NASA-CR-3267 19800015748

# NASA Contractor Report 3267

Application of Advanced Computational Procedures for Modeling Solar-Wind Interactions With Venus -Theory and Computer Code

Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter

**CONTRACT NASW-3182** 

**MAY 1980** 

NV2



Application of Advanced Computational Procedures for Modeling Solar-Wind Interactions With Venus -Theory and Computer Code

Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter Nielsen Engineering & Research, Inc. Mountain View, California

Prepared for NASA Headquarters under Contract NASW-3182



Scientific and Technical Information Office

TABLE OF CONTENTS

Section	Page No.
LIST OF ILLUSTRATIONS	iv
SUMMARY	1
INTRODUCTION	2
LIST OF SYMBOLS	4
ANALYSIS	8
The Mathematical Model - Formulation of the Fluid Representation	8
Governing_equations	8
Conditions at discontinuities	10
Frozen-field approximation	12
Determination of the Ionosphere Boundary	14
Calculation of the Gasdynamic Flow Properties	20
Nose region solution - implicit unsteady Euler equation method	21
Downstream region solution - shock capturing marching method	25
Calculation of the streamlines	27
Calculation of the Magnetic Field	27
Calculation of the Contour Lines	30
Solar-Ecliptic/Solar-Wind Coordinate Transformations	31
Properties Along a Spacecraft Trajectory	33
RESULTS	36
CONCLUDING REMARKS	47
ACKNOWLEDGEMENTS	48
APPENDIX A - COMPUTER PROGRAM USER'S MANUAL	49
APPENDIX B - LISTING OF COMPUTER PROGRAM	131
APPENDIX C - CATALOG OF TEST CASES	177
REFERENCES	287
TABLE 1	289
FIGURES 1 THROUGH 20	291

.

## LIST OF ILLUSTRATIONS

Figu	ire	Page No.
1.	Illustration of ionopause shapes for atmospheres with various (i) constant scale heights $H/R_O$ and (ii) gravi-tational variation included in the scale height $\overline{H}/R_O$ .	291
2.	Comparison of former and present computational procedures for determining the gasdynamic flow properties of solar wind-magneto/ionopause interactions	292
3.	Transformation from physical domain to rectangular computa- tional domain	293
4.	Illustration of capability for providing an additional flow-field segment to the obstacle nose solution in the computational procedure for determining the gasdynamic flow properties of solar wind-ionopause interactions	294
5.	Illustration of quantities used for streamline calculation	295
6.	Illustration of quantities used for magnetic field-line calculation in the plane of magnetic symmetry	295
7.	Illustration of the components of the three-dimensional magnetic field	296
8.	Illustration of the sun-planet $(x_s, y_s, z_s)$ and solar wind $(x, y, z)$ coordinate systems and the azimuthal $(\Omega)$ and polar $(\phi_p)$ solar-wind angles, both shown in a positive sense	297
9.	Illustration of solar-wind $(x,y,z)$ and $(X,Y,Z)$ coordinate systems and the interplanetary magnetic field and magnetic-field angles $(\alpha_p, \alpha_n)$	298
10.	Bow shock locations for $M_{\infty}$ = 8.0, $\gamma$ = 5/3 flow past constant scale-height ionopause shapes with H/R <sub>0</sub> = 0.5 and 1.0	299
11.	Bow shock shapes for flow past an ionopause shape with gravitational variation included in scale height with $H/R_O$ = 0.25, $\gamma$ = 5/3 and $M_{\infty}$ = 2.0 and 3.0	300
12.	Overall features of Pioneer-Venus Orbiter trajectory crossings of solar-wind/Venus-ionosphere interaction region	301
13.	Illustration of typical flow-field grid density for gas- dynamic solution; $M_{\infty} = 3.0$ , $\gamma = 5/3$	302
14.	P-V Orbit 6 trajectories and observational bow shock crossings as viewed in solar-wind coordinates based on inbound and outbound interplanetary solar-wind directions; also, various bow shock shapes for different interplanetary solar-wind conditions	303

## LIST OF ILLUSTRATIONS (Concluded)

## Figure

.

15.	Comparison of observed (OPA) and theoretical time histories of ionosheath plasma properties for P-V Orbit 6 based on inbound and outbound interplanetary solar-wind conditions using a gasdynamic solution for $M_{\infty} = 13.3$ , $\gamma = 2.0$	304
16.	Comparison of observed (OMAG) and theoretical time histories for the magnitude of the magnetic field for P-V Orbit 6 based on inbound and outbound interplanetary con- ditions using gasdynamic solution for $M_{\infty} = 13.3$ , $\gamma = 2$	305
17.	P-V Orbit 3 trajectories and observational bow shock cross- ings as viewed in solar-wind coordinates based on inbound and outbound interplanetary solar-wind directions; also, various bow shock shapes for different interplanetary solar wind conditions	307
18.	Comparison of observed and theoretical time histories of ionosheath plasma properties for P-V Orbit 3 based on inbound and outbound interplanetary solar-wind conditions	308
19.	Comparison of observed (OMAG) and theoretical time histories for the magnetic field for P-V Orbit 3 based on inbound and outbound interplanetary solar-wind conditions using gasdynamic solutions $M_{\infty} = 7.38$ , $\gamma = 2.0$ for inbound and $M_{\infty} = 5.96$ , $\gamma = 2.0$ for outbound calculations	309
20.	Comparison of observed (OMAG) and theoretical time histories of the magnetic field for P-V Orbit 3 based on inbound solar wind interplanetary conditions using a gas-dynamic solution for $M_{\infty} = 3.0$ , $\gamma = 5/3$	311

## APPLICATION OF ADVANCED COMPUTATIONAL PROCEDURES FOR MODELING SOLAR-WIND INTERACTIONS WITH VENUS - THEORY AND COMPUTER CODE

by

Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter

### SUMMARY

Advanced computational procedures are developed and applied to the prediction of solar-wind interaction with nonmagnetic terrestrial-planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single-fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvénic solar-wind flow past terrestrial planets. The procedures, which consist of finite-difference codes to determine the gasdynamic properties and a variety of special-purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program which has been extensively documented and is presented in a general user's manual included as part of this report.

Theoretical results based upon these procedures are reported for a wide variety of solar-wind conditions and ionopause obstacle shapes. Plasma and magnetic-field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer-Venus Orbiter. These results have verified the appropriateness of the basic theoretical model, and have indicated the importance of accounting for the variable oncoming direction of the interplanetary solar wind.

### INTRODUCTION

The magnetohydrodynamic models (refs. 1-9) of solar-wind interaction with planetary magneto/ionospheres and their associated calculations of the detailed flow and magnetic-field properties provide the basis of the theoretical understanding and interpretation of phenomena occurring in space around terrestrial planets from the viewpoint of a fluid rather than particle description of the flow. The general value and usefulness of results based on these models are now well established, and have advanced to the point where theoretical calculations can be used to predict important planetary and magnetic-field characteristics.

Prior to the previous work reported in reference 9, the utility of calculations based on these models was severely restricted due both to the fact that the original solution techniques employed bordered on what was barely possible at the time, as well as that considerable hand computation and intervention was required. Moreover, reported results were carried out for only a limited set of solar-wind conditions such as obstacle shape, oncoming Mach number, interplanetary magnetic field, etc., and were presented in archival publications only in the form of plots from which results for other conditions had to be determined by interpolation. The importance of the preliminary work of reference 9 was that advanced computational methods, based on current state-of-the-art algorithms, were introduced to this problem to provide the basic gasdynamic solutions. The frozen-in magnetic-field was then solved for on the high-resolution flow-field grid, and the entire computational procedure was assembled into a user-oriented program providing the detailed flow-field and magnetic-field properties in a convenient output format.

In the current work reported here, those basic procedures have been extended and generalized in several important directions. These include the capability for treating very low oncoming interplanetary gasdynamic Mach numbers ( $M_{\infty} \approx 2.0$ ), as well as quite general ionopause shapes. A new family of ionopause shapes has been developed which accounts for the effect of gravitational variation in scale height. Additionally, the capability for determining the plasma gasdynamic and magnetic-field properties along an arbitrary spacecraft trajectory, simultaneously accounting

for an arbitrary oncoming direction of the solar wind, has been developed. Moreover, a large number of sample calculations have been performed for typical solar-wind conditions and, using the output contour-plot capability, a catalog of these cases were established and are archived here for convenient quick-look use. Finally, a number of successful comparisons were made by the present computational model with actual spacecraft observations obtained from initial orbits of the Pioneer-Venus Orbiter. These comparisons have both provided a verification of the basic theoretical model as well as demonstrated its value as a convenient research tool capable of routinely providing details of the solar-wind/ planetary atmosphere interaction process not previously attainable--at modest computational cost and in a format directly compatible with observational data.

## LIST OF SYMBOLS

	1/2
a	speed of sound, $(\gamma p/\rho)^{1/2}$
А	Alfvén speed, $(B^2/4\pi\rho)^{1/2}$
Ā	Jacobian matrix associated with IMP code, equal to $\Im \hat{E} / \Im \hat{U}$
B	magnetic field vector
B	Jacobian matrix associated with IMP code, equal to $\partial \hat{F} / \partial \hat{U}$
C <sub>p</sub>	specific heat at constant pressure
C <sub>v</sub>	specific heat at constant volume
D	distance defined by eq. (59)
е	internal energy, eq. (3)
et	total energy, eq. (44)
Е	column matrix defined by eq. (42)
Ê	column matrix associated with IMP code, equal to $(\xi_T^U + \xi_X^E + \xi_R^F)/J$
F	column matrix defined by eq. (42)
Ê	column matrix associated with IMP code, equal to $(n_T^U + n_X^E + n_R^F)/J$
a	acceleration due to gravity
gk	gravitational component, eq. (5)
G	column matrix defined by eq. (42)
h	enthalpy, eq. (47)
h <sub>t</sub>	total enthalpy, eq. (47)
Н	local scale height of atmosphere, $\overline{R}T/\overline{M}g$
Ħ	local scale height with gravitational variation, $H(R_R/R_s)^2$
J	Jacobian matrix, eq. (43)
К	constant defined by eq. (34)
۵Ł	vector length of elemental magnetic flux tube
М	local Mach number, $ y /a$
M	nondimensional mean molecular mass, equal to 1/2 for ionized atomic hydrogen

.

## LIST OF SYMBOLS (Continued)

MA	local Alfven Mach number, $ v /A$
р	pressure
q	shock velocity
Q	dummy parameter
r	spherical radial distance
R	cylindrical radial distance
R	gas constant, 8.315 × 10 <sup>7</sup> ergs/gm°K
R <sub>i</sub>	spherical radius of ionopause, eq. (39)
R <sub>O</sub>	spherical distance from center of planet to ionopause nose
<sup>S</sup> k	Poynting vector component
ΔS	incremental distance along streamline
t,T	time
(u,v,w)	velocity components associated with the $(X,Y,Z)$ coordinate directions, respectively
U	column matrix defined by eq. (42)
Û	column matrix associated with IMP code, equal to U/J $$
¥	velocity vector
(x,y,z) or $(x_w,y_w,z_w)$	solar-wind oriented Cartesian coordinates with origin at planetary center, x positive upstream and z positive northward
$(x_s, y_s, z_s)$	sun-planet oriented Cartesian coordinates with origin at planetary center, $x_s$ positive toward sun, $y_s$ positive opposite to planetary orbital motion, and $z_s$ positive northward
(x',y',z')	solar-wind oriented Cartesian coordinates defined by an azimuthal rotation given by eq. (70)
(X,Y,Z)	solar-wind oriented Cartesian coordinates with origin at planetary center, X positive downstream and Z positive northward
αp	interplanetary magnetic-field angle between perpendicular and parallel components, eq. (62)
α <sub>n</sub>	interplanetary magnetic-field angle between normal and in- plane components, eq. (63)

## LIST OF SYMBOLS (Continued)

β	spherical polar angle, measured with origin at planet center, from subsolar point away from undisturbed solar wind direction; varies from 0 in upstream direction to $\pi$ in downstream direction; eq. (39)
γ	ratio of plasma specific heats
δ	angle defined by eq. (59)
<sup>δ</sup> ik	Kronecker delta
δ <sub>s</sub>	local angle of bow shock wave
(δ <sub>ξ</sub> ,δ <sub>η</sub> )	second-order difference operators in ( , ) direction
ε	smoothing coefficient in IMP code
η	transformation variable, eqs. (40), (48)
θ	azimuthal rotation angle in solar-wind (X,Y,Z) system, eq. (69); also shock tangency angle, eq. (59)
Λ	quantity defined by eq. (36)
ξ	transformation variable, eqs. (40), (48)
ρ	density
σ	conductivity
τ	transformed time, eq. (40)
Φ	gravitational potential, eq. (5)
<sup>¢</sup> p	solar-wind polar angle
ψ	angle between outward normal to magneto/ionosphere boundary and oncoming undisturbed solar wind, eq. (32); also, angle of magnetic component $(\underline{B}/B_{\infty})_{\perp}$ , eq. (58)
Subscripts	
b	obstacle body
i	ionopause
n	normal direction
Р	arbitrary point
R	reference quantity
S	planetary surface; also streamline
S	shock surface
6	

# LIST OF SYMBOLS (Concluded)

s <sub>t</sub>	stagnation conditions
t	tangential direction
0	reference quantity at subsolar point
1	conditions upstream of a discontinuity
2	conditions downstream of a discontinuity
ω	interplanetary undisturbed quantity
(", <b>1</b> ,n)	parallel, perpendicular, and normal magnetic-field components as defined in eq. (56)
Superscripts	

^	unit vector
*	relative to shock

## ANALYSIS

# The Mathematical Model - Formulation of the Fluid Representation

The fundamental assumption underlying the present work and that reported in all of the references cited above is that the average bulk properties of solar-wind flow around a planetary magneto/ionosphere can be adequately described by the continuum equations of magnetohydrodynamics for a single-component perfect gas having infinite electrical conductivity and zero viscosity and thermal conductivity. Theoretical justification of this point has not yet been established, and proof remains essentially qualitative at present. The primary justification for use of the continuum fluid model is the outstanding agreement of the qualitative results predicted on this basis with those actually measured in space. It appears that the continuum model is capable of accounting both for many of the details as well as the broad features of the observations.

<u>Governing equations</u>.- The equations which express the conservation of the average bulk mass, momentum, energy, and magnetic field of the solar-wind plasma are given by the following expressions:

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x_k} (\rho v_k) = 0$$
 (1)

$$\frac{\partial}{\partial t} (\rho \mathbf{v}_{i}) + \frac{\partial}{\partial \mathbf{x}_{k}} \left( \rho \mathbf{v}_{i} \mathbf{v}_{k} + p \delta_{ik} - \frac{B_{i} B_{k}}{4\pi} + \frac{B^{2}}{8\pi} \delta_{ik} + \frac{g_{i} g_{k}}{4\pi G} - \frac{g^{2}}{8\pi G} \delta_{ik} \right) = 0$$
(2)

$$\frac{\partial}{\partial t} \left[ \frac{\rho v^2}{2} + \rho e + \rho \phi + \frac{B^2}{8\pi} \right] + \frac{\partial}{\partial x_k} \left[ \rho v_k \left[ \frac{v^2}{2} + e + \frac{p}{\rho} + \phi \right] + s_k \right] = 0$$
(3)

$$\frac{\partial B_{i}}{\partial t} = \frac{\partial}{\partial x_{k}} (v_{i}B_{k} - v_{k}B_{i}) , \frac{\partial B_{i}}{\partial x_{i}} = 0$$
 (4)

where

$$g_{i} = -\frac{\partial \Phi}{\partial x_{i}}$$
,  $S_{k} = \frac{1}{4\pi} \left( v_{k} B^{2} - B_{k} v_{i} B_{i} \right)$  (5)

and the equation of state of a perfect gas is given by

$$p = \frac{\rho \overline{R} T}{\overline{M}}$$
(6)

In these equations and those to follow, the symbols  $\rho$ , p, v, T, e =  $C_vT$ , and h =  $C_pT$  refer to the density, pressure, velocity, temperature, internal energy and enthalpy, and  $C_v$  and  $C_p$  refer to the specific heats at constant volume and pressure. We define the symbol  $\overline{R} = (C_p - C_v) \overline{M} =$  $8.31 \times 10^7 \text{ ergs/gm}^\circ K$  as the universal gas constant, and  $\overline{M}$  as the mean molecular weight nondimensionalized so that  $\overline{M} = 16$  for atomic oxygen. For fully ionized hydrogen,  $\overline{M}$  is thus 1/2. The magnetic field  $\underline{B}$  and the Poynting vector  $\underline{S}$  for the flux of electromagnetic energy are expressed in terms of gaussian units. The gravitational potential  $\Phi$  and acceleration  $\underline{g}$  are assumed to be due to massive fixed bodies so that their time derivatives are zero. These equations apply in the region exterior to the ionosphere boundary, as shown in the sketch below, and also in a degenerate sense in the ionosphere.



Conditions at discontinuities.- Because of the omission of dissipative terms in these equations, surfaces of discontinuity may develop in the solution, across which the fluid and magnetic properties change abruptly, but in such a way that mass, momentum, magnetic flux, and energy are conserved. These are approximations to comparatively thin surfaces across which similar but continuous changes in the fluid and magnetic properties occur in the corresponding theory of a dissipative gas, and correspond physically to the bow wave, ionosphere boundary, and possibly other thin regions of rapidly changing properties. Across these surfaces, continuous solutions of the dissipationless differential equations cease to exist. The flow is no longer governed solely by the differential equations (1) to (4), but must be supplemented by additional considerations. The conservation of mass, momentum, magnetic flux, and energy lead to the following conditions which relate quantities on the two sides of any such discontinuity:

$$\left[\rho \mathbf{v}_{n}^{\star}\right] = 0 \tag{7}$$

$$\left[\rho v \cdot v_{n}^{*} + (p + B^{2}/8\pi)\hat{n} - B_{n} \tilde{v}_{t}/4\pi\right] = 0$$
(8)

$$\begin{bmatrix} B_{t} \cdot v_{n}^{*} - B_{n} \cdot v_{t} \end{bmatrix} = 0$$
(9)

$$\left[v_{n}^{*}\left(\frac{1}{2}\rho v^{2} + \rho e + p + \frac{B^{2}}{4\pi}\right) + q_{n} \cdot \left(p + \frac{B^{2}}{8\pi}\right) - \frac{B_{n}(v \cdot \bar{v})}{4\pi}\right] = 0 \quad (10)$$

Here,  $(\hat{n}, \hat{t})$  denote unit vectors normal and tangential to the discontinuity surface, as sketched below,



where  $q_n$  represents the local normal velocity of the discontinuity surface, and  $v_n^* = v_n - q_n$  is the fluid normal velocity component relative to the normal velocity  $q_n$  of the discontinuity surface. The square brackets are used to indicate the difference between the enclosed quantities on the two sides of the discontinuity, as in  $[Q] = Q_2 - Q_1$ where subscripts 1 and 2 refer to conditions on the upstream and downstream sides, respectively, of the discontinuity.

Five classes of discontinuities are described by Eqs. (7-10). Those with  $v_n^* = 0$  are called tangential discontinuities or contact discontinuities according to whether or not  $B_n$  vanishes. Discontinuities across which there is flow  $(v_n^* \neq 0)$  are divided into three categories called rotational discontinuities, and fast and slow shock waves. Some properties which distinguish the various discontinuities are indicated by the following relationships:

Tangential:

$$v_n^{\star} = B_n = 0, [v_t] \neq 0, [B_t] \neq 0, [\rho] \neq 0, [p + B^2/8\pi] = 0$$
 (11)

Contact:

$$v_n^* = 0, B_n \neq 0, [v] = [B] = [p] = 0, [\rho] \neq 0$$
 (12)

Rotational:

$$v_n^* = \pm B_n / \sqrt{4\pi\rho}$$
,  $[v_t] = \pm [B_t] / \sqrt{4\pi\rho}$   
 $[\rho] = [p] = [v_n] = [v^2] = [B^2] = [B_n] = 0$ 
(13)

Fast and Slow Shock Waves:

$$v_{n}^{\star} \neq 0, \ [\rho] > 0, \ [p] > 0, \ [B_{n}] = 0$$

$$\left(\rho v_{n}^{\star}\right)_{fast} \geq \left(\rho v_{n}^{\star}\right)_{rot.} \geq \left(\rho v_{n}^{\star}\right)_{slow}$$

$$B_{t} \text{ and } B^{2} \left(\text{increase} \right) \text{ through } \left(\text{fast}_{slow}\right) \text{ shock waves}$$

$$(14)$$

Of the five classes of discontinuities possible, two of these, the fast shock wave and the tangential discontinuity, are of concern in the present applications. The first relates conditions on the two sides of the bow shock wave, and any other shock waves present, while the latter has properties required to describe a boundary surface (ionopause) that separates the flowing solar wind and the planetary ionosphere. More detailed consideration of the tangential discontinuity condition leads to a determination of the ionopause shape, as described in the following sections.

With regard to conditions at the bow wave, for solar-wind flows past Venus, as well as Mars and the Earth, that discontinuity can only be represented by a fast shock wave since the mass flux through each of the other possible choices is too small. With regard to conditions at the ionopause, of the various possibilities, only the tangential discontinuity has properties compatible with those required to describe a boundary surface that separates the externally flowing solar wind and the planetary atmosphere; that is, the condition  $v_n^* = 0$  prohibits flow across the boundary, while the condition  $B_n = 0$  must hold since by assumption no magnetic field exists interior to the ionopause and the solenoidal jump condition  $[B_n] = 0$  always holds.

<u>Frozen-field approximation</u>. Two important parameters characterize the solar-wind flow at any field point as described by eqs. (1-5). These are the Mach number M = v/a and the Alfvén Mach number  $M_A = v/A$ . The former is the ratio of the flow velocity to the speed of sound  $a = (\gamma p/\rho)^{\frac{1}{2}}$ , while the latter is the ratio of the flow velocity to the speed A =

 $(B^2/4\pi\rho)^{\frac{1}{2}}$  of a rotational or Alfvén wave propagating along the direction of the magnetic field.

For typical solar-wind conditions (refs. 5,6), both the oncoming Mach number and the Alfvén Mach number are high  $(M_{\infty} \simeq M_{\lambda} \simeq 0(10))$ . In this instance, an important simplification of the magnetohydrodynamic equations occurs. This is so because the order of magnitude of the inertia term in differential equation (2) for the momentum is related to that of the magnetic terms by the square of the Alfvén Mach number. When the latter is large, therefore, the magnetic terms in eqs. (2),(3),(8), and (10) decouple from the gasdynamic portions of those equations. Furthermore, for Earth, Venus, or Mars, the strong interactive nature of the flow permits the terms involving g and  $\Phi$  to be disregarded because of the relative smallness of their effect on the fluid motion (ref. 5). The equations for the fluid motion thereby reduce to those of qasdynamics, while the magnetic field B can be determined subsequently by solving the remaining equations using the values for y already determined. The magnetic field, determined in this fashion, is usually interpreted as being "frozen-in" or moving with the fluid (ref. 5).

This then results in the following differential and conservation equations; for the flow field

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x_k} (\rho v_k) = 0$$
 (15)

$$\frac{\partial}{\partial t} (\rho v_{i}) + \frac{\partial}{\partial x_{k}} (\rho v_{i} v_{k} + p \delta_{ik}) = 0$$
 (16)

$$\frac{\partial}{\partial t} \left( \frac{\rho v^2}{2} + \rho e \right) + \frac{\partial}{\partial x_k} \left[ \rho v_k \left( \frac{v^2}{2} + e + p/\rho \right) \right] = 0$$
 (17)

$$\left[\rho \mathbf{v}_{n}^{\star}\right] = 0 \tag{18}$$

 $\left[\rho \mathbf{v} \cdot \mathbf{v}_{n}^{\star} + \mathbf{p}\right] = \mathbf{0}$ (19)

$$\left[v_{n}^{\star} \cdot \left(\frac{1}{2}\rho v^{2} + \rho e + p\right)\right] = 0$$
 (20)

and for the magnetic field

$$\frac{\partial B_{i}}{\partial t} + \frac{\partial}{\partial x_{k}} (v_{k}B_{i} - v_{i}B_{k}) = 0$$
 (21)

$$\frac{\partial B_{i}}{\partial x_{i}} = 0$$
 (22)

$$\begin{bmatrix} B_n \end{bmatrix} = 0 \tag{23}$$

$$\begin{bmatrix} B_n \cdot v_t - B_t \cdot v_n^* \end{bmatrix} = 0$$
 (24)

Equations (15) to (24) provide the governing equations which form the basis of the mathematical representation of the solar wind-magneto/ ionosphere interaction problem considered here. For all of the results as well as the computer codes presented herein, we are interested exclusively in the steady-state solution to these equations which are obtained by setting  $\partial/\partial t = 0$  and  $v_n^* = v_n$ , i.e.  $q_n = 0$ . We have presented the unsteady equations, however, since one of the computational methods used to determine the gasdynamic solution employs an unsteady procedure, integrating in time until the steady-state solution is asymptotically obtained.

#### Determination of the Ionosphere Boundary

The determination of the ionosphere boundary initiates from the assumptions that the ionosphere, or at least the outer part of it that participates in the interaction with the solar wind, is idealized as a spherically-symmetric and hydrostatically-supported plasma having infinite electrical conductivity, effectively bound to the planet and incapable of mixing with the solar wind, as indicated in the sketch below:



This interior plasma is separated from the flowing solar plasma by a tangential discontinuity across which the relations

$$v_n = B_n = [p + B^2/8\pi] = 0$$
  
 $[v_t] \neq 0; [B_t] \neq 0; [\rho] \neq 0$ 
(25)

given previously (eq. (11)) must hold. The basis for important simplifying approximations to these conditions, which can be assumed to apply at the Venusian ionosphere boundary and possibly for that at Mars as well, is that the gas pressure p is much larger than the magnetic pressure  $B^2/8\pi$  on both sides of the ionopause. Therefore, the discontinuity pressure balance relation  $[p + B^2/8\pi] = 0$  of eq. (25) reduces to a simple equality between the ionosphere pressure and the static pressure of the flowing solar plasma adjacent to the ionopause, i.e.

$$(p)_{atm} = (p)_{flow}$$
(26)

Determination of the ionospheric pressure in the vicinity of the ionopause for the ionosphere models chosen in this study proceeds from the assumption of hydrostatic support, which implies a quiescent ionosphere where the bulk motions of the gas with respect to the planet are sufficiently small (v = 0) that equilibrium exists between the pressure gradient and gravity, viz.

$$dp/dr = -\rho g \tag{27}$$

where p and  $\rho$  are the gas pressure and density, r is the radial distance measured from the center of the planet, and g is the acceleration due to gravity. The variation of g is inversely proportional to  $r_s$ , so that  $g = g_s (r_s/r)^2$  where the subscript s denotes values at the surface of the planet. Since the density  $\rho$  is related to the pressure according to the perfect gas law eq. (6), eq. (27) can be integrated to yield

$$p = p_{R} \exp \left(-\int_{R_{R}}^{r} \frac{dr}{H}\right)$$
(28)

where  $p_R$  is the pressure at some reference radius  $R_R$  and H is the local scale height of the atmosphere given by  $H = \overline{R}T/\overline{M}g$ .

If H is regarded as constant; that is, if variations of g and T with r are neglected, eq. (27) can be integrated directly to yield

$$p = p_R \exp\left(-\frac{r - R_R}{H}\right)$$
(29)

In view of uncertainties associated with measurements of the atmospheric properties of Venus and Mars, the variation of p with r as given by eq. (29) was adopted in the initial solar wind/ionosphere applications (ref. 6) and was also used in the previous study (ref. 9) involving the initial application of advanced computational methods to this problem. With preliminary ionospheric data now available from the Pioneer-Venus spacecraft (refs. 10 and 11), some of these uncertainties for Venus have been removed. It has been found that the assumption of an isothermal (T = constant) atmosphere at typical ionopause heights is quite reasonable. Consequently, there is no need to neglect the variation of gravity in the scale height in eq. (28). Including this effect leads to the following result for the pressure

$$p = p_{R} \exp \left[ - \frac{R_{R} \cdot (r - R_{R})}{\overline{H} \cdot r} \right]$$
(30)

where

$$\overline{H} = H_{s} \cdot (R_{R}/R_{s})^{2}$$
(31)

and  $R_s$  is the planetary radius and  $H_s = \overline{RT}/\overline{Mg}_s$ . Equations (29) and (30) provide the two models employed in this study for the ionosphere pressure variation which is required in eq. (26) for the pressure balance condition at the ionopause.

For the a priori determination of the static pressure of the flowing solar-wind plasma on the exterior boundary of the ionosphere -  $(p)_{flow}$  in eq. (26) - we use, as in all previous applications, the Newtonian approximation

$$p = p_{st} \cos^2 \psi$$
 (32)

where  $\psi$  is the angle between the outward normal to the magnetosphere boundary and the flow direction of the oncoming undisturbed solar wind, and  $p_{st}$  is the stagnation or ram pressure exerted on the nose of the ionopause and is given by

$$p_{st} = K \rho_{\infty} v_{\infty}^{2}$$
(33)

In this relation, K is a constant usually taken as one, but whose actual value is

$$K = \frac{1}{\gamma} \left[ \frac{(\gamma + 1)/2}{(\gamma - 1)/2M_{\infty}^{2}} \right]^{\frac{1}{\gamma - 1}}$$
(34)

For the high Mach number flows typical of solar-wind conditions, K approaches 0.844 for  $\gamma = 2$  and 0.881 for  $\gamma = 5/3$ . Modification of the product  $K\rho_{\infty}$  in eq. (33) to account for the presence of minor constituents such as ionized helium in the solar wind, as well as a discussion of the differences in that product between a fluid and collisionless representative, is provided in reference 8. The important implication associated with the introduction of the Newtonian approximation is that the calculation of the shape of the ionosphere boundary decouples from the calculation of the external flow. We then arrive at the following equation for the pressure balance at the ionopause locations  $R_i$ :

$$K\rho_{\infty}v_{\infty}^{2}\cos^{2}\psi = p_{R} \Lambda(R_{i})$$
(35)

where

$$) = \begin{cases} \exp\left[-\left(\frac{R_{1} - R_{R}}{H}\right)\right] \\ \left[-\left(\frac{R_{R} - R_{R}}{$$

$$\Lambda(R_{i}) = \left\{ \exp\left[-R_{R}\left(\frac{R_{i}-R_{R}}{\overline{H}-R_{i}}\right)\right] \right\} \quad g = g_{s}\left(\frac{r_{s}}{r}\right)^{2}, T = \text{Const.} \quad (36b)$$

depending upon whether the gravitational variation is included in scale height or not. It is convenient to choose as the reference radius and location the stagnation point on the ionopause; that is,  $R_R = R_O$  where  $R_O$ is the distance from the center of the planet to the nose of the ionopause. This implies that  $p_R = p_O = K \rho_{\infty} v_{\infty}^2$  and that at all points along the ionosphere boundary

$$\cos^2 \psi = \Lambda(R_i) \tag{37}$$

The final mathematical statement of the free-boundary problem for determining the shape of the ionosphere boundary then is summarized in the sketch below:



In order to proceed to a final determination of the ionopause shape, it is necessary to relate the local angle  $\psi$  to the local coordinates ( $R_i$ ,  $\beta$ ) of the boundary. This is accomplished with the help of the following sketch



from which we find

$$\cos^{2} \psi = \left(\frac{dY_{i}}{dS}\right)^{2} = \frac{\left(R_{i}d\beta\cos\beta + dR_{i}\sin\beta\right)^{2}}{dR_{i}^{2} + \left(R_{i}d\beta\right)^{2}}$$
(38)

This results in the following ordinary differential equation for the ordinates of the ionosphere boundary

$$\frac{\mathrm{dR}_{i}}{\mathrm{d\beta}} = R_{i} \left[ \frac{\sin 2 \beta - 2 \sqrt{\Lambda - \Lambda^{2}}}{2(\Lambda - \sin^{2} \beta)} \right] \quad 0 \leq \beta \leq \pi$$
(39)

where  $\Lambda$  is defined by eqs. (36a,b) and  $\beta$  is the angle measured from the subsolar point as indicated above. Results for various ionopause shapes obtained by integrating eq. (39) for different values of H/R<sub>0</sub> using the constant scale-height model eq. (36a) were provided in ref. 9. Similar results using the isothermal model, eq. (36b) for different values of  $\overline{H/R_0}$  in the range  $0.01 \leq \overline{H/R_0} \leq 0.5$  are provided in figure 1, where for comparison purposes the constant scale-height shapes for corresponding H/R<sub>0</sub> values are also illustrated. We note that the range of interest for planetary applications to Venus and Mars appears to be  $0.01 \leq \overline{H/R_0} \leq 0.10$ . Tabulated ordinates of  $Y_i/R_0$  vs.  $X/R_0$  are provided in Table 1 for  $\overline{H/R_0} = 0.01, 0.05, 0.10, 0.20, and 0.25$ , where  $Y_i = R_i \sin \beta$  is the cylindrical radial coordinate of the ionopause profile.

#### Calculation of the Gasdynamic Flow Properties

Determination of the gasdynamic flow properties is, both conceptually and computationally, the most difficult and time-consuming portion of the total calculation of the solar-wind/terrestrial-planet interaction; and represents the heart of the present modeling effort insofar as the application of advanced computational procedures is concerned. The calculation consists of determining solutions to the differential equations and discontinuity conservation equations given by eqs. (15-20). Since in solar-wind/terrestrial-planet interactions, both the downstream tail region (far field) as well as the region in the vicinity of the obstacle nose (near field) are generally of interest, the computational methods selected must be capable of efficiently determining this entire flow field. In view of the need to carry the flow calculation to an arbitrary downstream distance, the most computationally-expedient procedure is to subdivide the flow field into two regions, as indicated in the sketch below:



This sketch illustrates the essential features of the high-supersonic Mach number flow typical of solar-wind flows past terrestrial planets. Of particular note is the embedded subsonic pocket located at the nose of the ionopause. The presence of this subsonic pocket necessitates use of a computational method capable of treating mixed subsonic/supersonic flows. Downstream of this region, the flow becomes supersonic and remains so for the convex shapes typical of solar-wind/ionosphere boundaries. In that region, a more computationally-economical procedure than that required near the nose can be employed. Such a subdivision of both flow field and solution procedures is common practice for calculating such flows and was employed in the previous solar-wind applications as well as in a related application to space shuttle reentry flows (ref. 12). The precise surface on which the solutions are joined is relatively

arbitrary; in our procedure it was convenient to place it along a plane through the planet center and normal to the free-stream direction of the solar wind, i.e. the dawn-dusk terminator. As illustrated in fig. 2, this position is further downstream than used in the former work in which an inverse iteration method was used for the nose region and the method of characteristics was used for the remaining supersonic region. In light of recent advances, both of the techniques used in the former procedures, particularly the inverse method, are now considered obsolete and much inferior to more current methods. In the new code, those two methods have been superceded by: (1) a new axisymmetric implicit unsteady Euler-equation solver (IMP) specifically developed for the present application, which determines the steady-state solution in the nose region by an asymptotic time-marching procedure, and (2) a shockcapturing marching solution (SCT) which spatially advances the solution downstream as far as required by solving the steady Euler equations.

Nose region solution - implicit unsteady Euler equation method. - The partial differential equations employed in the implicit (IMP) code are the unsteady gasdynamic Euler eqs. (15-20) for axisymmetric flow. These equations may be written in conservation-law form under the generalized independent variable transformation

$$\tau = T, \quad \xi = \xi(T, X, R), \quad \eta = \eta(T, X, R)$$
(40)

as follows

$$(U/J)_{\tau} + \left[ (\xi_{T}U + \xi_{X}E + \xi_{R}F)/J \right]_{\xi} + \left[ (\eta_{T}U + \eta_{X}E + \eta_{R}F)/J \right]_{\eta} + G = 0$$

$$(41)$$

where

$$U = \begin{bmatrix} \rho \\ \rho u \\ \rho v \\ \rho e_{t} \end{bmatrix} \qquad E = \begin{bmatrix} \rho u \\ p + \rho u^{2} \\ \rho u v \\ (\rho e_{t} + p) u \end{bmatrix}$$
(42)

$$F = \begin{bmatrix} \rho v \\ \rho u v \\ p + \rho v^{2} \\ (\rho e_{t} + p) v \end{bmatrix} \qquad G = \frac{1}{RJ} \begin{bmatrix} \rho v \\ \rho u v \\ \rho v^{2} \\ (\rho e_{t} + p) v \end{bmatrix}$$

and the Jacobian

$$J = \xi_X \eta_R - \xi_R \eta_X \tag{43}$$

In eqs. (40) through (43), T denotes time, X is the axial downstream coordinate, and R the cylindrical radial distance; u and v the velocity components in the X and R directions; and  $e_t$  is the total energy per unit mass, which for a perfect gas is related to the other quantities by

$$e_{t} = p/[\rho(\gamma - 1)] + (u^{2} + v^{2})/2$$
(44)

The subscripts in eqs. (41) and (43) denote partial derivatives with respect to the indicated variable.

The analysis commences by introducing a computational mesh in polar (r,  $\beta$ ) coordinates such that one family of coordinates consists of rays from the planetary center spaced at equal increments of  $\beta$  measured from the obstacle nose, and the other of curved lines intersecting each ray so as to divide the portion of it between the ionopause and the shock wave into a fixed number of equal segments. The coordinate transformation eq. (40) is then used to map the portion of the X,R,T physical space bounded by (1) the bow wave, (2) the downstream outflow boundary at  $\beta = \pi/2$ , (3) the obstacle surface, and (4) the stagnation streamline at  $\beta = 0$  into a rectangle in the  $\xi$ ,n, $\tau$  computational space as illustrated in fig. 3. Generally, the transformation metrics at each time step are not known beforehand, and must be determined numerically as part of the solution. Integration step size is established by using the eigenvalues of the Jacobian matrices  $\overline{A}$  and  $\overline{B}$ , where  $\overline{A} = \partial \hat{E}/\partial \hat{U}$ ,  $\overline{B} = \partial \hat{F}/\partial \hat{U}$ , and  $\hat{U} = U/J$ ,  $\hat{E} = (\xi_T U + \xi_X E + \xi_R F)/J$ , and  $\hat{F} = (n_T U + n_X E + n_R F)/J$ .

Boundary conditions necessary for the specification of a properly-posed mathematical problem are that the flow (a) satisfy the axisymmetric Rankine-Hugoniot shock relations derivable from eq. (41) along (1), (b) be entirely supersonic along (2), (c) be parallel to boundaries (3) and (4), and (d) be symmetric about boundary (4). Initial flow-field conditions are determined by use of an approximating formula for the coordinates of the bow shock wave which is dependent on  $\gamma$ ,  $M_{\infty}$  and the shape of the obstacle, and by prescribing a Newtonian pressure

distribution on the obstacle. Since the maximum entropy streamline wets the obstacle surface, that fact plus the known flow direction on the obstacle serve to determine the remainder of the flow properties on that surface. A linear variation for the flow properties between the bow shock and the obstacle is then prescribed. This provides the initial flow field which is then integrated in a time-asymptotic fashion until the steady-state solution is obtained.

The basic numerical algorithm used in the IMP code was developed by Beam and Warming (ref. 13) and is second-order accurate, noniterative, and spatially factored. In particular, the "delta form" with Euler time differencing is employed. When applied to eq. (41), the algorithm assumes the form

$$(\mathbf{I} + \Delta \tau \delta_{\xi} \overline{\mathbf{A}}^{n}) (\mathbf{I} + \Delta \tau \delta_{\eta} \overline{\mathbf{B}}^{n}) (\hat{\mathbf{U}}^{n+1} - \hat{\mathbf{U}}^{n}) = -\Delta \tau (\delta_{\xi} \hat{\mathbf{E}}^{n} + \delta_{\eta} \hat{\mathbf{F}}^{n} + G)$$
(45)

where  $\overline{A}$  and  $\overline{B}$  are the Jacobian matrices, I is the identity matrix,  $\delta_{\xi}$  and  $\delta_{\eta}$  are second-order, central-difference operators,  $\hat{U}^{n+1} = \hat{U}(n\Delta\tau)$  and  $\Delta\tau$  is the integration step size.

Equation (45) is solved at the interior points only. It requires two 4x4 block tridiagonal inversions at each time step of the integration. The solution proceeds as follows:

- 1. Define  $\Delta \hat{U} = \hat{U}^{n+1} \hat{U}^n$
- 2. Form the right-hand side of eq. (45) and store results in the  $\hat{\upsilon}^{n+1}$  array.
- 3. Apply smoothing  $\hat{U}^{n+1} = \hat{U}^{n+1} (\epsilon/8)S/J$ .
- 4. Define  $\overline{U} = (I + \Delta \tau \delta_{\eta} \overline{B}^{n}) \Delta \hat{U}$  and solve the matrix equation  $(I + \Delta \tau \delta_{\xi} \overline{A}^{n}) \overline{U} = \hat{U}^{n+1}$  for  $\overline{U}$  storing the result in the  $\hat{U}^{n+1}$  array.

5. Solve the matrix equation  $(I + \Delta_{\tau} \delta_n \overline{B}^n) \Delta \hat{U} = \hat{U}^{n+1}$  for  $\Delta \hat{U}$ .

6. Obtain the values of  $\hat{U}^{n+1}$  from the relation  $\hat{U}^{n+1} = \Delta \hat{U} + \hat{U}^{n}$ .

7. Transfer contents of  $\hat{U}^{n+1}$  to  $\hat{U}^n$  and repeat all steps until satisfactory convergence is attained.

In step 3 a fourth-order smoothing term S is used to eliminate nonlinear instabilities that may arise since the use of central differences in the spatial directions results in a neutrally stable algorithm. This smoothing term is given by

$$s_{jk} = (\hat{U}J)_{j+2,k}^{n+1} - 4 \left[ (\hat{U}J)_{j+1,k}^{n+1} + (\hat{U}J)_{j-1,k}^{n+1} \right] + 12 (\hat{U}J)_{j,k}^{n+1} + (\hat{U}J)_{j-2,k}^{n+1} + (\hat{U}J)_{j,k+2}^{n+1} - 4 \left[ (\hat{U}J)_{j,k+1}^{n+1} + (\hat{U}J)_{j,k-1}^{n+1} \right] + (\hat{U}J)_{j,k-2}^{n+1}$$

$$(46)$$

and  $\varepsilon$ , the smoothing coefficient, chosen from the range  $0 \le \varepsilon \le 0.4$ depending upon the size of the time step. The j and k indices correspond to the  $\xi$  and  $\eta$  directions, respectively. At the points adjacent to the boundaries a special form of the smoothing term is used.

At the boundaries, modification of the differencing algorithm to account for the particular conditions described above is accomplished as follows. The obstacle-surface flow-tangency condition is incorporated through the use of Kentzer's scheme (ref. 14), while at the symmetry plane, the variables are reflected according to whether they are odd or even. At the outflow boundary where the flow is entirely supersonic, the dependent variables are determined by extrapolation from the adjacent interior points. For the upstream boundary formed by the bow shock wave, the sharp discontinuity approach of reference 15 is used. The interior flow field bounded by these various boundaries is treated in shockcapturing fashion and, therefore, allows for the correct formation of secondary internal shocks.

In the initial development of the nose-region solution procedure (ref. 9), it was found that for certain ionopause obstacle shapes which have a significant amount of lateral flaring at the dawn-dusk terminator, for example, constant scale-height shapes for  $H/R_O \ge 0.5$ , and/or cases involving low free-stream Mach numbers  $M_\infty \le 3$ , the axial component of velocity at some points on the terminator plane  $\beta = \pi/2$  may become

subsonic. Although this has no effect whatsoever on the nose-region solver, for these cases the downstream solution cannot be obtained since the marching-region solver which determines the solution downstream of this starting plane, and which is described in detail in the following section, requires supersonic axial velocities in order to proceed. Under the work reported here, this limitation has been removed by developing the capability for adding an additional portion of the flow field, located downstream of the terminator, to the blunt-body solution as illustrated in figure 4. This effectively generalizes the capability of the present procedures to treat a wide variety of ionopause shapes including all of the shapes of interest described by the constant scale-height and scale-height with gravitational variation atmospheric models found from eqs. (36a,b) - as well as to treat relatively low free-stream Mach numbers,  $M_m \simeq 2.0$ . Details of this capability are provided in the Computer Program Users Manual, Section A.2.1.1 of this report.

Downstream region solution - shock capturing marching method.- Since the shock-capturing technique employed has been described previously in references 16-18, only an outline of the salient features is provided here. The analysis is based on the conservation-law form of the gasdynamic Euler equations for steady axisymmetric flow, which can be readily obtained from eqs. (40) through (44) by setting the  $\tau$  derivatives to zero. The fourth of this set of equations representing conservation of energy  $\rho e_t$  can be integrated for steady flow to yield the following relation for the total enthalpy

$$h_{+} = h + (u^{2} + v^{2})/2 = constant$$
 (47)

where  $h = e + p/\rho = C_p T$  is the enthalpy per unit mass.

The computational mesh is defined by lines of constant X and  $(R-R_b)/(R_s-R_b)$ , where  $R_s$  and  $R_b$  are functions of X that describe the radial cylindrical coordinates of the ionopause and bow shock wave at the same X as the field point (X,R). The three remaining partial differential equations for conservation of mass and of axial and radial momentum are then transformed to a rectangular computational space by the transformation

$$\xi = X, \quad \eta = \frac{R - R_{b}}{(R_{s} - R_{b})}$$
 (48)

to obtain

$$\partial \tilde{E}/\partial \xi + \partial \tilde{F}/\partial \eta + \tilde{G} = 0$$
 (49)

$$\widetilde{E} = E, \quad \widetilde{F} = \left\{ F - \left[ \frac{\partial}{\partial \xi} R_{b} + \eta \frac{\partial}{\partial \xi} (R_{s} - R_{b}) \right] \right\} / (R_{s} - R_{b})$$

$$\widetilde{G} = G + \frac{E}{R_{s} - R_{b}} \frac{\partial}{\partial \xi} (R_{s} - R_{b}) \quad (50)$$

The finite-difference counterpart of eq. (49) is integrated with respect to the hyperbolic coordinate  $\xi$  to yield values of the conservative variable E. Subsequent to each integration step, the physical flow variables p,  $\rho$ , u, and v must be decoded from the components  $e_i$  of E. This necessitates the solution of four simultaneous, nonlinear equations consisting of eq. (47) together with the three elements  $e_i$ . This can be done readily by using the relations  $v = e_3/e_1$ ,  $p = e_2 - e_1u$ , and  $\rho = e_1/u$  together with the expression  $h = \gamma/(\gamma-1)(p/\rho)$  for a perfect gas to determine the following quadratic equation for u

$$\frac{u^{2}}{2} + \frac{\gamma}{\gamma - 1} \left( \frac{e_{2} - e_{1}u}{e_{1}} \right) u - h_{t} + \left( \frac{e_{3}}{e_{1}} \right)^{2}$$
$$= -\frac{\gamma + 1}{2(\gamma - 1)} u^{2} + \left( \frac{\gamma}{\gamma - 1} \right) \frac{e_{2}}{e_{1}} u - h_{t} + \left( \frac{e_{3}}{e_{1}} \right)^{2} = 0 \quad (51)$$

Two roots exist; one corresponds to subsonic flow and is discarded since u is always supersonic in the present application, while the other corresponds to supersonic flow and gives the desired solution.

Since only the bow shock wave is treated as a sharp discontinuity and any others that may be present are "captured" by the difference algorithm, selection of the appropriate finite difference scheme to advance the calculation in the  $\xi$  direction is of prime importance. Following the analysis of refs. 16-18, the numerical integration of eq. (49) is accomplished using the finite-difference predictor-corrector scheme of MacCormack (ref. 19), the most efficient second-order algorithm for shock-capturing calculations. General descriptions of the method can be found in the references cited.

<u>Calculation of the streamlines</u>.- The streamlines are determined by integrating fluid particle trajectories through the known velocity field since this procedure was found to be more accurate than the alternative mass-flow calculation. The calculation of a particular streamline is initiated at the point where the streamline crosses the bow shock, as illustrated in figure 5. At that point, exact values of the streamline slope dR<sub>S</sub>/dX are known in terms of the local shock angle  $\delta_S$  and free-stream quantities according to the relation

$$\frac{\mathrm{dR}_{\mathrm{S}}}{\mathrm{dX}} = \frac{(2\mathrm{cot}\ \delta_{\mathrm{S}})\ (\mathrm{M}_{\mathrm{m}}^{2}\mathrm{sin}^{2}\ \delta_{\mathrm{S}} - 1)}{2\ +\ \mathrm{M}_{\mathrm{m}}^{2}(\gamma\ +\ 1\ -\ 2\mathrm{sin}^{2}\ \delta_{\mathrm{S}})}$$
(52)

which is contained implicitly in both the blunt-body (IMP) and marching (SCT) code solutions. At other points in the flow field, the local streamline slope is given by the ratio of radial to downstream velocity, i.e.,

$$dR_{c}/dX = v/u$$
 (53)

and the streamline determination is made by stepwise integration in X using a modified third-order Euler predictor-corrector method. Bivariate linear interpolation from the flow-field grid points is employed to obtained the velocity components (u,v) required at the stepwise points along the streamline trajectory. Separate streamline calculations are made for the nose region (IMP results) and downstream region (SCT results) because of the different coordinate systems employed in those two regions.

## Calculation of the Magnetic Field

With the flow properties known from the gasdynamic calculations, determination of the steady magnetic field B proceeds by integrating the remaining magnetohydrodynamic equations not employed in the gasdynamic analysis, that is eqs. (21-24) with  $\partial/\partial t = 0$ :

curl (
$$B \times v$$
) = 0, div  $B = 0$   
[ $B_n v_t - B_t v_n$ ] = 0, [ $B_n$ ] = 0
(54)

These equations are commonly interpreted as indicating the field lines move with the fluid. The analysis associated with eqs. (54) leads to a straightforward calculation in which the vector distance from each point on an arbitrarily-selected field line to its corresponding point on an adjacent field line in the downstream direction is determined by numerically integrating  $\int v dt$  over a fixed time interval  $\Delta t$ . Once the coordinates of the field lines are determined, the magnetic field at any point may be calculated from the relation

$$\frac{\frac{B}{\rho_{\infty}}}{|B_{\infty}|} = \frac{\rho}{\rho_{\infty}} \frac{\Delta \ell}{|\Delta \ell_{\infty}|}$$
(55)

where  $\Delta \underline{\ell}$  is the vector length of a small element of a flux tube. Figure 6 clarifies these quantities for the plane of magnetic symmetry defined by the plane containing the axis of symmetry of the obstacle and the magnetic-field lines upstream of the bow wave for the special case when the latter is perpendicular to the flow. In that figure the open symbol O denotes locations of points on the streamlines corresponding to the fixed-time interval  $\Delta t = \Delta S_m/v_m$ .

Such a procedure is valid generally, but its use in the present calculations is confined to only the component of the magnetic field  $(\underline{B})_{\perp}$  just described. The remainder of the magnetic-field calculation makes use of a decomposition due to Alksne and Webster (ref. 20) in which the axisymmetric properties of the gasdynamic solution and the linearity of the magnetic-field eqs. (54) are employed to derive the following relationship for the magnetic field  $\underline{B}_p$  at any point P:

$$B_{p} = \left(\frac{B_{p}}{B_{\infty}}\right)_{\mu} B_{\infty \mu} + \left(\frac{B_{p}}{B_{\infty}}\right)_{\perp} B_{\infty \mu} + \hat{e}_{n} \left(\frac{B_{p}}{B_{\infty}}\right)_{n} B_{\infty n}$$
(56)

As illustrated in figure 7, subscripts ", <sup>1</sup>, and n refer to contributions associated with the components  $B_{\omega_n}$  of  $\underline{B}_{\omega}$  parallel to  $\underline{v}_{\omega}$ ; the component  $B_{\omega_n}$  perpendicular to  $\underline{v}_{\omega}$  in the plane that contains the point P, the center of the planet, and the vector  $\underline{v}_{\omega}$ ; and the component  $B_{\omega_n}$  normal to the latter plane, and  $\hat{e}_n$  is a unit vector in the latter direction. The unit ratios  $(\underline{B}_p/\underline{B}_{\omega})_n$  and  $(\underline{B}_p/\underline{B}_{\omega})_n$  can be calculated directly from the gasdynamic solution by the expressions

$$\left(\frac{\mathbb{B}_{\mathbf{p}}}{\mathbb{B}_{\infty}}\right)_{\mu} = \frac{\rho_{\mathbf{p}} \underline{\mathbf{v}}_{\mathbf{p}}}{\rho_{\infty} |\underline{\mathbf{v}}_{\infty}|}, \quad \left(\frac{\mathbb{B}_{\mathbf{p}}}{\mathbb{B}_{\infty}}\right)_{n} = \frac{\mathbb{R}_{\mathbf{p}} \rho_{\mathbf{p}}}{\mathbb{R}_{\mathbf{p}_{\infty}} \rho_{\infty}}$$
(57)

where  $R_p$  is the radial cylindrical coordinate of the streamline through P, as indicated in figure 7.

In carrying out the determination of  $(\underline{B}_{\mathbf{P}}/B_{\infty})_{\perp}$  using eq. (55), values for  $\Delta \underline{\ell}/|\Delta \underline{\ell}_{\infty}|$  are determined initially at the points where the streamlines and perpendicular-component field lines intersect. A generalized quadrilateral interpolation scheme followed by a fifth-order smoothing is then employed to determine the corresponding values at the computational grid points where values for  $\rho/\rho_{\infty}$  are available for calculation of  $(\underline{B}_{\mathbf{P}}/B_{\infty})_{\perp}$ . At the bow shock, an exact formula is used

$$\left( \left| \Delta \underline{\ell} \right| / \left| \Delta \underline{\ell}_{\infty} \right| \right)^{2} = 1 + \cot^{2} \theta \left( 1 + D^{2} \right) - 2D \times \csc \theta \times \cot \theta \times \cos \left( \theta - \delta \right)$$

$$\psi = \theta + \sin^{-1} \left\{ \left[ D \times \cot \theta \times \sin \left( \theta - \delta \right) \right] / \left( \left| \Delta \underline{\ell} \right| / \left| \Delta \underline{\ell}_{\infty} \right| \right) \right\}$$

$$(58)$$

where

$$D^{2} = 1 - 4 \left( M_{\infty}^{2} \sin^{2} \theta - 1 \right) \left( \gamma M_{\infty}^{2} \sin^{2} \theta + 1 \right) / \left[ \left( \gamma + 1 \right)^{2} M_{\infty}^{4} \sin^{2} \theta \right]$$
  

$$\cot \delta = \tan \theta \times \left\{ (\gamma + 1) M_{\infty}^{2} / \left[ 2 \left( M_{\infty}^{2} \sin^{2} \theta - 1 \right) \right] - 1 \right\}$$
(59)  

$$\theta = \tan^{-1} \left( \frac{dR_{S}}{dx} \right)$$

Finally, the resultant magnetic field can then be expressed in components relative to any orthogonal (X,Y,Z) coordinate system. For convenience of illustration, we have chosen the point P to lie in the (X,Y) plane. Relative to this reference frame, the magnetic components are

$$B_{X}/B_{\infty} = \left[ \left( \left| \underline{B} \right| / B_{\infty} \right)_{\mu} \cos \phi \cos \alpha_{p} + \left( \left| \underline{B} \right| / B_{\infty} \right)_{\perp} \cos \psi \sin \alpha_{p} \right) \right] \cos \alpha_{n}$$

$$B_{Y}/B_{\infty} = \left[ \left( \left| \underline{B} \right| / B_{\infty} \right)_{\mu} \sin \phi \cos \alpha_{p} + \left( \left| \underline{B} \right| / B_{\infty} \right)_{\perp} \sin \psi \sin \alpha_{p} \right) \right] \cos \alpha_{n}$$

$$B_{Z}/B_{\infty} = \left( B/B_{\infty} \right)_{n} \sin \alpha_{n}$$
(60)

where  $\phi$  is the local flow angle given by

$$\phi = \tan^{-1} \left( \frac{\mathbf{v}}{\mathbf{u}} \right) \tag{61}$$

and the interplanetary magnetic field angles  $\alpha_p$  and  $\alpha_n$  indicated in figure 7 are defined by

$$\alpha_{p} = \tan^{-1} \left[ \frac{B_{\infty}}{B_{\infty}} \right] = \tan^{-1} \left[ \frac{B_{Y_{\infty}}}{B_{X_{\infty}}} \right]$$
(62)

$$\alpha_{n} = \tan^{-1} \left[ \frac{B_{\infty}}{\sqrt{(B_{\infty_{n}})^{2} + (B_{\infty_{\perp}})^{2}}} \right] = \tan^{-1} \left[ \frac{B_{Z_{\infty}}}{\sqrt{(B_{X_{\infty}})^{2} + (B_{Y_{\infty}})^{2}}} \right] (63)$$

The generalizations of these results when the point P is at some arbitrary (Y,Z) location, i.e. not in the (X,Y) plane, are provided below in the spacecraft trajectory section.

## Calculation of the Contour Lines

Contours are calculated for nondimensionalized velocity  $|y|/v_{\infty}$ , density  $\rho/\rho_{\infty}$ , magnetic field components  $(|\underline{B}|/B_{\infty})_{n}$ ,  $(|\underline{B}|/B_{\infty})_{n}$ , and  $(B/B_{\infty})_{n}$  by application of a modified version of a contour procedure developed at NASA/Ames Research Center. After specifying a value for the contour line, the boundary is searched for intervals which bracket the selected value. After locating one such point by interpolation, the remainder of the contour is determined by 'walking' around the contour, searching at each step for the interval and then interpolating to find the point through which the contour line next passes. This is repeated until a boundary

point is reached. Then closed contours are found in a similar manner. Linear interpolation is used throughout the process. Since the temperature is a function of  $|v|/v_m$  only for a specified  $M_m$  and  $\gamma_r$ 

$$T/T_{\infty} = 1 + \left[ \left( \frac{\gamma - 1}{2} \right) M_{\infty}^{2} \right] \left[ 1 - \left( \frac{|v|}{v_{\infty}} \right)^{2} \right]$$
(64)

velocity contours may also be considered as temperature contours with only a relabeling required. The coordinates of the contour lines are output either or both as listings and pen plots.

#### Solar-Ecliptic/Solar-Wind Coordinate Transformations

In order to facilitate comparison of results from the current theoretical model with actual observational data obtained by a spacecraft, it is necessary to consider the appropriate transformations between the spacecraft and solar-wind coordinate systems. Part of the data required as input to the theoretical model consists of oncoming interplanetary values of solar-wind temperature, density, and velocity and magnetic-field vector components. These are naturally obtained in the spacecraft coordinate system, and are usually reported in a sun-planet or solarecliptic reference frame. The key coordinate system for the theoretical model is one which aligns the axial direction with the oncoming solar wind, since the gasdynamic calculation is assumed to be axisymmetric about this direction. Thus, the interplanetary input data must be transformed to the solar-wind system to initiate the theoretical determination. Once the gasdynamic and magnetic-field calculations in the solarwind system are complete, those results must then be transformed back to the sun-planet system to allow direct comparison with spacecraft data obtained at arbitrary locations in the solar-wind/ionosphere interaction region. Consequently, direct and inverse transformations for both spatial coordinates as well as vector quantities between these reference frames are required.

For the measurements of the oncoming interplanetary solar-wind velocity we have assumed that the velocity is obtained with reference to a
sun-planet  $(x_g, y_g, z_g)$  system with origin at planetary center and in which the  $x_g$ -axis points to the sun, the  $y_g$ -axis is opposite to the planetary orbital motion, and the  $z_g$ -axis points northward. The direction of the oncoming solar wind is such that the total abberation or azimuthal angle, including planetary orbital motion, of the solar-wind velocity vector in the plane of the ecliptic is  $\Omega$  and the out-of-ecliptic plane or polar angle is  $\phi_p$ . The positive sense of the azimuthal angle is for east-towest flow and for the polar angle for north-to-south flow, as indicated in figure 8. In that figure we have also indicated the solar-wind (x,y,z) coordinate system so defined by  $(\Omega, \phi_p)$ . For the gas-dynamic calculation, the (x,y,z) system is somewhat inconvenient since the direction of solar-wind flow is in the negative x-direction. Hence, the internal gasdynamic and magnetic-field calculations are performed in an (X,Y,Z) system as shown in figure 9.

The coordinate and vector transformations from the ecliptic sun-planet  $(x_s, y_s, z_s)$  system to the (X, Y, Z) solar-wind system are given by

$$\begin{pmatrix} Q_{\rm X} \\ Q_{\rm Y} \\ Q_{\rm Z} \end{pmatrix} = \begin{pmatrix} -\cos \,\Omega \,\cos \,\phi_{\rm p} & -\sin \,\Omega \,\cos \,\phi_{\rm p} & \sin \,\phi_{\rm p} \\ \sin \,\Omega & -\cos \,\Omega & 0 \\ -\cos \,\Omega \,\sin \,\phi_{\rm p} & \sin \,\Omega \,\sin \,\phi_{\rm p} & \cos \,\phi_{\rm p} \end{pmatrix} \begin{pmatrix} Q_{\rm X} \\ Q_{\rm Y} \\ Q_{\rm Z} \\ Q_{\rm Z} \end{pmatrix}$$
(65)

where  $(Q_X, Q_Y, Q_Z)$  represents the Cartesian components of any vector referred to the solar-wind (X,Y,Z) coordinate system, and  $(Q_{X_S}, Q_{Y_S}, Q_{Z_S})$  represents the corresponding vector in the sun-planet ecliptic  $(x_s, y_s, z_s)$  system. Thus, for a transformation of coordinates

$$(Q_{x}, Q_{y}, Q_{z}) = (X, Y, Z)$$

$$(Q_{x}, Q_{y}, Q_{z}) = (x_{s}, Y_{s}, Z_{s})$$
(66)

while for a vector transformation of, say, the magnetic field

$$(Q_{x}, Q_{y}, Q_{z}) = (B_{x}, B_{y}, B_{z})$$

$$(Q_{x}, Q_{y}, Q_{z}) = (B_{x}, B_{y}, B_{z})$$

$$(G_{x}, Q_{y}, Q_{z}) = (B_{x}, B_{y}, B_{z})$$
(67)

The inverse transformation from the solar-wind to the sun-ecliptic system is given by

$$\begin{pmatrix} Q_{\mathbf{x}_{\mathbf{S}}} \\ Q_{\mathbf{y}_{\mathbf{S}}} \\ Q_{\mathbf{z}_{\mathbf{S}}} \end{pmatrix} = \begin{pmatrix} -\cos \Omega \cos \phi_{\mathbf{p}} & \sin \Omega & -\cos \Omega \sin \phi_{\mathbf{p}} \\ \sin \Omega \cos \phi_{\mathbf{p}} & -\cos \Omega & \sin \Omega \sin \phi_{\mathbf{p}} \\ \sin \phi_{\mathbf{p}} & 0 & \cos \phi_{\mathbf{p}} \end{pmatrix} \begin{pmatrix} Q_{\mathbf{X}} \\ Q_{\mathbf{y}} \\ Q_{\mathbf{z}} \end{pmatrix}$$
(68)

#### Properties Along a Spacecraft Trajectory

One of the primary aims of the present effort has been the development of the capability to determine plasma and magnetic-field properties, as predicted by the present theoretical model, at locations specified along an arbitrary spacecraft trajectory, and in such a form as to enable comparisons to be made directly with actual spacecraft data. To this end, the following procedure has been developed and implemented in the associated computer code. First, from the known oncoming interplanetary conditions provided in a sun-planet reference frame, the azimuthal and polar solar-wind angles  $(\Omega, \phi_p)$  are employed to establish both the location of the trajectory point in the solar-wind (X,Y,Z) frame as well as the interplanetary magnetic-field components  $(B_{X_m}, B_{Y_m}, B_{Z_m})$  using the transformation eq. (65). Next, the axisymmetric gasdynamic and unit magnetic-field calculations are carried out. Because the gasdynamic flow is axisymmetric in the (X,Y,Z) system, the internal coordinate system in which the trajectory calculations are actually performed may be rotated about the X axis into the most convenient orientation. If we consider a point P located at  $(X_p, Y_p, Z_p)$ , then the rotation most appropriate for the present application is indicated in the sketch below



where the angle  $\boldsymbol{\theta}$  is given by

$$\theta = \tan^{-1} \left[ \frac{z_p}{Y_p} \right]$$
 (69)

This rotation defines a new coordinate system (x',y',z') where

$$\begin{pmatrix} \mathbf{x}' \\ \mathbf{y}' \\ \mathbf{z}' \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & \sin \theta \\ 0 & -\sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} \mathbf{x} \\ \mathbf{y} \\ \mathbf{z} \end{pmatrix}$$
(70)

in which

$$x' = X_{p}$$

$$y' = \sqrt{Y_{p}^{2} + Z_{p}^{2}}$$

$$z' = 0$$
(71)

Thus, the (x',y') plane which contains the X axis and the arbitrary point P corresponds directly to the plane (X,R) =  $(X_p, \sqrt{Y_p^2 + Z_p^2})$  in which the axisymmetric gasdynamic flow properties are calculated. In particular, the velocity magnitude v, density  $\rho$ , and flow angle  $\phi$  at the point P are found by bilinear interpolation through the (X,R) flow-field grid. The vector velocity in the (X,Y,Z) system is then given by the transformation

$$\begin{pmatrix} \mathbf{v}_{\mathbf{X}} \\ \mathbf{v}_{\mathbf{Y}} \\ \mathbf{v}_{\mathbf{Z}} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} \mathbf{v} \cos \phi \\ \mathbf{v} \sin \phi \\ 0 \end{pmatrix}$$
(72)

and then in the sun-ecliptic system by the transformation given in eq. (68)

$$\begin{pmatrix} \mathbf{v}_{\mathbf{X}_{\mathbf{S}}} \\ \mathbf{v}_{\mathbf{Y}_{\mathbf{S}}} \\ \mathbf{v}_{\mathbf{Z}_{\mathbf{S}}} \end{pmatrix} = \begin{pmatrix} -\cos \Omega \cos \phi_{\mathbf{p}} & \sin \Omega & -\cos \Omega \sin \phi_{\mathbf{p}} \\ \sin \Omega \cos \phi_{\mathbf{p}} & -\cos \Omega & \sin \Omega \sin \phi_{\mathbf{p}} \\ \sin \phi_{\mathbf{p}} & 0 & \cos \phi_{\mathbf{p}} \end{pmatrix} \begin{pmatrix} \mathbf{v}_{\mathbf{X}} \\ \mathbf{v}_{\mathbf{Y}} \\ \mathbf{v}_{\mathbf{Z}} \end{pmatrix}$$
(73)

Calculation of the magnetic field at an arbitrary point is somewhat more complicated since these components are dependent upon the orientation of the incident interplanetary magnetic field. With the known  $(B_{X_{\infty}}, B_{Y_{\infty}}, B_{Z_{\infty}})$  components, the corresponding components  $(B'_{X_{\infty}}, B'_{Y_{\infty}}, B'_{Z_{\infty}})$  in the rotated (x', y', z') system are given by

$$\begin{pmatrix} \mathbf{B}_{\mathbf{X}_{\infty}}^{\prime} \\ \mathbf{B}_{\mathbf{Y}_{\infty}}^{\prime} \\ \mathbf{B}_{\mathbf{Z}_{\infty}}^{\prime} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & \sin \theta \\ 0 & -\sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} \mathbf{B}_{\mathbf{X}_{\infty}} \\ \mathbf{B}_{\mathbf{Y}_{\infty}} \\ \mathbf{B}_{\mathbf{Z}_{\infty}} \end{pmatrix}$$
(74)

In this reference frame, the perpendicular, parallel, and normal interplanetary components are identified as

$$B_{\infty_{II}} = B_{X_{\infty}}^{I}$$

$$B_{\infty_{I}} = B_{Y_{\infty}}^{I}$$

$$B_{\infty_{II}} = B_{Z_{\infty}}^{I}$$
(75)

Then, the magnetic field angles  $\alpha_p^{\prime}$  and  $\alpha_n^{\prime}$  in the rotated system are given by

$$\alpha_{\mathbf{p}}^{\prime} = \tan^{-1} \left[ \frac{\mathbf{B}_{\infty}}{\mathbf{B}_{\infty}} \right] = \tan^{-1} \left[ \frac{\mathbf{B}_{\mathbf{y}}^{\prime}}{\mathbf{B}_{\mathbf{x}}^{\prime}} \right]$$
(76)

$$\alpha_{n}^{\prime} = \tan^{-1} \left[ \frac{B_{\infty}}{\sqrt{\left(B_{\infty}\right)^{2} + \left(B_{\infty}\right)^{2}}} \right] = \tan^{-1} \left[ \frac{B_{Z_{\infty}}^{\prime}}{\sqrt{\left(B_{X_{\infty}}^{\prime}\right)^{2} + \left(B_{Y_{\infty}}^{\prime}\right)^{2}}} \right]$$
(77)

The magnetic angle  $\psi$  associated with the incident perpendicular component and the unit magnetic-field ratios  $(|B|/B_{\infty})_{,}$ ,  $(|B|/B_{\infty})_{,}$ ,  $(B/B_{\infty})_{,}$  in the rotated system are next determined by bilinear interpolation through the flow-field grid. Then, the magnetic-field components  $(B_{x}^{*}, B_{y}^{*}, B_{z}^{*})$  in the rotated system are calculated from

$$B_{\mathbf{x}} = \cos \alpha_{\mathbf{n}} \left[ \cos \phi \cdot \cos \alpha_{\mathbf{p}} \cdot \left| \frac{\mathbf{B}}{\mathbf{B}_{\infty}} \right|_{\mathbf{H}} + \cos \psi \cdot \sin \alpha_{\mathbf{p}} \cdot \left| \frac{\mathbf{B}}{\mathbf{B}_{\infty}} \right|_{\mathbf{I}} \right] \cdot B_{\infty}$$
(78)

$$B'_{Y} = \cos \alpha'_{n} \left[ \sin \phi \cdot \cos \alpha'_{p} \cdot \left| \frac{\tilde{B}}{B_{\infty}} \right|_{\mu} + \sin \psi \cdot \sin \alpha'_{p} \cdot \left| \frac{\tilde{B}}{B_{\infty}} \right|_{L} \right] \cdot B_{\infty}$$
(79)

$$B_{z}' = \sin \alpha_{n}' \cdot \left(\frac{B}{B_{\infty}}\right)_{n} \cdot B_{\infty}$$
(80)

The magnetic-field components in the solar-wind (X,Y,Z) system are then determined from the rotational transformation.

$$\begin{pmatrix} B_{X} \\ B_{Y} \\ B_{Z} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} B_{X}^{\prime} \\ B_{Y}^{\prime} \\ B_{Z}^{\prime} \end{pmatrix}$$
(81)

and finally in the sun-planet system from

$$\begin{pmatrix} B_{X} \\ B_{Y} \\ B_{Y} \\ B_{Z} \\ S \end{pmatrix} = \begin{pmatrix} -\cos \Omega \cos \phi_{p} & \sin \Omega & -\cos \Omega \sin \phi_{p} \\ \sin \Omega \cos \phi_{p} & -\cos \Omega & \sin \Omega \sin \phi_{p} \\ \sin \phi_{p} & 0 & \cos \phi_{p} \end{pmatrix} \begin{pmatrix} B_{X} \\ B_{Y} \\ B_{Z} \end{pmatrix}$$
(82)

#### RESULTS

Using the computational procedures developed under the current modeling effort, a large variety and number of different solarwind/planetary-ionosphere interraction results were systematically obtained. These results were directed toward the following specific objectives: (1) verification of the correctness of the procedures, (2) demonstration of their flexibility and generality for a variety of cases covering ranges typical of solar-wind conditions, (3) establishment of a catalog of flow and magnetic-field results for a large number of solarwind flows, and (4) comparisons of theoretical predictions with data obtained from spacecraft measurements. The results obtained associated with these objectives are discussed below.

Verification of the correctness of the procedures developed under the current effort primarily involved testing the computational extensions developed regarding both the gasdynamic and magnetic-field calculation methods reported in ref. 9. For the qasdynamic solver, this consists of demonstrating the extended blunt-body capability. As discussed previously in the section describing the nose-region solution and also in section A.2.1.1 of the computer manual, that extension involves the addition to the nose-region flow field of a region downstream of the dawn-dusk terminator - which is the usual plane terminating the noseregion solution. This added capability effectively removes any restriction with regard to obstacle shape and interplanetary gasdynamic Mach number of the previous procedures (ref. 9); and permits the calculation of ionopause shapes which have significant flaring in the radial direction at the dawn-dusk terminator, as well as flows at very low ( $M_m \simeq 2.0$ ) free-stream Mach numbers. In figure 10, we present results for the bow shock locations for  $M_{\rm m}$  = 8.0,  $\gamma$  = 5/3 flow past constant scale-height ionopause shapes (see eq. (36a) with  $H/R_{o} = 0.5$  and 1.0. The downstream solutions for neither of these shapes could be determined with the previous procedures (ref. 9), whereas with the present method they present no problem. The downstream locations to which the nose-region solutions were extended were  $X/R_0 = (0.54, 0.67)$ , respectively, for the  $H/R_{o} = (0.5, 1.0)$  ionopause shapes - indicating that the addition of an extensive downstream region to the nose solution for such flows is unnecessary. This is important, as the nose-region solver requires significantly more computational time for a given flow-field region than the marching solver. Hence, minimization of the nose-region flow field is essential in minimizing the total computational time.

In figure 11, we display additional results using the extended noseregion grid capability to demonstrate the ability of the current method for calculating very low interplanetary gasdynamic Mach number flows. Bow shock locations are shown for  $M_{\infty} = 2.0$  and 3.0,  $\gamma = 5/3$  flows past an

ionopause obstacle shape with gravitational variation included in scale-height having  $\overline{H}/R_{O} = 0.25$  (see eq. (36b)). This particular obstacle is a relatively blunt shape, as can be observed from the ionopause profiles presented previously in figure 1, and, computationally, presents a more difficult flow to determine than flows for shapes having less flaring. For applications to terrestrial planets, such as Mars and Venus, typical ionopause shapes occurring in nature appear to lie in the range  $0.01 \leq \overline{H}/R_{O} \leq 0.10$ . Consequently, demonstration of the ability of the current procedures to treat successfully such flows as shown in figures 10 and 11 - which lie at the limits of interest as far as applications to nonmagnetic terrestrial planets, indicates that these procedures will not be restricted insofar as ionopause geometry and interplanetary solar-wind conditions are concerned.

Corresponding verification of the extensions to the procedures for the magnetic-field calculation has involved demonstration of the correctness of the magnetic-field prediction at any arbitrary point in the solar-wind flow field. This was accomplished by consideration of a variety of special test cases in which the location in the flow field and the incident interplanetary magnetic-field orientation were systematically changed so as to produce both symmetric and antisymmetric changes in the resultant ionosheath magnetic field, as well as to reverse the roles of the perpendicular and normal components. All of these various permutations of the magnetic-field calculation procedure were successfully verified.

One of the primary objectives of the present work was to demonstrate the flexibility and generality of the present procedures by exercising them over a wide range of ionopause geometries and solar wind oncoming conditions so as to cover, insofar as possible, the entire range of practical interest of these parameters. These calculations were to be summarized in a convenient format and then archived so as to provide at-a-glance information regarding the variation of the flow-field and unit magnetic-field quantities. The output format selected was the automatic pen-plot output option of the program involving plots of the flow-field streamlines, and contours of the velocity magnitude  $|y|/v_{\infty}$ , temperature  $T/T_{\infty}$ , density  $\rho/\rho_{\infty}$ , and the field-line locations and contours of the unit magnetic-field ratios  $(|B|/B_{\infty})_{\perp}$  and  $(|B|/B_{\infty})_{\perp}$ . The test cases selected for this catalog involved a ratio of specific heats  $\gamma = 5/3$  and the following matrix of free-stream Mach numbers  $M_{\infty}$  and ionopause shapes:

$$M_{\infty} = \{2.0, 3.0, 5.0, 8.0, 12.0, 25.0\}$$
  
H/R<sub>0</sub> = {0.01, 0.10, 0.25}  
 $\vec{H}/R_0 = \{0.10, 0.20, 0.25\}$ 

Thus, a total of 36 separate cases were calculated. The plot output for these cases is provided in Appendix B, which also presents a convenient page index to the individual results. These archived results provide an very convenient means of determining the overall dependence of flowfield and magnetic-field quantities with  $M_{\infty}$  and obstacle shape, in particular the variation of bow shock location and flow-field contour changes. We note that the range of free-stream Mach numbers selected easily spans the entire range of solar-wind conditions usually encountered, while the different obstacle shapes provide a wide variation as well, as can be observed from figure 1.

The final and ultimate check of the current procedures lies in the comparison of the results predicted by the present model with data actually measured by a spacecraft. To that end, we have made a number of preliminary comparisons with data obtained from orbits 3 and 6 of the Pioneer-Venus Orbiter spacecraft.

The overall features of the spacecraft trajectory crossings of the solar-wind/Venus-ionosphere interaction region are provided in the sketch given in figure 12. In that figure, which is referred to the sun-Venus solar-ecliptic coordinate system, we note in particular the highly elliptic spacecraft orbit (periapsis  $\approx 200$  Km, apoapsis  $\approx 66,000$  Km) and the crossings of the bow shock and ionopause surfaces. The oncoming solar-wind direction, with arbitrary azimuthal (aberration) and polar angles  $(\Omega, \phi_p)$  is as indicated, with the ionopause and bow shock surfaces symmetric about that direction. The oncoming arbitrary interplanetary magnetic field B is also as indicated.

The procedural outline employed for the theoretical comparisons is as follows:

I. Orbital data selection

Select data from an orbit when solar-wind conditions are relatively steady.

II. Theoretical calculations

Input:

Ionospheric  $\rho$  and T versus altitude from orbiter retarding potential analyzer (ORPA)

Solar wind  $y_{m}$ ,  $\rho_{m}$ ,  $T_{m}$  from orbiter plasma analyzer (OPA)

Solar wind B from orbiter magnetometer (OMAG)

Trajectory coordinates

Output: (Contours and/or time histories along orbital trajectory)

Ionosheath  $\rho$ , T, y, B and their scalar components in solar ecliptic coordinates

III. Comparisons with Spacecraft data

Observational ionosheath data for  $\rho$ ,  $|\underline{v}|$ , T from OPA and for B from OMAG with two sets of theoretical predictions based on  $\{last \\ first \}$  interplanetary solar-wind properties  $(v_{\infty}, T_{\infty}, \rho_{\infty}, B_{\infty})$ measured  $\{before \\ after \}$  bow shock  $\{lnbound \\ outbound \}$  crossings.

First, the selection of the particular orbit for which theoretical calculations and data comparisons will be carried out must be made. This choice is based on spacecraft observations of the oncoming interplanetary solar wind, and for the cases reported here, the selections were made when conditions appeared relatively steady. In particular, the interplanetary conditions regarding solar-wind velocity, density, temperature and magnetic field based on the orbiter solar-wind plasma analyzer (OPA) and fluxgate magnetometer (OMAG) measurements just prior

to inbound bow shock crossing and immediately after outbound bow shock crossing were analyzed by the Pioneer-Venus investigators responsible for these instruments for a number of the initial orbits of the Pioneer-Venus spacecraft, and on this basis the selection of Orbits 3 and 6 were made.\*

To initiate the theoretical calculations, information regarding both the ionospheric obstacle shape and the oncoming interplanetary conditions are required. The determination of the obstacle shape is based on measurements of atmospheric density and temperature as a function of altitude made by the orbiter retarding potential analyzer at (ORPA) locations interior to the ionopause boundary.\*\* These measurements yield the variation of atmospheric pressure with altitude in the vicinity of ionopause altitudes. From this information, the value of the scale-height parameter from the atmospheric pressure model given by either eq. (29) or (30) can be determined. For Venus, it appears that the ionosphere/solar-wind interaction is such that the ionopause wraps tightly about the planet (ref. 10). Our calculations based on ORPA data for Orbits 3 and 6 indicate scale heights of approximately 200 Km, which yield a corresponding range of values for H and  $\overline{H}$  of 0.02  $\leq$  H/R,  $\overline{H}/R$   $\leq$  0.05. We note that for such small values of scale height, the two ionospheric pressure models eqs. (29) and (30) yield essentially the same obstacle shape, as can be seen from figure 1. For the comparisons reported here for both Orbits 3 and 6, we have selected a value of  $\overline{H}/R_{o} = 0.03$ . With regard to oncoming interplanetary conditions, we require as input the solar-wind bulk velocity  $\underline{v}_{\infty}$ , density  $\rho_{\omega}$ , temperature  $\underline{T}_{\omega}$ , and magnetic field  $\underline{B}_{\infty}$ . The first three are provided by the orbiter plasma analyzer (OPA), while the magnetic field is given by the orbiter fluxgate magnetometer (OMAG). We note that the OPA provides either ion density and temperature or electron density and temperature, but not both simultaneously. For orbits 3 and

Special thanks are due to J. H. Wolfe and J. P. Mihalov who provided information regarding the solar-wind plasma from OPA measurements (refs. 21,22) and to C. T. Russell, R. C. Elphic, and J. A. Slavin for magnetic-field information from OMAG measurements (refs. 23,24).

<sup>&</sup>lt;sup>3</sup>Special thanks are due to W. C. Knudsen and K. Spenner for providing the ionospheric plasma information from ORPA measurements (refs. 10,11).

6, ion measurements were available and have been employed. Information regarding the oncoming direction of the solar wind, as given by the angles  $(\Omega, \phi_p)$ , defines the requisite coordinate rotations required to align the gasdynamic calculation in the oncoming solar-wind direction; while information of solar-wind speed, density, and temperature serve to define the oncoming gasdynamic Mach number required to initiate the gasdynamic calculations.

With this information, the detailed gasdynamic and unit magnetic-field calculations in the ionosheath region can be carried out. In order to provide an idea of the detail obtained by the present computational procedures in these calculations, we have displayed in figure 13 the flow-field grid for one of the gasdynamic flow solutions used in the data comparisons discussed below. The result shown is for  $M_{\infty}$  = 3.0,  $\gamma$  = 5/3 flow past an ionopause obstacle shape with  $\overline{H}/R_{o}$  = 0.03, and is shown carried to a downstream location of  $X/R_0 = 3.0$ . The flow field properties  $[v/v_{\infty}, \rho/\rho_{\infty}, T/T_{m}]$  and the unit frozen magnetic-field ratios  $[(B/B_{\infty})_{\mu}, (B/B_{\infty})_{\mu}, (B/B_{\infty})_{\mu}]$  are determined at each intersection of the grid lines, including the bow shock, stagnation streamline, and ionopause boundaries. The final output of the calculaton consists of detailed flow-field and magnetic-field properties in the ionosheath region, both in terms of tabular output and plotted contours and time histories along the orbital trajectory of the velocity magnitude and components, density, temperature, and magnetic-field magnitude and components. Complete details are provided in section A.4 of the Computer User's Manual.

For the comparisons with spacecraft data, the most convenient portion of the output format are the time-history predictions along the spacecraft orbit. The observational data used for comparisons with the theoretical predictions in the ionosheath region include plasma density, velocity, and temperature from OPA measurements and magnetic field from OMAG measurements. For the theoretical predictions, two sets of results are usually generated based on  $\begin{cases} last \\ first \end{cases}$  interplanetary solarwind properties  $(v_{\infty}, T_{\infty}, \rho_{\infty}, B_{\infty})$  measured  $\begin{cases} before \\ after \end{cases}$  bow shock  $\begin{cases} inbound \\ outbound \end{cases}$ crossing.

In figure 14, we have displayed some overall flow-field results for Orbit 6. Indicated in that figure are bow shock locations for the three combinations of free-stream Mach number  $M_{\infty}$  and plasma specific heat ratio  $\gamma$ , i.e.  $(M_{m}, \gamma) = (13.3, 5/3)$ , (13.3, 2), (3.0, 5/3) for flow about an ionopause with  $\overline{H}/R_{\odot}$  = 0.03. Also indicated are two sets of points (- $\odot$ -, - $\Box$ -) representing the spacecraft trajectory for orbit 6 as viewed in two solar-wind oriented coordinate systems. The trajectory indicated by the solid lines and circles  $(-\bigcirc -)$  is that based on the last measured direction  $(\Omega, \phi_n) = (6.5^\circ, -1.4^\circ)$  of the interplanetary solar wind just prior to crossing the bow shock on the inbound leg, while the dashed line and squares (-- []--) denotes the trajectory based on the first measured direction  $(\Omega, \phi_p) = (4.9^\circ, 7.6^\circ)$  of the solar wind immediately after crossing the bow shock on the outboard leg. We note that the spatial location of the spacecraft trajectory in solar-wind coordinates depends only on the direction  $(\Omega, \phi_n)$  of the oncoming solar wind, but not on its magnitude. With regard to the results indicated in figure 14 for the spacecraft trajectory, we observe the extremely large dependence of spatial position of a trajectory point, as viewed in solar-wind coordinates, on solar-wind direction. For the particular inbound and outbound solar-wind angles indicated, the shift in X-coordinate of a trajectory point can be as high as a quarter of the Venusian planetary radius, which obviously results in substantial differences in predicted flow and magnetic-field properties. In previous work, the influence of the angular shift in the solar wind was generally considered to be small and negligible. The current results, however, indicate that this purely geometrical effect can be surprisingly large, even for directional shifts of less than 5°, and must be accounted for in any realistic theoretical comparison with data. See reference 7 for another example of the importance of this effect.

Finally, with regard to the three sets of bow shock results displayed in figure 14, these calculations represent an attempt to resolve the uncertainty in the oncoming free-stream Mach number and ratio of specific heats of the plasma. Because only solar-wind ion temperatures from the OPA were available for Orbit 6, the initial calculation of the free-stream Mach number was based on the assumption that  $T_e = T_i$ , which leads to  $M_{\infty} = 13.3$ . A ratio of specific heats  $\gamma = 5/3$  was assumed, and these interplanetary values result in the bow shock indicated by the

dot-dash line. That shock location is in poor agreement with the observational shock crossings, indicated as occurring between the pairs of solid circles and squares. A separate uncertainty arises from the possibility that the magnetic field may act to align the plasma particle motion in its direction, thus effectively reducing the number of degrees of translational freedom from 3 to 2 and thereby increasing the ratio of specific heats from 5/3 to 2. To investigate this possibility, we have repeated the  $M_{\infty}$  = 13.3 calculation using  $\gamma$  = 2. That result is indicated by the dashed line, and is in better but still not completely satisfactory agreement with the observed shock locations. Finally, if it is assumed that the oncoming interplanetary electron temperature is not equal to the ion temperature, but is substantially higher, we are lead to low Mach numbers of the order of M  $\simeq$  3-5. We have displayed bow shock results of a  $M_m$  = 3.0,  $\gamma$  = 5/3 calculation in figure 14 as the solid line, and observe that based on this Mach number and the inbound solar-wind direction, the observational shock crossings display very good agreement with the theoretical results.

Figure 15 displays the time-history comparisons of the theoretically-predicted bulk plasma density, speed and temperature in the ionosheath region with OPA measurements of these quantities. These theoretical results were based on a gasdynamic flow solution with  $M_{m}$  = 13.3,  $\gamma$  = 2.0. In these results, the solid lines with circles correspond to results based on inbound interplanetary conditions, while the dashed lines with squares correspond to outbound conditions. We note that while the few data points available are in general agreement with the theoretical calculations, the lack of more detailed plasma measurements in the ionosheath prevents a definitive conclusion. The OPA instrument requires approximately 9 minutes to acquire sufficient data to enable predictions of the bulk plasma quantities. While this time lag presents no problem when the spacecraft is in the interplanetary solar wind, the large resolution time effectively averages the plasma quantities in the ionosheath over such a large spatial range that only overall comparisons of the bulk plasma properties are possible.

The situation is quite different for the magnetic field, as the OMAG instrument provides essentially instantaneous magnetic-field measurements. Comparisons of the frozen magnetic-field predictions with data

are displayed in figures 16(a,b). These comparisons employ the gasdynamic solution  $M_{m}$  = 13.3,  $\gamma$  = 2 for which plasma properties were given in figure 15. In figure 16a, we display two sets of theoretical calculations for the magnitude of the magnetic field, based on the inbound and outbound interplanetary magnetic field conditions as indicated on the figure. In these comparisons, we observe very good agreement with both sets of predictions. In particular, on the inbound leg, the theoretical predictions based on the inbound interplanetary conditions are in very good agreement with the data, while the outboundcondition predictions are clearly not as favorable. On the other hand, as we proceed in time along the outbound leg, the opposite is true. Here, the outbound-condition predictions are in very good agreement with the data, while the inbound-condition predictions are notably inferior, particularly with regard to shock crossing. Corresponding results for the magnetic-field components are provided in figure 16b, and display a similar behavior. The agreement of the theoretical results with data for the individual components is remarkable, confirming the accuracy of the frozen-field model, as well as the shift of the ionosheath magnetic field from a solution related to inbound interplanetary conditions to one related to outbound conditions.

For Orbit 3, similar comparisons as those shown in figures 14-16 for Orbit 6 are given in figures 17 to 19. In figure 17, we have provided the bow shock locations for five different combinations of  $M_{\infty}$  and  $\gamma$  as indicated. The Mach numbers  $M_{\infty} = 7.38$ , 5,96 correspond, respectively, to the inbound and outbound interplanetary conditions for  $|y_{\infty}|$ ,  $\rho_{\infty}$ ,  $T_{\infty}$  as measured by the OPA, while the two values of  $\gamma = 5/3,2$  used in the calculations represent our uncertainty of the ratio of plasma specific heats. We have also indicated for reference the bow shock location for  $M_{\infty}$ = 3.0,  $\gamma = 5/3$  as given previously in figure 14 for Orbit 6. Note that the observational shock crossings are again closest to the  $M_{\infty} = 3.0$ ,  $\gamma = 5/3$  shock. Also provided in figure 17 are the orbital trajectories as viewed in solar-wind coordinates for the inbound  $(\Omega, \phi_p) = (3.3^{\circ}, 0.15^{\circ})$ and outbound  $(\Omega, \phi_p) = (3.7^{\circ}, 4.9^{\circ})$  solar-wind directions.

The comparisons for the bulk plasma properties for Orbit 3 are provided in figure 18. Again we note an overall agreement for bulk plasma speed and density, but note an observable discrepancy in the temperature.

This is thought to be indicative of the manner in which the bulk properties from the theoretical model are being interpreted in relation to the observational measurements; i.e. the theoretical values correspond to those for a single-component plasma, while the measurements are in terms of a multi-component plasma. Whether the theoretical plasma properties require rescaling or reformulation, or whether their present formulation is appropriate for comparison with the multi-component data, appears to be a necessary and important subject for future study.

Results for the magnetic-field comparisons are displayed in figures 19(a,b), which provide time-histories of both the magnitude and the individual magnetic-field components based on both inbound and outbound interplanetary conditions. We note again, although the shock crossing comparisons are somewhat in disagreement since the gasdynamic flow fields used in these results were for  $M_{\infty} = 7.56$ , 5.96 and  $\gamma = 2$ , the reasonable comparisons are obtained for the ionosheath magnetic field. In particular, we observe the drift with time along the trajectory of the trajectory of the agreement of theory with data from the predictions based on inbound interplanetary conditions on the inbound leg, to those based on outbound conditions on the outbound leg.

In order to demonstrate the improvement obtained in magnetic-field results when a gasdynamic flow-field solution is employed which more closely agrees with the observational bow shock location, we have displayed in figure 20(a,b) the analogous time-history magnetic-field comparisons when using a  $M_{\infty} = 3.0$ ,  $\gamma = 5/3$  gasdynamic result. In this case, results were computed for only the inbound direction  $(\Omega, \phi_p) =$  $(3.3^\circ, 0.15^\circ)$  of the solar wind. As can be seen, there is a marked improvement in the agreement near the bow shock, and quite good agreement throughout the ionosheath as well as, for both the magnitude and the individual magnetic-field components. We note that the general agreement of theory and observation of the individual components demonstrates both the accuracy of the calculation and, in particular, the need for accounting in the theoretical results of the variable direction of the interplanetary solar wind.

#### CONCLUDING REMARKS

The application of advanced computational procedures was undertaken for the purpose of modeling the interaction of the solar wind with nonmagnetic planets, with particular emphasis on Venus. Based on the successful theoretical model employed previously (ref. 9), i.e., the steady, dissipationless, magnetohydrodynamic model for axisymmetric, supersonic, super-Alfvénic solar-wind flow, a number of important theoretical extensions have been developed and included in the computational procedures. These include the capability for treating very low oncoming interplanetary gasdynamic Mach numbers ( $M_m \approx 2.0$ ), as well as quite general ionopause shapes. A new family of ionopause shapes has been developed which includes the effect of gravitational variation in scale height, and has been incorporated in the computational program. Additionally, the capability for determining the plasma gasdynamic and magnetic-field properties along any arbitrary spacecraft trajectory, accounting for an arbitrary oncoming direction of the solar wind, has been developed. All of these developments have been incorporated into an assemblage of computer codes to enable detailed calculations of the solar-wind interaction with planetary atmospheres. The computer codes have been extensively documented and are described in a computer user's manual included as part of this report.

Comparisons are reported which verify the correctness of these new procedures, and which demonstrate their capability for computing a wide range of flows encompassing those typical of solar-wind conditions about terrestrial planetary atmospheres. A catalog of sample solar-wind flows covering a large number of flow conditions and ionopause geometries was established, and reported in summary format in the forms of contour plots of important flow-field and magnetic-field properties. Finally, successful comparisons of results from the theoretical model were made with actual spacecraft data obtained from initial orbits of the Pioneer-Venus Orbiter. These results have indicated the importance, heretofor largely neglected, of the directional variability of the oncoming solar wind. All of these results, taken in toto, serve to verify the basic theoretical model which underlies the present procedures. Furthermore, it demonstrates the value of the present computational procedures as a research tool capable of routinely providing - at small computation cost

and in a format directly compatible with experimental observations - details of the solar-wind/planetary atmosphere interaction process not previously attainable.

With regard to future uses as well as improvements of the present model, the obvious need for a detailed study involving comparisons between theory and observations for a large number of orbits of the Pioneer-Venus Orbiter is clear. Based on the preliminary comparisons for orbits 3 and 6, the frozen magnetic-field model appears to be remarkably accurate for relatively quiet-time conditions. Similar comparisons of the plasma properties indicate a need for an improved interpretation of the results from the single-fluid theory in terms of multi-component measurements. Questions regarding the possible suppression by the interplanetary magnetic field of the number of degrees of freedom of the plasma require further study and could be clarified through systematic comparisons with data. Additionally, observations from the Pioneer-Venus Orbiter of the nightside ionosphere of Venus have indicated a more complex and dynamic structure than suspected. These observations point, in particular, toward the need for improvement of the simple model used in the present method for the determination of the ionosphere boundary. This improved determination would involve an iterative procedure in which a balance of the sum of the solar-wind gasdynamic plus magnetic pressure along the ionopause surface would be maintained against the ionospheric pressure. The present method, which balances the Newtonian pressure distribution against the ionospheric pressure, represents the first step in this iteration.

#### ACKNOWLEDGEMENTS

Support for the research reported in this investigation was provided by National Aeronautics and Space Administration, Headquarters under Contract NASW-3182 with Robert Murphy as Technical Monitor. Special thanks are given to J. H. Wolfe and J. D. Mihalov for generously providing solar-wind plasma information from Pioneer-Venus Orbiter plasma analyer measurements, to C. T. Russell and J. A. Slavin for magnetic field information from Pioneer-Venus Orbiter fluxgate magnetometer measurements, and W. C. Knudsen for ionosphere plasma information from Pioneer-Venus Orbiter retarding potential analyzer measurements.

# APPENDIX A

# COMPUTER PROGRAM USER'S MANUAL

# APPENDIX A

# COMPUTER PROGRAM USER'S MANUAL

## TABLE OF CONTENTS

Section			Page No.
A.1	INTROE	DUCTION	53
A.2	PROGRA	54	
	A.2.1	Calculation Procedure	56
		A.2.1.1 Blunt-body calculation	56
		A.2.1.2 Marching calculation	58
		A.2.1.3 Streamline calculation	59
		A.2.1.4 Magnetic-field calculation	61
		A.2.1.5 Contour calculation and plot generation	64
		A.2.1.6 Trajectory calculation	65
	A.2.2	Rerun Option	70
	A.2.3	Program Limitations and Precautions	70
	A.2.4	Convergence Criteria for Blunt-Body Calculation	71
A.3	DESCRI	72	
	A.3.1	Dictionary of Input Variables	72
	A.3.2	Preparation of Input Data	77
	A.3.3	Format of Input Data	81
A.4	DESCRI	85	
A.5	PROGRA	87	
A.6	SAMPLE	E CASE	90
FIGURES A.1 THROUGH A.6			92

This Page Intentionally Left Blank

•

#### APPENDIX A

## A.1 INTRODUCTION

The purpose of this appendix is to describe the operation of the assemblage of computer codes which were developed in conjunction with the theoretical work presented in this report and organized into one program, and to provide sufficient detail to permit understanding and use of the program. The program computes the flow field of the solar wind about a terrestrial planet, using a procedure for the calculation of supersonic/hypersonic flow about an axisymmetric blunt body. The corresponding frozen-in magnetic field is calculated from the previously-determined velocity and density fields. Streamlines and contour lines of various flowfield properties and magnetic-field components are also determined. Next, these flow-field and magnetic-field values are calculated for points along a user-specified trajectory.

A description of the general operating procedure of the program is given, with descriptions of input and output. The program is written in FORTRAN IV and has been developed on a CDC 7600 computer. University Computing Company (UCC) Standard Plotting Software and Functional Software packages are used to produce automated plots. Files used, besides TAPE5 for INPUT and TAPE6 for OUTPUT, are TAPE1 for the plot file (system default), TAPE4 for input file for rerun option, and TAPE9 for storing data for rerun. Typical run times for cases using the default parameters are 110 to 120 seconds, using the OPT=2 compiler. For a case using the rerun option, which employs a previously-calculated flow field, the run time is approximately 15 seconds. The storage requirements are 146K<sub>8</sub> for small core memory and 273K<sub>8</sub> for large core memory.

#### A.2 PROGRAM DESCRIPTION

For computational purposes, the flow is subdivided into two regions, as indicated in the sketch below, with the center of the planet as origin.



The region near the nose of the magnetopause/ionopause includes all of the imbedded subsonic flow and part of the supersonic flow. An axisymmetric implicit unsteady Euler equation solver is used to calculate this part of the flow field. Using the solution plane at x = 0.0 to provide starting conditions, the flow field in the purely supersonic downstream region is determined by integrating the steady Euler equations using a spatial-marching procedure. Streamlines, the magnetic field, and contours are calculated using the entire flow field, distinguishing between the two regions as required by the different forms of the computational grids. A rerun capability is provided, where flow-field data is read from a file written on a previous run, rather than repeating the blunt-body and marching calculations. The computations proceed as shown in the sketch below, which provides an overall flow chart of the complete program. The program provides for several cases to be run consecutively.





#### A.2.1 Calculation Procedure

After reading in the number of cases in the run, each case is calculated independently. Subroutine INPUT reads in all card input required for one case, viz. a title, flow conditions, obstacle geometry, calculation and print control parameters, and desired contour values. The user may supply the obstacle geometry in the form of a shape table for an axisymmetric body, or use one of the default shapes which are calculated internally by the program. These default shapes are the magnetopause equatorial trace, constant scaleheight ionopauses, and ionopauses having gravitational variation in scale-height. The input is printed as the first item of output.

#### A.2.1.1 Blunt-body calculation

A computational mesh in polar  $(R_p, \theta)$  coordinates is established for the blunt-body calculation; then, for the marching calculation, this is extended into a cylindrical (x,R) system, as indicated below:



This method has proven effective except for certain obstacle shapes which have a significant amount of flaring at the terminator and/or cases involving low free-stream Mach numbers  $M_{\infty} \leq 3$ . Under such conditions, the axial component of velocity may become subsonic at the starting plane of a marching calculation (terminator) and the calculation cannot proceed. In this case the blunt-body grid must be extended past  $\theta = 90^{\circ}$  as shown below:



The number of rays added to the blunt-body mesh is controlled by the input variable NXADD, and are limited by the requirement, NBLUNT + NXADD < 39.

All lengths, x, R,  $R_{p}$ , are normalized so that the nose of the obstacle is at x = 1.0. For the default shapes, rays at equal angular increments of  $\Delta\theta$  are used, starting at  $-\Delta\theta/2$ , up to 90° +  $\Delta \theta$ , where  $\Delta \theta = 90^{\circ}/(\text{NBLUNT}-1.5)$ , and NBLUNT is an input parameter describing the number of angular mesh points to be used in the bluntbody calculation. Program default value is NBLUNT = 24, so that for the default mesh,  $\Delta \theta = 4^{\circ}$ . The obstacle shape is determined by integrating the appropriate differential equation by a trapezoidal predictor-corrector method. For a user-supplied shape, the  $\theta$  grid is determine by rays from the origin through the first NBLUNT points, and the reflection of the first ray about the x-axis. Values for  $R_p$ are determined by dividing the line segments between the body and bow shock wave into NR-1 equal intervals. Thus, including the obstacle and bow shock wave, the grid forms NR arcs around the obstacle. A starting solution for the blunt-body calculation is obtained by guessing a bow shock shape and by prescribing a Newtonian pressure distribution on the body. Noting that the maximum entropy streamline wets the body, other flow properties on the body surface can then be calculated. An initial flow field is then established by linear interpolation between the obstacle and the guessed bow shock, where the Rankine-Hugoniot relations hold. The integration proceeds in time for ITER steps. The initial bow shock shape used for the magnetopause equatorial trace and for an

ionopause with  $H/R_o \ge 0.1$  is a correlation shape depending on  $(M_{\infty}, \gamma, H/R_o)$  and given by the parabola  $R_p = \delta_1 \sqrt{\delta_0 - x} / \sqrt{\delta_0}$  where

$$\begin{split} \delta_{0} &= 1.0 + 1.1 \left\{ \left[ (\gamma - 1) M_{\infty}^{2} + 2 \right] / (\gamma + 1) M_{\infty}^{2} \right\} \times (0.9 + 0.5 \text{ H/R}_{0}) \\ \delta_{1} &= \Delta_{0} \left\{ (1.273 + 0.009 \text{ M}_{\infty}^{2}) (0.904 + 0.655 \text{ H/R}_{0}) \\ &\times [3.95 - 5.3 \text{ H/R}_{0} + 3.85 \text{ (H/R}_{0})^{2}] \right\} + (R_{\text{body}})_{x} = 0.0 \\ \Delta_{0} &= [(\gamma - 1) M_{\infty}^{2} + 2] / [(\gamma + 1) M_{\infty}^{2}] \times 0.78 \end{split}$$

For a user-supplied obstacle shape and for an ionopause with  $H/R_0 < 0.1$ , the initial shock shape used is the curve  $R_p = \sqrt{[1 + \Delta_0(1 + 0.68 \ \theta^2 + 0.16 \ \theta^4)]}$ . Information on convergence, the final sonic line locations, and the body and final bow shock shape are printed from this calculation.

The flow chart for the blunt-body code is shown in Figure A.1(a).

## A.2.1.2 Marching calculation

The results at the  $\theta = 90^{\circ}$  plane of the blunt-body calculation are used as starting conditions for the marching calculation, after proper variable normalization for the internal marching calculation. For default geometries, the obstacle shape is determined by integration of the appropriate differential equation proceeding from the nose downstream at equal  $\theta$  increments to form a body-shape table. The stepsize along the x-axis is recalculated at every ICONST(49) with ICONST(49) being set to 10. At each x-location,  $R_{body}$  is determined by linear interpolation. The computational mesh is extended by adding the line perpendicular to the x-axis at each step, divided in the same manner as for the blunt nose. The calculation marches downstream with a maximum stepsize of 1.0 until the terminal location specified

by the user has been passed. However, the number of steps is limited to 75, after which the calculation will end regardless of the x-location. The coordinates of the obstacle and bow shock are printed at each step.

The grid coordinates and flow-field values are written to a file, TAPE9, which may be saved to use as input for a later run. This rerun option, which replaces construction of the computational mesh and performance of the blunt-body and marching calculations with the reading of the rerun input file TAPE4, is described in section A.2.2. The flow chart for the marching calculation is provided in figure A.1(b).

## A.2.1.3 Streamline calculation

The streamlines are calculated in two sections, following each of the flow-field calculations. Using the results of the blunt-body calculation, i.e. the (x,R) grid coordinates,  $(R_p,\theta)$  grid coordinates, density  $\rho/\rho_{\infty}$ , and velocity components  $v_X/v_{\infty}$  and  $v_R/v_{\infty}$ , the velocity magnitude  $|y|/v_{\infty}$  and flow angle  $\phi$  are calculated. Density  $\rho/\rho_{\infty}$  and velocity magnitude  $|y|/v_{\infty}$  are first smoothed along the rays of constant- $\theta$ , using a third-degree least-squares fit with respect to  $R_p$ . Streamlines are then calculated downstream to x = 0.0, using the trajectory method and integrating through the velocity field by means of a third-order modified Euler integration procedure with the grid locations on the bow shock used as starting positions. The flow angle  $\phi = \tan^{-1}(v_R/v_X)$  at each point is determined using bivariate linear interpolation first in  $\theta$ , then  $R_p$ . Points for which  $\theta < 0^\circ$  or  $\theta > 90^\circ$  are discarded in the interpolation.

The marching calculation provides (x,R) grid coordinates, and values of density  $\rho/\rho_t$ , and velocity components  $v_X/v_t$  and  $v_R/v_t$ , where t denotes free-stream stagnation conditions. For compatibility with the blunt-body solution, the flow-field values are converted to  $\rho/\rho_{\infty}$ ,  $v_X/v_{\infty}$ ,  $v_R/v_{\infty}$  before calculating the resultant velocity magnitude

 $|\underline{v}|/v_{\infty}$  and flow angle  $\phi$ . The streamline calculation is continued downstream, employing the same method as in the nose region. Starting positions on the shock wave for the streamline calculation in the marching zone are set at equal R-increments, with a maximum of 50 streamlines calculated. The flow angle is determined using bivariate linear interpolation first in x, then in R.

Along the symmetry axis, values of x,  $\rho/\rho_{\infty}$ , and  $|\underline{y}|/v_{\infty}$  are determined by extrapolation, using a third-order Lagrangian polynomial in  $\theta$  on each arc of the computational grid. Exact values for the stagnation streamline are used where possible, viz. at the bow shock

$$\rho/\rho_{\infty} = (\gamma+1)M_{\infty}^2/[(\gamma-1)M_{\infty}^2 + 2]$$
$$|\mathbf{y}|/\mathbf{v}_{\infty} = 1/(\rho/\rho_{\infty})$$

at the body surface

$$\rho/\rho_{\infty} = (\rho/\rho_{\infty})_{\text{shock}} \cdot \left\{ \left[ \left[ (\gamma+1)M_{\infty} \right]^2 / \left[ 4\gamma M_{\infty}^2 - 2(\gamma-1) \right] \right]^{1/(\gamma-1)} \right\}$$
$$|\underline{v}|/\underline{v}_{\infty} = 0.0$$
$$x = 1.0$$

Detailed flow-field output may now be printed by subroutine FLOUT, with LPRFL as print control variable. In addition to grid coordinates, density, velocities and flow angle, values of temperature  $T/T_{\infty}$  and pressure P/P<sub>m</sub> are output, where

$$T/T_{\infty} = 1 + [(\gamma - 1)/2] \cdot M_{\infty}^{2} \cdot [1 - (|v|/v_{\infty})^{2}]$$
$$P/P_{\infty} = (\rho/\rho_{\infty}) (T/T_{\infty})$$

Streamline coordinates may also be printed by subroutine STOUT, with LPRST as print control variable. A plot of the streamlines is generated if the variable LPLOT is true. A flow chart of the streamline calculation is shown in figure A.1(c).

## A.2.1.4 Magnetic-field calculation

The magnetic field is determined by separately calculating the unit components whose directions are parallel, perpendicular, and normal to the flow, in the undisturbed solar wind. These components are then added vectorially, the resultant being expressed in orthogonal (x,y,z) components. The angles in the free stream  $\alpha_p$  and  $\alpha_n$  between the magnetic field and the flow, as shown in the sketch below, are either input or, in the case of a trajectory calculation, are calculated internally from the input interplanetary magnetic field.



The magnetic-field components are calculated using the following formulae in which e signifies a vector of magnitude e in the direction of the component field line, and  $\hat{n}$  the unit normal vector.

$$\begin{pmatrix} \frac{B}{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{u}} = \begin{pmatrix} \frac{V}{v_{\infty}} \end{pmatrix} \begin{pmatrix} \frac{\rho}{\rho_{\infty}} \end{pmatrix}; \quad \begin{pmatrix} \frac{B}{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{L}} = \begin{pmatrix} \frac{\Delta \ell}{\Delta \ell_{\infty}} \end{pmatrix} \begin{pmatrix} \frac{\rho}{\rho_{\infty}} \end{pmatrix}; \quad \begin{pmatrix} \frac{B}{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{n}} = \begin{pmatrix} \frac{R}{R_{\infty}} \end{pmatrix} \begin{pmatrix} \frac{\rho}{\rho_{\infty}} \end{pmatrix}$$
$$\begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{m}} = \begin{pmatrix} \frac{B}{R_{\infty}} \end{pmatrix} \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{n}} + \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \end{pmatrix}_{\mathbf{m}} \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} + \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{m}} \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix}_{\mathbf{m}} \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B_{\infty}} \end{pmatrix} = \begin{pmatrix} \frac{B}{R_{\infty}} \\ \overline{B_{\infty}} \\ \overline{B$$

The magnetic-field line vector component  ${\tt B}_{\tt w}$  which results from the interplanetary component  $\mathbf{B}_{\mathbf{w}_{\mathbf{n}}}$  that is parallel to the undisturbed solar flow has local magnitude given by ( $|y|/v_{\infty}$ ) ( $\rho/\rho_{\infty}$ ), and the same local direction  $\phi$  as the fluid flow. Determination of the normal magnetic-field component  ${\rm B_n}$  requires calculation of  ${\rm R/R_{\infty}}$  , where  ${\rm R_{\infty}}$ is the free-stream cylindrical R-ordinate of the streamline through the point under consideration. This is calculated by linearly interpolating in the local radial cylindrical coordinate R between the streamlines, with  $R/R_{\infty} = 1.0$  along the x-axis. The magneticfield vector component  $\underline{B}_{\perp}$  resulting from the interplanetary component  $B_{m}$ , which is perpendicular to the undisturbed solar-wind flow requires the distance vector  $\Delta \ell / \Delta \ell_{\infty}$ , whose magnitude is  $|\Delta \ell| / \Delta \ell_{\infty}$  and direction is  $\psi$ , where  $|\Delta \ell| / \Delta \ell_{\infty}$  is the stretching factor of the perpendicular field at the point, and  $\psi$  is the direction of the field line through the point. The magnitude and direction of  $\Delta \ell / \Delta \ell_m$  are calculated according to

$$\frac{|\Delta \ell|}{\Delta \ell_{\infty}} = \frac{\mathbf{d}_1 \cdot \mathbf{d}_2}{\mathbf{d}_1 + \mathbf{d}_2} \cdot \frac{1}{\Delta \ell_{\infty_1} + \Delta \ell_{\infty_2}}$$

and

$$\psi = \frac{\tan^{-1} \left( \frac{\Delta r_1}{\Delta x_1} \right) \cdot d_2 + \tan^{-1} \left( \frac{\Delta r_2}{\Delta x_2} \right) \cdot d_1}{(d_1 + d_2)}$$

where the quantities  $d_1$ ,  $d_2$ ,  $\Delta x_1$ ,  $\Delta x_2$ ,  $\Delta r_1$ ,  $\Delta r_2$ ,  $\Delta \ell_{\infty 1}$ , and  $\Delta \ell_{\infty 2}$ are described by the sketch below. The points marked (•) on the streamlines represent equal-time intervals in the flow.



The perpendicular field lines are determined by integrating  $\int y dt$ along each streamline, using trapezoidal integration to locate points along the streamline at regular increments in time,  $\Delta t$ , starting at a perpendicular field line ahead of the bow shock. Values for  $|\Delta \ell| / \Delta \ell_{\infty}$ and  $\psi$  are calculated at the points where the perpendicular field lines and streamlines intersect, interpolating only along the field lines. A generalized quadrilateral interpolation scheme is then employed to determine  $|\Delta \ell| / \Delta \ell_{\infty}$  and  $\psi$  at the computational grid points, using the quadrilateral containing the point formed by the intersection of pairs of adjacent streamlines and perpendicular field lines. At the bow shock, an exact formula is used, viz.

$$(|\Delta \ell| / \Delta \ell_{\infty})^{2} = 1 + \cot^{2} \theta (1 + D^{2}) - 2D \times \csc \theta \times \cot \theta \times \cos (\theta - \delta)$$
$$\psi = \theta + \sin^{-1} [D \times \cot \theta \times \sin (\theta - \delta) / (|\Delta \ell| / \Delta \ell_{\infty})]$$

where

$$D^{2} = 1 - 4 (M_{\infty}^{2} \sin^{2} \theta - 1) (\gamma M_{\infty}^{2} \sin^{2} \theta + 1) / [(\gamma + 1)^{2} M_{\infty}^{4} \sin^{2} \theta]$$
  

$$\cot \delta = \tan \theta \times \{ (\gamma + 1) M_{\infty}^{2} / [2 (M_{\infty}^{2} \sin^{2} \theta - 1)] - 1 \}$$
  

$$\theta = \tan^{-1} \left( \frac{dR_{shock}}{dx} \right)$$

The values of  $|\Delta \ell| / \Delta \ell_{\infty}$  at the grid points are smoothed using fifthorder least-squares fit with respect to arc length along the arcs of th grid. The resultant magnetic field can then be expressed in orthogonal (x,y,z) components. The code determines these components for the case when the field point is located in the (x,y) plane, i.e., z = 0. These components are given by

$$B_{X}/B_{\infty} = \cos \alpha_{n} \times [\cos \phi \times \cos \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n} + \cos \psi \times \sin \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n}]$$

$$B_{Y}/B_{\infty} = \cos \alpha_{n} \times [\sin \phi \times \cos \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n} + \sin \psi \times \sin \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n}]$$

$$B_{Z}/B_{\infty} = \sin \alpha_{n} \times (B/B_{\infty})_{n}$$

Magnetic-field components may now be printed by subroutine BOUT, with LPRB as print control parameter. The magnetic field is not calculated when LPRB = .FALSE. and KBCON=0. A flow chart of the magnetic-field calculation is shown in figure A.1(d).

A.2.1.5 Contour calculation and plot generation

Contours are calculated for velocity  $|\underline{v}|/\underline{v}_{\infty}$ , density  $\rho/\rho_{\infty}$ , and magnetic components  $(|\underline{B}|/B_{\infty})_{\mu}$ ,  $(|\underline{B}|/B_{\infty})_{\mu}$ , and  $(|\underline{B}|/B_{\infty})_{\mu}$ . The method used is a modified version of a procedure developed by R. Sorenson

of NASA/Ames Research Center. The boundary is searched for intervals which bracket a contour point. Having found one point, the remainder of the contour is determined by 'walking' around the contour, searching at each step for the interval through which the contour line next passes, until a boundary point is reached. Then closed contours are found in a similar manner. Linear interpolation is used throughout the process. Note that since  $T/T_{\infty}$  is a function of  $|v|/v_{\infty}$  only, velocity contours may also be considered as temperature contours. Temperature and velocity are related by the following function.

$$T/T_{\infty} = 1 + \frac{\gamma - 1}{2} M_{\infty}^{2} \left[ 1 - \left( \frac{|\underline{v}|}{v_{\infty}} \right)^{2} \right]$$

The coordinates of the contour lines can be printed by subroutine CONOUT, with LPRCON as print control parameter.

The program segment which controls the generation of contour plots is accessed only when LPLOT = .TRUE. The UCC Plot Routines used to produce these plots are AXIS, CHAR, DASH, DOTLN, ENPLT, GREEK, MATH, NUMPLT, PLOT, PLTLN, POLAR, RESET, SCALF, and VECTOR. A flow chart of the contour calculation and plot generation in figure A.1(e).

### A.2.1.6 Trajectory calculation

This segment of the program provides theoretical plasma and magnetic-field properties in an output form that is useful for direct comparison with actual spacecraft data. Given a sequence of coordinates describing the spacecraft trajectory, the program calculates the density, temperature, and velocity and magnetic-field components at each point. Generation of trajectory plots is controlled by the logical variable LPLTRJ. The trajectory calculation proceeds as follows.

Input to this calculation includes interplanetary values of temperature, density, velocity, and magnetic field together with

the trajectory coordinates. The trajectory input is required as a function of time and normalized by planetary radius. If the logical variable LSUN is TRUE, then it is assumed that the trajectory coordinates and vector quantities are expressed in terms of a sun-planet (ecliptic) coordinate system. In this case, these quantities are converted by the program into a solar-wind coordinate system by the transformation

$$\begin{pmatrix} \mathbf{x}_{\mathbf{w}} \\ \mathbf{y}_{\mathbf{w}} \\ \mathbf{z}_{\mathbf{w}} \end{pmatrix} = \begin{pmatrix} \cos \alpha \cos \phi_{\mathbf{p}} & -\sin \alpha \cos \phi_{\mathbf{p}} & \sin \phi_{\mathbf{p}} \\ \sin \alpha & \cos \alpha & 0 \\ -\cos \alpha \sin \phi_{\mathbf{p}} & \sin \alpha \sin \phi_{\mathbf{p}} & \cos \phi_{\mathbf{p}} \end{pmatrix} \begin{pmatrix} \mathbf{x}_{\mathbf{s}} \\ \mathbf{y}_{\mathbf{s}} \\ \mathbf{z}_{\mathbf{s}} \end{pmatrix}$$

where  $(x_w, y_w, z_w)$  are coordinates in the solar-wind system and  $(x_s, y_s, z_s)$  are coordinates in the sun-planet system. The angles  $\Omega$  and  $\phi_p$  are the azimuthal (total aberration) and polar angles, respectively. The azimuthal angle,  $\Omega$ , is the angle in the plane of the ecliptic between the sun-planet line and the oncoming solar-wind, i.e., the  $x_s$ -axis and the  $x_w$ -axis as shown in figure A.2. The angle  $\phi_p$ , positive for southward solar-wind flow, measures the deviation of the solar-wind from the plane of the ecliptic. Figure A.2 illustrates the transformation from sun-planet ecliptic coordinates to solar-wind coordinates. In this case the azimuthal and polar angles indicated are both positive.

If LSUN is FALSE, it is assumed that all input data are referenced to the solar-wind coordinate system and this transformation is not performed.

In order to conform with the internal flow-field and magneticfield calculations, the signs of the x and y components of the trajectory and vector quantities are reversed. This is, in effect, another coordinate transformation which is defined by

$$\begin{pmatrix} \mathbf{x}_{c} \\ \mathbf{y}_{c} \\ \mathbf{z}_{c} \end{pmatrix} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{x}_{w} \\ \mathbf{y}_{w} \\ \mathbf{z}_{w} \end{pmatrix} = \begin{pmatrix} -\cos \alpha \cos \phi_{p} & -\sin \alpha \cos \phi_{p} & \sin \phi_{p} \\ \sin \alpha & -\cos \alpha & 0 \\ -\cos \alpha \sin \phi_{p} & \sin \alpha \sin \phi_{p} & \cos \phi_{p} \end{pmatrix} \begin{pmatrix} \mathbf{x}_{s} \\ \mathbf{y}_{s} \\ \mathbf{z}_{s} \end{pmatrix}$$

where  $(x_c, y_c, z_c)$  are coordinates referenced to the internal calculation system. This transformation is illustrated in figure A.3. Also shown in figure A.3 is the relationship of the interplanetary parallel, perpendicular, and normal magnetic field components to the internal calculation system. Specifically,

$$B_{\infty_{\parallel}} = B_{X_{C}}, B_{\infty_{\perp}} = B_{Y_{C}}, \text{ and } B_{\infty_{n}} = B_{Z_{C}}$$

The angles  $\alpha_{_{D}}$  and  $\alpha_{_{n}}$  are now calculated from the relationships

$$\alpha_{p} = \tan^{-1} \left( \frac{B_{Y_{C}}}{B_{X_{C}}} \right)$$

and

$$\alpha_{n} = \tan^{-1} \left( \frac{B_{Y_{C}}}{\sqrt{(B_{X_{C}})^{2} + (B_{Y_{C}})^{2}}} \right)$$

At this point, all data is in a form compatible with the internal calculations and the program can interpolate for flow and magneticfield values along the trajectory. The following procedure is repeated at each trajectory point. Noting that the flow is axisymmetric, the coordinate system may be rotated to the most convenient orientation for the calculation. The present  $(x_c, y_c, z_c)$  coordinates are converted to  $(x_c, R)$  coordinates by a rotation in the  $(y_c, z_c)$  plane about the  $x_c$ -axis through the angle  $\theta = \tan^{-1}[z_c/y_c]$ . This rotation defines a new coordinate system (x', y', z') in which z' = 0. Subroutine IJRAJ now locates the point with reference to the computational flow-field grid. The point is either within the ionopause, in the grid region, or beyond the bow shock. If the point is within the ionopause, all values are set to zero. If the point lies beyond the bow shock, all quantities assume their free-stream values. For points within the grid, the velocity magnitude, density, and flow angle  $\phi$  are found by interpolation using function FTRAJ. From the flow angle  $\phi$  and the rotation angle  $\theta$ , velocity components in the ( $x_c, y_c, z_c$ ) system can be calculated according to

> $v_{x_{c}} = v\cos \phi$  $v_{y_{c}} = v\sin \phi \cos \theta$  $v_{z_{c}} = v\sin \phi \sin \theta$

Calculation of the magnetic field is complicated somewhat because the components are dependent on the incident magnetic field. Using  $\alpha_p$  and  $\alpha_n$ ,  $B'_{x_{\infty}}$ ,  $B'_{y_{\infty}}$ , and  $B'_{z_{\infty}}$  are calculated in the rotated (x',y',z') system by

$$B_{\mathbf{x}_{\infty}}^{\dagger} = B_{\mathbf{x}_{\mathbf{C}_{\infty}}}$$

$$B_{\mathbf{y}_{\infty}}^{\dagger} = B_{\mathbf{y}_{\mathbf{C}_{\infty}}} \cos \theta + B_{\mathbf{z}_{\mathbf{C}_{\infty}}} \sin \theta$$

$$B_{\mathbf{z}_{\infty}}^{\dagger} = -B_{\mathbf{y}_{\mathbf{C}_{\infty}}} \sin \theta + B_{\mathbf{z}_{\mathbf{C}_{\infty}}} \cos \theta$$

Then  $\alpha_p^{\, \textbf{i}}$  and  $\alpha_n^{\, \textbf{i}}$  are defined by

$$\alpha_{p}^{\prime} = \tan^{-1} \left( \frac{B_{Y_{\infty}}^{\prime}}{B_{X_{\infty}}^{\prime}} \right) \text{ and } \alpha_{n}^{\prime} = \tan^{-1} \left[ \frac{B_{Z_{\infty}}^{\prime}}{\sqrt{(B_{X_{\infty}}^{\prime})^{2} + (B_{Y_{\infty}}^{\prime})^{2}}} \right]$$
Interpolation is then carried out to determine the magnetic angle  $\psi$  and the ratios  $\left|\frac{B}{B_{\infty}}\right|_{n}$ ,  $\left|\frac{B}{B_{\infty}}\right|_{1}$ , and  $\left(\frac{B}{B_{\infty}}\right)_{n}$  in the rotated system again using the function FTRAJ. Next, the magnetic-field components  $B'_{x}$ ,  $B'_{y}$ ,  $B'_{z}$  in the rotated system are calculated from

$$B_{X}' = \cos \alpha_{n}' \left[ \cos \phi \cdot \cos \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{\mu} + \cos \psi \cdot \sin \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{\mu} \right] \cdot B_{\infty}$$

$$B_{Y}' = \cos \alpha_{n}' \left( \sin \phi \cdot \cos \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{*} + \sin \psi \cdot \sin \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{1} \right) \cdot B_{\infty}$$
$$B_{Z}' = \sin \alpha_{n}' \cdot \left( \frac{B}{B_{\infty}} \right)_{n} \cdot B_{\infty}$$

Finally, these magnetic-field components are rotated back through the angle  $\theta$  to yield magnetic-field components referenced to the internal calculation system (x<sub>c</sub>, y<sub>c</sub>, z<sub>c</sub>) by

$$\begin{pmatrix} \mathbf{B}_{\mathbf{x}_{\mathbf{C}}} \\ \mathbf{B}_{\mathbf{y}_{\mathbf{C}}} \\ \mathbf{B}_{\mathbf{z}_{\mathbf{C}}} \end{pmatrix} = \begin{pmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \cos \theta & -\sin \theta \\ \mathbf{0} & \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} \mathbf{B}_{\mathbf{x}}^{\dagger} \\ \mathbf{B}_{\mathbf{y}}^{\dagger} \\ \mathbf{B}_{\mathbf{z}}^{\dagger} \end{pmatrix}$$

Subroutine TROUT now prints the trajectory output in both the solar-wind  $(x_{c}, y_{c}, z_{c})$  and the sun-planet  $(x_{s}, y_{s}, z_{s})$  coordinate systems using the transformation below to obtain sun-planet magnetic-field vector components from solar-wind magnetic-field vector components.

$$\begin{pmatrix} B_{\mathbf{x}} \\ B_{\mathbf{y}} \\ B_{\mathbf{y}} \\ B_{\mathbf{z}} \\ B_{\mathbf{z}} \end{pmatrix} = \begin{pmatrix} -\cos \alpha \cos \phi_{\mathbf{p}} & \sin \alpha & -\cos \alpha \sin \phi_{\mathbf{p}} \\ \sin \alpha \cos \phi_{\mathbf{p}} & -\cos \alpha & \sin \alpha \sin \phi_{\mathbf{p}} \\ \sin \phi_{\mathbf{p}} & 0 & \cos \phi_{\mathbf{p}} \end{pmatrix} \begin{pmatrix} B_{\mathbf{x}} \\ B_{\mathbf{y}} \\ B_{\mathbf{z}} \\ B_{\mathbf{z}} \end{pmatrix}$$

The transformation of the solar-wind velocity components  $(v_{x_C}, v_{y_C}, v_{z_C})$  into sun-planet components  $(v_{x_S}, v_{y_S}, v_{z_S})$  is also done using the same transformation.

Finally, if LPLTRJ is true, a file of trajectory plots is created. A flow chart for this program segment is shown in figure A.l(f).

### A.2.2 Rerun Option

The rerun option is used when LRERUN = .TRUE. The blunt-body and marching calculations are replaced with the reading of grid coordinates and flow-field values from the rerun file, TAPE4, which contains data written to TAPE9, then saved, on a previous run. Different values for any parameter not used in the flow-field calculations may be specified, viz. contour values, plot length, magnetic-field angles, and output options. Values of AMACH, GAMMA, and HRO are required input, to ensure that the input rerun file does contain the case desired for rerun. If the geometry is user-supplied, the body-shape table will be read from TAPE4, and should not be input from cards.

After reading the card input, MACH, GAMMA, and HRO are tested against values from TAPE4. The grid coordinates and flow-field values from the blunt-body calculation are read in, then smoothed, and streamlines calculated for this region, as previously described. The results of the marching calculation are then read, and the streamline calculation continued downstream. The calculations then proceed as described in section A.2.1.

A run must not contain more than one case which uses the rerun option.

### A.2.3 Program Limitations and Precautions

The program makes some assumptions about the geometry of the obstacle shape around which flow is to be calculated, and about the

flow field. The obstacle shape is assumed to be monotonically increasing in cylindrical radius R, going downstream. The nose of the obstacle is at x = 1.0. The origin of the (x,R) coordinate system is the center of the planet. Obstacle shapes with sharp corners should be avoided. In the magnetic-field calculation, the first streamline is assumed to be inside the arc described by the grid points immediately off the body, downstream of x = 0.0. To reduce computational costs, a grid using NR = 10 may be used, in which case a lower value of CN may be required. This would reduce the running time by approximately 40 percent. A free-stream Mach number less than 2.0 is not advised.

A.2.4 Convergence Criteria for Blunt-Body Calculation

The output provides two measures of the convergence of the bluntbody calculation. The RMS of shock speed and maximum shock speed are printed at each iteration. These quantities should both tend to zero as the iterations proceed. A value for q<sub>RMS</sub>, RMS of shock speed, of

 $q_{RMS} < \sqrt{\gamma} \times M_{\infty} \times 10^{-3}$ 

where  $\gamma$  is the specific heat ratio, and  $M_{\infty}$  is the free-stream Mach number, usually indicates a converged solution. The RMS of error in enthalpy, HT, should be less than 1 percent, with the maximum enthalpy error also of that order.

The Courant number, CN, determines the time step size used by the calculation. A value not greater than the default of 3.0 should be used. For low Mach numbers or a coarser mesh than the default grid, a lower value may be preferable. If the default value does not generate a converged solution, or if the error message from subroutine SHOCK is printed, try lowering CN in increments of 0.5 to find a better value of CN. User-supplied bodies may also require a lower Courant number.

#### A.3 DESCRIPTION OF INPUT

This section describes the card input for the program. An alphabetized dictionary of input variables is provided, defining the varibles, listing default values and limitations. A discussion of the preparation of the card input is then presented, followed by a description of the input card format.

A.3.1 Dictionary of Input Variables

AMACH free-stream Mach number; 3.0 < AMACH < 25.0 is recommended

- ANGN the angle, in degrees, measuring the deviation of the freestream magnetic field from the plane in which  $\mathbb{B}_{\infty}$  and  $\mathbb{B}_{\infty}$ lie; equal to  $\tan^{-1}\left(\mathbb{B}_{\infty}/\sqrt{|\mathbb{B}_{\infty}^2|} + |\mathbb{B}_{\infty}^2|\right)$ ; see figure A.3, measured in the  $(x_c, y_c, z_c)$  coordinate system; only specified when interplanetary magnetic-field components not specified.
- ANGP the angle, in degrees, measuring the deviation of the inplane magnetic component  $(B_{\infty_{m}} + B_{\infty_{m}})$  from the direction of flow; equal to  $\tan^{-1}(B_{\infty_{m}}/B_{\infty_{m}})$ ; see figure A.3, measured in the  $(x_{C}, y_{C}, z_{C})$  coordinate system; only specified when interplanetary magnetic-field components not specified.
- AZANG angle in the ecliptic plane between the sun-planet line and the direction of solar-wind flow. See figure A.2 for positive direction.
- BCON(I) KBCON-dimensional array specifying values to be used for magnetic field strength contours
- BINF magnetic field strength free-stream value; set to 1.0 if plots desired in nondimensionalized units.

 $x_{c}$ -component of interplanetary magnetic field; referred to BX1 sun-planet coordinates  $y_{c}$ -component of interplanetary magnetic field; referred to BY1 sun-planet coordinates  $z_s$ -component of interplanetary magnetic field; referred to BZ1 sun-planet coordinates CN Courant number used for blunt-body calculation; program default value is 3.0 GAMMA ratio of plasma specific heats HRO obstacle geometry indicator: HRO > 0. - ionopause with  $H/R_0 = HRO$ HRO = 0. - magnetopause equatorial trace HRO < 0. - geometry is user-supplied ITER integer, number of iterations for blunt-body calculation; program default value is 300 KBCON integer, number of values specified for magnetic-field contours;  $0 \leq \text{KBCON} \leq 20$ KRCON integer, number of values specified for density contours; 0 < KRCON < 20K VC ON integer, number of values specified for velocity magnitude contours; 0 < KVCON < 20 LGRAV logical variable indicating whether default ionopause is calculated with gravitational variation in scale height FALSE - no TRUE - yes

- LPLOT logical variable indicating whether to create plots or plot file FALSE - no TRUE - yes
- LPLTRJ logical variable indicating whether to create trajectory and time history plots FALSE - no TRUE - yes
- LPRB logical variable indicating whether to print magnetic field output FALSE - no TRUE - yes
- LPRCON logical variable indicating whether to print coordinates of contours lines FALSE - no TRUE - yes
- LPRFL logical variable indicating whether to print detailed flowfield output FALSE - no TRUE - yes
- LPRST logical variable indicating whether to print coordinates of streamlines FALSE - no TRUE - yes
- LRERUN logical variable indicating whether this case uses rerun option FALSE - perform blunt-body and marching calculations TRUE - read results of a previous calculation from TAPE4

- LRSTRT logical variable indicating whether to use previous shock shape as initial guess for blunt body TRUE - use shock shape from previous solution. (Must have a full solution as an earlier run in same job.) FALSE - use default initial guess for shock shape
- LSUN logical variable indicating whether trajectory input is referenced to sun-planet coordinate system FALSE - trajectory input in solar-wind coordinates TRUE - trajectory input in sun-planet coordinates
- LTRAJ logical variable indicating whether to perform a trajectory calculation TRUE - trajectory calculation, data provided FALSE - no trajectory calculation
- MARKT(I) NMARKT dimensional array specifying points to be marked for cross reference. If K = NMARKT(I), the Kth point of the trajectory is to be marked.
- NBLUNT integer, number of angular mesh points for blunt-body calculation; for user-supplied geometry, XX(NBLUNT-1)=0.0; program default value, and maximum, is 24
- NBOD integer, number of points in body-shape table when geometry is user-supplied; 1 < NBOD < 100
- NCASE integer, number of cases to be run consecutively; NCASE > 1
- NMARKT integer, numbered values specified for cross reference points;  $0 \le NMARKT \le 12$ .
- NR integer, number of radial mesh points; program default value, and maximum, is 19

- NTRAJ integer, number of points specified in trajectory table
- NXADD integer, number of points to be added to blunt-body grid past  $\theta = 90^\circ$ , default value is 0.
- POLANG angle, measured in degrees, between the plane of the ecliptic and direction of solar-wind flow; positive for southward flow; see figure A.2
- RCON(I) KRCON dimensional array specifying values to be used for density contours
- RHOINF density-free stream value; set to 1.0 if plots desired in nondimensional units
- RPLNT radius of planet in units of nose radius, R<sub>PLNT</sub>/R<sub>o</sub>
- RR(I) NBOD dimensional array representing the R-locations, in cylindrical (x,R) coordinates, of the user-supplied body shape; in units of nose radius
- TITLE descriptive heading of the case, to be printed on the first page of output; may contain up to 80 characters, including blanks
- TMPINF free-stream temperature; set to 1.0 if plots desired in nondimensional units
- TTRAJ(I) NTRAJ dimensioned array specifying time locations of trajectory points
- VCON(I) KVCON dimensional array specifying values to be used for velocity contours

- VINF free-stream velocity; set to 1.0 if plots desired in nondimensional units
- XCALC terminal downstream x-location for marching calculation of flow field; XCALC < 0.0; program default value is -1.0</pre>
- XPLOT terminal downstream x-location for calculation of streamlines, magnetic field, and contours; XCALC  $\leq$  XPLOT  $\leq$  0.0; program default value is -1.0
- XTRAJ(I) NTRAJ dimensioned array specifying x<sub>S</sub>-locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, XTRAJ(I) is referred to solar-wind x<sub>C</sub>-locations; see figures A.2 and A.3
- XX(I) NBOD dimensional array representing the x-locations, in cylindrical (x,R) coordinates, of the user-supplied body shape; in units of nose radius. See figures A.2 and A.3
- YTRAJ(I) NTRAJ dimensioned array specifying y<sub>S</sub>-locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, YTRAJ(I) is referred to solar-wind y<sub>C</sub>-locations; see figures A.2 and A.3
- ZTRAJ(I) NTRAJ dimensioned array specifying z<sub>S</sub>-locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, ZTRAJ(I) is referred to solar-wind z<sub>C</sub>-locations; see figures A.2 and A.3

A.3.2 Preparation of Input Data

The card input for a run consists of one card containing the number of cases to be run consecutively, Item 0, followed by a set of input for each case, Item 1 through Item 7, and Item 8 if required. Where a default value is to be used, the input field should be left blank. For each case, all required variables which do not assume their default values should be specified. The input format for all cards is described in section A.3.3.

Item 0 - This item consists of one card, containing the number of cases in this run, NCASE.

Item 1 - This card provides identification of the case, TITLE, which is printed on the first page of the output for this case.

Item 2 - This card contains information on the flow conditions and body geometry, and parameters required for the blunt-body and marching calculations. AMACH, GAMMA, and HRO must be specified for each case. For the rerun option, the values are tested against the values from the rerun file. The parameters XCALC, NR, NBLUNT, CN, ITER are used only when the flow field is to be calculated. These variables each assume a default value if the input field is blank.

Item 3 - This item consists of one card containing the rerun indicator, LRERUN, the output control variables LPRFL, LPRST, LPRCON, LPRB, and LPLOT, the trajectory indicator LTRAJ, and the restart indicator LRSTRT.

Item 4 - This card contains the variables XPLOT, ANGP, ANGN, NXADD, and LGRAV. The value for XPLOT is changed by the program to be the x-location of the marching calculation immediately upstream of the input value for XPLOT. The angles describing the deviation of the magnetic field from the flow, ANGP and ANGN, are not required when LPRB = .FALSE; KBCON = 0, and LTRAJ = .FALSE. since the magnetic field is not calculated under these conditions. ANGP is the angle between the vectors  $(B_{\infty_{m}} + B_{\infty_{m}})$  and  $y_{\infty}$ , while ANGN is the angle between  $B_{\infty}$ and  $(B_{\infty_{m}} + B_{\infty_{m}})$ , where  $B_{\infty_{m}}$ ,  $B_{\infty_{m}}$ ,  $B_{\infty_{m}}$  are the components of the freestream magnetic field,  $B_{\infty}$ , which are parallel, perpendicular, and normal to  $y_{\infty}$ , and are as indicated in figure A.3. The two angles ANGP and ANGN fully determine the half plane for which the magnetic field

is to be calculated. The magnetic field for the other half of the plane may be calculated by rerunning with the sign of ANGP reversed. When  $(B_{\omega_{n}} + B_{\omega_{1}}) = 0$ , ANGN =  $\pm 90^{\circ}$ , ANGP =  $0^{\circ}$ ; and, when  $B_{\omega_{n}} = 0$ , ANGN =  $0^{\circ}$ . Note that ANGP and ANGN are referenced to the  $(x_{c}, y_{c}, z_{c})$  system and are specified only when the interplanetary magnetic-field components are not specified.

If both LTRAJ = .TRUE. and LSUN = .TRUE., then ANGP and ANGN are calculated internally from the interplanetary magnetic-field components BX1, BY1, and BZ1.

Item 5 - This item contains the values for the velocity contours. The first card contains KVCON, the number of values specified for VCON. If KVCON > 0, the contour values are then read. Up to three cards may be required to accommodate the values, eight per card, maximum of 20. The contour values should be monotonically increasing, with at least one value within the range of the magnitude of the velocity in the region for which contours are to be calculated.

Item 6 - This item contains the values for the density contours. The description is similar to that for Item 5, with KRCON being the number of values specified, and RCON the array of values.

Item 7 - This item contains the values for the magnetic-field contours. The description is similar to that for Item 5, with KBCON being the number of values specified, and BCON the array of values. Note that the same contour values are used for the parallel and perpendicular components.

Item 8 - This optional item is required when HRO < 0.0 and LRERUN = .FALSE., and contains the body-shape table for the user-supplied geometry. The first card contains NBOD, the number of points in the shape table. The next NBOD cards contain the cylindrical (x,R) coordinates of these points, [XX(I), RR(I)], one point per card. The points supplied by the user determine the  $\theta$ -spacing of the mesh used for the

blunt-body calculation. The first point should be near, but not on, the x-axis. A suggested location is such that the  $\theta$ -spacing between the first point and the x-axis is half the  $\theta$ -spacing between the first two points. The blunt-body calculation adds a point which is the reflection about the x-axis of the first point in the body-shape table. The (NBLUNT-1)<sup>th</sup> point should be at x = 0.0. The BLUNT<sup>th</sup> point is also used to create the grid for the blunt-body calculation. The coordinates must be normalized so that the planet center is at (0.,0.) and the nose of the body at (1.,0.).

Item 9 - This optional item is read only when LTRAJ is TRUE. The first card contains NTRAJ, the number of points in the trajectory. Then follows NTRAJ cards, each containing the time T, and location  $(x_s, y_s, z_s)$  of one point. The time values should be monotonically increasing. At present, NTRAJ  $\leq$  100 is required. Note that when ANGP and ANGN are specified, the trajectory is specified in  $(x_s, y_c, z_c)$  coordinates.

Item 10 - This item is ready only when LTRAJ is TRUE. The variable LPLTRJ indicates whether plots are to be produced of the trajectory and time histories. The relative size of the planet to the ionopause is given by RPLNT, which may be 0.0, in which case, a value of 1.0 is assumed in the calculations, but the planet is not drawn on the plots. Next are the four free-stream values  $v_{\infty}$ ,  $T_{\infty}$ ,  $\rho_{\infty}$ ,  $B_{\infty}$ . If the plots are desired to be in nondimensional units, any or all of these values may be input as 1.0. Each quantity must have a value, zero is not permissible.

Item 11 - This item is read only when LTRAJ is TRUE. The first card contains NMARKT, the number of values specified for MARKT, (presently maximum of 12). If NMARKT = 0, only this card is required. If NMARKT > 0, the values of MARKT are read, 8 per card.

Item 12 - This item, which includes the variables LSUN, AZANG, POLANG, BX1, BY1, and BZ1, is read only when LTRAJ is true.

### A.3.3 Format of Input Data

Four format types are used for the input data. For real numbers (F-format), a decimal point is required. Integers (I-format) should be right-adjusted in the field. For logical variables (L-format), the first non-blank character in the field, which should be 'T' or 'F', determines the value. Note that a blank input field is interpreted as 'FALSE'. The title, which is in A-format, may contain any valid character.

A description of the card format of the input data follows, with item numbers corresponding to those in section A.3.2:

Format type

I

Variable	NCASE							
Card Column	10							
Format type	I							
	Item No.	1: 1 card						
Variable		······································	· · · · · · · · · · · · · · · · · · ·	Title				
Card Column								80
Format type				A				
_	Item No.	. 2: 1 card						
Variable	AMACH	GAMMA	HRO	XCALC	NR	NBLUNT	CN	ITER
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F
-	Item No.	. 3: 1 card						
Variable	LRERUN	LPRFL	LPRST	LPRCON	LPRB	LPLOT	LTRAJ	LRSTRT
Card column	10	20	30	40	50	60	70	80
Format type	L	L	L	L	L	L	L	L
_	Item No.	. 4: 1 card						
Variable	XPLOT	ANGP	ANGN	NXADD	LGRAV			
Card column	10	20	30	40	50			
Format type	F	F	F	N	L			
	Item No	.5: a) 1 car	cđ					
Variable	KVCON							
Card column	10							

Variable	VCON(1)	VCON(2)			VCON (KVCON)			
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F

b) 0 to 3 cards as needed for up to 20 values, 8 per card

/

	Item No.	6: a) l ca	rd					
Variable	KRCON							
Card column	10							
Format type	I							
		b) 0 to	3 cards					
Variable	RCON(1)	RCON(2)			RCON (KRCON)			
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F
	Ttom No.	7 2) 7 22	<b>ل</b> م					
Variable	KBCON	• / a) i Ca.	Lu					
Card column	KBCON 10							
	10							
Format type	<u>L</u>							
		b) 0 to	3 cards					
Variable	BCON(1)	BCON(2)			BCON (KBCON)			
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F
-	Ttom No.	9 a) ] aa	ad (this it a	n waanimad a	lu uban UDO	< 0.0 and 700		、
	I Lem NO.		a (this ite	a required of	ity when HRO	< 0.0 and LRE	RON = .FLASE.	)
Variable	NBOD							
Card column	10							
Format type	I							
		b) NBOD	cards					
1	XX(I)	RR(I)	1					
	10	20	1					

.

•

# Item No. 9: a) 1 card (this item read only when LTRAJ is TRUE)

Variable	NTRAJ								
Card column	10								
Format type	I								
	_	b) NTRAL	/ cards						
Variable	TTRAJ(I)	XTRAJ(I)	YTRAJ(I)	ZTRAJ(I)					
Card column	10	20	30	40					
Format type	F	F	F	F					
	Item No	. 10: 1 card	l (this item	read only wi	hen LTRAJ is	TRUE)			
Variable	LPLTRJ	RPLNT	VINF	RHOINF	TMPINF	BINF			
Card column	10	20	30	40	50	60			
Format type	L	F	F	F	F	F			
Variable Card column Format type	NMARKT 10 I	. 11; a) I C	ard (this it	cem read only	y when LTRAJ	is TRUE)			
		b) 0-2	cards						
Variable	MARKT(1)	MARKT(2)			MARKT (NMARKT	}			
Card column	10	20	30	40	50	60		70	80
Format type	I	I	I	I	I	I	<u> </u>	I	
	Item No.	. 12: 1 card	(this item	read only wh	nen LTRAJ is	TRUE)			
Variable	LSUN	AZANG	POLANG	BX1	BY1	BZ1			
Card column	10	20	30	40	50	60			
Format type		F	F	F	F	F			

#### A.4 DESCRIPTION OF OUTPUT

This section describes the output of the computer program. The contents of each output item are specified and discussed. The printed output consists of seven items, five of which are optional and are controlled with input parameters. Plotted output is also optional.

The first output item consists of a banner page and the input data. The input is presented in two forms: first, as images of the input cards, and then with identification of each variable. Default values are printed as if they were input. Parameters CN, NR, NBLUNT, ITER for the blunt-body calculation and XCALC, the terminal location for the marching calculation, are printed only when the flow field is to be calculated. When the obstacle geometry is user-supplied, the input body-shape table is printed. For a default geometry, the body shape is indicated by the description "default ionopause shape for constant scale height with H/RO = ", or "default ionopause shape with gravitational variation in scale height, H/RO = ". Trajectory input is printed only when LTRAJ is true.

The second output item is not printed when LRERUN = .TRUE. From the blunt-body calculation, the shock speed at each iteration, the final enthalpy error, final sonic-line location, and body and final bow-shock shape are printed. For the marching calculation, the downstream x-location and body and shock ordinates are output. There is no control variable allowing the user to suppress this item of output when the flow field is calculated.

Detailed flow-field output is the third item, and is printed only when LPRFL = .TRUE. Coordinates are labeled as X/D, R/D, RP/D, or X/RO, R/RO, RP/RO, to emphasize that distances are normalized by the distance from the center of the planet to the nose of the body, D for the magnetopause, RO for an ionopause. Along the symmetry axis, the values printed are velocity magnitude V/VINF, density RHO/RHOINF,

temperature T/TINF, and pressure P/PINF. Over the rest of the flow field, values are also given for velocity components VX/VINF, VR/VINF, and flow angle  $\phi$ . Note that the flow angle is the deviation of the flow about the obstacle, and so  $0^{\circ} \leq \phi \leq 90^{\circ}$ .

The next output item is the (x,R) coordinates of the streamlines. For blunt-body region, the  $(R_p, \theta)$  coordinates of the starting position on the bow shock wave are also given. This item is printed only when LPRST = .TRUE.

The magnetic-field components are then printed, if LPPRB = .TRUE. The location of each point is defined in  $(R_p, \theta)$  coordinates for the blunt-body region, and (x,R) coordinates for the downstream marching region. The components along field lines parallel, perpendicular, and normal to the flow in the free stream are printed as B/BINF(PARALLEL), B/BINF(PERP), B/BINF(NORMAL). The orthogonal  $(x_c, y_c, z_c)$  components of the resultant are printed as BX/BINF(RESULTANT), BY/BINF (RESULTANT), BZ/BINF(RESULTANT). The magnetic field in the symmetry  $(x_c, y_c)$  plane, defined by the vector sum  $[(B/B_{\infty})_{\mu} + (B/B_{\infty})_{\mu}]$ , is also printed, and is given by the magnitude B/BINF(IN-PLANE) and direction B-ANGLE(IN-PLANE) of the vector. We note, as pointed out in the text, that the orthogonal magnetic-field components printed here correspond to those in the  $(x_c, y_c)$  plane, i.e.,  $z_c = 0$ .

The next item printed is the  $(x_{C},R)$  coordinates of the contours, for which LPRCON is the logical control variable. Noting that temperature and velocity contours coincide, the corresponding value of T/TINF is printed along with V/VINF for the velocity contours. There are three nonfatal error messages which may occur - see section A.5.

Trajectory output is the last item to be printed. This output is presented first in terms of the solar-wind coordinate system  $(x_c, y_c, z_c)$ , and then in terms of sun-planet coordinates  $(x_e, y_e, z_c)$ .

The trajectory coordinates are printed as a function of time and are shown normalized by both RO and the planetary radius. Next, flow and magnetic-field componets are printed for each trajectory point. This output is presented in both nondimensional and dimensionalized forms and includes |v|,  $v_x$ ,  $v_y$ ,  $v_z$ , density, temperature, |B|,  $B_x$ ,  $B_y$ , and  $B_z$ .

The program also has the capability to produce two sets of plotted output using UCC plot routines AXIS, CHAR, DASH, DOTLN, ENPLT, GREEK, MATH, NUMPLT, PLOT, PLTLN, POLAR, SCALF, and VECTOR. The first set of plots is generated when LPLOT = .TRUE. and provides a pictorial representation of the streamlines and contours with a maximum of seven frames produced. The first frame is a plot of the streamlines followed by contour plots of velocity magnitude, temperature, and density. The next three frames are contour plots of the unit parallel, perpendicular, and normal magnetic-field components. These plots are referred to the solar-wind (x,R) coordinate system.

The second set of plots is produced according to the value of the logical variable LPLTRJ. This set consists of twelve plots. The first frame is a projection of the trajectory rotated onto the x-R plane. The second frame is a plot of the trajectory projected onto the  $y_C - z_C$  plane. The remaining frames are time-history plots of density, temperature, velocity, and magnetic field. The velocity plots include magnitude and three components as do the magnetic field plots. The vector components are referred to the sun-planet ecliptic ( $x_S, y_S, z_S$ ) coordinates.

#### A.5 PROGRAM ERROR MESSAGES

This section lists the messages printed by the program, and indicates what action should be taken by the user.

(1) \*\*\*\*\* EXECUTION TERMINATED \*\*\*\* RERUN DATA ON TAPE4 DOES NOT AGREE WITH CASE SPECIFIED ON CARD INPUT: MACH NO. GAMMA H/RO

FROM CARDS FROM TAPE4

The first three parameters of item 2 of the input for a case using the rerun option should agree with those used when creating the file. The tolerance used in comparing the values is  $10^{-5}$ . For a user-supplied geometry, it is sufficient for both values of H/R<sub>o</sub> to be negative.

## (2) \*\*\*\*\* EXECUTION TERMINATED \*\*\*\*\* ARRAY OF CONTOUR VALUES IMPROPERLY SPECIFIED

When specified, the contour values should be monotonically increasing with at least one value in the range of the velocity, density, or magnetic-field strength for the region under consideration. This error does not inhibit generation of the rerun file.

(3) CONTOUR SEARCH ABORTED - TABLE OVERFLOW IN NAD

The program allows for 29 contour lines to be found, storing the starting address of each contour line in array NAD. This message indicates that at least one more contour line could be found. If the user requires all the contours of the levels specified, the case should be rerun in two parts. Otherwise, reduce the number of contour levels specified.

(4) CONTOUR SEARCH ABORTED - TABLE OVERFLOW IN (X,Y)

The contour lines may be described by up to 1000 points, stored in arrays X and Y. This message indicates that more points would be

required for the contour lines requested. The last contour line found will be incomplete. As with (3), either reduce the number of contour levels or run as two cases.

### (5) NEGATIVE PRESSURE DETECTED BY SHOCK AT J= PN= PO= PTAU=

This message is printed by the blunt-body code when a negative pressure has been calculated at the shock on this iteration, at radial locations J. The quantities printed are: PN, the pressure calculated on this step; PO, the pressure from the previous step; and PTAU, the partial derivative of pressure with respect to time. This condition indicates that the shock wave motion is too extreme. Lowering the value of CN, and thus reducing the time step, may remove the problem.

The following messages (6)-(10) usually result from using an obstacle geometry which is in some way too severe for the program to handle in its present form. The obstacle slope may be sufficiently high at x = 0.0 that the axial Mach number becomes subsonic in the starting solution for the marching calculation, or there may be a sharp corner in the profile. Check input, particularly free-stream Mach number and body geometry.

(6) NEGATIVE PRESSURE ON BODY DETECTED BY BNDRY, PB= AT J=

This message indicates that a negative pressure on the body, PB, has been calculated at radial location J.

The program makes internal corrections when this condition occurs, resulting pressure PB, density RHOB, and velocity components VXB and VRB.

(8) NEGATIVE SIGMA-BAR-1 IN EIGENM INDICATES SUBSONIC FLOW AT I=

(9) NEGATIVE SIGMA-BAR-2 IN EIGENM INDICATES SUBSONIC FLOW AT I=

These messages are printed when subsonic flow is detected by the marching calculation. The computed stepsize for this region will be quite small.

(10) -----BODY TURN STOPPED AT M2=100-----

This message indicates that the body has a sharp corner, which has been limited to 100° when being transformed.

#### A.6 SAMPLE CASE

The sample case presented in this section is based on actual interplanetary conditions as measured by the solar-wind plasma analyzer, the fluxgate magnetometer, and retarding potential plasma analyzer on the Pioneer-Venus Orbiter for orbit 3.

The sample case is run alone and is set up to produce all possible output. The gasdynamic solution is to be calculated about a default ionopause shape with  $H/R_0 = 0.03$ ,  $M_\infty = 3.0$ , and  $\gamma = 5/3$ . The value of  $H/R_0$  is based on measurements of ionospheric density and temperature by the retarding potential plasma analyzer. Streamlines, magnetic-field components, and contours are desired to a downstream location of -5.5 x/R\_0. Contour values are specified for all quantities. Interplanetary values for velocity magnitude and direction, density, and temperature were provided by the solar-wind plasma analyzer and for the magnetic field by the fluxgate magnetometer.

The input data is tabulated in figure A.4, with item numbers corresponding to those in sections A.3.2 and A.3.3. The first card, item 0, indicates that there is one case to run. The remaining fifty-five cards provide the data for this case. Item 1 contains the identifying title. On the next card, item 2, values are specified for AMACH, GAMMA, HRO, and XCALC. The other data fields are left blank to indicate that the default values will be used. The values of the logical variables of item 3 specify that the flow field is to be calculated and that full printed and plotted output is to be produced. Item 4 defines the plot length to be  $-5.5 \text{ x/R}_{2}$ . The fields for ANGP and ANGN are left blank as they are to be calculated internally by the program. Items 5, 6, and 7 specify the contour levels to be used - 14 for velocity and temperature, 11 for density, and 13 for magnetic-field strength. Item 8 is omitted because the obstacle geometry is one of the default shapes for which the coordinates are calculated internally. The next 37 cards, item 9, are the trajectory coordinates, indicating time (in minutes from periapsis and the three spacial coordinates normalized by planetary radius). Item 10 indicates that trajectory plots are to be generated. This item also specifies free-stream values of velocity, density, temperature, and magnetic-field strength. The next two cards, item 11, indicates that the fourth, ninth, eleventh, and nineteenth trajectory points are to be marked on the plots for cross- reference. The last input card, item 12 indicates that the given trajectory coordinates are expressed in sun-planet coordinates. The azimuthal and polar angles,  $\Omega$  and  $\varphi_{\rm p},$  are also specified by this item as are the free-stream magnetic-field components.

Figure A.5 presents portions of the printed output from this sample case. The full printed output is approximately 6,000 lines. Figure A.6 shows the 19 plots which are produced by the program for this case.



Figure A.1(a).- Flow chart for blunt-body calculation.



Figure A.1(b).- Flow chart for marching calculation.



Figure A.1(c).- Flow chart of streamline calculation.



Figure A.1(d). - Flow chart of magnetic-field calculation.



Figure A.1(e).- Flow chart of contour and plot generation calculation.



Figure A.1(e).- Concluded

,



Figure A.1(f).- Flow chart of trajectory calculation.



Figure A.2.- Illustration of the azimuthal ( $\Omega$ ) and polar ( $\phi_p)$  solar-wind angles, both shown in a positive sense.



Figure A.3.- Illustration of the interplanetary magnetic field and magnetic-field angles  $(\alpha_p, \alpha_n)$  in the solar-wind aligned coordinate systems (x, y, z),  $(x_w, y_w, z_w)$ , and  $(x_c, y_c, z_c)$ .

	Column							
Item	NO.	• •						
No.	10	20	30	। 4.0	) 50	J 60	, ,(	J 80
	↓ I				1		ļ	. 1
0	1	i	•	¥	V	V		
1	SAMPLE	CASE (	DEFAULT IO	NOPAUSE SHA	PE WITH H/	(RO = 0.03)		
2	3.0	1.6666667	0.03	-10.0		L		
3	F	т	Т	Т	T	T	IT	IF
4	-5.5			L	ļ	J		
5	14		·					
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.75
6	<u> </u>	0.33	0.05	0.9	0.92	0.94	1	<u></u>
Ŭ	0.5	0.8	1 2	1.6	2.0	2.5	3.0	3.5
	3.8	4.0	4.2	1.0				
7	13				· · · · · · · · · · · · · · · · · · ·	<u> </u>	<u> </u>	· · · · · ·
	0.45	0.6	0.8	1.0	1.25	1.5	2.0	2.5
	3.0	3.5	4.0	5.0	6.0			
9	37		12 2 6 2	0.00	<b>-</b>			
	-90.870	-0.843	3./8/	2.027	1			
	-80.203		3 393	2.062	4			
	-74.870	-0.600	3.177	2.073	-			
	-70,603	-0 533	2,999	2.078				
	-64.203	-0.430	2.721	2.079				
	-57.802	-0.324	2.427	2.067	1			
	-51.402	-0.217	2.118	2.043	]			
	-40.735	-0.034	1.562	1.961	4			
	-39.668	-0.017	1.509	1,951	4			
	-38.602		1.422	1.932	-			
	-34 867	0.049	1 232	1.886	1			
	-32.735	0.158	1.108	1.852	1			
	-24.202	0.2456	0.5826	1.6658	1			
1	-21.002	0.2954	0.3749	1.5693				
	-16.735	0.356	0.090	1.409	]			
	-14.602	0.382	-0.052	1.315				
	-11.402	0.415	-0.205	1.150	-			
	-8.102	0.437	-0.478	0.945	-			
	6.298	0.309	-1.042	-0.266	-			
	9.498	0.237	-1.055	-0.546	1			
	12.593	0.160	-1.038	-0.801	1			
	17.393	0.034	-0.966	-1.162	1			
1	29.127	-0.275	-0.673	-1.887	]			
	34.460	-0.407	-0.512	-2.155	]			
1	43.860	-0.561	-0.312	-2,444	4			
	47.260	-0.705	-0.108	-2.670	4			
	53.660	-0.844	0.0982	-2.925	4			
	58 993	-0.91	0.201	-3.031	4			
	60.060	-0.975	0.303	-3.131	1			
	62.193	-1.018	0.371	-3.195	1			
	67.528	-1.122	0.541	-3.347	1			
1	73.928	-1.241	0.739	-3.514	]			
	80.328	-1,357	0.839	-3.671		<u>la 0005</u>	1	
10	T	0.968	392.0	20.2	μ02000.	8.8225	J	
-T	4		1	1	<u> </u>	<del></del>		<b></b>
12	<u>ч</u>	3.3	0.15	1-1.74	-8.64	0.4		أسيب سيا
**	-	1 -	1 ~ * * ~		1	1		

Figure A.4.- Card input for sample case.



LISTING OF INPUT CARDS FOR THIS RUN

3.0	1.666660	7 0.03	-13+0		Ŧ	Ŧ	
-				•	•	•	•
-,							
6.1		2.3	u.i4	5	1.6	0.7	0.75
0.0	0.85	0.48	. 9	392	2 2.9	4	
	11						_
0.5	8	1.2	1.6	2.0	2.5	3.0	3.5
3.8	4.4	4.2					
1	53						
3.45	5.6	¢.a	1.7	1.25	1.5	Z • 3	2.5
3.0	3.5	4.0	5.6	6. U			
	31						
-71 -71		3. 4.0	2-345				
-80 303	-0.494	3. 292	2.562				
74.470	-0.600	3.177	2 73				
73.533	-2.533	2.939	2.378				
64.743	-7.630	2.721	2.079				
57 432	-2.324	2.427	2.367				
51.402	-0.217	2.118	2.543				
40.735	-0.034	1.502	1.961				
39.668	-0.017	1.5.9	1.951				
-38.602	-2.4 10	1. 422	1.932				
35.935	C. ( 49	2 <u>9</u> l	1.035				
34.*67	0.067	1.0232	1.986				
-32.735	0.15 P	1.108	1.052				
24.262	0.2456	0.5826	1.5603				
21.302	1 264	0.00	1.419				
14.432	0.382	mf = 152	1.315				
11.402	0.415	-0.255	1.152				
1.152	3.437	-1 - 478	C . 945				
4.900	0.44Z	-0.703	3.660				
.291	3.3.9	-1.64?	-0.266				
9.498	2.237	-1.655	-2.545				
12.593	C.163	-1.,34	-J.861				
17.393	2.034	-0.965	-1.162				
29.127	-0.275	-3.673	-1.687				
4.453	-2+41.7	-6.512	-7.155				
	-1.56.	-3.312	-2				
67.Z6J	-3.7.5	-0.104	-2.073				
3.653	-0.444	0.1982	-2.925				
70.30/	-0.91	0.201	-3.007				
60.060	975	0.2.3	-3.13				
12.101	-1.018	1.371	-1.195				
	-1-122	0.541	-3.347				
73.928	-1.241	0.739	-3.514				
13.321	-1.357	6 . 93 9	-3.671				
¥	0.968	392.5	2r • 2	10230	8.8215		
	4						
_	4	9 1	1	19			
T	3.3	0.15	-1.74	-0.04	Ve 7		

Figure A.5.- Abbreviated print output for sample case.

Figure A.5.- Continued.

103

TEPPINAL DOWNSTREAM LOCATION FOR PLOTTING, X/R/+ +5.51 LREQIN . F LPFFL + T --LPLOT . T LTPAJ = T LRSTRT . F LPLTRJ + T

TERMENAL PROMITERAN LOCATION FOR MARCHINE CALCULATION, X/RC+-1, 60

 Yn. OF PADIAL MESH POINTS
 : C

 MM. OF ANGLEAR MESH POINTS
 : A

 MM. OF ANGLEAR MESH POINTS
 : A

 N. OF ADDITIONAL POINTS
 : A

 AUNT RODY MESH
 : A

 YM. OF LIMPACE
 : B

 YM. OF LIMPACE
 : B

PAPANETROS FOR REINT RODY CALCULATION

DRSTAFIE GEORSTRYS OFFAILT IONOPAUSE SHARE FOR CONSTANT STALL HEIGHT WITH HIRD- 4/3

SPECIFIC HEAT RATIO = 1.667

THTERPLANETARY MACH NO. . 3.CC

ENPUT VARIARLES

SAMPLS CASE - EDUFAULT ENMONAUSE SHAPE HETH HIRE + Court

## 112001 FOR TRAJ-CTORY CALCULATION

4. / PPLANET		•	1.3331
TNTEOPE ANE TAOY	VELOCITY	•	3.926 :+72
[NTESOLVNĖTADA	DENSITY	•	2 2 . 2 . 1 . 1
INTESO INSTADY	TIMPLRATUPE	•	1.0205+05
INT/PPLANTTAPY	MARNETIC FILD HAGNITIDE + Y-COMPONENT +		2ē+01 4f+11
	T-COMPONENT +		2E+1-
ATTRITUAL ANGL		• 33	
POLAP ENGL:		.15	SE 🖞

## ИТРАЈ – 37 – ЧАРКТ – 4 7 – РОЈИТ ТЈ Р, МАРКЕЛ БОР СРЈСК РЕБІКЕНСИ

N	LA . TT	YTPEJ	<b>VTPAJ</b>	27PAJ
	150	N-PLAN-T COD	PPINATE SYST	[4]
1	- 73.5737	343.	3.7972	2.0270
,	- 35 . 537 ;	17536	3.6000	2.6453
3	- 5 - 2 - 3 /		3.3932	2.1520
4 *	-74 . R76 3	5332	3.177	2 .: 731
5	-73.5630	:330	2.599.	2.6750
4	-64.2.34	437.	2.7210	2.6795
7	-57.0(20	-+3246	7.4270	2.576
•	-5: 4.2	2.77	2.325	2.0433
9 e	-47353		1.5621	1.951
10	-34.6293		1.234.	1.9:10
11 •	-34.6121	++0236	1.4221	1.9326
17	-35.9252	.2492	1.2916	1.9026
23	-3+.177		1.2320	1.6363
14	- 22 . 725	5 9:	1.108.	1.652.
15	-24.2 2.	.2435	.5926	1.655*
16	-21 21	. 2954	. 3747	1.5593
17	-15.7350	. 7555	+0900	1.4390
1.1	+1 + + + 2.	. 3 1 2	3573	1.2150
19.4	+11+4.2	415	- 2	1.130
20	-1.1.2.	. 437.	475	4 5453
21		. 4 . 21	- 7330	. 65 .
27	0.2683	.3.00	-1.6470	2fec
*3	9.498	. 237.	-1.0" 57	:460
24	12.593		-1	2.13.
25	27.393.	.1. 34(	96t	-1. 2521
26	23.127.		6736	-1
•7	34. 5563	4:71	517.	-2.1952
2.0	4		3120	-2.4442
2a	47.267.			-2.47
30	3. 5		. 1987	+2.9750
11	27.362.		.201.	-3.(313
12	24.2433	9541	.2693	-3.6771
33	51. t.	973.	. 1010	-3.1310
34	62 93 .	-44 190	.37.	-3.195
3.	67.29	-1.22.	.5410	-3.347L
10	73.923		.739-	-3, 5144
37	+u.3?*3	-1.3570	. 239.	-3.671.

VALUES PROTETED FOR CONTONR CALCULATION

2.50 3

.500 .617 .83 .921

2+03: 4+236

104

,

.3 CONTONE LEVELS FOR MAGNETIC FIELD STRENGTHE -660 -400 1-664 2-566 2-400 3-566 1.230 .45. 2.036 5.636 1.500 5.000

14 CONTIME LEVELS FOR VELOCITYS

42 CONTINUE LEVELS FOR DENSITYS

2026C 30870

13.J. 1 A JU

• 7• i • 75 C • 94 G

.892 3.505

•194 •700 •926

.500 3.436

Figure A.5.- Continued.

• 4 3 1 • 851

1.650 4.650
# 413NT 8007 CALCULATION

# HAVTHIH SHOCK SPEEN+ 5.24572-2 AT J=23 HAVTHIH SHOCK SPEEN+ 2.402635-2 AT J=23 HAVTHI SHOCK SPEEN+ 2.402635-2 AT J=23 HAVTHI SHOCK SPEEN+ 4.2555+2 AT J=23 HAVTHIH SHOCK SPEEN+ 5.24572-2 AT J=23 TTEPATTON PMG GC SMORK Spirsh 1.51771-.2 TTEPATTON DMS DF Safeto T.64221-3 TTEPATTON DMS DF Safeto T.64221-3 TTEPATTON DMS DF Safeto T.64221-3 TTEPATTON DMS DF Safeto T.632212-32 TTERATTON DMS DF Safeto T.64322-12 URS OF CHOPE SPICE (-326325-24 HAVINI CHOPE CPD-)- 1.29732-3 AT J=16 QHS OF CHOCK PPCID: 3.32472-4 HAVINI CHOCK SPEED: 1.2752-3 AT J=16 URS OF CHOCK SPEED: 3.2272-4 HAVINI SHOCK SPEED: 1.2752-3 AT J=13 PHS OF CHOCK SPIED: 3.272-4 HAVINI SHOCK SPEED: 1.2752-3 AT J=13 PHS OF CHOPE SPIED: 3.272-4 HAVINI SHOCK SPEED: 1.2772-4 3 AT J=13 PHS OF CHOPE SPIED: 3.272-4 HAVINI SHOCK SPEED: 1.2772-4 3 AT J=13 TTERATION 296 ITERATION 297 ITERATION 298 TTERATION 296 ITERATION 396 FTHAL SONTE LINE LOCATION FTMAL SONTE LINE LOFATION YEL= -6672 PTL= -7745 YEL= -6671 351= -6631 YEL= -6671 51= -6737 YEL= -7147 S1= -7237 YEL= -7211 DS1= -6034 YEL= -777 YEL= -777 YEL= -7737 SE= -6034 YEL= -7737 SE= -6234 YEL= -7743 SE= -6233 YEL= -7440 351= -6637 YEL= -6474 RE= -6233 YEL= -6474 RE= -6140 YEL= -6141 -6140 -6140 YEL= -6141 -6140 -BODY AND STNAL SHOCK SHAPS Y(\$ H(C\$) • (455 • 1356 • 2275 • 3186 • 4 99 • 5893 • 6557 • 7732 • 851 ¥f RD9¥} • 9994 • 9944 • 9556 • 9729 K(SHACK) 1+31(1) 1+32(1) 1+ V( = nny ) = 1349 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17344 = 17 J 2 3 4 5 67 e 9312 34557 A 9 312 234

-----

ST## 47.	UUMNSTOFTH FULTLUN	AUDY ORDINATE	SHICK SPOINFTE
		1.1.98	2.2710
1		1-1167	2.2635
	- 14/ 3	1.1225	2.2993
1		1.1273	2.1377
	2425	1.13.9	2.3.423
:	2979	1.1354	2.4267
,		1.1784	2.4751
		1.1400	2.5131
•	4 5 4 1	1	2.5555
10		444 42 3	2.6.73
iì		1.1432	2.6583
12	57:13	1.1436	2.7.87
11	7307	1.1439	2.7543
14		1.1440	2.4073
16	39? 2	1.144.	2.4574
16		1.1441	2.976*
17	-1	1.1441	2.9851
1.	-1.1474	101441	3.1426
ta	-1.2349	1.1441	3.3997
21	-1.341 4	1441	3.1692
21	-:	1.1441	3.237*
2?	-1.5515	1.1441	3.3053
<b>13</b> -	-1 -3971	1.1441	3.3722
24	-1.7626	1	3,431
25	-1.3927	1.1441	3.7174
24	-2233	1.1.444	3,5967
27	-2 -1 536	1.144.	1.0743
31	-2.2799	1.1441	3.7115
56	-2.4393	141991.	3.8776
31	-2.5467	1.1.1	1.0145
31	-2.7234	1.1.41	4.0243
37			4.347.
	-3.13/5	1 1 4 4 7	4.7744
	-1.1817	1.144.	4.3786
	-3.5738	1.1441	4 . 4 . 7
17	-2.7619	1.1441	4.5.437
1.	-1.941;	1.1441	4.6347
ia	-4	1.1441	4.7849
41	-4.3659	1.1441	4.9632
42	-4.59 7	1.1441	5.0234
42	-4.5175	1	1.1?65
43	-: ++ 433	1441	*.2517
44	-: .2691	2+2443	5.3659
4.*	-1.5367	2+2444	5.5032
46	-5.1043	1.1441	5.6333
47	-6.0719	1.1441	5.7650
44		1+1441	
69	-+.5072	1.1444	0.0255
51	-t • 9222	1.441	5+1776
<u>51</u>	-7.2373	1	3+32+2
52	-7.3571	1.1.41	54 4777
	-7.3673	1	3.8252
11	-**1824	1.1441	E . 7/3/
	-1212		7 1184
11	-6.4144	1.4.4	7
		1.1.4.1	7.4834
		1. 1. 1.	7.4148
	T 41 4 . C 7 7	******	

# PETATLES FLOW FIFLS OUTPUT

•

FL N	FTELD VALUES	EXTRAPOLATEN		AVIS, THETA	+ 3.6. DEGREES
1	¥ /P、	VINT	******	TITINE	P/PINF
1	1.000	0.0000	3.41.63	4.0363	13.6730
2	1.1.169	. 3740	3.4094	3, 9983	13.6278
3	1.(338		2.4326	3.9946	13.5900
	1.0507	. 4551	3.13941	3.4073	13.5331
	10.070	.2453	3.3429	3.9762	13.4578
ذ	1.1945	.1 . 53	3.3592	3.9567	13.3549
7	1.1014	. 1756	7.3531	3.9531	13.2554
	1.1.43		3. 3347	3.9375	13.1303
٩	1. 1352	.1534	3.3:4/	3.0,99	12.9935
10	1.15 21	.1 *21	3.2911	3.9015	12.8378
11	1.1690	12014	3.2562	3.2745	12.6711
12	1.1857	. 71 84	1.2393	3.0770	12.4937
13	1.2625	.2358	3.21.4	3. 42 32	12.3361
	1.7197	. 24.2.8	3.1798	3.0.082	12.1394
15	1.2366	.2694	3.1475	3.7*23	11.9047
16	1.2135	.2854	3.1135	3.7556	11.6932
17	1.2764	.3309	3.3743	3.7244	11,4760
1*	1.2273	.3759	3.6410	3.7008	11.2543
19	1.3642	.3323	ろんよしい	3.6667	11.1010

Figure A.5.- Continued.

### FURN FRITE VALUES FROM PLONT BODY CALCOLATION

ANGULAR LOCATION NO. 2, AT THETA . 2. J. DECREAS

т	**/*	₹/¤.	¥ /R(	VRIVINE	VX/VT~F	PLOW ANCLE	V/VIN=	PHJ/PHJTNF	TITT	P/PINE
1	1064.00	. 349	. 9794	• : * *	• 30 •	AF.1063	.0.35	3.4161	3.9994	13.6624
ž	1.117.	•.355	1		+-237	44,5965	• 347	3.4115	3.0013	13.6877
1	1.4.54.6	347	14323			18.8328	41 735	1, 1340	3.9837	13-5243
÷	1.6675	.0373	1.0672		.0923	13.7715	929	3.3431	3.9741	.3.4445
6	3.L 84A	. 370	1.04.41	.0713	.11 20	1.9114	.111-	3.7589	3.9625	13.3492
7	1.1417	.1364	1.1.1	+1217	• 292	9.079	.1314	3.3525	3.949	13.2390
•	1.1.87		1.1180	.0201	+1440	7.7517	.1487	7.3330	3.9337	13.1147
•	1++376	+1796		• 96	+1541	6.7313	.1565	3.3132	3.9167	12.9769
10	1+1525	*C4F2	1.1548	•1 191	.[4]4	. 9443	•1*•3	1,2404	1,8981	12.6284
11	1.1091		1.12.1	45 Å 7 7		4 7000	•2017	3.2337	3.0//9	12.0039
13	1.2734	1420	1.2.24		.2349	4.3+94	.2344	3.21.02	1. #331	12.3052
14	1.2203	- 3476	1.2196	6176	.2415	4.0637	2525	3.1797	3.6-57	12.1143
15	1.2373	.0432		. 172	. 254.	3.0847	•269J	3.1473	3.7829	11.9(59
16	1.2542	. 43#	1.2534		.2944	3.3095	.2853	3.1133	3.7557	11.6920
17	1.2712	.0444	1.2764		•3014	3.1221	+3625	3+1775	3.7274	11.4769
1.	1.268.	• 455	.2-71	.61.5	• 314.4	2.8742	+3174	3+0401	3.6977	11.2414
14	1.31.54	• '* 27		• - 21	• 3 5 5 7	1.3434	• 3332	307011	1.0004	11.0040
ANGULAP	FULTION NO	. 3, AT THET	* * Serrica	0.904512						
T	49/8.	310.	X/P	VEINE	VX/VINE	FUTW ANGLE	VIVINE	847/847[NF	TITINF	#/#1NF
1	1.64.5	.1**46	.9748		.3647	94.3214		3.4.125	1.9914	13.5010
2	1.6374	•4163	2119	. * 6 * 4	. 3274	48.4425	.0694	7.3975	3.9856	13.5411
3	1.6344	•1 <b>•1</b>			• /12.	54+2212	+0452	3.3903	3.9782	13.4873
•	1.6515	.1099	1.0457	. 66 4 4	. 737	43.47##	• 1 3 1	3.3979	3.9693	13.4200
	1.6655	+1117	1.0527	• C = 5 9		34. 1732	•1169	3.3694	1,9596	13.3393
<b>,</b>	206525	.1769	1.1.944		.1374	24.4636		3,1399	3.4314	1302939
	1.1.67	.1170	1.1134		.1410	21.0274	.1647	3,1991	3,0104	13.6190
9	1.347	110	1.315	5.57	.1507	10.0432	1917	2, 3022	3.9626	12.8871
10	1+153*	.176			.197	14.9878	.196.	3.2962	1.8848	12.7429
11	1+1756	.1774	1.1644	.1562	.2045	15.3034	+2119	2.2563	3.8653	12,5060
12	1.1679	• 42	1.214	. 549	• 2217	13.9075	• 227 3	3.2305	3.0443	12.4190
13	1.2131	• 1 2 5.	1.984	. 529	+2344	17.7295	. 2435	2.2727	3.8217	12.2397
12	1. 1.0.	•1277	1.2.2.7			11.7267	• 2596	341729	3.7475	12.0493
26	1.2567	.1373			.2877	1.1209	. 2631	7.1979	3.7440	11.4250
17	1.2732	.1331	266?		.3 4 1	G. 4773	.3084	3. 726	3.7146	11.4136
Ĩ#	1.29.22	.1349	1.2132	1 2.4	. 32 3	P. 9494	. 3249	3.1356	1.0834	11.1813
19	1 . 3. 73	.1 160			.3776	* 4842	.3414	2.0965	3.6563	10.9392
	-								_	
ANGULAP	LOCATION NO	.23, 17 THET	a = 85	31.6R=65						
-										
				V4 /V[ 47	VY/V·NE	FEIN ANGLE	VIVINE	843/843146	TTINE	P/PINF
;	1-1474	1.1364	767			15.1913		1.3072	1.0423	2.0212
;	1. 1944	1.121		. 7319	. 7007	14.2007		1.1007	1.0110	2.9041
4	1.2564	1.2471		2424	7*48	174.651		1.2959	1.9764	2.5535
5	1.31.4-	2.34.2		.2495	. 773	17.8554	.51.32	1.3976	2161	2.7974
6	1.3254	1.3551	. 74 2	. 254	.70-3	1*.3849	. 1067	1.4745	2.1513	3.0247
7	1.4124	1.4796	• • 78 j	•2562	. 75 79	14.8133	.8375	1.5570	2.0776	3.2348
	1.4664	1.442.9	• • • • • •	. 26. C	• * 53 *	19.1555	•7967	1.5353	2.6966	3.4276
	1.7203	1.0108	••••	.25.5	.7457	19.4333	.7942	• 7, 97	**1079	3.6038
ií	1.6285	1.5265	- 1135	.7.94	.742	16.8693	.792.	1.6477	2.1142	3.7092
12	1.6425	1.4784	.1174	. 714	.74* 7	21 41 1 56	.7977	1.9120	2.1349	6-6436
13	1.7365	1.7323	.1211	.7731	.745 1	26.1348	.7935	1.9734	201112	4.1663
14	3 . 79:5	1.7362	24 3	.2747	.7440	20.2473	.7945	2.0323	2.1063	4.2806
15	1.6445	1.5401	• 12 37	•27el	•7451	24.3361	.7956	2.3559	2, 1612	4.3892
16	1. FG Ro	1. 18 9 39	•1324	•2773	• 7454	21 + 41-52	. 7964	2.1434	2.0970	4.4948
H	1.95 26	1.7479	• 4362	• 275 3	• 7 • > >	21 +4365	•7969	2.1963	2.0548	4.6307
19	2.6 6.6	2.1556	. 14 37	+2787	.7639	25.44719	.7961	2.2477	2.0933	4.7100
•			••••	••••	•••••		••••••	102410	242004	480203
ANGULAR	LOCATION NO	.24		07687FS						
Ţ	80/P	2/93	¥/0,	VE / VI NE	VX/VINF	FLIW ANGLE	VIVINE	PHO/PHOINE	TITINE	PZPINF
1	1.1517	1.1.17			• 1722	1: +6:63	.6649	. 8977	1.0566	1.4018
<u></u>	10.1610	1.7914		.1773	. 34 4 7	12013530	.6672	1.3383	1.17437	1.7576
	1.2116	1.2014		27716		15.21.7	• 772•	1.1121	1.8438	2.0237
3	1.3415	1.3415	0200	.2335	7953	16.1522	.83[2	3-3169	1.9325	2.4247
5	1.4.15	2.4 15		.237	.7857	16.8154	. 9224	1.3968	1.9711	2.7533
7	1.4614	3.4014		.2435	. 7795	17.3513	. 5.65	1.4922	2.3631	2.9647
•	1.5214	1.5714		.2495	.7742	17.7921	. 51 2 2	1.9534	2.0268	3.15 95
	1.5813	2+**23	<b>*•</b> •	.2526	+ 77:3	19.1583	. 90.94	1.6407	2.0345	3.3380
10	1.6413	2.6413		.2563	.7574	10.4654	+3278	1+7142	2.0423	3.5011
12	1.76.12	107312		. 25 4-	.7441	1	.8371	1. 7443	7.6455	3.5499
15	1.0211	1. 47 11	0330	.2649	. 76.3.2	19.1395	- 93 74	1.0715	2.6426	3.0117
14	1.6411	2.9*11	• a.J.a. a	.7671	.76 ?5	19.3041	. 50RA	1.0741	2.0187	4.0303
15	1.9411	1.941		.2591	.7521	19.4481	.84.94	2.0351	2.0347	4.1406
16						-				
	7.0010	2.r. 10		.27.7	•7618	19.5544	.8163	2.0916	2.6317	4.2495
17	2.0010 2.001L	2.r. 10 2.0610		.27.7	•7614 •7619	19.5544	.8163	2.0916 2.1462	2.0309	4.2495 4.3507
17	2.0010 2.0010 2.001L 2.1209	2.7. 10 2.0610 2.1200		27.7 2719 2731	•7619 •7619 •7622	19.5544 19.6466 19.7114	.8163 .9102 .3097	2.0916 2.1462 2.1991	2.0309	4.2495 4.3507 4.4716

# Figure A.5.- Continued.

### FLOW FILLS VALUES FROM MARCHING CALCULATION

100111	MAL ANTAL L	30AT 134 MC. 3	. AT X/P.	n ma.463				
,	7 /8.	VEZVENE	WY/WTNF	FLOW ANDLE	¥/¥1×F	a anya wether	7/T1%F	PPTNE
1	1.10 06	.1421	. 24.91	9. 3.1	.9. 4		1.5679	1.315
2	1.17.5	.1772	.2149	:1.:141	. 1776	. 2522	2+5354	1+47#7
3	1.2337		. 5397	13. 472	. 1519	1	2.7722	1.4412
4	1.297	+71 66	• * * * * *	14+7234	. 14 . 9	1.17.4	1. 4017	2+1713
	1+3147	• • • •				1.3644	9767	2.6136
	1.4425		. 739	176402	4241	4365	1.7574	7.9177
<b>1</b>			7447	7. 799	. 87. 1	1.5213	1.9775	2.0343
3	1.063?	- 44 2	. 7 3	17.1.96	. 11 * *	T+ 5462	1.9976	3.1971
<b>9</b> N			.77.5-	17.+745	• 91 6 3	1.0754	2.0012	3.3549
11	1.7271	.2***	.7743	. 6	• 113 .	3.7499	2.0077	7+3124
12	1.75.45	. 1578	. 7724	1.4142		1.4705	2.0100	2.0507
17	1.65	. 15: 8	• 77 : .	18.6423		1.5-73	206117	3.0001
14	1.5123	•	• 77.0	10 6471		2.145	2.0133	6.0569
		• / 35 /	• / 3 • 4	4.2411	4. 25	7. 1. 728	2.0144	4.1755
17	746.321	. 2452	7.7	19. 1777	5137	2.1269	2.0129	4. 2 1 3 2
1.4		. 77 6	. 75 **	9.411	. 144	1 . 1774	2.0102	4.3770
19	2.22.1	. 2722	.75*4	29.5 40	+3132	7+2247	2.4 61	4.4734
477575	MAL ANTAL L		* AT ***_	0935				
· T		VEZNINE	**/*!**	FLOW ANGLE	VIVINE	947/84714F	TITING	P/PTNE
	1 07	.17*1	. 6. 33	7.7014	. 7115	.7913	2.5 175	1.1925
,	1.16.2	.1972	723	1 aca	. 1870	. 9644	2+6347	1.4791
3.	7.2431	+1794	. 5527	11.4424	.87.4	1.224	1.7219	1.7605
4	2 . 31 73		. 5354	22.1470	. 15 10	1+1263	1.7725	2.3179
•	1.37.9	. 2/ 44	• - 21 -	14.147.	+ 44 71	1 4 2 7 2 1	2.5473	- Z.2377
2	1.4244			15.1156		1.3.32	1.03	244798
	4970	•		1248141	4 7 3 5 7		1. 91. 9	2 8804
-	10201	1107	7807	16 6840		1	1.9547	3.0676
1.	1.6636			7.2.49	. 12 1	46434	9579	1.2341
iı	1.7571	74.93	.7427	17.6551	. 12 . 5	1.7.43	1.9755	3.3957
12	1.7357	2532	7466	17.576.		2.7915	1.9465	3.5481
12	1.+742	. 2"e7	.77ne	19.7452	. 5198	i.seli	2.9438	3.6921
14	1.9427	.2197	.7771	2+.4752	. 193	1.4274	1.9843	3.4580
- 15	201163	.?523	. 775 -			1. 9967	1.9843	1.9575
16	2.LE 98	.2646	.7746	*******	• 1,50	2.	1.9899	4.3809
17	241354		. // 10		• 11 - 5	1 100		4.3499
	2.26	7497	.7743	9.2.22	•167	2.2121	9444	4.3 796
479175	MAL AXTAL L	UCTIUN NU"	10 AT 9752	• -9.571				
T	•/•	VEZVINE	VY/VINE	FLOW ANGLE	VIVINE	2.43 / P.40 I.N.E	7/11ws	#/PTNF
i	1.1442	-			. 14: 2	. 5:45	1.3423	. 3919
•	1.4940	12	. 4545	-4.747	. ?!45	+7:44	1.2615	. 9921
,	1.6451	23	· 207.	133*	. 7576	.7455	1.1945	. 4929
•	2.1950			1701		. 7. 75	201327	
	2.240		0.3.23		. 1975		1-2467	. 4901
	200927					76 .	1.0229	- 8961
4	3.4674					4158	1.0314	. 4962
	1. 6. 70			- 7 . 2 4	1. 16		. 3764	. *639
1	6.2664	- 11/1	1		1	. = 454	. 9745	.8726
11	4.64+4	· · ·	5	1334	1.3014	. 931 .	. 991 3	• 9223
12	4.4443	• 124		• 74. :	. 2273	792	1+-162	. 9951
13	5.3.94	• . 2 •		1.1.97	. 9921	1	3+6463	1.0793
12	2. 1(1)			245799			1.1.04	141712
			273	3.6347		1. 280	1.1427	1. 1491
			. 64.74	4.427*	37:16	1.2=14	1.1717	1.4687
	7.1.27		64.54	5.3726	2544	1.3.95	2377	2.5415
a	7.4:20	. co3	4244	5.5305	.9600	1.3779	1.7352	1.6771
*****	MAL ANTAL E		. AT X/RU	-:-:-				
,		¥#/¥INC	VELVING	FICH INSLE	¥/VENF	*47/*40INF	TTINE	P/PINF
i	1.1441		. 446 9		. 3619	. ot 57	1.3439	. 1946
:	1.5.29	++0513	. 9: 47	-a. 7!* /	.9547	.7.65	2.2659	. 8947
3	1.8037	( + 23	. 90 74	-•:3e3	. 7674	.7511	1.1922	. *943
•	7.2234	11	.97#1	1707	• 77 * 1	.7920	1.1297	. 1948
1	2.5432		. 9567	2432		. 3276	1.0795	. 5934
	2.9429						1.0453	. 3414
	** 3,27					4919	23000	. 4907
e	300C/4 4./733	-4 . 07 -4 176	1				.9747	. 4674
:	4.3t2.		1.0045	- 6*75	1	. 6 96 5	. 9725	. 8719
11	4.7417	2:	22			. 9795	.9973	.9174
2	5.1613		. 9779	+6416	.9366	.9751	1. 122	. 9880
13	5.4612	** 591	. 9727	1.4491	. 9930	1. 3270	1.0416	1.0703
14	9.621	. 300		2.202	. 3977	1.1915	1.4731	1.1605
15	5+1407	• 33.70	.9113	3.(3:3	.9524	1.1393	1.1.147	1.2543
14	5.54.5		. 9745	3		1.2441	1.1.3/0	1.103752
17	7 54 -		- 24 17	4.9491	. 26 5 7	1.3014	1.2022	1.5648
10	7. A. GR	371	.938.	1. A. A.	2411	1. 3494	1.2201	1.6590

Figure A.5.- Continued.

49 STREAMLINES CALCHUATED

CTBEAMETHE NO STAFTIN (FURD SPONS	* #T ¥/P. * . TN T48TA * <u>2</u> *	•3)+3, •/0 • 7,48255,	+ 4-453 8979, + -43 5 3
4/0	D /D .		
1+3-43	415		
	4 4		
1.226	•.3.3		
1.1736	• • • • •		
477	. 59.		
1217	. 7 7		
1.0434	•" 97 c		
	. 2 975		
	4335		
	4453		
• 10. 5	• 123		
• 73 • 7 • 1:50	• 137		
.74.0	1		
• 7* 65	. 7* 2 3		
7. 4 2	74		
• <b>57</b> F I	•7571		
•==== •52 t			
• *	P 273		
	. 4 77		
	16.3		
.493	. 2174		
*****			
. 417-	.95-1		
.2913			
.319	2464		
.3133	1.0111		
	1. 115		
.234 3	1 . 421		
. 2. * *			
	571		
•12.*	1 1753		
	1		
• • • •	1. 24 -		
• . 6.	242.00		
-1 - 5 6			
1127	1.1231		
•• 771 <del>.</del>	34"		
27t s	1 109		
	1.1444		
	4 . 1 4 5 1		
	1.1473		
6. 61	1.1427		
	1.1491		
77*2	1.1474		
	1.1405		
9413	1.44		
-,904-			
-1. (**)	1.1490		
	1.14.75		
-1.21.61	141475		
-1.3245	1		
-1.3842	405		
-1.4343	1.1494		
-1.5503	1.1494		
	3.1494		
7154	1.1444		
-1.7719	1.1494		
-100216 -10022	3.494		
-: • 9379	1.1494		
-1.0923 -2.148n	1.1493		
-2.1.4	1.1493		
-101594	1.433		
-2021-1	1.1453		
-2.3255	1.1433		
-236	1.1493		

Figure A.5.- Continued.

+7,47 <u>1</u> 5	141943
	1.1493
	1.1491
-2.7.3.	1.:434
-1.7/	1.*403
******	
7 .	1.1443
	1.1693
	1,1421
-34 -33	2
• 5 . 1 · 4	24, 435
-7-1**	1.1493
	1 1 4 1 1
- 3 + 2 + 4	
-3,2017	1.1403
-7.3721	1,1493
- 1 . 7 7 .	1.101
-3.377	
-3.432-	241972
-3.44.1	1.1473
	1. 401
- 34 3	
-3.5613	1
-3.c:43	
-7.97	1.1493
-3.707.	
-7+3254	1.1
-1.11	1.443
	1.1691
	1 1463
- 2. 00-5	1
-44	1.473
071	1.1493
	1 . 425
- 4. 2. 5.	
-4.2534	:
-4-3'4"	1
- 4 374	
-4.430	14/472
-6.6+6*	3.1472
-4.14.3	2.4.4.72
	4.01
	A
-4,05.7	2.0.012
-4.7. : 3	1.442
-4.7617	1.1677
	40*
	1
-472.	1.1497
-4.9271	1.1.1.92
-4.461.	1.1497
	1 1403
• 2 • 1 * 1	44.77
-:. 414	
	1.147?
	1.1407
-2.25	• • • •
-5.3253	1.1.1.1.1
-2.37 7	1.1497
	1.1672
	1 1437
-2 F L -	• • •
-5.3.3.7	4.4.4.4
	•

412	710
-5-1643	* . 3 . 29
-1.2197	F.2711
->+2751	5.229.
-5.32v4	5.3371
-1.2151	5.7447
-5.44.2	5.1524
-5.4555	5.3601
-1.1367	5.1615

X/RG	e 12 -
41 3 3	5.4341
-t.45*t	5 . 4 4 t .
-1.524	÷.4539
-:.5367	1.4257

Figure A.5.- Continued.

# HAGNETEC STELD COMPONENTS

		0. 1. ST THIT	• • 0.0000	, nacelie					
t	PP / F	3/8THE (PARALLEL)	1050B)	R/RINF (IN-PLANE)	9-ANGLE (TH-PLANT)	#/#[NF (H7P#4L)	RY/RING (RESULTANT)	AV/AINF (PESULTANT)	A7/SINF FFSULTANT
1	Tables	1. 410 L.C.							
•	1.0169	. 1419	12	11.6849	99.9445	3.4. 84		11. 724	*1558
1		1.1.27	5.7572	6.6753	49.3448	3-4126	211	9-6113	.1555
	1.1.1.7		7.19.5	7.1197	46.75 11	3. 3941		7.1116	.1 5 5 1
	1. 476	7667	6.2660	A. 217A	49. 4241	3. 3870	.16(5	6.2112	. 1 5 4 6
					40 40 4		34.04		
5			7.004			24 3 24 2		2+0227	
	1.1014				14.3433	3.3:31		7+1357	+1233
	1 1 1 1 3		4. 1735	5.5217	99.944	3.3347		4.9202	+1524
4	1.1352	•543e	4.:573	4.5177	96* 1332	3.3.42	• 1763	4.5174	+1515
13	1.1571	.5994	4,334,4	4.2928	14 . 1735	4.2911	• 1942	4.2975	+1564
11	1.169,	+6247	4	4.0700	40.7377	3.2662	.3919	4.0746	
12	1.1659	•7.73	2. 9295	3.8017	*8.5362	2.2393	.3403	3.8964	.1481
13	1.2.25		3.7933	3.7478	66.3729	3.2164	.1063	3.7424	.1467
14	1.2297	■ P. 4%	3.4351	3.6718	**. 1116	2.1708	.1129	7.5953	.1453
15	1.23:6	. 3479	1. 4934	3.4414	44267	3.1475	.19.	2.4551	.1419
16			3, 1432	1. 35.26	87.1551	3.1135	.1263	7.3469	.1423
17	1.77 4		1 7	2.2442		3.0780		3. 2602	. 146 7
	1 14 71								
17	1.20/2	4 751 2	34 14 51	3+1446	7743352	200010	*****	1.133	•11W
14	1.3692	1.0	24.54	2.4733	47.1426	340,00	.1.04	5.4011	+1311
1611L A P	-	0. 2. AT TH'T	A = 2. ();	n26911*					
Ţ	20/8		. / . THE		RANGE F			SY/STNF	
•	•	1947411511	10.201	(TN-PLANE)	ITN-PLANES	ENGRHAL 1	CRESULTANTS	FRESH TANTS	CRESHL TANT
•	1.006.0	. 1666							
		*141	11 2004	11 74 64		6 1016			
1		•	11. 200	24.720				11. 1917	• 4 5 1 2
	101324	• 1 7 7 7	C. 7.1.3	7456 (L	ec.1.1.	20 34 23	.2334	- 01 33	
2	1	. 24.04	7.1015	7.1016	31429	4,7499	• 2203	7.3907	•5788
5	1.44 678	s3142	5.239	6.2.47	A4.1349	4.0098	.2619	6.1989	.2167
6	1.0846	+376e	5.0.5.	5.65	4×. 1966	4.46 j P	1845	4.5925	.2039
7	7.1617	.417]	5749	5.1341	47.974*	4.3127	.1811	5.1256	.1971
	1.1147	.43**	4.235	4.8171	47.3727	4.1792	.1755	4.*087	.1910
9	1.1356	4571	4. 14.12	4.51 EE	17.75.7	6	6.754	4.4985	.1854
12	1.1225	A 65	4.3268	4.2554	47.5474	3. 7327	17.7	4.2773	.1797
11	1 6 9 7	.45*6	4	4 775	47.53.4	3.8381	.1753	4.0455	. 1747
12	1.1844	• • •	3. 41 3.3	3.85	47. 3 4 7	3. 7. 74	747	3.6765	1495
<b></b>	1.2.34	7 . 71	3.7-53	3.76.2	**	1.504.0	1777	2. 7311	1.1.4.4
	1 326 1			5 . 64.6		1			
12	1 93 99			3.3.4.4				303150	1240
17			2	204244	37.432	202007	+1/15	3.990-	
10	. 2342		2.3005	3. 7445	47.1041	3.2473	.16.7	2.3370	+15ÇZ
17	1.2712	* 6 3 24	3.2564	3.2.7	37.1714	3.19/6	+1595	3.2296	.1458
14	1.1851	. 745	3.15.3	3.1244	37.7493	3.1952	.15.1	3.1225	.1415
19	• 24 5	•••	3. 1.4	2.9424	*5.437*	3. 11	.1921	2.9735	•1372
	LOCATION N	n, 3, 47 THLT	4 • 540422	)=685r5					
					B-ANGLE		97/3TNF	SY/STNF	
	•	(PAPAFLEL)	(P-0P)	(IN-PLAPE)	(IN-PLANT)	FFRANKLE	IRE SHLTANTS	(RESILTANT)	CRESULTANT
1	13	.1317							
2	1.6174	.2756	1:.5576	11.474C	44.4470	4.9765	1.1.1.1	11.4099	. 4685
ŝ	1. (344	.2490		4. 17	14.6493	4. 3471	. 7 31 3	*. 4551	.3815
		1.44	7. 4	7./ 110	44. 24.98	A		A. 0004	
	1								• 3 4 4 7
÷.				04432.	-1ex100	2010		201133	+ 2144
7	14.050		101732					7+7307	• 2 • 86
7	· • • • • • •		24		15.1275	4.9977	+ + 3 ? ?	2.0791	.2284
	1.1197	.5459	4.74.7	4.7	25. 936	4+2535	+4.175	4.7594	+2141
a	1.1367	.5949	4.4395	4.4722	85.3739	4.4229	.3541	4.4577	• 2 • 2 2
1.	1.1538	+5429	4.2557	4.7584	*!.0?50	4. 1955	.36*7	4.2359	.1918
11	1.17.4	. 4 3 6 9	4 563	4.2457	34,9971	4.0059	.3524	4.3293	.1831
1.2	1.4479	.7350	1. 97: 5	3. *544	94. 2394	3.8344	.3465	3. 5453	.1755
13	1.24.	. 791 7	3.72.7	3.7.79	14. 1762	3.0448	. 3317	3.6992	.1684
14	1.77?	. 82 4 4	7. 1774	3.4730	54.5751	3.5494	1724	3.5558	. 1 . 2 .
1.	1	4566A	3. 43 9 2	3.43*0	44.7584	3, 4741	. 3131	1.4180	. 1
14	1.2.4	. 3 70	3.1241	3.534*	64 7/ 63	3.30 8-	- 31.44	3 9471	
17	1.2737	94.77	3 916	3+32+1	3447 23	3 1004		3.5771	+1311
	1 10		20 1 70	3.61.10		201404		5.2301	+1402
		• ****1	38	50.41.7	79.39Q	3.3957	• 5 4 9 1	3.0 - 44	+1415
12									

# Figure A.5.- Continued.

_					1.4.461 -	8/81NF	PTITUE	RVIRTNE	**/*TNF
T		#/#TNE /#42411715	(	11N-914N-1	(TH-PLANT)	1+724663	(PERILTANT)	(PT*ILTANTS	CRESULTANTS
,	1-1566								
;	1	.936.e	3. 54 84	3.7+22	21 444	4. 37;9	3,4003	1.3424	.1563
,	1.19:4		74 2 2 4 7	2.717.	274.345	2	234.	1.2.5	.1411
4	1.25:4	1.1659	7.1947	2.321:	32.3** 1	2.7372	3,0587	1.2429	
:		14.2*4	1.0745	2.1:e1	36.03**	2.3233	1.5-10	1.1.7	- 1326
1		-1584			4141927	2.4.2	1,1774	1442	.1.98
	1				. 7. 144.	2.3434	1. 745	1.1140	.10 ec
	1.77	2. 3. 7.			+9.3.24	2.3364	.1006	1.4197	. 1668
	1.1745	1.16.11	1.0773	14:1	51.4353	2.3271	2,1349	. 4491	.1.60
	1.52.04	. 4442	1.565.	1.0364	33.7759	2.3-67		1.4797	.1654
12	1.6670	1.2147	1.0755	1321	55.3173	2.3.	2	1.5154	• • • • •
11.	1.7255	1.5654		1.5374	56.7373		1.0041	1.4943	11.47
24	1.79 :	5' 47	******	441257	2/4/13.	2.2.2.1		1.5810	.1044
15		1.561			14.11.7	2,2293	9222	1. 5056	1446
10	1 6.1	7563			61 . 99 35	2.29.4	2 44		.1647
14	2-1.46		71 37	1. #7 #2	51.5431	2.2917	. 4 92 9	3.4502	+1-48
10	7416 0	1.4245	2.7. 5	1.+777	52. 3624	2.2978	. 57#3	1.6772	.1.56
				3468118					
TAUNER	8 23 81134	N1.24.2 11 14614		1604					
	80/0	9/9745	4/9TNC	A/AINF	3-ANSL 4	RFRINE	RYPRINE	97/9145	47/5INF
-		(PAPARLEL)	12 003	EIN-PLANTS	(IN-PLANE)	INCRAL)	EPESUL TANTE	(PERILTANT)	ERESHL TANTE
1	1.1.17	.7144				·			
,	1.1010	. *741	3.305#	3.4:4:	· · · · · · ·	2+ 2213	3+261 +	1+1314	• • • •
3	1.2216	. 34 44	2,4144	2		7.2490	2.2765	1.1996	1145
:			1. 246	202957	3263570	7.4152	1.5663	1.1465	.1694
1		1.3447		4546	41.7471	7.3271	1.4317	1.2394	.1664
,	1.4414	1.2102				>. 2795	.2424	1.2614	.1642
	1.1714	. 74 90	1.6343	1. 7768	47.2574	2.2349	1.2.17	1.2091	+ic31
q	1.50.2	4+374	1.5152	1.7548	46,0315	2.2.79	1+1289	1.3416	.1653
10	1+6413	24.3548	4.5.3.	4. 7475	2	2.22.99	2.41722	1.3751	. 2.19
11	1.7.1:	1.44.2	1. 5966	1.7416	53.4357	7.2257	1.7256	3.4737	
12	1.76.2	:*****		4. 142.6	75	2.2745		1.4432	. 1617
	1. 8211	1.5687			51,2328	2.7763		1.4998	1618
17	1.6411	4472	1.51.9	1.765	59.1552	2.2295	. 8993	1. 9174	.1019
14	2.0610	2.6342	1	7749	04.2769	7.2337		1.7+35	.1.21
17	241 61	73.08	1.5340	1.7935	51.3413	7.2345	**574	1.5577	.1623
14	2.1269	ie'7* *	1.5484	2.45.67	51	2.2435		1.5705	.1.26
19	2.15.19	7	1.0258	2.4197	42	5 . 22 .2		190-24	• 11 2 4
ADDITI	ONAL AXIAL	LOCATION MON 14	AT 177						
	2/1	PERTNE	AJATHE	REATHE	REANGLE	4/SINF	WAVAINE	AV/ATHE	47/5[NF
		60 A7 A1, L 41 3	(»(?e)	(IN-PLANC)	(!N-0L4N=}	(MORHAL)	INFRULTANT)	(RECULTANT)	(PEZHLTANT)
1	1.1.98	. * * * 2							
2	1.1715	****7	7	2017		34137	302673	1.1149	1248
		2226		2.1-68	1. 34 1	7.4755	1.7644	1.5581	. 1111
	1.36.7		. 7	1.175.	36	7. 14. 5	1.51.53	1.1972	· · · · 70
	1.4165	1,175	1.6395	1.75 .7	45.3115	7.2672	1.35 PA	1.1557	.1136
i			a c. tv		44.14.2	2.2735	1.7493	1.7105	.1016
۰.	1.5419	1.7401	1.1777	1.71.5	+7563	2 . 2 . 2 .	1.1026	1.2535	.1006
	1. E. 37	:. 3493	1.5034	1.7	45.7439	2+15-3	2.3977	1.2464	.1061
17	1.5654		1.5562		7 7915	2.1874	146435	1.2494	
	1. /2/1		1.1673	1.7/31	5 * 6 77 ¥ 1	2.1907	9634	1.4071	
12	1				56. 3933	2. 972	.9317	1.4341	. 16.4
14	. 9123	192	1. 724	1.7274	58.2436	7.2622	a9649	1.4641	.1667
15	1.074.	1.6791	1.5944	4.7375	59.4370	2.2095		1.4945	.1616
16	P++32P	1 6 ?	1.5285	1.7.25	53645	2.2.44	. 5657	1.5221	.1012
17	241.971	1.7301	1.6110	1.76 3	6	2.2199	.0349	1.8443	01613
	2+1592	1.7713	1.0136	1.7.74	514114C	2.2291		147702	- 2010
14	2.22.24	20 3 1 4 7	1.0332	1	960V267				
ADDITI	DNAT AFTAL	LOCATION MR. T.	AT 7793 +	6415					
1	₹/₽.	8/9745	4/4INC	A/P]NF	S-ANGLE	RINT	#1/814# /ACCIN #14#**		9778INF 886816 94494
		(PAVALLEL)	(-(*))	([N=+[xN[]	(.w-s[942]	( TREAK )		****************	ANT THE FAMILY
;	1 . 1	4134	3	3.1155	45.6.01	3.41.65	2.9829	. 8946	.1557
i	1.243+	. 496.9	2.2335	2.334.	23. 3501	2.6573	2.1349	.9310	.1215
4	1.21 72	. 7564	1. 25 97	1. 4767	36.7432	2.3979	1.7367	\$9926	.1190
9	1.37.9	1.1373	1.035.	2. 1( 34	35+53+3	2. 2737	1.4557	1.6468	• <u>1</u> 4 34
2	1.4344	4.4	1.1962	1.144	40.1533	2 1 7 9 7	1.2074	1.1631	
!	1.4070		1.1277	1.45.47	47.1171	7.1561	1.1291	1.2124	.0985
	1.675	1,9917	1.11.5	1.1524	44.6167	2. 492	2.3695	1.2977	.0982
15		. 1 4 2 4	1.1147	1.6423	51.4964	2.1489	1.4185	1.2988	. 0982
ii	1.7571	1.4126	1.5.65	1.6.70	53. 1526	2.1542	.9764	1.3366	
12	1.6117		1.5122	1.0556	5: 5619	2.1197	.9409	1.3722	.0587
13	1. 4792	*****		1.4.776	76.9954	2.16.95	.9129	1.4074	
14	1.9427	1.5743	1. 2424	1.5975	20.3149	2.1440	. 2672	1.4400	
	7.6.63	1.4373	1.5734	1.7356	5	2.4000		1.4791	.]2
17	2.114	1.7744	1.5475	1.7432	51.3454	2.2004	.8421	1.5243	.1.66
18	2.1969	1.7592	· • • * • •	1.752	61.3974	2.2054	. 9427	1.5454	.1468
19	2.26.15	1.5132	3.0.42	1.77.	52.1791	2.2121	+ 1365	1.5677	• <del>14</del> 11
400771		1.0CATTON NO.44-	AT 1/83 -	-1.2651					
	• • • • • • • • • • • • • • • • • • •	A/ATHE	R/91N#	AVATHE	4-449LE	<b>B/BTNF</b>	RY/SINF	AY/AINE	57/8ENF
•		(PAPALLEL)	(PERP)	(IN-PLANE)	(IN-+LANE)	(NORMAL)	(RESULTANT)	[RESULTANT)	(PESULTANT)
1	******	.e148							
2	1.3747	.5440	1.1571	1.26.7	17+2734	1.3484	141931	4032	
1	1.6132			44 Gr 70	J 40 1775	24442	.3825	. 4777	.0524
2	108478	.7494	. #910	9: 11	76.5326	1	.3645	4544	
	2.3.45	74 44	14 5		72.5504	1	.2543		492
		<u> </u>							

TAUNTED FOURTLUM HUPCED AL LAGLE & 14" T. UPDAHE (IN-OFAN-) (IH-OFAN]) (MUSHOF) (OCCHFTANI) (DIGHFTANI) (DIGHFTANI) Badar Johnston (IH-OFANI) (MUSHOF) (DIGHFTANI) Badar Johnston (IH-OFANI)

. 96 5	
.9787	.2846
. \$976	. 2P 24
1.1171	.2775
1.(373	.7693
41 2 4 2	.262.
1.3579	.2578
17#6	.2437
2. 1961	•2163
1.1171	. 97.
1.1224	
1.1457	.1350
141517	+1211
1.1672	

TE POTNES IN	CUF.4016	LINT	٩r	v/ <b>v</b> t×=	•	• 201. •	TITINE .	3.440
¥ / P :				19:				

14 V.L05	114 11	 1.4	SUNTOUR	t T Nº S	FOUND

y /R 1

.6442 1.6067 1.6059 1.6044 1.6044 1.604 1.604 1.607 1.607 1.673 1.673

Y / P .:

/

.7013 .70.7 .7503 .7714 .7973 .507 .9567 .9486 .4986 .4986 .4986 .4986 .4986 .4986 .4986 .4986 .4986 .4986 .4266

A PRIMIS IN CONTROL LING OF VIVINE +	•	P714TS 1		LINE OF	V/V[NF -	•157•	T/TTNE .	3.470	
--------------------------------------	---	----------	--	---------	----------	-------	----------	-------	--

P / 2 ,

• 542 • 455 • 13. • 1370 • 1375 • 1375

T	0/0	b\=Ivt	uleivc	RITHE	R-ANGLE	A VAINE	RY/RTHE	44/4]WF	**/81NF
		(PAQALLEL)	(****)	(IN-P[ 4H- }	(IN-7[#NE)	(MUGHVE)	{PESULTANT}	[PESIJETANT]	{PESIIL TANT
)	1.443	.5"55							
2	1.3461	s€457	1.424	1. 852	19.957	1.5337	2+1287	.3 * 2	a u 701
3	".tzh]	* 6755			56 <b>.</b> 3793	2.2410	+5341	. 1635	.[!67
4	1.87.1	.7116	. 936 -		66.2543	1.1413	. 3 5 4 7		.0522
5	2.1171	.7470	.9165	.c341	72.u7.t	1.1(:5	.2573	. 8574	au 563
6	2.3:4.	.77:4	· ** 7		74.J=30	1.0759	+2451	. 85 99	• 6 4 9 2
7	7.5962	.7894	• \$372	. F47+	74.1527		• 2213	. 9775	.0478
	2.8301	4 N. 75	• 743.	af 74	73.9732	1.0340	.2227	.7752	473
9	1.18.3	. 5454	.7	. F. 71	74.4476	1.565	.2141	.7779	.0423
10	3.3271	* acue	. 7367	• * 1 * 7	74.7-45	· • • • • •	+2152	.7869	
11	3.5641	. 2513	. 100	. F419	74.2**7	1.1.22	• ? ? ? ? ?	. 9 . 92	
:2	3.1.5.	. ?24	• č313	. • ? • 4	74	1.2035	.2465	. 4439	.6550
13	4.1.453	1. A39	7	• 41 72	72543	1.2593	. ? 7 5 1	.8622	
14	4.25:1	2.1441	. 9. 97	.04.	71.6379	2.3011	.2993	. 9113	
15	4.5321	2.7.23	. 9c P	1 36	73313	: 499	• 31 ° i	. 9609	.0615
16	4,7741	1. 25.93	1121	1	73940	389.	•336A	1.1/63	635
17	5.1.03	1.3127	1. 328	1.1007	71.1551	1.4272	. 35 74	1.5482	
	8. 3463	1.3468	4.365	1.1579	76. 225.9	1.4677	+ 3774	1.1933	.( 671
10									

73.6124 72.524. 73.224. 73.3052 73.3052 73.1431 71.471 71.1471 71.1471 71.4471 71.4471 71.4471 71.4471 71.4471 71.4471

.7754 .7425 .7440 .7525 .7857 .8464 .9463 .9398 .9393 .3341 1.3341 1.42.2

• 2313 • 23143 • 2344 • 2344 • 2344 • 23483 • 2481 • 32437 • 32437 • 32437 • 3437 • 34527 • 3527 • 3527

- 477 - 474 - 476 + 562 - 532 - 556 - 579 - 664 - 659 - 677 - 69

,

# VELOCITY AND TIMPERATURE CONTOURS

### 11 NAGNETTC FLELD CHMMINE LINES FORMD (FOR CHMPDHENT ALDNE FILLD LINES PARALLEL TO FLDW IN FREESTREAM)

¥79:3	* /? 6
.9411	. 1963
9999	.19.4
1.0122	.1813
1-0212	.1861
	.15 *?
1	. : 473
792	.1169
1-0512	.1136
hat is i	. 15 5 3
1.1.44	.1385
1.1.90	2

15 POTNTS TH CONTOIR ETHT OF BURTHE (PAPALLEL) # 1677

¥/P2	E / 9 ()
. 4467	.1515
.9853	.25 58
411 47	42554
2.2.7	.7525
4 2 4 2	.2481
1.439	. 2373
1.15.66	
1. 977	.1925
	. 7. 3
1.1.94	1245
1.1493	
1.1.11	

• ·

IS MACH-TIC FIELD FONTALLE LINES SJUND

») bůzníš zn uchimio Tání ne bíběhe tošeběnutčnítku = 0°300.

¥/3	• /• ÷
•:214	.7242
.****	•4.3*
47761	.**1-
	. 75 43
7844	.7.14
74.66	.7. 57
4374	. 4 : 43
63.04	
	44.75
• 44. T	
1.1265	• 3 3 . 4
1.534-	• 75 95
	•2-43
1.15%	• 2 • • •
1. 679	.11 22
1.2743	.1375
1 753	1.666-644

### 35 PRIVES TH CONTOUR LINE OF AFAINE (PERPENCIPULAR) + 5-101

¥/4 .	\$ /\$ L.	
. 2	1.1242	
4721	144726	
442		
45 67	.95 45	
74	4146	
4352	*743	
	4653	
	429.	
. 71 74	7754	
. 8. 23	72 79	
	1755	
2148	. 60 56	
• • • • • •		
	43.7	
341344		
*** * <del>* *</del>	• 34 . 3	
2. 712	+2571	
1. F20	• 21 74	
1.2-51	•192.	
1.102-	.1134	
	• 2 * *	
Figure	A.5	Continued.

### 24HCT4C0 4178860

### A DENSITA CURLUID FINGS EDINU

32 MUANTS IN CONTINUE LINE OF ANOVANOINE # 24-01

¥70-j	₽/₽j
.**3-	. 45 . 2
. 5. 55	.47+2
. 9701	4949
.9339	
. 94 31	. 200
9024	+413
. 9741	4549
9945	45672
3.4.1	. 77 74
	5810
1 71	
1	6010
	• 79 LU
•	
1.13.2	• 26.34
20.403	4591
3+10.04	• 5 3 40
1.2.27	.46.59
202-62	• 49 2 9
1.2394	•4)27
1.2466	• 3 * 15
1.267n	•31¢1
1.2462	•2°63
2.02987	*`sef
1.3632	•76 55

### SA POTNTS IN CONTRUE LINE OF RUCKPURINE + 7.52

¥/5.	P/9 ,
• * > ? ?	
.7560	•7171
.75.5	. 74 34
.7+47	.776
.766:	7931
757	
. 76 .6	. 64.4.3
. 776 .	61 43
77 4	12.4
	.4511
• * * * *	
• 76 5	
•7635	1.519
.7558	1
•748(	1.1213
.74:4	
.735.	1.7.3.57
.7196	1.2725
.7.40	
	1.7435
. 605	1.42.32
46517	1.4527
6281	1.1.10
. #843	1.4.8
47.7	1 4 9 9 3
07131	10, 034

NTS IN	[0+7413	E ENT	- e	<b>**</b> *151
×/*0				146
. 25 . 5			:.	.7-4
. 2453	1		- 44	. 645
. 37 92	•		- 2 -	. 391
. 4 . 5 4			•	. 72
	•		•	95.97
.5352			•	3363
			•	93.4
+6441			•	
• 7: 2 4	,		•	· · · · ·
. /1 34			•	
				737.
				20.20
				.744
91 53				5.74
. 95 4 4				55 23
. 4e 5.				5366
.9431	,			4645
1. 223				4:42
1.052.				3414
3. 72				2573
1	ì		•	22#2
2 59				1951
1.0941			•	1.93
1.1945			•	1157
1.11			•	
1			•	1 4 4 1
1 1 2 3 3 3				6.3.4.
1.6313				
1.0164				. 3 . 7
	•			

------

¥/0.	R/R:
1.2142	
1.0319	• (575
4. 475	. 794
1 027	.1115
4	+11.7
1.0627	•117)
1.52.	.1955
1.0427	.2547
1.0400	. 25 93
1	.2611
1 190	.3311
.9945	
. 96 4 3	.4703
.9291	
	5006
	A
. #4 54	. 65 5
.7581	.71.85
.7459	.7724
. 6994	.8.19
. 6 9 9 5	. #217
	.47. 7
	9154
79	. 97.55
	. Cê ve
. 1976	

TO PATHTS IN CONTRUS LINE IN PARTNE ENGRALL + SALLA

18 MACHETTE FILLE FONTOUR LINES COUND TEDR COMPONENT ALONG FILLE COUND

	(4)H-DIMERETINALTIN DAY INFIGALANETARY VALUES)										
N	* T 4 E	V/ VI N F	44/V†NC	"Y /VTNF	VT FATNE	947/9477NE	<b>TE NØ/T</b> ØØ]*E	***]##	**/****	AY/SINF	87/81N#
1	-70.57.7					444.00	2	2.0033	.1464	.9690	.0457
2		1.0000	1.0000	Jeices	Joktic	1.0733	2015-22	1.000	.1434	.9890	.0457
3	-****2131	A . L	2.44	# . 1 ki	1.6330	1.0363	1.0000	1.06.13	.1404	.9893	
4	-74.9700	2 40 2 N	2.46.	1.03.61.2	10.20	1. 5	2.011	2.0000	.1404	.9890	.0457
5	-72.5030	1	Levi.	Joni J.	445.146	1.000	1.3.2	1.0000	.1404	.9894	.3457
6	-54.2630	1.0200	204	Jan FC J	10.000	10013.	10-11 ( 2	1.0001	-1404	.9890	.0457
7	-57, +326	1.000	1.0.1.	J. CC 4.		1	4444.54		.1454	.9890	-0457
•	-51.4121	1.0310	1.0000	3.0003	2.0030	1.0000	1.000		.1404	9890	-9457
9	-4735.	1.1.1.		2011		1.01.00	1.0000	1.66.01	1404	9893	.0457
12	-30.668	2.010	3.11	1.000.0	44.236	1.221.	1.76.00	1.00.0	1404	9890	
11	-38.5(2:			Leve v		1.0030	1.0010	1.0000	-1404	9890	-3457
12	-15.0351		4.84.14			1	1.116	1.0000	1404	9890	.0457
11	-34,9670	1.2335	1.0000	2.6201	2.03.0	1.1.1.1	44053	1.11	1404	989-	
14	-37.735.		.7563	1435	. 2334	2.2767	7.179.0	2.0915		2.1343	.4487
15	-24.2:2:	. 741	.7294			2. 697	2	2.2484	0223	2.2119	4032
15	-21.34.2	. 7568	.7115	1692		2.0072	2.2170	2.257#	. 17.96	2.32.1	.7613
17	-16.735	. 76 6 5		7 3 .	95	1.077	2.1171	2.4844	144.5	2.5720	.2303
19	-14.412.	. 73 3 *	466.0		3.115	1.4938	2.3866	2.7636	. 2707	2.7472	.1911
10	-11.4620	. 72.00	. 6 6 2 1		1 74	7653	2.4410	7.7844		1.2100	
20	-1.1.20	7997		.1407		7412	2.40.1	4.445	1.4848	4 7/44	
	-4.9(10					0.1.000			1 01 10	4.2004	
;;	A.768	.754.		. 1154	- 6871	1.5.44	2.2464	1.0870	3.1313	2.3417	- 7710
21	9.4081	7711		. 76.97		1.6111	3 3144	3.1417	7 1 1 1 0	2 4 3 0 4 7	
24	17.5610	71 17	. 7176	. 21 88		1.8170	2.1878	2.5055	1.1714	2+4477	. 7087
29	7. 1930		. 7 . 7 .	1447	- 086	1.4.134	2. 201	7 9001	4411	1 07.4	
24	29.1270		.7967			24 36 37	2.01.35	2.6886	- 3976	2	. 7447
77	16.661	****5	+115	05.47	2334	1.4111	1.8505	2-0435	. 2 2 2 1	2.4.1 69	.179.
2.6	AT . 841				- 1368	1.0331	1.4037	2.0980	3483		
50	47.74	85.76				1.9611	1.7475	2.0047	. 3367	1 00 4	.0747
10	#2.AA1.					1 0000	1.0000	1 0000	1464	0.00	
11	56.8420	1				1-1-1	1.0000	1.000.3	1404		-0467
÷?	58.003/	1-0101	1.64.5	6	1.1.1.1.1		1		1404	0.00	
	61		1.0// 3	2.1.00	0.000	1.000	1.4.36	1.0	1464	0800	
14	42.1531	1		Set ut		1	1.3000	1.00010	1404		-0457
24	67.628		1.000	0.0001	0.000	1.0003	1.3003	1.0000	1404		
14	73.826		1.0000			1. 033	1.0000	1.0002	.1404	.0490	.0457
				•• • •			1 1000	1.4.4	• • • • • •		16444
11		100033	Tennets		•••••	101 111	442633	1000022		• 4840	+0457

# CETH FT.LD AND NAGN.TIC FT.LD COMPONENTS ALONG TRAJECTORY

۷	T 1*1	* 101	× /0.	718.	R /P :	¥ /P PLAN É T	*/**L ** : T	TIRPLANET	@/polaneT
:	-91.47	1.12	-5.417*	1. 50 40	4.1175	1.3543	-2.7322	2.1294	4.2484
2	-44.537.	.9347	-3.4354	C42.	3.457.	. 7555	-7.5000	7. 1475	4. 1782
3	-#*.2:30		-3.24.5		3.2.74	. 2778	-3.34%	2.0643	3,9332
4	-74.57	.75.5	-336>	2 * 5	3.6415	.7765	-3-1372	Z. 1756	3.7614
٩	-7:.6.76	.6740	-1 + 1e +t	2	3.5 /42	. 5993	-2.9633	2. 799	3.5704
5	-44,2333	.5519	-2.6006	2.135	3.2932	.58 5	-2.69.7	241835	3.4121
7	-57.8.2.	. 44 ? 1	-2.3274	2.0076	3.6705	.4:78	-2.4743	2. 1642	3.1715
	1.4.2.	.122*	-2.347		2.8385	. 3732	-2+1 +2.	2. 1437	2.9319
۰	-47.73*.	+3140	-1. j. 7a	1.00086	2 . 4243	.1187	-1.5575	1.9613	2.5245
10	-19.6085	.: 95A	-:+4*73		2.3447	.,997	-7.5.55	1.9513	7.4646
11	-19.6070	.5446	-1.2737	1764	2.37 6	. *68	-1.4.9:	1. 93 22	2.3773
12	-35.435	. 192	-1.2407	1 417	2.12 2	198	-1.2317	1.9121	7.2936
13	-14.167	-476.05	-1.1943	44 72 47	2.1414		-1.2336	1.1951	2.2537
14	-32.736.	1954	-1.07 35	1.7975	2.1.224		-1.1153	1	241517
15	-24.2.2	+.Z. 9;	757	1.4.1.24	1.7177	2160		1.5552	1.7556
16	-21.6621	2686	3795	44.54	4.5649	2774	-, 79, 3	1.5656	1.6155
17	-15.73.0	3475	1· 5ª	2. 2530	1.3572	35 39	1173	1.4391	1.4124
19	-14.6522	3754		1.27:0	1.2723	3178	. 299	443147	1.3143
19	-11.4L2ú	4154	7	1.1.21	1+125*	4201	.14.4	1.14.99	1.1530
24	-* 2 -	45:3	.4375	.01 76	1.(1*)	4663	+521	. 9435	1.0455
21	-4.9.44	46%		4:277	.5.39	-, 4935	.5764	. 15 97	.9442
22	6.244.	356	* 583#	?:64	1.1220	3479	1.(22:	2570	1.1.48
23	0,408.	2454	21 63		1.237.	-,29:9	1.0376	5459	1.1746
24	17.5430	2104	.9942	7759		-+217+	127;	17,5	1.3978
25	17,3432	0837	.9316	-1.1766	1.4557		.9624	-1.2522	1.5.9.
26	29.127	.233,	.5557	-1.5250	1.9474	.2407	.6577	-1.9964	2.0178
27	34,4401	. ? 7 ? ?	+5175	-2. 251	2.1493	.3425	.5346	-2.1543	2.2194
24	43.601	•1314	.332#	-2.3444	2.3477	42445	.3437	-2.4425	7.456E
29	47.2e .		+ . + 37	-2.:4:0	2.596*	.7 45	.1494	-7.4652	7 6723
30	53.etl:	. 62 85	;479	-22 -2	2. * 295	. 1277	495	-2.9224	2.9232
31	56 añ 62		1435	-2.93.7	2.4352	. 9265	1449	-3.5284	3.6322
32	59.6930	.9448	-+26*	-2.99:4	3. :26	.9767	2:36	-3. 945	3.1018
33	A7 .2 60 0	. 4671	2345	-3.1253	3.1 377	. 976-	2454	-3.2784	3.134.
34	42 43	1.(325	··3 1·	-3 0 1	3.1.14 *	1.3463	3118	-7.1923	3.2375
35	47.5260	1.1229	46.3	-3.237	3.2695	1	475:	-7. 3440	3.3776
35	73.424C	1.2494	545.	-3,19#3	3.4.9	2967	4651	-3.5106	3.5793
37	A. 32c.	1+372/	c3.A	-3. 490	. 3.646.	1.4.94	1503	-3.6573	3.7556

9 /FPLAMET + ... 331

22144507024 COOPDENETS

## FLOW FIELD AND MAGNETIC FIELD COMPONENTS ALONG TRAJECTORY

### (SOLAR WIND COOPDINATE SYSTER)

### (DIMENSIONAL, USING INPUT INTERPLANETARY VALUES)

INTER®LANETARY MACH NU®BER Ratij of specific yeats Interplanetary velocity Interplanetary density Interplanetary temperature	<ul> <li>3.30</li> <li>1.6667</li> <li>3.920E+02</li> <li>2.023E+31</li> <li>1.023E+05</li> </ul>	INTERPLANETARY MAGNETIC FIELD Magnitudeprzedl x-cj=ponent - 1.239E+00 y-cj=ponent - 4.726E+30 Z-cj=ponent - 4.032E-01
--	---	---

N	TT#E	/ //	VX	**	V2	4 HD	TEMP	/8/	42	BY .	9Z
1	-93.8700	3.9266+92	3.9268+02	G.	2.	2.020E+91	1.0296+05	8.823E+0v	1.2398+00	A.726E+UU	4.6326-61
ž	-15.5374	3.92( E+32	3.920E+u2		<b>0.</b>	2.020F+01	1.020E+05	8.6232+00	1.239€+00	9.726£+00	4.632E-Gì
3	-50.2030	3.9205+02	3.9266+42	ů.	0.	2.0205+31	1.4206+05	8.823E+00	1.239E+00	* <b>.</b> 726E+03	4.032 2-01
-	-74.8700	3.920F+02	3-920F+02	ć.	0.	2.0206+01	1.0205+05	0.43536+30	1.239F+37		4.0326-01
5	-70.6630	3.92LE+62	3.920 5+02	Ū.	<b>0.</b>	2.0205+01	1.3202+35	8.8232+00	1.2396+00	8.726E+30	4.032E-01
, i	-64-2630	1.9765+02	1-97CF+02	6.	<u>.</u>	2.020E+01	1.0205+05	8.#23E+60	1,2398+00	9.726E+uL	4.C32E-01
ž	-57.812.	3.92( 6+02	3.9205+02	0.	0.	2.0206+01	1.0205+05	8.823E+30	1.2298+03	4.7266460	4 oU 32 E+G L
	-51.4023	3.0205462	3-9207+02		D.	2+0205+01	1.0236+05	8.8236+00	1.2395+00	9.726E+00	4.032E-01
à	-40.7350	3.9706407	2.970541.2		ř.	2.020E+91	1.3236+95	P. P23E+00	1.2395+00	P. 726E+06	4.C32E+u1
10	-10.4480	3.99/5402	3.92054.7		6.	2.0202+91	1.0206+05	8.823E+00	1.239E+DJ	5.726E+00	4.6328-01
11	-38.4620	3.0205402	3.0265447		2.	2.020F+01	1.020 6+05	8.823E+00	1.2396+00	R. 726E+00	4.032E-01
;;	-35.9350	1.9205+02	3.970F+02	<u>.</u>	G.	2.020F+01	1+320F+65	9*653E+36	1.239E+AU	9.726E+L0	4.0326-61
	-14 - 8475	3.92(64.12	3.026.647	0.	<u>6</u> .	2.0702+01	1.020E+05	a.ez3E+00	1.2395+50	9.726E+LL	4.6328-01
11	-12.7140	3.1376.17	2.9615402	-5-6272442	9.3435+01	4.5955+01	2.121E+05	1.8446+01	-5.400E-01	1.797±+61	4.135E+00
- 11	-24 - 27 20	3	7.85054.12	-1.7176+01	1.0195+02	4.1795+01	2.21CE+05	1.9546+01	-1.970E-01	1.9516+61	3.5576+00
14	-21.0120	3.0045407	2.7896+02	-7.7.4F+11	1.05EF+C2	4.055E+01	2.281E+05	2.080E+31	1.7296-01	2.0576+01	3.6996+03
	-14-7360	2.0185402	2.4785402	-9.0415400	1.1576462	3.8436+01	2.384 6+05	2.2928+01	1.295 6+90	2.269E+01	2.0326+00
	-104/370	5.8775407	2.4105402	2.710E+00	1.190 5+42	3.7996+31	2.4326+05	2.4386+01	2.3455+90	2.4248+01	1.157E+00
10	-11.4620	2.8765492	2.429542	1.961660	1.2445+62	3.628E+01	2.490E+05	2.9306+31	4.8902+30	?. #56E+ú1	-4.856E-61
20	-1104020	2.78/5+02	2.4285+02	5.847F+01	1.271E+02	3.5376+31	2.5416+45	4.027E+01	1.461E+01	3.7.12+01	-5.589E+00
51	-4-96.00	6.	G.		D.	0.	0.	0.	n	0.	0.
;;	4.3000	2.0446402	3.67354L2	1.2186462	-3.2126401	3-0396+31	2.331E+05	3.518E+01	2.763E+01	2.0045+01	6.3698+60
51	9.6940	3.4232+02	7.789F+42	1-0126+12	-5.427E+01	3.056 8+01	2.261E+05	2.789E+.1	1.925 8+01	1.8778+01	7.433E+03
34	19.5030	3.0728462	2.4716+02	E. 576E+01	-6.6915+01	3.107E+01	2.2618+05	2.210E+01	1.2126+91	1.7396+01	6.262E+CO
	17.1610	3.1386482	2.97f F+ 32	A.457E+31	-7.797E+01	3.2395+01	2.1226+95	1.9495+01	7.4226+00	1.735E+U1	4.749E+33
26	29.1270	3.2775+02	3.135F+02	3.258E+01	-8.9655+01	3.571E+01	1.942E+05	1.8162+01	3.5086+10	1.766E+U1	2.335E+0J
	24.440	3. 31 85402	3.1815402	2.2745441	-9-1645+11	3.6995+01	1.888E+05	1. 7308+91	2.842E+90	1.7716+01	1.579E+03
56	40.8600	3.3555+02	3.2226+02	1.305E+31	-9.271F+L1	3.5425+01	1.839E+C5	1.7576+31	2.375 8+30	1.7696+01	8.5978-01
20	47.2411	3.3825402	3-2525+02	5-1475+40	-9.245F+L1	3.921=+31	1.803E+35	1.768E+J1	2.035E+00	1.7566+01	3.0156-01
10	93.4460	1.92CF+02	3.9766+02	6.	P.	2.0208+91	1.0236+45	8.8235+00	1.2396+03	9.726E+0C	4.0326-01
11	54-8626	1.0205+02	3.9205+02	č.	0.	2.020F+01	1.0205+65	8.8236+30	1.2398+34	9.726E+UG	4.1328-01
	58.0010	3.975432	3.921 641.2		0.	2.02CE+01	1.3236+05	8.823E+00	1.2395+00	1.726E+Lu	4.6328-61
	60-0405	3. 921 7432	3.9265462		G.,	2.026 6+31	1.0206+05	4.823E+00	1.2396+30	5.7268+00	4.632E-01
	47.1034	3. 920-432	3.0205402	3.		2.0205+01	1.020E+05	8.6236+00	1.2396+00	8.7262+00	4.632E-01
11	67.5280	3.92.6+32	1.920F+62	21	6.	2.0205+01	1.0205+05	8.8236+30	1.2398+00	A. 726E+u0	4.032E-C1
24	73 0300	3 0302403	3 9705463			2	1-02( ++0*	8.82354.0	1.2396+90	9.7268+00	4.0326-01
	/					280205703					

# 

### TRAJECTORY COOPDINATES

### RG/RPLANET = 1.3331

N	TINE	¥/PÇ	¥ /RS	2/86	R/Pj	*/RPLANET	Y/RPLANET	7/RPLANET	R/PPLANET
1	-90.8763	8160	3.6658	1.9621	4.1579	8430	3.7870	2.0270	4.2954
;	-45-5370	7405	3.4848	1.5796	4.0078	7650	3.6030	2.0450	4.1463
- 1	-83.2433	- 6621	3.2844	1.9960	3,8434	6840	3.3930	2.0620	3 . 9734
1	-74.8764		3. 1753	2.6167	3.6721	6000	3.1770	2.0730	3.7935
	-70.6030	5159	2.9430	2.6115	3.5318	5330	2.9990	Z.0780	3.6486
	-64.2.30	- 6162	2.6339	2.6125	3.3148	-, 4300	2.7213	2.0790	3,4243
ž	-57.8023	3136	2.3493	2.0309	3.6459	3240	2.4270 -	2.0673	3.1979
	-51.4020	2101	2.0502	1.9775	2.8456	2170	2.1180	2.0433	2 • 945 7
ě	-41.7350	0329	1.5126	1.6982	2.4268	0340	1.5626	1.9610	2.5971
10	-39-6683	0165	1.4607	1.8886	2.3875	0170	1.5090	1.9510	2.4665
11	-11-6620	30 97	1.3765	1.8762	2.3221	0100	1.4220	1.9320	2.3989
17	-15-9150	.3474	1.240.	1.8411	2.2198	493	1.2810	1.9020	2.2732
	-34-8670	.0649	1.1926	1.8256	2.1696	.0670	1.2326	1.0960	2.2527
14	-17.7350	.1529	1.0725	1.7927	2.6891	.1589	1.1080	1.8520	2.1501
15	-24.2620	.2377	5640	1.6125	1.7083	.2456	.5826	1.6659	1.7647
14	-21-662.3	2859	.3629	1.5191	1.5618	.2954	.3749	2.5693	1.6135
17	-16.7355	.3446	.0871	1.3639	1.3667	. 3560	.0900	1.4090	1.4119
18	-16-6020	. 36.98	523	1.2729	1.2739	.38Zv	0526	1.3150	1.3160
19	-11.4070	+017	1984	1.1132	1.1337	.4150	2050	1.1500	1.1681
20	-8-1020	+4230	4627	.9148	1.0251	.4370	4780	.9450	1.0990
21	-4-9060	.4279	6805	.6399	.9334	. 4420	7630	.6633	• 964 3
<b>;;</b>	6.2984	.2991	-1.0087	2575	1.0410	.3090	-1.0426	2660	1.0754
	9.4980	.2294	-1.1212	5285	1.1499	.2370	-1.0556	5460	1.1979
24	12.5933	.1549	-1.3048	7754	1.2692	.1600	-1.0380	8010	1.3111
25	17.1930	.0329	9351	-1.1248	1.4627	.0340	9660	-1.1620	1.5111
26	29.1270	2662	6515	-1.8266	1.9393	2753	6736	-1.0070	2.0734
27	34.4600	3940	4956	-2.0860	2.1441	40 70	5120	-2.1552	2.2196
28	40.8603	5430	3020	-Z.3558	2.3850	5610	3120	-2.4440	2.4638
29	67.2600	6824	1045	-2.5846	2.5867	7050	1086	-2.6700	2.6722
30	53.6600	9170	.0951	-2.8314	2.8330	8440	.0 98Z	-2.9250	2.9266
31	56.8620	8809	+1946	-2.9340	2.9405	9160	.2010	-3.0310	3.0377
32	58.9930	- 9235	.2604	-2.9979	3.0092	9540	s269C	-3.0970	3.1997
33	60.600	-,9438	.2933	-3.0308	3.0450	9754	.3030	-3.1310	3.1456
34	62.1930	9854	.3591	-3.0928	3.1135	-1.0180	.3710	-3,1952	3.2165
35	67.5260	-1.0861	5237	-3.2399	3.2819	-1.1220	.5410	-3.3470	3.3934
36	73.9260	-1.2013	.7154	-3.4016	3.4764	-1.2410	•7390	-3.5140	3.5909
37	80.3280	-1.3136	.9090	-3.5535	3.6679	-1.3570	.9396	-3.6710	3.7992

Figure A.5.- Continued.

# COMPORTED AND MECHILIC ELERY CURPTURE SALES FUNG SEFICITURE

### INTHERTOTALIZED BY INTERPLANETARY VALUES

N	T146	ALAING.	MAINIAN	AA \AIde	4.1A1#E	0401049146	1	*****	JAleide	#Y/FINF	NZ/NINF
7	-9 17.		66.83	•·. = 7h		2	1.3003		1472	9793	453
÷.	-**.*37			• 175	26	1.000	1.0000		+.1972	-+67+3	.0453
3	-41.2.3.	40.00		. 574	t 26	1.01.32	1	20.021	1972	9793	453
4	-74.47.		9913	7 -	66.20	1.0000	1.0000	4+1631	+.197*	4793	+5453
5	-77.6.036		ackj		26	3.61.192	1	1.0000	1979	9793	.0453
5	-64.7231	1.000	9CA3	.1574	Ze	241.397	44-4 5	1. 1.1	1972	9793	au 453
7	-57.412.	A	07:3	+(: 75	:, Ze	4.1 1.17	1.366.0	4 . C. S	1472	9793	. 453
	-51.412.	496.00	95/3	. 15.75		2.4	4.4.4	1. 4.	: 972	9793	.0453
9	-40.735.	40.01	95F 3	• - 5 7 5	26	2.0530	1.)000	1.466	1972	9793	+1453
1.0	-39.462'	1	0063	75	+.1 . 26	1.0000	1.0000	1.0000	1972	9793	su453
11	-3*.6(20	1.1134	9943	++ : 7t	24	2.41.32	2.4.4.5.1	4	-,197*	9793	.0453
12	-15.9350	1.0100	- \$9"3	•1 1 75	26	1., 37	1.0635	1.5032	1972	9793	
13	-34.847.		99-3	. 575	26	1	1	えんじじゅう	1977	4793	.0453
14	-37.7356	• 2369	7414		. 2354	2.2747	2.179	2.2415	2573	-2.1.364	.4688
11	-24.21.21	• 7-1.5	7:16	.1367	.2691	2.11 47	2.1642	2.24 15	1(6ì	-2.2.95	.4032
16	-21. ** 2.	. 744.0	7 7_	• • • • •	12757	2 72	5*5378	7.357*	1547	-2.3261	.3512
17	-16.735.	.744*	5-14	. 624	. 2992	1.9225	2.3373	2.5864	5625	-2.5592	.230C
16	-14+512"	.733*	644	• -315	.3(2)	1. **34	2.3245	2.7435	42 .7	-2.727j	•1304
19	-13.402.	.7230	6477	: 27	• 2 1.5 c	1.7059	2.4416	3.2855	7195	-3.2617	0565
2:	-8.1(2)	.7397	677 -	1137	.3096	1.7512	2.4911	4.565.	-1-5942	141	6378
21	-4.P.L.	1.65.24	· • f > · ·	1 a 4 a 7	<b>0.000</b> €	0+0-133	e e 24 240	( • • C ( •	1.0703	i.Liu	4.3000
22	5.298.	.7>5	6 5 # 7	2761		1.5:44	2.2774	1.9877	-3.2639	-2.174	.7137
55	9.498.	• 7711	723-	2217	1403	1.5100	2.2144	3.1617	-2.3029	9982	*5364
24	12.5930	. 7937	+.7427			1.5779	2.1575	2.5055	-1+4 557	-1.6891	.7061
25	37.1920	.5.34	7652	1269	2 :9	1.6135	2.7#1	2.2.41	9547	-1.9166	.5361
26	29.127.	. 136	9(25	-+1372	2316	1. 7575	1.4135	2.1 594	5129	-1.9759	.2636
27	34.461	. **55	*:2-		??39	144213	1.4515	2	4376	-1.9850	•1782
24	41 a <sup>#</sup> 6	. 65 5 *	4216	• 31 4 3	2337	1,9121	1.227	2.(259	3*44	-1.9868	+ÿ 967
29	47.251		*2	. 343	23*	1.9413	1.7675	2.0047	3450	-1.974ú	•0336
30	53.5660	1.0.00	9543	• 174	26	341 211	3.0-1.1.	1	1972	9793	.0453
31	55. E2	1.0000		4. 75		1.1.1.72	1.4.11.9	1.0012	1972	-,9793	.0453
35	58.993.		99-3	• . 1 74	-+++ 25	1.000	A + C + C >	7.000	197?	9793	.0453
33	60.0660	1.000	- ccx3	75	c.20	1.073	4 a 25 4 1		1972	9793	•0453
- 34	62.143	-• *	9^3	a 1 5 7 5		1	1.9600	1.0007	1972	9793	•J453
35	57.525.	••	- acl 3	• <u>\$ 7</u> €	26		1.3690	1.0000	197?	9793	.6453
36	73.924.	4+5+3		• 75	2e	1	1.7000	1446.04	1972	9793	.0453
37	<b>326</b>	Tet if		• . 176	2e	Territ	1.0000	1.0000	1972	5793	.0453

## (ERN-SEARCE CONSUMPLE SACEA) EFON ELTO AND AVANUEL LEFO CONSUMPLES PEONE ISATECIOSA

IDINENSTINAL, ITINE INPUT THTEPALANETARY VALUEST

INTEROFACTOR NTEROFACTOR NTEROFACTOR NTEROFACTOR INTEROFACTOR INTEROFACTOR NT	<ul> <li>5</li> <li>1</li> <li>2</li> <li>2</li> <li>2</li> <li>2</li> <li>3</li> <li>3</li> <li>3</li> </ul>	TNT:991442T499 44645T1C FEEL9 44641T495 - #525433 4-0799984T -12742333 9-0799784T -12742333 7-0799784T -44005-31
--	---	--

۲	<b>₩</b> t <b>#</b> E	/ ¥/	¥¥	V <del>v</del>	¥7	340	TEMP	/8/	e y	57	nt
1	-9	3.9206+12	-3.913:+.2	2.2:7 + 1	-1.,26:++4	2.1212+11	*	4.P23E+30	-1.74CE+03	-9.64.6+.0	4.0008-61
	-95.537.	3.92.2+12	-3+913(+-2	2+257E+j1	-1.0262+66	2+0205+31	1.3236+u5	8.#23E+00	-1.740F+99	-**6468+00	4.6008-01
3	-40.7036	3+92+2+52	-3.9/31++2	2.2572+ 3	-126E+.!	24.2.5+31	10+74.5Lee	9.623F+00	+1.740E+00	-8.640E+00	4.COOE-01
4	-74.9701	3. 726 .+52	-7.913-+52	2.2372+32		2.0275432	2.3225495	3.P23E+34	-1.749 #+77	-9.646 2+00	4.000E-01
5	-71.+513.	3+921 ++07	-3.913:+u2	2+237++31	-1+.266+++	2Z :+):	1.3236+35	8.5236+00	-1.7402+03	-9.64LE+60	4.000E-01
6	-64.703/	3.92/5+17	-3.9:3/+.2	2+7576+31	-1. 265+11	2.2 -+ 13	1.0278+45	# <b>.#27E+3</b> U	-1.743E+35	-**640E+00	- 4.000E-01
7	-57.4120	3+920±+32	-3.9135+62	2.2572+11	-1.726.+65	2.(2:::+7)	2+32-14-5	*********	-1.740F+33	-** 646 2+06	4.0002-01
	-5144121	3.42:++:2	-3.9.3/+.2	2+2576+ 1	-1.J24E+CC	5*0202+31	1.173:+05	4.#238+36	-1.7405+30	-9.0402+66	4.6665-61
9	-43.735*	3+9265+12	-3.9.35+.2	Z+257E+ 3	-1	2.222941	こんのそうちゃいき	4.823E+0C	-1.740E+00	-9+6462+64	4.00vE-01
12	-39.662.	3.9252+02	-3.913:+12	2 . 25 7E + 11	-1.2010.0	2.72r3+L1	1.4236+05	-∂ <b>.</b> 823E+3ü	-1.74GE+03	-9+64u£+ú0	4.u062-01
11	-38.5021	3. 02 ( 2+* 2	-*.913E+ 2	Z . 257F + 1	-1. 1262+1 1	2.205+93	1.44215+65	A.823E+00	-1.7405+03	-1.6402+00	4.000E-01
12	-15.9350	3+921+72	-3.9135+UZ	2+5376+01	-1+1565+11	2+12,5+31	104217445	4,423E+20	-1.7406+3/J	-7.040 6400	4.000E-01
: 3	-34 ** 57	3+4212+12	-7.9175+02	2+2221+31	-1.0265+66	2.020**31	1.7735+05	3.8236+33	-3.7495+6)	-9+641 8+64	4.6002-01
:+	-52.735.	3+_275+-2		7.3.25+ 1	\$+266F+/1	4.5955+01	7 <b>.</b> 121(+0	1.#44E+31	-5.0598-01	-1.797E+61	4.1368+00
15	-24.2.2.	5+15:1+12	-2+7363+92	· · · · · · · · · ·	1325+12	4.1792+31	2+2126+35	1.9*4E+11	-9.3638-31	-1.9496+.1	3.557E+00
34	-21 a 74 Z	3. 0. + 2	-2.*72**.2	4.3166+.1	1.0912+02	4.0558+01	2.2015435	2.1305+31	-1.3655+05	-?.u52E+01	3.6996+60
17	-16.7355	5*476E+ 5	-2+671++.2	2044384,1	1.49t+'2	3.473:413	2.38+E+c5	2.7*7E+31	-2.5048+07	-?.256E+U1	2.029E+00
19	-14.602	2.6773+02	-2.6195+u2	1.2396+31	1	3.7996+31	2+432*+-5	2.43*E+/1	-3.762540.	-?.4LEE+U1	1.150E+00
. •	-:1.4.2	2+4263+07	-7.539:+02	-4.9991+00	1.2393+12	3.6246+91	2.49.00+05	2.9362+01	-6.527*+00	-?.625E+01	-4.9842-01
20	-9.1.2/	2+7805+/2	-?.4522+u2	-4.433F+j1	1.2142+12	3.537E+11	2.5416+15	4+0278+31	-1.6715+01	-3.621E+J1	-5+627E+00
21	-4.94.6.	52 e	6.	٤.	<b>L</b> .	fre -	Ü.	<b>.</b>	<b>n</b> .	1.	9 <b>.</b>
2?	6.298(	1.9543472	-2.7391+,2	-1. 926+.2	-3.3)25+61	7,3192+31	2.3318+05	3.5186+31	-2.980E+01	-1+921E+01	6+297E+00
23	9.4960	3+0235+72	-7.4422+.2	-E.598L+.1	-5.j` E+"i	3 35 16+12	2+2616+65	5.7498+01	-2.0325+01	-1.763E+01	7.383E+CO
24	12.543.	3+072=+?2	-2.916F+ÿ2	-6.9396+33	-0.769£+.1	3.1777+31	2.2016+05	2.210E+51	-1+3156+51	-1.0076+01	6.230E+00
52	17.393(	3+1382+62	-9.LCCE+12	-4.7381+21	-7.9752+-1	3.2395+31	2.1206+15	1.9496+11	-1.423E+00	-1.693E+01	4.730E+60
7 E	29.1270	3+777++12	-3*1*61*55	-1.45LE+)1	-0.147E+01	3.5715+31	4425+15	1.0105+01	-4-5258+34	-1.743E+91	2.326E+00
27	34.46	3+3145+15	-3-1561+05	-4.4341+96	-9.247c+U1	3.6995+21	1.8095+35	1.4006+01	-3.9612+31	-1+7516+01	1.5728+00
2 P	4" . C 6L .	3.3555+*2	-3-22214-2	5.514E+.	-9.1552+	3. 424+01	1.934(+0:	1.7972+31	-3.3926+7"	-1.753E+31	0.235E-01
29	47.26.4	3+3025+52	-3.247.+.2	1+357E++1	-0.3366+-1	3,921(+71	1.8036+67	1.759E+31	-3.744E+30	-1.742E+01	Z.962E-01
30	.3.66.	3+92+ E+-2	-3,9132+22	2+257E+J3		2.070-+01	1.020.+0:	4.653F+3C	-1.740E+0C	-*. 5462+00	4.COUE-01
31	56.PEZL	3.926	-7.9126+.2	Z + 257E + 34	=1a.201+cu	24 - 25 - 4 - 75	1+721=+-5	447236474	-1.740F+09	-1.840E+00	4.300E-01
72	54.9430	3.97 CE +02	-1.013(+.2	Z+257E+31	-1.2262+46	2 • CZ + 3 1	1.0236425	8.7238+.0	-1.7428+32		4.uJCE-01
33	5 • 61 1	3.92( 2+" 2	-3.7134+C2	2+2:71+31	-1.0262+00	200236001	100205+22	5.8232436	-1.7405+08	+ 0+CE+00	+.000E-01
34	62 <b>.</b> 1933	3.92(E+)2	-3.9138+42	2+257(+)	-1.0265+00	2.0202011	1.3232+4.5	5.7236+10	-1.7402+33		*******
35	57.5280	3.92(6+25	+3.913:+02	2+2226+31	-1.0026E+CU	C. UZCE+51	1.0237.05	6+5C3E+3P	-1.740E+27		4.0J3E-01
36	73.920.	2.43 126 45	-3+9136+ /2	2+2571+/1	-1261+00	2+0203+01	1.9276+0	5.823E+30	-1.740E+00	-1.6466+03	4.000E-01
37	97.3256	3.472.24.2	-3.4.2[+ Z	2 . 2 . 7		2 . · 2 · ! • / J	14723****	0.2232+00	-la/+0t+00	-7.0402+00	7.0002-01

Figure A.5.- Concluded.



Figure A.6.- Plot output for sample case.



Figure A.6.- Continued



Figure A.6.- Continued



Figure A.6.- Continued



Figure A.6.- Continued







Figure A.6.- Continued







Figure A.6.- Continued.





## APPENDIX B

-

LISTING OF COMPUTER PROGRAM

•	SURROUTINE ANGEL(ELLINF,GANEL,I,J)	ANGEL	z
2		ANGEL	•
5	THIS STANDINE INTERPOLATES FOR ELVELINE AND GAM AT THE (I) JE GOLD	ANGEL	- 4
5	PUINT FROM THE ARRAYS ELRE AND GAMME	ANGEL	5
C		ANGEL	6
	LEVEL ZANBANSFAXAFARSFAELBFAGAMAG	4 VAL	2
	COMMON /BVAL/ NR, NBF(51), XBF(51, 100), RBF(51, 100), ELBF(51, 100),	AVAL	3
	• GA===151,107.3	•VAL	- 4
	COMMIN /SHICKS/ DRSDX(100),DST(50)	\$40085	z
	LEVEL 2, XST, YST, NUMST, NST	STRE AM	2
	COMMON /STREAM/ XST(50,152),YST(50,152),NUMST(5(),NST	STREAM	i i
	"OHMON /ROUNOS/ X80D(106),Y800(130),X548(373),Y548(130),	ROUNDS	,
	NEMAX + NYMAX + AMACH + GAMMA + HRO + NHINDX	ROUNDS	ī
	COMMON /FLOW/ XC(20,100),YC(27,136),YF(23,133),RH0F(26,100)	FLIN	,
	COMMON JONSTRMJ ZPLOT,NZEND,NZADD,NXPLCT	DNSTRM	;
	MIMENSIAN XO(4),PO(4),ELQ(4),GAMQ(4)	ANGEL	1 1
C.		ANGEL	14
¢	IF POINT IS ON SHOCK, USE FORMULAE AND SAVE RESULTS	ANESI	1.4
с		ANGEL	16
	1F (I +LT+ NRMAX) GO TO 100	ANCEL	17
	IF (J .GT. 1) 60 TO 1C	ANGEL	
	£L=£L4F(1,2)	ANGEL	ìŏ
	ANG=GAMRF(1,2)	ANGEL	20
	GO TO 40	ANGEL	21
	1J THET=ATAN(DRSDX(J))	ANCEL	
	\$2=514(THET)++2	ANGER	
	EH2+4H4CH++2	ANCEL	
	GAM2+ (GAMMA+1+0+0+0+5+EH2	ANCEL	- 53
	002=1+0-(EM2+52+1+0)+(GAMMA+FM2+52+1+0)/(GAM2+2+52)	AMORI	
	ND+504T(NN2)	AMCEL	
	CGTH-1-0/08 SDX(J)	INCEL	
	TD+GA42/(E42+52-1.0)-1.0	ANCEL	20
	DELT-ATAN(COTH/TO)	44026	
	EL=SQ#T(1,)+COTH+COTH+(1,0+002)-2,0+00+(TD+1,0)+COTH+STH(0517)	ANCCI	31
	ANG THE THAS IN CODECOTHESING THET OF IN SET IN THE INTERNATIONAL STRUCTURE	ANCE1	
		ANOSE	32

	PROGRAM MAIN (INPUT, OUTPUT, TAPES+INPUT, TAPEA=OUTPUT,	-
	• TAPE1, TAPE4, TAPE91	MATH
	LOGICAL LPERUN, LPRFL, LPRS T, LPRCON, LPRA, LPLOT, LTRAJ, LRSTRT	PROPT
	COMMON /PROPT/ LRERUN, LPPFL, LPRST, LPRCON, LPRS, LPLOT, LTRAJ, LRSTRT	PROPT
C		MATH
	W# 1 TE (6, 200 )	MATH
	CALL ECHINP	MATH
	FAD(5,100) NCASE	RATH
	TO 24 ICASE+1, NCASE	MATH
	CALL INPUT	MATH
	IF CLRERUNI 68 TO 10	MATH
	CALL BLUNTS	MATH
	FALL MAUCH	MATH
	50 TO 15	MAIN
	CALL REPUN	MATH
12	CHATLADE	PAIN
	CALL FLOWST	HATN
	TE (LERFL) CALL FLOIT	HAIN
	IF (LPPST) CALL STOUT	PATH
	TALL SCUMP	HATH
	IF (LPHS) CALL HOUT	MAIN
	CALL CUNTUR	NATN
	CONTRACT TRAJEC	MAIN
~ ~ ~		HAIN
		MAIN
L 14.5		MAIN
20.0	, THEMBER LINE FRANKARA AND A CONTRACTOR OF THE STREET	RATH
		HATH
	- ISHP KYGRAM STLAR, ZZX, ZH++, /337, ZH++, 58%, 2H++/, 33%, ZH++, 24%,	NATN
	Enutrie in the speak state of the state of t	NAIN
	DURING WIND FLOW PAST PLANETARY HAGNETD/TONOSPHERES, 4%	MATH
	21	MATN
	A DISEEDENE AL CONTUNE OF SUPERIORS AND A SUPERIORS AND	MAIN
	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	MAIN
		PATH
	APA ( TOINTNETD-BY SUAL AND AUA AND AUA AND AND AND AND AND AND AND AND AND AN	PATH
		MAIN
	• 200 00 00 0001255 00 05500 000 000 000 000 000 000 000	PAIN
	+ FNGT VEFETNG AND RECEARCH. THE TOW, THAN THE	MATN
	•	4414
	* FAY, 2446, /.327, 2466, 687, 3166, 7.37, 497, 466, /.337, 2466, /.337, 2466, /.337, 2466, /.327, 466, /.327,	PATH
	FND	= A 1 4
	•••	MAIN

23235678901234567890123456789012345678901223

,

		_		
	43	ELLINFFEL	ANGEL	11
		GAMELUANG	ANCEL	14
		PETURM	ANGEL	15
С			ANGEL	34
¢		IF POINT IS ON AXIS USE LINEAR INTERPOLATION	ANGEL	37
c			ANGEL	3.6
	100	x-xc(1, 1)	ANGEL	10
		Y-YC([, ])	ANGEL	40
		TF (J .GT. 1) GO TO 20J	ANGEL	
		N=NRF(1)	ANGEL	42
		70 110 K=1,N	ANGEL	41
		IF (X +LT+ X9F(1+K)) 60 TO 125	ANGEL	
	110	CONTINUE	ANGEL	44
	120	£LLINF=ELBF(1,K-1)+(X-XBF(1,K-1))+(ELBF(1,K-1))	ANGEL	46
		/fx8Ff1;k1=x8Ff1;k=1))	ANGEL	47
		GAMEL-ANG	ANGEL	
		PETURN	ANGEL	40
C			ANGEL	50
c		TF POINT IS AT X=ZPLOTD USE LINEAR INTERPOLATION	ANGEL	
c			ANGEL	
	263.	TF (J .LT. NXMAX) 69 T9 309	ANGEL	
		NIM=NAF(3)+1	ANGEL	54
		PT 210 TH=3.NST	ANCEL	
		TN=TH+1	ANCS	55
		N=N=F { T N 1+1	ANCEL	
		IF (Y .LT. RAF(IN.N)) 60 TO 220	ANCEL	
		NTM-N	ANCEL	
	212.	CONTINIF	ANCCI	
		FLLTHFOELRFEIN,NJOEY-PRFEIN,NJJOEFL-FLRFETN,NJJ	ANCEL	4.
	•	/(YC(NRMAX, NYMAX)-RBS(IN, N))	ANCEL	
		GAPFI HGANRFETNINIAE V-PREFTNINISAFANG-GANREFTU, NIS		02
		/IYCENRMAK, NXMAY)-RAFETN. N33	ANCEL	44
		PETIEN	ANCEL	
	223	ELLINFEELOF(TM.NIM)+(Y+PRF(TM.NIM))+(+)+C(TN.N)_E(AC(TM.NTM))	ANCEL	22
	•	/(PRFIIN-N)-PRF(IN-NIM))	ANCEL	4.3
		GANEL=GANEF(IN,NIN)+(Y-RREITH,NIN))+(CANREITN,N)-GANRETTH,NTH))	ANCEL	
		/(PAF(IN,N)-RBF(IH,NIM))	ANCEL	4.0
		PETIJEN	ANCEL	70
c			ANCEL	
Ċ		INTERIOR POINT - USE OUADRILATERAL INTERPOLATION	ANCE	
¢			ANCEL	11
	363	NI=N3F(1)	ANCEL	73
		N44Y# N#E(3)+J	ANGEL	
		ON 6'D TST-1+NST	ANCEL	
		N2=N4F(T5++1+1	ANGEL	
		IF (NZ .GT. NMAX) NZ=NMAX	ANCEL	
		N=HIND(N1.N2)	ANCEL	
		00 31. JJ-1.N	ANCEL	
		TF (X .LT. XSF(TST+1,JJ)) 60 TO 340	ANCTI	
	313	CONTINUE	ANCEL	
		EQ TO SEA	ANCEL	
r			ANCEL	
c		FIND DUADPILATERAL WHICH CONTAINS POINT	44651	
ċ			ANCEL	
	34.	TE (Y STA REFIISTALALLE ON TO SAC	ANOTE	
		TF (Y3F(IST+1,44) .LT. XST(IST-1)) GO TO 590	ANCEL	
		SLOPE=(PRF(1ST+1,JJ)=Y)/(XRF(1ST+1,J))=Y)	ANGEL	
		\$LOPF1=(P*F(IST+1+JJ)=RAF(IST+1+J)=711		
		/(X5F(TST+1+JJ)-X8F(TST+1+J+1))	44671	
		IF (SLAPEL .GT. SLOPE) ON TO SPO	ANCEL	
		TF (JJ .= EQ. N) 60 TO 35.		
		\$10762=[886(151414]]=886(1514]]//YRE(1514).]]=TRE(151.))	44/21	
		TE (SLOPEZ +LT+ SLOPE) 69 TO 39L	ANCEL	
	350	CONTINUE	ANCEL	
		¥Q(1)=X9F(TST+1,1)	41011	
		R0(1)=RPF(1ST+1,JJ)	44651	
		510(1)=FLRF(1ST+1+J#)	ANCEL	98
		5440[1]=64495[15T+1+J]3	44651	
		IF (XSF(IST+1+J-1) .IT. XST(IST-11) OD TO 540	ANGEL	100
		X0(4)+**F(TST+1,JJ-1)	ANCEL	111
		PO(4)=R8F(15T+1,JJ=1)	ANCEL	105
		ELQ(4)=ELAF (IST+1,JJ-1)	49000	103
		GANO(4)+GANAF(IST+1,JJ-1)	ANCEL	104
		TF (JJ .EQ. N) 60 TO 430	ANCEL	195
	362	TF (157 .EQ. 1) 60 TO 373	ANCEL	100
		TE (XAE(ISTAJJ-1) ALTA XST(IST-1A1)) GO TO SAC	A4-21	107
	373	YO(3)+X8F(15T-11-1)	ANCEL	108
		RQ(3)=RAF(15T, JJ=1)	ANCEL	134
		ELQ(3)+ELBF(IST,JJ-1)	ANCE1	110
		GAMQ(3)=GAMBF(IST,JJ-1)	ANGEL	111
	383	YOL2 - YAFLIST, JJJ	ANCEL	
		40(2)+8#F(IST-JJ)	ANCEL	
		FLO(?)+ELAF(IST.JJ)	ANCEL	114
		GANG(2) - GANAF(1ST, JJ)	ANGEL	112

h.

.

		ELLINF= TUAD (XO, PO, ELO, X, Y)	ANGEL	117
		GAMEL +OUADE X0, R0, GAMO, X, Y)	ANGEL	11*
	201		ANGEL	119
		TF (517+E2 .LT. 0.) 60 TO 350	ANGEL	121
		TE (VBE(1"T,JJ-1) .GT. X) GO TO 500	ANGEL	122
		JJ=JJ+j Tr (), if which to (),	ANGEL	123
¢		17 133 26-6 13 40 13 340	ANGEL	125
¢		DOWNSTREAM BOUNDARY CUTS OUADRILATERAL CONTAINING POINT	ANGEL	126
C		** *****	ANGEL	127
		10 (X14)(15T+10JJ=1) 0LT0 X5T([ST0])) 60 TO 480	ANCEL	127
		P0(4)-RAF([ST+1,JJ-1]	ANGEL	130
		ELO(4)+EL#F(IST+1,JJ-1)	ANGEL	131
	413	GAHQ(4)+GAN9G(IST4),JJ-1) TE (IET OT NET) OD TO 478	44651	132
	417	YO(1)+Y4F{[ST+1.J]	ANGEL	134
		PO(1)+**F(15T+1,JJ)	ANGEL	135
		E(0(1)+ELPE(TST+1,JJ)	ANGEL	136
	63.	**************************************	ANGEL	137
		¥n(3)+¥AF(1ST,JJ-1)	ANGEL	139
		P0[3]=94#[[ST,JJ=1]	ANGFL	140
		{[0{3}#*[#F{15]pJ]=]}	ANGEL	141
	450	45=44F(IST)+1	ANGEL	143
		10(21+14F(15T,NS)	ANGEL	244
		#0{7}=R#F{{\$T+M\$} 5:0/2)=8:#5/187.W\$	ANGEL	145
		\$4#0(2)+64#9F(TST_4S)	ANGEL	147
		ELLINF+ OUAD (YO, PO, ELO, X, Y)	ANCEL	14#
		GANEL+QUADEXG,RQ,GAMQ,X,Y)	ANCEL	149
	660	1010 M	ANGEL	151
		90(4)=Y54K(J)	ANGEL	152
		FLO(4)+EL	ANGEL	153
			ANCE1	144
	473	TOLES PLOT	ANGEL	156
		CALL 45481(X0(1),R0(1),GAP0(1),EL0(1))	ANGEL	157
	600	50 T3 436	A46+L	1
		TALL 454K3(X0(3), R0(3), GAM0(3), EL 0(3))	ANGEL	166
		GN TO 450	ANCEL	161
Г. Г		OUNDERLATTERAL CONTAINING POINT IS REFLEXIVE	ANGEL	167
č			ANGEL	154
	562	11+11- <u>1</u>	ANCEL	165
		<pre>{[]P+#{Y+#A+{[STp]]#_]}}/{X+X4F{[S1p]]=_}} P{(DF1={PAF{ISTp}]} </pre>	ANG51	160
		• /(XAF{IST+1,JJ+1)-XAF[IST,JJ-1))	ANCEL	16.
		TF (SLAPE1 .LT. SLAPE) ON TA SCO	ANGEL	149
		<pre>{[nPE2*(RMF([ST,JJ)-RBF([ST,J]-1))/(NRF([ST,JJ)-INF([ST,JM-1))])]</pre>	ANGEL	172
		50 TO 150	ANGEL	172
С			ANCEL	173
ç		POINT IS CLOSE TO SHOCK - NEED VALUES ON SHOCK	ANGEL	174
C	f 73	10(1)=Y=F(TST+1,JJ)	ANGEL	176
		TALL ASHKICYDELD, ROELD, GAMOELD, ELOELDD	ANCEL	177
		\$Loof+{PO(1}-Y)/{X3(1}-Y)	ANGEL	175
		TE (\$19962 .LT. \$1996) 69 TO 100	ANGEL	1.85
	\$40	(L)*HY2x=L)0X	ANGEL	141
		00(4)=Y5HK(J)	ANGEL	142
		CL 7 (4  = EL CA # 0/4) = AVG	ANGEL	194
		40 TO 360	ANGEL	145
	560	Y0(3)+Y5T(TST-1,1)	ANGEL	1 46
		CALL TOTALLEVISIONUSIONUSIONUSIONUSIONUSIONUSIONUSION	A462L	187
	5.80	41eMP	ANGEL	1
	663	PONTINIE	ANCEL	100
ŝ		PROSPAN SUDITS NEVER REACH THIS CONSTITUT	ANGEL	191
ě		The stander serve weather they countried	ANGEL	193
		W#TTE(6,103C)	ANGEL	194
	1003	STOP FORMATCINI, 10X, 14HERROR IN ANGEL //5%.	ANGEL	195
		* 354PRIMAMLE CAUSE - XPLOT IS TOO LARGE)	ANGEL	197
		END	ANGFL	195

	SUPPOYTINE ACOMP	SCORP	2
ç		SCONP	3
ç	THIS SUMPRUTINE CALFULATES THE COMPONENTS OF THE MAGNETIC FIELD	35 QAP	
č	TRANCEED FERFENDIEDERA AND AJRAGE () (HE FEIDA	80 089	é
-	COMPON /ADUNDS/ XAUD(100), YAUD(100), X5HK(100), Y5HK(100),	BOINDS	2
	NON AT , NYMAY , AMAC 4, GAMMA, HRO, NHINFY	ROUNDS	3
	504404 /FL3W/ XC(20/100)/YC(23/10L)/YF(2C/133)/RH9F(2C/14C) Level 9. Braba, Breb, Bugen, Blac, Bang	FL JW	Ş
	COMMON /ACONPS/ APARA(20,100), APERP(23,100), ANORM(20,100),	ACONES	3
		REMARS	
	LOGICAL LPERUN, LPRFL, LPRST, LPRCON, LPRS, LPLOT, LTRAJ, LRSTRT	PROPT	2
	COMMON (PPOPI/ LEEGUN)LPPELJLPESTJLPESTJLPESTJLPESTJLPESTJLPESTET		3
	01#FNSIDN \$(100+6)+W(100)+6(5)+XL\$0(1(C)+YL\$0(1))	80049	12
	NATA W/100+1.6/	80 mm p	13
c		<b>BCUND</b>	14
Ě	CALCULATE PEPPENDICULAR FIELD LINES	4C04P	11
•	TE (KACON-FOLL AND, ANDALERS AND, ANTALTRALL RETURN	90.049	17
	CALL ASTEP	RCCHP	1.
	CALL MELGAM	RCORP	10
ç	ALL CHARTER AND THE FILL AND THE AND AN AND ADDRESS THAT A CHARTER	90 049	20
è	ALONG CONSTANT I LINES. USING FIFTH OPDER LEAST SOMARES FIT	RC PHP	22
č		8C04P	23
	NBH0NB42X0]	RCOMP	24
	NYMANYMAYAI	4C0HP	25
	ANTRALANDRAY, JI-OPINE/WOMAY, JI	80088	57
	CALL ANGEL(ELLINF+SLGPEL+NP#AX+J)	***	2
	*PFP*(WRMAY,J)*ELLINF	80040	29
	*ANGENDHAY, J)=SLOPEL	80.049	30
	11 13 1425444 AMD8W/T, 13-BATHE/T, 13	4504F	11
	TALL ANGELLENESSLOPELSIS	90 04P	33
	APFP>(T,J)=ELLINF	80,049	34
	AANG(T, J)+TLAPEL	80.049	37
	13 CONTINUE VISO(1)+0-0	80088	36
	NR 6. 1=2-494	80049	
	00 20 1+1+NXM	8004e	ja
	xL < 0(J+1)=xL <0(J)+SOPT((YC(T,J+1)-VC(T+J))++2	AC05P	40
	• +{XC{1,,J+1}-XC{1,,J}+**2}	*****	41
	DO 60 JELONXMAX	SCORE	
	VLSO(J)=##E##(1,J)	BCOHP.	
	4. CONTINIE	<b>ACONP</b>	45
	"#LL =L<0=¥ (N¥4A¥,5,¥L<0;¥L<0;¥,1;*,*,4;]F>1	4C D4P	
	44 - 21 - 3 - 3 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	80040	- 24
	APEPP([, ])+{{{(4(6)+x4+4(5)}+x4+4(4)}+x4+4(3)}+x4+4(2)}+x4+4(1)	87.044	49
	3 CONTINIE	*0.04*	50
	63 CONTINUE	AC DAD	-1
÷.	CALFRINTS COMPONENTS OF MAGNETTE STOLD - PARALLEL, BERRENDTENLAR,	80000	
è	AND NORMAL TO DIRECTION FLOW	8C114P	- 54
C		RCOMP	54
	00 73 J=1,874AX	AC 04 P	24
	#P#4#(1,J)#¥4(1,J)##H94(1,J)		77
	9849417.J3eVF17.J3ePH0F17.J3	SCORP.	50
	APE * P (*, J) + APE R P ( [, J) + P 40 F ( [, J ]	9C 04P	50
	ANOR4(T, J) + ANOR#(I, J) + RHOF(I, J)	RC DHP	51
	7) COMTINU=	85048	62
¢	BCTIM	95049	54
	END	8¢ ()#P	65
	CHREDUTINE AELGAM LEVEL 2,MR,MBF,XAF,SAF,FLBF,GAMAF CCMMGN /BVAL/ NR,MAF(51),XBF(51,JCC),PAF(5),JCO),ELAF(51,JOO), • CAMAF(51,JOO) COMMGN /ANSTRA/ ZPLOT,HZEND,N7ADO,NYADO,NYALOT	RELGAM RVAL RVAL Dustram	27742
	LEVEL ?, YTT, YST, WINST, MST	STOPAN	2
	COMMON /STREAM/ XST(50,152),YST(50,152),NUMST(50),NST	SHOCHE	
	94T4 PTONZ /1.5707961327/	RELGAN	Ť
c		9ELGAM	

ŀ	-
C	s
¢	J

10

1.1					
5	C THIS SHE DUTINE CALCULATES THE MAGNITUDE AND DIRECTION OF	RELGAN	ė.		7x2=x4=(3,J)=x8F(2,J)
	C MACHETIC FIELD LINES WHEN ARE PERPENDICINAR TO THE RIDU	PELGAN	10		"#Z=\$0#T(DY3+DY3+D8\$(2, J)
	C IN FRESTREAM	REL CAN	11		GAM2=ATAN(DR2/012+082)
		ASLGAN	13		ELAF(2, J)={ELAF(2, J-1)+01+05T(
	nst(1)=f=5/YST(1,2)	SELGAN	14		CAMBE(2, J)=(D1+GAH2+D2+GAPBE(2
	0 17 T+2+45T	RELGAN	15	163	CONTINUE
	757617=1+0777612+13=75761=1213 12 CONTINUS	9EL GA 4	16		00 173 1+3, NST
		MELGAN	17		1+ (NAFII+1) +LT+ J) 60 TO 183
	C RET APPAYS TO FREE STREAM VALUES	BELGAN	10		GAM3+GAM2
	e	SELGAN	20		7×2-×9F(1+1,J)-×8F(1,J)
	N5TP1=N5T+1	BELGAN	21		NR2=RAF([+1,])=RAF([,])
	1=F=44=.xPF(1)	**L544	22		12=50#T(0x2+0x2+0R2+0R2)
	THE FALLANSTON TO LOOMAN OF THE AVE	RELGAM	23		FLAF(1, J)+01+02/(01+02)+(057(1
	IN FORE VERY NET TO THE AND AND TO THE	RELGAN	24		CANES/F. 11.4(CAN1403.CAN3403.1.4)
	3) CUALIANE	851 644	25	17.	CONTINUE
	DU S P Telblewek	AFLGAN	27	16,	CONTINUE
	30 2 1=1,NSTP1	RELGAN	2.		EL1+01+05T(1-2)
		AELG+=	ža		: CS=45+021(1=1)
	· · · · · · · · · · · · · · · · · · ·	RELGAN	31		72=01+2+0+92
		ELG44	31		ELSE(1.1)=(FL1+02+FL2+01)//01+
	C VALUET ALONG FIELD LINES WHICH CONSS SHOCK	RELGAN	12		GAMAE(1, J)= (GAM1+02+GAM2+01)/(
	c c	BELGAN	34		TE (GAMAE(TAJ) ALTA SAS) GAMBE
	00 130 J=3, NR		35	193	CONTENUC
	YE (J.GT. NAF(1)) GO TO 100	RELGAN	36	ç	
	^^_TTTU{TTFUZ;J}=URF(1;J)\$\$2+R%F(2;J)\$\$2,]\$\$2,0 E1 #E/1;1:000000775	BELGAN	37	÷.	EXTERPOLATE ALONG STREAMLINES
	CAN1-07/ND2	SELGAN	3*	•	CALL 35483178101.41.6483.6111
	772+795(3,3)+295(2,3)	******	39		DD 211 1+3+NSTP1
	NP2=P4=(3,J)=P4=(2,J)	RELGAN	41		NwNRF([)
	12+514T(1X2+1X2+14240#2)	BELGAN	47		WITH HE MITHER I ( I+1 )
	54#2=5TAN(9#270#2]	RELGEN	43		TF (VAC(I,N-1) +LT, XST(I-1+1)
	<pre>FLRF(2, J)=02/(01+02)+(05T(2)+05T(1)) Characteristics</pre>	RELGAN	44		- AC = ( 7PL 01 - XAF(1, N-1))/(YBF(1,
	cn to 140	PELGAN	45		PAF(T.NATIAYCT/T_1.NIMMI
	1.1 CONTINIE	461584 851584	44		FL8F/T.N+11+F4C+=L8F[T.N1+(1.2
	12+50471(144F(2,1)+18F(2,1+1))**2+(845(2,1)+445(	851 544			"AMPEIT,N+1)=FAC+GAMEFIT,N)+(1
	172+74F(3,J)-X4F(2,J)	AELSAN	40		IF (CAMAR(I,N+1) .LT. 0.0) CAM
	P#2=P#F(3, J}=#\$F(2, J)	RELGAN	4.5		N
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	PELGAN	51		14#0 69 To 240
		HELGAN	22	22)	PSF([.N+1)=YST([-1.WUNN)
	FAMAF (2, J) = () = 6442+17+64+17+64+1+11+(1+1+2)	ALL CAR	53		YAF(I,N+) = XST(I+) + NUMM}
	140 CONTINIE	AFIGAN	54		FAC=(Y1-RAF([,N+1))/(Y1-RAF(])
	0.0 310 F=3#MST	45LGA4	56		FL#FEI+N+13+ELBFEII+N1+13+FAC+
	∩1 = 02	RELGAN	57		GAMBE(I, N+1)=GAMBE(11, N1+1)=FA
	TENTINGANY TENTINGANY	BELFAN	5.8	21.	CONTINUE
	OVTOVOCIALALALAVALALA	551 GA 4	59		RETURN
	DP2+P9F(1+1,4)=PRF(1,4)	NELGAN BELGAN	20		END
	h 2 = 5 G & T ( D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2 + D X 2	REEGAN	67		
	EL#Eff+13+32*02/(02+02)+(DST(T-13+DST(T))	SEL GAN	63		
	GAM2=ATAN(DR2/OX2)	RELGAN	64		
	-4PH-11-JJ+(-4H1+02+6AH2+C1)/(-1+02)	MELGAN	55		
	127 - 1949 F 1972 127 - 126 H + 126 F 141 - 15	RELGAN	6 E	~	COMPROTINE ADDIND
	Call 954412(354, 254, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24, 24 24	461.544	57	è	THIS CONTINE DRAWS AND LABORS
	1¥2+¥5++×#F([,J)	RELGAN	50	ř	"LONSTOSPHERE OR INNOVPHE
	ηφ2=#\$34=BAF(Isj)	RELGAN	70	ć	HOC PLOT SURROUTINES USED
	12+52F*(0*2+5*2+5*2+D#2)+2+0	RELGAN	71	c	VECTOP, CHAR, POLAR,
	ELRF(1, J)+11+(DST(1-1)+12+ELS41/(D1+12)	RELGAN	72	с	
	~####{[];]]#["Z#F##]#N]#F##54}/[D]#A2}	PELGAN	73		COMMON /500005/ \$400(100), 7400
	JOF MAYON REETS	HELGAM	74		COMMON SCRACT VCC. VCC. VALV. VM
	c c	RELGAN	75		"IMENSICN # (21)+4(21)
	C VALUES ALONG FIELD LINES WHICH END AT DOWNSTREAM ROUNDARY	<b>BELGAR</b>	77		DIPENSION LASPGIZS
	c and a second se	RELGAN	78		- MATA LARMGEIIJELARMGEZIELARIM/1
		9ELGA4	79		DATA LARSH/10HSHOCK WAVE/
	TE II CT NATIII AN TO IE	NELGAN	36		7474 4/5++15738++31416++47124
	1 10 6016 UTF1211 00 10 274 73•57971(236F22,3)#88673,310092688673,11062163,5	RELGAN			L + ++244,1.079956,1.256 7 1.72788 1.88404 7.74
	c[ac(],J)=01=05T(1)	RELIAN			3 7.51377.7.47038.3 ===
	GAN1=PTON2	AELGAN	86		NATA #/?1+0+1/
	7x2+x4F(3,J)-x8F(2,J)	RELGAN	45		DATA NP/21/
	N#Z=###{3,J}=###{2,J}	BELGA.	96	ç	
	12 # 50 # T L D T Z # N T Z & OR Z # DR Z 3	RELGAN	.7	ç	THAW AND LABEL BODY BOUNDARY.
		PELGAN	30	c	CALL VECTOR (VECD. VECD. NUMAY .)
			54		ニュールル・ナルションハススロウリタイプロロタロスペタスタムタ
	54M9F(2, J)+ (GAM1+92+CAM2+01)/(01+02)	REIGAN	or.		X1 ARL ++1+0+1+0/X5E
	54 MB- (7) JI- (64M1+72+64M2+01)/(01+02) 50 TO 160	RELGAN	9¢ 91		XLARL==1+0+1+0/¥SF ¥LARL=3+6

THE MAGNITUDE AND DIRECTION OF	RELGAN	•	∿x2=x4∈(3≠J)−x8F(2≠J)	BELGAM	93
E THE STREAMLINES INTERSECT THE	PELGAR	10	NR2=PAF(3,J}=BBF(2,J)	RELGAM	94
ARE PERPENDICULAR TO THE FLOW	RELGAN	11	12=50#TfDX2+DX2+D#23	RELGAN	95
	MELGAN	12	G4H2=4TAN(DR2/9¥2)	RELGAN	96
	AELGAN	13	ELAF(2, J]={ELAF(2, J-1)+(1+(2+)+(2+)+(2+)+(2+)+(2+)+(2+)+(2+)	RELGAM	97
	SELGAN	14	"AMM+(2,J)=(D1*GAM2+02*GAP8F(2,J-1))/(01+02)	9 ELGAM	98
	MELSAN	15	162 FINTENDE	9ELGA4	99
19199	9 EL GA 4	16		RELGAM	100
	MELGAN	17	1 (MAR(1+1) +LT+ J) 60 TO IRJ	SELGA4	101
AL 115 C	TLGAR	1.		RELGAN	192
	926949	19	0#~]=(#FC 0Y2=V8C(TA), IL_V8C(T, IL	BELGAN	103
	BELGAM	20	/	RELGAR	124
		11		TEL SAN	105
	BELGAN				1.40
10.20	BELGAN	<u></u>	GARZeatan (DRZ 20 YZ)	721647	107
			GARESTE, DESCARDADESCARDADESCARDADES	TELGAT	10-
	RELGAN	29	173 CONTINUE	761047	1.14
		20	18J CONTINUE	851014	
	RELGAN	28	EL1+01+057(1-2)	RELCAN	112
	AFIGAM	20	FL2=N2+DST(1-1)	REICAN	112
	RELGAN	ir	91=01+2+C+92	BEACAM	111
	PELGAN	11	·2*-·2	RELOR	117
	RELGAN	12	EL9F(I,1)=(EL1+02+EL2+01)/(01+02)	RELGAN	116
HICH CENSS SHOCK	AELGAN	11	CAMME(T,J)=(CAM1+02+CAM2+D1)/(D1+D2)	RELGAN	117
	SELGAN	34	TF (GAMARE(TyJ) wLTw GwG) GAMBEETyJ)=>wN	REIGAN	11.
	*ELGAN	35	193 CONTENUC	SEL GAN	110
0	RELEAN	36	C .	RELGAN	120
**2+855{2,31**23*2.0	BELGAN	37	EXTERPOLATE ALGING STPEAMLINES TO LAST GPIN LINE	AFLGAN	121
	SELGAN	3.	C	RELGAN	122
	AELGAM	39	CALL SCHRITZPLOT, Y1, CAM1, EL1)	PELGAN	123
•	RELGAN	40	D7 210 1+3, NSTP1	9ELGA4	174
	PELGEN	41	New RF (1)	RELOAN	125
	BELGAN	42	NIMPENINST(I-1)	PELGAN	126
	RELCEN	43	T (TAR(1)N-1) .LT. XST(1-1,1)) SO T3 227	RELGAN	127
T(2)+05T(1))	RELGAM	44	= 4C = ( 7PL NT = XAF(TpN=1))/(YBF(TpN)=YBF(TpN=1))	BELGAN	128
1/(01+02)	PELGAN	45	The (1+ + + 1+ + 3 + (1+ + ) + U(M))	RELGAN	129
	MELGAM	46	□ • • • • • • • • • • • • • • • • • • •	RELGAN	130
	RELGAN	47	T 1 7 7 7 1 7 7 1 1 7 8 1 7 7 1 9 7 8 1 7 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8	RELGAM	131
}}**Z+{#5={Z,J}=**={2,J=1}}**Z}**	RELGAN	4 *	TE TEMPET JEFA, GAPPIISHI (1, C-FACIOGAMAE(T, N-1)	BELGAM	132
	AEL SAN	49	N. CHARACTINGIL PCIC 0003 CHARE(INVEI)=0°L	PELGAN	133
	AFLCVA	4.5	T := T	BELGAM	134
	TLGAT	51	ch to sut	RELGAN	135
	SEL GAN	22	22) PSF(1, ++1)=YST(1=1, +)(#4)	PELGAN	136
1 1 1 2 1 1 - U 2 1 (U 1 - U 2 )		23	YAF(T.N.) BYST(T.). MIMMA	RELGAN	137
			FAC=(Y)-PRF(T, N+1))/(Y)-PRF(T)-N1-1))	BELGAM	138
	42 L 14 4 4	22	FLEFEIAN+13+ELBFEIIAN1+13+FAF4FI.LEEFIAFF	MELGAM	139
		20	GANAF (I. NAI JUGANARE TI. NJAJ JAFAFAT, J. SECANARA	TELGAT	140
			TE (CAMBELLANAL) ALTA 1413 GAMPELTANALIANA	<b>HELGAN</b>	141
1) 60 TO 120	SELCAN	29	2CU CONTINUE	HELGAN	142
			9 T LIPN	761947	143
	REIGAN	41	END	851544	144
	SEI GAN	4.9		~e164*	745
T([-1)+DST(T))	AFI GAM	41			
1/("1+02)	AFLGAN	45			
	REEGAN	Å Å	SUPPOUTINE ADUND	BOIND	,
	AELGAN	47	c	BOING	<b>1</b>
e us					-

		37				
	RELGAN	64		SUPROUTINE ADUND	50190	,
	RELGAN	57	с		BOUND	3
	RELGA.	44	c	THIS ROUTINE DRAWS AND LARELS SHOCK WAVE AND	POUND	
	RELGAN	50	r	MAGNETOSPHERE OR IONOSPHERE BOUNDARY.	90140	Ś
	RELGAN	70	(	HAR PLAT SUPROUTINES USER ARE	BOUND	Á
	RELGAN	71	c	VECTOP, CHAR, POLAR,	BOIND	ž
	RELGAN	72	С		ROUND	i i
	<b>MELGAN</b>	73		COMMON /809N05/ X80D(10C)/ Y800(10C)/ Y54K(1(3))/ Y54K(10C)/	POHNOS	,
	RELGAN	74		NPMAY, NKMAX, AMACH, GAMMA, HPO, NHINDX	BOUNDS	
		75		COMMON ISCALEI ISF, YSF, XMAX, YMAX, XLNGYH, VLNGYH	5 C AL 3	,
	PELGAN	76		"IMENSICN P(21)-4(21)	BOUND	
BOUNDERY	RELGAR	77		PTPENSTON LABPG(2)	40UND	12
	RELGAN	78		PATA LARMG(1);LARMG(2);LARIP/1CHMAGNETOPAU;245C;94IONOPAUSE/	P GUND	
	9ELGA4	79		NATA LARSY/10HSHOCK WAVE/	POUND	14
	RELGAN	36		"ATA A/"+++15738++31416++47124++62832++78547+	9 2010	15
	RELGAN	41		1	801IND	16
	RELGAN	92		7 1.72758,1.88496,2.54204,2.19911,2.35519.	81011	17
	RELGAN	93		3 2 • 51327, 2 • 67035, 2 • 52743, 2 • 98451, 3 • 14159/	ROUND	
	AELGAM	84		DATA 9/21+0.17	BOUND	
	RELGAN	45		DATA NP/23/	90000	20
	BELGAM	96	c		800111	
	RELGAN	47	c	ORAW AND LABEL BODY BOUNDARY.	4 <b>1</b> UN 1	;;
	PELGAN	9.6	e		BOUND	
	RELGAN	59		CALL VECTOREXADD, VADD, NXMAX, 1, C, IH 1	80100	24
	RELGAN	95		X1 ARL++1+0/#SF	BOUND	25
	RELGAN	91		YLA8L=3+6	R DUND	žó
J-111++21+2.0	RELGAN	92		IF {NHINDX .EQ.1) GO TO 5	#nu+h	27

.

	CALL CHARTILAGL, YLAGL, J. 0, . 12, LAGME, 12)	BOUND	28
c	KQ 19 19	50040	29
ř.	TONOPAUSE - ADD HPO TO LAREL	BOUND	- 51
r		ROUND	32
	2 CHLL UTPERKENGSTLANLSUNUSSICSLESLUS91 XCHmml.549.45XXX	101010 10100	33
	YFH=Y#4X=J. 3/YSF	80*MD	35
	CALL CHAR(XCH, YCH, D.C., 2, 3HH/R, 3)	ROUND	36
	CPLL THAR (XCH+++2/XSF+YCH+0+0+075+140+1)	81319919	37
	CALL NUMPLT (XCH+1./YSF.YCH+0.32.Mag.)	801000	34
c		ADUND	40
ç	NPAW AND LABEL SHOCK WAVE.	87090	41
Ľ	13 CONTENSE	5011NO	4Z
	CALL VECTOR EXSHK, VSHK, NYHAX, 1, C, LH 1	8 <b>5 UN 5</b>	- 44
	Y[ & #L == ] . U= ] . C/YS#	97099	45
	144769199 1411 - 144953148149148141447724548544773	17(11) 801140	45
C		Rgywn	49
ç	NPAW AND LABEL PLANET FOR MAGNETUSPHEPE	RJUNN	49
r	TE (NUTROX	R10ND	50
	PM41+.1+15F	ROUND	57
	TALL POLARER, A, NP+1+C+1+ ,-RH&Y+1+3	ROUND	59
~	CALL CHAR(.1,.CB,3,0,.12,6HPLAHET,6)	8.gijiji n	- 24
•	9 5 T (10 N	80010	
	ζ wņ	# 10ND	57
	5138901TTN= 800T	Anut	,
ç	Tutt CHREMITTHE BRENTE MIT THE RECORDER FORM	8 7117	3
è	ANT SAMMARIAN METHOD AND THE MERGEDIC MEMORY	5001 5001	
	COMMON /RENA ANGP, ANGN, KACON, ACONE2 13	PTN	ż
	FRMMAN /DNSTRM/ ZPLOT,NZEND,NZEDD,NXPLAT	NYCTEN	2
	CONMON / PRO/ ANG(22,122), PXTH(1,3), NTA	DPD	
	LEVEL *, APAQA, APERP, BHORM, MAAG, MANG	2 4 PG 1 P	2
	COMMON /ACOMPS/ APARA(25,100),5#5R#(27,17,1,8%9R%(26,16)),	RCOMPS	3
	COMMON /RLUNT/ THETA(25), PP(20, 25), NOLINT	PLINT	,
	CONHON /ADUNDS/ #800(100), YEON(100), YEHK(100), YSHK(10),	#31943S	ż
	• NPMAY, NYMAY, AMACH, GAMMA, HER, NHINNY Common Jelous Velse, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1	130405	3
r	2000 002300 0023020300 00230200 00230200 0020 020	8 2417	11
	( \$NGP = { IN( ANGP }	ROUT	14
	CANFPECINE (ANGP) SANGHESTNEANGH)	A CUT	11
	CANCH+C35(ANGH)	901 9017	17
	notic(*)127)	● giit	19
ř	POINT MACHETTE CILLS END MOST DICING	RGUT	12
č	Construction of the second	RAUT	21
	NN 10 J+1+HPLUNT	#GUT	
	'F EMMENDE DE DD 13 GO TO 3 Notteda 11 11 1. Thetad in	RGUT	23
	Ch th S	101 101	24
	3 WETTERS,115) JETMETACUI	NOUT	26
	5 Tel Wolf2014.12.3 T.Deff.13.eo.00.011.13	5017	27
	nn 15 Tu2pHQMAX	800T	25
	4]+544CP+**EPP([,J)	ROUT	30
	#2=C#46P##P&R&(1)}	+OUT	31
	F2=SIN(ANG(1+J))+42+SIN(RANG(1+J))+41	101	37
	PMAG([, J)=SQRT(F1+F2+F2)	POINT	34
	#ANGP+ATAN2(F2+F1)+0F6	ROUT	35
	- ************************************	3011	15
	97=84704(7, J)+56NGN	1001	34
	<b>VPITE (5,.2.) I, PP(I, J), PPAPA(I, J), PPEP(I, J), AMAG(I, J), BANGP,</b>	TUDE	39
	ም ማግባት የመጀመር የሰው	BOUT	40
c	•• •• ••	SOUT	42
ç	PPINT MAGNETIC FIELD DOWNSTPEAM	R OUT	41
¢	NT 1 - NAI 11NT - 1	800T 800T	44
	00 26 J=NT1,NTNAT	50117	46
	17 = J-45 L U4 T	1001	47
	. mm z. 179 91	RGUT	4 8

CALL CHAREFLAGE, YLAGE, J. 0, . 12, LABRG, 121 GD TO 16

	IF (NYINDX	<b>ROUT</b>	49
	VR1 TE (6.13) 17.7	ROUT	50
	60 10 15	BOUT	51
	13 89175(6,135) 42.2	8101	52
	15 1+1	ROUT	53
	WOITE(6.12), I. VC(1.4), BPARA(1.4)	NOUT	54
	00 20 T=2, NRMAN	ROUT	55
	N1=5ANGP+NP ERP(T)]	5.0117	56
	92=C196++PAPAEI;J3	AGUT	57
	F1=CN5(ANG(T,J1)+82+COS(PANG(T,J))+91	ROUT	5 P
	F2=STN(ANG(I)))+52+51N(BANG(I))+51	AGUT	59
	5%AG([/J]=5 ORT(F1+F1+F2+F2)	89117	66
	BANGP-ATANZ (F2,F1)+NEG	9001	61
	ахагј фСтиси	ROUT	62
	4 Y#F2 #CANGN	RGUT	53
	*7=8478#{1, J}+51NGN	9997	64
	WRITE (6,120) E,YC(I,J),#PARA(I,J),BPERP(T,J),RMAG(I,J),RANSP,	83UT	65
	+ ==₩178=[[#J]#8X#8Y#8Z	ROUT	66
	2 S CONTENIE	P.0197	67
	PETIPN	ROUT	6*
C		AGUT	49
	163 FORMATELHI//S2Xy254MAGNETIC FEELD COMPONENTS/57Xy25ELH#1/}	8.QHT	70
	113 FORMATE//21H ANGULAR LOCATEON NOAPT22124, AT THETA HEFRAGE	8007	71
	+ +H DEGREES//	4301	72
	* 4¥,14T,5X,4HPP10,6X,2(6HP191NF,6X1,6H9191NF,5X,7HR-ANGLE,5X,	RIJUT	73
	•	PIUT	74
	717,104(PA4ALLEL),4X,64(PERP),4X,2(104(TH+PIANE),2X),1X,	R (3137	75
	* RHENDRHAL F, 1X, 3(1X, 11H(RESULTANTEE)	57UT	76
	115 THEMATE//214 ANGULAR LOCATION HO., 12, 124, AT THETA ., FR.4,	ROUT	77
	• • • • • • • • • • • • • • • • • • • •	ROUT	7*
	• 47.141.67.54PP/R3.77.2(EHR/STNF.671.648/STNC.58.7HS-ANGLE.58.	ROUT	79
	• 7H R/RINF,5X,7HRX/BINF,5X,74RY/RINE,5X,74R7/RINF/	RUIT	
	<ul> <li>211, JCH(PARALLEL), 41, 64(PERP), 41, 2(1(4(IN+PLANE), 21), 14)</li> </ul>	<b>N () () T</b>	*1
	• PH(MIDHAL), 14, 3(18, 11H(MESULTANT)))	NGUY	52
	20 FN04AT(15,012x,F13,41)	1001	43
	ISJ HERMATT//334 ADDITYUNAL AVIAL LOCATION NO.+12,144, AT 7/0 +,F*.4//	4007	
	• 41, 147, 74, 348/0, 57, 2(648/BINF, 5X), 648/BINF, 5Y, 745-ANGLE, 5Y,	NOUT	
	74 474[NF#53,744478[NF,53,74478[NF,53,744774]NF/	4707	76
	21x,10H(PARALLEL),4x,EH(PERP),4x,2(3'H(TN-PLANE),2X),1Y,	TUDE	
	• JHENTOMAL 1, 1X, 3(1X, 114(PESULTANT))	3307	
	133 FORMATCH/304 ADDITIONAL AVIAL LOCATION NO 12,114, AT Y/RC +,F8.44	ROUT	99
	# \$\$*14!#/\$*\$###/#_*7\$*7\$*7!\$###/#!#F*BT!*6##/#!#F*51*7###################################	•101	90
	• 74 4/ • INF, 5X, 744K / # INF, 5X, 744Y/8 INF, 5X, 7447 / # INF/	ROUT	01
	• 74 8/01NE,5%,748%/01NE,5%,748%/01VE,5%,748%/01VE/ • 71*1046484LEL),4%,646E001,4%,2(104674-01463,2%),1%,	ROUT	01 92
	• 74 4.4145,32,7442,4145,52,7447,4535,52,7447,4535,7447,4536, • 72 4.204764641261,445,64162691,43,22154674-FL+463,223,174 • #4649944Lb-12,32,32124,114(0654)2447313 FUN	8-3UT 8-3117 8-3117 8-3117	01 92 93
	• 74 4.4145,32,7442,4146,52,7447,4245,52,7447,6346,534,7447,6146, • 714.10476464(LE(),44,64(PEOP),44,72(17447),645,223),17, • #4449644L5,12,3(14,214(#ESUL*A4T))) END	R1UT R1117 R1117 R1117 R1117	01 92 93 94
	• 74 4145,523744245146,523,744745,524,7447,6347,6146, • 714,1047646411813,6146,647,647,647,627,7447,61474-61,223,17, • #4496441,537,24,2147#8533,7447333 • #499441,537,24,2147#8533,7447333	R1UT R117 R117 R117 R117	01 92 93 94
	• 74 4747455267442747465525774477476552577447747467 • 724610478426128174456418289164752126474-PL84835223517 • 44759746748253275224722447553 • 849746747475774727472577447553 • 849747747474777777777777777777777777777	8907 8947 8947 8947 8947	41 42 43 94
	<ul> <li>74 4/474553,74437/4145,53,744774345,53,7447741457</li> <li>7244204154264152051,43,2124174451,231,137</li> <li>8440094413,13,3124,005501*447333</li> <li>840094413,13,3124,005501*447333</li> <li>840094413,13,144005501*447333</li> </ul>	R1UT R1117 R1117 R1117 R1117 R1117	41 42 43 94
¢	• 74 414514532374423514532374475324532374475244532474475454 • 7240204764441281354754476447653237447541474-82542333374 • ####################################	R1UT R1117 R1117 R1117 R1117 R1117 R54471	41 42 43 94 2
	<ul> <li>TH RIGHTSSX, THRY, THRY, SI, THAY, RIWS, SX, THAY, RIWS,</li> <li>TIV: DHIP ARALLEL ), AT, GHIP SILL</li> <li>RUHAPMALL, IX, BILY, JLH(PESULTANT))</li> <li>RUHAPMALL, IX, BILY, BILY</li></ul>	R1UT R11T R11T R11T R11T R11T R11T R54F1 R54F1 R54F1	2 9 9 4
	<ul> <li>TH ALASTATUATINE STATUS THATS THAT THAT</li></ul>	R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117	41 92 94 23 94
	<ul> <li>TH ATATUFSER THAR FAILS SETTING ANT THE ARGUETEN AT ATTENT AT A THE ARGUETEN A THE ARGUETEN AT A THE ARGUETEN A THE ARGUETEN AT A THE ARGUETEN ARG</li></ul>	R-111 R-111 R-1117 R-1117 R-1117 R-1117 R-1117 R-1117 R-1117 R-1117 R-1117	1 2 3 4 5 6
	<ul> <li>TH ALASTATAKY AND ASST THAY ATTASST THAT AT A THAT ATTAS THAT ATTACK THAT ATT</li></ul>	R-111 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117 R-117	81 9 9 9 7 7 8 8 8 8 7 7
	<ul> <li>TH ATATUFSETHARTARESTATION STATES STAT</li></ul>	R101 R1017 R1017 R1017 R1017 R107 R107 R	81 9 9 9 2 7 4 5 6 7 2 0
	<ul> <li>TH AVATUREST THAT AT A SATE THAT A SATE A SATE A SATE THAT A SATE A SATE A SATE A SATE A SATE A SA</li></ul>	R107 R107 R107 R107 R107 R107 R547 R547 R547 R547 R547 R547 R547 R1087 R1087 R1087 R1087 R1087 R1087 R107 R107 R107 R107 R107 R107 R107 R10	01 02 03 94 2? 4 5 67 2 3
C C C C C C	<ul> <li>TH RYSTRYSTRYSTRYSTRSSTATERSSTATERSSTATERSSTATERSSTATERS</li> <li>TINOINFARALLELYSTARSSTATERSSTATERSSTATERSSTATERSSTATERS</li> <li>TINOPPALESTATERSSTATERSSTATERSSTATERSSTATERSSTATERS</li> <li>GUIMPPALESTATERSSTATERSSTATERSSTATERSSTATERS</li> <li>THYS SUPPONTIME CALCULATES THE MAGNITUME AND OTREFTION OF ELVELUE AT THE SUPORT AND THE RELOCATION. STRENTHE FLOCATION OF THE POINT</li> <li>COMMON JANGTES THE POINT</li> <li>NOTARS, NUMBER AND OF SUPERAL PROMUMENTS</li> <li>NUMBER, NUMBER AND OF SUPERAL PROMUMENTS</li> <li>NUMBER AND OF SUPERAL PROMUMENTS</li> </ul>	R)UT R)UT R)UT R)UT R)UT R)UT R)UT R)UT	81 92 93 94 2 ? 4 5 6 7 2 3 2 2
C C C C C C	<ul> <li>TH AVATUREST THAT AT A SATE THAT A SATE A SA</li></ul>	R107 R107 R107 R107 R107 R107 R107 R107	81 92 94 2 ? 4 5 6 7 2 3 2 r 1
	<ul> <li>TH AVATURESST THAT FIRESST FIREST FIRESST FIREST FIRESST FIRESST FIRESST FIRESST FIRESST</li></ul>	RjUT RjUT RjUT RjUT RjUT RjUT RjUT RjUT	81 92 93 94 27 45 67 23 27 11
	<ul> <li>TH AVATUALSYSTMAKYATIASSTYTATYATYASSTYTHATYATYA</li> <li>TH AVATUALSYSTMAKYATIASSTYTATYATYASSTYTHATYATYA</li> <li>TH AVATHATYATYATYASTYAATYATYASTYASSTYTHATYATYATYA</li> <li>TH AVATHATYATYATYASTYAATYASTYASTYASTYASSTYTHATYATYATYATYATYATYATYATYATYATYATYATYATYA</li></ul>	RjUT RJUT RJUT RJUT RJUT RJUT RSW1 RSW1 RSW1 RSW1 RSW1 RSW1 RSW1 RSW1	81 92 94 27 45 67 23 27 11 12
	<ul> <li>TH AVATURESST THAY ATTRESST FARVERIST FURTHER TO COMPARE THE STATE AND TH</li></ul>	RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT RJUT	41 92 94 2 ? 4 5 6 7 2 3 2 r 1 1 1 2 3 4
	<ul> <li>THE AVAILABLE LANGE AND AND AND AND AND AND AND AND AND AND</li></ul>	RJUT AJUT AJUT AJUT AJUT AJUT AJUT ASUT ASUT ASUT ASUT ASUT ASUT ASUT AS	01 92 94 27 45 67 23 2 11 11 11 11 11 11 11
C C C C C	• $T_{M}$ $X_{1} = T_{M} = T_$	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	47 42 42 42 42 42 42 42 42 42 42 42 42 42
CCCCC	<ul> <li>THE AVAILABLE LANGE AND AND AND AND AND AND AND AND AND AND</li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	01 92 94 27 45 67 27 27 11 11 14 5 10 7
6 C C C C C C	<ul> <li>         74 % 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1</li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	89 94 27 45 67 23 27 11 12 34 56 78
	<ul> <li>THE AVAILABLE 1. AT A CHIEF DI LAVATIAN STATUTE STATUTE THE THE THE THE THE THE THE THE THE T</li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	0994 274567232711234567
	<pre></pre>	NUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT A	099 274567232111234567890
	<ul> <li>THE AVAILABLE 1. AT A CHIEF DI LY AVAILABLE STATUTE STATUTE THE AND AND AND AND AND AND AND AND AND AND</li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	
	<pre></pre>	NUT NUT NUT NUT NUT NUT NUT NUT	01234 2745672324123456789012
	<ul> <li>THE AVAILABLE IN ALL OF AVAILABLE IN THE POINT AVAILABLE IN THE THE POINT AND ALL OF AVAILABLE IN A AND THE EVALUATES THE MAGHITHME AND ATREPTION OF ELISELIVE AT THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF ALL OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF ALL OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF ALL OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF ALL OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF ALL OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTOM OF A THE SHOLE, AND THE R-LOCATION, GIVEN THE FLICE ATTAM OF A DATA AND THE R-LOCATION, GIVEN THE THE THE SHOLE, AND THE R AND THE R</li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	
	<pre></pre>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	
	<ul> <li></li></ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	••••• •••• ••• ••• ••• ••• ••• ••• •••
	<pre></pre>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	
00000	<pre></pre>	Ariur           Ariur </td <td></td>	
	<pre></pre>	المالية مالية ممالية مالية مالية مالية مالية مالية مالياليمالية ماليمالية ماليم ماليمالية مممالية مممالية مممالية مممالية	•••• ••• •• •• •• •• •• •• •• •• •• ••
	<pre></pre>	NUT NUT NUT NUT NUT NUT NUT NUT	•••• ••• •• •• •• •• •• •• •• •• •• ••
	<pre></pre>	ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTT ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA ATUTTA A	•••• ••• •• •• •• •• •• •• •• •• •• ••
	<pre></pre>	1445 140 140 140 140 140 140 140 140	•••• ••• •• •• •• •• •• •• •• •• •• ••
	<ul> <li>THE AVAILABLE IN AT A CHIEF DI JARYATYA, STATUTATION OF THE AVAILABLE IN AT A CHIEF DI JARYATYA STATUTATION OF AUXING AND A CHIEF DI JARYATYA STATUTATION OF EL/ELIVE AT THE SHOLE, AND THE R-LOCATION. GIVEN THE T-ORATION OF THE SHOLE, STATUTATION OF EL/ELIVE AT THE SHOLE, STATUTATION OF EL/ELIVE AT THE SHOLE, STATUTATION OF EL/ELIVE, AT THE SHOLE, STATUTATION OF EL/ELIVE, AT THE SHOLE, STATUTATION, STATUTATION ON THE SHOLE, STATUTATION ON THE SHOLE, STATUTATION OF SHOLE, STATUTON, STATUCALL, ON THE SHOLE, STATUTATION OF SHOLE, STATUTATION TO J-I, NEAR SHORE, STATUTATION OF STATUTATION OF SHOLE, SHORE, STATUTATION CALCULATE MAGNETIDE OF VERTICAL FIELD COMPONENT OF SHOLE THE STATUTATION CALCULATE ANGLE OF VERTICAL FIELD COMPONENT TO STATUTATION EL-SARTIL.OOKSTHECOTHELE, SHODE:-2, COSOE(THOL, O) COTHESTMINELT)) CALCULATE ANGLE OF VERTICAL FIELD COMPONENT</li> </ul>	ATUT ATUT ATUT ATUT ATUT ATUT ATUT ATUT	
	<pre></pre>	Тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир. тир.	•••• ••• •• •• •• •• •• •• •• •• •• ••
	<ul> <li>THE AVAILABLE 1. AT A MODE DE VIENTALE STATES STA</li></ul>	NIUT       TUTO       TUTO <td></td>	

.

		SIIRPOUTINE ASTEP		,
С			STEP	÷
č		THIS SUBROUTINE CALCULATES THE VERTICAL FIELD LINES,	RSTEP	- Ā
-		AT INTEGRATING ALONG SACH STREAMLINE TO LOCATE POSITIONS	<b>NSTEP</b>	5
ċ.		WE COULD' ELAG TWILEAAPER	ASTEP	6
		COMMON /ALUNT/ THETAI251. PP(21.251. NALIINT	ALCINT	
		COMMON /ROUNDS/ KBOD(100), YROD(100), YSHK(110), YSHK(10(),	AUNOS	ź
		NAMAY, NYMAY, ANACH, GAMMA, HRA, HHTNDY	#31W35	3
		COMPON /FLUW/ TC(23,103), YC(23,13,13,VF(20,100), RHOF(20,100)	FL OV	3
		LEVEL 2. NS. NSF. XSF. PRF. FIRF. GANRE	DACTEN	Ş
		COMMON /AVAL/ NR, NSF(51), XSF(51,150), RSF(51,10), FLBF(51,10),	AV AL	
		GAM9F(51,100)	RVAL	4
		LEVEL 20 KSTOTSTONUMSTONST	STREAM	2
c		10014 / SIREAN/ ASICOCOLOCIONOSICOCOLOCIONONSICOCIONSI	STREAM	
Ċ		SECOND FIELD LINE IS TANGENT TO SHOCK NOSE	85750	12
¢			<b>4576</b>	16
		JRF447499 NB#4781/78107410 2414 0.90 Pt	ASTEP	17
		YCHK7a¥CfNew4%.11		12
		DSINF+FYSTENST+13+XSHK73/(FLOAT(NA)+1+5)	45150	20
		NELT=NSINF	RETER	21
٢			ASTEP	??
č		CHERCHER ANGRE ABALICAE HIVES ENDES ENDER CAMPELBA VAIL	45 7 5 9	23
		PR 605 J-1, JAFMAX	ASTER	
		9AF(1,1)+64C	ASTER	26
	ers.		RSTER	27
		YRF().2)=YSWK7	85759	2.
c			RSTEP	10
¢		ASSUME CONSTANT DECELERATION BETWEEN RRTH POINTS	*5T2#	32
c		1=7	RSTEP	37
		TOL 0+0-0		
		7 B NO 44 Y	95750	
		A5=Ac(16'1)	45TEP	36
	611	V1 = V2 TB = TB = 1	ASTEP	37
		IF (19 -15- 0) 60 TO 660	87759	34
		w==v=(Te,1)	85759	41.
		^T=?.)+(*C(TR#1)+XC(TR+1#1))/(V2+V1)		41
		1={V7=V1}/0T	ASTER	42
		TE (TNEW SEE, DELT) ON TO ARA	457EP	43
		TOLD-THEN	97728	- 12
		10 10 516	ATTEP	45
	۴Z.	NT=05LT=TNLD	45758	47
		34743	5576	4.8
		X#F(1+1)+XC(T#+1+1)+DELS	42729	
		TOLD+TNEW+DELT	957F#	51
	63)	1F (1 .GE. JAFNAX) GO TA 640	A C TEP	52
		A3 = A1, 47 + 0 + 1 + 0 + 1 + 0 + 0 + 0 + 0 + 0 + 0	NSTER BETER	- 22
		DELS=V1+OFLT+C.S+4+OFLT++2	RSTER	55
		TOLPHTOLD-DELT	<b>4572</b> P	
		38.341	ASTEP	57
		XAF(1, )) + XAF(1, J-1)+OELS	RSTEP	59
		50 TO 630	RSTOP	76
	ė 4.,	CONTINUE NO CALLER	N\$TEP	51
		Tel	RSTED	52
٢			RETEP	54
ç		CALCHLATE WHERE VERTICAL FIELD LINES CONST STOFAHLINES	ASTER	65
¢		DR 704 18-1 HET	957 <u>6</u> P	66
		TelMet	PSTEP	67
		XAF(T,1)=XSHKZ-DSINF	ASTEP	64
		R4F (1,1)+YST(14,1)	STEP	76
		THE [[]]] = 75 HTZ BBE(T. 2) = 45 HTZ	<b>NSTEP</b>	71
r			5315P	72
c		LOCATE POINTS REFORF SHOCK WAVE	457EP	74
¢			<b>NSTEP</b>	75

95 HK1 85 HK1 35 36

	PR 719 J=3+N8	BS TFP	74
	TF (¥9F(I+J+I)+DSINF +GT+ XST(IM+1)) GO TO 72C	ASTEP	77
	XRF((,J)=X9F(T,J=1)+DSINF	8575.	7.6
	PBF(T+J)=YST(TH+1)	NS TEP	79
713	CONTINUE	PSTEP	51
		9575P	
	LOCATE POINTS WITHIN THE MAGNETO/IONSPHERE	* 5 T C P	92
		AS TEP	69
723	TOLD+(XST(IH,1)-XBF(1,J-1))	85 T# 9	
	1-1-1	95750	
	*\$*=1	RSTEP	
	tf (IM .GE. NALUNT) GO TO P1/		87
	V2=V=(NRMAX,I)	<b>SSTEP</b>	8.8
	cp 19 730	<b>RSTEP</b>	49
637	DO PZA JJENNELUNTANKAAK	AS TEP	9.0
	TF (XST(IN+1) +GT+ XC(NRHAX,JJ)) GO TO #20	RŠTEP	91
	V2=VF{NPMAX+JJ-1+{VF{NQMAX+JJ}-VF{NQMAX+JJ-1}}	<b>SSTEP</b>	92
•	• • • • • • • • • • • • • • • • • • •	ASTEP	• • •
	cg 13 730	95 75 0	94
# 20	CONTINIE	55 TEP	95
73,	V1=V2	ASTER	96
	¥1=¥\$7(TM#K\$T#1)	ASTER	
	¥1+¥ <t(t#,kst+1}< td=""><td><b>PSTËP</b></td><td>98</td></t(t#,kst+1}<>	<b>PSTËP</b>	98
	V2=VI4TP#{X1, Y1}	AS TEP	90
	PS7=59RTff¥STfIN+KST+1)=K*TfIN+KST}14+2	ASTER	130
•	+ (YST([#,KST+1}-YST([M,KST))++2)	PS TEP	101
	nT+2+0+057/(V1+V2)	AS TEP	152
	A={ Y2=Y3 }/nT	AS TEP	103
	THEN TOLDOT	ASTER	104
	TFITHEW.GE.DELTI GO TO 746	<b>ASTER</b>	105
	**T*K\$T+1	85750	196
	TALDETAEN		107
	TF (#\$7 .FE. NUNSTEIN) 60 TO 760		116
	AN TO 73C	85 759	110
743	J = J = J		110
	7T=9FLT-TPLD		
	7FL 5= V1 + D7 + 0, 5 + 4 + 07 + 07	RETER	1112
	Y#F([,J]=XST([4,KST)+DELS#(XST)[A,KST+1]=YST(T4,KST))/DST		112
	PAF(T+J)=YST(TM+KST)+DELS+LYST(TM+KST+1)=VST(TM+KST1)/DST		111
	TOLD=TNEW=JELT		114
	K5T+KCT+1		
	1# (KST .RE. NUMST(TH)) 60 TO 763	85 750	- ::::
752	TE (J .GE. JSEMAN) OD TO 765		117
	IF (TOLD .LT. DELT) CO TO 730		
	J=J+1		120
	V1+V1+4+0T		
	NELS=VI+NELT+J.S+A+NELT+DELT	85 76.0	
	XAF(7, ])=XAF(1, ]=1)+DELS+(XST(1)+KST)=YST(1, KST=1))/// *	88768	
	PRF(T,J)+PRF(T,J=1)+DELS#(YST(TM+KST)+YST(TM+KST)+IST		101
	NTENELT	85760	124
	TOLDATOLDADELT		112
	6n Th 760		111
763	CONTINUE		121
	NRC(T)=J		
	TE (J .CT. NAE(I-1)) NAE(T)ANGE(T-1)		114
763	CONTINUE		1 3 2
	DETION		111
		-3.64	132
	FND		

	SUMMOUTINE AUANLEA, 5, A.K. TLAJNLAN)	8/J 48 L	,
<b>C</b>			
<u> </u>	USING A RUGALE TECHNIQUE, THIS ROUTINE CORES THE REAL		2
c	APPAY S INTO ASCENDING ORDER AND CHANGES		
C.	THE ORDER OF APRAYS & AND B IN & CORPTSPONDING		
C	MANNER, K IS THE NUMBER OF DATA POINTS TO		
c	RE SORTED.		7
с		PIP ST	•
	3THENSTON ATTACTS	40946	•
c		9989L	11
-	TE/M-EA-11 BYTHAN	*1#*E	1:
	Alexal silven	#(J#R)	12
		RURAL	
	the function of the second sec	BILBSI	
			- 17
	NO ILA JOLAK		- 17
	TF(S(J).GT.S(I)) GO TO 100		
ç			- 11
ç	INTE#CHINGE ARRAYS		- 17
с		ROARL	19
	TEMP=5(T)		2 C
	5673=5623	9/302	21
		44981	22

ана 1 — селот

136

BETURN Enn

	SURPOUTINE CONDUT LACONT, FACT, NHINDX)	C0409T	2
	THE ADDRESS UPTER OUT THE CONTOUR LINES FOUND BY	CONOUT	4
	THESE CONTINE ANTING THE CONTINUE CONTINUES FOR CONTINUES	CONDUT	
	24-MOLINE HER	CONDUT	
	404404 1TC15C41 TC4414.13TL1	TCHECK	
	COMMON ANTITE CONTRESSOR CONTRESSOR CONTRESSOR CONTRESSOR AND CONTRESSOR	PLOTO	7
		CONDIT	
	ALACATION RECORDED	C GNO!!T	12
	29UNTRO 3 PT TAZ 21HT 90 2 AT 40 AT	CONDUT	11
	astri defertad how roth 16, en en en e	CONDUT	12
	NMAY-MAD (7)	CUMUIL	11
		CONDIT	14
		CONDUT	15
		CONDUT	16
		CONJUT	17
1.	NOTTELA. SOOT NEAR	CONDUT	1.6
		CUNDAL.	19
15	TE (TRINT . FO. 5) WETTERSSUS NAAK	CONDUT	20
**	TE (IPLAT . 53. 6) WPITE(6,610) NHAY	CONDUT	21
	15 (10LOT.EQ.7) WRITE (6.640) NMAY	COMUUT	27
23	CONTINUS	CONDIT	23
		CONGUT	24
	PEVERST TIGN OF X FOR OUTPUT	CONDIT	- 75
		CONDUT	25
	1##X=N#D(N##X+1)-1	COMOUT	- 27
	XAHL, JAL S OF	CUMULT	
2	CONTY(J)=-CONTE(J)	CONDUT	29
•		CONCUT	30
	PRINT CONTOUR LINE FOR EACH VALUE	TUPHED	- 11
		~3#3UT	17
	NAN(1)=1	CONJUT	33
	00 1 N=1, NMAX	CONOUT	- 34
	NP=NA31N+11-NA0{N}	CUNJOT	37
	NC MAT-NAD(N)	CUNDUT	36
	1 - 1 CHK(4, HCONT)	CONDUT	37
	CVALEN3=ASONTEL3	CONJUT	36

	SUBSCRITTER CHECKETCHE.NEY.KOD2.J.K.NVAL.KOD93	CHECK	z
r		CHECK	3
÷.	CONTOUR PROGRAMS HAR, WALK, SERCH, ENTER, AND CHECK	CHECK	4
ř.	WETTTEN BY REESE SURFISIONS NASA-AMES RES. CTR., AUG., 1974.	CHECK	
÷.	(HODTETED VERSION)	CHECK	6
ě.		CHECK	7
ě	GIVEN THAT A LINE PASSES THROUGH AN INTERVAL UNDER	CHEC*	
č	INVESTIGATION. QUESTIONE IS IT A NEW LINE, DP IS TT	CHECK	4
ř.	PART OF A LINE ALREADY RECORDEDA	CHECK	10
č		CHECK	11
ř.	KANG -1 OK. NEW POINT.	CHECK	17
ř	KNNG =2 840, 0L0 POINT.	CHECK	13
e.		CHECK	14
•	DIMENSION ICHK(4,1)	CHECK	15
C		CHECK	16
•	00 1 L+1+NYY	CHECK	17
	1 F(KOD2 NE, ICHK(1,L)) 60 TO 1	<b>CHECK</b>	1.
	TELINE.TCHK[2.1] 60 TO 1	CHFCK	10
	TF(K, NG, 104K(3)(1) 60 TO 1	CHECK	20
	TECNVAL, EQ. ICHK(4.L)) ED TO 2	CHFCK	
1	CONTINUE	LAELK	55
-	* (D 3= 1	CHECK	2 ?
	- C T D	CHECK	2.4
2	¥999=2	CHECK	25
3	● E T I P N	CHECK	26
-	END	CHECK	27

	\$ ( J ) + TE # P	4U#4£	23
	TE#P=4(1)	80951	24
	A(1)=A(J)	7/18%L	25
	ATJ)+TEMP	9U85L	26
	TEMP+A(T)	80981	27
	9(1)+9(4)	59951	28
	A(J)=TEMP	RIJAL	29
105	CONTINUE	8188L	30
c		8.0=91	31
•	* FTU**	9(JANL	32
	END	5164L	33

	#1=NA9fN}	CONDUT	19
	#2=NAD(N+1)-1	CONDUT	40
	1F(1PL07-E0-2) 60 TO 30	CONDUT	41
	TE (TPLOT - GT. 4) 60 TO 35	CONDUT	Å2
	TVAL=1.5+FACT=11.0-CVAL(N1++2)	CONDIT	11
	UNITE(6.4153 NP.CVALINI.TVAL	CONDUT	
	60 TO 43	CONTUT	45
30	WPITE(0.51D) NP.CVAL(N)	CONDUT	46
	60 TO 43	CONDUT	47
35	TE (IPLOT . EQ. 53 WEITE (A.620) NP.CVAL(N)	CONDUT	4.
	TE LIPLOT .EQ. 6) WEITELG.630) NP.CVALLWI	CONDUCT	40
	IF (TPLOT.FO.7) WRITE (0.653) NP.CVAL(N)	COMPUT	50
60	TE(NHINNY-E0.1) 60 TO 45	CONDUT	51
	WRITE(6, 420)	CONDUT	52
	50 TO 9r	CONDUT	53
45	WRITE(6.425)	CONOUT	54
	CONTINUE	CONDUT	45
	WEITERS, A33) (CONTYIT), CONTYIT), T. #1, #2)	CONDUT	64
1		CONSIST	
-		CONDUT	
		CONDUT	
	PETTOPS TICH OF Y	CONCUT	40
		CONDUT	4.1
	0.0.1.1.1.1.1.1	600017	
•	10 3 47224788	5 G N O I T	26
,	nerina ta re-, garagas	CONDIT	11
		CONSULT CONSULT	
403	FORMATING FRAME SOUNDADATE AND TEMPERATURE CONTOURTION STATUS	CONDUT	27
-03	-UTTATISTICATALISTICATICATICATICATICATICATICATICATICATICA	CONCUT	47
	T INTELISTAN TO BOTHTE TH CONTOUR I THE OF MANTALE - TO D	1. UM/111	
		CONTUT	4.0
4 3 3		CONCUT	
		014001	10
4 3 3	- 16 14 1 1 4 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4	C () 4 ) () 7	11
	***************************************	CONCUT	<u></u>
2.00	- UNAN TA TA AN OFFEN CONTINUES TO A DURATE CONTINUES	C 94101	11
	$\sim$ 1.574139204 DENTITY CURIDUE (175) $\sim$ 19409	CONDAT	
710	- THE MATCH / / / / / / / / / / / / / / / / / / /	C 147UT	<u>.</u>
61	- 118 MA 11 41 / / 334, 234 464E1 10 FLELD CONTINUE / 7337, 231 [H 1//	- narit	12
	- IJXFIJFJ74 MRANEILU FIEL CINITTY LINES FUNNTY	014001	11
		CONDIT	
	· AIMPARALLEL TO FLOW IN PREPSIE ANTI		74
	THE ALL HITTERS STANGACINE AND THE LINES FOR ADV	508977	
	· JAT, SSA(FAR CHAPTAGEN) ALTAG · LET LIAPS ,	CONDUT	
	- 364PERPENDICULAR TO FLID IN SAFESTREAMIN	CONTIT	97
e 23.	-SHARIC///SK/13/344 PUINTS IN CONTROP LINE TE N/RINE /	r gagur	
		C 34311T	
0.50	FURALLY//SCIIS/SCA POINTS IN CONTOUR (Inc. on a Value )	C DAUDIT	12
	174(PERPENDICJLAF) =, F7.37/1	CONTUT	56
C 4 J	FURNALLY IT AT A SOM MAGNETIC FIELD FONTWIN LINES FRINKLY	CONJUT	•7
	INTERS A CENT COMPONENT ALONG FIED LINES .	CONDUT	58
	· EVANIERAL TH FLOW IN FREESTREAM)	Edwant	• •
6.50	CONTRACTOR AND A POINTS IN CONTOUR LINE TE AVAINE ,	CONDUT	9.1
	- 104647844L1 =/=7+3/71	דניראסי	9]
	enn	CUNUIT	97
	CIRENUTINE CONTR	FONTE	2
		FONTP	2
	THE COMPONENTE PLATS AND LABELS CONTAIN LINES.	CUNTR	4
	ALSO DRAWS FIELD LINES FOR MAGNETIC STELD STRENGTH PLOTS.	CONTR	5
	VCC PLOT SUBROUTENES USED APE	CUNT P	e
	DOTLN, NUMPLT, VECTOR.	¢ NHT#	7
		CONTR	
	NTMENSION V513531/V513531	CUNTR	9
	COMMON /LANLS/ YEANTSODDYLANTSCDDCVESCDDNCLDILATSODDNEAM	LAPLS	2
	CUMMUN ISCALEI XSEAYSEAHAXAYHAXAXAXINCTHAYINGTH	55 AL F	,
	LEVEL 2.NA.NSF.JAF.PEF.FLAF.GAMSF	RVAL	2
	COMMON /RVAL/ NA, NRE(51), VAF(51,1/4), 24F(51,100), ELRE(71,100),	AV AL	2
	• 64****(51,10()	SVAL	4
	COMMON JONSTRAJ ZELOT, NZEND, NZEND, NXELOT	045794	2
	COMMON (ANDUNDS) X000(1063)/3800(1003)/354K(1,33)/454K(103)	R DUNDS	,
	<ul> <li>NRMAY, NYMAY, AMACH, GANPA, HPO, NHYNDY</li> </ul>	a gimne	2
			,
	LEVEL 2, VSTAVSTANUMSTANST	214644	•
	LEVEL 2, VST, VST, NUMST, NST MMMMM /STREAM/ XST(50, 152), VST(50, 152), NUMST(50), NST	STRFAM	•
	LEVEL 2, VST,VST,HUHST,HST COMMAN /STREAM/ XST(50,152),VST(50,152),HUMST(50),HST CAMMAN /PLOTOK CONTX(10,2),CANTY(10,2),CVAT(30),HO(30),FLAT	STREAM	;
	LEVEL 2, VST,VST,HUMST,HVT COMMON VSTREAMY XST(50,1521,VST(50,1521,VUMST(50)),NST COMMON VSLOTC/ CONTX(100,3),CONTX(1033),CVA((30),NA0(30),ISLOT	STRFAM PLOTO CONTR	; ; ; 7
	LEVEL 2, VST,VST,HUHST,HVT - OMMAN ISTREANIXST(50,152),VST(50,152),VUHST(50)),VST CAMMAN PLOTOX CONTX(100,1),CANTV(10,33),CVA(33),NAD(33),IPLAT TF(TPLOTA-40,3) GO TO 72	STRFAM PLOTO CONTR CONTR	; 2 17 1-
	LEVEL 2, VST,VST,HUMST,MST «DAMMA VSTREAM/ VST(50,152),VST(50,152),VUMST(50),VST «DAMMA /PLOTC/ CONTX(100,),CONTX(10)),CVA((30),NAD(30),IPLAT TF(TPLOT=40,3) 60 TC 72	STRFAM PLOTO CONTR CONTR CONTR	; ; ;7 1= 10
	LEVEL 2, VST,VST,HUHST,HYT COMMON (STREAM) XST(50,152),YST(50,152),WUHST(50)),HST COMMON /PLOTC/ CONTX(100,)>CONTY(10)),CV4((30),NAO(3(),IPLOT If(IPLOT,40,3) GO TO TO ORAW CONTOUR LINES.	STRFAM PLATC CONTR CONTR CONTR CONTR	; 2 17 1• 10 20
	LEVEL 2, VST, VST, HUHST, HST COMMON /STREAM / XST (50, 152), VST (50, 152), HUHST (50), HST COMMON /FLOTC/ CONTX(100, ), CONTX(10)), CVA((30), NAD(30), IFLOT If(IFLOT. 40, 3) 60 TC 72 ORAW CONTOUR LINES.	STREAM PLOTC CONTR CONTR CONTR CONTR CONTR	; 2 17 1 1 2 7 2 7
	LEVEL 2, 153,531,40035,451 COMMON STREAM SITESO,3523,9551(50,1521,400451(50),457 COMMON SPLOTCS CONTX(1000),CONTY(1003),CV4((30),440(3),440(3)) I=(IPLOT.40,3) GO TO TO ORAM CONTOUR LIMES. TA-1	STREAM STREAM PLOTC CONTR CONTR CONTR CONTR	2 17 19 20 71 22

۰.

"I=NAT(N)

с с с

C

000000

с

c Ĉ

MCL = NAD(1)	CONTR 23		
TE-M47(142)		NNewDWS T(K)	CJNTP 100
to the fight of the second s	CONTR 26		CONTR 100
	CONTR 27		CONTR 110 FONTE 111
LAREL CONTOURS.			CONT4 112
C DETERMINE WHICH END OF CONTOUR LINE IT CLATER	CONTR 30	12.2 CONTENTS	CONTR 111 FONTE 114
TO AMJANARY.			CONTE 119
LASEL COMPANY AT THAT END.	CONTR 33	532 FONTENERS 1919 1919 1919 1919 1919 1919 1919 2090	CONTE 116 CONTE 117
FIND WENTHIN DISTANCE ENDM CONTOUR END ACTURE	CONTR 35	LID CAMTTMUE Return	C3474 119
TO ANUMARY.	CONTR 35 CONTR 37		CONTE 120
[**	CONTR. 30	C DUAN FERENDICULAR FIELD LINES FOR MARMETIC FIELD PLOT C	CJWTE 123 CJWTE 123
rc-contrets)	CONTR 30	35) CONTINE V(2)	CONTR 123
t Constrating	CONTR 41		
P. 10 1-1,4144	CONTR 43	45(1)=0°C	CONTR 126
TFED.FE.BUNIN] 67 TO 10 TFED.FE.DMIN] 67 TO 10	CONTR 44	C4LL_03TLN(YETLPYSTL)YSTL)YST2122223	CONTR 127 CONTR 128
	CONTR 45	45exef(2)=3 00 5ec #=3-#s-2	CONTR 129
TF(K,E0,2) 60 TO 15		PD 170 Jels HKMAK	CJWTR 131
	CONTR 44	IF (X54R(J) elte Kaf(NSTelski) 60 to 170 61 to 146	CONTA 132
		17. FONTEWIE	CONTE 134
	52 01HL0		CONTE 135 CONTE 135
STATINIE	CONTE 54	854=744K(J=1)+6K8F(MST=X54K(J=1))={Y54K(J)-Y54K(J+1)} 4	
	CONT0 55	transmittering	CONTO 130
DETERMINE WHICH END OF CONTOUR LINE IS	CONTO 56 CONTO 56	TE (BAE(Jak) 6616 RSM) 60 TO 200	CONTR 140
CLPSFR TP ROUNDARY.	CONTE 51		C1478 141 C1478 142
TECHNINI.LT.DMINZ) 60 TO 23		10- 704774161 24 Yr Yr Yr Yr Yr Yr Yr	CONT& 143
VLA9(N)+C^NTx(TE=1)+_1/r5F VLA9(N)-C^NTx(TE=1)+_1/r5F	C7470 61		CONTE 144
		777.14.17=17.44.17=2.44.17=2.44.44.44.44.44.44.44.44.44.44.44.44.44	CONTR 146
JSX/IIIIALZOJICTILIA JSX/IIIIALZOJICTILIA JSX/IIIIALZOJICTILIA	CONTE 54		CJNTE 14
			CONTR 149
T Y T 41 = T Y 42 ( N ) T + + X 45 ( N + 2 )	73NT4 67 73NT4 54	C Juit Pagt of LINE IF IT WIGHT 92 DRAWN THPJUGH ANDY	CONTE 191
S. TONTTWOF. S	CONTR 50	TE [VT(4N-1] .LT. 3.0] EN TO 2.7	CJNTE 152 CJNTE 153
CIMPTITIEL LABEL CHECKS THE ARRAYS OF LAFT			CONTR 154
TT TE MATES FIR OVERLAP. IF A LIAFL AVERLAPS, TT TE MATESAVEN INLEGE TE AFTURE A MANAGEMEN	CONTO 72	202 TF (N .666. NN) 60 TO 226	CONTR 155
OP MATTER CONTROL OF DEFINES A MINIMUM	11410 73 11410 74	IF (YT(M) .GT. Y900(1)) AD TO 264 Menay	CJNTe 141
APPAY ILS CONTAINS INDICES OF LABELY TO RE PLATTED.	Course 75	40 TO 2.2	CONTR 158
	CONTE 77	2(4 YS#ATD=YS(M-1)+(YS(M)-YS(M)-YS(M-1))+(XADD(J)-XS(M-1))/(XS(M)-YK(M-1)) If (YSYADD _17, YAOD(J)) Wi-W	CONT 150
	COMT# 70 70470 70	2.6 CINTTWIS	CONTP 162
LAGE: Crutolie LINES	CONTR NC	2. T. T. D. 213 Weiller	CONTR 151
-11m41-1 29 Uu		ניקרב אין	CJWTE 165
Maltaff) fall Wimplf(xlan(N)sYLanfN]sGafsalsCV(N)s21	CONTR DA	TE (MS aLT, K) RETURN	CONTE 157
e) cowrywys te it aint so si co to to	10110		CONTR 165
TE (T PLOT -20. 6) 60 TO 15.	CONTR 97	C DARK FITLP LINES WHICH DO HOT CACSS SAARK	C7478 170
	C1474 40 70274 40		
Saultreat Ator	CONTR	DO 222 KeNSPMF=2	CONTP 173
7. PONTYWSE	70478 92 CANTE 92	1581397 GeZ Ui 1748131758	CONTR 179
50 75 X=1,45T XX=X74ATTX1	C1479 93	YS(J)=BAF(J_W)	C1414 170
15(1) •15T(4, <sub>5</sub> 1)+( •2	20 ALNGS	7 147714011 0LT0 KP 60 TO 249 233 fortruit	CONTE 17
TELLETSTERSIN	CONTR 05 FANTE 07	240 MMs ] FTMMLA1-Paint	0011 1100 041 1100
۲۵٫۱۹۰۲) = ۲۶۲ (۲٫۶۲) ۲۰۶۴ ۵۹۹ - ۲۰۶۳ (۲٫۶۲)	e alwii	(12+hn)SA-(hh)SA)+(1Nn)SA-(1+Nn)SA)+(Nh)JA+(1+Nh)SA	CONTE 14
	CONTE 10C		Conte 19
CALL VESTTRETS#YS#MM+L#J#G#14 ) 79 Sourt Wite	CONTE 102 CONTE 102	MIAT Dr. 246 Jal, MYMAX	
	CONTE 102 FONTE 102	242 TERN GF. MN GD TO 246 Te tyten .ct. vanning of 70	CONTR 196
NOAN STREAMLINES FOR MAENETIC FIELD PLOT	CONTA 105	1	CONTR 188 CONTR 198
	007 ALMON	262 t.t. La	CONTE 140

٠.

SHAROUTTHE CONTUR	CONTHR	z
	CONTUR	j
SUPPOYTINE CONTUR CONTACLY CALCULATING AND PRIMITING THE CONTOURS	CONTUR	4
AND CREATING THE PLOTS	CONTRA	
	C.947.94	- t
LEVEL () #FAF	BCONST	
	241034	
TOPHIN / ROUNDS/ REDAILOCH VEAD (136) - VSHK (161) - VSHK (136) -	RTUNDS	;
<ul> <li>NRMAY, NYMAX, AMACH, GANMA, HRO, NHINDX</li> </ul>	AQUNDS	,
COMMON /CONT/ KYCON-YCON(201, KRCON, RCON (201	CONT	ż
COMMON /FLOW/ XC(20+100)+YC(20+100)+VF(20+100)+RHOF(27+1(0)	FLOW	2
COMMON JONS TRNJ PPLOT, NTEND, NZADO, NXPLOT	DHSTON	2
CUMMUN /PEOIC/ CONTX(10C;)+CONTY(1(3))+CVAL(30)+NAU(3C)+IPEOI	PLOTC	5
LOGICAL LRERUNALPRELALPPSTALPPCON, LPDPALPLOTALTRAJ, LPETRT	PPOPT	2
COMMON /PODOT/ LESRIN, LPRFL, LPRST, LPRCON, LPRA, LPLOT, LTRAJ, LRSTPI	. DEUDT	
	714644	
-114004 /214664/ X21(20/22/171(20/22/27)40431(40/243)	TOWERK	;
	CONTUR	17
ALL SHIT ALL ALL ALL ALL ALL ALL ALL ALL ALL AL	CONTUR	1.
PI TT STREAM I THES	CONTUR	10
	CONTUR	2 *
TE (LPLAT) CALL SECALCINGHK,YSHK,NYMAX)	CONTUR	21
TPLOT=1	CONTUR	• 2
TF (LPLOT) CALL PLOTCN	CONTUR	23
	CONTUR	24
	CONTIN	21
CALCHEATE VELOCITY CONTOUP LINES	CONTIN	
THE LD IS NEVER AT ARABA	CONTUR	
TE (KYCON -15- 5) 60 TO 12	CONTUR	
CALL MARE VEL 20. CONTY, CONTY, KYCON, 2. VCON, NAD. 1	CONTUR	1:
+ 1.1.NP MAX.NXMAX)	CONTUR	11
• • • • • • • • • • • • • • • • • • • •	CONTUR	32
CONTRACT AND TEMPERATURE CONTURS	CONTIN	33
	CONTHE	14
TPL0T+1	CONTUR	35
FACT-3.5+1549MA-1.63+AMACH+AMACH	CONTUR	36
IF (LOPEN) CALL CONDUTIVEON, FACT, NHTNOX)	CONTUR	37
TH (LPENT) CALL PEDTEN	CONTON	37
CALPHEATE DENETTY CONTING I THES	CONTUR	
CHEIDERIE VENIII CONTING EINET	CONTUR	A1
10 TE (KAPAN .LE. 0) 60 TO 24	CONTUP	47
CALL MAP (MADE = 20 - CONTX - CONTY - KPCON - 2 - PCON - NAD-134 (+ 33 - TCHK+	CONTHE	43
• 1.1, NR MAX, NX MAX]	CONTUR	44
	CONTHE	4.5
C PLOT DENSITY CONTOURS	PONTUR	46
	CONTUR	47
TPL07+2	CONTUR	47
TE (LPOCHA) CALL CONOUTINEON, FACT, NYINGY)	CUNTUR	
IF GENERAL PLOTEN	CONTUR	20
	CONTUR	21
. · FLUCESCO FRINTS AND FUEL LUTION LINES FOR PREALLEL	CONTIN	
And researchers and the conditions	CONTRO	54
2) TE TWORDH . I.E. C) CO TO 200	CONTIN	
TO 100 JULAN KMAN	CONTUP	56
NO 109 1-1, NEMAX	CONTUR	57
ASCH(T,J)-APARA(T,J)	CONTUR	58
IGD CONTINUE	CONTIR	59
CALL MAP (ASCM, 20, CONTX, CONTY, KBCON, 2, ACMM, MAD, 1000, 30, ICHM,	CONTUR	60
* 1,2,484AX, NXHAX)	CONTUR	61
TPLOT+5	CUNTUR	62
TF TLPRCOMP CALL CONDUTTSCONFFACTFN4(NDF)	CONTRE	03
17 11-71013 LALL FLUILM	CONTRA	4.4
TI AAT WEAPHARA	40	

1	2 4 4	YSX400-YS(N-1)+(YS(N)-YS(N-1))+(X400(J)-XS(N-1))/(XS(N)-XS(N-1))	CONTO	191	
		IF (YSX800 .LT. Y800(J)) N1=N	CONTR	192	
1	2 45	CONTINUE	CONTR	193	
		D.O. 250 N=NE #NN	CONTR	194	
		CALL_DUTLNEXSEN1, YSEN1, XSEN+11, YSEN+11, 20, 71	CONTR	195	
	527	CONTINUE	CONTR	196	
1	22.	CONTINIE	CONTR	197	
		*ETUPN	CONTR	198	
C .			CONTR	199	
		e ND	CONTR	200	

	FUNCTEON DROXEX, V)	DRDX	2
c		DROY	9
•	THIS FUNCTION DETERMINES THE SLOPE OF THE STREAMLINE	DRPY	4
C	AT THE POINT (X,Y)	08 NX	5
c		Denr	6
	COMMON /ALUNT/ THETA(25),PP(23,25),NALUNT	ALUNT	2
	COMMAN /ANUMADS/ XBAN(100),YA00(100),XS4K(100),VS4K(100),	ROUNDS	2
	* NR*AY, NY*AY, A*ACH. GAMPA, HRD, NHI NDY	900905	3
	LEVEL 2, ANG, DXTH, DEG	980	Ż
	COMMON JORDJ ANGEZO,1001,PXTHE1011,056	Den	3
	COMMON /FLOW/ XC(20,100),YC(20,100),YF(20,100),RH0F(20,100)	FLOW	ż
•		DROX	11
٠	LOPATING POINT IN GRID	04 0x	12
c		DROX	13
	TF (Y .6F. 3.5) GD TO 10	0201	14
	T47A= 4T4H2fY;->1+95G	DROX	19
	#=\$0#T(Y##2+X##2)	7401	16
	nn 3 Jelenelunt	DROX	37
	TF (THETA(J)+GT+THTA) GO TO 5	DROT	1*
	3 CONTINIE	ŋ##¥	1 *
	] = W R L 194 T	NRN4	54
	5 J°=J-1	080X	Z1
	TF {JP+lT+l} JP+l	D\$ 97	22
	\$L DPC={THTA-THETA(JR)}/DYTH(JR)	DRNK	23
	P2=#~{1,Jx}+{RP{1,Jx}R+1}-#P{1,JR}}+5LOPE	989X	24
	91 7 [#7#HRHAX	DRDX	25
	R1+82	08.01	26
	02=0P(I,JR)+{RP(I,JR+1)=0P(I,JR))+SL(PF	<b>58</b> 5 Y	27
	_ TF (P2 +6T+ R) 60 TO 8	09.9¥	2#
	7 CUNTING	Deux	20
	1 = N = 4 X	0R91	30
	1 50 TC 21	DRDX	31
С		0972	32
	12 CONTINUE	9 <b>R</b> 97	32
	P-4	DRNY	34
	DO 13 JANALINTANAN	DR DY	35
	TE (YC(1)) .5T.X) 60 TO 15	DRNX	36
	13 CONTENIE	<b>NP NY</b>	37
	J=N¥44X	DROX	14
	15 J#+J-1	04°1	30
	TF (JP.LT.HALUMT) JP-NELUMT	DEDT	41.
	\$LOPE+{X-XC{1,J+}}/0X74(J#)	09.01	- 41
	#Z=YC(1,j#)+(YC(1,j#+1)-YC(1,j#))+SLOPE	78 72	42
	10 17 T=2,N=4AX	24 DX	43
	#3 = #2	DROT	44
	#2=YC(T, J0)+(YC(T, JP+1)-YC(T, JR))+SLOPE	0871	45
	15 182 .6T. 4) 60 TO 18	DRAX	46
	17 CONTINUE	UBUX	47
		Denx	48
	12 . Dutiuns	DRDX	49
č		0801	50
C.	BLVARIATE LINEAR INTERPOLATION	DRDT	51
C		DRAT	52
	70 CONTINUE	DRDY	53
	NPI=ANG(I=1,JR)+(ANG(I=1,JR+1)=ANG(I=1,JR))+SLAPE	DRDX	54
	DRZ#ANSIT#JRJ+[ANSII#JR+1]-ANGII#JR])+SLOPE	DRDY	55
	ukurade 1+ (3=5+DK11=(#=K1) / (#5=#1)	ORDX	56

00 110 T=2, NRMAF	CONTUR	66
ASCH(1,J)=80ER0(1.J)	CONTUR	67
110 CONTINUE	CONTUR	6.8
CALL MAPESSCH-22. CONTY. CONTY.KBCON. 2. SCON. NAD. 1000. 30. TCHK.	CONTUR	49
• 2.1. NR MAX. NY MAX1	CONTUR	70
TPL 07=6	CONTUR	71
TE (LPRCON) CALL CONDUTINGON-FACT-NHINDY)	CONTUR	77
TE (LPIOT) CALL PLOTEN	CONTILE	73
	CONTUR	76
00 123 T+2-NRMAX	CONTUR	75
85CHIT. 13-8H08HIT. 13	CONTRA	76
123 CONTINUE	CONTUR	77
	CONTINE	78
	CONTUR	70
	CONTUR	
TE IL BRECHA CALL CONCULTERCON, FACT, NUTNOVA	CONTUR	
	CONTUR	
	CONTIN	
	604740	7.5
	CUNTUR	
I (I LOIT CALL EMPLI(3+0+0)	CUNTUR	
	CONTIN	- 6
END.	CONTUR	57

· --

0000

с с с

......

r c c

с с г

C C C

С. С. С.

		SURGINT THE ENTERINGS J. K. MMAI . 41 . 42. INTM. MUTH. TOW, MODA . V. V. M. M.		
		4 ACANTA ISI 711	24124	
с			FNTER	
ē		CONTRUE PROGRAMS PAPA WALKA SEACHA ENTER, AND CHECK	E#758	- 1
ċ		WRITTEN BY PEESE SORENSON, NASA-AMES RES. CTR., AUG., 1074.	SHTER	
Ĉ.		LYONTETED VERSIOND	FUTER	
с			FNTER	
с		ASSUMING THAT A POINT ON A CONTOUR LINE HAS BEEN FRIND.	ENTER	ě
С		THIS SUGROUTINE RECORDS THAT POINT IN THE BOOKKEEPPING APPAYS.	ENTER	10
C			ENTER	- ii
		COMMYN /FLYW/ XC(20,10); YC(23,10); },YF(23,100;,RHDF(20,100)	FLOW	
		THENSTON ICHK(4,1),X(1),X(1),ACONT(1)	ENTEP	19
¢			ENTER	14
		MAA=N AA=J	ENTER	15
		TERMIN-GT-ISIZIE GT TO 1	FHTFR	16
¢			ENTER	17
		[CHR(1, NIY) -KOD2	ENTER	18
		TCHK(Z)#IT1=J	ENTER	19
			ENTER	20
~		LEWRE SP WATS - WAAL	ENTER	71
2			ENTER	22
2		IN END-DINTS ARE EQUAL, ENTER HIDPOINT	ENTER	23
•			ENTER	24
		1 11 PCTRIMAR 1 A1 0 A1 0 B	EALEB	25
		21 - 1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	ENTER	Z 6
٨			ENTER	27
		50 TO (2-3).*000	Fales	28
r		10 10 129319K012		24
č		INTERPOLATE FOR CONTOUR POSTTION		30
ē			ENTER	
	2	¥2 = ¥C (J = K+1 )		
	-	Y2=Y([],K+1)	ENTER	
		60 TO 4	ENTER	
	3	¥2-¥C()+3,43	ENTER	
		¥2=¥C (J+1,K)	FNTER	37
	- 4	¥1+#C(J,#)	ENTER	1.0
		VI=YC(J,K)	FNTER	10
		¥ (WXY)=X1+DIF+(XZ-X1)	ENTER	40
		¥{NXY}=Y1+BIF+{Y2-Y1}	ENTER	41
		K 117 4 = 1	ENTER	42
		FO TO \$	ENTER	43
c			ENTER	44
1		W# 1 TE (6, 131 )	ENTER	45
	101	FORMAT(49HLCONTOUR SEARCH ANORTED - TABLE OVERFLOW IN (X, Y))	ENTER	46
_		# 7D4= Z	ENTER	47
ç			ENTER	48
2		CONICIANE	ENTER	- 49
		RETURN	ENTER	50
		249	ENTER	51

	SUSPDUTTNE ECHINP	0# DX	59
C		DRDY	60
ċ	PPINTS INPUT CARDS USED FOR RIM	DRDT	61
ċ		DEDX	
-	TINENSIGN CRO(9)	DEDI	
	WETTE (6-110)	DEDX	
	13. CONTINUE	DEOX	
	4FAD (5-134) CRD	DEDT	
•	VES. NO	DEDY	47
•	TE (FOR(=1) 30-20	0101	- 11
	LUNITE LA.1313 PBR	DROY	
		98.91	
	SJ FORTINUF	0444	
	TENING :	ORDX	73
	RETURN	04 NY	74
1	LC3 FAMMATIBA131	DEDX	75
1	LO1 FORMAT(1), 8A10}	0#0x	76
1	112 FREMATEIM1,49X,35HLISTING OF INPUT CARRS FRE THIS RUM/407,35f1H01	DROX	77
	1 ///)	DEDX	78
	Ê ND	0402	79

.

DEDX

57 58

с ссс с

С С С

4	
0	

_	SUBRNUTINÉ EXTRAP	EXTRAP	z
ç		EXTRAP	3
5	THIS GOUTINE CALCULATES EXTRAPOLATED VALUES OF	EXTRAP	4
5	RHD AND W/W AT POINTS ALONG THE BUTHDARY THETA-D USING	EXTRAP	5
Ę.	A LAGRANGIAN INTERPOLATING POLYNONIAL OVER	EXTRAP	6
5	THREE UNEQUALLY SPACED PDINTS ON EACH RADIAL CURVE.	EXTRAP	7
· ·	CONDUM ARTING THE ALASSA DALAS AND MALINE	EXTRAP	
	CONTRACT A CLUMIN INCLASSING CONTRACT AND A CONTRAC	RLURT	2
	COULOM ANDANA TRACK CAMPA CAMPA CARA AND ANALYSING TO BE A 200 M CAMPACITY AND AND AND ANALYSING TO BE A 200 M CAMPACITY AND A 20	800435	2
		800402	3
С		340643	
c	CALCULATE LAGRANGIAN COFFFICIENTS	ET TRAN	14
c		EXTRAP	- 12
	*H23=THETA(2)-THETA(3)	FTTRAP	14
	T424+T4ETA(2)-THETA(4)	FTTRAP	
	TH36+THETA(3)-THETA(4)	EXTRAP	10
	E2+THET4(3)+THETA(4)/(TH23+T424)	EXTRAP	19
	F3-THETA(2) +THETA(4)/(-TH23+TH34)	EXTRAP	20
-	F4=THFT4{Z}+THET4{3}/[TH24+TH34]	EXTRAP	21
ç		EXTRAP	22
5	CALCULATE XC, RHDJAND V AT THETA-D.	EXTRAP	23
Ľ		EXTRAP	24
		EXTRAP	25
	70 17 7-2948784 YCT.196.6	EXTRAP	26
	· • • • • • • • • • • • • • • • • • • •	EXTRAP	- 27
	**************************************	EXTRAP	2 B
	TE (T.EQ.WRHAY) CO TO 10	ELIVAP	24
	940F(1,1)=E2+P40F(1,2)+F3+P80F(1,3)+F4+P80F(1,4)	EXTRAP	30
	VF(1-1)=E2=VF(1-2)+E3=VF(1-1)+F4=VF(1-4)	EVTRAP	
	TR (VF(1)1) .LT. 0.) VF(1)1-0.	EVIDAD	
	14 CONTINUE	FYTRAP	
С		EXTRAP	15
ç	CALCHLATE EXACT VALUES AT SHICK WAVE	EXTRAP	16
¢.,		FXTRAP	37
	WHEFENDHAYD 1)=(GANMA+10)+AN2/EEGAMMA-10)+AN2+20)	EXTRAP	38
	VF (NR HAX, 1) = 1.0/RHDF (NR HAX, 1)	EXTRAP	39
5		EXTRAP	40
2	EAACI VALUES AT BODY	EXTRAP	41
•	Y6(1, 1)-0. A	EXTRAP	47
		FYTRAP	43
		EXTRAP	44
	¥F(1,1)+0.0	EX ISAN	
	940F(1-1)= 949F(109 847-1)=((CAN4441,0)=2448240,8/(27,00040400)=	21144	
	• (SAMRA-1-2))+++(1-3)/(SAMRA-1-7))	CI ITAP	- 21
	n#50# (11=9999-0	EVTRAD	49
C		FTTPAP	50
C	PEFTNE POUNDARY ARRAYS FOR IGNOPAUSE/HARNETOPAUSE AND SHOCK	FTTTAP	51
c		FETRAP	52
	00 23 J=1,4X4AX	EXTRAP	53
	TAUDIJJ#XC(1, j)	EXTRAP	54
	ΥΠΙΔΕΣ ΔΕΦΥΓΕΣΑΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔΕΣ ΔΕΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ ΦΟΙΔ	EXTRAP	55
	······································	EXTRAP	56
	*)****JJ=*L{******************************	EXTRAP	57
~	C.N Craw 9 - July 19	EXTRAP	58
•	8 2 7 116 M	EXTRAP	59
	FUR	£x7₽∆₽	50
		EXTRAP	51
	FND	EXTRAP EXTRAP	

SURROUTTNE FLOUT	FL 0U T	,
-	FLORIT	
THIS ADUTINE PRINTS THE FLOW FIELD VALUES WHICH WILL HE USED	FI MIT	
TO CALCULATE THE STPEAMLIMES AND CONTOURS	FLOUT	
	FI DUT	
COMMON /ALUNT/ THETAC251,PPC23,251,NALUNT	BI UN T	
COMMON /809NDS/ \$900(100), Y800(134), \$548(133), Y548(146),	BOIMDE	
• NPMAX, NXMAX, AMACH, GAMMA, NRM, NHTNDX	a filmes	
LEVEL Z, ANG, DXTH, DEG		
COMMON /DRO/ ANG(23,100), DXTH(1001-DEG	DED	2
COMMON /FLOW/ XC(20,100) + YC(20,100) + YE(20,100) + BHOE (20,10)		
LEVEL 2. VI.VY	FLOW	2
COMMON/VCOMP/ VX120-1801-VV/20-1801		2
COMMON /ONSTRA/ 70LDT N7END N7ADD NYPL DT	AC OWN	1
	DHITTH	
STATISTICS FOR DE TO FOR DITAUT	FLORT	13
	E LIMIT	14
	FLOUT	19

¶ETURN ≓ND

		JPAX-N7 FND+NZADD	FLOUT	16
		NO 2 J-1, JHAX	FLOUT	17
	,	10 2 1=1,N# AAY YCAT. AX=-YCAT. AX	FLOUT	18
с	-	************	FLOUT	19
ç		PRINT VALUES ALONG SYNHETPY AXIS	FLOUT	•1
c		HPTTE (4 - 212)	FLOUT	22
		FACT=0.50(SAMMA-1.2)+AMACH+AMACH	FLOUT	23
		IF(NHINDX.EQ.1) 60 TO 10	FLOUT	•••
		WRTTE(6,223)	FLOUT	26
	13	WETTERA.2303	FLOUT	27
	ż	CUNTIAL	FLOUT	29
		00 30 I+1,4PHAX	FLOIT	30
		7=1a2+54CT#(1a2=¥F([a])##2) BeBMD6/T.1\4T	FLOUT	31
		WPITE(6,200) I. XC([,1),VF(I,1),PHOF(I,1),T.P	FLOUT	
	. 90	CONTINUE	FLOHT	34
ç.			FLOJT	35
č		ANTAL ANTIGO DATK ATOMI 2004	FLOIT	
		WPITF(6,24))	FLOUT	38
		00 40 \$+2,+8LUNT	FLOUT	39
		VF112(0)27.1 J)THETALJ) TEENHINDY.EA.11 CO TO 56	FLORIT	47
		WPITE(6,267)	FLOUT	42
		60 TO 61	EL (9) T	43
	- 53	V*1T=(6,270) CONTYNIS	FLMIT	
	60	10 40 T-1, NPMAX	FL 70 T	46
		T=1+C+F#CT+(1+0-VF(1+J)++2)	FLOUT	47
		P+PH0F(1, j)+T	FLOUT	48
		ALFMAIN-GTANGT[]]] WETTEIA-2001 T.BRIT-13-YCIT-13-YCIT-13-YVIT-13-YVIT-13-ALRGA.	FL(7))T	49
		• VF(T, J),R49F(T, J),T,P	FLOUT	51
	43	CONTINUE	FLOUT	52
ç		STAT VINIT FOR WIRFUTHE FORE SECTOR	FLOUT	57
č		setur setiti ele percular Cont atatia	FLOUT	55
		¥#\$TE(6,2PC)	FLOUT	56
		NY] = NALIMT+ ]	FLINIT	47
		JTH JANKEJJANK JTHJANKEINT	FLOOT	59
		TF(NHTN)X.E0.1) GT TO 8'	FLOIT	60
		WPITE(6,290) J7, KC(1, J)	CL OUT	-11
		44(12(0)3(*)) 60 to 90	FLOUT	52
	60	WPITE(5,310) JZ, VC(1, J)	FLOIT	54
		V#17E(6,32))	FLOUT	55
	90	CONTINUE DC 70 Inlangmay	FLOUT	66
		T=1.F+FACT+EL.C-VEET,JI++23	FLOUT	5.
		a shueli bloi	FLONT	69
		4LPH&#7EG7#NR([p]) 	FLOUT	71
	7.	CONTINUE	FLMIT	72
<u>e</u>			FLMIT	73
F		TESTITE STEM UP IL	SU001 FL001	74
		NO 3 J=1, J=4Y	FLOIT	74
		OG 3 Telphemax	FLOHT	77
	3	x({],});==x({],}) 9F7()=M	FLOUT	70
c		• • •	FLINIT	
	267	FAR=4T(2X,T3,10(2X,F10.4))	FLCUT	81
	212	FORMATELHL//SLV,264DETAILED FLOW FIELD MUTPUT/SLV,26(104)////	FLOUT	
		• POHTNETA + D.CC DEEPEES/)	FLOHT	. A4
	22.	FOR MATEAX, 141, 74, 34X/D, 4X, 544/414F, 3X, 174843/P4314F, 5X, 64T/TINE,	FLOUT	22
	, '	▼	*L097	96
		• • • • • • • • • • • • • • • • • • •	FLOUT	8.
	24.	FORMATELHI, 414, 454FLOW FEELS VALUES FROM ALUNT ACOY CALCH ATTONS	FLOIT	59
	253	SUPSATEFFZEM ANGULAR LUGATIUN NUOPIZPIZMO AT THETA BOFFOGO A. Am Afericeti	51 (M17	90
	260	FOR HATE & X, 1 41,7 X, 44 RP /0, 8X, 348 /0, 9X, 34X /3, 7X, 7448/4145, 5Y,	FLOUT	92
		• 74VX/VINF, 31, 104FLOW ANGLE, 57, 64V/VINF, 21, 104840/040INF, 51,	FLOUT	93
	· · · '	Ф — БИТ / ТТИРУ БХУБИР/Р [NF] Епомьт/ку, тигуку, биво /b/, ву, кир /b/, ву, киу /bл, ку, тиче /чтис = ч.	FLOUT	74
	- · · ·	• 7HVX/VINF,3X,10HFLOW ANGLE,5X,6HV/VINF,3X,11.4040/040014F,5X,	FLOUT	96
		• 647 /TINF, 61, 64P/PINF)	FLOUT	97
	282	FORMATCINE, ALK, ABMFLOW FEELD VALUES FROM MARCHING CALCULATIONS	FLOUT	98
	E 44	THE PROPERTY ADDRESSMENT AVENUE TOTALEDA ADDRESSEDED BE AND BE ADDRESSED.		74

	3( $3$ FORMATIAY, 14I, 7X, 348/0, 7X, 7448/VINF, 5X, 744X/VINF, 3X, 104FLOW ANGLE, 5X, 649/VINF, 3X, 104PHO/R43144, 5X, 647/TINF, 6X, 649/PINF3 310 FORMATI//334 ADDITICWAL AXIAL LOCATION N3, 12, 124, AT X/8C =, • F8, 471 323 FORMATIAX, 14I, 7X, 948/R3, 6X, 7448/VINF, 5X, 744X/VINF, 3X, 104FLOW ANGLE, 5X, 644/VINF, 3X, 134PH3/R40144F, 5X, 647/TINF, 6X, • 649/PINF3 ENF	FL01T FL01T FL01T FL01T FL01T FL01T FL01T FL01T FL01T FL01T	100 171 172 173 174 175 106 107
_	SURPOUTINE FLOWST	FLINST	z
	THIS ROUTINE CALCULATES THE MAGNITUDE AND DIRECTION OF The velocity, then calculates the trajectory streamlines	FLOWST	4 5 6
-	COMMON /BLUNT/ THETA(25),0P(23,25),VALUNT COMMON /AMOUNDS/ XMOR(100),VADD(100),XSHK(100),YSHK(15(), • NATAY NYAXXAMACHGANALANGON NINDX	RUNT RUNUS RUNUS	2 3
	COMMON /DNST#W/ ZPLOT,WZEND,WZADD,NXPLOT LEVEL 2, ANG,DXTH,DEG Common /DRD/ Ang(22,303),DXTH(1cu),DEG	045784 040 080	2 2 3
	COMMON /FLOW/ XC(2)/10); YC(2)/10); YC(2)/20); VC(2)/20); RHOF(2(/10) LEVEL // XST/ST/MUNST/NST COMMON /STEEN/ XST(50,122)/YST(50,132)/WUNST(50)/NST	FLOW STREAM STREAM	7 2 3
	LEVEL 2, VI,VV CAMMANAVCAMP, VX(23)1033,VV(23,103) CIMENSTAN V(23),S(22,6),AP(5),AV(5)	VCANP VCANP FLAWST	2 3 14
c	NATĂ WZCHI-JZ Calpulate velocity and flow angle from vflocity components	FLOWST FLOWST FLOWST	15 14 17
C	POLAR CHORDINATE REGION	FLOWST FLOWST FLOWST	18
	∩EG=772297733] THET#11=CG=0 NJ N444+N4FARTAPD NJ N4 (1=2NAF4)TAPD	FLOWST	22
	716 (1) - 20 - 20 - 20 - 20 - 20 - 20 - 20 - 2	FLOWST FLOWST FLOWST	25
	VF(T,3)=\$90T(VF(L,3)=+2+VY(L,3)=+2) TF (A=<(VX(L,3)) (LT, 1+0E+4) (0 Th 6 Av(CT) (1)=VY(L)=1) (VX(L,3)	FLOWST FLOWST FLOWST	24 29 30
	60 TO 17 5 Apeterjj=2	FLOWST FLOWST FLOWST	31 32 33
c	SYLINDRICAL COOPPINATE PEGIDY	FL DWST FL DWST FL DWST	35
	70 70 1007,83442 7774(J-1)82(1,J-2(1,J-1) 70 20 101,844	FLOWST FLOWST FLOWST	14 39 40
	VFF7,J1=57974VXT2,J3++2+VYT2,J3++23 TF {444(VXT2,J3) ct. 1=00++3 c7 T0 16 Aug(T2,J3+VYT2,J3) VXT2,J3	FLOWST FLOWST FLOWST	41 42 43
	GN TO 27 15 Ave(Fr3)=1=CE4 29 CNNTINIE	FLOWST FLOWST FLOWST	44 45 46
	SMORTH RHOF AND VE ALONG CONSTANT-THETA LINES AT NOSE, Using third derpee least squares fit	FLOWST FLOWST FLOWST	4R 49 50
•	90 25 J=2,48LU4T CALL ={50CY(###Ax>3,8P(],d],440F(1,d],4y25,5,4*,1E%) CALL ={50CY(##Ax>3,8P(],d],4y40F(1,d),4y25,5,4%;1E%)	FLOWST FLOWST FLOWST	51 57 53
	10 25 TalineMax VPD=PfTpJ) VF(TpJ)=(14V(4)=XRD+4V(3))=VRD+4V(2))=VPD+4V(1)	FLOWST FLOWST FLOWST	54 59 56
ç	44164[5,3164[68[4]4748+48[3]]478+48[2]]478+48[2]]478+48[2]] 25 FONTINIS 57784501475 505 VALUES ALONG AVEC DE SVMSTOV	FLOWST FLOWST FLOWST	57
č	CALL EXTRAP DD 30 Televerax	FLOWST FLOWST FLOWST	51 62
c	4M413,1346.4 33 CANTTAJE	FLOWST	64 55 64
C		FLIWST	- 57

ł

-

.
ç	CALCULATE STARTING POINTS FOR STREAMLINE CALCULATION	FLOWST	68
	USE GRID POINTS ON SHICK IN HISE REGIM	FLOWST	69
c	EADYE 1+2-MULING ON 2MOCK UNANTHEYN	FLOWST	70
	NU 32 J-2, NOLINY	EL DUCT	
	¥576J-1,2)=XC6NPMAX,J)	FLOWST	73
	YST(1-1,2)=YC(NRMAX,J)	FLOWIT	74
	32 C (141) (49) E	FLOWST	75
	400\$T=51+#KT	FLONST	74
	NO 34 K-NALUNTANANAN	FLOWER	
	TF FYCELSHE .GT. TPLOTE ON TO 35	FLOWST	70
	34 CONTINUE	FLOWST	10
	K=NI767 75 ¥FTC-¥FINANAN #1	FLOWST	91
	47P1 7Tax	FLOWST	82
	YSTN=YST(NST.1)	FLORST	
	DRST-AMAX_IVSTN-YSTINST-1,11, (YSTF-YSTN)/AMOST)	FLOWST	
	K X = Nu [ I]N T	FLOWST	46
	NT 39 KINALUATISO	*LOWST	47
	TE LYSTN -GE-YSTEL CO TO AC	FLOWST	
	4CT=45T+1	FL DVST	34
	TO 37 IX-KX, NXNAX	FLOWST	41
	TE EVETH . CT. VC(NPMAX, JX)) CO TO 97	FLOWST	92
	TTT [NT];]]=TTIN VET/DET.11-VETNBMAN, IV-TTAATAANAMAA INT AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	FLOWST	• 3
	\$ + { YSTN-YC { MANAY, } } + } } } + } + C { MANAY, } + C { MANAY, } + - 1 } } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } / { MANAY, } + - 1 } } / { MANAY, } + - 1 } / / { MANAY, } + - 1 } / { MANAY, } + - 1 / {		94
	CO TO 30	FLOWST	
	37 CONTENIS	FLONST	97
	30 KX+1A	FLOWST	98
	AJ FONTENIE	FLOWST	96
c	CHEMERAL STRUCTURE	FLOWST	170
ĉ	CALCULATE STREAMLINE TRAJECTORIES	EL DUCT	121
Ċ.	USING THIRD DROER MODIFIED SHIER INTERMATION PROFEMURE	FLOWST	133
r	• • • • • • • • • • • • • • • • • • •	*LOWST	124
	₩₩₩₩X;#₩¥₩E{₩₩₩₩X##¥##₩Z ₩₩₩₩X;#₩₩₩¥##₩₩₩¥##₩######	FLOWST	10-
	9n 50 IST014451	FLOWST	176
	******* IST, 1)	FLOWST	197
	45+9576357,13	FLOWST	109
	Unal-Unal	FLONST	119
	** *** *6** Coul BARDONAXZ	FLOWST	- 113
	10 47 4#29132 TE (VSADUAN CE TALOTA CO TO CO	FLOWST	112
	NX=DA644*5	EL DUST	173
	NG 43 K+1,5	FLOWST	115
	vdux1=usDx{x2*A2}	FLOWT	iié
	YS1=Y5+78PX1+PX	FLONST	117
	44-44 1744 1 / 112	FLOWST	114
	YS=YS+2,5+f080#1+080#E#S=YS133+0#	FLOWST	110
	IF (V51.L=, 0.C .AND. X5.67.0.3) NUPY-NUPY?	FLOWST	121
	43 CONTENIE	FLOWST	127
	*****	FLOWST	1?3
	47 CRUTTWIE	FLOWST	124
	N=152	FLINST FLINST	125
	47 N#= [7PLNT=#\$}++2	FLOWST	127
	nn 44 4+1,5	FLOWST	124
	nany1=nanx(xS, YS)	FLOWST	129
	AG#AGTUA 133413740438T408	FLONST	130
	YS=YC+C.5+1030X1+D80X1X5,V5133+NY	FLOWST	131
	48 CONTINUE	FLOWST	112
	¥\$T(J\$T,#}=XS	FLOWST	134
	YTT(JTT,N)=YT	FLOWST	135
	AUTOLICA INT	FLOWST	136
c		FLOWST	137
C.	CONVERT AND APRAY FROM FLOW FIELD SLOPE TO FLOW ANGLE	FLOWST	110
C		FLOWST	140
	00 10 J-2+NX4AX	FLOWST	141
	111 DU 1947ANGANGET. 111	FLOWST	142
	6 FONTTHIE	PLOWST EL OV**	143
	NYMAY -NYPLOT	FLOWST	177
	4 ETUP 4	FLOWST	146
	e atr	FLOVST	147

	SUBWOUTINE FLSQFY (##NeX#Y#W#N1#S1#A#15#)	FLSOFY	,
¢		FLSOFY	j
ç	PITEPOSE	FLEGEY	4
2	PLNOFT CONSTRUCTS & LEAST SQUARES POLYMONIAL APPPOXIMATION	FLSOFY	•
÷	THE RECEIPTED DEGREE TO A GIVEN SET DE DATA POINTS WITH	FLSOFY	5
ē	DIACE SCIENTS OFFIC SCIENCE SCIENTERS.	FLSQFT	
ċ	010=45104 X(4)+Y(4)+Y(4)+S1(94)+S1(44)+	EL CAEV	
c	CALL FLSOFY (M, N, X, Y, W, MN1, S1, 4, ISA)	FLSOFY	10
Ç	TVPIJT PARAMETEPS	FLSOFY	11
ç	M - NURSER OF DATA POTRTS	FLEGFY	12
ç	N - DEGREE OF POLYNOMIAL DESIDED, Naltam	FLSOFY	19
÷	T ARRAY UP INDEPENDENT WARTANES	ELZJEY	14
č	U - ABBAY OF DEFENSEL VATINELE	FLSQFY	17
č	HNL + FOW DIVENSION OF SCRATCH APRAY ST. HNL CZ.H	EL SAEN	10
ċ	SI - SCRATCH ARRAY	FLSOFY	1.
c	IN THE COLUMN DEFINITIONS BELOW,	FLSOFY	19
ç	T BEFERS TO POLYNDHIAL ORDEP	FLSSEV	20
5	3 BERTOS TO ONN INVEXING WITHIN A CALUMA	FLSDEY	21
ç	COL 1 POLYNORTAL P(T-1), VALUE AT EACH YEJ) THEN 240	FLSQFY	22
÷	COLFFICITAT OF FACH TOOL(J-1) TERM AFTER 263	ELCORY	53
č	COL 2 ALBARTAN, WEDE TATA		
Ċ	COL 4 BETA(1), WHEPE THIAI	FLSOFY	26
r	COL 5 S(I), WHERE T+J-1	FLSOFY	,,,
¢	COL 6 SIGMA##2, WHERE T=J+1	FLSOFY	20
ç	MITPHT PARAMETERS	FLSOFY	29
5	A - ARRAY OF COMPUTED COEFFICYCATS	FLSOFY	30
÷	A(1) THEN A(N+1) CONTAIN COMPUTED POLYNONIAL	ELSOFY	31
-	TER - EDONE INVESTIGATION IN JULIE OF ONTREASING DIGATES	FL 57FT	32
ř		EL SOLV	
٢	. FO. 1 (N. GE. 4). 18. (N.L 1. 0)	FISOFY	35
c	SEOSZ MNISLTSM	FLSOFY	35
<u>.</u>	•E0.3 4.LE.1	FLSDEY	37
ç	.60.4 V(I).LE.0	FLSOFY	3.0
ž		FLSOFY	30
č	PRETAINED OF CONCERNING WITH A DIGITAL CONDUCTOR.	FLEGFY	
ē	Ja SIAN VILLA SA NGA ZA (JUMA 1957) DE TOTAL CHANGE	EL PACY	
ŕ	NOTE - MOST NOTATION AND NOST LOCAL VARIABLE RAMES APE	FLSOFY	
r	PASEN ON THE PEFERENCE. TE WPP TS WITHTSHIPLTS, PETTS.	FLSOFY	
<u> </u>	ANT WE WE AND WELD PEFER TO THE VETENTS ARRAY.	FLEDEY	45
		FLSOFY	46
r	71#E43(NW X(1)#Y(1)#X(1)#51(#M1#1)#A(3)	FLSOFY	47
ř	*** INTITAL CIT-10 444	FLSOFY	45
è	761 196 USER = #0.000	FLEGEN	40
	10. TER + 4	EL'ENEY	27
	TF ((N_ACE_N)_ARA(N_LE_))) 180-1	FISOFY	
	TE (MATOLTON) TEROZ	FLSOFY	53
	YF (Haltal) IL003	FLCOFY	- 44
	** (ISP,NE.4) GN TY 99;	ELSOFY	55
è		ELZJEN	5e
•		FLCOFV	
	<1(1,4)=0.	EL SOLY	
	NSQ=C.	FISOFY	A.
	WPP=0.	FLSOCY	51
	777 115 Jels # #154 55	ef 20e A	67
	- 11421-14	FLSフFY	63
		FLSOFY	64
	TE (WTALEAUA) 60 TO 980	*	55
	VPP = UPP+VT	FL 50FV	2.7
	110 050 = 050+WT+Y(J)+Y(J)	FLSOFY	4.8
5		FLSOFY	40
Ľ	GENERATE GRINGENAL POLYNGWLALS - THOU 940 +++	FLCOFY	75
	AABA4 AA fatis	FLSOFY	*1
	WY * P * 7.	FL 5054	72
c	COMPUTE (WALLINXPETII), AND OMEGALLINEF, PETI)	-13977	73
	00 22% J=1+H	FLSOFY	7-
	TEmara(1)+23(1)5)	FLSOFY	76
	TP [[oLToN]] WXPPoWXPPoT2MPoX(J)+S1(J,2)	FLSOFY	77
c	\$(T)=08664(T)/W(T.T)	FLSOFY	78
-	\$1(T, \$1+WY0/WD0	FLSOFY	79
c	DELTA++2(1)+DELTA++2(1-1)-5(1)++2w(1-1)	EI CAEV	
-	D\$Q=D\$Q-\$1(1,5)+\$1(T,5)+WPP	FLSOFY	A2
Ę.	TIGHA++2(I)+DELTA++2(I)/(DEGREES OF FREEDOM)	FLSOFY	43
	50 a Mat	ELSORA	84
		FLSDEY	*5

.

.

,

	SURBOUTINE IJTRAJEXP, YP, IT, JT, OI, GJ, 4FLAGS	LAPTEI	2
C		TATES	2
с	THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN	TJTRAJ	4
c	THE COMPUTATIONAL GRID	LAPTLI	
c		I J T P A J	6
ċ	IT, IT IS LOVER LEFT CORNER OF GPID SECTION CONTAINING (XP, YP)	LAPTLI	7
ė		TJTRAJ	
•	COMMON /ALUNT/ THST4(25), PP(23,25), NOLINT	4L114T	2
	CORMON /AMUNOS/ XADD(13C), YAOD(13C), XAMK(13C), YAMK(146),	8311105	2
	. NOPAY, NXNAX, ANACH, GANKA, HOD, NHINEX	900405	3
	I FYEL 2. ANG. DITH.DEG	DRA	2
	COMPON /DRD / ANG (24-133)- DXT4(164)-366	091	3
	COMMON /FLOW/ XC123.1001. YC123.1301.VF(20.1001.RHOF(20.1(0)	FLON	2
r		TJTTAJ	13
÷	POINT IS IN POLAR COORDINATE REGION	TATEAS	14
2	- INT TO THE ADDA ADDAUTE - FOULD	TATEL	- if
•	TE IVA JELI SJEL EN TO IN	TATTAL	16
		TITPAI	17
		LAPTLE	1.
		LAPTET	19
	TE TTATTAT AT THIS OF TO 25	LATEAL	20
	TA CONTINUE	LAPTET	21
			22
	3===[1]] 3 17=1-1	TATEAS	22
		7 179 4 1	24
	73-117-14137-177417041717-1 07-1877-17147170170171717-1	TITPAI	25
		TITPAI	26
			27
	UU SU IEZPARAL	TITOAT	
		TITAL	
	*2em-(1)]1-QJet-(1)J1-(1+J-0]]	1	10
	TP (FZ +GT+ R) 63 (1) 40	TITOLI	31
	33 CONTET7F	LUIRAJ	
	69 TO 19C	LINGT	52

	TF (84.HE.). 88 = DS0/88	FLSOFY	56
	51(Tp6) = 8R	FL SOFY	87
C	THPU 240 - CALCULATIONS FOR NEXT I. SKTP WHEN I-N+1	FLSOFY	58
С	ALPHA(1+1)+(WP(1),XP(1))/W(1,1)	FL SOFY	89
	15 (1.65-N1) 60 TO 246	FLSOFY	90
	\$1(T, 3)-WXPP/WPP	FL SOFY	91
	VPPC=VPP	FLSOFY	92
	UPP=^,	FL SQFY	93
	RT=51([.4)	FLSOFY	94
	41-51(1,3)	FLSOFY	95
C	P(T+1)={X-ALP4A[I+1)}P(I)-BETA(I)P(I-1)	. FL SOFY	96
c	WET+1,T+1)=(WP(1+1),P(1+1)), 8(1+1)=WET+1,T+1)/WET,T)	FLSOFY	97
	00 230 4=1+ H	FLSOFY	98
	TEMP=(X(J)-4L)+51(J,2)+M+51(J,1)	FLSQFY	99
	UPP=WPP+W{J]+TENP++2	FLSOFY	100
	11+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1	FL TOFY	191
	233 51(J,2)=TE4P	FLSOFY	102
	5367+1,43+WPP/WPP0	FLSOFY	103
	240 CONTENJE	FLSQFY	134
с		FLSOFY	105
c	*** COMPUTE COEFFICIENTS OF LEAST SQUARES POLYNOMIAL	FLSQFY	106
r.	A = \${{C}}P{O}++++\${N}P{N} +++	FLSQFY	117
C	P(0)+1, P(-1)+0, A(14ITTAL)+5(()+())+())	FL 50FY	109
	00 900 IN-1,01	FLSOFY	179
	4(18) = D.	EL 20 E 4	110
	51(I9,1)=r.	FLSQFY	111
	363 <1174;23+5+	FLSOFY	112
	\$1(1,2)+1.	FLSQFY	113
	4(1)=51(1,5)	FLSOFY	114
¢	ZIM FUUD IMBA 310+ 1 + OGDER OF BUFANDAITE EUDAED	EF 20EA	115
	D3 310 1=1+N	FLSOCY	116
	46=42(7,3)	ELZOFA	117
	#T=51(T=4)	FLSQFY	11*
	T2=C.	ELZGEA	114
	T1 = T+1	EL ZOEA	120
¢	FORM P(I+1)=XP(I)=ALPHA(I+1)P(I)=RCTA(I)P(I-1)	EL ZOEA	121
c	AND ADD TO POLYNOPIAL SUM IN A	EL 40EA	122
	nc 311 IS=1,11	ELKDEN	127
	T_=TZ=&L+S1(1=,2}=97#51(1=,1)	FLSGFY	174
	72=51(78,2)	FLSOFY	125
	51(TR+1)=51(TS+2)	FL CORY	126
	\$1(14,2)+1]	FF23EA	121
	312 A(IA)+A(IA)+T1+S1(T+1,5)	+L SQ + Y	111
	- 16 <b>4</b> • 2	*L*9**	
	de) BEllad	FLIGHT	111
	5=0	-234-1	* 11

	TITRAI	71
ENG	IJTOAJ	72
5 <b>~0</b>	TJTRAJ	73
SHERNITTHE TWENT	THEIT	•
	THPIT	
THIS ROUTINE READS ALL DATA REDUIRED FOR ONE CASE.	TNPIT	i.
EVCEPT FLOW FLELD CATA FOR RERUN	THPIT	
	THHIT	6
CONMON ARTHY ANGRAANGNAKACONASCON(20)	4 T N	
COMMO4/COM1/JMAX,KMAX,JM,KA,X44C4,4L+44,CAM4C4,CAM41,CM+PT,SMI,1PRT,	CONT	,
CHORD, NCA, NCB, NCC, AA, H, DNEGA, NU, NL, IT, TAU, IT, FNT, FTORT, FINF,	6441	1
<pinf, cinf,="" clus,="" horn,="" jcs,="" ncase,="" npunch<="" othf,="" phose,="" pt,="" td="" th,=""><td>COME</td><td>4</td></pinf,>	COME	4
COMMON /CONT/ KYCON/YCON(20)/KPCON/RCON(2))	CONT	2
COMMON JALUNTJ THETA(25),PP(20,25),MALUNT	BLUNT	2
TOMMON JONS TRAJ 2PLOTANZENDANZADDANXALAT	ONSTRM	2
FORMON/JOE/ZL1,CF1,CF2,ZLF,ZTEAN,DZTPAN	106	2
LOGICAL LGPAV	NUPDO	2
COMMON/NUMOD/XX(1))1, YY(1621, NBO9,LGRAV	41870	3
COMMUNA \HUGHDZ\ ANDO(190)*ANDD(100)*AZHK(190)*AZHK(170)*	BAUNDS	2
• NF=NT, NT, AT, AT, AT, AT, AT, AT, AT, AT, AT, A	NUDININS	2
LUGICAL L*ERUNALPREAL FESTALPRETONAL PRATING TALATA LERTAT	PROPT	Z
COMMENT FRUITE READING FREISLERS SELVECTING FREISLERSTUT	a state t	3
COMMENT FILIDATE MIREAUFILMAILIDED FILMAULIDIDE THAULIDIDE THAULIDIDE	TRUDAT	Z
	IN JULT	
<ul> <li>ALATION PROVING AND AND AND AND AND AND AND AND AND AND</li></ul>	TRIDAT	
There is a second		-
LINE CALL PLAN AND AND AND AND AND AND AND AND AND A	TROPT	
CONMON / TROAT/ I BETRIARDINT, VINE, PHOTNE, THOTNE, ATHE	TROPT	÷
INGTCAL ISUN	SILWDAT	-
COMMON /SUNDAT/ LSUN-XTRAJS(133).VTRAJS(100). TTRAJS(100).	SUMDAT	5
• • • • • • • • • • • • • • • • • • •	SUMBAT	
DIMENSION TITLE(8)	THRIT	20
DIMENSION NK(100)	TNPUT	21
DIMENSION RREIDS)	THPIT	;;
EQUIVALENCE (RR(1), VY(1))	THPIT	23
DATA MSLAHK/2H /#MSTAR/2H#/	INPUT	24
	THPIT	25
FAD CARD INPUT FOR ONE COMPLETE CALCULATION	TNPIT	26
	INPUT	27
PEAD(5,100) TITLE	INPUT	28

c c c

	40	17•1-1	TATEAJ	11
		QI={PZ-R}/{R2-R1}	TATEAS	34
		#FLAG+U	TATRAS	15
		RETURN	TATEAS	14
Ċ			TITRAI	17
C		POINT IS IN RECTANGULAR COOPDINATE REGION	TITAL	
C			TATEAS	10
	50	CONTINUE		
		NX1=NBLINT+1	TATEAN	- 25
		DD 60 J=NX1, NXMAX	TITEAT	
		1" (XC(1,J) .GT.X+) GO TO 70	TATEAL	
	62	CONTINUE	TITAL	
		]=NA4TA	TITEL	
	70	17+1-1		
		0J={YC(1+JT+1)-YP1/NYT4(JT1	117041	
		Y2=YC(1, JT)+0J+YC(1, JT+1)#(1, J=01)	1.144.4	- 74
		1º (YP .LT. Y2) 60 TO 101		
		DO 80 TAZANRHAY		
		Y1= Y2	131443	20
		Y2=YC (1, JT) #034YC (1, JT4114(1, )-01)	1 3 1 4 3	21
		TF. 172 .GT. YP1 60 TO 90	LJIVAJ	22
	83	CONTINUE	1 J TFAJ	23
		CR TR 150	IJTRAJ	54
	90	Tatal	TJTVAJ	- 25
		01-1+3-+++ // +1-+++	I J T & A J	3e
			TJTRAJ	57
		PETIAN	TJTPAJ	58
		4 E I QUIN	T JTRA J	59
2			TITET	61
2		AUTHE 12 THEIDE TOMORAO24	TJTRAJ	61
¢	1 0 0		TJTRAJ	62
	103	CONTINUE.	IJT+AJ	53
			IJTRAJ	64
		a é l'Oran	TJTRAJ	65
c			T J TR & J	56
ç		POINT IS REYOND BOW SHOCK	IJTRAJ	57
¢			IJTAJ	6.
	15,	CUMAI MIE	TJTRAJ	59
		H-LAGHI	TJTRAJ	70
		PETION	LATET	71
¢			I J TO A J	77

-

	לבאז(\$,114) אאאברא,562 אאפרא,542 איז גיבאנר, אאפרטאז, כא, גדבא אחדאי אשר לבאז(\$,120) LRERUN+LPRFL+LPPST,LPRCON,LPR+LPLNT,LTPA,5LPSTRT	INPUT INPUT	24	WRITE (6,240
	HIDHAHRA REAN(5,120) LRERUH, LPRFL, LPRST, LPRCON, LPRA, LPLAT, TRAJ, LRSTRT	TNPUT		
	REAN(5+120) LRERUN+LPRFL+LPRST+LPRCON+LPR+LPLNT+LTRAJ+LRSTRT		10	W# 1 TF (A. 242
		TH PUT	11	TE EXVEDN
	TEADI ( 130) XPLOT, ANG P, ANG N, NXADD, LGRAV	INPUT		WRITE 16+244
	IF ILPENTI LPRCONS, TRUE,	TNPIT	ji i	EF ERACON .
	TH (IPLAT .GE. 0.0) IPLAT-1.)	TNPUT	34	W#TTF16,246
	PELOIDE APLUI	INPIT	35	IF (KACON .
		TNPJT	36	9798+.01745
	THE THE SET OF READ(5,160) (VCDH(1),1=1,KVCDH)	INPUT	37	ANG P+ANG P+D
	TE TRACOM	TNPUT	38	ANGN= ANGN+N
	I THAT THE ATE OF READESTICE (REDMILISTEL RECOM)	ENPUT	39	4 F T U# N
	TE (NACAN AT IL AFACTA AAA AAAAAAAAAAAAAAAAAAAAAAAAAAAA	THPUT	40	c
	TE LUCH AND DE READISPIONI (ACON(I), I+1, CRCON)	INPUT	41	103. FORMATCRAIS
	IT LONGID LINAJ 60 10 2 Beaning the transformer states and the transformer and the tra	INPUT	42	110 FORMATCAFIS
	PEARS IN THE TALL AND THE AND	THPIFT	43	155 EUBHATCHLIC
	-CANIDATAJI CULIKIANUKAIDAINHOKHJINEDINEDINEDINE Bevilataji Culikidane	THPIT	64	140 FORMAT [34]
	TE INVASUT -CT- AL BEARE. LANK INAMUTIK. A - AMAGUMA	TIMPIT	- 45	140 FURMAT(11C)
	FEAS(5.190) LSUN.AFAG.POLAMC.BY, AVI. BVI. BY	THP:IT:	46	153 FUPRATULAS
	TE (LSUN) CALL ROTATES)	INPUT	47	TOD COMMANNELD
,	CONTINUE			
	N 4 T N/7 K= Č	1 1 1 1 1		
	1 F ( 409N, GT, D. D) N 47NDX=1	THEFT		TAS SUBSCIEDAD
	TF (1969UN) 60 TO 10	THEFT	21	303 50884711454
	TE (HORN alle wat) PEAD(5+15-) NSDD-(1111)-RP(T)-TAT-MADNS	THRIT	22	210 EDBHAT(//20
£		TMBILT	33	
c	INTITALI"E DEFAULT PARAMFTERS	THPIT		216 FORMATI //21
C		TMPIIT	33	• 74.7
	TF (VEALC .GE. C.O) XCALC==1.0	THPIT	57	• fafy.
	7LF==HCALC	THEFT		215 FORMATE //2:
	TF (NP .LÉ. 3) NR-19	TNPIT	50	* 21HF
	IF (MALUNT ALE. C) MALUNT-24	THPIT	Å.	218 FOR MATE 2225
	TF (CN .LE. J.D) CN-3.j	INPUT	61	• /.39
	TF(TTEP.LT.C) TTER-306	TNPIT	47	219 FORPATE//20
	TE (NYADD .LE. A) NXADD-D	TNPIT	63	* /,39
	J#4 K= 49 LU4T +4 X ADD+1	THPUT	64	• 7,39
	NFP81=JMAX-1	INPUT	65	223 500841(//23
		THPIJT	66	• ?5,7,2
	* M & X + MR	<u>TN PUT</u>	67	* 257,
	47640F=J4A1-1	INPUT	6.8	• 25¥,
		THPUT	69	* 35×+
	*/##UN##################################	THPIT	71	* 25Xa
~	······································	THPIT	72	* 25×+
È.	HETTE OUT TNEUT AND DEFAULT UNLIKE OF AS WARD	THPUT	72	• //2:x
2	and the first was benefit welde? In an bill	THPUT	77	74C
<u>`</u> 13	CONTINUS	THPIJT	74	230 FOWMAT(7/2.
	UPT F (A. 343) TTTLE	THURST	75	5+6+2
	IF (L GFRING) PETINDA	INPJT	76	231 -OKHAT(//23
	VETTERS. 2103 AMACH. CAMMA	1 4 5 1 1		/231
	VPIT-(9) NALUNT-NR-ANACH-GANNA-HIDM	THEFT		• 72019174 +
	TE (47PN) 14:16-18	THEFT		
- 14	\$ ##TTF16,2161 N40D/(XX(T),#R(T),T=1,N477)	INDIT		
	WP175(9) NR00, (VT(1), R4(1), 1-1, NA00)	THEFT		235 EDB #47(2/3)
	GO TO 2.	THPIT	*1	• //25
15	WRITE(5,216)	TNPIT		• 102
	53 TO 20	THMIT	8*	249 FORMATE141/
11	1 TF (LG4AV) 60 TO 19	TNPUT	46	* 4FY.
	WPITE (6,214) HCRN	THPIT	97	242 COBHAT(////
	GD TO 20	TNPIT	44	244. FORMAT(////
19	walle (0,2]9] HJRN	INPUT	39	245 FORMATE////
23	r matenue	<b>thPUT</b>	90	253 FORMATE/115
	WETTER, 2233 NE, NELUNT, NXAND, CN, ITER, YCALC	TNPIT	• 7	260 FREMATE/2CX
	WEITE 1962100 AFLIT	INMIT	92	* 1H1//5CX/
	IP 11.50MT 50 TO 17	INPUT	93	* 5G¥+32(14
	WTIF (6,231) AMEP, ANGN	INPUT	<b>Q4</b>	* /25%,3448
1,	CONTINUE	TNPJT	35	• /20X,344I
	TE 19235 LEERUNGLPRLJLPRSTJLPRCTNJLPANJLPLOTJLTRAJJLRSTRT	INPUT	96	• /237,3447
	J- 14116 LINAJI 60 10 25	TH PIT	97	• /2;x,3441
	USTTEIA, 2631 181TOI. B/ BB. WING, BURING, THRIVE	144411		* /20 %, 34411
	TE ILCORE OF ALL AND THE PARTY INFORMATION AND AND AND AND AND AND AND AND AND AN	LAPUT	99	205
	WPITE(6.253) NTRAJANNAJKT	[NPIT	101	¥ 301,45H(
	00 21 NolanTRAS	14 14 1	101	- ZOT,144,9
71	NK ( N ) + M 1 ANK	INPUT	162	207 5787471(25%
	TE INMARKE LEA LE DO TO PA	14-11	193	263 - 18 - 18 441
	NR 22 TelaNHARKT	( SPIT	104	· 207 PUTAI(351)
	KAMADUTITA	19-01	1.75	· /33X).
	NY I XI ANT TAO	THEFT	105	+ /15¥.
22			497	
22	CONTINUE	THPIT	138	# //201.1
22 24	(CNIIN/E Velte (6,208)	TNPUT	130	* //207, * //207.
22	, CCNITHUS,	TNPUT TNPUT	138 199 110	* //207, * /207, End
22	CCMITHUE VAITE (6,268) VAITE (6,268) (M,MK(N),TTPAJ(N),XTPAJS(N),YTAJS(N),7TAJS(N), M-1,MTRAJ)	TNPUT TNPUT TNPUT TNPUT TNPUT	130 190 110 111	* //20%; * /20%; END

IPUT	24	WRITE(6,240)	-	11.5
PUT	10	W917E(6.242) KWCOW	THREE	114
PUT	31	TF (KVCDN . ST. Q) WRITE(6.253) (VCDN(T).T=1.KVCDN)	THRIT	115
19'9 T	12	WRITE 16,2441 KRCM	THREE	114
TLY	<u>jj</u>	IF (KRCON . GT. 0) WRITE(6,253) (RCON(T),1=1.KRCON)	THEUT	117
(PUT	34	W#TTF16,2461 KBCON	TRAILT	
TCMP	35	I# (K9C9N .GT. 0) WRITE(6,253) (BCDH(I),T-1.K8C0N)	THPUT	110
TLMP	36	nTn#++01745329252	THPIT	120
PUT	37	ANGP=ANGP=D TOR	THPUT	121
(PUT	38	4NGN= 4NGN+D TOR	THPIT	122
IPUT -	39	#FTU#W	THPUT	123
(997	40	c	TNOT	124
(PUT	41	103, FORMAT(#A10)	THPIT	125
( P() T	42	110 FORMAT(4FI3.0,2117,F10.6,110)	INPUT	126
(PIJT	43	120 COBMATCHLLLD	THPIT	177
PUT	44	130 FOPMAT (3410.6,110,110)	TNPUT	124
e PI J T	- 45	140 FORMAT(TTC)	INPUT	129
1 P(J T 1	46	15J FOPMATITIJ/(2F10.3))	THPHT	130
PUT	47	160 EREMAT(#10.0)	INPUT	131
IPUT	4.8	171 FORMAT(115/(4F100))	TNPUT	132
PUT	49	7 E. FORMAT(411)	THPIJT	133
(PUT	50	19. FORMAT(110,5F10.0)	THPUT	134
(PIJ T	53		THPIT	135
PUT	52	2C3 # 7##4T(1H1//2SX,#4_\////SSX,15HINPUT VAPIAPLES/SSX,15(14+1)	INPUT	136
TLAN	53	TU FINANTI //ZOX, ZSHINTEPPLANETARY HACH NG. +, F5.2	TH PIT	137
PHT	54	<pre>///2.X&gt;21#SPECIFIC HEAT #ATIO =.F5.*)</pre>	INPUT	139
111		214 PHEMAILTYZIK, ADHORSTACLE GEGRETETT USER-SHPPLIED COORDINATES	TNPUT	139
PUT	26	(4,74 PUINTS//338,349/0,118,340/0/	INPUT	145
1911	57	* {3(T,F,F,4,6);F,4)}	ENPUT	141
	22	213 TURNATI 7/231, GANUTSTACLE GEUNETRYT DEFAULT MAGNETOPAUSE COORDINAT,	THPUT	142
		21 COMPANY - FOUND FILL TRACES	THPIT	143
	21	1. OF HALLY 17274 CHURSTALLE SEGRETRYT DEFAULT LONDAUSE SMAPE,	INPUT	144
	01	713 FORMATI // 30 / 43 MORTH CONSIANT SCALE HEIGHT BITH H/RUS, F4,21	TNPUT	145
	23	A A A A A A A A A A A A A A A A A A A	INPIT	146
		A F-304 SATELY WEATHALLMAL ANTIALLY AND	INPUT	147
0117	22	727. ECOMAT/1/2314.22 MELETERE FOR ALLUT BOOM CALOULATION.	INPUT	149
		9 2642 AUNT OF BARTAL MEEN BOTHTE - 44	THPIT	149
PIT	67		Ident	150
DIT		$= 2 F Y_{2} 2 F W P_{2} = 0 \text{ or } T T F W H = 0 \text{ or } T T F W H$	I dent	171
PIT	40			122
PIT	71	4 25 K. 16HC DUBANT NUMBER. 137. 34. 5. 5.		177
PIT	72	* 25% 174WDs OF ITERATIONS 12% 1H= TA/	THEFT	174
TUAL	77	//2:X-424TERBINAL DOWNSTRIAM LICATION FOR MARCHING	THATT	175
(PUT	79	<ul> <li>THCALCULATION, X /RD=F6_21</li> </ul>	THEIT	120
PUT	74	232 FORMATE //2. XA 474TERMINAL DOWNSTREAM LOCATION FOR PLOTTING VIRCO	THOUT	177
PIT	75	* F6421	THPIT	150
TL <sup>re</sup>	76	231 FORMATE//2016 SHUSER SPECIFIED DEVIATION IN SOLAR-WIND COORDINATES	TRAIT	140
PIT	**	1231,4740F MAGNETIC FILLO SYMMETRY-PLANE COMPANENT FROM.	THPUT	141
LP'IT	7 *	+ /20%,174 FLOW DIRECTION +, FT.2, BH DECREES	THPIT	147
神リヤー	79	* //23%,50HUSER SPECIFIED DEVIATION IN SOLAR-WIND COOPDINATES	THPUT	161
(PIJT	40	* 72"¥+58HDF HAGNETIC FIELD FROM MAGNETIC SYMMETRY PLANE	INPIT	144
( 1) 7	43	• F7+2+34 DEGREES)	THPIT	165
(PIT	42	235 CR PAT(//2)X+8HL*ERUN ++L2//2)X+84LPRFL ++L2//20X+84LPRST ++L2+	THPUT	166
19-17	73	* //20%,84LP4CON +,12//21%,94LP45 +,12//21%,9414LP45 +,12	INPUT	167
Tites	A4	• //2'%,84LTR4J =,L2//2'%,84LR5TRT +,L2)	THPHT	168
		245 FINAATCIAL/ASX, 404VALHES SPECIFIED FOR CONTOUR CALCULATION/	INPUT	159
	20		TNPUT	170
	71	The commutation control control teres and the decision of the second states and the seco	THPIT	171
10117		244 FORMATI ////// ISSC // CUNIQUE LEVELS FOR MENSITY:)	THPIT	172
PUT	20	241 FORMETERSTREAM CONTOUR LEVELS FOR MAGNETIC FIELD STOENGTHE	LABIT	173
PIT	01		THPUT	174
TIP	- -	* 141 //SCY. 324 TABUT COR TRAJECTORY CALCULATIONS	INPUT	175
	93	* 56T+32(14+)///	INPIT	176
PUT		4 /2GV-34MRD/RDIANET	[4=0]	177
TIM	95	<ul> <li>ZOX, 344INTERPLANETARY VELOCITY</li> </ul>	[ H PIJ I	17.
PUT	96	/23Y, 36HTNTERPLANETARY DENSITY     /////////////////////////////////	100.11	1.4
PIT	97	* /23X, 344INTEROLANSTARY TENDERATUPE 111.3/	THEFT	140
P'11		<ul> <li>/2: *.344INTERPLANETARY #AGNETIC FIELD</li> </ul>	TNPIIT	1
PUT	99	263 594447(////25X,7HNTRAJ =, 14015X,4HNHARKT -, 13/	THPIT	111
PIT	101	· 301,45HE · · POINT TO BE MARKED FOR CROSS DEFENDANCES	THPIT	144
PH T	101	* 284,144,9X,54TTRAJ,8X,54XTRAJ,7X,54YTPAJ,7X,54YTPAJ,7	TNPIT	1.85
PUT	162	267 FRRMATI(258,14,18,41,38,F10,4,58,F8,4,2(47,F9,411)	THEUT	1.84
PJT	123	265 SUPHATIGER, 324(SUN-PLANET COORDINATE SYSTEM))	THPIT	147
PIT	104	- Z69 FORMAT(35%,14H MAGNITUDE =,511+3	THPIT	198
PUT	175	* /35X+14HX+CD4PDNEHT ++E11+3	THPUT	199
PIT	146	* /35X+14HY-COMPONENT ++E11+3	THPUT	190
TIM	197	735X,144Z-COMPONENT =,E11+3	THPUT	101
TLA	136	- //203/ 294AZIMUTHAL ANGLE	ENPIST	142
PUT	144	- /20X/294+0LAR ANGLE -/£11.3)	TUPUT	193
PUT	110		INPUT	144

		LAPEL	3	
	THIS POUTINE FLIMINATES OVERLAP IN PLOTTING A	LAMEL	4	
	SET OF CONTOUR LARELS.	LASEL		
		LAMEL	6	
	COMMAAN /LARUS/ XLAR(30}#YLAR(30)#CV(30)#NCL#TLR(30}#NLAR	LABLS	2 1	
	"NH49H ISCALEI XSF, YSF, X4AX, YHAX, XLNGTH, VLNGTH	SCALE	2	
		LANEL	9	
	FORT THE ARRAY YLAS INTO ASCENDING ORDER. CHANGE	LAPEL	10	
	THE OPDER OF YIAR AND CV TO CORRESPOND.	LAREL	11	
		LAPPL	12	
	**************************************	LARFL	13	
			14	
		ARFI	17	
	ETUR STREP LARCE SARA PROTER LARLY THAT TO LARGE V-AVED			
	THO FLAT CROEF AND THEIR RANKED LAND IS HAD A	LAPEL	10	
			11	
	nn 3 keisel	LANEL	16	
	**************************************		14	
		LANCL	57	
-	50 79 10		21	
,	(1) at the second se	LANCL	22	
		LARTL	23	
	NT LARELS FOUND AROVE X-AXIS. RAD SET OF FUNTUR VALUES	LAMEL	24	
	SPECIFIEN, STOP PROGRAM.	LAMEL	25	
		LANGL	24	
	4PITE16+21u1	LAMEL	27	
2 ° J.	FORMATE 143,104++++++++++13%,484UNABLE TO LABEL CONTOUR LINES REC.	LAMEL	2*	
1	LIISE TE TVERLAP,101,104++++++++	LABEL	29	
	\$10*	LAREL	30	
		LARFL	31	
12	T1 8/1 }=KMIN	Ë A PEL	12	
•••	NLAR+1	Ŭ A NËŬ	32	
	TELUCI. EA. 1 1 051194	ANEL	34	
		I A REI	16	
	EVINITIE ATT LARCES BEVON LART WHIN FOR OUTBLAR.		34	
	STATIST ALL LANGES STUDU LANSE ANIA FUN UNVALANA		17	
	<b>v</b> _ <b>a</b>			
	ON T. TECHINENCE	LANCL		
	TECYLANCES LT. YLANCKHENIN AIYYSE, ANDAXLANCES ILE TALTAXCANTNI	LAMEL	41	
1	4,4785F1 GO TO 15	LANSL	47	
		LANEL	47	
	CAVE ARRAY INDEX FOR LAPEL TO BE PLOTTER.	LAREL	44	
		LAPEL	41	
	K ÞÝ Na Ť	14491	44	
	\$L4{K}+1	LANSL	47	
	rtan-r	LANGL	4.8	
	K = K + ]	LAMEL	49	
15	P ON T T NIIC	LAREL	÷c	
		LAPSL	51	
	THE THE LAST LEAST 1 AND	LAREL	52	
		LAREL	53	
	TI 8/91 483-001		84	
	1 2 2 4 F = 1 - 4 4 F	LARGI		
			70	
		LATEL	21	
•	SURPOINTING MAP (ApJDIMpXpYpMLIMpKODpACONYpNAOpISIZ1pISIZ2pICHCp JMENpKMINpJMAYpKMAX;	-4P	23	
	CONTOUR PROCRAMS MAP, WALK, SERCH, ENTER, AND CHECK	HAP	-	
	UNITED BY DECK CONTROL MALEAMAGE DEC. FTD., ANG., 1074.	HAP	Å	
	INDATETED VERSTONS	HAP	ž	
	t white a provide the state of			
	THE PRODUCTS AND THESE SHIPS IT FALLS BEEADE DATA			
	THE STRUCTURE AND THIS WITH IN GREAT THETHE UPIN And Point and Antonia.		10	
	CALLING FRANCIERSI		14	
			13	
	A TWO-DIMENSIONAL APPART TO BE CONTOUR PLOTTED.	TAP	14	
	JOIN FIRST-POSITION DIMENSION-SITE OF 4.	H L P	17	
	N.Y ARRAYS TO CONTAIN CONTOUR LINE DATA UPON RETURN.	PA P	16	
	EACH PAIR OF XEES AND YEES PEPRESENTS & POINT ON A	MAP	17	
	CONTOUR LINE.	₩ <b>A</b> ₽	1*	
	NEEN IS THE NURBER OF CONSTANT-& CONTOUR LEVELS.	MAP	19	
	KOD +1 IF CONTOUR LEVELS AVE TO AE COMPUTED INTERNALLY	MAP	29	
	BY LINSARLY INTERPOLATING BETWEEN THE MAXIMUM AND	MAP	21	

TWO-DIMENSIONAL ARRAY TO BE CONTOUR PLOTTED. FRAT-POSITION DIMENSION-SITE OF A. ARRAYS TO CONTAIN CONTOUR LINE DATA UPON RETURN, CACH DAIR OF XII) AND YII) PERFYENTS A POINT ON A CONTOUR LINE. IS THE NUMBER OF CONSTANT-A CONTOUR LEVELS. -1 JF CONTOUR LEVELS ARE TO BE COMPUTED INTERNALLY '37 LINEARLY INTERPOLATING BETWEEN THE MAXIMUM AND MINIMUM VALUES OF A. -2 JF CONTOUR LEVELS ARE TO BE GIVEN BY THE USER.

LAMEL

2

HAP

SURPOUTTNE LABEL

0000

0000

ĉ Ċ

c

c c c

с с с

000 ć

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

		NY, 1100 B	ARPAT UP CUNITWYR LEVELS& SCHAITH IF RIJJOLA	na P	24
C			IF KOD+2, ACONT MUST BE FILLED WITH HONGTONICALLY	HAP	25
c			INCREASING CONTOUR LEVELS. SHOULD BE DIMENSIONED	MAP	26
é			AT I FAST NITH.		
2					
			TI SHOOLO BE KECHDATYED THAT HARA HUMIDON FINES	nar.	26
c			HIGHT RESULT FROM SACH CONTOUR LEVEL.	MAP	29
c			UPON RETURN, NAD(1) IS THE TOTAL NUMBER OF CONTOUR	RAP	38
<u>د</u>			ITNES. ALL THE ITNES ARE PUN-TOCETHER. HEAD TO TAVI	HAP.	
ř			THAD ALL THE LINES AND A THE SUMPTONE THE STATE AT AND THE		
			14 ACATS A AND 16 112 FINST LINE STARTS AN ALLS		15
			AND TILLY AND ENDS &T KILL AND TILLY - UM LONADIZI-1.		13
C			THE N-TH CONTOUR LINE STARTS AT S(T) AND S(T) FOR	ндр	34
C			I=NAD(N) AND ENDS AT X(I) AND Y(I) FOR I=NAD(N+1)-1.	449	35
c			NADENS FOR NAGE-2 IS THE STARTING ADDRESS IN Y AND Y	HAD	34
ř			AS THE MATH CONTOUS IT NE.	MAR	
			OF THE STIRL CONTROL FILE		
ç		19161	DIMENSION SIZE OF & AND T.	PAP .	34
c		14172	DIMENSION SIZE OF NAD. IT IS OTFFICULT TO SAY	NA P	39
c			HOW LARGE X. Y. AND NAD SHOULD BE DIMENSIONED.	HAP	40
c			THIS DEPENDS ON THE OTHENSTON STIE OF ARRAY A.	HAP	Á1
è			THE VALUE OF WITH, AND THE DECREE OF FREENINGTETTY		
÷			THE THEORY OF ALLAND AND THE DEALERS AN ELLENIPICITY		75
- ÷ -			OF THE SUPPLIE PERESCHIST AT ATCAT AS CANUE RESSAGES		• • •
c			WILL RESULT IF THESE ARRAYS ARE TOD SHALL.	MAD	44
c		ICHY	AN ARRAY TO BE USED AS SCRATCH BY THE CONTOUR PROGRAMS.	MAP	45
с			IT SHOULD HAVE AT LEAST 4+ISIZI CELLS.	HAP	46
•		147N.KMT	N.JNAX.KMAX IT IS RECOGNIZED THAT ONE PIGHT	"HAP	67
•			WISH TO CONTONS BUT AN ASPAY & FOR SUBSCRIPTS	HAD.	
ř			STADTING AT COME VALUE LADGED THAN & THEF PROPAGATION		
2			STARTING AT SUCC TALUS LARUSE THAN IN THIS SURROUTINS		
			WILL PULLESS BERAY ALISKS FUR JELALLESSELESJALES	- 4 -	20
<u> </u>			AND KMINGLEGKGLEGKMAYG. JMING KMING JMAXG AND KMAX	PAP	51
c			ARE THE LIPITS ON THE SUBSCRIPTS. JHIN AND KRIN MAY	MAP	52
¢			85 1.	PAR	53
ř					
2					
· ·					
		DIMENSION A	{13,x(1,),Y(1,),ACONT(1,),NAD(1,),TCHK(4,1)	MAP	56
c				HAP	57
		TDFX(J.K)=J	+CK-2)+J0TN	NA P	Ś.A.
<b>r</b>					
÷		67 NO. 184	V AND ANTH		
· ·		7-705-41-4	ATTA OF		60
		Intoerchein	\$<=[n]	MTD	51
		A PAX= 61 (3)		MAP	62
		6 M T N= 8 M \$ X		MAP	63
		00 1 K=KMTN	****	MAR	
		00 1 JUJ#1N	- JMAX		
		1.105.411.41			0.5
				201	00
				пар	67
-		TELAT-THTT	12,1,3	MAP	68
3		THV * X V V		利益中	59
		40 TO 1			70
2		TFIVAL-AMIN	14.1.1		
4		AMIN-VAL			
		CONTENIE			14
		C Dist of Arrest		141	73
				PAP	74
c		FIND ACT	NY BY LINEARLY INTERPOLATING	46.0	75
		60 TO (5,6)	rK0D	нар	76
5			MIN)/FLGAT(NLIN+1)	MAP	77
		DO 7 N=1+NL	IN		
7		ACONT (N1 .A.	THATINIANTS		
•		NOT N- 1	The Contract of the Contract o		14
				449	ar.
				HAP .	51
		F9 T9 *		HAP	• 2
¢				MAP	, ș i
r		CHECK AC	ONT IF GIVEN NY USER	HAB	
6		MHIN=0			
12		NHTNENHTNES			-13
••		TEINHTH AT	NI TN1 CO TO O	142	96
		TERAMON AT		71 F P	
		Terradiates	ALUMITAMINII 60 10 10	MAP	• •
¢				HAP	89
		NM&X=NLIN+1		HAP	90
11		NH&Y=N4AX-1			
		TEENVAY.I T.	13 60 70 9		1
		TELANAT	ACONT(MMAY1) CO TO 11		42
		TELNHTH		HAP	93
		1-1-4-14044		416	94
C				HAP	95
		IF ENMINAEQ	•MMAX1 G7 TO 12	MAP	96
		#ST=N#7N+3		PAP	
		NR 13 N=NST	, 4 M & X		
		TELACONTENS	LE.ACONT(N-1)) 60 10 0		40
12		CONTINIE	apparenter at an a		49
* 3		CONTINUE		476	100
	12	<ul> <li>On LT white</li> </ul>		MAP	191
ç				<b>847</b>	107
C		P497 11	67 AROUND THE ROUNDARY LOOKING FOR LINES WHICH	HAP	101
C		THTEPSEC	T THE BOUNDARY.	HAP	144
i.		NADELIAN	· · · · · · · · · · · · · · · · · · ·		127
-		Ja Juru		147	105
				446	136
				MAP	187

.

.

	NINT=2=[JAAX-JAIN]+2+(KAAX-KAIN]	MAP	108
		MAP	129
		нар	116
		HAP	111
	NTYO	MAP	112
c	-	747	113
	NG 26 N=1, NINT		114
	GN TN (71,22,23,241,K007	MAP	119
ç		HAP	117
ç	ORIENTATION I: UPWARDS	MA*	110
21	3-3-1	HAP	119
	1 - 1 DE V ( J, K )	HAP	120
	1-13-6J#[N] 63 TO 25	44P	121
		MAP	172
	1-(12)(13)-411	MAP	123
	(0,7-5) (0,7-5)	MAP	124
		HAP	125
c		747	126
с	OPTENTATION 21 TO THE BIGHT	211	177
22	K=K+1		120
	T=T95X(J+K+1)	HAP	130
	1F(K+LT+KHAX) =0 TO 25	MAP	111
	I=TDF¥(J+1+K)	HAP	132
	4007-3	MAP	132
		HAP	134
~		PAP	135
è.		4A P	135
	Jaiai	MAP	137
.,	Y=105Y[]=1.41	44.0	130
	TELJALTAJNAN) GO TO 24		130
	K=K#A X-1		147
	1=10=¥(J,k)		141
	# nn 7= 4	HAP	143
	«Ov5+T	MAP	144
-	GD TO 25	MAP	145
ç		44.0	146
5	OFTENTATION AT TO THE LEFT	MAP	147
24		MAP	144
	TELV.CI.KBTHL CO TO 36	mų p	140
		MAP	150
	1-1-44-2		151
	1-TOEX(),++)		172
	4 °D 7= 1		1.5.4
	* 1P Z + 2	MAP	155
¢.		MAP	156
ç	FIND AN AND AL	MAP	157
62		MAP	15*
	2894(T) TELAD_11174	MAP	150
2.6		MAP	160
	41 • 43	MAP	151
	60 TO 24		162
27	440 A 4		103
	4L=44		144
c		HAP	144
ç	CHECK TO SEE IF A CONTOUR LINE PASSES THROUGH THE INTERVAL	MAP	167
E.	UNDER CONSIDERATION.	M& P	16.
78		PAP	159
	UU 2º HVALEHSINAMAAA	MAP	170
	44[ 41( )M] (MV4[ ]	MAP	171
		MAP	172
37	IFIVALALI GO TO 29	MAP	173
		-	175
ċ	1 1 1 4 5 6 1 1 6 A 7 1 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4 1 C 4		175
č	PHECK TO SEE TE THE CONTOUR LINE POINT WEST COUND IS A		177
č	NEW ONE. OR THE TAIL END OF ONE ALREADY FOUND.	MAP	170
	TALL CHECK(ICHK, NXY,KON2, J,K, NYAL,KON9)	HAP	179
	[F(K0)9+EQ+2) 60 TO 29	***	180
ç		PAP	1.91
c	DETERMINE AL AND AZ	PAP	172
	TFFK077.EQ.1.0R.K007.EQ.41 67 TO 32	нар	143
	42-44	PAP .	174
	=;==7 60 TO 13	7147	197
12	42.44		1-6
	43+44	TAP	17/
e i		MAP	189
с	ENTER IN THE TABLES THE POINT JUST FOUND.	MAP	190
33	NDUM=NAP(1)+1	MAP	191

TERNOVA-GT.ISIZZ) GO TO 35 WAD(1)-NDUA CALL ENTERFUNDA I M MAL IN INC. 100 MIL MAL IN INC.	HAP	197 193
·/////////////////////////////////////	HEP	194
TF(KOD4.E0.2) 60 TO 70	RAP	194
HTD{40MH}=#XX	NAP	197
	HAP	198
#305=K997		199
K 006-2	HAP	251
12=1	MLP	232
CALL WALKERDSAUSAKSAA INTRATOUR, INTRA INAY, MATH. MALY, MORA MAY	MAP	203
4CONT#KOD6#X#Y#NYAL#ISI71		204
TF(K004.E0.2) 60 10 70	HAP	226
1F(KND5.6T.W) 60 TO 36	MAP	297
CONTINUE	MAP	208
CONTINUE	***	210
	MAP	211
PART 21 SCAN THE WHOLE ETSLD FOR LINES THAT DOWNT THTEREET	-	217
THE BOINDARY	PAP	213
]== ]# AY = ]	HEP	215
4	= A =	216
I-TOTY(JATN.K)	MAP	217
42+4711	HAP	210
DO 40 JOJHIN, JE	нар	220
aj=az DR 66 KNN2=1.2	PAP	221
60 TO (41,42), KOD2	***	222
TE(J.E7.JHIN) G3 T9 44	HAP	224
T=TOFY(J;K+1) A2-A/T)	MAP	225
60 TO 43	MAP	226
T=IDF¥(J+1, K)	HAP	227
42-4(7)	-	***
1º(K.E9.KMIN) FO TO 44 Comiting	-	230
	74P	231
FIND AH AND AL	HAP	231
16641-42145,45,46	HAP	234
A We & Z A I = A 1	HAP	235
L	HAP HAP	236
AH=41	MAP	230
41.+ 4?	HAP	239
CHICK TO SEE TE & CONTONN I THE RASSES THROUGH THE THETHER	242	241
UNDER CONSIDERATION.	HAP	241
KUL-1	HAP	243
ባጡ ፋዶ · ካሂፈር። እዛ፤ እ.» ለዛሬ አ ለ 4 · • • • • • • • • • • • • • • • • • •	MEP	244
VALHAUUNIINVALI G9 T9 14945014KDD8	MA	245
IFEVAL.LT.ALL GO TO 48	HAP	247
x () * 8	HAP	24.8
TERVALOGTOAND GO TO 64	MAP	249
VE HAVE FOUND & POINT ON & CONTOUR LINE, CHECK TO SEE TE	47.4	256
IT IS A NEW ONE, OF IF WE HAVE ALPEADY OUNS THIS LINE.	PAP	251
CALL CHECKETCHK, MYY, KODZ, J, K, NVAL, KOD91	HAP	253
TF(K009.E0.2) 60 TO 44	PAP	254
VE HAVE A POINT. ENTER IT IN THE TANKES.	***	215
NDUMANAN(1)+1	HAP	256
TFENDIM.GT. ISTZ23 AD TO 35		250
MAD(1)=ND()M	44.9	259
······································	#4.P	760
TF(KD04.E0.2) 60 TO 70	PAP	261
NYDENGIN}=4XX		153
NOU MALE THE LENETH OF THE LEVE	HAP	264
KUNSAKANZ	MAP	255
4096+2	74.7	260
HEART PHEA	PAP	269
nçen 12=1	46.0	269
CALL VALKIKODE-JS-KS-A-JOTH-TONA-JOIN-JWAY-KUTU-KMAV-MORA-MAV-	MAP	270
ACONT_KOD6, X, Y, NYAL, IST21	HAP	271
TF(K004.E3.2) 60 TO 70	HAP	273
TELK772.65T.01 GO TO 56	HAP	274
	MAP	276

.

ł.

¢	IF THIS LINE IS A CLOSED CURVE, CLOSE IT BY ENTERING FIR
r	PRINT AGAIN.
	715T+50PT((Y(NKYST)-X(4XY))++2+(Y(NXYST)-Y(4XY))++2)
	1-(1)51+61+1+421 61 10 44
	IF (MITAGIAL) I CUIUEU
	A (MAA ) - A (MAAGA ) > / / / / / - > / / / / / / / / / / /
	· · · · · · · · · · · · · · · · · · ·
	1,4412, NYV3, TCHK12, NYV273
	TCHAT2, NYYS ATCHAT3, NYYCYS
	TC4K(4+NYY)=TC4K(4+NYYT)
c	
4 A	CONTINUE
44	CONTINIE
40	CONTENUS
¢	
¢	ENTER END DE LAST LINE IN BODKKEEPPING ARPAYS.
	42X=xXX+J
7.:	H0H#+N40(1)+1
	TF(NDUM.GT.15122) GD TO 35
	NTD ENUTINE NEA
	49 TT 34
ę.	
<u>ç</u>	WRITE TRAJE MESSAGES.
39	WPITE (6,100)
105	ANNATION CONTRACTOR SEVERA MADAIED & LAAFE DAENELUM EA MED.
~	40 10 34
2	WETTE (4.1)11
101	CORRETEING, SY.S. JA1.3Y. 2005YEPHTYNN TERMINATEN.9V.S.C.DA14
	114.444884 V CE CONTONIS VALUES TASSOFT V COLLETENA
	STOP
e .	
ée	W#TTE(6,104)
	40 TO 13
1 14	FORMATEAGHICONTOUR SEARCH ANOPTED - TABLE OVERFLOW IN EXPYS
c	
34	2ET1J04
	FWA
	SUBPRITTE MORPHICY, V. KSE, VSES

HAP

	SUMPRUTTNE MARPLT(X.Y.KSF.YSF)	MRKPLT	2
c		HARDET	
ć	THTE SUBPOTENE MARKS WITH & STRADL AND A LETTER. A+4 AND J-4.	MRKPLT	4
÷.	THRE PRIVER WITH ARE TO BE FLAGGED TO FACTITATE	MOKOL T	
è	PRISS-REFERENTING RETWEEN THE VARIAUS PLOTS FOR THE TRAJECTORY	PREPIT	
č		NEVELT	,
	COMMON SPREIGTS NHARKT. MARKT(12)	HKPINT	. ÷
	ATMENETAL VILLAVILL		
	DIMENSION NARTICAT	MBKBIT	
r .	D1	Marph	11
	9474 MERRINGS.108.108.309.105.305.305.300.101.101.308.308.308.4		
~		HOVEL T	11
C.	TE SUMARY TO DEPTING	MANAL T	
	17 123 J=40 44KI	HERPL.	17
	N=P&PKT(])	AAKEL1	16
	¥ • • F ( N)	MERPLY	17
	YP=Y(N)	MRKPLT	18
	CALL GRAF(XP,YP,a03/3)	MQKPLT	19
	X*4=X++L=67/XSF	MRKPLT	20
	YCH-YP C4/YSF	HEKPI T	21
	CALL CUARTYCU, YOU, 1.1		
1 1 1	CONTANTS		- 55
1.1			
		- CARACI	Z 4
	END	MENDIL	25

SHRRDUTINE P	LOTCN	PLOTCH	2
		PLOTON	3
THTS ROUTINE	CONTROLS THE DRAWING OF THE PLOTS	PLOTON	
9. DOU	LOT SUBPOUTINES CALLED ARE	PLOTON	5
DA	SH, ENPLT, PLOT.	PLOTCN	6
		PERTEN	7
*PLOT + 1	FOR VELOCITY CONTOUR PLOT	PLOTON	ė
TPLOT = 2	FOR DENSITY CONTOUR PLOT	PLOTCH	é
1PENT + 3	FOR STREAMLINE PLOT	PLOTON	10

	••••••		
C	TPLOT FOR TEMPEPATINE PLCT	PLOTCH	11
C	TPLAT - 5 FOR PARALLEL B-FIELD COMPONENT PLOT	PLOTCH	12
ç	IPLAT = 5 FOR PERPENDICULAR 8-FIELD CAMPONENT PLAT	PLOTCH	13
ç	TPLOT = 7 FOP NORMAL 8-FIELD COMPONENT PLOT	PLOTCH	14
c		PLOTCH	15
	COMMON /PLOTC/ CONTX(1000)/CONTY(1600)/CV4L(30)/WAD(30)/IPLOT	PLOTC	2
	COMMON /89UNDS/ X99D(100),Y900(100),X54K(199),A54K(190),	ROUNDS	2
	ቀ 🚽 እ ዋ። ልሂቃ እሂዞ ልሂቃ ልጫልር ዞቃ ና ልክሥል ቃ ዞዎ ናንቃ ካዛቿ እ ቦ ሂ	90005	3
	COMMON /SCALE/ XSF, YSF, XMAX, YMAX, YLNGTH, YLNGTH	SCALE	Ż
С		PLOTCH	19
r		PLOTCH	20
С	PLOT STREAMLINES	PLOTCN	21
C	THE FIRST CALL TO PLOT INITIALTYES THE PLAT.	PLOTCN	22
С	SCALE FACTORS APE FOULL TO 1.	PLOTCN	23
r	SUBROUTINE SETUP ESTABLISHES PERMANENT PLOT ORIGIN,	PLOTCH	24
С	DAAWS ARES, LABELS, AND TITLE.	PLOTON	25
e	SURATURE SAUND DRAWS AND LABELS SHITH WAVE. PLANET.	PLOTCN	26
С	AND MAGNETOSPHERE (TEODY-C) OF TONOSPHERE	PLOTCH	27
С	(TRONY=1) ROUNDARY.	PLOTCH	28
c		PLOTCH	29
	[FfIPLAT.NE.3] 60 TO 10	PLOTEN	36
	CALL DASHID AUPRALIPSAUPSAUPSAUPS	PLOTCH	· 11
	FALL PLOT(3.4,-12.0,-3)	PLOTCN	32
	CALL SETUPETPLOT, ANACH, GAPMA, NHINDY)	PLOTCH	11
	CALL ADJND	PLOTCH	14
	CALL CONTR	PLOTCH	15
	54LL PLAT(* M4*+G-3)	PLOTCN	36
	CALL RESET	PLOTCH	17
	CALL PL97(2.300.00-3)	PLOTCN	30
	e E Ttie N	PLOTCH	10
۲.		PL OTCH	
e.		PLOTCN	41
С	CRAW CONTOUR PLOTS	PENTCH	4.7
ć		PLOTEN	43
	13 CONTINUE	PLOTCH	44
	*ALL PLOT(2++++12+2++3)	PLOTCH	45
	CALL SETIPETTPLOT. AMACH. GAMMA. NHTNDY)	PLOTCH	46
	CALL ROUND	PI OTCH	47
	CALL CONTR	PLOTCH	4.8
	CALL 91 71 (X #4X+ U-C+-3)	REDTON	40
	CALL RASET	BI OTCH	50
	CALL PLOT(2-0.12-11+3)	BI OTCH	4.1
	TELTELOT. (0.1) 60 TO 23	PLATCH	
	8 E T 1 1 0 N	AL OTCH	
c			
c	CHANGE VELOCITY CONTROL VALUES TO TENDEDATION	PLOTEN	
ř.		REDICH	
•	23 1PL01=4	PL OTCH	57
	EAFT-3.50/54884-1.3304845/46885/4	BL OTCH	
		PLOTOP	50
	CO 25 1-1- VAI	PLOTCH	
			43
	· ************************************	PLUINE	4.7
		PLUT N	43
	END	PL OTCH	53

.

	CURRINTING PLOTER	PLOTER	2
с		PLOTER	3
ċ	THIS SUBROUTINE CONTROLS THE DRAWING OF THE TIME HISTOPY PLOTS	PLOTES	4
ċ.	DE VELOCITY, TEMPERATURE, DENSITY, AND MAGNETIC FIELD	PLOTER	5
ċ		PLOTER	6
	COMMON /TRIDAT/ NTRAJ.TTPAJ(100).XTRAJ(100).YTRAJ(100).7TPAJ(100).	TRJOAT	,
	• VTPAJ(1.: ). VETRAJ(100). VYTPAJ(100). V7TRAJ(103). THETPALIFOI.	TRJOAT	i
	• STRAILIGT D. STRAILIGT. BY TRAILIGLE ST TRAILIGT. BUTRAI (16.).	TRADAT	
	+ #TPAJ(100)	TRADAT	5
		TROPT	;
	COMMON /TROOT/   PITPJ, PDI NT, VINE, PHOTNE, TMPINE, BINE	TROPT	
	DATA 91 TSTE/7.0/. TINGTH/P.0/	PI NTEA	á
			10.
e .		PINTER	11
ř.	PAIPHIATE SETTID DARAMETERS FOR TIME AVIS	PLOTER	
2			
•	NT4 77 5-7	BI OTER	14
		PLOTER	- 17
•		PLUTPS	
5	NOT U UT TIME	PL01+5	10
5		PLUIPS	
C.		PLUIPS	10
	CALL VATISLIIMESPATOPPSTATINGINANTALISA	PLOTER	19
	CALL WAXIS(WSF, WOFFST, WINF, PLTSZE, 23)	PLOTES	zo
	CALL SCALF(TIMESF, WSF, 1)	PLOTER	21

CALL OFFST(TOFFST,VOFFST,1)	01 ATE 8	••	
CALL VECTOPITTRAJ, VTRAJ, NTRAJ, 1, 15YH, HSYN)	N OTEN	~~	
FALL MOKPLTITTRAJ, VTRAJ, TIMESF, VSF)	PLOTEN	23	
CALL MESET	PL OTEN		
FALL PLOT(PLTS7E, 3, 0, -3)	PLOTES	26	
	PLOTEN	27	
PLIT AT AZ LINE	PLOTES	28	
	PLOTFA	79	
CALL TAXISCITHESFOTOFFSTOTENGTHONTAXES	PL OT FR	36	
CALL VATISCUSF, VOFFST, VINF, +LTS7E, 11)	PLOTES	<b>1</b> 1	
CALL SCALFITIMESF, VSF, 11	PLOTER	12	
TALL J-STLTJAPST, 498 FST, 11	PLETES	11	
TALL VECTOR (TTRAJ, VYTRAJ, NTRAJ, 1, ISVN, MSVN)	PLOTER	34	
CALL HRKPLTITRAJ, WITRAJ, TINESF, WSF)	PLOTES	35	
CALL VESET	PLOTES	36	
CALL PLOT(PLTSZE,0.0,-3)	PLOTES	37	
	PL OT FS	10	
PLOT AV AS TIME	PLOTES	10	
	PLOTES	40	
ALL INTICITINESE TOFFST, TLNGTH, NTAXTS	PLATER	41	
TALL VAXISCASP, AGREST, VINE, PLTSZE, 12)	PLOTFA	42	
CALL SCALFITINESFOYSFOLD	PLOTER	41	
CALL IP-316 FIF+318 W0F+319 18	PLOTEN	44	
CALL VECTOR (TTRAJ, VYTRAJ, NTRAJ, 1, TSYN, NSYN)	PLOTER	45	
CALC MERTLICICATINATINATINESPASES	PLOTEN	46	
	PLOTES	47	
**** FLUITFETS(2;0;0;=3)	PLOTES	4.8	
	PLATES	49	
PCDT WY WS TIME	PL 97F3	50	
**** *****************	PENTES	51	
ALL TAKIST TIMESF, THEFST, TLNGTH, NTAKTS)	PLOTFN	52	
ALC VIVIS(VSF) VOFFST, VINF, PLTS7E, 23)	PLOTFA	53	
CPLL SCALF(114ExF)4SF,11	PLOTER	54	
CALL REEST(TREEST, VOEEST, 1)	PLOTES	55	
TALL VECTOR (TTRAJ, VZTRAJ, NTRAJ, 1, TSYM, HSVH)	PLOTES	56	
CALL WRY PLTITTRAJ, WZTRAJ, TIMESE, WSF1	PLOTER	57	
FALL PESET	PLOTES	5.4	
CALL PLOT(PLTSZE,0.0,-3)	PLOTES	59	
	PLATES	66	
PLOT TEMPERATURE VS TIME	. PLOTER	51	
	PLOTER	52	
CALL TAXIS(TIMESF, TOFFST, TLNGTY, NTAXIS)	PLOTES	67	
CALL WATTER VSF, VOFFST, THPINE, PLTSZE, 25)	PLOTFS	64	
FALL SCALETTIMESE,VSE,11	PL 137 F 4	55	
CALC PPST(TOPPST, VOPPST, 1)	<u>የር ጥ</u> ቸኖ ዓ	56	
TALL VETTIR (TTRAJ, THPTPJ, NTRAJ, 1, TSYN, HSYN)	PLOTES	67	
CALL MERPLICITEAUSTRPIRUS TIRESF, 45F)	PLOTES	5.8	
CALL RENET	PLOTER	69	
\$ #LL #L''IIFLI32290.69#31	PLOTES	76.	
	PLOTER	7:	
PEDEDENSITE AS 1146	PLOTES	77	
	PLOTER	73	
CALL TARISTITESPETOPESTATLACTASATAXIS	PLOTEN	74	
CALL VALLATION OF STARMOUNE PLINAPPIN	PLOTER	75	
TALL STALFTILFSTPYSTPA1	PLCTEN	76	
	PLOTEN	77	
CALL MANDITITATOVI WUAVI AIMIGU MOLV	PLOTES	76	
TALL DECET	PLATES	79	
	PLOTES	20	
	PLOTES	71	
PLOT & WS TING	PLOTES	82	
	PL 1175 1		
CALL TAXISETENESS, TOREST, TENETH, NTAVES	PLITTES	54	
CALL VATTSIVSF.VOFFST.ATNF.BLTSF.AAN	PLPTER	55	
CALL SCALFETINESE.WSE.13	PLUTFA	76	
TALL OFFSTETOFFST. VOFFST. 13		17	
FALL VECTORITIRAL STRAL NTRAL STRAN		77	
CALL MARPLTCTTRAJ.ATRAJ.TTNESE.WSES	PL0754	59	
CALL RESET		40	
CALL PLOT(PLTS75+1-0+=3)		41	
		42	
PLOT RX VS TINE	PLUIPS	43	
· · · · · · ·	PLUIPS		
CALL TAVISETEMESE. TOPPST. TENSTH. NTAXESE		*7	
CALL VATISINSF. VOFFST. AINF. DITSTE. ALL		¥0	
CALL SCALFITIMESF.WSF.1)			
CALL OFFST(INFEST.WOFFST.))			
CALL VECTORETTRAJ.BYTRAJ.NTPAI.4.TEVM.MEVMI	PLOTPS	44	
CALL MANPLT (TTRAJ. RYTRAJ. TT MELE. WEEL	PLITTER	100	
CALL RESET	FLUIPB	141	
FALL PLOT(PLTSZE,D.D3)	PL0173	107	
		103	
PLOT BY VS TIME		104	
·· ···		483	

SUBROUTINE PLOTTP	PLOTTP	1
	PLOTTP	1
	PLOTTP	
THIS SUPROUTINE PLOTS (X,R) AND (Y,Z) PROJECTIONS OF THE	PLNTTP	
TPAJECTORY, WHERE R-SORT(Y+Y+2+2), USING THE SAME SCALE FACTOR	PL0TTP	
FOR SCH PLOTS.	PLOTTE	1
CERTAIN POINTS ARE FLAGGED TO PEPAIT CROSS-PEFERENCING	PLOTTP	
WITH THE PLATS OF FLOW FIELD AND MAGNETIC FIELD DATA	PLATTO	
	PLOTTP	- 10
	PLTTP	
	BOUNDS	
· · · · · · · · · · · · · · · · · · ·	100475	
WT94191.1. WT9419 AIR WT9419 AIR WT9419 AIR WT9419 AIR AIR AND	18 314	
	183981	
• TTAITINI	TRIDAT	
10GTCAL LBITE I		
TORMAL LILITATION AND AND AND AND AND AND AND AND AND AN	10.007	
The second s	AL OTTO	
718645108 111188/91.711187/91	PLOTT-	
2414 PTON2/1-570796327/	PL DTTP	
DATA PLISTE/R.O/		:
DATA TITLEI/IDHTPAJECTORY/	PLOTTA	
PATA TITLYZ/IGH(Y-Z PROJE.SUCTIONI/	BLOTTE	
PATA TITLYR/ILHIY-R PROJE. ANCTIONIA		
	BLOTTE	
2000 TO PLATE PLATE	PLOTTA	
	PLOTTA	5
RNPSF=1=D/RPLNT		
TTHEY WIG C	PLOTTP	;
YTHING ISC	PLOTTP	;
YT=At=G C	PLOTTR	,
VTHIN=0.0		
7THAY-Jol		Ĩ
7TMTN=2.0C	PLOTTP	
PTPAT*J.C	PLOTTP	
00 70 N=1,NTRAJ	PLOTTR	
I" {XTPAJ(N)+GT+XTMAX} XTMAX+XTRAJ(%)	PLOTTP	1
TE (YTRAJ(N)oLToXTNIN) XTMINoXTRAJ(N)	PLOTTP	
TF (YTRAJ(N).GT.YTMAY) YTMAX=YTRAJ(4)	PLOTTP	1
IF (YTPAJ(N).LT.YTHIN) YTHIN=YTRAJ(N)	PLOTTP	
IF (7TRAJ(N)+GT+ZTHAX) ZTHAX=ZTRAJ(N)	PLOTTP	3
TF (7TQAJ(N)+LT+7THTN) ZTHIN=ZTRAJ(N)	PLOTTP	
TE (RTDAJ(4).GT.RTMAX) RTMAT-RTRAJ(4)	PLOTTP	
CONTINUE	PLOTTP	
# T M & X = 4 M A X + R M A X + R M O S E = 1 = 51	PLOTTP	
¥TMIN=4MIN1{XTMIN+RNOSE;==1=5}	PLOTTP	
YTMAX=AMAX1(YTMAX+QNDSE,1.5)	PLOTTP	4
<u>Alwin=Faim1{Alwin=#0255+=1*2}</u>	PLOTTP	4
*TMAY=AMAY1 (7TMAX+#NOSE+1+5)	PLOTTP	- 4
7THIN-AHIH1(ZTHIN+RHOSE,-1.5)	PLOTTP	
THAT-AWAYI IRTMAXORNOSE/2.0}	PLOTTP	
XT#4x=0.5+4[HT(2.0+XTH4x+.999)	PLOTTP	
XTHIN="+5+AINT(2,J+XTHIN=,909)	PLOTTP	3
YTHAY=0.5+AINT(2.3+YTHAY+.999)	PLOTTP	
YT#IN=D.5+AINT(2.0+YTHIN999)		

с		-	
	FALL TAYIS/ TINESE, TOEET, TI MATH MTANAAL	PLUIPE	100
	CALL VALTSIVES WOEST ATHE ALTERIAL	PLOTER	197
		PLOTES	108
	CHIL SCALFT []HESP, WSF, []	PLOTES	104
	CALL GPPST(TOPPST, VOPPST, 1)	PLNTF9	110
	GALL VECTOR (TTRAJ, BYTRAJ, NTRAJ, 1, ISYM, MSYM)	PI OTER	111
	GALL #RYPLTITTRAJ, BYTRAJ, TINESF, VSF1	PĽOTFÁ	iiż
	CALL RESET	PLOTER	111
	CALL PLOT(PLTSZEpJaCy=3)	PLOTER	111
c		PL OTER	
č	PLOT AZ VS TINE	FLUIPS	117
ř.		PLUIP3	110
•	FALL TAVIES TRACE VOCAT TIMOTA ATANAN	PLOTES	117
	CPEE TAXIST THESE TOPPS TO TENGT AD ATTAXIST	PLOTES	116
	CALL VATISIUSF, VOFFST, SINF, PLTSZE, 431	PLOTFS	119
	CALL SCALFCTINESF, WSF, 11	PL0759	120
	- CALL DEESTITOEEST, VOEEST, 1)	PLOTES	121
	CALL VECTOR(TTRAJ, NZTRAJ, NTRAJ, 1, ISYM, MSYM)	PLOTFR	122
	CALL MRKPLT(TTRAJoBZTRAJoTINESFOVSF)	PL OTER	111
	CALL RESET	BI OTES	
	CALL PLOTEPLTS7Falle Samal		
			123
r .		PLUTER	126
•		PLOTES	127
		PLOTES	12*
		PLOTFA	129

148

с с с

с с с с

с с с

с с с

C C C C

с с с

> c c c

C C

	7TMAX=0+5+1[NT(2+0+ZTMAX++999)	PLOTTP	53	
	*THT4=0.5*AI4T(2.0*ZTH1H999)	PLOTTP	54	
	*TMAX=3=5*AINT(2=J*RTMLX+=999)	PLOTTP	55	
÷.		PLOTTP	56	
č	COPPORE SCALE PACINA	PLOTTP	51	
-	YTST?E=YT4AX-YTHIN	PLOTT	59	
	TSF=PLTS7F/AMAX1EYTST2E,RTMAX1	PLOTTP	60	
	TSFRO=TSF+RHOSE	PLATTP	*1	
~	C/LL PUBT(4.0)+12.0)+3)	PLOTTP	62	
ě	(Y.7) ##03FCTTOW		53	
ē		PLOTTP	45	
ċ	DRAW AXES USING SUBROUTINE AXIS	PLOTTA	66	
c		PLOTTP	67	
	CALL PLOT(0.0,1.5-YTHINOTSF,-3)	PLOTTP	67	
	716 =1976267677988721919393600 Call AVT\$1	PLOTTP	59	
	CALL PLOT(-ZTHIN+TSF, YTHIN+TSF,-3)	PLOTTP	71	ř
	NTC-ENT(Z.U+YTSIZE+1.0)	PLOTTP	72	č
	CALL AFTS(0.0,0.0,14 ,0.YTSIZE+TS#,-NTC,Z,PIONZ)	PLOTTP	73	
	CALL PLOT(0.0,-YTHIH+TSF,-3)	PLOTTP	74	
Č,		PENT IN		
č	FAASE WAN ANNOTHIS CARATE CARATEDRIAL	PLOTTP	77	
-	CALL SCALF(TSF,TSF,1)	PLOTTP	78	
	YCH++.15/TSF	PLOTTP	79	
	7CH+AINT(7THIN)	PLOTTO	80	
•		PLOTTP		
	CALL WIPPITIZCH-YCH-C-J-m(-T-ZCH-1)	PLUTTP	82	
	764=264+07642	PLOTTP	- 44	
	1F (7CH.LE. ZTHAX) 60 TO 100	PLOTTP	45	
	7CH=7THAX++27TSF	PLOTTP	56	
	Y[4=+,55/TSF	PLOTTP		
	0 #LL_UTP#{{UTP#}{UTPU40760761493427#\$3}	PLOTTP		
	CALL CHAP (2CH, YCH, 3.6.666HPLANET, 6)	PLOTTP	90	
c		PLOTTP	91	
ç	LAREL AND ANNOTATE Y-AXIS (VERTICAL)	PLOTTP	92	
¢	MAIL	PLUTTP	93	
	T(42+1,4) DY(42+1,4)	PLOTTP	36	
	7(H++)5/TSF	PLOTTP	40	
11	L CONTINIE	PLOTTP	97	•
	IF (YC4+HF+0+0) CALL WINPLT(20H)YCH-+05/TSF+0+0+J+1+YC4+2)	PLOTTP	98	c
	YCH=YCH=DYCH2	PE UT T P	99	c
	1- (TCT+L-+TIMAR) 60 19 19 19	PLOTTP	151	
	YCH+YTHAX+,1/TSF	PLOTTP	172	
	CALL CHARTZCH, YCH, D.D., 14, 3HY/R, 3)	PLOTTP	193	
	TE CRPLNT .LE. C.D) GO TO 120	PLOTTP	194	
	75H076444427TSF #111 84407764.964.5 %. 84.44004957.45	*LGTT#	105	
r	(	PLOTTP	197	
č	ARAW PLANET AND LABEL PLOT	PLOTTP	10.	
c		PLOTTO	179	
	CALL ELIPS(1.0,0.0,1.0,1.0,0.0,0.0,0.0,0.0,3)	PLOTTP	110	
3.	20 FINTINJE 20	PLOTTP	111	
	YCH=YTHTH=3.7/TSF	PLOTTP	113	
	CALL CHAP(ZCH, YCH, 0.0,0.2, TITLE1, 1C)	PLOTT	114	
	7CH=7CH++04/TSF	PLOTTP	115	
	YCH+YCH-U.3/TSF	PLOTTO	116	
	CALL SHAWTZCHATCHAUGDADALZATITLY/ALDA			
- <u>}</u>	DRAW (Y.7) PROJECTION	PLOTTP	119	
è		PLOTTP	120	
	7TM&X=7TM&X+&PLNT	PLOTTP	121	
	YTMIN=YTMIN+RPLNT	PLOTTP	122	
	CALL *LTT(0=0;0=0;3) CALL SCALE(TEERC,TEERC,1)	PLOTTP	123	
	CALL VECTOR (FTRAJ.YTRAJ.NTPAJ.1.1.141)	PLOTTP	125	
	FALL MRXPLT(2TPAJ,YTRAJ,TSF,TSF)	PLOTTP	126	
	CALL PLOTEZTHAX, YTHIN,-3)	PLOTTP	127	c
	CALL PESET	PLOTTP	122	ç
C C	(V.D.) POD (67770)	PLUITP	119	c
č	(KPK) PRUJEVIJUM	PLOTTA	131	
č		PLOTTP	192	
ċ	TRAW, LABEL, AND ANNOTATE X-AXIS (HORITONTAL)	PLOTTP	133	
C		PLOTTP	134	
	HIC-INIIZ&D#{XTMAX=XTMIN}#160} Yr Mefað	PL011#	134	
	*****			

	TE (YTSI7E-RTMAX.GE.1.0) YCH+0.5	PI 0778	137
		PL OTTA	
	CALL AVTERS. A.R. 6.10		
			- 137
	CALL PLITT - XIMIN IST 90409-37	PL UI IP	140
	CALL SCALFEISPAISPALA	PLOTTP	141
	4CH=-,15/15F	PLOTTP	142
	*CH=AINTEXTHIN]	PLOTTP	143
	0×C42=1.0B	PLOTTO	144
· 203	CONTINUE	PL 077P	145
	CALL MIMPLT(XCH,RCH,0.0,-0.1,-XCH,1)	PLOTTP	146
	X C H=X CH+DX C H2	PLOTTP	147
	TE EXCHAITE XTHAXI GO TO 200	PLOTTA	148
	YCHOY THIN-3.9/TSF	HOTTP	140
	PCH	PL OTTA	160
	CALL CHARTYCH, BCH, B.G., 14, 3HY/B. 31	AL OT TA	
			121
		PLUTTP	172
	CALL CHARTELAPHCHPSONDOCDDOMPLANE [36]	Latte	193
		PL UI I P	129
	DRAW, LABEL, AND ANNULATE R-AXIZ (VERTICAL)	PLOTT	133
<b>c</b>		PL OTTP	156
	NTC=TNT[2.+RTHAX+1.0]	PLOTTP	157
	CALL AXIS(U.J,O.O,14 ,J,RTMAX+TSF,-4TC,2,PI7H2)	PLOTTP	158
	PCH=1.0	PLOTTP	159
	PRCHZ=1.c	PLOTTP	166
	XCHCS/TSF	PLOTTP	141
215	CONTINUE	PLOTTE	14.2
	CALL WIRELTERCH.BCH-65/TSF.0.C.0.1.PCH.11	HOTTE	141
	80M487M4887M9		403
	107770708676 TE IBCU IE BTWAYS CO TO 218	LUTI	102
	TE TECHELEBRITARI SU IU 215	PLOT IP	103
	FCH0.4/TSF	PLOTTP	166
	PCHARTHAX+J.1/TSF	PLOTTP	167
	CALL MATHIXCH,RCH,+24/TSF,6+0,21)	PLOTTP	16.
	XC4=XC4+0.16/TSF	PLOTTP	169
	^ALL PL97(¥C4++55/TSF)RC4++22/TSF)2)	PLOTTP	170
	CALL CHAR(XCH)RCH20+(2+14/147/1)	PL 0TTP	171
	CALL CHAR(YCH++14/TSF+RCH++11/TSF+G+3++06+142+1)	PLOTTP	172
	¥C4=XC4+L-2/TSF	PLOTTP	173
	CA11 CHARIYCH-RCH-0-D-18-2447-21	PLOTTR	174
	CALL CHARTYCH- 28/TSE-8CH4-11/TSE-0-0-06-142-11	PLOTTE	
		BL OTTO	
		PLOTTA	110
		·Luite	
	15 (RPLMT +LE+ 6+01 40 19 215	PLOTTP	170
	*CH=*C4++25/TSF	LOTT	179
	CALL CHAR(XCH,RCH,D.Q,0707676764PLANET;6)	PLOTTP	1 46
•		PLOTTP	171
:	PRAW PLANET AND IONOPAUSE, AND LABEL PLOT	PLOTTP	102
		PLOTTP	183
	CALL ELIPS(1.0,0,0,1.0,1.0,0.0,0.0,100.0,3)	PLOTTP	194
215	CONTINUE	PLOTTP	185
	XTHINOXTHINARPLNT	PLOTTP	186
	YTHAY-YTHAY ORPLNT	PLOTTP	187
	OTMAX -RTMAY OR PL NT	PLOTTP	1.8.6
	CALL PL 0710-0-0-0-31	PLOTTP	140
	CALL CALE/TEBL . TEBA. 13	AL OTTO	100
	DO 221 Tel.NYNAY	PL OTTA	101
			171
	te tennotti en anti da	71.077	145
	LE LES DELLASTARIARI MELLO 230	PLUTTP	143
		FLOTTE	194
222	CUNTINUE	PLOTTP	142
23,	CENTINGE	PLOTTP	196
	NG 243 T-1,NYMAX	PLOTTP	197
	TF (VS4K(I).ST.XTMAX) GO TO 256	PLOTTP	198
	TF (YSHK(T).GT.RTMAX) GD TO 250	PLOTTP	199
	N\$40K = ]	PLOTTP	200
240	CONTINUE	PLOTTP	201
250	CONTINUE	PLOTTP	202
	CALL VECTOR (XBOD, YBOD, NRODY, 1.( .1H )	PLOTTP	201
	CALL VECTOP LYSHK, YSHK, NSHOK, 1. J. 14 3	PLOTTP	204
	YCH+0.5+(YTHTN+YTHAT)-1.5/TSF80	PI OTTA	200
	RCH+-O.7/TSFRD	PI OTTA	204
	CALL CHARTYCH, PCH. 9.6.0.2. TTTI 51.1.1		100
	YCHAYCHAN.NA/TCEPN		201
			200
		PLOTTP	209
-	LALL LTHRIKLTARCHAJADAJA12AILILXRA18}	PLOTT	Z10
5		PLOTTP	211
C	DRAW (X,P) PROJECTION	PLOTTP	212
Ç		PL 011P	213
	CALL VECTOR(XTRAJ,RTRAJ,NTRAJ,1,1,14%)	+L0TTP	214
	CALL MRKPLTERTRAJ,RTRAJ,TSF,TSF)	PL OT TP	215
	CALL PLOT(XTRAX+0.0+-3)	PL OTTO	21 4
	CALL RESET	PLOTTO	
	PETIEN	1 ATTA	
	ENO		

.

	+ +F(3)+(1.(+X))	QUAD	20
	#FTIMM	QUAN	28
	FND	OFFAD	29
		01147	30
	SURROUTING RECON	RERIN	z
	COMPAN FEDRE & WEINS WEINS BERE DISK CONSCIONS 215	CONT	Z
	COMPANY FUTURE RULESSIOD FTC (20) 1001 PF(20) 101 PHOF (20) 1(0)	EL 04	2
	ISVE 2. VE.V	PLUNT	2
		ACUWE	2
	COMMON /890005/ X800(166)+Y800(166)+Y8044(13)+Y8044(14/)+	VC 04P	3
	· NPMAY, NYMAY, APACH, GAMPA, HEG. NHT NOT		2
	COMMEN JONS TRAJ ZPLOTANTENDA NZADOANZPLOT	DHETHH	
	LOGICAL LERAY	NURDO	
	^ NN 413 N/ 4 UNG N/ XX ( 1 J 3 ) # YY ( 1 J 3 ) # NB 03# LGP AY	NURDO	
	COMPAN JAINJ ANEPLANGNEKACONEACONEACONE	RTN	;
	LIA ISAL IRERUNALPPFLAIPPSTALPRCONALPRAALPLUTAIAJALPSTOT	PROPT	
	COPHON /PPODT/ LRERUN, LPRFL, LPRST, LPRCON, LPRS, LPLOT, LTRAJ, LRSTRT	PROPT	
	CON414 /SHOCKS/ DRSD3(103), 057(53)	SHOCKS	ž
	TOPTON PARFLITZ NMARKT, MARKT(12)	ዛኛ ምይ ባቸ	2
	LOW ILAL LPLING	TROPT	2
	CONHON ATRIDATA NTALL TTALLER VINE, RHOINE, THPINE, BINE	TROPT	3
	The state of the state and the state of the	TRJAAT	2
	A REALINE THE AVERAGE WAR AVERAGE STATE AND	TRJOAT	3
	• PTPAIETS31	THJOAT	4
	LOGICAL LSUN	TRJDAT	
	CONHON /SUNDATE LSUN, XTRAIS(1001, VTRAIS(1001, VTRAIS(1001,	5799367	Z
		2.14.171	
		9591M	3
	OTHENSTON PRILIES	REPHIN	- 11
	FONTWALENCE (\$4(1), 44(1))	REPIN	1.0
	STHENSTON NK(100)	REPUN	20
	JATA HALANK/IH /pHSTAR/IH+/	PERUN	21
		REPUN	ZŻ
	THIS SURREUTINE READS DATA FROM TAPES EWRITTEN TO TAPES ON	P 든 막기에	23
	- PETIDIS RORI TO ALLOW PESTARTING OF THE PROGRAM USING	RERIN	24
	AND A STATION FALUES, PLOT SIZE, AND/OR MAGNETIC FIELD	8E#1M	27
	AND DENETH EVENTS AND THE CALCULATION OF THE VELOCITY	RERUM	26
	AND DEN3111 -122030	#E#UN	27
	PEADIAL MAI HAT. MANAY, AMACUL, CAMA MAGA	RE 8.14	28
		RENTIN	29
	TE (ARSEAMACH-ANACHAL .CT. 1.) E-AL CO. TO 100	REA.IN	30
	IF [445][649-6494] .6T. 1.0F-51 CO TO 100	- EANN	- 31
	TF (HOD ALTA (ALTA ANDA HERA ALTA DADI GO TO 2	*****	
	TF (445(HR7-4804) .6T. 1-0E-5) 60 TO 100		33
2	PEAD(4) NADD, (XX(I), PR(I), I=1, NBCD)	REPUN	32
3	CONTINUE	REPUN	17
	MXMAX-NALUNT	RERUN	
		REPUN	19
	PRINT INPUT DATA	REPUN	44
		REPUN	41

TORCTION QUAD EXPYRESYDAYDS		
	QUAD	2
THIS FUNCTION PERFORMS & GENERALIZED ONLODELLEDGIA ONLO	QUAD	3
GIVEN THE COURDINATES OF THE VERTICES. THE LATERAL INTERPRATION,	01) 40	4
AT THOSE POINTS, AND THE COOPDIMATE OF THE FUNCTION	QUAD	5
VALUE OF THE FUNCTION IS DESTRED. THE PUT AT WHICH A	00 40	Å
AND Y ARE THE COORDINATE ADDITION TO THE PARTY	QUAD	ž
THE FUNCTION APPAY	OUAD	
DIMENSION 8841-8841-8841	OTIAD	ė
	0149	10
51=4+0+22=5255555555555555555555555555555555	OUAD	
72+X(1)+X(2)+X(3)-X(4)	QUAD	
53= ¥ (1) - ¥ (2) - ¥ (3) - ¥ (4)	OUAD	
\$49-¥{1}4¥{2}44¥4	QUAD	11
	OULAD	
72=7(1)=772=771	QUAD	14
T3=Y(1)=Y(2)=Y(2)=Y(4)	OUAD	17
T4==Y[1]+Y[2]+Y[2]=Y(4)	OTAD	
4+52+13-53+77	DIFAR	10
9=51=57=54=54=54=54=54=5	QUAN	20
F#510T4-540T1	01147	
7=50=T(8+8=++,0=++++)	OIJAD	;;
FTA(R+D)/(AA2-3)	QUAD	
TE LANSIETAL CT. LON FRANKLAND	QU 47	51
1 = 1 1 = F T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T A + C T	01140	
	01147	
+ + + + + + + + + + + + + + + + + + +	OHAD	20
PFTIPN	QUAN	28
END	OITAD	9.0
• •		27

1977777 8333 - MAAN A.M.		
THE IT TO SET A MACHAGAM	RERUM	42
1 - 14K(1 - 466)B	RERIN	43
<pre>4 44116(8,214) NEOD([XX(1], KH(1], I=1, 4400]</pre>	REPUN	44
	RFPUN	45
6 WRITE(6+216)	<b>医</b> 里根切除	46
	REPUN	47
5 IF ILGRAVI GO TO 11	PERIIN	48
	REBIN	49
THE ALL THE ALL AND A	<b>KEAOM</b>	50
7 40116(8)(14) 440	<b>BEBÜN</b>	51
		52
	REPUM	53
1F TEXONS GR TO 17	RERIJN	54
WITE (6,231) ANGP, ARGN	PERUN	55
17 CONTENSE	PERUN	56
WETTE (6,233) LEERUN, LPREL, LPRST, LPRCON, LPRA, LPLOT, LTRAJ	RFRIIN	57
TF T-NDT- LTRAJJ GO TO 25	RERUN	58
FC#P=1.C/#PLNT	* ****	59
WFITE(D,200) LPLTRJ,RORP,VINF,RHJINF,T4PINF	REPUN	67
IF ILSUMJ WRITE (6#269) RINF#HRI#BY1#871#871#A74NG#POLANG	#E#UN	
WILLE (6) ZD33 NTKAJ, NPARKT	RERUN	62
UN 21 WILDHIRKJ	READN	63
	REAIN	64
The second secon	REARM	65
UL ZZ TEJPHARKI Mamanatas	PERUN	66
- WERELIEF	a.E.e.itW	67
22 "TLNIFTHE	RERUN	6 P
	RERIH	59
TTIE TOPESTE ENERGIETTAJENEETTAJENEETTAJS(N), TTAJS(N), TTAJS(N), TTAJS(N),	RERIN	70
	=Ebild	71
	E BUJH	72
	B E #13M	73
TE FYVENU .CT. AL UDITEIA.IEAL IVANUITL.T.L MUANUL	KE bill	74
ANTE LE SALA MECON MELLENDESSI NUCLINELINESSI DEVELONI	READE	79
TE EXPENSE TO A DETERMENT AND TREASTS AROUNTS TO AROUND	459174	76
	*****	77
	a Faûd	74
	<b>NEWON</b>	26
IF TRACON .CT. 31 URITERA.2535 JACOMETS.T.I. MACONS	45404	1
C C C C C C C C C C C C C C C C C C C	******	82
213 FORMATE//22%+25HENTERPLANETARY MACH NO. 5-54-2	REALM.	
# ///ZakaZiHSPECIFIC HEAT BATIO == 64-31		
214 FORMATE//238-46HOMSTACLE CEOMETRYS USED-SUPPLITED COMPTHATES	P C PUIN	
• 74-74 POINTS //332 349/0.112.309/0/		
* (207, FA.446%, F8.41)	BEDIN	
216 FORMATE // 20X+49495TACLE GEOMETRY: DEFAILT MACHETOPAUSE COOPDINAL		
* 21HES - EQUATORIAL TRACEL	B C BULL	
213 FORMATE //2JK, 48408STACLE GEGRETRYS DEFAULT TONOPAUSE COOPDINATES.		
//JANKA JOHENR CONSTANT SCALE HETCHT HTTH HIRAN E4.23		
213 FORMAT 1//2/14/75HOASTACLE GEOMETRYS OFFAULT TOMODAUSE WITH CRAWYS	TA BE 811M	
TIONAL VATIATION FOR H/R(=,F6.2)	PERIM	
233 FORMATC//223,47HTERMINAL DOWNSTREAM LOCATION FOR PLOTTING. Y/PL	25 PILM	
* F6+2)		
231 FORMATC//23X+50HUSER SPECIFIED DEVIATION IN SOLAR WIND COORDINATE	C	
<ul> <li>/20x,47HDF MAGNETIC FIELD SYMMETRY-PLANE COMPONENT FROM.</li> </ul>	PFRIM	
17H FLOW DIRECTION +, F7.2, BH DEGREES	PERIN	
# //20%/50HIJSER SPECIFIED DEVIATION IN SOLAR WIND CONRDINATE		110
<ul> <li>IZUX-SEMUE MAGNETIC FIELD FROM MAGNETIC SYMMETRY PLANE</li> </ul>	RERIN	1 11
• FT+2,94 DEGRFES1	REPUN	112
235 FORMAT(//20%+84LRERUN ++L2//20%+84LPRFL ++L2//20%+84LPRST ++L2/		103
# //23%,84LPRCON =,L2//20%,84LPRR =,L2//20%,84LPLOT =,L2/	PERUN	134
• //ZOX, CHLTRAJ +,L21	REPHY	12.
242 "CRHATTINI//451/451/45HVALUES SPECIFIED FOR CONTOUR CALCULATION/		106
· 431,40(14-3)	RÉRIJA	137
CHC TOWNETE////231,12,294 CONTOUR LEVELS FOR VELOCITY))	REPIN	119
244 -DEMATTIFFEEST, 12, 284 CONTOUR LEVELS FOR MENCITYES	PEPUN	109
200 FURTATI////ZWIJI2+444 CONTOUR LEVELS FOR MAGNETIC FIELD STRENGTH	I) RERIN	110
620 - 125 MAILER 1837 907 100 513 940 - Endmate 1979 - Autoritation - 200	<b>BE</b> BIN	111
A THE FREE AND AND THE FEAST AND AN AND AND AND AND AND AND AND AND	PERIN	112
	<b>Bēsil</b> in	113
- 2777261277777777 • 2217213240728072	REPIIN	114
	<b>BEeild</b>	115
	RERIN	116
# /2019/34/194568/14/2748/ VENSLIT #9F1163/	电影电话的	117
	REBUN	110
2A3 ENDMAT(////SXY.SUMTDALKAVES.AUMAANS	~ 문 # 194	119
<ul> <li>30%************************************</li></ul>	REPUN	120
2.8% alwho sy shift reads we wanted for the trust proventies ///	# 2 年時間	121
267 FORMAT((25%)(6,1%)A), 8%, 630, 64, 5%, 68, 64, 7%, 58, 4%)	REANN	122
263 FORMAT(45%, 30H SUM-PLANET CONDITING EVELTED)	A C AVIN	123
269 FORMAT(35F,24H MAGNITUDE #FILLA	*****	124
/35x,144X+C74+ONENT *,E11.1		123
· · · · · · · · · · · · · · · · · · ·	*****	

.......

¢

¢

00000000

с с с

FUNCTION QUAD (X,Y,F, XP, YP)

	5/1880/171NF 80747/1ND)		•
	CONSON JEENS ANGE-ANGE-KECON-BCON(223)		;
	COMMON STRIGATS NTRAS, TTRASLIDS UT TRASLIDGS, VTRASISON, 7TRASSISON,	TACLET	5
,	<ul> <li>VTPAJ(100). WTTPAJ(100). WTTPAJ(100). V7TPAJ(143). THPT0J(1/0).</li> </ul>	TRIDAT	ì
	• ST#AJ(100), SXTRAJ(100), SYTRAJ(100), STTPAJ(100), ROTRAJ(136),	TRIDAT	
	• PTPAJ(100)	TRJOAT	
	I TOTCAL LSUN	SUNDAT	ź
	CONMON /SUNDAT/ LSUN, XTPAJS(100), YTRAJS(10C), TTRAJS(10C),	SUNDAT	
	RTPAJS(100)+A7ANG+POLANG+RX1+RY1+R71	SUNDAT	- 4
		ROTAT	6
		ROTAT	7
		RUTAT	
	\$F (INN+LT+C) 53 T3 100	ROTAT	4
		#176 <b>T</b>	14
	TRANSFORM TRAJECTORY AND FREESTREAM B-FTFLD CODRDINATES	ROTAT	11
	TH SHLAR WIND CHORNINATE SYSTEM	ROTAT	17
		POTAT	13
	TEPP1/1/10506174329	POTAT	14
	12770107014NG4331743329	RUTAT	15
		# 13 T 4 T	10
	1.42 ************************************	#'] ] & T	17
			10
		PUTAT	12
		ROTAT	
	YTPAJS(T)-YTRAJ(T)	POTAT	55
	778434673677843673	POTAT	22
1	CONTINIE	ROTAT	24
-	90 2 T=1,4TRAJ	POTAT	25
	XTRAJ(I)=(XTRAJS(T)+CAZ-YTRAJS(I)+SAZ)+CPOL+7TRAJS(I)+SPOL	RUTAT	26
	YTPAJ(T)=XTRAJS(T)=SAZ+YTPAJC(T)=CAZ	ROTAT	27
	7TRAJ{[]+=-[}TPAJS{[]+CA7-YTRAJS[]+SA7]+SPOL+7TRAJS[]+CPOL	ROTAT	28
	11)LA9TX-={1]LA9TY	ROTAT	29
	{{}}	RUTAT	30
2	CONTINUE	ROTAT	31
		ROTAT	32
	CALCULATE ANGN AND ANGP	RUTAT	33
		ROTAT	34

	•	/357,148	IY-COMPONEN	T =,E11.3		REPUN	127
	•	/35×,14H	IZ-COMPONEN	T =,E11.3		RERUN	128
	•	11201,294	ATTRUTHAL	ANGLE	=,E11.3/	REPUN	129
	•	/26¥,294	IPOLAR ANGL	.E	+,511.31	RERUN	130
с						PERUN	111
٢						PERUN	132
c	READ	DATA GENE	RATED BY P	LUNT BODY CO	JOE	RERITH	133
c						RERUN	134
	READ	43 (J1,TH	IETA (J), DRS	60×(J),{11,#(	P( [, ]), [=1, NR #4 X), ]=2, H9L UN1	() RERUN	135
	00 10	J+2,47LU	JNT			RERUN	136
	READI	43 KyEI1y	xc(1,J),YC	(I#J]#VX(I#	}#¥Y{T#J}#90F([pJ]#T#]#N#1	AX) RERUN	137
	15. CONTE	NUE				REPUN	135
C						RERIN	139
С	READ	DATA GENE	ERATED BY P	ARCHING COD		REPUN	140
c						PEPUN	141
	NZADO	•G				RERIN	142
	N 7 E ND	WALLINT				RERIN	143
	***	BLUNT+1				RE PILM	144
	nn 20	. J=N77,16	<i>,</i> ,			REPUN	145
	READS	41 31.2.0	8507(3)			REDUN	144
	1F (1	NTIENF (5)	1 . NE. 61	60 TO 36		PEPIN	147
	TF (1	((1.J-1)	.GT. 79107	0 60 TO 36			148
	NZADD	HANTADD+1				8 C 811 N	149
	20 20	Tota NRMA	X			PEDIN	150
	READO	41 T1.YC	T		HDF([.])	REPIIN	141
	vert.	11.7					167
	Z. CONTE	NUE					165
	3a CONTE	MIF				PEPIN	154
		N				REDIN	111
r						PEDIIN	164
č	DETNT	62809 Mg	STARE TE T		THE SAME PASE AS		167
ř	SPECT	FIED TH	ARD THRUT	- PRINCPAN	TC STOPPED	REPIIN	15.4
č						DEDIN	110
•	101 40175	14.12.01				RENIN	179
	C	74141.104			M TERMENITER SV. CALUALAAN		
		34 10 6 011	AATA DH T	ADEL DOLL NO	T ACDCE/384.1044174 FACE .	BEDIN	121
			TETER ON CO	BR THRUTS	AN AUGAPU NO .AV EUPANNA A		145
			11 2 V. 10HEBC		(.E1A.41/17V.1045000 TADE4.	n Eatin	133
	-	3/47.51			**************************************	82 811M	100
		21 419 44					107
	ENO					ACRINE	100
	5						701

		Rx+(Rx1+CA7+By1+SA2)+CPOL+B71+SPOL By=Ax1=SA2+By1=SA2)+SPOL+R71+CPOL Ry=-Ry(CA2-By1=SA2)+SPOL+R71+CPOL Ry=-Ry Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By-Sy) Ang-Artanz(By) Ang-Artanz(By) Ang-Artanz(By) Ang-Artanz(By) Ang-Artanz(By) Ang-Artanz(By) Ang-Artanz	ROTAT ROTAT ROTAT POTAT ROTAT ROTAT ROTAT ROTAT ROTAT ROTAT ROTAT ROTAT ROTAT	3567 379 401 445 445 445 445
	1 00	C DNTIWJE Peturn	RITAT	49 90
		Fair	#'JT&T	51
с		FUNCTION REINF([,J)	RR INF RR INF	23
Ċ		THIS ROUTINE CALCULATES PARING AT THE (T.J) GRID POINT	RRINF	4
		COMMON /ROUNDS/ X83DE13C3, Y80DE1063, X54KE1373, Y54KE18C3, • NRM4X, MYMAX, 4MACH, GAMMA, HRO, NMENDX	ROUNDS BOUNDS	2
		COMMON /FLOW/ XC(20,100), YC(20,100), VF(20,100), RHOF(20,100) LEVEL 2, XST, YST, HUMST, MST	FLNW STREAM	2
ç		CONMON /STPEAN/ XST(50,152), YST(50,152), NUMST(50), NST	STREAM	9
ĉ		TE POINT IS ON SHOCK BOUNDARY WRINE-1.0	RRINF	10
		16 (1 olto 9694X oando, 3 obto 13 69 79 13 88(NF0]ob Domini	REINF	13
C C		REACKET POINT BY TWO STREAMLINES	RRINE	15
¢	24	CONTINUE	*RINF PTTNF	17
		*+YC(1,J) Y+YC(1,J)	RRINE	19
		92=0+0 10 2: JST=1+NST	RRINF	21 22
		44=44447(J\$T) 30 401=44	RR INF PRINF	23
	32	IF (VST(JST,K) .GT. X) 69 TO 40 CONTINUE	RTINF	25
	43	K = NN COMTINUE	RR THF RR THF	27 2 P
		T2L=2L 1=T2L=1	RRINF RRINF	29 30
		#1##2 TF (K +E3+ 1) R2#YST(J2+1)	RRINF	31 32
		↑F (K •GT, 1) R2+YST(J2,K-1)+(X-XST(J2,K-1)) • • (YST(J2,K)-YST(J2,K-1))/(XST(J2,K)-XST(J2,K-1))	RRÍNE	33
	2,	IF (R2 .6T. Y) EO TO 60 Continue	RRTHF BRTHF	35
e	69	1F (J2 .E0. 1) FO TO 100	ROINF RRINF	37 3P
c		THTERPOLATE FOR RIPTINF	RRINF RRINF	39 40
	73	41HC1=YST(J1,1) pIWF2=YST(J2,1)	RRINF RRINF	41 42
		#RINF=V/{FINFI+{BINF2-RINF1}+{V-R1}/{R2-B1}} PETIJRN	RRTNF RRINF	43 44
CCC		USE SYMPETRY AXIS AND BODY FOR ZERD-TH STREAMLINE	PRINE	45
•	103	CONTINUE	REINF	44
		1- (, 401, -1.0) (0 11) 0)710-1,0+7/82*(#2/YST(1,1)-1,0) 077100	RRINF	50
	113	TE 11. 15. V011-01 CO TO 121	RRINF	52
	123		PRINC	34
	1 30	-1	REINF	56
		ፍር 11 70 ቶክር	WR THF BR THF	57 58

C C C 1

	91HENSTON AL139ACONT(139ATOHK(4+13)
C	105 W4 1 M1- 1-44
c	r.c
•	50 TO (1+21+KDD2
:	T+TDEX(J,W+1)
	47 TO 3
2	T=[D[X{J+],K}
3	42+471) T-TDFV/
	A9mA(T)
c	
-	TF(4)-1234.5.5
4	44= 42
	4[+4]
_	60 TT A
5	44-A1
~	41+42
¥.	¥41 - 4 FRMT/ MM44 3
•7	
	TELVAL ST.AH) SO TO 12
с	
	CALL CHECKEICHK, NXY, KODZ, J, K, NVAL, KODO3
	(F(KNN9.E0.2) 60 TO 12
с.	K003-1
	50 TO 20
12	KND3=2
Z٤	* ETURN
	FND
÷	SUMMOUTTHE SCTUPCIPLOTETHACH-FGAMEINGCY) THTS NOUTINE ESTANLISHES PLOT OPIGINE DAANS
e	AND LABELS AKES, AND WRITES TITLE.
ç.,	HCC PLOT SUBPONTINES USED ARE
5	PLOTAXISANUMPLIACHARASCALF,
č	
	DIMENSION TITLE3(2),TITLE4(2)
	DIMENSION TITLES(2) TITLE6(3) TITLE7(2) TITLS4(2)
	DIMENSION TITLEFIZS
	FORTON /SFALS/ ISF, TSF, TAX, TAX, XLNSTN, YLNSTN
	9414 71271637879537 7474 111171.711153/9485197178848645178./
	DATA TITLES (1.). TITE ES (23/104STR FAMILTHE. 145/
	MATA TITLEA(1), TITLEA(2)/10HTEMPERATUR, 14E/
	MATA TITLES (11) TITLES (21/10H (PARALL SL + 10HC3MP3NENT)/
	TATA TITLES(1), TITLES(2), TITLES(3)/104(PERPEND(C,104)LAR COMPO,
	NATA TITISATILLATILLATILLATILAATANAAL CONTONNAL
	NATA TITLES/94CONTOURS/ TITLEF(1) TITLEF(2)/104FTFLD LINE-145/
c .	
ç	
2	SPT GRIGIN AT LEFT END OF K+AKIS
•	CALL PLOTEN-0-1-0-=31
	XSeXCE
	¥5=¥9F
	CALL SCALFEXS, YS, 13
ç	
Ċ	REGUIRES PARAMETERS IN INCHES, NOT USER UNITS.

NTC-INT(2.0+{XHAX+1.5}+1.0} CALL AYTSED.9.0.01H .0.XLN6T4,-4TC,1.0.0

SET PERMANENT ORIGEN AT X+0

CURROUTINE SERCHEJ, K, KODZ, A, JOIN, ICHK, NXY, KODZ, NVAL, A1, A2, ACONT)

CONTOUP PROGRAMS MAP, VALK, SERCH, ENTER, AND CHECK WPITTEN NY REESE SORENSON, NASA-ANES REE, CTR., AUG., 1974. Andified Versioni

THIS SUARDUTING CHECKS WHETHER A CONTOUP LINE AT LEVEL NVAL PASSES THROUGH AN INTERVAL HAVING INDICES J.K AT ITES Left(Kod2=2) or aditom(Kod2=1) point.

58+C4 58+CH

SERCH

SERCH

SFRCH

SERCH

**SETUP SETUP SETUP SETUP SETUP SETUP SETUP SETUP** 

SETUP

SETUP SETUP SETUP SETUP

2

5

6 7

40123456789012345678001233333333444

2

4

		CALL PLOT(1.5,0.0,-3)	5 S T11 P	40
		45=x5F	SETIL	41
		42=43E	SETUP	42
		CALL SCALFEXS, Y*, 1)	SETUP	43
ç			SETUP	44
Ę.		ORAW Y-AXIS	SETUP	45
Ľ			SETUP	46
		WILL WINIETHANIET	SETUP	47
c		CALL 4775(0:0)0.00174 90, VINET4, -NTC, 2, 9121	SETUP	48
ř		LARGI V-AVIE	SETUP	40
č		C-011 - 8/13	SETUP	50
		YCH=+_4/YSF	SETUP	51
		XCH=0.5+XHAX7521/XSF	5 8 1118	22
		TF (IROPY.F0.1) 60 TO 2	15110	
		CALL CHARTYCH, YCH, Jos, 14, 3HY/D, 31	SETUP	55
		67 TO 3	SETTIP	56
	Z	TALL CHAP(YCH, YCH, Job / 24, 3HX/P, 3)	SE 715=	57
			SETUP	58
		CONTINUE	SETUP	59
c		- Section	SETUP	50
ċ		ANNOTATE X-AXIS - NOTATONNA IS POSTIVE LEET	12100	01
Ċ		the production is contract the	SETUP	
		YY=15/YSF	SETUP	64
		f x = G	SETIP	65
		VID-1.5	SETUP	66
	,	TELEVEL TATEINIAC.5	SETUP	67
			SETUP	58
		TY#TY#1	SETUP	69
		IF (YOX-LT-XPAX) OD TO S	14198	70
C			SETIL	
ç		ANNOTATE Y-AXIS AT SIDE EDGE OF PLOT	SETUP	71
C			SETUP	74
	•••	¥¥=0.0	SETIF	74
	:		SETUP	76
			SETUP	77
		TTC+YCH42_167856	SETUP	78
		CALL CHAR(* TIC, YY-, 05/YSF, 0, 0, . 39, 14-, 11	251114	
		IFTYY.LT.YMAXI CO TO 10	52110	30
¢			SETIL	8.2
ç		LAREL Y-ATTS.	5 # T'1P	
¢			SETUP	
			<b>CELID</b>	
		TE (1900x = 0.11) EO TO 19	SETUP	۹6
		CALL CHARTERCHAYCHADAGAALAADARZOADA	SETIP	
		CO TO 12	251110	
	12	CALL CHAR(YCH, YCH, 0.0, 14, 348/8, 31	55110	84
		xCH=xCH+_42/xSF	557118	
		CALL CHAR(XCH+YCH+D+D+05+1H0+1)	SETUP	42
	73	CONTINUE	SETUP	93
2			5E 1118	94
č		CHOILD BE DRAWN.	SETUP	05
ć			SETUP	75
		¥CH=¥441+C.8/YSF	SETTIP	97
		YC4=+1.5+0.45/X4F	SETUP	90
		IF( IPL 7T. EQ.2) GO TO 15	SETUP	104
		TF(1PLOT.F0.3) 60 TO 20	SETUP	151
		IF (IPLOT.E0.4) 60 TO 14	SETUP	102
<b>r</b>		THE STARTANIANE AND THE ST	SETHP	133
č		VELOCITY PLOT	SETUP	104
ē			SETUP	105
		CALL CHAP1XCH, VCH, 0. C, 20, TITL51, 9)	557119	120
		YCH+XCH+2./XSF	\$ F TIJ D	10.0
		CALL PLTLNEXCH, YCH, XCH, YCH+, 2/YSF)	SETUP	139
			S# TITP	110
		TALE DETENDEDENSE VEN. VEN. VEN. NEWERS	SETUP	111
		CALL CHARINGHAMANYSELVCH.A.A	SETUP	112
		ALL MATHIXCH+4.4/XSFJYCH05/YSF4.15/XSF40.0.141	SETUP	113
		40 TO 25	12107	114
ç			SETUP	112
ç		TEMPERATURE PLOT	SETUP	117
۰.	14	CON TI WIE	SETTE	114
	••	FALL CHARINGHAYCHADAL 20. TETLEA	SETIJP	119
		YCH=XCH+2.4/XSF	SETUP	120
		CALL CHARIXCH, YCH, 0. 0, . 2, 3HT/T, 31	5 E T110	121
		*ALL HATH(XCH+.55/XSF,YCH05/YSF,.15/XSF,0.0,15)	SETUR	123

c c

......

č

Ê

		60 TT 25	SETUP	124
C			SETUP	125
ç		DENSITY PLOT	SETUP	126
¢			SETUP	127
	15		SETUP	128
		YEMAYEMAD, 2855	5 E 10 P	124
		CALL GREEK(XCH+YCH++2+0+17)	SETIP	131
		CALL CHAR(XCH++Z/XSF+YCH+0+0+R+1H/+1)	SE TUP	132
		CALL SREEKEYCH+.35/35F, YCH, .2, 0.0, 17)	SETUP	133
		FALL 44TH(XC4++45/XSF+YCH++05/YSF++15/XSF+0+0+15)	SETUP	134
		60 TO 25	SETUP	135
C C			SETUP	136
5		CINERALINES NEDI	SETIP	137
•	,	CONTINUE	557110	130
	•.	CALL CHARIXCH, YCH, J.G., 25, TITLE3, 11)	SETUP	140
		SR T1 25	SETUP	141
e			SETIP	142
- C		MAGNETIC FIELD PLOTS	SETUP	143
c			SETUP	144
	z.	CONTINUE	SETUP	145
		TALL 54A# (XCH) XCH) 0+0000+201112560150	SETTIP	140
		CALL CURPTYCH, VCH, 7. C. H. S. AMERER, AS	55105	17/
		CALL HATHIXCH+.75/X5F.YCH05/Y5F15/X5F.*.3.151	SETTIP	149
		CALL (447(XC4+0.9/XSF+YC4+0+0+0.2+14)+1)	SETUP	150
		1F ITMLOT .EQ. 61 GO TO 22	SETUP	151
		14 (TPLOT.50.7) 60 TO 24	SETUP	152
		CALL CHAR(XCH+1+2/XSF+YCH-+05/YSF+1+5705+0+1+1H=+1)	SETUP	153
		¥CH=-1.5+*.4/¥SF	SETUP	154
		VCH=YP&Y=1,1/YSF	SETTIP	122
		CALL (HAP(ECH)TCH)J_0J0103(11/L23/23)	SEIUP	156
	,,	CALL CHARTYCHAL.15/YSE.YCHAD5/YSE.3.1414.1.1.147.13	SETIO	157
		YCH=+1.5+.4/XSF	SETIP	159
		YCH+Y44X-1,1/YSF	SETUP	161
		CALL CHARCECHAYCHAUGUSCOLCOTITE569253	SETUP	161
		60 TO 23	SETUP	162
	24	CALL CHARIXCH+1+15/XSF#YCH+0+35/YSF#3+0+0+1+144+11	SETUP	163
		YCH=-1.5+j.4/XSF	SETUP	164
		TENUTAITIAI	SETUP	107
		(ALL , MARTINGTONGTONGTONT (LE/)23) VCM-VMAV-1, 3/VCC	50 197	100
		YCH1.5+0.4/XSF	SETT	148
		CALL FHARIXCH, YCH, 0.0.0.1C. TITLEC. 81	SETUP	159
		CALL PLTENIXCH+1.1/XSF.YCH.XCH+1.5/XSF.YCH)	5 E THP	170
		4CH+4484-3+3142E	SETU-	171
		CALL CHAPTERCHATCHAD.CAD.CATITLEFALL	CE TIP	172
-		CALL MUTLAERCH+1+197X3FFYCHFXCH+1+37X3FFYCHF2CF0F	151110	171
5			52107	176
2		HEATS (CANNA).	5F T11P	175
č			SETIN	177
	25	CONTINUE	SETUP	17*
		YC4-Y41Y3/YSF	SETIJA	170
		¥CH=+1+5++4/XSF	SETUP	150
		CALL CHARENCH, VCH, Jal + 2, 24M+, 23	SETHP	141
		FALL WIMPLT (XCH++4/XSF)TTH)0+C)+2+TH4TH11	52700	162
		16776776777777777777777777777777777777	52 TUA	184
		CALL CHARTYCH+.2/XSF.YCH.C.D7.1H+.13	<b>SETIP</b>	195
		CALL MIMPLY (XCH++4/XSF+YCH+C+0++2+644+2)	SETUP	186
c			SETUP	1+7
		*ETIPN	SETUP	198
		FND	SETUP	169
c		SUBPOUTINE SECALC(XSHK,VSHK,NTMAX)	SFCALC SFCALC	2
ĉ		THIS BOUTTNE DETERMINES SCALE FACTORS AND SIZE OF PLOT.	SPEALE	\$
-		COMMON ISCALEI XSF, YSF, XMAX, YMAX, YLNGTH, YLNGTH	SCALE	2
		DIMENSION XSHK(1), YSHK(1)	SFCALC	7
		NATA VSTZE/8.0/	SECALC	4
<u> </u>			SECALC	
C C		CATCATALS HAWY MAD AWAY WARED ON FURL DUAL DE 200CK MAAE*	SPCALC	10
c		******	SPERCE	12
		[FETMAY_LT.XSHK(NTMAX}] YMAY+XMAY+.5	SECALC	ii
		YMAX=AINT(YS4K(NTHAX))+1.0	SFCALC	14

		[F[YMAX=LT=3=0]YMAX=3=0 [F[YMAX=LT=j=5]	SFCALC SFCALC	15 16
6		FTY PLOT SIZE IN Y-DIRECTION Adjust Scale factors for equal x and y scale factors	SPEALE	17 18 19
`		VLNGTH=YST7E	SFCALC SFCALC	20
		¥\$F=¥\$F	SFCALC	22
		YL NGT4-X5F+(XMAX+1.5)	SFCALC	24
		F NO	SFCALC	24 26
		<pre></pre> <pre>&lt;</pre>	Seute Seute	2
è	T	HIS SURROUTINE CALCULATES THE PARAMETERS REGULTED TO DRAW THE	SFORE	5
č		VERTICAL AXIS OF THE TPAJECTORY DATA PLOTS	SENEE	6
Č		LF + 1 VELOCITY	SFOFF	- <b>i</b>
č		= 2 TEMPEMATURE = 3 DENSITY	58088 56068	
ç		. 4 "AGHETIC FIELD	SFOFF	iĭ
Ľ		COMMON /TPJDAT/ NTRAJATTRAJ(100)+XTRAJ(100)+YTRAJ(100)+ 7TRAJ(100)+	SFOFF TRJDAT	12
		• VT*AJ112-1, VXTRAJ10-1, VYTRAJ116, 1, VZTRAJ11001, THPTPJ1001,	TRJOAT	5
		• RT0AJ(1)))	TR JOAT TR JOAT	1
۴			SFORE	14
c			\$F0FF \$5066	15
2		VELOTITY	SECEE	17
٢	່າ ເວ	, FMTNo^oC	5F9FF 5F9FF	- 18
		NO 11: THAN HTRAJ	6e0ee	20
	11,	CONTINUE	58088	21
		NO 125 TeleNTRAJ TE ENVTRAIETE ET ENTRE ENTRE ENTRE ENTRE	SFOFF	23
	12,	CONTINUE	\$F0FF \$F0FF	24
		30 130 Televites TF (V7Tes/171 -17, Entry Entry-V7Tes/1/1)	\$*nFF	?6
	1 30	CONTINUE	SFOFF	27
		th¥artINt thInotaInti	SENEE	29
		cn Tn 7co	SFOFF	31
è		TFMPERATIRE	SEDEE	32
c	••	E M 7 M - F	SFOFF	34
	21.2		SEDEE	35
		10 710 T+1, NTRAS	REDEE	37
	211	CONTINUE	5F0FF	30
		FMAY=F4AY=F[4F 60 T0 710	Seute	40
r			5F0FF	41
ç		0245114	SENEE	43
•	363	F M ] N= 3+ 0	5F(1FF	45
		FMAYACA: DO 314 TALANTRAJ	SFOFF	46
		TE (ROTRASEL) .GT. FHALL FHAV-POTRAJELS	5=0FF	4.0
	313	ENVINE ENVINE	SFAFF	49
		50 TO 795	SFOFF	50
è		MAGNETTC FIFLD STRENGTH	55955	52
٢		Photo	SFORE	54
	407		45055 45055	55
		00 413 T=1, NTRAJ	SFOFF	57
	414	CONTINUE 1. ILVINUTI OFIO BUIND EMINANTIATILI	5F0FF 5F0FF	59
	_	NR 426 1=1. NTRAJ	SECEE	60
	427	CONTINUE PL PULLENGE PLAN, FUTUE FUTUERTIARTIE	3F0FF 3F0FF	51
		DG 430 T-1,NTRAJ TE ERTTRAJET, ENTRA ERTMARTTALIST.	35055	63
	4 3 3	CONTINUE	1 F (# F 5 F NF F	64
		ND 440 T=1,NTRAJ	SFOFF	66

с сс

.

	440 CONTINIE	SEVEE	67	
	FMAYoFMAYOFTUF	SFOFF	68	r
	FMTN-FMTN+FTNF	24046	69	č
÷.	the second se	55055	70	c
<u>د</u>	EIND WEDEN JE WAGNITUDE	Segee		
ι	20) 60077416	SEGEE	73	
	ENTER-ENAV-ENTM	SECEE	74	
	FI OGAL OGTO (ENTER)	ZEVEE	75	
	NLOG-THT(FLOG)	2 5 7 5 5	76	
	TE (FLNG .LT. U.G) MLDG=MLDG=1	55055		c
- 5		5F0FF	78	c
ç	FIND INCREMENT AS POWER OF 10 TIMES +1, +2, DR +5	SFOFE	96	с
ι		SENEE	91	
	TF (ADTES - CT. 2.5) CO TO TO	5 F D F F	92	
	APEL+G.2	2000	93	
	NA=NL 3G	SENEE SENEE	24	
	69 TO 740	SEDEC		
	723 CONTINUE	SENEE	87	c
	IF (ADIFF .GT. 5.0) 60 TO 730	SENEE		e
	AUTL=Set	SEOFE	49	
	ER TO 745	SEDEE	91	
	73. CONTINUE	SEDEE	91	
	4761=6.1	55056	91	
	NA-NLDG+1	5505E	94	ŧ
	74J 1104410.004A	5=1==	95	
	17 170 69to 11 60 TC 730	\$ F 0 F F	96	4
	440C	6 E OF F	97	
	4104=1.0	SENEE	• •	
	75. CONTENIE	10000	100	0
c		SEDEE	101	
ç	CALCULATE SCALE AND OFFSET	8 # DF #	102	
¢	ANTN-4 4	22025	103	
	16 (5474 J) T. (J.D.) BUTHAL A.1 AC.4	22.000	104	
	MAIN-INTIENTN/IANSI AANONI-AMENI	teges	175	-
	**A*+1.f-1.UE-6	SEDEE	196	Ş
	HMAY=INT(FMAX/CADEL+ALUN)+BHAX)	SENSE	1.4.8	ž
	HIICK-HMAY-HHIW+3	\$EJEE	179	- ř
	ARTNOFLIATENTINICADEL	\$=0==	111	c
		SEURE	111	
	FSF=PLTS7F/((AMAX=AMFM)=A17M)	SEVEE	112	
	CDFL=ANEL+A13N+FSF	SEUCE	113	
	FSF#FSF#FINF	SEGEE	114	r
	#Etilam	SENEE	116	č
	E #1)	SENEE	117	c
	-			C
c	SURPOUTINE STOUT	57417	2	
ç	THIS SUBROUTING PRINTS THE STREAMLINES CALCULATED	STOIT	Ĩ,	
Ċ,	IN SURPOUTINE FLOWST	é T M T	5	
С		STOUT	6	
	**************************************	511147	7	
	<ul> <li>NRMAX, NKMAX, ANACH, GAMMA, HRO, NHENDY</li> </ul>	500005	í	
	LEVEL 2, VST.VST.NUMST.NST	STREAM	,	
	COMMON /STREAM/ XST(56,192), YST(5,,152), NUMST(5,), NST	STREAT	i	
C		STOUT	10	
Ę.	ARAGNZE ZICH UN XZX NOK DUIDANY	STOUT	11	
c	00 2 Kat. NST	517917	12	
	NN=NU45764)	\$1'01T	11	
	10 2 J=1, NN	STOUT	14	
	2 YTT(#,J)=-XST(#,J)	STOUT	16	
c		STOUT	17	
ç	21464-TINES EUR MAGNETUSPHERE	51017	10	
¢	WETTERA.ADDI NET	51001	19	
	TEENVENDE FOIL OF TO 1	51011	20	•
	DO 10 K-1, NST	STOIT	žź	
	V417E16,6133 K,¥ST(K,1),VST(K,13	\$T0UT	23	
	TEEKSTER, 11.5E.C.W) WEITE(6,620) THETA(K+1), RP(NDMAX,K+1)	STOUT	24	
	38=85751663 Mattel6.6383 /vet/v=11.vet/v=11.s.	STOUT	25	c
	1) CONTINUE	\$100T	65	ç
				c

* 748*/43 **	F9,4,2433	STRIFT	57
630 FORMATE/15X, BHX/	D,22X,3H4/D/(9X,F1C.4,5Y,F10.4))	5T0UT	58
621 EOPHATE/15X+44X/	RC,11X,448/80/(9X,F13,4,5X,F10,4))	STRUT	59
E NO		STINIT	60
SURROUTINE TAXES	{ TI MESF, TOFFST, PL TS 7F, NAX TS 1	74¥[5	2
		TAYIS	3
SHAPPUTINE TA	KTS CALCULATES THE SCALE FACTOR AND DEFSET FOR	TAXES	
THE TIME AXIS	# AND PARAMETERS REQUIRED TO DRAW THE AXIS.	TAXIS	5
AHEM MVAIZ=7°S	THE TIME AXIS IS PLOTTED	TAXTS	6
		TAXIS	7
COMMON FIRSDATZ	MTRAJ, TTPAJ(100), XTRAJ(100), YTPAJ(100), ZTPAJ(136),	TRUDAT	2
• • • • • • • • • • • • • • • • • • • •	RAJ(163), VYTRAJ(135), V7TRAJ(100), TMPTRJ(100),	TRJDAT	3
	AATTTATISHAATTATTATTATTTATTTTSSEDTATTTTSS	TRJPAT	4
		TR JOAT	- E
STND THE BANK	S AND THERE BEAUTARD	TAXIS	
THEREMENT TO	C 440 140-14011 KENDIKED	TAXIS	10
1.00-2-0041 13	ADACH ON TO 114452 #12#523 .14 #3	TATIS	11
TE CHANTS AGT. D	1 CO TO 150	18211	
NAVIS=1	1 40 10 1.0	TATES	13.
THINS TIPAJESS			
THAX-TTRAJENTRAJ	•	TAVIS	12
TOJEE-THAX-THIN			
TI DG+ AL DG10 (TDIF	s)	TATIS	16
NTLOGETNT(TLOG)		TATTS	10
TF (TLOS+(T+3+2)	NTLOG+NTLOG-1	TATT	
fulee=10166+70*+	*{~NTL76}	TAXIS	21
IF LADIFFAGTAZAW	A SO TO 20	TAXIS	22
40FL=2.0		TAXIS	23
NA=NTLOG=_		74X15	24
57 TO AP		TAXIS	25
23. CONTINUS		TAXIS	26
IF [47[FF+6743+2	1 60 73 47	TAYTS	27
412L#3.J		TAVIS	28
60 10 40		TAVIS	20
AL CONTINUE		TAXTS	30
ADELater		TAXIS	31
NANTI OG		TATES	32
60 CONTINUE		TANTE	
NA=N4+1		TAVTE	
ADEL=ADEL+0.1		TAVIS	37
A104-10		TAYTS	3.4
LF (NA.LT.O .OP.	NA.67.1) 60 TO 100	TAXIS	
ADEL+ADEL+ALON		TAXTS	19
416H=1.7		TAXIS	40
N A X 15 = 5		TAXIS	41
		TAXIS	42
CALCULATE SCA	LE AND REFSET	TAXES	43
		TAXTS	44

,

		60 TO 4	STOUT	28
c			STOUT 2	29
c		STREAMLINES FOR IGHOPAUSE SHAPE	STOUT	30
c			STOUT	11
	1	DO 11 K=1,NST	STOIT	
		WRITF(6,611) K.KST(K.1).VST(K.1)	5 TOUT	
		IF (XST(K+1) .GE. 3.0) WRITE(6.621) THETA(K+1), RP(NRMAX,K+1)	STOUT	
		NNONLING TERS		
		WPITF(6+631) (XST(K+J)+YST(K+3)+J=1+MN)	5100	32
	11	fourtimes	1 601	
r.	••		21001	
ř		BETTABE TICH OF VEV	51001	
ř		-F-10-7 310-4 0- 331	51001	34
•			STOUT	40
	•		STOUT	41
			5 1 (*) 1	42
		u H= 4(+42 T ( K )	STOUT	43
		N13 3 3-1, NN	STOUT	44
	3	***(*,J)==*ST(K,J)	\$10HT	45
		RETURN	STOUT	46
C			STOPIT	47
	- 61. a	FORMATISH1//49X,334STREAMLINE TRAJECTORY CALCULATION/49X,33(144)/	STRIT	6.8
		//lot,13,23H STREAMLINES CALCULATED1	STINIT	40
	619	FORMATC/////154 STREAMLINE MO.L.T.2.194. STADTING AT V/D	TINT	
		* 84. R/O =+F8.41	STOUT	
	611	FORMATE ///// SH STREAN THE NO. 172.204. STARTING AT VIR		
		A OH, B/RD s.FR.41	TOIT	24
	F 20	ENRATINAL SHIERDEREDANCE TO THETA ALEA S.ON DECREE. ST	*****	23
			51001	22
	4 37		1001	>>
		- UP THE TELEVISION CONRESPONDS IN THE TE #PE0+2994 TEGREES09289	21001	56
	'	• 7480/83 =, F9. 4, 1411	STRIT	57
	e 30	FDR4\$T{/15%,3HX/Ds12%,3H4/D/(9%,F1C.4,5%,F13.4)}	\$1001	58

1 00	CONTINUE	TAXIS	44
	SHIN-D.D	TATTS	14
	R#AX=0+0	TAXIS	47
	[F (TMIN_LT_00.0] 3MIN=1.0-1.0E=6	TATT	4.8
	IF (THAY.GT.D.D) BHAX-1-0-1-0E-6	TAXIS	49
	AFTRST+AINT(THIN/(ADEL+AIDN)+BHIN)+ADEL	TAVIS	50
	ALAST-AINTET"AX/EADEL+AIDHI+84AXI+ADEL	TAXIS	51
	"TIC"=[NT((ALAST-AFIRST)/ADEL+1.0E=6)+1	T4715	52
	TOFFSTWAFTPSTWAIDN	TAXIS	53
	TIMESF=#LTS7E/{{ALAST-&FIRST}#A10N}	TAXIS	54
	THELPARELPAIUNTIMESE	TAXIS	55
	RETURN	TAXES	56
e		TAYTS	57
c	DRAW AXIS ONE INCH UP FROM PLOT SOUNDARY	TAXIS	58
C .		TAYES	59
15)	. CONTINIE	TAYIS	50
	CALL PIOT(4+0,-12+0,-3)	TAXIS	61
	CALL PLOTID.0,1.0,-3)	74115	62
	CALL ARTSCC+UpusOp1H p+1pPLTSZFp+HTICKp1pC+33	TAXIS	63
C		TAXIS	54
C	ANNITATE AND LABEL AVIS	TATIS	65
C		TA ¥T 5	65
	4Cn==*12	TAXIS	67
	TCH=3+3	APAId .	6.
	ACHIATIPST	TAYTS	59
	14 22 4 40 4 4 1 CK	TATIS	70
	FALL MINPLI (ICH) TCHPL + JPACHP11	TATIS	71
	TCHATCHATDEL	TAYTS	72
		TATIS	73
563	FIRTENJE	TAYYS	
		TAKLS	
	[F (NAT(SotQoZ) GU IC 2:0	TAXIS	74
	*#EL CHERTICHETCHETCHETCHETCHETCHETCHETCHETCHETCHET	74715	7.
	A MER COMPANY AND COMPANY FOR FEASTER FEASTER		
	CALIBN CALIBN		
	CONTINUE	74 47 6	12
• • •			
	CALL CHARTTCH.YCH. 3.16.64TTHE.61	TAVIE	
	BETION		
	END	TATT	
	SUMPOUTTNE TRAJEC	TRAJEC	2
c		TRAJEC	3
c	THIS SUBROUTINE CALCULATES THE VALUES OF THE FLOW FIELD	TRAJEC	•
c	AND THE PAGNETIC FIELD COMPONENTS ALONG & SPECIFIED	TRAJEC	
c	to Y TEC LUGA	TRAJEC	6
r		TRAJEC	7

THIS SUBROUTINE CALCULATES THE VALUES OF THE FLOW FIELD	TRAJEC	
AND THE PAGNETIC FIFLD COMPONENTS ALONG A SPECIFIED	TPAJEC	
TPAJFCTORY	TRAJEC	
	TRAJEC	
LEVEL 7. APARA, BPERD, BNAPH, BNAF, AANG	BCOMPS	
"DENTN /BCDH45/ 84884(20.100).47548(20.103).59994(20.103).	80,0445	
* ************************************	BÇ QMP4	
COMMON /PIN/ ANGP, ANGN, KSCON, SCON(27)	414	
COMMON /ROUNDE/ X500(100), VR00(1111),X54K(130),V54K(13/),	8.709974	
Nº44Y, NYHAY, AFACH, GARWA, HP 7, NHI VDI	8311435	
LEVEL 2. ANG. DITHADEG	DRD	:
COMMON /DRD/ ANG(20,103), DYT4(103), DEG	DRP	
COMMON /FLOW/ XC(20,10)1.YC(2),1001,VF(25,1001,RHOF(25,1001	FLOW	
COPHIN /TRADAT/ NTRAJ, TTRAJ(1,0), FTRAJ(101, YTRAJ(104), 71041(100)	. TR JDAT	
• VTPAJ(1,3), VXTRAJ(100), VYTPAJ(10,), V7TPAJ(100), THPTRJ(170),	TUJDAT	
* %TPAJ(100).8%TRAJ(100).8%TPAJ(100).8779AJ(100).8379AJ(2'L).	TRJOAT	
+ PTRAJ(300)	TRJDAT	
LOGICAL LPLTRJ	TROOT	1
COMMON / TO OPT/ LPLTDJ, DOLNT, VINF, RHOINF, THPINF, SINF	TROPT	
	79 4 3 EC	1 !
FTPAJ(1.J.VAL)={GI+VAL(1.J)+{1.0}-GI)+VAL(1+1.J)+OJ	TRAJEC	10
+(0[+VAL(1,J+1)+(1,C-0])+VAL(1+1,J+1))+(1,C-0J)	TRAJÉC	- ī'
	TRAJEC	1
FANGN=595{ANGN}	TRAJEC	- ī ·
SANGN-STN (ANGN)	TRAJEC	24
CANGP=rnstangp}	TRAJEC	ž.
SANGP = STRIANGP)	TRAJEC	2
	TRAJFC	21
CONVERT X, Y, Y FOR TRAJECTORY FROM UNITS OF PLANET RADII	TRAJEC	24
TO UNITS OF IONOPAUSE NOTE RADII	TRAJEC	21
	TRAJEC	20
TF (PPLNT .EQ. C.) 60 TO 20	TRAJEC	21
DO 14 NOLANTRAJ	TRAJEC	21
XTRAJ(4)-XTRAJ(N)+RPLNT	TRAJEC	Ž
YTALINA YT BAJINA ODD NT	TRAJEC	ū

		7TRAJ(N}+ZTRAJ(N)+RPLNT	TRAJEC	33
		R T# AJ (N) = SQRT (Z TRAJ (N) + +2 + Y TRAJ(N) + +2 }	TRAJEC	32
	25	CONTINUE	TRAJEC	33
ç			TRAJEC	3
ç		ROTATE ABDIJT X-AXIS UNTIL 7+3+0	TRAJEC	30
÷		10 150 N=1, NTRAJ	TRAJEC	3
		THE TO ATAN2(ZTPAJ(N), YTRAJ(N))	TRAJEC	3
		57467=67817467) STHEY-STNITUETS	TRAJEC	40
		XP=XTRAJ(N)	TRAJEC	4
		YP-YTRAJENI+CTHET+TTRAJENI+STHET	TRAJEC	4
r		7Pelle A	TRAJEC	44
č		INTERPOLATE FOR FLOW FIELD	TRAJEC	- 23
с			TRAJEC	4
		CALL TJTPAJ(XP,YP,T,J,QT,QJ,MFLAG) TE INFLAGI 80.40.00	TRAJEC	4
	43	CONTINUE	TRAJEC	50
		PHT=FTPAJIT,J,ANG}	TRAJEC	5
		VTPAJ(N)=FTRAJ(I,J,VF)	TPAJEC	5
		THPTPJ(N)=1_;+((GANHA-1_3)+5_5+AHACH++2)+(1_7-VTRAJ(N)++2)	TRAJEC	5
		Conlocation 13	TRAJEC	
		ZAN TAZIA(AMI)	TRAJEC	5
		WYTPAJENJ+VTRAJENJ+CPHE+CTHET	TRAJEC	5
		VZTRAJ(H)=VTRAJ{N)+SPHI+STHET	TRAJEC	
ř		THTEPPOLATE END MACHETIC STELD	TRAJEC	6
è		The deale the second second	TRAJEC	5
		*PARAT=FTPAJ(T,J,N*ARA)	TRAJEC	5
		10 11 0E00 10 102 9PFPDTnFTPA (17.1.00CDD)	TRAJEC	6
		SWNPHT-FTRAJIL, J. RNOPH)	TRAJEC	6
		PST=FTPAJ(I,J,RANG)	TRAJEC	6
		<pre>cbc1=cuclbc11 <pre>cbc1=cuclbc11</pre></pre>	TRAJEC	5
		AVINE PUCANENTENEP	TRAJEC	2
		NYTNEP+CANGN+SANGP+CTHET+SANGN+STHET	TRAJEC	7
		47145P#SA4GN#STHET-CANGN#SA4GP#STHET ANCPD=ATAN248YTNED. BYTNED.	TRAJEC	7
		ANGNOVATANZ (RZTNEP, SORTINXINEP++Z+RVINEP++7))	TRAJEC	
		CANGPP+COS(ANGPP)	TRAIEC	7
		CANGNDA-COST ANGNDS	TRAJEC	7
		SANGNP=SINEANGNP)	TRAJEC	÷
		* VP=CANCNP+(CPHT+CANGPP+PARAT+CPSI+SANCOP+APEPPT)	TRASEC	7
		**************************************	TRAJEC	90
		************	TRAJEC	. 8
		*YTPAJIN}=NYP+CTHET-BZP+STHET	TRAJEC	
		4TR&J(4)=508T(4Y###2#RY###2#R7###2)	TRAJEC	5
		40 TO 1.	TRAJEC	
Ş.,			TRAJEC	•
ċ		(#1 15 14210: 1:)#08035	TRAIFC	74
	63	TONTINIF	TRAJEC	9
		VTPAJ(%)=0,0 POTPAJ(N)=	TRAJEC	3
		THO TO SENDADAD	TRAJEC	3
		VXTDAJ(*)=0.0	TRAJEC	9
		VYTP4 J(N)=	TOAJEC	9
		4TRAJ(4)=0.0	TRAJEC	3
		9XT#LJ[4}=0.0	TRAJEC	
		17704 (KN)-2	TRAJEC	9
		67 TO 146	TRAJEC	101
c			TRAJEC	10
2		POINT IS REVOND BOW SHOCK	TRAJEC	121
·	95.	CONTINUE	TRAJEC	174
		VTPAJINJ+1.C	TRAJEC	100
			TRAJEC	131
		AX1647(4)+1/2	TRAJEC	10
		VYTPAJ(N)-0.0	TRAJEC	ii
		V?TRAJ(H)-J.J	TRAJEC	11
		strajtnjetauchetaucp	TRAJEC	11
		AYTPA JIN) - CANCHESANCE	TRAJEC	- 11

٠.,

c c

> C C C C C

C C C	NZTRAJENJOSANGH 100 CONTINUE Outpijt trajectory information, and create plots if requiped Call Trout	TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC	115 116 117 114 119 120
	FALL PLOTTS CALL PLOTTS CSL CONTINUE Return FND	TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC TRAJEC	121 127 123 124 125 126
	1180011714E TANIT		_
ç		TROUT	2
č	FLOW FIELD AND MAGNETIC FIELD COMPONENTS ALONG THE TRAJECTORY	TROUT	4 5
ĉ	AS TABLES WITH TIME AS THE REFERENCE QUANTITY	TROUT	6
	CONMON /ATH/ ANGP/ANGN/KBCON,BCON(20)	AIN	2
	<ul> <li>NBMAX, NXMAX, AMACH, GAMMA, HRI, NHENDX</li> </ul>	100005	23
	LINEICAL LPERUNALPRELALPRETALPRECONALPREALPLITALTALAJALRETRT COMMIN /PPOPT/ LRERUNALPRELALPRETALPRECINALPREALPLITALTRAJALRETRT	PROPT	2
	COMMON /TPJDAT/ NTRAJ,TTRAJ(130),XTRAJ(15),YTRAJ(10), ZTRAJ(130),	TRUDAT	ź
	• RTRAJ(100), BXTRAJ(160), BYTRAJ(160), RZTPAJ(160), POTRAJ(160),	TRJDAT TRJDAT	1
	UNATAL LPLTQJ	TR JOAT TROPT	5
	COMMON /TROPT/ LPLTRJ,RPLNT,VINF,RHOTNF,TMPINF,SINF	TROPT	j
	COMMON /SUNDAT/ LSUN, XTRAJS (100), YTRAJS (100), 7TRAJS (100),	SUMBAT	3
	TINENSION WITHAJS(100), WITHAJS(100), WITHAJS(100), WITHAJS(10), WITHA	SUNDAT	14
с	• BYTRAJS(100), 92TRAJS(100)	TRINIT	15
ç	WRITE COORDINATES (X,Y,Z,R) AS A FUNCTION OF TIME,	TUDT	17
č	TH GRETS UP BOTH RG AND RPLANET	TROUT TP (P)T	10
	RN955=1.0 TF {RPLNT_GT. 0.03 ENDSFe1_0/RPLNT	TEDIT	20
	WPITE(6,1000)	TOUT	22
	WRITE(6,1103) RMOSE	TERNIT	23
	49176(5,1230) 70 20 M=1.NTRAJ	TROUT	75
	Y#PLNT=XTPAJ(N)+RNJSF	TROUT	27
	TROLAT-ZTRAJENJERNOSE	TROUT	24
	R#PLNT-RTPAJ(N) +#NJSE XT=XT4AJ(N)	TENUT	30
	VRITE(6,2333 N,TTRAJ(N),XT,YTRAJ(N),TTRAJ(N),RTPAJ(N),XPPLNT,	TROUT	32
	23. CONTINUE	TRUT	33
č	WRITE OUT FLOW FIELD AND MAGNETIC FIFLD COMPONENTS	TROUT	35
ç	NON-DIMENSIONAL WITH RESPECT TO FREE STRFAM	TRMIT	37
Ť	WPITE(6,13uC)	TROUT	30
	WRITE (6,1721) WRITE(6,1400)	TROUT	40
	VEITE (6, 1530) DD 60 Mai MTRAI	TROUT	42
	WPITE(6,2100) N, TTRAJ(N), VTRAJ(N), VYTRAJ(N), VYTRAJ(N), VZTRAJ(N),	TROUT	44
	40 CONTINUE	TRAUT	45
ĉ	WTTE OUT FLOW STELD AND MACHETIC STELD COMPONENTS	TROUT	47
ç	DIMENSIONALIZE BY INPUT FREE STREAM VALUES	TROUT	49
•	SANGN-STN (ANGN)	TROUT	50 51
	CANGN=COSCANGN} Sangp=Stmlangp3	TOUT	52
	CANGP-COS(ANGP)	TROUT	54
	X U= 5 I NF + CAN GH + CAN GP Y O= 5 I NF + CAN GH + CAN GP	TR (M) T	55 44
	2 0= AT NF +5AN GN WRTTF (A- 3 380 3	TOUT	57
	WRITE (6,1001)	TROUT	54
	W# I TE (6, 1630)	TROUT	40

	MAILE(0,1700) AUTCH CANNA'S LINE'S AINE'S XO'S SHULHE'S A OF LUE'S XU	TROUT	61
		TROUT	62
	111 OU WEIPRIKAA	TEMIT	63
	801-9878834878878787	TROUT	64
		TRINIT	65
	*;	TRONT	66
		TROUT	67
		TROUT	68
	SDTM-STRAICHIGHTHE	14.101	89
	AVOTH-RYTEAJINIANTHE	TRUUT	70
	AVDIM-AVTPA JINI GAINE	10.001	
	87014-8778AJ(N)+814F	18 991	
	WEITE (6, 2234) No TTRAJ(N), VOIN, VIDIN, VYDIN, VYDIN, PHONTH, THONYH,	78017	
	BDIM, BXDIM, BYDIM, BZDIM	TROUT	
	63 COMTINUE	TROUT	74
	IF (LS114) 60 TO 70	TROUT	77
	et tûs v	TROUT	7.
ç		TROUT	79
5	TRANSFORM DUTPUT QUANTITIES TO SUM-PLANET COORDINATE SYSTEM	TROUT	
e.		TROUT	81
		TRAJT	92
	17977777777777777777777777777777777777	TROUT	- 43
		TROUT	- 34
	7784JS[N]=7784JS[N]+00 NT	TROUT	
	75 CONTINUE	10.01	70
	TEMPA7-474NG4.01745329		- 17
	TE##0L=POLANG#+31745329	TROUT	
	<a7=sin(tempaz)< td=""><td>TERUT</td><td>30</td></a7=sin(tempaz)<>	TERUT	30
	647+0958754P47)	TROUT	
	<pre>\$POL=\$TW(TEMPOL)</pre>	TROUT	
	CPOL-CAS (TEHPOL)	TROUT	
	TH RO HEINTRAJ	TOUT	94
	#T#A15[N]=5 QR T[YTRAJ5[N]+YTPAJ7[N]+7[A]5[N]+7[A]5[N]+7]	TROUT	95
	TTALJS(N)=-CAZ#CPOL#XXTRAJ(N)=SAZ#YYTRAJ(N)=CAZ#SPOL#Y7TPAJ(N)	TROUT	96
	VTIKAJSINJE SAZECPOLEVITRAJINJ-CAZEVYTEAJINJ+CEZESPOLEVZTEAJINJ	TR O'IT	. 97
		TUNIT	49
	RYTRA 15 (M) = C = 7 + C = C = C = 1 + A J (M) + C = 7 + 7 + A J (M) = C = 7 + 6 + 7 + 6 + 7 + 6 + 7 + 6 + 7 + 6 + 7 + 7	TOUT	99
		TERUT	170
	SJ CONTINUS	14101	101
	X95=-547+F9L+X0-547+Y9-C47+5P01+70	TROUT	102
	YOS=5A7+CPOL+XO=CA7+YD+SA7+SPOL+70	TROUT	103
	7 N\$ == \$POL +X O+C POL +Z O	TROUT	105
ç		TROUT	126
5	WRITE COMPDINATES (X,Y,Z,R) AS A FUNCTION OF TIME	TROUT	127
ç.	IN UNITS OF BOTH RO AND RPLANET	TRONT	198
C.		TE MIT	139
		T# (P) T	116
	WETE LOJIJUCJ	TUPPT	111
	MAILE (D)1701 MUSE	TUCHT	- 112
		1001	113
	YPPLTS-YTRAJS(N) PRINCE	TROUT	
	VAPLTS-VTRAJS (N)+RNOSE	78007	117
	TRPLTS-ZTPAJS(N) PRNOSE	Territ	117
	320HR+ERJ2RA	TRAIT	
	173-274 JS(N)	TROUT	119
	WPTTE (6,2500) NoTTRAJ(N),XTS,YTRAJS(N),ZTRAJS(N),RTRAJS(N),XDPLTS	TI D'IT	120
	*, YRPLTS,ZR*LTS,RRPLTS	TROUT	121
~	A) CUALINGE	TROUT	122
ç		TR 3117	173
2	WHITE FLUW FIELD AND HAGNETIC FIELD COMPONENTS	TROUT	124
2	NIN-PITCHSIUMALIZED WITH RESPECT TO PREESTRIAN	TENUT	125
	NOTTE (A.1300)	TROUT	126
	WEITE (6-1002)	TRUGT	- 127
	WRITE (6.1403)	TACIT	127
	WRTTE (6,1500)	TRONT	129
	00 95 H=1, NTRAJ	TRATT	1 2 2 2
	WPITE (6,2160) NATTRAJ(N)AVTRAJ(N)AVTRAJS(N)AVTPAJS(N)A	TROUT	117
	* VZTRAJSENI,ROTRAJENI, THPTRJENI, STRAJENI, BYTRAJSENI,	TROUT	111
	BYTRAJS(N), BTTRAJS(N)	TROUT	134
	YS TONTINUE	TROUT	135
C C		TROUT	135
2	WTITE FLUW FIELD AND RAGNETIC FTELD COMPONENTS	TROUT	137
č	UTHENSTOWARTERD BY INDAL «BEEZLBETW AVERS	TROUT	138
•	WFITE (6-1100)	TROUT	139
	WRITE (6,1002)	TROUT	140
	WRITE (6.1600)	TROUT	141
	WPITE (6,1700) AMACH, GAMMA, AINE, VINE, XOS, PHOINE, YOS, TRETHE, TOS	TROUT	- 122
	WRITE (6,1701) AZANG, POLANG	TROUT	144

20 A

.

#411- (D)*9731	TROUT	145
10 100 N-1, NTRAJ	TROUT	146
ADIm=AIKVI(W}+AINt	TROUT	147
AXUIN+AXIHT72(N)+AINE	180711	140
AAU EW-AAABV 72 (N) OAI NE	TEDUT	149
ASUIM-AILEVIR (VI) AAI ME	TRIVIT	150
PHODT==POTRAJ(N) +R 10TNF	TROUT	1 51
T##DT4=T##T#J{N}+T4#TNF	TROUT	152
BDI M-STRAJENI-BINE	TRIMIT	161
RYDTM+RYTRA IS INI+RTNE	TROUT	144
AVDIH-AVT#AJS(4)+ATHF	TERUT	166
ATOTA-ATTALISTNAATNE	TROUT	
WETTE (A. 27.4) N. TTRAJENS. UNTH. WYDTH. WYDTH. WYDTH. BUDDTH. THANTH.	TROUT	110
	14011	157
TCY FONTING	TOOLT	110
TE CONT. LETTER OF TO SEC		129
		150
C TRANSFORM FORMANY DATA TO SUNANY ANY COMMONYATES	10.001	191
Construction Construction of States Fragman Construction	18101	192
	TROUT	163
	TROUT	104
	10.001	105
4714AJ(~)+VTTAJS(4)	TOMIT	164
TTAJENJA TRAJECNI	TROUT	157
4x1#4j(+)+4x1#4j\${N}	TO MIT	155
44104J(N)+44144J3(N)	TPOUT	159
RTTBAJ(N)=RZTRAJC(N)	TOCPT	170
TEV CONTANIE	16011	173
20J CONTINUE	19 (M) T	1.15
⇒ C TIJE N	46 6134	172
c	74 (MJ 7	174
1003 FR9MATE1H1#52X#22HTPAJECTOPY CELCULATTON#53Y#99E_4493	TONIT	175
1001 FARMAT (5)X+30465ALAR VINA CHARDINATE SYSTEMP)	TENT	176
13"2 FORMAT ESUX,BUHESUN-PLANET CHORDENATE SYSTEMAT	TRCIT	177
1100 SORMAT(77753X,224T#AJECTORY CODROINATES753X,22(_H-)	TROUT	17*
* //*J¥+17493/@PLANET +,F#+43	TROUT	179
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	L. TROUT	1.45
# #¥# 944/0PLANET#2X+9H4/7PLANE*#2X,94*/QBLANE*,2X,9H8/00LANE*/)	TROUT	191
136. FORMATE/////36X.464FEDW FIELD AND MAGNETIC FIFLD COMPONENTS ALON	C. TORUT	1+2
<ul> <li>114 TPAJECTORY/36X,57(1H-1)</li> </ul>	TROTT	jej
14- STIPMATC/42X,464(NON-DIMENSIONALT7ED AV INTERPLANTIARY VALVES)	TROUT	
51 - TOP NATE //44,244,54,54,44TT HE, 78,644/VINE, 54,7444/VINE, 44,7444/VINE.	TRMIT	1.5
4 4X, 7447/V INF. 2X. 1. HR-10/PHOINF. 1X. 1947 440/THPT NF. 2X. 648/PINE. 5X	. TEMIT	186
* 74RY/PTNF.4Y.74RY/RINF.4Y.74R7/PTNF/}	TROUT	1 . 7
15C) FERMATE / 41% 484 (DIN' NSIDNAL . USING THOUT THTEES ANT TADY VALUES)	TROUT	
TLA FREMATE /2 14.36HTNTEPPLANETARY PACH NUMBER	TEMIT	140
294ENTERPLANFTARY MAGNETIC FIFLORD X.	TOPIT	19
• JOHOATTO OF SPECIFIC HEATS •• FO. 4. 94. " THMAGHT THDE		1 22
F1C. 3/20X. 3.4TNTERPIANTERRY VELOCITY     ALTER ANTERPIA	TROUT	103
• 134Y-COMPONENT = 10.3/2.4.	TEMIT	125
ALINTERIANTARY RENTLY     ALE ALINT ALINT ALE ALINT ALINTALALINT ALINT ALINTA ALINT ALINTI ALINTI ALINTI ALINTI ALINTI ALINT ALIN	TROUT	1 34
	11011	1.20
• 7(4TNTED01ANETADY TENDEDATIOT	TROUT	194
• 1347=COMPONENT =.clo.31	TROUT	217
The second	78017	1
	14.417	100
- reveaurrus ar ander ander ar subma ar	T 4 ( ( ) T	
1	10.411	237
	1879)1	11
//////////////////////////////////////	L C C P V T	1.1
<pre>cl: ************************************</pre>	TRINT	111
22. · · · · · · · · · · · · · · · · · ·	10 Line L	224
F N 1	14001	2.5

	SURPOUTINE VAXISEVSF,VOFFST,VINF,PLTS1F,LV)	VAYTS	,
с		VAVIS	2
ċ	SUBPOUTING VALUE CALCULATES THE PARAMETERS REDITED FOR THE	¥4 X T S	4
c	VERTICAL AXIS FOR THE TRAJECTORY PLOTS. THEN DRAWS AND	VAXIS	
ċ	LABELS THE AXIS. LV INDICATES FOR WHIPH COMPONENT THE	VANTS	6
ċ.	ATTS TS MEDITED. TT IS ASSUND THAT THE X. V. T COMPONENTS	VAXTS	7
Ċ	THREDTATELY FOLLOW THE RAGHITUDE PLOTS. AND THE PARAMETERS	VAYTS	
c	APE NOT RE-CALCULATIO.	VAVIS	•
ċ		¥4¥15	10
	34T4 #E942/1.5767963/	VAVIS	11
¢.		VAYTS	12
0	CALFULATE PARAMETERS, THEN DRAW ARES WITH TTOK MARKS	VAVIS	13
ċ		VAXTS	14
	1.5+1.9/1	VAVIS	15
	LCOMP+LV-17+LF+1	VATES	16
	1º (LC740, 6T. 1) 60 TO 10	AFAId	17
	CALL SFOFFULF, VINF, PLTSTE, VSF, VOFFST, MA, MTICK, AMIN, ADEL, VOEL)	VAXTS	1.0
	15 CONTENUE	VATES	19

		CALL AXIS(3.0,0.0,1H .1,PLTSZE,-HTTCK,2,PTONZ)	VATIS	20
ĉ		ANNOTATE AVIS. TO THE LEET	VAVIS	21
č			VAXIS	23
		TGHa−₀29 VCHa−₀35	ATIC	24
		ACHEANEN	VATES	26
		"U 30 4=1+416CK C#LL NUMPLT(TCH+VCH+G+3++C+1+ACH+1)	VATES	27
		ACH-ACH+AUET	VATES	29
	10	ACH+ACH+ADEL Continue	VAXIS	30
C			VATIS	32
ş		LAREL AKIS, AND WRITE TITLE ON PLOT	ATAIZ	33
		VCH2=C+S+PLTSZE	VATIS	35
		TC47+-0+8 VC4+01T575+1-7	A 41 4	36
		TCHaran	VANIS	38
	114	A7 17 1110,126,133,1401,LF	VANTS	29
		CALL CHARETCH2, VCH2,	PATTS	41
		- ALL_CHAP(TCH,VCH,)+C,+2,8HVELOCITY,*) TCH+TCH+1.#	VATIS	42
		60 TO 152	VATES	- 11
	123	CONTENIC CALL CHARTERIZ-VEHZ-T-1	VATIS	11
		CALL CHARITCH, VCH, J.C., 2,114TEMBERATURE,111	VAVIS	47
		TCH=TCH+2+4	VAVIS	4.
	12.	CONTINUE	VATIS	
		CALL SPEEKITCH2+VSH2+G+25+D+C+17)	ATAIC	51
		TCH=TCH+1.6	VAYES	52
	• • •	60 TO 150 60475405	VAVIS	- 54
	. • /	CALL CHAR(TCH2, VCH2, ( + 1, 5, 7, 148, 1)	VATES	56
		TALL CHAPTTCH, VCH, 3,00, 2, 34446642710 51510,143	VAXTS	57
	153	CONTRAIS.	VATIS	5.0
		CALL CHAPTTCH, VCH, 3+(++1+24V5+2)	VAVIS	se
		***************************************	VAXIS	51
		** (1 *.= 0.7 . 19. LF.E9.3) GD TO 362	AFALE	- 51
		*641#165 VC41#165	VAYTS	64
		60 To (210, 220, 230, 240). LCOMP	VAVIS	- 55
ŕ	2	¢0471NIF	VATIC	57
		CALL CHARETCHL, VCH1,C+Up+14,11HCHAGYTTUDE1,111	VATTS	59
		SALT PTTLATICA2++++594CH2+TC42++++594CH2++2+3 SALT PLTEN(TC42++++1494CH2+TC42++++1494CH2++++33	AAAAA	70
		5P Th 300	VAVES	72
	22:	" ON T' NILE	AAAIS	73
		CALL CHARITCH1, VCH1, C.D., 14, 13H(X+C34PONENT), 191	VATTS	75
		TPLL FHEFTTHZ+0.13,VCH2-C.05,C.0,C.1,14V.1) TO TO 300	VATE	74
Ċ			VATE	
	<i></i>	CALL CHARTTCH1+VCH1+C+C+14+13H(Y+COMPONENT)-131	WAYTE	79
		"ALL C44P(TC42+6+13+VC42-0+05+++1+C+1+147+1)	VAVES	* 2
•		54 TT 30C	VANIC	
	247	CUNTINIE	VAVIS	
		**************************************	AAALA	
c			VANTS	47
ř		193 LINN SCALING FACTOR IF PROUIDIN	VANTS	
	363	CONTENUS	VAVES	30
		1 - 144 -240 JT 67 TA 357 Trus-7,00	VAVIS	22
		Vf4+Vf42-*.35	VANES	93
		**************************************	44 Y C C C C C C C C C C C C C C C C C C	94
		TCH+TCH+0.30	VATE	46
		**##*L'ATTMA) ©4LL WIMPLT(TCH#VCH+#11#D#C#=36#¥N&##1)</td><td>VAVIS</td><td>97</td></tr><tr><td></td><td>95 A.</td><td>CONTINUE</td><td>VATIS</td><td>99</td></tr><tr><td></td><td></td><td>- CIU-1 SNA</td><td>VATIS</td><td>170</td></tr><tr><td></td><td></td><td></td><td>*****</td><td></td></tr></tbody></table>		

•

	FUNCTION VINTEP(X,Y)	VINTER	,
ř		VINTER	5
č	THIS PORCELLAR ENTERPOLATES FOR W AT (KJW) FROM THE GRED VALUES	VINTRP	4
-	COMMON /RLUNT/ THETA(251,00/20,20), MOLINY	VINTRO	
	COMMON /SOUNDS/ X83D(100) Y803(100) Y5 HK(15.1) Y5HK(150)	REINT	2
	· NEMAY, NEMAY, APACH, GAMMA, HED, HHINDY	801Wpe	Z
	COMMON /FLOW/ XC123,1031, YC123,1301, VF123,1331, RHDF131, 10/1	ET DV	;
	DATA 026/57.29578/	VINTER	è
	TF (X. GT.G.S) 63 T3 100	VINTER	10
	10/10/10/07/210026 30 13 NT-2-N010NT	<b>VINTED</b>	11
	TETHERLIT.THETALMENT CO. TO AN	VINTQP	1,2
	1) CONTINUE	VINTER	13
	2, *=50*1(x+x+y+y)	Aldies	14
	"THFT#(THTTALNT)=THET)/(THETA(NT)+THETA(NT=3))	VINTOR	12
	*#1=DT4ET#8PE1,NT-L3+E1,J-DTH=T3+8PE1,NT3	VINTOR	17
	71: 3) NR=2, NRMAY	VINTRA	1.
	TELO.17 PORT TO 11	VINTRP	19
	RP1#RP2	VINTRE	えい
	31 FRNTTWIT	VINTRP	21
	45 NR=[9P2-R]/(RP2-0P1)	VINTOP	22
	VINTDD+(DT4ET+VFINR-1,NT-1)+(1.C-DTHFT)+VF/NP-1.NT))+DB	VINTER	
	* +{^T4FT+¥FEN#, *T-1)+(1,C-DT4ET)+¥F(*R, *T))+(1,C-DR)	VINTRO	25
	BETIBA	VINTOP	26
,	NO 11* NT-NELINT NYMEN	VINTRP	*7
	TELY TT TELEVILLA CO TO TOO	VINTRA	2.8
1	L, CONTINUE	VINTOP	20
	HT=HTHAT	VINTEP	30
1	2, TTHET={*f(1,NT)-X}/(XC(1,NT)-XC(1,NT-1)}	VINTOP	12
	**1-*T4ET4YC61, NT-11+61.C-NTHET1+YC61, NT)	VINTRO	11
	10 140 N607 M647X	VTNTOP	34
	TETRITION CONTRACTOR (1, C-DIN(T) +YC(NP, NT)	VINTOO	35
	991m092	VIMTRP	34
:	3. CONTRAJE	VINTOP	37
	PETION .	WINTON	3.
	C NU	VINTER	12
		WALK VALK	Z
¢		VALK	
ç	CONTRUP PROGRAMS MAP, VALK, SERCH, ENTER, AND SHEEK	WALK	•
č	THENTET AN REESE STREASDAY HASA-ARES 415. FT4., AUG., 1974.	WALK	6
č	· · · · · · · · · · · · · · · · · · ·	WALK	
ć.	CIVEN THE POINT ON A LINE, THIS SUPPOINTE HALKS APOINT	WATE	ő
•	THE PEST OF THE LINE, RECORDING THE REST OF THE LINE.	WALK	10
ſ.	**************************************	WALK	11
	1(=:45')4 #111;TC44(4;1);ACONT(1)	VALK	12
r .	100 4 4 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	WAL.	
•	CO TO (10+11+12+13)+K005		
C		WALK	16
ç	OFTENTATION 18 UPWARD	VALK	17
76	JJ(1)**	VALK	19
	JJ121=J  1/21=141	WALK	19
	AK ( . ) ek	WALK	
	r#(2)+K+1	MATE	21
	KH (4)=4	VALK	23
	50 TO 15	VAL	24
ç		WALK	25
ц. л.	Jalijej Dereministre St. Di def bilent	WALK	26
••	JJ 7 2) + J + 2	WAL*	27
		_	27
	11(3)+3	WALF	29
	кк[]»к+] ??{}}	WALK	29 30
	JJ(3)=] «K(2)=x 	WALK WALK	20 30 31
	JJ(3)+] ««(1)+»+] ««(2)-» ««(2)-» «(3)-»	WALW WALW WALK	20 30 31 32
c	JJ(3)=] #{{}}=x+1 #k{}}=x \$60 To 15	WALW WALW WALW WALK WALK	29 30 31 32 33
c	JJ(3)=] #K(2)=# KK(2)=# KK(3)=K 60 T0 16 OPTENTATION 31 DOWNWARD	WALW WALW WALK WALK WALK WALK	29 30 31 32 33 34 35
с С 12	JJ(5)=J KK(1)=K KK(3)=K GD TO 15 OPTENTATION 34 DOWNWARD J4(1)=J+1	WALK WALK WALK WALK WALK WALK	20 30 32 33 34 35 36
C C 12	JJ(3)=3 W(1)=X=1 W(1)=X=1 K(1)=X GO TO 15 DPTENTATION 30 DOWNWARD JJ(1)=J JJ(2)=J	WALK WALK WALK WALK WALK WALK WALK	20 30 31 32 34 35 36 37
C C 12	JJ(3)=] #K(2)=x KK(2)=x KK(3)=x 67 T7 16 TPTENTATION 30 DOWNWARD JJ(3)=J JJ(3)=J JJ(3)=J JJ(3)=J K(1)=n=2	ATK ATK ATK ATK ATK ATK ATK ATK ATK ATK	20 31 32 334 36 38 36 38

	Martin		
		WALK	40
	K# (3)=====1	VALK	41
15	*2(1)+1	WALK	42
	K2{2}=2	WALK	43
	K2[3]=1	WALK	44
	60 TO 14	MATE	44
c		WATE	44
C	OPTENTATION 41 TO THE LEFT		47
11			
••		AALA	
		WALK	49
	31131-3-1	WALK	56
	****	WALK	51
	KK ( 2 ) = R	WALK	52
	<pre>«k(3)=k+1</pre>	WALK	53
16	**(1)=?	WALK	54
	*2(2)=1	WATE	54
	K2(3)=2	WATE	56
e .		MALW	
ř	5400 H THE 3 BUSINE E DIDECTIONS.		
14			
17	TALL SEPTHELIENS, KEINS, KOINS, A. INTH. TOUR MAN MOTOL MAL ALONG	-ALS	
•••	CHER JEAN AGAINING HIS STATISTICALL AND	WALK	60
~	RZENJPBCINIJ	WALK	63
C.		WALK	62
	#35=#311)+#3(2)+#3(3)	WALK	63
	1=(#35-1)1, 2,19	WALK	64
c .		WALK	45
¢	ARANCH POINT		
18	TELKILKONSI NELLI SO TO 9	444	
	¥6+K036		21
•		MUTA	59
		ATTK	75
Č.	UNS INT DAL OUT. FIND WHERE OUT.	MAEN	72
2	07 3 KA1+3	WALK	72
	TF(#3(#6)+EQ+1) 60 TO 4	WALK	73
3	CONTINIE	VALK	74
C		MATE	78
•	RECORD THE POINT		
4	CALL FUTEPERSTRATESTERSTERSTERSTERSTERSTERSTERSTERSTERST		10
•	A RUDE A MAN TURN TO AN A T	WAL-	
~	A DISPATIBAL BACUNIPISITIS	AVER	7#
÷ .	AFTER I AND Y	MATA	79
•	4 (IFA 6 176.2 F	MATK	47
	3-331843	WALK	-1
-	*=K((KC)	WALK	52
с		WALK	43
C	STE TE WEFPE AT A BOUNDARY, IF SO, DUIT,	VALK	RĂ
	1 ( J. CT. J4[ N] 67 T7 23	MAIN	
	FO TO (26+19+26+23)+K005		
23	TELJALTAJMANA GO TO 19		
	60 TO (24-36-34-30) work	WALK	
24		WALK	56
*-	171-746/453 971-17 I	WALK	
• •		WALK	9
25	IF(R6+E3+2) GO TO 1	WALM	91
	5H TA 19	WALK	92
26	TEE#6.F0.11 ED TO 1	WATE	03
c		WALK	94
19	IF(K.GT.KNIN) 50 TO 27		
	55 TO 19+15-29+281+8005	WAL-	
27	TERNIT WANT COTO B	WALK	
••	CO TO	ATEK	87
		WALK	98
20	THE SECOND GUID I	VALK	90
	511 111 -	WALK	105
29	1FFR5+=0+21 59 TO 1	WALK	101
	CD TO R	WARK	1.12
36	TF(K6+E0+3) GB TO 3	WALK	10.
с			104
ċ	PREPART FOR NEXT STEP	WALK .	191
ē	¥00A=4-XA	SAL N	102
•	KIDS & KIDS & K &= 2	WALK	136
	TENDETTIC	WALK	107
	** LRU172 = 51 = 63 K 075 = 6	WALK	169
	······································	WALK	179
	ee tu il	WALK	112
C		WALK	īiı
	3 CONTINUE	WATE	112
1	× 01 5 = 0	VALK	115
32	9 E TIIP N		
	FNO	WALL	114
	• •	WALK	115

ςιπθημιτικς Απηρίτε(j, κ, [] • Ομημιμ/Ομιζομι/Jamax, κπακ, jm, κη, τη ασι, αιρμα, σαμ, σαμ, σαμ, συ, στο το το • Ομηθη, μπα, μας, μαζας αδμής ομεσά, μυ, μι, τη ταυ, ττε τ, εμτ, στο ατ, ρ τακ,	45 H4 TX COH1 COH1	
---	--------------------------	--

÷.

2 2 3

FUNCTION VINTEP(X,Y)

с С 12

# 0 0 i	77		:2:	:5	;;	ŝ	21	:5	::	5		2	9 <b>9</b>	• •	6.9	<b>.</b>	1	-		27	12	22	5	*5	<b>8</b>	2	7;	r er	::	•	53	; ;	ŏ	56	53	;;	-	5 5	:	5	ć			~	~ ~	•	~ ~	n - 4	~ -	•
01.0479 01.0479 01.0479	9LUNT9 ALUNT9	AL UNTS		BLUNTS	AL INTS	1		AL WTA	9L IMT9	AL UNTA	AL UNTA	PLUMTS	al INT	11016	ALUNTS		at man		11.11	11 I'W TA		AL UNTS	IL UNT	-1414	1 1/1 1/1	1		I UNT	11111				MINT &		*L (NTA		11011		AL UNTA		11011			10076		5	i i	2.42	55	Alid
V(K, J=0(1,K, J)0(1,K, J)=FACV PHOFK, J=0(1,K, J)0(1,K, J)=FACV 10 (Thottwid)	NO 20 J=2,MBLUMT Theta(J =4TAW2(TC(1,J)=-TC(1,J))	00 20 KeljaKaka D1 20 KeljaKaka	20 CONTINUE 20 CONTINUE	WRITE(9) (J.TWETA(J)/DRSDX(J)/IK/RFIK.4)/KAL/FRAX//4-6/MAL/UM// 10 36 J-2/M6LUMT	¥R176(9) ], (K,×C(K, J),×C(K, J), ¥K(K, J), ¥Y(K, J), R40F(K, J), K•L, KA4X) 		TE (JMAX GEQ. NXI) 50 TO 60 Do an i-nyi-im	WRTTT(9) J, XC(1, J), D%SDX(J)	AP 45 Kelkmak Vettergi k.yf(k.ji.yt(k.ji.vytk.ji.e4nfek.ji	41, FONTIMIE	e. contratere	C PPINT RUDY AND SHICK LOCATIONS	, , , , , , , , , , , , , , , , , , ,		(Palluter)	YKWY⇔-YG[KWAXpJ] 491T5f5+]133 J+X430+YG(]#J]+X54K,YG(KMA¥+J]		11. CORRETT/7274 BODY AND FINEL STOCK STEPE// A theiterstockingstreetstockingstreetstockingstockingstocking	· • • • • • • • • • • • • • • • • • • •	C ftteptive blave end midrive rong at tugtamot blogbeet	·····································								0 2 3 1 2 4 2 0 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				I [ Aenofiei] esetue; ] estate and a setue of the setue o	555(4,51)=00BX0EVFFKF	RANG (K. TIAPAJAPKATNE/RINE		2°+		953(1441)=44,14,14841) 95797(441)=-454(14,4844,21,21,44,141,4844,31	PSeutar (rrt + D.a)	C 7			Sile built we should be a set of the set of	· Later A. C. C	49 14 5 01 45 50 145 JCS TASCLIS PT HOR 4, PHOSE NT 45 6, NPUNCH	LEVEL 7.X*Y.XET.XET.XEY.XEY.A Pommany (com22 ktad.201.Xtac.201.KETtad.20.7).VETtad.25.21.	• YEY (40,20,21,0(40,20)	t EVEL ?povEFs5s6p49 rm4nn /cn43/ ot40.20.41.FFt43.41.5t43.29.41.6t43.41	- COTATATATATATATATATATATATATATATATATATATA
***	<b>4</b> N	en vo	) F (	•	1	2	61	1	11	5	00	. T.	2 6		4° 4	<u>.</u>		<u>د</u>	, . M	25					~ ~		• •		••		~ *	• •	• •	n <b>n</b>	<b>m</b> 4	•		1	•. 9	11	 52		4 L.	56 26		0 4	1	22		
	C0M2 C0M3	CTH3 ARMATK	A9117X	X	48 44 T V		174464 174464	*****	441474 44174		4944TX	21 MM F 2			A944TK	117-17 194471	11465	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		1 2 4 4 7 X					1. IN T	5			10	55	54079 B	104	AC Date	She hi	<b>TO ANCE</b>	A TOTA	1 Ni 1	1		LINI H	11 11113	INT I	4 (MT4	N. WT	AL UNTA	-1-1-1		AL UNTA		AT UNT A
'T, HORN, RNOSE, NCASE, NPINCH '21   XET(43, 20, 21, YEX(40, 20, 21,		F(40,4),S(40,20,4),E(4),AB(4,4) Given J-k Node Poimt. A hatrix if [=].											6 G) €'] ← T 7 7 €(			12 €U 2.016¥+T									and the strong tradit for strat. for 51.500. then		So TA PCL USo PTo 40840440550 4040550 NPUNCH FR x FF - C	2234 YEAL #231 # XET (43+27+71+ YEAL 40+20+21+		 . 21 okto FF (40okt) = 514Co 20okto C(4)okk(4ok)	L 7T "47ENN"47400, N4PL 0T 24145 - 24142 - 24142	3+1031+VC(23+1041+VC(34)35+P440F42C+1CF)		2012/11041(24012CL) ACM964MF044208114F00214F04114F006(2003)0				14LUNT 905Y CALCULATI 7N/534+22[144]//}								Aliai ata gata Li Ngillan USTV	7 ( 2 M ) )		41,21/1ET(JoKMB1,21	

00 12 FF1,KHAR			
<u> </u>	E-STOR 7		SUPPOUTINE
9(1+K+1)=9(2+K+1)+00	##'2R ¥	9	I'DGTCAL LG
311-8-21-0012-8-21-030	N N D R Y	16	COMMON/WILK
2(1) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	8 N 7 K Y	11	514)-5481-
	# 4 D# Y	12	
	<b>BHUSY</b>	13	
THE THE UPDER SEPTAPOLATION TO STRUCATE SUPERSONIC DUTELOW	54D47	14	P (1814)
CARACTURDARY CONDITION AT JRAY	RNDRY	1.	~{*********
70 1 4+1,4	RHOPY	14	•
nd 7 K=S <sup>b</sup> KW	SHORY.		F2(4, P, C, D)
▖	BHORY	11	F2{A, A}=EY
> Df 4447.K3	10101746	10	c
GARASATISFY TANGENCY CONDITION HEING CHARACTERISTON - CHARTON		10	Conserve M. (Nat. ).
PO 3 Katal		zr	C
90 9 Ja	84 NEY	*1	
	44267	22	
· · · · · · · · · · · · · · · · · · ·	9408Y	23	
······································	ANDRY	24	14 (HeLTeS
11 Jac 100 ( Jp K , 7 ) +7	RNDRY	21	-
¥{];{};{}];{}];{}];{}];{}];{}];{}];{}];{}	PHORY	24	General THIS DETER
F2=0fJ;F;41+3fJ;K1	RHORY		r
3 *{J#K}={F2+C#{\$#F{J#K}#{}+{U{J+K}##2+¥FJ_K}##*3}#CAMM-			c
CasaComplity Parts Hartsvarts Patta Jaffa, SNN Watta Detwarture	BHDAY		T#4¥=301
OD 4 J=2+J#			*******
PY76119106143413-06614341344	34087	3.	TELANG
HYTE FIREHELAL TALLE ALTERATE	114 PM	47	01e3. : 6740
	RHPVY	3,2	BAD-14 A
BALINI- CALIFICATION 10 10 10 10 10 10 10 10 10 10 10 10 10	8408X	33	
	84027	34	
	94087	14	
a1(1)-a1(5)	RANKY	34	6. * 84UZ E
###\$\$J#\$#\$#\$Z#+##\$J##### <u>}}####</u> }#### <u>#</u> }###{J# <u>#</u> }###{J# <u>#</u> }###}## <u>#</u> #########################	PHORY	17	*ST40T=*
**************************************	BHDBY		TF (4.13.0)
"YT ( 144Y)=( 3.( + Y ( 144Y + ) - 6. 3+ Y ( 14. 3+ Y ( 14 13)) +			r
OF 5 Ja1. 1944		44	C
PT TAT J101-3. (0011-1) + + + + + + + + + + + + + + + + + + +		47	¢
	11 J - 4 A	42	2 CONTINUE
	RHOPY	47	TE (LONANA
· · · · · · · · · · · · · · · · · · ·	# # 17 P Y	43	
1-1J- 9-1-0 . J-E0- JMAX1 CO TO 5	n i n a y	44	5 10131
	93087	4.7	Cassassassassit
5 - CONTENIE	RHOPY	44	
P(1,2)P(2,2)			THETPINE
~fJ454,23+	ANDAY	11	Met
K • '	BNDOV		P=P*+1'LTA1
PD 2 J=1+JHAY			THETASTHET
CAR4557787594#883.537874.533		21	C
7+1,5/50PT(YEV(1,1,2)++++++++++++++++++++++++++++++++++		22	CONTINUE
	d H JA A		PaPta,
1. HAR 45. 6 19 19 19 406 19 19 45 76 19 19 49 6 39 19 4 6 39 19 19		*3	¥ #¥ #*
V#####. 11.10 10234UE 10334#=#E3010234WE30110474430125	RUNBY	54	TELW
	8N 7 8 Y	<b>4</b> •	¥-1 _2460
»	#40#¥	56 -	
» AEAL 1>1>44XEALT>1>45AELT>+64T>T>AEALT>	RNDRY	49	1000014[14]
> +{V/J+1}/V/J,1}}+FLDATEJCS}	ANDRY		
#T&!!#C###F####T&&J}###&J##########################	94787	* a	s continue
> 9574(1))-66			• E T 17P N
P1=Pf 1, 13+P TAHANTA', 2+1, 1368/1, 23		2.	S CONTINUE
7F (P1 - (1, 2,0) GO TO S	C-4-10-4	22	TE (4 .LT.
1) CONTINUE		22	nn 75 T+1+1
Trities at all and the state of a state of the state of t	24084	÷3	***********
1-132-027 -1-87799793921889341183111133 Banda James Andrik (1993)	4 N P & V	64	¥=1.c-#+C1
	4409¥	65	********
**************************************	8 N D Q Y	54	7 C T 40 T. T
1-1-11111111111111111111111111111111111	₿4 D¥ ¥	47	21.00
5 1411416577794327	****	5*	- 4 TE - 6714. **
en 1	a d u a A	59	THE TA _ THE TA
7 THETPOATANE-VEVEJ,2,23/VEVEI,233	PADEA	71	2. CONT.
P CONTENTS CONTENTS	99027	÷,	23 FUNTTHIE
113 # 01 #CPS # 7 HE TH F	8408Y	72	C
¥1=01=51wff4;T4;	SH DO Y		C HZE STNH
ntele (Intelect)	BUDBY	74	s
214-1-11-P'+D1	BN007		33, 8#BM052+H45
11,1,7,00,01,00T		11	¥=1+0-9+C49
061.3.3.3.007		10	APB+LINETAN
			e t tie a
> cumatanie 	RADBA	78	۲
The second se	BNNEV	79	CTHIS DETER
a a finad	9.4797	97	6
	RADBA	*1	CONTINUE
C PRINT RESTART FOR NECATIVE PRESSUR:	5404Y	42	Anter and
r i i i i i i i i i i i i i i i i i i i	RUNRY	**	1
a vettetail () essi	PUDEY	44	1
+2+145{+2}	ANDEY		TELANG .FO
10 TO 12	ANDPY		• 7 • 3 • 7 • 1 5 • 2
11) FRENATISTAGANACATTUE BEESSING ON ROOM DETCOTED AN ANDRE-AN			RAD=190.7P1
<ul> <li>A SUPPrint Price And AT Instant</li> <li>A SUPPrint Price And AT Instant</li> </ul>		77	"LTOTANC
			THETASPT #2.
- 72	는 에 다운 Y	40	RjeRwose

CUPPOUTINE ANDY(Y,X,RNO(E,ANG,H) Logital (Sray Compony Numpoy XX (1911-YY(191-V,Nand, (Sray	80 MY N'1 89 D	2
F(A)=EYP(-ARS(A-RNDSE }/4) F(A-R-K)=.644(S1N/2) - 0014(-1, )004(0), 05007/5/41-5/414431)	RODY	ì
> /(E(4)-SIN(R)0+2))	8110¥	5
• • • • • • • • • • • • • • • • • • •	9 30¥ 93 9¥	
F2{4,F}F/)+A+{A+C+SQAT(D+{;F})}/(D+F4) F2{A,F}FF/-A65{;2,FA}/A}	8(17Y 9(10Y	9
C Canada H (NA) 14 I TONDANSE FOR A NONPACHITIC BLANST	9.774	ii
Conserve H .FO & EQUATORIAL PLANS FOR & MAGNETTE PLANET	9 707	11
TER .= 0. J.JEN TO 10	9007 9007	14
TH (Haltaiau) GO TO 35 C	93 DY 90 PY	16
Geelevelethts determines the body shape of a nonhagnotic planet P	800Y	19
C THAT#303	5077	20
* 44 Y 41 = 1 H 6 X - 1	413-3¥ 913°¥	22
•f=3.1415926535698	990¥ 990¥	23
₽&D+3,40,4₽E DFLT&T++NG/FL4#TEE##X#1}	9304	25
THE78=	83NY	27
fST 40TH	400¥	20
1 - 1 - 1 - 2 - 2 - 2 - 5 - 9 - 1 - 7 - 2 - C	9977 8007	37
CPEPFOPM INTEGRATION FROM 5 TO KANGK DECRETS C	9.907	12
2 CONTINUE To (CORAN) CO TO AS	8004	34
n 5 Teistaptelaava	RGNY	35
C	870Y 800Y	37
LACIT ILLAL	# <u>) ŋ</u> y # ŋ ŋy	30
P=P[===:LTAT+F(R],T4ETA1,N) THETA=THETA+DELTAT	8344	41
C	900Y	42
P=P3+, 43+0ELTAT+FFF93, THETA3, N3+FF9, THETA, N33	800¥ 807¥	44 -
40407 Tel# 0170 5967 TP 1	9130¥ 8130¥	44
¥#*•.—=>+CNS{T45T4} ¥#₽+*T4{THFT4}	*()*Y	
	8007	50
•Etiba	800¥	5,
TE (4 ALTA GALI) AN IN BU	8.90¥	52 54
	8707	5*
¥=1	830Y	51
1 CT 40 Te T	8017 8017	50
TF (T4-TA +GC+ 5+C/9AD) 69 TO 2	839¥ 839¥	51
ZS CONTINIE	#9PY	52
	9797	54
	500¥ 577¥	55
Veleverecos (ANG)	80 PY	67 58
6tica Arbelica	9 () NY	Å 9
C	RUNY	'n
C C CONTINUE	407¥ 807¥	72
IMAXH 301	4977 7977	74
1468445 6836 Jaw BEMAXM1#1	101Y	76
97+3-7415925337898 RAP+192-7PT		10
OFL TO TOANG/FLOAT (ENAXME)	40.0¥	80
RjeRwose	900¥ 930¥	*1
	-	
,		

N Contraction of the second second

55	соната сонатија в 200 Ено	9707 9307 9007 9007 9007	145 146 147 148
	1	4097	148
			_
	SURPOTINE BIRICL, IU)	TPT	2
	LFVEL 2+0+EF+5+6+A4	COM3	Z
	COMMON /CO43/ 0(43,26,43,EF(43,41,*(43,26,43,6(4),AB(4,4)	C11#3	3
	LEVEL 2, A, 8, C, HD	COM	Z
	COMMON /COM4/ A(4),4,41,8(40,4,41,C(45,4,41,40(40,4,4)	C3=4	
	₩₩##L L11,L21,L22,L31,L32,L33,L41,L42,L43,L44	LUN	2
	COMMON /LUD/ L11,L21,L22,L31,L32,L33,L41,L42,L43,L44,V1,V2,V3,V4,	LIND	3
	<ul> <li>U12, U13, U14, U23, U24, U34</li> </ul>	LUD	4
	DIMENSION 4(4,4)	9181	6
C 1	INVERSION OF BLOCK TRIDIAGONAL A,B,C ARE 4+4 PLOCKS	9181	7
C I	EF IS FORCING FUNCTION AND SOLUTION IS DUTPUT IN EF, & IS OVERLOADED.	8787	8
c ,	NLOCK INVERSIONS USE NONPIVOTED LU DECOMPOSITION	ATRI	•
C 1	IL AND TU ARE STARTING AND FINISHING INDICES	ATRE	10

č	GOPERFORM INTEGRATION FROM / TO ANG DEGREES	BODY BODY	83 84
c		8007	85
	00 15 I=1+IMAXM1	83DY	86
C	. PEDICTOR	900Y	87
	THETALOTHETA	8007	
	PARIADEL TATAGURISTHETAS	BODY	99
	INE TANTHE TANDEL TAT	8707	96
		500¥	91
	<pre>**= 4</pre> *** L = C = C = C = C = C = C = C = C = C =	ROOY	92
		BODY	93
75	10411407 Ye3. 6-DACOS (ANC)	80.07	94
		<b>W3D</b> ¥	95
	5 E TIP M	5707	96
		8001	
·	LASTNTERPOLATE FROM USERSIDELTED BODY CALES	NUDY	46
~	ASSESSMENTS FROM USER-SUPPLIED HODY SHERE	8907	
`	CONTENIE	-00Y	136
		8007	121
	TE CATANZEVVETALAVETALANGA CO TO A.	5001	192
34	Continue	8007	103
40		80.07	117
••	#2=508T(YY(1=1)##2+XX(1=1)##21	8007	107
	ANGI - ATANZI VYITI. VYITII	80.04	190
	ANG2 - ATAN2 ( YY ( T - 1 ) . YX ( T - 1 ) )	8007	107
	P=R1+fanG+anG11/fanG2-anG11+f82-011	8007	105
	1-1-0-9+C75 (ANG)	RODY	110
	Y-STN(ANG)+#	80.07	
	PFTIJRN	8007	112
c		80.07	111
S	LADETEPHINES SUDV SHAPE WITH GRAVITATIONAL VARIATION IN H	PODY	114
c		RODY	115
45	CONTENTE	80NY	116
	TF (HoLToJol) 60 TO 20	9707	117
C		80.0Y	11*
C	WEPFORM INTEGRATION FROM 3 TO ANG DEGREES	8 <u>7</u> 9 Y	119
C		8307	120
	DA 22 INISTART, INAXHI	RONY	121
	AS-SIN(THETA)	<b>RGD</b> ¥	122
	AC-COS(THETA)	RUNY	1?3
_	THETA1=THETA	8304	124
C	G . PREDICTOR	#0.0¥	125
	e1==3(e7)4)	BODY	126
		509Y	127
	9PT=F2[7],45,4C,4])	BOCY	124
	1 - TIKA - LIGGO DI URI - Zg - H-AS-AT	5307	154
	1451 - 1451 - 1451 - 147	6044	130
		6507	131
	401-0001745143	4 I) NY	132
		5007	133
		1007	111
	A11=63(P+4)	800Y	132
	4.4	8007	130
	TE ENERY.IT.S.S. DEVENS. BUBICIBLES	5-307 800¥	
	\$1 OPE+-5+(D41+D41)	80.07	110
		80.07	144
	Ya¥e]	8107	141
	TF (#.LT.5) AD TO SC	8007	142
	Y=1+1-4+4C1	8007	141
	Y+P+451	9 GDY	164
	*1+*	83.07	145
	CONTENUE	5007	146
55			
55	P F T119 %	500Y	147
55	e șt tije N - E N ()	500Y	147

IS = IL +1 I = IL	STPI STPI	11
00 11 H+1,4	STRI	13
90 11 H=1+4	STPT	14
11 HEN, M) + REE, N, M)	STRI	15
CALL LUDEC(4)	BTPT	16
$\mathbf{n}_{1} = \mathbf{v}_{1} \circ \mathbf{e}_{1} (\mathbf{i}_{1})$	BTRI	17
V2 - V2-V2F(1)27 - L21+D11 D3 - V3+(SE(7.3) - 121+D1 - 137+D2)		10
N4 + V4+(EF(1+4) - L41+D1 - L42+D2 - L43+N3)	BTPT	żó
EF(1,4) = 04	STRI	21
EF(1,3) = D3 - U34+D4	ATRE	22
• EF(1,2) = D2 - U24+D4 - U23+EF(1,3)	ATPI	23
EF(1,1) = D1 = U14+D4 = U13+EF(1,3) = U12+FF(1,2)	1111	
10 12	8787	24
$D7 = V7+(C(T_{2},N) = 171+D1)$	9T#T	27
N3 + V3+( C(1,3,4) - L31+D1 - 132+D2)	<b>NTRT</b>	28
N4 + V4+1 C(1,4,M) -L41+D1 - L42+D2 - L43+D3)	ATRE	59
R{[;4;4] = D4	STRT	30
5(1,3,4) + D3 - U34+D4	4141	31
"{[j2j"] = D2 = U24#D4 = U23#B{[j3j#] #47.3.W1 = D1 = U14#D4 = U134#B47.3.W1 = U134#B47.3.W1		32
	ATET	3,7
12 CONTINUE	BTRT	35
90 13 I+IS, IU	STRT.	36
1* + T -1	9191	37
nn 14 N=1,6	STRT	3.0
EF(I, N) = EF(I, N) - A(I, N, 1) + EF(IR, 1) - A(I, N, 2) + EF(IR, 2)	ALAI	39
• -4([+Ny3]*FF([#y3] -A([+Ny4)*[F(T#+4]	9141	47
468.83 e 817.8.83 -417.8.2348178.3.83 -417.8.2348178.2.83	RTPT	
1 -4(1,4,3)+9(18,3,8) - 4(1,8,4)+9(18,4,4)	*T #T	43
14 CONTINUE	ATRT	44
CALL L"DEC(4)	BTRT	45
n1 = V1+EF{[,1}	ATRE	46
72 = V2*(EF(1,2) - L21*D1)	4787	
75 • VSV(CP(193) - CS2V02 - CS2V02) 76 • V60(FF(1,6) - 16]001 - 162002 - 163003)	ATPT	
FF(1+4) + D4	ATET	50
EF(1,3) = N3 - U344N4	STPT	- 51
FF(1,2) = D2 - U24+04 - U23+EF(1,3)	ATRT	52
5F(1,1) = n1 - U14+04 - U13+EF(1,3) - U12+EF(1,2)	STRE	53
TF( T = 10)16,13,13	ATRI	
15 Clist   mit-	8787	54
P1 + V1+C11-3-H3		67
N2 - V2+( C(1,2,4) - L21+D1)	ATRI	56
N3 = V3+€ C4E,3,H3 - 131+D1 - 132+D23	57#7	59
N4 = V4+1 2(I,4,4) -L41+D1 - L42+D2 - L43+D3)	ATRT	6C
4(Te6e4) = D6	ATAT	- 51
#11959M3 # US # H94+U4 #11-2.45 # 02 # H94+D4 # H92##112.5.45		41
=====================================	ATAT	
15 CONTINUE	ATRT	63
13 CONTINIE	9TRÌ	56
SALAR SHASTITUTION	STRI	67
TT + TL + TU	RTPI	6.
00 21 TT + IS,IU	RTRI	
TP + T+1	RTOT	70
nn 22 H+1.4	ATRT	72
FF(1,4) - FF(1,4) -8(1,4,1)+FF(19,1) -8(1,4,2)+EF(19,2)	STRT	73
* -*{[.N,3}*EF(19,3) -R(1,N,4)*EF(19,4)	STRI	74
22 CONTINUE	STRT	75
21 CONTINUE	STRI	76
# ETURM	RTEI	

x

SUBPOUTINE DISSIP	NT551P	2
COMMON/COM1/JMAX,KMAX,JM,KM,XNACH,ALPHA,GAM,GAMM1.CN.DT,SMU.IPQT.	CON1	•
> CHORDSNCASNCBSNCCSAASHSOMEGASNUSNLSTTSTAUSTTERSENTSPTORTSPENES	C041	ġ
<rinf, cinf,="" clus,="" horn,="" jcs,="" ncase,="" npunch<="" pt,="" qinf,="" rndse,="" td="" th,=""><td>COM</td><td></td></rinf,>	COM	
LEVEL 2,X,Y,KET,XEX,KEY.D	C0#2	2
COMMON /COM2/ X(49,20),Y(40,23),KEY(40,26,2),XEX(40,26,2),	C0#2	3
* XEV(40,20,2),D(43,20)	C0#2	4
LEVEL 2,0,6 F, 5, 6, 43	Com	ż
COMMON /COM3/ 0140.20.41.EF140.43.5140.20.43.6143.4814.41	COM2	
C SHOUTH IN THE X AND Y DIRECTIONS AND ADD SMOUTHING TERM TO S ARRAY	013578	
K##+K#-1	DISSIP	7

SUBBOUTINE EICEN	ETGEN	,
^ΠΗΝΟΝ/COM2/JΗΔΥ#ΚΗΔΥ#JΗ#ΚΗ#ΧΗΔCH#ΔLOHA#SAM#CA#HI#CN#OT#CHHI#TPOT#	CO#1	
> fHARA, "CAPNCR, NCC, RAPH, AMEGA, NUPNLPIT, TAU, TTER, ENT, PTAR, PINE,	6 1 *1	
COTHE, DINE, CINE, JCS, TH, CLUS, PT, HARN, RUNSE, NEASE, NEUNCH	C 13 M 1	
LEVF1 ?+Y+XET+XEX+YEY+9	C042	
COMMON /COM2/ X145,2Cl,X146,2,}x457145,27,27,27,43,25,21,	r 1 = 2	5
• YEY (44,22),23,0(44,20)	C0.82	
LEV <sup>E1</sup> . 2, Q, EF, S, G, AB	C 1 P 1	,
COMMON 203437 0140,20,43,FE143,6143,5143,20,41,41,41,41	CO#3	
CasaCOMPUTE STEPSIZE GIVEN COURANT NUMBER	FTGEN	i i
TF(1++T+GT+G) WEITE(6+103)	STOCH	
SIG#Aten.C	FTOFN	
10 1 K=3pKHAX	ETCEN	à
PD 1 J=1, JMAY	ETEEN	10

CHARTUTINE LECON(JAWAI)	EECON	,
COMMONICOMLISMAX, KMAX, JM, KM, XMACH, ALOHA, GAM, CAMMI, CH. DT. SHII. 1997.	C 1 41	,
> CHITED, NCS, NCS, NCS, AS, HATHEGA, NU, KLATT, TAHATT-S, SNT, BTORT, OTHE.	covi	
STINF, DINF, JCS, TH, JCS, TH, CLUS, PT, HORN, RNOT, NCASE, NPHYCH	che <sup>1</sup>	2
LEVEL 21X9V1X, TOKEROXEVON	C0.97	,
" 3MMTN /C3M2/ X143,2(3, V140,2)1,XET14,22,421,VEX143,2C,21,	C7#7	à
* *57(47)73)73)70(4)72(1	C3#2	i.
LEVEL 2+ Q+CF+S+G+AB	r ini	,
COMMON /CON3/ G[4:+2.+4]+FF[40+4]+S[40+4]+C[4]+C[4]+AR[4+6]	****	1
T+++COOM 5 CONSERVATIVE VARIABLES (T+1) OR COONSERVATIVE VARIABLES	Éschw.	,
C+++(I+Z) AT A RIVIN NODE OUTHT	ECC1N	7
4-0(1,4,3)	FERN	, i
₹ <b>1</b> #1 <u>0</u> :/₩	5 F C O N	¢
1=C13***53*8I	SECON	1.0
V=0(],*.3)*0I	25 CON	11
D(1=E4=+;+{0f};K;4}=H0 (;F+f)+(F+V+V)}	SECON	12
44-4-4(J-K) 1)	FECTN	13
AA====================================	FECON	1.4
7-464(1,4,1)	FFCON	1.5
- # = 1 / # 2 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 +	EFCON	14
- { 1 } + 40 * API / V	SECON.	17
S (21=9(3) ** 23** 4 PJY*YY*P(1)	EFC3N	1.
G[3]=0[J,F,3]+CAPUV+Z+PNJ	FFCIN	19
	7F()N	21
CONSCRETE TERM IN TAMMIN, CON. FOR AXISYMUCTRIC FINA	RECON	21
1+13' Set0+2+14E2+2+14E2+2+1+19+K+E0+K+AX1 2=+10+	FECAN	22
v ant/v(j,k)	6500N	22
· {J} ~ { } ] ~ { } ] ~ { } ] ~ { } ~ { } ] ~ { } ~ { } ] ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ~ { } ~ { } ] ~ { } ~ { } ~ { } ~ { } ~ { } ] ~ { } ~ ~ { } ~ { } ~ { } ~ ~ { } ~ { } ~ { } ~ ~ { } ~ { } ~ ~ { } ~ ~ { } ~ ~ { } ~ ~ ~ ~	55 CJN	74
\${J_\$K_\$2}=\${J_\$K_\$2}\$+3{J_\$K_\$3}\$*YT+11	FECON	25
\\J,F,J]=\\J,F,Z]+J[J,K,J]+V[+V	FE03N	? <del>6</del>
` { ! • # • 4 ! = ` { J , ≪ , 4 } + { 0 { J , # , 4 } + ₽ ] ]}	FE C 3N	27
	3643N	2.0
• ••••	FFC7N	54

1 m a = ] m = J		•
CARASHINT TNG IN #1 DIRECTION	013317	-
70 1 Ne. 44	111510	
DD 2 X+2-XW	612216	10
517-Kallast 2.Kallast 1960-12841-2. 14011	71551	11
		12
<pre>fills.c.utering with the second state is a second state of the second state of th</pre>	714416	13
	012216	14
~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	UI22ID	15
	01221P	15
10 S 1=3, 14M	919910	17
2+ 5(J)#3)=5(J)#8,N3=5HU#0,125#(Q{J=2,K+H3+0([=2,K3=4,(+n{J=1,K3)}	PI551P	15
> +0 fJ−1+K}+5+5+5+1+K+N}+2 fJ+K)+4+0+7fJ+1+2+K+N}+0 fJ+L+K+0{fJ+2+K+N}	015510	10
> +n(j+2,K))/n(j,K)	PISSIP	2r
CSHOUTHING IN LIA DIRECTION	DISTIP	21
<b>℃ 1 J=2, J</b> H	015510	· · ·
\${J#7#N}#\${I#2#N]+\$#U#6#125#{-?#J#0{J#1#N}#9{J#J#5#N#0{J#2#N}	912210	22
> *n { J, *1-6, 0*0{ J, 3, N1 +n (J, 31+3( J, 4, N1+n { J, 6) } /n { J, 2 }	012210	34
5 [ J+ # 4+ H) =5 ( J+ KH+ H) =5 H) +3.125+ (-7.1 + 93 ( J+ KH+4. H) +9 ( J+ KH+4.) +		
* f. 040( J.KH.N) + 0 ( J.KH) + 4. C+0( J.KHN.N) + 0 ( J.KHN) + 0 ( J.KH-2.N)	DISTIN	5.
> +D(J,KH-2))/D(J,KH)		
00 1 K+3+KHH		
5 1 JeK + M 3 - St JeK + M 3 - St M 2 -		
> $\pi n [J_{ak} = 1] + 6 \pi f \oplus 0 [J_{ak} = 1] + 6 \pi f \oplus 0 f J_{ak} = 1 \oplus 0$	012310	1.
> +0( 1.4 - 2) 3 (0 - 1.4 )	91251	31.
5.5715 H		
		32
	012210	33

Ч	
σ	
Ν	

		1,
** \$\$\$\$##\$\$\$\$\$#\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$	ST GEN	24
1 + FORMATE215,2F12.6)	FTCEN	26
2 FORMATELEDOM NETCONTINENE STERSET. 24. THETEMAKE SOFTA & AN ANAL		17
	616-M	j.
	FICEN	31
0 - T()4 N	ETCEN	3.2
É N Û	FTGEN	11
		,,
SHADDITTNE INITIA	INITIA	,
**************************************	CO.91	,
> CHOPDANCAANCRANCCAAAAHAOHEGAANUANIATATATATATATATATATATATATATATATATATATA	e de la	;
COINE, OTNE, CINE, ICS, THEOLIS, AT. HODE, ANDRES, MARKET, MARKET,	C 9 4 1	1
	19-7	3
Commit 7CH#27 Altajs2r 157865221578167921578140521578846521521	CÚMS	•
• ¥=Y(40,23,23+0(4,+2C)	0.0 #2	4
LEVEL 2,0,5 F,5,6,49	CJ#3	2
COMMON /COM3/ 0(4)/20/41/EF14//41/5145/20/41/C141/AP14/43	C 3 #3	3
1 EV-1 2, 4, 4, 7,40	C 1944	2
COMMON /COM4/ 4140.4.4). P140.4.4). C140.4.4). 401.4.4.4)	C 11 HA	;
P1=3, 14: F92654	TNTTTA	÷
		<u> </u>
		-
	1 1 1 1 4	4
· [ · · · · · · · · · · · · · · · · · ·	INTTIA	12
T PU T = _	INITIA	11
220420.01	ENITTA	12
162-1	ENTTEL	13
PHOCE #1 #1	TNTTEA	14
< mile	TNTTTA	15
CINF=57P7(#INF+5A4/#INF)	TNTTTA	1.4
AL PHILAL PHA/ PAPT	TNITTA	÷.,
ATNE-YMACUACTNE		
		17
	141114	14
1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	ENTTE	24
11-1-1-1	TNITIA	21
x = x = y = 1	ENTTE	22
	1417TA	**
\$A#11=1+(/GAM#1	INTTIA	74
TAU=0+1	TN TT TA	25
1T=C	1	24
TANAL GOATE Y AND Y NODAL POINTS OF MESH	INTTI	
214 100 1142		
	141714	~
	141114	20
	INTTIA	36
AT AT AT A A A A A A A A A A A A A	TNITIA	3?
70 1 K=1,KMAX	INITIA	32
DO 1 (#1,944K	INTTA	33
0]=1, J/0(J, K)	TNÍTÍL	34
76 J+K+11 =01 NF+D1	TNTTA	3.
Q[]=K=21==TNF+1TNF+01		
11.4 . 31.0 T NE OVINCONT		
AILE ALGERT MEAN AND AND AND AND AND AND AND AND AND A	141114	
	LNITIA	3.0
A A A A A A A A A A A A A A A A A A A	TNTTTA	39
10 1 H 194	INTTIA	40
1 (1)4 (4)=0.0	TNITIA	41
TeeeINTTIALITE FLOW FIELD FOR ALUNT ADDY PROALEM	<b>ENTETA</b>	42
Campingamesia.	TNITIA	63
XAFE, 5 DO	THITTA	
TEEABSEXEXE		
6 THETHON / PADI	1. 17774	71
	EN JE LA	
7 74674 474 487 474 5 4 5 4 7 4 7 4 7 4 7 4 7 4 7 4 7	INTTA	47
	LNITIA	4.8
- Vielente	TNETEA	49
	TNITTA	50
54NG=7=5=PI-ATAN(-XEY(J;K;2)/XEX(J;K;2))	TNTTTA	51
#X=#MAC4++2+\$IN(\$ANG}++2	TNITIA	52
	• • •	

,

	P1=1.3/0(J,#,1)		
	1=0tJ=K=2}++T	FTCEN	
	V=0{J,*,3]+*]	FTCCN	
	545404714V+V+V+1+1	STOCK	12
	x1x+rExfJ,r,1)	67464	- 12
	x1A=xEA(1*4*1)	ET CEN	
	FTAX=¥€¥{J,K.2}	FT CC.	10
	ETAY= YEY ( J. 4. 2)		- 17
	TGATAS IT I TALL	61424	1.
		TGEN	1.0
	CTCABA4444, /CTCA_CTCAA	616 <u>5</u> 0	27
	TETETELLOT CTANT ATTANY PTOIN	ETGEN	21
	TELEVISION CLOBER, SLOVERNIGER	eicen	22
	1971	ETGEN	23
		ETCEN	24
1		FTCEN	*5
	THUR TATAL IGNAL	FTGEN	26
		ETGEN .	27
t	<u> </u>	ET GEN	2.5
٠	EDE=41(21:,2F12.6)	ETCEN	29
2	FORMATE//224 DETERMENENG STEPSIZES, 34, 74556444, 1PE11, 4, 34, 340 Map	FEGEN	30
	• E9.2.3K,347T=,E11.4//3	ELCEN	

YEX(1,K,1)=-XEX(2,K,1)	INITTA	91
XEY(1,K,1)=XEY(2,K,1)	THITTA	92
¥F¥(1,K,2)+¥F¥(2,K,2)	TNITTA	
XFY(1.K.2)=-XFY(2.K.2)	THITTA	94
DO 5 W+1.6	TWITTA	
5 0f1-K-M180f2-K-M140D	THITTA	
	THTTTA	
	THEFTA	
	14(1)14	••
TUARDUTING INTERR	TNTEGR	2
<u>ϹͲΝϤϮϤͿϾϹϤϤͺͿͿͿϐϪϫϧ</u> ΚΝΑΧϧͺͿϷϧΚΝϧΧϤΑϹϤϧΑΈϘϤΑϧϬϐϤϤͽϬϐϤϤͽϲϹΝϧϴϮ϶ϚϷϤϧͳΡϚͳͽ	C7#1	2
> CHORDONCAD NCBONCCO AADADOMEGAD NUD NLOTTO TAMO TTERDENTOPTORTOPTINED	CO#1	2
COTHES GINESCIMES JESS THOLISS PTSHERNSRNOSESNELSES NOUNCH	0.041	4
1 EVEL 2. 0. FF. S. G. AN	COM3	5
CONHON /CON3/ 0(40,20,4), EF(40,4),S(40,20,4), C(4), AP(4,4)	CU#3	3
COMPUTE FORTING FUNCTION AND STORE TERPOPARTLY TH S APRAY	INTESP	5
CALL RUS	INTEGR	. e
C	THTEGR	7
CALL DISSIP	INTEGR	
CARASTI VE FOR G-BAR-BAR	TNTEGT	9
	INTEGR	10
CARAFTEL FLEMENTS OF THURDER A FOR BLOCK TRIDIAGONAL INVERSION AT EACH	INTEGR	11
	INTEGR	12
CALL LALTRACKS	INTEGR	13
CTHEFT BEDER TOTOTACINAL NATERY AT & THIEVEL AND STOPE SOLPTION IN	INTEGR	14
	TNTEGR	15
Call STRT(7, 185	THTEGR	16
	INTEGR	17
	TNTEGR	18
	INTEGR	19
	INTEAR	20
	THTEGO	21
A STAL STREAM TO TAMANY & COD BLOCK TRIDIAGONAL INVERTION AT FACH	THTECH	22
Lessill ILICATION OF INTERIO STOR GEOCK STOLADORE INTERIOR AT LOS	THTECH	21
Const in Level	TNTECT	24
UNLE EDELYDIAF MATORY AT A TH I CHCI AND STORE COUNTED IN	THTECH	25
CONTRACT PERCENTRIDIAGONAL MATRIX BY 2 TH FIRE BAN STORE SCOTTON AN	INTEGR	26
	THTECP	
LALL 07-3169579 DA 9 1-1-6	THTECH	2.
171 C LTAFT DA 9 V-9-VM	THTECH	20
111 5 376731 3 841 - 11 6 6 7 7 1 1 4 8 1 1	THTEGR	30
2 VIII - CTINELI - VIII - CTINELI - VIII - CTINELI - CTI		

PS={Z=0+GAN+XX=GANH3}/GANP1+PINF	INITIA	53
FS=GAMP1+XX/EGAMM1+XX+Z+D)+FF	INITIA	54
US ={1.0-2.0+{XX-1.0}}/GAMP1/XM4CH++2}+01NF	INITIA	55
VS=2+0+(XX-1+0)+COS(SANG)/(GA4P1+XNAC4++2+S[N[SANG]}+QINF	INITIA	56
TF1J.GT.21 GQ TQ 3	INTTA	97
¥1={2.0+GAN+XMACH++2-GANH1}/{GAN+1.0}	INITIA	58
X2={GAM+1.0}+XMACH++2/{GAMM1+XMACH++2+2.0}	INTTIA	59
P1=X1+PINF	THETTA	66
#1 = X2 +# THF	TNTTTA	61
ENT-P1/P1/P1++GAM	TNTTTA	4.2
#T+ (1.0/X1)**(1.0/GANH1)*(0.5*(GAN+1.)*YMAC4**2)**(GAN/GANH1)*PINF	INTTIA	63
XX=1.0+0.5+6APM1+XNACH++2	TNTTTA	64
PTORT-XX PPINF/RINF	THITTA	65
3 CONTINUE	THITTA	Å.6
P8+P1NF+((PT/PINF-1.0)+(1.0-1.02+SIN(THET)++2+0.12+SIN(THET)++4)+	THITTA	Å.7
> 1.01	THITTA	Ă.R
RA-{PB/ENT}++(1_0/GAM)	TNITTA	A G
OR-SORT (2.) +GAN/GANMI +ARS (PTORT-PR/PR) 3	THITTA	76
YY+91+0.5-THET	INTTA	71
	TNTTTA	72
VR-08-51 N(VY)	TNTTTA	73
7 K N - K M A X - 1	THITTA	74
00 2 K-1,KMAX	TNITTA	75
Y Y - FL 04 T (K - 1) / Z K M	INTITA	76
PPESS-PR+YY+(PS-PR)	TNITTA	77
R4(1=9 R+YY+( RS-RR)	THITTA	78
1)VEL=UR+VY+ (US-U9)	THITTA	79
VVFL=VR+YY+ (VS=VB)	TNITTA	80
91-1.0/P(J,K)	TNITTA	91
0{J,K,1}=R40+D[	ENETTA	82
0 ( J . K . 2 ) - R4 D+UYEL +D T	TNITTA	83
0(J.K.3)=R40+VVFL+DT	THITTA	84
2 0(J,K,4)=(PRESS+64411+RH0+(UVEL++2+VVEL++2)+0,5)+D1	TNITTA	
CREFLECT METRICS AND DEPENDENT VARIABLES ANOUT PLANE OF SYMMETRY	THITTA	
DT 4 K=1, KHAX	INITIA	87
DD={-1_01++JCS	THITTA	
nn=(+1=0)+++JCS	INITIA	
D(1+K)=D(2+K)+DD	THTTTA	93
YEX(1,K,1)=-XEX(2,K,1)	INITTA	91
XEY(1+K+1)=XEY(2+K+1)	THITTA	92
XEX(1,K,2)=XEX(2,K,2)	INITIA	93
XEY(1,K,2)XEY(2,K,2)	INTTIA	94
00 5 N+1,4	INITIA	95
5 0(1)=K,NI=0(2,K,NI+DD	INITIA	96
4 0(1,1,4,3)=-9(2,4,3)+00	THITTA	97
PETUPN	ENTITA	98

<pre><pinf, cinf,="" clus,="" hcase,="" horn,="" jcs,="" npunch<br="" oinf,="" pt,="" rhose,="" th,="">I EVEL 2.0 FF CONTRACTOR CONT CONTRACTOR CONTRACTOR CONTRACTOR</pinf,></pre>	COM1	4
LEVEL 6395673396980 Foundu JP0032 0346.91.41.55748 31.6445 80 31.6445 40.4.4.	C0#3	Z
LEVEL 29 4 8. C. HD	CO #5	3
COMMON /COM6/ A143-6-61-5140-6-61-5160-6-61-5160-6-61-41	COMA	
nn 1 J=1, JHAX	I BJ TPA	
CLOAD BLOCK & MATRIX EVALUATED AT N TH LEVEL FOR ALL 3 INTO HD ARRAY	IRITRA	ž
CALL ARMATE(JPKP1)	LBLTRA	i
01 1 M=1+4	LBLTRA	9
DD 1 L=196	LOLTRA	10
1 40(J,L,M)=A9(L,M)	LBLTRA	11
CFILL OFF-DIAGONAL AND DIAGONAL ELEMENTS BASED ON A 2-ND ORDER	LBLTRA	12
CGENTRAL DIFFERENCE	LSLTRA	13
00 S 1=S+14	LBLTRA	14
70 Z N=1,4	LBLTRA	15
NO 3 L+1#4	LALTPA	16
4 ( J ) L ) H   0 − L   J − L ) L ) H   H   H   H   H   H   H   H   H   H	LOLTRA	17
	LBLTRA	10
3 CTJFLFTFHN(J+1)LFNTH	LBLTRA	1.9
Coopering Function From S ARRAY	LBLTRA	20
TELEVISION CONTRACTOR AND A CONTRACT AND AND A CONTRACT AND AND A CONTRACT AND A	LULTRA	21
CANADA A THE DIAGONAL REPRESENTING THE LOENITTY WATPIN TO GHE	LULTRA	22
E TIJPTYTYTIAU Betindau	LALTRA	23
	LSLIVA	24
SHAPAUTINE LOLTRA(J)	LSLTRA	2
SUAPOUTINE LALTRA(J) ГлимомчСОМГ/ЈИАХ»КНАХ»ЈИ»КИ,ХЧАСЧ»АLРИА∘GAM+GAM+1.0СН.DT»SMU,ТР€Т»	LSLTRA Comi	2
SUAPPUTINE LBLT#A(J) ΕΠΑΝΟΊ/COPL/JMAX,KNAX,JM,KN,X14C4,ΔLPHA,GAH,GAH1,CN,DT,SHU,TPRT, >CHOP3,MCA,NCB,MCC,AA,Ч2ORGA,NU,NL,TT,TAUSTTER,ENT,PTOPT,PTNF,	LSLTRA COM1 COM1	2 2 3
519ΑΡΟυΤΙΝΕ L9LTRA(J) ΓΛΑΝΟΊΑ/COML/JMAXAKNAXρJMAKM,XЧΑСЧ,ΔLΡΗΔ.GAM-GAM-1.CN.DT,SMU,IPRT, - CHORD,KCA.NCB,NCC,ΔΑ24-DORGGA.NU-NL,IT,TAU-TYRAENT,PTOPT,PINF. «Ο ΤΨΕ,ΟΤΨΤΑ:CHE,JCSTPT,CLUS,PT,HORN,RAUSENTCATF,NEUNCH	LSLTRA COMI COMI COMI	2 2 3 4
SUAPOUTINE LBLTRA(J) CANAQUYCOMIJIMAXAKHAXAJIMAKMAXUACUAALPHAAGAMAGAMUJOCNODTASHUAIPATA > CHODDANGANGBANGBANGBANGANUANLAITAUSTIERJENTAPTOPT.PINFA <01MFJOINFJCINFJISTAJANTAUSPTAHDUNABHDSEANGASFANDUCU LEVELIZADEFS,SGAAB	LSLTRA COM1 COM1 COM1 COM3	22342
SIARPOUTINE LSLTRA(J) ΓΑΛΗΟΊΧ/COML/JMAXAKNAXPJMPKM,XYACY,ALPHA,GAM-GAMYI.CN.DT,SMU,IPRT, ΓΟΝΟΊΡ,CAPHCB,MCCPAAP4OREGAPHUPKI,IT,TAUTIYEP,EMT.PTOPT.PINF. «ΤΗΥ, ΟΙΨΓ,CIEF,JCSTM-CLUSPT.PIONPAROSENCATCHTONYC LEVEL 2.0,EF.S.G.AB ΓΟΜΜΥ /COMP3/ OLAP20A4).EF(40,4),S(40,20,4).G(4).AB(4,4)	LSLTRA COM1 COM1 COM3 COM3	223423
SUBPOUTINE LBLTRA(J) COMMONYCOML/JMAXAKMAXPJMPKMPXMACMPALPHA+GAM-GAMMI+CN+DT/SMUATPRT/ > CHORD,NGA,NGB,NGCPAAPHONEGA+NU-NLJTIFAUPTTEPENT,PTOPT.PINF, «PINF,OTMF,CINF,JCS,TM,CLUS,PT,HORN,RHOSE,NGASF,NPUNCH LEVEL 2:,0;EF,S,G,AS,28,41,EF(40,41,S(40,20.4),G(4),AB(4,4) LFVEL 2:, A,B,C,MO	L91784 COM1 COM1 COM3 COM3 COM3 COM4	2 3 4 2 3 2
SIARDUTINE LSLTRA(J) PANMON/COML/JAAXAKAXPJM,FM,X44C4,ALPHA,GAM-GAM4I.CN.DT,SHU,TPRT, CHOP3,KC4,MC5,MC2,AA4-DORGGA,NU-NL,IT,TAUTTREPENT,PTOPT.PINF, CT44,0147,C1447,LC3,PTA,CLU3,PT,HDBN,B4NG5E,NC454,NUMC4 LEVEL 2.0;EF,S,G,AB POMMM /CLU3,0143/20+4).EF(40,4),S(40,20+4),G(4),AB(4,4) LFVEL 2. AFRC,40 CDM44, CC444, A1400454374(40+4)41,C(4C,4+4),HD(40,4+4)	LSLTRA COM1 COM1 COM3 COM3 COM4 COM4	2 3 4 2 7 2 3
SUAPOUTINE LALTRA(J) COMMONYCOME/JARXXKMAX,JH+KH,XM4CH,ALPMA+GAH+GAMMI+CM+DT,SMU+IPET, > CMOP5,MC4,MC5,MCC5AA+JOHEG4,NU-NL-IT,TAU*ITER;ENT,PTD9T,PINF, <0144,5014F,CIUFJ,CIST,PT,HOM,RNOSE,MCASF,NPUNCH LEVEL 2:0;EF,SSG,AB COMMO /COMSJ 0143,223+43,EF(40,43),S(40,20+4),6(4),4314,41 LEVEL 2: ArB;C+M0 COMMO /COMSJ 0143,23,43,41,41,41,41,41,41 LEVEL 2: ArB;C+M0 COMMO /COMSJ 0143,23,43,41,41,41,41,41,41,41 LEVEL 2: ArB;C+M0 COMMO /COMSJ 0143,23,43,41,41,41,41,41,41,41 LEVEL 2: ArB;C+M0 COMMO /COMSJ 0143,23,43,41,41,41,41,41,41,41,41,41,41,41,41,41,	LSLTRA COM1 COM1 COM3 COM3 COM3 COM4 COM4 LBLTRA	223427236
SIAPOUTINE LALTAR(J) CANAQUYCOMI, JARAYAKAXYJM, KM, XMACM, ALPHA, GAMAGAMMI, CN, DT, SHU, IPRT, > CHODD, NCA, NCB, NCC, AA, 40 ONEGA, NU, NL, IT, TAU, ITER, ENT, PTOPT, PINF, COTMF, OINF, CIME, JCS, TM, CLUS, PT, HORN, RMOSE, NCASF, NRUMCH LEVEL 2, 0, EF, S, G, AB COMMAN, YCOM3/ 0140, 2043, EF (40,4), S(40,2044), C(4), AB(4,4) LFVEL 2, A, RG, MO COMMAN, YCOM4/ A(40,4,4), R(40,4,4), C(4C,4,4), HD(40,4,4) NC 1 K-1, KMAX CLOAN ALACK A WATBIK EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY	LS1TRA COM1 COM1 COM3 COM3 COM4 COM4 COM4 COM4 LBLTRS LSLTRS	2234272367
5194P0UTINE L9LTRA(J) FORMOUYCOME/JAMAXAKHAX>JH>FH,XMACH>ALPHA>GAH>GAMMI>CHODT,SMUATPET, > CHODD,MCA>NCB>NCCAAA-HONEGA>NU-NLJIT,TAUSTTERJENT,PTOMF- CQTMF,OTMFCIUFJSCTPT,JCUSPFT,HONNPROSE,NFASF,NBUNCH LEVEL 2.05EF,SSGAA FOMMON /COMSY OLG3>20+3)=EF(40,4),S(40,20+4)=C(4)=A0(4)=4) LFVEL 2. AARJCAMO COMMON /COMSY OLG3>20+3)=A(40+4,4)=C(4C+4+4)=VN(40,4+4) LFVEL 2. AARJCAMO COMMON /COMSY ALG0,4+4)=A(40+4,4)=C(4C+4+4)=VN(40,4+4) NO 1 K=1,KMAX Co.LOAN ALTCK M ANTER EVALUATED AT N TH LEVEL FOP ALL K INTO 40 APRAY CALL AAMATX(J=K+2) DO 1 H=14+4	L91784 C041 C041 C043 C043 C044 C044 C044 L91789 L91789 L91789	22342723678
SUBPOUTINE LELTER(J) COMPOSITINE LELTER(J) COMPOSITINE LELTER(J) COMPOSITION CALMESINGCA ALLAND ONE GALMUL NUL IT TAUE TREFS INT PTOPT.PINE. COTHE, OTHE, CURFS, CLUS, PT, LUS, PT, HORN, RMOSE, HCASE, NUNCH LEVEL 2:0, EF, S, G, AB COMMON /COMS/ CLUS, CASE, ST, S(40, 20.4), C(4), AB(4, 4) LEVEL 2: A RCC, MO COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) LEVEL 2: A RCC, MO COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COMS/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COM/ CLOSA, S), CE(40, 4), S(40, 20.4), C(4), AB(4, 4) COMMON /COM/ CLOSA, S), COMMON COMMON COMMON COMMON /COM/ CLOSA, S), COMMON COMMON COMMON /COM/ CLOSA, S), COMMON COMMON COMMON /COM/ CLOSA, S), COMMON COMMON /COMMON COMMON /COMMON COMMO	LSITRA COM1 COM1 COM3 COM3 COM4 COM4 COM4 LSITRS LSITRS LSITRS	223423236789
SURPOUTINE LBLTRR(J) FRAMOUTCOME/JAMAXAKHAX>JH>FH,XMACH>ALPHA>GAH>GAMMI,CH.DT,SMU,TPET> CHOPD,MCA>NCB>MCC;AA>HOPGGA>NU>NL,TT,TAUSTTER;ENTPTOPT>PINF- COTHFOTHFC:UF#,JCSTPTCUS>PT,HOMNSENCSE>NCASF,NBUNCH LEVEL 2:0;EF,SSG,A8 FGMMN /COMBY G(43):20+4)=EF(40;4);S(40;20;4);G(4);A8(4;4) LFVEL 2: AFR;C>M0 COMMUN /COMBY G(43):20+4);F(40;4);S(40;20;4);G(4);A8(4;4) LFVEL 2: AFR;C>M0 COMMUN /COMBY A(40);4);A(40);4);C(4C;4;4);HD(40;4;4) COMUN /COMBY A(40);4);A(40);4);C(4C;4;4);HD(40;4;4) CO.LGAN ALCK M WATEIX EVALUATED AT N TH LEVEL FOP ALL K INTO 40 APRAY CALL ANATY(J;FK;2) DO 1 H=1;4 YD(K4);FT:AFI(;FK)	LSITRA COM1 COM1 COM3 COM4 COM4 COM4 LSITRS LSITRS LSITRS LSITRS	2234272367896.
SUBPOUTINE LBLTRA(J) COMMONYCOMI, JAMAYAKMAX, JMAXMAXYAGCH, ALPHA, GAMAGAMHI, CN, DT, SMU, IPRT, > CMORD, MGA, MGB, MGC, AAG-HOMEGA, NU, NL, IT, TAU, ITRE, INT, PTOPT, PINF, c0144, OTHF, CIHF, JCS, TH, CLUS, PT, HORN, RMOSE, MCASF, NPUNCH LEVEL 2, 0, 5F, S, G, AJ, CLUS, PT, HORN, RMOSE, MCASF, NPUNCH LEVEL 2, A, R, C, MO COMMON /COMSJ 0143, 28, 41, 86 (40, 41, 53 (40, 20, 41, 63 (41, 43 LFVEL 2, A, R, C, MO COMMON /COMSJ 0143, 28, 41, 86 (40, 44, 51, 40, 40, 40, 40) IFVEL 2, A, R, C, MO COMMON /COMSJ 0143, 41, 004, 41, C14C, 44, 41, MO COMMON /COMSJ 0143, 44, 004, 41, 41, 41, 41, 41, 41, 41, 41, 41, 4	L91784 C0M1 C0M1 C0M3 C0M4 C0M3 C0M4 C0M4 L91789 L91789 L91789 L91789 L91789 L91789	223423236789011
SUBPOUTINE LELTRA(J) rnamou/COMI/JMAX.KNAX.JM.KNAX.JA.CH, ALPHA.GAM.GAM.GAM.GAM.OT,SMU, TPET, b. CHORD, MCA.MCG.MCG.AA.HODEGA.NU.HL,TT, TAUSTYERJENT,PTOPT.PINF. c0744,07496,0149,2149,JCSTPT,CLUS.PT,HOMN,PHOSE.MCASE,MOUNCH LEVEL 2.05EF.S.G.AB rommu /COMBY 0143220.45).EEf(40,41,51(40,20.4).6(4).40,4).41 LEVEL 2. ALB.G.MO rommu /Comby 0140,443.P1(40,4).51(40,20.4).6(4).40,4). nn 1 K=1,KMAX CLORA ALTOK EVALUATED AT N TH LEVEL FOR ALL K INTO HO APRAY CALL ANATX(J.K.2) DO 1 L=1.4 1 HOTKSL,MI-ABIL,PM CETL 0FE-DIAGONAL AND DIAGONAL ELEMENTS BASED ON A 2-HD ORDER	L91784 COM1 COM1 COM3 COM3 COM3 COM4 L91789 L91789 L91789 L91789 L91789 L91789	22342323678961123
SUBPOUTINE LBLTRA(J) COMPGATCOME/JARXXKMAX,JH+KH,XMACH,ALPMA,GAH-GAMMI,CM.DT,SMU,EPET, > CMOPS,MCA,MCB,MCC,AA,HONEGA,NU,ML,FIT,TAUSTTER,ENT,PTDBT,PINF, (0 THF,OTHF,CI HF,JCS,TH,CLUS,PT,HORM,RNOSE,MCASE,NPUNCH LEVEL 2,0;EF,S;G,AB COMMM /COMBJ 0(43)28,41,8EF(40,41);S(40,20,41);G(4),43[4,4] LEVEL 2, A,R;G,MO COMMM /COMBJ 0(43)28,41,8EF(40,41);S(40,20,41);G(4),43[4,4] LEVEL 2, A,R;G,MO COMMA /COMBJ 0(43)28,41,8EF(40,41);S(40,20,41);G(4),43[4,4] LEVEL 2, A,R;G,MO COMBJ (41,41);S(4);S(4);S(4);S(4);S(4);S(4);S(4);S(4	L91789 COM1 COM1 COM3 COM3 COM4 COM4 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789	2 2 3 4 2 7 2 3 6 7 R 9 C 1 2 3 4
SUBPOUTINE LELTRA(J) rannow/COML/JMAX.KNAX.JM.XMACH, ALPMA.GAM.GAM.GAM.GAM.OT,SMU, IPET, b. CHORD, MCA.MCG.MCC, AA.4-DORGGA.NU.ML, IT, TAUSIYER, EMT.PTOPT.PINF. c074%, OTWF, CIWF, JCSTPH, DUDN.PHOSENCAST, ANDUCH LEVEL 2.0, EF.S,G.AB rommu /Commy /Commy oldspeck.Schast(40, 20, 4), 6(4), AB(4, 4) LFVEL 2. ARB/C/MO rommu /Commy /Commy oldspeck. Commu /Commy /Commy oldspeck. commo / K=1, KMAX Commo / K=1, KMAX Commo / L = 1.4 1 MOK sL, MI-AB(L, M) Commo / TL = 0.1 Commo / TL = 0.1 Com	LSITRA COM1 COM1 COM3 COM3 COM3 COM4 COM4 COM4 LSITRS LSITRS LSITRS LSITRS LSITRS LSITRS LSITRS LSITRS LSITRS LSITRS	2234232367890112345 1112345
SUBPOUTINE LBLTRR(J) FRAMOUYCOME/JARXXKHAXPJH+KH,XMACH,ALPHA.GAH-GAMMI.CH.DT,SMU.EPETF > CHOP3,MCA.MCB.MCC.AA.HONEGA.NU.ML.FIT.TAUSITER;ENT.PTD9T.PINF. COIMF,OTWF.CIMF.JCS.TP.CLUS.PT,HOM.NOSE,MCASF,NBUNCH LEVEL 2.0;EF.SSG.AB FOMMM /COMBJ GI43/22D.4).EF(40,4),S(40,20.4).G(4).A9[4,4] LFVEL 2. A.R.C.MO COMMUN /CALAY AL400,4,4).A[40.4,4].C(4C.44,4].MD(40,4,4] LFVEL 2. A.R.C.MO COMMUN /CALAY AL400,4,4].A[40.4,4].C(4C.44,4].MD(40,4,4] LFVEL 2. A.R.C.MO COMMUN /CALAY AL400,4,4].A[40.4,4].C(4C.44,4].MD(40,4,4] DCLORM ALAY AL400,4,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4,4].A[40.4,4].C(4C.44,4].MD(40,4,4] DCLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4].MD(40,4,4].MD(40,4,4] COMLORM ALAY AL400,4].A[40.4,4].C(4C.44,4].MD(40,4]	L91789 COM1 COM1 COM3 COM3 COM4 COM4 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789	22342723678901223456
SUBPOUTINE LELTRA(J) ranmay(COML/JMAX,KMAX,JM,XM,XMACH,ALPMA,GAM-GAMMI,CM,DT,SMU,IPRT, COTAM,CA,MCG,MCC,AA,JOHCGA,NU,ML,TT,TAUTT(R,EMT,PTOPT,PINF, (OTMP,STWF,CIEW,JCSTPA,CUISSPT,MAN,MCM,ALPMA,BACSENCATE,MENUCH LEVEL 2,0;EF,S,G,AB ramma /CIm4/ 2(140,220,4),EF(40,4),S(40,20,4),C(4),AB(4,4) LEVEL 2, A,R;C,MO ramma /CIm4/ A(400,4,4),P(40,4),5(40,20,4),C(4),AB(4,4) LEVEL 2, A,R;C,MO ramma /CIm4/ A(400,4,4),P(40,4),4),C(4C,4,4),HD(40,4,4) NA 1 # 4,XMAX Co.LDAR MATT(J,K,2) DO 1 # 1,4 1 # 0(Ks1,M1-AB(1,M) Co.CENTAL OFF-DIAGONAL AND DIAGONAL ELEMENTS BASSO ON A 2-ND ORDFR Co.CENTAL DIFERENCE DO 2 % 2,2KM DO 3 L=2,4 A(X,4),4] == 40(K-1,4),4),4)	L91789 COM1 COM1 COM3 COM3 COM3 COM4 L91799 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789	22342323678901234567 111111111111111111111111111111111111
SUBPOUTINE LBLTRR(J) rnmm(JYCOM)/JMAXAKHAX,JMAKH,XYACH,ALPHA,GAM,GAM,GAMY,CM,DT,SHU,IPET, > CHOPS,MCA,MCB,MCC,AA,YOMEGA,NU,ML,IT,TAUSITER,EMT,PTOPT,PINF, (0744,014%)(UF)/248,JCSTPT,JCUS,PT,HOW,MOSE,MCASF,NBUNCH LEVEL 2,0;EF,S,G,AB r0MMM /COM37 0(43)-20,43).EF(40,43),S(40,20,43).G(43).A8(4,4) LEVEL 2, A,R,C,MO r0MMM /CMAY 0(43).A(40,43).C(4C,44).HO(40,44), 1 EVEL 2, A,R,C,MO r0MMM /CMAY A(400,44).A(40,43).C(4C,44).HO(40,44) nn 1 K-1,KMAX Co.LORA MATRIX,EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY CALL ANATR(J,K,2) NO 1 K-1,4 1 MO(K,L,M)-BAB(L,M) Co.SETLL OFF-01260VAL AND DIAGONAL ELEMENTS BASED ON A 2-ND ORDER Co.SETTAL DIFFERENCE n0 2 K-2,KM n0 3 L-2,4 ATK,L,M)-0,0	L91789 COM1 COM1 COM3 COM3 COM4 COM4 COM4 COM4 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789	2 2 3 4 2 7 2 3 6 7 R 9 6 1 2 3 4 7 6 7 R 1 1 1 2 3 4 7 6 7 R
SUBAPOUTINE LELTRA(J) ranmay(COML/JMAXAKMAX)JMAJMA,X43C4,ALPMA,GAM-GAM-GAM4,CM.DT,SMU,IPRT, b CHODS,MCA,MCS,MCC,AAA-4,OMEGGA,MU,ML,IT,TAUTT(R,EMT,PTORT,PIMF, c0 TH4,010%,CL47,JCS TH-ALDN,PANDSENTASF,MONCH LEVEL 2.0,FF,S,GAB rgmmn /CL47,JCS TH-ALDN,PANDSENTASF,MONCH LEVEL 2.0,FF,S,GAB rgmmn /CL44,JCS TH-ALDN,PANDSENTASF,MUNCH LEVEL 2.0,FF,S,GAB rgmmn /CL44,JCS TH-ALDN,F1,CL4C,4+3,HOL40,4,4) LFVEL 2. ARR/C,MO rgmmn /CL44,JCS TH-ALDN,F1,CL4C,4+3,HOL40,4,4) CL0RA MATY(J,K2) D0 1 M-1,4 1 MOLKSL,MI-ABIL,MI CCEMTAA LIFFERANCE ng 2 K-2,KM ng 2 K-2,KM ng 2 K-2,KM ng 2 K-2,KM ng 2 K-2,KM ng 2 K-2,KM ng 3 LC2,4 AKK,L41-4-MOLK-1,2L,MI+H AKK,L41-4-MOLK-1,2L,MI+H	LSITRA COMI COMI COMI COMS COMS COMS COMS COMS LSITRA LSIT	2234232347890123456789
SUBPOUTINE LELTER(J) rnamourcomt, Jamaxakhaxpjmakh, xuacu, alpma, Gam, Gamui, cu, DT, SHU, TPET, > CHORD, MCA, MCB, MCC, AA, 40 DEGGA, NU, NL, IT, TIU, TTER, EMT, PTOPT, PTNF, co Tuf, otwp: Cufe, JCS TPC, CUS, PT, HOBM, PHOSE, MCASE, NBUNCH LEVEL 2, 0; EF, S, G, AB rommun /Comma, JC, MS, G(4), 20, 4), 5(40, 20, 4), 6(4), ag(4, 4) LEVEL 2, A, R, C, MO rommun /Comma, JC, MS, G(4), 20, 4), 5(40, 20, 4), 6(4), ag(4, 4) LEVEL 2, A, R, C, MO rommun /Comma, JC, MS, G(4), 20, 4), 5(40, 20, 4), 6(4), ag(4, 4) LEVEL 2, A, R, C, MO rommun /Comma, JC, MS, G(4), 4), 7(4C, 4, 4), HD(40, 4, 4) no 1 will, kmax CoClarm, Altok M, MTEIX EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY fall ANATX(J, K, 2) DO 1 wils, AMTEX EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY fall ANATX(J, K, 2) DO 1 wils, AMTEX EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY fall ANATX(J, K, 2) DO 1 wils, AMTEX EVALUATED AT N TH LEVEL FOR ALL K INTO 40 APRAY fall ANATX(J, K, 2) DO 1 wils, AMTEX CoFTLL DFE-DIAGONAL AND DIAGONAL ELEMENTS RASED ON A 2-HD ORDER CoFTL, DFE-DIAGONAL AND DIAGONAL ELEMENTS RASED ON A 2-HD ORDER for 2 wils, AM DO 2 wils, AM DO 3 LEJ, A ATX, S, MI=-MOTH, J, J, MIH-4 ATX, J, MI=-MOTH, J, J, J, MIH-4 ATX, J, MIH-4 ATX, J, MIH-5 ATX, J, MIH-5 ATX, J, MIH-5 ATX, J, MIH-4 ATX, J, MIH-4 ATX, J, MIH, J,	L91784 COM1 COM1 COM3 COM3 COM3 COM4 L91789 L91780 L91789 L917855 L9178555555555555555555555555555555555555	2234272347A901234567890 111111112
SUBAPOUTINE LELTRA(J) PARMONYCOML/JAMAXAKMAXPJM-KM,XMACH,ALPMA,GAM-GAM-GAMMI,CM.DT,SHU,IPRT, COTAMONYCOML/JAMAXAKMAXPJM-KM,XMACH,ALPMA,GAM-GAMMI,CM.DT,SHU,IPRT, COTAMONYCOML/JAMAXAKMAXPJM-KM,XMACH,ALPMA,GAM-GAMMI,CM.DT,SHU,IPRT, COTAMONYCOML/GAJJOSTICLUSPTLAUDANAROSENTASEANUCCH LEVEL 2.0;EF,S;G,AB POMMM /COMBY 0140/2024).EF(40,4),S(40,20,4),C(4),AN(4,4) LEVEL 2. AFRC,MO POMMM /COMBY 0140/2024).EF(40,4),S(40,20,4),C(4),AN(4,4) LEVEL 2. AFRC,MO POMMM /COMBY 0140/2024).EF(40,4),S(40,20,4),C(4),AN(40,4,4) NC 1 4=1,XMAX Co.6LORA MATK(J=K2) DO 1 4=1,4 1 401Ks1,M1-ABIL,M1 Co.6LORA MATK(J=K2) DO 1 L=1,4 1 401Ks1,M1-ABIL,M1 Co.6LORA MAL DIAGONAL ELEMENTS MASSO ON A 2-MD ORDER Co.6LORA MAL DIAGONAL AND DIAGONAL ELEMENTS MASSO ON A 2-MD ORDER CO.6LORA MAL DIAGONAL AND ARAY DO 1 L=1,4 ATK:LM1-MOKALJE,M1+M ATK:LM1-MOKALJE,M1+M CO.5CHIL FORCTMG FUNCTION FROM S ARRAY CONSELLANDON CONSELVATION FROM S ARRAY	L91784 Comi Comi Comi Comi Comi Comi Comi Comi	223423234789012345678901
SUBPOUTINE LELTRA(J) rnamonycomt, Jamaya Knax, Japara, Xnach, Alpha, Gam, Ganni, Ch. DT, Shu, TPT, > CHORD, MCA, MCB, MCC, AA, HOPEGA, NU, NL, IT, TIU, TYR, JENT, PTDBT, PTNF, COTH, OTHF, CIWF, JCS, TPT, JCDN, PTN, MCN, NC, NCASF, NEUNCH LEVEL 2, 0; EF, S, G, AB romann /Couns, G(43), 20, 4), EF(40, 4), 5(40, 20, 4), G(4), AB(4, 4) LFVEL 2, A, RGC, MO romann /Couns, Alfon, 4, Alfon, 4, 4), C(4C, 4, 4), HO(40, 4, 4) nn 1 K-1, KMAX Co. JCAN, Alfon, A WITIK EVALUATED AT N TH LEVEL FIP ALL K INTO 40 APRAY CALL ANATX(J, K, 2) DO 1 H-14 1 40KK, L, MI-ABIL, M) Co. FTIL OFF-DIAGONAL AND DIAGONAL ELEMENTS BASED ON A 2-ND ORDER Co. CCHTACH, DIFFERENCE NO 2 K-2, KM NO 3 L-2, 4 A (K, L, MI-ABIL, M) Co. FTIL OFF-DIAGONAL AND DIAGONAL ELEMENTS BASED ON A 2-ND ORDER Co. CCHTACH, DIFFERENCE NO 2 K-2, KM NO 3 L-2, 4 A (K, L, MI-ABIL, M) Co. FTIL OFF-DIAGONAL AND NA CO. STIL FORCMC FUNCTION FROM S ARRAY EF(K, MI-0, 0 3 C(K, L, MI-MC)(K, L, MI-M CO. STIL FORCH CHACTUR FROM S ARRAY EF(K, MI-0, 0 3 C(K, L, MI-MC)(K, L, MI-M CO. STIL FORCH CHACTUR FROM S ARRAY EF(K, MI-0, 0 CO. STIL FORCH CHACTUR FROM S ARRAY EF(K, MI-0, 0 CO. STIL FORCH CHACTUR FROM S ARRAY EF(K, MI-S)(J, K, MI)	L91784 COM1 COM1 COM3 COM3 COM4 L91789	2234232347890123456789012 21111111222
SUBPOUTINE LELTRA(J) PARMONYCOML/JAMAXAKMAXPJM,XMACM,ALPMA,GAM-GAMMI,CM.DT,SMU,IPRT, COTAMONYCOML/JAMAXAKMAXPJM,XMACM,ALPMA,GAM-GAMMI,CM.DT,SMU,IPRT, COTAMONYCOML/JAMAXAKMAXPJM,XMACM,ALPMA,GAM-GAMMI,CM.DT,SMU,IPRT, COTAMONYCOML/GAJ,JCSTMC,JUSPT,JMAN,AGSENCASE,ANUMCH LEVEL 2.0;EF,S;G,AB POMMM /COMS/ 0143/2024).EF(40,4),S(40,20,4).G(4),AB(4,4) LFVEL 2. ARBCCMO POMMM /COMS/ 0143/2024).EF(40,4),S(40,20,4).G(4),AB(4,4) LFVEL 2. ARBCCMO POMMM /COMS/ 0143/2024).EF(40,4),S(40,20,4).G(4),AB(4,4) LFVEL 2. ARBCCMO POMMM /COMS/ 0143/2024).EF(40,4),S(40,20,4).G(4),AB(4,4) DC = JONA ALTON A MATRIX EVALUATED AT N TH LEVEL FOR ALL K [NTO 40 APRAY CALL AMATR(JSK2) DO 1 L=1.4 1 401Ks1,MI=ABIL,MI CCEMTAM AND DIAGONAL ELEMENTS BASED ON A 2-ND ORDER CCEMTAMI, DIFENCE NO 2 K42,KM MO 3 LC:A4 ATXL/MI=MOTKAILLANIAM CFILL FORCING FUNCTION FROM S ARRAY EFILMAISCASE FUNCTION FROM S ARRAY EFILE FORCING FUNCTION FROM S ARRAY FOR FUNCTION FROM S ARRAY FOR FUNCTION FROM S ARRAY	LGITRA COMI COMI COMI COMI COMI COMI COMI COMI	22342723478901234767890123
SUBPOUTINE LELTRA(J) ranmay(COML/JMAX,KMAX,JM,XMACM,ALPMA,GAM,GAM,GAMM,CM,DT,SMU,IPET, b CHORD,MCA,MCB,MCC,AA,HOMEGA,NU,ML,TT,TAUSTYER,EMT,PTOPT,PINF, c0744,5144,CLUE,JCSTPT,CLUS,PT,HOMN,RMSCE,MCASE,MUNCH LEVEL 2.0;EF,S,GAB rommu /COMB/SUB/SID:EF(40,4),S(40,20,4),G(4),AB(4,4) LEVEL 2. AFRC,MO rommu /COMB/SID:ASAJ,A140,4,4),C(4C,4,4),HD(40,4,4) nn 1 K=1,KMAX Co.LORA MITKI EVALUATED AT N TH LEVEL FOP ALL K INTO HO APRAY CALL AMATR(J,K,2) DO 1 L=1.4 1 HOKK,J,MI-ABIL,M) Co.CENTEAL DIFFERENCE n0 2 K=2,KM n0 3 L=2.4 AIKA,LMI-MO(K=1,J,L,M)=H SIGE/SIGE/SIGE/SIGE/SIGE/SIGE/SIGE/SIGE/	L91784 COM1 COM1 COM3 COM3 COM4 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91789 L91788 L91788 L91788	223423234789412345678901234

ς.

INTEGR INTEGR INTEGR

LBLTRA Comi Comi

31 32 33

2 ä

TAU=TAU+DT Return SND

	SUBROUTTNE LUDEC(A)	LUDEC	2
	DIMENSION A (4+4)	LUDEC	3
	REAL L11,L21,L22,L31,L32,L33,L41,L42,L43,L44	190	ž
	COMMON /LUD/ 111.121.122.131.132.133.141.147.143.144.V1.V2.V3.V4.	LUD	19
	<ul> <li>U12, U13, U14, U23, U24, U34</li> </ul>	LUD	4
C	SUARDUTINE COMPUTES L-U DECOMPOSITION REMENTS	1.0050	5
	111 = 4(1,1)	LUDEC	Ă
	$v_1 = 1./(11)$	LUDEC	Ť

.

SURRAUTINE HOLPTS	NDLPTS	2
€₽₽₽94/€Q#1/J#AX≠K#AX≠J#≠K#≠X#4€4≠AL₽4A≠4A4+GA4H3+CH≠₽T≠\$₩1+[₽₽T≠	C2#1	2
> CHOPD, NCA, NCB, NCC, AA, Y, OHEGA, NU, NL, IT, TAU, ITER, ENT, PTORT, PINF,	CO#1	3
<pinf, cinf,="" clus,="" hcase,="" horn,="" jcs,="" nphnc4<="" othf,="" pt,="" rhdse,="" td="" th,=""><td>CONL</td><td>4</td></pinf,>	CONL	4
FEARF S'x'A'YEL'YEK'AEA'D	C0#2	2
^ NMMUN /COM2/ X140,2C3,7440,231,XET143,2C,23,XEX140,20,23,	C0P2	3
* XEY(40,20,21,0(43,20)	C3#2	4
LPGICAL LREQUNALPRFLALPRSTALPRCONALPR9ALPLOTALTRAJALRSTRT	PROPT	2
COMMON /PPOPT/ LRERUN,EPRFL,LPRST,LPRCOM,LPRA,LPLOT,LTAJ,LRSTRT	PR (PT	3
CAN40N /ALDNT/ THETA(25), RP(2), 25), NSLINT	BLIJNT	,
Constants SUBPOUTTNE DETERMINES THE K AND Y LOCATIONS OF THE HODE POINTS	NUTS	7
TTHET-1.57079633/(FLOATINELUNT)-1.5)	HULPTS	8
CJ-" FOR CYLINDER, J=1 FOR SPHERE.	NULAIS	<u> </u>
7EL17=16A=#1#XMACH##2+2+2+73/116A#+1+03#¥MACH##23#0+78#3+C##41=JCS3	NDLPTS	10
TETX44CH-LT-3-1 DELTC=E2+02475+EX44CH-1+2+3++2+3+6539+5+EX44CH-	NOLP TS	11
· 1.2=1.4441/460443C3	NOLPTS	12
TF (HUMA & LT. 0.0) GO TH 13	NOLPTS	1?
IFITIEN ALTO DAL ANDA HORN ASTA CASIAN TO LA	NOLPTS	14
	ROLPTS	15
TALL WITTIYOD TOURNUS DIANG HIMI AND	NUTLATE	16
	NULPIS	17
12212-12213-13613-13613-16514613-15140044723+140	401-15	17
	HOLP 15	14
	NULPTS	21
	HULPIS	21
		22
	NO1075	
	NDIRTE	
TAUTR	NDIATE	
Conservation SHAPE	NOIPTS	57
IF (LESTET) 60 10 20	NOINTS	
17 (4778) aLTa 3.61 60 TO 15	NDIBTS	20
TE (HOPNELTEJEL EANDE HOPNEGTECES) GO TO 35	NOIPTS	10
IF (J .6T. NSLUNT) 40 TO 12	NOIPTS	<b>11</b>
988=9ELT1++2+{1,\$[%{THET}++2]/\$[%{THET}++2/(],-+961 To)	NOLPTS	12
FOURAC=4.4RR\$+(1.4DELTw)	NOLPTS	33
¥4=1。+{#9%-50%T{PBB++2+FCUPAC}}*9=3	NOLPTS	34
THE T90=1.570796326679	NOLPTS	35
[Ff[[T4ET-T4ET90] .GF. C.S]XA=1.+(BR9+SQ#T[999+42+F]URAC}]+1.5	NOLPTS	36
12	NOLPTS	37
60 TA 30	NOLPTS	
T2 CUMITINE	N91#T5	39
TE (3 .6T. HOLUNT) THET-ATAN2(YA,1YA)	N71PTS	40
7EL T= {1.6C+,,,68*THST++2+6.16*THET++4}+DELT;	NOLPTS	41
TF (J GT, NALUNT) GO TO 17	NOLPTS	42
***1.d-(1.d+DELT)*COS(THET)	NDLPTS	43
17 VATIL.J+DELTJ+SIN(THET)	NDL+TS	- 44
50 TO 30	NOLPTS	45
2. CURTING:	451+12	46
	NOLPTS	47
	MOLPTS	48
C++++++CALCULATE NUDAL POINTS	NOLPTS	49
	NOLOTS	50
· • • • • • • • • • • • • • • • • • • •	WOLPTS	- 51
U = - 1 = = = = = = = = = = = = = = = = =	NUL TS	57
······································	775 PTS	53
· / ビーマサート ますた 対象系 - マイットー・キ	NOLPTS	54
/ N - N - L	NOLPTS	51

LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC LUNEC	• 18 112 13 15 16 17 18 9 24 22 23 25 25	
LUDEC	27	
	LUPEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC LUDEC	LUDEC 0 LUDEC 10 LUDEC 10 LUDEC 11 LUDEC 12 LUDEC 13 LUDEC 14 LUDEC 14 LUDEC 14 LUDEC 14 LUDEC 16 LUMEC 10 LUDEC 19 LUDEC 21 LUDEC 21 LUDEC 21 LUDEC 23 LUDEC 23 LUDEC 25 LUDEC 26 LUDEC 27

7 (J,K)=XB=ZK+DX 7 (J,K)=YN=ZK+DY 4. CONTINUE NG 50 K=J,KNAX X (L,K)=X(2,K) Y (L,K)==Y(2,K) 55 CONTINUE URTURN END	NDLPTS NDLPTS NDLPTS NDLPTS NDLPTS NDLPTS NDLPTS NDLPTS NDLPTS	56 57 58 60 61 62 63 64
SUMMONITINE CUTPUT(1) C(MMONYCOMJ/JPAJ, KMAJ, JM, KM, XMACM, ALPHA, GAM, GAM, GAM, DT, SMU, IPRT, > C(MMONYCOMJ/JPAJ, KMAJ, JM, KM, XMACM, ALPTA, GAM, GAM, GAM, GM, DT, SMU, IPRT, C(MMONYCOMJ/JPAJ, KMAJ, JM, KM, MORK, MU, TT, TAN, TTEM, EMT, P(DT, PTMF, C(MMONYCOMJ/JAC, KIAO, 2G), YTAO, PT, MORK, MOSE, MCASF, MPUNCM LEVEL 27, 57, FXET, XEX, XET, D C(DMMONYCOMJ/21, 20, 25, 57, 62, 43 C(DMMONYCOMJ/21, 44, 44 C(DMMONYCOMJ/21, 4	OUTPHT COM1 COM1 COM2 COM2 COM2 COM2 COM2 COM2 COM3 OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT	223423423678901234567890123
<pre></pre>		2727793333336789012 37333456789012 37333456789012
<pre></pre>		4444445955555666664

		17
	***	
FN1 .	<b>PH</b> 5	۹.
SUAPOUT THE SHOCK	540CK	,
COMMONICOME JEAKE KREAKE EMERACHEE CHARGE AND CAMMER CAMME CAN TO SHUE TERTE	C0P1	ž
> CHORD, NCA, NCA, NCC, AA, H, ONEGA, NU, NL, IT, TA', ITER, ENT, PTORT, PINF,	C0#1	. j
<pinf, 4="" cinf,="" clus,="" jcs,="" nrase,="" nruyca<="" oimf,="" orn,="" pt,="" ranse,="" td="" th,=""><td>0.9#1</td><td></td></pinf,>	0.9#1	
LEVEL Z,X,Y,XET,XEX,XEY,D	C042	2
^^^++++++++++++++++++++++++++++++++++++	6.0 %5	1
* xEv{43,20,21,0140,201	C0#2	4
LEVEL 2,0,6,6,5,6,4B	Cum3	Z
^^##### /C3#3/ 0(48;20;4);EF(4);4];5(43;20;4);6(4);48(4;4)	C0#3	3
COMMON /PUV/ P(40,33,PXI(4C),PETA(461,U(40,31,UXI(46),UETA(47),	PUV	2
• V(40, 31, VXT(40), VETA(40), R(40, 3)	, PUV	3
CDHPUTE THE FLOW VARIABLES ONE MESH INTERVAL MELOW SHOCK	SHICK	7
P MS = 0 + 0	SHOCK	
05EH= 3.0	540CK	•
J # A + J # A + - 2	540CK	10
7 K M = K M A X = 2	240CK	11
n(1 3 K=1,3	SHOCK	12
NO 3 J=1, J=4X	SHOCK	13
	540CK	14
7=1.00 PQ(J,KK,))	540°K	15
$H(J_{j}K) = O(J_{j}KK) + O(J_{j}KK)$	SHOCK	16
U(3,K)=O(3,KK,Z)+Z	SHOCK	17
A ( ] <sup>1</sup> K ] = O ( ] • K K <sup>1</sup> 3 } + 5	SHOCK	14
E2=Q(J,KK,4)+D(J,KK)	540CK	19
3 P[J,K]={E2=0+5+R[J,K]+{U[J,K]++2+V[J,K]++21]+64,442	540CK	20
CCOMPUTE P-XI, U-XI, P-ETA, U-ETA, AND Y-ETA DEGIVATIVES	SHOCK	21
N() 4 J=2, JM	\$40CK	22
PIT(J)=(P(J+1,3)-P(J-1,3))+0.5	540CK	23
UXI(J)+(U(J+1,3)-U(J-1,3))+0.3	540CK	Z4

SURROUTINE RHS	245	2
CΠΗΗΠΝ/COM1/JHAX, ΚΗΑΧ, JH, ΚΗ, ΧΗΑCH, ΑLΡΗΔ, GAM, GAMH1, CN, DT, SHU, IPRT,	C0#1	,
> CHOPDACANCE, NCB, NCC, AA, HOMEGA, NU, NL, IT, TAU, ITEP, ENT, PTORT, PINF,	có=1	j
<pinf, cinf,="" clus,="" ginf,="" horn,="" jcs,="" ncasf,="" npunch<="" pt,="" rnosf,="" td="" th,=""><td>60 ML</td><td>4</td></pinf,>	60 ML	4
LEVEL ZAGAEFASAGAB	C0/13	ź
COMMON /COM3/ Q{43,20,41,EF(42,41,S(40,27,41,5(4),41,41,4)	C0#3	3
CTHIS SUARDUTINE COMPUTES THE RIGHT HAND SIDE OF THE DELTA FORM	845	ġ
CEQUATION	RHS	6
CFORM E CONSERVATIVE VARIABLES AND DIFFERENCE. STORE IN THE S ARRAY	*45	7
5Π 1 K=2→KM	245	
DO 2 J=1,JMAX	PHS .	Ģ
CALL EFCON(J,K,1)	.45	10
NG 2 N=3,4	RHS	11
2 *F(J+N)=G(N)	R45	12
CassCENTRAL OTFFERENCE E CONSERVATIVE VAPIARLE	4HS	13
03 1 4=1,4	845	14
00 1 J=2,JM	#45 '	15
1 ~{{],K}}N}={EF{],A}_}N}={EF{},J}={}N}={EF{},J}={}N}={}N}={}N}={}N}={}N}={}N}={}N}={}	845	16
Constrain & CONSERVATIVE VARIABLES AND DIFFERENCES ADD TO PREVIOUS S	646	17
	*45	1.
ML4Set 6 DO	e45	19
ФП 4 К=19KHAY	# 45	25
CALL ESCONTJAKASI	PH\$	21
nn 4 Malia	945	29
4 FF(K,N)=G(N)	*45	*3
CSFNTRAL DIFFERENCE F CONSERVATIVE VARIABLE	P 45	24
NR 3 H=1;4	***	25
70 3 K=2,K4	*45	26
5 { J_FK_FN}=-S { J_FK_FN}={EF{K+1}FN}=EF{K-1}FN}}		27
3 CONTENTE	***	2.0
P E T UP N	*45	<b>,</b> .

*ETU**	0179117	47
C3 FORMATEIND, 37X, 32H4444 FONSERVATIVE WARTARIES >>>>>	OUTBUT	
	001701	00
1' + FUFHAIL3HOK + 12//41,1HJ, BX, 2HE1,10X,2HE2,10X,2HE3,1CX,2HE4,10X,	1041901	69
» ZMF1,10X,ZMFZ,10X,ZMF3,1CX,2MF4/)	DUTPUT	70
105 ENPHAT(15, FE1244)	<b>NUTPUT</b>	71
107 FOPMATEP1H0<<<< X EPPOR IN HT =>E12+4+3X+224RHS OF 2 FDROB IN HT		77
> pE12.4,54 >>>>)	OUTPUT	23
108 FORMATELMIN 3X01HJ.4X014K08X014X011X014Y013X064XX-T.8X.644XT-Y.8Y.	OUTBUT	74
> 44X1-Y, 7X, 54ETA-T, 7X, 5HETA-X, 7X, 5HETA-Y, 8X, 141/1	OUTPUT	28
109 FORMAT(215,9F12.6)	NITRUT	74
110 FOR PATESHATSE PAF7. 6.37. 64951		
	001-01	
III - MARACETZEM FINAL CONIC LINE LOCATION/)	104100	78
ENP	<b>CUTPUT</b>	79

4 VX[[J]=[V[J+1,3]-V[J-1,3]]+D_5	2 HOCK	25
PXT(1)a-PXT(2)	SHOCK	26
11 Y 1 1 II Y 1 1 3 1	SHOCK	27
AXI(1)-AXI(5)	SHOCK	20
*X[{JHAX}=(3+0*P{JHAX,3}=4+C**{JH,3}++{JHH,3})+0+5	540CK	29
5.0+0+5 (5+44L)(+55+14)(+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0	5H0CK	30
WTT / 104 V1 - / 3 . GAW/ 104 V . 31 - 4. GAW/ 10. 31 AV/ 100. 31 140. 5	SHOCK	11
44[13~44]=[380~4]3844[31~40~4[34]3144[344]3144[344]3114353	51004	
DO 5 J=1pJHAX	24004	32
PETA(J)=(3,0+P(J,3)-4,0+P(J,2)+P(J,1))+0.5	SHOCK	32
UETA(1)=(1, 0)((1, 3)=4.00)((1, 7)+0)((1, 1))00.5	\$40C#	34
AEIV(1)+(3°G+A(1)3)-+°9+A(9)5)+A(1)1+2°+2	N 40,00 K	37
1F(J.E0.1.DR.J.E0.JMAX) GO TO 5	< HDCK	36
P(1,2)=P(1+1,3)=P(1=1,3)=2.0*P(1,3)	SHOCK	37
5 CHAILENDE	34064	20
P(1,2)=P(2,2)	SHOCK	39
P(JHAX-2)=0.0	SHOCK	40
	SUDER	41
10 1 4-194-6A	34004	
< = # <b># 4</b> 2	SHOCK	4 Z
CDETERMINE SHOCK ANGLE DELTAHARCTAN(-ETAY/ETAX) J;KMAX	SHOCK	48
DELTA-ATAWI-YEV/ I.K. 31/YEV/ I.K. 31	CHOCH -	
100 FR-81811 - ACT COPRESS AC ACOPRESS	34.904	
SUMPLIAT	24064	97
CD=CPS(PELTA)	\$40CK	46
()1 T=0 INF+CD	540CK	47
11848-VETE 1. V. SSAILE 1. STAVEYE 1. V. SSAVEL. STAVEL. STAVE	Succe	
		72
**************************************	14068	49
RCS=644+P[J=3]	\$ 40CK	51
OTAILAHIPAPAPYTI JI-VRARAPETAT JI-PPCATILYTI JIAYEYTI.K. 114	SHOCK	8.1
	370.8	
* ¥FILJ)#XEYLJ}K91)+"ETATJ]#XEKLJ\$K92}+¥ETALJ}#XETLJ\$K92}+	34058	
> [V(J,3)/Y(J,K))+FLOAT(JCS)}	\$400K	52
87-86 1-7 LAB TAUANTAN - 740 - 1 ( 40/ 1 - 3)	funer.	
	340-5	
1FCJ 4E00 JH4X3FZ+Z+FCJH533-FCJH-1,3)	24004	55
IF(#2.LE.J.0) 67 77 6	<40CK	56
7864941-0	THOCK	47
ENEN-361(3*3)(EVALATAL +542441))	SHIDER	5=
75=CT4=+X#X-U1T	SHACK	59
PA+P(), 3)	SHOCK	61
88-87 L 11	f HOEK	
	SHOCK	
11=-17(J,3)	540CK	62
VR-V(J,3)	540CK	63
58-98/CANNIA4-56886/18849AV84431	Succe	
	3 47 JC K	
UZT=Za?=(1+U=XHX++Z}+CIN>/{{G4H+1+0}+XHX}+U1T	SHOCK	65
\$2=\$INF\${\$2/\$INF+6&##1/7}/{1_}}/{1_}}</td><td>SHOCK</td><td>**</td></tr><tr><td>113-01 NE +508 42412 TAF D</td><td>SHOCK</td><td>1.1</td></tr><tr><td>112-12-12-24021-23</td><td>31004</td><td></td></tr><tr><td>A5=01#==2u=c0-051=20</td><td>5 40CK</td><td></td></tr><tr><td>E2w#2/~*********</td><td>SHOCK</td><td>69</td></tr><tr><td>C PRIMARY CONSERVATIVE MARIARIES AT SUCCE</td><td>Funer</td><td></td></tr><tr><td>LIGHTUTE CURTERFALLYE VALATLES HI SHUCK</td><td>3917.8</td><td>10</td></tr><tr><td></td><td>SHOCK</td><td>71</td></tr><tr><td>PT=1.3/9(J,K)</td><td>54008</td><td>72</td></tr><tr><td>014.8.13.882407</td><td>SHOCK</td><td>73</td></tr><tr><td></td><td></td><td></td></tr><tr><td>01358521=2201</td><td>340CK</td><td>74</td></tr><tr><td>0{J,#*,3]=P2+W2+DI</td><td>2402K</td><td>- 75</td></tr><tr><td>013.*.4)#F2#DT</td><td>SHOCK</td><td>76</td></tr><tr><td>C SETERMINE ANGLE OF VI-PONEY LINE UTTU V-AVIE</td><td>£ 40.6 H</td><td></td></tr><tr><td>Constructed angle of stacoust cive Mile Same</td><td>NHUCK</td><td></td></tr><tr><td>X=X P4 F</td><td>5400%</td><td>74</td></tr><tr><td>TF(ARS(XEY(J+K+1))-0+03(661) 7+7+8</td><td>54008</td><td>79</td></tr><tr><td>7 THETAN1. FT.170433</td><td>Euner</td><td></td></tr><tr><td></td><td>3</td><td>10</td></tr><tr><td>÷0 16 4</td><td>14064</td><td> 1</td></tr><tr><td>8 CONTINE</td><td>SHOCK</td><td><b>52</b></td></tr><tr><td>T4FT&=&T&N(X5X{J,K,1}/XEY(J,K,1})</td><td>SHOCK</td><td></td></tr><tr><td></td><td>54064</td><td></td></tr><tr><td>A CONTENTS</td><td>3479.8</td><td>- 72</td></tr><tr><td>COORDERSTRUCK STEEN OF A BAD T STRECTIONS</td><td>2.4058</td><td></td></tr><tr><td>RETARTHETARDELTA</td><td>\$40CK</td><td>96</td></tr><tr><td>05E+05/C05(5E7A)</td><td>SHOCK</td><td>87</td></tr><tr><td>TELASCIOLES</td><td></td><td></td></tr><tr><td>LEX</td><td>2410,6</td><td></td></tr><tr><td>1+(*#2[0261 *86* #42[026#1]026#=326</td><td>< 40rx</td><td>64</td></tr><tr><td>BHZ=BA42+0256++5</td><td>SHOCK</td><td>90</td></tr><tr><td>X5705F+C05FTHETA1</td><td>SHOCH</td><td></td></tr><tr><td></td><td>37000</td><td></td></tr><tr><td>131-452-43146146143</td><td>240CK</td><td>92</td></tr><tr><td>IHET&+THET&+37.29378</td><td>540CK</td><td>93</td></tr><tr><td>DELTA=DELTA=57=2957=</td><td>SUDER</td><td></td></tr><tr><td></td><td>2 - U - K</td><td></td></tr><tr><td></td><td>2 40CK</td><td>95</td></tr><tr><td>CPRIPAGRTE SHACK</td><td>SHOCK</td><td>76</td></tr><tr><td>TQ+TZX+{>,cl}X={},cl}X</td><td>SHOCK</td><td>07</td></tr><tr><td>Y ( 1. K) - Y ( 1. K) - YSTONT</td><td></td><td>11</td></tr><tr><td>1 4 4 5 7 7 7 1 4 5 7 7 3 1 7 7 1</td><td>SHOCK</td><td>.98</td></tr><tr><td>CeeeshyJUST DIMER GRID POINTS</td><td>540CK</td><td>99</td></tr><tr><td>70 2 K=2,KH</td><td>tunte</td><td></td></tr><tr><td>THE AC ARL OAT / M-11 / 70 M</td><td>C</td><td></td></tr><tr><td></td><td>SHICK</td><td>131</td></tr><tr><td>x [ ]# T = [ X [ ]# HAX } = X [ ]# ]</td><td>\$40CK</td><td>102</td></tr><tr><td>Y{J,K}={Y{J,KMAX}-Y{J,1}=YZKFAC+Y[J,1]</td><td>SHOCK</td><td>101</td></tr><tr><td>2 CONTINUE</td><td></td><td></td></tr><tr><td></td><td>SMOCK</td><td>194</td></tr><tr><td>T LINELINDE</td><td>240°K</td><td>105</td></tr><tr><td>PMS+S9T(PMS/FLOAT(JMAX)}</td><td>54004</td><td>1.74</td></tr><tr><td>VOTTE/6.1331 TT. BHC. 055H. 105</td><td>5</td><td>100</td></tr><tr><td></td><td>N 41 R, R</td><td>197</td></tr><tr><td>a F I On M</td><td>SHOCK</td><td>108</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></tbody></table>		

,

.

A CONTINUE	
	SHOCK
STAP	SHITCK
102 FORMATEING TERRATION, TALAN, LOURNE OF FUREN PAPER, LANS 4 AN	341764
A STANATION LIGATIONS (4948) GATANA UP SHICK SPECOSIPEII.49389	SHOCK
- commented and state period of a set [2]	SHINCK
103 FIF MAILINGS ALMAEGATIVE PRESSURE DETECTED AV SHICK AT J+,12/	540CK
3*5544451FE10+3+3K+5HFU=+31+E10+31,5H=TAH++E10+31	SHOCK
280	540CK
COMPART AND	XIETAD
AUAN DALA BARASA BARAS	Cami
THUR US HCAP HCAP HCCS AASHS UNEEA, NUS NESTS TAUSTTER, ENTS PTORTS PINES	C3*1
a the stars of the sector of the sector of the sector sect	C0M1
CTWEN _ CFAFTFAC (FFCFAFETF) CTWENT _ FCFAFTFAC _ FCFA	COM2
- YEVAN,	C0 #2
	CUas
FORMAN FORMER FORMER AND FORMER AND AND AND AND AND AND	C 3 43
	COM3
	ALETAD
VET (Jaka) and a	TIETAD
¥F7{J+K+2}=	ALTAG
	X1 - TA9
K M P = K 4 - 1	212147
CARACOMPLITE Y-YT AND Y-YTS DYY AND DEVA - 1	FLETA?
PO 1 K-1-KHAK	1 - I AI)
1 2 J=2. JH	XIETAG
XFY[]=K=2]=[X{]=1,K}=X{[=1,K]=0,S	-15-40
2 XEX(J+K+2)=(Y(J+1+X)-Y(J-1+K))+0.5	ALTIAN WESTAR
YEY(1,K,2)=(-3,;4)(1,K)+6,C4)(2,K)=Y(3,K)+9,F	** 5 ***
XEV(J4AY, K, 2)=(), 0+1(JHAX, K)-4, 0+X(JH, K)+X(JH, K)) +(, =	YTETAD
YEY(1, ", 2)=(-3,0+Y(1,K)+4,D+Y(2,K)-Y(3,K))+3,5	TETAN
1 YEX(JMAX,K,2)=(3.0+Y(JMAX,K)=4.0+Y(JN,K)+Y(JNH,K))+C.5	VIETAD
CCOMPUTE X-ETA AND Y-ETA	TTTTAD
TO 3 J=1, JMAX	XTETAD
5D 4 4=2, KM	XTETAD
¥EY{},x,1}=[x{],K+1}-x{],x-1},*0,5	XTETAD
4 ¥EX{J,×,1}={Y{J,×,1}-Y{J,×	XISTAN
xEY(J+1+1)=(-3+6+x(J+1)+4+0+x(J+2)-x(J+3))+9+5	XIETAN
4E463,K444,13=63=0+X63,0+X63,K44X3=4=6=0+X63,K443,4+C43,K443,4+C45	XIETAD
IEI(J,1)=[-3.0+Y(J,1)+4.6+Y(J,2)+Y(J,3))+7.5	KIETAD
3 TFT(J, MAX, 1)=(3,04Y(J, MAX)-4,04Y(J, MA)+Y(J, MA))+(,5	ギエテナネウ
Constitute Timer, VI-Y, ETA-V, AND ETA-V	おしモエヤン
PH 5 RELEAR	XIETAN
	XIETAN
0173007 017007	XI ETAD
	XIETAN
TELEVERVERVE VERTER ET BATTO ON NEU MERN	TT ETAD
	E L ET AU
5 0[].K.W)+0[].K.W)+0[].K.W)+0[].K.W)	*****
7 CONTINUE	******
CTHE GEOMETRIC JACOBIAN IS DEFINED HERE AND STUDED THE DARRAW	*****
Startsent1	VIETAN
X#X(J,K,1)+XEX(J,K,1)+7]	TETAD
¥ ~ Y { J, K , 1} = - X E Y { J, K , 1 } = DI	TETAN
Y#¥(J,K,Z)=-XE¥(J,K,Z)=NT	VIETAD
5 (EY(J,#,Z)+XEY(J,K,Z)+D]	TETAD
CREFLECT "FTTICS AND DEPENDENT VARIABLES ANDIT PLANE OF SYMMETRY	XIFTAD
IF(IFLAG.EQ.P) 60 TO 8	XTETAD
DD 9 K-lpthat	TIETAD
55={+1=63++3CS	XLETAD
n { 2 # } = 0 { 2 # K } + 0 D	XIETAD
¥EX41+K+1}+-XEX(2+K+1)	XTETAD
¥FY(1,+K,1)=XEY(2,K,1)	TITAD
xEv(l,k,2)=xEx(2,k,2)	XISTAD
¥FY{l,K,2}=+¥EY{2,K,2]	<b>TT ETAD</b>
0° IC #=1,4	XIETAD
3. Q(1,x,x)=Q(2,x,x)=BD	XTETAN
✓ U(1)==>1==U(2)=K,3)=DD	XIETAD
	XIETAD
~ E 10~ J	XIETAD
- TU	XTETAD

CDMMNN /INVARB/RK,ETA(41),PMIP(41),DTIL(41),DTTLE(41),NETA,TP(24)	TOVARS	2
COMMUN/JOE/ZL1+CF1+CF2+ZLF+ZTRAN+DZTRAN	JOE	
LEVEL 2, RH0,P;U,V,W,R0P,R08Z,VIHF,WIHF,R0RPH,R8,R8Z,B4PH,DT8PH,	PYARS	
ACT, DTDZ, DTDR, ACT, ICONST, GAM, CONST, NPEGON, RS, RS7, PSPH T, RS7, RS7,	PVARA	
* R\$+4[T	P ¥ 4 9 9	
"04404 /PVAR5/ R40(24,41), P(24,41), U(24,41), V(24,41), V(24,41),	PYARS	
• • • • • • • • • • • • • • • • • • •	PVARA	
• ROBPHE413 +	PVARS	
<ul> <li>NTDPH(24+41) BCT(41) DTD2(24+41), NTDP(41) ACT(41)</li> </ul>	PVARS	
ICONSTISON , GAM(2C) , CONSTISON , NEEGON , PS(41) ,	PVARS	
* #SZ(41) # PSPHI(41)# #ST(41) # PSZT(41)# PSPHIT(41)	PVARS	10
COMMON/SWARB/T#Z # PHY # DT # DZ # OPHI # 71NT #	SVARA	1
4 ZEND & PT & ALPHA & GAMMA & STOMA & XMACH & TAPEL &	SVARA	1
* TAPEZ > DISKI > ALPH > DISK2 > STGM > NPRNT > D70T >	SVARA	
POTAL STAND STALD STAL STAL STAND STAL STAND	SVARA	
* TTHL # R? # PZ # NTPHT # NTT # KPHT # NTTFP #	SVARA	ē
* PP4I > NP4I > NAMI > NAMI > NAMI > NAMA	SVAPA	
* NT = NT1 = NT2 = NT3 = PHIFO = NCONE = RADI =	SVARA	
PHIF > METHOD> LAG > NSC > PINC > RHOIN > YINF >	SVARA	
POTHF, GASCON, MREAL, NFUNCH	SVARA	11
COMMON /DNSTRM/ ZPLOTANZENDANZADDANXPLOT	DNSTRM	
r	HARCH	i
·	PARCH	
CALL SETDAT	HARCH	11
CALL GEOM3(0; PHIP, NPHI; 7; RR; R#7; RBPH; IPPNT;	MARCH	i
SIG44=4TA4(C=2)+57.29578 '	MAPCH	11
ICONSTEAR3-0	MAPCH	1
CALL INITA	44904	1
IF (7 .AT. ZEND) 63 TO 19	HAPCH	19
4TTE9=1CO+47END	наясн	10
WPIT=(6,61))	MAPCH	1
5 TP 57 E= N T= <u>1</u>	PARCH	- ī
CALL ANDRYN(2)	HARCH	1.
DO 6 PHOIESMITER	HAPCH	ž
10451(5)=JUQI	МАРСН	2 3
Conservation Compute AutomAtic Stepsize	HAPCH	2
IF (1997, .EO, 1) 60 TO 3	MARCH	23
TF ("OD(J)DI#ICONST(49)]#NE#C) 60 T3 5	MARCH	- 21
3 CALL FIGENM	MAPCH	25
TE (M7 .LT. 1.3) 60 TO 5	MARCH	21
DTOTASTASTE	MARCH	2.
17#97UT#07	MARCH	2
978P4=07/0514	МАРСЧ	2 '
7 CURTINY	HARCH	- 30
CALL DIFFR	HARCH	3
Constant of the second star for rerun on taken	PARCH	
C AND STOPE IN ARPAYS USED BY CONTONP RONTINES	MARCH	3.
CALL CUTPTM	MARCH	3
YE (7 .6T. 75HD) 60 TO 19	MARCH	3 5
4 ····································	MARCH	- 3
7.a. cualifaile	MARCH	
Connection of the section of the section of the state of the section of the secti	MARCH	3
SAD FILF 9		- 9
	MARCH	- ÁI
	MARCH	
DID FURNETEINE//SEXESSINGECHING CALCHLATION/SEVESILINEL//	PARCH	- 4
TREATER NO. 442 19HOOWNSTREAM LOCATION, 41, 19HBOOV OPATNATE.	MARCH	
* <u>44,144943CK ORDINATE/)</u>	MARCH	
5 NJ	MARCH	- 4

SUBROUTTNE BNDRYM(K2)	NNRYH	,
COMMAN/ENTRO/S(41), 785, 7FLD, ITPRT9, ITPRTF, 4C455, NTD595	ENTRA	ž
LEVEL 2. PHO, P, H, V, Y, ROR, POST, VINF, VINF, ROSPH, R. PR7, PPPU, DTOP4.	PVARA	,
* RCT, DTDZ, DTDR, ACT, ICONST, CAN, CONST, NR TGON, RS, RSZ, RSPH1, RST, RST, PST.	PV APR	
4 P\$P417	PVARA	4
COMMON /PVAR9/ PH9(24,41), P(24,41), U(24,41), V(24,41), V(24,41),	PVARS	5
POP(41) , ROBZ(41) , VINF(41) , WINF(41) .	PYARS	Ā
* POAPH(41) , PR(41) , PR(41) , RRPH(41) ,		7
<ul> <li>DTDPH(24+41), BCT(41) , DTD2(24+41), DTDP(41) , ACT(41) .</li> </ul>	PVARA	÷
<ul> <li>TCONST(50) + CAN(25) + CONST(53) +NR2674 - R5(65) -</li> </ul>	PVAPS	à
<ul> <li>#ST(41) . #SPHT(413. RST(41) . #ST(413. RS#HTT(415</li> </ul>	PVARS	10
COMMON/SVARE/TAZ A PHI + OT + DZ A DPHI + ZINT +	SVARA	•••
TEND + PT + ALPHA + GANNA + STGMA + XNACH + TAPF1 +	SVAP 8	
* TAPE2 + DISK1 + ALPH + DISK2 + STGH + N*PHT + DIDT +	SVAPS	- Ă
* DZDPH + ZM + THWD + THLD + THW + THL + TTHW +	SVARA	
<ul> <li>TTHL # P2 # AZ # NTPHT # NTT # KPH1 # NTTER #</li> </ul>	SVAPA	é
<ul> <li>NPHT - NPHI1 - NPHI2 - NPHI3 - NPHI1 - NPHI7 - NPHI3 -</li> </ul>	SVARS	ī
NT + NT1 + NT2 + NT3 + PHIED + NCOME + RADI +	SVARA	, é
<ul> <li>PHIF + METHOD+ LAG + NSC + PINE + RHOIN + UTHE +</li> </ul>	SVARA	ĕ
*QINF, GASCON, NREAL, NPUNCH	SVAPP	10

۰.

SURROUTINE MARCH

MAPC4

	DTMENSTON PK13(41), PK14(41), PK21(41), PK22(41), PK23(41)	BNDRYH	6
	485TN (A)+45TN (A)	9492Y4	- 1
	GD TO (10,18,11),K1	84D274	ē
10	CONTINUE	8 NDR YM	10
C VE A	IN OR SMALL ANGLE CORRECTIONS (USES PRANDTL-MEVER RELATIONS)	8N DR 7 4	11
	90 9 KEJPAPAL 9K681.0/508T(887/8196741.04/8898/81/886/811447)	BNDR Y4	12
	PK1=-487(K)+PK4	RNORTH	14
	PK2=PK4	BNDRYH	15
	PK3PRPHIK}/RA(K)+PK4	BNDRYN	16
	1124046FALSE6	BNORTH	17
	1F(P(3+K)+GE+C+F) GO TO 4	5 N DE TA RN DE TA	17
C NE 5	ATIVE SURFACE PRESSIRE	RNDRYN	20
	ICHECK+1	ANDRYS	23
		84 DR AN	22
	77 14 8546 37 88115107257 APRISKIPENULSEKIPULSEKIPULSEK	540674	21
	RHU(1,K)+(P13,K)/S(K))++(1.C/GANNA)	84 DR Y 4	15
	Q3K+5 0PT(1.0-P(3,K)/RHO(3,K))	BNDRYM	26
	11(3, K)=U(3, K)+Q3K/Q5Q++C.5	RH 78 VH	27
	V/3.K1=V/3.K1=03K/050007.5	BNDBYN	2.4
	320+33K++5		ŝr
4	PONTENIE	BHORAH	31
	TF(R40(3,4) .62. 0.0160 TO 5	AN DR YM	32
	10-00 K=2 Y=3.0-7	53,02 V 4	37
	TE (K .EQ. 31 WRITE(6,100) X, #(3,K),RHD(3,K),U(3,K),V(3,K)		35
	PH((3,F)=(P(3,K)/S(K))++(1.0/GAMMA)	AN DR YN	36
	03%=\$ 9PT(1.0-P(3,K)/PH9(3,K))	BNORYH	37
	V(3,K)=V(3,K)=Q3K/Q50=00.5		38
	W(3, K)+W(3, K)+03K/050++(.5	BNDRYN	40
5	CONTENIE	PHORYH	41
	PK5=5 OR 1 ( 05 7) PK5=5 OR 1 ( 05 7)	941974	42
	PK7+495IN(PK6)	9 10 10 10	44
	PK#=644611+P(3,K)/RHO(1,K)	84 0444	45
	PK9+PK5++2/FKF	8408X4	46
	7F(9K16 .67. 6-0160 TO 6	RNDOYN	- 24
	TCHECK+1	PHDRYH	49
		840874	50
	1* (* 4006 3) ##110(0)1003 X##(3)KJ##0(3)KJ#U(3)KJ#(3)KJ PK10e0.4	BNDRYN	21
	Px 9+1.5	PNDRYM	53
	PK8=PK5++2/PK9	5 N D2 Y 4	54
	VH1133K3+GAF(1)+P(3)K1/PK8	ENDE YN	
	11 (3+K1+11 (3+K)+03K/05Q++C.5	ENDRYN	57
	¥[3,K]=¥[3,K]+Q3K/QSQ++0.5	54 DR Y4	58
	V(3,K)=V(3,K)+Q3K/QCQ++C."	840974	59
•		RN DO YM	-00 -11
	PK12=54MM44PK94((54MM4+1_C)+PK9++2=4,24PK10)/(4,C+PK1C++2)	ANDRYS	62
	*K13(K)=P(3,K)+(1,0-PK11+PK7+PK12+PK7++2)	SNDR Y4	6?
	FACT79=3.5+GANMA+PK9/(PK10++3.5)	8N 09 Y #	54
	TEPH2=={4,	SN DO YH	55
	TER#3= 5.C+ (GAMMA+1.0)+PK9+2/3.C	SNORYM	67
	TE\$M4=4.0/3.0-2.0*PK9	BNORYH	6.2
	COEFF3=FACTOR+(TERN1+TERN2+TERN3+TERN4)	RN 78 YH	69
	TF [495(9K7].IT.495(6.01))60 TO 123	RNDEVA	71
	THI . SOPT(PKG)	RNDPYH	72
	CALL PHTURN (XM1, PK7, P2P1, NTTS, GANHA)	6N D# 74	73
	PTRIIS - PI3,KI+P2P1	840874	76
123	CONTINUE	RN PRYN	76
-	PK13(K)=PTEST	9N 0R Y M	77
	PK34(K)={PK13(K)/S(K))++{1+{/GAMMA}}	RNJRYN	78
	PK16=PK6+PK5+PK4	940874	90
	#K17+U(3+K)+PK16+RN7(K)	AN DR YH	61
	PK18=V(3,K)-PK16	RNDRYN	92
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	8 N DR 7 N	73
	PX24=PX15/PK20	BNDR YN	85
	PK21[K]=PK24+PK17	PNDRYM	96
	PKZZ[K]=PKZ40PK]8 PKJ3[K]=PKZ40PK]8	RNDR YM	97
4	CONTINUE	BNDRYS	49
11	CONTINUE	#N 16 4 H	90

C	RESET BODY VARIABLES TO THOSE CALCULATED BY ASSETTS SCHEME	-	91
	TO 12 ##SPHPHI	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	92
	0(3,K]0PK13(K)	BNDRYM	93
	440(3,K)+PK14(K)	BNDRVM	94
	1183px3=PK228K3	8N0874	95
	¥(3,4)===K22 (K)	ANDRAH	96
	¥{3,K}=PK23(K)	AN DR VH	97
12	CONTINIE	BNDRYN	99
	on To 21	BNDEVH	99
18	CONTINIE	BHORYH	100
c		PHORYN	101
C	APPLY REFLECTION PRINCIPLE AT PLANES OF SYMMETRY	BUDDYN	1 3 2
ċ		BNDFYH	165
	PA 1 K=1+2		1 14
	Mag-K	PUDPYN	105
	t BNRHTAK		
	N = N PH T = K	BNDOVA	100
	30 3 1=3-NT2	Bullen MM	111
		549474	195
			1 7 4
			110
		****	111
		SNOR YH	112
		BH DE YH	113
	11 Jol 9-11 Jan 9	9 N D R Y H	114
	V(J,K)=V(J,R)	84 NR 7 4	115
	VTJ,L 3-V(3,N)	SNDRVH	116
	A()'&)++A()'A)	8 M US X M	117
	A()*()*+A()*#)	8 N DR Y H	119
	W(J+33+C+C	840874	119
	41748412=0*0	PNDRYM	120
1	CUNTIMIE	RHORYM	121
21	C 04 TT 4114	BNNRYH	122
2.	FORMATCING, 494NEGATIVE PRESSURE OF DENSITY ON GODY DETECTED BY	5117875	123
	* 1145NORY AT X=,F7.3/3X,34P5=,1PE17.3,3X,54P40*,5E10.3,3X,	5N0874	124
	4 44 44 44 44 45 10.3.3.4 44 48 8.4 E1C. 33	BNDFYN	125
	PETURN	RNDOVH	124
	END	BHDBYN	127
			•••
	CHREGHTINE DIFFR	DIFFR	2
	LEVFL 2,ETEMP,EL,,F9.GU,H.	CVARA	2
	COMMON /CVADS/ ETEMP(4,24,41), E0(4,24,41),	CVARR	3
		C	

~

A DATE OF THE THE PARTY OF THE	ULFPR	
LEVEL 2,ETEMP,EC,,F).GU,H.	CVARA	
COMMON /CV408/ ETEMP(4,24,41}, ED(4,24,41},	CATEN	
FUT4,24,411 , GU(4,24,41) , 4/(4,24,41)	CVAPS	
1 EVFL 2, PHO; P;U; ¥; ¥; RO\$; RO\$Z; VINF; 4INF; RO\$PH; R\$; R\$Z; R\$PH; \$TOPH;	PVARA	
• • • • • • • • • • • • • • • • • • •	PVAPS	
* Those *	PVARA	
194898 /PV488/ F49(24,41), P(24,41), 9(24,41), V(24,41), W(24,41),	PYAPA	
* POB(41) . POPZ(41) . VINF(41) . WINF(41) .	PVARA	
• P0994(41) . R9(41) . P37(41) . P894(41) .	PVARS	
• DTDP4(24.41), ACT(41) .DTD7(24.61).DTDP(41) . ACT(41) .	PVARA	
ICONSTERS - GAMERSS - CONSTERS - NREGON - RS (43)	PVARA	
•	PVARR	1
COMMON/SVARG/T.7 . PHI . DT . 17 . DPHI . 7INT .	SVAPS	•
- 7ENT . BT . ALBUA . CANNA . STONA . TABET .	SVARA	
• TAPE? . DISK? . ALPH . DISK? . SIGM . NOWNT . DISK? .		
<ul> <li>MOLT - MOLT - MOLT - MOLT - MOLUT - MOLUT - MOLUS - MOLT - MOLT - MOLT - MOLT - MOLUS - M</li></ul>	CUAR D	
A NT . NT: . NT: . NT: . NT: . NT: . NT:		
• BUTE , RETURN (AC) , NGC , BINE , BUATA MARK .		
ANTIEL CASTON AND ALL DE THE PARTY AND ANTIELE PARTY ANTIELE	SWADE	1
Constructive variables at all antite	01660	•
CAN TOCHTAL AND	Of CER	
	07000	
	01000	
	1111-58	- 1
TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT		
CONFERENCE ALL FURTHER ALL FURTHER ALL FOR ALL	01114	- !
**************************************	DIFFE	
• DEDEMACTORNESSKELLAGEN, 35K11+DEAMC(N, 35K1)	0[	
	01664	
	Ditte	1
C. PREMICHINE SIFE AT SHOCK	Dites	1
ETEN=(4, J, C)=EU(N, J, K)=(020(=CFG(N, J, K)=EO(N, J-1, K))	U. C.	_ <u>1</u>
**************************************	Ditte	1
60 TO L	77	Z
1 CONTINUE	DIFFR	z
7 = 7 + 17	UILLA	- 2
C++DECUDE CONSERVATIVE VARIABLES	UIEEB	2
CALL TOCON(2)	Úlces	2
CANCALCULATE PREDICTED SHOCK VALUES	DIFFR	Z
CALL SHOCKH(1)	NTEFR	2

CCALCULATES GETPETRIC FACTORS RASED ON NEW RORY AND SHOCK GEOMETRY	DIFFE	**
CALL SEDMICIS	DIFFE	
CONAPPLIES PLANE OF SYMMETRY ROUNDARY CONDITIONS	DIFFE	29
CALL SADRYA(2)	DIFFE	10
CONFIGER INTERREDIATE CONSERVATIVE VARIABLES AT ALL POINTS	DIFFE	
TALL TOCON(1)	DIFFE	
TO 3 KPHIN3, NPHI	DIFFR	
DN 3 J-3,4YZ	DIFFE	
· · · · · · · · · · · · · · · · · · ·	DIFFR	
	DIFFE	34
CDISCIPATION FUNCTION	DIFFE	17
D122=0*6	DTEEP	
IF (CONST(4).NE.C.D .OR. CONST(5).NE.C.O) PALL DISSPHIN.J.K.DISS)	DIFFE	
1F(J. 59.3) 60 TO 9	DIFFO	
TF(J.E0.MT2) 60 TO 5	NTERP	
GAACORAECTOR IN FIELD	DTFFP	
# TE4+ {N+ J+ K}=G+ 5+ {E0 {N+ J+ K}+ ETE NP {N+ J+ K}+ (N 20 T+ (FD {N+ J+ K}		
*===0(N, J=1,K))+020*H+(G0(N, J,K)==9(N, J,K=1))+97+40(N, J,K)+01553	NTEED	- 11
60 19 3	DTEER	
- CONTINUE	NTEFR	
ECOPPECTOR AT SHOCK	DIFFE	47
FTF## (N, J, K) # 0a5+(ETEM#(N, J, K)+ED(N, J, K)-(D70T+(FO(N, J, K)	OTFFR	
	DIFFR	49
60 10 3	DTFFR	50
Y PONTENJE	OTFFR	51
CAACHY EFTOR AT 500Y	DIFFE	52
**************************************	DTFFE	
	DIFFR	94
**************************************	DIFFR	
	DIFFR	56
LOUDE CONSERVATIVE VARIABLES	DIFER	
CALL IJCON(2)	<b>11FFR</b>	
CARGE TED SHOCK VALUES	DIFFR	59
	<b>NTFFR</b>	56
CONTACTORATES OFFICIATE FACTORS BASED ON OLD RODY AND NEW SHOCK GEOMETRY	01***	51
CALL SECONI(2)	DIFFR	52
LEERCHT IN THIS VERIARLES	OTECO	63
······································	DIFFR	54
CALL PLANE UP STHMETRY HOUNDARY CONDITIONS		65
'. FL 'AN IRTA (2) 6 time	DIFFR	66
	DIFFR	67
2.3%	NTECO	Á.

5U987UTT%F 7155894(No.JoKo755)	PT55PN	,
LEVEL 24 ETE MP + EL+ 52 +60+40	CVAPS	;
CORMON / CVAR3/ STENPIG.24.411. 53(4.24.41).	CVARR	
F3(4)24.411 . 6(4.24.41) . 47(4)24.411	CVAPS	
"04404 /TOYARA/RK, FTA(63), PHIP(63), OTTI (63), DTTI 5(63), DETA, TP(26)	TOVARA	,
LEVEL 2. PHO. P. U. V. W. ROR. BOAT. VINE. VINE. BOAPH. PA. 837. BAPH. DIDPH.	PVARA	;
* SC*+DTD7+DTD8+ACT+TC0NST+GAN+C0NST+N#F60N++S+#S7+#S8HT+PST+#S7+	PVARA	
• <b>\$\$</b> \$477		- i
COMMON /PVARB/ RH0126.613. P424.613. U(24.613. V(24.63). V(24.63).	PVARS	5
* PO9(41) , PO97(41) , VINF(41) , WINF(41) ,		6
4	PVAPR	7
<ul> <li>DTFPH(24,41), BCT(41) , DTD2(24,41), DTD8(41) , ACT(41) .</li> </ul>	****	
TCONSTISCI + GAMIZCI + CONSTISCI +NTEGON + PS(42) +	PVARS	
• R\$7(41) , R\$P4T(41), P\$T(41) , R\$7T(41), P\$04TT(41)	****	10
COMMON/SVARB/T.Z A PHT & DT & DZ & DPHE & ZINT &	SVARA	
* ZEND / PI / ALPHA / GANNA / STOMA / XHACH - TAPFI -	SVAPR	
<ul> <li>TAPEZ # DISK1 # ALPH # DISK2 # ST64 # NPRNT # DZ0T #</li> </ul>	SVARS	4
4 020PH 2 2H 2 THEO 2 THEO 3 THE 2 THE 2 THE	SVLPA	. ÷
<ul> <li>TTML # RZ # RZ # NIPHI # WIT # KPMI # NITER #</li> </ul>	SYARA	é
<ul> <li>MPHT &gt; NPHT1 &gt; NPHT2 &gt; NPHT3 &gt; NPHH1 &gt; NPHH2 &gt; NPHH3 &gt;</li> </ul>	SVAPA	- <b>7</b>
NT > NT > NT2 > NT3 > PHTED > NCDNE - RADI -	SVARB	
PHIE > HETHODS LAG > NOC > PINE > RHOIN > UINE >	SVATS	ġ
40THF, GASCON, HREAL, HPUNCH	57489	10
	DISSPH	7
c	0155 PH	<u>é</u>
C CONST(4) <0 . LAX DAMPING	PESSPH	9
Constant CONST(4)=0 . NO DAMPINE	0155 #4	10
Conserve CONSTINTED & ATH ORDER DAMPING	9155 #4	ii
c	DISSPH	12
c ,	015594	13
1F(CONST(4))21.1.23	DISSPH	14
C	DISSPA	15
20 TF(J .GE. 5 .AND. J .LE. NT)60 TO 5	DISSPH	16
TF(J.LT.5) 60 TO 7	DISSON	17
ТИФЛЕ	0155#4	14
5P TO 6	DISSPH	- 19
7 JD=5	0755PH	20
G TO 6	P47730	21

5 30-3	0155PM	22
5 DISSPCONST(4)+D.J1+(E0(N,JD+2,K)+E0(N,JD-2,K)-4.C+(FC(N,JD+1,K)	DISSPR	23
+ +EQ(N,JD-1+K))+6.0+EQ(N,JD,K))	DISSPH	- 24
60 TO 2	NT\$\$\$PH	2 5
21 CONTEMPE	DISSPH	24
IF(J SE. 4 ANDA J ALEA NTI)GO TO 53	DISSPY	27
TE(J_LT_ 4)60 TO 70	DISSPH	28
JD=NT	#4221G	29
60 TO 68	DISSPH	30
70 JD=6	015594	31
60 10 64	DISSPR	32
56 10+1	DISSPH	33
AC 01559	DISSPH	34
	NISSPH	3 5
1 01558#0.0	DISSPH	36
c	n155P4	31
Ē	0155#4	31
CANADA CONSTISTION LAX DAMPINE	PISSPH	- <u>š</u>
Constant CONSTANT AND DAMPING	DISSPH	40
	N155PH	
Ceesses		
	442210	
2 (FETTRESTESTISSISSIE) 	01111	- 2
Cesedisiralian lean in the arriviance Discutton	N755.0H	
3. THELEDE	0155.04	
IFIK ONES & GARUG K GLEG REMILIGU I'U DV		
		- 1
	DISTRA	
	DISC.	÷.
	DISCON	- ÷
The state and the second state of the substant of the state of the second state of the		
4( )] \\ \ - \ () \\ \ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ () \\ (		
	BTSSAM	
11 I DRII 1000 TEINE EN AL DIE 11-011-011-01	0155.00	
1-186-8631 Flag11-18931 - 18931 - 18941 - 18941 - 1894		
[FIN_704MF4][FIN_4047F][FFN][FFN][FNN][FN][FN][FN][FN][FN][FN	0155.04	
	0755.88	
***	0155.04	
	015594	Ă
• • • • • • • • • • • • • • • • • • •	P42210	ň
		Ă
*17 NTEER-D. BIN STAATZASTASSASSASSASSASSASSASSASSASSASSASSASSA	NTESPH	Ň
	1155.00	
- (FF2)-(2)(())))()-(0)()))())())	DISSPA	6
	0155.04	Å
3 7132080 4 NYCE-ATCCBANTECB	NTSSPR	6
	015400	İ

	\$119.870	111	NE	E1	GE	NP																						ST 65	N4	
	COMMON	νċι	L II S	TR	ji.	J , X	11	241	P T	¥11	24)	1.1	1 X 1	Tf	24	1												CLUS	79	1
	-	11	thv		87	RK,	ET		11	e P4	1.0	(4)	0	DT	ÍL.	14	13	• 7 '	11	LEI	(41	1.0	) E 1	14.	T٩	(Z	41	TOVA		
	LEVEL	7.	P-4	Ô.	P.,	Vן	a V	. 81	٩.	838	ž.,	11	i F	ΥÏ	ų P		ñ•	•4	, İ.	8,1	197	1.	L P I	ι, η	TD	P4,		PVAR	٩	
				DT	D.		т.	100	2 1	TG	A.M.	. cr	111	τ.	4.8	FG	лч.		è.		7.8	ς ρι	ŧ۲.		1.		Z T.	PVAR	ė.	
		ίτŤ.						•••																				PVAR	á –	
	*****	1 1			1	B H 1	112	4.4	11		(2)				118	24		11.		ve	24.	<b>61</b>	۱.	ve	24		1).	PVAR		
	•		1.0	41	ŝ.			101	iże	411		¥1	EN P	1.	ñ	٠.	Ŵ	TN	51	41							•••		۹.	
			NRP	HE	Å1	•					•		114		•			Ň7	14	:1			L PH	414	11			PVAR	<u>.</u>	
	•	01	DP4	12	47	41 I		501	r 14	11		N TI	DŻ (	24	. 4	лī	• 2	t?	RE	41	١.		11	(41	1			PVAR	<u>ن</u>	
		Ē	r 14	\$T	15	<u>65</u>		GAI		01		er	-	tte	53	1	١N	÷F.	ĥ۵	N.		÷.	İ.					PVAR	é	
			ŝźi	41	ï	••			-	141	١î.	÷.	5 11	4	ŝ.			15	īτ	64	11.			411		лí		PVAR	é .	1
	0440	1/5	VAR	87	Ť.	2	•			it -		0	T			<b>n7</b>	·			DP	HT		21	INT	r			SVA	8	-
	•	Ť	END			PT.		- 1				ě.	A M I		:	51	64			¥.	ACH	۰.	Ť		1	5		SVAR	ŝ.	
	•	T	APE	,	1	011	K X X			PH		0	151	cž.		ŝī	6 *	÷		NP	RNT		0	7 01				SVA	é i	
	•	'n	70.	н	2	7 14			TH	MD		Ť		n -		TH				TH	1	<i>.</i>	- 1	7 **				SWAR		
	•	T	THI		:			- 1	87			Ň	TPI	11		NI	Ť.		:	ŘР.	ĤT.			T T I		1		SVAR		
		Ň			1	NP-	111	11		HT 2			B H		2		HIS	1	2	NP	411.2		N			:		SVAR	é.	
	•		τ.		2	NTI	i	• •	NT	2			T 3		1		ITF	÷.	:	NC	ON E			AD	r"	1		Ś¥A	é –	
			HTF		:	RET	rur	۱n.	1.4	ē.			80		1		NS		2		111		- uř	T N		-		C VAR		
	*atur.	242	CON			A1 .	N	HIN	сŇ															• • • •		•		SWAR	R	1
f			1.00			\$ 10		-	116	5 1	-		* * *															FTC	N 44	-
	TPONT	10	กมร		Ā1	•••						-	•••			•												FTCF	11	
	\$7617		- 6																										NR	
	1111	H=0	10																											1
	00.1			н																										- 1
	00 1	1. 1																										FTC	10.00	- 1
	Tavir			•																								FTE		i
			***	-		<b>K</b> 1 1	1+1		K \$																			FTC	11	- 1
		- 1-																												•

17 F1(2), 70-714 17 C0-72 18 C0-72 19 C0-72 19 C0-72 19 C0-72 19 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72 10 C0-72		C2+64H(1)+P(J,K)/RHD(J,K)	EIGENM	15
<pre>CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C2 CP-C</pre>	17	TF(C2) 17/17/18 CONTINUE	EIGENM	16
10 CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONTINE - CONTINUE - CONTINUE - CONTINUE - CONTINUE - CONT	•••	C2=-C2	ETGENM	16
<pre>closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeric_closeri</pre>	18	CONTENUE	EIGENM	19
<pre>city_ity_ity_ity_ity_ity_ity_ity_ity_ity_</pre>		F • 5 0# 11/2) # 9= 0109 4/1, #1 +/ #08/#1_###/#11/#	EIGENM	20
cn01=U1_pt3 #2pt1_pt3Pt2[st(V1_pt3)=V1_pt3Pt1_st_e=C_20[1_pt3Pt=0]]         cc2           19         Cn01=U1_pt3Pt2[st_pt3]         cc2           19         Cn01=U1_pt3Pt2[st_pt3]         cc2           19         Cn01=U1_pt3Pt2[st_pt3]         cc2           10         Cn01=U1_pt3Pt2[st_pt3]         cc2           11         Cn01=U1_pt3Pt2[st_pt3]         cc2           12         Cn01=U1_pt3Pt2[st_pt3]         cc2           13         Cn01=U1_pt3Pt2[st_pt3]         cc2           14         Cn01=U1_pt3Pt2[st_pt3]         cc2           15         Cn01=U1_pt3Pt2[st_pt3]         cc2           14         Cn01=U1_pt3Pt2[st_pt3]         cc2           15         Cn01=U1_pt3Pt2[st_pt3]         cc2           16         Cn01=U1_pt3Pt2[st_pt3]         cc2           17         Cn01=U1_pt3Pt2[st_pt3]         cc2           17         Cn01=U1_pt3Pt2[st_pt3]         cc2           16         Cn02=U1_pt3[st_pt3]         cc2           17         Cn02=U1_pt3[st_pt3]         cc2           17         Cn02=U1_pt3[st_pt3]         cc2           17         Cn02=U1_pt3[st_pt3]         cc2           17         Cn02=U1_pt3[st_pt3] <tdcc02=u1_pt3]< td="">           17<!--</td--><td></td><td>01+(V{J+K1+W(J+K1+891+4)(J+K1</td><td>ETGENM</td><td>21</td></tdcc02=u1_pt3]<>		01+(V{J+K1+W(J+K1+891+4)(J+K1	ETGENM	21
1         ΓΙΔΟΥΝΙ 10.245.20.         ΓΙΔΟΥΝΙ 10.245.20.           1         ΓΙΔΟΥΝΙ 10.245.20.         ΓΙΔΟΥΝΙ 10.245.20.           1         ΓΙΔΟΥΝΙ 10.245.20.         ΓΙΔΟΥΝΙ 10.25.20.           2         ΓΙΔΟΥΝΙ 10.25.20.20.         ΓΙΔΟΥΝΙ 10.25.20.20.           2         ΓΙΔΟΥΝΙ 10.25.20.20.20.20.20.20.20.20.20.20.20.20.20.		G001-U(J,K)++2+(1+2+8P++2)+(V(J,K)+V(J,K)+RP)++2-C2+(1+0+PP++2)	ETGENM	23
1. Continue         1. Continue           1. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           2. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue         1. Continue           3. Continue	10	YF(6001) 19,19,20	EIGENM	24
1 - 1 - 2         1 - 1 - 2         1 - 1 - 2           1 - 1 - 2         1 - 1 - 2         1 - 1 - 2           2 - 1 - 2         1 - 2 - 2         1 - 2 - 2           2 - 1 - 2         1 - 2 - 2         1 - 2 - 2           2 - 1 - 2 - 2         1 - 2 - 2         1 - 2 - 2           2 - 1 - 2 - 2         1 - 2 - 2         1 - 2 - 2           1 - 2 - 2 - 2         1 - 2 - 2         1 - 2 - 2           1 - 2 - 2 - 2         1 - 2 - 2         1 - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         1 - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 1 - 2 - 2         - 2 - 2         - 2 - 2           2 - 2 - 2 - 2         - 2 - 2         - 2 - 2           2 - 2 - 2 - 2         - 2 - 2         - 2 - 2           2 - 2 - 2 - 2         - 2 - 2         - 2 - 2           2 - 2 - 2 - 2         - 2 - 2         - 2 - 2           2 - 2 - 2 - 2         - 2 - 2 - 2         - 2 - 2	1.	6991=-6001	EIGENA	25
1         C (CVTTNUE           2         CVTTNUE           3         CVTTNUE           3         CVTTNUE           3         CVTTNUE           3         CVTTNUE           4         CVTTNUE           5         CVTTNUE           5         CVTTNUE           5         CVTTNUE           6         CVTTNUE           6         CVTTNUE           7         CVTTNUE           7 </td <td></td> <td>1=j=2</td> <td>EIGENM</td> <td>27</td>		1=j=2	EIGENM	27
22 Objective of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second sec	•.	1º (« .EO. 3) WRITE(6,163) I	EIGENM	29
0:=0:0:0:0:0:0:0:0:0:0:0:0:0:0:0:0:0:0:	26	02+C+S0+T(601)	EIGENA	29
STGR1+01-022/03         ETGR44           STGR1+01-022/03         ETGR44           STGR1+01-022/03         ETGR44           STGR1+01-022/03         ETGR44           STGR1+022/03         ETGR44           STGR1+022/03         ETGR44           STGR1+022/03         ETGR44           STGR1+022/03         ETGR44           STGR1+022/03         ETGG44           STGR1+022/03         ETGG44           STGR1+022/03         ETGG44           STGR1+022/03         ETGG44           STGR1+021/03/14071L(R)         ETGG44           STGR1+021/03/4071L(R)         ETGG44           STGR1+021/03/4071L(R)         ETGG44           STGR1+021/03/4071L(R)         ETGG44           STGR1+021/03/4071L(R)         ETGG44           STGR1+021/03/4071L(R)         ETGG44           STGR1+021/0102(L)/03/03/4071L(R)         ETGG44           STGR1+021/0102(L)/03/03/04/071L(R)         ETGG44           STGR1+021/0102(L)/03/03/04/071L(R)         ETGG44           STGR1+021/0102(L)/03/05/04/071L(R)         ETGG44           STGR1+021/0102(L)/03/05/070(R)/071/01         ETGG44           STGR1+021/0102(L)/03/05/04/071L(R)         ETGG44           STGR1+021/0102(L)/03/070/01         ETGG44		03-UI J,K]++2-CZ	ELGENM	
114-24101-021/03         EIGENA           21         Composition 1222-22         EIGENA           22         Composition 222-22         EIGENA           23         Composition 222-22         EIGENA           24         Composition 222-22         EIGENA           25         Composition 222-22         EIGENA           26         Composition 222-22         EIGENA           27         Fig.K. 200.31         EIGENA           28         Composition 222-22         EIGENA           29         Composition 222-22         EIGENA           21         Composition 222-22         EIGENA           22         Composition 222-22         EIGENA           22         Composition 222-22         EIGENA           23         Composition 222-22         EIGENA           24         Composition 222-22         EIGENA           25         Composition 222-22         EIGENA           26         Composition 222-22         EIGENA           27         Composition 222-22         EIGENA           28         Composition 222-22         EIGENA           29         Composition 222-22-22         EIGENA           20         Composition 222-22-22-22-22-22-22		\$1641=(01+02)/03	ETGENM	32
Friding: 21,21,22         Friding: 21,21,22           Construction         Friding: 21,21,22           Frid: 21, 21, 22         Frid: 21, 21, 22           Frid: 21, 21, 21, 22         Frid: 21, 21, 22           Frid: 21, 21, 21, 21, 21         Frid: 21, 21, 21, 21, 21           Frid: 22, 21, 21, 21, 21, 21         Frid: 21, 21, 21, 21, 21           Frid: 21, 21, 21, 21, 21, 21         Frid: 21, 21, 21, 21, 21           Frid: 21, 21, 21, 21, 21, 21, 21, 21, 21         Frid: 21, 21, 21, 21, 21, 21           Frid: 21, 21, 21, 21, 21, 21, 21, 21, 21, 21,		516#2#101+021/03 GPN7#H(1+K)##24K(1+K)##2+C2	EIGENM	33
21:         Crwfywis         Eigewa 3           602Charp         Eigewa 3           7 wik (* 60.3) white(61.04) T         Eigewa 3           22:         Tr (*, 60.3) white(61.04) T           34:         Ujstimulski           35:         Eigewa 3           36:         Ujstimulski           36:         Eigewa 3           37:         Eig		TF(6002) 21,21,22	FTGENM	35
Image=ching         Election           Tr 10:	21	CUNALMIE	EEGENM	36
TT         TT         TT           22         CONTINUE         TT         TT           24         TTATUME         TT         TT           25         CONTANT         TT         TT           25         TT         TT         TT         TT           25         TT         TT         TT         TT           26         TT         TT         TT         TT         TT           27         TT         TT         TT         TT         TT         TT           27         TT         TT         TT         TT         TT         TT           28         TT         TT         TT         TT         TT         TT           27         TT         TT         TT         TT         TT         TT           28         TT         TT         TT         TT         TT         TT           29         TT         TT<		67824+6782 Telet	EIGENM	37
22 PANTYNG 34 ULARIANULARI 35-CESSOFTEOD21 CTCATS-104-051/03/PENTILIK) FTGEWAULARIANULARI CICHANGENERGENERGENERGENERGENERGENERGENERGEN		TF (K .EQ. 3) WEITE(6,1,4) T	FTGENM	10
94-11(1, 81, 81, 81, 81, 81, 81, 81, 81, 81, 8	22	AUN LINIT	ETGENN	40
Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction       Construction         Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Construction       Const		34* 4(J,K)*W(J,K) A5=C45A97(CA02)	EIGENM	41
*TEGA-051/05/*0712(4) C		STCR3+(04+05)/03/0+NTTI (#)	FTGFNM	- 43
C		*1684+(04-05)/03/#+DTIL(X)	EIGTH	44
SIGL=ANSIGNTO2LJANSIGN=SIGN=ODDARKIJ=TIT(J])       Clearn         SIGL=ANSIGNTO2LJANSIGN=SIGN=ODDARKIJ=TIT(J])       FIGEN         SIGL=ANSIGNTO2LJANSIGN=SIGN=ODDARKIJ=TIT(J])       FIGEN         SIGL=ANSIGNTO2LJANSIGN=SIGN=ODDARKIJ=TIT(J])       FIGEN         SIGL=ANSIGNTO2LJANSIGN=SIGL=SIGN=ODDARKIJ=TIT(J])       FIGEN         SIGL=ANSIGNTO2LJANSIGN=SIGN=SIGN=SIGN=SIGN=SIGN=SIGN=SIGN	C	Ness COMPUTE LOCAL T AND PHT ETGENVALUES	ET GENM	45
11632-34021(101,5162)       FTGENM         11632-34021(101,5163,5164)       FTGENM         1164-341516431       FTGENM         1164-341516431       FTGENM         1164-341516431       FTGENM         1164-341516431       FTGENM         1164-341516431       FTGENM         1164-34151643       FTGENM         1164-3415164       FTGENM         1164-34164       FTGENM         1164-34164       FTGENM         1164-34164       FTGENM         1170011115       FTGENM         1170011111       FTGENM		\$16]=445((^TOZ(J=K)+\$1G8]=DTOR(K)]=TX1(J)) \$16]=445((^TOZ(J=K)+\$1G8]=DTOR(K)]=TX1(J))	EIGENM	- 17
STG1-435(STG44)         ETERM           STG1-435(STG44)         ETERM           STG3-435(STG44)         ETERM           STG3-435(STG44)         ETERM           STG1-435(STG44)         ETERM           STG3-435(STG44)         ETERM <t< td=""><td></td><td>\$1612+A4AY; (\$161,\$162)</td><td>FIGENM</td><td>4.4</td></t<>		\$1612+A4AY; (\$161,\$162)	FIGENM	4.4
VIGA-MAXISTERAN       SIGRAM         VIGA-MAXISTERAN       SIGRAM         VIGA-MAXISTERAN       SIGRAM         IFFTIGEZ,LE.SIGEJSTERAN       SIGRAM         IFFTIGEZ,LE.SIGEJSTERAN       SIGRAM         JMAXI-J       SIGRAM         VMAXI-J       SIGRAM         Convertigize       SIGRAM         Convertigize       SIGRAM         Convertigize       SIGRAM         Convertigize       SIGRAM         SIGRAM       SIGRAM         Convertigize       SIGRAM         SIGRAM       SIG		5163-445(51643)	EICENM	49
TEREVISE TEREVISED CO TO 2 C		5164-495(51694) 87896-1049178763-87663	ETGEN4	51
Comment of the second model and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and second and		1 - ( \$1 G12 + LE + \$1 G12 H) GD TO 2	ETGENM	2
J#A1-J       EIC+M       EIC+M         YTE12+*IE12       EIC+M       EIC+M         TCMSTE12)-*MAX1       EIC+M       EIC+M         Z       CONTINUE       EIC+M       EIC+M         TFS153ALE_YEG3AND AD TO 3       EIC+M       EIC+M         Constraint       EIC+M       EIC+M       EIC+M         J#A22-J       EIC+M       EIC+M       EIC+M         YEG3ALE_YEG3AND AD TO 3       EIC+M       EIC+M       EIC+M         CONSTRUCTOR       EIC+M       EIC+M       EIC+M       EIC+M         J#A22-J       EIC+M	C	****LUCATE WAXIMUM U-V EIGENVALUE	EIGENM	- 53
\$TG12**TG12       \$IG14M         \$TG12**TG12       \$IG4M         \$TG13**TG12**TG14*       \$IG4M         \$TG13**TG13**TG13**       \$IG4M         \$TG13**TG13**TG13**       \$IG6M         \$TG13**TG13**       \$IG6M         \$TG13**TG13**       \$IG6M         \$TG13**TG13**       \$IG6M         \$TG13**TG13**       \$IG6M         \$TG13**TG13**       \$IG6M         \$TG14**		KhVAJ = K ThVVI	ETGENM	35
ICONSTILIE-JAAXI EEEEMA ICONSTILIE-AAXI EEEEMA 2 CONTINUS TFISISA-LE-SIGSAND GD TO 3 Construct AAXI UN U-W EIGENVALUE IFISISA-LE-SIGSAND GD TO 3 Construct AAXI EEEEMA MAX2-A TONSTILIE-AAXI UN U-W EIGENVALUE ICONSTILIE-AAXI EEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TEEEMA TEEEMA TEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TEEEMA TEEEMA TONSTILIE-AAXI EEEEMA TONSTILIE-AAXI EEEEMA		\$1612 4= \$1612	EIGENM	56
1000000000000000000000000000000000000		100HST(31)=JMAX3	ELCENN	57
TF:SIG34_LE_SIG34N} &D TO 3         FIGENM           Co	2	CUNTINE	FTGENM	59
Construction and and and and and and and and and an	-	TF(\$1534.LE.\$1634H) 60 TO 3	ETGENN	62
Jackson         EIGENA           Markson         EIGENA           CONTINUE         EIGENA           Continue <t< td=""><td>C</td><td>SHAAALUCATE MAXIMUM U-W EIGENVALUE</td><td>EIGENM</td><td>51</td></t<>	C	SHAAALUCATE MAXIMUM U-W EIGENVALUE	EIGENM	51
TCNAST(13)-JUARZ       ETGENM         ICONST(13)-SUMAZZ       ETGENM         SIG34M-SIG34       ETGENM         1       CONTINUE         1       CONTONIONICONSTONTO         1       CONTONICONSTONTO         1       CONTONICONS		KWTK5 ek 9.446 - 9	ETGENM	63
ICANSTILISTER MAX2 SIGSAM-SIGSA CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CO		TCDHST(13)= JMAX2	ETGENA	64
3         CONTINUE         FIGENM           1         CONTINUE         FIGENM         FIGENM           1         CONTINUE         STESSIFE PASED ON MAXIMUM FIGENVALUE         FIGENM           1         CONTINUE         STESSIFE         FIGENM           1         CONTINUE         STESSIFE         FIGENM           1         STANDALESTIVE         STESSIFE         FIGENM           1         STESSIFE         STESSIFE         FIGENM           1         STESSIFE         STESSIFE         FIGENM		TCNNST(16)=KMAX2 STC34W=STC34	ETGENM	65
1         CONTINUE         ETGENM           Conversion         Conversion         ETGENM           Conversion         ETGENM         ETGENM           Conver	3	CUNTINIE	FTGENM	67
Commute Stepsize Pased on Maximum FireMvalus         Figenma           0723-07500000000000000000000000000000000000	i	CONTENSE	ETGENM	6*
0.244-05140-00035149351834*       EIGENH         1.7544-05140-00035149351834*       EIGENH         1.7544-05140-00035149351834*       EIGENH         1.7544-05140-000351433       EIGENH         1.7544-05140-000351433       EIGENH         1.7544-05140-00035143       EIGENH         1.7574-0513       EIGENH         1.7574-0513       EIGENH         1.7574-0513       EIGENH         1.7574-0513       EIGENH         1.7574-0513       EIGENH         1.7574-0514       EIGENH         1.7574       EIGENH<	C	DITE STEPSITE MASED ON MATIMUR ETGENVALUE	ETGEN4 Etcenn	70
IF(7222,GT=0724) GO TO 4       EICENN T         YOTO-YOSTOOJ /SIG32#       EICENN T         YOTO-YOSTOOT       EICENN T         YOTO-YOSTON TOY, YIG34#       EICENN T         YOTO-YOSTON YOSTOOT       EICENN T         YOTO-YOSTOON YOSTOOT		0736=95T4+CDNSTE9751634#	EIGENM	71
0701-070851(0)/S1632#       ETGENM         07070707       ETGENM         1707070707       ETGENM         1007070707       ETGENM         1007070707       ETGENM         1007070707       ETGENM         1007070707       ETGENM         1007070707       ETGENM         1007070707111       ETGENM         10070707071120       ETGENM         10070707071110       ETGENM         10070707071110       ETGENM         10070707071110       ETGENM         10070707071100       ETGENM         10070707071100       ETGENM <td></td> <td>TF[9212.GT.9734] GO TO 4</td> <td>EICENA</td> <td>72</td>		TF[9212.GT.9734] GO TO 4	EICENA	72
n2D#407/00TA         ETERM           n2D#407/00TA         ETERM           TCN477143+12001CONST(13)         ETERM           GN TN h         ETERM           TOTPHECINKST(0)/STG34**         ETERM           MTST110-100FCNST(11)         ETERM           TCONST(12)-120-FCONST(12)         FTERM           CONTTWE         ETERM           PTERM         ETERM           CONTTWE         ETERM           ETERM         ETERM           ILD SOMAT(10)-SUMECATIVE SIGMA-MAR-1 IN ETGENS THDICATES ,         ETERM           ILD SOMAT(100-SUMECATIVE SIGMA-MAR-2 IN ETGENS THDICATES ,         ETERM           ILD SOMAT(100-SUMAT T-5.72)         ETERM           I ONSTRUCTINE SEDM(ENDEPARCENT)         ETERM           I ONSTRUCTINE SEDM AT I-5.72)         ETERM           TNN         ETERM         ETERM           SUBROUTINE SEDM(ENDEPARC		n7NT+r9NST(9)/S[612# n7+h74TenT	ETGEN4 Ftgen4	73
TCNNST[13]       ETCENN         TCNNST[14]       ETCENN         GO TO A       ET		NZD+4+07/DETA	ETCENN	75
ICONSTRIATE SECONSTRIAN       ETERNA         GD TO A       ETERNA         CONSTRIATION CONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         OTOPACONSTRIAN       ETERNA         ICONSTRIANCONSTRIAN       ETERNA         ICONSTRIANCE       ETERNA         ICONSTRUCTIONSTITUE       SIGNACONSTRIANCE         ICONSTRUCTIONSTITUE       SIGNACONSTRIANCE         ICONSTRUCTIONSTRIANCE       ICONSTRUCTORSTRIANCE         ICONSTRUCTIONSTRIANCE       ICONSTRIANCE         ICONSTRUCTIONSTRIANCE       ETERNA         ICONSTRUCTIONSTRIANCE       ETERNA         ICONSTRUCTIONSTRIANCE       ICONSTRIANCE         ICONSTRUCTIO		TCDNST(13)+130+1CONST(13)	ETGENM	76
		TCONST(14)=100+ICONST(14)	ETGENM Ftgenm	77
970944CINKST(9)/STG34=         ÉTÉÉRM           070944CINKST(1):         ÉTÉÉRM           070704061         ÉTÉÉRM           070704061         ÉTÉÉRM           1071707         ÉTÉÉRM           1071707         ÉTÉÉRM           1071707         ÉTÉÉRM           100171701         ÉTÉÉRM           100171701         ÉTÉÉRM           100171701         ÉTÉÉRM           100171701         ÉTÉÉRM           100171701         ÉTÉÉRM           100171702         ÉTÉÉRM           100171702         ÉTÉÉRM           1001707         ÉTÉÉÉRM           1001707         ÉTÉÉÉRM           1001707         ÉTÉÉÉRM           1001707         ÉTÉÉÉRM           10017	4	CONTINUE	ETGENM	79
OT+0770400ETA     EIGENM       OTTONSTELLIO     EIGENM       ICONSTELLIO     EIGENM       ICONSTELLIO     EIGENM       ICONSTELLIO     EIGENM       ICONSTELLIO     EIGENM       ICONSTELLIO     EIGENM       ILIS COMMANDIC FLOWATELIN     EIGENM       ILIS COMMATINEGATIVE SIGNA-948-1     IN EIGENM       ILIS COMMATINEGATIVE SIGNA-948-1     IN EIGENM       ILIS COMMATINEGATIVE SIGNA-948-2     IN EIGENM       ILIS COMMATINEGATIVE SIGNA-948-2     IN EIGENM       ILIS COMMATINEGATIVE SIGNA-948-2     IN EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM       ILIS COMMATINE GEDMIC FLOW AT I-,123     EIGENM	-	97024=CANSTE91/SIG36#	ETGENA	80
ICANSTITIE     ICANSTITIE     ICANSTITIE       ICANSTITIE     ICANSTITIE     ICANSTITIE       ICANSTITIE     ICANSTITE     ICANSTITE       ICANSTITE     ICANSTITE     ICANSTITE       ICANST		ካ 7 # 07 7 ጣቅ H ቀ ቦይ T Å ጎ 2 ሰ ሽ # ሰ 7 4 በ ሽ	EIGENM FIGSNM	51
ICONST(12)=13L+ICONST(12)     FIGENM       6     CONTTAUE     FIGENM       9     CONTTAUE     FIGENM       9     CONTAUE     FIGENM       123     CONST(12)=130     FIGENM       123     CONST(12)=130     FIGENM       123     CONST(12)=130     FIGENM       123     CONST(10)=100     FIGENM       124     CONST(10)=100     FIGENM		TCONST 111-100+TCONST (11)	ETGENM	
6 CINTTNUE EIGENN RETURN 1.3 CORMATING, SINNEGATIVE SIGNA-GAR-1 IN EIGENN INDICATES, EIGENN 9 JUNE CONTRACTIVE SIGNA-GAR-2 IN EIGENN INDICATES, EIGENN 1.4 CORMATING, SINNEGATIVE SIGNA-GAR-2 IN EIGENN INDICATES, EIGENN 1.4 CORMATING SIGNATIVE SIGNA-GAR-2 IN EIGENN INDICATES, EIGENN 5.0 SUBSUNIC FLOW AT I-, I2) SUBSUNITINE GEORIGNOSE, ANG, RZ, DRDZ, ZSTA, M, PQB, NNAX) GEOR DIRECTION TEXAZOOL, DRDZ/ZOOL, ZSTA, M, PQB, NNAX) GEOR		TCONST(12)=12L+ICONST(12)	FIGENM	84
1L3 FORMAT(1MG,AIMHEGATIVE SIGMA-MAR-1 IN EIGENM TNDICATES , EIGENM 1 GAV(1ASDMIC FLOW AT I+,12) EIGENM INDICATES , EIGENM 1 GAV(1ASDMIC FLOW AT I+,12) EIGENM INDICATES , EIGENM 1 JOHS(1850)NIC FLOW AT I+,12) EIGENM INDICATES , EIGENM TND EIGENM SUBROUTINE GEOM(RNOSE,ANG,RZ,DRDZ,ZSTA,M,P00,MMAX) GEOM DIRECTON ZZAJ2001.0007/2001.02/2001	5	CINTTAUE	EIGENM	75
1945UNASONIC FLOW AT I-,12)     ETGENM     SUBSONIC FLOW AT I-,12)     ETGENM     SUBSONIC FLOW AT I-,12)     THO     SUBSONIC FLOW AT I-,12)     SUBSONIC FLOW AT I-	1.	S "ORMATELHO, ALMNEGATIVE SIGNA-MAR-1 IN EIGENM INDICATES >	ETGENM	87
LOB FORMATING SLIMEGATIVE SIGNA-BAR-2 IN EIGENN INDIGATES > ETGENN G		• 19499ASONIC FLOW AT I++IZ)	ETGENM	99
τηΠ ΕΤΟΝΑΤΙΑΝΟΣΕ, ΑΝΟ, RZ, DRDZ, ZSTA, Μ, P9D, ΝΥΑΧ) ΘΕΟΝ ΤΙ ΠΟΙΤΙΝΕ GEON(RNOSE, ΑΝΟ, RZ, DRDZ, ZSTA, Μ, P9D, ΝΥΑΧ) GEON	24	♦ FORWAT(ING, 4]HNEGATIVE SIGMA-BAR-2 IN EIGENM INDICATES >	ETGENN	96
SUBROUTINE SECRERNOSE, ANG, RZ, DRDZ, ZSTA, M, P90, M4X) SECR DIRECTION ZETAL2001, DRDZ(2001, BZ(2001)		\$NN	ETGENM	91
SUBRUTINE SECHERNOSE, ANG, RZ, DRDZ, 2514, M, P90, NY AX) SECH Dimention Jetal 2001, DRDZ(200), BJ(200)				
		SUBRAUTINE GEOM(RMOSE, AMG, RZ, DRDZ, ZSTA, M, P90, N4AX) DIBENETAN, ZSTA/2001, ABD7/2001, P7/2003	620M	ž

	LOGICAL LGRAV	NUSTO	2
	COMMON/NUBOD/XX(100), YY(166), NBOD, LGRAV	NUPDO	3
c .	-	6604	5
<b>C</b>	**FUNCTION DEFINITIONS	SEOM	6
L.	E / A \= E Y B / - L B f / L - B HO F F A / LA	CEUM	
	E(A, FEA), CAAD(ATA(), AA), ACAAT/2/AL_2/ALAAAL//////////////////////////	6614	
	514+51+45444444444444444444444444444444	6504	
	< 1.11)	GEDW	11
	F2(A, A, C, D) = A+(B+C-SORT(D+(1D)))/(D-R+A)	GEDH	12
	F3(A, R)=EXP(-ABS(1,-1,/A)/R)	GEOM	13
¢		6504	24
C	9-9 ONES OND & IONDPAUSE FOR ANONMAGNETIC PLANET	6504	1:
C	954 5835 658 F EQUATORIAL PLANE FOR A MAGNETIC PLANET	6EUM	16
¢		6604	17
		GEDM	18
	15 (H 17 0 01 00 70 00	6604	19
c		GENM	2r
č	ANTHIS DETERNINES THE BODY SHARE OF A NONRACHETTE MANET	6504	21
c	the state of the state of the state 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	CEON	<b>.</b>
Ċ		GERM	54
	1 PAY= 233	GEPH	25
	PI=3.1415926535898	68/14	26
	PANT-150./PT	6604	27
	DELTAT ANG/RADI/FLOAT(IMAX)	CE MI	2 <b>*</b>
	THE TA == T / 2 .	6604	29
	K Takub	64D4	30
~	te (19444) 60 10 40	6504	31
č	- BERSOOM AN INTECRATION FROM & TO STA DEGREE	GENN	32
č	escender as twickerting skind 3 in 113 brassiz	66.04	33
•	75T4(1) + 2-5	66.04	
	*711)-Por	6504	
	THETAL THETA	65.04	17
	0807(1)=F(P1,THETA1)/81	GENN	. ii
	]•7	65.04	39
	f#▲¥≈1≈FHA¥→2	6604	40
-	nn s I=1,THAXH2	CEU4	47
C	• • PPEDICTOM	6604	42
	Vevie 16 16 L TAT #P (W1) T45 TAL 3	6 E DM	43
~	CONSERVATION	65.04	44
	8 - C C 13# 9 = 9 = 40. 5 = 5 = 5 = 1 = 7 = 7 = 7 = 5 = 5 = 5 = 5 = 5 = 5 = 5	GEng	45
	Denty ac fe rulling to 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 stat	6504	
		6504	
	THE TALETHETA	65.04	
	75T4(J)==#+C05(THETA)	6504	50
	#7EJ}=#+STNETHETA)	GFOM	
	DRDT(J)+CORDTH+SIN(THETA)+R+CDS(THETA))/	GE 04	52
	f-DRDTH+CDS (THETA)+R+SIN(THETA))	GENM	53
-	1-1+1	CEUM	54
,	- CONTENUE	6E04	55
	9C1194	GENR	56
		GE	57
č	1155 CVI THORICAL BOOM FOR HIRA .1 T. A.AL	4807 6508	28
ž	OSE CALINDATCAL MOST PUP WARD ALLA DADI	6504	
ໍ່ກ	7574/11=1-1	65.04	60
	7574(2)=102.6	GERM	42
	#7(1)=#90	GF 04	
	*7(2)+**	GEOM	- 54
	DRD2(1)+0+0	6104	65
	n#17123=0.0	6Enm	66
	MMAX=>	6604	67
	PETURN	G E 04	5 P
_*E	CONTENTS	66.04	69
C .		GENM	70
C '	PPINTS DELEGNTHER THE ROOM RAVE DE 4 ARGAELLE DEVAEL	66.04	- 71
, r		67.04	
•	1=1	CEON	73
	1 NG+ 1 NG+ 9G.	6609	
	THAT-350	GEON	76
	PT=3.1415926535898	6604	77
	PADI-180./*I	GECT	× 78
	DELTAT+ANG/RADI/FLOAT(IMAX+1)	CH	79
	THETANPT/?.	GEOM	90
	#] =RNO*#	GEON	91
c	· · · · · · · · · · · · · · · · · · ·	GENN	42
ç	*PERFIRM AN INTEGRATION FROM 90 TO 263 DEGREES	GENN	*3
C		GEOM	84
<b>.</b> .	"O 15 T+1, [NAT	GENN	85
	) e v K C D L C I C K	6E04	94

۰.

	THETAINTHETA		
	*=R1+NEL TAT+6 (R1, THETAL)	GEDM	
	THETA-THETA+DELTAT	65.04	
		GEON	
	DRDTH=G(R,THETAL)+G(R,THETAL)+G(R,THETA))	GEOM	91
	*1+*	6E04	92
	IF (THETA .LT. PI) GO TO 15	66.04	93.
	7STACJ) ROSINCTHETAS	65.08	94
		GE DH	96
	<pre># (=DeDTHeSIN(THETA)_Becos(THETA))</pre>	6604	97
	J=J+1	GEOM	98
15	CONTENIE	CEON	
	4##X=J=1 86711=-	68.04	100
C		GEOM	192
č	WARDY SHAPE TABLE SUPPLIED BY USED	GEON	103
C		GEON	104
Ζ.	CONTINUE	65.04	105
	J*1	GEOM	107
	792=3.7	6504	10 #
	NRODM-NROD-1	GEON	139
	00 25 T-1, NBODH	ee on	116
	n#1=n#2	66.04	
	183-8982 DX3-8982	GEON	111
	Ne3-WWITA11-WWITA	GENH	114
		5E 04	115
	75TA(J)=-XX(T)	6604	116
	47(J)=YY(T)	6504	117
	D1=50RT(DR1+DR1+DX1+DX1)	GEDM	119
	n2=594T(n42+D#2+D#2+D#2)	GE CM	120
	1=1+1	GEDM	121
25	CONTIWIE	6504	122
	7STALJI-FX (NBOD)	CE CH	125
	47(J)=YY(NS(D)	SED4	125
	NHAX+1	6 E 0M	126
	RETUPN	GE CH	127
40	C IN TI MUS	66.00	120
	7574(1)=0.0	6604	136
	R7(1)+R9C THFTA1=THCTA	GE DH	131
	A1+F3(F1+4)	GE 04	132
	N=DZ(1)=F2(#1,1.G,3.6,A1)/49/	6504	133
	1-2	CEON	135
	175171+[F83-1 00 50 7-1.504vm3	6E 0#	136
	AS# <sup>®</sup> IN(THETA)	65.04	137
	AC=COSTTHETAD	6210	138
C	. PREDICTOP	GEON	140
	A10=3(#1,4)	GE04	141
	787+F2193+45+4C+433	6E 04	142
	JF (DRY.LT.O.U) DRX=2.+H+AS+AC	6604	143
	R.BI+DRYADELTAT	6504	145
	THE TA = THETA + OCL TAT	6504	146
	434** [N [ ] 7E ] 8.7	GEO"	147
c	. CORRECTOR	6604	148
45	CONTENSE	6504	144
	A11=F3(R,H)	SE PH	151
	TE (DEXY_IT_D, D) DEXY_D AVAARAAAA	eãŭm	152
		GEOM	153
	#=#1+SLOPE+DELTAT	65.04	154
		SETH	156
	1° (Kal Taj) 60 70 45 75Taj 11Dalot	6EQ4	157
	#2fJ)=#+A51	GERM	150
	DP07[J]=(#+AC1+AS1+SLOPE)/(#+AS1-AC1+SLOPE)	GENN	159
	P1+8	GEOM	141
	J= J+) CONTINUE	6E0M	162
ч <b>р</b>	MPA Ye Je 1	GEDH	163
	RETURN	6604	164
	#ND	6504	107
		9504	190

<pre>SUBROUTINE GEOMINS] COMMON/CLUSTRALX[24\FYIT[24\FYIT[24) COMMON/CLUSTRALX[24\FYIT[24\FYIT[24) COMMON/CLUSTRALX[ETA161]FHIP(41)=0TIL[64])DETAFTP(24) LEVEL 2, PHO.P.UJ&amp;V.MAGR.PD32.VIFF(41) FORDEND4, BARTJARRHADTOP4, * SCT.DTD7.DTDR.CT.ICONST.GAM.COMST.WRESOM.S., SST.PSPH[, RST,RS2T, * RSYHIT CDMNOM /PVARA/ RHO[24.41], P(24.41], U/24.41], V(24.41), V(24.41), * ROO(41) . RORT(41) P(24.41), U/24.41], V(24.41), V(24.41), * ROO(41) . RORT(41) VIFF(41) J VIFF(41), J VIF(41), * ROO(414), RORT(41) VIFF(41), J VIFF(41), ACT(41), * ROO(414), RORT(41) VIFF(41), STR(41), RCT(41), * STR(41) REPHILAN, STR(41), RSTT(41), RSTT(41), SCT(41), * STR(41) REPHILAN, STR(41), RSTT(41), SCT(41), * STR(41) REPHILAN, STR(41), RSTT(41), SCT(41), * STR(41), REPHILAN, STR(41), RSTT(41), SCT(41), * STR(41), REPHILAN, STR(41), RSTT(41), RSTT(41), SCT(41), * STR(41), REPHILAN, STR(41), RSTT(41), RSTT(41), SCT(41), * STR(41), STR(41), STR(41), STR(41), SCT(41), * STR(41), STR(41), STR(41), STR(41), STR(41), * STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), * STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(41), STR(4</pre>	GEOM1 CLUSTR IUSTR PVAR PVAR PVAR PVAR PVAR SVAR SVAR SVAR SVAR SVAR SVAR SVAR S	2 2 2 2 3 4 5 6 7 8 9 10 ? 3 4 5 6 7 8 9 10 7 8 9 10 11 2 3 4 5 6 7 8 9 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
<pre>     SUBROUTINE GEOM2(K3)     COMMON /IDVARD/RK, STALA1, PHIP(41), DITL(61), DITL(61), DETA, TP(24)     LFVEL 2, PHOP, JUN, NUR ROP, ROBT, VINF, JUNF, SDRM, PS, RSJ, RSPH, DIDP',     FSHUT /VINF, ALD, PLOAD, JUNF, ALD, PLOAD, JUNF, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, ALD, VILA, VILA, VILA, ALD, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VILA, VIL</pre>	6E072 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 97483 9777 9777 97777 977777 97777777777777	2 2 2 3 4 5 6 7 R 9 1 C 2 3 4 5 6 7 R 9 0 C 2 3 4 5 6 7 R 9 1 L 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

z

4	CONTENUE	66087	1.8
1	CONTINIE	GEON2	11
	PETURN	SED#2	20
	END	GEOMZ	21

		SURROUTINE GERMS(K7, PHIP, NPHI, Z, RB, RB7, RRPH, IPANT)	GE (14 3	2
		CUMMON/JUE/ZLI, CFI, CF2, 71F, ZTRAN, BZTGAN	376	2
		COMMON / IMANSE/ AMACH, GARE, KHZ, PLINE, PLINE, VLINE, POCIZC, 31,	TRANSF	2
		Reinol20,31,040(20,31,490(20,31,493(20,3),R\$90(3),	TPANSF	3
			TRANSF	
		LEVEL Za PSakBPHak6Z	GETHS	5
		UITENSIUM # 4419437444198724199474419	65043	6
•		11MEMS10M 251A(200);0K07(200);#2(200)	GEOM3	
ř			GEmag	
<b>``</b>		6 ( ) M 14 M 13	65043	
C.		15/87 HE	6E0-3	16
		TENERSEL ON NO L	65043	11
			1- E OH 3	
			CEON3	13
			4E013	
		PNOSE 1.	65043	15
			66043	17
		NAAYIANAYA	66093	- 44
		PETIDEN.	65083	10
c i			CEONS	20
ć.,		AFIND CORRECT Z INTERVAL	GERNA	
ċ			CE ON S	
-	1	CONTINUE	GERNA	22
		Nenst	GEN#3	
		1F (7.LT.75TA(NST)) 6D TO 22	GEDHS	17
		00 18 N-N-T-N-MAX1	GEONA	24
		TF (T+LT-75TA(N+1)) GD TO 20	65043	27
	2.5	CONTINUE	GE DM 3	29
		N=N4&Y]	66043	20
20	)	CONTINUE	GEONS	30
		wit I an	62043	- 33
	22	CONTINUE	62043	32
		P50DY=P2(N}+{R2{N+1}-R2{N}}/{25TA{N+1}-25TA{N}}+{7-75TA{N}}	GE043	37
		\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$	66043	34
		RSTDP4=0.0	66443	35
		10 30 K=31NPHI	GEDMB	36
			6 E 104 3	37
		P = = = = = = = = = = = = = = = = = = =	GEC#3	3 P
		4.8.7.6.8.8.8.9.10.9.7	GEC43	39
	30		GEON3	40
		10 35 R=1,2	6EDH3	
			6E(1+3	•7
			660-3	23
		ладия (= h Вајиј = h	GEUTS	- 22
			65043	
			62003	
		- 3(1- J-K KZ(1-) DR\$f\$1-087(M)	62053	- 11
			65083	
		PRP4(T)========	GERNS	50
36		CONTINUE	GEONA	
		RETURN	65013	- 55
		FND	GE DK3	
		# 10		

SUBROUTINE THATA	INTTA	2
COMMON/CIUS TR /R J. X1 (24) . TX1 (24) . TX1 (24)	CLUSTR	2
COMMON/ENTRO/SIAII.ZBS.ZFLD.ITPRTB.ITPRTF.NCASE.NTOSOS	ENTRO	ž
COMMON / TOWARD /9K. ETA(613. PHIP(61). OTTL (61). OTTLE(61). DETA. TP(24)	TOVARS	2
COMMON/106/711.CF1.CF2.71F.AN.D7TRAN	195	2
EVEL 2. BUT BATAN, WARDE, BORT, VINE, WINE, SOPPHARE, PSTAFSPHATOPHA	PVARA	2
· BCT-DTD7-DTD8-ACT-TCONST-GAM+CONST-WREGON-RS-RS7+PSPHI+RST-PS7T+	PVARA	3
	PVARB	
COMPAN / VANER/ BHO(24.41), P(24.41), U(24.41), V(24.41), V(24.41),	PVARA	5
• • • • • • • • • • • • • • • • • • •	PVLRA	6
• #(RP4(41) - R\$(41) + R\$7(41) + R\$P4(41) +	PVARS	7
• DTDBU (24.41), BCT (41) .DTD7 (24.41), DTDR (41) . ACT (41)	PVARS	ŝ
• TCONSTISON . GAM(20) . CONST(53) .NREGON . RS(41) .	PVARA	
• • • • • • • • • • • • • • • • • • •	PVARR	10
COMMON/SWIDA/TAZ PHI BI DI DZ DPHI ZINT	SVARB	ż
* TEND , PI , ALPHA , GANNA , SIGNA , XMACH , TAPEL ,	SVARB	3

	* TAPE2 + DISK1 + ALPH + DISK2 + SIGH + NPPHT + DZDT	. SYARA	
	<ul> <li>DZDPH # ZH # INWD # THLD # THW # THL # TTHW</li> <li>TTHL # RZ # BZ # NIPHI # NIT # KPHI # NITER</li> </ul>	* SVAR3	I
	<ul> <li>NPHI , NPHIL , NPHIZ , NPHIB , NPHMI , NPHMZ , NPHM3</li> </ul>	SVARA	
	* NI PHIL PHIZ PHIS PHIFT PHICTURE RATE * PHIF PHILDELAG PHIC PHICTORE RATE	» SVARM	1
	+QINF, GASCON, MREAL, NPUNCH	SVARB	
	COMMON /IRAMSF/ AMACH,GAMF,MMZ,PliwF,RlimF,VlimF,P90(20,3), • RH090(26,3),U90(23,3),V96(28,3),V90(26,3),R590(3),	TRANS TRANS	f F
	* PS790(3), RSPH90(3), HRU, R90, XINIT	TRANS	F
	RADI=57.029578 PT=3.16189265	TNETA	
	TINTHYIMIT	INITA	
	7 = 7 ]NT 7 = N = 71 6	INITA	
	ALPHA-J.O	INITA	
	NIPHI+7	INITA	
	KITCH NTCH	INTTA INTTA	
	SANMA=GAMF	TNITA	
	AL PH= AL PHA/ XAO1 STGM=STCMA/RAO1	INJTA TNITA	
	PHIF-18C. T/RADI	INITA	
	NPHI=NTPHI+3 NPHI=NPHI+1	14774	
	NP412=4041+2	INTTA	
	NP4M1=NP4T-1	INITA	
	NT=NT T+2	INITA INITA	
	NT1 =NT+1	TNTTA	
	TCONST(1)=1	INITA INITA	
	1CONST(10)-1	TNTTA	
	TPPNT=IC(NST(4) TE (ICONST(48)_NE_1) TCONST(5)=0	TNITA	
	LAG=1	INITA	
	9ETA=941E/FL9AT(N1941)	INTTA	
	7T=1.7/FLGAT(NT=1)	INITA	
	77+D79T+DT	INETA	
	GAN113+CGANNA-1_01+0_5	19114	
	GANEZI-FAFELI/GANNA	THTTA	
C M9	RIDIONAL CLUSTERING	INTTA THTTA	
	PK=0.0	INITA	
	PJ=0.) TETPE-E0-D-DL CO TO 1E	ÎNȚTA TRITA	
	Y0=0.5/RK+ALOG((1.3+(EYP(RK)=1.0)*PHIF5/1*C.0)/	THITA	
	13.0-(1.0-EXP(+RK))*P41FD/183.0))	THTTA	
	Y2=Y21/(RK+PHIFD/R 4D1)	INTI	
15	CONTINUE	INITA	
	719 35 11=25 MPM11 7T=TT=3	INITA	
	FTA(TT)=ZT*NETA	INITA	
	TP:ERK.05100000000000000000000000000000000000	14174 14174	
	<b>DTIL(IT)=1.0</b>	TNITA	
	ΩTILE(IT)+5.40 GO TO 35	[NTTA  NTTA	
4	CONTINUS	INITA	
	Y/3=PK+(ETA(II)/PI=YC)	INITA	
	CHETA+COSH(Y)3)	1NJTA	
	PHTP(TI)=PHTFD/RADI+(1.0+SHETA/Y01)	TNITA	
	ntle(11)++y02+RK+SHETA/CHETA++2	TNTTA TNTTA	
35	CONTINUE	TNITA	
	P41P12J==P4[P14] P41P{NP41]]==P41P{NP44]}	ENITA TNTTA	
	NTIL(2)=DTIL(4)	INTT	
	DT[[(NPH]])=DT[[(NPHN]) DT[[[2]=DT][[(A)	[N]T4	
	TILE(NPHI1)=-DTILE(NPHH1)	TNSTA	
	nTILF(3)=C.L	TNITA	
C R4	DIAL CLUSTERING	INITA Inita	
	51NH0J=51NH (RJ)	INTI	
	PU 36 LL#I#NTZ 77#TT+1	TNJTA TNTTA	:
	TP(11)=71+NT	INITA	
	IF(RJ.E0.0.0) 60 TO 41	14174	

**N** 1

	\$01-5 TM4EDT 1					
	CDT+CDSH(PT)	INTA	4	COMMO4 /IOVAR9/RK.ET4(41).P41P(41).DT1[61].DT1LE(41).DF1L.F.		
	ZI(II)=SOT/SIMMPJ TXI(II)=SIMMPJ/(RJ=COT)	ATT PI		LETEL Zo RHOPPOVYSAVAO99.809.8091.VIMF.VEMF.80044.88.88.87.8494.07049. 9 967.0707.0708.467.4667.6644.60057.644.50057.45.455.457.457.85947.8574.	VAR.	
	TTTTTTT: CD TD A2	INTA		<ul> <li>RSPUTT</li> <li>COMMON / PYARR/ RHOT24.411. BI22.411. HI24.411. VIA.441. VIA.441.</li> </ul>	1 UVA	
7		[M[74	•	404(41) - 4082(41) - VINF(41) - VINF(41) -	AARS	
	14111191.0 141761199.J	ATTAT	10	• TUPH(41) • #8(41) • 412(41) • 412(41) • 412(41) • 412(41) • 412(41) • 112(41)	TAR.	
¥\$	1 74 11 AU 1 24 11 AU 1 24 11 AU	ATTA ATTAT	26 6 6	P SCONST(50) - CAN(20) - CONST(53) - NEERSN		
2		IN TTA	1	(T+)LINeS& (T+)LLLY A TT+)ISA (T+)TLTLA A Z+LYWHTAS/NGWHUU A LNLZ A 1440 A ZQ A LQ A LHA A Z+LYWHTAS/NGWHUU	VARB 1	0
	NCONF=2 NTS4D5=D	ATT N		TAPE2 & DISK1 & ALPHA & GAMMA & SIGMA & XMACH & TAPE1 & TAPE2 & DISK2 & ALPH & DISK2 & SIGM & MAPMI & AAAT		
	7 A S = 9 9 9 4 D	A 11 M 1		ANAL THA ANAL GINL OANL WZ A HAG2O	847A	
	7 = 6 + 6 + 6 + 6 + 6 + 6 + 6 + 6 + 6 + 6	ATTA	6	APTIA ILAN A THAN A		••
		THTTA	100	LIVEN ANTON A CEN A SUT A WITH A MODULE A MANT	6ava	
	[.n45149]=.9 tromert 481-4	VA INI	102	PATE A RETADD, LAG , NGC , PINE , ALDIN , UIME , ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, ADINF, AD	AARB AAAR	• •
		14174 THTTA	173	DIMENSTOM E(4), F(4), 6(4), H(4)	NODO	
	ALCULATE EREE STREAM GUANTITIES	TTNT TT			9CON 10	• •
		1111	4 C T	CONTINUE CONTINUE	000M	
	C # 1 # 0 * 0 * 0 * 0 * 0 * 0 * 0 * 0 * 0 * 0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	601 601	TLHANSZON C DL		~
	1444-1.( 1745-1.424-1444)	4774	alt	Taril(1)	1000	
		24144 14144		:CDF CONSEPARTIVE VARIABLES	DCON 10	<b>.</b> .
	014Fe\$38T(89/AA)	ATTN:	113			•
		14774 14174	11		JCON 1	
	iitwf=STNf=CMST(2) 90 3 k=2.nputi	THTA	911	(X <sup>4</sup> T )A=AA	900M 20	o
		INITA		VV-44 (J. X.) A=0T0+(J. X.)	000M	
	▼ I H = L X = =============================	THTA	911		NGUO	n -
<b>.</b> .		LINI	121		12 NUJO	
	itettet us un	1111 1111	122	7711 .F3. 1959 TO 4975		
	(2=x)==0/(4=x)=(	TALT A	124	¥\$74#]=770?(J=1;#K)=((J=1;#)+9;#Y)=9;T0#4;J=1;#X)=9;T0#4;J=1;#X1#U[J=1;#X1#B]	20104	• •
	**************************************	TNTTA TNTTA	125	VST492=VST493=UU/UC4=1,K) 4875 VST492=Ashin_Asvuz_suviz	0000	
	V ( ] = X ) = Y = Y = Z = X = Z = Z = Z = Z = Z = Z = Z = Z	INTTA	121		100M 31	
Ň		1111 1111	129	PJP3=TT(J+1)=04mq(K) VSTA93=nTn2fJ+1_K1=Tt/J+1_K1=m4V2 #1,_V1=nTtha_d2 #1,_V1=V1+1.	000	
	(2-x)-265e={x}-52	1414 1474	190			• •
	957 (K)=9579 ú(K=2) Prestruitareaucontaria	I TTA	142		NDOC	
Ň		11114 14174	113	4 V44.8+V7.14P2	DCON 36	
	50 25 K+1≠2 N=4→K	INITA	135	16(1 -346 4M2-1)60 TO 14	NCLD NCLD	• -
		INTA	136	IF(WSTAP2 .6T. VST4R_)V948-2.56(WST4R2+VST4R1)	NLLC	
	2 = X 9 1   - X = S ( X ) = 9 S ( Y )	1111	135	IF (VV .657. V(J/K-1))V94A-5.50(VV+V(J/K-1))		N -
	(h)Se=(1)Se	1111	24	CONTRACTOR A	ACTON ACTON	
	(M) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) / S & a ( ) /	14774 TMT74				n -
		INTA		TFLJ 65F6 (MT2−1)6O TJ ]5 FF[VSTAP3 66T4 VST4R2)V9AAF≏2,5€(VSTAR3+VSTAR2)	000M +1	
\$2		1111	i+1	15 U94ReW	JUN NUIG	
	7 3 5 7 1 3 1 7 1 8 2 ( 5 2 0 ( 3 7 1 ) ) 5 5 6 5 2 2 4 7 5 5 5 5 7 2 1	14 17 A	146		019N 50	u
	0 36 44374945 11111111111111111111111111111111111	THTA		E(1)=#==Uti F(2)====================================		
;		41141	150	13)-5(1)-4V	0101	
	COMTT 455 5 (2) = 5 (4)	1111 1111	191			
	S(NeH1))=S(NeH1)	41141	193		100K	~
	CALL GOOMAGE JOPHERSKPMISZARAJRAZJARPHSEPANT) Call Growicsi	ATTA ATTA	154	F13)=9=0+F1,21=4 W	NO20	
		1411	9.1		3C1N 61	<b>د</b> -
		41141	157	U19-2(7)9-2(7)9-00 444112-44415	1010	
				6(4)=9/645(1)+4W 4(1)=44+4V/8=4CT(4)=46C1)=46CT(4)+67T(4)+496Å4V/2=-77TT(1)+498Å4V/2=44V		n - p =
				H448R 0Y 0U /R 4(2)+44		ا به ا
	SURROUTINE TOCOMERT)	NG JO I	~	Anexs of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s	1000	
	TUMMUN/CLUSTR/HJJTIIZ4)⇒TXIIZ4)⇒TXITIZ4) LEVEL 2×ETEMP_E0≠F0≠60≠M0	CLUSTR CVAR	~ ~	4f3}=4f4(f7f0e2-4W0e2)/f4ACTfK}\$Ef3}=fACTfK}+7TLEfK]) 57fffj)ef6Anf2}0Pp+qpeVVe42}		• •
	COMMON /CVARR/ ETERP(4)24041), EQ(4/24041) • Enta-Patali - Enta-Patali - Maia Patali	CVAN		4 (\$ )=2,3 689 eVY 24 4 (7 (K) 6E (\$ )={ 8C7 (K) + 8T2 (E (K ) ) e (64 mi 2) e 0 + 0 € 0 W ε e 0 > 1 / 2 − Y TT ( 1) e 80 e V × e w	La Nujo	-
	ITTATZATION A ITTATZATION A ITTATZATION	CVARR	•		100	

++(1**)		S OR T	11011	)/I:	2.04															1000	121
*******	()=4/U	( J. K	1																	10004	12
*{3,×}	PHOEI	, K ] *	£4+1-1	-U{	1, K ) I	**2	- 76	3,8	()+(	2-		p K	) **	21						10004	12
CONTIN	۲																			10000	121
PITUPN																				10004	124
E MJ																				[JUCON	17
			_																		
20100000	TINE OF	1141	- 																	C1 1/2 7.0	
CORREN.	CLUST	e / P J	, TL G	241	111	124		*11	121											CLOSIC	
	I DNS T	R#/	2 PL OI	Ten	TEND!	117	100		21	Ϋ.	•••							•••		DRVICE	
CONNON	VIDVA	44/R	KJETA	A ( 4	1 3	110	(		11	. 19	170		112		123		. <b>*</b> 2.		2.41		
LEVEL	2, 949	• P • 1)	, V , W	, en			11	5.0	IN			12	• • • •	37 X							
а вета	1102.0	TOR,	ACTA	ייסז	NS T # 1	544	, C	1821			1.1.1.9	4.2	, K S	2 # K	36.		<b>~</b> >				
P BCOH	11													•••							
- Owned	/PVAR	57 B	4462	4, 4	11,		4,1	11,	17	24				2 <b>4</b> 9	•1	••		241	14111	P V A V	
	P04(4	11	. e I	F 08.	2641	.,		NFC	41	• •	- WI	25	<u></u>	, ,							
•	60464	(41)										7.0		. *					•		
•	U L U U U U	24,4	1), (	ECT	(41)	•	717	PZ (Z		n,	, "1	25	141	, ,	- 11		21	,	,		
•	1 CONS	T ( 5 0		6 A 4	(20)	*	- C (	3 N S 1	1121	"				*							
•	95764	1)		PSP	4114	1).	R 3	5714	11		• •	21	114	1),		5		(4)		PVACE	- 17
CONNUN	12400	KS/	DRSO	x(1)	633*1	דצי	(5)													SHUCKS	
e De HUM	VEATER .	/ *, Z		, '	-41		- 01	r		nz			0.6	4 <u>1</u>		21	NT	. 1	•	SVARA	
•	7 END		1	•	ALPH	۰,	61		۱,	51	644		XM	ACH	•		PE:	1 1	•	S V A P N	
•	TAPEZ	• D	12K J	,	AL PH		_D1	ESK?	2.0	SI	64		-	RNT		27	CT.		,	SVARB	
•	02004	• T	н		тнур	•	_T'	11.0	,	TH			्रम	L	,	-11			,	SAVA	
•	TTHE	· . *	2		# <u>7</u>		N 1	[#4]	۰.	NI	Τ.		K P	HT.		NI	TE	۰.	•	57499	
•	нрнт	, N	рнта	, 1	NPHT	2,	N	P413		N.P	.441		NP	482		NP	HH	3,	•	SVARB	
•	NT	ъ N	T1		NTZ	,	11	13		PH	ITEO		NC	ONE	,	RA	101		•	SVARA	
•	PHTE	, н	ETHO	D, 1	LAG		N 1	sc	,	•1	WF.	٠,	R 4	ÜÜN		U	NF	- 4	•	ZAVAd	
Þ9INF,G	45 CON #1	N₽EA	LANP	UNCI	H															SVARA	10
	/FLOW	/ XC	(20,)	100	), YC	126	.15	. ( 0(	٧F	150	,13	31	, RH	0 F (	244	<b>, 1</b> L	<b>D</b> 1			FLOV	
LEVEL	7. ¥X.	V۷																		AC UH N	:
COMMON	/VCONP	/ VX	(20,)	100	3, VY	(23	.10	101												AC Date	1
																				NUTPTH	13

	NO 16 N=1+4	toran	73
	4 ( N ) = 4 ( N )	TOCON	74
	F (N)=F{N}+TX[(J)	TOCON	1 75
	~{N}=G(N)+7TI((N)	TOCON	76
15	CONTINIE	TOCON	77
-	GO TO (17,18),IT	TOCON	78
17	CONTINUE	TOCON	79
C 5	SET CONSERVATIVE VARIABLES AT N	19098	40
	10 26 N=1,4	TOCON	41
	#3(N, J, K)=6(N)	TREAN	82
	FS (N) J, H ) + F (N)	1000	43
	CC ( N. 1. K ) = G ( N )	TOCAN	
	40(4), 3, 43=4(4)	10004	95
2.	CONTINUE	TOCON	86
	5 TA 3	TOCON	87
1.	CONTINUE.	TOCON	58
C	SET CONSERVATIVE VARIABLES AT NOL TILDE	THENN	40
• •	N3 0 N=1,4	TOCON	90
	TF(1.F0.NT2) 60 TO 36	TOCON	91
	60 TO 35	11014	92
C	PESSER ETENS AT BODY AND SHOCK	TOCON	23
36	LTEMP(N, J, X)=E(N)	LOCON	94
35	* ON TTNUE	1009	95
	F. (N. J.K)=F(N)	TOCON	96
	CO(N. J. F)=G(N)	TOCON	97
	4f f N, J, K j = 4 (N)	TOCON	
9	CONTINUS	TOCON	
3	ά η Ν ΤΙ ΝΠΕ	TOCON	100
	PETIJAN	TOCON	101
2	PONTINIE	TOCON	112
C I	DECODE CONSERVATIVE VARIABLESPERFECT GAS.	TACAN	123
	\$4=1.C-G1=(2)	TUCON.	1 14
	NO 1 K=3,4P41	IDCON	- 1-÷
	00 1 J#3,NT2	TOCON	106
	A = C TE MP (] + J + K)	TOCON	117
	9=ETE=>12,1,K)	TOCON	138
	C=ET=40(3,J,K)	TUCIN	119
	N=FTEHP(4, J,K)	TOCON	110
	• • • • • • / <u>·</u>	TOCON	111
	V [ ] # ] # ^ / A	TOČON	117
	ut 3, Kjansa	TUCON	113
	CC=C4HE2]+E1	TOCON	114
	<u> </u>	TOPON	117
	TF1073 7,8+5	10004	116
7	CUMTINIE	TOCON	117
	PP=C+3	T T T T T	11 8
۹	CONTINUE	EBCON	119
	**{\$;**}={-99+5087{03}}/{2+2+4A}	1909	120
	447(J,K)=4/U(J,K)	toton.	121
	*{J;K}*P47{J;K}*{ <sub>40</sub> ,=U{J;K}**2=V{J;K}**2=W{J;K}**2=W{J;K}**2	10004	127
•	CONTINUE	10001	123
	9 T 119 N	TOCON	1 74

FACT=0.5*XMACH+XMACH+(GAMMA-1.0)	0117PT#	12
FACD+(FACT+1, 91++(1, P/(SAMMA=1, 0))	OUTST	
FACV-SORT((FACT+)-3)/FACT)	OUTETH	- 11
NZADDENZADDA1		
KZ = NZ END +NZ ADD		17
		10
	001414	- 11
ARTICLE OF THE ARTICLE CONTRACTOR (C)	001714	1.7
UNTERNING ISI	001914	19
WELLET AT MEADON CONSTRUCTION	011414	20
0U 20 J=3,NT2	OUTPTH	21
	0UT=14	22
Y=T=(=)=(3)=RB(3))+RR(3)		23
JZ= J-2	0U TP T 4	24
XC(J?+KZ)=Z	017771	25
YCLJ9K73=Y	007273	26
¥¥{J7,KZ}=U{J,3}+F4C¥	DUTPTH	27
AA(75°K5)=A(7°3)+EVCA	0177779	24
940F(J7,K7)=R40(J,3)+FACN	OUTPTH	20
WRITE(9) J.Y.VX(JZ,XZ).VY(JZ,XZ).RHDF(J7,X7)	OUTPTS	10
2J CONTINUE	CHITPTH	11
P & TILE N	0117874	
r ci i i i	0,710 14	
A.) FORMATI FY. 13.3/104.510.411		
	001214	
	OUTPTH	35

	SURPRISTING PHTUPH(41.0HU.P2P1.HTTS.GA44A)	PRTIDN	,
	9FAL H1. H2. H	PHTHEN	- 1
	1,11,1 = ATAN(50,1,1,1))/((),1,1))/()/()/()/()/()/()/()/()/()/()/()/()/(	PHTIPH	
	YNUP(4) = SOPT(H+H-1,)/(1,+(GH-1,)/7,+4+4)/H	04 T118 M	ĩ
	CHACANNA	B IN THE M	
	C = (CH-1-)/(CH+1-)	ANTHON	
	50PTC - 50PTC1		
			- 2
		PR10 PR	
		PHTIEN	10
	the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the start of the s	PHTIJEN	- 11
	** * H	PHTJPN	12
	<b>10 1-1,20</b>	PHTURN	13
	47TS # T	PHTIPH	14
	42 + XM - EXNIEXM)-XNU2)/XNUP(XM)	PATURN	1.
	TE (#7 .6T. 143.6) 60 TO 20	PHTIPH	14
	TF (445((42+14)/14) +LT, EPS) 60 TO 34		
	YM • 45		
;;	CONTINUE		- 12
•			1.4
		P4719N	ý.
	v [ 1 - [ 6 - ] ]	PHTYPH	- ?1
30	C TH T INUE	P # 135 2 M	- 22
	= {{1.+{GH-1.}}/2.+H1+H1}/{1.+{GH-1.}}/2.+H2+H2}}++{GH/{GH-1.}}	P H T139 N	22
	PETIJAN	PHTIRN	24
- 1	FORMAT(1614447H RODY TURN STORNED AT 42 + 100-0	BH TILE N	2.4
	FMD	PRTHEN	
			1.2

<134871171NF \$40CKHEK4}	\$49CK#	2
LEVEL 2, CTEMP, ES, FU, GC, HU	CATE	2
COMMON / / VARR/ ETEMP(4,24,41), EJ(4,24,41),	CVARS	3
* F(14,24,41) + GO(4,24,41) + 40(4,24,41)	CANNA	4
COMMON /IPVARB/05,5TA(41),PHIP(41),OTTL(41),OTTLE(4)),DETA,TP(74)	19V4#4	2
LEVEL 2. PHO. P.U. V. W. ROA. POST. VINF, WINF, SOPPH, S5, PS7, BSPH, DTOPH,	PV AR 5	2
+ +CT+NTD7+NTDR+ACT+TCNNST+GA*+CNNST+NPEGNN+RS+RSZ+RSPHI+PST+PS7T	. PVLRA	
T114224 +	PVARS	4
COMMON /PVARS/ RHO(24,431, P(24,41), U(24,41), V(24,41), W(24,41),	PVARA	5
• POR(41) • POR7(41) • VINE(41) • VINE(41) •	PVLAN	÷
• 90804(41) . P4(41) . P47(41) . P874(41) .	PVARA	7
* 0T094(24.41), BCT(41) , DT07(24.41), 9T09(41) , ACT(4)) .	PVIRA	
TCONSTISCI & GAMIZZI & CONSTISSI INTEGON & PSIALI		e
• P\$7(41) . P\$PHT(61), P\$T(61) . P\$7(41), P\$PHT(61)		11
COMMON/SWARP/T.Z PHI DT . DT . DHI . ZINT .	SVARA	
· ZEND PT ALPHA GANNA STONA STACH - TAPEL -	SVAPR	· i
TAPEZ & DISKI & ALPH & DISKZ & SIGH & NEENT & DZET .	SVAPA	
• CZOPH ZA THYD THLD THY THL TTHY	SVAPS	÷.
• TTMI . •7 . 87 . NTPHT . NTT . KOHT . NTTER .	SWARR	Ā
•	SVARA	7
* NT ANTI ANTO ANTO ANTO A PHIED A NCONE A BADT	SWARR	. j.
. PHTE . HETHOD, LAG	SVARA	è
TOTHE GASCON NEED AND WINCH	SVARR	10
CARPANETHE-HIGHLOT FUNCTIONS	540088	•••
11TTLD(A)=SORT(C)+C2+(A=1-))	540084	i i

e

	9RSDZ(A+8+C+D)=(UTNF+C+A+SQQT(D+(1+8+9)+C+C))/D	5 13 <b>10</b> 10 10	
	PHOS(A)=(A+GRATIO)/(1.+GRATIO+A)	SHOCKS	
	A#A#[A, #, D, E, F)={F-1, }#A55(-UINF+D+A-R+E1/((D+D+1,+E+E)+F)	SHOCKN	11
	US(A, B, C)+A-C+B	\$40CKM	12
	V3(4)5)8449	540CK4	13
	43145795.505464C	SHOCKH	14
	GANNY DEANNA_1.	SHOCKA	15
	GRATTO-CANNI/CANNI	SHOCKN	16
	GAMPI G-GAMPI / GAMMA	240044	17
	C1=0.5+GAH=1+PINF/RHDIN	240CKH	18
	C2+0.5*GAN+16+C1	34UCK#	14
	40 TO (1,2),K4	540044	20
1	CONTINUE	5400.00	
C 741	NCK PPEDICTOR	540CKH	23
•	TT 3 K+3, NPHI	SHOCKR	24
<b>.</b>	**************************************	\$40CK4	25
	Haday	SHOCKH	26
	Tenputer	240044	27
	Nenputer	5400KM	28
	*STEKJ=#STEH)	34700	29
	*STEEJ=#STENJ	540044	50
4	CONTENJE	SHOCKH	17
	NO 5 K-3, NPHI	SHOCKH	33
	RSPHIT(#)=(RST(#+1)=PST(K=1))/(2+D+DETA)+OT(L(K)	SHOCKN	34
		SHOCKN	35
		SHOCKN	36
	RAPATAR MOCI PERSYS	240048	37
	P\$1=P\$1(K)	540CKN	3 P
	PSPHARSPHITEKI	240064	39
	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SHUCKH	
	FACTI AVINC/NI-WINC/NIAD CAUG	SHOCKH	41
	FACT2=UINF+UINF-UIT+UIT	SHOCKH	
	TELEACTE ALTA DAIULTA-ULT	SHOCKH	- 11
	*STTI =NPSNZ (UIT,RSPHR,FACTI,FACT2)	540004	45
	R\$FTEK]=P\$ZT1	\$40CK8	46
	ARART-APAREVINEEKI, WINEEKI, PSZTI, RSPHR, RHRATI	540CKH	47
	"IST-US("IMF, AMAPT, RSZT1)	\$40¢KM	48
		SHOCKH	49
	TE INDEAL EA AL BORT-BUBATABURTH	SHOCKH	50
	PHOINT7_K1_BOST	540564	- 21
	U(NT2+K)=UST	240564	22
	V(NT2,K)=VST		23
	WINT2 JK1+WST	SHOCKH	
5	CONTINIE	SHOCKH	56
	00 6 K=1,2	540064	57
	4=6=<	540CKM	5 P
	1 - H - H - H - H - H - H - H - H - H -	SHOCKH	59
		SHICK	60
	PC71/73-PC77/W3	SHOCKM	61
	RSPHTTCKIn+RSPHTTCHI	547088	6Z
	*SPHIT(T)==#SPHIT(N)	54004	44
6	CONTENUE	SHOCKH	45
	RETIPN	SHOCKH	66
2	CUN TINUE	\$40CKH	67
C 54	JCK CORRECTOR	\$400KH	6.
		SHOCKM	69
•	5/1 9 K=1.2	SHOCKH	70
	Magant .	540084	71
	T=NPHT+F	240644	
	N=NP4I=K	SHOCKH	74
	#\${#}=#\${#}	540CKH	75
_	#5(1)=P5(N)	SHOCKH	76
9	CONTINUE	SHOCKM	77
	UU 17 K=52NPHI BEBUTERSAEDERASSAEDERASSAEDERASSAEDERASSAEDERASSA	540CK4	78
	<pre>43 = 41 (K ) = (K ) (K + 1 ) = K S (K - 1 ) ) / (Z + 0 = DETA) = D TTL (K) = 4 = 4 / MTP - K )</pre>	540CKH	79
	PERTARS	540084	96
	VIT-UITILD(PSRAT)	SHOCKN	22
	RHRAT=RHOSEPSRAT)	240644	
	452=P5(K)	54004	73 84
	*SPH-RSPHI(K)	SHOCK	
	#SPHR##SPH/RS1	540084	86
	FACTI-VINF(K)-WINF(K) ORSPHR	SHOCKM	A7
	*ACTZ=UIMF+UINF-UIT+UIT	SHOCKH	58
	IFIFACIZ +CT+ 0+1017+-017	SHOCKM	99
	*SEL =UFBUETULTARSPHRAFACT2AFACT23 BS76F1+B673	SHOCKM	, 90
	ARARTWARARCVENECKI,WENECKI, DC21	SHOCKH	21
		2405.64	45

				NE		*																						
		COMMON		1.116	10		11	***																			SETDAT	2
		LEVEL	2.	ĒTF	-		έ.	È.	64			241				• '											CLUST	Z
		COMMON	.,	. v.							1	۰.	6.0				•••										CVARS	ž
		•	È	014		έ.	41					22		11	124	<u>ил</u> ,	:::	. <b>.</b> .									CVARN	3
		004404	(/F	NTP	07	\$1	÷1	i.,	n c.	75	. n.									1.							CVARS	
		COMMON	i i	TOV	AR	8/	e K	ē 1		11	PH	Ť e i	41	1.5		1			17	12							TOWLOO	
		104401	v's	DE /	ZL	1.	CF	1.0	F2.	71	F . 7	TRA	N.	071												••	101-10	
		LEVEL	2,		10,		Ū,		. R(	19.1	ROE	ž.1	111	F	ITN	F . I	80,			-				- 01	neu.			÷
		<ul> <li>BCT</li> </ul>	01	07.	DT	DR	, .	ĊT,	10	INS	T. G	4.	ca	NSI		REC	601		÷.				41.			77.	BWAP B	
		* #5#1	II T																			•••					PVARA	
		COM HO?	• 1	PVA	RB	1	RH	0 ( Z	4	111		(24	.,4	11,	. 17	(z	4.4	11)		VC:	24	411		wr z	4 . 4 3	1).	PYARB	,
		•	٠	096	41	1		,	80	126	41)		٧I	NF (	41	÷,	. 1	WT 1	(Ft	41						•••	PVARA	6
		•		0%P	H	41	1	,					R٩	(4)	1		, ,	192	14	11		R 7	<b>I</b> PH	141	1.		PVARB	Ť
		•	DT	DPH	112	4.	41	۱,	BCI	164	11	• 1	70	212	24,0	41	,,,	179	) R (	41		. A C	:16	411	•		PVARS	8
			I	C BN	51	(5	C )	,	GAN	1121	D)		C0	NSI	162	01		NR E	60	IN		R	664	11			PVARB	9
		·		221	-1	<u>.</u>	-	•	.21	HI	[41		RS	T ( 4	11)			٩5	21	[[4]	.,,	• 5	S P H	ITC	431		PVARB	10
		, constraints	~	44 P		T.	Ζ.		•	PH	I		DT	·	•	Di	Ľ		•	0P'	4T		21	NT			SVARB	2
			÷			,			. *	AL	PHA		64	104		2	16.	•	,	XM/	ьсн	٠	TA	PE1	وا		SVARN	3
				708	2		21	5 K J		4L.	24	•	<u>DI</u>	2572		- 51	Ľ G*	•	,	NPI	CHT.	,	DZ	DT	,		SVARM	4
				-					•			,		LU	. *				,	TPI		,	TT	19			24762	5
			Ň	PHT						30					•		11		,	SPI	11	,	11	TER			CAVE B	6
												•			•••				•	100	142	•		483			SVARA	7
		•	- P	HTF		:	RE.	Ťнг	m.	14	É	:		2			4 L P 7 M B		2	RUT	345			10			SVARB	
		OTNE.C		CON	- N		AL.			·	•	•	- 0		•				•	8 m.	11.00	,	01	M 8-	•		STATS	
с									0																		57444	10
ć		TNETE	L I	SE			27																				321941	10
ć																											SETRAL	
		ICONS1	(1	)-)																							3210A1	
		TCONST	r(Ż	)-ż																							SETRAT	
		100451	113	)=0																							CTRAT	- 17
		100451	184	}=1																							SETOAT	14
		PO 1 1	• 5	.52																							CETRAT	
		TCDNS1	1)1	3=0																							SETDAT	. î.
	1	CONTIN	IVE																								SETRAT	19
		NRC =1																									SETDAT	20
		TETHOR	) <u>n</u> 2																								SETDAT	21
		NPPNT	Ω.																								SETDAT	22
		07NT+0																									SETDAT	23
	•	CONTIN	50																								SETDAT	24
		00 6 1	•1	• <u>7 °</u>																							SETDAT	25
				• 0																							SETDAT	26
	2	00 0 1	101																								SETOAT	27
		CONST																									SETDAT	28
		CONTIN			۰.																						SETDAT	29
	•	00 10		1.2																							SETDAT	30
		Tertis	à.,	676	•																						SETDAT	31
	10	CONTEN	шF	-																							SETRAT	35
		00 11	1.	1.4	1																						SETDAT	33
		*08 TT	- 0	.0	•																						321041	. 34
		RUNZII	11-	ō. n																							301741	35
		VINFEI		0.0																							SEIVAT	36
		VINEL	11=	0.3																							CETRAN	
		PORPH	T)	-3.	L																						SETHAT	35
		R8(1).		¢ .																							SETRAT	
		997(1)	- 5	• •																							CETRAT	
		RAPHE	()÷	0.0																							SETDAT	- 74
																												46

	USF-USIUEHF,ABART,RSZ1)	SHOCKA	
	VSF=VS(VINF(K),ABART)	SHOCKE	
	WSF+WS(WINF(K),ABART,RSPHR)	tuocre	
	IF (HREAL.EQ.Q) ROSF-RHRATARHOTH	5 400 KM	
	\$K0(NT2-K1=80\$5	3400.00	
		SHOCKH	97
		SHOCKA	98
	**********	2400KH	
	W(MTZ,K)+WSF	2400KM	190
10	CONTINUE	SHOCKH	161
	90 11 K=1+2	THOP Y R	100
	N=6-K	SHOCK H	101
	Townstag	340684	103
		SHOCKH	104
		SHOCKA	105
	- 5 2 ( F ) - 4 3 2 ( F )	540CKM	126
	#57([]=R\$7(N)	54 NC K #	107
	RSPHI (K) ==RSPHI (N)	\$100.00	10.8
	RS PHI (7) =-RSPHI ( N)	SHOCK	1.00
11	CONTINUE	1400444	
	PS THOM	SHULKH	110
		SHOCKA	111
	5-0	540CK#	112

ACT(1)=L+3	SETALT	41	
DTDR(T)=C.D	SETOAT		
ACTELI-D-D	TETRAT	12	
R\$(1)=0.0	351981 tetait	47	
#S7171an-A	321041		
#\$PUT (T)+1-1	321041		
BETITION. N	SETURI		
	SEIDAT		
*3(11)*****	SEIDAT	50	
- 3F 41 1 4 1 - <b>V 6 V</b>	SETONI	91	
	SETDAT	52	
	SETDAT	53	
DTILII=0.0	SETOAT	54	
TTLECT)=0.C	SETDAT	35	
00 11 J=1,24	SETDAT	56	
R40(J)T)=0.C	SETDAT	57	
*(J,T)=C+D	SETDAT	58	
Utjøt)=Dev	SETALT	59	
V(J)T3=C.U	SETDAT	60	
WIJ,TI=C.B	SETDAT	61	
DTDP4(J.T)+0.0	SETRAT	6.2	
07026 J. E1=0.0	SETDAT	Å1	
11 CONTINUE	SETAT		
RETURN	SETDAT		
FWD	SETONT	44	
	197041		

This Page Intentionally Left Blank

## APPENDIX C

## CATALOG OF TEST CASES

.
	·		(Page No.) Streamlines	(Page No.) Velocity magnitude	(Page No.) Density ρ/ρ <sub>∞</sub>	(Page No.) Temperature $T/T_{\infty}$	(Page No.) Parallel magnetic	(Page No.) Perpendicular magnetic
H/R	M <sub>∞</sub>	Y		1 2 1 / • 00			( B /B <sub>w</sub> ) .	$( \underline{B} /\underline{B}_{\infty})_{\perp}$
.10	$\begin{array}{c} 2.0\\ 3.0\\ 5.0\\ 8.0\\ 12.0\\ 25.0\\ 3.0\\ 5.0\\ 8.0\\ 12.0\\ 25.0\\ 3.0\\ 5.0\\ 8.0\\ 12.0\\ 3.0\\ 5.0\\ 8.0\\ 12.0\\ 25.0\end{array}$	5/3	179 182 185 188 191 194 197 200 203 206 209 212 215 218 221 224 227 230	179 182 185 188 191 194 197 200 203 206 209 212 215 218 221 221 221 221 221 221 221	180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231	180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231	181 184 187 190 193 196 199 202 205 208 211 214 217 220 223 226 229 232	181 184 187 190 193 196 199 202 205 208 211 214 217 220 223 226 229 232
H/R <sub>o</sub>	M <sub>∞</sub>	Ŷ	Streamlines	v /v_	ρ/ρ	T/T <sub>w</sub>	( B /B <sub>w</sub> ) "	( B /B <sub>w</sub> )_
.10 .20 .25	2.0 3.0 5.0 12.0 25.0 3.0 5.0 8.0 12.0 25.0 3.0 5.0 8.0 12.0 25.0	5/3	233 236 239 242 245 248 251 254 257 260 263 266 269 272 275 278 281 284	233 236 239 242 245 248 251 254 257 260 263 266 269 272 275 278 281 284	234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285	234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285	235 238 241 244 247 250 253 256 259 262 265 268 271 274 277 280 283 286	235 238 241 244 247 250 253 256 259 262 265 268 271 274 277 280 283 286

Catalog page number index for plasma streamline, velocity magnitude, density, temperature, and unit magnetic-field maps for various solar-wind flows past planetary ionopauses































-





























.






























,

































































































































## REFERENCES

- Spreiter, J. R. and Jones, W. P.: On the Effect of a Weak Interplanetary Magnetic Field on the Interaction Between the Solar Wind and the Geomagnetic Field. J. Geophy. Res., Vol. 68, 1963, pp. 3555-3564.
- Spreiter, J. R., Alksne, A. Y., and Summers, A. L.: Hydromagnetic Flow Around the Magnetopause. Plan. & Space Sci., Vol. 14, 1966, pp. 223-253.
- Dryer, M. and Faye-Petersen, R.: Magnetogasdynamic Boundary Condition for a Self-Consistent Solution to the Closed Magnetopause. AIAA Journal, Vol. 4, 1966, pp. 246-254.
- Dryer, M. and Heckman, G. R.: Application of the Hypersonic Analogy to the Standing Shock of Mars. Solar Phys., Vol. 2, 1967, pp. 112-120.
- 5. Spreiter, J. R., Alksne, A. Y., and Summers, A. L.: External Aerodynamics of the Magnetosphere. Physics of the Magnetosphere (Ed. R. L. Carovillano, J. F. McClay, and H. R. Radoski), D. Reidel Pub. Co., 1968, pp. 304-378 (also NASA TN 4482, 1968).
- Spreiter, J. R., Summers, A. L., and Rizzi, A. W.: Solar Wind Flow Past Nonmagnetic Planets - Venus and Mars. Plan. & Space Sci., Vol. 18, 1970, pp. 1281-1289.
- Spreiter, J. R. and Rizzi, A. W.: Aligned Magnetohydrodynamics Solution for Solar Wind Flow Past the Earth's Magnetosphere. Acta Astronautica, Vol. 1, 1974, pp. 15-35.
- Spreiter, J. R.: Magnetohydrodynamic and Gasdynamic Aspects of Solar-Wind Flow Around Terrestrial Planets: A Critical Review. NASA SP-397, 1975, pp. 135-150.
- 9. Stahara, S. S., Chaussee, D. S., Trudinger, B. C., and Spreiter, J. R.: Computational Techniques for Solar Wind Flows Past Terrestrial Planets - Theory and Computer Programs. NASA CR-2924, Nov. 1977.
- Knudsen, W. C., Spenner, K., Spreiter, J. R., Miller, K. L., and Novak, V.: Thermal Structure and Major Ion Composition of the Venusian Ionosphere: First RPA Results from Venus Orbiter. Science, Vol. 203, No. 4382, Feb. 1979, pp. 757-763.
- 11. Knudsen, W. C., Spenner, K., Whitter, R. C., Spreiter, J. R., Miller, K. L., and Novak, V.: Thermal Structure and Energy Influx to the Day- and Nightside Venus Ionsphere. Science, Vol. 205, No. 4401, July 1979, pp. 105-107.
- 12. Kuhn, G. D., Goodwin, F. K., and Perkins, S. C., Jr.: User's Manual for Space-Shuttle Computer Programs. NEAR TR 110, Apr. 1976.

## REFERENCES (Concluded)

- Beam, R. M. and Warming, R. F.: An Implicit Finite-Difference Algorithm for Hyperbolic Systems in Conservation-Law Form. J. Comp. Phys., Vol. 22, No. 1, Sept. 1976.
- Kentzer, C. P.: Discretization of Boundary Conditions on Moving Discontinuities. Proceedings of the Second International Conference on Numerical Methods in Fluid Dynamics, Lecture Notes in Physics, Vol. 8, M. Holt, ed., Berkeley, CA, 1970, pp. 108-113.
- 15. Thomas, P. D., Vinokur, M., Bastionon, R., and Conti, R. J.: Numerical Solution for the Three-Dimensional Hypersonic Flow Field of a Blunt Delta Body. AIAA J., Vol. 10, July 1972, pp. 887-894.
- 16. Kutler, P., Reinhardt, W. A., and Warming, R. F.: Numerical Computations of Multi-Shocked Three-Dimensional Supersonic Flow Fields with Real Gas Effects. AIAA Paper No. 72-702, June 1972.
- 17. Kutler, P., Reinhardt, W. A., and Warming, R. F.: Multi-Shocked, Three-Dimensional Supersonic Flow Fields with Real Gas Effects. AIAA J., Vol. 11, May 1973, pp. 657-664.
- Chaussee, D. S., Holtz, T., and Kutler, P.: Inviscid Supersonic/ Hypersonic Body Flow Fields and Aerodynamics from Shock-Capturing Technique Calculations. AIAA Paper No. 75-837, June 1975.
- 19. MacCormak, R. W.: The Effect of Viscosity in Hypervelocity Impact Cratering. AIAA Paper No. 69-354, 1969.
- 20. Alksne, A. Y. and Webster, D. L.: Magnetic and Electric Fields in the Magnetosheath. Plan. & Space Sci., Vol. 18, 1970, pp. 1203-1212.
- 21. Wolfe, J., Intriligator, D. S., Mihalov, J., Collard, H., McKibbin, D., Whitten, R., and Barnes, A.: Initial Observations of the Pioneer Venus Orbiter Solar Wind Plasma Experiment. Science, Vol. 203, No. 4382, Feb. 1979, pp. 750-752.
- 22. Intriligator, D. S., Collard, H. R., Mihalov, J. P., Whitten, R. C., and Wolfe, J. H.: Electron Observation and Ion Flows from the Pioneer Venus Orbiter Plasma Analyzer Experiment. Science, Vol. 205, No. 4401, July 1979, pp. 116-119.
- Russell, C. T., Elphic, R. C., and Slavin, J. A.: Initial Pioneer Venus Magnetic Field Results: Dayside Observations. Science, Vol. 203, No. 4382, Feb. 1979, pp. 745-748.
- 24. Russell, C. T., Elphic, R. C., and Slavin, J. A.: Initial Pioneer Venus Magnetic Field Results: Nightside Observations. Science, Vol. 205, No. 4401, July 1979, pp. 114-116.

Table 1.- Ordinates of Various Ionopause Shapes

## V<sub>w</sub> B X/R<sub>o</sub> Y<sub>i</sub>/R<sub>o</sub>

	IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE	
	$\overline{H}/R_{o} = 0.01$		$\overline{H}/R_{0} = 0.05$		$\overline{H}/R_{o} = 0.10$		$\overline{H}/R_0 = 0.20$		$\overline{H}/R_{o} = 0.25$	
β	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>
0°	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
2°	0.9994	0.0349	0.9995	0.0349	0.9995	0.0349	0.9995	0.0349	0.9996	0.0349
6°	0.9946	0.1045	0.9950	0.1046	0.9953	0.1046	0.9958	0.1047	0.9960	0.1047
10°	0.9851	0.1737	0.9861	0.1739	0.9870	0.1740	0.9883	0.1743	0.9888	0.1744
14°	0.9709	0.2421	0.9727	0.2425	0.9746	0.2430	0.9771	0.2436	0.9781	0.2439
18°	0.9520	0.3093	0.9550	0.3103	0.9580	0.3113	0.9622	0.3126	0.9638	0.3132
22°	0.9285	0.3751	0.9330	0.3770	0.9374	0.3787	0.9435	0.3812	0.9459	0.3822
26°	0.9006	0.4393	0.9068	0.4423	0.9127	0.4451	0.9211	0.4492	0.9243	0.4508
30°	0.8684	0.5014	0.8764	0.5060	0.8840	0.5104	0.8949	0.5167	0.8991	0.5191
34°	0.8320	0.5612	0.8419	0.5679	0.8514	0.5743	0.8649	0.5834	0.8701	0.5869
38°	0.7916	0.6185	0.8035	0.6278	0.8148	0.6366	0.8312	0.6494	0.8374	0.6543
42°	0.7474	0.6729	0.7613	0.6854	0.7745	0.6973	0.7935	0.7145	0.8009	0.7211
46°	0.6995	0.7243	0.7153	0.7407	0.7303	0.7563	0.7520	0.7787	0.7604	0.7874
50°	0.6482	0.7725	0.6658	0.7934	0.6824	0.8133	0.7066	0.8421	0.7159	0.8532
54°	0.5937	0.8172	0.6128	0.8435	0.6309	0.8683	0.6571	0.9044	0.6673	0.9184
58°	0.5363	0.8582	0.5565	0.8906	0.5756	0.9212	0.6035	0.9657	0.6143	0.9831
62°	0.4761	0.8954	0.4971	0.9349	0.5168	0.9719	0.5456	1.0261	0.5569	1.0473
66°	0.4135	0.9287	0.4346	0.9761	0.4543	1.0203	0.4504	1.1147	0.4947	1.1744
70°	0.3487	0.9581	0.3691	1.0142	0.3882	1.0665	0.4163	1.1437	0.4274	1.1744
74°	0.2820	0.9833	0.3009	1.0492	0.3184	1.1103	0.3444	1.2010	0.3548	1.2374
78°	0.2135	1.0046	0.2298	1.0811	0.2448	1.1517	0.2673	1.2574	0.2764	1.3001
82°	0.1436	1.0219	0.1560	1.1098	0.1674	1.1908	0.1845	1.3130	0.1915	1.3628
86°	0.0724	1.0354	0.0794	1.1355	0.0858	1.2276	0.0956	1.3677	0.0997	1.4254
90°	0.0000	1.0454	0.0000	1.1583	0.0000	1.2620	0.0000	1.4218	0.0000	1.4883
94°	-0.0736	1.0523	-0.0824	1.1782	-0.0905	1.2943	-0.1032	1.4753	-0.1085	1.5516
98°	-0.1485	1.0566	-0.1680	1.1955	-0.1861	1.3244	-0.2148	1.5284	-0.2271	1.6156
102°	-0.2251	1.0591	-0.2572	1.2102	-0.2875	1.3524	-0.3361	1.5813	-0.3572	1.6807
106°	-0.3040	1.0603	-0.3506	1.2226	-0.3953	1.3785	-0.4686	1.6343	-0.5010	1.7472
110°	-0.3861	1.0607	-0.4488	1.2330	-0.5106	1.4027	-0.6142	1.6875	-0.6608	1.8156
114°	-0.4723	1.0609	-0.5527	1.2415	-0.6346	1.4253	-0.7753	1.7414	-0.8400	1.8866
1	1				<b>(</b>					4 4

,

	$\frac{\text{IONOPAUSE}}{\overline{H}/R_{o}} = 0.01$		$\frac{\text{IONOPAUSE}}{\overline{H}/R_{o}} = 0.05$		$\frac{\text{IONOPAUSE}}{\overline{H}/R_{o}} = 0.10$		$\frac{\text{IONOPAUSE}}{\overline{H}/R_{0}} = 0.20$		$\frac{\text{IONOPAUSE}}{\overline{\text{H}}/\text{R}_{0}} = 0.25$	
β	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>	x/R <sub>o</sub>	Y <sub>i</sub> /R <sub>o</sub>
118° 122° 130° 134° 142° 146° 150° 154° 158° 162° 166° 170° 174°	-0.5641 -0.6630 -0.7708 -0.8903 -1.0246 -1.1783 -1.3580 -1.5730 -1.8377 -2.1754 -2.6262 -3.3654 -4.2564 -6.0204 -10.1111	1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610	-0.6638 -0.7835 -0.9142 -1.0587 -1.2209 -1.4064 -1.6229 -1.8816 -2.1999 -2.6057 -3.1471 -3.9152 -5.1047 -7.2230 -12.1370	1.2484 1.2539 1.2583 1.2617 1.2643 1.2664 1.2679 1.2692 1.2701 1.2709 1.2715 1.2721 1.2727 1.2736 1.2758	-0.7690 -0.9159 -1.0782 -1.2597 -1.4654 -1.7027 -2.3176 -2.7338 -3.2686 -3.9884 -5.0210 -6.6450 -10.1609 -16.8192	1.4462 1.4657 1.4840 1.5012 1.5175 1.5331 1.5482 1.5632 1.5784 1.5942 1.6114 1.6314 1.6568 1.7004 1.7678	-0.9551 -1.1578 -1.3890 -1.6562 -2.3465 -2.8081 -3.3909 -4.1545 -5.2045 -5.2045 -6.7470 -9.2448 -13.9882 -26.3596	1.7963 1.8529 1.9118 1.9738 2.0403 2.1128 2.1939 2.2872 2.3986 2.5384 2.7260 3.0038 3.4877 4.6480	-1.0427 -1.2746 -1.5434 -1.8598 -2.2393 -2.7047 -3.2913 -4.0570 -5.1025 -6.6208 -9.0300 -13.4322 -23.9161	1.9610 2.0397 2.1243 2.2165 2.3189 2.4353 2.5715 2.7365 2.9460 3.2292 3.644 4.3644 5.9630

Table 1.- Concluded.











(b) Present method.



. . . . . .



Figure 3.- Transformation from physical domain to rectangular computational domain.



Figure 4.- Illustration of capability for providing an additional flow-field segment to the obstacle nose solution in the computational procedure for determining the gasdynamic flow properties of solar wind-ionopause interactions.



Figure 5.- Illustration of quantities used for streamline calculation.



Figure 6.- Illustration of quantities used for magnetic field-line calculation in the plane of magnetic symmetry.



Figure 7.- Illustration of the components of the three-dimensional magnetic field.



Figure 8.- Illustration of sun-planet  $(x_g, y_g, z_g)$  and solar wind (x,y,z) coordinate systems and the azimuthal  $(\Omega)$ and polar  $(\phi_p)$  solar-wind angles, both shown in a positive sense.







Figure 10. – Bow shock locations for  $M_{\infty}$  = 8.0,  $\gamma$  = 5/3 flow past constant scale-height ionopause shapes with H/R<sub>0</sub> = 0.5 and 1.0.



Figure 11.- Bow shock shapes for flow past an ionopause shape with gravitational variation included in scale height with  $\bar{\mathbf{H}}/\mathbf{R}_{o}$  = 0.25,  $\gamma$  = 5/3 and  $M_{\infty}$  = 2.0 and 3.0.



Figure 12.- Overall features of Pioneer-Venus orbiter trajectory crossings of solar-wind/Venus-ionosphere interaction region.



Figure 13.- Illustration of typical flow-field grid density for gasdynamic solution;  $M_{\infty}$  = 3.0,  $\gamma$  = 5/3.



Figure 14.- P-V Orbit 6 trajectories and observational bow shock crossings as viewed in solar-wind coordinates based on inbound and outbound interplanetary solarwind directions; also, various bow shock shapes for different interplanetary solar-wind conditions.



Figure 15.- Comparison of observed (OPA) and theoretical time histories of ionosheath plasma properties for P-V Orbit 6 based on inbound and outbound interplanetary solar-wind conditions using a gasdynamic solution for  $M_{\infty} = 13.3$ ,  $\gamma = 2.0$ .









directions; also, various bow shock shapes for different interplanetary solar-wind solar wind conditions.



Figure 18.- Comparison of observed and theoretical time histories of ionosheath plasma properties for P-V Orbit 3 based on inbound and outbound interplanetary solar-wind conditions.



(a) Magnetic-field magnitudes.



309



Figure 19.- Concluded.



(a) Magnetic-field magnitude.

Figure 20.- Comparison of observed (OMAG) and theoretical time histories of the magnetic field for P-V Orbit 3 based on inbound solar wind interplanetary conditions using a gasdynamic solution for  $M_{\infty} = 3.0$ ,  $\gamma = 5/3$ .

311



Figure 20. - Concluded.

1. Report No. NASA CR-3267	2. Government Access	ion No.	3. Recipient's Catalog	No.			
4. Title and Subtitle APPLICATION OF PROCEDURES FOR MODELING SOL	MPUTATIONAL ACTIONS WITH	5. Report Date May 1980					
VENUS - THEORY AND COMPUTER		6. Performing Organization Code 498/C					
7. Author(s) Stephen S. Staha Barbara C. Trudinger,	Klenke, Spreiter	8. Performing Organization Report No. NEAR TR 202					
9. Performing Organization Name and Address Nielsen Engineering &	nc.						
510 Clyde Avenue Mountain View, CA 940	11. Contract or Grant NASW-3182	No.					
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered Contractor Report					
National Aeronautics an Washington, DC 20546	inistration -	14. Sponsoring Agency	Code				
15. Supplementary Notes		<u></u>					
NASA Headquarters Technica	1 Monitor: R	obert E. Murphy					
<sup>16. Abstract</sup> Advanced computational procedures are developed and applied to the prediction of solar-wind interaction with nonmagnetic ter- restrial-planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single-fluid, steady, dissipa- tionless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvénic solar-wind flow past terrestrial planets. The procedures, which consist of finite-difference codes to determine the gasdynamic properties and a variety of special-purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program which has been extensively documented and is presented in a general user's manual included as part of this report. Theoretical results based upon these procedures are reported for a wide variety of solar-wind conditions and ionopause obstacle shapes. Plasma and magnetic-field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer-Venus Orbiter. These results have verified the appropri- ateness of the basic theoretical model, and have indicated the importance of accounting for the variable oncoming direction of							
17. Key Words (Suggested by Author(s))18. Distribution StatementSolar-Wind/Ionosphere InteractionUnclassified - UnlimitedFinite-Difference MethodsSteady Flow							
riozen Magnetic Field			Subject Category 92				
19. Security Classif. (of this report) Unclassified	20. Security Classif. (o Unclassifie	f this page) ed	21. No. of Pages 316	22. Price* \$11.75			

,

## **End of Document**