Z	Z	Z	NZ	NP
8	7	-2.000000	-2.000000	- 2.500000	-2.500000	396212	-2.21
		800000	-1.200000	-1.080060	800000	458473	95 <b>6</b>
		.600000	. 400000	.235700	• 3815 <b>00</b>	•795499	• 416
	8	-2.300000	-2.000000	-2.500000	-2.500000	537231	-2.21
		-1.200600	-1.490700	-1.05500 <b>0</b>	-1.000000	740960	-1.209
		.40000	0.000000	0.000000	.235700	•452941	. 166
	9	-2.900000	-2.000000	-2.500000	-2.500000	597981	-2.218
		-1.490700	-1.322000	-1.000000	-1.055000	747834	-1.240
		0.000000	344400	235700	0.00000	288382	149
	10	-2.000000	-2.000000	- 2.500 000	-2.500000	425912	-2.214
		-1.322000	800000	800000	-1.000000	463200	990
		344400	628900	381500	235700	777203	41 1
	11	-2.630000	-2.000000	-2.500000	-2.500000	397801	-2.25 <b>0</b>
		800000	400000	400000	800000	246251	60 <b>0</b>
		628900	718000	515300	381500	883807	- • 56 <b>0</b>
ω	12	-2.000000	-2.000000	-2.500000	-2.500000	366578	-2.25 <b>0</b>
ن ا		400000	0.000000	0.00000	400000	075231	20 <b>0</b>
		718090	745400	552800	515300	927341	632
	13	-2.000000	-2.000000	-2.500000	-2.50000 <b>0</b>	366578	- 2. 25 <b>0</b>
		0.300000	. 40 0000	.400000	0.000000	.075231	• 20 <b>0</b>
		745400	71 8000	515300	552800	927341	632
	14	-2.000000	-2.300000	-2.500000	-2.50000 <b>0</b>	397801	-2.250
		.400000	.80000	.800000	. 400000	.246251	.60 <b>0</b> (
		718000	628900	381500	515300	883807	<b></b> 56 <b>0</b>
	15	-2.000000	-2.060000	-2.500000	-2.500000	425912	-2.214
		.800000	1.322000	1.000000	.8000 <b>0</b> 0	•463200	.990
		628990	344400	235700	381500	777203	411
	16	-2.000000	-2.000000	-2.500000	-2.500000	597981	-2.218
		1.322000	1.490700	1.055000	1.600000	.747834	1.240
		344400	0.000000	0.000000	235700	288382	149
		***	******		* * * * * * * * * * * * * * * * * * * *	***	
9	1	-2.500000	-2.500000	-3.000000	-3.009000	868756	-2.626
		1.055000	.800000	0.000000	0.000000	.411733	. 687
		0.000000	.381500	0.00000	0.00000	.275208	. 149

BODY

X	X	NX	NP X	D
Y	Y	NY	NP Y	T
Z	Z	NZ	NP Z	A
-2.500000	-2.500000	396212	-2.218355	.1214E-01
-1.000080	800000	458473	956945	.6502E+00
.235700	.381500	.795499	.416059	.1886E+00
-2.500000	-2.500000	537231	-2.212088	.2711E-81
-1.055000	-1.000000	740960	-1.209729	.7351E+00
0.00000	.235700	.402941	.166619	.2145E+80
-2.500000	-2.500000	597981	-2.218024	•1342E-01
-1.000000	-1.055000	747834	-1.240723	•7351E+00
235700	0.00000	288382	149617	•1939E+00
-2.500000	-2.500000	425912	-2.214445	.1934E-01
800000	-1.090000	463200	990269	.7238E+00
381500	235700	777203	411267	.2322E+00
-2.500000	-2.500000	397801	-2.250969	•9877E-02
400000	800000	246251	600392	•7233E+00
515300	381500	883807	660379	•2263E+00
-2.580000	-2.500000	366578	-2.250074	.2342E-G2
0.00000	400000	075231	208104	.6804E+00
552800	515300	927341	632837	.2157E+60
-2.500000	-2.500000	366578	-2.250074	.23425-02
.400000	0.000000	.075231	.200164	.68046+00
515300	552800	927341	632837	.21576+00
-2.500000	-2.500000	397801	-2.250969	.9877E-02
.800000	.40000	.246251	.600392	.7233E+00
381500	515300	883807	560379	.2263E+00
-2.500100	-2.500000	425912	-2.214445	.1034E-01
1.000000	.800000	.463200	.990269	.7238E+00
235700	381500	777203	411287	.2322E+00
-2.50000	-2.500000	597981	-2.218024	•1342E-01
1.055000	1.60000	.747834	1.240723	•7391E+00
0.00000	235760	288382	149617	•1939E+00
	*****	** *	***	***
-3.000000	-3.009000	868756	-2.626833	0.
0.000000	0.000000	.411733	.687692	.11 67E+01
0.000000	0.000000	.275298	.149145	.2316E+00

### ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

800	<b>``</b>	ID.	TEST
PK 1 11	17	1116	1 - 1
	, ,	TO 8	1 1 1 1

<b>1</b> 1		14	* <b>.</b>		•		<b>XPX</b> XP X NP <b>X</b>
N	М	X	X	X	X	NX	NP X
		Y	Y	Y	Y	NY	NP Y
		Z	Z	Z	Z	NZ	NP 4
9	2	-2.500000	-2.500000	-3.000000	-3.000000	776209	-2.6 <b>29</b>
		.800000	.400000	0.00000	0.00000	.200002	• 43 <b>4</b>
		.38150C	•515300	0.000000	0.60000	•597912	• 33 6
	3	-2.500000	-2.500000	- 1.000000	-3.000000	740175	-2.635
		.400000	0.000000	0.000000	0.00000	.062764	. 14 1
		.515300	• 55 28 0 0	0.000000	0.00000	•669478	• 38 9
	l <u>.</u>	-2.500000	-2.500000	- 3.000000	-3.00000	740175	- 2. 63 <i>5</i>
		0.000000	480000	0.00000	0.000000	062764	141
		•552 <b>800</b>	.515300	0.00000	0.0000 <b>0</b>	.669478	• 38 <b>9</b> 7
	5	-2.500000	-2.500000	- 3.000000	-3.000000	776209	-2 - 62 91
		400000	800000	0.00000	3.600000	200002	- • 43 4
		.515300	•38 15 <b>00</b>	0.00000	0.00000	•597912	• 33 6 <b>2</b>
	6	-2.500000	-2.500000	- 3.000000	-3.000000	868756	-2.626
		809009	-1.055000	0.00000	0.00000	411733	687 <b>6</b>
		.381500	0.000000	0.00000	9.000000	.275208	• 1491
36	7	-2.500000	-2.580000	-3.000000	-3.000000	868756	-2.626
6		-1.055000	800000	0.080000	0.000000	411733	687 <b>6</b>
		0.000000	381500	0.00000	0.000000	275208	1491
	8	-2.500000	-2.500000	-3.000000	-3.000000	776209	-2.6291
		800000	400000	0.000000	0.00000	200002	4341
		381500	515300	0.00000	0.00000	597912	3362
	9	-2.500000	-2.500000	- 3.000000	-3.000000	740175	-2.6354
		400000	0.000000	0.000000	0.00000	062764	1412
		515300	552800	0.00000	0.00000	669478	3897
	10	-2.500000	-2.500000	-3.000000	-3.000000	740175	-2.6354
		0.00000	.400000	0.000000	0.000000	.062764	. 1412
		552800	515300	0.00000	0.000400	669478	3897
	11	-2.500000	-2.500000	-3.000000	-3.600000	776209	-2.6291
		.400000	.800000	0.000000	0.00000	.200002	• 43 41
		51530 <b>0</b>	381500	0.00000	u. 690 660	597912	-• 33 62
	12	-2.500000	-2.560000	-3.000000	-3.000000	868756	-2.6268
		.800000	1.055000	0.00000	0.00000	•411733	• 68 <b>76</b>
		381500	0.000000	G.00000	0.00000	275208	1491
							,

BOD Y

X	X	NX	NP X	0
<b>Y</b>	Y	NY	NP Y	T
Ž	ż	NZ	NP Z	À
-3.000000	-3.00000	776209	-2.629150	.1332E-14
0.000000	0.00000	.200002	.434170	.1018E+01
0.000000	0.00000	.597912	.336208	.1672E+00
0.000000	000000.5-	740175	-2.635472	.2220E-15
0.000000	000000.0	.062764	.141262	.8219E+00
0.000000	000000.u	.669478	.389779	.1494E+00
- 3.000000	-3.00000	740175	-2.635472	.3053E-15
0.00000	0.00000	062764	141262	.8219E+00
0.00000	0.00000	.669478	.389779	.1494E+00
- 2.000000	-3.000000	776209	-2 • 62 91 50	•1110E-14
0.000000	000000.0	200002	- • 43 41 70	•1016E+01
0.000000	000000	.597912	= 33 62 08	•1672E+00
-7.00.330	-3.000000	868756	-2.626833	.8882E-15
0.00000	0.00000	411733	687692	.1167E+01
0.00000	0.00000	.275208	.149145	.2316E+00
-3.000000	-3.00000	868756	-2.626833	0.
0.000000	0.00000	411733	687692	•1167E+01
0.000000	0.00000	275208	149145	•2316E+00
-3.600000	-3.000000	776209	-2.62915 <b>0</b>	.1332E-14
0000000	0.00000	200002	434170	.1018E+01
0000000	0.00000	597912	336208	.1672E+00
- 3.000000	-3.000000	740175	-2.635472	.2227E-15
0 0000000	0.00000	062764	141262	.8219E+00
0 000000	0.00000	669478	389779	.1494E+00
-3.000000	000000.00	740175	-2.635472	•3053E-15
0.000000	000000.00	.062764	.141262	•8219E+00
0.000000	000000.0	669478	389779	•1494E+00
	-3.600000 0.00000 0.00000 0.00000	776209 .200002 597912	-2.629150 .434170 336208	• 1110E-14 • 1018E+01 • 1672E+00
	-3.000000	868756	-2.626833	.8862E-15
	0.00000	.411733	.687692	.1167E+01
	u.00000	275238	149145	.2316E+00
	*****	<b>₹</b> ₩ ¥	***	*****

# 189 BASIC ELEMENTS WERE INPUT FLOWS HAS SET UP 1 X FLOWS, 0 Y FLOWS, AND 0 Z FLOWS.

NEAR ELEMENTS = 12340

INTERMEDIATE ELEMENTS = 12849

FAR ELEMENTS = 10532

LEAVING VFORM

LEAVING AFORM

THE 189 X 189 MATRIX WITH 1 RIGHT SIDES WAS SOLVED DIRECTLY.

LEAVING ATAPES

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	М	NPX	VT	1437		
			NPY	VTSQ	VX	DCX	NX
			NPZ	CP	VY	DCY	NY
				O1	٧Z	DCZ	NZ
	1	1	1.591395	• 650542	•186355	• 28 E4 60	05055
			1.389794	• 423205	683774	-,928109	•958 <b>0</b> 86
			• 0 9 4 8 9 9	• 576795	154737	237613	• 276584
		2	4 506745			• 207013	.074655
		۷	1.598349	• 722874	.242954	:336094	•941794
			1.254020	• 522546	520217	719651	•251249
			• 282927	• 477454	439138	607572	.223380
		3	1.605113	227705			4550308
			1.019539	• 82 73 95 604 500	.333118	• 40 25 99	•915363
			• 445612	• 684582	<b></b> 38 963∂	470922	.202414
			* 447012	. 31 5418	54 9454	784950	.348352
		4	1.609275	• 907577	•410652	1 = 0	
			.750320	• 8236 56	257457	• 452482	.891771
			• 557494	• 176304	<b></b> 767312	283676	.146221
		_			*101312	645451	•428210
		5	1.620269	940808	. 45 60 97	• 484793	07 505
			• 447981	•885119	124538	132373	.87+522
			.613081	• 114881	81 337 p	864553	• 988802
õ		c	4 60:64			***************************************	•476787
		6	1.624811	• 975755	• 487598	• 499713	8556.0
			• 1470 89	• 952098	.010372	.01630	.865649 .029238
			.641222	• 147902	845127	866126	•499797
		7	1.626941	1.0225 {2			
			148316	1.045673	• 516023	. 504625	.863087
			623224	045673	.185219	.161129	082222
				• 049673	36 31 8 6	844124	•493318
		8	1.627233	1.027046	.501079	602700	
			4428.46	1.354824	• 38 5641	•487683	.872872
			• 524111	554824	899336	• 375436 - 3880 07	218218
		_			00 \$ 3000	788023	• 436436
		9	1.618821	1.037872	•505633	•487230	072076
			751160	1.077179	• +54951	•436350	.872872
			• 386778	077179	783833	755286	-#218218 •436436
	1	.0	1.607148	4 015555		4 - 5 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6	• 430436
	-		-1.085976	1.045350	•507243	.485237	.872872
			• 242718	1. (92756	• 58 4246	• 48 ≥ 370	218218
			V C 4 E 1 1 10	-• 092756	762363	725290	• 436 436
	1	1	1.589795	. 843584	275890		
			-1.365206	• 711633	•275038 •631390	.326094	•9≒5063
			. 034464	• 288367	487141	• 748462	272824
		_			•40/141	577466	•180964
	1	2	1.591395	• 659238	•182435	• 276812	051555
			-1.339794	• 4345 54	·63345ø	• 960895	•95808E
•			094899	• 565406	354927	007473	- 276584
					/ <del> /</del>	***********	074655

	X-F_OW			
VT TSQ CP	VX VY VZ	DCX DCY DCZ	NX NY NZ	VN Sig
<b>50</b> 542 <b>2320</b> 5 <b>76</b> 795	•186355 -•683774 -•154737	•286460 -•928109 -•237613	•958086 •276584 •074655	.000000 139050
22874 22546 77454	•242954 -•520217 -•439138	.336094 719651 607572	.941794 .251249 .223380	.00e830 137437
<b>273</b> 95 <b>845</b> 82 <b>1541</b> 8	•333118 -•389636 -•649454	• 402599 -•470922 -•784950	•915363 •202414 •348052	.000000 133778
07577 236	•410652 -•257457 -•767312	• 452482 -• 283676 -• 8 45451	.891771 .146221 .428210	.2060c0 130613
<b>40</b> 808 <b>851</b> 19 <b>14</b> 881	.456097 124538 813376	•484793 -•132373 -•864553	.874522 .388302 .476787	.000000 123792
<b>757</b> 55 <b>520</b> 98 <b>47</b> 902	.487598 .010372 845127	.499713 .616638 866126	.865649 .929238 .499797	• 00 0 6 u G - • 1276 £4
<b>22</b> 5 {2 •5673 •5673	•516023 •185219 ••363186	• 504625 • 181129 • • 844124	.863987 082222 .493318	.000050 127758
<b>270</b> 46 <b>54</b> 824 <b>54</b> 824	.501379 .385641 809336	.487683 .375436 788023	.872072 218218 .436436	• 000039 -•134528
<b>57</b> 872 <b>771</b> 79 <b>771</b> 79	•505633 •≠54951 ••783893	•487230 •436350 ••755286	.872872 213218 .436436	. სძმსძმ 136386
<b>53</b> 50 <b>27</b> 56 <b>27</b> 56	.507243 .584246 762363	•485237 •482370 ••725290	.872872 218218 .436436	.0000J0 128897
3584 1633 8367	.275038 .631390 487141	•326094 •748462 ••577466	.945063 272824 .180364	.000050 145478
9238 4554 5406	•182435 •633458 ••354927	•276812 •960895 ••007473	.958086 276584 074655	. 1100000 143742

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	M	NPX	VT	vx	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
1	13	1.598349	.686910	. 228418	.332515	.941794
		-1.254020	• 4718 45	. 54 55 3 3	.794140	251249
		282927	• 52 <b>815</b> 5	•349431	•508700	223380
	14	1.605113	•794765	.319054	.401444	•915363
		-1.019539	•631651	• 417354	• 5 2 5 1 2 9	262414
		-•445612	• 368349	•596382	.750386	348052
	15	1.609275	.883963	.399134	• 452056	.891771
		750320	.779800	.290737	.329203	146221
		<b>-</b> • 55 <b>7</b> 4 94	.220200	.732075	829018	428210
	16	1.620269	•918614	• 44 53 5 U	•484818	.874522
		447901	.843852	.170819	.185953	088802
		613981	• 156148	.785065	.854619	476787
	17	1.624811	• 938859	•469935	•50 b5 <b>02</b>	.865649
		147089	.881457	.060633	• 0 6 45 8 <b>1</b>	029238
(4)		641222	• 118543	.810495	.863265	499797
39	. 8	1.624811	.941987	.471601	.500645	.865649
		•147089	.887340	0 .2714	045345	•02923€
		641222	•112660	.814314	•864464	499797
	19	1.620269	.923862	.450482	•484982	.874522
		• 447901	<ul><li>862784</li></ul>	152091	163739	.088802
		613081	•137216	•797947	.859059	476767
	29	1.609275	•902372	. 40 8274	• 452446	.891771
		<ul><li>750320</li></ul>	<ul><li>814275</li></ul>	271614	301000	•146221
		557494	•185725	.757505	.839459	428210
	21	1.605113	• 824376	.331816	· 4 <b>3</b> 25 0 5	•915363
		1.019539	679596	397026	481607	. 202414
		445612	.320404	.641767	.77.6488	348052
	22	1.598349	•721173	.242312	.335997	.941794
		1.254020	• 520090	523530	~•726025	• 251249
		282927	.479910	. 432699	•595994	223380
	23	1.591395	• 6499 87	•186167	.286416	.958086
		1.389794	• 422484	604720	930356	.276584
		1948 99	.577516	•148793	•228917	074655
2	1	1.220560	1.298463	1.168799	. 900141	• 435365
		1.831729	1.686005	543418	418509	.855263
		•149900	686005	156877	120818	.281036

DCX DCY DCZ	NX NY NZ	VN SIG
.332515 .794140 .508700	.941794 251249 223380	.000030 141206
.401444 .525129 .750388	.915363 2 £2414 348152	.000000 136358
.452056 .329203 .829018	.891771 146221 428210	.000000 132383
.484818 .185953 .854619	.874522 088802 476787	.000000 129915
.500602 .064581 .863265	.865649 029238 499797	.000000 126441
.506645 045345 .864464	.865649 .029238 499797	• 000000 -•128168
.484982 163739 .859059	.874522 .088802 476787	.000000 129054
.452446 301000 .839459	.891771 .146221 428216	.6040a0 130873
.492505 481607 .778488	.915363 .202414 348052	.00000u 133979
.335997 726026 .599994	.941794 .251249 223380	.300000 137551
.286416 930356 .228917	.958986 .276584 074655	.000056 139085
.900141 418509 120818	.435365 .855263 .281038	.000000 041547

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	M	NPX	٧T	٧x	DCX	NX
			NPY	VTSQ	VY	DCY	NY
			NPZ	CP	VZ	DCZ	NZ
	2	2	1.241719	1.342441	1.235652	• 920459	.390089
			1.652830	1.802147	<b></b> 395679	294746	.652170
			• 414680	802147	344554	-,256670	.650004
		3	1.241630	1.394162	1.318375	• 945640	.324553
			1.351646	1.9436 67	240723	172665	.44700€
			• 631851	-•9436 87	384222	<b></b> 275593	.833577
	,	4	1.242993	1.422806	1.362458	• 957585	.2880 <b>0</b> 9
			. 985715	2.024378	135694	095371	,28715 L
			.786135	-1.024378	386876	271910	.913561
		5	1.250180	1.439029	1.385168	.962571	.278929
			.600088	2.070805	055319	038442	.163401
			.876683	-1.970805	386075	268289	•948629
	;	6	1.250017	1.440042	1.388034	•963884	264704
		•	.200026	2.073722	.055597	• 953604	•261384 • <b>0</b> 5252 <b>7</b>
			. 9220 94	-1.073722	379465	263509	.963805
40		7	1.246098	4 4.54.053	4 144656	004475	47644
		1	<b>199566</b>	1•454052 2•114266	1.441656	.991475	.126140
			.867167	-1.114266	•103242 -•158854	•071603 <b>-•10</b> 9249	312996
			• • • • • • • • • • • • • • • • • • • •	10 11 42 60	- 4 1 2 0 0 2 9 4	- 103249	.941341
		8	1.250000	1.464273	1.463954	•999782	0.030000
			600000	2.144096	.027353	.018687	447214
			.700000	-1.144096	.013631	.009344	.894427
	(	9	1.250000	1.459110	1.458563	•999623	0.000000
			-1.000000	2.129001	• 035829	•024556	447214
			•500000	-1.129001	.017915	.012278	.894427
	11	O	1.250000	1.413037	1.412346	•999511	0.000000
			-1.400000	1.996674	.039537	.027980	447214
			.300000	-•996674	•019768	.013990	.894427
	1:	1	1.216789	1.329756	1.312735	• 987245	•1590 <b>0</b> 8
			-1.739216	1.768252	.118463	.089086	593315
			.102018	76 8252	175463	131951	.78910 9
	18	2	1.220560	1.246825	1.106576	.891807	• 435365
			-1.831729	1.539647	•561339	. 452391	855263
			149900	539647	.005949	.004795	201038
	13	3	1.241719	1.307517	1.201637	.919023	•390089
			-1.652830	1.709599	•417526	.319327	652170
			414680	709599	• 30 2225	. 231144	650004

X-FLOW

Y	

٧X	DCX	NX	VN
VY	DCY	NY	SIG
٧Z	DCZ	NZ	
1.235652	• 920459	•390089	0.0.0.0.2.0
395679	294746	•652170	•000000 -•031945
344554	256670	.650304	631945
1.318375	•945640	• 324553	.000000
240723	172665	•44788€	019186
384222	275593	.833577	
1.362458	• 957585	•2880 <b>0</b> 9	. 300000
135694	095371	.287154	011885
386876	271910	.913561	
1.385168	•962571	270020	<b>68</b> 67.6
055319	038442	•270929 •163401	000000
386075	268289	• 948629	008418
	4 6 0 0 6 0 3	• 540025	
1.368034	• 963884	.261384	.000000
·055597	.038608	.052527	007881
379465	263509	•963805	
1.441656	•991475	•126140	• 600000
•103242	.071003	312996	.022592
158854	109249	.941341	***************************************
1.463954	•999782	0.050000	and the second
•027353	•018687	447214	.00000
• 013631	.009344	.894427	. 651235
		# O J T T E. P	
1.458563	• 999623	0.000000	. 300000
• 935829	• 02 45 56	447214	· L49986
.017915	·012278	.894427	
1.412346	• 999511	0. ១ ដល់ប៉ុង្ស	. 600000
.039537	.027980	447214	• £47884
.019753	· C 1 39 9 C	.894427	1211004
1.312795	• 987245	4.508.60	<b>.</b> .
•118453	• 889086	•159008 -•593315	000000
175453	131951	.78910 S	.011237
- · · · · · ·	V = 0 = 3 > 2	•••	
1.106576	.891807	• 435365	.000000
• 561339	. 452391	855263	U52420
• 00 5949	.004795	201938	
1.201637	.919023	•390089	• 000036
•417526	.319327	652170	039199
• 30 2225	. 231144	65u004	100 31 33

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NPX	٧T	٧x	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
2	14	1.241638	1.375733	1.388194	.945891	• 324553
		-1.351646	1.892642	.259936	•188943	44700E
		631851	892642	.366843	.266651	833577
	15	1.242990	1.414596	1.354295	•95 <b>730</b> 9	.288009
		985715	2.001080	.156928	•116935	287154
		786135	-1.001080	.377600	.266931	913561
	16	1.250180	1.43 91 88	1.385197	.962478	.270929
		600088	2.071262	.088699	.061631	163481
		876683	-1.071262	.380331	.264268	<b></b> 943629
	17	1.250917	1.449715	1.399232	•965212	.261384
		200026	2.101673	.030686	.621167	052527
		922094	-1.101673	.377813	.260612	963805
	18	1.250017	1.451738	1.401258	•965235	•261384
		.200026	2.107544	022042	015183	.052527
		922094	-1.107544	.378823	.260944	963805
41	19	1.250180	1.445716	1,391539	• 962560	.270929
		• 500088	2.090095	079317	-•054863	.163401
		876683	-1.090095	.383776	.265457	948629
	20	1.242993	1.426664	1.366014	• 957488	.288009
		.985715	2.035371	146440	102645	.287154
		786135	-1.635371	•384619	.269593	913561
	21	1.241630	1.396261	1.320233	•945549	•324553
		1.351646	1.949544	245998	176183	.447006
		631851	949544	.382116	.273671	833577
	22	1.241719	1.343418	1.236477	•920396	.390089
		1.652830	1.804772	398238	296481	.652170
		414680	804772	.342426	.254891	650004
	23	1.220560	1.298765	1,169035	.900112	•435365
		1.831729	1.686792	544235	419079	.855263
		149900	686792	.154613	119039	281038
3	1	•500000	1.212633	1.212570	• 999948	0.00000
•	-	1.935000	1.470479	004275	003526	.938893
		.177300	478479	.011662	.009617	.344208
	2	.500000	1.2214.63	1.221289	.999841	0.00000
	-	1.735000	1.492020	016098	013179	.672591
		.477300	- 492020	.014632	.011979	.740014

DCX DCY DCZ	NX N Y N Z	VN SIG
•945091 •186943 •266651	.324553 447006 833577	.000000 024030
.95 <b>730</b> 9 .116935 .266931	.288009 287154 913561	.000000 314970
.962478 .961631 .264268	.270929 163401 948629	.000000 010137
.965212 .021167 .260612	.261384 052527 963805	.000000 007697
.965235 015183 .260944	.261384 .052527 963805	.000000 007196
•962560 ••054863 •265457	.27u929 .163401 948629	• u0 0000 •• 008545
•957488 ••102645 •269593	.288009 .287154 913561	.000000 012085
.945549 176183 .273671	•324553 •447886 ••833577	.000000 019350
.920396 296481 .254891	.390089 .652170 650004	.0000u0 032050
.900112 419079 .119039	•435365 •855263 ••281038	• 6600J0 -• 041587
.999948 003526 .009617	0.000000 .938893 .344208	.000000 .009526
.999841 013179 .011979	0.000000 .672591 .740014	.00050 <b>0</b> .009772

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	M	NPX	VT	٧x	DCX	NX
	••	•	NPY	VTSQ	۷Y	DCY	NY
			NPZ	CP	٧Z	DCZ	NZ
	3	3	.500000	1.232356	1.232287	.999879	0.000006
			1.400000	1.518701	017153	013919	.447214
			.700000	518701	.008577	.006960	.894427
		4	.500000	1.237037	1.236932	•999955	0.000000
			1.000000	1.530261	011243	009088	.279631
			.858250	530261	.00 3274	.002647	.960107
		5	.500000	1.234013	1.234011	.999998	0.000000
			.60 <b>00</b> 00	1.522789	002482	002011	.156305
			.948150	5227 89	.000333	.006318	.987709
		6	.500000	1.2200 64	1.220020	.999964	0.000000
			.200300	1.488557	.010370	.008500	.050436
			.989900	488557	900524	000429	.998727
		7	.500000	1.20 6541	1.206516	.999979	0.00000
		•	200000	1.455742	007029	005826	447214
			.996000	455742	003515	002913	.894427
42		8	.500000	1.196347	1.196331	•999986	0.000000
		J	600000	1.431247	.005573	.004659	447214
			.700000	431247	.002787	.002329	.894427
		9	•5000C0	1.185439	1.185352	.999927	0.000000
			-1.000000	1.405265	• 11 2836	.610828	447214
			.500000	40 5265	.006418	.005414	。894427
	1	LO	.500000	1.175488	1.175237	•999829	0.000000
			-1.400000	1.381772	.019439	.016537	447214
			.300000	381772	.009719	.008268	.894427
		11	.500000	1.164000	1.163439	.999519	0.000000
			-1.800000	1.3548 5	.032332	.027751	447214
			.190000	354895	.016151	.013876	.89+427
		12	.590000	1.16 (003	1.167855	.999873	0.000000
			-1.935000	1.364231	.006398	•005477	938893
			177300	364231	017450	014940	344208
		13	.50 <b>000</b> 0	1.195483	1.195120	.999763	0.000000
			-1.735000	1.42 8989	.019253	.016106	672591
			477300	428989	017499	014638	743014
		14	.500000	1.218760	1.218532	•999813	0.300000
			-1.400000	1 - 48 5377	.021030	.017296	447214
			700900	485377	010540	CU 8648	894427

X-FLOW

VX VY VZ	DCX DCY DCZ	NX NY NZ	SIG
1.232207 017153 .008577	.999879 013919 .006960	0.000000 .447214 .894427	.006630 .010857
1.236932 011243 .003274	.999955 069088 .002647	0.000000 .279631 .960107	. 000000 . 011576
1.234011 002482 .000393	.999998 002011 .006318	0.000000 .156305 .987709	.000090 .011805
1.220020 .010370 000524	•999964 •008500 ••000429	0.000000 .050436 .998727	.000000 .010980
1.206516 007029 003515	.999979 005826 002913	0.00000 447214 .894427	.000000 .011147
1.196331 .005573 .002787	.999986 .004659 .002329	0.000000 447214 .894427	.000000 .011654
1.185352 .012836 .006418	.999927 .010828 .005414	0.00000 447214 .894427	.000080 .010632
1.175237 .019439 .009719	.999829 .016537 .006268	0.000000 447214 .894427	000000. e03800.
1.163439 .032332 .016151	,999519 .027751 .013876	0.000000 447214 .89+427	.001880 .004981
1.167855 .006398 .017450	•999873 •005477 •014940	u.00000 938893 344208	.000000 .006411
.032332 .016151 .167855 .006398 .017450 .195120 .019253 .017499	.999763 .016106 014638	0.000000 672591 743014	.000688 .007340
.21 8532 .0 21030 .0 10540	•999813 •017296 -•008648	0.360000 447214 894427	000000 000000

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NPX NPY NPZ	VT VTSQ CP	VX VY VZ	DCX DCY DCZ	NX NY NZ
3	15	.500000 -1.000000 858250	1.234579 1.524186 524186	1.234452 .016316 004752	.999905 .013216 003849	0.000000 279631 960107
	16	•500000 ••600100 ••948150	1.244132 1.547863 547863	1.244037 .010366 001640	.999964 .008332 001319	0.000000 156305 987709
	17	•500000 ••20000 ••989900	1.249397 1.560993 560993	1.249390 .004210 000213	.999994 .003369 000170	0.000000 050436 998727
	18	•500000 •200000 ••989900	1.251259 1.565650 565650	1.251258 001969 000039	.999999 001573 000079	0.000000 .050436 998727
	19	.500000 .600000 948150	1.249969 1.562422 562422	1.249942 008053 001276	.999979 006451 001021	0.030300 .156305 987709
43	20	.509000 1.000000 858250	1.245269 1.550694	1.245195 013854 004038	• 999933 -• 011133 -• 003242	0.000000 .279631 960107
	21	.500000 1.400000 700003	1.236471 1.528862 528862	1.236305 018128 009064	.999866 014661 007331	0.090000 .447214 894427
	22	.500000 1.735000 477300	1.223413 1.496738 496738	1.223215 016278 014795	.999838 013306 012093	0.0 b ú 0 J 0 .672591 740314
	23	.500000 1.935000 177300	1.213215 1.471890 471890	1.213153 004220 011510	.999949 003478 009487	0.00000 .938893 344208
4	1	248968 1.923092 .174952	1.156990 1.338626 338626	1.155568 .053200 .021401	.998771 .045981 .018497	049532 .939127 .339980
	2	249477 1.726269 .470683	1.161134 1.348232 348232	1.160040 .029883 .040558	.995058 .025736 .034938	043145 .67515 { .736411
	3	249169 1.395016 .692774	1.165449 1.358272 358272	1.164718 .010548 .040195	.999364 .005051 .034489	034875 .449471 .892614

X-FLOW

YGC

VX	DCX	NX	۷N
VY VZ	DCY DCZ	NY NZ	SIG
1.234452	•999905	0.000000	.000000
.016316	.013216	279631	.010302
104752	003849	960107	• #1#3#5
1.244037	. 999964	0.000000	.000600
.010356	.008332	156305	.011310
001640	001319	987709	
1.249390	• 999994	0.000000	. 600000
.004210	.003369	050436	.011924
000213	000170	998727	7 4 4 4 4 4
1.251258	.999999	0.00000	.000000
001969	001573	.050436	.012193
000099	000079	998727	
1.249942	•999979	0.000000	
008053	6 0 64 51	.156305	.012128
001276	001021	987709	
1.245135	• 999933	0.000000	.000000
013854	011133	•279631	.011760
004038	003242	968107	• 6771.60
1.236305	•999866	0.080000	.000000
018128	014661	.447214	.010921
009054	007331	894427	
1.223215	•999838	0.000000	.000000
016278	013306	•672591	.009813
014795	012093	740014	
1.213153	• 999949	0.00000	.000000
90 4220	003478	.938893	.009545
011510	009487	344208	
1.155568	• 998771	049532	•ប្រាសិច្ចប្រ
.053200	.045981	•939127	.004922
.021491	.018497	.339980	-
1.160040	•999058	043145	. 600000
.029883	.025736	.675151	.004422
• 0 4 0 5 5 8	• 0 3 49 38	.736411	
1.164738	• 9 9 9 3 6 4	034875	. 600000
.010548	005051	• 449471	• 00 40 10
.040195	.034489	892614	4 0 0 70 TC
	, ,	* = * <b>* V &amp;</b> T	

### ATMOSPHERIC SGIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NPX	V 1	VX	DCX	NX
		NPY	VTSQ	۷Y	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
4	4	249537	1.166421	1.165810	•999476	031043
		•998756	1.360539	000124	000106	281449
		.850538	360539	.037770	.032381	.959074
	5	250016	1.163090	1.162535	.999497	029218
		.600001	1.352777	008797	007555	.157442
		.940749	352777	.035812	.030790	.987096
	6	250602	1.152040	1.151345	.999397	028252
		.200000	1.327195	021558	018722	. 850769
		• 98 <b>2</b> 8 25	327196	.033693	.029235	.998310
	7	249496	1.13 5124	1.134800	.999714	012608
		199997	1.288507	026978	023767	434526
		.896509	2885 (7	.002870	.002529	.900571
	8	250000	1.119936	1.119873	.999944	0.009000
	-	690000	1.254256	010588	009454	447214
		.700000	254256	005294	004727	.894427
_	9	250000	1.111342	1.111342	• 999999	0.00000
44		-1.030990	1.2350 82	.301286	.001157	447214
		.500000	235082	.001643	.000578	.894427
	10	250000	1.108832	1.108740	.999917	0.000000
		-1.400000	1.229508	.012740	.011489	447214
		.30000	2295(8	.006370	.00 57 45	•894427
	11	247831	1.115217	1.114799	.999625	012880
		-1.793015	1.243710	.0173+2	.015550	460010
		.100024	243710	.025159	• 0 2 2 5 5 9	.887820
	12	248168	1.128924	1.126893	•998201	049532
		-1.923092	1.274468	0655+5	058060	939127
		174052	274468	.016879	•014951	339980
	13	249477	1.147986	1.146858	.999018	043145
		-1.726269	1.317872	042024	036607	675158
		478688	317872	028665	024969	736411
	14	249169	1.160735	1.160026	.999389	034875
		-1.395016	1.347306	020453	017620	449471
		692774	347306	035024	030174	892614
	15	249537	1.169028	1.168465	.999518	931943
	~·	998756	1.366627	009974	008532	281449
		850538	366627	034893	029848	959074

. 8	

DCX	NX	٧N
DCY	NY	SIG
DCZ	NZ	
.999476	031943	.000000
000106	281449	• GC 40 83
.032381	959074	
	• • • • • • • • • • • • • • • • • • • •	
999497	029218	.000000
007555	.157442	.094254
.030790	•98 <b>70</b> 96	
0.007.07	800050	200000
•999397	028252	.000000
018722 -029235	.050789 .998310	.084249
• 6 7 7 0 2	• 330218	
.999714	012608	.000000
023767	434526	.000604
.002529	.908571	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
999944	0.000000	.000000
009454		501173
004727	.894427	
•999999	0.038030	.000000
.001157		001694
.000578	894427	0002034
.999917	0.000000	. 600000
.011489	447214	062980
00 57 45	.894427	
•999625	012880	•000060
.015550	460010	003264
.022559	.887820	# C # O F C 4
.998201	049532	.000000
058060	939127	.007805
• D 1 49 51	339980	
000040	M . T	****
.999018	043145	.000000
036607 024969	<del>-</del>	.006628
- • 0 2 4 3 0 3		
•999389	034875	. 6000640
	44947i	,005602
	892614	
0.00540	Maria de la maria	ناسب معددة الأسماولي
999518	031043	. 000000
008532	281449	.005201
029848	959074	

### ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	M	NPX	v 7	vx	OCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	NZ
4	16	250116	1.174210	1.173709	•999573	029218
		600001	1.378769	005058	004308	157442
		940749	<b></b> 378769	133935	028900	- 987096
	17	250002	1.177071	1.176631	.999601	028252
		··· 200000	1.385457	092132	001854	350789
		982825	- 3854 97	033187	028194	996310
	18	250002	1.177939	1.177467	.999600	028252
		• 200000	1.387539	980154	000131	•351789
		982825	387539	033330	4 28295	993310
	19	250016	1.176983	1.176476	• 999569	329218
		.600991	1.385288	• 90 SSS 4	001940	.157442
		946749	385288	034459	029278	987096
	50	249537	1.174127	1.173553	.999511	031043
		998756	1.378574	• 90 6152	• 9 0 5 2 4 8	.281449
45		850538	378574	036176	030811	959074
0,	21	249169	1.169520	1.168830	• 995384	03+675
		1.395316	1.367777	.014296	.012223	• 449471
		692774	367777	038458	032892	892614
	22	249477	1.163098	1.162013	•999367	643145
		1.726269	1.352797	.032273	• 6 277 48	.675158
		-•470688	352797	138492	033094	~.736411
	23	248968	1.157588	1.156167	•998772	049532
		1.923992	1.344010	.054224	• U 4 E6 42	•939127
		174052	340010	013660	016120	339980
5	1	743334	1.160425	1.146655	•988142	153543
		1.874150	1.346567	.168493	•145199	.934141
		.161626	-•346587	• 057936	.049927	.32218 &
	2	747389	1.166631	1.156315	•991149	132740
		1.690281	1.361028	.104989	.089994	.683173
		• 444215	361028	•113850	.097597	.710191
	3	747752	1.171864	1.164831	. 994042	1 (8809
		1.373892	1.373264	.051919	• 0 4 42 9 6	• 457325
		.663304	373264	•116710	• 0 9 9 5 9 3	.882618
	4	747958	1.173024	1.167559	• 995350	095703
		• 992572	1.375986	.020130	•017212	·288525
		.819383	375986	.111176	.094777	•952677
			· - <del>-</del>		0027111	• 576.611

OCX OCY OCZ	NX NY NZ	VN SIG
•999573 -•004308 -•028900	029218 157442 987096	. 900000 . 905076
.999651 001854 028194	028252 050789 998310	• 99 0 0 0 0 • 50 4937
.999600 ~.000131 u28295	028252 .05J789 998310	• 60 47 66
.999569 .001940 029278	329218 .157442 967096	• เป็นผมปี • เป็น633
.999511 .005248 030811	031043 .281449 959074	• 006000 • 004347
.995384 .012223 032892	03+675 .449471 892614	• 3006.8 • 604212
.999067 .027748 033094	043145 .675158 736411	• 19009n • 384566
.998772 .046842 016120	049532 .939127 339986	. 60 00 LD . 00 4987
.988142 .145199 .049927	-,153543 .934141 .322188	006090 .015792
.991149 .089994 .097597	132740 .683173 .710091	000010 -613445
• 994042 • 044296 • 099593	1 [8809 -457325 -882618	006000 .010693
•995350 •017212 •094777	095703 .288525 .952677	u00000 .u09621

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	М	NPX	VT	٧x	DCX	
			NPY	VTSQ	VY	DCY	NX
			NPZ	CP	٧Z	DCZ	NY NZ
	5	5	750055	1.170769	1.165817	005774	
			•600009	1.370699	004751	•995771	089915
			•910468	370699	.107457	- · CC 40 67	• 162020
		c	<b>3 .</b>		101451	.091784	•982682
		б	750065	1.161565	1.156220	•995398	
			.20003	1.349234	041883	-•036057	986851
			• 953924	349234	•103132	• C 8 67 87	•052106 •99485£
	7	7	748551	1.145511	4 41.7073		• > > + 0 > C
			199961	1.312155	1.143638	• 998365	031425
			.882279	312195	060743	053027	379842
		•	· ·	• 012199	.024440	.021335	•924189
	8	3	750000	1.124601	1.124251	• 999689	0.0.22.2
			600000	1.264728	325032	022312	0.0.0000
			.708808	264728	312546	011156	447214
	9	<b>a</b>	- 7-6066			• 0 411 90	.894427
	-	,	-•750000 -1•000000	1.114870	1.114851	• 999992	0.001006
				1.242934	004028	003613	447214
46			•500000	242934	002014	001807	.894427
٠.	10		750000	1.115443	4 44		
			-1.400000	1.244214	1.115255	•999831	0.000000
			.300000	- 244214	•118316	.016420	447214
				• C 4 4 C T 4	.009158	· C 0 62 1 0	.894427
	11		741375	1.132611	1.130300	C 0 70 4 W	
			-1.764760	1.282807	• 917624	997960	-•044855
			• 130234	282807	. 37 0123	•015560	519160
	12		<b>*</b> . * * * * .		• 57 4123	·961913	• 853495
	1.4		743334	1.132236	1.115714	.985408	457545
			-1.874150	1.261958	191336	168990	153543
			161626	281958	.023044	• 0 20353	934141
	13		- 7/77.00		,	***************************************	322188
	10		<b></b> 747389	1.151358	1.140735	•996816	- 1707/0
			-1.690281	1.325626	126978	110286	132740
			444215	325626	090072	076231	683173 718091
	14		747752	1 1652.00	•		• 1 103 31
			-1.373892	1.165286	1.158299	• 994004	138869
			-• 663394	1.357891 357891	069581	059712	457325
					1067+1	091601	882618
	15		747958	1.173015	1.167615		
			992572	1.375964	038301	• 9953 97	095763
			819383	375964	105695	032652	**•288525
	4.5		<b></b>		6 TO 2022	090106	952677
	16		750055	1.177768	1.172932	• 995944	<b>A</b>
			600009	1.387138	023972	017807	039915
			910468	387138	103871		162020
						088193	982682

CX			ΝX		٧١	-
CY			NY		٥.	IG
OCZ			ΝZ			
3577	L	08	99	15	. 000	0000
406	7 .	16	2 <b>ü</b>	20	• 600	9344
917 84	+ •	98	26	82		
95398	3 -	. na	68	51	wd	គ្រង១០
<b>3</b> 60 57				0 6		
87 87		99	48	5 E		
<b>98</b> 369	<u> </u>	0.7	ئدد	25	. 00	0.0
				42	00	
2133		92				. ,
		•				a (
996 89				JC 14	.03. 50	
<b>2231</b> 3		89			-• 50	1 4 7 6
<b>***</b> 7			74	<b>-</b> 1		
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361	3 <b>-</b> ,			14	00	7455
180	7,	89	44	27		
9983	1 0.	00	00	00	. 00	0000
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0821	0	. 8 9	44	27		
<b>97</b> 96 <b>15</b> 56 <b>51</b> 91	o	. 1) 4	48	55	.00	0000
<b>15</b> 56	0 -	_		60	66	5237
<b>51</b> 91	3 .	85	34	9 č		
540 5899	8 <b>-</b>	. 15	3 5	43	69	0000
5899	u	• 73	41	41	.02	2441
2035	3 -	. 32	21	3.8		
9081	6 <b>-</b>	. 13	27	40	00	0000
K .				73		ö214
823	1 -	.71	80	91		
	ř.	د و		60		C A 3 P
9480 5074	4 <del>-</del>			69 25	ŭÜ	4426
9911 1111	- 1 -	• 4 5 • 8 8			• U.I.	7760
	<b>.</b> .	500				
<b>9</b> 539	7 -			0.3	00	
3265	<b>2</b> -			25	.01	2115
1028 7623 9400 95971 9160 9539 9010	o <del>-</del>	•95	) <b>2</b> t	) [ {		
9594 1780 8819	4 -	• D 8	99	15		0000
78C	7 -			20	. 01	1020
8819	3 -	9 8	126	8.2		

### ATMOSPHERIC SCIENCE ASSOCIATES BEGFORD, MASSACHUSETTS

BODY ID. TEST

				X-FLOW		
N	М	NOA	1.4 199			
14	11	NPX	٧٢	٧x	DCX	NX
		NPY	VTSQ	VY	DCY	NY
		NPZ	CP	٧Z	DCZ	ΝZ
5	17	750005	1.180390	1.175928	•996219	086851
		200003	1.393322	997814	006620	052106
		953924	393322	102249	-• U8 66 23	
				- 20 22 4 7	- • 90 00 23	994858
	18	750005	1.181278	1.176812	•99622 <b>0</b>	086851
		.200003	1.395417	.003321	.002812	.052186
		953924	395417	102552	086823	99+858
	19	75û055	1.180608	1.175825	.995949	- 0.0045
		.600009	1.393835	•015707	.013304	069915
		915468	393835	104938	088936	•162020 - 063600
				0.204330	- 6 8 6 6 5 5 6	982682
	20	<b></b> 747958	1.178349	1.172939	.995419	095743
		• 992572	1.388506	.031346	.026601	-288525
		819383	388506	108337	091940	952677
	21	747752	1.174632	4 407057		
		1.373892	1.379760	1.167657	.994063	108809
		663394	379760	•958416	. 049732	• 457325
47		¥ 0000 j 4	3/9/60	113680	096779	882618
	22	747389	1.167891	1.157552	.991148	132740
		1.690281	1.363969	•10897ú	.093305	•683173
		444215	363969	110334	994447	718191
						01 70 0 9 7
	23	743334	1.160774	1.146999	. 988133	- • 1 53 543
		1.874150	1.3473 96	. 17 0113	.146548	• 93+141
		161626	- • 3473 <b>5</b> 6	053408	046011	322188
6	1	-1.229655	1.132362	1.090828	067704	
		1.773614	1. 282243	•291159	.963321	268347
		.134912	282243	•486937	• 257134	.921489
			000000	• #0 0 33 t	.076775	.280799
	2	-1.245329	1.144713	1.111521	.971303	239165
		1.614691	1.310369	.197828	.172819	•7 02123
		• 336555	310369	•189089	. 155185	.670724
	3	-1.245068	1.15 8983	1.136725	0.4670#	
		1.329324	1.343242	•102894	•980795	194936
		.600627	343242	•201273	.088779	•475316
		***************************************	•040242	• 20 12/3	.173663	.857948
	4	-1.245783	1.165866	1.148618	.985205	170981
		.979064	1.35 9244	.048514	.041612	•304683
		.753512	359244	.193825	•16 £2 50	•936981
	5	-1.250120	4 46 87 64			
	,	•600034	1.16 9561	1.154226	• 986888	159881
		• 846449	1.367873	.00 6877	· D 0 58 8 0	•172638
		e 040447	-•367873	•188649	•161299	•971923

DCX DCY DCZ	NX NY NZ	VN SIG
•996219 ••006620 ••086623	086851 052106 994858	.900000 .518240
.996220 .002812 086823	086851 -052106 99+858	. 200000 . 00 9850
.995949 .013304 088936	089915 .162020 982682	.000660 .609820
.995409 .026601 091940	095743 .288525 952677	-• 406630 . *0025
•994063 •049732 •096779	1 [8809 .457325 882618	000000 .511212
•991148 •093305 •094447	132740 .683173 718391	000000 .013668
• 988133 • 146548 • 046011	153543 .934141 322188	000L00 .015888
•963321 •257134 •076775	268347 .921489 .280799	uÜ ü d u ü . ü 2 72 32
•971J03 •172819 •165185	239165 .792123 .670724	66 00 00 -62 4419
•980795 •088779 •173663	194936 .475316 .857948	000630 -619161
•985205 •041612 •166250	170981 .3J4683 .936981	0350B .016512
986888 •005880 •161299	159881 .172638 .971923	000000 •015703

Maria - - - Control Control Control Control

# ATMOSPHERIC SCIENCE ASSOCIATES BECFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	М	NPX	VT	٧x	DCX	ΝX
			NPY	VTSQ	VY	DCY	NY
			NPZ	CP	٧Z	DCZ	NZ
	6	6	-1.250012	1.170850	1.155253	. 986679	153515
			.200010	1.370889	053638	045811	.055250
			.893198	374889	•18 2761	•156093	986601
		7	-1.248100	1.174562	1.168731	•995078	074106
			199835	1.379597	096916	082504	251846
			• 852389	379597	• 0 6 4 4 7 0	.054888	.964926
		8	-1.250000	1.154940	1.154001	. 999187	0.000000
			60 <b>0</b> 000	1.333886	341635	036050	447214
			•700000	333886	020818	018025	.894427
		9	-1.250000	1.138016	1.137954	• 999954	0.040000
			-1.000000	1.2950 61	909750	008568	447214
			.500000	295081	904875	~•004284	.89+427
		10	-1.250000	1.1438 92	1.143401	•999571	0.0.0000
			-1.470000	1.308488	•029956	.026188	447214
48			.30000	308488	.014978	.013094	.894427
ω		11	-1.225923	1.161360	1.150415	000576	
			-1.707445	1.348756	011041	•990576 <b>-•00</b> 9507	105654
			· 100626	348756	.158631	• 136634	687853 .718119
		13	-1.229655	1.118520	1.069951	• 956586	_
			-1.773614	1.2510 (8	323600	289310	- • 268347
			134912	-•2510 88	.039432	≈€35254	-•921489 -•280799
		13	-1.245329	1.130909	1.097016	.970030	239065
			-1.614691	1.278956	230259	203614	7 (2123
			<b>3</b> 86555	<b>-•</b> 278956	149950	132601	670724
		14	-1.245068	1.151328	1.129039	•98ü641	194936
			-1.329324	1.325556	127739	110993	475316
			600627	325556	185734	161321	857948
		15	-1.245783	1.162543	1.145364	• 985223	170981
			979304	1.351506	072753	062581	3[4683
			753512	351566	185350	159435	936981
		16	-1.250120	1.169385	1.154316	.987114	- 450004
			600034	1.367462	040457	034597	- · 159881
			846449	367462	182699	156235	172638 971923
		17	-1.250012	1.172927	1.159016	• 98814G	- 457545
			270010	1.375757	D1 4301	012192	153515
			893198	375757	179542	-•153072	<b>*•</b> 055250
					JJT6	X 200 / C	986601

OX CY CZ	NX NY NZ	VN SIG
679 5811 6093	153515 .055250 .986601	000000 .615444
	074106 251846 .964926	
91 87 90 5 0 80 25		
954 8568 4284		
	0.01000 447214 .894427	.000000 016569
1576 9507 6634	105654 687853 .718119	.00000 002403
<b>55</b> 86 <b>93</b> 1 0 <b>52</b> 5 4	268347 921489 280799	800930 .636636
0030 5614 2601	239065 762123 670724	506600 -031398
0641 0993 1321	194936 475316 857948	000000 .024287
5223 5581 9435	170981 354683 935981	050090 .020145
7114 4597 6235	159881 172638 971923	0000000 .018139
140 192 1072	153515 055250 986601	000u00 .u16626

### ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

					X-FLOW		
	N	M	NPX	٧T	٧x	DCX	NX
			NPY	VTSQ	٧Ÿ	DCY	NY
			NPZ	CP	٧Z	DCZ	NZ
	6	18	-1.250012	1,173694	1.159779	-986144	153515
			.200010	1.377557	.007630	•006552	.055250
			893198	377557	180031	153388	986601
		19	-1.250120	1.171902	1.156827	.987136	159881
			.600034	1.373354	.032555	.027788	.172638
			846449	373354	184514	157448	971923
		25	-1.245783	1.167332	1.150142	. 985274	170981
			•979004	1.362663	.062430	.053481	.384683
			753512	3626£3	189579	162403	936981
		21	-1.245968	1.159668	1.137419	.988815	194936
			1.329324	1.344829	.111184	.095876	•475316
			69 G627	344829	<del>-</del> •196837	169736	857948
		22	-1.245329	1.144845	1.111627	.976984	239065
			1.614691	1.310671	.202859	.177193	·702123
49			<del>-</del> .386555	310671	183850	160598	670724
9		23	-1.229655	1.132343	1.090732	• 963296	268347
			1.773614	1.282201	.293104	· 258848	.921489
			134912	282201	080540	071127	280799
	7	1	-1.699678	1.071793	• 97 53 9 4	•910058	414479
			1.611865	1.148740	a431871	. 40 29 43	.885202
			• 096576	148740	.104985	.097113	.211244
		2	-1.733772	1.092781	1.014192	928083	372374
			1.484752	1.194171	.318158	. 291155	.725701
			• 297994	194171	• 253683	.232145	.578529
		3	-1.738932	1.121965	1.066664	.950711	310024
			1.250730	1.25 8805	.179758	.160226	•507279
			.497910	25 88 05	• 297852	• 265474	• 8 £4¥ 85
		4	-1.738266	1.142165	1.099857	• 962958	269527
			954054	1.304542	.097975	• 085780	•335023
			• 644837	304542	.291988	. 255644	.932837
		5	-1.750276	1.158627	1.121590	.968034	25022 9
			.600104	1.342417	.037916	.032716	.193980
			.739306	342417	.288124	. 248677	• 948555
		6	-1.750025	1.174333	1.139526	.976360	237694
			.200030	1.379059	034957	029776	.061556
			•792992	379059	.281632	.239823	•969388

DCX DCY DCZ	NX NY NZ	VN SIG
• 986144 • 006552 •• 153388	153515 .055250 9866 <b>0</b> 1	000030 .016044
• 987136 • 0 27788 •• 157448	159881 .172638 971923	004030 -016340
.985274 .053481 162403	170981 .304683 936981	000030 -017048
.980815 .095876 169736	194936 .475316 857948	.003630 .019582
• 970984 • 177193 -• 160598	239065 .702123 670724	00 0000 -024706
• 963296 • 258848 •• 071127	268347 .921489 280799	000000 -027344
• 910058 • 402943 • 097113	414479 .885202 .211244	000030 .041810
• 928083 • 291155 • 232145	372374 .725701 .578529	000000 .037841
•950711 •160226 •265474	310024 .507279 .8ü4ü85	6000 a0 . 030138
• 962958 • 085780 • 255644	269527 .335023 .902837	000000 .025359
•968034 •032716 •248677	25022 9 .193980 .948555	000030 .023756
•970360 •029776 •239823	237694 .061556 .969388	000000 .022518

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

TEST BODY

				X-FLOW			
					•		
N	М	NPX	٧T	٧X	DCX	NX	VN A
		NPY	VTSQ	VY	DCY	NY	SIG
		NPZ	CF	VZ	DCZ	ΝZ	:
7	7	-1.749550	1.205607	1.178638	.977672	197278	. 000000
		199759	1.453488	115921	096152	113 683	.015226
		.782469	453488	.225268	.186851	.973734	
	8	-1.747311	1.230972	1.225355	•995437	075980	. ស្បីមិន
		599857	1.515291	100709	081813	368319	008877
		•679777	515291	.069447	.049105	•92658 <b>\$</b>	
	9	-1.750000	1.2273 60	1.227221	.999871	0.098000	.000000
		-1.000000	1.50 64 61	017632	014365	447214	024519
		•500000	506461	008816	007183	.894427	
	10	-1.725409	1.218753	1.215655	•997458	050829	.000630
		-1.352829	1.485359	.022100	.018133	- 496741	018933
		.314114	485359	.083939	. 468914	.866409	
	11	-1.762537	1.166416	1.083066	• 928542	348626	0000000
		-1.550513	1.360526	29 2335	250627	842191	. 63 44 54
ເກ		.113943	360526	• 31 9428	. 273854	.411307	
50	12	-1.699678	1.081512	.977211	.903560	414479	0.000000
		-1.611865	1.169668	462855	427970	885202	.049582
		096576	-•165668	.922186	. u 20514	211244	
	13	-1.733772	1.086144	1.006208	• 926484	372374	640000
		-1.484752	1.179709	356337	328121	725701	.045341
		297994	179709	250604	184693	578529	
	14	-1.738932	1.114650	1.059335	.950374	310024	000000
		-1.250730	1.242445	210056	188450	507279	• 0359C1
		497910	242445	275918	247538	<b>- ∙</b> 8 ± 40 85	
	15	-1.738266	1.13 6204	1.093988	. 962844	··269527	១០១១១០០
		954054	1.290960	125252	110237	335623	. 029572
		644837	290960	280114	246534	912837	
	16	-1.750276	1.151282	1.114573	.968114	25ü229	600600
		600104	1.325451	071497	062102	193980	.026698
		···7393 <b>0</b> 6	3254 51	279403	242689	948555	
	17	-1.750025	1.158015	1.124810	.971326	237694	806080
		200030	1.340998	023565	026350	ú6155e	.024180
		792992	340998	-,274397	236877	969388	
	18	-1.750025	1.158514	1.125318	.971338	237694	000000
		.200030	1.342154	.015083	.013019	.061556	• 623583
		792992	342154	27 4958	237345	969368	

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# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

PAGE

BODY ID. TEST

TEST BODY

				X-FLOW			
				V-LFOM			
N	М	NPX	VT	٧X	DCX	NX	VN
		NPY	VTSQ	VY	DCY	NY	SIG
		NPZ	CP	VZ	OCZ	NZ	
7	19	-1.750276	1.152916	1.116233	• 96 81 83	250229	000000
		.600104	1.329215	. 161952	.052876	.19398ü	.024579
		739306	329215	281996	244593	948555	
	20	-1.738266	1.139416	1.097239	.962984	269527	000000
		• 954054	1.298269	.111503	.097859	.335023	.026002
		644837	298269	<b></b> 28 <b>61</b> 36	251169	902837	
	21	-1.738932	1.129131	1.064935	.950724	310024	000000
		1.250730	1.254694	.188418	.168210	.507279	• 030634
		497910	254694	291729	260442	834085	
	22	-1.733772	1.091523	1.012990	.928952	372374	000630
		1.484752	1.191423	.323365	.296251	.725701	.038158
		297994	191423	246391	225731	578529	
	23	-1.699678	1.071357	. 97 497 3	.910036	414475	600000
		1.611865	1.147806	• 433686	•40480 <b>0</b>	.885202	.041913
	,	096576	147806	095654	089283	-+211244	
		*****	***	*** * * *	****	** **	****
8	1	+*************************************	• 953 <u>0</u> 89	******* • 763560	.801143	**** 597981	000000
8	1						
8	1	-2.218024	• 9530 89	.763560	.801143	597981	005000
8	1	-2.218024 1.24 <b>07</b> 23	•953089 •98378	.763560 .521127	.801143 .546777	597981 .747834	005000
8		-2.218024 1.240723 .149617	.953089 .908378 .091622	.763560 .521127 .231907	.801143 .546777 .243322	597981 .747834 .288382	000000 .065691
8		-2.218024 1.240723 .149617	.953089 .908378 .091622	.763560 .521127 .231907	.801143 .546777 .243322	597981 .747834 .288382 425912	000000 .065691 000000
8		-2.218024 1.240723 .149617 -2.214445 .990269	.953089 .908378 .091622 1.078634 1.163451	.763560 .521127 .231907 .975907 .237422	.801143 .546777 .243322 .904762 .220114	597981 .747834 .288382 425912 .463200	000000 .065691 000000
8	2	-2.218024 1.240723 .149617 -2.214445 .990269 .411287	.953089 .908378 .091622 1.078634 1.163451 163451	.763560 .521127 .231907 .975907 .237422 .393304	.801143 .546777 .243322 .904762 .220114 .364631	597981 .747834 .288382 425912 .463200 .777203	000000 .065691 000000 .039168
8	2	-2.218024 1.240723 .149617 -2.214445 .990269 .411287	.953089 .908378 .091622 1.078634 1.163451 163451	.763560 .521127 .231907 .975907 .237422 .393304	.801143 .546777 .243322 .904762 .220114 .364631	597981 .747834 .288382 425912 .463200 .777203	000000 .065691 000000 .039168
8	2	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.27743	.763560 .521127 .231907 .975907 .237422 .393304 1.034668 .117301	.801143 .546777 .243322 .904762 .220114 .364631	597981 .747834 .288382 425912 .463200 .777203 397801 .246251	000000 .065691 000000 .039168
8	2 3	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.27743 1.271805 271805	.763560 .521127 .231907 .975917 .237422 .393304 1.034668 .117301 .433021	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569	000000 .065691 00000 .039168 00000 .136289
8	2 3	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805	.763560 .521127 .231907 .975907 .237422 .393304 1.034668 .117301 .433021	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807	000000 .065691 00000 .039168 00000 .136289
8	2 3	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379 -2.250072 .200101	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805 1.160877 1.347636	.763560 .521127 .231907 .975917 .237422 .393314 1.034668 .117301 .433021 1.079656 .007608	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569	000000 .065691 00000 .039168 00000 .136289
8	2 3 4	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379 -2.250072 .200101 .632913	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805 271805 1.160877 1.347636 347636	.763560 .521127 .231907 .975907 .237422 .393304 1.034668 .117301 .433021 1.079656 .007608 .426436	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971 .930043 .006554 .367391	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569 .927222	000000 .065691 000000 .039168 000000 .136289 000000 .032128
8	2 3 4	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379 -2.250072 .200101 .632913 -2.250072	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805 271805 271805 1.160877 1.347636 347636	.763560 .521127 .231907 .975907 .237422 .393304 1.034668 .117301 .433021 1.079656 .007608 .426436	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971 .930043 .006554 .367391	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569 .927222	00000 .065691 00000 .039168 00000 .136289 00000 .632128
8	2 3 4	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379 -2.250072 .200101 .632913 -2.250072 -200101	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805 271805 271805 1.160877 1.347636 347636	.763560 .521127 .231907 .975907 .237422 .393304 1.034668 .117301 .433021 1.079656 .007608 .426436 1.104142 -082736	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971 .930043 .006554 .367391 .929551 -069654	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569 .927222 366809 075569	00000 .065691 00000 .039168 00000 .136289 00000 .632128
8	2 3 4	-2.218024 1.240723 .149617 -2.214445 .990269 .411287 -2.250969 .600392 .560379 -2.250072 .200101 .632913 -2.250072 -200101 .632913	.953089 .908378 .091622 1.078634 1.163451 163451 1.127743 1.271805 271805 271805 271805 1.160877 1.347636 347636 1.187823 1.410923 410923	.763560 .521127 .231907 .975917 .237422 .393314 1.034668 .117301 .433021 1.079656 .007608 .426436 1.104142 -082736 .430056	.801143 .546777 .243322 .904762 .220114 .364631 .917468 .104014 .383971 .930043 .006554 .367391 .929551 -069654 .362054	597981 .747834 .288382 425912 .463200 .777203 397801 .246251 .883807 366809 .075569 .927222 366809 075569 .927222	00000 .065691 00000 .039168 00000 .136289 00000 .632128

# ATMOSPHERIC SCIENCE ASSOCIATES BEDFORD, MASSACHUSETTS

BODY ID. TEST

TEST BODY

X-FLOW Ν M NPX VT VX DCX NX VN NPY VTSQ VY DCY NY SIG NPZ CP ٧Z DCZ NZ 8 7 -2.218355 1.107315 1.206050 .918433 -.396212 -.0000000 -.956945 1.454557 -.246493 -.204380 -.458473 .033963 .416059 -- 454557 .409454 .339500 .795499 8 -2.212888 1.083768 .912254 ·841752 -.537231 -. 6000000 -1.209729 1.174554 - . 477735 - . 449855 ~.743960 · 658742 .165619 -- 174554 .337711 .311608 .402941 9 -2.218024 .965398 .772784 .806483 -.597981 -. 0000000 -1.249723 .931993 -.555522 - . 57 5433 -.747834 · u69724 -. 149617 · 06 80 07 -- 151841 -. 167642 -.288382 10 -2.214445 1.074426 .971412 .904113 --425912 .000000 1.154391 -.99 02 69 -.269128 -.250485 -.463230 .043639 -.154391 -.411287 -.371939 -.346175 -.777203 11 -2.256969 1.117305 1.024831 .917209 -.397881 -.000000 -.600392 1.248379 - . 145033 -.129804 -.246251 .039174 -.560379 -. 248370 -.420854 -.376669 -.883807 52 12 -2.250074 1.138957 1.059640 .930360 -.366578 -. 3000000 -.200104 1.297223 -.042453 -.037274 -.075231 .033966 -.632837 -. 297223 - . 415432 -.364748 - 09 27 341 13 1.139033 -2.250074 1.059741 . 930387 -.366578 -.0000000 .200104 1.297395 . 232406 .028451 .075231 .033347 -.632837 - 297395 -- 41 6287 -.365474 -.927341 14 -2.250969 1.117486 1.325131 .917498 -.397881 . . 000000 .600392 1.248774 .131954 .118082 .246251 .037211 -.560379 - . 248774 -.424672 -.380025 -.883807 15 -2.214445 1.073381 .971068 . 904682 -.425912 .000000 .990269 1.152146 . 246456 .229607 .463200 .039860 -.411237 -. 152146 -.385268 -.358930 -.777203 16 -2.218024 .950934 ·76 2055 .801375 -.597981 -.0000000 1.240723 .934276 .524166 .551212 .747834 · ü6 58 33 -.149617 . 095724 -. 220904 -.232302 -.288382 \*\*\*\* \*\*\*\*\* \*\*\*\* 9 -2.626833 1 .660120 .326828 .495184 -.868756 .000000 . 68 7692 . 435759 .468030 .709007 •411733 · 10 4713 . 149145 .564241 .331497 . 502177 .275208

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PAGE

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BODY ID. TEST

## ATMOSPHERIC SCIENCE ASSOCIATES BEDFORE, MASSACHUSETTS

	. 100		TEST BOD	Y			
				X-FLOW			
N	М	NPX	VΤ	٧x	DCX	ΝX	٧N
		NPY	VTSQ	VY	DCY	NY	SIG
		NPZ	CP	٧Z	DCZ	NZ	
9	2	-2.629150	.835434	• 526675	.630421	776209	000000
		• 434170	•697949	•195323	• 233798	.208002	. 688646
		.336208	.302051	.618394	.740208	•597912	
	3	-2.635472	.875817	.591517	.672319	740175	.688830
		.141262	•774078	.046040	.052329	.062764	.08 61 47
		•389779	• 225922	• 64 9635	.738410	.669478	
	4	-2.635472	• 89 <b>0</b> 7 66	.598838	. 672273	740175	0000000
		141262	• 793463	379632	089465	062764	.0864u <b>0</b>
		.389779	•206537	.654634	.734878	.669478	
	5	-2.629150	. 86 96 68	•548218	.630376	776209	• 600050
		434170	•756323	228735	263014	200002	.089534
		.336208	• 243677	.635135	.730376	.597912	
	6	-2.626833	.703717	•348373	.495047	868756	.008080
		687692	• 495218	497144	706454	411733	.106041
G		• 1481 45	.504782	.355953	•5 <b>0</b> 58 <b>1</b> 8	.275208	
ω	7	-2.626933	.664268	.328750	•4949 <b>0</b> 6	868756	. 500000
		<b></b> 68 <b>7</b> 692	• 441252	493026	742209	411733	116522
		149145	• 558748	300168	451879	27520 E	
	8	-2.629150	.820631	•51723 <i>T</i>	. 630352	776209	. 200000
		434170	• 673435	217408	264928	20002	.690273
		336208	• 326565	598819	729705	597912	
	9	-2.635472	.857280	•576419	.672381	740175	0000000
		141262	.734930	067674	078941	062764	.187213
		389779	· 2650 <b>70</b>	630944	<b>~.73</b> 5984	66947€	
	10	-2.635472	.856967	•576233	.672410	740175	000000
		•141262	• 7343 {2	.056429	.065847	.062764	.086864
		389779	• 2656 <b>0</b> 8	631793	737244	669478	
	11	-2.629150	.819951	•516958	.636475	776209	. 000000
		. 434170	.672319	.203153	. 247763	.200002	.089184
		336208	• 32 76 81	603150·	735605	597912	
	12	-2.626833	.653104	.323443	• 49524 <b>0</b>	868756	000000
		687692	• 426545	•471156	.721410	.411733	.104895
		1+9145	• 573455	316135	484050	27520 8	

PAGE

LEAVING FRINT1

LEAVING MAIN

FLOPNT

BODY IDENTIFIER IS TEST NUMBER OF SYMMETRY PLANES = 0

NUMBER OF QUADRALATERALS= 189 MACH NUMBER= 0.

FITI BOUT FRAM 2

#### INPUT DATA -

C

(

```
INITIAL X=-4.5000E+00 INCREMENT= 1.0000E+00 NUMBER OF VALUES= 4
INITIAL Y= 0. INCREMENT= 0. NUMBER OF VALUES= 1
INITIAL Z= 1.0000E+00 INCREMENT=-5.0002E-01 NUMBER OF VALUES= 5
```

X AXIS IS INCREMENTED FIRST Y AXIS IS INCREMENTED THIRD Z AXIS IS INCREMENTED SECOND

#### \* INDICATES THE POINT IS INSIDE THE BODY

```
Z
                                                                          ٧Z
     X
                                              VX
                                                            VY
                                                                      3.1225E-02
-4.5000000
              0.0000000
                           1.0000000
                                          9.4274E-01
                                                       -1.8463E-03
-3.5000000
              0.0000000
                           1.0000000
                                          8.9363E-01
                                                       -5.2865E-03
                                                                      1.0830E-01
-2.5000000
              0.0000000
                           1.0000000
                                          9.850+E-01
                                                       -2.1047E-02
                                                                      2.8638E-01
              0.9000000
                                                                      1.6956E-01
-1.5000000
                           1.0000000
                                          1.1528E+00
                                                       -7.7206E-02
                               Ζ
                                              VX
                                                            VY
                                                                          ٧Z
     X
                  Y
-4.5000000
              0.0000000
                            .5000000
                                          9.2698E-01
                                                       -1.8687E-03
                                                                      2.0175E-02
              0.0000000
-3.5000000
                            .5000000
                                          8.0239E-01
                                                       -5.3770E-03
                                                                      1.0116E-01
     INSIDE QUAD
                   179
                            I2=1
     ZNP ,RO SQ , TSQ , H=
                        -8.9149E-02
                                                                   1.0000E-01
                                       2.2821E-31
                                                     1.0355E+00
     INSIDE QUAD
                   180
                            I2= 1
     ZNP,ROSQ,TSQ,H=
                        -3.5348E-02
                                       6.6282E-12
                                                     6.7553E-01
                                                                   1.00008E-01
     INSIDE QUAD
                   181
                            I2=1
     ZNP,ROSQ,TSQ,H=
                        -3 • 53 48 E - 02
                                       6.6282E-12
                                                     6.7553E-01
                                                                   1.0000E-01
                  182
     INSIDE QUAD
                            I 2=
                                                                   1.0000E-01
     ZNP, ROSQ, TSQ, H= -8.9149E-02
                                       2.2821E-01
                                                     1.0355E+10
                                                       -2.2314E-02
              0.0000000
-2.50000000
                            ·5000000
                                          1.4448E+00
                                                                      1.2787E-01
-1.5000000
              0.0000000
                            . 5000000
                                          1.2122E+00
                                                       -6.2494E-02
                                                                      3.9898E-02
                                              VX
                                                            VY
                                                                          ٧Z
                               Z
-4.5000000
              0.000000
                           0.0000000
                                          9.1975E-01
                                                       -1.7342E-03
                                                                      1.5068E-03
-3.5000000
              0.0000000
                           0.0000000
                                          7.3093E-01
                                                       -4.4575E-03
                                                                      4.6059E-03
-2.5000000
              0.0000000
                           0.0000000
                                          1.2744E+00
                                                       -1.3880E-02
                                                                      1.8615E-02
-1.5000000
              0.0000000
                           0.0000000
                                          1.2164E+00
                                                       -3.0605E-02
                                                                      3.3288E-02
                               Z
                                              ٧X
                                                            VY
                                                                          ٧Z
     X
                                                       -1.4964E-03
-4.5000000
              0.0000000
                           -.5000000
                                          9.2565E-01
                                                                     -1.7501E-02
-3.5000000
              0.0000000
                           -- 5000000
                                          7.9717E-01 -3.3034E-03
                                                                     -9.4089E-02
     INSIDE QUAD
                   185
                            I 2=
                                 1
     ZNP,ROSQ,TSQ,H=
                        -8.9149E-02
                                       2.2821E-01
                                                     1.0355E+00
                                                                   1.0000E-01
                            I 2=
     INSIDE QUAD
                   186
     ZNP, ROSQ, TSQ, H=
                        -3.5348E-02
                                                     6.7553E-01
                                                                   1.0000E-01
                                       6.6282E-02
     INSIDE QUAD
                   187
                            I2= 1
     ZNP,ROSQ,TSQ,H=
                        -3.5348E-02
                                       6.6282E-02
                                                     6.7553E-01
                                                                   1.0000E-01
     INSIDE QUAD
                  188
                            I 2=
                                1
     ZNP, ROSQ, TSQ, H=
                        -8.9149E-02
                                       2.2821E-01
                                                     1.0355E+00
                                                                   1.0000E-01
-2.5000000
              0.0000000
                           -.5000000
                                          1.4261E+00
                                                       -4.1937E-03
                                                                     -1.0065E-01
-1.5000000
              0.0000000
                           -- 5000000
                                          1.2105E+00
                                                       -1.1531E-02
                                                                      1.9700E-02
```

```
NUMBER OF VALUES=
                           1
-01
     NUMBER OF VALUES=
E THE BODY
           VY
                         ٧Z
-01
     -1.8463E-03
                    3. 1225E-02
                                  9.4326E-01
-01
-01
     -5.2865E -03
                    1.0830E-01
                                  9.0019E-01
     -2.1047E-02
                    2.8638E-01
                                  1.0 260E+00
+00
     -7.7206E-02
                    1. 6956E-01
                                  1.1678E+00
          VY
                         ٧Z
-01
    -1.8687E-03
                    2. 0175E-U2
                                  9.2720E-01
-01 -5.3770E-03
                    1.0116E-01
                                  8.0876E-01
   1.0355E+00
                 1.0000E-01
   6.7553E-01
                 1.000 BE-01
   6.7553E-01
                 1.0000E-01
   1.0355E+00
                1.0000E-01
+00 -2.2314E-02 1.2787E-01
                                  1.4506E+00
★00 -6.2494E-02
                    3.9898E-02
                                  1.2145E+00
          VY
                        ٧Z
-01
     -1.7342E-03
                    1.5068E-03
                                  9.1975E-01
-01
     -4.4575E-03
                    4.6959E-83
                                  7.3096E-01
+00
     -1.3880E-02
                                  1.2746E+00
                    1.8615E-02
+00
     -3.0605E-02
                    3.3288E-02
                                  1.2173E+60
          VY
                        ٧Z
01 -1.4964E-03 -1.7501E-02
01 -3.3034E-03 -9.4089E-02
                                  9.2582E-01
                                  8.0271E-01
   1.0355E+00
                 1.0000E-01
   6.7553E-01
                 1.0000E-01
   6.7553E-01
                 1.0000E-01
  1.0355E+00
                1.0000E-01
00 -4.1937E-03 -1.0065E-01
                                  1.4297E+00
00 -1.1531E-02
                    1.9700E-02
```

1.2108E+00

FIN DONN FIRMS

+00

NUMBER OF VALUES=

X	Y	Z	٧x	٧Y	W7	V
-4.5000000	9.6000000	-1.0000000	9.4052E-61	-1.2184E-03	-2.9389E-02	9.4498E-01
-3.5000000	0.0000000	-1.0000000	8.8645E-U1	-2.3480E-03	-1.0521E-01	8.9268E-01
-2.5000000	0.0000000	-1.0000 COO	9.6251E-01	-3.3361E-03	-2.8834E-01	1.0048E+00
-1.5000000	0.0000000	-1.0000000	1.1359E+80	-2.5233E-03	-2.0899E-01	1.1550E+00

<sup>\*</sup> INDICATES THE POINT IS INSIDE THE BODY

ARYTRJ

BODY IDENTIFIER IS TEST

NUMBER OF SYMMETRY PLANES = 0

NUMBER OF QUADRAL

PLANES= 0 NUMBER OF QUADRALATERALS= 189 MACH NUMBER= 0.

FOR BOALT FRAME

ARYTRU RUN ID -TEST PROBLEM WITH TEST BODY

PHYSICAL INPUT DATA AIR SPEED= 9.000000E+01 CHARACTERISTIC DIMENSION OF THE BODY= 1.000000E+00
DENSITY AND TEMPERATURE OF AIR ARE 9.092500E-01 AND 2.686590E+02 AIR VISCOS

NUMERICAL INTEGRATOR INPUTS TIME STEP= 1.0000E-01 MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTERVAL= 1.0
LOCAL ERROR TOLERANCES FOR DVDQ - 1.0000E-05 1.0000E-05

IMENSION OF THE BODY= 1.000000E+00 00E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

5.0000E-03 PRINT TIME INTERVAL= 1.0000E+00 X COORD. OF FINAL PLANE= 0.

9E-05 1.0000E-05 1.0000E-05

### WATER DROP DIAMETER = 3.00 COOE+02 MICROMETERS

```
PARTICLE SETTLING SPEED= 1.27827E+00 M/SEC
INITIAL X=-5.0000E+00 INCREMENT= 0. NUMBER OF VALUES= 1
INITIAL Y=-1.0000E+00 INCREMENT= 2.0000E+00 NUMBER OF VALUES= 2
INITIAL Z= 1.0000E+00 INCREMENT=-2.0000E+00 NUMBER OF VALUES= 2
```

X AXIS IS INCREMENTED THIRD Y AXIS IS INCREMENTED FIRST Z AXIS IS INCREMENTED SECOND

\* \* \* \* \* \* \* INITIAL COORDINATES X=-5.00000E+30 Y=-1.00000E+00 Z= 1.00000E IFLAG= 7 FOR KSTEP= 27 NEVAL= 49 HMIN IS SET TO 3.1250E-03

```
KSTEP
                        X
                                                            VPX
                                                                         VPY
                  -5.0000E+30 -1.0000E+00
   . 0
       0.
                                            1.0000 E+00
                                                        9.6596E-01 -1.4267E-02
         H= 1.0000E-01 R= 2.0586E+01 AC= 0.
                                                        NEVAL=
                                                                   1
       1.0000E+00 -4.0344E+00 -1.0145E+00
                                            1.0021E+00
                                                        9.6478E-01 -1.5232E-02
                                                                                 3.
         H= 1.0000E-01 R= 6.8363E+01 AC= 7.6445E-04
                                                        NEVAL=
                                                                  12
   11
       1.0000E+00 -4.0344E+00 -1.0145E+00
                                            1.0021E+00
                                                        9.6478E-01 -1.5232E-02
                                                                                 3.
         H= 1.0000E-01 R= 7.6138E+01 AC= 6.1633E-64
                                                        NEVAL=
                                                                  13
   21
       2.0000E+00 -3.0718E+00 -1.0325E+00
                                            1.0094E+00
                                                        9.5991E-01 -2.2680E-02
         H= 1.0000E-01 R= 1.8029E+02 AC= 5.1923E-04
                                                        NEVAL=
                                                                   31
   31
       2.31.25E+00 -2.7720E+00 -1.[404E+00
                                                        9.5930E-01 -2.7841E-02
                                            1.0151E+00
                                                                                 2.
         H= 3.1250E-03 R= 2.0134E002 AC= 5.1576E-04
                                                        NEVAL=
                                                                   57
   41
       2.4000E+00 -2.6881E+00 -1.0429E+00
                                                        9.5956E-01 -2.9385E-02
                                                                                 2.
                                            1.0172E+00
         H= 1.2500E-02 R= 2.0860E+02 AC= 5.0906E-04
                                                        NEVAL=
                                                                  77
   51
       2.80 COE+ 00 -2.3035E+00 -1.05 61E+00
                                            1.0293E+00
                                                        9.6440E-01 -3.6556E-02
                                                                                 3.
         H= 1.0000E-01 R= 2.2229E+02
                                       AC= 4.9923E-04
                                                        NEVAL=
                                                                   97
   54
       3.0000E+00 -2.1101E+00 -1.0637E+00
                                                        9.6916E-01 -3.9522E-02
                                            1.0373E+00
                                                                                 4.
         H= 1.0000E-01 R= 2.0962E+02 AC= 5.3733E-04
                                                        NEVAL=
                                                                 184
       3.25 00E+00 -1.8670E+00 -1.0739E+00
   64
                                            1.0492E+00
                                                        9.7641E-01 -4.2069E-02
         H= 1.2500E-02 R= 1.9778E+02 AC= 5.6993E-04
                                                                 130
                                                        NEVAL=
   74
       3.50 00E+00 -1.6219E+00 -1.0846E+00
                                            1.0613E+00
                                                        9.8411E-01 -4.3370E-02
         H= 5.0000E-02 R= 1.7680E+02 AC= 5.9854E-04
                                                                 150
                                                        NEVAL=
   81
       4.0000E+00 -1.1265E+00 -1.1064E+00
                                            1.0860E+00
                                                        9.9693E-01 -4.3131E-02
         H= 2.0000E-01 R= 1.4402E+02 AC= 6.9847E-04
                                                        NEVAL=
                                                                 164
       5.0000E+00 -1.1968E-01 -1.1471E+00
   86
                                                        1.0160E+00 -3.7496E-02
                                            1.1313 E+00
         H= 2.0000E-01 R= 1.5173E+02 AC= 6.0359E-04
                                                        NEVAL=
                                                                 175
       5.1177E+00 0.
                              -1.1515E+00
                                            1.1361E+00
                                                        1.0181E+00 -3.6517E-02
                                                                                 3.
         H= 2.0000E-01 R= 1.5173E+02
                                        AC= 6.2904E-04
                                                        NEVAL=
                                                                 175
```

INITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) ALPHAD= -.8 462 BETAQ= .0988
ALPHAR= -2.0542 BETAR= 2.2413

DRAG VECTOR AT FINAL POINT DIRECTION COSINES- 8.2179E-01 3.8626E-01 -4.1888E-01 ANGLES A AND GAM
AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.10221E+00 1.01954E+00

\* \* \* \* \* \* \* INITIAL COORDINATES X=-5.00000E+00 Y= 1.00000E+00 Z=-1.00000E IFLAG= 7 FOR KSTEP= 28 NEVAL= 60 HMIN IS SET TO 3.1250E-03

#### ROMETERS

Z

```
27827E+00 M/SEC

NUMBER OF VALUES= 1

1000E+00 NUMBER OF VALUES= 2

1000E+00 NUMBER OF VALUES= 2
```

**VPX** 

#### E+30 Y=-1.00000E+00 Z= 1.00000E+00 HMIN IS SET TO 3.1250E-03

VPY

```
003E+00
         9.6596E-01 -1.4267E-02
                                 1.6667E-03 9.6596E-01 -1.4267E-02 1.5870E-02
         NEVAL=
                    1
0218+00
         9.6478 E-01 -1.5232E-02
                                3.1541E-03 9.43(2E-01 -3.4403E-02
                                                                     4.0864E-02
445E-04
         NEVAL=
                  12
                                 3.1541E-03 9.4151E-01 -3.7761E-02
021E+00
         9.6478E-01 -1.5232E-02
                                                                      4.5294E-02
         NEVAL=
631E-54
                   13
                                 1.4476E-02
         9.5991E-01 -2.2680E-02
                                             9.4637E-01 -8.7974E-02
                                                                     1.2281E-01
894E+00
923E-64
         NEVAL=
                   31
151E+00
                                 2.2740E-02 9.6591E-01 -9.7990E-02 1.4245E-01
         9.5930E-01 -2.7841E-02
576E-04
         NEVAL=
                   57
         9.5956E-01 -2.9385E-02
                                 2.5288E-02 9.7691E-01 -1.0088E-01
                                                                     1.4898E-01
172E+00
905E-04
                   77
         NEVAL=
         9.6448E-01 -3.6556E-02
293 E+00
                                 3.7613E-02
                                             1.0420E+00 -9.9754E-02
                                                                     1.5379E-01
9298-84
                 97
         NEVAL=
                                             1.0858E+00 -8.3119E-02
         9.6916E-01 -3.9522E-02
                                 4. 2861 E-02
                                                                     1.2343E-01
373E+00
731E-04
         NEVAL=
                  184
         9.7641E-01 -4.2069E-02
                                4.7262E-02 1.0977E+00 -7.2147E-02 1.0213E-01
1492E+00
999E-04
         NEVAL=
                 130
613E+00
         9.8411E-01 -4.3370E-02
                                4.9320E-02 1.1037E+00 -5.4774E-02 7.0318E-02
854E-04
         NEVAL=
                  150
867E+00
847E-04
         9.9693E-01 -4.3131E-02 4.8716E-02 1.09E7E+00 -2.2761E-02 2.4140E-02
                 164
         NEVAL=
         1.0160E+00 -3.7496E-02
                                 4.1078E-02 1.1046E+00 5.6844E-03 -6.0732E-03
313 E+00
                  175
359E-04
         NEVAL=
         1.0161E+00 -3.6517E-02 3.9872E-02 1.1046E+00 5.6844E-03 -6.0732E-03
361 E+00
904E-84
                 175
         NEVAL=
```

VPZ

ANGLES (DEGREES) -

AQ = .0988 AR = 2.2413

01 -4.1888E-01 ANGLES A AND GAMMA- 2.5175E+(1 1.1476E+02 RARE 1.10221E+00 1.01954E+00

+00 Y= 1.00000E+00 Z=-1.00000E+00 HMIN IS SET TO 3.1250E-03

FIN BOUT FRAMA

VY

V X

¥7

```
KSTEP
                                                                        VPY
                                                            VPX
                                                 Z
                                                                   1.2975E-02 -2.
                  -5.0000E+00 1.0000E+00 -1.0000E+00
                                                        9.6340E-01
    n
         H= 1.0000E-01 R= 1.5173E+02 AC= 0.
                                                        NEVAL=
   10
       1.0000E+00 -4.0369E+00
                               1.0132E+00 -1.0295E+00
                                                        9.6232E-01
                                                                    1.3708E-02
         H= 1.0000E-01 R= 4.5689E+01 AC= 1.2573E-03
                                                        NEVAL=
                                                                  16
       1.0000E+00 -4.0369E+00 1.(132E+00 -1.0295E+00
                                                        9.6232E-01 1.3708E-02
   11
         H= 1.0 CODE-01 R= 5.2997E+01 AC= 9.3450E-04
                                                        NEVAL=
                                                                  18
                               1.0291E+00 -1.0623E+00
   21
       2.0000E+00 -3.0769E+00
                                                        9.5692E- 51
                                                                    1.9735E-02
         H= 1.0000E-01 R= 1.5349E+02 AC= 5.8890E-04
                                                                  38
                                                        NEVAL=
   31
       2.7656E+00 -2.3454E+00
                               1.0485E+00 -1.0985E+00
                                                        9.5602E-01
                                                                    3.1574E-02 -5.
         H= 3.1 250E-03 R= 2.0016E+02 AC= 5.497JE-04
                                                        NEVAL=
                                                                  66
   41
       2.9000E+00 -2.2168E+00
                                                        9.5733E-01
                                                                    3.3578E-02 -6
                                1.0529E+00 -1.1066E+00
         H= 5.0000E-02 R= 2.0280E+02 AC= 5.4600E-04
                                                                  86
                                                        NEVAL=
                                                        9.5864E-01 3.4974E-02 -6.
       3.0000E+00 -2.1210E+00 1.0563E+00 -1.1130E+00
   44
                                                                  92
         H= 5.0000E-02 R= 2.0340E+02 AC= 5.4493E-04
                                                        NEVAL=
       3.3875E+00 -1.7482E+00
                               1.0707E+00 -1.1405E+00
                                                        9.6613E-01
                                                                    3.9311E-02 -7.
   54
         H= 6.2500E-03 R= 1.9948E+02 AC= 5.8877E-04
                                                        NEVAL=
                                                                 117
       3.5500E+ 00 -1.5909E+00
                                                        9.7046E-01
                                                                    4.0630E-02 -8.
   64
                                1.0772E+00 -1.1532E+00
         W= 5.0000E-02 R= 1.9617E+02 AC= 5.9103E-04
                                                        NEVAL=
                                                                 137
       4.00 DOE+ DO -1.1512E+00
                               1.0960E+00 -1.1910E+00
                                                        9.8418E-01
                                                                    4.2377E-02 -8.
   71
         H= 1.0 000E-01 R= 1.8893E+02 AC= 5.9535E-04
                                                        NEVAL=
                                                                 1 52
                                                        1.0170E+00
       5.0000E+00 -1.5051E-01
                               1.1371E+00 -1.2785E+00
                                                                    3.8245E-02 -8.
   80
         H= 5.0000E-02 R= 2.0139E+02 AC= 5.5777E-04
                                                                 172
                                                        NEVAL=
                                                                    3.6966E-02
   84
       5.1477E+00
                   1.3878E-17 1.1427E+00 -1.2909E+00
                                                        1.0214E+50
         H= 2.5 000E-02 R= 2.0627E+02 AC= 5.1777E-04
                                                        NEVAL=
                                                                 181
```

INITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) ALPHAU - .7716 BETAU -1.7363
ALPHAR 2.0727 BETAR -4.5852

DRAG VECTOR AT FINAL POINT DIRECTION COSINES- 8.4447E-01 -2.5705E-01 4.6989E-01 ANGLES A AND GAMM
AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.14163E+00 1.02538E+00

```
VPX
                       VPY
                                   VPZ
                                                ٧X
                                                            VY
                                                                        ٧Z
10E+00
       9.634BE-01 1.2975E-02 -2.9207E-02 9.634BE-01 1.2975E-02 -1.5004E-02
       NEVAL=
                1
95E+80
       9.6232E-01
                   1.3708E-02 -3.0100E-82 9.3841E-01 3.1623E-02 -4.0163E-02
73E-43
       NEVAL=
               16
35E+00
       9.6232E-01 1.3708E-02 -3.0100E-02 9.3552E-01 3.4700E-02 -4.4642E-02
50E-04
       NEVAL=
                 18
23 E+00
       9.5692E-01 1.9735E-02 - 3.8095E-02 9.2806E-01 7.9368E-02 -1.2368E-01
30E-04
       NEVAL=
                 38
3 E+00
       9.5502E-01 3.1574E-02 -5.8414E-02 9. 8771E-01 9.4036E-02 -1.7743E-01
73E-04
       NEVAL=
                 66
66E+00
       9.5733E-01 3.3578E-02 -6.2513E-02 1.0045E+00 9.1879E-02 -1.8064E-01
10E-04
       NEVAL=
                86
30E+00
       9.5864E-01 3.4974E-02 -6.5529E-02
                                          1.0231E+00 8.7796E-02 -1.8064E-01
       NEVAL=
                92
33E-04
15E+00
       9.6613E-81 3.9311E-82 -7.6149E-02
                                           1.0615E+00 7.4554E-02 -1.6886E-01
77E-04
       NEVAL=
              117
32E+00
       9.7046E-01 4.0630E-02 -8.0008E-02
                                           1.0775E+00 6.7191E-02 -1.5845E-01
13E-U4
       NEVAL=
               137
       9.8418E-01 4.2377E-02 -8.7065E-02 1.1159E+00 4.1874E-02 -1.1020E-01
LD E+00
       NEVAL=
                1 52
35E-04
36E+00
       1.0170E+00 3.8245E-02 -8.4091E-02 1.1389E+00 3.9491E-03 -2.2823E-02
77E-04
       NEVAL=
              172
19E+00
       1.0214E+00 3.6966E-02 -8.1971E-02 1.1416E+00 3.2180E-04 -1.4954E-02
77E-04
       NEVAL=
                181
```

ANGLES (DEGREES) -

= -1.7363

-4.5852

11 4.6989E-01 ANGLES A AND GAMMA- -1.6930E+(1 6.1973E+01 ARE 1.14163E+80 1.02538E+00

FOR BOILT FRAME

CONFAC

BODY IDENTIFIER IS TEST NUMBER OF SYMMETRY PLANES = 0 NUMBER OF QUADRALA

ETRY PLANES= 0 NUMBER OF QUADRALATERALS= 189 MACH NUMBER= 0.

FM DOLLT FRAN.

CONFAC RUN ID -TEST PROBLEM WITH TEST BOLY

PHYSICAL INPUT DATA AIR SPEED= 9.000000E+01 CHARACTERISTIC DIMENSION OF THE BODY= 1.000000E+00
DENSITY AND TEMPERATURE OF AIR ARE 9.092500E-01 AND 2.686590E+02 AIR VIS

NUMERICAL INTEGRATOR INPUTS TIME STEP= 1.0000E-0: MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTERVAL=

LOCAL ERROR TOLERANCES FOR DVDQ - 1.0003E-05 1.0000E-05 1.0000E-05

PARTICLE FLUX TUBE SPECIFICATIONS NUMBER OF TRAJECTORIES ON FLUX TUBE PERIPHERY= 4 FLUX TUBE RADIUS AT TARG

TARGET AND INITIAL COORDINATE ESTIMATES-**JGUESS** YT ZT YI ZI 1 0.00000 0.00000 0.60000 0.00000 2 0.00000 0.00000 0.00000 0.00000 TERISTIC DIMENSION OF THE BODY= 1.000000E+00 RE 9.092500E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

TIME STEP= 5.0000E-03 PRINT TIME INTERVAL= 1.0000E+00 UPSTREAM START DISTANCE=-5.0000E+

1.0003E-05 1.0000E-05 1.0000E-05

UEE PERIPHERY= 4 FLUX TUBE RADIUS AT TARGET= .00326 TOLERANCE= .5000

IMATES-

ZT

ZI ΥI 0.00000 0.60000 0 0000 0.00000 4.00000 0 6000

#### WATER DROP DIAMETER = 3.0000E+02 MICROMETERS

TARGET COORDINATES X=-1.50000E+00

#### PARTICLE SETTLING SPEED= 1.27827E+00 M/SEC

Y= 1.10000E+00

Z= 8.00000E-013

```
TRAJECTORY NUMBER 0
                             TARGET COORDINATES - XPSTAR = -1.500000
                                                                            YPSTAR =
                                                                                       1.3
                                                                            YPSTARP=
                                                                                       1.1
                                                                                     ERROR
                  YFINAL
                               ZFINAL
                                           ITERATIONS
                                                           YINIT
                                                                        ZINIT
                .1209E+01
                            .8803E+00
                                                                      .8012E+08
                                                                                   .1352E
                                                1
                                                         .1101E+01
                .1210E+01
                            .8813E+ 00
                                                2
                                                         .1102E+01
                                                                      .8024E+00
                                                                                   .1367E
                ·1097E+01
                            .8052E+00
                                                3
                                                         .9795E+00
                                                                      .7039E+00
                                                                                   •5981E₩
                                                                                   .2112E
                .1102E+01
                            .7993E+00
                                                         .9834E+00
                                                                      .6981E+0u
                            .7979E+00
                .1099E+01
                                                5
                                                         .9800E+00
                                                                      .6961E+00
                                                                                   .2383E
                .1100E+01
                            .7998E+00
                                                                                   .4269E
                                                         .9811E+00
                                                                      .6983E+00
   KSTEP
                                                                  VP X
                                                                               VPY
       0
                      -5.0000E+00
                                    9.8110E- (1
                                                 6.9823E-01
                                                             9.6002E-01
                                                                         1.3571E-02 -1.6
          0.
            H= 1.0000E-01 R= 2.7725E+02 AC= 0.
                                                             NEVAL=
                                                                         1
                                                                          1.3983E-02
          7.0000E-01 -4.3281E+80
                                    9.90 68E-01
                                                 6.9725E-01
                                                             9.5929E-01
      10
            H= 1.0000E-01 R= 5.2057E+01
                                           AC= 8.3495E-04
                                                             NEVAL=
                                                                        13
          1.0000E+00 -4.0405E+00
      14
                                    9.9497E-01
                                                 6.9705E-01
                                                             9.5819E-01
                                                                         1.4671E-02 -2.0
            H= 1.0000E-01 R= 8.7192E+01
                                            AC= 5.9458E-04
                                                             NEVAL=
                                                                        17
      24
          1.8625E+00 -3.2173E+00
                                    1.0101E+00
                                                 6.9995E-01
                                                             9.4867E-01
                                                                          2.2660E-02
                                                                                       9.6
            H= 6.2500E-03 R= 2.0038E+02
                                            AC= 5.2003E-04
                                                             NEVAL=
                                                                        42
      34
          2.0000E+00 -3.0870E+00
                                    1.0134E+ (0
                                                 7.0151E-01
                                                             9.4620E-01
                                                                          2.5388E-02
                                                                                       1.3
            H= 5.0 COOE-02 R= 2.2830E+02
                                            AC= 4.9527E-04
                                                             NEVAL=
                                                                        62
      35
                                    1. 6134E+ 60
          2.0000E+00 -3.0870E+00
                                                 7.0151E-01
                                                              9.4620E-01
                                                                          2.5388E-02
                                                                                       1.3
            H= 5.0 000E-02 R= 2.3878E+02
                                            AC= 4.5273E-04
                                                             NEVAL=
                                                                        64
                                                             9.3723E-01
      45
          2.8000E+00 -2.3352E+00
                                    1.0437E+ 00
                                                                          5.2614E-02
                                                                                       5. 5
                                                 7.2664E-01
                                                                        86
            H= 5.0 000E-02 R= 3.3778E+02
                                            AC= 4.3878E-04
                                                             NEVAL=
          3.0000E+00 -2.1475E+00
                                    1.0549E+00
                                                 7.3919E-01
                                                             9.4051E-01
                                                                                       6. 9
                                                                          5.9150E-02
                            R= 3.2750E+02
                                                                        94
            H= 1.0 000E-01
                                            AC= 4.4993E-04
                                                             NEVAL=
      59
          3.6804E+00 -1.5000E+00
                                    1.0996E+00
                                                 7.9973E-01
                                                             9.6535E-01 6.9304E-02
                                                                                       1.0
             H= 5.0000E-02 R= 2.7658E+02
                                                             NEVAL=
                                           AC= 4.7412E-04
                                                                       117
       DRAG VECTOR AT FINAL POINT -
        DIRECTION COSINES-
                               8.1247E-01
                                            4.2971E-02
                                                          5.8142E-01
                                                                        ANGLES A AND GAMM
       AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                             1.14461E+08
                                                                             9.73484E-81
                       INITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -
RIGINAL PAGE IS
                         ALPHAC=
                                      .8099
                                                 BET A0 =
                                                           -.0973
                                                           6.1774
OF POOR QUALITY
                         ALPHAR=
                                     4.1063
                                                 BETAR=
   TRAJECTORY NUMBER 1
                             TARGET COORDINATES + XPSTAR = -1.503352
                                                                            YPSTAR =
                                                                                       1.0
                                                                             YPSTARF=
                                                                                       0. D
                  YFINAL
                               ZFINAL
                                           ITERATIONS
                                                           YINIT
                                                                        ZINIT
                                                                                     ERROR
               -.30 22E-03
                                                                      .4269E-02
                                                                                   .448 3E-
                            .3611E-02
                                                1
                                                         .7256E-03
   KSTEP
                                                                               VPY
                                                                  VP X
                                                 7.0256E-01
                      -5.0000E+00
                                                             9.6008E-01
          0.
                                    9.8182E- (1
                                                                          1.35635-02 -1.5
       Ω
            H= 1.0000E-01
                            R= 2.7658E+02
                                            AC= 0.
                                                             NEVAL=
                                                                         1
          7.0000E-01 -4.3281E+00
                                    9.9140E- (1
                                                             9.5935E-01
                                                                          1.3974E-02 -1.0
                                                 7.0157E-01
                                             AC= 8.3454E-04
            H= 1.0000E-01
                            R= 5.2019E+01
                                                             NEVAL=
                                                                        15
          1.0000E+00 -4.0404E+00
                                    9.9568E- [1
                                                 7.0133E-01
                                                             9.5825E-01 1.4660E-02 -1.5
      14
```

FOLDOLO FRAME

K.

```
₽00 M/SEC
. 10000E+00
               Z= 8.00000E-01
                                         ZFSTAR =
                                                    .800000 (FLOW SYSTEM)
R = -1.500000
                 YPSTAR = 1.100000
                                                    .800000 (FLUX TUBE SYSTEM)
                 YPSTARP= 1.100000
                                         ZPSTARP=
YINIT
                         ERROR (FLUX TUBE SYSTEM)
             ZINIT
1101E+01
           .8012E+0U
                       .1352E+00
                       .1367E+00
           .8024E+00
1102E+01
                       .5981E-02
           .7039E+00
9795E+00
           .6981E+0u
                       .2112E-02
9834E+00
9800E+00
           .6961E+0U
                       .2383E-02
                       .4269E-03
9811E+00
           .6983E+00
                                                                      VZ
                               VPZ
                                                         VY
       VP X
                   VPY
                                             V X
                                                    1.3571E-02 1.2572E-02
  9.6002E-01
               1.3571E-02 -1.6308E-03
                                        9.6002E-01
   NEVAL=
              1
   9.5929E-01
               1.3983E-02 -1.0880E-03
                                        9.3821E-01
                                                    2.6512E-02
                                                                2.5% 91E-02
  NEVAL=
             13
               1.4671E-02 -2.0919E-J4
   9.5819E-01
                                        9.1998E-01
                                                    4.0543E-02
                                                                3,9618E-02
   NEVAL=
             17
   9.4867E-01
              2.2660E-02
                           9.6867E-03
                                        8.7914E-01
                                                    9.4479E-02
                                                                1.0518E-01
  NEVAL=
            42
                                        8.7511E-01
                                                    1.0894E-01
                                                                1.2621E-01
   9.4620E-01 2.5388E-02
                           1.3176E-02
   NEVAL=
             62
                           1.3176E-02
                                        8.7450E-61
                                                                1.3473E-01
   9.4620E-01 2.5388E-02
                                                    1.1444E-01
  NEVAL=
             64
                                                                2.6234E-01
   9.3723E-01
               5.2614E-02
                            5.5791E-02
                                        9.6531E-01
                                                    1.5681E-01
             86
   NEVAL=
                                                    1.4009E-01
                                                                2.7029E-01
   9.4051E-01 5.9150E-02
                           6.9614E-12
                                        1. 0177E+80
            94
  NEVAL=
                           1.0475E-01
                                       1.1213E+00 7.7552E-02 2.1635E-01
   9.6535E-01 6.9304E-02
   NEVAL=
            117
             ANGLES A AND GAMMA-
                                    3.0275E+00
                                                 5.4450E+01
5.8142E-01
   1.14461E+08
                  9.73484E-01
ES (DEGREES) -
-.0973
6.1774
                 YPSTAR =
                           1.699975
                                         ZPSTAR =
                                                    .803261 (FLOW SYSTEM)
R = -1.509352
                                         ZPSTARP=
                                                    .003280 (FLUX TUBE SYSTEM)
                 YPSTARF= 0.000000
                         ERROR (FLUX TUBE SYSTEM)
             ZINIT
YINIT
7256E-03
           .4269E-02
                        .4483E-03
                                                          VY
                                                                      ٧Z
                   VPY
                                VPZ
                                             VX
       VP X
                                        9.6008E-01
                                                    1.3563E-02
                                                                 1.2628E-02
               1.3563E-02 -1.5749E-03
   9.6008E-01
   NEVAL=
```

9.5935E-01 1.3974E-02 -1.0309E-03

9.5825E-01 1.4660E-02 -1.5069E-04

15

NEVAL=

3.9745E-02

9.3835E-01 2.6478E-02 2.5248E-02

4.0463E-02

9.2023E-01

P

```
H= 2.5000E-02 R= 2.3257E+02 AC= 4.7405E-04
                                                         NEVAL=
                                                                   72
    46
        2.4750E+00 -2.6395E+00
                                                         9.38 03 E- 01
                                                                      3.9867E-02
                                1.0293E+00
                                             7.1651E-01
          H= 5.0000E-02 R= 3.1803E+02 AC= 4.4628E-04
                                                         NEVAL=
                                                                   92
    53
        3.0000E+00 -2.1471E+00 1.0554E+00
                                                         9.4086E-01
                                                                     5.8707E-02
                                             7.4345E-01
          H= 2.0000E-01 8= 3.2760E+02 AC= 4.4585E-04
                                                         NEVAL=
                                                                  106
                                1.0959E+(0 \7.9798E-01
        3.6250E+00 -1.5528E+00
                                                         9.6301E-01
    63
                                                                      6.8579E-02
          H= 5.0000E-02 R= 2.8288E+02 AC= 4.6314E-04
                                                         NEVAL=
                                                                  129
        3.67 94E+00 -1.5004E+00 1.0997E+(0
                                             8.0359E-01
                                                         9.6549E-01 6.8798E-02
          H= 5.0000E-02 R= 2.7205E+02 AC= 4.8639E-04
                                                         NEVAL=
                                                                  133
     DRAG VECTOR AT FINAL POINT -
      DIRECTION COSINES-
                           8.2736E-01
                                         3.1554E-02
                                                      5.6078E-01
                                                                   ANGLES A AND
                                                         1.14496E+00
     AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                                        9.73520E
 TRAJECTORY NUMBER 2
                          TARGET COORDINATES - XPSTAR = -1.500235
                                                                        YPSTAR =
                                                                       YPSTARF=
                                        ITERATIONS
               YFINAL
                            ZFINAL
                                                       YINIT
                                                                   ZINIT
                                                                               EA
             .3951E-02
                        -. 1236E-02
                                                     .4128E-02 -.3891E-03
                                                                              .140
                                            1
 KSTEP
                                                             VPX
                                                                          VPY
                                                  Z
                   -5.0001E+00
                                 9.8523E- (1
                                             6.9791E-01
                                                         9.6007E-01
                                                                     1.3617E-02
          H= 1.0000E-01 R= 2.7205E+02 AC= 0.
                                                         NEVAL=
                                                                    1
        7.0000E-01 -4.3282E+00 9.9484E-(1
                                                                      1.4030E-02
                                             6.9686E-01
                                                         9.5934E-01
          H= 1.0 000E-01 R= 5.1988E+01 AC= 8.3522E-04
                                                         NEVAL=
                                                                   15
        1.0000E+00 -4.0405E+00
                                                         9.5824E-01
                                                                      1. 4719E-02
    14
                                 9.9914E- (1
                                             6.9664E-01
          H= 1.0000E-01 R= 8.7042E+01
                                        AC= 5.9501E-04
                                                         NEVAL=
                                                                   23
    24
        1.8688E+00 -3.2113E+00
                                 1.0145E+60
                                             6.9955E-01
                                                         9.4866E-01
                                                                     2.2828E-02
65
          H= 6.2500E-03 R= 2.0108E+02 AC= 5.1932E-04
                                                         NEVAL=
                                                                   48
    34
        1.9750E+00 -3.1106E+00
                                 1. 01 70 E+ 00
                                             7.0074E-01
                                                         9.4677E-01
                                                                      2. 4901E-02
          H= 2.5000E-02 R= 2.2250E+02 AC= 4.9985E-04
                                                         NEVAL=
                                                                   68
    36
        2.0000E+00 -3.0870E+00
                                 1.0176E+00
                                             7.0105E-01
                                                         9.4630E- (1
                                                                      2.5444E-02
          H= 2.5000E-02 R= 2.3288E+02 AC= 4.7383E-04
                                                         NEVAL=
                                                                   72
    46
        2.6250E+00 -2.4990E+00
                                1.0393E+00
                                             7.1738E-01
                                                         9.3677E-01
                                                                    4.6008E-12
          H= 5.0000E-02 R= 3.3341E+02 AC= 4.4043E-04
                                                         NEVAL=
                                                                   93
        3.0000 E+00 -2.1473E+00 1.0592E+00
    52
                                             7.3850E-01
                                                         9.4062E-01 5.9214E-02
          H= 1.0000E-01 R= 3.2871E+02 AC= 4.4545E-04
                                                         NEVAL=
                                                                  105
        3.6250E+00 -1.5532E+00 1.1001E+(0
                                                         9.6281E-01 6.9236E-02
    62
                                             7.9309E-01
          H= 5.0000E-02 R= 2.8409E+02 AC= 4.6253E-04
                                                         NEVAL=
                                                                  128
        3.6800E+00 -1.5002E+00
                                                         9.6534E-01
                                 1.1039E+00
                                             7.9877E-01
                                                                      6.9463E-02
          H= 5.0000E-02 R= 2.7313E+02 AC= 4.8587E-04
                                                         NEVAL=
                                                                  132
     DRAG VECTOR AT FINAL POINT -
      DIRECTION COSINES-
                            8.2653E-01
                                         3.2372E-02
                                                                   ANGLES A AND G
                                                      5,6197E-01
     AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE
                                                         1.14547E+00
                                                                        9.73446E-
 TRAJECTORY NUMBER
                   3
                          TARGET COORDINATES - XPSTAR = -1.499648
                                                                        YPSTAR =
                                                                        YPSTARP=
               YFINAL
                            ZFINAL
                                        ITERATIONS
                                                                                ER
                                                       YINIT
                                                                    ZINIT
             .3971E-03
                                                     .4452E-03 -.1895E-02
                        -. 2 022E- 02
                                            1
                                                                              .131
```

NEVAL=

NEVAL=

NEVAL=

9.4870E-01

9.4682E-01

9.4636E-01

VP X

9.5927E-01

1

13

9.5817E-01 1.4684E-02 -

9.6000E-01

NEVAL=

NEVAL=

ALEMAI -

Z

6.9640E-01

6.9535E-01

CONFERMANCE

VPY

1.3583E-02 -

1.3995E-02 -

48

68

2.2724E-02

2.4783E-02

2.5322E-02

7.0439E-01

7.0557E-01

7.0590E-01

H= 1.000000-01 K= 0.10000+01 AU= 0.74046-04

H= 6.2500E-03 R= 2.0090E+02 AC= 5.1944E-04

H= 2.5000E-02 R= 2.2224E+02 AC= 5.0001E-04

1.0135E+ (0

1.0141E+00

1.8688E+00 -3.2112E+00 1.0110E+(0

X

THE A DOOD TOLD DE DE TRADELEL LOS

H= 1.0000E-01 R= 2.7313E+02 AC= 0.

H= 1.0000E-01 R= 5.2060E+01 AC= 8.3513E-04

1.0000E+00 -4.0405E+00 9.9542E-(1 6.9513E-01

9.8154E- (1

9.9114E-[1

-5.0000E+00

7.0000E-01 -4.3282E+00

1.9750E+00 -3.1105E+00

2.0000E+00 -3.0869E+00

34

36

KSTEP

10

```
the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s
70E-01 2.2724E-02 9.8992E-03 8.7962E-01 9.4692E-02 1.0612E-01
=
         48
68
6E-01 2.5322E-02
                                    1.3231E-02
                                                           8.7562E-01 1.1110E-01 1.3036E-01
        72
35-01 3.9867E-02 3.3994E-02 9.0337E-01 1.5468E-01 2.1774E-01
_=
        92
36E-01 5.8707E-02 6.9232E-02 1.0128E+00 1.4126E÷01 2.6912E-01
= 106
129
=
+9E-01 6.8798E-02 1.0407E-01 1.1229E+00 7.4802E-02 2.1077E-01
=
       133
-01
      ANGLES A AND GAMMA- 2.1841E+00 5.5890E+01
96E+00
                9.73520E-01
500235
                 YPSTAR = 1.103272 	 ZPSTAR = .800000 (FLOW SYSTEM)
                 YPSTARF= .003280
                                                           ZPSTARP= -.000000 (FLUX TUBE SYSTEM)
                              ERROR (FLUX TUBE SYSTEM)
         ZINIT
2 -.3891E-03 .1406E-02
IP X
                     VPY
                                            VPZ
                                                                    VX
                                                                                                                  VZ
$7E-01 1.3617E-02 -1.6521E-03 9.6007E-01 1.3617E-02 1.2551E-02
           1
34E-01 1.4030E-02 -1.1109E-03 9.3831E-01 2.6589E-02 2.5095E-02
         15
24E-U1 1.4719E-D2 -2.3501E-04 9.2016E-U1 4.0642E-02 3.9509E-02
=
        23
56E-01 2.2828E-02 9.7640E-03 8.7928E-01 9.5248E-02 1.0563E-01
[=
        48
7E-01 2.4901E-02 1.2396E-02 8.7602E-01 1.0636E-01 1.2160E-01
        68
30E- C1 2.5444E-02 1.3095E-02
                                                           8.7515E-01 1.1181E-01 1.2984E-01
         72
77E-01 4.6008E-02 4.3395E-02 9.2909E-01 1.6091E-01 2.4252E-01
        93
32E-01 5.9214E-02 6.9218E-02 1.0123E+00 1.4274E-01 2.6969E-01
       105
1E-01 6.9236E-02 1.0236E-01 1.1112E+00 8.5586E-02 2.2938E-01
       128
4E-01 6.9463E-02 1.0433E-01 1.1232E+00 7.5645E-02 2.1166E-01
       132
01
       ANGLES A AND GAMMA- 2.2429E+10 5.5808E+01
妈7E+00
              9.73446E-01
99648
                                                            ZFSTAR = .796739 (FLOW SYSTEM)
                YPSTAR = 1.100025
                                                             ZPSTARP= -.003280 (FLUX TUBE SYSTEM)
                'YPSTARP= -.000000
PX
        ZINIT
                             ERROR (FLUX TUBE SYSTEM)
  -.1895E-02 .1319E-02
                   VPY
                                           VPZ
                                                                    V X
QE-01 1.3583E-02 -1.6586E-03 9.6000E-01 1.3583E-02 1.2544E-02
ZE-01 1.3995E-02 -1.1167E-03 9.3816E-01 2.6541E-02 2.5099E-02
         13
E-01 1.4684E-02 -2.3900E-04 9.1991E-01 4.0595E-02 3.9543E-02
```

FM BOWT FRAM 2

```
・ガニ・1。ひりひひにっひ1。 ベニ り。/ とととにヤリュ (おしニーブ・フォララにデザギー)
                                                  NEVAL- 1/
    1.8625E+00 -3.2174E+00 1.0106E+00 6.9800E-01
                                                  9.4863E-01 2.2692E-02
24
                                                           42
     H= 6.2500E-03 R= 2.0058E+02 AC= 5.1985E-04
                                                  NEVAL=
                                                  9.4614E-01 2.5428E-02
    2.0000E+00 -3.0871E+00 1.0139E+00 6.9955E-01
     H= 5.0 000E-02 R= 2.2856E+02 AC= 4.9509E-04
                                                           62
                                                  NEVAL=
35
                                                             2.5428E-02
   2.0000E+00 -3.0871E+00 1.0139E+00 6.9955E-01
                                                  9.4614E-01
     H= 5.0000E-02 R= 2.3908E+02 AC= 4.5250E-04
                                                  NEVAL=
                                                           64
    2.8000E+00 -2.3354E+00 1.0443E+(0 7.2468E-01
                                                  9.3711E-01
45
                                                              5.2784E-02
     H= 5.0000E-02 R= 3.3842E+02 AC= 4.3855E-04
                                                  NEVAL=
                                                           86
    3.00 00E+08 -2.1477E+00 1.65 55E+00 7.3724E-01
49
                                                  9.4038E-01 5.9353E-02
                                                           94
     H= 1.0 CODE+01 R= 3.2808E+02 AC= 4.4975E-04
                                                  NEVAL=
59
    3.6500E+00 -1.5296E+00 1.0983E+00 7.9477E-01
                                                  9.6385E-81 6.9443E-82
     H= 5.0000E-02 R= 2.8269E+02 AC= 4.6343E-04
                                                  NEVAL=
                                                           117
    3.6808E+00 -1.4998E+00 1.1004E+00 7.9793E-61
                                                  9.6528E-01 6.9554E-02
     H= 5.0 000E-02 R= 2.7710E+02 AC= 4.7361E-04
                                                  NEVAL=
                                                           119
DRAG VECTOR AT FINAL POINT -
  DIRECTION COSINES- 8.1238E-01 4.2836E-02 5.8156E-01
                                                            ANGLES A AND G
 AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.14489E+00
                                                                9.73459E-
                                                                YPSTAR =
                    TARGET COORDINATES - XPSTAR = -1.499765
                                                                YPSTARP=
                                  ITERATIONS
                                                                        ERA
          YFINAL
                      ZFINAL
                                                YINIT
                                                            ZINIT
```

TRAJECTORY NUMBER 4 -.4310E-02 .7579E-04 -.3891E-02 -.3977E-03 .1033 1 **KSTEP** VP X

-4.9999E+00 9.7721E-(1 6.9798E-01 9.5996E-01 1.3530E-02 -1 0. 0 H= 1.0000E-01 R= 2.7710E+02 AC= 0. NEVAL= 1 7.0000E-01 -4.3281E+00 9.8676E-01 6.9687E-01 9.5923E-01 1.3941E-02 -1 H= 1.0000E-01 R= 5.2125E+01 AC= 8.3479E-04 NEVAL= 13 99 14 1.0000E+00 -4.0405E+00 9.9104E-(1 6.9667E-01 9.5813E-01 1.4628E-02 -1 H= 1.0000E-01 R= 8.7353E+01 AC= 5.9414E-04 NEVAL= 17 1.86 25E+00 -3.2174E+00 1.00 £1E+ (0 6.9959E-01 24 9.4856E-01 2.2624E-02 H= 6.2500E-03 R= 2.0095E+02 AC= 5.1945E-04 NEVAL= 42 34 2.0000E+00 -3.0871E+00 1.0094E+ (0 7.0115E-01 9.4606E-01 2.5356E-02 H= 5.0000E-02 R= 2.2900E+02 AC= 4.9474E-04 NEVAL= 62 9.4666E-01 2.5356E-02 35 2.0000E+00 -3.0871E+00 1.0094E+00 7.0115E-01

H= 5.0 000E-02 R= 2.3953E+02 AC= 4.5218E-04 64 NEVAL= 45 2.8000E+00 -2.3355E+00 1.03 (8E+00 7.2645E-01 9.3704E-01 5.2642E-02 H= 5.0000E-02 R= 3.3867E+02 AC= 4.3847E-04 NEVAL= 86 3.0000E+00 -2.1478E+00 1.0510E+00 7.3908E-01 9.4034E-01 5.9173E-02 H= 1.0000E-01 R= 3.2816E+02 AC= 4.4983E-04 94 NEVAL=

5**9** 3.65 00 E+00 -1.5297 E+00 1.09 35 E+00 7.9682 E-01 9.6387E-01 6.9148E-02 H= 5.0000E-02 R= 2.8240E+02 AC= 4.6353E-04 NEVAL= 116

3.6811E+00 -1.4997E+00 1.0957E+00 8.0003E-01 9.6531E-01 6.9255E-02 H= 5.0 000E-02 R= 2.7685E+02 AC= 4.7364E-04 NEVAL= 118

DRAG VECTOR AT FINAL POINT -

DIRECTION COSINES- 8.1378E-01 4.0887E-02 5.7973E-01 ANGLES A AND GA AIR AND PARTICLE SPEEDS AT THE FINAL POINT ARE 1.14496E+00 9.73502E-0

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```
42
5E-U4 NEVAL=
5E-01
     9E-04
     NEVAL=
             62
5E-01
     9.4614E-01 2.5428E-02 1.3140E-J2 8.7418E-01 1.1472E-01 1.3465E-01
    NEVAL= 64
DE-04
    9.3711E-01 5.2784E-02 5.5842E-02 9.6504E-01 1.5739E-01 2.6271E-01
8E-01
     NEVAL=
5E-04
             86
     9.4038E-01 5.9353E-02 6.9706E-02 1.0176E+00 1.4059E-01 2.7074E-01
4E-01
5E-04
     NEVAL= 94
7E-01
     9.6385E-01 6.9443E-02 1.0389E-01 1.1154E+00 8.2849E-02 2.2593E-01
3E-04 NEVAL= 117
     9.6528E-01 6.9554E-02 1.0497E-01 1.1215E+00 7.7790E-02 2.1679E-01
3 E - 61
12-04 NEVAL= 119
2 5.8156E-01 ANGLES A AND GAHMA- 3.0184E+00 5.4440E+01
ARE
    1.14489E+00 9.73459E-01
                                      ZPSTAR = .800000 (FLOW SYSTEM)
PSTAR = -1.499765
                 YPSTAR = 1.096728
                                      ZPSTARP= .000000 (FLUX TUBE SYSTEM)
                  YPSTARP= -. 003280
   YINIT
                        ERROR (FLUX TUBE SYSTEM)
             ZINIT
-.3891E-02 -.3977E-03 .1033E-02
         VPX
                   VPY
                              VP Z
                                                    ٧Y
                                                               ٧Z
                                          V X
0E-U1 9.5996E-U1 1.3530E-U2 -i.6213E-U3 9.5996E-U1 1.3530E-U2 1.2582E-U2
     NEVAL= 1
7E-01 9.5923E-01 1.3941E-02 -1.0773E-03 9.3808E-01 2.6448E-02 2.5186E-02
SE-04 NEVAL= 13
7E-01 9.5813E-01 1.4628E-02 -1.9607E-04 9.1978E-01 4.0466E-02 3.9694E-02
4E-04
     NEVAL=
              17
     9.4856E-01 2.2624E-02 9.7440E-03 8.7866E-01 9.4430E-02 1.0556E-01
9E-01
5E-04
     NEVAL=
             42
5E-01
     9.4606E-81 2.5356E-82 1.3253E-82 8.7459E-01 1.0891E-01 1.2671E-01
NEVAL= 62
5E-01
     9.46U6E-01 2.5356E-02 1.3253E-U2 8.7396E-U1 1.1442E-01 1.3528E-01
BE-04 NEVAL= 64
$E-01 9.3704E-01 5.2642E-02 5.6158E-02 9.6537E-01 1.5667E-01 2.6346E-01
E-04 NEVAL= 86
¥E-01 9.4034E-01 5.9173E-02 7.0049E-02 1.0180E+00 1.3981E-01 2.7122E-01
5E-04
     NEVAL= 94
#E-U1 9.6387E-D1 6.9148E-D2 1.0418E-D1 1.1156E+DD 8.2154E-D2 2.2576E-D1
E-04 NEVAL= 116
[E-01 9.6531E-01 6.9255E-02 1.0526E-01 1.1216E+00 7.7109E-02 2.1662E-01
E-04 NEVAL= 118
```

5.7973E-01 ANGLES A AND GAMMA- 2.8763E+00 5.4568E+01

1.14496E+00 9.73502E-01

9.4863E-01 2.2692E-02 9.6505E-03 8.7890E-01 9.4679E-02 1.0508E-01

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0E-01

RE

(1) resulting to the control of the

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### FLUX TUBE CROSS SECTION COORCINATES IN THE -

			TARGET PLAN		
IP	ΧP	YP	Z₽	ΧP	ΥP
CENTER	-5.0000E+00	9.8110E-01	6.9829E-01	-1.5000E+00	1.100 CE+00
1	1.5884E-14	7.2555E-04	4.2635E-03	-5.2934E-15	-3.0215E-04
2	1.1492E-14	4.1278E-03	-3.8912E-84	-1.0963E-15	3.950 6E - 03
3	2.8054E-14	4.4517E-04	-1.8950E-03	-2.9064E-15	3.9710E-04
4	9.7370E-15	-3.8913E-03	-3.9756E-04	1.6757E-15	-4.3100E-03

FLUX TUBE CROSS SECTION AREA IN THE INITIAL PLANE = 2.47114E-05

CONCENTRATION FACTOR= 1.08337

AT THE POINT (X,Y,Z) = -1.50000 1.10000 .80000

FOR A PARTICLE OF DIAMETER = 300.00000 WITH DIAMETER TO LENGTH RATIO = 1.14339

PARTICLE CONCENTRATION FATIO = 1.11288

# ROSS SECTION COORCINATES IN THE -

### TARGET PLANE

ΖP	ΧP	YP	ZP		
9829E-01	-1.5000E+00	1.100 GE+00	8.00 COE-01	(FLCW	SYSTEM
	-5.2934E-15	-3.0 21 5E -0 4	3.6111E-03	(FLUX	TUBE SYSTEM)
263 5E - 0 3	-1.0963E-15	3.950 6E-03	-1.2361E-03	(FLUX	TUBE SYSTEM)
8912E-84		3.9710E-04	-2.0225E-03	(FLUX	TUBE SYSTEM)
			7.5786E-05	(FLUX	TUBE SYSTEM)
8950E-03	-2.9064E-15	-4.310 0E-03	7.5786E-05	(FLUX	TUBE SYSTEM)

THE INITIAL PLANE = 2.47114E-05 IN THE TARGET PLANE = 2.28097E-05

1.10000 .80000 WITH DIAMETER TO LENGTH RATIO= 1.00000E+00 AND DENSITY= 1.00000E+03 1.14339 1288

TANTRA

BODY IDENTIFIER IS TEST

NUMBER OF SYMMETRY PLANES = 0

NUMBER OF QUADRALA

MMETRY PLANES = 0 NUMBER OF QUADRALATERALS = 189 MACH NUMBER = 0.

TANGENT TRAJECTORY CODE RUN ID -TEST PROBLEM WITH TEST BO LY

NUMERICAL INTEGRATOR INPUTS TIME STEP= 1.0000E-01 MINIMUM TIME STEP= 5.0000E-03 PRINT TIME INTERV
LOCAL ERROR TOLERANCES FOR DVDQ - 1.0000E-05 1.0000E-05 1.0000E-

TRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTTING

C DIMENSION OF THE BODY= 1.000000E+00 92500E-01 AND 2.686590E+02 AIR VISCOSITY IS 1.693764E-05

EP= 5.0000E-03 PRINT TIME INTERVAL= 1.0000E+00 X COORD. OF FINAL PLANE= 0.

0000E-05 1.0000E-05 1.0000E-05

OR PLOTTING

#### WATER DROP DIAMETER = 2.00000E+02 MICROMETERS

#### PARTICLE SETTLING SPEED= 7.69093E-01 M/SEC

```
TRAJECTORIES ARE TO BEGIN ALONG A LINE DEFINED BY THE POINTS (X1, Y1, Z1,) AND
              -5.00000E+00
                              0.
                                                                        -5.00000E+
         (
                                            -4.50000E-01 )
                                                             AND
    WITH DIRECTION COSINES - (COS(ALPHA), COS(BETA), COS(GAMMA)) -
    STARTING POINT INCREMENTS ARE - COARSE INCREMENT= 5.00000E-02
                                                                     FINE INCREMEN
                INITIAL COORDINATES X=-5.00000E+00
                                                                        Z=-4.50000E
                                                      Y = 0.
    IFLAG = 7 FOR KSTEP=
                            27
                                NEVAL=
                                          58
                                                        HMIN IS SET TO 3.1250E-03
    IFLAG = 7 FOR KSTEP=
                                          59
                            27
                                NEVAL=
                                                        HMIN IS SET TO 1.5625E-03
         INSIDE QUAD
                      185
                               I 2 = 1
          ZNP, ROSQ, TSQ, H= -5.4665E-03
                                         2.4343E-01
                                                      1.0355E+00
                                                                   2.500 JE-02
          INSIDE QUAD 188
                               I 2=
                                    1
          ZNP,ROSQ,TSQ,H=
                                         2.5035E-01
                          -7.1977E-03
                                                      1.0355E+00
                                                                    2.500 DE-02
         THE BODY SURFACE IS PENETRATED. PARTICLE COORDINATES ARE (X,Y,Z)-2.5523
          TRIAL INITIAL COORDINATES ARE (YINIT, ZINIT)
                                                       0.
                                                                   -4.500 UE-01
               AFTER
                       O ATTEMPTS PARTICLE STILL PENETRATES THE BODY.
KSTEP
            T
                         Х
                                                            VP X
                                                                         VPY
                   -5.0000E+00 0.
                                                        9.4971E-01 -1.0353E-03 -1.
                                           -4.5000E-01
         H= 1.0 COOE-01 R= 8.2573E+00 AC= 1.9004E-17
                                                        NEVAL=
       5. 0000E-01 -4.5253E+00 -5.2030E-04 -4.5857E-01
                                                        9.4686E-01 -1.0526E-03 -1.
         H= 5.0000E-02 R= 2.1823E+01 AC= 1.6453E-03
                                                        NEVAL=
                                                                  17
    19
        1.0000E+00 -4.0517E+00 -1.0637E-03 -4.6742E-01.
                                                        9.4439E-01 -1.1384E-03 -1.
         H= 1.0000E-01 R= 6.8350E+01 AC= 6.6054E-04
                                                        NEVAL=
                                                                  35
       1.8406E+00 -3.2695E+00 -2.2201E-03 -4.8800E-01
   29
                                                        9.0566E-01 -1.7706E-03 -3.
                                                        NEVAL=
         H= 1.5625E-03 R= 2.0070E+02 AC= 4.9963E-04
                                                                 63
       1.8750E+00 -3.2385E+00 -2.2817E-(3 -4.8936E-01
   39
                                                        9.0255E-01 -1.8174E-03 -4.
         H= 1.2500E-02 R= 2.1011E+02 AC= 4.9009E-04
                                                        NEVAL=
                                                                  83
   47
       2.0000E+00 -3.1264E+00 -2.5204E-C3 -4.9505E-01
                                                        8.8980E-01 -2.0074E-03 -5.
         H= 5.0000E-02 R= 2.6029E+02 AC= 4.1124E-04
                                                        NEVAL=
                                                                  99
       2.5750E+00 -2.6346E+00 -3.9965E-03 -5.5196E-01
    57
                                                        8.2481E-01 -3.1898E-03 -1.
         H= 2.5000E-02 R= 3.9701E+02 AC= 3.9795E-04
                                                        NEVAL=
                                                                 121
                INITIAL COORDINATES X=-5.00000E+00
                                                      Y = 0
                                                                       Z=-5.00000E
    IFLAG= 7 FOR KSTEP=
                            28
                                NEVAL=
                                          60
                                                        HMIN IS SET TO 3.125CE-03
    IFLAG= 7 FOR KSTEP=
                            29
                                NEVAL=
                                          63
                                                        HPIN IS SET TO 1.5625E-03
    IFLAG= 7 FOR KSTEP=
                           108
                                NEVAL=
                                                        HMIN IS SET TO 7.8125E-04
                                         235
KSTEP
            T
                                                             VP X
                                                                         VPY
                   -5.0000E+00 0.
                                           -5.0000E-01
                                                        9.5022E-01 -1.0211E-03 -1.
         H= 1.0000E-01 R= 3.9701E+02 AC= 8.2203E-21
                                                        NEVAL=
        5.0000E-01 -4.5250E+00 -5.1313E-04 -5.0905E-01
                                                        9.4939E-01 -1.0379E-03 -1.
         H= 5.0000E-02 R= 2.1255E+01 AC= 1.6923E-03
                                                        NEVAL=
                                                                   17
```

9.4510E-01 -1.12J4E-03 -1.

37

9.0617E-01 -1.7668E-03

NEVAL=

NEVAL=

1.00 COE+ 00 -4.0512E+00 -1.0485E-03 -5.1842E-01

1.8797E+00 -3.2321E+00 -2.2468E-[3 -5.4173E-01

H= 1.0 000E-01 R= 6.6581E+01 AC= 6.7263E-04

H= 1.5625E-03 R= 1.9997E+02 AC= 5.3975E-04

```
(X1,Y1,Z1,) ANG (X2,Y2,Z2) -
      -5.00000E+00
                                      0.
    0.
                   Ç.
                                  1.00000E+00
   FINE INCREMENT= 5.00000E-03
     Z=-4.50000E-01
                       FOR TRAJECTORY NUMBER
ET TO 3.1250E-03
ET TO 1.5625E-03
  2.500 JE-02
  2.500 0E-02
RE (X,Y,Z)-2.55232E+00-4.32804E-03-5.70585E-01
-4.50005-01
                 ATTEMPT NUMBER
DDY.
      VPY
                   VPZ
                                V X
                                            VY
                                                        VZ
1 -1.0353E-03 -1.7077E-02 9.4971E-01 -1.0353E-03 -8.5312E-03
L -1.0526E-03 -1.7267E-02 9.2635E-01 -1.5046E-03 -1.5595E-02
17
1 -1.1384E-03 -1.8462E-02
                           8.7433E-01 -2.4196E-03 -3.7486E-02
35
1 -1.7706E-03 -3.8358E-02
                           7.3501E-01 -4.3441E-03 -1.5675E-01
63
1 -1.8174E-03 -4.0613E-62
                           7.2654E-01 -4.4526E-03 -1.6882E-01
83
L -2.0074E-03 -5.1080E-02
                           6.9105E-01 -4.9664E-03 -2.4430E-01
99
-3.1898E-03 -1.6851E-01
                          7.4570E-01 -6.1109E-03 -5.7168E-01
21
                                                           RIGINAL PAGE IS
                                                           OF POOR QUALITY
     Z=-5.00000E-01
                       FOR TRAJECTORY NUMBER
T TO 3.125CE-03
T TO 1.5625E-03
T TO 7.8125E-04
                   VP Z
                                VX
                                            VY
                                                        ٧Z
-1.0211E-03 -1.8037E-02
                           9.5022E-01 -1.0211E-03 -9.4917E-03
 -1.0379E-03 -1.8253E-02
                           9.2743E-01 -1.4781E-03 -1.7214E-02
17
-1.12J4E-03 -1.9572E-02 8.7764E-01 -2.3594E-03 -4.0720E-02
37
```

-1.7668E-03 -4.2684E-02 7.4553E-01 -4.2808E-03 -1.7362E-01

2

```
SWITCH TO FINE STEPSIZE * *
FOLDOUT FRAGE
                                                                  Y = 0.
                       INITIAL COORDINATES X=-5.00000E+00
          IFLAG= 7 FOR KSTEP=
                                    30
                                         NEVAL=
                                                    57
          IFLAG= 7 FOR KSTEP=
                                         NEVAL=
                                                    58
                                    30
                INSIDE QUAD
                                        I2=
                               187
                                             1
                ZNF, ROSQ, TSQ, H=
                                   -3.2026E-04
```

1. プリウンにゃむは こう。というしたもい ここ。とり4ととったう こう。4と94とでは1

2.0000E+00 -3.1237E+00 -2.4692E-03 -5.4747E-01

2.5250E+00 -2.6674E+00 -3.7260E-(3 -5.9541E-01

2.7125E+00 -2.5091E+00 -4.3054E-03 -6.2775E-01

2.8750E+00 -2.3701E+00 -4.8572E-03 -6.6329E-01

3.0000E+00 -2.2614E+00 -5.3004E-03 -6.9338E-01

3.2687E+00 -2.0226E+00 -6.2920E-03 -7.6277E-01

3.3750E+00 -1.9261E+00 -6.6963E-03 -7.9143E-01

3.3937E+00 -1.9089E+00 -6.7679E-03 -7.9658E-01

3.4500E+00 -1.8572E+00 -6.9827E-03 -8.1193E-01 H= 1.2500E-02 R= 1.8939E+02 AC= 5.4795E-04

3.8000E+00 -1.5285E+00 -8.3154E-03 -9.0780E-01

4.0000E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01

4.0000E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01

4.3500E+00 -9.8803E-01 -1.0328E-02 -1.0523E+00

4.7750E+00 -5.5306E-01 -1.1753E-02 -1.1520E+00

5.000UE+00 -3.1772E-01 -1.2444E-(2 -1.1993E+00

5.2995E+00 1.1102E-16 -1.3284E-02 -1.2559E+00 H= 1.0000E-01 R= 1.7534E+02 AC= 5.5777E-04

H= 5.0000E-02 R= 1.9086E+02 AC= 5.4461E-04

H= 5.0000E-02 R= 1.8499E+02 AC= 5.4930E-04

H= 2.5000E-02 R= 1.8398E+02 AC= 5.5533E-04

H= 2.5000E-02 R= 1.9043E+02 AC= 5.4239E-04

H= 5.0000E-02 R= 1.8739E+02 AC= 5.4448E-04

H= 5.0000E-02 R= 1.8378E+02 AC= 5.5173E-04

H= 1.5625E=93 R= 1.9867E+02 AC= 5.3852E-04

H= 2.5000E-02 R= 2.2479E+02 AC= 4.9517E-04

H= 6.2500E-03 R= 2.2802E+02 AC= 4.7372E-04

H= 1.2500E-02 R= 3.6565E+02

H= 2.5000E-02 R= 2.7019E+02

H= 2.5000E-02 R= 2.0274E+02

49

59

69

79

84

94

104

114

124

134

144

145

155

165

170

175

H= 5.0 000E-02

H= 6.2500E-03 R= 2.0666E+02 AC= 4.9383E-04

H= 2.5000E-02 R= 2.3735E+02 AC= 4.4684E-04

R= 3.5235 E+02 AC= 4.1138 E-04

AC= 4.0703E-04

AC= 4.4649E-04

AC= 4.9549E-04

```
HMIN IS SET TO 3.1250E-03
                                               HMIN IS SET TO 1.5625E-03
                                1.67372-01
                                             6.7553E-01
                                                           2.500 BE-02
THE BODY SURFACE IS PENETRATED. PARTICLE COORDINATES ARE (X,Y,Z)-2.414
TRIAL INITIAL COORDINATES ARE (YINIT, ZIVIT)
                                              0.
                                                          -4.9500E-01
```

YOUNGETUL TIOUTOETUS 85

8.9545E-01 -1.9350E-03

8.4607E-01 -2.8990E-03

8.46925-01 -3.2768E-03 -

8.6379E-01 -3.4910E-03 -

8.7616E-01 -3.5962E-03 -

9.1405E-01 -3.8160E-63 -

9.1608E-01 -3.8177E-03 -

9.5632E-01 -3.7791E-03 -2

9.7643E-01 -3.7025E-03 -2

9.7643E- C1 -3.7025E- C3 -2

1.0069E+00 -3.5092E-03 -2 335

1.0387E+00 -3.1772E-03 -2

1.0528E+00 -2.9619E-03 -2

Z=-4.95000

103

124

147

167

178 9.0165E-01 -3.7829E-03 -

505

222

247 9.2214E-01 -3.8205E-03 -2

267

288

311

314

356

367 1.0682E+00 -2.6446E-03 -1

377

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL:

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NEVAL=

NE VAL=

AFTER O ATTEMPTS PARTICLE STILL PENETRATES THE BODY.

```
VPY
KSTEP
                                                Z
                                                           VPX
       D.
                  -5.0000E+00
                                          -4.9503E-01
                                                       9.5017E-01 -1.0226E-03 -1
                               G.
                                                       NEVAL=
         H= 1.0000E-01 R= 1.7534E+02 AC= 4.2147E-20
   10
       5. 00 00E-01 -4.5250E+00 -5.1385E-04 -5.0401E-01
                                                       9.4934E-01 -1.0394E-03 -1
         H= 5.0000E-02 R= 2.1313E+01 AC= 1.6874E-03
                                                       NEVAL=
                                                                 13
   20
       1.0000E+00 -4.0512E+00 -1.0501E-(3 -5.1333E-01
                                                       9.4502E-01 -1.1222E-03 -1
         H= 1.0000E-01 R= 5.6799E+01 AC= 9.2763E-04
                                                       NEVAL=
                                                                 31
   21
       1.0000E+00 -4.0512E+00 -1.0501E-03 -5.1333E-01
                                                       9.4502E-01 -1.1222E-03 -1
         H= 1.0000E-01
                        R= 6.6762E+01
                                       AC= 6.7141E-04
                                                       NEVAL=
                                                                 33
   31
       1.8766E+00 -3.2352E+00 -2.2457E-(3 -5.3643E+01
                                                       9.0602E-01 -1.7688E-03 -4
         H= 1.5625E-03 R= 2.0029E+02 AC= 5.0045E-04
                                                       NEVAL=
                                                                 60
       1.9063E+00 -3.2083E+00 -2.2988E-03 -5.3772E-01
                                                       9.0350E-01 -1.8081E-03 -4
   41
         H= 6.2500E-03 R= 2.0786E+02 AC= 4.926JE-04
                                                       NEVAL=
                                                                 80
```

```
12-01 -1.0010t-03 -4.45/9t-02
                                / 0 41 U C C - U 1 - 4 0 3 2 0 1 E - U 3 - 7 0 0 3 1 3 E - U 1
     85
                                                                                 ( )
E-01 -1.9350E-03 -5.2476E-02
                                7.2203E-01 -4.6783E-03 -2.3124E-01
    103
FE-01 -2.8990E-03 -1.4541E-01
                                7.7503E-01 -5.6161E-03 -5.0306E-01
                                                                                 13
    124
                                9.5347E-01 -5.6300E-03 -5.6342E-01
2E-01 -3.2768E-03 -2.0033E-01
    147
9E-01 -3.4910E-03 -2.3312E-01
                                1.4317E+00 -5.0500E-03 -4.5671E-01
    1 67
BE-01 -3.5962E-03 -2.4746E-01
                                1.0474E+00 -4.9247E-03 -4.0973E-01
    178
5E-01 -3.7829E-03 -2.6766E-01
                                1.1074E+00 -5.0931E-03 -3.8329E-01
    202
5E-01 -3.8160E-(3 -2.7199E-01
                                1.1195E+00 -4.0114E-03 -3.1470E-01
                                1.1183E+00 -3.9671E-03 -3.0931E-01
8E-01 -3.8177E-03 -2.7241E-01
    247
4E-01 -3.8205E-03 -2.7338E-01
                                1.1168E+00 -3.8600E-03 -2.9616E-01
    267
                                                                                  2E-01 -3.7791E-03 -2.7288E-01
                                1.1511E+00 -3.2909E-03 -2.4028E-01
    288
3E-01 -3.7025E-03 -2.6648E-31
                                1.1507E+00 -2.8540E-03 -1.8720E-01
                                                                                  1
    311
3E- C1 -3.7025E- C3 -2.6648E-01
                                1.1506E+00 -2.8140E-03 -1.8361E-01
    314
9E+00 -3.5092E-03 -2.4919E-U1
                                1.1656E+00 -2.2839E-03 -1.3240E-01
    335
7E+00 -3.1772E-03 -2.1923E-01
                                1.1649E+00 -1.4809E-03 -7.1961E-02
=
    356
8E+00 -2.9619E-03 -2.0115E-01
                                1.16(3E+00 -1.0059E-03 -4.1299E-02
    367
2E+00 -2.6446E-03 -1.7707E-01
                                1.1631E+00 -4.1830E-04 -1.9720E-02
    377
O FINE STEPSIZE * *
          Z=-4.95000E-01
                            FOR TRAJECTORY NUMBER
                                                                ORIGINAL PAGE IS
IS SET TO 3.1250E-03
IS SET TO 1.5625E-03
                                                                OF POOR QUALITY
-01
      2.500 BE-02
                                                                                  17
EES ARE (X,Y,Z)-2.41459E+88-4.70245E-83-6.47195E-01
     -4.9500E-01
                    ATTEMPT NUMBER
                                                                                  4 b
HE BODY.
```

IPX VPY 7E-01 -1.0226E-03 -1.7943E-02 9.5017E-01 -1.0226E-03 -9.3971E-03 4E-01 -1.0394E-03 -1.8156E-02 9.2731E-01 -1.4808E-03 -1.7056E-02 13 2E-01 -1.1222E-03 -1.9463E-02 8.8821E-01 -2.1833E-03 -3.4500E-02 31 2E-01 -1.1222E-03 -1.9463E-02 8.7730E-01 -2.3654E-03 -4.0409E-02 = 33 12E-01 -1.7688E-03 -4.2313E-(2 7.4457E-01 -4.2901E-03 -1.7230E-01 \_= 60 80

50

```
68
         2.7125E+00 -2.5103E+00 -4.3208E-03 -6.2286E-01
                                                          8.4491E-01 -3.3024E-03 -
                                                          NEVAL=
           H= 1.2500E-02
                          R= 3.7292E+02
                                          AC= 4.0480E-04
                                                                   137
                                                * * TANGENT TRAJECTORY IS AS FOLLO
                 INITIAL COORDINATES X=-5.00000E+00
                                                                          Z=-5.00000
                                                        Y = 0.
                                                          HMIN IS SET TO 3.1250E-03
     IFLAG= 7 FOR KSTEP=
                             28
                                 NEVAL=
                                           60
                                                          HMIN IS SET TO 1.5625E-03
     IFLAG= 7 FOR KSTEP=
                             29
                                 NEVAL=
                                           63
     IFLAG = 7 FOR KSTEP=
                                 NEVAL=
                                                          HMIN IS SET TO 7.8125E-04
                            108
                                           235
 KSTEP
                                                              VP X
                                                                           VPY
                    -5.0000E+00
                                             -5.0003E-01
                                                          9.5022E-01 -1.0211E-03 -1
     0
                                0.
        ٥.
          H= 1.0000E-01 R= 3.7292E+02
                                        AC= 9.3174E-21
                                                          NEVAL=
                                                                     1
    10
         5.0000E-01 -4.5250E+00 -5.1313E-04 -5.0905E-01
                                                          9.4939E-01 -1.0379E-03 -1
           H= 5.0 000E-02 R= 2.1255E+01
                                         AC= 1.6923E-03
                                                          NEVAL=
                                                                    17
    20
         1.0000E+00 -4.0512E+00 -1.0485E-63 -5.1842E-01
                                                          9.4510E-01 -1.1204E-03 -1
           H= 1.0 (00E-01 R= 6.6581E+01 AC= 6.7263E-04
                                                          NEVAL=
                                                                    37
         1.8797E+00 -3.2321E+00 -2.2468E-(3 -5.4178E-01
    30
                                                          9.0617E-01 -1.7668E-03 -4
           H= 1.5625E-03 R= 1.9997E+02 AC= 5.3975E-04
                                                          NEVAL=
                                                                     65
    40
         1.9063E+00 -3.2081E+00 -2.2942E-03 +5.4294E-01
                                                          9.0393E-01 -1.8018E-03 -4
           H= 6.2500E-03 R= 2.0666E+02 AC= 4.9383E-04
                                                          NEVAL=
                                                                     85
         2.0000E+00 -3.1237E+00 -2.4692E-03 -5.4747E-01
                                                          8.9545E-01 -1.9350E-03 -5
           H= 2.5000E-02 R= 2.3735E+02 AC= 4.4684E-04
                                                          NEVAL=
                                                                   103
    59
         2.5250E+00 -2.6674E+00 -3.7260E-03 -5.9541E-01
                                                          8.4607E-01 -2.899UE-03 -1
72
           H= 5.0 000E-02 R= 3.5235E+02 AC= 4.1138E-04
                                                          NEVAL=
                                                                   124
    69
         2.7125E+00 -2.5091E+00 -4.3054E-03 -6.2775E-01
                                                          8.4692E-01 -3.2768E-03 -2
           H= 1.2500E-02 R= 3.6565E+02 AC= 4.0703E-04
                                                          NE VAL=
                                                                   147
    79
         2.8750E+00 -2.3701E+00 -4.8572E-03 -6.6328E-01
                                                          8.6379E-81 -3.4918E-03 -2
           H= 2.5000E-02 R= 2.7019E+02 AC= 4.4643E-04
                                                          NEVAL=
                                                                   167
         3.0000E+00 -2.2614E+00 -5.3004E-03 -6.9338E-01
                                                          8.7616E-01 -3.5962E-03 -2
    84
           H= 2.5000E-02 R= 2.2479E+02 AC= 4.9517E-04
                                                          NEVAL=
                                                                    178
    94
         3.2687E+00 -2.0226E+00 -6.2920E-03 -7.6277E-01
                                                          9.0165E-01 -3.7829E-03 -2
           H= 6.2500E-03 R= 2.2802E+02 AC= 4.7372E-04
                                                          NEVAL=
                                                                    202
         3.3750E+00 -1.9261E+00 -6.6963E-03 -7.9148E-01
                                                          9.1405E-01 -3.8160E-03 -2
   104
           H= 2.5 000E-02 R= 2.0274E+02 AC= 4.9549E-04
                                                          NEVAL=
                                                                    222
         3.3937E+00 -1.9089E+00 -6.7679E-03 -7.9658E-01
                                                          9.1688E-01 -3.8177E-03 -2
   114
                                          AC= 5.3852E-04
           H= 1.5625E-03 R= 1.9867E+02
                                                          NEVAL=
                                                                   247
        3.4500E+00 -1.8572E+00 -6.9827E-03 -8.1193E-01
   124
                                                          9.2214E-01 -3.8205E-03 -2
           H= 1.2500E-02
                          R= 1.8939E+02 AC= 5.4795E-04
                                                          NEVAL=
                                                                    267
   134
         3.8000E+00 -1.5285E+00 -8.3154E-03 -9.0780E-01
                                                          9.5632E-01 -3.7791E-03 -2
                          R= 1.9886E+02 AC= 5.4461E-04
                                                                    288
           H= 5.0000E-02
                                                          NEVAL=
         4.0000E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01
    144
                                                          9.7643E-01 -3.7025E-03 -2
           H= 5.0 000E-02 R= 1.8499E+02 AC= 5.4930E-04
                                                          NEVAL=
                                                                    311
         4. 00 00E+00 -1.3352E+00 -9.0641E-03 -9.6181E-01
                                                          9.7643E-01 -3.7025E-03 -2
    145
           H= 2.5000E-02 R= 1.8398E+02 AC= 5.5533E-04
                                                          NEVAL=
                                                                    314
    155
         4.3500E+00 -9.8803E-01 -1.0328E-02 -1.0523E+00
                                                          1.0069E+00 -3.5092E-03 -2
           H= 2.5 000E-C2 R= 1.9043E+02
                                         AC= 5.4239E-04
                                                          NEVAL=
                                                                    335
   165
         4.7750E+00 -5.5306E-01 -1.1753E-02 -1.1520E+00
                                                           1.0387E+00 -3.1772E-03 -2
           H= 5.0000E-02 R= 1.8739E+02 AC= 5.4448E-04
                                                          NEVAL=
                                                                    356
   170
         5.0000E+00 -3.1772E-01 -1.2444E-02 -1.1993E+00
                                                          1.0528E+00 -2.9619E-03 -2
           H= 5.0000E-02
                          R= 1.8378E+02 AC= 5.5173E-04
                                                          NEVAL=
                                                                    367
    175
         5.2995E+00
                     1.1102E-16 -1.3284E-02 -1.2553E+00
                                                          1.0682E+00 -2.6446E-03 -1
           H= 1.0 COOE-01 R= 1.7534E+02 AC= 5.5777E-04
                                                          NEVAL=
                                                                    377
```

2.000000400 -3.12400+00 -2.41430-63 -3.42240-01

2.4750E+00 -2.7105E+00 -3.5943E-13 -5.8330E-01

R= 3.4415E+02

58

H= 5.0 CO 0E-02

FOLDOLD FRAME

H= 2.5000E-02 R= 2.3887E+02 AC= 4.4563E-04

0.74700

94

115

8.4764E-01 -2.8141E-03 -4

NEVAL=

NEVAL=

AC= 4.1415E-04

```
1 -2.8141E-03 -1.3307E-01 7.4906E-01 -5.5837E-03 -4.7531E-01
115
1 -3.3024E-03 -2.0236E-01 9.5275E-01 -5.7009E-03 -5.7291E-01
137
FORY IS AS FOLLOWS * * * *
     Z=-5.000000E-01
                      FOR TRAJECTORY NUMBER
ET TO 3.125 CE-0,3
T TO 1.5625E-83
ET TO 7.8125E-04
                  VPZ
                               V Y
 -1.0211E-03 -1.8037E-02 9.5022E-01 -1.0211E-03 -9.4917E-03
1 -1.0379E-03 -1.8253E-02
                          9.2743E-01 -1.4781E-03 -1.7214E-02
17
-1.1204E-03 -1.9572E-02
                          8.7764E-01 -2.3594E-03 -4.0720E-02
37
L -1.7668E-U3 -4.2684E-02
                          7.4593E-01 -4.2808E-03 -1.7362E-01
65
-1.8018E-03 -4.4579E-02 7.4102E-01 -4.3561E-03 -1.8313E-01
85
■ -1.9350E-03 -5.2476E-02
                          7-2203E-01 -4-6783E-03 -2-3124E-01
LO3
-2.899 BE-03 -1.4541E-01
                          7.7503E-01 -5.6161E-03 -5.0306E-01
24
-3.2768E-03 -2.0033E-01 9.5347E-01 -5.6300E-03 -5.6342E-01
47
-3.4910E-03 -2.3312E-01
                          1.0317E+00 -5.0500E-03 -4.5671E-01
67
-3.5962E-03 -2.4746E-01
                          1.0474E+00 -4.9247E-03 -4.0973E-01
78
-3.78 29 E- [3 -2.6766 E-01
                          1.1074E+00 -5.0931E-03 -3.8329E-01
02
$ -3.8160E-83 -2.7199E-81 1.1195E+88 -4.8114E-83 -3.1478E-81
22
-3.8177E-03 -2.7241E-01 1.11 | 3E+00 -3.9671E-03 -3.0931E-01
47
-3.8205E-03 -2.7338E-01
                         1.1168E+00 -3.8600E-[3 -2.9616E-01
67
$ -3.7791E-03 -2.7288E-01
                          1.1511E+00 -3.2909E-03 -2.4028E-01
88
                          1.1507E+00 -2,8540E-03 -1.8720E-01
-3.7025E-03 -2.6648E-01
111
-3.7025E-03 -2.6648E-01
                          1.1506E+00 -2.8140E-03 -1.8361E-01
14
-3.5092E-03 -2.4919E-11
                          1.1656E+00 -2.2839E-03 -1.3240E-01
35
-3.1772E-03 -2.1923E-11
                          1.1649E+00 -1.4809E-03 -7.1961E-02
56
□-2.9619E-03 -2.0115E-01 1.16G3E+00 -1.0059E-03 -4.1299E-02
67
-2.6446E-03 -1.7707E-01 1.1631E+00 -4.1830E-04 -1.9720E-02
```

T -1.7452 -00 -0.5000 -05 7.1740E-07 '-4.6777E-00 -6.0140E-01

73

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## PLOT TANGENT TRAJECTORY TO THE TEST BODY

NUMBER OF SYMMETRY PLANES = 0 NUMBER OF TRAJECTORIES = 1 XSTART

MINIMUM AND MAXIMUM COORDINATES -

X AXIS= -5.0 COOQE+00 2.00000E+00 Y AXIS= -2.00000E+00 2.00000E+00 Z AXIS= -1.25593E+00 1.00000E+00

COORDINATE TRANSLATIONS USED TO CENTER THE PLOTS - DELX, DELY, DELZ -1.50000E+00 3. -1.27964E-01

CRT PLOTS

THETA = 0.0 C PSI = 160.00 DELTA = 3.50 PLOT LABEL - THETA=0, PSI=160, DELTA=3.5 PEMSF = 1.5466E+00

TRAJ. NO. 1 OF 22 POINTS

0.

0.

-.5131E-03

-.1049E-02

-.2247E-02

-.2294E-02

-.2469E-02

-.3726E-02

-.5000E+01

-.5000E+01

-.4525E+01

-.4051E+01

-.3232E+01

-.3208E+01

-.3124E+01

-.2667E+01

YTRAJ	ZTRAJ	XPLCT	YPLOT
0.	5000E+00	2158E+01	5754E+00
Ð •	5000E+00		5754E+00
5131E-03	_	1865E+01	5894E+00
1049E-02	518 4E+80	1572E+01	6039E+00
2247E-02	541 8E+00	10 65E+01	6480E+08
2294E-02	542 SE+00	10 50E+01	6418E+00
- 02469E-92	5475E+80	9978E+00	6488E+00
3726E-02	5954E+00	7146E+00	7229E+00
4305E-02	6277E+00	6162E+00	7729E+00
4857E-02	6633E+00	5297E+00	8279E+0#
5300E-02	6934E+00	4620E+00	8744E+00
6292E-02	762 EE+00	3133E+00	9818E+00
6696E-02	7915E+00	2533E+00	1026E+01
6768E-02	7966E+00	2426E+00	1034E+01
6983E-02	8119E+00	2104E+00	1058E+01
8315E-02	907 <i>E</i> E+00	5772E-02	1296E+01
9064E-02	961 EE+00	• 1145E+00	1290E+01
9064E-02	961 EE+80	.1145E+80	1298E+81
1033E-01	1052E+01	•3304E+G0	1429E+01
1175E-01	1152E+01	.6006E+00	1584E+01
1244E-01	1199E+01	.7468E+00	1657E+01
1328E-01	125 6E+01	.9439E+00	1744E+01
22 POINTS			
YTRAJ	ZTRAJ	XPLOT	YPLOT
	0.  0.  131E-03 1049E-02 2247E-02 2294E-02 2294E-02 3726E-02 4305E-02 4857E-02 5300E-02 6696E-02 6768E-02 6768E-02 6983E-02 6983E-02 9064E-02 9064E-01 1175E-01 1244E-01 1328E-01	0. 5000E+005000E+005000E+005131E-035091E+005184E+002247E-025418E+002294E-025475E+005475E+005726E-024305E-024305E-024857E-026633E+006292E-026633E+006292E-026696E-026696E-026768E-026983E-026983E-029078E+009064E-029064E-029064E-011033E-011152E+011244E-011328E-011256E+01	0.

-.5000E+00

-.500 0E+00

-.5091E+00

-.5184E+00

-.5418E+00

-.5429E+00

-.5475E+00

-.5954E+00

-.1537E+01

-.1537E+01

-.1328E+01

-.1119E+01

-.7575E+00

-.7469E+00

-.7096E+00

-.5073E+00

-.5754E+00

-.5754E+00

-.5894E+00

-.6039E+00

-.6400E+00

-.6418E+00

-.6488E+00

-.7229E+00

DELY. DELZ -27964E-01

## YPLOT

```
-.5754E+00
```

- -.5754E+00 -.5894E+00
- -.6039E+00
- -.6400E+00 -.6418E+00
- -.6488E+00
- -.7229E+00
- -.7729E+80
- -.8279E+00
- -.8744E+00
- -.9818E+00
- -.1526E+01
- -.1634E+01
- -.1058E+01
- -.1206E+01
- -.1290E+01 -.1298E+01
- -.1429E+01
- -.1584E+01
- -.1657E+01
- -.1744E+01

## YPLOT

- -.5754E+00
- -.5754E+00
- -.5894E+00
- -.6039E+00
- -.640UE+00
- -.6418E+00
- -.6488E+00
- -.7229E+00

FIRE DOLLT FRAME

3

**€** 

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● ● とうひうピナゼユ
                    -043UDE-UZ
                                                                      - . / / ZYE + UU
                                     -.02776+00
                                                     -. 45 6 9E TUU
   -. 2370E+01
                    -.4857E-12
                                     -.6633E+00
                                                      -.3750E+00
                                                                       -.8279E+00
   -. 2261E+01
                    -.5300E-02
                                     -.6934E+00
                                                      -.3266E+00
                                                                       -.8744E+00
   -.2023E+01
                    -.6292E-02
                                     -.7 £28E+00
                                                      -.2202E+00
                                                                       -.9818E+00
   -. 1926E+01
                    -.6696E-02
                                     - 67915E+00
                                                      -.1772E+00
                                                                       -.1026E+01
                    -.6768E-02
   -.1909E+01
                                     -.7966E+00
                                                      -.1696E+00
                                                                       -.1034E+01
   -.1857E+01
                    -.6983E-02
                                     -.8 119E+00
                                                      -.1466E+00
                                                                      -.1058E+01
   -.1528E+01
                    -.8315E-02
                                     -.9078E+00
                                                      -.1809E-03
                                                                      -.1206E+01
   -.1335E+01
                    -.9064E-02
                                     -. 961 EE+00
                                                       .8585E-01
                                                                      -.1290E+01
   -.1335E+01
                    -.9064E-02
                                     -.9 £18E+00
                                                       .8585E-01
                                                                      -.1290E+01
   -.9880E+00
                    -.1033E-01
                                     -.1052E+01
                                                       .2402E+00
                                                                       -.1429E+01
   -.5531E+00
                    -.1175E-01
                                     -.1152E+01
                                                       .4334E+00
                                                                      -.1584E+01
   -.3177E+00
                    -.1244E-B1
                                     -.1199E+01
                                                       .5378E+G0
                                                                      -.1657E+01
    .111 DE-15
                    -.1328E-01
                                     -.1256E+01
                                                       .6786E+00
                                                                      -.1744E+01
THETA =
            0.06
                            PSI =
                                    160.00
                                                     DELTA =
                                                                  3.00
PLOT LABEL -
               THETA=0, PSI=160, DELTA=3.0
TRAJ. NO.
            1 OF
                    22 POINTS
      XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                         XPLOT
                                                                        YPLOT
                    0 .
   -. 5000E+01
                                     -. 50 0 0E+00
                                                     -. 2129E+01
                                                                      -.5792E+00
   -.500 0E+01
                                     -.5000E+00
                                                     -. 2129E+01
                                                                      -.5792E+00
                    -.5131E-03
                                     -.5091E+00
   -.4525E+01
                                                      -.1839E+01
                                                                      -.5933E+00
   -. 4051E+01
                    -.1049E-02
                                     -.5184E+80
                                                     -. 1550E+01
                                                                      -.6079E+00
   -.3232E+01
                    -.2247E-02
                                     -.541 8E+00
                                                      -. 1050E+01
                                                                      -.6442E+00
   -.3208E+01
                    -.2294E-02
                                     -.5429E+00
                                                     -.1036E+01
                                                                      -.6460E+00
   -.3124E+01
                    -.2469E-02
                                     -.547 5E+80
                                                      -. 9841E+00
                                                                      -.6531E+00
   -.2667E+01
                    -.3726E-02
                                     -.5954E+00
                                                      -.7048E+00
                                                                      -.7277E+00
   -. 2509E+01
                    -.4305E-02
                                     -.6277E+00
                                                     -. 6076E+00
                                                                      -.7780E+00
   -. 2370E+01
                    -.4857E-D2
                                     -.6633E+00
                                                      -.5223E+00
                                                                      -.8334E+00
   -. 2261E+01
                    -.5300E-02
                                     -.6934E+00
                                                      -. 4555E+00
                                                                      -.8802E+00
   -.2023E+01
                    -.6292E-02
                                     -.7628E+00
                                                     -.3088E+00
                                                                      -.9882E+00
   -.1926E+01
                    -.6696E-02
                                    -. 791 5E+ 00
                                                     -.2496E+00
                                                                      -.1033E+01
   -.1909E+01
                    -.6768E-02
                                     -.7966E+00
                                                     -. 2390E+00
                                                                      -.1541E+81
   -.1857E+01
                    -.6983E-02
                                     -.8119E+00
                                                      -.2073E+00
                                                                      -.1065E+01
   -. 1528E+01
                    -.8315E-02
                                     -.9078E+00
                                                     -.5410E-02
                                                                      -.1214E+01
   -.1335E+01
                    -.90642-02
                                     -.961 8E+00
                                                       .1133E+00
                                                                      -.1298E+81
   -.1335E+01
                    -.9064E-02
                                     -.961 &E+ 00
                                                       .1133E+00
                                                                      -.1298E+01
   -. 9880E+00
                    -. 1033E-01
                                     -.1052E+01
                                                       .3262E+00
                                                                      -.1439E+01
   -.5531E+00
                    -.1175E-01
                                     -.1152E+01
                                                       .5928E+00
                                                                      -.1594E+81
   -.3177E+00
                    -.1244E-01
                                     -.11 99E+61
                                                       .7370E+00
                                                                      -.1668E+#1
    .1110E-15
                    -.1328E-01
                                     -.125 EE+01
                                                       .9315E+00
                                                                      -.1756E+01
TRAJ. NO.
            1 OF
                    22 POINTS
     XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                         XPLOT
                                                                          YPLOT
   -.5000E+01
                    10 .
                                     -.5000E+00
                                                     -.1593E+01
                                                                      -.5792E+00
                    0.
   -.5000E+01
                                    - .500 0E+00
                                                      -.1593E+01
                                                                      -.579 2E+00
   -.4525E+01
                    -.5131E-03
                                     -.5091E+00
                                                     -.1376E+01
                                                                      -.5933E+00
   -. 4051E+01
                    -.1049E-02
                                     -.5184E+D0
                                                     -. 11 60E+01
                                                                      -.6679E+00
   -.3232E+01
                    -.2247E-02
                                     -.5418E+00
                                                     -. 7850E+U0
                                                                      -.6442E+00
   -. 3208E+01
                    -.2294E-02
                                     -.5429E+00
                                                     -.7740E+00
                                                                      -.646DE+00
   -.3124E+Q1
                    -.2469E-02
                                                                      -.6531E+00
                                     -.5475E+00
                                                     -.7354E+00
   -.2667E+91
                    -.3726E-02
                                     -.5 954E+00
                                                     -.5258E+00
                                                                      -.7277E+00
   -. 2509E+01
                    -.4305E-02
                                     -.627 7E+00
                                                     -.4529E+00
                                                                      -.7780E+00
   -. 2370E+01
                    -.4857E-02
                                     -.6633E+00
                                                     -.3888E+00
                                                                      -.8334E+00
   -. 2261E+01
                    -.5300E-02
                                                                      -.8802E+00
                                     -.6934E+00
                                                      -.3387E+00
   -. 20 23E+0 1
                    -.6292E-02
                                     -.7628E+00
                                                     -.2285E+00
                                                                      -.9882E+00
   -.1926E+01
                    -.6696E-02
                                     -.7915E+00
                                                      -.1840E+00
                                                                      -.1033E+01
     4.0 0.0 5.0.4...
                      war and the California of the stand of the same
                                                                       and Market and America
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-. 17075701
                    -. 0/00E=UZ
                                    * . / 9 COET UU
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                                                                      ~ . I U41E+UI
   -.1857E+01
                    -.6983E-02
                                    -.8119E+00
                                                                      --1065E+01
                                                     -. 1522E+00
   -.1528E+01
                    -.8315E-02
                                    -.9078E+00
                                                     -.5852E-03
                                                                      -.1214E+01
   -.1335E+01
                    -.9064E-02
                                     -.9618E+03
                                                      .8853E-01
                                                                      -.1298E+01
   -.1335E+01
                    -.9064E-02
                                     -.9618E+00
                                                      .8853E-01
                                                                      -.1298E+01
   -. 988 DE+D (
                    -.1033E-01
                                     -.105 2E+01
                                                      .2484E+00
                                                                      -.1439E+01
   -.5531E+00
                    -.1175E-01
                                    -.1152E+01
                                                      .4485E+00
                                                                      --1594E+01
   -.3177E+00
                    -.1244E-01
                                     -.1199E+81
                                                      .5566E+00
                                                                      -.1668E+81
    •1110E-15
                    -.1328E-81
                                     -.125 €E+01
                                                      .7025E+00
                                                                      -.1756E+01
            0.00
THETA =
                            PSI =
                                   160.00
                                                     DELTA =
                                                                 2.50
PLOT LABEL -
               THETA=0, PSI=160, DELT#=2.5
         PEMSF =
                   1.5672E+00
            1 0F
TRAJ. NO.
                    22 POINTS
      XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                        XPLOT
                                                                         YPLOT
   -.5000E+01
                    0.
                                    -.5000E+00
                                                     -. 20 99E+01
                                                                      -.5831E+00
                                    -. 500 0E+00
   -.5000E+01
                    J.
                                                     -.2099E+01
                                                                      -.5831E+00
   -. 452 5E+01
                    -.5131E-03
                                    -.5091E+00
                                                     -.1814E+01
                                                                      -.5973E+00
   -.4051E+01
                    -.1049E-02
                                    -.5184E+00
                                                     -.1529E+01
                                                                      -.6119E+00
   -.3232E+01
                    -.2247E-02
                                     -.5418E+00
                                                     -. 10 3 EE+01
                                                                      -.6485E+00
   -. 3208E+01
                    -.2294E-02
                                    -.542 SE+00
                                                     -.1021E+01
                                                                      -.6504E+00
                    -.2469 E-B2
   -.3124E+01
                                     -.5475E+00
                                                     -. 9703E+00
                                                                      -.6575E+00
   -. 2667E+01
                    -.3726E-02
                                    -.5954E+00
                                                     -.6948E+00
                                                                      -.7326E+00
   -.2509E+01
                    -.4305E-02
                                     -.6277E+00
                                                     -.5990E+00
                                                                      -.7833E+00
   -. 2370E+01
                    -.4857E-02
                                     -.6633E+00
                                                     -.5148E+00
                                                                      -.8398E+00
   -. 2261E+0 1
                    -.5300E-02
                                     -. 6934E+00
                                                     -. 449 GE+00
                                                                      -.8861E+00
                    -.6292E-02
   -.2023E+01
                                    -.762 EE+00
                                                                      -.9949E+88
                                                     -.3043E+00
   -.1926E+01
                    -.6696E-02
                                    -.7915E+80
                                                     - · 2459E+00
                                                                      -.1840E+81
   -.1909E+01
                    -.6768E-02
                                     -.7966E+00
                                                     -.2355E+00
                                                                      -.1048E+01
   -.1857E+01
                    -.6983E-02
                                     -.8119E+00
                                                     -.2041E+00
                                                                      -.1072E+81
   -.1528E+01
                    -.8315E-02
                                    -.9078E+00
                                                     -.5043E-02
                                                                      -.1222E+01
   -.1335E+01
                    -.9064E-02
                                    -.961 €E+00
                                                      .1129E+00
                                                                      -.1307E+01
   -.1335E+01
                    -.9064E-02
                                     -.9618E+B0
                                                      .1120E+00
                                                                      -.1307E+01
   -.988 CE+00
                    -.1033E-01
                                    -.1052E+01
                                                      .3220E+00
                                                                      -.1449E+01
   -.5531E+00
                    -.1175E-01
                                    -.1152E+81
                                                      .5849E+08
                                                                      -.1605E+01
   -.3177E+00
                    -.1244E-01
                                    -.1199E+01
                                                      .7271E+00
                                                                      -.1679E+01
    .1110E-15
                    -.1328E-01
                                    -.1256E+01
                                                      .9189E+00
                                                                      -.1768E+01
            1 0F
TRAJ. NO.
                    22 POINTS
      XTRAJ
                       YTRAJ
                                        ZTRAJ
                                                        XPLOT
                                                                         YPLOT
   -.5000E+01
                    0.
                                    -.5000E+00
                                                     -.1649E+01
                                                                      -.5831E+00
   -.5000E+01
                                                                      -.5831E+00
                                    -.5000E+00
                                                     -.1649E+81
                    -.5131E-03
                                     -.5091E+00
   -.4525E+01
                                                     -.1425E+01
                                                                      -.5973E+30
   -.4051E+01
                    -.1049E-02
                                    -.5184E+00
                                                     -.1201E+01
                                                                      -.6119E+00
   -.3232E+01
                    -.2247E-02
                                     -.541 EE+00
                                                     -.8129E+00
                                                                      -.6485E+00
   -. 3208E+01
                    -.2294E-02
                                                                      -.6504E+00
                                    -.5429E+00
                                                     -.8015E+00
   -.3124E+01
                    -. 2469E-02
                                     -.5475E+00
                                                     -.7615E+00
                                                                      -.6575E+00
   -.2667E+01
                    -.3726E-02
                                     -.5954E+08
                                                     -.5446E+00
                                                                      -.7326E+80
   -. 25 19E+11
                    -.4305E-02
                                     -.6277E+00
                                                     - . 4691E+00
                                                                      -.7833E+90
   -.237 0E+01
                    -.4857E-02
                                    -.6633E+00
                                                     -. 40 28E+00
                                                                      -.8390E+00
                    -.5300E-02
                                                     -.3509E+00
   -.2261E+01
                                     -.6934E+00
                                                                      -.8861E+00
                    -.6292E-62
   -.2023E+G1
                                     -.7628E+00
                                                     -.2369E+00
                                                                      -.9949E+00
   -.1926E+01
                    -.6696E-02
                                    -.791 5E+00
                                                     -.1908E+00
                                                                      -.1040E+01
   -.1909E+01
                    -.6768E-02
                                     -.7966E+00
                                                     -. 1826E+00
                                                                      -.1048E+01
   -.1857E+01
                    -.6983E-02
                                     -.8 119E+00
                                                     -.1579E+00
                                                                      --1072E+01
   -.1528E+01
                    -.8315E-02
                                     -.9078E+00
                                                     -.9949E-03
                                                                      -.1222E+01
   -.1335E+01
                    -.9064E-02
                                    -.9618E+00
                                                      .9124E-01
                                                                      -.1307E+01
   -.1335E+01
                    --9064E-02
                                     -. 9618E+00
                                                      •9124E-01
                                                                      -.1307E+01
   . . OAART . NO.
```

\_40COC:A4

0ECZ5+06

ORIGINA

1

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1

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4

1

- • A000F+88	- • T020C-DI	~ • 1 4 2 4 5 4 4 1	• 25 C/CTUU	~ • 1 4495 + 81
5531E+00	1175E-01	1152E+01	.4638E+00	1605E+01
3177E+00	1244E-01	1199E+01	.5758E+00	1679E+01
.1110E-15	1328E-#1	1256E+01	.7268E+01	1768E+81

## CODE LISTINGS

```
PROGRAF PRUXC(INPUT, TAPE6, TAPE5=INPUT, OUTPUT,
      1 TAPES , TAPES, TAPESS, PUNCH, TAPEL=PUNCH)
                                                                               FBOXC
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                               PBOXC
C
                                                                               PROXC
      THIS CODE HAS THREE PRINCIPAL USES -
                                                                               PBCXC
            1. DEBUG HESS-SMITH CODE INPUT DATA.
                                                                               PBOXC
                                                                                       6
            2. PLCT 3-DIMENSICNAL BODY SURFACE DESCRIPTION.
                                                                               PBCXC
            3. TRANSFER QUADRA_ATERAL ELEMENT DATA TO UNIT 9 FOR LATER
C
                                                                               PBCX(
                                                                               PBOXC
C
               USE BY PROGRAM STEREO.
                                                                               FBCXC 10
C
      PERFORMS FRELIMINARY PROCESSING (IPROS=TRUE) (SCALING.
                                                                               PBOXC 11
C
      TRANSLATING, RITATING) OF INFUT DATA FOR THE HESS-SMITH
C
                                                                               PBCXC 12
      NON-LIFTING COCE (RPT. E.S. 40622). PRELIMINARY PROCESSEU DATA PBCXC 14
C
                                                                               PBOXC 13
      MAY BE PUNCHED (IPUNCH=TRUE). AFTER PRELIMINARY PROCESSING, DATAPBOXC 15
C
      ALSO MAY BE PROCESSED INTO QUADRALATERAL ELEMENTS AND THE HESS-
C
      SMITH FIRST OUTPUT (L.S. 41622 SEC. 9.4) MAY BE PRINTED (IPRNT = PBCXC 17 TRUE). DATA ALSO MAY BE PLOTTED (IPICT=TRUE). IN ANY CASE THE PBCXC 18
C
      DATA ARE WRITTEN ON TO JULT 9, WHICH MAY BE SAVED FOR USE LATER
      BY SR STEREO WHICH PLOTS THE BODY ALONG WITH TRAJECTORIES.
                                                                              PECKC 19
C
                                                                               P80XC 20
      COMMON HEDRE 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, FBCXC 22
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, FBCXC 23
                                                                               FBCXC 24
      REAL MACH
      LOGICAL IPROS, IPUNCH, IPRNT, IFICT, ICRT
                                                                               FBCXC 25
                                                                               PBCXC 26
      COMMON / P/ MACH, BETA, RBETA
                                                                              FBCXC 27
      READ IN CONTROL DATA
    I READ ( 5. 9000 ) (HEDR (I) .1=1,15) . IFLAG . NSYM. KMACH. KASE
                                                                              PBCXC 28
9000 FORMAT ( 1544, II. 10x. II. 1x, II. 2x, A4)
                                                                              PBCXC 29
                                                                              PBOXC 30
      MACH = C.O
      IF(KMACH .NE. () READ(5.6) MACH
                                                                              FBCX( 31
                                                                              FBOXC 32
    6 FORMAT (F10.6)
      BETA = SCRT(1.0 - MACH * MACH)
                                                                              PBUXC 33
                                                                              PBCXC 34
      RBETA = 1.0 / BETA
      READ(5,8000)IPROS, IPUNCH, IPRNT, IPICT, ICRT
                                                                              PBCX( 35
8000 FORMAT (5L1)
                                                                              FBCXC 36
     IF( IPRO : ) READ(5,7000) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                              PBOXC 37
                                                                              PBCXC 38
       YTRANS. ZTRANS
7000 FORMAT ( 7F 10.0)
                                                                              PBCX( 39
                                                                              PBOXC 40
     IF(.NOT. IFROS) GC TO 53
                                                                              FBOXC 41
     IF(XSCALE .EG. 0.0) XSCALE=1.0
                                                                              PBOXC 42
     IF (YSCALE .EQ. U. U) YSCALE=1.0
     IF(ZSCALE .EQ. 0.0) ZSCALE=1.0
                                                                              FBCXC 43
                                                                              PBCXC 44
     COSA = COS( 0.0174533 * ANGLE)
     SINA = SIN( 0.0174533 * ANGLE)
                                                                              PBCXC 45
                                                                              PBCXC 46
 50 REWIND 8
                                                                              PBCX ( 47
     REHIND 9
                                                                              FBCXC 48
     CALL PINFUT
                                                                              PBOXC 49
     IF(IPICT ) CALL PICTUR
     IF( ICRT ) CALL FRAME (0.5, 0.5)
                                                                              PBCXC 50
     IF(IPICT .AND. .NOT. I)RT) CALL PLOT(15.0, 0.0.-3)
IF(IPICT .AND. .NOT. I)RT) CALL ENDCC
IF(IPICT .AND.ICRT) CALL ENDPLT
                                                                              FBCX( 51
                                                                              PBOXC51A
                                                                              FBCXC 52
                                                                             PBCXC 53
     REHIND 9
                                                                             FBCX( 54
     STOP
                                                                             FBCXC 55
     E 10
                                       78
                                                                             PBOXC 56
```

```
*DECK, PEADER
                                                                            PEAD
                                                                                   1
      SUBROUTINE PEADER
                                                                           PEAD
                                                                                   2
      COMMON HEDR ( 15), NQUAD, KASE, NSYM, IFLAG. IPROS, IPUNCH, IPRNT, PEAD
                                                                                   3
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, PEAD
     2 ZTRANS
                                                                           PEAD
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT
                                                                           PEAD
                                                                                   6
      DATA IPAGE/0/
                                                                           PEAD
                                                                                   7
    1 FORMAT ( 141, 4X, 14H PROGRAM PBCXC, 15X, 30HATMOSPHERIC SCIENCE ASPEAD
     1SOCIATES/
                           38X, 22HBEDFORD, MASSACHUSETTS, 22X, 4HPAGEI5/PEAD
                                                                                   9
     2 7X, 8HBODY ID., 2X, A4/ 30X, 15A4)
                                                                           PEAD
                                                                                  10
   10 IPAGE = IPAGE + 1
                                                                           PEAD
                                                                                  11
      WRITE (6,1) IPAGE, KASE, (HEDR(I), I=1,15)
                                                                           PEAD
                                                                                  12
                                                                           PEAD
      RETURN
                                                                                  13
      END
                                                                           PEAD
                                                                                  14
*DECK, PATPROS
                                                                           PATP
```

```
SUBROUTINE PATPROS( X, Y, Z, XX, YY, ZZ )
                                                                            PATP
                                                                                   2
C
                                                                            PATP
                                                                                   3
C
      THIS IS A SIMPLE SCALING AND ORIGIN TRANSLATION CODE FOR THE
                                                                            PATP
C
      DOUGLAS BOXC POTENTIAL FLOW CODE DATA INPUT
                                                                            PATP
                                                                                   5
C
         XTRANS, YTRANS, ZTRANS ARE ORIGIN TRANSLATIONS
                                                                            PATP
         XSCALE, YSCALE, ZSCALE ARE SCALE FACTORS
C
                                                                            PATP
                                                                                   7
C
      THE CODE ALSO ALLOWS FOR ROTATION IN THE M - Z PLANE TO ADJUST
                                                                            PATP
                                                                                   8
C
      FOR ARBITRARY ANGLE OF ATTACK
                                                                            PATP
                                                                                   9
C
         SINA, COSA ARE SINE AND COSINE OF ANGLE
                                                                            PATP
                                                                                  10
C
         ANGLE IS THE ANGLE( INPUT IN DEGREES) THAT THE AIRPLANE AXIS
                                                                            PATP
                                                                                  11
C
         MAKES WITH THE NEGATIVE X AXIS (POSITIVE COUNTERCLOCKWISE
                                                                            PATP
                                                                                  12
C
         FROM THE-X AXIS) AFTER SCALING ( NOTE - AFTER SCALING THE
                                                                            PATP
                                                                                  13
C
         AIRPLANE NOSE POINTS DOWN THE NEGATIVE X AXIS)
                                                                            PATP
                                                                            PATP
                                                                                  15
C
      THIS VERSION FOR USE WITH PROXC
                                                                            PATP
                                                                                  16
C
                                                                            PATP
                                                                                  17
                                                                            PATP
                                                                                  18
      LOGICAL IPROS, IPUNCH, IPRNT, IPICT, ICRT
                                                                            PATP
                                                                                  19
      COMMON HEDR( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IPRNT, PATP
                                                                                  20
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, PATP
                                                                                  21
     2 ZTRANS
                                                                            PATP
                                                                                  22
      X = (X - XTRANS) + XSCALE
                                                                            PATP
                                                                                  23
      Y = (Y - YTRANS) + YSCALE
                                                                            PATP
                                                                                  24
      Z = (Z - ZTRANS) + ZSCALE
                                                                            PATP
                                                                                  25
      XX= ( XX- XTRANS ) * XSCALE
                                                                            PATP
                                                                                  26
      YY= ( YY- Y TRANS ) * YSCALE
                                                                            PATP
                                                                                  27
      ZZ= ( ZZ- ZTRANS ) * ZSCALE
                                                                            PATP
                                                                                  28
      XP = X
                                                                            PATP
                                                                                  29
      X = XP + COSA - Z + SINA
                                                                            PATP
                                                                                  30
      Z = XP + SINA + Z + GOSA
                                                                            PATP
                                                                                  31
      XP = XX
                                                                            PATP
                                                                                  32
      XX= XP * COSA - ZZ* SINA
                                                                            PATP
                                                                                  33
      ZZ= XP * SINA + ZZ* COSA
                                                                            PATP
                                                                                  34
      RETURN
                                                                            PATP
                                                                                  35
      END
                                                                            PATP
                                                                                  36
```

```
*DECK, PINPUT
                                                                            PINP
      SUBROUTINE PINPUT
                                                                            PINP
C
                                                                            PINP
C
      PROCESSES THE HESS-SMITH CODE INPUT DATA
                                                                            PINP
C
                                                                            PIMP
      REAL NX, NY, NZ , MACH
                                                                            PINP
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT, RFLAG, AFLAG, BFLAG
                                                                            PINP
      INTEGER STAT, STATT, CONV
                                                                            PINP
      COMMON HEDR ( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, PINP
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, PINP
     2 ZTRANS
                                                                            PINP
      COMMON /M/ MACH, BETA, REETA
                                                                            PINP
                                                                                  12
      DIMENSION SPH ( 200 ), CPH ( 200 ), XINP ( 200 ), ZINP ( 200 )
                                                                           PINP
      DIMENSION LAXIS(8), RAXIS(6), L45(6), L(5)
                                                                            PINP
                                                                                  14
      DIMENSION XA ( 500 ), XE ( 500 ), YA ( 500 ), YB ( 500 ),
                                                                            PINP
                                                                                  15
        ZA ( 500 ), ZB ( 500 ), NLINE(500 ), NLT ( 500 ), CFLAG(3),
                                                                            PINP
                                                                                  16
                                                                           PINP
        XI (4), ETA (4), XIN (4), YIN (4), ZIN (4),
                                                                                  17
                                        RX (4). R (4). RY (4)
                                                                            PINP
                                                                                  18
      EQUIVALENCE (NULL, NQUAD)
                                                                            PINP
                                                                                  19
      DATA
            CFLAG
                                      '/ 2H 1, 2H 2, 2H /
                                                                            PINP
      DATA PI/3.141593E0/, HAFPI/1.570796E0/, EPS/.0001/
                                                                            PINP
                                                                                  21
      DATA LAXIS / 4HVIEW, 4H CF , 4HBODY, 4H LOO, 4HKING, 4H DOW,
                                                                           PINP
     1 4HN TH. 1HE/
                                                                                  23
                                                                           PINP
      DATA RAXIS/ 4H AXI, 4HS TO, 4HWARD, 4H THE, 4H ORI, 4HGIN /
                                                                            PINP
                                                                                  24
      DATA L45/ 4H45-D, 4HEGRE, 4HE VI, 4HEW F, 4HROM, 4HTHE /
                                                                           PINP
                                                                                  25
      DATA R45/ 4HSIDE/, L/5+4H
                                                                            PINP
                                                                                  26
      DATA PLUSX, MINUSX, FLUSY, MINUSY, PLUSZ, MINUSZ
                                                                           PINP
                                                                                  27
     1 / 4H +X , 4H -X , 4H +Y , 4H -Y , 4H +Z , 4H -Z /
                                                                            PINP
                                                                                  28
                    3E10.0, I2 / 3F10.0, I2)
                                                                           PINP
                                                                                  29
 4882 FORMAT ( 1H0, 6x 5H) M, 7X, 4 ( 1HX, 11X ), 2HNX, 11X, 3HNFX,
                                                                            PINP
                                                                                  30
        11X, 1HD / 19X, 4 ( 1HY, 11X ), 2HNY, 11X, 3HNPY, 11X, 1HT /
                                                                           PINP
                                                                                  31
        19X, 4(1HZ, 11X), 2HNZ, 11X, 3HNPZ, 11X, 1HA
                                                             )
                                                                            PINP
                                                                                  32
 4005 FORMAT (.1H0, 7X, I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                            PINP
                                                                                  33
        2F13.6, E14.4 ) )
                                                                            PINP
                                                                                  34
 4010 FORMAT ( 1H0, 3X, 2I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                            PINP
                                                                                  35
        2F13.6, E14.4 ) )
                                                                            PINP
                                                                                  36
 4015 FORMAT ( 1H0, 3 ( 20 X, 12H++++++++++ ))
                                                                           PINP
                                                                                  37
                                                                            PINP
                                                                                  38
   INPUT -- SECTION 9.1 INPUT SCHEME
                                                                            PINP
                                                                                  39
      KLCT = 0
                                                                                  40
                                                                            PINP
      NULL = 0
                                                                            PINP
                                                                                  41
      NPRT = 13
                                                                            PINP
                                                                                  42
      CALL PEADER
                                                                            PINP
                                                                                  43
      WRITE (6, 40)
                                                                            PINP
                                                                                  44
   40 FORMAT (1H0,16X,44HP A R A M E T R I C I N F O R M A T I O N//) PINP
                                                                                  45
      IF (NSYM - 1) 54, 56, 58
                                                                            PINP
                                                                                  46
   54 WRITE (6, 55)
                                                                            PINP
                                                                                  47
   55 FORMAT (1H0,16X,21HNC SYMMETRY SPECIFIED)
                                                                           PINP
                                                                                  48
      GO TO 61
                                                                           PINP
                                                                                  49
   56 WRITE (6, 57)
                                                                           PINP
                                                                                  50
   57 FORMAT (1H0 16X, 30HTHERE IS ONE PLANE OF SYMMETRY)
                                                                            PINP
                                                                                  51
      GO TO 61
                                                                           PINP
                                                                                  52
   58 WRITE (6, 59) NSYM
                                                                            PINP
   59 FORMAT (1HD, 16X, 9HTHERE ARE, 12, 19H PLANES OF SYMMETRY)
                                                                           PINP
                                                                                  54
   61 IF ( MACH .NE. 0.0 ) WRITE (6, 21) MACH
                                                                           PINP
                                                                                  55
   21 FORMAT (1H0,16X,13HMACH NUMBER =,F10.5)
                                                                           PINP
                                                                                  56
      IF (IFLAG .EQ. 0) GO TO 29
                                                                           PINP
                                                                                  57
      READ (5, 20) NLM1, MMIN, B, C
                                                                         · PI NP
                                                                                  58
      IF (8 \cdot EQ \cdot 0 \cdot 0) B = 1 \cdot 0
                                                                           PINP
                                                                                  59
      IF (C \cdot EQ \cdot O \cdot O) \cdot C = 1 \cdot O
                                                                           PINP
                                   80
```

```
20 FORMAT ( 215, 2F10.5 )
                                                                       PINP
                                                                             61
 4 FORMAT ( 8F10.0 )
                                                                       PINP
                                                                             62
   WRITE (6, 62) NLM1, MMIN, B. C
                                                                       PINP
                                                                             63
62 FORMAT (1H0,16X,10HGENERATE A,I3, 2H X,I3, 12H SPHERE. B ≈,F10.5, PINP
  1 4X.3HC = .F10.5
                                                                       PINP
                                                                             65
   MLINES = MMIN + 1
                                                                       PINP
                                                                             66
   NLINES = NLM1 + 1
                                                                       PINP
                                                                             67
                                                                       PINP
                                                                             68
   IF ( NSYM .EQ. 8 ) GO TO 2
                                                                       PINP
                                                                             69
   IF (NSYM - 2) 3, 5, 6
                                                                       PINP
                                                                             70
 2 PITH = PI
                                                                       PINP
                                                                             71
   PIPHI = PI + PI
                                                                       PINP
                                                                             72
   GO TO 7
                                                                       PINP
                                                                             73
 3 PITH = PI
                                                                       PINP
                                                                             74
   PIPHI = PI
                                                                       PINP
                                                                             75
   GO TO 7
                                                                       PINP
                                                                             76
 5 PITH = PI
                                                                       PINP
                                                                             77
   PIPHI = HAFPI
                                                                       PINP
                                                                             78
   GO TO 7
                                                                       PINP
                                                                             79
 6 PITH = HAFPI
                                                                       PINP
                                                                             80
   PIPHI = PITH
                                                                       PINP
                                                                             81
 7 SPH ( MLINES ) = SIN ( PIPHI )
                                                                       PINP
                                                                             82
   SPH (1) = 0.0
                                                                       PINP
                                                                             83
   CPH ( MLINES ) = COS ( PIPHI )
                                                                       PINP
                                                                             84
   CPH (1) = 1.0
                                                                       PINP
                                                                             85
   EKM = MMIN
                                                                       PINP
                                                                             86
   EKN = NLM1
                                                                       PINP
                                                                             87
   EMM = 0.0
                                                                       PINP
                                                                             88
   DO 8 I = 2, MMIN
                                                                       PINP
                                                                             89
   EMM = EMM + 1.0
                                                                       PINP
                                                                             90
   PHI = EMM / EKM * PIFHI
                                                                             91
                                                                       PINP
   SPH (I) = SIN (PHI)
                                                                       PINP
                                                                             92
 8 CPH ( I ) = COS ( PHI )
                                                                       PINP
                                                                             93
   IF ( IFLAG .EQ. 2 ) GO TO 10
                                                                       PINP
                                                                             94
   ENN = 1.0
                                                                       PINP
                                                                             95
   DO 9 I = 1, MLINES
                                                                       PINP
                                                                             96
   XA (I) = 1.0
                                                                       PINP
                                                                             97
   YA (I) = 0.0
                                                                       PINP
                                                                             98
9 ZA (I) = 0.0
                                                                       PINP
                                                                             99
   GO TO 18
                                                                       PINP
                                                                            100
10 READ ( 5, 4 ) ( XINP ( I ), ZINP ( I ), I = 1, NLINES )
                                                                       PINP 101
   DO 11 I = 1, MLINES
                                                                       PINP 102
   XA (I) = XINP (1)
                                                                       PINP 103
   YA (I) = B * ZINP (1) * SPH (I)
                                                                       PINP 104
   ZA (I) = -C + ZINP (1) + CPH (I)
                                                                       PINP 105
   XB ( I ) = XINP ( 2 )
                                                                       PINP 106
   YB (I) = B * ZINP (2) * SPH (I)
                                                                       PINP 197
11 ZB ( I ) = - C + ZINF ( 2 ) + CPH ( I )
                                                                       PINP 108
   NLCT = 2
                                                                       PINP 109
   GO TO 250
                                                                       PINP 110
12 DO 14 I = 1, MLINES
                                                                       PINP 111
   XA (I) = XB (I)
                                                                       PINP 112
   YA (I) = YB (I)
                                                                       PINP 113
14 ZA (I) = ZB (I)
                                                                       PINP 114
   IF ( IFLAG .EQ. 1 ) GO TO 16
                                                                       PINP 115
   NLCT = NLCT + 1
                                                                       PINP 116
          I = 1, MLINES
   DO 15
                                                                       PINP 117
   XB (I) =
              XINP ( NLCT )
                                                                       PINP 118
   YB (I) = B * ZINP (NLCT) * SPH (I)
                                                                       PINP 119
15 ZB ( I ) = - C + ZINP ( NLCT ) + CPH ( I )
                                                                       PINP 120
```

```
GO TO 250
                                                                          PINP 121
   16 ENN = ENN + 1.0
                                                                          PINP 122
   18 THETA = ENN / EKN * PITH
                                                                          PINP 123
      STH = SIN ( THETA )
                                                                          PINP 124
      CTH = COS ( THETA )
                                                                          PINP 125
      DO 17 I = 1, MLINES
                                                                          PINP 126
      XB (I) = CTH
                                                                          PINP 127
      YB (I) = B * STH * SPH (I)
                                                                          PINP 128
   17 ZB ( I ) = - C * STH * CPH ( I )
                                                                          PINP 129
      GO TO 250
                                                                          PINP 130
   29 N = -1
                                                                          PINP 131
      IF (IPROS) WRITE (6, 101)
                                                                          PINP 132
                                                                          PINP 133
      IF(IPROS) WRITE(6,102) XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS,
     1 ZTRANS, COSA, SINA
                                                                          PINP 134
      IF(IPICT) WRITE(6,103)
                                                                          PINP 135
      IF (IPUNCH) WRITE (6,104)
                                                                          PINP 136
C
                                                                          PINP 137
  101 FORMAT( 1HO, 16X, 61HINPUT DATA ARE PROCESSED BY SCALING, ROTATING PINP 138
     1 AND TRANSLATING)
                                                                          PINP 139
  102 FORMAT( 18X, 58HXSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, ZTRANS, COPINP 140
     1SA, SINA/ 15X, 8 (1PE 14.4))
                                                                          PINP 141
  103 FORMAT( 1H0, 16x, 18HFLOTS ARE PREPARED)
                                                                          PINP 142
  104 FORMAT( 1HO. 16X, 16HDATA ARE PUNCHED)
                                                                          PINP 143
      XMIN = 1.0E6
                                                                          PINP 144
      XMAX = -1.0E6
                                                                          PINP 1.45
      YMIN = 1.0E6
                                                                          PINP 146
      YMAX = -1.0E6
                                                                          PINP 147
      ZMIN = 1.0E6
                                                                          PINP 148
      ZMAX = -1.0E6
                                                                          PINP 149
      GO TO 50
                                                                          PINP 150
   30 IF ( RFLAG ) GO TO 50
                                                                          PINP 151
      RFLAG = .TRUE.
                                                                          PINP 152
      X = XX
                                                                          PINP 153
      Y = YY
                                                                          PINP 154
      Z = ZZ
                                                                          PINP 155
      STAT = STATT
                                                                          PINP 156
      GO TO 66
                                                                          PINP 157
   50 RFLAG = .FALSE.
                                                                          PINP 158
   51 READ ( 5, 1 ) X, Y, Z, STAT, XX, YY, ZZ, STATT
                                                                          PINP 159
      IF ( IPROS ) CALL FATPROS( X, Y, Z, XX, YY, ZZ )
                                                                          PINP 160
      IF(IPUNCH) WRITE(1,5100) X, Y, Z, STAT, XX, YY, ZZ, STATT
                                                                         PINP 161
 5100 FORMAT( 3( F10.7), I2/ 3( F10.7), I2)
                                                                          PINP 162
      WRITE (9) X,Y,Z,STAT,XX,YY,ZZ,STATT
                                                                          PINP 163
C
                                                                          PINP 164
   64 \times MIN = AMINI(XMIN, X + RBETA)
                                                                          PINP 165
      YMIN = AMIN1(YMIN,Y)
                                                                          PINP 166
      ZMIN = AMIN1(ZMIN.Z)
                                                                          PINP 167
      XMAX = AMAX1(XMAX, X + REETA)
                                                                          PINP 168
      YMAX = AMAX1(YMAX,Y)
                                                                          PINP 169
      ZMAX = AMAX1(ZMAX,Z)
                                                                          PINP 170
      IF(STAT .EQ. 3) GO TO 164
                                                                          PINP 171
      XMIN = AMIN1(XMIN, XX* REETA)
                                                                          PINP 172
      YMIN = AMIN1(YMIN, YY)
                                                                          PINP 173
      ZMIN = AMINI(ZMIN, ZZ)
                                                                          PINP 174
      XMAX = AMAX1(XMAX, XX* RBETA)
                                                                          PINP 175
      YMAX = AMAX1(YMAX,YY)
                                                                          PINP 176
      ZMAX = AMAXI(ZMAX,ZZ)
                                                                          PINP 177
  164 IF ( NSYM .EQ. 0 ) GO TO 65
                                                                          PINP 178
      YMIN = AMIN1(YMIN, -Y)
                                                                          PINP 179
      YMAX = AMAX1(YMAX, -Y)
                                                                          PINP 180
```

```
IF(STAT .EQ. 3) GO TO 165
                                                                        PINP 181
    YMIN = AMIN1(YMIN, -YY)
                                                                         PINP 182
    YMAX = AMAX1(YMAX, -YY)
                                                                        PINP 183
165 IF( NSYM .EQ. 1 ) GO TO 65
                                                                        PINP 184
    ZMIN = AMIN1(ZMIN, -Z)
                                                                        PINP 185
    ZMAX = AMAX1(ZMAX, -Z)
                                                                        PINP 186
    IF (STAT .EQ. 3) GO TO 65
                                                                        PINP 187
    ZMIN = AMIN1(ZMIN, -ZZ)
                                                                         PINP 168
    ZMAX = AMAXIC ZMAX, -ZZ)
                                                                        PINP 189
65 IF (N .EQ. (-1))GO TO 80
                                                                         PINP 190
66 IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180
                                                                         PINP 191
    IF ( STAT .EQ. 2 ) GO TO 200
                                                                        PINP 192
    IF ( .NOT. AFLAG ) GO TO 200
                                                                         PINP 193
    MC = M
                                                                        PINP 194
80 M = 1
                                                                        PINP 195
    IF ( STAT .EQ. 2 ) GO TO 150
                                                                        PINP 196
    IF ( .NOT. BFLAG ) GO TO 84
                                                                        PINP 197
75 \ 00 \ 81 \ J = 1, MC
                                                                         PINP 198
    XA(J) = XB(J)
                                                                        PINP 199
    YA (J) = YB (J)
                                                                         PINP 200
 81 ZA (J) = ZB (J)
                                                                        PINP 201
83 XB (1) = X
                                                                         PINP 202
    YB (1) = Y
                                                                         PINP 203
                                                                        PINP 204
    Z8 (1) = Z
    GO TO 30
                                                                         PINP 205
84 IF ( AFLAG ) GO TO 85
                                                                         PINP 206
    BFLAG = . TRUE.
                                                                         PINP 207
    GO TO 75
                                                                         PINP 208
85 AFLAG = .FALSE.
                                                                         PINP 209
    GO TO 83
                                                                         PINP 210
150 AFLAG = .TRUE.
                                                                         PINP 211
    BFLAG = .FALSE.
                                                                         PINP 212
    IF (N \cdot EQ \cdot (-1))N = 0
                                                                        PINP 213
160 XA (M) = X
                                                                        PINP 214
    YA (M) = Y
                                                                         PINP 215
    ZA (M) = Z
                                                                        PINP 216
    GO TO 30
                                                                        PINP 217
180 M = M + 1
                                                                         PINP 218
    IF ( AFLAG ) GO TO 160
                                                                        PINP 219
    XB(M) = X
                                                                        PINP 220
                                                                        PINP 221
    YB (M) = Y
    ZB (M) = Z
                                                                        PINP 222
    IF ( STAT .NE. 3 ) GO TO 30
                                                                        PINP 223
200 \text{ MMIN} = \text{MINO(N, MC)} - 1
                                                                         PINP 224
                                                                        PINP 225
    MC = M
250 N = N + 1
                                                                        PINP 226
    KLCT = KLCT + 1
                                                                         PINP 227
    IF( .00T. IPRNT) GO TO 2100
                                                                         PINP 228
                                                                        PINP 229
BEGIN COMPUTATION OF NULL PCINTS AND 28 QUANTITIES
                                                                         PINP 230
                                                                         PINP 231
    DO 2000 I = 1, MMIN
                                                                         PINP 232
    NULL = NULL + 1
                                                                         PINP 233
    XIN(1) = XA(I) + RBETA
                                                                         PINP 234
    XIN(2) = XA(I+1) * RBETA
                                                                         PINP 235
    XIN(3) = XB(I+1) + RBETA
                                                                         PINP 236
    XIN(4) = XB(I) + RBETA
                                                                         PINP 237
    YIN(1) = YA(I)
                                                                         PINP 236
    YIN(2) = YA(I+1)
                                                                         PINP 239
    YIN(3) = YB(I+1)
                                                                         PINP 240
```

```
YIN(4) = YB(I)
                                                                          PINP 241
      ZIN(1) = ZA(I)
                                                                          PINP 242
      ZIN(2) = ZA(I+1)
                                                                          PINP 243
      ZIN(3) = ZB(I+1)
                                                                          PINP 244
      ZIN(4) = ZB(I)
                                                                          PINP 245
                                                                          PINP 246
  FORM DIAGONAL VECTORS
                                                                          PINP 247
   ECUATION (64)
                                                                          PINP 248
                                                                          PINP 249
      T1X = XIN(3) - XIN(1)
                                                                          PINP 250
      T2X = XIN(4) - XIN(2)
                                                                          PINP 251
      T1Y = YIN(3) - YIN(1)
                                                                          PINP 252
      T2Y = YIN(4) - YIN(2)
                                                                          PINP 253
      T1Z = ZIN(3) - ZIN(1)
                                                                          PINP 254
      T2Z = ZIN(4) - ZIN(2)
                                                                          PINP 255
                                                                          PINP 256
C
   FORM CROSS PRODUCT N = T2 X T1
                                                                          PINP 257
   EQUATION (65)
                                                                          PINP 258
                                                                          PINP 259
      NX = T2Y*T1Z - T1Y*T2Z
                                                                          PINP 260
      NY = T1X*T2Z - T2X*T1Z
                                                                          PINP 261
      NZ = T2X+T1Y - T1X+T2Y
                                                                          PINP 262
      VN = SQRT ( NX* NX + NY* NY + NZ* NZ )
                                                                          PINP 263
                                                                          PINP 264
   FORM UNIT NORMAL VECTOR
                                                                          PINP 265
C
   EQUATION (66)
                                                                          PINP 266
                                                                          PINP 267
      NX = NX / VN
                                                                          PINP 268
      NY = NY / VN
                                                                          PINP 269
      NZ = NZ / VN
                                                                          PINP 270
                                                                          PINP 271
   COMPUTE AVERAGE POINT
C
                                                                          PINP 272
C
   EQUATION (68)
                                                                          PINP 273
                                                                          PINP 274
      AVX = .25 + (XIN(1) + XIN(2) + XIN(3) + XIN(4))
                                                                          PINP 275
      AVY = .25 * (YIN(1) + YIN(2) + YIN(3) + YIN(4))
                                                                          PINP 276
      AVZ = .25 + (ZIN(1) + ZIN(2) + ZIN(3) + ZIN(4))
                                                                          PINP 277
                                                                          PINP 278
   COMPUTE PROJECTION DISTANCE
                                                                          PINP 279
   EQUATIONS (69) AND (71)
                                                                          PINP 280
                                                                          PINP 281
      D = NX + (AVX - XIN(1)) + NY + (AVY - YIN(1)) + NZ + (AVZ - ZIN(1)) PINP 282
      PD = ABS(D)
                                                                          PINP 283
                                                                          PINP 284
   EQUATIONS ( 73 ) AND ( 74 )
                                                                          PINP 285
                                                                          PINP 286
      T = SQRT (T1X*T1X + T1Y*T1Y + T1Z*T1Z)
                                                                          PINP 287
      T1X = T1X / T
                                                                          PINP 288
      T1Y = T1Y / T
                                                                          PINP 289
      T1Z = T1Z / T
                                                                          PINP 290
                                                                          PINP 291
   EQUATION
             ( 75 )
                                                                          PINP 292
                                                                          PINP 293
      T2X = NY*T1Z - NZ*T1Y
                                                                          PINP 294
      T2Y = NZ*T1X - NX*T1Z
                                                                          PINP 295
      T2Z = NX + T1Y - NY + T1X
                                                                          PINP 296
                                                                          PINP 297
  COMPUTE COORDINATES OF CORNER POINTS IN REFERENCE COORD. SYSTEM
                                                                          PINP 298
  EQUATION (72)
                                                                          PINP 299
                                                                          PINP 300
```

```
DO 1990 J = 1.4
                                                                      PINP 301
     XP = XIN(J) + NX + D
                                                                      PINP 302
     YP = YIN(J) + NY + D
                                                                       PINP 303
     ZP = ZIN(J) + NZ + D
                                                                      PINP 304
     D = -D
                                                                       PINP 305
     XDIF = XP - AVX
                                                                      PINP 306
     YDIF = YP - AVY
                                                                       PINP 307
     ZDIF = ZP - AVZ
                                                                       PINP 308
                                                                       PINP 309
C TRANSFORM CORNER POINTS TO ELEMENT COORDINATE SYSTEM ( XI, ETA )
                                                                      PINP 310
 WITH AVERAGE POINT AS ORIGIN
                                                                      PINP 311
 EQUATION (80)
                                                                      PINP 312
                                                                      PINP 313
     XI(J) = T1X+XDIF + T1Y+YBIF + T1Z+ZDIF
                                                                      PINP 314
 1000 ETA(J) = T2X*XDIF + T2Y*YDIF + T2Z*ZDIF
                                                                      PINP 315
                                                                       PINP 316
 COMPUTE CENTRICED
                                                                       PINP 317
 EQUATION (81)
                                                                      PINP 318
                                                                      PINP 319
     XI0 = .3333333E0 * (XI (4) * (ETA (1) - ETA (2)) + XI (2)
                                                                      PINP 320
    1 * ( ETA (4) - ETA (1) ) ) / ( ETA (2 ) - ETA (4) )
                                                                      PINP 321
      ETAO = -.3333333EO * ETA(1)
                                                                      PINP 322
                                                                      PINP 323
                                                                      PINP 324
  OBTAIN CORNER POINTS IN SYSTEM WITH CENTROID AS ORIGIN
                                                                      PINP 325
 EQUATION (82)

    PINP 326

                                                                      PINP 327
     00 \ 1620 \ J = 1, 4
                                                                      PINP 328
     XI(J) = XI(J) - XIO
                                                                      PINP 329
 1020 ETA(J) = ETA(J) - ETAO
                                                                      PINP 330
                                                                      PINP 331
 COMPUTATION AIDS
                                                                      PINP 332
                                                                      PINP 333
     ETA2M1 = ETA (2) - ETA (1)
      ETA3M2 = ETA (3) - ETA (2)
                                                                      PINP 334
      ETA4M3 = ETA (4) - ETA (3)
                                                                      PINP 335
      ETA1M4 = ETA (1) - ETA (4)
                                                                      PINP 336
     XI1M2 = XI (1) - XI (2)
                                                                      PINP 337
     XI2M3 = XI (2) - XI (3)
                                                                      PINP 338
     XI3M4 = XI (3) - XI (4)
                                                                      PINP 339
     XI4M1 = XI (4) - XI (1)
                                                                      PINP 340
      ETA2P4 = ETA (2) + ETA (4)
                                                                      PINP 341
     XI3M1 = XI (3) - XI (1)
                                                                      PINP 342
     XI4H2 = XI (4) - XI (2)
                                                                      FINP 343
      ETA2M4 = ETA (2) - ETA (4)
                                                                      PINP 344
      XI1234 = XI (1) + XI (2) + XI (3) + XI (4)
                                                                      PINP 345
                                                                      PINP 346
  TRANSFORM CENTROID TO REFERENCE COORDINATE SYSTEM
                                                                      PINP 347
  EQUATION (83)
                                                                      PINP 348
      XCENT = AVX + T1X*XIO + T2X*ETAO
                                                                     PINP 349
      YCENT = AVY + T1Y*XIO + T2Y*ETAO
                                                                       PINP 350
      ZCENT = AVZ + T1Z*XIC + T2Z*ETAC
                                                                       PINP 351
                                                                      PINP 352
  COMPUTE LARGER DIAGONAL VECTOR
                                                                      PINP 353
  EQUATION (84)
                                                                      PINP 354
      TSQ = AMAX1 ( XI3M1 ** 2, XI4M2 ** 2 + ETA2M4 ** 2 )
                                                                       PINP 355
     T = SQRT (TSQ)
                                                                       PINP 356
                                                                       PINP 357
                                                                       PINP 358
  COMPUTE AREA
                                                                       PINP 359
  EQUATION (85)
                                                                       PINP 360
```

```
AREA
                     = •5 * XI3M1 * ETA2M4
                                                                       PINP 361
                                                                       PINP 362
   COMPUTE CONSTANTS FOR EQUATIONS ( 42 ) AND ( 43 )
                                                                       PINP 363
   EQUATION (45)
                                                                       PINP 364
      D12SQ = XI1M2 ** 2 + ETA2M1 ** 2
                                                                       PINP 365
                                                                       PINP 366
      D12 = SQRT (D12SQ)
      D23SQ = XI2M3 *#2 + ETA3M2 ** 2
                                                                       PINP 367
      D23 = SQRT (D23SQ)
                                                                       PINP 368
      D34SQ = XI3M4 ** 2 + ETA4M3 ** 2
                                                                       PINP 369
      D34 = SQRT (D34SQ)
                                                                       PINP 370
      D41SQ = XI4M1 ** 2 + ETA1M4 ** 2
                                                                       PINP 371
     D41 = SQRT ( D41SQ )
                                                                       PINP 372
     C1 = 0.0
                                                                       PINP 373
     C2 = 0.0
                                                                       PINP 374
     C3 = 0.0
                                                                       PINP 375
      04 = 0.0
                                                                       PINP 376
     C5 = 0.0
                                                                       PINP 377
                                                                       PINP 378
     C6 = 0.0
      C7 = 0.0
                                                                       PINP 379
      C8 = 0.0
                                                                       PINP 380
      XNP = 0.0
                                                                       PINP 381
                                                                       PINP 382
      YNP = 0.0
      IF ( D12 ) 1030, 1040, 1030
                                                                       PINP 383
 1030 C1 = ETA2M1 / D12
                                                                       PINP 384
      C5 = XI1M2 / D12
                                                                       PINP 385
 1940 IF ( D23 ) 1050, 1060, 1050 .
                                                                       PINP 386
 1050 C2 = ETA3M2 / D23
                                                                       PINP 387
                                                                       PINP 388
      C6 = XI2M3 / D23
 1060 IF ( D34 ) 1078, 1080, 1070
                                                                       PINP 389
 1070 C3 = ETA4M3 / D34
                                                                       PINP 390
      C7 = XI3M4 / D34
                                                                       PINP 391
 1080 IF ( D41 ) 1090, 1100, 1090
                                                                       PINP 392
 1090 C4 = ETA1M4 / D41
                                                                       PINP 393
      C8 = XI4M1 / D41
                                                                       PINP 394
 1100 \text{ CONV} = 3
                                                                       PINP 395
                                                                       PINP 396
                                                                       PINP 397
C BEGIN NULL POINT ITERATION
                                                                       PINP 398
                                                                       PINP 399
      DO 1590 ITR = 1.30
                                                                       PINP 400
      D0 1580 K = 1.4
                                                                       PINP 401
   EQUATION (47)
                                                                       PINP 482
      R(K) = SQRT(XNP - XI(K)) + 2 + (YNP - ETA(K)) + 2)
                                                                       PINP 403
      RX (K) = (XNP - XI (K)) / R(K)
                                                                       PINP 404
 1580 RY (K ) = ( YNP - ETA ( K ) ) / R ( K )
                                                                       PINP 405
      R1PR2 = R(1) + R(2)
                                                                       PINP 406
      R2PR3 = R(2) + R(3)
                                                                       PINP 407
      R3PR4 = R(3) + R(4)
                                                                       PINP 408
      R4PR1 = R (4) + R (1)
                                                                       PINP 409
                                                                     PINP 410
PINP 411
PINP 412
      ARG1 = ALOG ( ( R1PR2 - D12 ) / ( R1PR2 + D12 ) )
      ARG2 = ALOG ( ( R2PR3 - D23 ) / ( R2PR3 + D23 ) )
      ARG3 = ALOG ((R3PR4 - D34) / (R3PR4 + D34))
      ARG4 = ALOG ((R4PR1 - D41) / (R4PR1 + D41))
                                                                      PINP 413
                                                                      PINP 414
                                                                       PINP 415
  COMPUTE INDUCED VELOCITY COMPONENTS
C
                                                                       PINP 416
C
   EGUATIONS (42) AND (43)
                                                                       PINP 417
      VX = C1 * ARG1 + C2 * ARG2 + C3 * ARG3 + C4 * ARG 4
                                                                      PINP 418
      VY = C5 * ARG1 + C6 * ARG2 + C7 * ARG 3 + C8 * ARG4
                                                                      PINP 419
                                                                       PINP 420
```

.....

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COMPUTE PARTIAL DERIVATIVES OF INDUCED VELOCITIES EQUATION ( 90 ), USING EQUATIONS ( 91 ) - ( 93 )
                                                                         PINP 421
                                                                         PINP 422
                                                                         PINP 423
                                                                         PINP 424
      D12P=
             ( R1PR2 ** 2 - D12 SQ
                                      ) * .5
                                                                         PINP 425
      D23P=
            € R2PR3 ** 2 - D23 SQ
                                     ) * .5
                                                                         PINP 426
            ( R3PR4 ** 2 - D34 SQ
                                     ) * .5
                                                                          PINP 427
            ( R4PR1 ** 2 - D41 SQ
      D41P=
                                     ) + .5
                                                                          PINP 428
      C1P = ETA2M1 / D12P
                                                                          PINP 429
      C2P = ETA3M2 / D23P
                                                                          PINP 430
      C3P = ETA4M3 / D34P
                                                                          PINP 431
      C4P = ETA1M4 / D41P
                                                                         PINP 432
      C5P = XI1M2 / D12P
                                                                         PINP 433
      C6P = XI2M3 / D23P
                                                                         PINP 434
      C7P = XI3M4 / D34P
                                                                         PINP 435
      C8P = XI4M1 / D41P
                                                                         PINP 436
      R12Y = RY (1) + RY (2)
                                                                          PINE 437
      R23Y = RY (2) + RY (3)
                                                                          PINP 438
      R34Y = RY (3) + RY (4)
                                                                          PINP 439
      R41Y = RY (4) + RY (1)
                                                                          PINP 440
      VXX = C1P^{+} (RX (1) + RX (2)) + C2P^{+} (RX (2) + RX (3)) + PINP 441
            C3P^{+} ( RX ( 3 ) + RX ( 4 ) ) + C4P^{+} ( RX ( 4 ) + RX ( 1 ) ) PINP 442
      VXY = C1P* R12Y + C2P* R23Y + C3P* R34Y + C4P* R41Y
                                                                          PINP 443
      VYY = C5P^{+} R12Y + C6F^{+} R23Y + C7P^{+} R34Y + C8P^{+} R41Y
                                                                         PINP 444
                                                                         PINP 445
                                                                          PINP 446
  COMPUTE NEW NULL POINT ( XNP, YNP )
                                                                          PINP 447
  EQUATION ( 94 )
                                                                         PINP 448
                                                                         PINP 449
      XMXP = (VY * VXY + VX * VYY) / (VXX * VYY - VXY ** 2)
                                                                         PINP 450
      XNP = XMXP + XNP
                                                                         PINP 451
      YNP = YNP - (VX + VXX + XMXP) / VXY
                                                                          PINP 452
                                                                         PINP 453
C
      TEST NULL POINT CONVERGENCE
                                                                          PINP 454
      IF ( ABS ( VX ) .LT. EPS .AND. ABS ( VY ) .LT. EPS ) GO TO 1600
                                                                          PINP 455
1590 CONTINUE
                                                                          PINP 456
      NO CONVERGENCE . USE 30TH ITERATION
                                                                          PINP 457
      CONV = 2
                                                                          PINP 458
                                                                          PINP 459
      TEST IF THIS POINT IS OUTSIDE THE ELEMENT
                                                                         PINP 460
1600 IF ( XNP ** 2 + YNP ** 2 .LE. TSQ ) GO TO 1620
                                                                         PINP 461
                                                                         PINP 462
      CONVERGES TO POINT AT INFINITY
                                                                          PINP 463
      CONV = 1
                                                                          PINP 464
      XNULL
                    = XCENT
                                                                          PINP 465
                    = YCENT
      YNULL
                                                                          PINP 466
      ZNULL
                    = ZCENT
                                                                          PINP 467
      GO TO 1700
                                                                          PINP 468
                                                                         PINP 469
      TRANSFORM NULL POINT TO REFERENCE COORDINATE SYSTEM
                                                                         PINP 470
   EQUATION ( 79 ) NOTE THAT Z - COORDINATE IS ZERO
                                                                         PINP 471
                    = XCENT + Tix + XNP + T2X + YNP
 1620 XNULL
                                                                         PINP 472
                    = YCENT + T1Y * XN3 + T2Y * YNP
      YNULL
                                                                        PINP 473
                    = ZCENT + T1Z + XNP + T2Z + YNP
      ZNULL
                                                                         PINP 474
                                                                         PINP 475
                                                                          PINP 476
 PRINT RESULTS -- SECTION 9.4 THE FIRST OUTPUT
                                                                          PINP 477
                                                                          PINP 478
 1700 IF ( NPRT .GE. 11 ) GO TO 1750
                                                                          PINP 479
      NPRT = NPRT + 1
                                                                          PINP 480
```

```
IF ( I .EQ. 1 ) GO TO 1760
                                                                          PINP 481
      WRITE (6, 4005) I, XIN, NX, XNULL , PD, CFLAG (CONV),
                                                                          PINP 482
     1 YIN, NY, YNULL , T, ZIN, NZ, ZNULL , AREA
                                                                          PINP 483
      GO TO 1770
                                                                          PINP 484
 1750 NPRT = 0
                                                                          PINP 485
      CALL PEADER
                                                                          PINP 486
      WRITE ( 6, 4002 )
                                                                          PINP 487
 1760 WRITE ( 6, 4010) N , I, XIN, NX, XNULL , PD, CFLAG (CONVPINP 488 1 ), YIN, NY, YNULL , T, ZIN, NZ, ZNULL , AREA PINP 489
 1770 CONTINUE
                                                                          PINP 490
 2000 CONTINUE
                                                                          PINP 491
 2100 NLT ( KLCT ) = MMIN
                                                                          PINP 492
      NLINE (KLCT) = N
                                                                          PINP 493
      IF ( IFLAG .EQ. 0 ) GO TO 2001
                                                                          PINP 494
      IF ( N .LT. NLM1 ) GC TO 12
                                                                          PINP 495
      IF( IPRNT ) WRITE(6,4015)
                                                                          PINP 496
      GO TO 2025
                                                                          PINP 497
2001 IF ( STAT .LT. 2 ) GO TO 80
                                                                          PINP 498
      NLT(KLCT) = -NLT(KLCT)
                                                                          PINP 499
      NPRT = NPRT + 1
                                                                          PINP 500
      IF( IPRNT ) WRITE(6,4015)
                                                                          PINP 501
                                                                          PINP 502
C TEST FOR END OF CASE
                                                                          PINP 503
2020 IF ( STAT .NE. 3 ) GO TO 80
                                                                          PINP 504
2025 \text{ NN1} = \text{MCD} (3 + \text{NQUAD}, 255)
                                                                          PINP 505
      NQNN1 = NQUAD
                                                                          PINP 506
      IF ( NN1 .LT. 5 .AND. NN1 .GT. 0 ) NQNN1 = NQUAD + 2
                                                                         PINP 507
      DELX = -0.5 * (XMIN + XMAX)
                                                                          PINP 508
      DELY = -0.5 * (YMIN + YMAX)
                                                                          PINP 509
      DELZ = -0.5 * (ZMIN + ZMAX)
                                                                          PINP 510
      WRITE (9) XMIN, XMAX, YMIN, YMAX, ZMIN, ZMAX, DELX, DELY, DELZ, PINP 511
     1 NSYM
                                                                          PINP 512
      ENDFILE 9
                                                                          PINP 513
      REWIND 9
                                                                          PINP 514
      IF ( .NOT. IPICT ) GO TO 8500
                                                                          PINP 515
C
      SET UP PERSPECTIVE ANGLES FOR PLOTS
                                                                          PINP 516
      WRITE (8) XMIN, XMAX, YMIN, YMAX, ZMIN, ZMAX, DELX, DELY, DELZ
                                                                          PINP 517
      LAST = B
                                                                          PINP 518
      PHI = 0.0
                                                                          PINP 519
C
      THE OPERATION OF ANGLES THETA AND PSI ARE AS FCLLOWS FOR A RIGHT
                                                                          PINP 520
      HANDED COORDINATE SYSTEM WITH THE Z AXIS DIRECTED UPWARD. FIRST PINP 521
C
      ROTATE THE COORDINATE SYSTEM BY ANGLE THETA ABOUT THE Y AXIS SUCH PINP 522
C
      THAT FOR POSITIVE THETA THE POSITIVE X AXIS TILTS UPWARD. THEN
                                                                          PINP 523
C
      ROTATE BY ANGLE PSI ABOUT THE NEW Z AXIS SUCH THAT FOR POSITIVE
                                                                          PINP 524
      PSI THE ROTATION IS CLOCKWISE WHEN VIEWED FROM ABOVE.
                                                                          PINP 525
      IF (NSYM •GT• 0) IF (NSYM - 2) 2028, 2029, 2030
                                                                          PINP 526
 2027 PSI = 90.
                                                                          PINP 527
      THETA = 0.0
                                                                          PINP 528
      WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSY, RAXIS
                                                                          PINP 529
      PSI = 45.
                                                                          PINP 530
      THETA = 45.
                                                                          PINP 531
      WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSX, MINUSY, PLUSZ, R45 , LPINP 532
      THETA = -45.
                                                                          PINP 533
      WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSX, MINUSY, MINUSZ, R45, LPINP 534
      PSI = 135.
                                                                          PINP 535
      WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, MINUSY, PLUSZ, R45, LPINP 536
      THETA = 45
                                                                          PINP 537
      WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, MINUSY, MINUSZ, R45, LPINP 538
 2028 PSI = 0.
                                                                          PINP 539
      THETA = -90.
                                                                          PINP 540
```

```
WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSZ, RAXIS
                                                                          PINP 541
     THETA= 45.
                                                                          PINP 542
     PSI =-135.
                                                                          PINP 543
     WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, PLUSY, MINUSZ, R45, L PINP 544
     THETA =- 45.
                                                                          PINP 54
     PSI=-45.
                                                                          PINP 546
     WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSX, PLUSY, MINUSZ, R45, L PINP 547
2029 PSI = 180.
                                                                         PINP 548
     THETA = 0.
                                                                         PINP
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, MINUSX, RAXIS
                                                                         PINP 550
     PSI = -135.
                                                                         PINP 55组
     THETA =-45.
                                                                         PINP 552
     WRITE (8) PSI, THETA, PHI, LAST, L45, MINUSX, PLUSY, PLUSZ, R45, L PINP 553
2030 THETA = 0.0
                                                                         PINP 554
     PSI = 0.
                                                                         PINP 555
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, PLUSX, RAXIS
                                                                         PINP 556
     THETA = 0.0
                                                                         PINP 557
     PSI = -90.
                                                                         PINP 558
     WRITE (8) PSI, THETA, PHI, LAST, LAXIS, PLUSY, RAXIS
                                                                         PINP 559
     THETA = 90.
                                                                         PINP 560
     PSI = 0.
                                                                        'PINP 561
     WRITE (6) PSI, THETA, PHI, LAST, LAXIS, PLUSZ, RAXIS
                                                                         PINP 562
     THETA = 45.
                                                                         PINP 563
     PSI =-45.
                                                                         PINP 564
     LAST = 1
                                                                         PINP
                                                                              565
     WRITE (8) PSI, THETA, PHI, LAST, L45, PLUSY, PLUSY, PLUSZ, R45, L PINP 566
8500 REWIND 8
                                                                         PINP 567
                                                                         PINP 568
     IF(IPRNT) WRITE(6,9999) NQUAD
                                                                         PINP 569
9999 FORMAT( 1HO, 16X, I5, 26H BASIC ELEMENTS WERE INPUT)
                                                                         PINP 570
     RETURN
                                                                         PINP 571
     END
                                                                         PINP 572
```

```
*DECK, PICTURE
                                                                            PICT
      SUBROUTINE PICTUR
                                                                            PICT
                                                                                    2
                                                                            PICT
                                                                                    3
C
      PLOTS SURFACE ELEMENTS ON A 3-DIMENSIONAL BODY
                                                                            PICT
                                                                            PICT
                                                                                    5
      LOGICAL IPROS, IPUNCH, IFRNT, IPICT, ICRT, RFLAG, AFLAG, BFLAG
                                                                            PICT
                                                                                    6
      COMMON HEDR( 15), NQUAD, KASE, NSYM, IFLAG, IPROS, IPUNCH, IFRNT, PICT
                                                                                    7
     1 IPICT, ICRT, SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS, YTFANS, PICT
     2 ZTRANS
                                                                            PICT
                                                                                    9
      DIMENSION XA(250), XE(250), YA(250), YB(250), ZA(250), ZB(250),
                                                                            PICT
                                                                                   10
                     XIN(4), YIN(4), ZIN(4), HLABEL(15), PROGID(3),
                                                                            PICT
                                                                                   11
     2 YIN2(4), ZIN2(4),
                                  YPLTSC( 4), ZPLTSC( 4), HLINE2(7),
                                                                            PICT
                                                                                   12
     3 HLINE1(7), XM(2), YM(2), ZM(2)
                                                                            PICT
      REAL NX, NY, NZ, NXO
                                                                            PICT
                                                                                   14
      INTEGER STAT, STATT
                                                                            PICT
                                                                                   15
      DATA PROGID/ 7HNORMENT, 4H3840, 3HLYC/
                                                                            PICT
                                                                                   16
                   ISHAD, IFRAME/0,0/ , XSC, YSC, ZSC/3*1.0/
                                                                            PICT
                                                                                   17
                                                                            PICT
                                                                                   18
      FIRST(QX,QY,QZ,Q1,Q2,Q3) = QX+Q1 + QY+Q2 + QZ+Q3
                                                                            PICT
                                                                                   19
                                                                            PICT
                                                                                   20
      THIRD(QX,QY,QZ,QPSI,QTHETA,QPHI) = QX*(COS(QTHETA)*COS(QPSI)) +
                                                                            PICT
                                                                                   21
     1 QY*(-SIN(QPSI)*COS(QPHI)+SIN(QTHETA)*COS(QPSI)*SIN(QPHI)) +
                                                                            PICT
                                                                                   22
        QZ*(SIN(QPSI)*SIN(QPHI)+SIN(QTHETA)*GOS(QPSI)*COS(QPHI))
                                                                            PICT
                                                                                   23
                                                                            PICT
                                                                                   24
      IREFL = NSYM
                                                                            PICT
                                                                                   25
      IF( IREFL .GT. 2 ) IREFL = 2
                                                                            PICT
                                                                                   26
      IPIC = 1
                                                                            PICT
                                                                                   27
      IF( ICRT ) GO TO 750
                                                                            PICT
                                                                                   28
      CALL PLOTID
                                                                            PICT
                                                                                   29
      CALL PLTID3 ( PROGID, 200.0, 11.8, 1.0)
C
                                                                            PICT
                                                                                   30
      CALL PLOT ( 5.0, 0.0, -3 )
                                                                            PICT
                                                                                   31
      GO TO 2
                                                                            PICT
                                                                                   32
  750 CALL MICRO(PROGID, 1.0, 14.0)
                                                                            PICT
                                                                                   33
      READ(5,3000) HLINE1, HLINE2
                                                                            PICT
                                                                                   34
 3000 FORMAT (7A6/7A6)
                                                                            PICT
                                                                                   35
      CALL TITL(HLINE1, HLINE2)
                                                                            PICT
                                                                                   36
      WRITE( 6, 5201 )
                                                                            PICT
                                                                                   37
 5201 FORMAT( 1H-, 12H
                        CRT PLOTS)
                                                                            PICT
                                                                                   38
      REWIND 9
                                                                            PICT
                                                                                   39
  301 READ (8) XM(1),XM(2),YM(1),YM(2),ZM(1),ZM(2),DELX,DELY,DELZ
                                                                            PICT
                                                                                   40
      WRITE(6,7400) XM(1), XM(2), YM(1), YM(2), ZM(1), ZM(2)
                                                                            PICT
                                                                                   41
      WRITE(6,7500)
                                                                            PICT
                                                                                   42
      WRITE(6,7700) DELX, DELY, DELZ
                                                                            PICT
                                                                                   43
 7400 FORMAT( 1H0, 9X, 81HMINIMUM AND MAXIMUM COORDINATES IN THE
                                                                       SCALEPICT
                                                                                   44
           TRANSLATED, ROTATED SYSTEM -/12X, 7HX AXIS=2(1PE15.5)/
                                                                            PICT
                                                                                   45
     2 12X, 7HY AXIS=2(1PE15.5)/ 12X, 7+Z AXIS=2(1PE15.5))
                                                                            PICT
                                                                                   46
 7500 FORMAT(1HO, 9X, 69HCCORDINATE TRANSLATIONS USED TO CENTER THE FLOTPICT
                                                                                   47
     1S - DELX, DELY, DELZ -)
                                                                            PICT
                                                                                   48
 7700 FORMAT(12X,39H AFTER SCALING, TRANSLATING, ROTATING -3(1PE15.5)/) PICT
                                                                                   49
    4 \text{ IPIC} = \text{IPIC} + 1
                                                                                   50
                                                                            PICT
                                                                            PICT
                                                                                   51
 READ PLOTTING INSTRUCTIONS
                                                                            PICT
                                                                                   52
      READ ( 8 ) PSI, THETA, PHI, LAST, HLABEL
                                                                            PICT
                                                                                   53
      WRITE(6,5205)HLAGEL
                                                                            PICT
                                                                                   54
 5205 FORMAT(5X, 15A4)
                                                                            PICT
                                                                            PICT
                                                                                   56
    8 IF( IPIC .GT. 2 .AND.
                              .NOT.
                                      IGRI ) CALL PLOT ( 10.0, -5.5, -3 )
                                                                            PICT
                                                                                   57
      IF( IPIC .GT. 2 .AND.
                                      ICRT ) CALL FRAME( 0.5, 0.5)
                                                                            PICT
                                                                                   58
                                                                            PICT
                                                                                   59
C
      SET UP STARTING CONSTANTS
                                                                            PICT
                                                                                   60
```

		IFADV -= 1	PICT	61
		PSI = PSI / 5% 29578EQ	PICT	62
		THETA = THETA / 57.29578E0	PICT	63
		PHI = PHI / 57.29578E0	PICT	64
		SINTH = SIN(THETA)	PICT	65
		COSTH = COS(THETA)	PICT	66
		SINPSI= SIN(PSI)	PICT	6 <b>7</b>
		COSPSI= COS(PSI)	PICT	68
		SINPHI= SIN(PHI)	PICT	6 <b>9</b>
		COSPHI= COS(PHI)	PICT	70
		A1 = COSTH * SINPSI	PICT	71
		A2 = COSPSI*COSPHI + SINTH*SINPSI*SINPHI	PICT	72
		A3 =-COSPSI*SINPHI + SINTH*SINPSI*COSPHI	PICT	73
		A4 =-SINTH	PICT	74
		A5 = COSTH*SINPHI	PICT	75
		A6 = COSTH*COSPHI	PICT	76
		A7 = COSTH*COSPSI	PICT	77
		A8 =-SINPSI*COSPHI + SINTH*COSPSI*SINPHI	PICT	78
		A9 = SINPSI*SINPHI + SINTH*COSPSI*COSPHI	PICT	79
C		SET SCALE FACTOR FOR THE PLOT	PICT	80
		YSM= 1. E50	PICT	81
		ZSM= 1.E50	PICT	82
		YLG=-1.E50	PICT	83
		ZLG=-1.E50	PICT	84
		DO 20 I=1,2	PICT	85
		X=XM(I)+DELX	PICT	86
		DO 20 J=1,2	PICT	87
		Y=YM(J)+DELY	PICT	88
		DO 28 K=1, 2	PICT	89
		Z=ZM(K)+DELZ	PICT	90
		YNR=FIRST(X,Y,Z,A1,A2,A3)	PICT	91
		ZNR=FIRST(X,Y,Z,A4,A5,A6)	PICT	92
		YSM=AMIN1(YSM, YNR)	PICT	93
		ZSM=AMIN1(ZSM, ZNR)	PICT	94
		YLG=AMAX1(YLG, YNR)	PICT	95
	20	ZLG=AMAX1(ZLG,ZNR)	PICT	96
		PENSF=9.99/AMAX1(YLG-YSM,ZLG-ZSM)	PICT	
		N = -1	PICT	
		NN = ~ 1	PICT	
			PICT	
			PICT	
С		READ IN SURFACE DATA	PICT	
	29	READ (9) X,Y,Z,STAT, XX,YY,ZZ,STATT	PICT	
		IF (STAT .EQ. 3 .CR. STATT .EQ. 3) REWIND 9	PICT	
		RFLAG = .FALSE.	PICT	
		GO TO 80	PICT	
	30		PICT	
	O u	RFLAG = • TRUE •	PICT	
		X = XX	PICT	
		$\hat{\mathbf{Y}} = \hat{\mathbf{Y}}\hat{\mathbf{Y}}$	PICT	
		Z = ZZ		
		STAT = STATT	PICT	
			PICT	
	50	GO TO 60 RFLAG = •FALSE•	PICT	
	20		PICT	
		READ (9) X,Y,Z,STAT, XX,YY,ZZ,STATT	PICT	
	c 8	IF (STAT .EQ. 3 .OR. STATT .EQ. 3) REWIND 9	PICT	
	6 <b>0</b>	IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180	PICT	
	7.0	IF (STAT •EQ. 2) GO TO 200	PICT	
	70	IF (.NOT. AFLAG) GO TO 200	PICT	
		MC = M 91	PICT	120
	iner e	<b>71</b>		
Lite" "		A TOTAL TO	A THE COLUMN TWO IS NOT THE PARTY AND ADDRESS OF THE	

```
80
     M = 1
                                                                           PICT 121
      IF (STAT .EQ. 2) GO TO 150
                                                                           PICT 122
      IF (.NOT. BFLAG) GO TO 84
                                                                           PICT 123
 75
     DO 81 J =1.MC
                                                                           PICT 124
       XA(J) = XB(J)
                                                                           PICT 125
       YA(J) = YB(J)
                                                                           PICT 126
81
       ZA(J) = ZB(J)
                                                                           PICT 127
 83
     XB(1) = X
                                                                           PICT 128
     YB(1) = Y
                                                                           PICT 129
     ZB(1) = Z
                                                                           PICT 130
     GO TO 30
                                                                           PICT 131
 84
     IF (AFLAG) GO TO 85
                                                                           PICT 132
      BFLAG = .TRUE.
                                                                           PICT 133
      GO TO 75
                                                                           PICT 134
85
     AFLAG = .FALSE.
                                                                           PICT 135
      GO TO 83
                                                                           PICT 136
150
     AFLAG = .TRUE.
                                                                           PICT 137
      BFLAG = .FALSE.
                                                                           PICT 138
      N = N+1
                                                                           PICT 139
160
     XA(M) = X
                                                                           PICT 140
     YA(M) = Y
                                                                           PICT 141
     ZA(M) = Z
                                                                           PICT 142
     GO TO 30
                                                                           PICT 143
180
     M = M + 1
                                                                           PICT 144
     IF (AFLAG) GO TO 160
                                                                           PICT 145
      XB(M) = X
                                                                           PICT 146
      YB(M) = Y
                                                                           PICT 147
      ZB(M) = Z
                                                                           PICT 148
     IF (STAT .NE. 3) GO TO 30
                                                                           PICT 149
200
     MMIN = MINO (M,MC) - 1
                                                                           PICT 150
      MC = M
                                                                           PICT 151
250
     N = N + 1
                                                                           PICT 152
     NN = NN + 1
                                                                           PICT 153
                                                                           PICT 154
                                                                           PICT 155
 BEGIN COMPUTATION OF SURFACE ELEMENT CHARACTERISTICS
                                                                           PICT 156
                                                                           PICT 157
450
     DO 2000 I= 1.NMIN
                                                                           PICT 158
       XIN(1) = XA(I) * XSC + DELX
                                                                           PICT 159
       XIN(2) = XA(I+1) + XSC + BELX
                                                                           PICT 160
       XIN(3) = XB(I+1) + XSC + DELX
                                                                           PICT 161
       XIN(4) = XB(I) + XSC + DELX
                                                                           PICT 162
       YIN(1) = YA(I) + YSC + DELY
                                                                           PICT 163
       YIN(2) = YA(I+1) + YSC + DELY
                                                                           PICT 164
       YIN(3) = YB(I+1) + YSC + DELY
                                                                           PICT 165
       YIN(4) = YB(I) + YSC + DELY
                                                                           PICT 166
       ZIN(1) = ZA(I) + ZSC + DELZ
                                                                           PICT 167
       ZIN(2) = ZA(I+1) + ZSC + DELZ
                                                                           PICT 168
       ZIN(3) = ZB(I+1) + ZSC + DELZ
                                                                           PICT 169
       ZIN(4) = ZB(I) * ZSC + DELZ
                                                                           PICT 170
       IRFLG = 0
                                                                           PICT 171
                                                                           PICT 172
  FORM DIAGONAL VECTORS - EQUATION (64)
                                                                           PICT 173
      T1X = XIN(3) - XIN(1)
                                                                           PICT 174
      T2X = XIN(4) - XIN(2)
                                                                           PICT 175
      T1Y = YIN(3) - YIN(1)
                                                                           PICT 176
      T2Y & YIN(4) - YIN(2)
                                                                           PICT 177
      T1Z = ZIN(3) - ZIN(1)
                                                                           PICT 178
      T2Z = ZIN(4) - ZIN(2)
                                                                           PICT 179
```

```
FORM CROSS PRODUCT N=T2 X T1 - EQUATION (65)
                                                                          PICT 181
       NX = T2Y+T1Z - T1Y+T2Z
                                                                          PICT 182
       NY = T1X*T2Z - T2X*T1Z
                                                                          PICT 183
       NZ = T2X*T1Y - T1X*T2Y
                                                                          PICT 184
       VN = SQRT (NX+NX + NY+NY + NZ+NZ)
                                                                         PICT 185
                                                                          PICT 186
 FORM UNIT NORMAL VECTOR - EQUATION (66)
                                                                          PICT 187
       NX = NX / VN
                                                                          PICT 188
       NY = NY / VN
                                                                          PICT 189
       NZ = NZ / VN
                                                                          PICT 190
                                                                          PICT 191
      IF (IFADV .EQ. 0) GO TO 471
                                                                          PICT 192
                                                                          PICT 193
C
      A NEW VIEW OF THE BODY IS TO BE PLOTTED. PLOT THE LEGEND AND
                                                                          PICT 194
C
      INITIALIZE FOR THE BODY PLOT.
                                                                          PICT 195
      IF( ICRT ) GO TO 524
                                                                          PICT 196
      CALL PLOT( 2.5, 0.0, 3 )
                                                                          PICT 197
      CALL SYMBOL ( 2.5, 0.0, 0.150, HLABEL, 0.0, 60)
                                                                         PICT 198
      CALL PLOT( 7.5, 5.5, -3)
                                                                         PICT 199
      GO TO 525
                                                                          PICT 200
  524 CALL STBEAM (24)
                                                                         PICT 201
      CALL SYMBOL ( 3.0, 0.0, 0.150, HLASEL, 0.0, 60)
                                                                         PICT 202
      CALL STBEAM(18)
                                                                         PICT 203
      CALL PLOT( 8.0, 5.5, -3)
                                                                          PICT 204
525
      IFADV = 0
                                                                          PICT 205
                                                                          PICT 206
471
     NXO = THIRD(NX,NY,NZ,PSI,THETA,PHI)
                                                                         PICT 207
      IF (NXO.LE.0.0 .AN (. ISHAD.EQ.0) 30 TO 571
                                                                         PICT 208
                                                                         PICT 209
                                                                         PICT 210
 CALCULATE POINTS TO BE PLOTTED
                                                                         PICT 211
     Y01 = FIRST(XIN(1), YIN(1), ZIN(1), A1, A2, A3)
                                                                         PICT 212
      Y02 = FIRST(XIN(2), YIN(2), ZIN(2), A1, A2, A3)
                                                                         PICT 213
PICT 214
      Y03 = FIRST(XIN(3), YIN(3), ZIN(3), A1, A2, A3)
      YO4 = FIRST(XIN(4), YIN(4), ZIN(4), A1, A2, A3)
                                                                         PICT 215
      ZO1 = FIRST(XIN(1), YIN(1), ZIN(1), 44, A5, A6)
                                                                         PICT 216
      ZO2 = FIRST(XIN(2), YIN(2), ZIN(2), A4, A5, A6)
                                                                         PICT 217
      ZO3 = FIRST(XIN(3), YIN(3), ZIN(3), A4, A5, A6)
                                                                          PICT 218
      ZO4 = FIRST(XIN(4), YIN(4), ZIN(4), A4, A5, A6)
                                                                          PICT 219
                                                                          PICT 220
      YIN2(1) = YO1
                                                                          PICT 221
      YIN2(2) = Y02
                                                                          PICT 222
      YIN2(3) = Y03
                                                                          PICT 223
      YIN2(4) = YC4
                                                                          PICT 224
      ZIN2(1) = Z01
                                                                          PICT 225
      ZIN2(2) = Z02
                                                                          PICT 226
      ZIN2(3) = ZO3
                                                                          PICT 227
      ZIN2(4) = ZO4
                                                                          PICT 228
                                                                          PICT 229
      SCALE AND PLOT A SINGLE QUADRALATERAL
                                                                          PICT 230
      DO 540 II=1,4
                                                                         PICT 231
      YPLTSC(II) = YIN2(II) * PENSF
                                                                         PICT 232
      ZPLTSC(II) = ZIN2(II) * PENSF
                                                                         PICT 233
      IF(
                                                                         PICT 234
                                     ABS(ZPLTSC(II)) .LE. 5.000)
                        GO TO 540
                                                                         PICT 235
     WRITE(6,5000) N. M
                                                                          PICT 236
5000 FORMAT( 100, 10x, 21HSCALE TROUBLE FOR N =14, 3x, 3HM =14)
                                                                         PICT 237
      GO TO 2000
                                                                          PICT 238
 540 CONTINUE
                                                                          PICT 239
      CALL PLOT( YPLTSC( 1), ZPLTSC( 1), 3)
                                                                          PICT 240
```

	DO 550 II=2,4	PICT 241
550	CALL PLOT( YPLTSC(II), ZPLTSC(II), 2)	PICT 242
	CALL PLOT( YPLTSC( 1), ZFLTSC( 1), 2)	PICT 243
		PICT 244
571	IF (IREFL .EQ. 0 .OR. IRFLG .EQ. 3) GO TO 2000	PICT 249
	IF (IREFL .EQ. 2 .AND. IRFLG .EQ. 1) GO TO 600	PICT 246
	IF (IREFL .EQ. 2 .AND. IRFLG .EQ. 2) GO TG 602	PICT 247
C		PICT 248
C	REFLECT QUADRANT I ELEMENTS TO QUADRANT II	PICT 249
	DO 586 II = 1,4	PICT 250
580	YIN(II) = -YIN(II)	PICT 251
	NY = -NY	PICT 252
	GO TO 604	PICT 253
C		PICT 254
C	REFLECT QUADRANT II ELEMENTS TO QUADRANT IV	PICT 259
6 <b>00</b>	DO 601 II = 1,4	PICT 256
	YIN(II) = -YIN(II)	PICT 257
601	ZIN(II) = -ZIN(II)	PICT 258
	NY = -NY	PICT 259
	NZ = -NZ	PICT 260
	GO TO 604	PICT 261
Ċ		PICT 262
С	REFLECT QUADRANT IN ELEMENTS TO QUADRANT III	PICT 263
602	DO 603 II = 1,4	PICT 264
603	YIN(II) = -YIN(II)	PICT 265
	NY = -NY	PICT 266
C		PICT 267
C	·	PICT 268
604	IRFLG = IRFLG + 1	PICT 269
	IF (IREFL •EQ• 1) IRFLG = 3	PICT 270
	GO TO 471	PICT 271
		PICT 272
		PICT 273
	CONTINUE	PICT 274
2001	IF (STAT .LT. 2) GO TO 480	PICT 275
	NN = NN - 1	PICT 276
	N = -1	PICT 277
	IF (IFRAME .EQ. 2) IFADV = 1	PICT 278
	IF (IFRAME .EQ. 1) IFADV = 1	PICT 279
485	IF (IFADV .EQ. 1) CALL PLOT(10.0,-5.5, -3)	PICT 280
		PICT 281
_		PICT 282
	ST FOR END OF CASE	PICT 283
2020	IF (STAT .NE. 3) GO TO 80	PICT 284
	IF (LAST .EQ. 1) RETURN	PICT 285
	GO TO 4	PICT 286
	END	DIOT 207

```
OVERLAY (BOXC, 0.0)
                                                                            BOXC
                                                                                    1
      PROGRAM MAIN( INPUT, TAPE6, TAPE5=INPUT, OUTPUT,
     1 TAPE1, TAPE3, TAPE8, TAPE9, TAPE11, TAPE12, TAPE13,
                                                                            BOXC
                                                                                    3
                     TAPE4, TAPE10, TAPE14)
                                                                             BOXC
C
                                                                             BOXC
                                                                                    5
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1979
                                                                             BOXC
                                                                                    6
C
                                                                             BOXC
                                                                                    7
C
      THIS IS ESSENTIALLY THE NON-LIFTING POTENTIAL FLOW CODE OF HESS
                                                                             BOXC
                                                                                    8
C
      AND SMITH AS DESCRIBED IN DOUGLAS AIRCRAFT CO. RPT. E.S. 40622
                                                                                    9
                                                                             BOXC
C
      (15 MARCH 1962), AD-282 255.
                                       THAT REPORT SHOULD BE CONSULTED FORBOXC
                                                                                   10
C
      DETAILS OF THE METHOD AND COMPUTATION.
                                                                             80 XC
                                                                                   11
C
                                                                             BOXC
                                                                                   12
C
      EIGHT OVERLAYS ARE USED.
                                   THE FINAL OVERLAY WRITES THE 28
                                                                             BOXC
                                                                                   13
C
      QUANTITIES ON UNIT 14 FOR USE BY SR FLOVEL IN CALCULATING FLOW
                                                                             EOXC
                                                                                   14
C
      VELOCITIES.
                                                                             BOXC
                                                                                   15
C
                                                                             BOXC
                                                                                   16
C
      ALSO REQUIRED, IN ADDITION TO THE SYSTEM INPUT, OUTPUT AND PUNCH
                                                                            BOXC
                                                                                   17
C
      UNITS, ARE THE FOLLOWING UNITS - 1,3,8,9,10,11,12,13.
                                                                             BOXC
                                                                                   18
                                                                             BOXC
                                                                                   19
      LOGICAL 1PROS
                                                                             BOXC
                                                                                   20
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                             BOXC
                                                                                   21
                                                                             BOXC
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                                   22
      REAL MACH
                                                                             80 XC
                                                                                   23
      COMMON /SPACER/ DUMMY (14000)
                                                                             BOXC
                                                                                   24
      COMMON / ATAPE / NATAPE
                                                                             BOXC
                                                                                   25
      COMMON / M/ MACH, BETA, RBETA
                                                                             BOXC
                                                                                   26
      LOGICAL AFLOW, BFLOW, SFLOW
                                                                             BO XC
                                                                                   27
      COMMON /DFLOW/ AFLOW, BFLOW, CFLCW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW BOXC
                                                                                   28
      COMMON/SOLVE/ N1, N2, N3, CORE, NFL
                                                                             BOXC
                                                                                   29
                                                                             BOXC
      COMMON /INPT/ LIST, IPROS
                                                                                   30
      COMMON /PROS/
                          SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                             BOXC
                                                                                   31
     1 YTRANS, ZTRANS
                                                                             BOXC
                                                                                   32
      COMMON /FLOWP/ NU, NNON
                                                                            BOXC
                                                                                   33
      COMMON /SIG/ NFLCOM
                                                                             EOXC
                                                                                   34
      COMMON / TAPES/ MN
                                                                            BOXC
                                                                                   35
      COMMON /FRINTO/ KMAT, NSEQ, KTP14
                                                                             BOXC
                                                                                   36
      COMMON / GLEAK/ LEAK, FRAGT
                                                                             BOXC
                                                                                   37
    6 FORMAT (F10.6)
                                                                             BOXC
                                                                                   38
 7000 FORMAT ( 7F10.0)
                                                                            BOXC
                 18X, 55HANGLE, XSCALE, YSCALE, ZSCALE, XTRANS, YTRANS, ZBOXC
 7500 FORMAT(
                                                                                   40
     1TRANS =/ 16X, 7(1PE13.4))
                                                                            BOXC
                                                                                   41
 8000 FORMAT ( L1)
                                                                            BOXC
                                                                                   42
 9000 FORMAT (15A4,2I1,3L1,4I1,I2,4I1,1X,A4)
                                                                             BOXC
                                                                                   43
 9300 FORMAT ( 14, F10.0 )
                                                                             BO XC
                                                                                   44
 9400 FORMAT ( 1H0, 17X, 31HNUMBER OF LEAKY QUADRALATERALS=14, 3X,
                                                                             BOXC
                                                                                   45
     1 40HFRACTION OF FREE-STREAM VELOCITY LEAKED=1PE11.4)
                                                                             BOXC
                                                                                   46
 9500 FORMAT( 1H0, 17X, 61HINPUT DATA ARE PROCESSED BY SCALING, ROTATINGBOXC
                                                                                   47
     1 AND TRANSLATING)
                                                                             BOXC
                                                                                   48
      DATA KORE /14000/
                                                                             BOXC
                                                                                   49
      NSEQ = 0
                                                                             BOXC
                                                                                   50
      READ IN CONTROL DATA
                                                                             BOXC
                                                                                   51
    1 READ ( 5, 9000 ) HEDR, IFLAG, LIST, AFLOW, BFLOW, CFLOW, ISIG,
                                                                             BOXC
                                                                                   52
     1 IPRS, MPR, NCODE, NNON, NSYM, NOFF, KMACH, KTP14, KASE
                                                                             BOXC
                                                                                   53
      READ(5,8000) IPROS
                                                                             BOXC
                                                                                   54
      IF( IPROS ) READ(5,7000) ANGLE, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                             BOXC
                                                                                   55
                                                                                   56
     1 YTRANS, ZTRANS
                                                                             BOXC
      IF(.NOT. IPROS) GC TO 2
                                                                             BOXC
                                                                                   57
```

B0 XC 114

PROGRAM MAIN

74/74 CPT=2

PROGRAM MAIN	74/74 OPT=2	FTN 4.7+476	02/27/80 17.14.35
	N3 = 8		BOXC 172
	MN = 2		BOXC 173
C **	POSITION THE TAPE FOR THE SIGNAS.		BOXC 174
	JJ = 2		EOXC 175
	IF (ISIG $\circ$ NE $\circ$ C) JJ = 3		BOXC 176
	JJ = NFLOW + JJ + NFL		BOXC 177
	DO 3750 J = 1, JJ		BOXC 178
3750	READ (3)		30XC 179
	NFL = NFLOW - NFL		BOXC 180
	i (KMAT - 2) 3830, 3900, 5000		BOXC 181
3800	IF (NBFLOW) 3900, 3900, 3850		BOXC 182
3850	KMAT = 2		EOXC 183
	GO TO 2450		80 XC 184
3989	KMAT = 3		BOXC 185
	GO TO 245 <b>0</b>		BOXC 186
5000	CONTINUE		BOXC 187
	WRITE (6, 5100)		80 XC 188
5100	FORMAT(1HO, 10X, 12HLEAVING MAIN)		BOXC 189
			BOXC 190
			BOXC 191
			BOXC 192
	CALL EXIT		BOXC 193
С	IF (LIST .NE. 0) STOP		BOXC 194
	GO TO 1		BOXC 195
	E ND		EOXC 196
			· ·

```
COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL OW, NQUAD,
                                                                                HEAD
                                                                                        3
      1 KASE, NOFF, NSYM, IFLAG, IFLOW, NGODE
                                                                                HEAD
       DATA IPAGE/0/
                                                                                        5
                                                                                HEAD
    1 FORMAT( 1H1, 5X, 13HPROGRAM BOXC , 15X, 30HATMOSPHERIC SCIENCE ASSHEAD
     10GIATES/ 38X, 22HBEOFCRO, MASSACHUSETTS, 22X, 4HPAGE, 15/
                                                                                        7
     2 7X, 8HBODY ID., 2X, A4/ 30X, 15A4)
                                                                               HEAD
                                                                                       8
   10 IPAGE = IPAGE + 1
                                                                               HEAD
                                                                                       9
       WRITE (6,1) IPAGE, KASE, HEDR
                                                                               HEAD
                                                                                      10
       RETURN
                                                                               HEAD
                                                                                      11
       END
                                                                               HEAD
                                                                                      12
*D ECK, ROWV
                                                                               ROWV
     . SUBROUTINE ROWY ( XIJ, YIL, ZIJ, III, KSKIP )
                                                                               ROWV
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL OW, NQUAD,
                                                                                       3
                                                                               ROWV
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                               ROWV
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                                       5
                                                                               ROWV
      COMMON /DFLOW/ AFLOW, BFLOW, CFLOW, NHAT, NMATM1, NAFLOW, NBFLOW, NCFLOW ROWV
                                                                                       6
       DIMENSION XIJ(1), YIJ(1), ZIJ(1)
                                                                               ROWV
                                                                                       7
      INTEGER CKFLG
                                                                               ROWV
                                                                                       8
      DIMENSION NT(3)
                                                                               ROWV
                                                                                       9
      DATA NT
                                / 1, 11, 12 /
                                                                               ROWV
                                                                                      10
    5 \text{ CKFLG} = 0
                                                                               ROWV
                                                                                      11
      N1 = 1
                                                                               ROWV
                                                                                      12
      N2 = NQUAD/3
                                                                               ROWV
                                                                                      13
      N3 = NQUAD - N2 - N2
                                                                               ROWV
                                                                                      14
      NN = N2
                                                                               ROWV
                                                                                      15
C
        READ IN ONE ROW OF THE VX. VY. VZ
                                                                               ROWV
                                                                                      16
      00 50 I1 = 1, 3
                                                                               ROWV
                                                                                      17
      NTAPE = NT(I1)
                                                                               ROWV
                                                                                      18
   10 READ(NTAPE)
                            (XIJ(I2) , YIJ(I2) , ZIJ(I2) , I2 = N1 , NN )
                                                                               ROWV
                                                                                      19
      N1 = NN + 1
                                                                               ROWV
                                                                                      20
      IF( I1 .EQ. 2 ) GO TO 35
                                                                               ROWV
                                                                                      21
      NN = NN + N2
                                                                               ROWV
                                                                                      22
      GO TO 50
                                                                               ROWV
                                                                                      23
   35 NN = NN + N3
                                                                               ROWV
                                                                                      24
   50 CONTINUE
                                                                               ROWV
                                                                                      25
      NER = 0
                                                                               ROWV
                                                                                      26
      IF ( III .NE. (NQUAD + NOFF)) IF ( KSKIP ) 80, 80, 100
                                                                               ROWV
                                                                                      27
      REWIND 1
                                                                               ROWV
                                                                                      28
      REWIND 11
                                                                               ROWV
                                                                                      29
      REWIND 12
                                                                               ROWV
                                                                                      30
   80 RETURN
                                                                               ROWV
                                                                                      31
  100 IF ( NMATH1 .EQ. 0 ) RETURN
                                                                               ROWV
                                                                                      32
      00 110 N1 = 1, NMATM1
                                                                               ROWV
                                                                                      33
      READ ( 1 )
                                                                               ROWV
                                                                                      34
      READ ( 11 )
                                                                               ROWV
                                                                                      35
  110 READ ( 12 )
                                                                               ROWY
                                                                                      36
      RETURN
                                                                               ROWV
                                                                                      37
      END
                                                                               ROWV
                                                                                      38
```

HEAD

HEAD

\*DECK, HEADER

SUBROUTINE HEADER

```
*DECK, INPUT
                                                                          INPU
                                                                                  1
      SUBROUTINE INPUT
                                                                          INPU
C
      SUBROUTINE INPUT (LIST)
                                                                          INPU
      LOGICAL IPROS
                                                                          INPU
      COMMON /INPT/ LIST, IPROS
                                                                          INPU
      REAL NX, NY, NZ , IXX, IXY, IYY, MACH
                                                                          INPU
      LOGICAL AFLOW, BFLOW, CFLOW, RFLAG, AFLAG, BFLAG
                                                                          INPU
      INTEGER STAT, STATT, CONV
                                                                          INPU
      DIMENSION SPH ( 200'), CPH ( 200 ), XINP ( 200 ), ZINP ( 200 )
                                                                          INPU
                                                                                  9
      DIMENSION XOFF(1000), YOFF (1000), ZOFF (1000)
                                                                                 10
                                                                          INPU
      DIMENSION XA ( 500 ), XB ( 500 ), YA ( 500 ), YB ( 500 ),
                                                                          INPU
                                                                                 11
              500 ), ZB ( 500 ), NLINE(500 ), NLT ( 500 ), CFLAG(3),
                                                                          INPU
                                                                                 12
        XI (4), ETA (4), XIN (4), YIN (4), ZIN (4), XNULL (1000),
                                                                          INPU
                                                                                 13
        YNULL (1000), ZNULL (1000),
                                             XNORM(1000).
                                                                          INPU
                                                                                 14
        YNORM ( 1 100), ZNORM (1000), RX (4), R (4), RY (4)
                                                                          INPU
                                                                                 15
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                          INPU
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                          INPU
                                                                                 17
      COMMON /M/ MACH, BETA, RBETA
                                                                          INPU
                                                                                 18
       COMMON /NORMS/ XNORM, YNORM, ZNORM
                                                                          INPU
                                                                                 19
                                  XOFF), ( YNULL,
      EQUIVALENCE (XNULL,
                                                         YOFF),
                                                                                 20
                                                                          INPU
     1 (ZNULL, ZOFF), (NULL, NQUAD)
                                                                          INPU
                                                                                 21
      COMMON /DFLOW/ AFLCW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLCW, NCFLOW INPU
                                                                                 22
             CFLAG
                                      / 2H 1, 2H 2, 2H /
                                                                                 23
                                                                          INPU
      DATA PI/3.141593E0/, HAFFI/1.570796E0/, EPS/.0001/
                                                                          INPU
                                                                                 24
3030 FORMAT (1H1)
                                                                          INPU
    1 FORMAT (
                   3E10.0, I2 / 3F10.0, I2)
                                                                          INPU
                                                                                 26
 4002 FORMAT ( 1H0, 6X,5HN M, 7X, 4 ( 1HX, 11X ), 2HNX, 11X, 3HNPX,
                                                                          INPU
                                                                                 27
       11X, 1HD / 19X, 4 ( 1HY, 11X ), 2HNY, 11X, 3HNPY, 11X, 1HT /
                                                                          INPU
                                                                                 28
        19X, 4(1HZ, 11X), 2HNZ, 11X, 3HNPZ, 11X, 1HA
                                                                          INPU
                                                                                 29
 4805 FORMAT ( 1H8, 7X, I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                          INPU
                                                                                 30
        2F13.6, E14.4 ) )
                                                                          INPU
                                                                                 31
 4010 FORMAT ( 1H0, 3X, 2I4, 4F12.6, 2F13.6, E14.4, A2/(12X, 4F12.6,
                                                                          INPU
                                                                                 32
        2F13.6, E14.4 ) )
                                                                          INPU
                                                                                 33
4015 FORMAT ( 1HC, 3 ( 20), 12H********* ))
                                                                          INPU
                                                                          INPU
                                                                                 35
   INPUT -- SECTION 9.1 INPUT SCHEME
                                                                          INPU
                                                                                 36
      KLCT = 0
                                                                          INPU
                                                                                 37
      NULL = 0
                                                                                 38
                                                                          INPU
      NPRT = 13
                                                                          INPU
                                                                                 39
      WRITE (6, 40)
                                                                                 40
                                                                          INPU
   40 FORMAT (1H0,16X,44HP A R A M E T R I C I N F O R M A T I O N
                                                                          INPU
                                                                                 41
     1 /// 38X,23HGENERATED UNIFORM FLOWS //)
                                                                          INPU
                                                                                 42
      IF ( AFLOW ) WRITE (6. 41)
                                                                          INPU
                                                                                 43
   41 FORMAT (46X,6HX-FLOW)
                                                                          INPU
                                                                                 44
      IF ( BFLOW ) WRITE (6, 42)
                                                                          INPU
                                                                                 45
   42 FORMAT (46X,6HY-FLOW)
                                                                                 46
                                                                          INPU
      IF ( CFLOW ) WRITE (6, 43)
                                                                          INPU
                                                                                 47
   43 FORMAT (46X,6HZ-FLOW)
                                                                          INPU
                                                                                 48
      IF (IPRS .. NE. 0) WRITE (6, 44)
                                                                          INPU
                                                                                 49
   44 FORMAT (1H0,16X,22HPRINT SIGMA ITERATIONS )
                                                                          INPU
                                                                                 50
      IF (MPR .EQ. 0) GO TO 52
                                                                          INPU
      IF (MPR - 2) 45, 47, 49
                                                                          INPU
                                                                                 52
   45 WRITE (6, 46)
                                                                          IMPU
                                                                                 53
   46 FORMAT (1H0,16X,18 PRINT VIJ MATRICES)
                                                                                 54
                                                                          INPU
    . GO TO 52
                                                                                 55
                                                                          INPU
   47 WRITE (6, 48)
                                                                          INPU
   48 FORMAT (1HO: 16X, 18HPFINT AIJ MATRICES )
                                                                          INPU
                                                                                 57
      GO TO 52
                                                                          INPU
   49 WRITE (6, 51)
                                                                          INPU
                                                                                 59
   51 FORMAT (1H0,16X,31+PRINT BOTH VIJ AND AIJ MATRICES )
                                                                          INPU
                                                                                 60
```

```
52 IF (ISIG .NE. 0) WRITE (6, 53)
                                                                          INPU
                                                                                 61
53 FORMAT (1H0,16X,19HINPUT SIGMA GUESSES )
                                                                           INPU
                                                                                 62
   IF (NSYM - 1) 54, 56, 58
                                                                                 63
                                                                          INPU
54 WRITE (6, 55)
                                                                          INPU
                                                                                 64
55 FORMAT (1H0,16X,21HNC SYMMETRY SPECIFIED )
                                                                          INPU
                                                                                 65
   GO TO 61
                                                                          INPU
                                                                                 66
56 WRITE (6, 57)
                                                                          INPU
                                                                                 67
57 FORMAT (1H0,16X, 30 HTHERE IS ONE PLANE OF SYMMETRY )
                                                                          INPU
                                                                                 68
   GO TO 61
                                                                          INPU
                                                                                 69
58 WRITE (6, 59) NSYM
                                                                          INPU
                                                                                 70
59 FORMAT (1H0,16%,9HTHERE ARE,12, 19H PLANES OF SYMMETRY )
                                                                                 71
                                                                          INPU
61 IF ( MACH .NE. 0.0 ) WRITE (6, 21) MACH
                                                                          INPU
                                                                                 72
21 FORMAT (1H0,16X,13HMACH NUMBER =,F10.5)
                                                                          INPU
                                                                                 73
   IF (IFLAG .EQ. 0) GO TO 29
                                                                          INPU
                                                                                 74
   READ (5, 20) NLM1, MMIN, B, C
                                                                                 75
                                                                          INPU
   IF (B \bullet EQ \bullet 0 \bullet 0) B = 1 \bullet 0
                                                                          INPU
                                                                                 76
   IF (C \cdot EQ \cdot 0 \cdot 0) C = 1 \cdot 0
                                                                          INPU
                                                                                 77
20 FORMAT ( 215, 2F10.5 )
                                                                          INPU
                                                                                 78
 4 FORMAT ( 8F10.0 )
                                                                                 79
                                                                          INPU
   WRITE (6, 62) NLM1, PMIN, B, C
                                                                          INPU
                                                                                 80
62 FORMAT (1H0,16X,10HGENERATE A,13, 2H X,13, 12H SPHERE. B =,F10.5, INPU
                                                                                 81
  1 4X, 3HC = F10.5
                                                                           INPU
                                                                                 82
   MLINES = MMIN + 1
                                                                          INPU
                                                                                 83
   NLINES = NLM1 + 1
                                                                           INPU
                                                                           INPU
                                                                                 85
   IF ( NSYM .EQ. 0 ) GO TO 2
                                                                           INPU
                                                                                 86
   IF ( NSYM - 2 ) 3, 5, 6
                                                                          INPU
                                                                                 87
 2 PITH = PI
                                                                          INPU
                                                                                 88
   PIPHI = PI + PI
                                                                          INPU
                                                                                 89
   GO TO 7
                                                                                 90
                                                                           INPU
 3 PITH = PI
                                                                          INPU
                                                                                 91
   PIPHI = PI
                                                                           INPU
                                                                                92
   GO TO 7
                                                                          INPU
                                                                                 93
 5 PITH = PI
                                                                          INPU
                                                                                 94
   PIPHI = HAFPI
                                                                          INPU
                                                                                95
   GO TO 7
                                                                          INPU
                                                                                 96
 6 PITH = HAFPI
                                                                          INPU
                                                                                 97
   PIPHI = PITH
                                                                          INPU
                                                                                 98
 7 \text{ SPH ( MLINES )} = \text{SIN ( PIPHI )}
                                                                                 99
                                                                          INPU
   SPH (1) = 0.0
                                                                           INPU 100
   CPH (MLINES) = CCS (PIPHI)
                                                                           INPU 101
   CPH ( 1 ) = 1.0
                                                                          INPU 182
   EKM = MMIN
                                                                           INPU 103
                                                                          INPU 104
   EKN = NLM1
   EMM = 0.0
                                                                           INPU 105
   DO 8 I = 2, MMIN
                                                                          INPU 106
   EMM = EMM + 1.0
                                                                          INPU 107
   PHI = EMM / EKM * PIFHI
                                                                          INPU 108
   SPH (I) = SIN (PHI)
                                                                          INPU 109
 8 \text{ CPH (I)} = \text{COS (PHI)}
                                                                          INPU 110
   IF ( IFLAG .EQ. 2 ) GO TO 10
                                                                          INPU 111
   ENN = 1.0
                                                                           INPU 112
   DO 9 I = 1, MLINES
                                                                          INPU 113
   XA (I) = 1.0
                                                                          INPU 114
   YA (I) = 0.0
                                                                          INPU 115
 9 ZA ( I ) = 0.0
                                                                           INPU 116
   GO TO 18
                                                                           INPU 117
10 READ ( 5, 4 ) ( XINP ( I ), ZINP ( I ), I = 1, NLINES )
                                                                          INPU 118
   DO 11 I = 1, MLINES
                                                                          INPU 119
   XA (I) = XINP (1)
                                                                           INPU 120
```

```
YA (I) = B * ZINF (1) * SPH (I)
                                                                    INPU 121
   ZA (I) = -C + ZINF (1) + CPH (I)
                                                                    INPU 122
   XB (I) = XINP (2)
                                                                    INPU 123
   YB (I) = B * ZINP (2) * SPH (I)
                                                                    INPU 124
11 ZB ( I ) = - C + ZINF ( 2 ) + CPH ( I )
                                                                    INPU 125
   NLCT = 2
                                                                    INPU 126
   GO TO 250
                                                                    INPU 127
12 DO 14 I = 1, NLINES
                                                                    INPU 128
   XA (I) = XB (I)
                                                                    INPU 129
   YA (I) = YB (I)
                                                                    INPU 130
14 ZA ( I ) = ZB ( I )
                                                                    INPU 131
  IF ( IFLAG .EQ. 1 ) GO TO 16
                                                                    INPU 132
   NLCT = NLCT + 1
                                                                    INPU 133
  DO 15 I = 1, MLINES
                                                                    INPU 134
   XB (I) = XINP (NLCT)
                                                                    INPU 135
   YB (I) = B * ZINP (NLCT) * SPH (I)
                                                                    INPU 136
15 ZB (I) = - C * ZIPP ( NLCT ) * CPH ( I )
                                                                    INPU 137
  GO TO 250
                                                                    INPU 138
16 ENN = ENN + 1.0
                                                                    INPU 139
18 THETA = ENN / EKN * FITH
                                                                    INPU 140
   STH = SIN ( THETA )
                                                                    INPU 141
   CTH = COS ( THETA )
                                                                    INPU 142
   DO 17 I = 1, MLINES
                                                                    INPU 143
   XB (I) = CTH
                                                                    INPU 144
   YB (I) = B * STH * SPH (I)
                                                                    INPU 145
17 ZB ( I ) = - C * STH * CPH ( I )
                                                                    INPU 146
  GO TO 250
                                                                    INPU 147
29 N = -1
                                                                    INPU 148
   IF (LIST .EQ. 0) GO TO 50
                                                                    INPU 149
   WRITE (6, 19)
                                                                    INPU 150
19 FORMAT (1H0 16X 28HBASIC DATA CALCULATIONS ONLY)
                                                                    INPU 151
   GO TO 50
                                                                    INPU 152
30 IF ( RFLAG ) GO TO 50
                                                                    INPU 153
   RFLAG = .TRUE.
                                                                    INPU 154
   X = XX
                                                                    INPU 155
   Y = YY
                                                                    INPU 156
   Z = ZZ
                                                                    INPU 157
   STAT = STATT
                                                                    INPU 158
   IF (LIST) 66, 66, 65
                                                                    INPU 159
50 RFLAG = .FALSE.
                                                                    INPU 168
   READ ( 5, 1 ) X, Y, Z, STAT, XX, YY, ZZ, STATT

IF ( IPROS ) CALL DATPROS( X, Y, Z, XX, YY, ZZ )
                                                                    INPU 161
                                                                  INPU 162
65 IF (N .EQ. (-1))GO TO 80
                                                                    INPU 163
66 IF (STAT .EQ. 0 .OR. STAT .EQ. 3) GO TO 180
                                                                   INPU 164
   IF ( STAT .EQ. 2 ) GC TO 200
                                                                    INPU 165
   IF ( .NOT. AFLAG ) GO TO 200
                                                                    INPU 166
   MC = M
                                                                    INPU 167
80 M = 1
                                                                    INPU 168
   IF ( STAT .EQ. 2 ) GO TC 150
                                                                    INPU 169
   IF ( .NOT. BFLAG ) GO TO 84
                                                                    INPU 170
75 DO 81 J = 1, NC
                                                                    INPU 171
   XA (J) = XB (J)
                                                                    INPU 172
   YA(J) = YB(J)
                                                                    INPU 173
                                                                    INPU 174
81 \ ZA \ (J) = ZB \ (J)
83 XB ( 1 ) = X
                                                                    INPU 175
   YB (1) = Y
                                                                    INPU 176
   ZB (1) = Z
                                                                    INPU 177
   GO TO 30
                                                                    INPU 178
84 IF ( AFLAG ) GO TO 85
                                                                    INPU 179
   BFLAG = .TRUE.
                                                                    INPU 180.
```

```
GO TO 75
                                                                          INPU 181
   85 AFLAG = .FALSE.
                                                                          INPU 182
      GO TO 83
                                                                          INPU 183
 150 AFLAG = .TRUE.
                                                                          INPU 184
      BFLAG = .FALSE.
                                                                          INPU 185
      IF (N \cdot EQ \cdot (-1))N = 0
                                                                          INPU 186
 160 XA ( M ) = X
                                                                          INPU 187
      YA (M) = Y
                                                                          INPU 188
      ZA(M)=Z
                                                                          INPU 189
      GO TO 30
                                                                          INPU 190
 180 M = M + 1
                                                                          INPU 191
      IF ( AFLAG ) GO TO 160
                                                                          INPU 192
      X = (M) = X
                                                                          INPU 193
      YB (M) = Y
                                                                          INPU 194
      ZB (M) = Z
                                                                          INPU 195
      IF ( STAT .NE. 3 ) GO TO 30
                                                                          INPU 196
  200 MMIN = MINO(M, MC) - 1
                                                                          INPU 197
      MC = M
                                                                          INPU 198
  250 N = N + 1
                                                                          INPU 199
      KLCT = KLCT + 1
                                                                          INPU 200
                                                                          INPU 201
 BEGIN COMPUTATION OF NULL POINTS AND 28 QUANTITIES
                                                                          INPU 262
                                                                          INPU 203
      DO 2000 I = 1, MMIN
                                                                          INPU 204
      NULL = NULL + 1
                                                                          INPU 205
      XIN(1) = XA(I) + RBETA
                                                                          INPU 206
      XIN(2) = XA(I+1) * REETA
                                                                          INPU 207
      XIN(3) = XB(I+1) + RBETA
                                                                          INPU 208
      XIN(4) = XB(I) + REETA
                                                                          INPU 209
      YIN(1) = YA(I)
                                                                          INPU 210
      YIN(2) = YA(I+1)
                                                                          INPU 211
      YIN(3) = YB(I+1)
                                                                          INPU 212
      YIN(4) = YB(I)
                                                                          INPU 213
      ZIN(1) = ZA(I)
                                                                          INPU 214
      ZIN(2) = ZA(I+1)
                                                                          INPU 215
      ZIN(3) = ZB(I+1)
                                                                          INPU 216
      ZIN(4) = ZB(I)
                                                                          INPU 217
                                                                          INPU 218
  FORM DIAGONAL VECTORS
                                                                          INPU 219
  EQUATION (64)
                                                                          INPU 220
                                                                          INPU 221
      T1X = XIN(3) - XIN(1)
                                                                          INPU 222
      T2X = XIN(4) - XIN(2)
                                                                          INPU 223
      T1Y = YIN(3) - YIN(1)
                                                                          INPU 224
      T2Y = YIN(4) - YIN(2)
                                                                          INPU 225
      T1Z = ZIN(3) - ZIN(1)
                                                                          INPU 226
      T2Z = ZIN(4) - ZIN(2)
                                                                          INPU 227
                                                                          INPU 228
  FORM CROSS PRODUCT N = T2 \times T1
                                                                          INPU 229
  EGUATION (65)
                                                                          INPU 230
                                                                          INPU 231
      NX = T2Y+T1Z - T1Y+T2Z
                                                                          INPU 232
      NY = T1X+T2Z - T2X+T1Z
                                                                          INPU 233
      NZ = T2X*T1Y - T1X*T2Y
                                                                          INPU 234
      VN = SQRT ( NX* NX + NY* NY + NZ* NZ )
                                                                          INPU 235
                                                                          INPU 236
C FORM UNIT NORMAL VECTOR
                                                                          INPU 237
  EQUATION (66)
                                                                          INPU 238
                                                                          INPU 239
      NX = NX / VN
                                                                          INPU 240
```

```
NY = NY / VN
                                                                          INPU 241
      NZ = NZ / VN
                                                                          INPU 242
                                                                          INPU 243
  COMPUTE AVERAGE POINT
                                                                          INPU 244
   EQUATION (68)
                                                                          INPU 245
                                                                     INPU 246
      AVX = .25 * (XIN(1) + XIN(2) + XIN(3) + XIN(4) )

AVY = .25 * (YIN(1) + YIN(2) + YIN(3) + YIN(4) )
                                                                          INPU 247
                                                                          INPU 248
      AVZ = .25 * (ZIN(1) + ZIN(2) + ZIN(3) + ZIN(4))
                                                                          INPU 249
                                                                          INPU 250
C COMPUTE PROJECTION DISTANCE
                                                                          INPU 251
C EQUATIONS ( 69 ) AND ( 71 )
                                                                          INPU 252
                                                                          INPU 253
      D = NX*(AVX - XIN(1)) + NY*(AVY - YIN(1)) + NZ*(AVZ-ZIN(1))INPU 254
      PD = ABS(D)
                                                                          INPU 255
                                                                          INPU 256
   EQUATIONS ( 73 ) AND ( 74 )
                                                                          INPU 257
                                                                          INPU 258
      T = SQRT ( TiX*TiX + TiY*TiY + TiZ*TiZ )
                                                                          INPU 259
      TiX = TiX / T
                                                                          INPU 260
      T1Y = T1Y / T
                                                                          INPU 261
      T1Z = T1Z / T
                                                                          INPU 262
                                                                          INPU 263
   EQUATION (75)
                                                                          INPU 2E4
                                                                          INPU 265
      T2X = NY+T1Z - NZ+T1Y
                                                                          INPU 266
      T2Y = NZ*T1X - NX*T1Z
                                                                          INPU 267
      T2Z = NX + T1Y - NY + T1X
                                                                          INPU 2E8
                                                                          INPU 269
  COMPUTE COORDINATES OF CORNER POINTS IN REFERENCE COORD. SYSTEM
                                                                          INPU 270
   EQUATION (72)
                                                                          INPU 271
                                                                          INPU 272
      DO 1000 J = 1, 4
                                                                          INPU 273
      XP = XIN(J) + NX + D
                                                                          INPU 274
      YP = YIN(J) + NY + D
                                                                          INPU 275
      ZP = ZIN(J) + NZ + D
                                                                          INPU 276
      0 = -0
                                                                          INPU 277
      XDIF = XP - AVX
                                                                          INPU 278
      YDIF = YP - AVY
                                                                          INPU 279
      ZDIF = ZP - AVZ
                                                                          INPU 280
                                                                          INPU 281
   TRANSFORM CORNER POINTS TO ELEMENT COORDINATE SYSTEM ( XI, ETA ) - INPU 282
   WITH AVERAGE P (INT AS ORIGIN
C
                                                                          INPU 283
   EGUATION (80)
                                                                          INPU 284
                                                                          INPU 285
      XI(J) = T1X*XDIF + T1Y*YDIF + T1Z*ZDIF
                                                                          INPU 286
1000 ETA(J) = T2X*XDIF + T2Y*YDIF + T2Z*ZDIF
                                                                          INPU 287
                                                                          INPU 288
   COMPUTE CENTROID
                                                                          INPU 289
C
   EQUATION (81)
                                                                          INPU 290
                                                                          INPU 291
      XIO = .3333333EO * (XI (4) * (ETA (1) - ETA (2) ) + XI (2)
                                                                          INPU 292
     1 + ( ETA (4) - ETA ( 1) ) / ( ETA (2 ) - ETA (4) )
                                                                          INPU 293
      ETAO = -.3333333EO * ETA(1)
                                                                          INPU 294
                                                                          INPU 295
                                                                          INPU 296
   OBTAIN CORNER POINTS IN SYSTEM WITH CENTROID AS ORIGIN
                                                                          INPU 297
   EQUATION (82)
                                                                          INPU 298
                                                                          INPU 299
      DO 1020 J = 1, 4
                                                                          INPU 300
```

```
XI(J) = XI(J) - XI0
                                                                       INPU 3ú1
 102C ETA(J) = ETA(J) - ETAO
                                                                       INPU 302
                                                                       INPU 383
 COMPUTATION AIDS
                                                                       INPU 304
      ETA 2M1 = ETA ( 2 ) - ETA ( 1 )
                                                                       INPU 305
      ETA3M2 = ETA (3) - ETA (2)
                                                                       INPU 366
      ETA4M3 = ETA (4) - ETA (3)
                                                                       INPU 307
      ETAIM4 = ETA (1) - ETA (4)
                                                                      INPU 308
      XI1M2 = XI (1) - XI (2)
                                                                      INPU 309
     XI2M3 = XI (2) - XI (3)
                                                                      INPU 310
      XI3M4 = XI (3) - XI (4)
                                                                      INPU 311
      XI4M1 = XI (4) - XI (1)
                                                                      INPU 312
      ETA2P4 = ETA (2) + ETA (4)
                                                                      INPU 313
      XI3M1 = XI (3) - XI (1)
                                                                      INPU 314
      XI4M2 = XI (4) - XI (2)
                                                                      INPU 315
      ETA2M4 = ETA (2) - ETA (4)
                                                                      INPU 316
      XI1234 = XI (1) + XI (2) + XI (3) + XI (4)
                                                                      INPU 317
                                                                      INPU 318
  TRANSFORM CENTROID TO REFERENCE COORDINATE SYSTEM
                                                                      INPU 319
  EGUATION (83)
                                                                      INPU 320
      XCENT = AVX + T1X*XIO + T2X*ETAO
                                                                      INPU 321
      YCENT = AVY + T1Y*XIO + T2Y*ETAO
                                                                      INPU 322
      ZCENT = AVZ + T1Z*XIO + T2Z*ETAO
                                                                      INPU 323
                                                                      INPU 324
  COMPUTE LARGER DIAGONAL VECTOR
C
                                                                      INPU 325
 EQUATION (84)
                                                                      INPU 326
      TSQ = AMAX1 ( XI3M1 ** 2, XI4M2 ** 2 + ETA2M4 ** 2 )
                                                                      INPU 327
      T = SQRT (TSQ)
                                                                      INPU 328
                                                                      INPU 329
                                                                      INPU 330
C
 COMPUTE AREA
                                                                      INPU 331
C
  EQUATION (85)
                                                                      INPU 332
                     = .5 * XI3M1 * ET42M4
      AREA
                                                                      INPU 333
                                                                       INPU 334
  COMPUTE 2ND HOMENTS IXX, IXY, IYY
C
                                                                      INPU 335
C
  EQUATIONS ( 86 ) - ( 88 )
                                                                      INPU 336
                     8.33333E-2 * XI3M1 * ( ETA ( 1 ) * XI4M2 *
      IXX =
                                                                      INPU 337
      XI1234 + ETA2M4 * ( XI (1) * ( XI(1) + XI (3 ) ) +
                                                                       INPU 338
       XI (3) + 2) + XI (2) + ETA (2) + (XI1234 - XI (4))
                                                                      INPU 339
    3 - XI (4) * ETA (4) * (XI1234 - XI (2))
                                                                       INPU 340
                      4.166667E-2 * XI3M1 * ( 2. * XI ( 4 ) * ( ETA (1) INPU 341
       ** 2 - ETA ( 4 ) ** 2 ) - 2. * XI ( 2 ) * ( ETA ( 1 ) ** 2 -
                                                                       INPU 342
       ETA ( 2 ) ** 2 ) + ( XI ( 1 ) + XI ( 3 ) ) * ETA2M4 * ( 2. *
                                                                      INPU 343
    3 ETA ( 1 ) + ETA2P4 ) )
                                                                      INPU 344
                      8.333333E-2 * XI3M1 * ETA2M4 * ((ETA ( 1 ) +
     IYY =
                                                                       INPU 345
     1 ETA2P4) ** 2 - ETA ( 1 ) * ETA2P4 - ETA ( 2 ) * ETA ( 4 ) )
                                                                      INPU 346
                                                                       INPU 347
  COMPUTE CONSTANTS FOR EQUATIONS ( 42 ) AND ( 43 )
C
                                                                      INPU 348
C
  E CUATION (45)
                                                                      INPU 349
      D12SQ = XI1M2 ** 2 + ET /2M1 ** 2
                                                                       INPU 350
      D12 = SORT (D12SQ)
                                                                       INPU 351
      D23SQ = XI2M3 **2 + ETA3M2 ** 2
                                                                       INPU 352
      D23 = SQRT (D23SQ)
                                                                       INPU 353
      D34SQ = XI3M4 ++ 2 + ETA4M3 ++ 2
                                                                       INPU 354
      D34 = SQRT (D34SQ)
                                                                       INPU 355
      D41SQ = XI4M1 ** 2 + ETA1M4 ** 2
                                                                       INPU 356
      D41 = SORT (D41SQ)
                                                                       INPU 357
     C1 = 0.0
                                                                       INPU 358
      C2 = 0.0
                                                                       INPU 359
      03 = 0.0
                                                                       INPU 360
```

```
C4 = 0.0
                                                                            INPU 361
       C5 = 0.0
                                                                            INPU 362
       C6 = 0.0
                                                                            INPU 363
       C7 = 0.0
                                                                            INPU 364
       C8 = 0.0
                                                                            INPU 365
       XNP = 0.0
                                                                            INPU 366
       YNP = 0.0
                                                                            INPU 367
       IF ( D12 ) 1030, 1040, 1030
                                                                            INPU 368
 1030 C1 = ETA2M1 / D12
                                                                            INPU 369
       C5 = XI1M2 / D12
                                                                            INPU 370
 1040 IF ( D23 ) 1050, 1060, 1050
                                                                            INPU 371
 1050 C2 = ETA3M2 / D23
                                                                            INPU 372
       C6 = XI2M3 / D23
                                                                            INPU 373
 1060 IF ( D34 ) 1070, 1080, 1070
                                                                            INPU 374
 1070 C3 = ETA4M3 / D34
                                                                            INPU 375
       C7 = XI3M4 / D34
                                                                            INPU 376
 1080 IF ( D41 ) 1090, 1100, 1090
                                                                            INPU 377
 1090 C4 = ETA1M4 / D41
                                                                            INPU 378
       C8 = XI4M1 / D41
                                                                            INPU 379
 1100 \text{ CONV} = 3
                                                                            INPU 380
                                                                            INPU 381
                                                                            INPU 382
C BEGIN NULL POINT ITERATION
                                                                            INPU 383
                                                                            INPU 384
      DO 1591 ITR = 1, 30
                                                                            INPU 385
      DO 1585 K = 1.4
                                                                            INPU 386
   EQUATION (47)
                                                                           INPU 387
      R(K) = SQRT((XNP - XI(K)) ** 2 + (YNF - ETA(K)) ** 2)
                                                                           INPU 388
      RX (K) = (XNP - XI (K)) / R(K)
                                                                           INPU 389
 1580 RY (K ) = ( YNP - ETA ( K ) ) / R ( K )
                                                                           INPU 390
      R1PR2 = R(1) + R(2)
                                                                           INPU 391
      R2PR3 = R(2) + R(3)
                                                                           INPU 392
      R3PR4 = R (3) + R (4)
                                                                           INPU 393
      R4PR1 = R (4) + R (1)
                                                                           INPU 394
      ARG1 = ALOG ( ( R1PR2 - D12 ) / ( R1PR2 + D12 ) )
                                                                           INPU 395
      R4PR1 = R(4) + R(1)
      ARG1 = ALOG ( ( R1PR2 - D12 ) / ( R1PR2 + D12 ) )
ARG2 = ALOG ( ( R2PR3 - D23 ) / ( R2PR3 + D23 ) )
                                                                           INPU 396
                                                                          INPU 397
                                                                          INPU 398
      ARG3 = ALOG ((R3PR4 - D34) / (R3PR4 + D34))
                                                                           INPU 399
      ARG4 = ALOG ((R4PR1 - D41) / (R4PR1 + D41))
                                                        NPU 4
INPU 4
INPU 40
INPU 404
INPU 405
INPU 406
INPU 4
C COMPUTE INDUCED VELOCITY COPPONENTS
   EQUATIONS (42) AND (43)
      VX = C1 * ARG1 + C2 * ARG2 + C3 * ARG3 + C4 * ARG 4
VY = C5 * ARG1 + C6 * ARG2 + C7 * ARG 3 + C8 * ARG4
 COMPUTE PARTIAL DERIVATIVES OF INDUCED VELOCITIES
C
  EQUATION ( 98 ), USING EQUATIONS ( 91 ) - ( 93 )
      D12P=
             ( R1PR2 ** 2 - D12 SQ
      D23P= ( R2PR3 ** 2 - D23 SQ
                                    ) * .5
      D34P= ( R3PR4 ** 2 - D34 SQ
                                      ) * •5
                                                                           INPU 414
      D41P= ( R4PR1 ** 2 - D41 SQ ) * .5
                                                                           INPU 415
      C1P = ETA2M1 / D12P
                                                                           INPU 416
      C2P = ETA3M2 / D23P
                                                                           INPU 417
      C3P = ETA4M3 / D34P
                                                                           INPU 418
      C4P = ETA1M4 / D41P
                                                                           INPU 419
      C5P = XI1M2 / D12P
                                                                           INPU 420
```

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C6P = XI2M3 / D23P
                                                                        INPU 42
      C7P = XI3M4 / D34P
                                                                        INPU 42
      C8P = XI4M1 / D41P
                                                                        INPU 42
      R12Y = RY (1) + RY (2)
                                                                        INPU 42
      R23Y = RY (2) + RY (3)
                                                                        INPU 42
      R34Y = RY (3) + RY (4)
                                                                        INPU
      R41Y = RY (4) + RY (1)
                                                                        INPU 421
      VXX = C1P^{*} (RX (1) + RX (2)) + C2P^{*} (RX (2) + RX (3)) + INPU 42
            C3P* ( RX ( 3 ) + RX ( 4 ) ) + C4P* ( RX ( 4 ) + RX ( 1 ) ) INPU 429
      VXY = G1P* R12Y + G2F* R23Y + G3P* R34Y + G4P* R41Y
                                                                        INPU 43
      VYY = C5P* R12Y + C6P* R23Y + C7P* R34Y + C8P* R41Y
                                                                        INPU 43
                                                                        INPU 432
                                                                        INPU 433
  COMPUTE NEW NULL POINT ( XNP, YNP )
                                                                        INPU 434
C EQUATION ( 94 )
                                                                        INPU 435
                                                                        INPU 436
      XMXP = (VY * VXY - VX * VYY ) / (VXX * VYY - VXY ** 2)
                                                                        INPU 437
      XNP = XMXP + XNP
                                                                        INPU 438
      YNP = YNP - (VX + VXX * XMXP) / VXY
                                                                        INPU 439
                                                                        INPU 440
      TEST NULL POINT CONVERGENCE
                                                                        INPU 441
1590 IF ( ABS ( VX ) .LT. EPS .AND. ABS ( VY ) .LT. EPS ) GO TO 1600
                                                                        INPU 442
1591 CONTINUE
                                                                        INPU 443
      NO CONVERGENCE . USE 30TH ITERATION
                                                                        INPU 444
      CONV = 2
                                                                        INPU 445
                                                                        INPU 446
      TEST IF THIS POINT IS OUTSIDE THE ELEMENT
                                                                        INPU 447
1600 IF ( XNP ** 2 + YNP ** 2 .LE. TSQ ) GO TO 1620
                                                                        INPU 448
                                                                        INPU 449/
      CONVERGES TO POINT AT INFINITY
                                                                        INPU 450
      CONV = 1
                                                                        INPU 451
      XNULL (NULL) = XCENT
                                                                        INPU 452
      YNULL ( NULL ) = YCENT
                                                                        INPU 453
      ZNULL ( NULL ) = ZCENT
                                                                        INPU 454
      GO TO 1700
                                                                        INPU 455
                                                                        INPU 456
      TRANSFORM NULL POINT TO REFERENCE COORDINATE SYSTEM
                                                                        INPU 457
 EQUATION ( 79 ) NOTE THAT Z - COORDINATE IS ZERO
                                                                        INPU 458
 1620 XNULL ( NULL ) = XCENT + T1X + XNP + T2X + YNP
                                                                        INPU 459
      YNULL ( NULL ) = YCENT + T1Y * XNP + T2Y * YNP
                                                                        INPU 460
      ZNULL ( NULL ) = ZCENT + T1Z + XNP + T2Z + YNP
                                                                        INPU 461
                                                                        INPU 462
                                                                        INPU 463
 PRINT RESULTS -- SECTION 9.4 THE FIRST OUTPUT
                                                                        INPU 464
                                                                        INPU 465
 1700 IF ( NPRT .GE. 11 ) GO TO 1750
                                                                        INPU 466
      NPRT = NPRT + 1
                                                                        INPU 467
      IF ( I .EQ. 1 ) GO TO 1760
                                                                        INPU 468
      WRITE (6, 4005) I, XIN, NX, XNULL ( NULL), PD, CFLAG (CONV),
                                                                        INPU 469
     1 YIN, NY, YNULL (NULL), T, ZIN, NZ, ZNULL ( NULL ), AREA
                                                                        INPU 470
      GO TO 1770
                                                                        INPU 471
 1750 NPRT = 0
                                                                        INPU 472
      CALL HEADER
                                                                        INPU 473
      WRITE ( 6, 4002 )
                                                                        INPU 474
 1760 WRITE ( 6, 4010) N
                         , I, XIN, NX, XNULL ( NULL ), PD, CFLAG (CONVINPU 475
         ), YIN, NY, YNULL (NULL), T, ZÎN, NZ, ZNULL ( NULL ), ARÊÂ
                                                                        INPU 476
 1770 XNORM ( NULL ) = NX
                                                                        INPU 477
      YNORM ( NULL ) = NY
                                                                        INPU 478
      ZNORM ( NULL ) = NZ
                                                                        INPU 479
                                                                        INPU 480
```

```
C WRITE 28 QUANTITIES ON TAPE 4 AS ONE LOGICAL RECORD
                                                                           INPU 481
                                                                           INPU 482
2000 IF (LIST .EQ. 0) WRITE (4) XCENT, YCENT, ZCENT, T1X, T1Y, T1Z, INPU 483 1 T2X, T2Y, T2Z, NX, NY, NZ, XI(1), ETA(1), XI(2), ETA(2), XI(3), INPU 484
     2 XI(4), ETA(4), TSQ, AREA, IXX, IXY, IYY, D12, D23, D34, D41 INPU 485
      NLT ( KLCT ) = MMIN
                                                                           INPU 486
      NLINE (KLCT) = N
                                                                           INPU 487
      IF ( IFLAG .EQ. 0 ) GO TO 2001
                                                                           INPU 488
      IF ( N .LT. NLM1 ) GO TO 12
                                                                           INPU 489
      WRITE ( 6, 4015 )
                                                                           INPU 490
      GO TO 2025
                                                                           INPU 491
 2001 IF ( STAT .LT. 2 ) GO TO 80
                                                                           INPU 492
      NLT(KLCT) = -NLT(KLCT)
                                                                           INPU 493
      NPRT = NPRT + 1
                                                                           INPU 494
      WRITE ( 6. 4015 )
                                                                           INPU 495
                                                                           INPU 496
C TEST FOR END OF CASE
                                                                           INPU 497
 2020 IF ( STAT .NE. 3 ) GO TO 80
                                                                           INPU 498
 2025 \text{ NN1} = MOD ( 3 * NQUAD, 255 )
                                                                           INPU 499
      NQNN1 = NQUAD
                                                                          INPU 500
      IF ( NN1 .LT. 5 .AND. NN1 .GT. 0 ) NQNN1 = NQUAD + 2
                                                                           INPU 501
      IF (LIST.NE. 0) GO TO 8500
                                                                          INPU 502
      WRITE UNIT NORMALS ON TAPE 4 AS ONE LOGICAL RECORD
                                                                          INPU 503
2031 WRITE (4) (XNORM(J), YNORM(J), ZNORM(J), J = 1, NQNN1)
                                                                          INPU 504
C WRITE CONTROL TABLES ON TAPE 4 AS ONE LOGICAL RECORD
WRITE ( 4 ) KLCT, ( NLINE (J), NLT(J), J = 1, KLCT )
                                                                          INPU 505
                                                                           INPU 506
 ** WRITE NULL POINTS AND NORMALS (1 RECORD)
                                                                           INPU 507
 3632 WRITE (4) (XNULL(J), YNULL(J), ZNULL(J), XNORM(J), YNORM(J), ZNORM(J)INPU 568
     1 \cdot J = 1 \cdot NQUAD
                                                                           INPU 509
 WRITE ( 6, 3030 )
WRITE ALL NULL POINTS ON TAPE 8 (1 LOGICAL RECORD / POINT)
                                                                           INPU 510
                                                                          INPU 511
                                                                          INPU 512
2058 WRITE (8) XNULL (I), YNULL(I), ZNULL(I)
                                                                          INPU 513
                                                                           INPU 514
C
      READ IN OFF-BODY POINTS
                                                                          INPU 515
                                                                           INPU 516
      IF ( NOFF .LE. 0 ) GO TO 8000
                                                                           INPU 517
      NOFF = 0
                                                                           INPU 518
5000 NOFF = NOFF + 1
                                                                           INPU 519
      READ (5, 1) XOFF (NCFF), YOFF (NOFF), ZOFF (NCFF), STAT, X,Y,Z, STATT
                                                                           INPU 520
      IF (STAT .EQ. 3) GO TO 5100
                                                                           INPU 521
      NOFF = NOFF + 1
                                                                           INPU 522
      XOFF(NOFF) = X
                                                                           INPU 523
      YOFF(NOFF) = Y
                                                                           INPU 524
      ZOFF(NOFF) = Z
                                                                           INPU 525
      IF (STATT .NE. 3) GO TO 5000
                                                                           INPU 526
                                                                          INPU 527
      WRITE OFF-BODY POINTS ON 8 ( 1 RECORD / POINT )
                                                                          INPU 528
                                                                          INPU 529
 5100 DO 7020 I = 1, NOFF
                                                                           INPU 530
      XOFF(I) = XOFF(I) * RBETA
                                                                           INPU 531
7020 WRITE ( 8) XOFF(I), YOFF(I), ZOFF(I)
                                                                           INPU 532
                                                                          INPU 533
C
      WRITE OFF-BODY POINTS ON 4 (1 RECORD)
                                                                           INPU 534
C
                                                                          INPU 535
      WRITE (4)(XOFF(I), YCFF(I), ZOFF(I), I = 1, NOFF)
                                                                          INPU 536
                                                                          INPU 537
      WRITE (6. 63) NOFF
                                                                           INPU 538
   63 FORMAT (1H0,16X,9HTHERE ARE,14, 15H OFF-BODY POINTS )
                                                                           INPU 539
8000 REWIND 4
                                                                          INPU 540
```

```
8500 REWIND 8

C

WRITE(6, 9999) NQUAD

9999 FORMAT( 1H0 , 5X, I5, 2 EH BASIC ELEMENTS WERE INPUT)

RETURN
END

INPU 545
INPU 546
```

```
*DECK. DATPR
                                                                             DATP
                                                                                    1
      SUBROUTINE DATPROS( X, Y, Z, XX, YY, ZZ)
                                                                             DATP
                                                                                    2
C
                                                                             DATP
                                                                                    3
C
      THIS IS A SIMPLE SCALING AND ORIGIN TRANSLATION CODE FOR THE
                                                                             DATP
                                                                                    4
C
      DOUGLAS BOXC POTENTIAL FLOW CODE DATA INPUT
                                                                                    5
                                                                             DATP
C
         XTRANS, YTRANS, ZTRANS ARE ORIGIN TRANSLATIONS
                                                                                    6
                                                                             DATP
C
         XSCALE, YSCALE, ZSCALE ARE SCALE FACTORS
                                                                             DATP
                                                                                    7
C
      THE CODE ALSO ALLOWS FOR ROTATION IN THE X - Z PLANE TO ADJUST
                                                                             DATP
                                                                                    8
      FOR ARBITRARY ANGLE OF ATTACK
                                                                                    9
C
                                                                             DATP
         SINA, COSA ARE SINE AND COSINE OF ANGLE
C
                                                                             DATP
                                                                                   10
C
          ANGLE IS THE ANGLE (INPUT IN DEGREES) THAT THE AIRPLANE AXIS
                                                                             DATP
                                                                                   11
         MAKES WITH THE NEGATIVE X AXIS (POSITIVE COUNTERCLOCKWISE
C
                                                                             DATP
                                                                                   12
         FROM THE-X AXIS) AFTER SCALING ( NOTE - AFTER SCALING THE
C
                                                                             DATP
                                                                                   13
C
         AIRPLANE NOSE POINTS DOWN THE VEGATIVE X AXIS)
                                                                                   14
                                                                             DATP
C
                                                                                   15
                                                                             DATP
C
      THIS VERSION FOR USE WITH BOXC
                                                                             DATP
                                                                                   16
C
                                                                             DATP
                                                                                   17
                                                                             DATP
                                                                                   18
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                             DATP
                                                                                   19
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                             DATP
                                                                                   20
                          SINA, COSA, XSCALE, YSCALE, ZSCALE, XTRANS,
                                                                             DATP
                                                                                   21
      COMMON /PROS/
     1 YTRANS, ZTRANS
                                                                             DATP
                                                                                   22
      X = (X - XTRANS) + XSCALE
                                                                             DATP
                                                                                   23
      Y = (Y - Y TRANS) + YSCALE
                                                                                   24
                                                                             DATP
      Z = (Z - ZTRANS) + ZSCALE
                                                                             DATP
                                                                                   25
      XX= ( XX- XTRANS ) * XSCALE
                                                                             DATP
                                                                                   26
                                                                                   27
      YY= ( YY- YTRANS ) * YSCALE
                                                                             DATP
                                                                                   28
      ZZ= ( ZZ- ZTRANS ) * ZSCALE
                                                                             DATP
      XP = X
                                                                             DATP
                                                                                   29
      X = XP + COSA - Z + SINA
                                                                             DATP
                                                                                   30
      Z = XP + SINA + Z + GOSA
                                                                             DATP
                                                                                   31
      XP = XX
                                                                             DATP
                                                                                   32
      XX= XP * COSA - ZZ* SINA
                                                                             DATP
                                                                                   33
      ZZ= XP * SINA + ZZ* COSA
                                                                                   34
                                                                             DATP
      RETURN
                                                                             DATP
                                                                                   35
                                                                             DATP
      END
                                                                                   36
```

```
*DECK, FLOWS
                                                                             FLOW
                                                                                     1
      SUBROUTINE FLOWS
                                                                             FLOW
                                                                                     2
C
      SUBROUTINE FLOWS (NU, NNON )
                                                                             FLOW
                                                                                     3
      COMMON /FLOWP/ NU, NNCN
                                                                                     4
                                                                             FLOW
     · COMMON HEDR(15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFL CW, NQUAD,
                                                                                     5
                                                                             FLOW
     1 KASE NOFF NSYM IFLAG IFLOW NOODE
                                                                                     6
                                                                             FLOW
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                                     7
                                                                             FLOW
      COMMON /DFLOW/ AFLCW, BFLOW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW FLOW
      COMMON / FLOW / NQ, NL, KFLOW, VX(2000), VY(2000), VZ(2000),
                                                                                     9
                                                                             FLOW
                                                 VNC (1000)
                                                                             FLOW
                                                                                    10
       COMMON /NORMS/ XNCRM(1000), YNORM(1000), ZNORM(1000)
                                                                             FLOW
                                                                                    11
   31 FORMAT ( 311 )
                                                                             FLOW
                                                                                    12
   40 FORMAT( 6F10.8 )
                                                                             FLOW
                                                                                    13
 9999 FORMAT (1H0,5X 16HFLOWS HAS SET UP.
                                                                             FLOW
                                                                                    14
     1 I3, 11H X FLOWS, I3, 15H Y FLOWS, AND I3, 11H Z FLOWS.)
                                                                             FLOW
                                                                                    15
      NAFLOW = 0
                                                                             FLOW
                                                                                    16
      NBFLOW = 0
                                                                             FLOW
                                                                                    17
      NCFLOW = 0
                                                                             FLOW
                                                                                    18
      NMAT = 0
                                                                             FLOW
                                                                                    19
      NQ = NQUAD + NOFF
                                                                             FLOW
                                                                                    20
      NL = NQUAD
                                                                             FLOW
                                                                                    21
      NN = MOD(3 + NQ , 255)
                                                                             FLOW
                                                                                    22
      IF ( NN .LT. 5 .ANC. NN .GT. 0 ) NQ = NQ + 5
                                                                             FL.OW
                                                                                    23
      KFLOW = 0
                                                                             FLOW
                                                                                    24
      NN = MOD(NQUAD, 255)
                                                                             FLOW
                                                                                    25
      IF ( NN .LT. 5 .AND. NN .GT. 0) NL = NL + 5
                                                                             FLOW
                                                                                    26
      IF (NNON .GT. 0) GC TO 140
                                                                                    27
                                                                             FLOW
      IF (NU .GT. 0) GO TO 50
                                                                                    28
                                                                             FLOW
      WRITE (6, 115)
                                                                             FLOW
                                                                                    29
  115 FORMAT (1H1,6X,24HNO ONSET FLOWS SPECIFIED )
                                                                             FLOW
                                                                                    30
      STOP
                                                                             FLOW
                                                                                    31
   50 IF ( .NOT. AFLOW ) GC TO 60
                                                                             FLOW
                                                                                    32
      KFLOW = 1
                                                                             FLOW
                                                                                    33
      GO TO 180
                                                                             FLOW
                                                                                    34
   60 IF ( .NCT. BFLOW ) GC TO 70
                                                                             FLOW
                                                                                    35
      KFLOW = 2
                                                                             FLOW
                                                                                    36
      GO TO 100
                                                                             FLOW
                                                                                    37
   70 IF ( CFLOW ) GO TO 90
                                                                             FLOW
                                                                                    38
      IF (KFLOW .NE. 0) GO TO 4000
                                                                             FLOW
                                                                                    39
      WRITE ( 6, 80 )
                                                                             FLOW
                                                                                    40
   80 FORMAT ( 1H1,6X,12HINPUT ERROR, 5X,25HNO FLOW MATRIX SPECIFIED. ) FLOW
                                                                                    41
      STOP
                                                                             FLOW
                                                                                    42
   90 \text{ KFLOW} = 3
                                                                             FLOW
                                                                                    43
  100 CALL UNIFRM
                                                                             FLOW
                                                                                    44
      IF (KFLOW - 2) 60, 70, 4000
                                                                                    45
                                                                             FLOW
                                                                             FLOW
                                                                                    46
C
      THIS SECTION SETS UP THE NON-UNIFORM ONSET FLOWS
                                                                             FLOW
                                                                                    47
                                                                             FLOW
                                                                                    48
  140 DO 3000 N = 1, NNON
                                                                             FLOW
                                                                                    49
      IERR = 0
                                                                             FLOW
                                                                                    50
                                                                             FLOW
                                                                                    51
 -- THE FLAGS READ IN HERE HAVE THE FOLLOWING VALUES...
C
                                                                             FLOW
                                                                                    52
C
                                                                                    53
                                                                             FLOW
C
          FLAG
                                     MEANING
                                                                             FLOW
                                                                                    54
C
                                                                             FLOW
                                                                                    55
C
                                                                             FLOW
                                                                                    56
C
                                    FLOW MATRIX-ASSOCIATION FLAG
          KFL
                                                                             FLOW
                                                                                    57
C
                                    1 X-FLOW, 2 Y-FLOW, 3 Z-FLOW
                                                                             FLOW
                                                                                    58
C
                                                                                    59
                                                                             FLOW
          KUN
                                    O NON-UNIFORM FLOW, 1 UNIFORM FLOW
                                                                             FLOW
                                                                                    60
```

```
C
                                                                           FLOW
                                                                                  61
C
                                                                                  62
          KTYPE
                                   O INPUT FLOW VELOCITY COMPONENTS,
                                                                           FLOW
C
                                   1 INPUT FLOW NORMAL VELOCITY
                                                                           FLOW
                                                                                  63
                                                                           FLOW
                                                                                  64
      READ ( 5, 31 ) KFL, KUN, KTY E
                                                                           FLOW
                                                                                  65
      KTEST = KFL - KFLOW
                                                                           FLOW
                                                                                  66
      IF (KTEST) 145, 220, 150
                                                                           FLOW
                                                                                  67
  145 WRITE (6, 146) KFLOW, *FL
                                                                           FLOW
                                                                                  €8 $
  146 FORMAT (15H1+++++NOTE+++++ / 25HCAN INPUT FLOW FOR MATRIX, I3,
                                                                           FLOW
                                                                                  69
     1 38H PHYSICALLY PRECEDED A FLOW FOR MATRIX.13 /
                                                                           FLOW
                                                                                  70 $
     2 26HOTHIS FLOW MUST BE SKIPPED //)
                                                                           FLOW
                                                                                  71
      IERR = 1
                                                                                 72
73
                                                                           FLOW
      GO TO 220
                                                                           FLOW
  150 IF (NU) 155, 155, 152
                                                                                 74
75
                                                                           FLOW
  152 IF (KTEST - 2) 170, 153, 160
                                                                           FLOW
  153 IF (KFL - 2) 145, 160, 161
                                                                           FLOW
                                                                                  76
  155 KFLOW = KFL
                                                                           FLOW
                                                                                  77
  156 IF (KFLOW - 2) 157, 158, 159
                                                                           FLOW
                                                                                  78
  157 AFLOW = .TRUE.
                                                                           FL.OW
                                                                                  79
      GO TO 220
                                                                           FLOW
                                                                                  80
  158 BFLOW = .TRUE.
                                                                           FLOW
                                                                                  81
      GO TO 220
                                                                           FLOW
                                                                                  82
  159 CFLOW = .TRUE.
                                                                           FLOW
                                                                                  83
      GO TO 220
                                                                           FLOW
                                                                                  84
  160 IF (.NOT. AFLOW) GC TO 161
                                                                           FLOW
                                                                                  85
      KFLOW = 1
                                                                           FLOW
                                                                                  86
      CALL UNIFRM
                                                                           FLOW
                                                                                  87
  161 IF (.NOT. BFLOW) GO TO 162
                                                                           FLOW
                                                                                 88
      KFLOW = 2
                                                                           FLOW
                                                                                  89
      CALL UNIFRM
                                                                           FLOW
                                                                                  90
  162 KFLOW = KFL
                                                                           FLOW
                                                                                  91
      IF (KFLOW .EQ. 2) GO TO 158
                                                                           FLOW
                                                                                  92
      IF (CFLOW) GO TO 200
                                                                           FLOW
                                                                                  93
      GO TO 159
                                                                           FLOW
                                                                                 94
  170 KFLOW = KFL
                                                                           FLOW
                                                                                  95
      IF (NU .EQ. () GO TO 156
                                                                           FLOW
                                                                                  96
      IF (KFLOW - 2) 175, 180, 185
                                                                           FLOW
                                                                                  97
  175 IF (AFLOW) GO TO 200
                                                                           FLOW
                                                                                 98
      GO TO 157
                                                                           FLOW
                                                                                 99
  180 IF (BFLOW) GO TO 200
                                                                           FLOW 100
      GO TO 158
                                                                           FLOW 101
  185 IF (CFLOW) GO TO 200
                                                                           FLOW 102
      GO TO 159
                                                                           FLOW 103
  200 CALL UNIFRM
                                                                           FLOW 104
  220 NVREAD = NQUAD
                                                                           FLOW 105
      IF (KUN .GT. 0) NVREAD = 1
                                                                           FLOW 186
      IF ( KTYPE .NE. 0 ) GO TO 222
                                                                          FLOW 107
      READ ( 5, 40 ) ( VX(I), VY(I), VZ(I), I = 1, NVREAD )
                                                                          FLOW 108
      GO TO 224
                                                                          FLOW 109
  222 READ ( 5, 40 ) ( VNC(I), I = 1, NVREAD )
                                                                           FLOW 110
      DO 223 I = 1, NQUAD
                                                                           FLOW 111
      VX(I) = 0.0
                                                                          FLOW 112
      VY(I) = 0.0
                                                                          FLOW 113
  223 \ VZ(I) = 0.0
                                                                           FLOW 114
  224 IF ( IERR .NE. 0 ) GO TO 1200
                                                                           FLOW 115
      NVREAD = NQUAD + NCFF
                                                                           FLOW 116
      IF (KUN .LE. 0) IF (NOFF) 240, 240, 230
                                                                           FLOW 117
      DO 225 NV = 2, NVREAD
                                                                           FLOW 118
      VX(NV) = VX(1)
                                                                           FLOW 119
      VY(NV) = VY(1)
                                                                           FLOW 120
```

```
225 VZ(NV) = VZ(1)
                                                                         FLOW 121
      GO TO 240
                                                                         FLOW 122
  230 \text{ NQP1} = \text{NQUAD} + 1
                                                                         FLOW 123
      DO 235 NV = NQP1, NVREAD
                                                                         FLOW 124
      VX(NV) = 0.0
                                                                        FLOW 125
      VY(NV) = 0.1
                                                                         FLOW 126
  235 VZ(NV) = 0.0
                                                                         FLOW 127
  240 IF ( KFLOW - 2 ) 600, 700, 800
                                                                         FLOW 128
  600 NAFLOW = NAFLOW + 1
                                                                         FLOW 129
      GO TO 900
                                                                         FLOW 130
  700 NBFLOW = NBFLOW + 1
                                                                         FLOW 131
      GO TO 900
                                                                         FLOW 132
  800 NCFLOW = NCFLOW + 1
                                                                         FLOW 133
  900 IF ( KTYPE .NE. 0 ) GO.TO 1075
                                                                         FLOW 134
      DO 1050 J = 1, NQUAD
                                                                        FLOW 135
 1050 VNC (J) = VX(J)*XNORM(J) + VY(J)*YNORM(J) + VZ(J)*ZNCRM(J)
                                                                        FLOW 136
 1075 WRITE ( 3 ) KFLOW, (VX(K), VY(K), VZ(K), K = 1, NQ)
                                                                        FLOW 137
 1100 WRITE (3) ( VNC(K), K = 1, NL)
                                                                        FLOW 138
                                                                         FLOW 139
      READ IN FIRST GUESSES FOR THE SIGNAS
                                                                        FLOW 140
 1200 IF ( ISIG ) 3000, 3000, 1600
                                                                        FLOW 141
1600 READ (5, 40) ( VNC(K), K = 1, NQUAD )
                                                                        FLOW 142
                                                                        FLOW 143
      WRITE SIGMA GUESSES ON TAPE 3 AS DNE LOGICAL RECORD
                                                                        FLOW 144
                                                                        FLOW 145
      IF (IERR \cdot EQ\circ 0) WRITE (3) (VNC(J), J = 1, NL)
                                                                        FLOW 146
 3000 CONTINUE
                                                                        FLOW 147
      IF (NU .NE. 0) IF (KFLOW - 2) 60, 70, 4000
                                                                         FLOW 148
 4000 REWIND 3
                                                                         FLOW 149
      IF ( AFLOW ) NMAT = 1
                                                                         FLOW 150
      IF ( BFLOW ) NMAT = NMAT + 1
                                                                         FLOW 151
      IF ( CFLOW ) NMAT = NMAT + 1
                                                                         FLOW 152
      NMATM1 = NMAT - 1
                                                                         FLOW 153
      NFLOW = NAFLOW + NBFLOW + NCFLOW
                                                                         FLOW 154
      WRITE(6, 9999) NAFLOW, NBFLOW, NCFLOW
                                                                         FLOW 155
C
      RETURN
                                                                         FLOW 156
      END
                                                                         FLOW 157
```

```
*DECK, UNIFRH
                                                                              UNIF
      SUBROUTINE UNIFRM
                                                                                      2
                                                                              UNIF
                                                                              UNIF
                                                                                      3
C
          SPECIAL FOR LEAKY QUADS *****
                                                                              UNIF
C
                                                                              UNIF
                                                                                      5
      COMMON / FLOW / NQ, NL, KFLOW, VX(2000), VY(2000), VZ(2000).
                                                                              UNIF
                                                                                      6
     1 VNC(1000)
                                                                              UNIF
                                                                                      7
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                              UNIF
                                                                                      8
      COMMON /DFLOW/ AFLOW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW UNIF
                                                                                      9
      COMMON /NORMS/ XNORM(1800), YNORM(1800), ZNORM(1000)
                                                                              UNIF
                                                                                     10
      COMMON HEDR (15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                              UNIF
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                              UNIF
                                                                                     12
      COMMON /QLEAK/ LEAK, FRACT
                                                                              UNIF
                                                                                     13
                                                                              UNIF
                                                                                     14
C
      THIS ROUTINE SETS UP THE UNIFORM DNSET FLOWS. FOR THESE FLOWS IT UNIF
                                                                                     15
C
       IS ONLY NECESSARY TO HAVE TWO VELOCITY MATRICES, ONE ALL ZERCES
                                                                              UNIF
                                                                                     16
       AND THE OTHER ALL ONES. WE SHALL FILL VX WITH 0"S AND VY WITH 1"S. UNIF
C
                                                                                     17
                                                                              UNIF
                                                                                     18
      DO 10 I = 1, NQ
                                                                              UNIF
                                                                                     19
      VX(I) = 0.0
                                                                              UNIF
                                                                                     20
   10 \text{ VY(I)} = 1.0
                                                                              UNIF
                                                                                     21
                                                                              UNIF
                                                                                     22
C
      NOW WE'LL TEST "KFLOW" TO DETERMINE WHAT FLOW TO SET UP FOR.
                                                                                     23
                                                                              UNIF
                                                                              UNIF
                                                                                     24
      IF ( KFLOW - 2 ) 20, 30, 40
                                                                              UNIF
                                                                                     25
                                                                              UNIF
                                                                                     26
C
      THIS PORTION SETS UP FOR "A" FLOW.
                                                                              UNIF
                                                                                     27
                                                                              UNIF
                                                                                     28
   20 NAFLOW = 1
                                                                              UNIF
                                                                                     29
      WRITE ( 3 ) KFLOW, ( VY(I), VX(I), VX(I), I = 1, NQ )
                                                                              UNIF
                                                                                     30
C
                                                                              UNIF
                                                                                     31
C
      THIS IS A PATCH TO PROVICE FOR LEAKY QUADS. THESE MUST BE THE
                                                                              UNIF
                                                                                     32
C
       FIRST QUADS IN THE TABLE. THEY LEAK AT A FRACTION FRACT OF THE
                                                                              UNIF
                                                                                     33
C
      FREE-STREAM RATE. DNLY THE A FLOW IS PROVIDED FOR HERE.
                                                                              UNIF
                                                                                     34
C
                                                                              UNIF
                                                                                     35
C
      LEAK = NO. OF LEAKY QUADS
                                                                              UNIF
                                                                                     36
C
                                                                              UNIF
                                                                                     37
       IF( LEAK .GT. 0 ) GO TO 21
                                                                              UNIF
                                                                                     38
      WRITE( 3) ( XNORM(I), I=1,NL)
                                                                              UNIF
                                                                                     39
      GO TO 50
                                                                                     40
                                                                              UNIF
   21 DO 22 I=1, LEAK
                                                                              UNIF
                                                                                     41
   22 VZ(I) = XNORM(I) + FRACT
                                                                              UNIF
                                                                                     42
      IF ( LEAK .GE. NL ) GO TO 25
                                                                              UNIF
                                                                                     43
      LEAKP = LEAK + 1
                                                                              UNIF
                                                                                     44
      DO 24 I=LEAKP, NL
                                                                              UNIF
                                                                                     45
   24 VZ(I) = XNORM(I)
                                                                              UNIF
                                                                                     46
   25 WRITE( 3 ) ( VZ(I), I=1,NL )
                                                                              UNIF
                                                                                     47
       DO 26 I=1.NL
                                                                              UNIF
                                                                                     48
   26 \ VZ(I) = 0.0
                                                                              UNIF
                                                                                     49
      GO TO 50
                                                                              UNIF
                                                                                     50
                                                                              UNIF
                                                                                     51
C
       THIS PORTION SETS UP FOR "B" FLOW.
                                                                              UNIF
                                                                                     52
                                                                              UNIF
                                                                                     53
   30 \text{ NBFLOW} = 1
                                                                              UNIF
                                                                                     54
       WRITE ( 3 ) KFLCW, ( VX(I), VY(I), VX(I), I = 1, NQ)
                                                                              UNIF
                                                                                     55
       WRITE (3) ( YNORM(I), I = 1, NL)
                                                                              UNIF
                                                                                     56
       GO TO 50
                                                                              UNIF
                                                                                     57
                                                                              UNIF
                                                                                     58
       THIS PORTION SETS UP FOR "C" FLOW.
                                                                                     59
                                                                              UNIF
                                                                              UNIF
                                                                                     60
```

```
UNIF
   40 NCFLOW = 1
                                                                                  61
      WRITE ( 3 ) KFLOW, ( VX(I), VX(I), VY(I), I = 1, NQ )
                                                                           UNIF
                                                                                  62
      WRITE (3) (ZNORM(I), I = 1, NL)
                                                                           UNIF
                                                                                  63
                                                                           UNIF
                                                                                  64
C
      CHECK FOR INPUT SIGMAS.
                                                                           UNIF
                                                                                  65
                                                                           UNIF
                                                                                  66
                                                                           UNIF
      IF ( ISIG .EQ. 0 ) RETURN
                                                                                  67
                                                                           UNIF
                                                                                  68
C
      READ THE SIGNA GUESSES INTO VZ.
                                                                           UNIF
                                                                                  69
                                                                           UNIF
                                                                                  70
      READ ( 5, 60 ) ( VZ(I), I = 1, NGUAD )
                                                                           UNIF
                                                                                  71
   60 FORMAT ( 6F10.8 )
                                                                           UNIF
                                                                                  72
                                                                           UNIF
                                                                                  73
C
      WRITE SIGMAS ON TAPE 3 AS ONE LOGICAL RECORD AND HANG IT UP. *TMR*UNIF
                                                                                  74
                                                                           UNIF
                                                                                  75
      WRITE (3) (VZ(I), I = 1, NL)
                                                                           UNIF
                                                                                  76
      RETURN
                                                                           UNIF
                                                                                  77
      END
                                                                           UNIF
                                                                                  78
*DECK. VFORM
                                                                           VF OR
                                                                           VFOR
      SUBROUTINE VFORM
                                                                                   3
      REAL M12, M23, M34, M41 , IXX, IXY, IYY
                                                                            VFOR
                                                                           VFOR
      INTEGER TAPES
                                                                                   4
                                                                                   5
                                                                            VF OR
                                                                                   6
      LOGICAL AFLOW, BFLOW, CFLOW
                                                                            VFOR
                                                                                   7
      DIMENSION NTAPE (3). 041 (335),
                                                                            VFOR
     1 XIJ1 (335), XIJ2 (335), XIJ3 (335), YIJ1 (335), YIJ2 (335),
                                                                           VFOR
                                                                                   8
     2 YIJ3 (335), ZIJ1 (335), ZIJ2 (335), ZIJ3 (335), XX1 ( 1340),
                                                                            VFOR
                                                                                   9
     3 XX2 (1340), XX3(1340), YY1(1340), YY2(1340), YY3(1340), ZZ1(1340),
                                                                           VFOR
                                                                                  19
     4 ZZ2(1340), ZZ3(1340), X(8), Y(8), Z(8), XC(335), YC(335), ZC(335), VFOR
     5 A11(335), A12 (335), A13 (335), A21(335), A22(335), A23(335),
                                                                            VFOR
                                                                                  12
     6 A31(335), A32 (335), A33 (335), XI1(335), XI2(335), XI3(335),
                                                                            VFOR
                                                                                  13
     7 XI4(335), ETA1(335), ETA2 (335), ETA4(335), TSQ(335), A (335),
                                                                            VFOR
                                                                                  14
     8 IXX(335), IXY (335), IYY (335), D12 (335), D23(335), D34(335)
                                                                            VFOR
                                                                                  15
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                            VFOR
                                                                                  16
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCOBE
                                                                            VFOR
                                                                                  17
      EQUIVALENCE ( XIJ1, YY1 (1) ), ( XC, YY1 (336) ), ( YC, YY1 (671)), VFOR
                                                                                  18
        ( ZC, YY1(1006) ), ( ETA4, XX1 ( 1 ) ), ( YIJ1, XX1 ( 336 ) ),
                                                                            VFOR
                                                                                  19
        ( XIJ2, YY2 (1) ), ( YIJ2, YY2 ( 336 )), ( A11, YY2 ( 671)),
                                                                            VFOR
                                                                                  20
        ( A12 , YY2 (1006)), ( A13, XX1 (671)), ( TSQ, XX1 ( 1006 )),
                                                                            VFOR
                                                                                  21
                              ( A22, YY3 ( 336)), ( A23, YY3 ( 671)),
        ( A21, YY3 (1) ) .
                                                                            VFOR
                                                                                  22
                               (XIJ3, XX2 ( 1)), ( YIJ3, XX2 ( 336) ),
        ( A . YY3 (100 E)).
                                                                            VFOR
                                                                                  23
                ZZ1 (1) ) ,
        (ZIJ1,
                                (A31 , ZZ1 (336 1), (A32 , ZZ1 ( 671)),
                                                                            VFOR
                                                                                  24
        ( A33,
                 ZZ1 (100 ()).
                                ( IXX, XX2 ( 671)), ( D12, XX2 (1906) ), VFOR
                                                                                  25
                 ZZ2 (1) ) ,
                               ( XI1, ZZ2 (336 )), ( XI2, ZZ2 ( 671)),
        (ZIJ2.
                                                                            VFOR
                                                                                  26
                              (IXY, XX3 (1)), (D23, XX3 (336)),
                                                                            VFOR
        (XI3.
                 ZZ2 (1006)).
                                                                                  27
               ZZ3 ( 1 ) ) , ( ZIJ3, ZZ3(336 )), (XI4, ZZ3 ( 67.1)),
                                                                            VF OR
        (D34,
                                                                                  28
        ( ETA1.ZZ3 ( 1006)), ( ETA2, XX3 (671)), ( IYY, XX3 ( 1006))
                                                                            VF OR
                                                                                  29
      COMMON /DFLOW/ AFLOW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLCW, NCFLO / VFOR
                                                                                  30
            RH01SQ, RH02SQ / 6.0, 16.0 /
                                                                            VF OR
      DATA
                                                                                  31
       DATA
               NTAPE
                                          / 1 , 11 , 12 /
                                                                            VF CR
                                                                                  32
 4004 FORMAT ( 1H0, 3HROW, 15,5), 6HX-FLOW)
                                                                            VFOR
                                                                                  33
 4005 FORMAT ( 1H0, 3HROW, 15, 5X, 6HY-FLDW)
                                                                            VFOR
                                                                                  34
 4006 FORMAT ( 1H0, 3HROW, 15, 5X, 6HZ-FLOW)
                                                                            VFOR
                                                                                  35
      INEAR = 0
                                                                            VFOR.
                                                                                  36
                                                                            VFOR
      INTERM = 0
                                                                                  37
```

```
IFAR = 0
                                                                        VFOR
                                                                              38
  10 IF ( NSYM - 1 ) 58, 52, 54
                                                                        VF OR
                                                                              39
  52 ASSIGN 2100 TO 129
                                                                        VF OR
                                                                              40
     ASSIGN 910 TO I19
                                                                        VF OR
                                                                              41
     GO TO 60
                                                                        VFOR
                                                                              42
  54 ASSIGN 2200 TO 129
                                                                        VFOR
                                                                              43
     IF ( NSYM .EQ. 3 ) GO TO 56
                                                                        VF OR
                                                                              44
     ASSIGN 920 TO I19
                                                                        VFOR
                                                                              45
     GO TO 60
                                                                        VFOR
                                                                              46
  56 ASSIGN 930 TO 119
                                                                        VFOR
                                                                              47
     GO TO 60
                                                                        VFOR
                                                                              48
  58 ASSIGN 2000 TO I19
                                                                       VFOR
                                                                              49
  60 LOOP = 2 ** NSYM + 1
                                                                        VFOR
                                                                              50
     NEL = NGUAD / 3
                                                                        VFOR
                                                                              51
     NELL = NEL
                                                                        VFOR
                                                                              52
     NELP = NEL
                                                                       VFOR
                                                                              53
     NREM = MOD ( 3 * NEL + 1, 255 )
                                                                       VFOR
                                                                              54
     IF ( NREM .LT. 5 .ANC. NREM .GT. ) NELP = NEL + 5
                                                                       VFOR
                                                                              55
     NON = NQUAD + NOFF
                                                                       VFOR
                                                                              56
     00 8000 M = 1, 3
                                                                        VFOR
                                                                              57
     KROW = 0
                                                                       VFOR
                                                                              58
 201 NT = NTAPE ( M )
                                                                       VFOR
                                                                              59
 202 IF (M .NE. 3) GO TO 300
                                                                       VFOR
                                                                              60
     NEL = NQUAD - 2 * NEL
                                                                       VFOR
                                                                              61
     NELP = NEL
                                                                       VFOR
                                                                              62
     NREM = MOD ( 3 + NEL + 1 , 255 )
                                                                       VFOR
                                                                              63
                                                                       VFOR
     IF ( NREM .LT. 5 .AND. NREM .GT. 3) NELP = NEL + 5
                                                                              64
                                                                       VFOR
                                                                              65
READ 28 QUANTITIES
                                                                        VFOR
                                                                              66
                                                                        VF OR
                                                                              67
 300 DO 500 J = 1, NEL
                                                                       VFOR
                                                                              68
 500 READ (4) XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                       VF心险
                                                                              69
    1 A22(J), A23(J), A31(J), A32(J), A33(J), X11(J), E1A1(J), X12( VFOR
                                                                              70
    2 \text{ J}), ETA2(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A(J), IXX(J), VFOR
                                                                              71
    3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J)
                                                                       VFOR
                                                                              72
 800 KROW = KROW + 1
                                                                       V F OR
                                                                              73
     READ ( 8 ) XNPP, YNPP, ZNPP
                                                                       VFOR
                                                                              74
     DO 2300 I1 = 1, NEL
                                                                       ∀FOR
                                                                              75
     DO 1700 I2 = 1, LOOP
                                                                       VFOR
                                                                              76
     IF ( I2 .EQ. LOOP ) GO TO I19, ( 2)00, 910, 929, 930 )
                                                                       VFOR
                                                                              77
     GO TO (1000, 910, 920, 910, 930, 910, 920, 910 ), I2
                                                                       VFOR
                                                                              78
910 YC ( I1 ) = - YC ( I1 )
                                                                       VFOR
                                                                              79
     A12 (I1) = -A12 (I1)
                                                                       VFOR
                                                                              80
     A22 (I1) = - A22 (I1)
                                                                       VFOR
                                                                              81
     A31 (I1) = -A31 (I1)
                                                                        VF OR
                                                                              82
     A33 (I1) = - A33 (I1)
                                                                       VFOR
                                                                              83
     GO TO 932
                                                                        VFOR
                                                                              84
 920 \ ZC \ (I1) = - ZC \ (I1)
                                                                        VFOR
                                                                              85
     A13 ( I1 ) = - A13 ( I1 )
                                                                        VF OR
                                                                              86
     A23 (I1) = - A23 (I1)
                                                                        VFOR
                                                                              87
     A31 (I1) = - A31 (I1)
                                                                        VFOR
                                                                              88
     A32 (I1) = -A32 (I1)
                                                                       VFOR
                                                                              89
     GO TO 932
                                                                        VFOR
                                                                              90
930 \times (I1) = - \times (I1)
                                                                       VFOR
                                                                              91
     A11 ( I1 ) = - A11 ( I1 )
                                                                       VFOR
                                                                              92
     A21 (I1) = - A21 (I1)
                                                                       VFOR
                                                                              93
     A32 (I1) = -A32 (I1)
                                                                       VFOR
                                                                              94
     A33 (I1) = -A33 (I1)
                                                                       VF OR
                                                                              95
932 IF ( I2 .EQ . LOOP ) GO TO I29, ( 2100, 2200
                                                       )
                                                                       VFOR
                                                                              96
1000 XDIF = XNPP- XC ( I1 )
                                                                        VFOR
                                                                              97
```

```
YDIF = YNPP- YC ( I1 )
                                                                            VF OR
                                                                                  98
      ZDIF = ZNPP- ZC ( I1 )
                                                                            VFOR
                                                                                  99
                                                                            VFOR 100
   COMPUTE DISTANCE FROM NULL FOINT TO DRIGIN OF J-TH ELEMENT COORDINATEVFOR 101
      SYSTEM ( J GORRESPONDS TO THE INDEX I1 )
                                                                            VF OR 102
                                                                            VFOR 103
  INEQUALITY ( 98 )
                                                                            VFOR 184
                                                                            VFOR 105
      ROSQ = XDIF ** 2 + YDIF ** 2 + ZBIF ** 2
                                                                           VF OR 106
      IF ( ROSQ .LT. RH02SQ * TSQ ( I1 ) ) GO TO 1400
                                                                           VFOR 107
                                                                           VFOR 188
 COMPUTE INDUCED VELOCITY COMPONENTS
                                                                           VFOR 109
C EQUATION (97)
                                                                           VF OR 110
                                                                           VFOR 111
      IFAR = IFAR + 1
                                                                            VFOR 112
      ARG1 = A ( I1) / SQRT ( ROSQ ) ** 3
                                                                           VFOR 113
      X = (I2) = ARG1 + XDIF
                                                                            VFOR 114
          (I2) = ARG1 + YDIF
                                                                            VFOR 115
      Z
         (I2) = ARG1 + ZDIF
                                                                            VFOR 116
      GO TO 1700
                                                                            VFOR 117
                                                                           VFOR 118
  TRANSFORM NULL POINT TO J - ELEMENT COORDINATE SYSTEM
                                                                           VFOR 119
C EQUATION (78)
                                                                            VFOR 120
                                                                            VFOR 121
                                                                           VFOR 122
1400 XNP = A11 ( I1 ) * XDIF + A12 ( I1 ) * YDIF + A13 ( I1 ) * ZCIF
                                                                           VFOR 123
      YNP = A21 ( I1 ) * XDIF + A22 ( I1) * YDIF + A23 (I1)*ZDIF
                                                                           VFOR 124
      ZNP = A31 ( I1 ) * XDIF * A32 ( I1 ) * YUIF * A33 ( I1 ) * ZDIF
                                                                           VFOR 125
                                                                           VFOR 126
   INEQUALITIES ( 99) AND ( 100 )
                                                                           VFOR 127
      IF ( ROSQ .LT. RH01SQ * TSQ ( I1 ) ) GO TO 1410
                                                                           VFOR 128
                                                                           VFOR 129
C COMPUTE INDUCED VELOCITY COMPONENTS
                                                                           VFOR 130
  EQUATIONS (57) - (62)
                                                                           VFOR 131
                                                                           VFOR 132
      INTERM = INTERM + 1
                                                                           VFOR 133
      P = YNP **2 + ZNP ** 2 ~ 4.0 * XNP ** 2
QP= XNP **2 + ZNP ** 2 - 4.0 * YNP ** 2
                                                                           VFOR 134
                                                                           VFOR 135
      RO = SQRT (ROSQ)
                                                                           VFOR 136
      ROP = RO ** (- 7)
                                                                           VFOR 137
      WXXX = XNP + (9.0 + P + 30.0 + XNP + 2) + ROP
                                                                           VFOR 138
      WXXY = 3.0 + P + RCP + YNP
                                                                           VFOR 139
      WXYY = 3.0 * XNP * QP * ROP
                                                                           VFOR 140
      W YYY = YNP + ( 9.1 + QP + 30.0 + YNP ++ 2 ) + ROP
                                                                           VFOR 141
      WXXZ = 3.0 * ZNP * P * ROP
                                                                           VFOR 142
      WXYZ
             = - 15.0 * XNP * YNP * ZNP * ROP
                                                                           VFOR 143
      WYYZ = 3.0 * ZNP * QP * ROP
                                                                           VFOR 144
      ROP = - RO + ( - 3)
                                                                           VFOR 145
      WX = ROP * XNP
                                                                           VFOR 146
      WY = ROP * YNP
                                                                            VFOR 147
      WZ = ROP * ZNP
                                                                            VFOR 148
      HIXX = .5 + IXX ( I1 )
                                                                           VFOR 149
      HIYY = .5 * IYY ( I1 )
                                                                           VFOR 150
      HIYY = .5 T IYY ( II ) - WXXX*HIXX - WX*A( I1)

VX = - WYYY*HIYY - WXYY*IXY( I1) - WXXX*HIXX - WX*A( I1)

VZ = - WYYZ*HIYY - WXYZ*IXY( I1) - WXXZ*HIXX - WZ*A( I1)
                                                                           VFOR 151
                                                                          VFOR 152
                                                                           VFOR 153
      GO TO 1600
                                                                           VFOR 154
                                                                           VFOR 155
 COMPUTE INDUCED VELOCITY COMPONENTS
                                                                            VFOR 156
   EQUATIONS ( 42 ) - ( 49 )
                                                                            VFUR 157
```

```
VFOR 158
1410 ETA 4M3 = ET A4 ( I1) - ETA1 ( I1 )
                                                                          VF OR 159
     INEAR = INEAR + 1
                                                                          VFOR 160
     RO = SQRT (ROSQ)
                                                                          VFOR 161
     ETA2M1 = ETA2 ( I1 ) - ETA1 ( I1 )
                                                                          VFOR 162
     XI4M3 = XI4 (I1) - XI 3 (I1)
                                                                          VFOR 163
     XI2M1 = XI2 (I1 ) - XI1 ( I1 )
                                                                          VFOR 164
     XI3M2 = XI3 (I1) - XI2 (I1)
                                                                          VFOR 165
     XI1M4 = XI1 ( I1 ) - XI4 ( I1 )
                                                                          ¥FOR 166
     XMXI 1 = XNP - XI1 ( I1 )
                                                                          VFOR 167
     XMXI2 = XNP - XI2 ( I1 )
                                                                          VFOR 168
     XMXI3 = XNP - XI3 ( I1 )
                                                                          VFOR 169
     XMXI4 = XNP - XI4 ( I1 )
                                                                          VFOR 170
     YMETA1= YNP - ETA1 ( I1 )
                                                                          VFOR 171
     YMETA 2 = YNP - ETA2 (I1)
                                                                          VFOR 172
     YMETA 4 = YNP - ETA4 ( I1 )
                                                                          VFOR 173
       ZNPSQ = ZNP * ZNP
                                                                          VFOR 174
     IF ( ZNPSQ .LT. TSQ ( I1 ) * 1.0E-6 ) ZNPSQ = 0.0
                                                                          VFOR 175
     E1 = ZNPSQ + XMXI1 ++2
                                                                          VFOR 176
     E2 = ZNPSQ + XMXI2 **2
                                                                          VFOR 177
     E3 = ZNPSQ + XMXI3 **2
                                                                          VFOR 178
     E4 = ZNPSQ + XMXI4 + 2
                                                                          VFOR 179
     H1 = YMETA1 + XMXI1
                                                                          VFOR 180
     H2 = YMETA2 + XMXI2
                                                                          VFOR 181
     H3 = YMETA1 * XMXI3
                                                                          VFOR 182
     H4 = YMETA4 * XMXI4
                                                                          VFOR 183
     M12 = 0.0
                                                                          VFOR 184
     IF ( XI2M1 \cdotNE \cdot 0 \cdot C) M12 = ETA2M1 / XI2M1
                                                                          VFOR 185
     M23 = 0.0
                                                                          VFOR 186
     IF ( X \times 13M2 \cdot NE \cdot 0 \cdot 0) M23 = - ETA2M1 / XI3M2
                                                                          VFOR 187
     M34 = 0.0
                                                                          VFOR 188
     IF ( XI4M3 .NE. 0.0) M34 = ETA4M3 / XI4M3
                                                                          VFOR 189
     M41 = 0.0
                                                                          VFOR 198
     IF ( XI1M4 \cdotNE\cdot C\cdotC) M41 = - ETA4M3 / XI1M4
                                                                          VFOR 191
     ANUM1 = M12 * E1 - H1
                                                                          VFOR 192
     ANUM2 = M12 * E2 - H2
                                                                          VFOR 193
     ANUM3 = M23 * E2 - H2
                                                                          VFOR 194
     ANUM4 = M23 * E3 - H3
                                                                          VFOR 195
     ANUM5 = M34 * E3 - H3
                                                                          VFOR 196
     ANUM6 = M34 * E4 - H4
                                                                          VFOR 197
     ANUM7 = M41 + E4 - H4
                                                                          VFOR 198
     ANUM8 = M41 \times E1 - H1
                                                                          VFOR 199
     R 1 = SQRT (XMXI1 + 2 + YMETA1 + 2 + ZNPSQ)
                                                                          VFOR 200
     R2 = SQRT (XMXI2 ** 2 + YMETA2 ** 2 + ZNPSQ)
                                                                         VFOR 201
     R3 = SQRT (XMXI3 + 2 + YMETA1 + 2 + ZNPSQ)
                                                                        VFOR 202
     R4 = SQRT ( XMXI4 ** 2 + YMETA4 ** 2 + ZNPSQ)
                                                                          VFOR 203
     025 = 012 ( I1 )
                                                                          VFOR 204
     Q26 = D23 (I1)
                                                                          VFOR 205
     Q27 = D34 (I1)
                                                                          VFOR 206
     Q28 = D41 (I1)
                                                                          VFOR 207
     VX = 0.0
                                                                          VFOR 208
     VY = 0.0
                                                                          VFOR 209
     VZ = 0.0
                                                                          VFOR 210
     IF ( Q25 ) 1420, 1430, 1420
                                                                          VFOR 211
1420 \text{ TEMP} = R1 + R2
                                                                          VFOR 212
     TEMP1 = TEMP - Q25
                                                                          VFOR 213
     TEMP2 = TEMP + Q25
                                                                          VFOR 214
     ARG1 = 1.0
                                                                          VFOR 215
     IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG1=ALOG(TEMP1/TEMP2) VFOR 216
     TEMP = ARG1 / Q25
                                                                          VFOR 217
```

```
VY = - XI2M1 * TEMP
                                                                          VFOR 219
 1430 IF ( Q26 ) 1435, 1440, 1435
                                                                          VFOR 220
                                                                          VFOR 221
 1435 \text{ TEMP} = R2 + R3
      TEMP1 = TEMP - Q26
                                                                          VFOR 222
      TEMP2 = TEMP + Q26
                                                                          VFOR 223
      ARG2 = 1.0
                                                                          VFOR 224
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG2=ALOG(TEMP1/TEMP2) yfor 225
      TEMP = ARG2 / Q26
                                                                          VFOR 226
      VX = VX - ETA2M1 * TEMP
                                                                          VFOR 227
      VY = VY - XI3H2 * TEMP
                                                                          VFOR 228
 1440 IF ( Q27 ) 1450, 1460, 1450
                                                                          VFOR 229
 1450 \text{ TEMP} = R3 + R4
                                                                          VFOR 230
      TEMP1 = TEMP - Q27
                                                                          VFOR 231
      TEMP2 = TEMP + Q27
                                                                          VFOR 232
      ARG3 = 1.0
                                                                          VFOR 233
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG3=ALOG(TEMP1/TEMP2) VFOR 234
      TEMP = ARG3 / Q27
                                                                          VFOR 235
      VX = VX + ETA4M3 * TEMP
                                                                          VFOR 236
      VY = VY - XI4M3 + TEMP
                                                                          VFOR 237
 1460 IF ( Q28 ) 1470, 1480, 1470
                                                                          VFOR 238
 1470 \text{ TEMP} = R4 + R1
                                                                          VFOR 239
      TEMP1 = TEMP - Q28
                                                                          VFOR 240
      TEMP2 = TEMP + Q28
                                                                          VFOR 241
      ARG4 = 1.0
                                                                          VFOR 242
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG4=ALOG(TEMP1/TEMP2) VFOR 243
      TEMP = ARG4 / Q28
                                                                          VFOR 244
      VX = VX - ETA4M3 * TEMP
                                                                          VFOR 245
      VY = VY - XI1M4 * TEMP
                                                                          VFOR 246
 1480 IF ( ZNPSQ .NE. 0.0 ) GO TO 1510
                                                                          VFOR 247
      TEST = SQRT(TSQ(I1) + 1.0E-3)
                                                                          VFOR 248
      IF(Q25.GT.TEST) IF((XMXI1*ETA2M1-YMETA1*XI2M1)/Q25) 1600,1502,1502 VFOR 249
 1502 IF (Q26.GT.TEST) IF ((-XMXI2*ETA2M1-YMETA2*XI3M2)/Q26)1600,1504,1504VFOR 250
 1504 IF(Q27.GT.TEST) IF((XMXI3+ETA4M3-YMETA1+XI4M3)/Q27) 1600,1506,1506VFOR 251
 1506 IF(Q28.GT.TEST) IF((-XMXI4*ETA4M3-YMETA4*XI1M4)/Q28)1600,1508,1508VFOR 252
 1508 \ VZ = 6.28318531ED
                                                                          VFOR 253
      GO TO 1600
                                                                          VFOR 254
 1510 IF (XI2M1 .NE. 0.0) VZ = ATAN(ANUM1/(ZNP*R1))-ATAN(ANUM2/(ZNP*R2)) VFOR 255
      IF (XI3M2 .NE. 8.0) VZ=VZ+ATAN(ANUM3/(ZNP*R2))-ATAN(ANUM4/(ZNP*R3)) VFOR 256
      IF (XI4M3 .NE. 0.0) VZ=VZ+ATAN(ANUM5/(ZNP*R3))-ATAN(ANUM6/(ZNP*R4)) VFOR 257
     ·IF (XI1M4 •NE• G•0)VZ=VZ+ATAN(ANUM7/(ZNP+R4))-ATAN(ANUM8/(ZNP+R1))VFOR 258
                                                                          VFOR 259
C
  TRANSFORM INDUCED VELOCITY COMPONENTS TO REFERENCE COORDINATE SISTEM VFOR 260
   EQUATION
             (79)
                                                                          VFOR 261
                                                                          VFOR 262
          (I2) = A11 (I1) * VX + A21 (I1) * VY * A31 (I1) * VZ
                                                                          VFOR 263
          (I2) = A12 (I1) * VX + A22 (I1) * VY + A32 (I1) * VZ
                                                                         VFOR 264
          (I2) = A13 (I1) + VX + A23 (I1) + VY + A33 (I1) + VZ
                                                                         VFOR 265
 1700 CONTINUE
                                                                          VFOR 266
                                                                          VFOR 267
 2000 IF (.NOT. AFLOW) GC TO 2010
                                                                          VFOR 268
      XIJi(I1) = X(1)
                                                                          VFOR 269
      YIJ1(I1) = Y(1)
                                                                          VFOR 270
      ZIJ1(I1) = Z(1)
                                                                          VFOR 271
 2010 IF (.NOT. BFLOW) GO TO 2020
                                                                          VFOR 272
      XIJ2(I1) = X(1)
                                                                          VFOR 273
      YIJ2(I1) = Y(1)
                                                                          VFOR 274
      ZIJ2(I1) = Z(1)
                                                                          VFOR 275
 2020 IF (.NOT. CFLOW) GO TO 2300
                                                                          VFOR 276
      XIJ3(I1) = X(1)
                                                                          VFOR 277
```

**VFOR 218** 

VX # ETA2M1 + TEMP

```
YIJ3(I1) = Y(1)
                                                                     VFOR 278
     ZIJ3(I1) = Z(1)
                                                                     VFOR 279
     GO TO 2300
                                                                     VFOR 280
 2100 IF ( .NOT. AFLOW) GO TO 2101
                                                                     VFOR 281
     XIJ1 (I1) = X (1) + X (2)
                                                                     VFOR 282
     YIJ1 (I1) = Y (1) + Y (2)
                                                                     VFOR 283
     ZIJ1 (I1) = Z (1) + Z (2)
                                                                     VFOR 284
 2101 IF (.NOT. BFLOW) GO TO 2102
                                                                     VFOR 285
     XIJ2 (I1) = X (1) - X (2)
                                                                     VFOR 286
     YIJ2 (Ii) = Y (1) - Y (2)
                                                                     VFOR 287
     ZIJ2 (I1) = Z (1) - Z (2)
                                                                     VFOR 288
 2102 IF (.NOT. CFLOW) GO TO 2300
                                                                     VFOR 289
     XIJ3 (I1) = X (1) + X (2)
                                                                     VFOR 290
     YIJ3 (I1) = Y (1) + Y (2)
                                                                     VFOR 291
     ZIJ3 (I1) = Z (1) + Z (2)
                                                                     VF OR 292
     GO TO 2300
                                                                     #FOR 293
 2200 IF (.NOT. AFLOW ) GO TO 2201
                                                                     VFOR 294
     XIJ1 (I1) = X (1) + X (2) + X (3) + X (4)
                                                                     VFOR 295
     YIJ1 (I1) = Y ( 1 ) + Y ( 2 ) + Y ( 3 ) + Y ( 4 )
                                                                    WE OR 296
     ZIJ1(II) = Z(1) + Z(2) + Z(3) + Z(4)
                                                                     VF OR 297
 2201 IF (.NOT. BFLOW ) GO TO 2202
                                                                    VF OR 298
     XIJ2 (I1) = X (1) - X (2) - X (3) + X (4)
                                                                    VFOR 299
                                                                   VFOR 300
VFOR 301
     YIJ2 (I1) = Y (1) - Y (2) - Y (3) + Y (4)
     ZIJ2(I1) = Z(1) - Z(2) - Z(3) + Z(4)
 2202 IF (.NOT. CFLOW ) GO TO 2204
                                                                     VFOR 3U2
     XIJ3 (I1) = X (1) + X (2) - X (3) - X (4)
                                                                    VFOR 393
     YIJ3(I1) = Y(1) + Y(2) - Y(3) - Y(4)
                                                                     VFOR 304
     ZIJ3 (I1) = Z (1) + Z (2) - Z (3) - Z (4)
                                                                     VFOR 305
 2204 IF ( NSYM .EQ. 2 ) GC TC 2300
                                                                     VFUR 305
     IF (SNOT. AFLOW ) GO TO 2205
                                                                     VFOR 397
     XIJ1 (I1) = XIJ1 (I1) - X (5) - X (6) - X (7) - X (8)
                                                                     VFOR 338
     YIJ1 (I1) = YIJ1 (I1) - Y (5) - Y (6) - Y (7) - Y (8)
                                                                     VFOR 309
     ZIJ1 (I1) = ZIJ1 (I1) - Z (5) - Z (6) - Z (7) - Z (8)
                                                                     VFOR 310
 2205 IF (.NOT. BFLOW ) GO TO 2206
                                                                     VFOR 311
     XIJ2 (I1) = XIJ2 (I1) + X (5) - X (6) - X (7) + X (8)
                                                                     VFOR 312
     YIJ2 ( I1 ) = YIJ2 ( 11 ) + Y ( 5 ) - Y ( 6 ) - Y ( 7 ) + Y ( 6 )
                                                                     VFOR 313
     ZIJ2 (I1) = ZIJ2 (I1) + Z (5) - Z (6) - Z (7) + Z (8)
                                                                     VFOR 314
2206 IF ( .NOT. CFLOW ) GO TO 2300
                                                                     VF OR 315
     XIJ3 (I1) = XIJ3 (I1) - X (5) - X (6) \leftarrow X (7) + X (8)
                                                                     VFOR 316
     YIJ3 (I1) = YIJ3 (I1) - Y ( 5 ) - Y ( 6 ) + Y ( 7 ) + Y ( 8 )
                                                                     VFOR 317
     ZIJ3 (I1) = ZIJ3 (I1) - Z (5) - Z (6) + Z (7) + Z (8)
                                                                     VFOR 318
 2300 CONTINUE
                                                                     VFOR 319
  WRITE ONE ROW ON TAPE
                                                                     VFOR 320
C
                                                                     VFOR 321
     IF (AFLOW) WRITE(NT)
     IF(AFLOW) WRITE(NT)
IF(BFLOW) WRITE(NT)
IF(CFLOW) WRITE(NT)
                            (XIJ1(J), YIJ1(J), ZIJ1(J), J=1, NELP)
                                                                     VFOR 322
                                                                     VFOR 323
                              (XIJ2(J),YIJ2(J),ZIJ2(J),J=1,NELP)
                                                                     VFOR 324
                             (XIJ3(J), YIJ3(J), ZIJ3(J), J=1, NELP)
                                                                     VFOR 325
     IF ( KROW .LT. NON ) GC TO 8U0
                                                                     VFOR 326
     REWIND 8
                                                                     VFOR 327
 8000 REWIND NT
                                                                     VFOR 328
   42 FORMAT ( 1HD, 5X, 13 | XI | CCMPONENT / ( 1H , 7F 15.8))
                                                                     VFOR 329
   43 FORMAT ( 1H0, 5%, 13HYIJ COMPONENT / ( 1H , 7F15.8))
                                                                    VFOR 330
   44 FORMAT ( 1H0, 5X, 13 HZIJ COMPONENT / ( 1H , 7F15,8))
                                                                     VFOR 331
     IF ( MPR .EQ. 0 .OR. MPR .EQ. 2 ) GO TO 9075
                                                                     VFOR 332
     CALL HEADER
                                                                     VFOR 333
     DO 9060 K = 1, KRCW
                                                                     VFOR 334
     IND1 = 1 - NELL
                                                                     VFOR 335
     IND2 = 0
                                                                     VFOR 336
     I = 0
                                                                     VFOR 337
```

```
VFOR 338
9003 IND1 = IND1 + NELL
                                                                         VFOR 339
     IND2 = IND2 + NELL
                                                                         VFOR 340
9002 I = I + 1
                                                                         VFOR 341
     NT = NTAPE (I)
                            (XX1(J), YY1(J), ZZ1(J), J = IND1, INC2)
                                                                         VFOR 342
 604 IF (AFLOW) READ (NT)
                                 (XX2(J),YY2(J), ZZ2(J),J=IND1,IND2)
                                                                         VFOR 343
     IF(BFLOW) READ(NT)
                                                                         VFOR 344
                                 (XX3(J), YY3(J), ZZ3(J), J=IND1, INC2)
     IF (CFLOW) READ (NT)
                                                                         VFOR 345
     IF ( I - 2 ) 9003, 9008, 9050
                                                                         VFOR 346
9008 IND1 = IND2 + 1
                                                                         VFOR 347
     IND2 = IND2 + NEL
                                                                         VFOR 348
     GO TO 9002
                                                                         VFOR 349
9050 IF (.NOT. AFLOW) GC TO 9051
                                                                         VFOR 350
     WRITE ( 6, 4304 ) K
                                                                         VFOR 351
     WRITE ( 6, 42 ) ( XX1 (J), J = 1, NQUAD)
                                                                         VFOR 352
     WRITE ( 6, 43 ) ( YY1 (J), J = 1, NQUAD)
                                                                         VFOR 353
                     (ZZ1 (J), J = 1, NQUAD)
     WRITE ( 6, 44 )
                                                                         VFOR 354
9851 IF (.NOT. BFLOW ) GO TO 9052
                                                                         VFOR 355
     WRITE ( 6. 4005 ) K
                                                                         VFOR 356
     WRITE ( 6, 42 ) ( XX2 (J), J = 1, NQUAD )
                                                                         VFOR 357
     WRITE ( 6. 43 ) ( YY; (J), J = 1, NQUAD )
                                                                         VFOR 358
     WRITE ( 6.44 ) ( ZZ2 (J), J = 1, NQUAC )
                                                                         VFOR 359
9052 IF ( .NOT. CFLOW ) GO TO 9060
                                                                         VFOR 360
     WRITE ( 6, 4006 ) K
                                                                         VFOR 361
     WRITE ( 6, 42 ) ( XX3 (J), J = 1, NQUAD )
                                                                         VFOR 362
     WRITE ( 6, 43 ) ( YY3 (J), J = 1, NQUAC )
                                                                         VFOR 363
      WRITE ( 6, 44 ) ( ZZ3 \{J\}, J = 1, NQUAD )
                                                                         VFOR 364
9869 CONTINUE
                                                                          VFOR 365
9070 REWIND 1
                                                                          VFOR 366
      REWIND 11
                                                                         VFOR 367
      REWIND 12
                                                                          VFOR 368
9075 WRITE ( 6, 4999 ) INEAR, INTERM, IFAR
4999 FORMAT ( 1HO, //16HONEAR ELEMENTS = , 17/ 24HO INTERMEDIATE ELEMENTS = VFOR 369
                                                                          VFOR 370
    1, I7 / 15H0FAR ELEMENTS = , I7 )
                                                                          VFOR 371
      WRITE(6, 9999)
                                                                          VFOR 372
9999 FORMAT( 1HD , 5X, 13 LEAVING VFORY)
                                                                          VFOR 373
      RETURN
                                                                          VFUR 37+
      END
```

```
*DECK, AFORM
                                                                             AFOR
                                                                                     1
      SUBROUTINE AFORM
                                                                             AFOR
                                                                                     2
      REAL NX , NY , NZ
                                                                             AF OR
                                                                                     3
       LOGICAL
                        AFLCW, BFLOW, CFLOW
                                                                             AFOR
      COMMON /DFLOW/ AFLCW, BFLCW, CFLOW, NMAT, NMATM1, NAFLOW, NBFLOW, NCFLOW AFOR
                                                                                     5
     COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                                    6
    1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                                    7
      DIMENSION C (6000)
                                                                             AFOR
                                                                                    8
      DIMENSION NX( 1860), NY( 1880), NZ( 1880), NTAPE(3)
                                                                             AFOR
                                                                                    9
     DIMENSION A( 1000), XIJ( 1000), YIJ( 1000), ZIJ( 1000)
                                                                             AFOR
                                                                                   10
      DATA NTAPE
                                 / 9, 10, 13 /
                                                                             AF OR
                                                                                   11
  42 FORMAT ( 1H0, 5%, 13HXIJ COMPONENT / ( 1H , 7F15.8))
  43 FORMAT ( 1HO, 5X, 13+YIJ COMPONENT / ( 1H , 7F15.8))
                                                                             AFOR
                                                                                   12
                                                                             AFOR
                                                                                   13
  44 FORMAT ( 1H0, 5%, 13HZIJ COMPONENT / ( 1H , 7F15.8))
                                                                            AFOR
                                                                                   14
  45 FORMAT ( 1H0, 3HROW, I6 )
                                                                             AF OR
                                                                                   15
  46 FORMAT(1H0, 5X, 3HAIJ / (1H, 7F15.8 ))
                                                                            AFOR
                                                                                   16
     IF (MPR .NE. 0) CALL HEADER
                                                                             AF OR
                                                                                   17
     NQNN1 = NQUAD + 2
                                                                             AFOR
                                                                                   18
     NQNN = MOD(NQNN1, 255)
                                                                            AFOR
                                                                                   19
     IF (NQNN .LT. 5 .AND. NCNN .GT. 0) NQNN1 = NQUAD + 5
                                                                            AFOR
                                                                                   20
     IF (NCODE .NE. 1) GO TO 20
                                                                            AFOR
                                                                                   21
     IF (NAFLOW) 2, 2, 1
                                                                            AFOR
                                                                                   22
   1 NF1 = NAFLOW
                                                                            AFOR
                                                                                   23
     GO TO 5
                                                                            AFOR
                                                                                   24
   2 IF (NBFLOW) 4, 4, 3
                                                                            AFOR
                                                                                   25
  3 NF1 = NBFLOW
                                                                            AFOR
                                                                                   26
     GO TO 5
                                                                            AFOR
                                                                                   27
   4 NF1 = NCFLOW
                                                                            AF OR
                                                                                   28
   5 NF2 = NFLOW - NF1
                                                                            AFOR
                                                                                   29
     L2 = 0
                                                                            AFOR
                                                                                   30
     DO 6 KK = 1, NF1
                                                                            AFOR
                                                                                   31
     L1 = L2 + 1
                                                                            AF OR
                                                                                   32
     L2 = L2 + NQUAD
                                                                            AFOR
                                                                                   33
     READ (3)
                                                                            AFOR
                                                                                   34
   6 READ (3) (C(K), K = L1, L2)
                                                                            AFOR
                                                                                   35
     LAST1 = L2
                                                                            AF OR
                                                                                   36
     IF (NF2 .EQ. 0) GO TO 8
                                                                            AFOR
                                                                                   37
     DO 7 KK = 1, NF2
                                                                            AF OR
                                                                                   35
     L1 = L2 + 1
                                                                            AFOR
                                                                                   39
     L2 = L2 + NQUAD
                                                                            AFOR
                                                                                   40
     READ (3)
                                                                            AFOR
                                                                                   41
   7 READ (3) (C(K), K = L1, L2)
                                                                            AFOR
                                                                                   42
  8 00 10 KK = 1, L2
                                                                            AFUR
                                                                                   43
 15 C(KK) = -C(KK)
                                                                            AFOR
                                                                                   44
      READ IN UNIT NORMAL VECTORS
                                                                            AFOR
                                                                                   45
 20 READ(4) (NX(I), NY(I), NZ(I), I = 1, NQUAD)
                                                                            AFOR
                                                                                   46
 FCRM NORMAL VELOCITIES - EQUATION 102
                                                                            AFOR
                                                                                   47
  30 DO 1000 KK = 1, NQUAD
                                                                            AF OR
                                                                                   48
     DO 1000 NM = 1, NMAT
                                                                            AFOR
                                                                                   49
     CALL ROWV (XIJ, YIJ, ZIJ, (KK * NM) / NMAT + NOFF, 0)
                                                                            AFOR
                                                                                   50
     DO 60 K= 1, NQUAD
                                                                            AFOR
                                                                                  51
 60 \stackrel{\cdot}{=} (K) = NX(KK)*XIJ(K) + NY(KK)* YIJ(K) + NZ(KK)*ZIJ(K)
                                                                            AFOR
                                                                                  52
     IF ( MPR.EQ. 0 ) GO TO 70
                                                                            AFOR
                                                                                  53
     WRITE(6,45) KK
                                                                            AFOR
                                                                                  54
     IF ( MPR .EQ. 2 ) GO TO 65
                                                                            AFOR
                                                                                  55
     WRITE(6,42) ( XIJ(I4), I4 = 1, NQUAD )
                                                                            AFOR
                                                                                  56
    WRITE(6,43) ( YIJ(I4), I4 = 1.NQUAD )
                                                                            AFOR
                                                                                  57
    WRITE(6,44) ( ZIJ(14), I4 = 1,NQUAD )
                                                                            AFOR
                                                                                  58
     IF ( MPR - 2 ) 70, 65, 65
                                                                            AFOR
                                                                                  59
 65 WRITE (6, 46) (A(I4), I4 = 1, NQUAD)
                                                                            AF OR
                                                                                  6 B
```

```
GO TO 1000
                                                                                  AFOR
                                                                                         64
  100 NT = KK + LAST1
                                                                                  AFOR
                                                                                         65
      WRITE (10)
                                  (A(I).I=1.NQUAD)./G(I).I=NT.L2.NQUAD)
                                                                                  AFOR
                                                                                         66
                                                                                  AF OR
      GO TO 1000
                                                                                         67
  500 \text{ NT} = \text{NTAPE(NM)}
                                                                                  AF OR
                                                                                         68
       IF (NM .EQ. 1) WRITE (8) NQNN1,
                                                                                  AF OR
                                                    (A(I), I = 1, NQNN1)
                                                                                         69
       WRITE ( NT ) NQNN1.
                                      (A(I), I = 1, NQNN1)
                                                                                  AFOR
                                                                                         70
 1000 CONTINUE
                                                                                  AFOR
                                                                                         71
      REWIND 8
                                                                                  AFOR
                                                                                         72
                                                                                  AFOR
      REWIND 9
                                                                                         73
      REWIND 10
                                                                                  AF OR
                                                                                         74
                                                                                  AF OR
      REWIND 13
                                                                                         75
       WRITE(6, 9999)
                                                                                  AF OR
                                                                                         76
 9999 FORMAT( 1HO , 5X, 13HLEAVING AFOR1)
                                                                                  AFOR
                                                                                         77
C
       RETURN
                                                                                  AF OR
                                                                                         78
      END
                                                                                  AFOR
                                                                                         79
*DECK, SOLVT
                                                                                  SOLV
                                                                                          1
      SUBROUTINE SOLVIT
                                                                                  SOLV
                                                                                          2
C
                                                                                          3
       SUBROUTINE SOLVIT (A, NI, MD, KD, NI, MM, NO, NW, *)
                                                                                  SOLV
      COMMON/SOLVE/ NI,MM, NO,KD, MD
                                                                                  SOLV
                                                                                          4
      COMMON HEDR (15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, ND,
                                                                                          5
                                                                                  SOLV
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NCODE
                                                                                  SOLV
                                                                                          6
       COMMON /SPACER/ A(14000)
                                                                                          7
                                                                                  SOLV
C
                                                                                  SOLV
                                                                                          8
Ü
                                                                                  SOLV
                                                                                          9
C
                                                                                  SOLV
                                                                                         10
C
                                                                                  SOLV
                                                                                         11
C
                                                                                  SOLV
                                                                                         12
C
                                                                                  SOLV
                                                                                         13
C
                                                        /++4
                                                                                  SOLV
                                                                                         14
C
                                                                                  SOLV
                                                                                         15
C
                DIRECT
                                PATRIX
                                                SOLUTION
                                                                                  SOLV
                                                                                         16
C
                                                                                  SOLV
                                                                                         17
C
      WRITTEN BY J. L. HESS * PROGRAMMED BY T. M. RIDDELL
                                                                                  SOLV
                                                                                         18
C**** LANGUAGE
                                                                                  SOLV
                                                                                         19
C
                                                                                  SOLV
                                                                                         20
C
           FORTRAN IV
                                                                                  SOLV
                                                                                         21
C
                                                                                  SOLV
                                                                                         22
C*****FUNCTIONAL DESCRIPTION
                                                                                  SOLV
                                                                                         23
C
                                                                                  SOLV
                                                                                         24
C
           THIS ROUTINE SOLVES THE REAL MATRIX EQUATION
                                                                                  SULV
                                                                                         25
C
                                                                                  SOLV
                                                                                         26
C
                                                                                  SOLV
                                                                                         27
C
                    Ι
                           I
                                  I
                                                      Ι
                                         I
                                                I
                                                                                  SOLV
                                                                                         28
C
                               *
                    Ι
                        A
                           Ι
                                  Ι
                                      В
                                         Ι
                                            =
                                                Ι
                                                   C
                                                      .I
                                                                                  SOLV
                                                                                         29
C
                    7
                           I
                                  Ι
                                         I
                                                I
                                                      I
                                                                                  SOLV
                                                                                         30
C
                                                                                  SOLV
                                                                                         31
C
                                                                                  SULV
                                                                                         32
C
                                                                                  SOLV
                                                                                         33
C
                          * C
                              ) .
                                    IF "A" IS THE REAL COEFFICIENT MATRIX
                                                                                  SOLV
                                                                                         34
C
                                                                                  SOLV
                                                                                         35
Ċ
       FOR A SET OF SIMULTANEOUS EQUATIONS AND "C" IS THE MATRIX OF
                                                                                  SOLV
                                                                                         36
```

(A(I), I=1, NQUAD), (C(I), I=KK, LAST1, NQUAD)

AFOR

AFOR

AFOR

61

62

63

70 IF (NCODE &NE. 1) GO TO 500

IF (NM .NE. 1) GO TO 100

WRITE(8)

```
C
                                                                             SOLV
                                                                                    37
C
      CONSTANTS ( RIGHT-SICES ), THEN "3" WILL BE THE SOLUTIONS OF THE
                                                                            SOLV
                                                                                    38
C
                                                                             SOLV
                                                                                    39
      SET OF SIMULTANEOUS EQUATIONS. NOTE THAT IF "C" IS A UNIT MATRIX, SOLV
C
                                                                                    40
C
                                                                             SOLV
                                                                                    41
C
      "B" WILL BE THE INVERSE OF "A".
                                                                             SOLV
                                                                                    42
C
                                                                             SOLV
                                                                                    43
C*** ** CALL STATEMENT
                                                                             SOLV
                                                                                    44
C
                                                                             SOLV
                                                                                    45
C
          CALL SOLVIT ( AREA, N, M, KORE, NT1, NT2, NT3, NOUT, &NNN )
                                                                             SOLV
                                                                                    46
C
                                                                             SOLV
                                                                                    47
C
      WHERE
                                                                             SOLV
                                                                                    48
C
                                                                             SOLV
                                                                                    49
C
        "AREA" IS AN ARRAY ( DIMENSIONED FOR AT LEAST "KORE" WORDS )
                                                                             SOLV
                                                                                    50
C
                THAT IS USED BY "SOLVIT" FOR SCRATCH PURPOSES.
                                                                             SOLV
                                                                                    51
C
                AFTER A NORMAL RETURN FROM "SOLVIT", THIS ARRAY WILL
                                                                             SOLV
C
                CONTAIN THE "B" MATRIX STORED IN COLUMNAR ORDER.
                                                                             SOLV
                                                                                    53
C
                                                                             SOLV
                                                                                    54
C
        · N ·
                IS THE ORDER OF THE "A" MATRIX
                                                                             SOLV
                                                                                    55
C
                                                                             SOLV
                                                                                    56
C
                IS THE NUMBER OF COLUMNS IN "B" AND "C"
                                                                                    57
                                                                             SOLV
C
                                                                             SOLV
                                                                                    58
C
        "KORE" IS THE DIMENSIONED SIZE OF "AREA" IN WORDS
                                                                             SOLV
                                                                                    59
C
                                                                             SOLV
                                                                                    60
        *NT1*
C
                IS THE LOGICAL FILE NUMBER OF THE INPUT DATA SET
                                                                             SQLV
                                                                                    61
C
                (THIS UNIT IS ALSO USED BY 'SOLVIT' AS A SCRATCH TAPE)
                                                                             SOLV
                                                                                    62
C
                SEE BELOW FOR THE DESCRIPTION OF THE INPUT FORMAT
                                                                             SOLV
                                                                                    63
C
                                                                             SOLV
                                                                                    64
C
                IS THE LOGICAL FILE NUMBER OF AN AVAILABLE SCRATCH UNIT
        *NT2*
                                                                             SOLV
                                                                                    65
C
                                                                             SOLV
                                                                                    66
C
        'NT3"
                IS THE LOGICAL FILE NUMBER OF AN AVAILABLE SCRATCH UNIT
                                                                             SOLV
                                                                                    67
C
                (NT1; NT2, AND NT3 MUST ALL HAVE DIFFERENT VALUES)
                                                                             SOLV
                                                                                    68
C
                                                                             SOLV
                                                                                    69
C
        "NOUT" IS THE LOGICAL FILE NUMBER OF THE OUTPUT DATA SET
                                                                             SOLV
                                                                                    70
C
                THE "8" MATRIX IS WRITTEN ON "NOUT" IN COLUMNAR ORDER.
                                                                             SOLV
                                                                                    71
C
                ONE LOGICAL RECORD PER COLUMN
                                                                             SOLV
                                                                                    72
C
                (*NOUT* MAY EQUAL NT1, NT2, OR NT3)
                                                                             SOLV
                                                                                    73
C
                                                                             SOLY
                                                                                    74
      *&NNN* IS THE FORTRAN STATEMENT NUMBER WHERE CONTROL IS TO BE
C
                                                                             SOLV
                                                                                    75
C
                TRANSFERRED IF 'SOLVIT' DETERMINES THAT THE VALUE OF
                                                                             SOLV
                                                                                    76
C
                "KORE" IS TOO SMALL TO ALLOW THE COMPUTATION TO CONTINUE SOLV
                                                                                    77
C
                (A FORTRAN VARIABLE RETURN)
                                                                                    78
                                                                             SOLV
C
                                                                             SOLV
                                                                                    79
C*****OUTPUT
                                                                             SOLV
                                                                                    80
C
                                                                             SOLV
                                                                                    61
C
                           WRITTEN IN COLUMNAR ORDER CONE LOGICAL RECORD
                                                                             SOLV
                                                                                    82
C
                           PER COLUMN) ON 'NOUT' AND STORED IN 'AREA'
                                                                                    83
                                                                             SOLV
                                                                             SOLV
C
                                                                                    84
C*****STORAGE REQUIRED
                                                                             SOLV
                                                                                    b 5
C
                                                                             SOLV
                                                                                    86
C
          F5E HEXADECIMAL BYTES
                                                                             SOLV
                                                                                    87
C
                                                                             SOLV
                                                                                    88
C**** METHOD
                                                                             SOLV
                                                                                    89
                                                                             SOLV
                                                                                    90
C
          GAUSSIAN ELIMINATION
                                                                             SOLV
                                                                                    91
C
                NOTE ... THE ROWS ARE NOT NORMALIZED
                                                                                    92
                                                                             SOLV
C
                       THE PIVOT IS ASSUMED TO BE THE DIAGONAL ELEMENT
                                                                             SOLV
                                                                                    93
C
                                                                             SOLV
                                                                                    94
C**** GENERAL NOTES
                                                                                    95
                                                                             SOLV
                                                                             SOLV
                                                                                    96
```

```
THE VALUE OF "KORE" MUST BE SJFFICIENT TO STORE
C
                                                                   SOLV 97
С
              MAXO ( 3 * (N + M), N * M ) REAL VALUES
                                                                   SOLV 98
С
                                                                   SOLV
                                                                        99
         THE "A" AND "C" MATRICES MUST BE INPUT IN ROW ORDER . . . .
С
                                                                   SOLV 100
C
              ONE LOGICAL RECCRD PER ROW OF THE "A" AND "C" MATRICES
                                                                   SOLV 101
C
                                                                   SOLV 102
C
                                                                   SOLV 103
                                                                   SOLV 184
С
             1 ROW OF THE #A# MATRIX . 1 ROW OF THE *C* MATRIX .
                                                                   SOLV 105
         SOLV 106
              ("N" REAL VALUES) . ("M" REAL VALUES) .
C
                                                                   SOLV 107
С
         SOLV 108
C
                                                                   SOLV 109
C
                                                                   SOLV 110
C
                          ("N" + "M" REAL VALUES)
                                                                   SOLV 111
                                                                   SOLV 112
                                                                   SOLV 113
         "NOUT" IS NOT POSITIONED PRICE TO THE WRITING OF "B"
                                                                   SOLV 114
C
                                                                   SOLV 115
C
                                                                   SOLV 116
С
      DIMENSION A ( KD )
                                                                   SOLV 117
C
                                                                   SOLV 118
      LOGICAL LAST
                                                                   SOLV 119
C
                                                                   SOLV 120
     NW = 3
                                                                   SOLV 121
      N = ND
                                                                   SOLV 122
     M = MD
                                                                   SOLV 123
      KORE = KD
                                                                   SOLV 124
      NPM = N + M
                                                                   SOLV 125
      IF (MAXO(3 * NPM, M * N) .LE. KORE) GO TO 5
                                                                   SOLV 126
 2475 WRITE (6, 2480) NQUAG, MD , KORE
                                                                   SOLV 127
 2480 FORMAT (4H1THE, 14, 2H X, 13, 15H MATRIX EXCEEDS, 16, 7H WORDS.)
                                                                   SOLV 128/
      CALL EXIT
                                                                   SOLV 129
   5 MT = MM
                                                                   SOLV 130
      REWIND MT
                                                                   SOLV 131
     NIN = NI
                                                                   SOLV 132
     REWIND NIN
                                                                   SOLV 133
     NOUT = NO
                                                                   SOLV 134
      REWIND NOUT
                                                                   SOLV 135
     MP1 = M + 1
                                                                   SOLV 136
     NN = N
                                                                   SOLV 137
     NEL = NPM
                                                                  SOLV 138
                                                                  SOLV 139
 - - CALCULATE THE MAXIMUM NO. OF ROWS, *K*
                                                                  SOLV 140
                                                                  SOLV 141
  10 K = (KORE - NEL) / NEL
                                                                  SOLV 142
C
                                                                  SOLV 143
 - - TEST TO SEE IF THE REST OF THE MATRIX WILL FIT IN CORE
C
                                                                  SOLV 144
                                                                  SOLV 145
     LAST = K .GE. NN
                                                                  SOLV 146
     IF (LAST) K = NN
                                                                   SOLV 147
C
                                                                   SOLV 148
C - - READ *K* ROWS OF THE AUGMENTED *A* MATRIX
                                                                  SOLV 149
                                                                   SOLV 150
  30 \text{ NT} = 0
                                                                   SOLV 151
     DO 49 IB = 1, K
                                                                   SOLV 152
     NS = NT + 1
                                                                  SOLV 153
     NT = NT + NEL
                                                                   SOLV 154
  40 READ (NIN) (A(ID), IO = NS, NT)
                                                                  SOLV 155
C
                                                                  SOLV 156
```

```
-- CHECK TO SEE IF WE WERE UNLUCKY ENOUGH TO END UP WITH ONLY ONE RCWSOLV 157
C
                                                                            SOLV 158
      IF (K .EQ. 1) GO TO 90
                                                                            SOLV 159
C
                                                                            SOLV 160
 - - "K" IS GREATER THAN "1" SO WE CAN START THE TRIANGULARIZATION
C
                                                                            SOLV 161
C
                                                                            SOLV 162
      NELP1 = NEL + 1
                                                                            SOLV 163
      NS = - NEL
                                                                            SOLV 164
      NELP2 = NELP1 + 1
                                                                            SOLV 165
                                                                            SOLV 166
 - - FORM THE "TRAPEZOICAL" AFRAY
C
                                                                            SOLV 167
                                      (8)
C
                                                                            SOLV 168
      DO 50 IB = 2, K
                                                                            SOLV 169
      NP = NELP2 - IB
                                                                            SOLV 170
      NS = NS + NELP1
                                                                            SOLV 171
      NT = NS
                                                                            SOLV 172
      00 50 IO = IB, K
                                                                            SOLV 173
      NT = NT + NEL
                                                                            SOLV 174
      MN = NT
                                                                            SOLV 175
      NB = NS
                                                                            SOLV 176
      A(NT) = (-A(NT)) / A(NS)
                                                                            SOLV 177
      DO 50 NF = 2, NP
                                                                            SOLV 178
      MN = MN + 1
                                                                            SOLV 179
      NB = NB + 1
                                                                            SOLV 180
   50 A(MN) = A(MN) + A(NT) + A(NB)
                                                                            SOLV 181
      IF (LAST) GO TO 90
                                                                            SOLV 182
C
                                                                            SOLV 183
С
  - - WRITE THE "TRAPEZOIDAL" MATRIX ON TAPE
                                                                            SOLV 184
C
                                                                            SOLV 185
      NT = 0
                                                                            SOLV 186
      NP = NEL
                                                                            SOLV 187
      NS = - NEL
                                                                            SOLV 188
      DO 60 IO = 1. K
                                                                            SOLV 189
      NS = NS + NELP1
                                                                            SOLV 190
      NT = NT + NEL
                                                                            SOLV 191
      WRITE (MT) NP, (A(IB), IB = NS, NT)
                                                                            SOLV 192
   60 NP = NP - 1
                                                                            SOLV 193
      NP = NP - M
                                                                            SOLV 194
      NS = KORE - NEL + 1
                                                                            SOLV 195
C
                                                                            SOLV 196
C
 - - READ ANOTHER ROW
                                                                            SOLV 197
                                                                            SOLV 158
C
      D0 80 I0 = 1, NP
                                                                            SOLV 199
      READ (NIN) (A(IB), IB = NS, KORE)
                                                                            SOLV 2J0
C
                                                                            SOLV 201
C
   - MODIFY THIS ROW BY THE 'TRAPEZOIDAL' ARRAY
                                                                            SOLV 202
C
                                                                            SOLV 203
      NT = 1
                                                                            SOLV 204
      MN = NS
                                                                            SOLV 295
      DO 70 IB = 1, K
                                                                            SOLV 206
      NB = NT
                                                                            SOLV 207
      NF = MN + 1
                                                                            SOLV 208
      A(MN) = (-A(MN)) / A(NT)
                                                                            SOLV 269
      DO 65 NN = NF, KORE
                                                                            SOLV 210
      NB = NB + 1
                                                                            SOLV 211
   65 A(NN) = A(NN) + A(MN) + A(NB)
                                                                            SOLV 212
      MN = NF
                                                                            SOLV 213
   70 NT = NT + NELP1
                                                                            SOLV 214
                                                                            SOLV 215
C - - WRITE THE MODIFIED RCW ON TAPE
                                                                            SOLV 216
```

```
C
                                                                              SOLV 217
   80 WRITE (NOUT)
                       (A(NT), NT = MN, KORE)
                                                                              SOLV 218
      REWIND NOUT
                                                                              SOLV 219
      REWIND NIN
                                                                              SOLV 220
C
                                                                              SOLV 221
  - - SWITCH THE TAPES
C
                                                                              SOLV 222
C
                                                                              SOLV 223
      NT = NIN
                                                                              SOLV 224
      NIN = NOUT
                                                                              SOLV 225
      NOUT = NT
                                                                              SOLV 226
C
                                                                              SOLV 227
C
  - - RE-CALCULATE ROW LENGTH AND LOOP BACK
                                                                              SOLV 228
C
                                                                              SOLV 229
      NEL = NEL - K
                                                                              SOLV 230
      NN = NEL - M
                                                                              SOLV 231
      GO TO 10
                                                                              SOLV 232
С
                                                                              SOLV 233
C
 - - REWIND ALL TAPES
                                                                              SOLV 234
C
                                                                              SOLV 235
   90 REWIND MT
                                                                              SOLV 236
      REWIND NIN
                                                                              SOLV 237
      REWIND NOUT
                                                                              SOLV 238
C
                                                                              SOLV 239
C
  - - CONDENSE THE MATRIX
                                                                              SOLV 240
C
                                                                              SOLV 241
      NN = NEL
                                                                              SOLV 242
      NL = NELP1
                                                                              SOLV 243
      IF (K .EQ. 1) GO TO 105
                                                                              SOLV 244
      NS = 1
                                                                              SOLV 245
      NT = NEL
                                                                              SOLV 246
      DO 100 IB = 2, K
                                                                              SOLV 247
      NS = NS + NELP1
                                                                              SOLV 248
      NT = NT + NEL
                                                                              SOLV 249
      00 \ 100 \ I0 = NS, NT
                                                                             SOLV 250
      A(NL) = A(IO)
                                                                             SOLV 251
  100 \text{ NL} = \text{NL} + 1
                                                                              SOLV 252
  105 N1 = KORE - K * M + 1
                                                                              SOLV 253
                                                                              SOLV 254
 - - THERE, NOW WE CAN START THE BACK-SOLUTION
                                                                              SOLV 255
C * * NOTE. THE FIRST AVAILABLE LOCATION FOR THE SCLUTIONS IS A(N1)
                                                                              SOLV 256
                                                                              SOLV 257
      NREM = N
                                                                             SOLV 258
      NEL = NPM
                                                                              SOLV 259
      LAST = K .EQ. N
                                                                             SOLV 260
      NPASS = 0
                                                                              SOLV 261
                                                                             SOLV 262
 - - SOLVE FOR THE ANSWERS COFRESPONDING TO "K" ROWS
                                                                              SOLV 263
                                                                              SOLV 264
  110 \text{ KM1} = \text{K} - 1
                                                                              SOLV 265
      KP1 = K + 1
                                                                              SOLV 266
      NS = NL - MP1
                                                                              SOLV 267
      NPASS = NPASS + 1
                                                                              SOLV 268
      DO 139 MN = 1, M
                                                                              SOLV 269
      NF = NS + MN
                                                                              SOLV 270
      A(NF) = A(NF) / A(NS)
                                                                              SOLV 271
      NT = NS
                                                                              SOLV 272
      IF (KM1 .EQ. 0) GO TO 130
                                                                              SOLV 273
      DO 125 IB = 1, KM1
                                                                              SOLV 274
      NF = NF - IB - M
                                                                              SOLV 275
      NT = NT - MP1 - IB
                                                                              SOLV 276
```

```
SUM = 0.0
                                                                           SOLV 277
      NP = NF
                                                                           SOLV 278
      N2 = MP1 + IB
                                                                           SOLV 279
      50 120 IO = 1, IB
                                                                           SOLV 280
      NN = NT + IO
                                                                           SOLV 281
      NP = NP + N2 - I0
                                                                           SOLV 282
  129 SUM = SUM + A(NN) + A(NP)
                                                                           SOLV 283
  125 A(NF) = (A(NF) - SUM) / A(NT)
                                                                           SOLV 284
  130 CONTINUE
                                                                           SOLV 285
                                                                           SOLV 286
 - - MOVE THE SOLUTIONS TO CONTIGUOUS LOCATIONS STARTING AT A (N1)
                                                                           SOLV 287
                                                                           SOLV 288
      N1 = KORE + 1
                                                                           SOLV 289
      DO 149 NN = 1, K
                                                                           SOLV 290
      DO 135 MN = 1, M
                                                                           SOLV 291
      NL = NL - 1
                                                                           SOLV 292
      N1 = N1 - 1
                                                                           SOLV 293
  135 A(N1) = A(NL)
                                                                           SOLV 294
  140 NL = NL - NA
                                                                           SOLV 295
                                                                           SOLY 296
C
 - - WRITE THE SOLUTIONS ON TAPE
                                                                           SOLV 297
                                                                           SOLV 298
      WRITE (NIN) K
                                                                           SOLV 299
      NS = N1 - 1
                                                                           SOLV 300
      DO 145 MN = 1, M
                                                                           SOLV 301
      NT = NS + MN
                                                                           SOLV 302
  145 WRITE ( NIN ) (A(I(), IO = NT, KORE, M)
                                                                           SOLV 303
                                                                           SOLV 304
C - - TEST IF THIS IS THE LAST PASS
                                                                           SOLV 305
                                                                           SOLV 306
      IF (LAST) GO TO 200
                                                                           SOLV 307
C
                                                                           SOLV 308
 - - WE MUST NOW MODIFY THE TRIANGULAR MATRIX TO REFLECT THE EFFECT OF SOLV 319
C
      THE SOLUTIONS OBTAINED SC FAR (EQ 21)
                                                                           SOLV 310
 * * NOTE..LOCATIONS A(1) TO A(N1-1) ARE NOW FREE TO USE
                                                                           SOLV 311
                                                                           SOLV 312
 - - CALCULATE THE NEXT VALUES OF "NEL" AND "NREM"
                                                                           SOLV 313
                                                                           SOLV 314
      NELOLD = NEL
                                                                           SOLV 315
      KOLD = K
                                                                           SOLV 316
      NEL = NEL - K
                                                                           SOLV 317
      NREM = NREM - K
                                                                           SOLV 318
                                                                           SOLV 319
C - - NOW APPLY THE INCREDIBLE FORMULA FOR THE NEW *K*
                                                                           SOLV 328
                                                                           SOLV 321
      K = (-4 + M - 1) / 2 + IFIX(SQRT().25 + FLOAT((4 + M + 2) + M +
                                                                           SOLV 322
     1 2 * (KORE - NELOLE))))
                                                                           SOLV 323
      NROW = NREM - K + 1
                                                                           SOLV 324
      IF (K .LT. NREM) GO TO 150
                                                                           SOLV 325
      LAST = .TRUE.
                                                                           SOLV 326
      NROW = 1
                                                                           SOLV 327
      K = NREM
                                                                           SOLV 328
  150 NS = 1
                                                                           SOLV 329
      NT = NELOLD + 1
                                                                           SOLV 330
                                                                           SOLV 331
C - - READ IN THE ROWS TO BE MODIFIED
                                                                           SOLV 332
                                                                           SOLV 333
      DO 190 IB = 1, NREM
                                                                           SOLV 334
      NT = NT - 1
                                                                           SOLV 335
      IF (IB .LE. NROW) GO TO 160
                                                                           SOLV 336
```

```
NS = NS + NN
                                                                             SOLV 337
      NT = NT + NN
                                                                             SOLV 338
  160 READ ( MT ) NN, (A(IC), IO = NS, NT)
                                                                             SOLV 339
      NP = N1 - 1
                                                                             SOLV 340
      NF = NT - M - KM1
                                                                             SOLV 341
      NN = NN - KOLD
                                                                             SOLV 342
      DO 170 MN = 1, M
                                                                             SOLV 343
      N2 = NF
                                                                             SOLV 344
      NA = NP + MN
                                                                             SOLV 345
      NB = NA
                                                                             SOLV 346
      SUM = 0.0
                                                                             SOLV 347
      DO 165 IO = 1, KOL [
                                                                             SOLV 348
      SUM = SUM + A(N2) + A(NA)
                                                                             SOLV 349
      N2 = N2 + 1
                                                                             SOLV 350
  165 NA = NA + M
                                                                             SOLV 351
      N2 = N2 + MN - 1
                                                                             SOLV 352
  170 \text{ A(N2)} = \text{A(N2)} - \text{SUM}
                                                                             SOLV 353
                                                                             SOLV 354
  - - WRITE THE MODIFIED ROW ON TAPE OR CONDENSE THE ROW
                                                                             SQLV 355
                                                                             SOLV 356
      NL = NT - M + 1
                                                                             SOLV 357
      IF (IB .GE. NROW) GO TO 175
                                                                             SOLV 358
      NF = NL - KP1
                                                                             SOLV 359
      WRITE (NOUT) NN, (A(IO), IO = NS, NF), (A(IO), IO = NL, NT)
                                                                             SOLV 360
      GO TO 190
                                                                             SOLV 361
  175 NF = NL - KOLD
                                                                             SOLV 3E2
      DO 180 MN = NL, NT
                                                                             SOLV 363
      A(NF) = A(MN)
                                                                             SOLV 364
  180 NF = NF + 1
                                                                             SOLV 365
  190 CONTINUE
                                                                             SOLV 366
      REWIND MT
                                                                             SOLV 367
      REWIND NOUT
                                                                             SOLV 368
C
                                                                             SOLV 369
C
 - - SWITCH THE TAPES
                                                                             SOLV 370
C
                                                                             SOLV 371
      NT = MT
                                                                             SOLV 372
      MT = NOUT
                                                                             SOLV 373
      NOUT = NT
                                                                             SOLV 374
C
                                                                             SOLV 375
C
   - LOOP BACK THRU THE SOLUTION
                                                                             SOLV 376
C
                                                                             SOLV 377
      NL = NF
                                                                             SOLV 378
      GO TO 110
                                                                             SOLV 379
                                                                             SOLV 380
C
 - - START TO WRAP IT UP
                                                                             SOLV 381
                                                                             SOLV 382
  200 REWIND NIN
                                                                             SOLV 383
      N2 = N
                                                                             SOLV 384
C
                                                                             SOLV 385
C * * NOTE.. AT THIS POINT ALL LOCATIONS A(1) THRU A(KORE) ARE FREE
                                                                             SOLV 386
                                                                             SOLV 387
      DO 220 IB = 1, NPASS
                                                                             SOLV 368
      READ (NIN) K
                                                                             SOLV 389
      N1 = N2 - K + 1
                                                                             SOLV 390
      NS = N1
                                                                             SOLV 391
      NT = N2
                                                                             SOLV 392
C
                                                                             SOLV 393
0
 - - READ IN THE SOLUTIONS
                                                                             SOLV 394
C
                                                                             SOLV 395
      DO 210 IO = 1, M
                                                                             SOLV 396
```

```
READ (NIN) (A(NN), NN = NS, NT)
                                                                            SOLV 397
      NT = NT + N
                                                                            SOLV 398
  210 NS = NS + N
                                                                            SOLV 399
  220 N2 = N1 - 1
                                                                            SOLV 400
C
                                                                            SOLV 401
C
 - - WRITE THE SOLUTIONS ON TAPE
                                                                            SOLV 402
C
                                                                            SOLV 403
      NT = 0
                                                                            SOLV 404
      DO 230 IO = 1, M
                                                                            SOLV 405
      NS = NT + 1
                                                                            SOLV 406
      NT = NT + N
                                                                            SOLV 407
  230 WRITE (NW) (A(NN), NN = NS, NT)
                                                                            SOLV 408
                                                                            SOLV 409
      WRITE (6. 300) N. N. M.
                                                                            SOLV 410
  300 FORMAT (4HOTHE, 15, 2H X, 15, 12H MATRIX WITH, 14, 33H RIGHT SICES WASOLV 411
     1S SOLVED DIRECTLY.)
                                                                            SOLV 412
C
      RETURN
                                                                            SOLW 413
      END
                                                                            SOLV 414
```

```
*DECK, SIGMA
                                                                               SIGM
                                                                                      1
      SUBROUTINE SIGMA
                                                                               SIGM
                                                                                      2
C
      SUBROUTINE SIGNA ( NSKIP )
                                                                                      3
                                                                               SIGM
      COMMON /SIG/ NSKIP
                                                                               SIGM
                                                                                      4
      DIMENSION L (100), C( 6000), DSIG1(100)
                                                                                      5
                                                                               SIGM
      DIMENSION A (1000)
                                                                               SIGM
                                                                                      6
      DIMENSION SIG(6000)
                                                                                      7
                                                                               SIGM
      COMMON HEDR(15), MPR, MER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD.
                                                                               SIGM
                                                                                      8
     1 KASE, NOFF, NSYM, IFLAG, I FLOW, NCODE
                                                                                      9
                                                                               SIGM
      COMMON / ATAPE / NCOPY
                                                                               SIGM
                                                                                     10
       NT = NCOPY + 8
                                                                               SIGM
                                                                                     11
      NTAPE = NCOPY
                                                                               SIGM
                                                                                     12
      IF ( ISIG .NE. 0 ) GG TO 1
                                                                               SIGM
                                                                                     13
      M = 2
                                                                               SIGM
                                                                                     14
      GO TO 2
                                                                               SIGM
                                                                                     15
    1 M = 3
                                                                               SIGM
                                                                                     16
    2 IF (NSKIP .EQ. 0) GO TO 11
                                                                               SIGM
                                                                                     17
      N = M * NSKIP
                                                                               SIGM
                                                                                     18
      D0 3 K = 1, N
                                                                                     19
                                                                               SIGM
    3 READ(3)
                                                                                     20
                                                                               SIGM
   11 N1 = 1
                                                                               SIGM
                                                                                     21
      N2 = NQUAD
                                                                               SIGM
                                                                                     22
      00 5 I = 1, NCFLG
                                                                               SIGM
                                                                                     23
      READ (3)
                                                                               SIGM
                                                                                     24
      READ(3) (C(K), K = N1, N2)
                                                                               SIGM
                                                                                     25
      IF( ISIG .NE. G) READ (3) (SIG(K), K = N1, N2)
                                                                               SIGM
                                                                                     26
      N1 = N2 + 1
                                                                                     27
                                                                               SIGM
    5 N2 = N2 + NQUAD
                                                                               SIGM
                                                                                     28
      N = (NFLOW - NSKIP - NCFLG) * M + NSKIP
                                                                               SIGM
                                                                                     29
      IF ( N .EQ. 0 ) GO TO 67
                                                                               SIGM
                                                                                     30
      00 66 K = 1, N
                                                                              SIGM
                                                                                     31
   66 READ (3)
                                                                               SIGM
                                                                                     32
   67 ITER = 0
                                                                              SIGM
                                                                                     33
      NCONV = 3
                                                                               SIGM
                                                                                     34
      DO 12 J = 1, NCFLG
                                                                               SIGM
                                                                                     35
      L(J) = 0
                                                                               SIGM
                                                                                     36
      JN = NQUAD * (J - 1)
                                                                               SIGM
                                                                                     37
```

```
38
39
40
    DO 12 I = 1, NQUAD
                                                                        SIGN
     K1 = I + JN
                                                                        SIGM
 12 IF( ISIG \cdotEQ\cdot 0) SIG(K1) = 0.0
                                                                        SIGM
                                                                              41
42
43
  20 DO 22 I = 1, NCFLG
                                                                        SIGM
 22 DSIG1 ( I ) = 0.6
                                                                        SIGM
     DO 80 I= 1, NQUAC
                                                                        SIGM
    READ ( NTAPE ) NQ, \{A(J), J = 1, NQUAD\}
                                                                              44
                                                                        SIGM
    DO 80 J = 1, NCFLG
                                                                        SIGM
                                                                              45
     IF( L(J) .NE. 0) GO TO 80
                                                                        SIGM
                                                                              46
     SUM = 0.0
                                                                        SIGM
                                                                              47
     JN = NQUAD * (J - 1)
                                                                        SIGM
                                                                              48
     00 60 K = 10 NQUAD
                                                                        SIGM
                                                                              49
     K2 = K + JN
                                                                        SIGM
                                                                              50
  60 SUM = SUM + A(K) * SIG(K2)
                                                                        SIGM
                                                                              51
     K1 = I + JN
                                                                       SIGM
                                                                              52
     DSIG2 = (-C(K1) - SUM) / A(I)
                                                                       SIGM
                                                                              53
     SIG(K1) = SIG(K1) + CSIG2
                                                                       SIGM
                                                                              54
     DSIG1(J) = AMAX1(ABS(DSIG2), DSIG1(J))
                                                                        SIGM
                                                                              55
 80 CONTINUE
                                                                              56
                                                                        SIGM
     ITER = ITER + 1
                                                                        SIGM
                                                                              57
     REWIND NTAPE
                                                                        SIGM
                                                                              58
     IF( IPRS .EQ. 0) GO TO 85
                                                                        SIGM 59
     WRITE(6,9998) ITER
                                                                        SIGM
                                                                              60 🚅
9998 FORMAT(1H , 5X, 17H ITERATION NOS. , 13)
                                                                        SIGM
                                                                              6 i
     DO 82 K = 1, NCFLG
                                                                       SIGM
                                                                              62
     K1 = NQUAD + (K-1) + 1
                                                                       SIGM
                                                                              63
     K2 = K1 + NQUAD
                                                                       SIGM
                                                                              64
  82 WRITE(6, 10) K , ( SIG(I), I = K1, K2)
                                                                       SIGM
                                                                              65
 10 FORMAT ( 1H , 5X, 12H FLCW NUMBER , I4 / ( 5X, 6F15.8))
                                                                       SIGM
                                                                              66
  85 DO 400 J = 1 , NCFLG
                                                                       SIGM
                                                                              67
     IF( L(J) .NE. 0) GO TO 400
                                                                       SIGM
                                                                              68
     IF(DSIG1(J) .GE. 1.0E-4) GO TO 400
                                                                       SIGM
                                                                              69
    L(J) = ITER
                                                                       SIGM
                                                                              70
     NCONV = NCONV + 1
                                                                       SIGM
                                                                              71
     IF ( NCONV .EQ. NCFLG ) GO TO 50)
                                                                       SIGM
                                                                              72
 400 CONTINUE
                                                                       SIGM
                                                                              73
     NTAPE = NT - NTAPE
                                                                       SIGM
                                                                              74
     IF ( ITER - 100) 20, 500, 20
                                                                       SIGM
                                                                              75
 500 DO 650 J = 1, NCFLG
                                                                       SIGM
                                                                              76
     IF ( L ( J ) .EQ. 0 ) GC TC 550
                                                                        SIGM
                                                                             77
     WRITE ( 6, 6 ) L ( J )
                                                                        SIGM
                                                                              78
   6 FORMAT (1H0, 5x, I5, 2x, 35HITERATIONS REQUIRED FOR CONVERGENCE) SIGN
                                                                              79
     GO TO 650
                                                                        SIGM
                                                                              80
 550 WRITE ( 6, 7 )
                                                                        SIGM
                                                                              81
  7 FORMAT (1HO, 8X, 35HNO CONVERGENCE AFTER 100 ITERATIONS )
                                                                       SIGM
                                                                              82
     K1 = NQUAD + (J-1) + 1
                                                                        SIGM
                                                                              83
     K2 = K1 + NQUAD
                                                                        SIGM
                                                                              84
     WRITE(6,8) (SIG(I), I = K1,K2)
                                                                        SIGM
                                                                              85
  8 FORMAT( 1H , 5X, 8F12.7)
                                                                        SIGM
                                                                              86
 650 CONTINUE
                                                                        SIGM
                                                                              87
     NN = NQUAD
                                                                        SIGM
                                                                              88
     M = MOD(NN_2 255)
                                                                        SIGM
                                                                              89
     IF (M .LT. 5 .AND. M .GT. 0) NN = NN + 5
                                                                       SIGM
                                                                              90
     N1 = 1
                                                                       SIGM
                                                                              91
     DO 675 J = 1, NCFLG
                                                                        SIGM
                                                                              92
     WRITE (3) (SIG(K), K = N1, NN)
                                                                        SIGM
                                                                              93
    N1 = N1 + NQUAD
                                                                        SIGM
                                                                             94
 675 NN = NN + NQUAD
                                                                        SIGM
                                                                              95
     REWIND 3
                                                                        SIGM
                                                                              96
     WRITE(6, 9999)
                                                                        SIGM
                                                                              97
```

```
*DECK, ATAPS
                                                                               ATAP
       SUBROUTINE ATAPES
                                                                               ATAP
       SUBROUTINE ATAPES ( KFLOW )
                                                                                       3
                                                                               ATAP
       COMMON /TAPES/ KFLOW
                                                                               ATAP
                                                                                       4
                                                                               ATAP
                                                                                       5
C- - - DEFINITION OF ARGUMENTS
                                                                               ATAP
                                                                                       7
                                                                               ATAP
C
       NQ
                     NUMBER OF VALUES OF "A" PER RECORD
                                                                               ATAP
                                                                                       8
C
       KFL OW
                     FLOW-FLAG, 1 = A-FLOW, 2 = B-FLOW, 3 = C-FLOW
                                                                               ATAP
                                                                                       9
       NCOPY
                     TAPE NUMBER TO BE USED BY PROMAP
                                                                               ATAP
                                                                                      10
                                                                               ATAP
                                                                                      11
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                               ATAP
                                                                                      12
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NGODE
                                                                               ATAP
                                                                                      13
      COMMON / ATAPE / NCOPY
                                                                               ATAP
                                                                                      14
       DIMENSION A (1000), NLINE (500), NLT (500), XNULL (1000), YNULL (1000),
                                                                               ATAP
                                                                                      15
     1 ZNULL(1900), XNORM(1000), YNORM(1900), ZNORM(1900), XOFF(1000),
                                                                               ATAP
                                                                                      16
     2 YOFF (1000), ZOFF (1000)
                                                                               ATAP.
                                                                                      17
      IF ( KFLOW - 2 ) 100, 200, 300
                                                                               ATAP
                                                                                      18
  100 NCOPY = 9
                                                                               ATAP
                                                                                      19
      GO TO 1000
                                                                               ATAP
                                                                                      20
  200 \text{ NCOPY} = 10
                                                                               AT AP
                                                                                      21
      GO TO 400
                                                                               ATAP
                                                                                      22
  300 \text{ NCOPY} = 13
                                                                               AT AP
                                                                                      23
                                                                               ATAP
                                                                                      24
C- - -START OF LOOP
                                                                               ATAP
                                                                                      25
                                                                               ATAP
                                                                                      26
  400 DO 900 N = 1, NQUAD
                                                                               ATAP
                                                                                      27
      NTRY = 0
                                                                               ATAP
                                                                                      28
  500 CKSUM = 0.0
                                                                               ATAP
                                                                                      29
                                                                               ATAP
                                                                                      30
C- - - READ THE #A* MATRIX FROM THE APPROPRIATE TAPE
                                                                               ATAP
                                                                                      31
                                                                               ATAP
                                                                                      32
      READ ( NCOPY ) NQ.
                                    (A(I), I = 1, NQ)
                                                                               ATAP
                                                                                      33
                                                                               AT AP
                                                                                      34
  900 WRITE ( 8 ) NQ.
                                 (A(I), I = 1, NQ)
                                                                               ATAP
                                                                                      35
      GO TO 1400
                                                                               ATAP
                                                                                      36
  - - THE PURPOSE OF THE FULLOWING "MICKEY MOUSE" IS TO RE-POSITION THE ATAP
                                                                                      37
      CONTROL TABLES, NULL POINTS, AND UNIT NORMALS AT THE BEGINNING OF ATAP
                                                                                      38
      THE TAPE. THIS ELIMINATES SKIPPING THE '28 QUANTITIES' EACH TIME.ATAP
                                                                                      39
 1800 READ (4) KLCT, (NLINE(J), NLT(J), J = 1, KLCT)
                                                                               ATAP
                                                                                      40
      READ (4) (XNULL(J), YNULL(J), ZNULL(J), XNORM(J), YNORM(J), ZNORM(J),
                                                                               ATAP
                                                                                      41
     1 J = 1, NQUAD)
                                                                               ATAP
                                                                                      42
      IF (NOFF .GT. D) READ (4) (XOFF(J), YOFF(J), ZOFF(J), J=1, NCFF)
                                                                               ATAP
                                                                                      43
      REWIND 4
                                                                               AT AP
                                                                                      44
      WRITE (4) KLCT, (NLINE(J), NLT(J), J = 1, KLCT)
                                                                               ATAP
                                                                                      45
      DO 1100 J = 1, NQUAD
                                                                               ATAP
                                                                                      46
 1100 WRITE (4) XNULL(J), YNULL(J), ZNULL(J), XNORM(J), YNORM(J), ZNORM(J)
                                                                               ATAP
                                                                                      47
      IF (NOFF .EQ. 0) GO TO 1300
                                                                               ATAP
                                                                                      48
      DO 1200 J = 1, NOFF
                                                                               ATAP
                                                                                      49
 1200 WRITE (4) XOFF(J), YOFF(J), ZOFF(J), XOFF(J), YOFF(J), ZOFF(J)
                                                                               ATAP
                                                                                      5 0
 1300 REWIND 4
                                                                               ATAP
                                                                                      51
 1400 REWIND 8
                                                                               ATAP
                                                                                      52
```

SIGM

SIGM

SIGM 100

98

99

9999 FORMAT( 1HD , 5X, 13HLEAVING SIGMA)

C

RETURN

END

```
*DECK. PRINT
                                                                             PRIN
      SUBROUTINE PRINT1
                                                                             PRIN
                                                                                    2
      SUBROUTINE PRINT1 ( NSKIP, MN, KMAT, NSEQ)
                                                                                    3
                                                                             PRIN
      COMMON /PRINTO/ KMAT.NSEQ.KTP14
                                                                             PRIN
                                                                                    4
      COMMON /TAPES/ MN
                                                                                     5
                                                                             PRIN
      COMMON /SIG/ NSKIP
                                                                             PRIN
                                                                                    6
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFL CW, NQUAD,
                                                                             PRIN
                                                                                    7
     1 KASE, NOFF, NSYM, IFLAG, IFLOW, NGODE
                                                                             PRIN
                                                                                    8
      REAL NX . NY . NZ. MACH
                                                                             PRIN
      LOGICAL PUNCHV
                                                                             PRIN
      COMMON /M/ MACH, BETA, REETA
                                                                             PRIN
      DIMENSION
                             FLOWID(3).
                                                                             PRIN
                                                                                   12
     1 VX(2500), VY(2500), VZ(2800),
                                                                             PRIN
                                                                                   13
     4 NST(500) . NCL(500)
                                                                             PRIN
                                                                                   14
      DIMENSION SIG(1000), XIJ(1000), YIJ(1000), ZIJ(1000)
                                                                             PRIN
                                                                                   15
      DATA FLOWID / 2HX-, 2HY-, 2HZ- /, PROG / 4HBCXC /
                                                                             PRIN
                                                                                   16
      PUNCHV = .FALSE.
                                                                             PRIN
                                                                                   17
      NTIME = NQUAD + NOFF
                                                                             PRIN
                                                                                   18
      LCMAX = 12
                                                                             PRIN
                                                                                   19
C
      READ IN IDENTIFYING INTEGERS
                                                                             PRIN
                                                                                   Źũ
G
                                                                             PRIN
                                                                                   21
      READ(4) INSECT, ( NS I(J) , NCL(J) , J = 1, INSECT)
                                                                             PRIN
                                                                                   22
      DO 2000 L = 1, NCFLG
                                                                             PRIN
                                                                                   23
      IF( ISIG .NE. 0) GO TO 1
                                                                             PRIN
                                                                                   24
      M = 2
                                                                             PRIN
                                                                                   25
      GO TO 2
                                                                             PRIN
                                                                                   26
    1 M = 3
                                                                             PRIN
                                                                                   27
    2 N = M * (NSKIP + L - 1)
                                                                             PRIN
                                                                                   28
      IF (N .EQ. 0) GD TO 4
                                                                             PRIN
                                                                                   29
      DO 3 J = 1. N
                                                                             PRIN
                                                                                   30
    3 READ (3)
                                                                             PRIN
                                                                                   31
    4 READ ( 3) KFLOW, (VX(IJ), VY(IJ), VZ(IJ), IJ = 1. NTIME )
                                                                             PRIN
                                                                                   32
      IF ( KFLOW .EQ. KMAT ) GO TO 9
                                                                             PRIN
                                                                                   33
      CALL HEADER
                                                                             PRIN
                                                                                   34
      WRITE (6. B) KFLOW, KMAT
                                                                             PRIN
                                                                                   35
    8 FORMAT ( 1H8,6X, 48HAN APPARENT FLOW MIS-MATCH HAS OCCURRED. KFLOW PRIN
                                                                                   36
   1=, I2, 7H KMAT =, I2 )
                                                                                   37
                                                                             PRIN
      CALL EXIT
                                                                                   38
                                                                             PRIN
    9 N = (NFLOW - NSKIP - L + 1) + M + NSKIP + L - 2
                                                                                   39
                                                                             PRIN
      D0 5 J = 1, N
                                                                             PRIN
                                                                                   40
    5 READ (3)
                                                                             PRIN
                                                                                   41
      READ (3) (SIG(J), J = 1, NQUAD)
                                                                             PRIN
                                                                                   42
                                                                             PRIN
                                                                                   43
      IF(KTP14 .EQ. 1) WRITE(14) (SIG(J), J=1, NQUAD)
                                                                             PRIN
                                                                                   44
      IF (KTP14 . EQ. 1) ENDFILE 14
                                                                             PRIN
                                                                                    45
      REWIND 14
                                                                             PRIN
                                                                                   46
      IF (MN .EQ. 1) GO TO 15
                                                                             PRIN
                                                                                   47
      NRSKIP = MN - 1
                                                                             PRIN
                                                                                   48
      DO 10 JM = 1, NRSKIP
                                                                             PRIN
                                                                                   49
      READ (1)
                                                                             PRIN
                                                                                    50
```

ATAP

ATAP

ATAP

ATAP

ATAP

53

54

55

56

57

REWIND NCOPY

RETURN

END

C

WRITE (6. 1500)

1500 FORMAT (1HO, 5X, 14HLEAVING ATAPES)

```
READ (11)
                                                                            PRIN
                                                                                  51
   10 READ (12)
                                                                                  52
                                                                            PRIN
   15 LC = LCMAX
                                                                            PRIN
      INSECT = 1
                                                                            PRIN
      M = 0
                                                                            PRIN
                                                                                   55
      IF (L .GT. 1) READ (4)
DO 1000 IS = 1, NTIME
                                                                            PRIN
                                                                            PRIN
      READ(4) XN, YN, ZN, AX, AY, NZ
                                                                            PRIN
                                                                                   58
      IF ( MACH .EQ. 0.0 ) GO TO 17
                                                                            PRIN
   CORR = 1.0 / SQRT(NX * NX + BETA * BETA * (NY * NY + NZ * NZ))
                                                                            PRIN
                                                                                   60
      NX = NX * CORR
                                                                            PRIN
      NY = NY * BETA * CCRR
                                                                            PRIN
                                                                                   62
      NZ = NZ + BETA + CORR
                                                                            PRIN
                                                                                  63
      XN = XN * BETA
                                                                            PRIN
                                                                                   64
   17 VIX = 0.0
                                                                            PRIN
                                                                                   65
      VIY = 5.0
                                                                            PRIN
                                                                                  66
      VIZ = 0.0
                                                                            PRIN
                                                                                   67
      CALL ROWV(XIJ, YIJ, ZIJ, IS, 1)
                                                                            PRIN
                                                                                  68
      DO 20 I1 = 1, NQUAD
                                                                            PRIN
                                                                                   69
C
                                                                            PRIN
                                                                                  70
C
      VELOCITY COMPONENTS EQ. (135) OR EQ. (140)
                                                                            PRIN
                                                                                  71
                                                                            PRIN
                                                                                  7 2
      VIX = VIX + XIJ(I1) + SIG(I1)
                                                                                  73
                                                                            PRIN
      VIY = VIY + YIJ(I1) + SIG(I1)
                                                                            PRIN
                                                                                  74
   20 VIZ = VIZ * ZIJ( I1 ) * SIG(I1)
                                                                            PRIN
                                                                                  75
      VIX = VIX * RBETA * RBETA + VX(IS)
                                                                            PRIN
                                                                                  76
      VIY = VIY * RBETA + VY(IS)
                                                                            PRIN
                                                                                  77
      VIZ = VIZ * RBETA + VZ(IS)
                                                                            PRIN
                                                                                  78
C
      IF ( PUNCHY ) GO TO 26
                                                                            PRIN
                                                                                  79
      IF ( IS .EQ. NQUAD .OR. IS .EQ. NTIME ) GO TO 22
                                                                            PRIN
                                                                                  80
      VIXT = VIX
                                                                            PRIN
                                                                                  81
      VIYT = VIY
                                                                            PRIN
                                                                                   82
      VIZT = VIZ
                                                                            PRIN
                                                                                  83
С
      PUNCHV = .TRUE.
                                                                            PRIN
                                                                                  84
      GO TO 30
                                                                            PRIN
                                                                                  85
   22 NSEQ = NSEQ + 1
                                                                            PRIN
                                                                                  86
      IF (PUNCHV)
                                                                            PRIN
                                                                                  87
     1WRITE ( 7, 24 ) VIX, VIY, VIZ, KASE, PROG, NSEQ
                                                                            PRIN
                                                                                  88
   24 FORMAT ( 3F10.7, 36X, A4, 2X, A4, I4)
                                                                            PRIN
                                                                                  89
      GO TO 28
                                                                                  90
                                                                            PRIN
   26 \text{ NSEQ} = \text{NSEQ} + 1
                                                                            PRIN
                                                                                  91
      WRITE ( 7, 27 ) VIXT, VIYT, VIZT, VIX, VIY, VIZ, KASE, PROG, NSEQ PRIN
                                                                                  92
   27 FORMAT ( 6F10.7, 6X, A4, 2X, A4, I4)
                                                                            PRIN
                                                                                  93
   28 PUNCHV = .FALSE.
                                                                            PRIN
                                                                                  94
C
            TOTAL VELOCITY MAGNITUDE
                                             EQ. ( 136 )
                                                                            PRIN
                                                                                  95
C
                                                                            PRIN
                                                                                  96
   30 VTSQ = VIX * VIX + VIY * VIY + VIZ * VIZ
                                                                            PRIN
                                                                                  97
      VT = SQRT ( VTSQ) .
                                                                            PRIN
                                                                                  98
C
                                                                            PRIN
                                                                                  99
C
      PRESSURE COEFFICIENT EQ. (137)
                                                                            PRIN 100
                                                                            PRIN 101
      CPI = 1.0 - VTSQ
                                                                            PRIN 102
C
                                                                            PRIN 103
C
      DIRECTION COSINES OF THE TOTAL VELOCITY VECTOR EQ. (138)
                                                                            PRIN 104
      GIX = VIX / VT
                                                                            PRIN 105
      GIY = VIY / VT
                                                                            PRIN 106
      GIZ = VIZ / VT
                                                                            PRIN 107
      LC = LC +1
                                                                            PRIN 108
      IF (IS .GT. NQUAD) GO TO 50
                                                                            PRIN 109
C
      TOTAL NORMAL VELOCITY EQ. (139)
                                                                            PRIN 110
```

```
C
                                                                          PRIN 111
      VNI = VIX * NX + VIY * NY + VIZ * NZ
                                                                          PRIN 112
      N = NST (INSECT)
                                                                          PRIN 113
      MMAX = IABS ( NCL ( INSECT ) )
                                                                          PRIN 114
                                                                          PRIN 115
      M = M + 1
                                                                          PRIN 116
      IF( LC .LT. LCMAX) IF (M - 1) 40, 35, 40
      WRITE (6, 3000)
                                                                          PRIN 117
 3000 FORMAT ( 1H0, 4X,1H.,84X,1H.)
                                                                          PRIN 118
      CALL HEADER
                                                                          PRIN 119
      LC = 0
                                                                          PRIN 120
      WRITE (6, 4030) FLOWID(KFLOW)
                                                                          PRIN 121
 4030 FORMAT (1H0, 45X, A2, 4HFLOW)
                                                                          PRIN 122
                                                                          PRIN 123
      WRITE(6,4000)
   35 WRITE(6, 4005) N, M, XN, VT, VIX, GIX, NX, VNI
                                                                          PRIN 124
                                                                          PRIN 125
      GO TO 45
 4015 FORMAT(1H0, 3(17X , 2(6H****** ) ) )
                                                                          PRIN 126
 4000 FORMAT(1HO, 6X,5HN M,8X, 3HNPX,10X, 2HVT, 12X, 2HVX, 10X,
                                                                          PRIN 127
     1 3HDCX, 11X, 2HNX ,10X, 2HVN /
                                                                          PRIN 128
     21M (19X, 3HNPY , 9X, 4HV NSQ ,11X, 2HWY ,10X, 3HDCY,11X, 2HNY,10X, PRIN 129
     33HSIG/
                                                                          PRIN 130
     41H #19X & 3HNPZ .10X, 4HCF , 10X, 2HVZ ,10X, 3HDCZ,11X, 2HNZ
                                                                         ) PRIN 131
 4005 FORMATITHO.3X. 214 . 6F13.6)
                                                                          PRIN 132
 4010 FORMAT(1H0,7X, I4 , 6F13.6)
                                                                          PRIN 133
 4020 FORMAT( 1H , 11X, 6F13.6)
                                                                          PRIN 134
   40 WRITE(6,4010) M. XN, VT, VIX, GIX, NX, VNI
                                                                          PRIN 135
   45 WRITE(6, 4020) YN, VTSQ, VIY, GIY, NY, SIG(IS), ZN,
                                                                          PRIN 136
     1 CPI , VIZ, GIZ, NZ
                                                                          PRIN 137
      IF( M .LT. MMAX) GC TO 1000
                                                                          PRIN 138
                                                                          PRIN 139
      IF (NCL(INSECT) .GT. 0) GO TO 48
                                                                          PRIN 140
      WRITE (6, 4015)
                                                                          PRIN 141
      LC = LC + 1
   48 M = 0
                                                                          PRIN 142
      INSECT = INSECT + 1
                                                                          PRIN 143
                                                                          PRIN 144
      GO TO 1000
   50 IF ( LC .LT. LCMAX .AND. IS .NE. (NQUAD + 1)) GO TO 60
                                                                          PRIN 145
      WRITE (6, 3000)
                                                                          PRIN 146
      CALL HEADER
                                                                          PRIN 147
      LC = B
                                                                          PRIN 148
      WRITE (6, 4030) FLOWID(KFLOW)
                                                                          PRIN 149
                                                                          PRIN 150
      WRITE (6, 55)
   55 FORMAT (1H0,6X,5HPCINT,13X,2HX ,18X,2HVT,18X,2HVX,17X,3HDCX, /,
                                                                          PRIN 151
     125X,2HY ,17 ),4HVTSQ,17X,2HVY,17 X,3HDCY, /,
                                                                          PRIN 152
                                                                          PRIN 153
     225X,2HZ ,18X,2HCP,18X,2HVZ,17X,3HDCZ, // )
C
                                                                          PRIN 154
C
      WRITE THE OFF-BORY ANSWERS
                                                                          PRIN 155
                                                                          PRIN 156
                                                                          PRIN 157
   60 N = IS - NQUAD
      WRITE (6,65) N,XN,VT,VIX,GIX,YN,VTSQ,VIY,GIY,ZN,CPI,VIZ,GIZ
                                                                          PRIN 158
   65 FORMAT (1H0, I9, 4F20.6, / (10X, 4F20.6))
                                                                          PRIN 159
                                                                          PRIN 160
 1000 CONTINUE
                                                                          PRIN 161
      REWIND 4
                                                                          PRIN 162
      IF (NOFF .GT. 0) WRITE (6, 4015)
                                                                          PRIN 163
 2000 CONTINUE
                                                                          PRIN 164
      WRITE(6, 9999)
                                                                          PRIN 165
                                                                          PRIN 166
 9999 FORMAT( 1H1 , 5X, 14HLEAVING PRINT1)
      RETURN
                                                                          PRIN 167
C
      END
                                                                          PRIN 168
```

```
*DECK, WTAP14
                                                                             WTAP
                                                                                    1
      SUBRCUTINE WTAP14
                                                                             WTAP
                                                                                    2
С
                                                                                    3
                                                                             WTAP
C
      WRITES 28 QUANTITIES ON TAPE14 FOR USE BY THE PARTICLE TRAJECTORY WTAP
                                                                                    4
C
              REVISED 3/22/77.
                                                                             WTAP
                                                                                    5
C
                                                                             WTAP
                                                                                    6
      COMMON HEDR(15), MPR, NER, IPRS, ISIG, ITER, NCFLG, NFLOW, NQUAD,
                                                                             WTAP
                                                                                    7
     1 KASE, NOFF, NSY M, IFLAG, IFLOW, NCODE
                                                                             WTAP
                                                                                    8
      COMMON /SPACER/ DUMMY (14000)
                                                                                    9
                                                                             WTAP
      REAL IXX, IXY, IYY, MACH
                                                                             WTAP
                                                                                   10
      COMMON /M/ MACH, BETA, RBETA
                                                                             WTAP
                                                                                   11
      DIMENSION
                                 041(1000),
                                                XC(1000), YC(1000), ZC(1000), WT AP
                                                                                   12
     1 A11(1000), A12 (1000), A13 (1000), A21(1000), A22(1000), A23(1000),
                                                                                   13
                                                                             WTAP
     2 A31(1000), A32 (1000), A33 (1000), XI1(1000), XI2(1000), XI3(1000),
                                                                             WTAP
                                                                                   14
     3 XI4(1000), ETA1(1000), ETA2(1000), ETA4(1000), TSQ(1000), A(1000),
                                                                                   15
                                                                             WTAP
     $ IXX(1000),IXY (1000),IYY (1000),312 (1000),D23(1000),D34(1000)
                                                                             WTAP
                                                                                   16
      EQUIVALENCE (DUMMY(1), D41), (DUMMY(1001), XC), (DUMMY(2001), YC), WTAP
                                                                                   17
        (DUMMY(3001), ZC), (DUMMY(4001), A11), (DUMMY(5001), A12),
                                                                             WTAP
                                                                                   18
                        A13), (CUMMY(7001), A21), (DUMMY(8001), A22),
        (DUMMY (6001),
                                                                             WTAP
                                                                                   19
        (DUMMY(9001), A23), (DUMMY(10001),
                                               A31), (DUMMY (11001), A32),
                                                                             WT AP
                                                                                   20
        (DUMMY(12001), A33), (DUMMY(13001), XI1)
                                                                             WTAP
                                                                                   21
C
                                                                                   22
                                                                             WTAP
      REWIND 14
                                                                             WTAP
                                                                                   23
      WRITE (14) KASE, NSYM, NQUAD, RBETA, MACH
                                                                             WTAP
                                                                                   24
      DO 100 J=1, NQUAD
                                                                                   25
                                                                             WTAP
  100 READ (4) XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                                   26
                                                                             WTAP
                                                  XI1(J), ETA1(J), XI2( WTAP
     1 A22(J), A23(J), A31(J), A32(J), A33(J),
                                                                                   27
     2 J), ETA2(J), XI3(J), X14(J), ETA4(J), X1, X2 (J), X3 (J),
                                                                             WTAP
                                                                                   28
     3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J)
                                                                             WTAP
                                                                                   29
      WRITE(14)(XC(J), YC (J), ZC(J), A11(J), A12(J), A13(J), A21(J),
                                                                             WT AP
                                                                                   30
     1 A22(J), A23(J), A31(J), A32(J), A33(J),
                                                       XI1(J), ETA1(J), XI2( WTAP
                                                                                   31
     2 J), ETA2(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                                   32
                                                                             WTAP
     3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J) ,J=1,NQUAD)
                                                                             WTAP
                                                                                   33
      REWIND 4
                                                                             WTAP
                                                                                   34
      END
                                                                             WT AP
                                                                                   35
```

FLCFT

FLCPT

FLOPT

FLOPT

FLCPT

FLOPT

FLOPT

FLOPT 1

FLCPT 1

FLOPT 1

FLOPT 1

FLOPT 2

FLOPT 3

FLOFT 2

FLCPT 2

FLOPT 2

FLOPT 2

FLOPT 27

FLOPT 2

FLOPT 29

FLOPT 3

FLOPT 3

FLOPT 3

FLOPT 3

FLOPT 34

FLOPT 3

FLGPT 30

FLCFT 37

FLOPT 30

FLOPT 39

FLOPT 4

FLOPT 45

FLOFT 42

FLOPT 4

FLOPT 44

FLOPT 4

FLOFT 4

FLOPT 47

FLOPT 4

FLOPT 49

FLOPT 5

FLOPT 5

FLOPT 5

FLOP 1 5

FLOFT 54

FLCPT 5

FLOPT 5

FLOP 1 57

FLOPT

FLOPT

FLOPT 1

```
PROGRAP FLOPNT ( INPUT, TAPE6, TAPE5=INPUT, TAPE14, OUTPUT)
C
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
C
C
      CALLS FLOVEL TO COMPUTE AND PRINT FLOW VELOCITIES AT SPECIFIED
C
      POINTS IN SPACE. INPUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH FLOFT
C
      INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3. FOR EXAMPLEFLEPT
C
      SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS FLOPT
C
      INCREMENTED SECOND AND Z IS INCREMENTED LAST.
C
      OTHER INPUT DATA ARE (IN ORDER OF X AXIS FIRST, Y AXIS SECOND,
C
      Z AXIS THIRD) - INITIAL COORDINATE, INCREMENT, NUMBER OF INCREMENT SFLCFT A
C
      DESTRED (INCLUTING THE INITIAL COORDINATE VALUE).
C
C
      NOTE - POINTS THAT ARE INSIDE THE BODY ARE MARKED WITH AN ASTERIX FLOPT
C
      IN THE PRINTOUT.
C
      DIMENSION HOLL(18), X(3), D(3), N(3), M(3), SX(3), SD(3), NS(3),
     1 SXI(3), SEQ(6)
      DATA SEQ/ 4HFIRS, 4HT , 4HSECO, 4HND , 4HTHIR, 4HD
      DATA STAF, BLNK / 3H +, 3H /
      READ( 5, 2600) KASE
      CALL SETFLO( KASE )
      READ( 5, 1300 ) HOLL
      WRITE( 6, 1400) HCLL
    5 READ(5,1100)M
      IF(IABS(M(1))+IABS(M(2))+IABS(M(3)).EQ. 0) STOP
      IF(M(1)+M(2)+M(3)) \cdot EQ. 6) GO TO 10
      WRITE (6, 1200)
      STOP
   10 DO 20 L=1.3
   20 READ(5,1000) X(L), D(L), N(L)
      WRITE( 6, 1700)
      WRITE(6,2000) X(1), D(1), N(1)
      WRITE(6,30(0) X(2), D(2), N(2)
      WRITE (6,4000) X(3), D(3), N(3)
      WRITE(6,9000)
      WRITE(6,5000) SEQ(2*M(1)-1), SEQ(2*M(1))
      WRITE(6,60(0) SEQ(2*M(2)-1), SEQ(2*M(2))
      WRITE (6,7000) SEQ(2*M(3)-1), SEQ(2*M(3))
      WRITE( 6. 1600 )
      DO 40 L=1,3
      LL=4-M(L)
      SD(LL)=D(L)
      SXI(LL)=X(L)-D(L)
   40 NS(LL)=N(L)
      N1=N5(1)
      N2=NS (2)
      N3 = NS(3)
      SX(1)=SXI(1)
      DO 500 I=1,N1
      SX(1) = SX(1) + SD(1)
```

SX(2) = SXI(2)

SX(3) = SXI(3)

DO 500 K=1.N3

DO 500 J=1.N2

W IITE ( 6,1900)

SX(2) = SX(2) + SD(2)

T

```
PROGRAN FLOPNT ( INPUT, TAPE6, TAPE5=INPUT, TAPE14, OUTPUT)
                                                                       FLCFT
H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                       FLCPT
                                                                               3
                                                                       FLOPT
CALLS FLOVEL TO COMPUTE AND PRINT FLOW VELOCITIES AT SPECIFIED
                                                                       FLOPT
POINTS IN SPACE. INPUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH
                                                                       FLCFT
INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3. FOR EXAMPLEFLEPT
SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS FLOPT
INCREMENTED SECOND AND Z IS INCREMENTED LAST.
OTHER INPUT DATA ARE (IN ORDER OF X AXIS FIRST, Y AXIS SECOND,
                                                                       FLOPT 10
Z AXIS THIRD) - INITIAL COORDINATE, INCREMENT, NUMBER OF INCREMENTSFLCFT 11
DESIRED (INCLUTING THE INITIAL COORDINATE VALUE).
                                                                       FLOPT 12
                                                                       FLOPT 13
NOTE - POINTS THAT ARE INSIDE THE BODY ARE MARKED WITH AN ASTERIX FLOPT 14
IN THE PRINTOUT.
                                                                       FLOPT 15
                                                                       FLCPT 16
DIMENSION HOLL(18), X(3), D(3), N(3), M(3), SX(3), SD(3), NS(3),
                                                                       FLOPT 17
SXI(3), SEQ(6)
                                                                       FLOPT 18
DATA SEQ/ 4HFIRS, 4HT   , 4HSECO, 4HND  , 4HTHIR, 4HD
                                                                       FLOPT 19
DATA STAF, BLNK / 3H *, 3H /
                                                                       FLOPT 20
READ( 5, 2600) KASE
                                                                       FLOPT 21
CALL SETFLO( KASE )
                                                                       FLOPT 22
                                                                       FLOPT 23
READ( 5, 1300 ) HOLL
WRITE( 6, 1400) HCLL
                                                                       FLOPT 24
                                                                       FLOP1 25
READ(5,1100)M
IF(IABS(M(1))+IABS(M(2))+IABS(M(3)).EQ. 0) STOP
                                                                       FLOPT 26
IF(H(1)+H(2)+H(3) .EQ. 6) GO TO 10
                                                                       FLOPT 27
WRITE (6.1200)
                                                                       FLOPT 28
STOP
                                                                       FLOPT 29
DO 20 L=1,3
                                                                       FLOPT 30
READ(5,1000) X(L), D(L), N(L)
                                                                       FLOPT 31
WRITE( 6, 1700)
                                                                       FLORT 32
WRITE(6,2000) X(1), D(1), N(1)
                                                                       FLOPT 33
WRITE(6,30(0) X(2), D(2), N(2)
                                                                       FLOFT 34
WRITE(6,4000) X(3), D(3), N(3)
                                                                       FLOPT 35
WRITE(6,9000)
                                                                       FLGPT 36
WRITE(6,5000) SEQ(2*M(1)-1), SEQ(2*M(1))
                                                                       FLCPT 37
WRITE(6,6000) SEQ(2*M(2)-1), SEQ(2*M(2))
                                                                       FLOPT 38
WRITE(6,7000) SEQ(2*M(3)-1), SEQ(2*M(3))
                                                                       FLOPT 39
WRITE( 6, 1600 )
                                                                       FLOPT 40
DO 40 L=1,3
                                                                       FLOPT 41
LL=4-M(L)
                                                                       FLOFT 42
SD(LL)=D(L)
                                                                       FLOFT 43
$XI(LL)=X(L)-D(L)
                                                                       FLOPT 44
NS(LL) = N(L)
N1=NS(1)
N2=NS(2)
N3=NS(3)
                                                                       FLOPT 45
                                                                       FLOFT 46
                                                                       FLOPT 47
                                                                       FLOPT 48
SX(1)=SXI(1)
                                                                       FLOPT 49
DO 500 I=1.N1
                                                                       FLOPT 50
SX(1) = SX(1) + SD(1)
                                                                       FLOPT 51
5X(2)=SXI(2)
                                                                       FLOPT 52
0 500 J=1,N2
MITE( 6,1900)
                                                                       FLOP 1 53
                                                                       FLOFT 54
SX(2)=SX(2)+SD(2)
                                                                       FLOPT 55
\mathbf{E} \mathbf{X}(3) = \mathbf{S} \mathbf{X} \mathbf{I}(3)
                                                                       FLOPT 56
00 500 K=1,N3
                                                                       FLOP 1 57
```

PRJGRAM FLOPNT

74/74

OPT =2

7000 FORMAT( 10x, 22HZ AXIS IS INCREMENTED 2A4)

9000 FORMAT (1H0)

END

- 1

FLOPT 90

FLCPT 91 FLOPT 92

IMPAC

THEAC

IMFAC

IMPAC

IMPAC 10

IMFAC 11

IMPAC 12

IMPAC 15

IMPAC 18

IMFAC 19

**APRIL 1979** 

ADJUSTS INITIALIMPAC

3

5

6

THE ADJUSTMENT IS CASE DEPENDENT SO THIS S.R. SHOULD BE REVISED

Y AND Z CO (RDINATES OF PARTICLE TRAJECTORY TO AVOID FURTHER IMPACTIMFAC

H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES

CALLED BY S.R. TRAJECT AFTER IMPACT ON THE BODY.

C

C

C

C

C

C

C

C

С

FOR EACH STUDY.

RETURN

END

the second second with the second 
```
*DECK, PAPTCL
      SUBROUTINE PARTCL (V, ELL, RHO, VIS, TEMP, DIAM, GLR, RHOP, VT, RF, PT, AGC, N) PARTC
C
                                                                           PAFTC
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                            PASTC
C
                                                                                   3
C
                                                                            PARTC
      CALLED BY CONFAC, ARYTRJ OR TANTRA TO READ PARTICLE SPECS. ANC
C
                                                                           PARTC
                                                                                   5
      COMPUTE GRAVITY SETTLING SPEED AND OTHER PARAMETERS. SEE CONFAC
                                                                           PARTC
                                                                                   6
C
C
                                                                           PARTC
                                                                                   7
      FOR WATER DROPS IN AIR
                                                                            PARTC
C
                                                                                   8
                                                                            PARTC
                                                                            PARTC 13
      CALLS FALMAT TO COMPUTE SETTLING SPEED VIA BEARDS EQUATIONS.
G
                                                                            PARTC 11
      REYNOLDS NUMBER(R)-DAVIES NUMBER(CORR) RELATIONS ARE AS FOLLOWS - PARTC 12
r:
С
      FOR REYNCLOS NUMBERS LARGER THAN 200 USE CORR VS R DATA OF GUNN
                                                                           FAFTC 13
      AND KINZER FOR WATER DROPS IN AIR. FOR SMALLER REYNOLDS NUMBERS PARTC 14
C
C
      USE DATA FOR RIGID SPHERES.
                                                                            PARTC 15
                                                                            PARTC 16
G
C
                          GLCSSARY
                                                                           PARTC 17
                                                                            PARTC 18
               DIAM/ELL - USED TO COMPUTE ACCELERATION MOCULUS
      ACC
C
                                                                           PARTC 19
C
      DIAM
               DIAMETER OF A WATER DROP
                                                                           PARTC 28
      DLR
               NOT RELEVANT TO WATER GROPS
C
C
      ELL
               CHARA (TERISTIC DIMENSION OF THE BODY ( METERS )
                                                                           PARTC 21
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGFARTC 22
С
      PT
C
               CF PARTICLES
                                                                            PARTC 23
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                           PAFTC 24
C
C
      RHO
               AIR DENSITY (SI)
                                                                            PARTC 25
                                                                            PARTC 26
C
      RHOP
               PARTICLE DENSITY (SI)
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                            FARTC 27
C
      v
               AIR SPEED (SI)
                                                                            PAFTC 28
               AIF VISCOSITY (SI)
C
      VIS
                                                                            PAFTC 29
C
      VT
               GRAVITY SETTLING SPEED OF FARTICLE
                                                                            PARTC 30
                                                                            PARTC 31
      READ (5, 11(0) DIAM
                                                                            PAFTC 32
                                                                            PARTC 33
      IF(DIAM .NE. C.C) GO TO 6
      N = 1
                                                                            FARTC 34
                                                                           PAFTC 35
      RETURN
    6 WRITE (6,2500) DIAM
                                                                           PARTC
                                                                                  36
      R HOP = 1.0E3
                                                                           PAFTC 37
      DLR=1.0
                                                                           PARTC 38
                                                                           PAFTC 39
      RF = DIAP*RHO /VIS * 1.1E-6
      ACC = DIAM/ELL * 1.0E-6
                                                                           PAFTC 40
      COMPUTE GRAVITY SETTLING SPEED OF PART. AND PARAMETERS DERIVED
                                                                           PAFTC 41
                                                                            PARTC 42
      FROM IT
      CALL FALKAT(DIAM*1.0E-6, RHO, VIS, TEMP, 287.04*RHO*TEMP, VT)
                                                                            PARTC 43
      R = RF*VT
                                                                            PARTC 44
      PT = CCRR(R)/R
                                                                            PARTC 45
      IF(R .GT. 200.) PT = KCDRR(R)/R
                                                                            PARTE 46
                                                                            PARTC 47
    7 HRITE(6, 3500) VT
      VT = VT/V
                                                                            PARTC 48
      RF = RF*V
                                                                            PARTC 49
      RETURN
                                                                            PARTO 50
                                                                            PARTC 51
 1100 FORMAT (7F10.0)
 2500 FORMAT ( 1H1, 9X, 21HWATER DROP DIAMETER =1FE12.5,12H MICROMETERS/)PARTC 52
                                                                            FARTC 53
 3500 FORMAT(
                  20X, 24HPARTICLE SETTLING SPEED=1PE12.5, 6H M/SEC)
                                                                            PARTC 54
      END
```

```
*DECK - CONFAC
                                                                             CONF
      SUBROUTINE CONFAC
                                                                             CONF
                                                                                    2
                                                                             CONF
                                                                                    3
C
      Ho.G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979
                                                                             CONF
C
                                                                                    5
                                                                             CONF
C
      EXECUTIVE FOR COMPUTATION OF CONCENTRATION FACTORS FOR PARTICLES
                                                                             CONF
                                                                                    6
C
      IN A FLOW ABOUT A 3-DIMENSIONAL BODY. CROSS SECTIONAL AREAS OF A CONF
                                                                                    7
C
      PARTICLE FLUX TUBE ARE CALCULATED ABOUT THE FOINT OF INTEREST AND CONF
C
      ABOUT A POINT FAR UPSTREAM. CONCENTRATION FACTOR IS THE RATIO OF CONF
                                                                                     9
C
      THESE AREAS.
                                                                             CONF
                                                                                   10
C
      SINGLE TRAJECTORIES TO A TARGET POINT MAY BE COMPUTED (NW=0)
                                                                             CONF
                                                                                   11
C
      FLOW DATA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14
                                                                             CONF
                                                                                   12
C
      VIA SR SETF 10.
                                                                             CONF
                                                                                   13
C
      UNIT 9 IS A SCRATCH UNIT USED FOR TRAJECTORY DATA STORAGE.
                                                                             CONF
                                                                                   14
C
                                                                                   15
      UNIT 10 IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.
                                                                             CONF
      SR PARTCL IS CALLED TO READ, PROCESS AND PRINT PARTICLE DATA.
                                                                             CONF
C
                                                                                   16
      THIS SR CAN BE ONE OF SEVERAL THAT TREATS WATER DROPS OR ONE OF
C
                                                                             CONF
                                                                                   17
      VARIOUS TYPES OF ICE CRYSTALS.
                                                                                   18
C
                                                                             CONF
C
                                                                             CONF
                                                                                   19
C
                                                                             CONF
                                                                                   20
      GLOSSARY
C
                                                                             CONF
                                                                                   21
   DISTINGUISH TWO COORDINATE SYSTEMS - 1. THE FLOW SYSTEM IS THE SYSTEMCONF
                                                                                   22
C
C
   IN WHICH THE AIRCRAFT AND FLOW ARE DEFINED, AND 2. THE FLUX TUB!
                                                                                   23
                                                                             CONF
C
   SYSTEM WHICH HAS ITS Y-Z PLANE IN THE PLANE OF A FLUX TUBE CROSS
                                                                             CONF
   SECTION WITH CRIGIN AT THE FLUX TUBE CENTER.
                                                                             CONF
                                                                                   25
C
                                                                             CONF
                                                                                   26
C
      ALL COORDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)
                                                                             CONF
                                                                                   27
C
                                                                             CONF
                                                                                    28
C
      ACC
               DIAM/ELL - USED TO COMPUTE ACCELERATION MODULUS
                                                                             CONF
                                                                                   29
C
      ALPHAD
               ANGLE BETWEEN PROJECTION OF INITIAL VELOCITY VECTOR IN
                                                                             CONF
                                                                                    30
C
                                                                             CONF
                                                                                   31
               X-Y PLANE AND X AXIS
C
      ALPHAR
               ANGLE BETWEEN PROJECTION OF FINAL VELOCITY VECTOR IN X-V
                                                                             CONF
                                                                                    32
C
               PLANE AND X AXIS
                                                                             CONF
                                                                                    33
C
               ANGLE BETWEEN INITIAL VELOCITY VECTOR AND ITS PROJECTION
                                                                             CONF
                                                                                    34
      BETAO
                                                                                    35
C
               IN THE X-Y PLANE
                                                                             CONF
                                                                             CONF
                                                                                   36
C
      BETAR
               ANGLE BETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION
                                                                             CONF
C
                                                                                   37
               IN THE X-Y PLANE
C
               RATIO OF PARTICLE CONCENTRATION AT TARGET POINT TO CONC.
                                                                             CONF
                                                                                    38
      CONRTO
C
                                                                             CONF
                                                                                    39
               AT INITIAL PCINT
C
      DIAM
               DIAMETER OF A WATER DROP OR ICE AGGREGATE
                                                                             CONF
                                                                                    40
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                             CONF
                                                                                    41
C
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
                                                                             CONF
                                                                                    42
      DLR
C
                                                                                    43
                                                                             CONF
               RATIO
C
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
      ELL
                                                                             CONF
                                                                                    44
C
               PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
                                                                             CONF
                                                                                    45
      EPSI()
C
               INTEGRATION (SEE DVDQ GLOSSARY)
                                                                             CONF
                                                                                    46
C
      FN
                                                                             CONF
                                                                                    47
               FROUDE NUMBER
C
      FNR
                                                                             CONF
                                                                                    48
               RECIPROCAL OF THE FROUDE NUMBER
C
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDQ)
                                                                             CONF
                                                                                    49
      HI
C
               MAXINUM TIME STEP (SEE DVDQ)
                                                                             CONF
                                                                                    50
      HMAX
C
      HMIN
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
                                                                             CONF
                                                                                    51
C
      IPLOT
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 10 FOR PLOTTINGCONF
C
               NUMBER OF TRAJECTORIES USED TO DEFINE THE FLUX TUBE
      NW
                                                                             CONF
                                                                                    53
С
               PERIPHERY.
                           IF(NM .EQ. 0) SINGLE TRAJECTORIES ARE COMPUTEDCONF
                                                                                    54
C
               CURRENT VALUES OF INDEPENDENT VARIABLES -
                                                                             CONF
                                                                                    55
       P( )
C
                  P(1) = X
                                                                             CONF
                                                                                    56
C
                  P(2) = DX/DT
                                                                             CONF
                                                                                    57
C
                  P(3) = Y
                                                                             CONIF
                                                                                    58
C
                                                                                    59
                  P(4) = DY/DT
                                                                             CONF
C
                  P(5) = Z
                                                                             CONF
                                                                                    60
```

```
C
                  P(6) = DZ/DT
                                                                              CONF
                                                                                     61
C
      PACT
               (SPARE)
                                                                              CONF
                                                                                    62
C
      PT
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGCONF
                                                                                     63
C
               OF PARTICLES
                                                                              CONF
                                                                                     64
C
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                              CONF
                                                                                     65
C
      RHO
               AIR DENSITY (KC/M**3)
                                                                              CONF
                                                                                     66
C
      RHOP
               PARTICLE DENSITY (KG/M**3)
                                                                              CONF
                                                                                     67
C
               RADIUS OF PARTICLE FLUX TUBE IN TARGET PLANE (NORMALIZED) CONF
      RW
                                                                                     68
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                              CONF
                                                                                    69
C
               TOLERANCE FOR REACHING A POINT ON TARGET PLANE WINDO >
      TOL
                                                                              CONF
                                                                                    70
C
               (FRACTION OF RW)
                                                                              CONF
                                                                                    71
               OUTPUT TIME INTERVAL
C
      TPRINT
                                                                              CONF
                                                                                     72
C
      V
               AIR SPEED (M/SEC)
                                                                              CONF
                                                                                    73
C
                                                                                     74
      VIS
               AIR WISCOSITY (KG/(M-SEC))
                                                                              CONF
C
      VPGT
               PARTICLE SPEED AT TARGET POINT
                                                                              CONF
                                                                                    75
               GRAVITY SETTLING SPEED OF PARTICLE
C
      VT
                                                                              CONF
                                                                                    76
C
      VIGI
               AIR SPEED AT TARGET POINT
                                                                              CONF
                                                                                    77
C
      XI3P, YI3P, ZI3P
                         INITIAL PLANE FLUX TUBE CENTER COORDINATES IN
                                                                              CONF
                                                                                    78
C
                         THE FLOW SYSTEM
                                                                              CONF
                                                                                    79
C
      XSTART TRAJECTORY INITIAL X COORDINATE
                                                                              CONF
                                                                                     80
C
      XP, YP, ZP
                 TARGET POINT CCORDINATES IN THE FLUX TUBE SYSTEM
                                                                              CONF
                                                                                     81
C
                 COORDINATES OF CENTER OF FLUX TUBE AT THE TARGET PLANE
      XW, YW, ZW
                                                                              CONF
                                                                                     82
C
                 IN THE FLOW SYSTEM
                                                                              CONF
                                                                                     83
C
                    TARGET FOINT COORDINATES OF THE LAST THREE GUESSES
                                                                              CONF
      YE(), ZE()
                                                                                     84
C
                    (FLOW SYSTEM)
                                                                              CONF
                                                                                    85
C
                    INITIAL POINT COORDINATES OF THE LAST THREE GUESSES
                                                                              CONF
      YI(),ZI()
                                                                                     86
C
                    (FLCW SYSTEM)
                                                                              CONF
                                                                                     87
C
                         TARGET POINT COORDINATES (FLOW SYSTEM)
      YPSTAR. ZPSTAR
                                                                              CONF
                                                                                    88
      YPSTARP. ZPSTARP
                           TARGET POINT COORDINATES (FLUX TUBE SYSTEM)
                                                                              CONF
                                                                                     89
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                                     90
                                                                              CONF
     1RF, REO, R, XPSTAR, YPSTAR, ZPSTAR, P(6), TPRINT, IT, ALPHAO, BETAO, IREC,
                                                                              CONF
                                                                                     91
     ZIPLOT, IPLT, XPLOT(60), YPLOT(60), ZPLOT(60), ALPHAR, BETAR, YPSTARF,
                                                                              CONF
                                                                                     92
     3ZPSTARP, XI3P, ZI3F, XP, YP, ZP, XWP, XP, ACC, DLR, JLIM
                                                                              CONF
                                                                                    93
      DIMENSION HOLL (18), XINIT (100), XEXIT (100)
                                                                              CONF
                                                                                     94
      DIMENSION YINIT (100), ZINIT (100), YEXIT (100), ZEXIT (100)
                                                                              CONF
                                                                                    95
       DIMENSION YI(3), ZI(3), YE(3), ZE(3)
                                                                              CONF
                                                                                    96
                      IPLOT
                                                                              CONF
                                                                                    97
      LOGICAL
                                                                                     98
      DATA PI/3.1415926536/
                                                                              CONF
                                                                              CONF
                                                                                    99
      NFIN=0
                                                                              CONF
C ,
                          READ AND WRITE DATA
                                                                                   100
      READ (5,2600) KASE
                                                                              CONF
                                                                                   101
      CALL SETFLO(KASE)
                                                                              CONF
                                                                                   102
                                  IPLOT
                                                                              CONF 103
      READ(5, 1000) HOLL,
      READ (5,1100) V, ELL, RHO, TEMP, XSTART
                                                                              CONF 104
      READ(5,1100) TPRINT, HI, HMINI, EPSI
                                                                              CONF
                                                                                   105
C
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS CONF
                                                                                   106
      IF (TPRINT .EQ. 0.0) TPRINT=0.1
                                                                              CONF
                                                                                   107
      IF (HI . EQ. 0.0) HI=0.1
                                                                              CONF
                                                                                   108
      IF(HMINI .EQ. 0.0) HMINI=0.005
                                                                              CONF
                                                                                   109
      IF(EPSI(1) .EQ. 0.0) EPSI(1)=1.0E-5
                                                                              CONF 110
      IF(EPSI(2) .EQ. 0.() EFSI(2)=1.0E-5
                                                                              CONF 111
      IF(EPSI(3) .EQ. 0.() EPSI(3)=1.0E-5
                                                                              CONF 112
      READ (5,1150) NW, RW, TOL
                                                                              CONF 113
      JLIM=25
                                                                              CONF 114
      IF(NW .EQ. 0) JLIM=0
                                                                              CONF 115
                                                                              CONF 116
      D0 3 J=2.3
      READ (5,1100) YE(J), ZE(J), YI(J), ZI(J)
                                                                              CONF
                                                                                   117
      VIS = 145.8E+8 + TEMP**(3.0/2.0)/(110.4 + TEMP)
                                                                              CONF 118
      WRITE (6,1200) HOLL
                                                                              CONF 119
      WRITE(6,1300) V, ELL, RHC, TEMP, VIS
                                                                              CONF 120
```

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WRITE(6,1400) HI, HMINI, TFRINT, XSTART
                                                                            CONF 121
      WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                            CONF 122
      WRITE (6.1520) NW. RW. TOL
                                                                            CONF 123
      WRITE (6.1548)
                                                                            CONF 124
                                                                            CONF 125
      D0 4 J = 2.3
                                                                            CONF 126
      I=J-1
      WRITE (6,1550) I, YE(J), ZE(J), YI(J) ,ZI(J)
                                                                            CONF 127
C
                                                                            CONF 128
      INITIALIZE
      FN = V + 2/(9.8 + ELL)
                                                                            CONF 129
      FNR = 1.0/FN
                                                                            CONF 130
       IF (.NOT. IPLOT) GO TO 5
                                                                            CONF 131
      REWIND 10
                                                                            CONF 132
      WRITE (6.1800)
                                                                            CONF 133
      ENTER TRAJECTORY CALCULATION LOOP
                                                                            CONF 134
    5 CALL PARTCL(V, ELL, RHC, VIS, TEMP, DIAM, DLR, RHOP, VT, RF, PT, ACC, NFIN)
                                                                            CONF 135
      IF(NFIN .EQ. 3) GO TO 6
                                                                            CONF 136
      IF( .NOT. IPLOT) RETURN
                                                                            CONF 137
      ENDFILE 10
                                                                            CONF 138
      REWIND 10
                                                                            CONF 139
      RETURN
                                                                            CONF 140
    6 READ(5.1100) XW. YW. ZW
                                                                            CONF 141
      WRITE(6,3500) XM, YW, ZW
                                                                            CONF 142
      IF NECESSARY SET DEFAULT VALUES FOR INITIAL AND FINAL TRAJECTORY
C
                                                                            CONF 143
C
                                                                            CONF 144
      IF (ABS (YE(2))+ABS (YE(3))+ABS (ZE(2))+ABS (ZE(3))+ABS (YI(2))+
                                                                            CONF 145
     1 ABS(YI(3))+ABS(ZI(2))+AES(ZI(3)) .NE. 0.0) GO TO 7
                                                                            CONF 146
      YE(2) = YH + SIGN(1.5*RW*TOL, YH)
                                                                            CONF 147
      ZE(2) = ZW + SIGN(1.5*RW*TOL. ZW)
                                                                            CONF 148
      YE(3) = YW - SIGN(1.5*RW*TOL, YW)
                                                                            CONF 149
      ZE(3) = ZW - SIGN(1.5*RW*TOL.ZW)
                                                                            CONF 150
      YI(2) = YW
                                                                            CONF 151
      ZI(2) = ZW
                                                                            CONF 152
      YI(3) = YE(2)
                                                                            CONF 153
      ZI(3) = ZE(2)
                                                                            CONF 154
    7 COF = PT*VT*FN
                                                                            CONF 155
      R = RF * VT
                                                                          CONF 156
      XPSTAR = XW
                                                                            CONF .1 57
      YPSTAR = YW
                                                                            CONF 158
                                                                            CONF 159
      ZPSTAR = ZW
      YPSTARP=YW
                                                                            CONF 160
      ZPSTARP=ZW
                                                                            CONF 161
      XI3P = 0.0
                                                                            CONF 162
      YI3P = 0.0
                                                                            CONF 163
      ZI3P = 0.0
                                                                            CONF 164
      XWP=XSTART
                                                                            CONF 165
      XPP = XW
                                                                            CONF 166
      XP = 0.0
                                                                            CONF 167
      YP = 0.0
                                                                            CONF 168
      ZP = 0.0
                                                                            CONF 169
      IP = 0
                                                                            CONF 170
C
                                                                            CONF 171
C
      COMPUTE TRAJECTORY THAT PASSES THROUGH THE CENTER OF THE FLUX TUBECONF 172
C
                                                                            CONF 173
                                                                            CONF 174
      ALPHAO = 0.0
      BETAO = 0.0
                                                                            CONF 175
      ALPHAR=0.0
                                                                            CONF 176
      BETAR=0.0
                                                                            CONF 177
      WRITE (6,2800) IP, XPSTAR, YPSTAR, ZPSTAR, YPSTARP, ZPSTARP
                                                                            CONF 178
      CALL MAP (YI, ZI, TCL, RW, YE, ZE)
                                                                            CONF 179
      IF( IT .LT, 0 ) GO TO 5
                                                                            CONF 180
```

```
C
              COMPUTE INITIAL AND FINAL TRAJECTORY ANGLES
                                                                          CONF 181
      CALL FLOVEL(XI3, YI3, ZI3, VX, VY, VZ, HI, INBODY)
                                                                          CONF 182
      ALPHAO = ATAN(VY/VX) * 180./PI
                                                                         CONF 183
      BETAO = ATAN((VZ-VT)/SQRT(VX**2 + VY**2)) * 180./PI
                                                                         CONF 184
      ALPHAR = ATAN(P(4)/P(2))+180./PI
                                                                         CONF 185
      BETAR = ATAN(P(6)/SQFT(P(2)**2+P(4)**2))*180./PI
                                                                         CONF 186
                                                                         CONF 187
      WRITE (6,2000) ALPHAD, BETAG, ALPHAR, BETAR
      IF(NW .EQ. 0) GO TO 5
                                                                         CONF 188
      ALPHAD = ALPHAD*PI/180.
                                                                          CONF 189
      BETAO = BETAU*PI/180.
                                                                         CONF 190
      ALPHAR = ALPHAR*PI/180.
                                                                         CONF 191
      BETAR = BETAR*PI/180.
                                                                         CONF 192
C
      COMPUTE AIR AND PARTICLE SPEEDS AT FINAL PCINT OF TRAJECTORY
                                                                         CONF 193
      CALL FLOVEL ( P(1), P(3), P(5), VX, VY, VZ, HI, INBODY)
                                                                         CONF 194
      VTGT = SQRT(VX**2 + VY**2 + VZ**2)
                                                                         CONF 195
      VPGT = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
                                                                         CONF 196
      XI3P = XI3
                                                                         CONF 197
      YI3P = YI3
                                                                         CONF 198
      ZI3P = ZI3
                                                                         CONF 199
                                                                         CONF 200
      CALL TRANSFM( 0.0, YI(2) - YI3, ZI(2) - ZI3, ALPHAU, BETAU,
     1 XP, YP, ZP, 1)
                                                                          CONF 201
      YI(2) = YP
                                                                         CONF 202
      ZI(2) = ZP
                                                                          CONF 203
      CALL TRANSFM(P(1) - XPSTAR, YE(2) - YPSTAR, ZE(2) - ZPSTAR,
                                                                          CONF 204
     1 ALPHAR, BETAR, XP, YP, ZP, 1)
                                                                         CONF 205
      YE(2) = YP
                                                                          CONF 206
      ZE(2) = ZP
                                                                          CONF 207
                                                                         CONF 208
      YI(.3) = 0.0
      ZI(3) = 0.0
                                                                         CONF 209
      CALL TRANSFM(P(1) - XPSTAR, YE(3) - YPSTAR, ZE(3) - ZPSTAR,
                                                                         CONF 210
     1 ALPHAR. BETAR. XP. YP. ZP. 1)
                                                                          CONF 211
                                                                          CONF 212
      YE(3) = YP
      ZE(3) = ZP
                                                                          CONF 213
      XP = XW
                                                                          CONF 214
      YP = YW
                                                                          CONF 215
      ZP = ZW
                                                                         CONF 216
                                                                         CONF 217
      XWP = 0 . 0
C
                   LOOP FOR EACH POINT ON FLUX TUBE PERIPHERY
                                                                         CONF 218
      DO 500 IP=1.NW
                                                                        CONF 219
      THETA = FLOAT (IP-1)/FLOAT (NW) +3.1415926536 +2.
                                                                         CONF 220
                                                                         CONF 221
C
               CALCULATE TARGET COORDINATES IN FLUX TUBE SYSTEM
      YPSTARP = RW * SIN(THETA) .
                                                                         CONF 222
      ZPSTARP = RW * COS (THETA)
                                                                         CONF 223
        IPSTAR = IP
                                                                         CONF 224
C
              TRANSFORM TARGET COORDINATES TO FLOW SYSTEM
                                                                         CONF 225
      CALL TRANSFMIO. G. YPSTARP, ZPSTARP, ALPHAR, BETAR, XPSTAR, YPSTAR, CONF 226
     1 ZPSTAR,-1)
                                                                         CONF 227
      XPSTAR = XW + XPSTAR
                                                                          CONF 228
      YPSTAR = YW + YPSTAR
                                                                          CONF 229
      ZPSTAR = ZW * ZPSTAR
                                                                          CONF 230
C
              GUESS INITIAL COORDINATES AND COMPUTE TRAJECTORY
                                                                          CONF 231
      WRITE (6,2800) IP, XPSTAR, YPSTAR, ZPSTAR, YPSTARP, ZPSTARP
                                                                          CONF 232
                                                                          CONF 233
      CALL MAP (YI, ZI, TOL, RW, YE, ZE)
      IF( IT .LT. 0 ) GO TC 5
                                                                          CONF 234
C
              TRANSFORM FINAL AND INITIAL COORDINATES TO FLUX TUBE SYS. CONF 235
      CALL TRANSFM (P(1) - XW , P(3) - YW , P(5) - ZW , ALPHAR, BETAR,
                                                                          CONF 236
     1XEXIT(IP), YEXIT(IP), ZEXIT(IP),1)
                                                                          CONF 237
      CALL TRANSFM (XI3-XI3P, YI3-YI3P, ZI3-ZI3P, ALPHAO, BETAO, XINIT(IP), CONF 238
     1 YINIT (IP), ZINIT (IP), 1)
                                                                          CONF 239
      IF ( ABS(XINIT(IP)) . LE . RW * TOL ) GO TO 500
                                                                          CONF 240
```

```
WRITE (6, 2900) XINIT(IP),XI3P
                                                                         CONF 241
  500 CONTINUE
                                                                         CONF 242
      COMPUTE FLUX TUBE CROSS SECTION AREAS IN THE INITIAL AND TARGET
                                                                         CONF 243
C
      PLANES, AND COMPUTE CONCENTRATION FACTOR, ETC.
                                                                         CONF 244
      WRITE (6, 2200) XI3P, YI3P, ZI3P, XW, YW, ZW
                                                                         CONF 245
      DO 600 IP=1.NW
                                                                         CONF 246
  600 WRITE (6.2300) IP, XINIT(IP), YINIT(IP), ZINIT(IP), XEXIT(IP),
                                                                         CONF 247
     1 YEXIT(IP) . ZEXIT(IP)
                                                                         CONF 248
                                                                         CONF 249
      CALL POLYGON (YINIT.ZINIT. NW. AREA)
      CALL POLYGON (YEXIT, ZEXIT, NW, DENOM)
                                                                         CONF 250
                                                                         CONF 251
      CONFAK = AREA/DENOM
      CONRTO = CONFAK / VPGT
                                                                         CONF 252
      WRITE (6,3000) AREA, DENCM, CONFAK, XW, YW, ZW, DIAM
                                                                         CONF 253
      WRITE(6,3400)DLR,RHOF
                                                                         CONF 254
      WRITE( 6, 3200 ) VTGT, CONRTO
                                                                         CONF 255
C
                                                                         CONF 256
C
                                                                         CONF 257
                                                                         CONF 258
C
      SET UP TRIAL COORDINATES FOR NEXT PARTICLE
                                                                         CONF 259
                                                                         CONF 260
                                                                         CONF 261
      YI(3) = YI3
      ZI(3) = ZI3
                                                                         CONF 262
                                                                         CONF 263
      YE(3) = P(3)
                                                                         CONF 264
      ZE(3) \approx P(5)
      CALL TRANSFM( 0.0, YI(2), ZI(2), ALPHAU, BETAU, XI3, YI3, ZI3, -1) CONF 265
      YI(2) = YI3 + YI3P
                                                                         CONF 266
                                                                         CONF 267
      ZI(2) = ZI3 + ZI3P
      CALL TRANSFM( 0.0, YE(2), ZE(2), ALPHAR, BETAR, XI3,YI3, ZI3, -1)CONF 268
    YE(2) = YI3 + YH
                                                                         CONF 2€9
      ZE(2) = ZI3 + ZW
                                                                         CONF 270
                                                                         CONF 271
      GO TO 5
                                                                         CONF 272
 1000 FORMAT(18A4, 7X,L1)
                                                                         CONF 273
 1100 FORMAT(8F10.5)
 1150 FORMAT (I10.7F10.5)
                                                                         CONF 274
 1200 FORMAT(-1H1, 5X, 15HCCNFAC RUN ID -/ 8X, 18A4)
                                                                         CONF 275
 1300 FORMAT (1HO, 5X, 21HPHYSICAL INPUT DATA -/7X, 10HAIR SPEED =1PE13.6, CONF 276
     1 3X, 37HCHARACTERISTIC DIMENSION OF THE BODY=1PE13.6/ 7X,35H (ENSIF CONF 277
     2Y AND TEMPERATURE OF AIR ARE 1PE13.6, 5H AND 1PE13.6,20H AIR VISCONF 278
                                                                         CONF 279
     3COSITY IS 1PE13.6)
 1480 FORMAT( 1HO, 5X, 29H NUMERICAL INTEGRATOR INPUTS -/ 7X, 18HTIME STECONF 280
     1P=1PE11.4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRINT TIME INTCONF 281
     2ERVAL=1PE11.4. 3X. 24HUPSTREAM START DISTANCE=1PE11.4)
                                                                         CONF 282
 1500 FORMAT( 1HO, 6X, 33HLOCAL ERROR TOLERANCES FOR DVDQ -, 3(1PE14.4)) CONF 283
 1520 FORMAT( 1H0, 5X, 35HFARTICLE FLUX TUBE SPECIFICATIONS -/ CONF 284
                7X, 46HNUMBER OF TRAJECTORIES ON FLUX TUBE PERIPHERY=13, CONF 285
     2 3x, 27HFLUX TUBE RADIUS AT TARGET=F9.5, 3x, 10HTOLERANCE=F8.4) CONF 286
 1540 FORMAT( 1H0, 5X, 40HTARGET AND INITIAL CCORDINATE ESTIMATES-/ 10X, CONF 287
                                                                         CONF 288
     1 6HJGUESS, 9X, 2HYT, 13X, 2HZT, 13X, 2HYI, 13X, 2HZI)
 1550 FORMAT( I14, 4(5X, F10.5))
                                                                         CONF 289
 1880 FORMAT( ///6x, 51HTRAJECTORY DATA ARE WRITTEN ON UNIT 18 FOR PLOTICONF 290
                                                                         CONF 291
     1 ING//)
 2000 FORMAT( ///20%, 47HINITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -CONF 292
     1/ 22X, 7HALPHA0=F10.4, 5X, 6HBETA0=F10.4/ 22X, 7HALPHAR=F10.4, 5XCONF 293
                                                                         CONF 294
         6HBETAR=F10.4)
 2200 FORMAT( 1H1, 35X, 44HFLUX TUBE CROSS SECTION COORDINATES IN THE -/CONF 295
               13HINITIAL PLANE, 33X, 12HTARGET PLANE//
                                                                         CONF 296
           8X, 2HIP, 2(9X, 2HXP, 13X, 2HYP, 13X, 2HZP, 4X)/ 4X, 6HCENTECONF 297
     3R6(1PE15.4),14H (FLO) SYSTEM))
                                                                         CONF 298
 2300 FORMAT (110,6(1PE15.4),19H (FLUX TUBE SYSTEM))
                                                                         CONF 299
 2600 FORMAT (A4)
                                                                         CONF 300
```

```
2800 FORMAT( ///
                    18H TRAJECTORY NUMBER, 13,5X, 29HTARGET COORDINATES - CONF 301
    1.10H XPSTAR =F10.6. 4X. 8HYPSTAR =F10.6.5X. 8HZPSTAR =F10.6.
    2 14H (FLOW SYSTEM)/
                           70 X.
                                 8HYPSTARP=F10.6, 5X, 8HZPSTARP=F10.6, CONF 303
    3 19H (FLUX TUBE SYSTEM) //
                                                                         CONF 304
        15X, 6HY FINAL, 6X, 6HZFINAL, 6X, 10HITERATIONS, 5X, 5HYINIT, 7X,
                                                                         CONF
                                                                              305
    5 SHZINIT, 7X, 25HERR CR (FLUX TUBE SYSTEM))
                                                                         CONF 356
2900 FORMAT(// 38%, 49HINITIAL POINT IS NOT IN CORRECT TRANSFORMED PLANECONF
    1/ 32X, 5HXINIT=1PE 12.5, 5X, 5HXI3P=1PE12.5)
                                                                         CONF
                                                                              308
3000 FORMAT(// 15X, 50HFLUX TUBE CROSS SECTION AREA IN THE INITIAL PLANCONF
                                                                              3119
    1E=1PE12.5, 8X, 20HIN THE TARGET PLANE=1FE12.5// 15X, 21HCONCENTRACONF 310
    2TION FACTOR=GPF11.5//
    3 10X, 21HAT THE PCINT (X,Y,Z)=,3F12.5/10X,27HFQR A PARTICLE (F DIACONF 312
    4METER= . F12.5)
                                                                         CONF
                                                                              313
3200 FORMAT( 10x, 36HNORMALIZED AIR SPEED AT FINAL POINT=F12.5/
                                                                         CONF
                                                                              314
       10X, 29HPARTICLE CCNCENTRATION RATIO=F12.5)
                                                                         CONF 315
3400 FORMAT( 1H+, 52X, 30HWITH DIAMETER TO LENGTH RATIO=1PE12.5, 3X,
                                                                         CONF 316
    1 12 HAND DENSITY=1PE12.5)
                                                                         CONF 317
3500 FORMAT( 1H0, 9X, 22HTARGET COORDINATES X=1PE12.5, 5X, 2HY=1PE12.CONF
                                                                              318
                                                                         CONF 319
    15, 5X, 2HZ=1PE12.5)
     END
                                                                         CONF 320
```

```
*DECK, MAP
                                                                             MAP
                                                                                     1
      SUBROUTINE MAP (YI, ZI, TCL, RW, YE, ZE)
                                                                             MAP
C
                                                                             MAP
                                                                                     3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1975
                                                                             MAP
                                                                                     4
                                                                                     5
C
                                                                             MAP
C
         MAP GUESSES THE INITIAL COORDINATES OF A TRAJECTORY THAT IS
                                                                             MAP
C
         AIMING FOR A POINT IN THE TARGET PLANE. AFTER THE TRAJECTORY
                                                                             MAP
                                                                                     7
C
         IS COMPUTED, THE DISTANCE FROM THE TARGET IS COMPARED TO
                                                                             MAP
                                                                                     8
C
         THE ALLOWABLE TOLERANCE. THE PROCESS IS REPEATED UNTIL DISTANCMAP
                                                                                     9
         FROM THE TARGET IS BELOW THE TOLERANCE.
C
                                                                             MAP
                                                                                    10
C
         ONCE A HISTORY OF GREATER THAN THREE TRAJECTORIES HAS BEEN
                                                                             MAP
                                                                                    11
C
         COMPUTED, LEAST SQUARES IS USED TO DETERMINE TRIAL INITIAL
                                                                             MAP
                                                                                    12
С
         COORDINATES
                                                                             MAP
                                                                                    13
C
               GLOSSARY
                                                                             MAP
                                                                                    14
C
                                                                                    15
              MATRIX OF COEFFICIENTS INVERTED IN MATINV
                                                                             MAP
C
               INTERMEDIATE STORAGE FOR LEAST SCUARES NORMAL MATRIX TERMSMAP
      AA, C
                                                                                    16
C
                                                                                    17
      AC
               ACCELERATION MODULUS
                                                                             MAP
               ANGLE OF DRAG VECTOR PROJECTED IN THE X-Y PLANE RELATIVE
C
      ANG
                                                                             MAP
                                                                                    18
                                                                             MAP
C
                                                                                    19
               TO THE X AXIS
C
               ENTERS MATINV AS CONSTANT MATRIX AND RETURNS AS SOLUTION MMAP
                                                                                    20
C
                       DIRECTION COSINES OF DRAG VECTOR
                                                                             MAP
                                                                                    21
      COSA, COSB, COSC
C
      CNG
               ANGLE OF DRAG VECTOR RELATIVE TO Z AXIS
                                                                             MAP
                                                                                    22
C
      DIST
               DISTANCE BETWEEN END OF TRAJECTORY AND TARGET POINT
                                                                             MAP
                                                                                    23
C
                                                                                    24
      DV
               VELOCITY OF FARTICLE RELATIVE TO AIR
                                                                             MAP
C
      IT
               ITERATION NUMBER
                                                                             MAP
                                                                                    25
C
      VA
               AIR SPEED AT TARGET POINT
                                                                             MAP
                                                                                    26
C
      VP
               PARTICLE SPEED AT TARGET POINT
                                                                             MAP
                                                                                    27
C
      W
               LEAST SQUARES SUMMAND WEIGHT
                                                                             MAP
                                                                                    28
C
      YE
               ARRAY OF FINAL
                                 Y COORD FOR LAST
                                                     3 GUESSES
                                                                             MAP
                                                                                    29
C
               ARRAY OF INITIAL Y COORD FOR LAST
                                                                             MAP
      YI
                                                                                    30
                                                     3 GUESSES
C
      YI3
               NEXT GUESS FCR INITIAL Y COORD (FLCW SYSTEM)
                                                                             MAP
                                                                                    31
C
      ZE
               ARRAY OF FINAL
                                 Z COORD FOR LAST
                                                                             MAP
                                                                                    32
                                                    3 GUESSES
C
      ZI
               ARRAY OF INITIAL Z COORD FOR LAST
                                                     3 GUESSES
                                                                             MAP
                                                                                    33
C
      ZI3
               NEXT GUESS FOR INITIAL Z COORD (FLOW SYSTEM)
                                                                             MAP
                                                                                    34
      LOGICAL IPLOT
                                                                             MAP
                                                                                    35
```

```
COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                               MAP
                                                                                      36
     ÍRF,REO.R.XPSTAR,YPSTAR,ZFSTAR,P(6),TPRINT,IT,ALPHAU,BETAU.IREC,
                                                                               MAP
                                                                                      37
     2 IPLOT, IPLT, XPLOT (60), YPLCT (60), ZPLOT (60), ALPHAR, BETAR, YPSTARP,
                                                                               MAP
                                                                                      38
     3ZPSTARP, XI3P, ZI3F, XP, YF, ZP, XWP, XPP, ACC, DLR, JLIM
                                                                               MAP
                                                                                      39
      DIMENSION YI(3), ZI(3), A(4,4), B(4), YE(3), ZE(3), DY(3), DZ(3), MAP
                                                                                      40
     1AA( 6), C(3), PSTR(3)
                                                                                      41
      DATA ILIN/ 25/
                                                                               MAP
                                                                                      42
      DO 50 J=2.3
                                                                               MAP
                                                                                      43
      DY(J) = YE(J) - YPSTARP
                                                                               MAP
                                                                                      44
   50 DZ(J) = ZE(J) - ZPSTARP
                                                                               MAP
                                                                                      45
      IT = 0
                                                                               MAP
                                                                                      46
      N = 4
                                                                               MAP
                                                                                      47
C
                     GENERAL ITERATION CALCULATION OF NEXT GUESS
                                                                               MAP
                                                                                      48
               GENERATE CONSTANT ARRAY (B) FOR MATING IF IT . LE . 3
                                                                                      49
                                                                               MAP
  100 DO 120 J=2,3
                                                                               MAP
                                                                                      50
      I = J - 1
                                                                                      51
                                                                               MAP
      B(2*I-1) = YI(J)
                                                                               MAP
                                                                                      52
                                                                                      53
      B(2*I) = ZI(J)
                                                                               MAP
  120 CONTINUE
                                                                               MAP
                                                                                      54
               GENERATE COEFFICIENT ARRAY (A) FOR MATINV
                                                                               MAP
                                                                                      55
      DO 148 J=2.3
                                                                               MAP
                                                                                      56
      I = J - 1
                                                                                      57
                                                                               MAP
      JROW = 2*I-1
                                                                                      58
                                                                               MAP
      JROW2 = 2*I
                                                                               MAP
                                                                                      59
      A(JROW, 1) = 1.
                                                                               MAP
                                                                                      60
      A(JROW, 2) = 0.
                                                                               MAP
                                                                                      61
      A(JROW,3) = BY(J)
                                                                                      62
                                                                               MAP
      A(JROW, 4) = -DZ(J)
                                                                               MAP
                                                                                      63
      A(JROW2,1) = 0.
                                                                               MAP
                                                                                      64
      A(JROW2,2) = 1.
                                                                               MAP
                                                                                      65
      A(JROW2,3) = DZ(J)
                                                                               MAP
                                                                                      66
      A(JROW2,4) = DY(J)
                                                                               MAP
                                                                                      67
  140 CONTINUE
                                                                               MAP
                                                                                      68
      GO TO 280
                                                                               MAP
                                                                                      69
C
      IF IT . GE . 3 SOLVE FCR THE NEXT INITIAL COORDINATES GUESS BY
                                                                               MAP
                                                                                      70
C
      LEAST SQUARES
                                                                               MAP
                                                                                      71
  200 CONTINUE
                                                                               MAP
                                                                                      72
C
                                                                               MAP
                                                                                      73
C
      INCREMENT LEAST SQUARES NORMAL EQUATIONS
                                                                               MAP
                                                                                      74
C
                                                                               MAP
                                                                                      75
      W = 1.8
                                                                               MAP
                                                                                      76
      G = DY(3) / DIST**2
                                                                               MAP
                                                                                      77
      Q = DZ(3) / DIST**2
                                                                               MAP
                                                                                      78
      S = G * YI(3) + Q * ZI(3)
                                                                               MAP
                                                                                      79
      AA(1) = AA(1) + G^{++}2 + W
                                                                               MAP
                                                                                      80
      AA(2) = AA(2) + G
                          * 0 * W
                                                                               MAP
                                                                                      81
      AA(3) = AA(3) + G
                                                                               MAP
                                                                                      82
      AA(4) = AA(4) + Q**2 * W
                                                                                      83
                                                                               MAP
      AA(5) = AA(5) + Q + W
                                                                               MAP
                                                                                      84
      AA(6) = AA(6) + W
                                                                               MAP
                                                                                      85
      C(1) = C(1) + G + S + W
                                                                               MAP
                                                                                      86
      C(2) = C(2) + Q + S + W
                                                                               MAP
                                                                                      87
      C(3) = C(3) + S + W
                                                                               MAP
                                                                                      88
C
                                                                               MAP
                                                                                      89
C
      SET-UP LEAST SQUARES NORMAL EQUATIONS
                                                                               MAP
                                                                                      90
                                                                               MAP
                                                                                      91
  220 A(1.1) = AA(1)
                                                                               MAP
                                                                                      92
      A(1,2) = AA(2)
                                                                               MAP
                                                                                      93
      A(1,3) = AA(3)
                                                                               MAP
                                                                                      94
      A(2,2) = AA(4)
                                                                               MAP
                                                                                      95
```

```
A(2,3) = AA(5)
                                                                             MAP
                                                                                    96
      A(3.3) = AA(6)
                                                                             MAP
                                                                                    97
      DO 250 I=2.3
                                                                             MAP
                                                                                    98
      K = I-1
                                                                             MAP
                                                                                    99
      00 250 J=I,3
                                                                             MAP
                                                                                   100
  250 A(J,K) = A(K,J)
                                                                             MAP
                                                                                   101
      DO 268 I=1.3
                                                                             MAP
                                                                                   102
  260 B(I) = C(I)
                                                                             MAP
                                                                                   103
      DO 265 I=1,3
                                                                             MAP
                                                                                   104
      A(4.I) = 0.0
                                                                             MAR
                                                                                  105
  265 A(I,4) = 0.0
                                                                             MAP
                                                                                   106
      A(4,4) = 1.0
                                                                             MAP
                                                                                   107
      B(4) = 0.0
                                                                                  108
                                                                             MAP
C
               SOLVE MATRIX EQNS TO GET NEXT GUESS
                                                                             MAP
                                                                                   109
  280 CALL MATINV (A, N, B, 1, OETERM)
                                                                             MAP
                                                                                   110
      CALL'TRANSFM(XWP, B(1), B(2), ALPHA0, BETA0, XI3, YI3, ZI3, -1)
                                                                             MAP
                                                                                   111
      XI3 = XI3 + XI3P
                                                                             MAP
                                                                                   112
      YI3 = YI3 + YI3P
                                                                             MAP
                                                                                   113
      ZI3 = ZI3 + ZI3P
                                                                             MAP
                                                                                  114
      CALL TRAJECT
                                                                             MAP
                                                                                  115
      IF (IT .LT. D) RETURN
                                                                             MAP
                                                                                  116
      IT = IT + 1
                                                                             MAP
                                                                                   117
      IF (IT . GT . 3) GO TO 305
C
                                                                             MAP
                                                                                  118
               UPDATE ARRAYS OF INITIAL AND FINAL CCORDS.
                                                                             MAP
                                                                                   119
  290 DO 300 J=1,2
                                                                             MAP
                                                                                  120
      YI(J) = YI(J+1)
                                                                             MAP
                                                                                  121
      ZI(J) = ZI(J+1)
                                                                             MAP
                                                                                  122
      DY(J) = DY(J+1)
                                                                             MAP
                                                                                  123
      DZ(J) = DZ(J+1)
                                                                             MAP
                                                                                   124
      YE(J) = YE(J+1)
                                                                             MAP
                                                                                  125
      ZE(J) = ZE(J+1)
                                                                             MAP
                                                                                  126
      PSTR(J) = PSTR(J+1)
                                                                             MAP
                                                                                  127
  300 CONTINUE
                                                                             MAP
                                                                                  128
  305 CONTINUE
                                                                             MAP
                                                                                  129
      YI(3) = B(1)
                                                                             MAP
                                                                                  130
      ZI(3) = 8(2)
                                                                             MAP
                                                                                  131
      CALL TRANSFM(P(1) - XP , P(3) - YP , P(5) - ZP , ALPHAR, BETAR,
                                                                             MAP
                                                                                  132
     1 XDUM, YE (3), ZE (3),1)
                                                                             MAP
                                                                                  133
      IF ( ABS(XP) . EQ . 0.0 ) XDUM = XDUM - XPP
                                                                             MAP
                                                                                  134
      IF (ABS (XDUM) . GT . RW * TOL ) WRITE(6, 3000 )
                                                                             MAP
                                                                                  135
      DY(3) = YE(3) - YPSTARP
                                                                             MAP
                                                                                  136
      DZ(3) = ZE(3) - ZPSTARP
                                                                             MAP
                                                                                   137
      DIST = SQRT(DY(3)**2 + DZ(3)**2)
                                                                             MAP
                                                                                   138
      PSTR(3) = DIST
                                                                             MAP
                                                                                   139
                GUESS AGAIN OR GO ON TO VEXT POINT ON WINDOW?
Ċ
                                                                             MAP
                                                                                  140
      WRITE (6,2700) YE(3), ZE(3), IT, YI(3), ZI(3), DIST
                                                                             MAP
                                                                                  141
      IF (DIST .LE. RW+TOL ) GO TO 490
                                                                             MAP
                                                                                  142
      IF( IT .LE. ILIM) IF( IT - 3) 100,310,200
                                                                             MAP
                                                                                   143
      WRITE (6,2900) ILIM
                                                                             MAP
                                                                                  144
      IT = -ILIM
                                                                             MAP
                                                                                   145
      RETURN
                                                                             MAP
                                                                                   146
C
                                                                             MAP
                                                                                   147
C
      INITIALIZE FOR LEAST SCUARES
                                                                             MAP
                                                                                   148
                                                                             MAP
                                                                                   149
  310 DO 320 I=1,3
                                                                             MAP
                                                                                   150
  328 C(I) = 0.0
                                                                             MAP
                                                                                  151
      DO 325 I=1.6
                                                                             MAP
                                                                                   152
  325 \text{ AA(I)} = 0.0
                                                                             MAP
                                                                                   153
      DO 330 I = 1.3
                                                                             MAP
                                                                                   154
      W = 1.0
                                                                             MAP
                                                                                   155
```

```
G = DY(I) / PSTR(I) + +2
                                                                            MAP
                                                                                  156
      Q = DZ(I) / PSTR(I)**2
                                                                            MAP
                                                                                  157
      S = G + YI(I) + Q + ZI(I)
                                                                            MAP
                                                                                  158
      AA(1) = AA(1) + G**2 * W
                                                                            MAP
                                                                                  159
      AA(2) = AA(2) + G + Q + W
                                                                            MAP
                                                                                  160
      AA(3) = AA(3) + G + W
                                                                            MAP
                                                                                  161
      AA(4) = AA(4) + Q**2 * W
                                                                            MAP
                                                                                  162
      AA(5) = AA(5) + Q + W
                                                                            MAP
                                                                                  163
      AA(6) = AA(6) + W
                                                                            MAP
                                                                                  164
      C(1) = C(1) + G + S + W
                                                                            MAP
                                                                                  165
      C(2) = C(2) + Q + S + W
                                                                            MAP
                                                                                  166
  330 \text{ C(3)} = \text{C(3)} + \text{S} + \text{W}
                                                                            MAP
                                                                                  167
      GO TO 100
                                                                            MAP
                                                                                  168
C
                       PRINT TRAJECTORY DUTPUT
                                                                            MAP
                                                                                  169
  490 REWIND 9
                                                                            MAP
                                                                                  170
      WRITE (6,1700)
                                                                            MAP
                                                                                  171
      DO 494 IWRITE = 1. IREC
                                                                            MAP
                                                                                  172
      READ (9) NEVAL, KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, MAP
                                                                                  173
     2 VZ, H, R,AC
                                                                            MAP
                                                                                  174
      WRITE(6,1600) KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, MAP
                                                                                  175
     2 VZ, H, R, AC, NEVAL
                                                                            MAP
                                                                                  176
  494 CONTINUE
                                                                            MAP
                                                                                  177
      COMPUTE AND PRINT DRAG VECTOR AT TARGET POINT
                                                                            MAP
                                                                                  178
      DV = SQRT( (VX - P(2))**2 + (VY - P(4))**2 + (VZ - P(6))**2)
                                                                            MAP
                                                                                  179
      COSA = (VX - P(2))/DV
                                                                            MAP
                                                                                  180
                                                                            MAP
      COSB = (VY - P(4))/DV
                                                                                  181
      COSC = (VZ - P(6))/DV
                                                                            MAP
                                                                                  182
      ANG = ATAN( COSB/COSA ) + 57.29577951
                                                                            MAP
                                                                                  183
      CNG = ACOS( COSC ) * 57.29577951
                                                                            MAP
                                                                                  184
      WRITE( 6, 3100 ) COSA, COSB, COSC, ANG, CNG
                                                                            MAP
                                                                                  185
      COMPUTE AND PRINT AIR AND PARTICLE SPEEDS AT TARGET POINT
C
                                                                            MAP.
                                                                                  186
           = SQRT(VX**2 + VY**2 + VZ**2)
                                                                            MAP
                                                                                  187
           = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
                                                                            MAP
                                                                                  188
      WRITE(6, 3200) VA, VP
                                                                            MAP
                                                                                  189
      IF (IPLOT) WRITE (10) IFLT, (XPLOT(J), YPLOT(J), ZPLOT(J), J=1, IPLT) MAP
                                                                                  190
       RETURN
                                                                            MAP
                                                                                  191
1600 FORMAT(I6, 10(1X,1PE11.4)/10X. 21H=1PE11.4,4H R=1PE11.4, 5H
                                                                         AC=MAP
                                                                                  192
     11PE11.4. 8H NEVAL=16)
                                                                            MAP
                                                                                  193
 1700 FORMAT( 6H0KSTEP, 7X, 1HT, 11X, 1HX, 11X, 1HY, 11X, 1HZ, 10X,
                                                                            MAP
                                                                                  194
     1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X, 2HVZ)
                                                                            MAP
                                                                                  195
 2700 FORMAT (10X, 2E12.4,7X, I3,5X,3E12.4)
                                                                            MAP
                                                                                  196
 2900 FORMAT(///20x, 28HTOLERANCE NOT SATISIFIED IN 14, 58H TRAJECTORY IMAP
                                                                                  197
     1 TERATIONS. GIVE UP AND TRY THE NEXT PARTICLE)
                                                                            MAP
                                                                                  198
 3000 FORMAT(///20x, 57HFINAL FARTICLE POSITION IS NOT IN THE ROTATED TAMAP
                                                                                  199
     1GET PLANE)
                                                                            MAP
                                                                                  200
 3100 FORMAT( 5%, 28HDRAG VECTOR AT FINAL POINT -/ 6%, 18HDIRECTION COSMAP
                                                                                  201
     1 INES-3(1PE13.4), 3X, 19HANGLES A 4ND GAMMA-2(1PE13.4))
                                                                            MAP
                                                                                  202
 3200 FORMAT(5X, 47HAIR AND FARTICLE SPEEDS AT THE FINAL FOINT ARE2(1PEMAP
                                                                                  203
     115.5))
                                                                            MAP
                                                                                  204
      END
                                                                            MAP
                                                                                  205
```

```
*DECK, TRAJECT
                                                                              TRAJ
                                                                                      1
      SUBROUTINE TRAJECT
                                                                                      2
                                                                              TRAJ
C
                                                                              TRAJ
                                                                                      3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1975
                                                                              TRAJ
                                                                                      4
C
                                                                                      5
                                                                              TRAJ
C
               TRAJECT CALCULATES 3-D PARTICLE TRAJECTORIES
                                                                              TRAJ
C
               EMBEDDED IN A FLOW FIELD DETERMINED BY FLOVEL.
                                                                              TRAJ
C
               THE PREDICTOR-CORRECTOR SUBROUTINE DVDQ IS USED
                                                                              TRAJ
                                                                                      8
C
               TO INTEGRATE THE EQUATIONS OF MOTION. OUTPUT AT TIME
                                                                              TRAJ
C
               INTERVAL TPRINT IS WRITTEN ON UNIT 9.
                                                                              TRAJ
                                                                                     10
С
      DRAG PARAMETERS ARE CALCULATED BY FUNCTION PREUN WHICH IS PARTICLETRAJ
                                                                                     11
C
                         S & R & I MPACT IS A PROBLEM-SPECIFIC CODE THAT, AFTERTRAJ
      TYPE-SPECIFIC.
                                                                                     12
C
      PARTICLE IMPACT ON THE BODY, ADJUSTS INITIAL PARTICLE COORDINATES TRAJ
                                                                                     13
C
      SUCH THAT ON THE NEXT TRIAL IMPACTION SHOULD NOT OCCUR.
                                                                              TRAJ
                                                                                     14
C
                                                                              TRAJ
                                                                                     15
C
               GLOSSARY
                                                                              TRAJ
                                                                                     16
C
      AC
               ACCELERATION MODULUS
                                                                              TRAJ
                                                                                     17
C
      DT1)
               STO FAGE FOR DVDQ
                                                                              TRAJ
                                                                                     18
C
      EPS()
               LOCAL ERROR TOLERANCE FOR THE NUMERICAL INTEGRATION
                                                                              TRAJ
                                                                                     19
C
      F()
               EQUATION OF MOTION OF THE PARTICLE -
                                                                              TRAJ
                                                                                     20
C
                  F(1) - X DIFECTION
                                                                              TRAJ
                                                                                     21
C
                  F(2) - Y DIRECTION
                                                                                     22
                                                                              TRAJ
C
                  F(3) - Z DIRECTION
                                                                                     23
                                                                              TRAJ
C
      G
               GSTOP FUNCTION (SEE DVDQ GLOSSARY)
                                                                                     24
                                                                              TRAJ
C
               TIME STEP
                                                                              TRAJ
                                                                                     25
C
      IFLAG
               DVD G STATUS FLAG (SEE DVDQ GLOSSARY)
                                                                              TRAJ
                                                                                     26
C
               FLAG TO INCICATE WHEN TRAJECTORY HAS
      INBODY
                                                                              TRAJ
                                                                                     27
C
               PENETRATED THE BODY
                                                                              TRAJ
                                                                                     28
C
      KD(I)
               ORDER OF THE ITH DIFFERENTIAL EQUATION
                                                                              TRAJ
                                                                                     29
C
      KQ(I)
               THE HIGHEST ORDER DIFFERENCE USED IN THE INTEGRATION OF
                                                                              TRAJ
                                                                                     30
C
               THE ITH EQUATION
                                                                              TRAJ
                                                                                     31
C
      NEO
               NUMBER OF EQUATIONS
                                                                                     32
                                                                              TRAJ
C
      NG
               NUMBER OF GSTOP FUNCTIONS (SEE DVDQ GLOSSARY)
                                                                              TRAJ
                                                                                     33
C
      NGE
               SEE DVDQ GLOSSARY
                                                                              TRAJ
                                                                                     34
C
      P()
               CURRENT VALUE OF THE DEPENDENT VARIABLES (SEE CONFAC)
                                                                              TRAJ
                                                                                     35
C
      PN()
               STORAGE FOR DVDQ
                                                                              TRAJ
                                                                                     36
C
               REYNOLDS NUMBER
      P
                                                                              TRAJ
                                                                                     37
C
      T
                                                                              TRAJ
                                                                                     38
C
               INTEGRATION CUT-OFF TIME
      TFINAL
                                                                                     39
                                                                              TRAJ
C
               AIR VELOCITY IN X DIRECTION
      VX
                                                                              TRAJ
                                                                                     40
C
      VY
               AIR VELOCITY IN Y DIRECTION
                                                                                     41
                                                                              TRAJ
C
               AIR WELOCITY IN Z DIRECTION
                                                                              TRAJ
                                                                                     42
      DIMENSION F(3), EPS(3), KD(3), PN(6), KQ(3), DT(20,3)
                                                                              TRAJ
                                                                                     43
      LOGICAL IPLOT
                                                                                     44
                                                                              TRAJ
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PAGT,
                                                                                     45
                                                                              TRAJ
     1RF, RED, R, XPSTAR, YPSTAR, ZPSTAR, P(6); TPRINT, IT, ALPHAQ, BETAQ, IREC,
                                                                              TRAJ
                                                                                     46
     2 IPLOT, IPLT, XPLOT (60), YPLCT (60), ZPLOT (60), ALPHAR, BETAR, YPSTARP.
                                                                              TRAJ
                                                                                     47
     3 ZPSTARP, XI3P, ZI3 F, XP, YP, ZP, XWP, XPP, ACC, DLR.JLIM
                                                                              TRAJ
                                                                                     48
      DATA MXSTEP, NEQ, NG, NGE/10,3,1,0/, KD/3*2/
                                                                                     49
                                                                              TRAJ
C
      INITIALIZE FOR THE NUMERICAL INTEGRATOR
                                                                              TRAJ
                                                                                     50
      JT = 0
                                                                              TRAJ
                                                                                     51
  100 IFLAG = 0
                                                                              TRAJ
                                                                                     52
      TFINAL = (XPSTAR-XI3) + 2.0
                                                                              TRAJ
                                                                                     53
      HMAX = TFINAL
                                                                              TRAJ
                                                                                     54
      A11 = COS( ALPHAR ) * COS( BETAR )
                                                                              TRAJ
                                                                                     55
      A12 = SIN( ALPHAR ) + COS( BETAR )
                                                                              TRAJ
                                                                                     56
      A13 = SIN(BETAR)
                                                                              TRAJ
                                                                                     57
      T = 0.0
                                                                              TRAJ
                                                                                     58
      EPS(1) = EPSI(1)
                                                                              TRAJ
                                                                                     59
      EPS(2) = EPSI(2)
                                                                              TRAJ
                                                                                     60
```

```
EPS(3) # EPSI(3)
                                                                            TRAJ
                                                                                   61
      H = HI
                                                                            TRAJ
                                                                                   62
      HMINI = WINI
                                                                            TRAJ
                                                                                   63
      XPLOT(1) = XI3
                                                                            TRAJ
                                                                                   64
      YPLOT(1) = YI3
                                                                            TRAJ
                                                                                   65
      ZPLOT(1) = ZI3
                                                                            TRAJ
                                                                                   66
      IPLT = 1
                                                                            TRAJ
                                                                                   67
C
      COMPUTE INITIAL AIR FLOW VELOCITIES
                                                                            TRAJ
                                                                                   68
  110 CALL FLOVEL(XI3, YI3, ZI3, VX, VY, VZ, H, INBODY)
                                                                            TRAJ
                                                                                   69
      P(1) = XI3
                                                                            TRAJ
                                                                                   70
      P(2) = VX
                                                                            TRAJ
                                                                                   71
      P(3) = YI3
                                                                            TRAJ
                                                                                   72
      P(4) = VY
                                                                            TRAJ
                                                                                   73
      P(5) = ZI3
                                                                            TRAJ
                                                                                   74
      P(6) = VZ - VT
                                                                            TRAJ
                                                                                   75
  120 F(1) = 0.0
                                                                            TRAJ
                                                                                   76
      F(2) = 8.0
                                                                            TRAJ
                                                                                   77
      F(3) = VT*PT/COF - FNR
                                                                            TRAJ
                                                                                   78
      G = A11*(P(1) - XPP) + A12 * (P(3) - YP) + A13 * (P(5) - ZP)
                                                                            TRAJ
                                                                                   79
      CALL
                  OVDQ(NEQ, T, P, F, KD, EPS, IFLAG, H, HMIN,
                                                                            TRAJ
                                                                                   80
     * HMAX, TPRINT, TFINAL, MXSTEP, KSTEP, KEMAX, EMAX,
                                                                                   81
                                                                            TRAJ
     * KQ,PN,DT, NEVAL, NG, NGE, NSTOP, G, GT)
                                                                            TRAJ
                                                                                   82
C
      COMPUTE THE TRAJECTORY
                                                                            TRAJ
                                                                                   83
      REWIND 9
                                                                            TRAJ
                                                                                   84
      IREC = 0
                                                                            TRAJ
                                                                                   85
      GO TO 200
                                                                            TRAJ
  150 AC = ACC * SQRT( F(1)**2 + F(2)**2 + F(3)**2 ) * (RF/R)**2
                                                                            TRAJ
                                                                                   87
      WRITE(9)NEVAL, KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, TRAJ
                                                                                   88
     2 VZ, H, R, AC
                                                                            TRAJ
                                                                                   89
      IREC = IREC + 1
                                                                            TRAJ
                                                                                   90
      IF (.NOT. IPLOT .ANC. IFLAG .LE. 18 ) GO TO 200
                                                                            TRAJ
                                                                                   91
      IPLT = IPLT + 1
                                                                            TRAJ
                                                                                   92
      XPLOT(IPLT) = P(1)
                                                                                   93
                                                                            TRAJ
      YPLOT(IPLT) = P(3)
                                                                            TRAJ
                                                                                   94
      ZPLOT(IPLT) = P(5)
                                                                            TRAJ
                                                                                   95
      IF( IFLAG .GT. 10 ) RETURN
                                                                            TRAJ
                                                                                   96
                  DVDQ(NEQ,T,P,F,KB,EPS,IFLAG,H,HMIN,
                                                                            TRAJ
                                                                                   97
     * HMAX, TPRINT, TFINAL, MXST EP, KSTEP, KEMAX, EMAX,
                                                                            TRAJ
                                                                                   98
     * KQ, PN, DT, NEVAL, NG, NGE, NSTOP, G, GT)
                                                                            TRAJ
                                                                                   99
      GO TO( 210, 210, 150, 250, 150, 220, 230, 250, 260, 260, 150,
                                                                            TRAJ 100
     1 150 ), IFLAG
                                                                            TRAJ 101
  210 CALL FLOVEL(P(1),P(3),P(5),VX,VY,VZ,H,IN8ODY)
                                                                            TRAJ 102
       IF (INBODY .EQ. 0) GO TO 215
                                                                            TRAJ 103
      WRITE (6,2200) P(1), P(3), P(5), YI3, ZI3, JT
                                                                            TRAJ 184
      CALL IMPACT (YI3, ZI3)
                                                                            TRAJ 105
      JT = JT + 1
                                                                            TRAJ 106
      IF(JT.LT. JLIM) GO TO 100
                                                                            TRAJ 107
      WRITE (6,2500) JLIM
                                                                            TRAJ 108
      IT=-JLIK
                                                                            TRAJ 109
      RETURN
                                                                            TRAJ 110
  215 R = RF*SQRT((VX - P(2))**2 + (VY - P(4))**2 + (VZ - P(6))**2)
                                                                            TRAJ 111
      PR = PRFUN (R, DLR, COF)
                                                                            TRAJ 112
      F(1) = (VX - P(2))*PR
                                                                            TRAJ 113
      F(2) = (VY - P(4))*PR
                                                                            TRAJ 114
      F(3) = (VZ - P(6)) + PR - FNR
                                                                            TRAJ 115
      GO TO 200
                                                                            TRAJ 116
  22 ( EPS (KEMAX) = 32. *EMAX*EPS (KEMAX)
                                                                            TRAJ 117
      WRITE(6,1900) IFLAG, KSTEP, NEVAL
                                                                            TRAJ 118
      WRITE(6,2000) EPS(KEMAX), KEMAX
                                                                            TRAJ 119
      GO TO 210
                                                                            TRAJ 120
```

```
230 HMIN = H
                                                                          TRAJ 121
      WRITE(6,1900) IFLAG, KSTEP, NEVAL
                                                                          TRAJ 122
      WRITE(6,2100) HMIN
                                                                          TRAJ 123
                                                                          TRAJ 124
      GO TO 200
  260 G = A11*(P(1) - XPP) + A12 * (P(3) - YP) + A13 * (P(5) - ZP)
                                                                          TRAJ 125
      GO TO 200
                                                                          TRAJ 126
                                                                          TRAJ 127
  258 WRITE(6,1900) IFLAG, KSTEP, NEVAL
      AC = ACC + SQRT( F(1) + + 2 + F(2) + + 2 + F(3) + 2 ) + (RF/R) + 2
                                                                          TRAJ 128
      WRITE(6,1600) KSTEP, T, F(1), P(3), P(5), F(2), P(4), P(6), VX, VY, TRAJ 129
                                                                          TRAJ 130
     1 VZ, H, R, AC
                                                                          TRAJ 131
      RETURN
                                                                          TRAJ 132
C
                                                                          TRAJ 133
                                                                        ACTRAJ 134
 1600 FORMAT(I6, 10(1x,1PE11.4)/ 10x, 2HH=1PE11.4, 4H R=1PE11.4, 5H
                                                                          TRAJ 135
     1=1PE11.4)
 1900 FORMAT( 5x, 6HIFL AG= 12, 11H FOR KSTEP= 16, 8H NEWAL= 16)
                                                                          TRAJ 136
 2000 FORMAT( 1H+, 55x, 23HEPS HAS BEEN CHANGED TOIPE11.4, 11H FOR KEMAXTRAJ 137
                                                                          TRAJ 138
     1=I2
 2100 FORMAT( 1H+, 55X, 14HHMIN IS SET TO1PE11.4)
                                                                          TRAJ 139
 2200 FORMAT( 10x, 65HTHE BODY SURFACE IS PENETRATED. PARTICLE COCRDINATRAJ 140
     1TES ARE (X,Y,Z),3(1PE12.5)/ 10X, 43HTRIAL INITIAL COORDINATES ARE TRAJ 141
     2(YINIT, ZINIT)2(1PE12.4), 5X, 14HATTEMPT NUMBERI4)
 2500 FORMAT( / 15X, 5HAFTERI4, 45H ATTEMPTS PARTICLE STILL PENETRATESTRAJ 143
     1 THE BODY.)
                                                                          TRAJ 144
      END
                                                                          TRAJ 145
```

```
*DECK, POLYGON
                                                                             POLY
                                                                                    1
      SUBROUTINE POLYGON(XIN, YIN, N, AREA)
                                                                             POLY
                                                                                     2
C
                                                                             POLY
C
      COMPUTES AREA OF A PLANE POLYGON WITH N VERTICES
                                                                             POLY
C
                                                                             POLY
                                                                                     5
                                                                             POLY
                                                                                     6
      DIMENSION XIN(N), YIN(N)
                                                                                     7
      DIMENSION X(100), Y(100)
                                                                             POLY
                                                                             POLY
      DATA PI/3.1415926536/
                                                                                     8
                    CALCULATE CENTER OF POLYGON
                                                                                    9
                                                                             POLY
      XSUM = 0.
                                                                             POLY
                                                                                   10
                                                                             POLY
      YSUM = 0.
                                                                                   11
      DO 2 I=1,N
                                                                             POLY
                                                                                   12
      XSUM = XSUM + XIN(I)
                                                                             POLY
                                                                                    13
      YSUM = YSUM + YIN(I)
                                                                             POLY
                                                                                   14
                                                                                   15
    2 CONTINUE
                                                                             POLY
      XCEN = XSUM/FLOAT(N)
                                                                             POLY
                                                                                   16
      YCEN = YSUM/FLOAT(N)
                                                                             POLY
                                                                                    17
C
                 REORDER FOINTS IN ASCENDING VALUES OF THETA
                                                                             POLY
                                                                                    18
                                                                             POLY
                                                                                    19
      TPIM1 = 0.
                                                                             POLY
      DO 8 IP=1.N
                                                                                    20
      THETAP = 2.*PI
                                                                             POLY
                                                                                    21
      DO 4 I=1.N
                                                                             POLY
                                                                                   22
      THETA = ATAN2( YIN(I)-YCEN, XIN(I)-XCEN)
                                                                             POLY
                                                                                    23
      IF (THETA .LT. O.) THETA = 2.*PI + THETA
                                                                             POLY
                                                                                   24
      IF (THETA .LE. TPIM1 .OR. THETA .GT. THETAP) GO TO 4
                                                                             POLY
                                                                                    25
      THETAP = THETA
                                                                             POLY
                                                                                    26
      X(IP) = XIN(I)
                                                                             POLY
                                                                                    27
                                                                             POLY
      Y(IP) = YIN(I)
                                                                                    28
                                                                             POLY
                                                                                    29
    4 CONTINUE
                                                                             POLY
      TPIM1 = THETAP
                                                                                    30
```

```
POLY
                                                                                 31
    CONTINUE
8
                                                                           POLY
                                                                                 32
    ASUM = 0.
                                                                           POLY
                                                                                 33
    DO 40 IN=1.N
                                                                           POLY
                                                                                 34
    INM1 = IN - 1
    IF (IN.EQ.1) INM1 = N
                                                                           POLY
                                                                                 35
    BASE = SQFT((X(IN)-X(INM1))**2 + (Y(IN)-Y(INM1))**2)
                                                                           POLY
                                                                                 36
    DENOM = X(IN) - X(INM1)
                                                                           POLY
                                                                                 37
                                                                           POLY
                                                                                 38
    IF (ABS(DENOM) .GT. 1.E-10) GO TO 31
                                                                           POLY
                                                                                 39
    ALT = ABS(XCEN-X(INM1))
                                                                           POLY
                                                                                 40
    GO TO 32
31 SLOPE = (Y(IN)-Y(INM1))/(X(IN)-X(INM1))
                                                                           POLY
                                                                                 41
    ALT = ABS(YCEN-Y(INM1)-SLOPE*(XCEN-X(INM1)))/SQRT(1.+SLOPE**2)
                                                                           POLY
                                                                                 42
                                                                           POLY
                                                                                 43
32 ASUM = ASUM + ALT*BASE/2.
                                                                           POLY
                                                                                 44
40 CONTINUE
                                                                           POLY
200 AREA = ASUM
                                                                                 45
                                                                           POLY
    RETURN
                                                                                 46
                                                                           POLY
                                                                                 47
    END
```

```
TRAN
*DECK, TRANSFM
                                                                              TRAN
                                                                                     2
      SUBROUTINE TRANSFM (X,Y,Z,ALPHA,BETA,XT,YT,ZT,IGC)
                                                                              TRAN
                                                                                     3
C
      TRANSFORMS COORDINATES FROM THE FLOW SYSTEM TO THE PARTICLE FLUX
C
                                                                             TRAN
                                                                             TRAN
C
      TUBE CROSS SECTION SYSTEM, OR VISE VERSA.
      IF( IGO .GT. 0) TRANSFORM FROM FLOW TO FLUX TUBE SYSTEM
                                                                             TRAN
C
      IF( IGO .LT. 0) TRANSFORM FROM FLUX TUBE TO FLOW SYSTEM
                                                                              TRAN
C
                                                                             TRAN
                                                                                     8
                                                                                     9
                                                                              TRAN
      COSA = COS(ALPHA)
                                                                             TRAN
                                                                                    10
      SINA = SIN(ALPHA)
                                                                              TRAN
       COSB = COS(BETA)
                                                                                    11
      SINB = SIN(BETA)
                                                                             TRAM
                                                                                    12
      IF (IGO .LT. 0) GO TO 20
                                                                             TRAN
                                                                                    13
                                                                              TRAN
      A11 = COSA*COSB
                                                                              TRAN
                                                                                    15
      A12 = SINA*COSB
                                                                              TRAN
                                                                                    16
      A13 = SINB
                                                                             TRAN
                                                                                    17
      A21 = -SINA
                                                                             TRAN
                                                                                    18
      A22 = COSA
      A23 = 0.
                                                                              TRAN
                                                                                    19
                                                                              TRAN
      A31 = -COSA*SINB
                                                                                    20
                                                                              TRAN
                                                                                    21
      A32 = -SINB*SINA
                                                                              TRAN
                                                                                    22
      A33 = COSB
                                                                              TRAN
                                                                                    23
      GO TO 30
               GOING THE OTHER WAY
                                                                              TRAN
                                                                                    24
C
                                                                              TRAN
                                                                                    25
  20
      A11= COSA*COSB
       A12 = -SINA
                                                                              TRAN
                                                                                    26
                                                                              TRAN
                                                                                    27
       A13 = -COSA+SINE
      A21 = SINA+COSB
                                                                              TRAN
                                                                                    28
                                                                              TRAN
                                                                                    29
      A22 = COSA
                                                                              TRAN
       A23 = -SINA*SINB
                                                                                    30
                                                                              TRAN
                                                                                    31
       A31 = SINB
      A32 = 9.
                                                                              TRAN
                                                                                    32
                                                                              TR AN
                                                                                    33
       A33=COSB
      XT = A11+X + A12+Y + A13+Z
                                                                              TRAN
                                                                                    34
  30
                                                                              TRAN
       YT = A21*X + A22*Y + A23*Z
                                                                                    35
         ZT = A31*X + A32*Y + A33*Z
                                                                              TRAN
                                                                                    36
                                                                              TRAN
                                                                                    37
       RETURN
                                                                              TRAN
                                                                                    38
       END
```

```
*DECK, MATINV
                                                                             ITAM
      SUBROUTINE MATINV(A,N,B,M,DETERM)
                                                                             ITAM
                                                                                     3
                                                                             MATI
C
      MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
                                                                              MATI
C
                                                                             ITAM
C
      THIS CODE SOLVES THE MATRIX EQUATION
                                                                             MATI
C
               À+X=B
                                                                             MATI
      FOR X.
C
                 A IS AN N+1 INFUT MATRIX.
                                              B IS AN N*1 INPUT VECTOR.
                                                                             MATI
C
      A IS REPLACED BY ITS INVERSE. B IS REPLACED BY THE VECTOR X.
                                                                             MATI
C
      THE CODE CAN BE USED FOR MATRIX INVERSION ALONE. IN THIS MCDE
                                                                             MATI
C
      SET M=0 IN THE INPUT. FOR MATRIX INVERSION PLUS LINEAR EQUATIONMATI
                                                                                    11
C
      SOLUTION, SET M=1 IN THE INPUT.
                                           THE VALUE OF THE DETERMINANT
                                                                             MATI
C
      OF A, DETERM, IS RETURNED FROM BOTH MODES.
                                                                             MATI
C
                                                                             MATI
      DIMENSION IPIVOT (30), A( N, N), B( N,1), INDEX (30,2), PIVOT (30)
                                                                             MATI
                                                                                    15
      EQUIVALENCE (IROW, JRCW), (ICOLUM, JCOLUM), (AMAX, T, SWAP)
                                                                             MATI
                                                                                    16
C
                                                                             MATI
                                                                                    17
C
      INITIALIZATION
                                                                             MATI
                                                                                    18
                                                                             MATI
                                                                                    19
   10 DETERM=1.0
                                                                             MATI
                                                                                    20
   15 DO 20 J=1.N
                                                                                    21
                                                                             MATI
   0 = (L) TOVIGI 0S
                                                                                    22
                                                                             MATI
   30 DO 550 I=1.N
                                                                             MATI
                                                                                    23
C
                                                                             MATI
                                                                                    24
C
      SEARCH FOR PIVOT ELEMENT
                                                                             ITAM
                                                                                    25
                                                                             MATI
                                                                                    26
   40 AMAX=0.0
                                                                             MATI
                                                                                    27
   45 DO 105 J=1.N
                                                                             MATI
                                                                                    28
   59 IF (IPIVOT(J)-1) 60, 105, 60
                                                                             MATI
                                                                                    29
   60 DO 100 K=1.N
                                                                             MATI
                                                                                    30
   70 IF (IPIVOT(K)-1) 80, 100, 740
                                                                             MATI
                                                                                    31
   80 IF (ABS (AMAX)-ABS (A(J,K))) 85/ 180, 100
                                                                                    32
                                                                             MATI
   85 IROW=J
                                                                             MATI
                                                                                    33
                                                                             MATI
   90 ICOLUM=K
                                                                                    34
   95 AMAX=A(J,K)
                                                                             MATI
                                                                                    35
  100 CONTINUE
                                                                             MATI
                                                                                    36
  105 CONTINUE
                                                                             MATI
                                                                                    37
  110 IPIVOT (ICOLUM) = IPIVO T (ICOLUM) + 1
                                                                             MATI
                                                                                    38
                                                                                    39
                                                                             MATI
      INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
                                                                             MATI
                                                                                    40
                                                                             MATI
                                                                                    41
  130 IF (IROW-ICOLUM) 140, 260, 140
                                                                             MATI
                                                                                    42
  140 DETERM=-DETERM
                                                                                    43
                                                                             MATI
  150 DO 200 L=1.N
                                                                             MATI
                                                                                    44
  160 SWAP=A(IROW,L)
                                                                             MATI
                                                                                    45
  170 A(IROW, L) = A(ICOLUM, L)
                                                                                    46
                                                                             MATI
  200 A(ICOLUM.L)=SWAP
                                                                             MATI
                                                                                    47
  205 IF(M) 260, 260, 210
                                                                             MATI
                                                                                    48
  210 DO 250 L=1, M
                                                                             MATI
                                                                                    49
  220 SWAP=B(IROW,L)
                                                                             MATI
                                                                                    50
  230 B(IROW, L)=B(ICOLUM, L)
                                                                             MATI
                                                                                    51
  250 B(ICOLUM, L) = SWAP
                                                                             MATI
                                                                                    52
  260 INDEX([,1)=IROW
                                                                             ITAM
                                                                                    53
  270 INDEX(I,2)=ICOLUM
                                                                             MATI
                                                                                    54
  310 PIVOT (I)=A (ICOLUM, ICCLUM)
                                                                             MATI
                                                                                    55
  320 DETERM=DETERM*PIVOT(I)
                                                                             MATI
                                                                                    56
C
                                                                             MATI
                                                                                    57
      DIVIDE PIVOT ROW BY PIVOT ELEMENT
                                                                             MATI
                                                                                    58
                                                                                    59
                                                                             MATI
  330 A(ICOLUM.ICOLUM) = 1.0
                                                                             MATI
                                                                                    60
```

	340	DO 350 L=1,N	MATI	61
	350	A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)	MATI	62
	355	IF(M) 380, 380, 360	MATI	63
	360	DO 370 L=1, M	MATI	64
	370	B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(I)	MATI	65
С		•	MATI	66
С		REDUCE NON-PIVOT RCWS	MATI	6
С			MATI	68
	380	DO 550 L1=1.N	MATI	69
	390	IF(L1-ICOLUM) 400, 550, 400	MATI	70
	400	T=A(L1, ICOLUM)	MATI	71
	420	A(L1,ICOLUM)=0.0	MATI	72
	430	DO 450 L=1,N	MATI	73
	450	A(L1,L) = A(L1,L) - A(ICOLUM,L) + T	MATI	74
		IF(M) 550, 550, 460	MATI	75
	460	DO 500 L=1,M	MATI	76
	500	B(L1,L) = B(L1,L) - B(ICCLUM,L) + T	MATI	77
	55 <b>0</b>	CONTINUE	MATI	78
С			MATI	79
C		INTERCHANGE COLUMNS	MATI	80
С			MATI	81
	600	DO 710 I=1,N	MATI	82
	610	L=N+1-I	MATI	83
	620	IF (INDEX(L,1)-INDEX(L,2)) 630, 710, 630	MATI	84
		JROW=INDEX(L,1)	MATI	85
	640	JCOLUM=INDEX(L,2)	MATI	86
	650	DO 705 K=1.N	MATI	87
	660	SWAP=A(K, JROW)	MATI	88
	670	A(K,JROW)=A(K,JCOLUM)	MATI	89
	700	A(K, JCOLUM) = SWAP	MATI	90
	705	CONTINUE	MATI	91
		CONTINUE	MATI	92
	740	RETURN	MATI	93
		FNO	MATT	94

```
*DECK, SETFLO
                                                                            SETF
      SUBROUTINE SETFLO( KASE )
                                                                            SETF
C
      INITIALIZES FOR FLOVEL CALCULATION BY READING IN DATA PREPARED
                                                                            SETF
                                                                                    3
      REAL IXX, IXY, IYY, MACH
                                                                            SETF
                                                                                    5
      COMMON /VELDAT/ NSYM, NQUAD, 119, 129, LOOP, RBETA
                                                                            SETF
      COMMON/COM29/ SIG(1000), D41(1000),
                                               XC(1000), YC(1000), ZC(1000), SETF
     1 A11(1000),A12 (1000),A13 (1000),A21(1000),A22(1000),A23(1000),
                                                                            SETF
     2 A31(1000), A32 (1000), A33 (1000), XI1(1000), XI2(1000), XI3(1000),
                                                                            SETF
     3 XI4(1000), ETA1(1000), ETA2(1000), ETA4(1000), TSQ(1000), A(1000),
                                                                                    9
                                                                            SETF
     4 IXX(1000),IXY (1000),IYY (1000),D12 (1000),D23(1000),D34(1000)
                                                                            SETF
                                                                                   10
      REWIND 14
                                                                            SETF
                                                                                   11
      READ(14) KASETP, NSYM, NQUAD, RBETA, MACH
                                                                            SETF
                                                                                   12
      WRITE (6,3000)
                          KASE , NSYM, NQUAD, MACH
                                                                            SETF
                                                                                   13
      IF ( KASE .EQ. KASETP) GO TO 100
                                                                            SETF
                                                                                   14
                                                                            SETF
                                                                                   15
      REWIND 14
      WRITE(6,2000) KASE, KASETP
                                                                            SETF
                                                                                   16
      STOP
                                                                            SETF
                                                                                   17
  100 READ (14){XC(J),YC (J), ZC(J), A11{J), A12{J), A13{J}, A21{J},
                                                                            SETF
                                                                                   18
     1 A22(J), A23(J), A31(J), A32(J), 433(J), XI1(J), ETA1(J), XI2( SETF
                                                                                   19
     2 J), ETA2(J), XI3(J), XI4(J), ETA4(J), TSQ(J), A (J), IXX (J),
                                                                            SETF
                                                                                   20
     3 IXY (J), IYY(J), D12(J), D23(J), D34(J), D41(J), J=1,NQUAD)
                                                                            SETF
                                                                                   21
      READ(14)(SIG(I), I=1,NQUAD)
                                                                            SETF
                                                                                   22
      REWIND 14
                                                                            SETF
                                                                                   23
   10 IF ( NSYM - 1 ) 58, 52, 54
                                                                            SETF
                                                                                   24
   52
                       129 = 1
                                                                            SETF
                                                                                   25
                       I19 = 2
                                                                            SETF
                                                                                   26
                                                                                   27
      GO TO 60
                                                                            SETF
   54
                      129
                           = 2
                                                                            SETF
                                                                                   28
      IF ( NSYM .EQ. 3 ) GO TO 56
                                                                            SETF
                                                                                   29
                      I19
                                                                            SETF
                                                                                   30
      GO TO 60
                                                                            SETF
                                                                                   31
   56
                      I19
                                                                            SETF
                                                                                   32
                                                                            SETF
      GO TO 60
                                                                                   33
   58
                      I19 = 1
                                                                            SETF
                                                                                   34
                                                                                   35
   60 LOOP = 2 ** NSYM + 1
                                                                            SETF
      RETURN
                                                                            SETF
                                                                                   36
 2000 FORMAT( 1H-, 5X, 50HTAPE AND CARD IDENTIFIERS DO NOT MATCH. TRY ASETF
                                                                                   37
     1GAIN/ 16X, 9HCARD ID= A4, 5X,9HTAPE ID= A4)
                                                                            SETF
                                                                                   38
                        19HBODY IDENTIFIER IS A4, 5X, 26HNUMBER OF SYMMESETF
                                                                                   39
 3000 FORMAT ( 1H14
     1TRY PLANES=13, 5X, 25HNUMBER OF QUADRALATERALS=15, 5X, 12HMACH NUMSETF
                                                                                   40
     2BER=E12.5)
                                                                            SETF
                                                                                   41
      END
                                                                            SETF
                                                                                   42
```

```
*DECK, FLOVEL
                                                                          FLOV
      SUBROUTINE FLOVEL( XNPP, YNPP, ZNPP, VXPP, VXPP, VZPP, H, INBODY) FLOV
C
      REVISED 5/11/79
                                                                          FLOV
C
                                                                          FLOV
C
      GIVEN SPACE COORDINATES, XNPP, YMPP, ZNPP, POTENTIAL FLOW VELOCITY
                                                                          FLOV
C
      COMPONENTS, WXPP, VYPP, VZPP, ARE COMPUTED AND RETURNED.
                                                                          FLOV
C
      THE HESS-SMITH METHOD IS USED. THE 28 QUANTITIES PLUS THE
                                                                          FLOV
                                                                                 7
C
      SOURCE STRENGTHS, SIG(), ARE STORED IN CCMMON/COM29/.
                                                                          FLOV
C
      CONTRIBUTIONS FROM NGUAD SURFACE ELEMENTS ARE SUMMED.
                                                                          FLOV
                                                                                 9
C
      UP TO THREE PLANES OF SYMMETRY CAN BE ACCOMODATED.
                                                                          FLOV
C
                                                                          FLOV
                                                                                11
      REAL M12, M23, M34, M41 , IXX, IXY, IYY
                                                                          FLOV
                                                                                12
      COMMON /VELDAT/ NSYM, NQUAD, I19, I29, LOOP,
                                                         RBETA
                                                                          FLOV
                                                                                13
                              X(8), Y(8), Z(8)
                                                                          FLOV
      COMMON/COM29/ SIG(1000), D41(1000),
                                              XC(1000), YC(1000), ZC(1000), FLOV
                                                                                15
     1 A11(1000),A12 (1000),A13 (1000),A21(1000),A22(1000),A23(1000),
                                                                        FLOV
     2 A31(1000), A32 (1000), A33 (1000), XI1(1000), XI2(1000), XI3(1000),
                                                                          FLOV
                                                                                17
     3 XI4(1000),ETA1(1000),ETA2(1000),ETA4(1000),TSQ(1000),A(1000),
                                                                          FLOV
     4 IXX(1000), IXY (1000), IYY (1000), D12 (1000), D23(1000), D34(1000)
                                                                          FLOV
                                                                                19
      DATA RH01SQ, RH02SQ/ 6.0, 16.0 /
                                                                          FLOV
                                                                                20
      VXPP=0.0
                                                                          FLOV
                                                                                21
      VYPP=0.0
                                                                          FLOV
                                                                                22
      VZPP=0.0
                                                                          FLOV
                                                                                23
       INBODY = 0
                                                                          FLOV
                                                                                24
      DO 2300 I1 = 1, NQUAD
                                                                          FLOV
                                                                                25
      DO 1700 I2 = 1, LOOP
                                                                          FLOV
                                                                                26
      IF ( I2 .EQ. LOOP ) GO TO
                                  ( 2000, 910, 920, 930 ),I19
                                                                          FLOV
                                                                                27
      GO TO (1000, 910, 920, 910, 930, 910, 920, 910), I2
                                                                          FLOV
                                                                                28
  910 YC ( I1 ) = - YC ( I1 )
                                                                          FLOV
                                                                                29
      A12 (I1) = -A12 (I1)
                                                                         FLOV
                                                                                30
      A22 (I1) = - A22 (I1)
                                                                         FLOV
                                                                                31
      A31 (I1) = -A31 (I1)
                                                                          FLOV
                                                                                32
      A33 (I1) = -A33 (I1)
                                                                          FLOV
                                                                                33
      GO TO 932
                                                                          FLOV
                                                                                34
  920 \ ZC \ (I1) = - \ ZC \ (I1)
                                                                          FLOV
                                                                                35
      A13 (I1) = -A13 (I1)
                                                                          FLOV
                                                                                36
      A23 (I1) = - A23 (I1)
                                                                          FLOV
                                                                                37
      A31 (I1) = - A31 (I1)
                                                                          FLOV
                                                                                38
      A32 (I1) = -A32 (I1)
                                                                          FLOV
                                                                                39
      GO TO 932
                                                                          FLOV
                                                                                40
  930 XC ( I1 ) = - XC ( I1 )
                                                                          FLOV
                                                                                41
      A11 ( I1 ) = - A11 ( I1 )
                                                                          FLOV
                                                                                42
      A21 (I1) = - A21 (I1)
                                                                          FLOV
                                                                                43
      A32 (I1) = -A32 (I1)
                                                                          FLOV
                                                                                44
      A33 (I1) = -A33 (I1)
                                                                          FLOV
                                                                                45
                                      ( 2100, 2200
  932 IF ( I2 .EQ. LOOP ) GO TO
                                                           ) , ,129
                                                                          FLOV
                                                                                46
 1000 \text{ XDIF} = \text{XNPP- XC} ( I1 )
                                                                          FLOV
                                                                                47
      YDIF = YNPP- YC ( I1 )
                                                                          FLOV
                                                                                48
      ZDIF = ZNPP- ZC ( I1 )
                                                                          FLOV
                                                                                49
                                                                          FLOV
                                                                                5 O
   COMPUTE DISTANCE FROM NULL POINT TO ORIGIN CF J-TH ELEMENT COORDINATEFLOV
C
      SYSTEM ( J CORRESPONDS TO THE INDEX I1 )
                                                                                53
                                                                          FLOV
   INEQUALITY ( 98 )
                                                                          FLOV
                                                                                54
                                                                          FLOV
                                                                                55
      ROSQ = XDIF ** 2 + YDIF ** 2 + ZDIF ** 2
                                                                          FLOV
                                                                                56
      IF ( ROSQ .LT. RHO2SQ * TSQ ( I1 ) ) GO TO 1400
                                                                          FLOV
                                                                                57
                                                                          FLOV.
                                                                                58
   COMPUTE INDUCED VELOCITY COPPONENTS
                                                                          FLOV
                                                                                59
   EQUATION (97)
                                                                          FLOV
                                                                                60
```

```
FLOV
                                                                               61
      ARG1 = A ( I1) / SGRT ( ROSQ ) ** 3
                                                                        FLOV
                                                                               62
          (I2) = ARG1 + XDIF
                                                                        FLOV
                                                                               63
          (I2) = ARG1 * YDIF
                                                                        FLOV
                                                                               64
          (I2) = ARG1 + ZDIF
                                                                        FLOV
                                                                               65
      GO TO 1700
                                                                        FLOV
                                                                               66
                                                                        FLOV
                                                                               67
  TRANSFORM NULL POINT TO J - ELEMENT COORDINATE SYSTEM
                                                                        FLOV
   EQUATION (78)
                                                                        FLOV
                                                                               69
                                                                        FLOV
                                                                               70
                                                                        FLOV
                                                                               71
 1400 XNP = A11 ( I1 ) * XEIF + A12 ( I1 ) * YOIF + A13 ( I1 ) * ZCIF
                                                                        FLOW
      YNP = A21 ( I1 ) * XDIF + A22 ( I1) * YDIF + A23 (I1)*ZDIF
                                                                        FLOV
                                                                               73
      ZNP = A31 ( I1 ) * XBIF + A32 (I1) * YDIF + A33 (I1) * ZDIF
                                                                        FLOV
                                                                               74
                                                                        FLOV
                                                                              75
 INEQUALITIES ( 99) AND ( 100 )
                                                                        FLOV
                                                                              76
      IF ( ROSQ .LT. RH01SQ * TSQ ( I1 ) ) GO TO 1410
                                                                        FLOV
                                                                               77
                                                                        FLOV
                                                                               78
  COMPUTE INDUCED VELOCITY COMPONENTS
                                                                        FLOV
                                                                               79
  EQUATIONS (57) - (62)
                                                                        FLOV
                                                                               80
                                                                        FLOV
                                                                               81
      P = YNP **2 + ZNP ** 2 - 4.0 * XNP ** 2
                                                                        FLOV
                                                                               82
      QP= XNP **2 + ZNP ** 2 - 4.8 * YNP ** 2
                                                                        FLOV
                                                                               83
      RO = SQRT (ROSQ)
                                                                        FLOV
                                                                               84
      ROP = RO ** (- 7)
                                                                        FLOV
                                                                               85
      WXXX = XNP * ( 9.0 * P + 30.0 * XNP ** 2 ) * ROP
                                                                        FLOV
                                                                               86
      WXXY = 3.0 + P + ROP + YNP
                                                                        FLOV
                                                                               87
     FLOV
                                                                               88
                                                                       FLOV
                                                                               89
                                                                        FLOV
                                                                               90
      WXYZ = -15.0 + XNP + YNP + ZNP + ROP
                                                                        FLOV
                                                                               91
      WYYZ = 3.0 * ZNP * QP * FOP
                                                                        FLOV
                                                                               92
      ROP = -RO ** ( - 3)
                                                                        FLOV
                                                                               93
      WX = ROP * XNP
                                                                        FLOV
                                                                              .94
      WY = ROP * YNP '
                                                                        FLOV
                                                                               95
      WZ = ROP * ZNP
                                                                        FLOV
                                                                               96
      HIXX = .5 + IXX ( I1 )
                                                                        FLOV
                                                                               97
      HIYY = .5 * IYY ( I1 )
                                                                        FLOV
                                                                               98
      VX = - WXYY*HIYY - WXXY*IXY( I1) - WXXX*HIXX - WX*A( I1)
VY = - WYYY*HIYY - WXYY*IXY( I1) - WXXY*HIXX - WY*A( I1)
VZ = - WYYZ*HIYY - WXYZ*IXY( I1) - WXXZ*HIXX - WZ*A( I1)
                                                                        FLOV
                                                                              99
                                                                       FLOV 100
                                                                        FLOV 101
      GO TO 1600
                                                                        FLOV 102
                                                                        FLOV 103
C COMPUTE INDUCED VELOCITY COMPONENTS
                                                                        FLOV 104
   EQUATIONS ( 42 ) + ( 49 )
                                                                        FLOV 105
                                                                        FLOV 106
                CHECK TO SEE IF POINT IS INSIDE BODY
                                                                        FLOV 107
 1410 GO TO ( 1300, 1310, 1300, 1310, 1300, 1310, 1310), 12
                                                                        FLOV 108
 1300 IF(ZNP .GT. 0.0 .OR. ROSQ .GT. 0.25*TSQ(I1) .OR. ABS(ZNP) .GT. H) FLOV 189
     1 GO TO 1411
                                                                        FLOV 110
      WRITE (6,5000) I1, I2, ZNP, ROSQ, TSQ(I1), H
                                                                        FLOV 111
 5000 FORMAT(19X,11HINSIDE QUADI5,5X,3HI2=I3/10X,15HZNP,ROSQ,TSQ,H=4(1PEFLOV 112
     113.4)}
                                                                        FLOV 113
      INBODY = 1
                                                                        FLOV 114
      GO TO 1411
                                                                        FLOV 115
 1310 IF(ZNP .LT. 0.0 .OR. ROSQ .GT. 0.25*TSQ(I1) .OR. ABS(ZNP) .GT. H) FLOW 116
     1 GO TO 1411
                                                                        FLOV 117
      WRITE (6,5000) I1, I2, ZNP, RCSQ, TSQ(I1), H
                                                                        FLOV 118
      INBODY = 1
                                                                        FLOV 119
 1411 ETA4M3 = ETA4 ( I1) - ETA1 ( I1 )
                                                                        FLOV 120
```

```
RO = SQRT ( ROSQ )
                                                                       FLOV 121
     ETA2M1 = ETA2 ( I1 ) - ETA1 ( I1 )
                                                                       FLOV 122
     XI4M3 = XI4 ( I1 ) - XI 3 ( I1 )
                                                                       FLOV 123
     XI2M1 = XI2 (I1) - XI1 (I1)
                                                                       FLOV 124
     XI3M2 = XI3 (I1) - XI2 (I1)
                                                                       FLOV 125
     XI1M4 = XI1 ( I1 ) - XI4 ( I1 )
                                                                       FLOV 126
     XMXI 1 = XNP - XI1 ( I1 )
                                                                       FLOV 127
     XMXI2 = XNP - XI2 ( I1 )
                                                                       FLOV 128
     XMXI3 = XNP - XI3 (I1)
                                                                       FLOV 129
     XMXI4 = XNP - XI4 ( I1 )
                                                                    FLOV 130
     YMETA1= YNP - ETA1 ( I1 )
                                                                      FLOV 131
     YMETA 2 = YNP - ETA2 ( I1 )
                                                                      FLOV 132
     YMETA 4 = YNP - ETA4 (I1)
                                                                      FLOV 133
       ZNPSQ = ZNP * ZNP
                                                                      FLOV 134
     IF ( ZNPSQ .LT. TSQ ( I1 ) * 1.0E-6 ) ZNPSQ = 0.0
                                                                      FLOV 135
     E1 = ZNPSQ + XMXI1 **2
                                                                      FLQV 136
     E2 = ZNPSQ + XMXI2 **2
                                                                      FLOV 137
     E3 = ZNPSQ + XMXI3 **2
                                                                       FLOV 138
     E4 = ZNPSQ + XMXI4 **2
                                                                     FLOV 139
     H1 = YMETA1 * XMXI1
                                                                      FLOV 140
     H2 = YMETA2 * XMXI2
                                                                       FLOY 141
     H3 = YMETA1 * XMXI3
                                                                       FLOV 142
     H4 # YMETA4 * XMXI4
                                                                       FLOV 143
     M12 = 0.0
                                                                       FLOV 144
     IF ( XI2M1 .NE. 0.() M12 = ETA2M1 / XI2M1
                                                                       FLOV 145
     M23 = 0.0
                                                                       FLOV 146
     IF ( XI3M2 .NE.0.0) M23 = - ETA2M1 / XI3M2
                                                                       FLOV 147
     M34 = 0.0
                                                                       FLOV 148
     IF ( XI4M3 .NE. 0.1) M34 = ETA4M3 / XI4M3
                                                                      FLOV 149
     M41 = 0.0
                                                                       FLOV 150
     IF ( XI1M4 .NE. 0.6) M41 = - ETA4M3 / XI1M4
                                                                       FLOV 151
     ANUM1 = M12 * E1 - H1
                                                                      FLOV 152
     ANUM2 = M12 * E2 - H2
                                                                      FLOV 153
     ANUM3 = M23 * E2 - H2
                                                                      FLOV 154
     ANUM4 = M23 * E3 - H3
                                                                      FLOV 155
     ANUM5 = M34 * E3 - H3
                                                                       FLOV 156
     ANUM6 = M34 * E4 - H4
                                                                      FLOV 157
     ANUM7 = M41 * E4 - H4
                                                                       FLOV 158
     ANUM8 = M41 * E1 - H1
                                                                      FLOV 159
     R 1 = SQRT (XMXII) ** 2 + YMETA1 ** 2 + ZNPSQ)
                                                                      FLOV 160
     R2 = SQRT ( XMXI2 ** 2 + YMETA2 ** 2 + ZNPSQ)
                                                                     FLOV 161
     R3 = SQRT ( XMXI3 ** 2 + YMETA1 ** 2 + ZNPSQ)
                                                                      FLOV 162
     R4 = SQRT (XMXI4 ** 2 + YMETA4 ** 2 + ZNPSQ)
                                                                      FLOV 163
                                                                    FLOV 164
     Q25 = D12 ( I1 )
     Q26 = D23 (I1)
                                                                       FLOV 165
     Q27 = D34 (I1)
                                                                       FLOV 166
     Q28 = D41 (I1)
                                                                       FLOV 167
     VX = 0.0
                                                                       FLOV 168
     VY = 0.0
                                                                       FLOV 169
     VZ = G \cdot O
                                                                       FLOV 170
     IF ( Q25 ) 1420, 1430, 1420
                                                                       FLOV 171
1420 \text{ TEMP} = R1 + R2
                                                                       FLOV 172
     TEMP1 = TEMP - Q25
                                                                       FLOV 173
     TEMP2 = TEMP + Q25
                                                                       FLOV 174
     ARG1 = 1.0
                                                                       FLOV 175
     IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG1=ALOG(TEMP1/TEMP2) FLOV 176
     TEMP = ARG1 / Q25
                                                                       FLOV 177
     VX = ETA2M1 * TEMP
                                                                       FLOV 178
     VY = - XISM1 * TEMP
                                                                       FLOV 179
1430 IF ( Q26 ) 1435, 1440, 1435
                                                                       FLOV 180
```

```
1435 \text{ TEMP} = R2 + R3
                                                                           FLOV 181
      TEMP1 = TEMP - Q26
                                                                           FLOV 182
      TEMP2 = TEMP + Q26
                                                                           FLOV 183
      ARG2 = 1.0
                                                                           FLOV 184
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG2=ALOG(TEMP1/TEMP2) FLOV 185
      TEMP = ARG2 / Q26
                                                                           FLOV 186
      VX = VX - ETA2M1 * TEMP
                                                                           FLOV 187
      VY = VY - XI3H2 + TEMP
                                                                           FLOV 188
 1440 IF ( Q27 ) 1456, 1468, 1450
                                                                           FLOV 189
 1450 \text{ TEMP} = R3 + R4
                                                                           FLOV 190
      TEMP1 = TEMP - Q27
                                                                           FLOV 191
      TEMP2 = TEMP + Q27
                                                                           FLOV 192
      ARG3 = 1.0
                                                                           FLOV 193
      IF ( TEMP1 .NE. 8.0 .AND. TEMP2 .NE. 0.0 ) ARG3=ALOG(TEMP1/TEMP2) FLOW 194
      TEMP = ARG3 / Q27
                                                                           FLOV 195
      VX = VX + ETA4M3 * TEMP
                                                                           FLOV 196
      VY = VY - XI4M3 + TEMP
                                                                           FLOV 197
 1460 IF ( Q28 ) 1470, 1480, 1470
                                                                           FLOV 198
 1470 \text{ TEMP} = R4 + R1
                                                                           FLOV 199
      TEMP1 = TEMP - 428
                                                                           FLOV 200
      TEMP2 = TEMF + Q28
                                                                           FLOV 201
      ARG4 = 1.0
                                                                           FLOV 202
      IF ( TEMP1 .NE. 0.0 .AND. TEMP2 .NE. 0.0 ) ARG4=ALOG(TEMP1/TEMP2) FLOV 203
      TEMP = ARG4 / Q28
                                                                           FLOV 204
      VX = VX - ETA4M3 * TEMP
                                                                           FLOV 205
      VY = VY - XI1M4 * TEMP
                                                                          FLOV 206
 1480 IF ( ZNPSQ .NE. 0.0 ) GO TO 1510
                                                                           FLOV 207
      TEST = SQRT(TSQ(I1) + 1.0E-3)
                                                                           FLOV 208
      IF(Q25.GT.TEST) IF ((XMXI1*ETA2N1-YMETA1*XI2M1)/Q25) 1600,1502,1502FLOV 209
 1502 IF(Q26.GT.TEST) IF((-XMXI2*ETA2M1-YMETA2*XI3M2)/Q26)1600,1504,1504FLOV 210
 1504 IF (Q27.GT.TEST) IF ((XMXI3+ETA4M3-YMETA1+XI4M3)/Q27) 1600,1506,1506FLOV 211
 1586 IF(Q28.GT.TEST) IF((-XMXI4*ETA4M3-YMETA4*XI1M4)/Q28)1688,1588,1588FLOV 212
 1508 \ VZ = 6.28318531E0
                                                                          FLOV 213
      GO TO 1600
                                                                          FLOV 214
 1510 IF (XI2M1 •NE• 0.0) VZ = ATAN(ANUM1/(ZNP*R1))-ATAN(ANUM2/(ZNF*R2))FLOV 215
      IF (XI3M2 .NE. 5.0) VZ=VZ+ATAN(ANUM3/(ZNP*R2)) ATAN(ANUM4/(ZNP*R3)) FLOV 216
      IF (XI4M3 .NE. 0.0) VZ=VZ+ATAN(ANUM5/(ZNP*R3))-ATAN(ANUM6/(ZNF*R4)) FLOV 217
      IF (XI1M4 •NE• 0.0) VZ=VZ+ATAN(ANUM7/(ZNP*R4))-ATAN(ANUM8/(ZNP*R1)) FLOV 218
C
                                                                          FLOV 219
  TRANSFORM INDUCED VELOCITY COMPONENTS TO REFERENCE COORDINATE SYSTEM FLOV 220
   EQUATION (79)
                                                                          FLOV 221
                                                                          FLOV 222
1600 X
          (I2) = A11 (I1) + VX + A21 (I1) + VY + A31 (I1) + VZ
                                                                          FLOV 223
          \{ I2\} = A12 \{I1\} * VX + A22 \{I1\} * VY + A32 \{I1\} * VZ
                                                                          FLOV 224
          (I2) = A13 (I1) * VX + A23 (I1) * VY + A33 (I1) * VZ
                                                                          FLOV 225
 1700 CONTINUE
                                                                          FLOV 226
                                                                          FLOV 227
 2000 VXPP = VXPP + SIG(I1) * \chi(1)
                                                                          FLOV 228
      VYPP = VYPP + SIG(I1) + Y(1)
                                                                          FLOV 229
      VZPP = VZPP + SIG(I1) + Z(1)
                                                                          FLOV 230
      GO TO 2380
                                                                          FLOV 231
 2100 VXPP = VXPP + SIG(I1) + (X(1) + X(2))
                                                                          FLOV 232
      VYPP = VYPP + SIG(11) + (Y(1) + Y(2))
                                                                          FLOV 233
      VZPP = VZPP + SIG(I1) * (Z(1) + Z(2))
                                                                          FLOV 234
      GO TO 2300
                                                                          FLOV 235
 2200 VXPP = VXPP + SIG(I1) + (X(3) + X(2) + X(3) + X(4))
                                                                          FLOV 236
      VYPP = VYPP + SIG(I1) + (Y(1) + Y(2) + Y(3) + Y(4))
                                                                          FLOV 237
      VZPP = VZPP + SIG(I1) + (Z(1) + Z(2) + Z(3) + Z(4))
                                                                         FLOV 238
2204 IF ( NSYM .EQ. 2 ) GO TO 2300
                                                                         FLOV 239
      VXPP = VXPP - SIG(I1) + (X(5) + X(6) + X(7) + X(8))
                                                                          FLOV 240
```

```
VYPP = VYPP - SIG(I1) + (Y(5) + Y(6) + Y(7) + Y(8))
                                                                         FLOV 241
     VZPP = VZPP - SIG(I1) + (Z(5) + Z(6) + Z(7) + Z(8))
                                                                         FLOV 242
2300 CONTINUE
                                                                         FLOV 243
     VXPP = VXPP * R8ETA**2 + 1.0
                                                                         FLOV 244
     VYPP = VYPP * RBETA
                                                                         FLOV 245
    VZPP = VZPP * RBETA
                                                                         FLOV 246
     RETURN
                                                                         FLOV 247
     END
                                                                         FLOV 248
```

```
*DECK, FLOAIR
                                                                           FLOA
                                                                                   1
      SUBROUTINE FLOAIR( X, Z, ECC, VX, VZ, PSI, IFLAG)
                                                                           FLOA
                                                                                   2
      THIS CODE RETURNS AIRFLOW VELOCITY (VX, VZ) FOR A GIVEN POINT
                                                                           FLOA
                                                                                   3
C
      (X. Z) EXTERIOR TO AN ELLIPSOID OF REVOLUTION IN AN AIRSTREAM.
                                                                           FLOA
С
      THE ELLIPSOID IS PROLATE WITH MAJOR AXIS PARALLEL WITH THE FREE
                                                                           FLOA
                                                                                   5
C
      STREAM FLOW. FLOW IS TOWARD THE POSITIVE X AXIS. PSI IS THE
                                                                           FLOA
                                                                                   6
      STREAM FUNCTION VALUE AT X, Z. ECC IS THE ELLIPSOID ECCENTRICITY. FLOA
C
                                                                                   7
      IF(IFLAG) 100,100,200
                                                                           FLOA
                                                                                   8
      INITIALIZE
                                                                                  9
                                                                           FLOA
  100 E2 = ECC**2
                                                                           FLOA
                                                                                  10
      OME2 = 1.0 - E2
                                                                           FLOA
                                                                                  11
      TEC = 2.0 * ECC
                                                                           FLOA
                                                                                  12
      CX = -ECC/(ALOG((1.0 + ECC)/(1.0 - ECC)) - TEC/OME2)
                                                                           FLOA
                                                                                 13
      CZ = TEC*CX
                                                                           FLOA
                                                                                 14
      CPSI = ECC*CX
                                                                           FLOA
                                                                                 15
      COMPUTE FLOW VELOCITIES AND STREAMFUNCTION VALUE
                                                                           FLOA
                                                                                 16
 200 SQRM = SQRT((X + ECC)**2 + Z**2)
                                                                           FLOA
                                                                                 17
      SQRN = SQRT((X - ECC) + 2 + Z + 2)
                                                                           FLOA
                                                                                 18
      VX =CX+(ALOG(( SGRM + SQRN + TEC)/ (SQRM + SGRN - TEC))/ECC
                                                                           FLOA
                                                                                 19
    1 - 1.0/SQRM - 1.0/SQRN) + 1.0
                                                                           FLOA
                                                                                 20
             CZ*Z*( 1.0/SQRM - 1.0/SQRN)/ (X*+2 + Z*+2 + SQRM*SQRN - E2)FLOA
      VZ =
                                                                                 21
      COSH = (SQRM + SQRN)/TEC
                                                                           FLOA
                                                                                 22
      COS = (SQRM - SQRN)/TEC
                                                                           FLOA
                                                                                 23
      PSI = CPSI*( COSH + 0.5*( COSH**2 - 1.0)*
                                                                           FLOA
                                                                                 24
    1 ALOG((COSH - 1.0)/(COSH + 1.0))) * (1.0 - COS++2) - Z++2/2.0
                                                                           FLOA
                                                                                 25
      RETURN
                                                                           FLOA
                                                                                 26
      END
                                                                           FLOA
                                                                                 27
```

```
*DECK, ARYTRJ
                                                                             ARYT
      SUBROUTINE ARYTRJ
                                                                                    2
                                                                             ARYT
                                                                             ARYT
                                                                                    3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1975
                                                                             ARYT
                                                                                    4
C
                                                                                    5
                                                                             ARYT
C
      CALLS TRAJECT TO COMPUTE TRAJECTORIES OF PARTICLES TO OR ABOUT
                                                                             ARYT
                                                                                    6
C
      AN ARBITRARY 3-DIMENSIONAL BODY: TRAJECTORIES BEGIN AT AN ARRAY
                                                                             ARYT
                                                                                    7
C
      OF POINTS IN SPACE.
                            THE ARRAY POINTS, AND CORRESPONDING
                                                                                    8
                                                                             ARYT
C
      TRAJECTORIES, ARE DEFINED BY SPECIFYING AN INITIAL POINT, INCREMENTARYT
                                                                                    9
      VALUES IN THE THREE COORDINATE DIRECTIONS, AND THE ORDER OF
C
                                                                             ARYT
                                                                                   10
C
                          INFUT INTEGERS M(3) SPECIFY THE ORDER IN WHICH
      INCREMENTING.
                                                                             ARYT
                                                                                   11
      INCREMENTING IS DONE - ALLOWED VALUES OF M ARE 1,2,3. FOR EXAMPLEARYT
C
                                                                                   12
C
      SUPPOSE M(1)=2, M(2)=1, M(3)=3, THEN Y IS INCREMENTED FIRST, X IS ARYT
                                                                                   13
C
      INCREMENTED SECOND AND Z IS INCREMENTED LAST.
                                                                             ARYT
                                                                                   14
C
      IF TRAJECTORIES ARE NOT CESTRED FROM ALL OF THE ARRAY POINTS, THE ARYT
                                                                                   15
C
      PARAMETER NSKIP CAN BE SIT GREATER THAN ZERO, AND AFTER THE FIRST ARYT
                                                                                   16
C
      TRAJECTORY ONLY EVERY NSKIP+1 TH TRAJECTORY IS COMPUTED.
                                                                             ARYT
                                                                                   17
C
      ALSO REQUIRED ARE - (IN ORDER OF X AXIS FIRST, Y AXIS SECOND,
                                                                             ARYT
                                                                                   18
      Z AXIS THIRE) - INITIAL COORDINATE, INCREMENT, NUMBER OF INCREMENTSARYT
C
                                                                                   19
C
      DESIRED (INCLUDING THE INITIAL COORDINATE VALUE).
                                                                             ARYT
                                                                                   20
C
                                                                                   21
                                                                             ARYT
C
      SR PARTCL IS CALLED TO READ, PROCESS AND PRINT PARTICLE DATA.
                                                                             ARYT
                                                                                   22
      THIS SR CAN BE ONE OF SEVERAL THAT TREATS WATER DROPS OR ONE OF
C
                                                                             ARYT
                                                                                   23
C
      VARIOUS TYPES OF ICE CRYSTALS.
                                                                             ARYT
                                                                                   24
C
                                                                             ARYT
                                                                                   25
C
      UNIT 9 IS A SCRATCH UNIT USED FOR TRAJECTORY DATA STORAGE.
                                                                             ARYT
                                                                                   26
C
      UNIT 10 IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.
                                                                             ARYT
                                                                                   27
C
                                                                             ARYT
                                                                                   28
C
      FLOW DATA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14
                                                                                   29
                                                                             ARYT
C
      VIA SR SETFLO.
                                                                             ARYT
                                                                                   30
C
                                                                             ARYT
                                                                                   31
C
      ALL COORDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)
                                                                             ARYT
                                                                                   32
C
                                                                             ARYT
                                                                                   33
C
      GLOSSARY
                                                                             ARYT
                                                                                   34
C
      ACC
               DIAM/ELL - USED TO COMPUTE ACCELERATION MODULUS
                                                                             ARYT
                                                                                   35
               ANGLE BETWEEN PROJECTION OF INITIAL VELOCITY VECTOR IN
C
      ALPHAC
                                                                             ARYT
                                                                                   36
               X-Y PLANE AND X AXIS
C
                                                                             ARYT
                                                                                   37
      ALPHAR
C
               ANGLE BETWEEN FREJECTION OF FINAL VELOCITY VECTOR IN X-Y
                                                                             ARYT
                                                                                   38
C
               PLANE AND X AXIS
                                                                             ARYT
                                                                                   39
C
      BETAG
               ANGLE BETWEEN INITIAL VELOCITY VECTOR AND ITS PROJECTION
                                                                             ARYT
                                                                                   40
C
               IN THE X-Y PLANE
                                                                             ARYT
                                                                                   41
C
               ANGLE BETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION
                                                                             ARYT
                                                                                   42
      BETAR
               IN THE X-Y PLANE
                                                                             ARYT
                                                                                   43
C
      D
               COORDINATE INCREMENT ARRAY
                                                                             ARYT
                                                                                   44
                                                                             ARYT
                                                                                   45
C
      DIAM
               DIAMETER OF A WATER DROP OR ICE AGGREGATE
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                             ARYT
                                                                                   46
C
      DLR
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
                                                                             ARYT
                                                                                   47
C
               RATIO
                                                                             ARYT
                                                                                   48
C
      ELL
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
                                                                             ARYT
                                                                                   49
C
      EPSI() PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
                                                                             ARYT
                                                                                   50
               INTEGRATION (SEE DVDQ GLOSSARY)
                                                                             ARYT
                                                                                   51
C
      FN
               FROUDE NUMBER
                                                                             ARYT
                                                                                   52
      FNR
               RECIPROCAL OF THE FROUDE NUMBER
C
                                                                             ARYT
                                                                                   53
C
      HI
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDQ)
                                                                             ARYT
                                                                                   54
               (DCVO 332) HAXINUM TIME STEP (SEE DVDQ)
C
      HMAX
                                                                             ARYT
                                                                                   55
C
      HMIN
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
                                                                             ARYT
                                                                                   56
C
      IPLOT
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 10 FOR PLOTTINGARYT
                                                                                   57
C
               NUMBER OF COORDINATE INCREMENT STEPS ARRAY (INCLUDING THE ARYT
                                                                                   58
               FIRST COORDINATE VALUE)
C
                                                                             ARYT
                                                                                   59
      NPOINT
               ARRAY POINT TALLY
                                                                             ARYT
                                                                                    6Ù
```

```
C
      NSKIP
               NUMBER OF ARRAY FOINTS SKIPPED BETWEEN TRAJECTORIES
                                                                             ARYT
                                                                                    61
C
      P( )
               CURRENT VALUES OF INDEPENDENT VARIABLES -
                                                                             ARYT
                                                                                    62
C
                  P(1) = X
                                                                              ARYT
                                                                                    63
C
                  P(2) = DX/DT
                                                                              ARYT
                                                                                    64
C
                  P(3) = Y
                                                                              ARYT
                                                                                    65
C
                  P(4) = DY/DT
                                                                              ARYT
                                                                                    66
C
                  P(5) = Z
                                                                              ARYT
                                                                                    67
C
                  P(6) = DZ/DT
                                                                              ARYT
                                                                                    68
C
      PT
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGARYT
                                                                                    69
C
               OF PARTICLES
                                                                                    70
                                                                              ARYT
C
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO REYNOLDS NUMBER
                                                                                    71
                                                                             ARYT
C
      RHO
               AIR DENSITY (KG/M*+3)
                                                                                    72
                                                                             ARYT
C
      RHOP
               PARTICLE DENSITY (KG/M**3)
                                                                             ARYT
                                                                                    73
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                                    74
                                                                             ARYT
C
      TPRINT
               OUTPUT TIME INTERVAL
                                                                                    75
                                                                             ARYT
C
               AIR SPEED (M/SEC)
                                                                                    76
                                                                             ARYT
C
               AIR VISCOSITY (KG/(M-SEC))
      VIS
                                                                             ARYT
                                                                                    77
C
      VPGT
               PARTICLE SPEED AT TARGET POINT
                                                                                    78
                                                                             ARYT
C
      VT
               GRAVITY SETTLING SPEED OF PARTICLE
                                                                             ARYT
                                                                                    79
C
      VIGI
               AIR SPEED AT TARGET POINT
                                                                             ARYT
                                                                                    80
C
               INITIAL COCRCINATE ARRAY
                                                                             ARYT
                                                                                    81
C
      XFINAL
               X COORDINATE OF THE FINAL PLANE
                                                                              ARYT
                                                                                    82
C
      XI3,YI3,ZI3
                    INITIAL COORDINATES PASSED TO TRAJECT
                                                                             AR YT
                                                                                    83
C
                                                                             ARYT
                                                                                    84
C
                                                                             ARYT
                                                                                    85
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, VT, PT, COF, FNR, PACT,
                                                                              ARYT
                                                                                    86
     1RF,REO,R,XPSTAR,YPSTAR,ZPSTAR,P(6),TPRINT,IT,ALPHAO,BETAO,IREC,
                                                                             ARYT
                                                                                    87
     2IPLOT, IPLT, XPLOT (60), YPLCT(60), ZPLOT(60), ALPHAR, BETAR, YPSTARP.
                                                                              ARYT
                                                                                    88
     3ZPSTARP,XI3P,ZI3P,XP,YP,ZP,XWP,XPP,ACC,DLR,JLIM
                                                                             ARYT
                                                                                    89
      DIMENSION HOLL (18), X(3), D(3), N(3), M(3), SX(3), SD(3), NS(3),
                                                                              ARYT
                                                                                    90
     1 SXI(3), SEQ(6)
                                                                                    91
                                                                             ARYT
      LOGICAL
                      IPLOT -
                                                                                    92
                                                                              ARYT
      DATA SEQ/ 4HFIRS, 4HT
                                , 4HSECO, 4HND , 4HTHIR, 4HD
                                                                              ARYT
                                                                                    93
      DATA STAR, BLNK / 3H *, 3H /, PI/3.1415926536/
                                                                              ARYT
                                                                                    94
      JLIM=0
                                                                             ARYT
                                                                                    95
      NFIN=0
                                                                             ARYT
                                                                                    96
C
                          READ AND WRITE DATA
                                                                                    97
                                                                             ARYT
      READ (5,2600) KASE
                                                                              AR YT
                                                                                    98
      CALL SETFLO(KASE)
                                                                                    99
                                                                             ARYT
      READ (5, 1000) HOLL,
                                  IPLOT
                                                                             ARYT 100
      READ(5,1100)V, ELL, RHO, TEMP, XFINAL
                                                                              ARYT 181
      READ(5,1100) TPRINT, HI, HMINI, EPSI
                                                                              ARYT 162
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS ARYT 103
C
      IF(TPRINT .EQ. 0.0) TPRINT=0.1
                                                                              ARYT 104
      IF(HI .EQ. 0.0) HI=0.1
                                                                              ARYT 105
      IF(HMINI .EQ. O.Q) HMINI#0.005
                                                                              ARYT 106
      IF(EPSI(1) \cdotEQ. 0.0) EFSI(1)=1.0E-5
                                                                              ARYT 107
      IF (EPSI(2) .EQ. 0.() EFSI(2)=1.0E-5
                                                                              ARYT 108
      IF(EPSI(3) .EQ. 0.0) EPSI(3)=1.0E-5
                                                                              ARYT 109
      VIS = 145.8E-8 + TEMP++(3.0/2.0)/(110.4 + TEMP)
                                                                              ARYT 110
      WRITE(6,1200) HOLL
                                                                             ARYT 111
      WRITE(6,1300) V, ELL, RHC, TEMP, VIS
                                                                              ARYT 112
      WRITE(6,1400) HI, HMINI, TFRINT, XFINAL
                                                                              ARYT 113
      WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                              ARYT 114
                                                                              ARYT 115
C
      INITIALIZE
      FN = V^{+}2/(9.8^{+}ELL)
                                                                              ARYT 116
      FNR = 1.0/FN
                                                                              ARYT 117
       IF (.NOT. IPLOT) GO TO 5
                                                                              ARYT 118
      REWIND 10
                                                                              ARYT 119
      WRITE (6,1800)
                                                                              ARYT 120
```

```
C
      ENTER PARTICLE LOOP
                                                                              ARYT 121
    5 CALL PARTCL(V, ELL, RHC, VIS, TEMP, DIAN, DLR, RHOP, VT, RF, PT, ACC, NFIN)
                                                                              ARYT 122
      IF(NFIN .EQ. 0) GO TO 6
                                                                              ARYT 123
      IF( .NOT. IPLOT) RETURN
                                                                              ARYT 124
      ENDFILE 10
                                                                              ARYT 125
      REWIND 10
                                                                              ARYT 126
      RETURN
                                                                              ARYT 127
    6 COF = PT*VT*FN
                                                                              ARYT 128
      R = RF + VT
                                                                              ARYT 129
      READ(5,8100)M. NSKIP
                                                                              ARYT 130
      IF(M(1)+M(2)+M(3) .EQ. 6) GO TO 10
                                                                              ARYT 131
      WRITE(6,8200)
                                                                              ARYT 132
      STOP
                                                                              ARYT 133
   10 00 20 L=1.3
                                                                              ARYT 134
   20 READ(5,8000) X(L), D(L), N(L)
                                                                              ARYT 135
      WRITE(6,2000) X(1), D(1), N(1)
                                                                              ARYT 136
      WRITE(6,3000) X(2), B(2), N(2)
                                                                              ARYT 137
      WRITE(6,4000) X(3), D(3), N(3)
                                                                              ARYT 138
      WRITE(6,9000)
                                                                              ARYT 139
      WRITE(6,5000) SEQ(2*M(1)-1), SEQ(2*M(1))
                                                                              ARYT 140
      WRITE(6,6000) SEQ(2*M(2)-1), SEQ(2*M(2))
                                                                              ARYT 141
      WRITE(6.7000) SEQ(2*M(3)-1). SEQ(2*M(3))
                                                                              ARYT 142
      DO 49 L=1.3
                                                                              ARYT 143
      LL=4-M(L)
                                                                              ARYT 144
      SD(LL)=D(L)
                                                                              ARYT 145
      SXI(LL) = X(L) -DEL)
                                                                              ARYT 146
   40 NS(LL)=N(L)
                                                                              ARYT 147
      N1=NS(1)
                                                                              ARYT 148
      N2=NS(2)
                                                                              ARYT 149
      N3=NS(3)
                                                                              ARYT 150
      NPOINT=0
                                                                              ARYT 151
      SX(1) = SXI(1)
                                                                              ARYT 152
      DO 500 I=1.N1
                                                                              ARYT 153
      SX(1) = SX(1) + SD(1)
                                                                              ARYT 154
      SX(2) = SXI(2)
                                                                              ARYT 155
      DO 500 J=1.N2
                                                                              ARYT 156
      SX(2) = SX(2) + SD(2)
                                                                              ARYT 157
      SX(3) = SXI(3)
                                                                              ARYT 158
      DO 500 K=1.N3
                                                                              ARYT 159
      SX(3) = SX(3) + SD(3)
                                                                              ARYT 160
      NPOINT=NPOINT+1
                                                                              ARYT 161
      IF(MOD(NPOINT, NSKIP+1) .NE. 1) GO TO 500
                                                                              ARYT 162
      DO 50 L=1.3
                                                                              ARYT 163
      LL=4-M(L)
                                                                              ARYT 164
   50 X(L)=SX(LL)
                                                                              ARYT 165
C
      INITIALIZE FOR TRAJECT
                                                                              ARYT 166
      XI3=X(1)
                                                                              ARYT 167
      YI3=X(2)
                                                                              ARYT 168
                                                                              ARYT 169
      ZI3=X(3)
      XPSTAR=XFINAL
                                                                              ARYT 170
      XPP = XFINAL
                                                                              ARYT 171
      ALPHAR = 0.0
                                                                              ARYT 172
      BETAR=0.0
                                                                              ARYT 173
      YP = 0.0
                                                                              ARYT 174
      ZP = 0.0
                                                                              ARYT 175
      WRITE(6,1600) XI3, YI3, ZI3
                                                                              ARYT 176
      CALL TRAJECT
                                                                              ARYT 177
C
                        PRINT TRAJECTORY OUTPUT
                                                                              ARYT 178
      REWIND 9
                                                                              ARYT 179
      WRITE (6,8700)
                                                                              ARYT 180
```

```
DO 494 IWRITE = 1. IREC
                                                                         ARYT 181
      READ (9) NEVAL, KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, ARYT 182
     2 VZ. H. R.AC
                                                                        ARYT 183
      WRITE(6,8600) KSTEP, T, f(1), P(3), P(5), P(2), P(4), P(6), VX, VY, ARYT 184
     2 VZ. H. R. AC. NEVAL
                                                                         ARYT 185
  494 CONTINUE
                                                                         ARYT 186
              COMPUTE INITIAL AND FINAL TRAJECTORY ANGLES
C
                                                                        ARYT 187
      CALL FLOVEL (XI3, YI3, ZI3, VX, VY, VZ, HI, INBODY)
                                                                        ARYT 188
      ALPHAO = ATAN(VY/VX) * 180./PI
                                                                        ARYT 189
      BETA0 = ATAN((VZ-VT)/SQRT(VX++2 + VY++2)) + 180./PI
                                                                        ARYT 190
      ALPHAR = ATAN(P(4)/P(2))*180./PI
                                                                        ARYT 191
      BETAR = ATAN(P(6)/$@RT(P(2)**2+P(4)**2))*180./PI
                                                                        ARYT 192
      WRITE (6,8800) ALPMAO, BETAO, ALPMAR, BETAR
                                                                        ARYT 193
C
      COMPUTE AND PRINT DRAG VECTOR AT FINAL POINT
                                                                        ARYT 194
      CALL FLOVEL (P(1), P(3), P(5), VX, VY, VZ, HI, INBOCY)
                                                                        ARYT 195
      DV = SQRT( (VX - P(2))**2 + (VY - P(4))**2 + (VZ - P(6))**2)  ARYT 196
      COSA = (VX - P(2))/DV
                                                                        ARYT 197
      COSB = (VY - P(4))/DV
                                                                        ARYT 198
      COSC = (VZ - P(6))/DV
                                                                        ARYT 199
      ANG = ATAN ( COSB/COSA ) + 57.29577951
                                                                        ARYT 200
      CNG = ACOS ( COSC ) * 57.29577951
                                                                        ARYT 201
      WRITE( 6, 3100 ) COSA, CCSB, COSC, ANG, CNG
                                                                        ARYT 202
C
      COMPUTE AND PRINT AIR AND PARTICLE SPEEDS AT FINAL POINT
                                                                        ARYT 203
           = SQRT(VX**2 + VY**2 + VZ**2)
                                                                        ARYT 204
      VP
           = SQRT(P(2)**2 + P(4)**2 + P(6)**2)
                                                                        ARYT 205
      WRITE(6, 3200) VA, VP
                                                                        ARYT 206
      IF (IPLOT) WRITE (10) IFLT, (XPLOT(L), YFLOT(L), ZPLOT(L), L=1, IPLT) ARYT 207
C
                                                                        ARYT 208
  500 CONTINUE
                                                                         ARYT 209
      GO TO 5
                                                                         ARYT 210
 1000 FORMAT(18A4, 7X,L1)
                                                                         ARYT 211
 1100 FORMAT (8F10.5)
                                                                         ARYT 212
 1200 FORMAT(1H1,5X, 15HARYTRJ RUN ID -/ 8X, 18A4)
                                                                         ARYT 213
 1300 FORMAT(1H0, 5X, 21HPHYSICAL INPUT DATA -/7X,10HAIR SPEED=1PE13.6, ARYT 214
     1 3X, 37HCHARACTERISTIC DIMENSION OF THE BODY=1PE13.6/ 7X,35HCENSITARYT 215
     2Y AND TEMPERATURE OF AIR ARE 1PE13.6, 5H AND 1PE13.6,20H AIR VISARYT 216
     3COSITY IS 1PE13.6)
                                                                         ARYT 217
 1400 FORMAT( 1H0, 5X, 29HNUMERICAL INTEGRATOR INPUTS -/ 7X, 10HTIME STEARYT 218
     1P=1PE11.4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRINT TIME INTARYT 219
     2ERVAL=1PE11.4, 3X, 24HX COORD. OF FINAL FLANE=1PE11.4)
                                                                         ARYT 220
 1500 FORMAT( 1H0, 6X, 33HLOCAL ERROR TOLERANCES FOR DVDQ -, 3(1PE14.4)) ARYT 221
 1600 FORMAT(//1H0, 38H+ + + + + + * INITIAL COORDINATES X=1PE12.5,
                                                                        ARYT 222
     2 3X, 2HY=1PE12.5, 3X, 2HZ=1PE12.5)
                                                                         ARYT 223
 1800 FORMATI ///6x, 52HTRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTNARYT 224
     1TING//)
                                                                         ARYT 225
 2000 FORMAT( 10X, 10HINITIAL X=1PE11.4, 12H INCREMENT=1PE11.4,
                                                                        ARYT 226
     1 19H NUMBER OF VALUES=14)
                                                                         ARYT 227
 2600 FORMAT (A4)
                                                                         ARYT 228
 3000 FORMAT( 10X, 10HINITIAL Y=1PE11.4, 12H INCREMENT=1PE11.4,
                                                                         ARYT 229
     1 19H NUMBER OF VALUES=14)
                                                                         ARYT 230
 3100 FORMAT(/5X, 29HDRAG VECTOR AT FINAL POINT -/ 6X, 18HDIRECTION COSARYT 231
     1INES-3(1PE13.4), 3X, 19HANGLES A AND GAMMA-2(1PE13.4))
                                                                         ARYT 232
 3200 FORMAT(5X, 47HAIR AND FAFTICLE SPEEDS AT THE FINAL POINT ARE2(1PEARYT 233
     115.5)
                                                                         ARYT 234
 4000 FORMAT( 10X, 10HINITIAL Z=1PE11.4, 12H INCREMENT=1PE11.4,
                                                                         ARYT 235
     1 19H NUMBER OF VALUES=14)
                                                                         ARYT 236
 5000 FORMAT( 10X, 22HX AXIS IS INCREMENTED 2A4)
                                                                        ARYT 237
 6000 FORMAT( 10X, 22HY AXIS IS INCREMENTED 2A4)
                                                                        ARYT 238
 7000 FORMAT ( 10X, 22HZ AXIS IS INCREMENTED 2A4)
                                                                        ARYT 239
 8000 FORMAT( 2F10.0. I4)
                                                                         ARYT 240
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8100 FORMAT(414)
                                                                                          ARYT 241
8200 FORMAT(///10x, 47HINCREMENTING SEQUENCE IS ERRONIOUS. TRY AGAIN.) ARYT 242
8600 FORMAT(I6, 10(1X,1PE11.4)/10X, 2HH=1PE11.4,4H R=1PE11.4, 5F AC=ARYT 243
     11PE11.4, 8H NEVAL=16)
                                                                                          ARYT 244
8700 FORMAT (/6H0KSTEP, 7X, 1HT, 11X, 1HX, 11X, 1HY, 11X) 1HZ, 10X, 1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X, 2HVZ)
                                                                                          ARYT 245
1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 10X, 2HVX, 10X, 2HVY, 10X, 2HVZ) ARYT 246 8800 FORMAT( /20X, 47HINITIAL AND FINAL TRAJECTORY ANGLES (DEGREES) -ARYT 247
     1/ 22X, THALPHAO=F10.4, 5X, 6HBETAO=F10.4/ 22X, THALPHAR=F10.4, 5X ARYT 248
     2. 6HBETAR=F10.4)
                                                                                          ARYT 249
                                                                                          ARYT 250
9000 FORMAT(1H0)
      END
                                                                                          ARYT 251
```

*DECK,	TANTRA		TANT	1
	SUBROUT	INE TANTRA	TANT	2
C			TANT	3 4
00000000000000000	H. G. NO	DRMENT, ATMOSPHERIC SCIENCE ASSOCIATES - NOVEMBER 1979		4
C			TANT	5 6
C			TANT	
C	3-DIMENS		TANT	7
C			TANT	8
C		RAJECT TO COMPUTE TRAJECTORIES OF PARTICLES TO OR ABOUT		9
C		RARY 3-DIMENSIONAL BODY. TRAJECTORIES BEGIN AT POINTS		10
С		RVE AS SPECIFIED BY SR. STRPNT, AND THE INITIAL POINTS ARE		. 11
C		TOWARD THE BODY USING FIRST A COARSE STEP SIZE UNTIL	TANT	12
C		ON OCCURS. THEN INITIAL COORDINATES ARE BACKED-UP ONE		13
C			TANT	14
C		SENT TRAJECTORY IS TAKEN TO BE THE ONE CALCULATED	TANT	15
C		TELY PRIOR TO THE SECOND IMPACTION. POINTS ON THE TANGEN		16
		DRY ONLY ARE STORED FOR PLOTTING LATER IF DESIRED.	TANT	17
C	ALL TRA.	JECTORIES AFE PRINTED.	TANT	18
C			TANT	19
С			TANT	20
			TANT	21
C	VARIOUS	TYPES OF ICE CRYSTALS.	TANT	22
00000			TANT	23
C		+ +	TANT	24
Ç	UNIT 10	IS USED FOR TRAJECTORY DATA OUTPUT FOR PLOTTING.	TANT	25
C			TANT	26
C		TA PREPARED BY THE HESS-SMITH CODE ARE READ FROM UNIT 14	TANT	27
C	VIA SR S	SETFLO.	TANT	28
C			TANT	29
C	ALL COOL	RDINATES AND TIMES ARE NORMALIZED (DIMENSIONLESS)	TANT	30
C			TANT	31
C	GLOSSAR'		TANT	32
C	ACC		TANT.	33
C	ALPHAR	ANGLE BETWEEN PROJECTION OF FINAL VELOCITY VECTOR IN X-Y		34
C		PLANE AND X AXIS	TANT	35
C	BETAR	ANGLE BETWEEN FINAL VELOCITY VECTOR AND ITS PROJECTION	TANT	36
C		IN THE X-Y PLANE	TANT	37
C	DCORS	COARSE VALUE OF DEL USED FOR ROUGH DETERMINATION OF		38
Ç		TANGENT TRAJECTORY	TANT	39
C	DEL	CURRENT VALUE OF STEP SIZE USED IN INCREMENTING INITIAL.	TANT	48
C		COORDINATES TOWARD THE BODY	TANT	41
C	DFINE	FINE VALUE OF DEL USED FOR PRECISE DETERMINATION OF	TANT	42
C		TANGENT TRAJECTORY	TANT	43
С	DIAM	DIAMETER OF A WATER DROP OR ICE AGGREGATE	TANT	44

```
C
               BASE DIAMETER FOR A PLATE OR CYLINDER (MICROMETERS)
                                                                              TANT
                                                                                     45
C
      DLR
               BASE DIAMETER TO LENGTH (CYLINDER) OR THICKNESS (PLATE)
                                                                              TANT
                                                                                     46
C
               RATIO
                                                                              TANT
                                                                                     47
C
               CHARACTERISTIC DIMENSION OF THE BODY ( METERS )
      ELL
                                                                              TANT
                                                                                     48
C
      EPSI( ) PARAMETERS USED TO CONTROL LOCAL ERROR IN THE NUMERICAL
                                                                              TANT
                                                                                     49
C
               INTEGRATION (SEE DVDQ GLOSSARY)
                                                                                     50
                                                                              TANT
C
      FN
               FROUDE NUMBER
                                                                              TANT
                                                                                     51
C
      FNR
               RECIPROCAL OF THE FROUDE NUMBER
                                                                              TANT
                                                                                     52
C
               INITIAL TIME STEP FOR NUMERICAL INTEGRATION (SEE DVDC)
      HI
                                                                              TANT
                                                                                     53
C
      HMAX
               MAXIMUM TIME STEP (SEE DVDQ)
                                                                              TANT
                                                                                     54
C
               MINIMUM ALLOWED TIME STEP (SEE DVDQ)
      HMIN
                                                                              TANT
                                                                                     55
C
               IF TRUE, TRAJECTORY DATA ARE COPIED TO UNIT 18 FOR PLOTINGTANT
      IPLOT
                                                                                     56.
C
               WHEN RETURNED FROM TRAJECT
      IT
                                                                              TANT
                                                                                     57
C
               WITH A VALUE OF ZERO, INDICATES IMPACTION HAS OCCURED.
                                                                              TANT
                                                                                     58
C
      ΚT
               TRAJECTORY TALLY
                                                                              TANT
                                                                                     59
C
      P()
               CURRENT VALUES OF INDEPENDENT VARIABLES -
                                                                              TANT
                                                                                     60
C
                  P(1) = X
                                                                              TANT
                                                                                     61
C
                  P(2) = DX/DT
                                                                              TANT
                                                                                     62
C
                  P(3) = Y
                                                                              TANT
                                                                                     63
C
                  P(4) = DY/DT
                                                                              TANT
                                                                                     64
C
                  P(5) = Z
                                                                              TANT
                                                                                     65
C
                  P(6) = DZ/DT
                                                                              TANT
                                                                                     66
C
      PT
               DRAG COEFFICIENT*ABS(REYNOLDS NUMBER) FOR GRAVITY SETTLINGTANT
                                                                                     67
C
               OF PARTICLES
                                                                              TANT
                                                                                     68
C
      RF
               FACTOR TO CONVERT VELOCITY DIFFERENCE TO, REYNOLDS NUMBER
                                                                              TANT
                                                                                     69
C
      RHO
               AIR DENSITY (KG/M**3)
                                                                              TANT
                                                                                     70
C
      RHOP
               PARTICLE DENSITY (KG/M**3)
                                                                              TANT
                                                                                     71
C
      TEMP
               AIR TEMPERATURE (DEG. KELVIN)
                                                                              TANT
                                                                                     72
C
               OUTPUT TIME INTERVAL
      TPRINT
                                                                              TANT
                                                                                     73
C
      V
               AIR SPEED (M/SEC)
                                                                              TANT
                                                                                     74
C
      VIS
               AIR VISCOSITY (KG/(M-SEG))
                                                                              TANT
                                                                                     75
С
      VT
               GRAVITY SETTLING SPEED OF PARTICLE -
                                                                                     76
                                                                              TANT
С
      XFINAL
               X COORDINATE OF THE FINAL PLANE
                                                                              TANT
                                                                                     77
C
      XI3, YI3, ZI3 INITIAL COORDINATES PASSED TO TRAJECT
                                                                                     78
                                                                              TANT
                                                                              TANT
                                                                                     79
      COMMON XI3, YI3, ZI3, YI3P, EPSI(3), HI, HMINI, YT, PT, COF, FNR, PACT,
                                                                              TANT
                                                                                     08
     1RF, REO, R, XPSTAR, YPSTAR, ZPSTAR, P(6), TPRINT, IT, ALPHA G, BETA O, IREC,
                                                                              TANT
                                                                                     81
     2 IPLOT, IPLT, XPLOT (60), YPLOT (60), ZPLOT (60), ALPHAR, BETAR, YPSTARF,
                                                                                     82
                                                                              TANT
     3ZPSTARP,XI3P,ZI3F,XP,YP,ZP,XWP,XPP,ACC,DLR,JLIM
                                                                              TANT
                                                                                     83
      DIMENSION HOLL(18)
                                                                              TANT
                                                                                     84
      LOGICAL IPLOT
                                                                              TANT
                                                                                     85
      DATA SIGNAL/999999./, KTLIM/ 25/
                                                                              TANT
                                                                                     86
      JLIM=0
                                                                              TANT
                                                                                     87
      NFIN=0
                                                                              TANT
                                                                                     88
C
                          READ AND WRITE DATA
                                                                              TANT
                                                                                     89
      READ (5,2600) KASE
                                                                              TANT
                                                                                     90
      CALL SETFLO(KASE)
                                                                              TANT
                                                                                     91
      READ(5, 1000) HOLL,
                                  IPLOT
                                                                                     92
                                                                              TANT
      READ(5,1100)V, ELL, RHO, TEMP, XFINAL
                                                                              TANT
                                                                                     93
      READ(5,1100) TPRINT, HI, HMINI, EPSI
                                                                                     94
                                                                              TANT
C
      SET DEFAULT VALUES FOR NUMERICAL INTEGRATION AND PRINT PARAMETERS TANT
                                                                                     95
      IF (TPRINT .EQ. 0.0) TPRINT=0.1
                                                                              TANT
                                                                                     96
      IF(HI .EQ. 0.0) HI=0.1
                                                                              TANT
                                                                                     97
      IF (HMINI .EQ. 0.0) HMINI=0.005
                                                                                     98
                                                                              TANT
      IF(EPSI(1) .EQ. 0.() EPSI(1)=1.0E-5
                                                                              TANT
                                                                                     99
      IF(EPSI(2) .EQ. 0.0) EPSI(2)=1.0E-5
                                                                              TANT 100
      IF (EPSI(3) \cdot EQ. 0. 0) EPSI(3)=1.0E-5
                                                                              TANT 101
      VIS = 145.8E-8 + TEMP+*(3.0/2.0)/(110.4 + TEMP)
                                                                              TANT 102
      WRITE (6,1200) HOLL
                                                                              TANT 103
      WRITE(6,1300) V, ELL, RHC, TEMP, VIS
                                                                              TANT 104
```

```
WRITE(6,1400) HI, HMINI, TPRINT, XFINAL
                                                                           TANT 105
      WRITE(6,1500) EPSI(1), EPSI(2), EPSI(3)
                                                                           TANT 106
C
      INITIALIZE
                                                                           TANT 107
      FN = V**2/(9.8*ELL)
                                                                           TANT 108
      FNR = 1.0/FN
                                                                           TANT 109
       IF (.NOT, IPLOT) GO TO 5
                                                                           TANT 110
      REWIND 10
                                                                           TANT 111
      WRITE (6,1800)
                                                                           TANT 112
C
      ENTER PARTICLE LCOP
                                                                           TANT 113
    5 CALL PARTCL(V, ELL, RHO, VIS, TEMP, DIAM, DLR, RHOP, VT, RF, PT, ACC, NFIN)
                                                                           TANT 114
      IF(NFIN .EQ. 0) GO TC 6
                                                                           TANT 115
      IF ( .NOT. IPLOT) RETURN
                                                                           TANT 116
      ENDFILE 10
                                                                           TANT 117
      REWIND 10
                                                                           TANT 118
      RETURN
                                                                           TANT 119
    6 COF = PT*VT*FN
                                                                           TANT 128
      R = RF + VT
                                                                           TANT 121
      MFIN=0
                                                                           TANT 122
C
      SET INITIAL COORDINATES
                                                                           TANT 123
   10 DFINE=SIGNAL
                                                                           TANT 124
      IT=1
                                                                           TANT 125
      KT = 3
                                                                           TANT 126
   20 CALL STRPNT(XI3, YI3, ZI3, DEL, DCORS, DFINE, MFIN)
                                                                           TANT 127
      IF(MFIN .GT. 0) GO TO 5
                                                                           TANT 128
      KT=KT+1
                                                                           TANT 129
      IF (KT .GT. KTLIM) GO TO 60
                                                                           TANT 130
      XPSTAR=XFINAL
                                                                           TANT 131
      XPP = XFINAL
                                                                           TANT 132
      ALPHAR=0.0
                                                                           TANT 133
      BETAR=0.0
                                                                           TANT 134
      YP = 0.0
                                                                           TANT 135
      ZP = 0.0
                                                                           TANT 136
      WRITE(6,1600) XI3, YI3, ZI3, KT
                                                                           TANT 137
      CALL TRAJECT
                                                                           TANT 138
                       PRINT TRAJECTORY DUTPUT
C
                                                                           TANT 139
      REWIND S
                                                                           TANT 140
      WRITE (6,8700)
                                                                           TANT 141
      DO 30 IWRITE = 1. IREC
                                                                           TANT 142
      READ (9) NEVAL, KSTEP, T, P(1), P(3), P(5), F(2), P(4), P(6), VX, VY, TANT 143
     2 VZ, H. R.AC
                                                                           TANT 144
      WRITE(6,8600) KSTEP, T, P(1), P(3), P(5), P(2), P(4), P(6), VX, VY, TANT 145
     2 VZ, H, R, AC, NEVAL
                                                                           TANT 146
   30 CONTINUE
                                                                           TANT 147
C
      CHECK FOR IMPACTION AND ADJUST DEL IF NECESSARY
                                                                           TANT 148
      IF(IT .LE. 0) GO TO 40
                                                                           TANT 149
      IF (DEL .EQ. -DFINE) GO TO 50
                                                                           TANT 150
      IF(DEL .NE. -DCORS) GO TO 20
                                                                           TANT 151
      DEL=DFINE
                                                                           TANT 152
      WRITE(6,3000)
                                                                           TANT 153
      GO TO 20
                                                                           TANT 154
C
      IMPACTION HAS OCCURED
                                                                           TANT 155
   40 IT=1
                                                                           TANT 156
      IF (DEL .EQ. -DCORS) GO TO 20
                                                                           TANT 157
      IF(DEL .EQ. DFINE) WRITE(6,4000)
                                                                           TANT 158
      KT = KT - 2
                                                                           TANT 159
      DEL =- DEL
                                                                           TANT 160
      GO TO 20
                                                                           TANT 161
   59 IF( .NOT. IPLOT) GO TO 10
                                                                           TANT 162
      IF (IPLOT) WRITE (10) IFLT, (XPLOT(L), YFLOT(L), ZPLOT(L), L=1, IPLT) TANT 163
      GO TO 10
                                                                           TANT 164
```

60 MK11E(6,2000) IILIM	IANT	165
GO TO 10	TANT	1.66
	TANT	167
1000 FORMAT(18A4, 7X,L1)	TANT	168
1100 FORMAT(8F10.5)	TANT	169
1200 FORMAT( 1H1, 5X, 32HTANGENT TRAJECTORY CODE RUN ID -/ 8X, 1874)	TANT	1,70
1300 FORMAT(1H0, 5X, 21HPHYSICAL INPUT DATA -/7X, 10HAIR SPEED=1PE13.6,	TANT	171
1 3X, 37HCHARACTERISTIC CIMENSION OF THE BODY=1PE13.6/ 7X,35HDENSIT	TANT	172
2 Y AND TEMPERATURE OF AIR ARE 1PE13.6, 5H AND 1PE13.6,20H AIR VIS	TANT	173
3COSITY IS 1PE13.6)	TANT	174
1400 FORMAT (1HO, 5X, 29HNUMERICAL INTEGRATOR INPUTS -/ 7X, 10HTIME STE	TANT	175
1P=1PE11.4, 3X, 18HMINIMUM TIME STEP=1PE11.4, 3X, 20HPRINT TIME IN	TANT	176
2ERVAL=1PE11.4, 3X, 24HX COORD. OF FINAL FLANE=1PE11.4)	TANT	177
1500 FORMAT (1H0, 6X, 33HLOCAL ERROR TOLERANCES FOR DVDQ -, 3(1PE14.4))	TANT	178
1600 FORMAT(//1H0, 38H* * * * INITIAL COORDINATES X=1PE12.5,	TANT	179
1 3X, 2HY=1PE12.5, 3X, 2HZ=1PE12.5, 3X, 21HFOR TRAJECTORY NUMBER,	TANT	180
2 14)	TANT	181
1800 FORMAT ( ///6x, 51H TRAJECTORY DATA ARE WRITTEN ON UNIT 10 FOR PLOTT	TANT	182
1 ING //)	TANT	183
2000 FORMAT(///5X, I4, 66H TRAJECTORIES HAVE BEEN COMPUTED. GIVE UP A	TANT	184
1ND TRY THE NEXT CASE.//)	TANT	185
2600 FORMAT (A4)	TANT	186
3000 FORMAT( //128H0* * * * * * * * * * * * * * * * * * *	TANT	187
1 SWITCH TO FINE STEPSIZE # * * * * * * * * * * * * * * * * * *	TANT	188
2 * * * * */)	TANT	189
8 600 FORMAT (16, 10(1X,1PE11.4)/10X, 2HH=1PE11.4,4H R=1PE11.4, 5H AC=	TANT	190
11PE11.4, 8H NEVAL=I6)	TANT	191
8700 FORMAT(/6HOKSTEP, 7X, 1HT, 11X, 1HX, 11X, 1HY, 11X, 1HZ, 10X,	TANT	152
1 3HVPX, 9X, 3HVPY, 9X, 3HVPZ, 1QX, 2HVX, 1QX, 2HVY, 1QX, 2HVZ)	TANT	193
4000 FORMAT( /// 129H * * * * * * * * * * * * * * * * * * *	TANT	194
1 TANGENT TRAJECTORY IS AS FOLLOWS * * * * * * * * * * * * * * * * * * *	TANT	195
2* * * * * * */)	TANT	_
END	TANT	

```
*DECK, STRPNT
                                                                            STRP
                                                                                    1
                                                                                    2
      SUBROUTINE STRPNT( X, Y, Z, D, DCORS, DFINE, M)
                                                                            STRP
C
                                                                            STRP
                                                                                    3
C
      H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1975
                                                                            STRP
C
                                                                            STRP
C
      CALLED BY TANTRA TO DEFINE TRAJECTORY STARTING COORDINATES FOR
                                                                            STRP
C
      DETERMINATION OF TANGENT TRAJECTORIES OF PARTICLES TO A THREE-
                                                                            STRP
      DIMENSIONAL BODY. / THIS VERSION STARTS ALL TRAJECTORIES ON A
C
                                                                            STRP
C
      POINTS ARE STEPPED: ALONG THE LINE TOWARD THE BODY USING
                                                                            STRP
                                                                                    9
C
      FIRST A COARSE STEP SIZE, AND AFTER IMPACTION AND BACK-UP A FINE
                                                                            STRP
                                                                                   10
C
      STEP SIZE UNTIL IMPACTION REOCCURS.
                                                                            STRP
                                                                                   11
C
                                                                            STRP
                                                                                   12
C
      GLOSSARY
                                                                            STRP
                                                                                   13
C
                        DIRECTION COSINES OF THE STARTING POINT LINE
      COSA, COSB, COSG
                                                                            STRP
                                                                                   14
               CURRENT VALUE OF STEP SIZE USED IN INCREMENTING INITIAL
C
                                                                            STRP
                                                                                   15
C
               COORDINATES TOWARD THE BODY
                                                                            STRP
                                                                                   16
               COARSE VALUE OF D USED FOR ROUGH DETERMINATION OF
C
      DCORS
                                                                            STRP
                                                                                   17
C
               TANGENT TRAJECTORY
                                                                            STRP
                                                                                   18
C
      DFINE
               FINE VALUE OF D USED FOR PRECISE DETERMINATION OF
                                                                                   19
                                                                            STRP
C
               TANGENT TRAJECTORY
                                                                            STRP
                                                                                   20
C
      X,Y,Z
               STARTING CCORDINATES
                                                                            STRP
                                                                                   21
C
      X1,Y1,Z1 POINT USED, ALONG WITH FIRST STARTING POINT, TO DEFINE
                                                                            STRP
                                                                                   22
                 THE STARTING POINT LINE
                                                                            STRP
                                                                                   23
C
                                                                            STRP
                                                                                   24
      DATA SIGNAL/999999./
                                                                            STRP
                                                                                   25
      IF(DFINE .LT. SIGNAL) GO TO 200
                                                                            STRP
                                                                                   26
COPY IN STEP SIZE INCREMENTS AND INITIALIZE FOR A NEW TANGENT LOCATION
                                                                            STRP
                                                                                   27
      READ(5,1100) DCORS, DFINE
                                                                            STRP
                                                                                   28
CHECK IF TRAJECTORIES FOR THIS PARTICLE SIZE ARE FINISHED
                                                                            STRP
                                                                                   29
                                                                            STRP
                                                                                   30
      IF(ABS(DCORS) + ABS(DFINE) .NE. 0.0) GO TO 100
                                                                            STRP
                                                                                   31
      M=1
                                                                            STRP
                                                                                   32
      RETURN
                                                                            STRP
                                                                                   33
COPY IN A PAIR OF POINT COORDINATES TO DEFINE THE STARTING POINT LINE. STRP
                                                                                   34
      THE FIRST COORDINATES SPECIFY THE START POINT FOR THE FIRST
                                                                            STRP
                                                                                   35
C
      TRAJECTORY, AND THE SECOND COORDINATES ARE FOR ANY POINT ON THE
                                                                            STRP
                                                                                   36
      LINE WHICH IS CLOSER TOWARD THE BODY.
                                                                            STRP
                                                                                   37
  100 READ(5,1100) X, Y, Z, X1, Y1, Z1
                                                                            STRP
                                                                                   38
COMPUTE DIRECTION COSINES OF THE STARTING POINT LINE
                                                                            STRP
                                                                                   39
      R = SQRT((X1-X)^{++2} + (Y1-Y)^{++2} + (Z1-Z)^{++2})
                                                                            STRP
                                                                                   40
      COSA = (X1-X)/R
                                                                            STRP
                                                                                   41
      COSB = (Y1-Y)/R
                                                                                   42
                                                                            STRP
      COSG = (Z1-Z)/R
                                                                            STRP
                                                                                   43
      D = DCORS
                                                                            STRP
                                                                                   44
      WRITE(6,1000) X, Y, Z, X1, Y1, Z1
                                                                            STRP
                                                                                   45
      WRITE(6,1200) COSA, GOSB, COSG
                                                                            STRP
                                                                                   46
      WRITE(6,1300) DCORS, DFINE
                                                                            STRP
                                                                                   47
      RETURN
                                                                            STRP
                                                                                   48
COMPUTE NEXT SET OF STARTING COORDINATES
                                                                            STRP
                                                                                   49
  200 X = X + D*COSA
                                                                            STRP
                                                                                   50
      Y = Y + D*COSB
                                                                                   51
                                                                            STRP
      Z = Z + D*COSG
                                                                            STRP
                                                                                   52
      RETURN
                                                                            STRP
                                                                                   53
 1000 FORMAT(////5x,89HTRAJECTORIES ARE TO BEGIN ALONG A LINE DEFINED BSTRP
                                                                                   54
     1Y THE POINTS (X1,Y1,Z1,) AND (X2,Y2,Z2) -/ 9X,2H( ,3(1PE15.5),
                                                                            STRP
                                                                                   55
                      ( , 3(1PE 15.5), 2H ))
     2 13H )
                AND
                                                                            STRP
 1100 FORMAT(8F10.0)
                                                                                   57
                                                                            STRP
 1200 FORMAT(5x, 60HWITH DIRECTION COSINES - (COS(ALPHA), COS(BETA), COS(GASTRP
                                                                                   58
     1MMA)) - 3(1PE15.5)/)
                                                                                   59
 1300 FORMAT( 5%, 49HSTARTING POINT INCREMENTS ARE - COARSE INCREMENT=1PSTRP
                                                                                   60
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```
*DECK. FALWAT
                                                                                                                                                                    FALW
              SUBROUTINE FALWATIO, RHOD ETA, T. P. V)
                                                                                                                                                                    FALW
                                                                                                                                                                    FALW
                                                                                                                                                                                     3
C
              H. G. NORMENT, ATMOSPHERIC SCIENCE ASSOCIATES - DECEMBER 1979
                                                                                                                                                                    FALW
C
                                                                                                                                                                                     5
                                                                                                                                                                    FALW
C
              COMPUTES STILL-AIR, TERMINAL SETTLING SPEED OF WATER DROPS
                                                                                                                                                                                     6
                                                                                                                                                                    FALW
C
              ACCORDING TO THE EQUATIONS OF BEARD (JAS 33, 852(1976))
                                                                                                                                                                    FALW
                                                                                                                                                                                    7
C
                                                                                                                                                                    FALW
                                                                                                                                                                                     8
C
              GLOSSARY (SI UNITS)
                                                                                                                                                                    FALW
                                                                                                                                                                                     9
C
                                4.0*G/3.0
              r:
                                                           WHERE G IS ACCELERATION OF GRAVITY (9.8)
                                                                                                                                                                    FALW
                                                                                                                                                                                   10
C
              CDRR
                                DAVIES NUMBER
                                                                                                                                                                    FALW
                                                                                                                                                                                   11
C
              B
                                DROP DIAMETER
                                                                                                                                                                    FALW
                                                                                                                                                                                   12
C
              ETA
                                VISCOSITY
                                                                                                                                                                    FALM
                                                                                                                                                                                   13
C
              P
                                PRESSURE
                                                                                                                                                                    FALW
                                                                                                                                                                                  14
C
              PN
                                PHYSICAL PROFERTY NUMBER TO 1/6 POWER
                                                                                                                                                                    FALW
                                                                                                                                                                                   15
C
              RHO
                                FLUID DENSITY
                                                                                                                                                                    FALW
                                                                                                                                                                                   16
C
              RHOP
                                WATER DENSITY
                                                                                                                                                                    FALW
                                                                                                                                                                                  17
C
              SIG
                                WATER SURFACE TENSION
                                                                                                                                                                    FALW
                                                                                                                                                                                  18
C
              T
                                TEMPERATURE
                                                                                                                                                                    FALW
                                                                                                                                                                                  19
C
                                SETTLING SPEED
                                                                                                                                                                    FALW
                                                                                                                                                                                  20
C
                                                                                                                                                                    FALW
                                                                                                                                                                                  21
              DATA C/13.066667/, RHOP/1000./, EX/0.1666666667/
                                                                                                                                                                    FALW
                                                                                                                                                                                  22
                                                                                                                                                                    FALW
                                                                                                                                                                                  23
COMPUTE DAVIES NUMBER
                                                                                                                                                                    FALW
                                                                                                                                                                                   24
              CDRR = C*(RHOP-RHO)*RHO*[**3/ETA**2
                                                                                                                                                                    FALW
                                                                                                                                                                                  25
CHECK DAVIES NUMBER VALUE FOR ROUTING
                                                                                                                                                                    FALW
                                                                                                                                                                                  26
              IF(CDRR .GT. 0.3261) IF(CDRR-58249.) 100,100,200
                                                                                                                                                                    FALW
                                                                                                                                                                                  27
COMPUTE VIA STOKES-LAW EQUATION
                                                                                                                                                                    FALW
                                                                                                                                                                                  28
              V = CDRR*ETA/(24.0*RHO*D)
                                                                                                                                                                    FALW
                                                                                                                                                                                   29
              GO TO 300
                                                                                                                                                                    FALW
                                                                                                                                                                                   30
COMPUTE VIA BEARDS EQUATION FOR MEDIUM SIZE DROPS
                                                                                                                                                                    FALW
                                                                                                                                                                                  31
            Y = ALOG(CDRR)
                                                                                                                                                                    FALW
                                                                                                                                                                                  32
              V = ETA/(RHO+D)+EXP(-3.18657 + Y+(0.992696 + Y+(-0.153193E-2))
                                                                                                                                                                    FALW
                                                                                                                                                                                  33
            1+Y*(-0.987059E-3 + Y*(-0.578878E-3 + Y*(0.855176E-4
                                                                                                                                                                    FALW
                                                                                                                                                                                  34
           2-Y*0.327815E-5))))
                                                                                                                                                                    FALW
                                                                                                                                                                                  35
              GO TO 300
                                                                                                                                                                    FALW
                                                                                                                                                                                   36
COMPLTE VIA BEARDS EQUATION FOR LARGE DROPS
                                                                                                                                                                    FALW
                                                                                                                                                                                   37
  200 SIG = 7.570E-2 - 1.535E-4*(T - 273.0)
                                                                                                                                                                    FALW
                                                                                                                                                                                  38
              PN = (SIG**3 * RHO**2/(9.8 * (RHOP-RHO) * ETA**4))**EX
                                                                                                                                                                    FALW
                                                                                                                                                                                  39
              Y = ALOG(PN+C+(RHOP-RHC) + D++2/SIG)
                                                                                                                                                                    FALW
                                                                                                                                                                                   40
              V = ETA+PN/(RHO+D) + EXP(-5.00015 + Y+(5.23778 + Y+(-2.04914 + Y+(-2.0
                                                                                                                                                                    FALW
                                                                                                                                                                                  41
           1 Y*(0.475294 + Y*(-0.0542819 + Y*0.00238449)))))
                                                                                                                                                                    FALW
                                                                                                                                                                                  42
              RETURN
                                                                                                                                                                    FALW
                                                                                                                                                                                  43
CORRECT SETTLING SPEED FOR SLIF
                                                                                                                                                                    FALW
                                                                                                                                                                                   44
              V = V^{+}(1.0 + 54.088^{+}ETA^{+}SQRT(T)/P/D)
                                                                                                                                                                    FALW
                                                                                                                                                                                   45
              RETURN
                                                                                                                                                                    FALW
                                                                                                                                                                                  46
```

STRP

STRP

FALW

47

61

62

1E12.5, 3X, 15HFINE INCREMENT=1PE12.5)

END

END

```
*DECK.WCDRR
                                                                            WCDR
      FUNCTION WCDRR( R )
                                                                            WCDR
                                                                            WCDR
                                                                                   3
C
      GIVEN THE REYNOLDS NUMBER, R, THE PRODUCT OF THE DRAG COEFFICIENTWODR
C
      AND THE THE SQUARE OF THE REYNOLDS NUMBER IS RETURNED FOR A WATER WODR
C
      DROP IN AIR. THIS FUNCTION SHOULD BE USED ONLY FOR R .GT. 200.
C
      ( SEE BEARD AND PRUPPACHER, JAS 25, 1066(1969)).
                                                                            WC DR
                                                                                   7
      THE DATA OF GUNN AND KINZER, J. METEOR. 6, 243(1949), ARE USED.
C
                                                                            WCDR
                                                                                   8
C
                                                                            WCDR
                                                                                   9
      IF( R .GT. 200. ) GO TO 100
                                                                           WCDR
                                                                                  10
      WCDRR = -1.0E20
                                                                            WCDR
                                                                                  11
      RETURN
                                                                           WCDR
                                                                                  12
  100 ALGR = ALOG10 ( R )
                                                                           WCDR
                                                                                  13
      WCDRR = 10.0**(21.38446 + ALGR * (-28.81245 + ALGR * (
                                                                           WCDR
                                                                                  14
     1 16.83269 + ALGR * ( -4.152207 + ALGR * 0.3872735 ))))
                                                                            WCDR
                                                                                  15
      RETURN
                                                                           WCDR
                                                                                  16
      END
                                                                           WCDR
                                                                                  17
*DECK, CDRR
                                                                           CDRR
                                                                                   1
      FUNCTION CORR(R)
                                                                           CDRR
C
                                                                           CDRR
С
      GIVEN THE REYNOLDS NUMBER, R, THE PRODUCT OF THE DRAG COEFFICIENT CORR
      AND THE SQUARE OF R IS RETURNED FOR A SPHERE. SEE NCRMENT, TO-B
C
                                                                           CORR
С
      64-102 (1 NOV. 1964).
                                                                           CDRR
C
                                                                           CORR
                                                                                   7
      IF(R .GT. 0.05) IF(R-3.) 100,100,200
                                                                           CORR
                                                                                   8
      CDRR = 24. * R
                                                                           CDRR
                                                                                   9
      RETURN
                                                                           CDRR
                                                                                  10
  100 CDRR = R*( 24.167 + R*( 3.254 - R*0.23564))
                                                                           CORR
                                                                                  11
      RETURN
                                                                           CORR
                                                                                  12
  200 IF(R .GT. 330.) GO TO 300
                                                                           CDRR
                                                                                  13
      CDRR = -28.339 + R*(38.969 + R * (0.73204 - R * 0.56084E-3))
                                                                           CDRR
                                                                                  14
                                                                           CORR
                                                                                  15
```

CORR

CDRR

CD RR

16

17

18

300 CDRR = R \* (93.462 + F \* 9.37576)

RETURN

END

		•	
*DE	CK, DVDQ	DVDQ	1
	SUBROUTINE DVDQ(NEQ,T,Y,F,KD,EPS,IFLAG,H,HMIN,	DVDQ	2
	* HMAX, TPRINT, TFINAL, MXSTEP, KSTEP, KEMAX, EMAX,	DVDQ	2
	* KQ, YN, DT, NEVAL, NG, NGE, NSTOP, G, GT)		3 4
С	way my or y make a graduct and a day day	DVDQ	4
Ċ		DVDQ	5 6 <b>7</b>
C	VARIABLE ORDER INTEGRATION SUBROUTINE	DADG	6
Č		DVDQ	
C	FOR THE SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS.	<b>DV</b> DQ	8.
Č		DVDQ	9
C	ANALYSIS AND CODING BY FRED T. KROGH, JET PROPULSION	DVDQ	10
C	LABORATORY, PASADENA, CALIF. APRIL 1, 1969.	DVDQ	11
C	MODIFIED BY CLEVE MOLER, UNIV. NEW MEXICO, OCT. 1972	DVDQ	12
C		DVDQ	· 13
C	VARIABLES IN THE CALLING SEQUENCE HAVE THE FOLLOWING	DVDQ	14
C	DIMENSIONS WHERE N=NEQ AND K=KD(1)+KD(2)++KD(N)	DVDQ	15
C	Y(K), F(N), KD(N), EPS(N), KQ(N), YN(K),	DVDQ	16
C	DT(20,N),G(NG),GT(NG)	DVDQ	17
С		DVDQ	18
C	PARAMETERS WHICH MUST BE ASSIGNED VALUES BEFORE THE INITIAL	DVDQ	
Č	ENTRY ARE IFLAG, NG, NEQ, T, Y, KD, H, HMIN, HMAX,		19
Č	TPRINT, TINAL, MXSTEP, AND (USUALLY) EPS.	DVDQ	20
Č	" KIN' I TIME INSIEF AND ENSURELY EFS.	DVDQ	21
Č	THE USER MUST ALSO PROVIDE CODE WHICH ASSIGNS	DADO	22
C	ANTHE ADER HOST WEST EACH FOR THE PART WAS THE BED USED	DVDQ	23
C	VALUES TO F (ONCE PER STEP INITIALLY, AND TWICE PER STEP	DVDQ	24
	AFTER GETTING STARTED) AND EPS (EITHER INITIALLY, OR DURING	DVDQ	25
C	THE INTEGRATION IF A RELATIVE ERROR TEST IS USED).	DVDQ	26
С		DVDQ	27
C	THE FOLLOWING PARAMETERS GIVE ADDITIONAL INFORMATION ABOUT THE	DVDQ	28
C	INTEGRATION AND ARE USED FOR STORAGE. THEY SHOULD NOT BE	DVDQ	29
C	CHANGED BY THE USER. IFLAG, KSTEP, KEMAX, EMAX, KQ, YN, AND DT.	DVDQ	30
C		DVDQ	31
C		DVDQ	32
C		DVDQ	33
C	THE USAGE OF THE VARIABLES IS GIVEN BELOW.	DVDQ	34
C		DVDQ	35
C	NEQ=NUMBER OF EQUATIONS (INPUT)	DVDQ	36
С		DVDQ	37
C	T=INDEPENDENT VARIABLE (INITIAL VALUE SUPPLIED BY THE USER)	DV DQ	38
Č	THE COLL STREET STREET STREET OF THE COLL	-	
Č	Y(J)=CURRENT VALUE OF A DEPENDENT VARIABLE OR DERIVATIVE.	DVDQ	39
C	THE INITIAL VALUE MUST BE SPECIFIED BY THE USER BEFORE	DVDQ	40
0	THE FIRST ENTRY. THE DIMENSION OF Y MUST BE	DVDQ	41
C	AT LEAST AS ESSAT AS THE SUM OF THE OPPEDS OF	DVDQ	42
Ų	AT LEAST AS GREAT AS THE SUM OF THE ORCERS OF	DVDQ	43

```
THE DIFFERENTIAL EQUATIONS WHICH ARE BEING
                                                                                                                                                                                                                                                                                                                                                             DVDQ
        C
                                                                                                                                                                                                                                                                                                                                                             DVDQ
                                                                                                                                                                                                                                                                                                                                                                                               45
                                       THE J-TH DERIVATIVE OF THE I-TH DEPENDENT VARIABLE IS
                                                                                                                                                                                                                                                                                                                                                            DVDQ
                                                                                                                                                                                                                                                                                                                                                                                               46
                                             STORED IN Y (K+J+1) WHERE K=KJ(1)+...+KD(I-1),
                                                                                                                                                                                                                                                                                                                                                            DVDQ
                                                                                                                                                                                                                                                                                                                                                                                               47
                                     I=1, ..., NEQ, J=0, ..., KD(I)-1 .
                               (FOR EXAMPLE, FOR THE SYSTEM F(1)=UPP, F(2)=VPP, WHERE P
DENOTES A PRIME, Y(1)=U, Y(2)=UP, Y(3)=V, Y(4)=VP.)

DVDQ
DVDQ
                                                                                                                                                                                                                                                                                                                                                                                              48
       C
                                                                                                                                                                                                                                                                                                                                                                                              49
                                                                                                                                                                                                                                                                                                                                                                                              50
                                                                                                                                                                                                                                                                                                                                                                                              51
                      F(I)=KD(I)=TH DERIVATIVT OF THE I-TH COMPONENT WITH RESPECT DVDQ
TO T. I=1.2..., NEQ. THE USER MJST PROVIDE DVDQ
THE CODE WHICH COMPUTES F GIVEN Y AND T.
                                                                                                                                                                                                                                                                                                                                                                                               52
       С
                                                                                                                                                                                                                                                                                                                                                                                               54
                                                                                                                                                                                                                                                                                                                                                             DVDC
                   KD(I)=THE ORDER OF THE I-TH DIFFERENTIAL EQUATION IN THE SYSTEM. KD(I) MUST BE LESS THAN OR EQUAL TO 4.
                                                                                                                                                                                                                                                                                                                                                          DVDQ
                                                                                                                                                                                                                                                                                                                                                         DVDQ
DVDQ
    C THE SYSTEM. KO(I) MUST BE LESS THAN OR EQUAL TO 4.

C DVDQ
C EPS(I) IS A PARAMETER USED TO CONTROL THE LOCAL ERROR.

C THE ESTIMATED LOCAL ERROR IS KEPT LESS THAN EPS(I) IN
C THE (KD(I)-1)-ST DERIVATIVE OF THE I-TH COMPONENT. THUS
C FOR EQUATIONS WITH ORDER GREATER THAN ONE, THE ERROR
C IN A DERIVATIVE IS ESTIMATED. IN THIS CASE THE VALUE OF
C EPS(I) REQUIRED TO OBTAIN A GIVEN ACCURACY IN THE DEPENDENT
C VARIABLE DEPENDS ON THE SCALING.
C IF ONE WANTS A RELATIVE ERROR TEST THEN ONE SHOULD SET EPS(I)
C WHEN IFLAG=1.
C IF EPS(I)=0 AND H*AX.NE.G, IFLAG IS SET EQUAL 8.
C IF EPS(I)=0 AND H*AX.NE.G, IFLAG IS SET EQUAL 8.
C THIS OPTION SHOULD NOT BE USED IF KQ(I)=1 FOR ANY I.
C DVDQ
C THIS OPTION SHOULD NOT BE USED IF KQ(I)=1 FOR ANY I.
C DVDQ
C
                                                                                                                                                                                                                                                                                                                                                                                              58
                                                                                                                                                                                                                                                                                                                                                                                              59
                                                                                                                                                                                                                                                                                                                                                                                              60
                                                                                                                                                                                                                                                                                                                                                                                              64
                                                                                                                                                                                                                                                                                                                                                                                              66
                                                                                                                                                                                                                                                                                                                                                                                               67
                                                                                                                                                                                                                                                                                                                                                                                              58
THIS OPTION SHOULE NOT BE USED IF KQ(I)=1 FOR ANY I.

C THIS OPTION SHOULE NOT BE USED IF KQ(I)=1 FOR ANY I.

DVOQ 72

C IFLAG IS USED FOR COMMUNICATION BETHEEN THE INTEGRATOR

OVOQ 73

C AND THE FROGRAM MHICH CALLS IT. TO BEGIN THE INTEGRATION THE

USER SHOULD SET IFLAG=0 AND CALL DVDQ. THIS MILL CAUSE

DVOQ 75

C INTITALIZATION OF INTERNAL VARIABLES AND A RETURN WITH

DVOQ 76

C IFLAG=1. AFTER THIS INITIAL EVIRY THE VALUE OF IFLAG

DVOQ 77

C SHOULD NOT BE CHANGED BY THE USER.

C THE FOLLOWING VALUES OF IFLAG HAVE THE FOLLOWING MEANINGS.

DVOQ 78

C THE FOLLOWING VALUES OF IFLAG HAVE THE FOLLOWING MEANINGS.

DVOQ 80

C =0 USED TC INITIALIZE THE INTEGRATOR.

C IFLAG=1. AFTER THIS INITIAL EVIRY THE VALUE OF IFLAG

DVOQ 83

C =1 THE VALUE OF Y FOR THE CURRENT STEP HAS BEEN

DVOQ 84

C OF EPS SHOULD ALSO BE COMPUTED HERE.

C ORRECTED. THE USER SHOULD COMPUTE F AND CALL DVDQ.

DVOQ 85

C =2 THE VALUE OF Y FOR THE CURRENT SIEP HAS BEEN

DVOQ 86

C OF TEPSINT). PRINT RESULTS AND CALL DVOQ.

DVOQ 87

C =3 AN OUTPUT POINT HAS BEEN REACHED (SEE DESCRIPTION

DVOQ 88

C =4 T=FFINAL IF DVOQ IS CALLED HITH T=TFINAL AND

DVOQ 89

C =4 T=FFINAL IF DVOQ IS CALLED HITH T=TFINAL AND

DVOQ 91

TFINAL IS CHANGEL THE INTEGRATION WILL CONTINUE.

DVOQ 92

C =5 KSTEP-KSOUT (SEE THE DESCRIPTION DVOQ 92

C =5 KSTEP-KSOUT (SEE THE DESCRIPTION DVOQ 93

C =6 EMAX.GT...1 AND IT APPEARS TO THE SUBROUTINE THAT

DVOQ 95

C PROBABLY BE USED. IF EPSIKEMAX) IS NOT INCREASED, TOO

DVOQ 96

C PROBABLY BE USED. IF EPSIKEMAX) IS NOT INCREASED, TOO

DVOQ 97

SMALL A STEPSIZE IS LIABLE TO BE USED. (HE HAVE FOUND THAT DVOQ 96

C PROBABLY BE USED. IF EPSIKEMAX) IS NOT INCREASED, TOO

DVOQ 99

INCREASING EPS IN THIS HAY MILL NOT DEGRADE THE ACCURACY,

DVOQ 101

C ABS(H).LT.HHIN. TC CONTINUE WITH THE CURRENT

DVOQ 103
                                                                                                                                                                                                                                                                                                                                                                                              71
```

C

С

C

C

C

С

C

С

C

С

```
VALUE OF H. SET HMIN.LE.ABS(H) AND CALL EVDQ.
                                                                         DVDQ 184
C
          IF THE INTEGRATOR HAS JUST HALVED H ONE MAY CONTINUE
                                                                         DVDQ 105
                                                                         DVDQ 106
          WITH TWICE THE STEPSIZE BY SIMPLY CALLING DVDQ. (SUCH
                                                                         DVDQ 107
C
          AN ACTION IS RISKY WITHOUT A CAREFUL ANALYSIS OF THE
          SITUATION.) IF THE STEPSIZE HAS NOT JUST BEEN HALVED
                                                                         DVDQ 168
          (ABS(H).LT.HMIN MAY BE DUE TO THE USER INCREASING THE
C
                                                                         DVDQ 109
          VALUE OF HAIN OR TO HAVING TOO SMALL AN H AT THE END
C
                                                                         DVDQ 110
C
          OF THE STARTING PHASE.) THE INTEGRATION WILL CONTINUE
                                                                         DVDQ 111
                                                                         DVDQ 112
          WITH THE CURRENT VALUE OF H AND A RETURN TO THE USER WITH
C
          IFLAG=7 WILL BE MADE ON EVERY STEP UNTIL ABS(H).GE.HMIN.
                                                                         DVDQ 113
          ILLEGAL PARAMETER IN THE CALLING SEQUENCE. IF DVDQ
                                                                         DVDQ 114
          IS CALLED WITH IFLAG=8 THE PROGRAM IS STOPPED.
                                                                         DVDQ 115
C
                                                                         DVDQ 116
C
      H=CURRENT VALUE OF THE STEPSIZE: IN SELECTING THE INITIAL
                                                                         DVDQ 117
        VALUE FOR H. THE USER SHOULD REMEMBER THE FOLLOWING--
C
                                                                         DVDQ 118
                                                                         DVDQ 119
C
       1. THE INTEGRATOR IS CAPABLE OF CHANGING H QUITE QUICKLY AND
C
          THUS THE INITIAL CHOICE IS NOT CRITICAL.
                                                                         DVDQ 120
                                                                          DVDQ 121
C
       2. IF IT DOES NOT LEAD TO PROBLEMS IN COMPUTING THE DERIVATIVES
          (E.G. BECAUSE OF OVERFLOW OR TRYING TO EXTRACT THE SQUARE.
C
                                                                          OVUQ 122
          ROOT OF A NEGATIVE NUMBER), IT IS BETTER TO CHOOSE H MUCH
C
                                                                          DVDQ 123
C
          TOO LARGE THAN MUCH TOO SMALL.
                                                                         DVDQ 124
C
       3. IF H*TPRINT.LE.O INITIALLY, AN IMMEDIATE RETURN IS MADE
                                                                          DVDQ 125
C
          WITH IFLAG=8. THE SIGN OF H IS WHAT DETERMINES THE
                                                                         DVDQ 126
C
          DIRECTION OF INTEGRATION.
                                                                          DVDQ 127
С
      4. IF TPRINT=H*(2**K) K A NCNNEGATIVE INTEGER THEN OUTPUT
                                                                          DVDQ 128
C
          VALUES WILL BE OBTAINED WITHOUT DOING AN INTERPOLATION.
                                                                          DVDQ 129
C
                                                                         DVDQ 130
                                                                         DVDQ 131
             AFTER GETTING STARTED, AND WHENEVER H
C
      HMIN
С
              IS HALVED, ABS(H) IS COMPARED WITH HMIN.
                                                                         DVDQ 132
C
              IF ABS(H).LT.HMIN CONTROL IS RETURNED TO
                                                                         DVDQ 133
C
              THE USER WITH IFLAG=7.
                                                                          DVDQ 134
С
                                                                         DVDQ 135
                                                                          DVDQ 136
C
      HMAX
             THE STEPSIZE IS NOT DOUBLED IF
С
              DOING SO WOULD MAKE ABS (H) . GT . HMAX
                                                                          DVDQ 137
С
                                                                         DVDQ 138
              ENABLES THE USER TO SPECIFY THE PCINTS WHERE
C
                                                                          DVDQ 139
        OUTPUT IS DESIRED. LET TOUT=TPRINT + THE VALUE OF T THE LAST
С
                                                                          DVDQ 140
C
        TIME CONTROL WAS RETURNED TO THE USER WITH IFLAG=3. (INITIALLY
                                                                         DVDQ 141
C
        TOUT=THE INITIAL VALUE OF T.) CONTROL IS RETURNED TO THE
                                                                          DVDQ 142
С
        USER WITH IFLAG=3 WHENEVER T=TOUT. IF TOUT DOES NOT FALL
                                                                          DV DQ 143
        ON AN INTEGRATION STEP. OUTPUT VALUES ARE OBTAINED BY
C
                                                                          DVDQ 144
C
        INTERPOLATION ON THE FIRST STEP THAT (T-TOUT)*H.GT.O.
                                                                         DV0Q 145
С
        INTERPOLATED VALUES FOR BOTH Y AND F ARE COMPUTED.
                                                                          DVDQ 146
С
        (NOTE THAT A RETURN WITH IFLAG=3 IS ALWAYS MADE
                                                                         DVDQ 147
C
        BEFORE TAKING THE FIRST STEP.)
                                                                          DVDQ 148
C
                                                                          DVDQ 149
C
               CONTROL IS RETURNED TO THE USER WITH IFLAG=4 WHEN
                                                                          DVDQ 150
C
        T REACHES TFINAL . IF TFINAL DGES NOT FALL ON AN INTEGRATION
                                                                          DVDQ 151
        STEP VALUES AT TFINAL ARE OBTAINED BY EXTRAPOLATION.
C
                                                                          DVDQ 152
C
                                                                          DVDQ 153
C
      MXSTEP
               ON THE INITIAL ENTRY, AND ON ENTRIES
                                                                          DVDQ 154
C
              2.LT.IFLAG.LT.6 KSOUT IS SET EQUAL TO
                                                                          DV DQ 155
        KSTEP+MXSTEP. AT THE END OF EACH STEP KSTEP IS INCREMENTED
C
                                                                          DVDQ 156
C
        AND COMPAFED WITH KSOUT. IF KSTEP.GE.KSOUT CONTROL IS
                                                                          DVDQ 157
C
        RETURNED TO THE USER WITH IFLAG=5. (THUS IF TPRINT IS
                                                                          DV DQ 158
С
        SUFFICIENTLY LARGE, CONTROL WILL BE RETURNED TO THE USER
                                                                          DVDQ 159
C
        WITH IFLAG=5 EVERY MXSTEP STEPS. )
                                                                          DVDQ 160
                                                                          DVDQ 161
C
C
      KSTEP=NUMBER OF INTEGRATION STEPS TAKEN (COMPUTED
                                                                          DVDQ 162
C
        BY THE INTEGRATOR.)
                                                                          DVDQ 163
```

```
DVDQ 164
C
C
      KEMAX=INDEX OF COMPONENT RESPONSIBLE FOR THE
                                                                          DV0Q 165
C
            VALUE OF EMAX (SEE BELOW).
                                                                          DVDQ 166
C
                                                                          DVDQ 167
C
      EMAX=LARGEST VALUE IN ANY COMPONENT OF (ESTIMATED ERROR) PEPS (I)
                                                                          DVDQ 168
C
        ORDINARILY THE STEFSIZE IS HALVED IF EMAX.GT...1. WITH A
                                                                          DVDQ 169
C
        RECENT HISTORY OF LOCAL ROUND-OFF PROBLEMS VALUES OF EMAX AS
                                                                          DVDQ 170
C
        LARGE AS 1 ARE PERMITTED. THE STEPSIZE IS NOT HALVED ON ANY
                                                                          DVDQ 171
C
        STEP THAT ROUND OFF ERROR APPEARS TO BE LIMITING THE PRECISION. DVDQ 172
C
                                                                          DVDQ 173
C
      KQ(I)=HIGHEST ORDER DIFFERENCE USED IN INTEGRATING
                                                                          DVDQ 174
C
        THE I-TH EQUATION. (COMPUTED BY THE INTEGRATOR)
                                                                          DVDQ 175
C
                                                                          DVDQ 176
C
      YN=A VECTOR WITH THE DIMENSION OF Y USED TO STORE
                                                                          DVDQ 177
C
        THE VALUE OF Y AT THE END OF EACH INTEGRATION STEP.
                                                                          DVDQ 178
C
                                                                          DVDQ 179
C
      DT=AN ARRAY WITH DIMENSION DT(20. NEQ) USED TO
                                                                          DVDQ 180
C
        STORE THE DIFFERENCE TABLE.
                                                                          DVDQ 181
C
                                                                          DVDQ 182
C
      NEVAL=NUMBER OF TIMES F IS EVALUATED (= NUMBER OF
                                                                          DVDQ 183
C
        RETURNS MADE WITH IFLAG=1 OR 2). (COMPUTED BY DVDQ.)
                                                                          DVDQ 184
C
                                                                          DVDQ 185
C
      NG MUST BE SET = 0 BY THE USER IF THE GSTOP FEATURE IS
                                                                          DVDQ 186
C
        NOT USED. OTHERWISE SEE BELOW.
                                                                          DVDQ 187
C
                                                                          DVDQ 188
C
                                                                          DVDQ 189
C
      A GSTOP IS DEFINED AS A RETURN WHICH IS MADE TO THE USER WHEN A
                                                                          DVDQ 190
C
      USER SPECIFIED FUNCTION G PASSES THROUGH ZERC. THE USER MAY
                                                                           DV DQ 191
C
      SPECIFY ANY NUMBER OF FUNCTIONS G OF TWO TYPES. ZEROS OF THE FIRSTOVDQ 192
C
      TYPE ARE LOCATED WITHOUT REQUIRING A DERIVATIVE EVALUATION
                                                                           DVDQ 193
C
      BEYOND THE ZERO. THIS TYPE OF GSTOP REQUIRES THAT G BE EVALUATED
                                                                          DVDQ 194
C
      BEFORE EACH DERIVATIVE EVALUATION. ZEROS OF THE SECOND TYPE ARE
                                                                          DVDQ 195
      LOCATED USING INTERPOLATION, WHICH IS MORE ACCURATE THAN THE
C
                                                                          DVDQ 196
C
      EXTRAPOLATION USED IN THE PRECEDING CASE AND ONLY REQUIRES ONE
                                                                          DVDQ 197
C
      EVALUATION OF G PER STEP. THUS ONE SHOULD USE THE SECOND TYPE OF
                                                                          DVDQ 198
      GSTOP IF POSSIBLE. USERS NOT USING THE GSTOP FEATURE NEED READ
C
                                                                          DVDQ 199
C
      NO FURTHER.
                                                                          DVDQ 200
C
                                                                          DVDQ 201
C
      THE GSTOP FEATURE IS INVCKED BY USING A NONZERO VALUE OF NG .
                                                                          DVDQ 202
C
      IT IS TURNED OFF BY SETTING NG=0 . IT IS NOT NECESSARY TO
                                                                           DVDQ 203
C
      MAKE SEPARATE CALLS TO DVDQ TO DO THIS.
                                                                          DVDQ 204
C
                                                                          DVDQ 285
C
      NG =
            THE NUMBER OF COMPONENTS IN G TO BE EXAMINED FOR A ZERO.
                                                                          DVDQ 206
C
                                                                          DV DQ 207
      NGE=THE NUMBER OF COPPONENTS OF G THAT MUST BE EXAMINED FOR
C
                                                                           DV DQ 298
            A ZERO BEFORE COMPUTING THE DERIVATIVES (FIRST TYPE OF
                                                                          DVDQ 219
C
            GSTOP). IF NGE.LT.O OR NGE.GT.NG, IFLAG IS SET
                                                                          DVDQ 210
С
            EQUAL 8 AND AN IMPEDIATE RETURN IS MADE. IF NGE.GT.O.
                                                                          DVDQ 211
C
            G(1), G(2), ..., G(NGE) ARE EXAMINED FOR A ZERO BEFORE EACH
                                                                           DVDQ 212
C
            DERIVATIVE EVALUATION, THE REMAINING COMPONENTS (IF ANY)
                                                                           OVDQ 213
C
            ARE EXAMINED AT THE END OF EACH STEP.
                                                                           DVDQ 214.
Ċ
                                                                           DVDQ 215
C
      NSTOP= THE COMPONENT OF G RESPONSIBLE FOR A GSTOP (COMPUTED BY
                                                                           DVDQ 216
C
             THE INTEGRATOR).
                                                                           DVDQ 217
C
                                                                           DVDQ 218
C
            A VECTOR CONTAINING THE CURRENT VALUES OF THE FUNCTIONS
      G=
                                                                           DVDQ 219
C
            WHOSE ZEROS ARE TO BE DETERMINED.
                                                                           DVDQ 220
C
                                                                           DVDQ 221
C
      GT≃
            A VECTOR WITH THE SAME DIMENSION AS G USED BY THE
                                                                           DVDQ 222
            SUBROUTINE FOR TEMPORARY STORAGE.
                                                                          DVDQ 223
```

```
C
                                                                              DVDQ 224
C
      RETURNS FROM CALLING DVDQ WITH IFLAG.GT.8 SHOULD BE INTERPETED
                                                                              DVDQ 225
C
      AS FOLLOWS.
                                                                              DVDQ 226
C
      IFLAG
                                                                              DVDQ 227
C
      = 9 COMPUTE G(NGE+1)....g(NG) (THE COMPONENTS OF G WITH
                                                                              DVDQ 228
C
           ZEROS TO BE LOCATED USING INTERPOLATION). THEN CALL DVDQ.
                                                                              DVDQ 229
C
          NO RETURN IS MADE WITH IFLAG=9 IF NGE=NG.
                                                                              DVDQ 230
C
                                                                              DVDQ 231
      =10 COMPUTE G(1),G(2),...,G(NGE) (THE COMPONENTS OF G WITH
C
           ZEROS TO BE LOCATED USING EXTRAPOLATION). THEN CALL DVDQ.
                                                                              DVDQ 232
C
           NO RETURN IS MADE WITH IFLAG=10 IF NGE=0.
                                                                              DVDQ 233
C
      =11 A GSTOP HAS BEEN FOUND. G(NSTOP)=0. FRINT RESULTS. IF THEIR DVDQ 234
C
           ARE NO DISCONTINUITIES CALL DVDQ TO CONTINUE THE INTEGRATION. DVDQ 235
      =12 G(NSTOP) CHANGES SIGN, BUT THERE IS DIFFICULTY IN CONVERGING
C
                                                                              DVDQ 236
C
           TO A ZERO. THE USER MAY WISH TO MAKE A SPECIAL CHECK TO BE
                                                                              OVDQ 237
C
           CERTAIN THAT EVERYTHING IS ALL RIGHT. TO CONTINUE THE
                                                                              DVDQ 238
C
           INTEGRATION CALL DVDC.
                                                                              DVDQ 239
C
                                                                              DVDQ 240
C
                                                                              DVDQ 241
C
      SUBROUTINE DVDQ(NEQ,T,Y,F,KD,EPS,IFLAG,H,HMIN,
                                                                              DVDQ 242
C
     * HMAX, TPRINT, TFINAL, MXSTEP, KSTEP, CEMAX, EMAX,
                                                                              DVDQ 243
C
     * KQ,YN,DT, NEWAL, NG, NEE, NSTOP, G, GT)
                                                                              DVDQ 244
      INTEGER NEQ, KD, IFLAG, MXSTEP, KSTEP, KEMAX, KQ, NEVAL, NG, NGE, NSTOP
                                                                              DVDQ 245
      REAL T,Y,F,EPS,H,HMIN,HMAX,TPRINT,TFINAL,EMAX,
                                                                              DVDQ 246
           YN, DT, G, GT
                                                                              DVDQ 247
      DIMENSION Y(1), F(1), YN(1), DT(20,1), KD(1), KQ(1), EPS(1), G(1), GT(1)
                                                                              DVDQ 248
      INTEGER IB, IFL, IFLG, IFLS, IFLGS, IGK, IGKM, KBIT2, KDMAX, KDD, KDC,
                                                                              DVDQ 249
           LDOUB, LFD, LGSS, LGSE, LGSE, NE, NGA, IM1, KK, JM2, KMAXO, KM, KMD, KM1,
                                                                              DVDQ 250
     3
                                                                              DVDQ 251
           KQMAX, KQM, KQQ, KQ1, KQQ2, LRND, JS, KSOUT, LSC, LSTC, NV, I, J, K, L
             FAC, GAM, GAS, DD, EIGHTH, GI, HH, EPSGS, ERRMX, ERND,
                                                                              DVDQ 252
           TWO, FR NO, RG, ETA, TG, O MEP1, RND, RNDC, RQMAX, TL, E 2HAVE,
                                                                              DVDQ 253
     3
           E2HMAX, E2HFAC, E2+, TOLT, PT, TP, PTS1, PTS2, PTS3, PTS4, PTS5, TPS1,
                                                                              DVDQ 254
           TPD, TPO1, TPS3, TPS5, TPS4, TPS2, TPS6, TPC2, D, 201, PC75, E, P1,
                                                                              DVDQ 255
           P25, P5, P75, S, ABS, AMOC, AMIN1, AMAX1, SIGN
                                                                              DVDQ 256
      DIMENSION GAM(20,4), GAS(20), ETA(13,18)
                                                                              DVDQ 257
                                                                              DVDQ 258
      DIMENSION DD(26),D(25),PT(21),FAC(3),GI(2),RG(3)
      EQUIVALENCE (DD(2),D(1))
                                                                              DVDQ 259
      DATA KBIT2 /U/
                                                                              DVDQ 260
C
                                                                              DVDQ 261
C
                                                                              DVDQ 262
C
      CHECK IFLAG
                                                                              DVDQ 263
                                                                              DVDQ 264
      IF (IFLAG) 1198, 10, 60
                                                                              DVDQ 265
C
                                                                              DVDQ 266
C
      CHECK TO INITIALIZE CONSTANTS
                                                                              DVDQ 267
                                                                              DVDQ 268
C
   10 IF (KBIT2) 50,12,50
                                                                              DVDQ 269
C
                                                                              DVDQ 270
Ċ
      DETERMINE MACHINE PRECISION
                                                                              DVDQ 271
                                                                              DVDQ 272
   12 RND=1.
                                                                              DVDQ 273
   14 RND=RND/2.
                                                                              DVDQ 274
      KBIT2=KBIT2+1
                                                                              DVDQ 275
      IF(1.+RND .GT. 1.) GO TO 14
                                                                              DVDQ 276
      RND=8.*RND
                                                                              DVDQ 277
      KQMAX=0.3*FLOAT(KB JT 2+1)
                                                                              DVDQ 278
      IF(KQMAX.GT.19) KQMAX=19
                                                                              DVDQ 279
      KBIT2=2*KBIT2+2
                                                                              DVDQ 280
C
                                                                              DVDQ 281
      KOMAK GIVES THE MAXIBUM CROER OF POLYNOMIAL APPROXIMATION USED.
C
                                                                              DVDQ 282
      THERE IS LITTLE POINT IN HAVING KAMAX MUCH BIGGER THAN THE NUMBER DVDQ 283
```

```
C
    . OF DECIMAL DIGITS IN THE MANTISSA.
                                                                            DVDQ 284
C
                                                                            DVDQ 285
C
      RND IS APPROXIMATELY 2++ (3-B) WHERE B IS
                                                                            DVDQ 286
C
      THE NUMBER OF BITS IN THE MANTISSA.
                                                                            DV DQ 287
C
      KBIT2=2*8+2 WHERE B IS THE NUMBER OF BITS IN THE MANTISSA.
                                                                            DV00 288
      IF THE DERIVATIVES ARE NOT COMPUTED TO THE ACCURACY EXPECTED
C
                                                                            DVDQ 289
C
      FROM THE WORD LENGTH OF THE COMPUTER (FOR EXAMPLE BECAUSE OF
                                                                            DVDQ 290
C
      CANCELLATION PROBLEMS OR TABULAR DATA), THEN THESE CONSTANTS
                                                                            DVDQ 291
C
      CAN BE CHANGED TO REFLECT THE NUMBER OF BITS WHICH ARE
                                                                            DVDQ 292
C
      SIGNIFICANT IN THE COMPUTED DERIVATIVES. (THIS IS NOT NECESSARY,
                                                                            DVDQ 293
C
      BUT IS WISE IF THE ACCURACY REQUESTED IS DIFFICULT TO OBTAIN
                                                                            DVDQ 294
C
      BECAUSE THE DERIVATIVES FAVE SO FEW SIGNIFICANT DIGITS.)
                                                                            DVDQ 295
C
                                                                            DVDQ 296
C
      ON IBM360, KQMAX WILL = 16, RND = 8.880-16, KBIT2 = 108
                                                                            DVDQ 297
C
      ON CDC6600, KQMAX WILL = 14, RND = 2.84E-14, KBIT2 = 98
                                                                            DVDQ 298
C
      ON UNIVAC 1108, KQMAX WILL = 18, RND = 6,94D-18, KBIT2 = 122
                                                                            DVDQ 299
C
                                                                            DVDQ 300
C
                                                                            DVDQ 301
      KMAX0=4
                                                                            DVDQ 302
C
      KMAXO IS THE MAXIMUM ORDER DIFFERENTIAL EQUATION THIS
                                                                            DVDQ 303
C
      IMPLEMENTATION WILL INTEGRATE.
                                                                            DVDQ 304
                                                                            DVDQ 305
      FAC(1)=1.
                                                                            DVDQ 306
      FAC(2)=FAC(1)/2.
                                                                            DVDQ 387
      FAC(3) = FAC(2)/3
                                                                            DVDQ 308
      TW0=2.
                                                                            DVDQ 309
      P1=.1
                                                                            DVDQ 310
      P01=.01
                                                                            DVDQ 311
      P25= 25
                                                                            DVDQ 312
      P5= • 5
                                                                            DVDQ 313
      P75=.75
                                                                            DVDQ 314
      P075=.075
                                                                            DV DQ 315
      ONE P1=1.1
                                                                            DVDQ 316
      PT(1)=1.
                                                                            DVDQ 317
      KM=KQMAX+1
                                                                            DVDQ 318
      DO 16 I=1, KM
                                                                            DVDQ 319
        PT(I+1)=2.*PT(I)
                                                                            DVDQ 320
   16 CONTINUE
                                                                            DVDQ 321
C
                                                                            DVDQ 322
C
      COMPUTE GAS AND GAM
                                                                            DVDQ 323
C
                                                                            BVBQ 324
C
      GAS(I) IS THE I-TH ABAMS-MOULTON CORRECTOR COEFFICIENT AND
                                                                            DV DQ 325
C
      GAM(I,J) IS THE I-TH ADAMS-FALKNER PREDICTOR COEFFICIENT
                                                                            DVDQ 326
C
      FOR INTEGRATING J-TH ORDER DIFFERENTIAL EQUATIONS,
                                                                            DVDQ 327
C
      I = 1,2,...,KQMAX+1, J = 1,2,...,KMAXO.
                                                                            DVDQ 328
                                                                            DVDQ 329
      KMD=KM+KMAXO
                                                                            DVDQ 330
      DO 20 K=1,KMD
                                                                            DVDQ 331
        S=K
                                                                            DVDQ 332
        D(K) = 1./S
                                                                            DVDQ 333
   20 CONTINUE
                                                                            DVDQ 334
      GAM(1,1)=D(1)
                                                                            DV DQ 335
      DO 22 J=2. KMAXO
                                                                            DVDQ 336
        GAM(1,J) = D(J) + FAC(J-1)
                                                                            DVDQ 337
   22 CONTINUE
                                                                            DVDQ 338
      DO 26 I=2.KM
                                                                            DVDQ 339
        KK=KMD+1-I
                                                                            DVDQ 340
        DO 24 K=1,KK
                                                                            DVDQ 341
          S=I-1
                                                                            DVDQ 342
          D(K)=D(K)-D(K+1)/S
                                                                            DVDQ 343
```

```
24
        CONTINUE
                                                                               DVDQ 344
        GAM(I_{9}1) = D(1)
                                                                               DVDQ 345
        DO 26 J=2.KMAXO
                                                                               DVDQ 346
           GAM(I, J)=D(J)*FAC(J-1)
                                                                               DVDQ 347
   26 CONTINUE
                                                                               DVDQ 348
      GAS(1) = 1.
                                                                               DVDQ 349
      DO 28 I=2.KM
                                                                               DVDQ 350
        GAS(I) = GAM(I, 1) - GAP(I-1, 1)
                                                                               DVDQ 351
   28 CONTINUE
                                                                               DV DQ 352
C
                                                                               DVDQ 353
C
      GENERATE ETA
                                                                               DVDQ 354
С
                                                                               DV DQ 355
C
      ETA(I, J), I=1,2,..., J IS USED IN THE FIRST MODIFICATION OF THE
                                                                               DV DQ 356
С
      I-TH DIFFERENCE CF A J-TH ORDER METHOD AFTER THE STEPSIZE IS
                                                                               DVDQ 357
С
      HAL VED.
                                                                               DVDQ 358
C
      ETA(I,J), J=1,2,...,I-1 IS USED IN THE SECOND MODIFICATION OF
                                                                               DVDQ 359
C
      THE (J+1)-ST DIFFERENCE OF AN I-TH ORDER METHOD
                                                                               DVDQ 360
C
                                                                               DVDQ 361
      K=KQMAX-1
                                                                               DVDQ 362
      EIGHTH=FAC(2)*FAC(2)*FAC(2)
                                                                               DVDQ 363
      ETA(1,1)=EIGHTH
                                                                               DVDQ 364
      ETA(2,1)=EIGHTH
                                                                               DVD0 365
      TP=FAC(2)*FAC(2)
                                                                               DV DU 366
      DO 33 J=2,K
                                                                               DVDQ 367
        TP=TP/2.
                                                                               DVDQ 368
        ETA(J,J) = (TP+ETA(J-1,J-1))/2.
                                                                               DVDQ 369
        IF(J.EQ.2) GO TO 32
                                                                               DYDQ 370
        JM2=J-2
                                                                               DVDQ 371
        DO 38 IB=1.JM2
                                                                               DVDQ 372
          I=J-IB
                                                                               DVDQ 373
           ETA(I, J) = (ETA(I+1, J) + ETA(I-1, J-1)) / 2.
                                                                               DVDQ 374
   30
        CONTINUE
                                                                               DVDQ 375
   32
        ETA (1, J) = ETA (2, J)/2.
                                                                               DVDQ 376
   33 CONTINUE
                                                                               DVDQ 377
      DO 34 I=1,K
                                                                               DVDQ 378
        TP=0.
                                                                               DVDQ 379
        DO 34 J=1,I
                                                                               DVDQ 380
          TP=TP+ETA(J.I)
                                                                               DVDQ 381
                                                                               DVDQ 382
          ETA(I+1,J)=TP
   34 CONTINUE
                                                                               DVDQ 383
      TP=FAG(2)
                                                                               DVDQ 384
      DO 36 J=1,K
                                                                               DVDQ 385
        TP=TP/2.
                                                                               DVDQ 386
        D(J) = ETA(J+1,J) + TP
                                                                               OV DQ 387
   36 CONTINUE
                                                                               DVDQ 388
      DO 38 J=1.K
                                                                               DVDQ 389
        DO 38 I=1,J
                                                                               DVDQ 390
           ETA(I,J) = ETA(I,J)/D(J)
                                                                               DVDQ 391
   38 CONTINUE
                                                                               DVDQ 392
      KM1=K-1
                                                                               DVDQ 393
      DO 40 J=1,KM1
                                                                               DVDQ 394
        D(J) = D(J+1)/D(J)
                                                                               DVDQ 395
   40 CONTINUE
                                                                               DV DQ 396
      DO 42 I=2, KM1
                                                                               DVDQ 397
        DO 42 J=1,I
                                                                               DVDQ 398
          ETA (I+1,J) = -ETA(I+2,J) + ETA(I+1,J) + D(I)
                                                                               DVDQ 399
   42 CONTINUE
                                                                               DVDQ 440
      TP=EIGHTH
                                                                               DV DQ 451
      DO 46 I=2,KM1
                                                                               DVDQ 402
        TP=TP/2.
                                                                               DVDQ 403
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S=TP
                                                                              DVDQ 404
        DO 44 J=1,I
                                                                              DVDQ 405
           S=S+ETA (I+1,J)
                                                                              DVDQ 406
   44
        CONTINUE
                                                                              DVDQ 407
        IM1=I-1
                                                                              DVDQ 408
        DO 46 J=1.IM1
                                                                              DVDQ 489
           ETA(I,J)=ETA(I+1,J)/S
                                                                              DVDQ 410
   46 CONTINUE
                                                                              DVDQ 411
C
                                                                              DV DQ 412
C
      INITIALIZE VARIABLES
                                                                              DVDQ 413
C
                                                                              DVDQ 414
   50 PTS1=PT(1)
                                                                              DVDQ 415
      PTS2=PT(2)
                                                                              DVDQ 416
      PTS3=PT (3)
                                                                              DVDQ 417
      PTS4=PT (4)
                                                                              DVDQ 418
      PTS5=PT(5)
                                                                             DVDQ 419
      LGSS=0
                                                                             DVDQ 420
      LGSD=0
                                                                              DVDQ 421
                                                                             DVDQ 422
      LGSE=0
      LFD=0
                                                                              DVDQ 423
      E2HAVE=0.
                                                                              DVDQ 424
      E2HMAX=0.
                                                                              DVDQ 425
      DO 52 I=1.KMD
                                                                              DVDQ 426
        DD(I)=0.
                                                                              DVDQ 427
   52 CONTINUE
                                                                              DVDQ 428
      KSTEP=-1
                                                                              DVDQ 429
      NE=NEQ
                                                                             DVDQ 430
      IF (NE.LE.0) GO TO 1190
                                                                              DV DQ 431
      HH=H
                                                                              DVDQ 432
      NV = 0
                                                                              DVDQ 433
      KDMAX=0
                                                                             DVDQ 434
      DO 56 J=1, NE
                                                                             DVDQ 435
        KQ(J)=1
                                                                              DVDQ 436
        DO 54 I=1,KQMAX
                                                                              DVDQ 437
           DT(I,J)=0.
                                                                              DVDQ 438
   54
        CONTINUE
                                                                             DVDQ 439
        KDD=KD(J)
                                                                             DVDQ 440
        IF ((KDD.EQ.0).OR.(KDD.GT.KMAXO)) HH=0.
                                                                             DVDQ 441
        IF (KDD.GT.KDMAX) KDMAX=KDD
                                                                              DVDQ 442
        NV = NV + KDD
                                                                             DVDQ 443
   56 CONTINUE
                                                                             DVDQ 444
C
                                                                              DVDQ 445
      IF ((TPRINT*HH).LE.O.) GO TO 1190
                                                                              DVDQ 446
      ERRMX=P1
                                                                             DVDQ 447
      ERND=0.
                                                                             DVDQ 448
      EMAX=ERNO
                                                                              DVDQ 449
      RNDC=RND*P25
                                                                             DVDQ 450
      LDOUB=0
                                                                              DVDQ 451
      E2HFAC=P25
                                                                              DVDQ 452
      LSC=8
                                                                              DVDQ 453
      LSTC=4
                                                                              DV DQ 454
C
      LSC AND LSTC ARE USED IN COMBINATION AS FOLLOWS
                                                                              DV DQ 455
C
        LSTC=4.
                  LSC=4
                             FIRST TIME THROUGH THE FIRST STEP
                                                                             DVDQ 456
C
        LSTC=3.
                  LSC=4
                             SEC CNO TIME THROUGH THE FIRST STEP
                                                                             DVDQ 457
C
                             (NECESSARY TO CHECK STABILITY)
                                                                             DVDQ 458
C
        LSTC=2.
                  LSC=4
                             THIRD TIME THROUGH THE FIRST STEP
                                                                              DVDQ 459
C
                             (CNLY OCCURS IF INSTABILITY FOSSIBLE)
                                                                              DVDQ 460
C
                             SECOND STEP (IF KQ(I)=2 , I=1,..., NEQ)
        LSTC=2.
                  LSC=2
                                                                             DVDQ 461
C
                             STAFFING, ONE DERIVATIVE EVAL. PER STEP.
        LSTC=1.
                  LSC=0
                                                                             DVDQ 462
C
                             SET WHEN STARTING TWO DERIV. EVAL. PER STEP
        LSTC=1.
                  LSC.GT.0
                                                                             DVDQ 463
```

```
C
        LSTC=-1 LSC.LT.0 SET WHEN HALVING THE STEPSIZE
                                                                            DVDQ 464
C
       IN THE LAST THO CASES LSC IS SET EQUAL TO LSTC+ (MAXIMUM KQ(I)
                                                                            DVDQ 465
       +1) . AT THE END OF EACH STEP IF LSC.NE.O IT IS REPLACED BY
                                                                            DVDQ 466
C
       LSC-LSTC UNTIL LSC=0, AT WHICH TIME LSTC IS SET EQUAL TO 0.
                                                                            DVDQ 467
C
        WHEN DOUBLING H, LSTC IS SET EQUAL TO -1 AND LSC TO -3.
                                                                            DVDQ 468
C
       UNDER CERTAIN CONDITIONS WHEN KQ(I)=1. LSTC IS SET =-1 AND LSC=-50VDQ 469
C
                                                                            DVDQ 470
      KSOUT=MXSTEP
                                                                            DVDQ 471
      TOUT=T
                                                                            DVDQ 472
      IFL=13
                                                                            DVDQ 473
      IFLAG=1
                                                                            DVDQ 474
      NGA=0
                                                                            DVDQ 475
      NEVAL = 0
                                                                            DVDQ 476
      IF(NG.NE.0) GO TO 1420
                                                                            DVDQ 477
      GO TO 315
                                                                            DVDQ 478
C
      END OF INITIALIZATION
                                                                            DVDQ 479
C
                                                                            DVDQ 480
C
                                                                            DVDQ 481
C
      ENTRY WITH IFLAG.GT. 0
                                                                            DVDQ 482
C
                                                                            DVDQ 483
C
      CHECK FOR GSTOPS
                                                                            DVDQ 484
C
                                                                            DVDQ 485
   60 IF(NG.EQ.NGA) GO TO 65
                                                                            DVDQ 486
      IF(NG.LT.0) GO TO 1190
                                                                            DVDQ 487
      NGA=NG
                                                                            DVDQ 488
      LGSS=-NGA
                                                                            DVDQ 489
      LGSD=0
                                                                            DVDQ 490
      LGSE=0
                                                                            DVDQ 491
      IFLG=-20
                                                                            DVDQ 492
C
                                                                            DVDQ 493
C
                                                                            DVDQ 494
   65 IF (IFL.LT.2) GO TO 320
                                                                            DVDQ 495
      IF (IFL.EQ.2) GO TO 80
                                                                            DYDQ 496
      IF (IFL.GT.5) GO TO 1180
                                                                            DVDQ 497
C
                                                                            DVDQ 498
C
      SET STEP STOP
                                                                            DVDQ 499
      KSOUT=KSTEP+MXSTEP
                                                                            DVDQ 500
      IF (IFL.EQ.5) GO TO 210
                                                                            DVDQ 501
      IF (IFL.EQ.4) GO TO 1219
                                                                            DVDQ 502
C
                                                                            DVDQ 503
      SET PRINT STOP
C
                                                                            DVDQ 504
   70 TOUT=T+TPRI IT
                                                                            DVDQ 505
C
                                                                            DVDQ 506
   75 TPS1=ABS(AMOD((TOUT-T)/HH, TWO)-PTS1)
                                                                            DVDQ 507
      LFD=-1
                                                                            DVDQ 508
      IF (TPS1.GE.P5) LFD=1
                                                                            CIV DQ 509
C
                                                                            DV DQ 510
      LFD IS USED TO INDICATE WHETHER DJUBLING H IS PERMITTED.
C
                                                                            DVDQ 511
      IF LFD. LT. 0 AT THE END OF A STEP THEN DOUBLING H IS
                                                                            DVDQ 512
      NOT PERMITTED. THE SIGN OF LFD IS CHANGED JUST BEFORE THE
                                                                            DVDQ 513
      END OF EACH STEP. IF TPRINT=H*(POWER OF 2) THEN
                                                                            DVDQ 514
C
      OUTPUT VALUES WILL BE OBTAINED WITHOUT INTERPOLATION.
                                                                            DVDQ 515
C
                                                                            DVDQ 516
      GO TO 200
                                                                            DVDQ 517
C
                                                                            DVDQ 518
C
                                                                            DVDQ 519
C
      ENTRY WITH IFLAG=2
                                                                            DVDQ 520
C
                                                                            DVDQ 521
C
      UPDATE DIFFERENCE TABLE
                                                                            DVDQ 522
C
      AND COMPUTE KQM=MAXIHUM VALUE OF (Q(I), I=1.2, ..., NEQ.
                                                                            DVDQ 523
```

```
DVDQ 524
   80 KQM=0
                                                                            DVDQ 525
      DO 90 I=1.NE
                                                                            DVDQ 526
        KQQ=KQ(I)
                                                                            DVDQ 527
        IF (KQQ.GT.KQM) KQM=KQQ
                                                                            DVDQ 528
        D(1) = F(I)
                                                                            DVDQ 529
        00 85 K=1,KQQ
                                                                            DVDQ 530
          D(K+1)=D(K)-DT(K.I)
                                                                            DVDQ 531
          DT(K \cdot I) = D(K)
                                                                            DVDQ 532
        CONTINUE
                                                                            DVDQ 533
        DT(KQQ+1,I)=D(KQQ+1)
                                                                            DVDQ 534
   90 CONTINUE
                                                                            DVDQ 535
C
      END OF UPDATING DIFFERENCE TABLE
                                                                            DVDQ 536
C
                                                                            DVDQ 537
C
      STORE Y (J) IN YN (J)
                                                                            DVDQ 538
      DO 95 J=1.NV
                                                                            DVDQ 539
        (L)Y=(L)NY
                                                                            DVDQ 540
   95 CONTINUE
                                                                            DVDQ 541
C
                                                                            DVDQ 542
      LFD=-LFD
                                                                            DVDQ 543
      TL=T
                                                                            DVDQ 544
      KSTEP=KSTEP+1
                                                                            DVDQ 545
C
                                                                            DVDQ 546
      IF (LGSS) 1430,110,1510
                                                                            DVDQ 547
  100 IFLAG=2
                                                                            DVDQ 548
  110 IF (LSC.EQ.0) GO TO 140
                                                                            DVDQ 549
      LSC=LSC-LSTC
                                                                            DVDQ 550
      IF (LSC.EQ.0) GO TO 130
                                                                            DV DQ 551
      IF (LSTC.NE.(-1)) GO TO 140
                                                                            DVDQ 552
      IF (LDOUS.LT.O) RNEC=RND*P1
                                                                           DVDQ 553
  120 E2HAVE=E2HM X
                                                                           DVDQ 554
      TPS1=PTS1
                                                                           DVDQ 555
      GO TO 190
                                                                            DVDQ 556
  130 IF (ABS(HH).LT.HMIN) GO TO 1808
                                                                           DVDQ 557
      LSTC=D
                                                                           DVDQ 558
  140 IF (LDOUB.NE.1) GO TO 150
                                                                           DVDQ 559
      IF ((LFD.GT.0).AND.(ABS(HH+HH).LE.HMAX)) GO TO 1030
                                                                           DVDQ 560
      GO TO 200
                                                                           DVDQ 561
  150 RQMAX=PTS1/FLOAT (KQM+3)
                                                                           DVDQ 562
      IF ((LSTC.NE.0).OR.(E2HAVE.EQ.0.)) GO TO 120
                                                                           DVDQ 563
      TPS1=E2HMAX/E2HAVE
                                                                          DVDQ 564
      IF (TPS1-PTS1) 160,190,170
                                                                          DVDQ 565
  160 E2HFAC=AMIN1(P075,E2HFAC-RQMAX,E2HFAC+TPS1)
                                                                           DVDQ 566
      GO TO 180
                                                                           DVDQ 567
  170 TPS1=TPS1*TPS1
                                                                           DVDQ 568
      E2HFAC=AMIN1(PTS1, E2HFAC*TPS1)
                                                                           DVDQ 569
  180 RNDC=(ONEP1-E2HFAC)*RND
                                                                            DVDQ 570
      E2HAVE=P5* (E2HMAX+E2HAVE)
                                                                           DVDQ 571
  19 C ERRMX=AMAX1 (P1, ERRMX-RQMAX+TPS1)
                                                                            DVDQ 572
      E2HFAC IS A FACTOR WHICH IS TAKEN TIMES AN INITIAL ESTIMATE CF
C
                                                                            DVDQ 573
             E2H TO GET A FINAL VALUE OF E2H. (E2H=ESTIMATE OF WHAT
C
                                                                           DVDQ 574
C
              (ESTIMATED ERROR)/(REQUESTED ERROR) WOULD BE IF H WERE
                                                                            DVDQ 575
C
             DOUBLED.)
                                                                            DVDQ 576
      EZHMAX IS THE MAXIMUM VALUE OF THE INITIAL ESTIMATE OF EZH OVER
C
                                                                            DVDQ 577
             ALL COMPONENTS WITH KQ(I).GT.1.
C
                                                                            DVDQ 578
      EZHAVE IS A WEIGHTED AVERAGE OF PAST VALUES OF EZHMAX.
C
                                                                            DVDQ 579
C
      THE VALUE OF E2HFAC TENDS TO BE SMALLER WHEN E2HMAX IS
                                                                            DVDQ 580
C
      CONSISTANTLY SMALLER THAN EZHAVE.
                                                                            DVDQ 581
C
                                                                           DVDQ 582
                                                                            DVDQ 583
```

```
C
      CHECK FOR PRINT STCP AND FOR T REACHING TFINAL
                                                                              DVDQ 584
  200 TPD=(TOUT-TL)/HH
                                                                              DVDQ 585
      TPO1=(TFINAL-TL)/HH
                                                                              DVDQ 566
C
                                                                              DVDQ 587
      IF (LGSE.LT.8) GO TO 1780
                                                                              DVDQ 588
      IF (TP01.LT.FAC(1)) GO TO 1220
                                                                              DVDQ 589
      IF (TPD.LE.Q.) GO TO 1280
                                                                              DVDQ 598
C
                                                                              DVDQ 591
C
      CHECK FOR STEP STOP
                                                                              DVDQ 592
      IF (KSOUT.GT.KSTEP) GO TO 210
                                                                              DVDQ 593
C
                                                                              DVDQ 594
      IFL=5
                                                                              DVDQ 595
      GO TO 310
                                                                              DVDQ 596
C
                                                                              DVDQ 597
C
      CHECK TO SEE IF ROUND-OFF ERROR IS PROMINENT
                                                                              DVDQ 598
  210 IF (EMAX.EQ.ERND) GO TO 220
                                                                              DVDQ 599
C
      IT IS
                                                                              DVDQ 600
      IFL=6
                                                                              DVDQ 601
      IF (EMAX.GE.P1) GO TO 318
                                                                              DVDQ 602
      IF ((LSTC.GE.O).OR.(LDOUB.EQ.1)) ERRMX=PTS1
                                                                              DVDQ 603
C
                                                                              DVDQ 604
  220 IFL=1
                                                                              DVDQ 605
  238 T=TL+HH
                                                                              DVDQ 606
C
                                                                              DVDQ 607
C
      START A NEW STEP
                                                                              DVDQ 608
C
                                                                              DVDQ 609
C
      PREDICT
                                                                              DVDQ 610
  240 J=0
                                                                              DVDQ 611
      DO 290 I=1.NE
                                                                              DVDQ 612
        KDD=KD(I)
                                                                              DVDQ 613
        KDC=KDD
                                                                              DVDQ 614
  250
        KQQ=KQ(I)
                                                                              DVDQ 615
        TPD=0.
                                                                              DVDQ 616
                                                                              DVDQ 617
        K=KDC
  260
        TPD=TPD+DT(KQQ,I)+GAM(KQQ,KDC)
                                                                              DVDQ 618
        KQQ=KQQ-1
                                                                              DVDQ 619
        IF (KQQ.GT.0) GO TO 260
                                                                              DVDQ 620
  270
        K=K-1
                                                                              DVDQ 621
        IF (K.LE.G) GO TO 280
                                                                              DVDQ 622
        L=J+K
                                                                              DVDQ 623
        TPD=YN(L+1) *FAC(K) +HH*TPD
                                                                              DVDQ 624
        GO TO 270
                                                                              DVDQ 625
  280
        J=J+1
                                                                              DVDQ 626
        Q(J) = V(J) + HH + TPD
                                                                              DVDQ 627
        KDC=KDC-1
                                                                              DVDQ 628
        IF (KDC.GT.0) GO TO 250
                                                                              DVDQ 629
  290 CONTINUE
                                                                              DVDQ 630
C
      END OF PREDICT
                                                                              DVDQ 631
C
                                                                              DVDQ 632
      IF (IFL) 1240,320,300
                                                                              DVDQ 633
  300 IF (LGSD.NE.0) GO TO 1520
                                                                              DVDQ 634
C
                                                                              DV DQ 635
  310 IFLAG=IFL
                                                                              DVDQ 636
  315 IF (IFLAG.LE.2) NEVAL=NEVAL+1
                                                                              DVDQ 637
C
                                                                              DVDQ 638
      RETURN
                                                                              DVDQ 639
C
                                                                              DVDQ 640
C
                                                                              DVDQ 641
C
      ENTRY WITH IFLAG=1
                                                                              DVDQ 642
  320 ERND=0.
                                                                              DVDQ 643
```

```
EMAX=0.
                                                                           DVDQ 644
      E2HMAX=0.
                                                                           DVDQ 645
      J=0
                                                                           DVDQ 646
      IF (LDOUB.GE.8) LDOUB=1
                                                                           DVDQ 647
                                                                           DVDQ 640
C
      LOOUB IS SET IN THE LOOP BELOW AS FOLLOWS
                                                                           DVDQ 649
C
      LDOUB=0
                HALVE
                                                                           DVDQ 650
C
      LDOUB=1
                DOUBLE
                                                                           DVDQ 654
C
      LDOUB=2
                DO NOT DOUBLE
                                                                           DVDQ 652
C
                                                                           DVDQ 653
C
      LDOUB.LT.O AT THE BEGINNING OF THE LOOP INDICATES THE FOLLOWING
                                                                           DVDQ 654
C
      =-3 STEPSIZE HAS JUST BEEN HALVED. IF A DISCONTINUITY IS
                                                                           DVDQ 655
C
             NOT INDICATED MCDIFY THE DIFFERENCE TABLE AND REPEAT
                                                                           DVDQ 656
C
             THE STEP.
                                                                           DVDQ 657
C
      =-2
             STEP AFTER LDOUB=-3. PROCEED AS USUAL (ORDER IS NOT
                                                                           DVDQ 658
C
             CHANGED)
                                                                           DVDQ 659
С
             STEP AFTER LOCUB =- 2. MODIFY THE DIFFERENCE TABLE ONCE
                                                                           DV DQ 660
C
             AGAIN AND REPEAT THE STEP.
                                                                           DVDQ 661
С
      IF LDOUB IS SET EQUAL TO -4 THE ORDER IN AT LEAST ONE COMPONENT
                                                                           DVDQ 662
      HAS BEEN GREATLY REDUCED AND THE STEP IS REPEATED.
C
                                                                           DVDQ 663
C
                                                                           DV DQ 664
C
                                                                           DVDQ 665
C
      BEGINNING OF LOOP FOR CORRECTING, ESTIMATING THE ERROR:
                                                                           DVDQ 666
C
      AND ADJUSTING THE NUMBER OF DIFFERENCES USED
                                                                           DVDQ 667
C
                                                                           DVDQ 668
      DO 790 I=1,NE
                                                                           DVDQ 669
        KDD=KD(I)
                                                                           DVDQ 670
        KQQ=KQ(I)
                                                                           DVDQ 671
C
        KQQ GIVES THE ORDER OF THE PREDICTOR FORMULA AND KQQ+1 THE
                                                                           DVDQ 672
C
        ORDER OF THE CORRECTOR FORMULA.
                                                                           DVDQ 673
C
                                                                           DVDQ 674
        KQ1=KQQ+1
                                                                           DVDQ 675
        D(1) = F(I)
                                                                           DVDQ 676
        FORM THE DIFFERENCE TABLE FROM PREDICTED DERIVATIVE VALUES.
C
                                                                           DVDQ 677
        DO 330 K=1.KQ1
                                                                           DVDQ 678
          D(K+1)=D(K)-DT(K,I)
                                                                           DVDQ 679
  330
        CONTINUE
                                                                           DVDQ 680
C
        D(K) GIVES THE (K-1)-ST DIFFERENCE FORMED FROM PREDICTED
                                                                           DVDQ 681
C
        DERIVATIVE VALUES
                                                                           DVDQ 682
        TPS3=ABS(D(KQQ+1))
                                                                           DVDQ 683
                                                                           DV DQ 684
        IF (LDOUB.LT.0) GO TO 720
C
                                                                           DVDQ 685
  340
        IF (KQQ.NE.1) GO TO 520
                                                                           DVDQ 686
C
                                                                           DVDQ 687
C
        KQ(I)=1 IS TREATED AS A SPECIAL CASE
                                                                           DVDQ 688
        E2H=PTS2
                                                                           DVDQ 689
        TPS5=0T(3,I)
                                                                           DVDQ 690
        IF (LSTC.LT.2) GO TO 370
                                                                           DVDQ 691
C
        FIRST STEP OF INTEGRATION
                                                                           DVDQ 692
        IF (LSTC.NE.4) GO TO 350
                                                                           DVDQ 693
        TPS4=0.
                                                                           DVDQ 694
        IF (KDD.GT.1) TPS3=AMAX1(TPS3,A3S(HH+D(1)))
                                                                           DVDQ 695
        TPS3=TPS3*P1
                                                                           DVDQ 696
        GO TO 510
                                                                           DVDQ 697
  350
        DT(2, I) = D(2)
                                                                           DVDQ 698
     D(2) = O(1) - DT(5, I)
                                                                           DVDQ 699
        TPS2 = -D(2)
                                                                           DVDQ 700
        TPS 3= PTS 5*ABS (TP S2)
                                                                           DV DQ 701
        FIRST STEP THAT KQ(I)=1
                                                                           DVDQ 782
  360
        DT(7,I)=PT(4)
                                                                           DVDQ 703
```

```
IF (LSTC-2) 420,380,380
                                                                            DVDQ 784
  370
        IF (TPS5.EQ.O.) GO TO 360
                                                                            DVDQ 705
        IF (OT(6.I).EQ.0.) GO TO 400
                                                                            DVDQ 706
        TPS2=DT(5,I)-DT(1,I)
                                                                            DVDQ 707
  380
        TPS4=DT(4,I)
                                                                            DVDQ 708
        TPS1=ABS(TPS4)
                                                                            DVDQ 709
        TPS4=TPS2*SIGN(PTS2,TPS4)-TPS5*TPS1
                                                                            DVDQ 710
        IF (TPS4.GT.(-TPS1)) GO TO 410
                                                                            DV DQ 711
  390
        TPS6=-PTS1
                                                                            DVDQ 712
        GO TO 450
                                                                            DVDQ 713
C
        FIRST STEP AFTER THE STEPSIZE HAS BEEN CHANGED
                                                                            DVDQ 714
  400
        DT(6,I)=PT(1)
                                                                            DVDQ 715
        TPS6=0.
                                                                            DVDQ 716
        GO TO 450
                                                                            DVDQ 717
        IF (TPS4.LT.TPS1) GO TO 440
  410
                                                                            DVDQ 718
        IF (TPS1.EQ.0.) GO TO 390
                                                                            DVDQ 719
        TPS6=PTS1
  420
                                                                            DV.DQ 720
        GO TO 450
                                                                            DVDQ 721
  430
        KQ(I)=2
                                                                            DVDQ 722
        IF (2-LSTC) 510,510,520
                                                                            DVDQ 723
  440
        TPS6=TPS4/TPS1
                                                                            DVDQ 724
  450
        TPS4=TPS5+TPS6
                                                                            DVDQ 725
        IF (TPS4.LT.P25) GO TO 430
                                                                            DVDQ 726
        INCREASE E2H IF (-S).GT..25
C
                                                                            DVDQ 727
        E 2H=PTS4*TPS4
                                                                            DVDQ 728
        IF (2-LSTC) 460,470,480
                                                                            DVDQ 729
  460
        LSC=0
                                                                            DVDQ 730
        GO TO 510
                                                                            DVDQ 731
        IF (TPS5-P25) 430,460,460
  470
                                                                            DVDQ 732
        IF (TPS4.GT.PTS2) GO TO 490
  480
                                                                            DVDQ 733
        IF (TPS4 \cdot GT \cdot P5) D(2)=D(2)*GAM(2.1)
                                                                            DVDQ 734
        GO TO 510
                                                                            DVDQ 735
  490
        IF (TPS4.LT.PTS4) GO TO 500
                                                                            DVDQ 736
        TPS4=PTS4
                                                                            DVDQ 737
        D(2) = D(2)/PT(3)
                                                                            DVDQ 738
C
        THE ESTIMATE OF E (AND HENCE OF E2H) IS INCREASED IF (-S).GE.8. DVDQ 739
        TPS3=TPS3*DT(7,I)
                                                                            DVDQ 740
        GO TO 510
                                                                            DVDQ 741
  500
        D(2)=D(2)*(PTS2*(TFS4-PTS1)/(TPS4*TPS4))
                                                                            DVDQ 742
        IF (TPS4.GE.3.) E2H=E2H+DT(7.I)
                                                                            DVDQ 743
C
        STORE D(1)=PREDICTED DERIVATIVE AND D(2)=2*(CORRECTED Y -
                                                                            DVDQ 744
C
        PREDICTED Y)/H
                           O(1) AND O(2) ARE USED TO COMPUTE (-S) ON
                                                                            DVDQ 745
C
        THE NEXT STEP.
                                                                            DVDQ 746
  510
        DT(5, I) = D(1)
                                                                            DVDQ 747
        DT(4.I) = D(2)
                                                                            DVDQ 748
        D(4) = TPS4
                                                                            DVDQ 749
C
      STORE D (4) = CURRENT ESTIMATE OF (-S). (-S).GT.3 IS AN INDICATION DVDQ 750
C
      THAT THE STEPSIZE SHOULD BE LIMITED BECAUSE OF STABILITY PROBLEMS. DVDQ 751
C
      S=H*(ESTIMATE OF EIGENVALUE OF F)=H*(DIFFERENCE BETWEEN PREDICTED DVDQ 752
C
      AND CORRECTED DERIVATIVE VALUES // DIFFERENCE BETWEEN PREDICTED
                                                                            DVDQ 753
C
      AND CORRECTED INTEGRALS OF THE DERIVATIVE VALUES)
                                                                            DVDQ 754
C
      THE TREATMENT OF THE CASE KQ(I)=1 COULD BE IMPROVED BY USING A
                                                                            DVDQ 755
      SPECIAL METHOD FOR STIFF EQUATIONS WHEN (-S).GT.3 (MAYBE).
C
                                                                            DVDQ 756
      (THE ENTIRE TREATMENT OF THE CASE KQ(I)=1 IS FAR FROM IDEAL.)
                                                                            DVDQ 757
        DT(3, I)=D(4)
                                                                            DVDQ 758
C
                                                                            DVDQ 759
C
        CORRECT
                                                                            DVDQ 760
  520
        KDC=0
                                                                            DVDQ 761
        TPD=D (KQ1)
                                                                            DVDQ 762
        J=J+KBD
                                                                            DVDQ 763
```

		K=J	DVDQ	764
	530	TPD=HH*TPD	DVDQ	
	<b>500</b>	KDC=KDC+1		
		Y(K)=Y(K)+GAM(KQQ+1,KDC)*TPD	DVDQ	
		· · · · · · · · · · · · · · · · · · ·	DADO	
		K=K-1	DADG	
_		IF (KOC.LT.KOD) GO TO 530	DVDQ	
C		END OF CORRECT	DADď	
C			DVDQ	771
		IF (EPS(I).NE. 0.) GO TO 560	DVDQ	772
•	550	IF (HMAX) 1190,780,1190	DVDQ	773
	56 <b>0</b>	TPS4=ABS(D(KQQ+2))	DVDQ	
		TPS2=ABS(D(KQQ))	DVDQ	
		TPS6=HH/EPS(I)	DVDQ	
С			DVDQ	
		E=ABS(GAS(KQQ+1)*TPS3*TPS6)	DVDQ	
С		E GIVES ABS((ESTIMATED ERROR)/EPS(I))	DVDQ	
Č		- orten woottentiinten Eurottiin		
·		LRND=1	DVDQ	
^		FKIAD-T	DVDQ	
C		LDND. 4 MEANS NO BOUND OFF FEBOR	DVDQ	
CCC		LRND= 1 MEANS NO ROUND-OFF ERROR	DVDQ	
Ų		= 0 MEANS SCME ROLND-OFF ERROR	DADG	
Ü		=-1 MEANS EXTREME ROUND+OFF ERROR	DVDQ	
C			DVDQ	786
		FRND=RNDC*ABS(PT(KQQ+2)*D(1))	DVDQ	787
С		CHECK TO SEE IF ROUND OFF ERROR IS DOMINANT	DVDQ	788
		IF ((TPS3+TPS4).GT.FRNO) GO TO 570	DVDQ	789
		LRND=0	DVDQ	790
		IF ((PTS4*TPS2).LT.FRNE) LRND=-1	DVDQ	
C			DVDQ	
	570	IF (E.LE.ERND) GO TO 550	DVDQ	
	•	IF (E.LE.EMAX) GO TO 580	DVDQ	
		EMAX=E	DVDQ	
		KEMAX=I	DVDQ	
	58 <b>6</b>	IF (LRND.LE.0) GO TO 550		
	200	ERND=E	DVDQ	
		IF (ERND.GT.ERRMX) LDOUB=0	DONG	
	59 <b>0</b>		DVDQ	
	שבכ	IF (LDOUB.LE.C) GO TO 780	DVDQ	
		TPS1=ABS(OD(KQQ))	DVDQ	
		TPS5=TPS1	DVDQ	
		IF (KQQ-2) 600,610,620	DVDQ	
	600	E2H=E*E2H	DVDQ	804
		IF (E2H.LT.P01) GO TO 780	DVDQ	805
		IF (D(4).LT.3.) GO TO 770	DODQ	806
		LSTC=-1	DV DQ	807
		LSC=-5	DVDQ	
		GO TO 776	DVDQ	
	610	TPS1=TPS2	DOVO	
		IF (LSTC. NE. 2) GC TO 620	DVDQ	
		KQ(I)=3	DVDQ	
		TPS2=0.	DVDQ	
	1	TPS4=0.	DVDQ	
		LRND=D		
	620	E2H=TPS2+TPS3+TPS4	DVDQ	
	020		DUDQ	
_		E2H=ABS(GAS(KQQ-1) *PT(KQQ+1) *E2H*TPS6)	DVDQ	
C		EZH IS USED AS AN ESTIMATE OF WHAT THE VALUE OF E WOULD BE	DVDQ	
С		IF H WERE DOUBLED. THE ESTIMATE IS CONSERVATIVELY LARGE.	DVDQ	
_		IF (E2H.GT.E2HMAX) E2HMAX=E2H	DVDQ	
С			DVDQ	
		IF (LRND) 630, 640, 660	DVDQ	
С		EXTREME ROUND-OFF ERRORREDUCE EZH	DV DQ	823

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630
        K = (KBIT2/KQQ) - 4
                                                                             DVDQ 824
        IF (K.LE.3) GO TO 640
                                                                             DVDQ 825
        IF (K.GT.KQMAX) K=KQMA)
                                                                             DVDQ 826
        E2H=E2H/PT(K+1)
                                                                             DVDQ 827
        GO TO 658
                                                                             DVDQ 828
  64 C
        E2H=AMIN1 (E2H+ E2H+ 3. + E2HFAC)
                                                                             DVDQ 829
  650
        E2H=E2H*P1
                                                                             DVDQ 830
        TPS6=PTS4
                                                                             DVDQ 831
        GO TO 670
                                                                             DVDQ 832
C
                                                                             DVDQ 833
  660
        E2H=E2H*E2HFAC
                                                                             DVDQ 834
        TPS6=KQQ+2
                                                                             DVDQ 835
C
        TEST TO SEE IF DIFFERENCES DECREASE MORE RAPIDLY THAN NECESSARY DVDQ 836
C
                                                                             DVDQ 837
  670
        IF (TPS5.LT.(TPS3*TPS6)) GO TO 680
                                                                             DVDQ 838
        IF (TPS2.LE.(TPS4*TPS6)) GO TO 760
                                                                             DVDQ 839
C
        THEY DO
                   INCREASE KQ(I)
                                                                             DVDQ 840
        IF (KQQ.NE.KQMAX) KQ(I)=KQ1
                                                                             DVDQ 841
        GO TO 760
                                                                             DVDQ 842
C
                                                                             DVDQ 843
C
        TEST TO SEE IF DIFFERENCES DECREASE TOO SLOWLY
                                                                             DVDQ 844
  680
        TPS6=TPS6*P25
                                                                             DVDQ 845
        IF ((TPS1.GT.(TPS3*TPS6)).OR.(TPS2.GT.(TPS4*TPS6))) GO TO 760
                                                                             DVDQ 846
C
        THEY DO
                                                                             DVDQ 847
        IF (LSTC.LE.0) GO TO 750
                                                                             DVDQ 848
        IF (E2H.LT.P01) GO TO 750
                                                                             DVDQ 849
        IF (LSC-LSTC) 690,750,770
                                                                             DVDQ 850
        IF (KSTEP-4) 750,700,710
                                                                             DVDQ 851
  700
        KQ1=LSTC
                                                                             DVDQ 852
  710
        LSC=KQ1
                                                                             DVDQ 853
C
        END OF ONE DERIVATIVE EVALUATION PER STEP
                                                                             DVDQ 854
        GO TO 770
                                                                             DVDQ 855
C
                                                                             DVDQ 856
        AFTER HALVING H. REDUCE KQ(I) IF A DISCONTINUITY HAS OCCURRED.
                                                                             DVDQ 857
  720
        IF (LDOUB.EQ. (-2)) GO TO 340
                                                                             DVDQ 858
        DT(KQQ+1,I)=D(KQQ+1)
                                                                             DVDQ 859
        IF (LDOUB.EQ.(-1)) DT(KQQ+1,I)=J(KQQ+2)
                                                                             DVDQ 860
        K=KQQ
                                                                             DVDQ 861
  730
        IF (K.EQ.1) GO TO 740
                                                                             DVDQ 862
        IF ((ABS(D(K-1)).GT.(PT(2)*ABS(D(K+1)))).OR.
                                                                             DVNQ 863
     1
           (ABS(D(K)).GT.(PT(2)*ABS(D(K+2)))) GO TO 740
                                                                             DWJQ 864
        K=K-1
                                                                             D/DQ 865
        GO TO 730
                                                                             DVDQ 866
  740
        IF ((K+K).GE.KQQ) GO TO 780
                                                                             DVDQ 867
        LD0UB=-4
                                                                             DVDQ 868
        E2H=0.
                                                                             DVDQ 869
        KQQ=K+1
                                                                             DVDQ 870
C
                                                                             DVDQ 871
C
                                                                             DVDQ 872
        DIFFERENCES DECREASE TOO SLOWLY REDUCE KQ(I).
                                                                             DVDQ 873
  750
        KQ(I) = KQQ-1
                                                                             DVDQ 874
        IF (KQQ.EQ.2) DT(3,I)=0.
                                                                             DVDQ 875
  760
        IF (E2H.LT.P01) GO TO 780
                                                                             DVDQ 876
  770
        LDOUB=2
                                                                             DVDQ 877
  780
        CONTINUE
                                                                             DVDQ 878
C
                                                                             DVDQ 879
C
                                                                             DVDQ 880
  790 CONTINUE
                                                                             DVDQ 881
C
                                                                             DVDQ 682
      END OF LOOP FOR CORRECTING, ESTIMATING THE ERROR, ETC.
C
                                                                             DVDQ 883
```

```
C
                                                                            DVDQ 884
C
                                                                            DVDQ 885
      IF (IFL.LT.0) GO TO 1250
                                                                            DVDQ 886
C
      TEST FOR HALVING H
                                                                            DVDQ 887
      IF (LDOUB) 800,950.870
                                                                            DVDQ 888
  800 LDOUB=LDOUB+1
                                                                            DVDQ 889
      IF (LDOUB+1) 8 10,870,820
                                                                            DVDQ 890
  819 IF (LDOUB.EQ.(-2)) GC TO 820
                                                                            DVDQ 891
      ORDER IN AT LEAST ONE COMPONENT HAS BEEN GREATLY REDUCED
                                                                            DVDQ 892
      LDOUB=0
                                                                            DV DQ 893
      GO TO 220
                                                                            DVDQ 894
  820 DO 860 I=1.NE
                                                                            DVDQ 895
        KQQ=KQ(I)
                                                                            DVDQ 896
        TP=DT (KQQ+1.I)
                                                                            DVDQ 897
        IF (KQQ.LE.3) GO TO 860
                                                                            DVDQ 898
        IF (LOOUB.NE.O) GO TO 840
                                                                            DVDQ 899
        DO 830 K=3, KQQ
                                                                            DVDQ 900
        SECOND MODIFICATION OF DIFFERENCE TABLE AFTER HALVING H
C
                                                                            DV DQ 901
          DT(K,I)=DT(K,I)+ETA(KQQ-1,K-2)*TP
                                                                            DVDQ 902
  830
        CONTINUE
                                                                            DVDQ 903
        GO TO 860
                                                                            DVDQ 984
  840
        DO 850 K=2, KQQ
                                                                            DVDQ 905
        FIRST MODIFICATION OF DIFFERENCE TABLE AFTER HALVING H
                                                                            DVDQ 906
          DT(K,I)=DT(K,I)+ETA(K-1,KQQ-1)+TP
                                                                            DVDQ 907
  850
        CONTINUE
                                                                            DVDQ 908
  860 CONTINUE
                                                                            DVDQ 989
      IFL=0
                                                                            DVDQ 910
      GO TO 240
                                                                            DVDQ 911
C
                                                                            DVDQ 912
  870 IFL=2
                                                                            DVDQ 913
      IF (LSTC.LE.O) GO TO 300
                                                                            DVDQ 914
      IF (2-LSTC) 880,900,940
                                                                            DVDQ 915
  880 LSTC=LSTC-1
                                                                            DVDQ 916
      IF (LSTC.EQ.3) GO TO 890
                                                                            DVDQ 917
      IF (LSC) 920,960,920
                                                                            DVDQ 918
  890 IFL=1
                                                                            DVDQ 919
      GO TO 300
                                                                            DVDQ 920
 900 IF (LSC-2) 910,930,920
                                                                            DVDQ 921
 910 LSTC=0
                                                                            OVDQ 922
 920 LDOUB=2
                                                                            DVDQ 923
      GO TO 80
                                                                            DVDQ 924
 930 LSTC=1
                                                                            CUDG 925
      LSC=0
                                                                            DVDQ 926
      GO TO 80
                                                                            DVDQ 927
  940 IF (LSC) 300.80.300
                                                                            DVDQ 928
C
                                                                            DVDQ 929
      HALVE H
                                                                            DVDQ 930
  950 HH=FAC(2)*HH
                                                                            DVDQ 931
      IF (LSTC.LT.2) GO TO 990
                                                                            DVDQ 932
      ERND=P25*ERND
                                                                            DVDQ 933
C
      IN LOOP TO FIND A NEW INITIAL STEPSIZE
                                                                            DVDQ 934
      IF (ERND.GE.P1) GO TO 950
                                                                            DVDQ 935
      LSTC=4
                                                                            DVDQ 936
  960 LSC=4
                                                                            DVDQ 937
      DO 970 I=1, NE
                                                                            DVDQ 938
        KQ(I)=1
                                                                            DVDQ 939
  970 CONTINUE
                                                                            DVDQ 946
      IF (LSTC-3) 890,890,1170
                                                                            DVDQ 941
C
                                                                            DVDQ 942
C
      ENTRY AFTER IFLAG=7
                                                                            DVDQ 943
```

```
980 IF (LDOUB.EQ.0) GO TO 990
                                                                              DVDQ 944
      LSC=1
                                                                              DVDQ 945
      LSTC=1
                                                                              DVDQ 946
      GC TO 140
                                                                              DVDQ 947
C
      TEST TO SEE IF H IS TOO SMALL FOR HALVING
                                                                              DVDQ 948
  990 IF (ABS(HH).GE.HMIN) GO TO 1040
                                                                              DVDQ 949
      IF (IFL.EQ.7) GO TO 1010
                                                                              DVDQ 950
 1000 IFL=7
                                                                              DVDQ 951
      GO TO 1020
                                                                              DVDQ 952
                                                                              DV DQ 953
 1010 HH=#H+#H
                                                                              DVDQ 954
      IFL=2
                                                                              DVDQ 955
 1020 H=HH
                                                                              DVDQ 956
      GO TO 310
                                                                              DVDQ 957
C
                                                                              DVDQ 958
C
                                                                              DVDQ 959
C
      ERROR CRITERIA PERMIT DOUBLING
                                                                              DVDQ 960
 1030 HH=HH+HH
                                                                              DVDQ 961
      IF (LSTC.EQ.1) GO TO 1050
                                                                              DVDQ 952
      LSC=-3
                                                                              DVDQ 963
 1040 LSTC=-1
                                                                              DVDQ 964
C
                                                                              DVDQ 965
      CHANGE THE STEPSIZE
                                                                              DVDQ 966
 1850 DO 1160 I=1.NE
                                                                              DVDQ 967
        KQQ=KQ(I)
                                                                              DVDQ 968
        IF (KQQ.NE.1) GO TO 1070
                                                                              DVDQ 969
        DT(6, I)=0.
                                                                              70Q 978
        D(3) = DT(3, I) + PT(2)
                                                                              DVDQ 971
        IF (0(3).GT.PT(3)) LSC=-6
                                                                              DVDQ 972
        IF (LDOUE.NE.O) GO TO 1060
                                                                              DVDQ 973
        KQM=8
                                                                             DVDQ 974
        IF (D(3).GE.PT(5)) DT(7,I)=DT(7,I)*PT(2)
                                                                              DV DQ 975
        D(3) = D(3)/PT(3)
                                                                              DVDQ 976
 1060
        DT(3.1) = D(3)
                                                                              DVDQ 977
        GO TO 1160
                                                                              DVDQ 978
C
                                                                              DVDQ 979
C
        BEGINNING OF LOOP FOR CHANGING DIFFERENCE TABLE TO
                                                                              DV DQ 980
        CORRESPOND TO NEW VALUE OF H
C
                                                                              DVDQ 981
        DO 1880 K=1,KQQ
 1070
                                                                              DVDQ 982
          D(K)=DT(K,I)/PT(K)
                                                                              DVDQ 983
          IF (LDOUB.EQ.0) D(K)=D(K)/PT(<)</pre>
                                                                              DVDQ 984
 1080
        CONTINUE
                                                                              DVDQ 985
        KQQ2=KQQ-2
                                                                              DVDQ 986
        IF (KQQ2) 1160,1140,1090
                                                                              DVDQ 987
 1690
        DO 1130 J=1,KQQ2
                                                                              DVDQ 988
          TF (LDOUB.NE.0) GO TO 1110
                                                                              DVDQ 989
C
                                                                              DVDQ 990
C
          HALVE
                                                                              DVDQ 991
           K=KQQ
                                                                              DVDQ 992
 1100
          D(K-1) = D(K-1) + D(K)
                                                                              DVDQ 993
          K=K-1
                                                                              DVDQ 994
          IF (K+J-KQQ) 1130,1130,1100
                                                                              DVDQ 995
C
                                                                              DVDQ 996
C
          DOUBLE
                                                                              DVDQ 997
 1110
          DO 1120 K= J, KQQ2
                                                                              DVDQ 998
             D(K+1)=D(K+1)-D(K+2)
                                                                              DVDQ 999
 1120
          CONTINUE
                                                                              DVDQ1000
 1130
        CONTINUE
                                                                              DVDQ 1001
C
                                                                              DVDQ1002
 1140
        DO 1150 K=2, KQQ
                                                                              DV DQ 1003
```

```
IF (LDOUB.NE.D) D(K)=D(K)*/*/(()
                                                                              DVDQ 1004
          DT(K_{\bullet}I)=D(K)*PT(K)
                                                                              DVDQ1005
 1150
        CONTINUE
                                                                              DVDQ1006
C
        DIFFERENCE TABLE NOW CORRESPONDS TO NEW VALUE OF H
                                                                              DVDQ1007
C
                                                                              DVDQ 1008
 1160 CONTINUE
                                                                              DVDQ1009
 1170 H=HH
                                                                              DVDQ1810
      IF (LDOUB.NE.O) GO TO 75
                                                                              DVDQ1011
      LED=1
                                                                              DVDQ1012
      IF (LSTC.GE.0) GO TO 220
                                                                              DVDQ1013
      LDOUB=-3
                                                                              DVDQ1014
      LSC=LSTC-KQM
                                                                              DVDQ1015
      GO TO 220
                                                                              DVDQ1016
C
      END OF CHANGING STEPSIZE
                                                                              DVDQ1017
C
                                                                              DVDQ1018
С
                                                                              DVDQ1019
 1180 K=IFL-5
                                                                              DV DQ 16 20
      GO TO (220,980,1200,1570,1570,1720,1720,80,1480,1450,1630,1570), KDVDQ1021
C
                                                                              DV DQ1022
C
      ILLEGAL VALUE OF PARAMETER
                                     INTEGRATION CAN NOT PROCEED
                                                                              DV DQ 10 23
 1190 IFL=8
                                                                              DVDQ1024
      GO TO 310
                                                                              DVDQ1025
                                                                              DV DQ 10 26
 1200 WRITE (6,4000)
 4000 FORMAT (26HOIFLAG=8 IN CALL TO DV)Q1.)
                                                                              DVDQ1027
      STOP
                                                                              DVDQ1028
C
                                                                              DVDQ1029
                                                                              DVDQ1030
 1210 IF (T-TFINAL) 200,1190,200
                                                                              DVDQ1831
                                                                              DVDQ1032
C
                                                                              DV DQ 10 33
 1220 IFL=4
                                                                              DVDQ1034
      IF (KSTEP.NE.0) GO TO 1270
                                                                              DVDQ1035
      TPD2=TPD
                                                                              DV DQ 1036
      ESTIMATE ERROR WHEN EXTRAPOLATION FROM INITIAL POINT IS REQUESTED DVDQ1037
C
 1230 HH=HH*TPD1*P75
                                                                              DVDQ1038
C
                                                                              DVDQ1039
      IFLS=IFL
                                                                              DV DQ 10 40
      IFL=-1
                                                                              DVDQ1841
      GO TO 230
                                                                              DVDQ1042
C
                                                                              DVDQ1043
 1240 IF ((LGSD.EQ.0).OR.(IFLS.NE.4)) GO TO 60
                                                                             DVDQ1044
      LGSE=-1
                                                                             DVDQ1045
      TPD=FAC(1)
                                                                             DVDQ1046
      GO TO 1820
                                                                             DVDQ1847
 1250 HH=H
                                                                             DVDQ1048
      IF (EMAX.LT.P01) GO TO 1260
                                                                              DVDQ1049
C
      ERROR IS TOO LARGE, REDUCE H AND REPEAT THE FIRST STEP
                                                                              DVDQ1050
      IF (TPD1.LT.0.) GO TO 1198
                                                                              OV DQ 10 51
      LDOUB=1
                                                                              DVDQ10 52
      ERND=FAC(1)/TPD1
                                                                              DVDQ1053
      ERND=ERND*ERND*P25
                                                                              DV DQ 10 54
      GO TC 950
                                                                              DVDQ1055
                                                                              DV DQ 10 56
 1260 IFL=IFLS
                                                                              DVDQ1057
      IF (IFL.NE.4) GO TO 1790
                                                                              DVDQ 1058
      TPD=TPD2
                                                                              DVDQ1059
      IFLAG=3
                                                                              DV DQ 1060
 1270 IF (TPD1.GT.TPD) GC TO 1280
                                                                              DVDQ10 61
      TETFINAL
                                                                              DVDQ1062
      TPO=TPD1
                                                                              DVDQ1063
```

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GO TO 1290
                                                                              DVDQ10 64
 1280 T=TOUT
                                                                              DVDQ1065
      IFL=3
                                                                              DVDQ1066
 1290 IF ((TPD.EQ.0.).ANC.(IFLAG.LE.2)) GO TO 310
                                                                              DVDQ10 E7
C
                                                                              DVDQ1068
C
      INTERPOLATE FOR CUTPUT
                                                                              DVDQ1069
 1300 TP=TPD
                                                                              DVDQ1070
      D(2)=TP
                                                                              DV DQ 1071
      KQQ 2= 0
                                                                              DVDQ1072
      KDC=0
                                                                             DVDQ1073
      D(1) = PT(1)
                                                                              DV0Q1074
      DD(1)=PT(1)
                                                                             DVDQ1075
      DO 1310 K= 2, KQM
                                                                             DVDQ1076
        DD(1) = DD(1) + PT(1)
                                                                             DVDQ1077
        TP=TP+PT(1)
                                                                             DVDQ1078
        D(K+1)=(D(K)*TP)/DD(1)
                                                                              DVDQ1079
 1310 CONTINUE
                                                                             DVDQ1080
      GO TO 1350
                                                                              DVDQ1081
C
                                                                              DVDQ1082
C
      COMPUTE THE INTERPOLATING INTEGRATION COEFFICIENTS
                                                                              DVDQ1083
 1320 KQQ2=1
                                                                             DVDQ1084
      L=KQM-KDC
                                                                             DVDQ1085
      KDC=KDC+1
                                                                              DVDQ1086
 1330 IF (L.LE.O) GO TO 1350
                                                                             DVDQ1087
      TP=C.
                                                                             DVDQ1088
      K≃L
                                                                             DVDQ1089
      J=L+KDC
                                                                             DVDQ1090
 1340 JS=J-K
                                                                             DV0Q1091
      TP=TP+GAS(K)*D(JS+1)
                                                                              DV001092
      K=K-1
                                                                              DVDQ1093
      IF (K.GT.0) GO TO 1340
                                                                             DVDQ1094
      D(J) = TP
                                                                             DVDQ1095
C
                                                                              DVDQ1096
C
      D(J) IS THE INTEGRATION COEFFICIENT FOR THE INTERPOLATION WHICH
                                                                             DVDQ1097
C
      CORRESPONDS TO GAM(J-KDC, KDC).
                                                                              DVDQ1098
C
                                                                             DVDQ1099
      L=L -1
                                                                              DVDQ 1100
      GO 70 1330
                                                                             DVDQ1101
C
      END OF COMPUTING INTEGRATION COEFFICIENTS
                                                                             DVDQ 1102
C
                                                                             DVDQ1103
C
      PERFORM THE PARTIAL STEP INTEGRATION
                                                                             DVDQ 1104
 1350 J=0
                                                                             DVDQ1105
      DO 1415 I=1.NE
                                                                             DVDQ1196
      KDD=KD(I)
                                                                             DVDQ1107
      IF (KDC.GT.KDD) GO TO 1410
                                                                             DVDQ1108
      TP=0.
                                                                             DVDQ 1109
      KQQ=KQ(I)+KQQ2
                                                                              DVDQ1110
 1360 L=KQQ-KDC
                                                                             DVDQ1111
      IF (L.LE.0) GO TO 1370
                                                                              DVDQ1112
      TP=TP+D(KQQ)*DT(L,I)
                                                                             DVDQ1113
      KQQ=KQQ-1
                                                                              DVDQ1114
      IF (KQQ) 1390,1390,1360
                                                                              DVDQ1115
 1370 K=J+KDD
                                                                              DVDQ1116
      L=KDC
                                                                              DVDQ1117
 1380 L=L-1
                                                                             DVDQ1118
      IF (L.EQ.0) GO TO 1400
                                                                              DV DQ 1119
      TP=TP*HH+YN(K)*FAC(L)*TPD
                                                                              DVDQ1120
      K=K-1
                                                                              DVDQ1121
      GO TO 1380
                                                                              DVDQ1122
 1390 F(I)=TP
                                                                              DVDQ1123
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	GO TO 1415	DV0Q1124
1400	Y(K)=YN(K)+HH*TP	DVDQ1125
1 410	J=J+KOD	DVDQ1126
1415	CONTINUE	DVDQ1127
	IF (KDC.NE.KDMAK) GO TO 1320	DVDQ1128
C	END OF PARTIAL STEP INTEGRATION	DVDQ1129
•	IF (LGSE) 1800,310,1810	DVDQ1130
С	, and an experience of the control o	DVDQ1131
Č	INITIALIZE FOR GSTOPS	DVDQ1132
	NGA=IABS(NG)	DVDQ1133
* 46A	LGSS=-NGA	DVDQ1134
	LGSD=0	DV0Q1135
	LGSE=0	DVDQ1136
	IFLG=-20	DVDQ1137
	IF (NG) 1425,315,315	
4 4 2 5	IFLG=-IFL	OVBQ1138
1469	IFLG=-IFL	DVDQ1139
4 1.70	LGSD=NGE	DVDQ1140
1430	IF (LGSD) 1190,1450,1440	DVDQ1141
a 1, 1, 0	IFL=15	DVDQ1142
T 440	GO TO 1470	DVDQ1143
•		DVDQ1144
8	ENTRY WITH IFL=15	DVDQ1145
1450	LGSS=0	OVDQ1146
4 4 6 9	IF (LGSD-NGA) 1460,1480,1190	DVDQ1147
1460	LGSS=LGSD+1	DV DQ1148
4 4 7 6	IFL=14	DVDQ1149
1 470	IFLAG=IFL-5	DVDQ1150
_	GO TO 315	DVDQ1151
C	ENTRY WITH IFL=14	DV DQ 11 52
1480		DVDQ1153
	GT(I)=G(I)	DVDQ1154
1 490	CONTINUE	DVDQ1155
_	GO TO 1730	DVDQ1156
C	END OF INITIALIZATION FOR GSTOPS	DVDQ1157
C		DVDQ1158
C	ENTRY TO EVALUATE G AT THE END OF THE STEP	DVDQ1159
	LGSE=1	DVDQ1160
1 510	IGK=LGSS	DVDQ1161
	IFLG=0	DVDQ1162
	IFL=9	DVDQ1163
	GO TO 310	DVDQ11 E4
С	ENTRY TO EVALUATE G BEFORE EVALUATING THE DERIVATIVES	DVDQ1165
1 520	IFLG=IFL	DVDQ1166
	IFL=10	DV DQ1167
1 530	IFLAG=10	DVDQ11 68
	IGKM=LGSD	DVDQ1169
1540	IGK=1	DVDQ1170
1 550	GO TO 315	DVDQ1171
1560	IGK=IGK+1	DVDQ1172
	IF (IGK.GT.IGKM) GO TO 1650	DVDQ1173
C	ENTRY WITH IFL=9,10, AND 17	DVDQ1174
C	TEST FOR G CHANGING SIGN	DVDQ1175
1570	IF (G(IGK)*GT(IGK)) 1600,1580,159)	DVDQ1176
1580	IF (GT(IGK).NE.D.) GO TO 1600	DVDQ1177
	IF (TL.EQ.TG) GO TO 1560	DVDQ1178
1590	IF (LGSE.GT.O) GT(IGK)=G(IGK)	DVDQ1179
	GO TO 1560	DVDQ1180
C	G CHANGES SIGN PREPARE FOR ITERATION TO FIND ZERO	DVDQ1181
1600	NSTOP=IGK	DVDQ1182
	IFLGS=IFL	DVDQ1163

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C
      COMPUTE INITIAL VALUE FOR RG (=RATIO OF FARTIAL STEPSIZE WHERE
                                                                             DV DQ1184
C
      G IS KNOWN/THE INTEGRATION STEPSIZE)
                                                                             DVDQ1185
      IF (IFLG.EQ.0) GO TO 1610
                                                                             DVDQ1186
      RG(3) = FAC(1)
                                                                             DVDQ1187
      RG(2) = 0
                                                                             DVDQ1188
      IF ((IFLG.EQ.2).AND.(IGK.LT.LGSS)) RG(2)=FAC(1)
                                                                             DVDQ1189
      GO TO 1620
                                                                             DVDQ1190
 1610 RG(3) = 0
                                                                             DVDQ1191
      RG(2) = -FAC(1)
                                                                             DVDQ1192
 1620 IF (LGSE-LT-0) RG(3)=TPD
                                                                             DVDQ1193
      LGSE=-3
                                                                             DV DQ1194
      GI(2) = GT(IGK)
                                                                             DVDQ1195
      EPSGS=RND
                                                                             DVDQ1196
      IFL=16
                                                                             DVDQ1197
      K=1
                                                                             DVDQ1198
      GO TO 1640
                                                                             DVDQ1199
C
      END OF PREPARATION TO BEGIN THE ITERATION
                                                                             DV DQ 1200
C
                                                                             DVDQ1201
C
      ENTRY WITH IFL=16
                                                                             DVDQ1202
C
      ITERATE TO FIND GSTOP
                                                                             DVDQ1203
 1630 K=1
                                                                             DV DQ 1204
      IF ((GI(2)+G(IGK)).GT.0_2) K=2
                                                                             DVDQ1205
      IF (ABS(GI(K)).GT.ABS(G(IGK))) GO TO 1640
                                                                             DV DQ 1206
C
      CONVERGENCE PROBLEMS
                                                                             DVDQ1207
      LGSE=LGSE-1
                                                                             DVDQ1208
      IF (LGSE.EQ.(-5)) EPSGS=PTS1
                                                                             DVDQ1209
      EPSGS=EPSGS*PTS4
                                                                             DVDQ1210
 1640 \text{ GI(K)} = \text{G(ISK)}
                                                                             DVDQ1211
      RG(K) = RG(3)
                                                                             DVDQ1212
C
      SECANT ITERATION (GIVES NEW PARTIAL STEPSIZE/H)
                                                                             DVDQ1213
      TPO=RG(1)-(GI(1)*(RG(2)-RG(1)))/(GI(2)-GI(1))
                                                                             DVDQ1214
      T=TL+TPD*HH
                                                                             DVDQ1215
C
      TEST FOR CONVERGENCE OF ITERATION
                                                                             DVDQ1216
      IF (ABS(TPD-RG(3)).LE.EPSGS) GO TO 1560
                                                                             DVDQ1217
      RG(3) = TPD
                                                                             DVDQ1218
      GO TO 1300
                                                                             DVDQ1219
 1650 IF (10-IFL) 1660,1700,100
                                                                             DVDQ1220
 1660 IF (IGKN.NE.NGA) GO TO 1710
                                                                             DVDQ1221
      IF (LGSE.GT.(-3)) GO TO 1690
                                                                             DVDQ1222
      IF (LSTC.NE.4) GO TO 1670
                                                                             DVDQ1223
C
      ESTIMATE ERROR -- GSTOP IS THE RESULT OF EXTRAPOLATING FROM
                                                                             DVDQ1224
C
      THE INITIAL POINT
                                                                             DVDQ1225
      TPD1=TPD
                                                                             DVDQ1226
      RG(3) = TPD
                                                                             DVDQ1227
      GO TO 1230
                                                                             DVDQ1228
 1670 IFL=11
                                                                             DVDQ1229
      IF (LGSE.LT.(-4)) IFL=12
                                                                             DVDQ1238
 1680 IFLAG=IFL
                                                                             DVDQ1231
      TEST TO SEE IF GSTOP IS PRECEDED BY ANOTHER STOP
C
                                                                             DVDQ1232
      IF ((HH*(T-TOUT) .LE.8.) .AND .(HH*(T-TFINAL) .L.É.8.)) GO TO 1300
                                                                             DVDQ1233
      IT IS
C
                                                                             DVDQ1234
      RG(3) = TPD
                                                                             DVDQ1235
      IFLS=IFL
                                                                             DVDQ1236
      GO TO 200
                                                                             DVDQ1237
 1690 LGSE=1
                                                                             DVDQ1238
      IFL=IFLG
                                                                             DVDQ1239
      IF (IFL.LT.0) GO TO 60
                                                                             DVDQ1240
 1700 IGKM=NGA
                                                                             DVDQ1241
      IFL=IFLG
                                                                             DVDQ1242
      GO TO 310
                                                                             DVDQ1243
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1710	IFL=17	DVDQ1244
	IFLAG=9	DVDQ1245
	IGKM=NGA	DVDQ1246
	GO TO 315	DVDQ1247
С	ENTRY WITH IFL=11 AND 12	DVDQ1248
С	SET PARAMETERS TO INCICATE A GSTOP HAS BEEN FOUND	DV DQ1249
1720	GT(NSTOP)=0.	DVDQ1250
1730	LGSE=1	DVDQ1251
	IGKM=NGA	DVDQ1252
	TG=TL	DVDQ1253
	IF (IFLG) 1740,1760,1770 .	DVDQ1254
1749	IF (IFL.LT.13) GO TO 1750	DVDQ1255
	IF (IFLG.EQ.(-20)) GO TO 100	DVDQ1256
	IFL=-IFLG	DVDQ1257
	GO TO 310	DVDQ1258
1750		DVDQ1259
	GO 70 200	DV DQ1260
1760	TPD=I).	DVDQ1261
	T=TL	DVDQ1262
	LGSE#-2	DVDQ1263
	GO TÚ 1300	DVDQ1264
	IF (IFLG-3) 220,200,200	<b>DV</b> DQ1265
1 780	IF (LGSE.EQ.(-1)) 60 TO 1790	DVDQ1266
	LGSE=-1	DVDQ1267
	GO TO 1220	DVDQ1268
1790	TPD=RG(3)	DVDQ1269
	T=TL+TPD*HH	DVDQ1270
	IF (LGSE.NE.(-1)) GO TO 1670	DVDQ1271
	IFL=IFLS	DVDQ1272
	LGSE=-3	DVDQ1273
4000	GO TO 1680	DVDQ1274
	IF (LGSE+2) 1550,1500,310	DVDQ1275
1010	IF (TPD.LE.0.) GO TO 310 . LGSE=-2	DVDQ1276
4 0 2 1	IFLG=IFL	DV DQ1277
	IFL=17	DVDQ1278
•	IFLAG=9	DVDQ1279
	IF (LGSD .GT. 0) GO TO 1530	DVDQ1280 DVDQ1281
	GO TO 1.540	
	END	DVDQ1282
	ENO	DVDQ1283

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