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SUMMARY

Six standard reference atmosphere models for the years 1962, 1963 (Patrick Air Force Base), and 1966 (for July and January at latitudes 30° and 60° N) are presented in tabular form. The tabulation, which is presented in block data format, is adequate for the accurate representation of the atmospheric parameters of pressure, density, speed of sound, and coefficient of viscosity as functions of altitude. The range of tabulated altitudes extends from 0 to 205 kilometers. Interpolation for the desired parameters is performed by using cubic spline functions. The recursive relations necessary to compute the cubic spline function coefficients are derived and implemented in subroutine form. Detailed FLOWGM flow charts and FORTRAN listings of the atmosphere package are presented in the appendix.

INTRODUCTION

This report presents a tabulation in block data format of selected altitude-correlated values of pressure, density, speed of sound, and coefficient of viscosity for each of six atmosphere models. These values were selected such that they adequately represent their respective functions for accurate interpolation by cubic spline functions throughout the range of tabulated altitudes. Three companion subprograms, which form the preprocessor (subroutines SDAT and SPLN1) and processor (subroutine ATMSFL), are presented. These subprograms, together with the data element, compose the spline fit atmosphere package. In the preprocessor, the data for the desired atmosphere model are selected and processed for proper order and unit consistency before SPLN1 is used to compute the spline function coefficients. In the processor, the data table is searched to establish the interval in which the desired altitude lies, and then the values of the previously mentioned parameters are computed by using the cubic spline function coefficients for the appropriate altitude interval.

The cubic spline technique provides an effective, easy-to-use method for the unerring reproduction of a function from tabulated data. The method also ensures continuity in the function and in its first and second derivatives. After the cubic spline function coefficients have been computed, they may be stored for repeated use as long as the tabulated data remain unchanged.

SYMBOLS

a, b, c, d	edges of the beam
a_k	defined in equation (37)
b_k	defined in equation (38)
C_1, C_2	arbitrary constants of integration
c_k	defined in equation (39)
$c_1(k)$	defined in equation (68)
$c_2(k)$	defined in equation (69)
$c_3(k)$	defined in equation (70)
dA	differential element of a cross-sectional area of a beam
ds	differential element of arc length
dx	differential element of the length of the beam
dθ	differential element of the angle through which a cross-sectional surface of a beam is rotated under load
d_k	defined in equation (49)
E	modulus of elasticity of the beam
EI	flexural rigidity (can be taken as unity for any plane curve without loss of generality)
ef	original unstressed length of the fiber
gh	typical fiber of the beam
hk	defined in equation (1)
I	area moment of inertia
ℓ	distance from the neutral surface to a deformed fiber of a loaded beam

$M(x)$	bending moment as a function of the distance x measured from the end of the beam
M_k	bending moment at the kth section of the beam or an approximation to the second derivative at the kth section
P	load that acts upon the beam
Q_k	defined in equation (44)
R_1, R_2	support reactions of the beam
S	stress
s	arc length of a curve
U_k	defined in equation (46)
V_k	shear force at the kth section of the beam
$y(k)$	defined in equation (24)
$y(x)$	defined in equation (23)
y'	slope of the deformation curve
$y'(x)$	defined in equation (22)
ε	strain (change in length per unit of length)
ρ	radius of curvature of the neutral surface
φ	angle that the tangent to a curve makes with the axis of abscissas

SPLINE FIT ATMOSPHERE MODEL PACKAGE

Model History

The spline fit atmosphere package discussed in this report, was originally developed for the space vehicle dynamic simulator (SVDS) program in November 1972. In February 1973, the package was incorporated with appreciable modification, into the Shuttle optimal abort program (SOAP). The package presented here is from an early version of the SOAP. For implementation into the SOAP, the SVDS version was modified, at the expense of storage, to improve its performance and execution requirements. The spline fit atmosphere package has performed accurately in both programs.

Description of the Models

The spline fit atmosphere package consists of six atmosphere models:

1. The 1962 standard reference atmosphere

2. The 1966 standard reference atmosphere for July at latitude 30° N

3. The 1966 standard reference atmosphere for January at latitude 30° N

4. The 1966 standard reference atmosphere for July at latitude 60° N

5. The 1966 standard reference atmosphere for January at latitude 60° N

6. The 1963 Patrick Air Force Base (AFB) reference atmosphere

Each model consists of a tabulation of altitude-correlated values of the atmospheric parameters of pressure, density, speed of sound, and coefficient of viscosity. All six models are correlated to the same table of altitudes and tabulated in the foregoing sequence. All tabulated atmospheric parameter values are expressed in the meter-kilogram-second (MKS) system of units. Altitude values are given in meters, pressure values are given in millibars, density values are given in kilograms per cubic meter, speed of sound values are given in meters per second, and coefficient of viscosity values are given in kilograms per meter per second. Each atmospheric parameter is represented as a function of altitude by 123 data points. These data have been selected on best-fit considerations, with particular emphasis on those regions in which the tabulation shows that the function is discontinuous in its first derivative. Each model is represented in the 0- to 205-kilometer altitude range. The tabulation was compiled from references 1 to 3.

Because the tabulation for the 1966 atmosphere extends only to 118 kilometers, the last data point is repeated to 205 kilometers for model consistency. If the model altitude boundaries are exceeded, the package returns the last tabulated parameter values at the violated boundary.

Assumptions and Approximations

The spline fit atmosphere model package was developed to accommodate the needs and restrictions of the SVDS program. As a result, temperature, an important atmospheric parameter, was not included in the list of parameters modeled when the package was built. This parameter can be added to any model desired at the cost of tabulating the parameter values required.

The tabulation was performed in the MKS system of units because this system was common to all the references used. A common system of units is advantageous because a single set of conversion factors can be used to place all models in any desired working units. The British engineering system of units was used to convert the atmospheric data in this package (i.e., pressure in pounds-force per square foot, density in slugs per cubic foot, speed of sound in feet per second, and coefficient of viscosity in pounds-mass seconds per square foot).

Atmospheric parameter function values were selected at various altitudes. The increment of altitude was varied as a function of altitude as follows.

Altitude range, km	Altitude increment, m
0 to 3	250
3 to 5	500
5 to 20	1000
20 to 160	2000
160 to 204	4000
204 to 205	1000

Additional data points were added to mark the location in which the atmospheric parameter functions undergo first-derivative discontinuities. These discontinuities occur only in the speed of sound and coefficient of viscosity functions, which are affected because of temperature variations. As a result, when temperature is added to the atmosphere models, the choice of altitudes should accommodate discontinuities in the first derivative of the temperature functions. Because of the need to intersperse additional points, an ordering scheme is included in the preprocessor SDAT to place all altitude values and associated function values in ascending order of the independent variable. This order must be established before calling subroutine SPLN1 to compute the cubic spline coefficients.

The small altitude increment used at the extremes of the tabulation permitted the approximation of the first derivatives of the function at the initial and terminal boundaries by forming the difference quotient. This assumption of linearity at the extremes of the tabulated function is the only assumption made in the model. (The theoretical arguments on which the algorithm is based result in the additional assumption that the curvature of the function can be represented by its second derivative. The data sample selected is expected to comply with this assumption.)

DERIVATION OF THE RECURSIVE RELATIONS FOR COMPUTING THE COEFFICIENTS OF THE CUBIC SPLINE FUNCTIONS

The mathematical spline is a formal analog of the draftsman's spline, a flexible beam device used to fair out a smooth curve between specified data points. The mechanical spline is anchored on the drawing board at each plotted data point. The curvature of the spline results from the bending moments applied to the beam.

In deriving the recursive relations of the spline algorithm, the elementary theory of elasticity is useful. Consider a simply supported beam (i.e., ends unrestrained) under the action of an applied load, however distributed. For an elementary analysis, the following assumptions are made:

1. Sections of the beam, which were originally plane, remain plane.

2. The material of the beam is homogeneous and obeys Hooke's law (the deformation is proportional to the applied load).

3. The moduli of elasticy for tension and for compression are equal.

4. The beam is initially straight and is of constant cross section.

Figure 1 shows a uniform homogeneous beam under the action of the load P. The beam is simply supported and is in static equilibrium under the action of the support reactions R_1 and R_2. The differential element of length dx, bounded by the edges a, b, c, and d, is bent or deformed under load into the exaggerated shape shown in figure 2 where c and d are deflected to c' and d'. The sections ab and cd are shown rotated relative to each other through an angle $d\theta$, but they remain undistorted in accordance with assumption 1. The fibers in the region of ac are contracted, or shortened, in compression, whereas those in the region bd are elongated, or lengthened, in tension. Because the beam is uniform and homogeneous in going from contraction to elongation, a region conceivably exists in which the fibers maintain their original unstressed length. This surface of unstressed fibers is referred to as the neutral surface. In the deformation of a typical fiber gh located at distance ℓ from the neutral surface, the elongation hk is the arc of a circle of radius ℓ, which subtends the angle $d\theta$ and is given by the relation

$$hk = \ell \, d\theta \tag{1}$$

The strain ε (the change in length per unit of length) is found by dividing the deformation hk by the original unstressed length of the fiber ef.

$$\varepsilon = \frac{hk}{ef} = \frac{\ell \, d\theta}{ef} \tag{2}$$

If the radius of curvature of the neutral surface is ρ, the curved length of ef is equal to $\rho \, d\theta$. The strain can then be expressed as

$$\varepsilon = \frac{\ell \, d\theta}{\rho \, d\theta} = \frac{\ell}{\rho} \tag{3}$$

Because the material is assumed to be homogeneous and to obey Hooke's law, the stress (force per unit area) in the fiber gh is given by

$$S = E_{\varepsilon} = \frac{E}{\rho} \ell \tag{4}$$

where E is the modulus of elasticity defined as the ratio of the stress S to the strain ε. Clearly, the sign of S varies with the sign of ℓ: negative or compressive stress for ℓ negative and positive or tensile stress for ℓ positive.

The beam in figure 1 is shown in static equilibrium. As a result, the algebraic sum of all forces and moments acting on the beam must be zero. The bending moment M(x) must be balanced by the resisting moment. The resisting moment is the sum of all stresses S acting on each differential area element of cross section dA multiplied by its moment arm ℓ measured from the neutral axis as shown in figure 3. Hence, the bending moment is

$$M(x) = \int \ell (S \, dA) \tag{5}$$

Replacing S with $E\ell/\rho$ from equation (4) gives

$$M(x) = EI/\rho \tag{6}$$

where I is the area moment of inertia.

$$\frac{1}{\rho} = \frac{M(x)}{EI} \tag{7}$$

The reciprocal of ρ, the radius of curvature of the beam, is called the curvature of the curve. For plane curves, the curvature is defined as the rate at which the tangent to the curve turns compared with the description of arc. Therefore. if φ is the angle that the tangent to a curve makes with the axis of abscissas and s is the element of arc length, then the curvature is defined as

$$\frac{1}{\rho} = \frac{d\varphi}{ds} \tag{8}$$

The slope of the tangent to the curve is

$$y' = \frac{dy}{dx} = \tan \varphi$$

or

$$\varphi = \arctan y' \tag{10}$$

and

$$d\varphi = \frac{dy'}{\left(1 + y'^2\right)^{\frac{1}{2}}} dx = \frac{y''}{\left(1 + y'^2\right)^{\frac{1}{2}}} dx \tag{11}$$

The differential element of arc length ds is defined as

$$ds = \left(1 + y'^2\right)^{\frac{1}{2}} dx \tag{12}$$

Therefore,

$$\frac{1}{\rho} = \frac{d\varphi}{ds} = \frac{y''}{\left(1 + y'^2\right)^{\frac{3}{2}}} \tag{13}$$

and

$$\frac{y''}{\left(1 + y'^2\right)^{\frac{3}{2}}} = \frac{M(x)}{EI} \tag{14}$$

The assumption is usually made that the slope of the deformation curve y' is small so that y'^2 can be ignored compared to unity. When this assumption is made, the differential equation of the deformation curve can be written as

$$M(x) = EIy''(x) \tag{15}$$

The assumption concerning the elastic behavior of a beam made at the beginning of this discussion can be realized by a mathematical function of one variable. The assumption that the slope of the curve is small and that its square can be neglected can be realized by an arbitrary mathematical function only over relatively short intervals. Under this condition, the curvature can be approximated by the second derivative of the function. This point must be remembered when selecting a set of data points to represent a function for spline fit. Sufficient data points must be chosen in the appropriate concentration such that in the regions where the curvature is large, each section of the curve can be considered as a simply supported beam (adequately supported so that the slope of the deformation curve is negligible).

The following definitions are required for the discussion that follows.

1. The shear at a section of a beam is the algebraic sum of all external forces acting on one side of the section.

2. The bending moment at a section of a beam is the algebraic sum of the moments of all the external forces on one side of the section.

Hence, if a mathematical function is represented in a region of definition by n data points, the region of definition will have been divided into $n - 1$ sections (fig. 4). If each section of the curve between given data points is considered to be a beam deflected under load, then the bending moment in the kth section between the kth and $(k + 1)$th data points will be given by the equation

$$M(x) = \int_{x_k}^{x} V_k \, dx + M_k \qquad (16)$$

where V_k and M_k are the shear and bending moments at the kth section. Therefore,

$$M(x) = V_k\left(x - x_k\right) + M_k \qquad (17)$$

Clearly, where $x = x_k$, $M(x_k) = M_k$ and where $x = x_{k+1}$, $M(x_{k+1}) = M_{k+1}$ or

$$M_{k+1} = V_k\left(x_{k+1} - x_k\right) + M_k \qquad (18)$$

Solving for V_k gives

$$V_k = \frac{M_{k+1} - M_k}{x_{k+1} - x_k} = \frac{\Delta M_k}{\Delta x_k} \qquad (19)$$

Substituting equation (19) into equation (17) gives

$$M(x) = \frac{\left(M_{k+1} - M_k\right)}{\left(x_{k+1} - x_k\right)} \left(x - x_k\right) + M_k$$

$$= M_{k+1} \frac{\left(x - x_k\right)}{\left(x_{k+1} - x_k\right)} + M_k \frac{\left(x_{k+1} - x\right)}{\left(x_{k+1} - x_k\right)} \qquad (20)$$

Substituting the bending moment $M(x)$ by its equivalent from equation (15) (the product EI is known as the flexural rigidity and can be taken as unity for any plane curve without loss of generality) in equation (20) gives

$$y''(x) = M_{k+1} \frac{\left(x - x_k\right)}{\Delta x_k} + M_k \frac{\left(x_{k+1} - x\right)}{\Delta x_k} \qquad (21)$$

where $\Delta x_k = x_{k+1} - x_k$. Integrating twice gives

$$y'(x) = M_{k+1} \frac{\left(x - x_k\right)^2}{2\Delta x_k} - M_k \frac{\left(x_{k+1} - x\right)^2}{2\Delta x_k} + C_1 \qquad (22)$$

$$y(x) = M_{k+1} \frac{\left(x - x_k\right)^3}{6\Delta x_k} + M_k \frac{\left(x_{k+1} - x\right)^3}{6\Delta x_k} + C_1 x + C_2 \qquad (23)$$

where C_1 and C_2 are constants of integration. At $x = x_k$, $y(x_k) = y_k$; at $x = x_{k+1}$, $y(x_{k+1}) = y_{k+1}$. Substituting y_k and y_{k+1} in equation (23) gives

$$y_k = M_k \frac{\Delta x_k^{\,2}}{6} + C_1 x_k + C_2 \qquad (24)$$

and

$$y_{k+1} = M_{k+1} \frac{\Delta x_k^{\,2}}{6} + C_1 x_{k+1} + C_2 \qquad (25)$$

Subtracting equation (24) from equation (25) gives

$$y_{k+1} - y_k = \left(M_{k+1} - M_k\right)\frac{\Delta x_k^{\,2}}{6} + C_1\Delta x_k \tag{26}$$

Solving for C_1 from equation (26) gives

$$C_1 = \frac{y_{k+1} - y_k}{\Delta x_k} - \frac{\left(M_{k+1} - M_k\right)\Delta x_k}{6}$$

$$= \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right) \tag{27}$$

Substituting for C_1 from equation (27) in equation (25) and solving for C_2 gives

$$C_2 = x_{k+1}\left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right) - x_k\left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) \tag{28}$$

Substituting the expressions for C_1 and C_2 from equations (27) and (28) in equations (22) and (23) gives the expression for the cubic spline function in the kth interval as

$$y(x) = M_{k+1}\frac{\left(x - x_k\right)^3}{6\Delta x_k} + M_k\frac{\left(x_{k+1} - x\right)^3}{6\Delta x_k}$$

$$+\left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right)\left(x - x_k\right) + \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right)\left(x_{k+1} - x\right) \tag{29}$$

and its first derivative is given by

$$y'(x) = M_{k+1} \frac{(x - x_k)^2}{2\Delta x_k} - M_k \frac{(x_{k+1} - x)^2}{2\Delta x_k} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k \Delta x_k}{6}\right) \qquad (30)$$

Equations (21), (29), and (30) provide expressions for the values of the cubic spline function and its first and second derivatives in the kth interval. These expressions can be written for the cubic spline function and its first and second derivatives in the $(k - 1)$th interval by replacing k with $k - 1$. Therefore, in the $(k - 1)$th interval,

$$y(x) = M_k \frac{(x - x_{k-1})^3}{6\Delta x_{k-1}} + M_{k-1} \frac{(x_k - x)^3}{6\Delta x_{k-1}} + \left(\frac{y_k}{\Delta x_{k-1}} - \frac{M_k \Delta x_{k-1}}{6}\right)(x - x_{k-1}) + \left(\frac{y_{k-1}}{\Delta x_{k-1}} - \frac{M_{k-1}\Delta x_{k-2}}{6}\right)(x_k - x) \qquad (31)$$

$$y'(x) = M_k \frac{(x - x_{k-1})^2}{2\Delta x_{k-1}} - M_{k-1} \frac{(x_k - x)^2}{2\Delta x_{k-1}} + \left(\frac{y_k}{\Delta x_{k-1}} - \frac{M_k \Delta x_{k-1}}{6}\right) - \left(\frac{y_{k-1}}{\Delta x_{k-1}} - \frac{M_{k-1}\Delta x_{k-1}}{6}\right) \qquad (32)$$

$$y''(x) = M_k \frac{(x - x_{k-1})}{\Delta x_{k-1}} + M_{k-1} \frac{(x_k - x)}{\Delta x_{k-1}} \qquad (33)$$

A cursory inspection of equations (29) and (31) and equations (21) and (33) will show that neither the cubic spline function nor its second derivative will experience discontinuity in going from the (k - 1)th to the kth interval. This may be shown simply be replacing x with x_k in these expressions. To ensure that the cubic spline functions will experience no discontinuity in the first derivative in going from the (k - 1)th to the kth interval, replace x with x_k in equations (30) and (32) and equate the results. Thus,

$$M_k \frac{\Delta x_{k-1}}{2} + \left(\frac{y_k}{\Delta x_{k-1}} - \frac{M_k \Delta x_{k-1}}{6}\right) - \left(\frac{y_{k-1}}{\Delta x_{k-1}} - \frac{M_{k-1}\Delta x_{k-1}}{6}\right)$$

$$= -M_k \frac{\Delta x_k}{2} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k \Delta x_k}{6}\right) \tag{34}$$

or

$$\frac{\Delta x_{k-1}}{6} M_{k-1} + \frac{\Delta x_{k-1} + \Delta x_k}{3} M_k + \frac{\Delta x_k}{6} M_{k+1} = \frac{\Delta y_k}{\Delta x_k} - \frac{\Delta y_{k-1}}{\Delta x_{k-1}} \tag{35}$$

where $\Delta y_k = y_{k+1} - y_k$ and $\Delta y_{k-1} = y_k - y_{k-1}$. Equation (35) permits the writing of k equations for the solution of $k + 2$ unknown values of M. Clearly, two second derivative values must be supplied at any two of the tabulated data points. However, if the second derivatives are not known, first derivative values may be used through equation (30). Further, if both the first and second derivatives of the function are known at any one of the tabulated points, the set of simultaneous equations given by equation (35) can still be solved.

Solving for M_{k+1} in equation (35) gives

$$M_{k+1} = -\frac{2\left(\Delta x_k + \Delta x_{k-1}\right)M_k}{\Delta x_k} - \frac{\Delta x_{k-1}}{\Delta x_k} M_{k-1} + \frac{6}{\Delta x_k}\left(\frac{\Delta y_k}{\Delta x_k} - \frac{\Delta y_{k-1}}{\Delta x_{k-1}}\right)$$

$$= a_k M_k + b_k M_{k-1} + c_k \tag{36}$$

where

$$a_k = -\frac{2\left(\Delta x_k + \Delta x_{k-1}\right)}{\Delta x_k} \tag{37}$$

$$b_k \quad -\frac{\Delta x_{k-1}}{\Delta x_k} \tag{38}$$

$$c_k = \frac{6}{\Delta x_k}\left(\frac{\Delta y_k}{\Delta x_k} - \frac{\Delta y_{k-1}}{\Delta x_{k-1}}\right) \tag{39}$$

Assume a solution of the form

$$M_{k+1} = \frac{1}{Q_k}\left(M_k - U_k\right) \tag{40}$$

so that in the (k - 1)th interval

$$M_{k-1} = Q_{k-1}M_k + U_{k-1} \tag{41}$$

Substituting equation (41) in equation (36) gives

$$\begin{aligned} M_{k+1} &= a_k M_k + b_k\left(Q_{k-1}M_k + U_{k-1}\right) + c_k \\ &= \left(a_k + b_k Q_{k-1}\right)M_k + b_k U_{k-1} + c_k \end{aligned} \tag{42}$$

Comparing equations (40) and (42) gives

$$\frac{1}{Q_k} = a_k + b_k Q_{k-1} \tag{43}$$

or

$$Q_k = \frac{1}{a_k + b_k Q_{k-1}} \tag{44}$$

and

$$-\frac{U_k}{Q_k} = b_k U_{k-1} + c_k \tag{45}$$

or

$$U_k = -Q_k\left(b_k U_{k-1} + c_k\right) \tag{46}$$

Substituting equations (37), (38), and (39) in equations (44) and (46) gives

$$Q_k = -\frac{\Delta x_k}{2\left(\Delta x_k + \Delta x_{k-1}\right) + \Delta x_{k-1} Q_{k-1}} = -\frac{\Delta x_k}{2\left(x_{k+1} - x_{k-1}\right) + \Delta x_{k-1} Q_{k-1}} \tag{47}$$

$$\begin{aligned} U_k &= -Q_k\left[-\frac{\Delta x_{k-1}}{\Delta x_k} U_{k-1} + \frac{6}{\Delta x_k}\left(\frac{\Delta y_k}{\Delta x_k} - \frac{\Delta y_{k-1}}{\Delta x_{k-1}}\right)\right] \\ &= \frac{Q_k}{\Delta x_k}\left[\Delta x_{k-1} U_{k-1} + 6\left(\frac{\Delta y_{k-1}}{\Delta x_{k-1}} - \frac{\Delta y_k}{\Delta x_k}\right)\right] \end{aligned} \tag{48}$$

Equations (40), (41), (47), and (48) are the recursive relations that will be used for the solution of the set of simultaneous linear equations given by equation (35). Before this is done, equations (29) and (30) will be put in a more convenient form by using the following difference operators.

$$d_k = x - x_k \tag{49}$$

$$d_{k+1} = x - x_{k+1} \tag{50}$$

Adding and subtracting x_k to the right-hand side of equation (50) gives

$$d_{k+1} = x - x_{k+1} + x_k - x_k = d_k - \Delta x_k \tag{51}$$

Substituting equations (49) and (50) in equations (29) and (30) gives

$$y(x) = M_{k+1}\frac{d_k^3}{6\Delta x_k} - M_k\frac{d_{k+1}^3}{6\Delta x_k} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right)d_k - \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right)d_{k+1} \tag{52}$$

$$y'(x) = M_{k+1}\frac{d_k^2}{2\Delta x_k} - M_k\frac{d_{k+1}^2}{2\Delta x_k} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right)$$

$$= M_{k+1}\frac{d_k^2}{2\Delta x_k} - M_k\frac{d_{k+1}^2}{2\Delta x_k} + \frac{\Delta y_k}{\Delta x_k} - \frac{\Delta M_k\Delta x_k}{6} \tag{53}$$

where $\Delta M_k = M_{k+1} - M_k$.

From equations (49), (50), and (51), when $x = x_k$, then $d_k = 0$ and $d_{k+1} = -\Delta x_k$; when $x = x_{k+1}$, then $d_k = \Delta x_k$ and $d_{k+1} = 0$. Substituting these results in equation (53) gives, for $x = x_k$,

$$y'(x_k) = -M_k\frac{\Delta x_k}{2} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right)$$

$$= \frac{\Delta y_k}{\Delta x_k} - \frac{\Delta x_k}{6}\left(M_{k+1} + 2M_k\right) \tag{54}$$

and, for $x = x_{k+1}$,

$$y'(x_{k+1}) = M_{k+1}\frac{\Delta x_k}{2} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right) - \left(\frac{y_k}{\Delta x_k} - \frac{M_k\Delta x_k}{6}\right)$$

$$= \frac{\Delta y_k}{\Delta x_k} + \frac{\Delta x_k}{6}\left(M_k + 2M_{k+1}\right) \tag{55}$$

The use of these recursive relations is described in the following six cases.

Case 1: Solution of the set of simultaneous equations given by equation (35) when the second derivatives of the function are known at the initial and terminal tabulated boundaries. In this case, $y''(x_1) = M_1$ and $y''(x_n) = M_n$. From equation (41) with $k = 2$, if $Q_1 = 0$, then $M_1 = U_1$. By using these values for Q_1 and U_1, equations (47) and (48) can be used to generate values of Q_k and U_k, recursively, for all values of k ranging from 2 to $n - 1$. After these values are available, then all values of M_k can be computed by using equation (40) written in the form of equation (41)

$$M_k = Q_k M_{k+1} + U_k \tag{56}$$

and propagating the solution backwards with k ranging from $n - 1$ to 2. As M_n and M_1 are known, all n second-derivative values will be available.

Case 2: Solution of the set of simultaneous equations given by equation (35) when the first derivatives of the function are known at the initial and terminal tabulated boundaries. In this case, $y'(x_1) = D_1$ and $y'(x_n) = D_n$. Substitute $k = 1$ in equation (54) for M_{k+1} from equation (40) and solve for U_1 to get

$$\left.\begin{aligned} y'(x_1) = D_1 &= \frac{\Delta y_1}{\Delta x_1} - \frac{\Delta x_1}{6}\left(\frac{M_1 - U_1}{Q_1} + 2M_1\right) \\ U_1 &= Q_1\left[M_1\left(2 + \frac{1}{Q_1}\right) + \frac{6}{\Delta x_1}\left(D_1 - \frac{\Delta y_1}{\Delta x_1}\right)\right] \end{aligned}\right\} \tag{57}$$

If $Q_1 = -1/2$, then from equation (57),

$$U_1 = \frac{3}{\Delta x_1}\left(\frac{\Delta y_1}{\Delta x_1} - D_1\right) \tag{58}$$

By using $Q_1 = -1/2$ and the value obtained for U_1 from equation (58), compute all values of Q_k and U_k from equations (47) and (48) for values of k ranging from 2 to $n - 1$. With the value of Q_{n-1} and U_{n-1} thus computed, substitute equation (41) in equation (55) for M_{n-1} such that at $x = x_n$,

$$y'(x_n) = D_n = \frac{\Delta y_{n-1}}{\Delta x_{n-1}} + \frac{\Delta x_{n-1}}{6}\left(Q_{n-1}M_{n-1} + U_{n-1} + 2M_n\right) \tag{59}$$

Solving for M_n from equation (59) gives

$$M_n = \frac{\frac{6}{\Delta x_{n-1}}\left(D_n - \frac{\Delta y_{n-1}}{\Delta x_{n-1}}\right) - U_{n-1}}{2 + Q_{n-1}} \tag{60}$$

With the value of M_n known, the solution can be propagated backward by using equation (41) with k ranging from n - 1 to 1. Thus, M_1 will be computed as the last value.

Case 3: Solution of the set of simultaneous equations given by equation (35) when the first and second derivatives of the function are known, respectively, at the initial and terminal tabulated boundaries. In this case, $y'(x_1) = D_1$ and $y''(x_n) = M_n$. Proceed as in case 2 excluding the computation for M_n, which is not needed.

Case 4: Solution of the set of simultaneous equations given by equation (35) when the first and second derivatives of the function are known, respectively, at the terminal and initial tabulated boundaries. In this case, $y'(x_n) = D_n$ and $y''(x_1) = M_1$. Proceed as in case 1 and compute the value of M_n as in case 2.

Case 5: Solution of the set of simultaneous equations given by equation (35) when the first and second derivatives of the function are known at the initial tabulated boundary. In this case, $y'(x_1) = D_1$ and $y''(x_1) = M_1$. From equation (56), if $Q_1 = 1$, then

$$U_1 = 3M_1 + \frac{6}{\Delta x_1}\left(D_1 - \frac{\Delta y_1}{\Delta x_1}\right) \tag{61}$$

With the value of $Q_1 = 1$ and the value of U_1 given by equation (61), compute all values of Q_k and U_k from equations (47) and (48) for $k = 2$ to $n - 1$. With these values of Q_k and U_k known, compute values for the second derivative from equation (40) by propagating the solution forward for k ranging from 1 to $n - 1$. The last value thus computed is M_n.

Case 6: Solution of the set of simultaneous equations given by equation (35) when the first and second derivatives of the function are known at the terminal tabulated boundary. In this case, $y'(x_n) = D_n$ and $y''(x_n) = M_n$. In equation (55), substitute M_k in equation (41) with $k = n - 1$ and solve for U_{n-1} to get

$$\left.\begin{aligned} y'(x_n) = D_n &= \frac{\Delta y_{n-1}}{\Delta x_{n-1}} + \frac{\Delta x_{n-1}}{6}\left(Q_{n-1}M_n + U_{n-1} + 2M_n\right) \\ U_{n-1} &= \frac{6}{\Delta x_{n-1}}\left(D_n - \frac{\Delta y_{n-1}}{\Delta x_{n-1}}\right) - M_n\left(2 + Q_{n-1}\right) \end{aligned}\right\} \tag{62}$$

If $Q_{n-1} = 1$, then from equation (62),

$$U_{n-1} = \frac{6}{\Delta x_{n-1}}\left(D_n - \frac{\Delta y_{n-1}}{\Delta x_{n-1}}\right) - 3M_n \tag{63}$$

Solving for Q_{k-1} and U_{k-1} from equations (47) and (48) gives

$$Q_{k-1} = -\frac{1}{\Delta x_{k-1}}\left[\frac{\Delta x_k}{Q_k} + 2\left(\Delta x_k + \Delta x_{k-1}\right)\right] = -\frac{1}{\Delta x_{k-1}}\left[\frac{\Delta x_k}{Q_k} + 2\left(x_{k+1} - x_{k-1}\right)\right] \tag{64}$$

$$U_{k-1} = \frac{1}{\Delta x_{k-1}}\left[U_k\frac{\Delta x_k}{Q_k} - 6\left(\frac{\Delta y_{k-1}}{\Delta x_{k-1}} - \frac{\Delta y_k}{\Delta x_k}\right)\right] \tag{65}$$

With $Q_{n-1} = 1$ and U_{n-1} given by equation (63), compute all values of Q_{k-1} and U_{k-1} from equations (64) and (65) for values of k ranging from $n - 1$ to 2. With the values of Q_k and U_k known, compute values for the second derivatives from equation (40) by propagating the solution backwards for k ranging from $n - 1$ to 1. The last value thus computed will be M_1.

Clearly, the solutions for case 5 and case 6 could have been obtained from equations (54) and (55). In the solution for case 5, M_{k+1} can be obtained from equation (54) and $y'(x_{k+1})$ from equation (55). The solution can be propagated forward recursively with k ranging from 1 to n - 1. In the solution for case 6, M_k can be obtained from equation (55) and $y'(x_k)$ from equation (54). The solution can be propagated backward recursively with k ranging from n - 1 to 1.

If equation (52) is written with d_{k+1} replaced by its equivalent $d_{k+1} = d_k - \Delta x_k$ given by equation (51), the result is

$$y(x) = M_{k+1}\frac{d_k^3}{6\Delta x_k} - M_k\frac{\left(d_k - \Delta x_k\right)^3}{6\Delta x_k} + \left(\frac{y_{k+1}}{\Delta x_k} - \frac{M_{k+1}\Delta x_k}{6}\right)d_k$$
$$- \left(\frac{y_k}{\Delta x_k} - \frac{M_k \Delta x_k}{6}\right)\left(d_k - \Delta x_k\right) = y_k + \left[\frac{\Delta y_k}{\Delta x_k} - \frac{\Delta x_k}{6}\left(M_{k+1} + 2M_k\right)\right]d_k$$
$$+ \frac{M_k}{2}d_k^2 + \frac{\Delta M_k}{6\Delta x_k}d_k^3 \tag{66}$$

Equation (66) is the equation for the cubic spline function coefficients in the kth interval. If there are n data points in the tabulation, there will be n - 1 intervals and n - 1 cubic spline functions to cover the range of tabulated data.

For computation purposes, equation (67) is usually written as

$$y(x) = y_k + \left\{\left[c_3(k)d_k + c_2(k)\right]d_k + c_1(k)\right\}d_k \tag{67}$$

where

$$c_1(k) = \frac{\Delta y_k}{\Delta x_k} - \frac{\Delta x_k}{6}\left(M_{k+1} + 2M_k\right) \tag{68}$$

$$c_2(k) = \frac{M_k}{2} \tag{69}$$

$$c_3(k) = \frac{\Delta M_k}{6\Delta x_k} \tag{70}$$

Equations (67) through (70) show that the coefficients are functions of the interval; however, the coefficients need to be computed only once. After the computation is made, the set pertaining to the interval in which the value of the independent variable lies can be brought in to compute the value of the dependent variable needed. Because there are three coefficients for each interval, if there are n data points, there will be $n - 1$ intervals and $3(n - 1)$ coefficients.

CONCLUDING REMARKS AND RECOMMENDATIONS

The atmosphere package for the 1962 and 1966 standard atmosphere models is recommended without reservation. When these models were built, it was possible to conduct comparison checks with the layered versions of these models in 250-meter increments. In both packages, these tests revealed errors that were properly corrected. The package for the 1963 Patrick Air Force Base reference standard model was not subjected to such strenuous tests because the layered version of this model was not available. However, with the other models so thoroughly tested, the choice of altitudes was established as adequate, and the only requirement for the Patrick Air Force Base reference standard model was to ensure that the data were tabulated correctly. The laborious task of comparing (digit for digit) each tabulated number in the model printouts with the numbers in the reference source was performed as carefully as possible, and all errors found were corrected. As a result, the accuracy of this model is reasonably ensured.

To test the accuracy of these models after they have been recoded for use in the Software Development Laboratory, the only requirement is to have the package reproduce the tabulated data. Because the interpolation is to be performed in a different set of units, the output must be converted to the units of the tabulated data for ease of comparison. The results should agree within an error of no greater than 10^{-8}. Additional verification can be obtained by evaluating the parameters of the models at various altitudes and comparing the results with those obtained from established operational sources, such as the space vehicle dynamic simulator and the Shuttle optimal abort programs. These tests should be performed for all models.

It is recommended that where the first and second derivatives are known at the same data point the cubic spline functions be used to interpolate data only in a small neighborhood of this point and not be extended for interpolation over the entire range of tabulated data.

Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas, June 4, 1976
986-16-00-00-72

REFERENCES

1. United States Committee on Extension to the Standard Atmosphere: U. S. Standard Atmosphere, 1962. U. S. Government Printing Office, 1962.

2. United States Committee on Extension to the Standard Atmosphere: U. S. Standard Atmosphere Supplements, 1966. U. S. Government Printing Office, 1966.

3. Smith, O. E.; and Weidner, Don K.: A Reference Atmosphere for Patrick Air Force Base, Florida, Annual (1963 Revision). NASA TM X-53139, 1964.

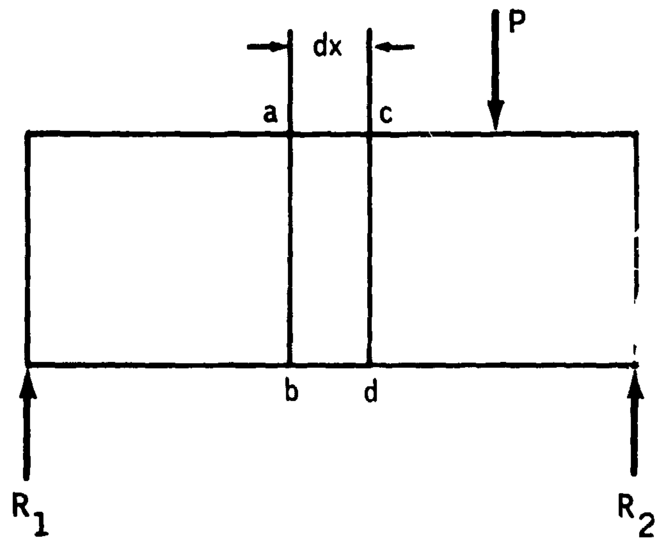


Figure 1.- Undeformed beam.

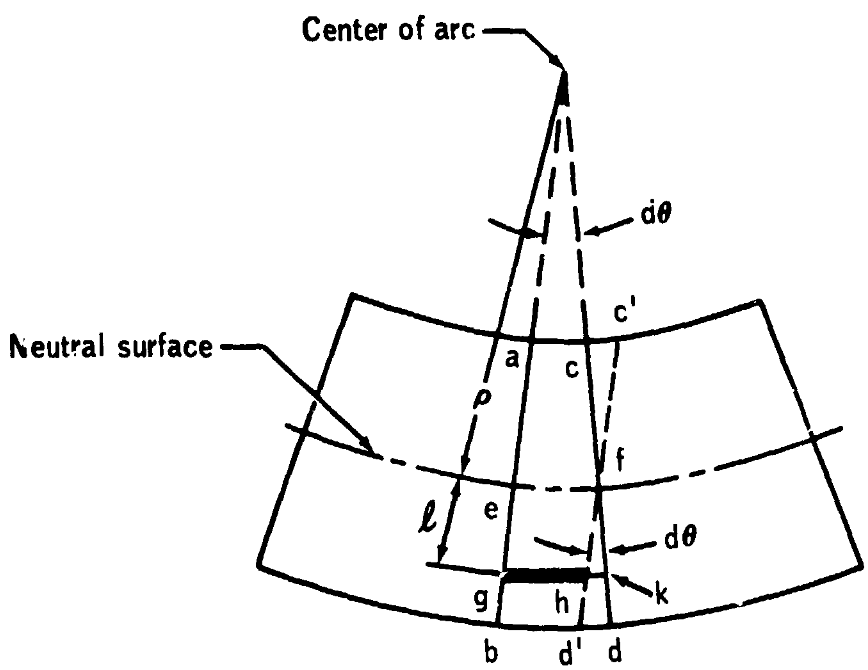


Figure 2.- Deformed section of a beam.

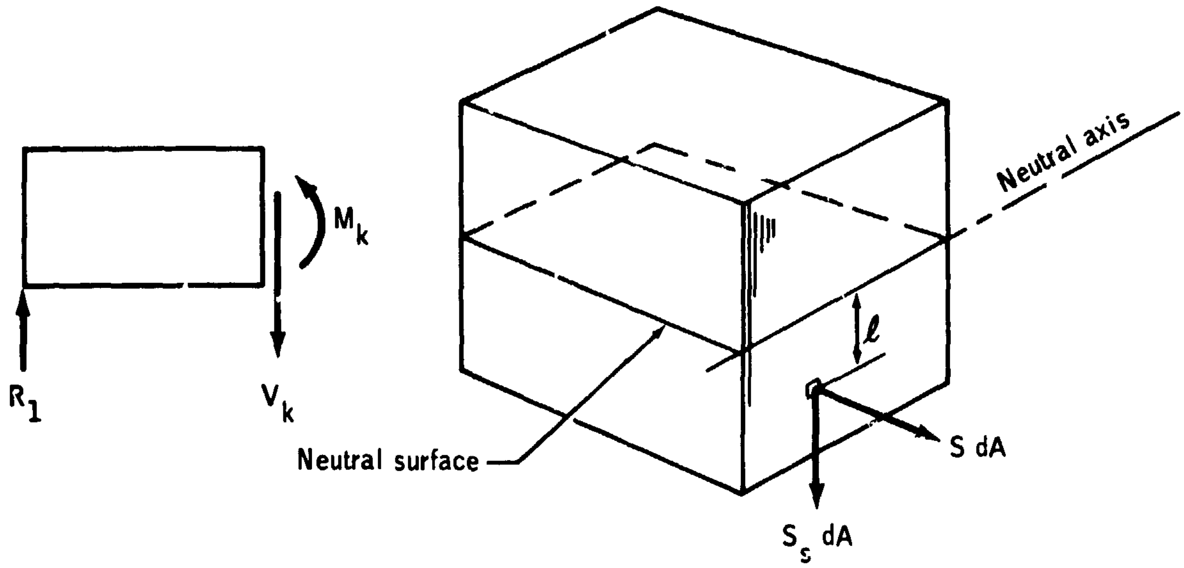


Figure 3.- Element of the cross section of a beam.

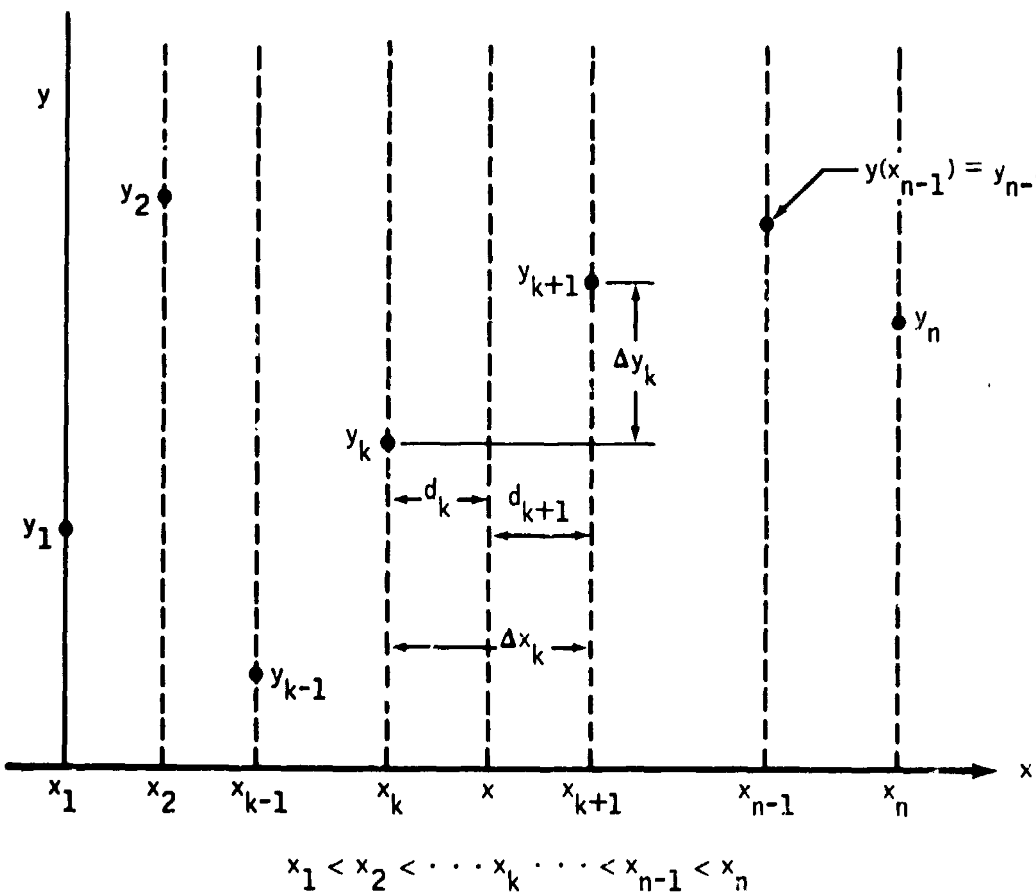


Figure 4.- Graph of a tabulated set of data for cubic spline interpolation.

APPENDIX

PROGRAM FLOW CHARTS AND LISTINGS

Definitions of the symbols used in the program flow charts and listings are as follows.

SYMBOLS USED IN SUBROUTINE SDAT(IOP)

IOP — an integer parameter used to designate the desired atmosphere based on the following set of values:

- IOP = 0 1962 standard atmosphere
- IOP = 1 1966 standard atmosphere for July at latitude 30° N
- IOP = 2 1966 standard atmosphere for January at latitude 30° N
- IOP = 3 1966 standard atmosphere for July at latitude 60° N
- IOP = 4 1966 standard atmosphere for January at latitude 60° N
- IOP = 5 1963 Patrick Air Force Base reference standard atmosphere

NP — an integer variable used to specify the number of data points used to describe each atmospheric parameter in each model (equal to 123)

NP64 — an integer variable used to specify the total number of data points used to describe all atmospheric parameters in each atmosphere model (equal to 6*NP or 6 X 123 = 738)

NP34 — an integer variable used to specify the total number of cubic spline coefficients for each atmospheric parameter (equal to 3*(NP - 1) or 3*(123 - 1) = 366)

PRSLST — a column vector array dimensioned by NP64 or 738 containing all pressure data values (in millibars) for all atmosphere models tabulated

RHOLST — a column vector array dimensioned by NP64 or 738 containing all density data values (in kilograms per cubic meter) for all atmosphere models tabulated

SONLST — a column vector array dimensioned by NP64 or 738 containing all speed of sound data values (in meters per second) for all atmosphere models tabulated

VISLST — a column vector array dimensioned by NP64 or 738 containing all coefficient of viscosity data values (in kilograms per meter per second) for all atmosphere models tabulated

ALTLST — a column vector array dimensioned by NP or 123 containing the altitude data values (in meters) for all atmosphere models tabulated

WORK — a column vector array dimensioned by NP or 123 used as a working array for subroutine SPLN1

D — a column vector array dimensioned by 2 containing the values of the first (or second) derivative of the function at either or both of the tabulated terminal boundaries (only first-derivative values are used for the atmosphere package)

ALTTAB — a column vector array dimensioned by NP or 123 containing altitude values in the working units of the program (feet)

PRSTAB — a column vector array dimensioned by NP or 123 containing pressure data values for the selected atmosphere model in the working units of the program (pounds-force per square foot)

RHOTAB — a column vector array dimensioned by NP or 123 containing density data values for the selected atmosphere model in the working units of the program (slugs per cubic foot)

SONTAB — a column vector array dimensioned by NP or 123 containing speed of sound data values for the selected atmosphere model in the working units of the program (feet per second)

VISTAB — a column vector array dimensioned by NP or 123 containing the coefficient of viscosity data values for the selected atmosphere model in the working units of the program (pounds-mass seconds per square foot)

CP — a column vector array dimensioned by NP34 or 366 containing the cubic spline function coefficients for the interpolation for pressure in pounds-force per square foot

CR — a column vector array dimensioned by NP34 or 366 containing the cubic spline function coefficients for the interpolation for density in slugs per cubic foot

CS — a column vector array dimensioned by NP34 or 366 containing the cubic spline function coefficients for the interpolation for the speed of sound in feet per second

CV a column vector array dimensioned by NP34 or 366 containing the cubic spline function coefficients for the interpolation for the coefficient of viscosity in pounds-mass seconds per square foot

J1 an integer variable used to designate the order of the derivative of the function supplied at the initial tabulated boundary (except when J1 = 4). It can have the following values:

J1 = 1 The first derivative of the function at the first tabulated point is supplied in D(1).

J1 = 2 The second derivative of the function at the first tabulated point is supplied in D(1).

J1 = 3 The first and second derivatives of the function at the first tabulated point are supplied in D(1) and D(2), respectively.

J1 = 4 The first and second derivatives of the function at the last tabulated point are supplied in D(1) and D(2), respectively.

JN an integer variable used to designate the order of the derivatives of the function supplied at the last tabulated boundary. It can have the following values:

JN = 1 The first derivative of the function at the last tabulated point is supplied in D(2).

JN = 2 The second derivative of the function at the last tabulated point is supplied in D(2).

xs, ys1, ys2, ys3, ys4 Variables used for temporary storage in the ordering process for altitude, pressure, density, speed of sound, and coefficient of viscosity, respectively

SYMBOLS USED IN SUBROUTINE SPLN1(N,X,Y,J1,JN,D,C,W)

N an integer variable used to specify the number of data points used to represent the function in the region of definition

X a column vector array dimensioned by at least N in the calling element containing the values of the independent variable in ascending order

Y a column vector array dimensioned by at least N in the calling element containing the values of the dependent variable in sequence with the values in the X array

J1 same as J1 defined in SDAT

JN same as JN defined in SDAT

D same as D defined in SDAT

C a column vector array dimensioned by at least 3*(N-1) in the calling element containing the cubic spline function coefficients for the first-, second-, and third-degree terms for each interval. A portion of the array is also used to compute and store the values of one of the recursive functions used in the computation of the second derivatives and in the computation of the second-derivative values.

W a column vector array dimensioned by at least N in the calling element used as a working array to compute and store the values of one of the recursive functions used in the computation of the second derivatives and in the computation of the cubic spline function coefficients

SYMBOLS USED IN SUBROUTINE ATMSPL(V,FANS)

V a real variable used to specify the altitude from the calling element containing the equations of motion at which values of the atmospheric parameters are desired

IS an integer variable used to save the interval number in which the specified altitude lies

FANS a column vector array dimensioned by 8 containing the following:

FANS(1) the interpolated value for pressure at V altitude in pounds-force per square foot

FANS(2) the interpolated value for density at V altitude in slugs per cubic foot

FANS(3) the interpolated value for speed of sound at V altitude in feet per second

FANS(4) the interpolated value for coefficient of viscosity at V altitude in pounds-mass seconds per square foot

FANS(5) the ratio of the pressure at V altitude and the pressure at 0 altitude

FANS(6) the ratio of the density at V altitude and the density at 0 altitude

FANS(7) the ratio of the speed of sound at V altitude and the speed of sound at 0 altitude

FANS (8) the ratio of the coefficient of viscosity at V altitude and the coefficient of viscosity at 0 altitude

All other variables are defined in subroutine SDAT.

```
SUBROUTINE SDAT(IOP)
PARAMETER  NP = 123,  NP64 = 6*NP,  NP34 = 3*NP - 3
DATA J1,JN /1,1/

C     IOP.......AN INTEGER VARIABLE RANGING FROM 0 TO 5 USED TO DESIGNATE
C               THE ATMOSPHERE MODEL TO BE USED
C                 IOP = 0 - 1962 STANDARD ATMOSPHERE
C                 IOP = 1 - 1966 STANDARD FOR JULY AT 30 DEG. N. LATITUDE
C                 IOP = 2 - 1966 STANDARD FOR JAN.  AT 30 DEG. N. LATITUDE
C                 IOP = 3 - 1966 STANDARD FOR JULY AT 60 DEG. N. LATITUDE
C                 IOP = 4 - 1966 STANDARD FOR JAN.  AT 60 DEG. N. LATITUDE
C                 IOP = 5 - 1963 PATRICK AFB REFERENCE STANDARD

C     SELECT DESIRED ATMOSPHERE INDEX ADJUSTOR

IOP1 = IOP*NP

C     TRANSFER PERTINENT ATMOSPHERE DATA FROM STORAGE ARRAY TO WORKING
C     ARRAY AND CONVERT TO DESIRED WORKING UNITS (BRITISH ENGINEERING)

DO 1 I = 1,NP   - - - ▷ 2

C     TRANSFER ALTITUDE VALUES LIST TO WORKING ARRAY

ALTTAB(I) = ALTLST(I)/0.3048

C     TRANSFER PRESSURE VALUES LIST TO WORKING ARRAY

PRSTAB(I) = PRSLST(IOP1 + I)*2.11622/1.01325

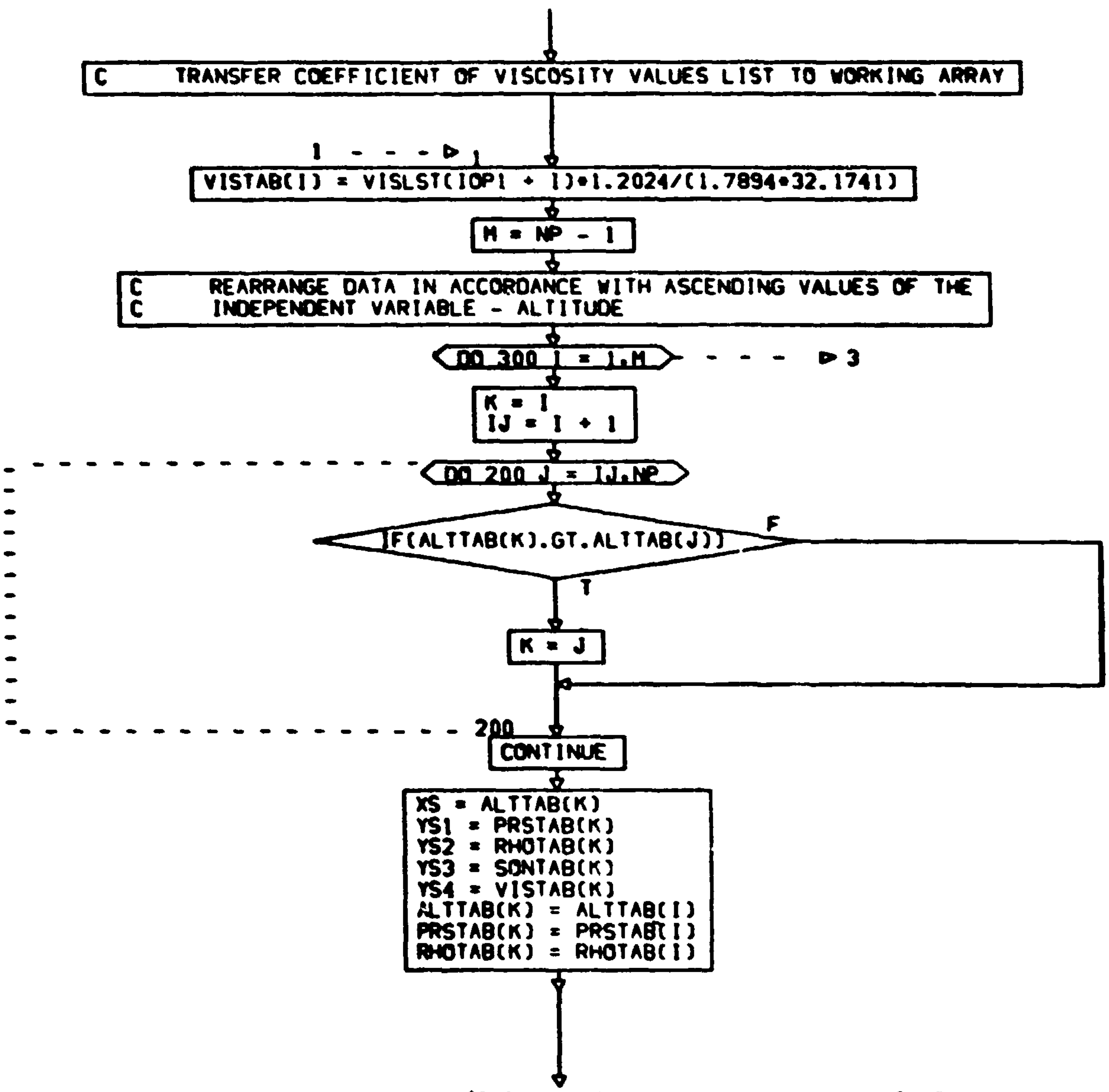
C     TRANSFER DENSITY VALUES LIST TO WORKING ARRAY

RHOTAB(I) = RHOLST(IOP1 + I)*7.6474E-2/(1.225*32.174049)

C     TRANSFER SPEED OF SOUND VALUES LIST TO WORKING ARRAY

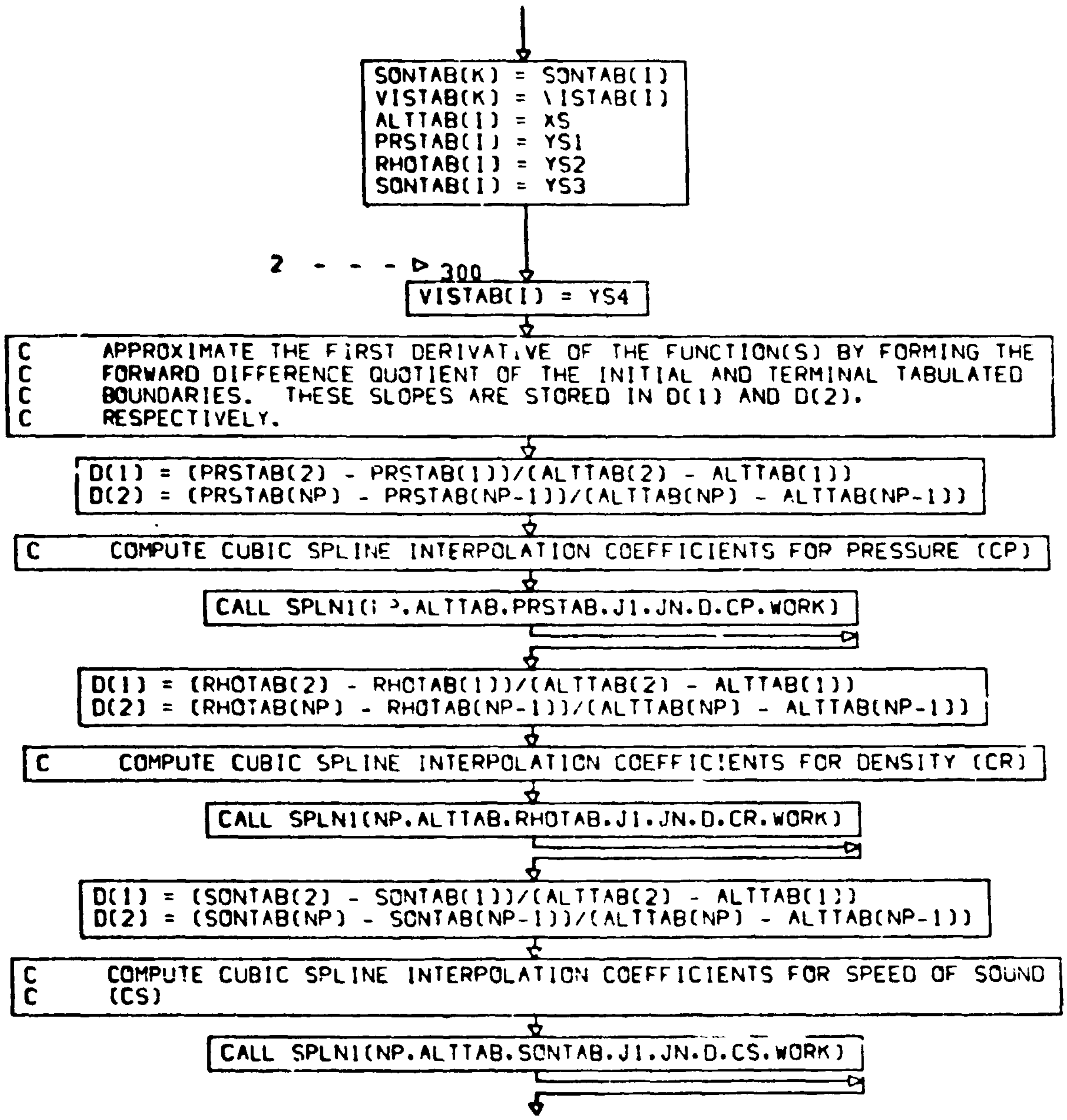
SONTAB(I) = SONLST(IOP1 + I)/0.3048
```

CONT. ON PG 2



C TRANSFER COEFFICIENT OF VISCOSITY VALUES LIST TO WORKING ARRAY
1
1
VISTAB(I) = VISLST(IOP1 + I)*1.2024/(1.7894*32.1741)
M = NP - 1
C REARRANGE DATA IN ACCORDANCE WITH ASCENDING VALUES OF THE
C INDEPENDENT VARIABLE - ALTITUDE
DO 300 I = 1,M
3
K = I
IJ = I + 1
DO 200 J = IJ,NP
IF(ALTTAB(K).GT.ALTTAB(J))
F
T
K = J
200
CONTINUE
XS = ALTTAB(K)
YS1 = PRSTAB(K)
YS2 = RHOTAB(K)
YS3 = SONTAB(K)
YS4 = VISTAB(K)
ALTTAB(K) = ALTTAB(I)
PRSTAB(K) = PRSTAB(I)
RHOTAB(K) = RHOTAB(I)

CONT. ON PG 3


SONTAB(K) = SONTAB(I)
VISTAB(K) = VISTAB(I)
ALTTAB(I) = XS
PRSTAB(I) = YS1
RHOTAB(I) = YS2
SONTAB(I) = YS3
2 - - - ▷ 300
VISTAB(I) = YS4
C APPROXIMATE THE FIRST DERIVATIVE OF THE FUNCTION(S) BY FORMING THE
C FORWARD DIFFERENCE QUOTIENT OF THE INITIAL AND TERMINAL TABULATED
C BOUNDARIES. THESE SLOPES ARE STORED IN D(1) AND D(2).
C RESPECTIVELY.
D(1) = (PRSTAB(2) - PRSTAB(1))/(ALTTAB(2) - ALTTAB(1))
D(2) = (PRSTAB(NP) - PRSTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
C COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR PRESSURE (CP)
CALL SPLN1(NP.ALTTAB.PRSTAB.J1.JN.D.CP.WORK)
D(1) = (RHOTAB(2) - RHOTAB(1))/(ALTTAB(2) - ALTTAB(1))
D(2) = (RHOTAB(NP) - RHOTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
C COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR DENSITY (CR)
CALL SPLN1(NP.ALTTAB.RHOTAB.J1.JN.D.CR.WORK)
D(1) = (SONTAB(2) - SONTAB(1))/(ALTTAB(2) - ALTTAB(1))
D(2) = (SONTAB(NP) - SONTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
C COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR SPEED OF SOUND
C (CS)
CALL SPLN1(NP.ALTTAB.SONTAB.J1.JN.D.CS.WORK)

CONT. ON PG 4

```
D(1) = (VISTAB(2) - VISTAB(1))/(ALTTAB(2) - ALTTAB(1))
D(2) = (VISTAB(NP) - VISTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))

C     COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR COEFFICIENT OF
C     VISCOSITY (CV)

CALL SPLN1(NP.ALTTAB.VISTAB.J1.JN.D.CV.WORK)

RETURN

END
```

SDAT
PG 4 FINAL

```
SUBROUTINE SPLN1(N.X.Y.J1.JN.D.C.W)
```

```
C      N  -  AN INTEGER DENOTING THE NUMBER OF DATA POINTS USED TO
C            REPRESENT THE FUNCTION IN THE REGION OF DEFINITION
C      X  -  A ONE-DEMENSIONAL ARRAY DIMENSIONED BY N CONTAINING THE
C            VALUES OF THE INDEPENDENT VARIABLE IN ASCENDING ORDER
C      Y  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY N CONTAINING THE
C            VALUES OF THE DEPENDENT VARIABLE CORRESPONDING IN
C            SEQUENCE TO THE VALUES IN THE X ARRAY
C      J1.JN - INTEGERS DEFINED AS FOLLOWS
```

```
C      J1 = 1 - FIRST DERIVATIVE OF THE FUNCTION AT THE FIRST TABULATED
C               DATA POINT IS SUPPLIED IN D(1)
C      J1 = 2 - SECOND DERIVATIVE OF THE FUNCTION AT THE FIRST TABULATED
C               DATA POINT IS SUPPLIED IN D(1)
C      J1 = 3 - FIRST AND SECOND DERIVATIVES OF THE FUNCTION AT THE FIRST
C               DATA POINT ARE SUPPLIED IN D(1) AND D(2). RESPECTIVELY
C      J1 = 4 - FIRST AND SECOND DERIVATIVES OF THE FUNCTION AT THE LAST
C               DATA POINT ARE SUPPLIED IN D(1) AND D(2). RESPECTIVELY
```

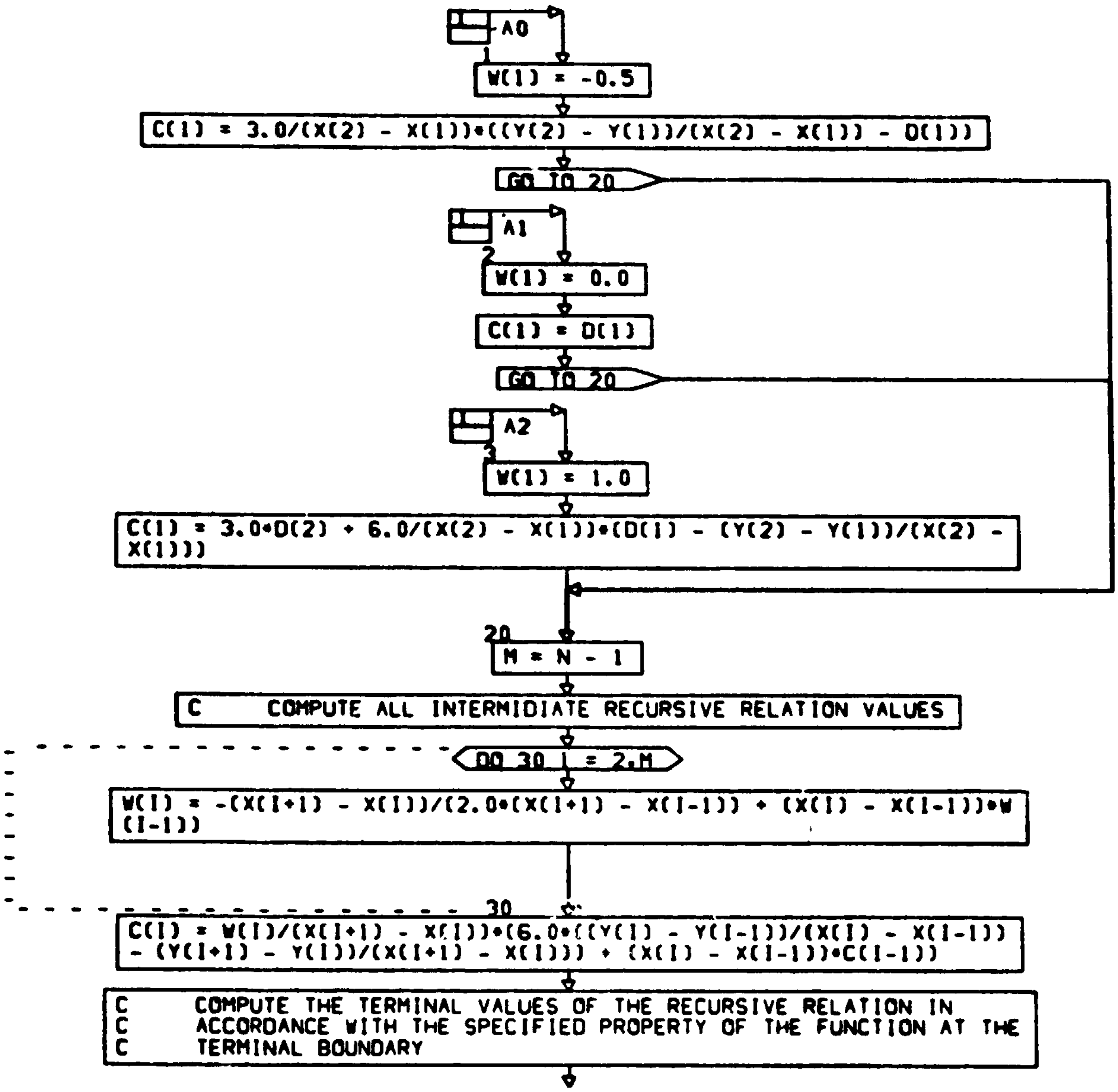
```
C      JN = 1 - FIRST DERIVATIVE OF THE FUNCTION AT THE LAST TABULATED
C               DATA POINT IS SUPPLIED IN D(2)
C      JN = 2 - SECOND DERIVATIVE OF THE FUNCTION AT THE LAST TABULATED
C               DATA POINT IS SUPPLIED IN D(2)
C      D  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY 2 CONTAINING THE
C            VALUES OF THE DERIVATIVES OF THE FUNCTION SPECIFIED IN
C            ACCORDANCE WITH J2 AND JN
C      C  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY 3*(N-1) CONTAINING
```

```
C            THE CUBIC SPLINE INTERPOLATING COEFFICIENTS FOR EACH
C            INTERVAL
C      W  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY N USED AS A WORKING
C            ARRAY ONLY
C      COMPUTE THE INITIAL VALUES OF THE RECURSIVE RELATIONS IN
C      ACCORDANCE WITH THE SPCIFIED PROPERTY OF THE FUNCTION AT THE
C      INITIAL BOUNDARY
```

```
GO TO (1.2.3.4).J1
```

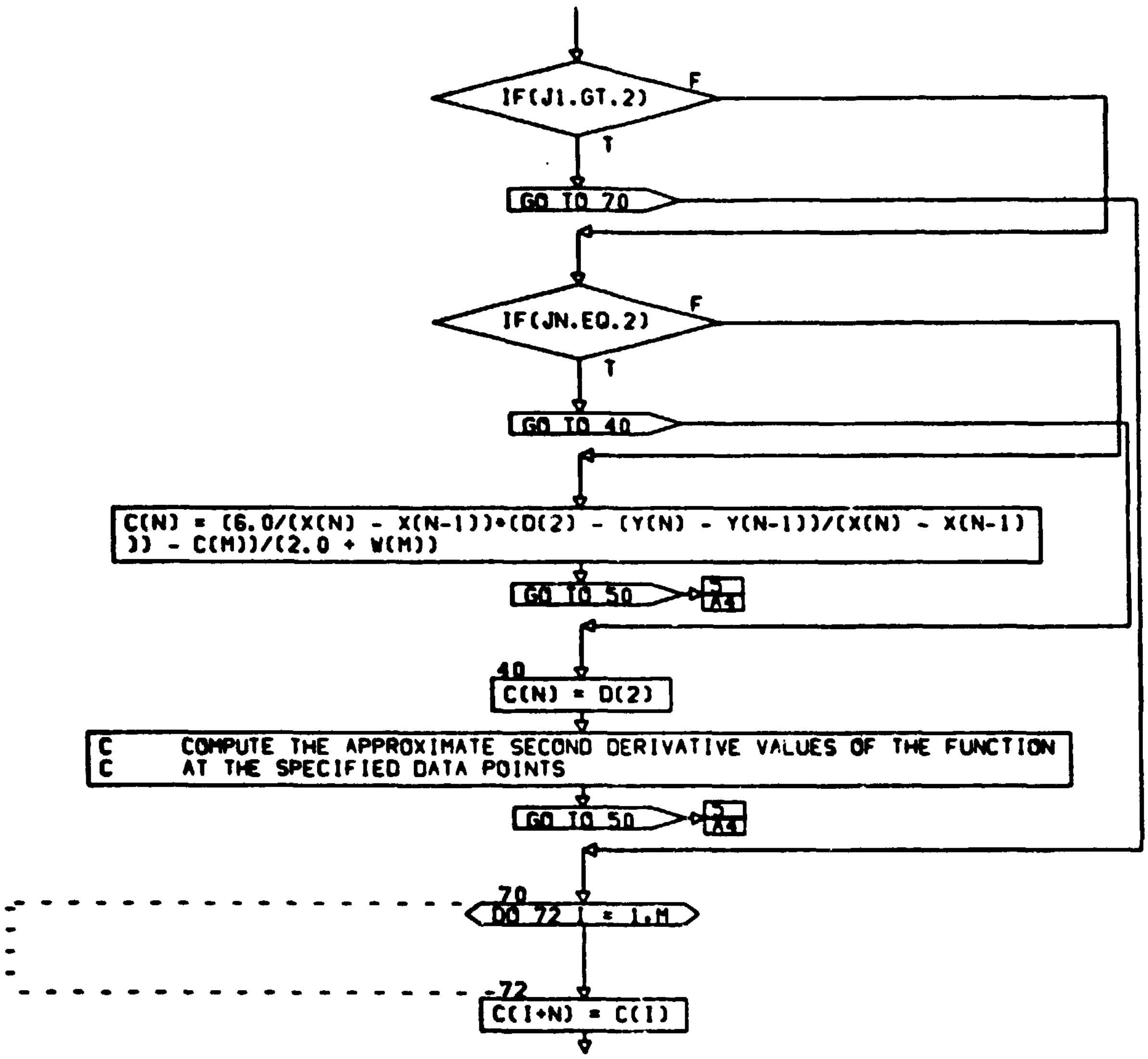
2 A0 | 2 A1 | 2 A2 | 2 A3

CONT. ON PG 2



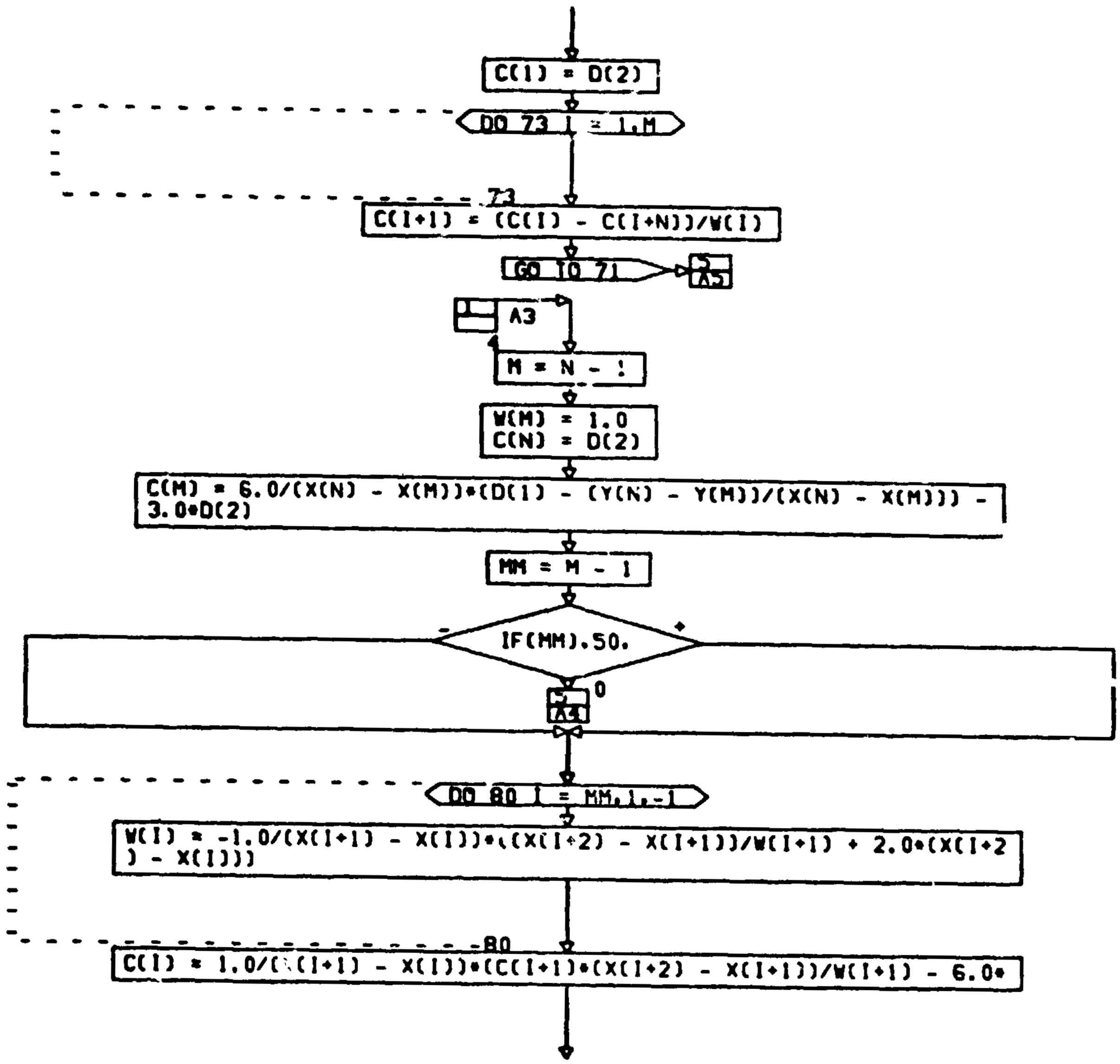
CONT. ON PG 3

SPLN1
PG 2 OF 5



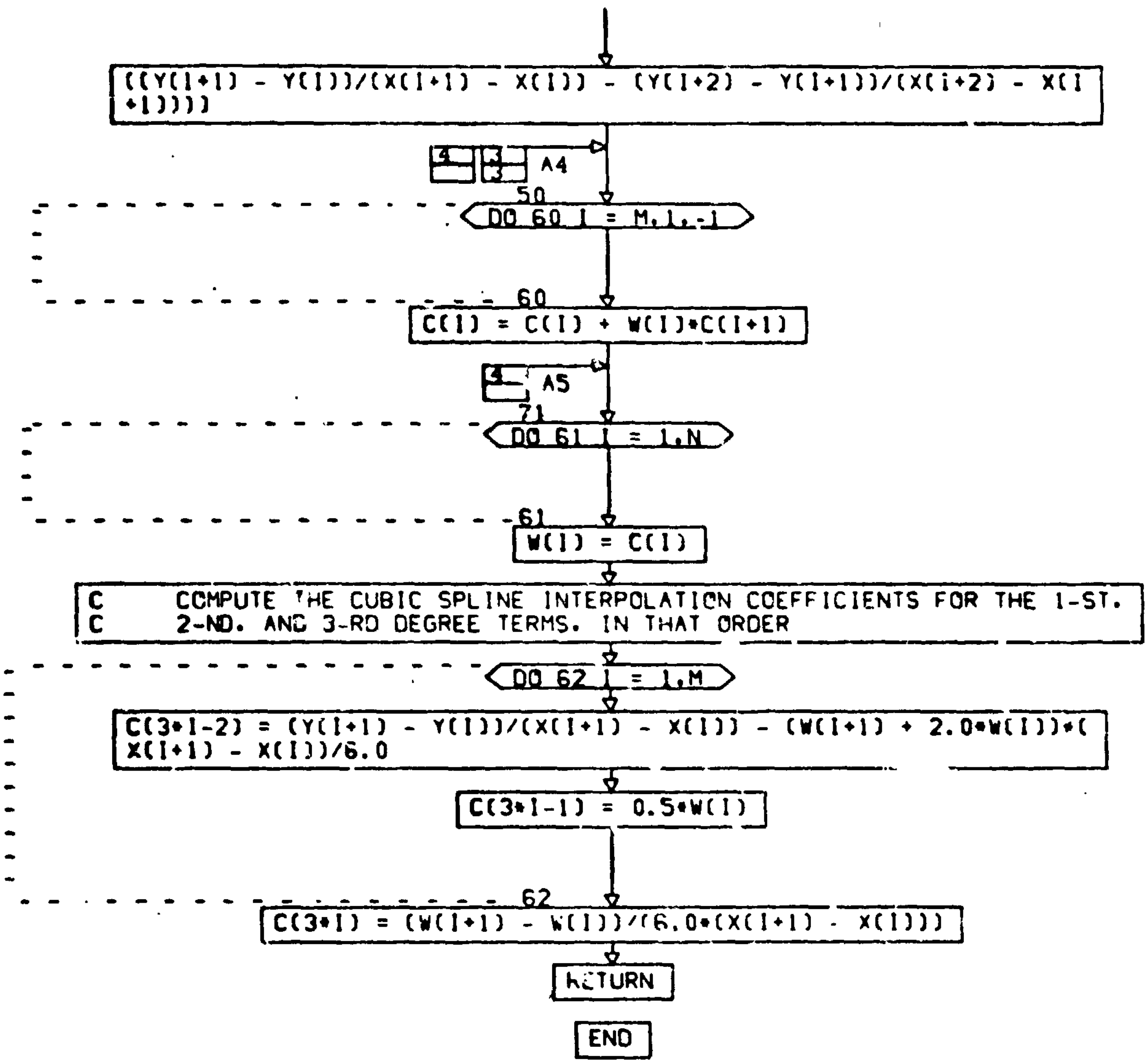
CONT. ON PG 4

SPLN1
PG 3 OF 5

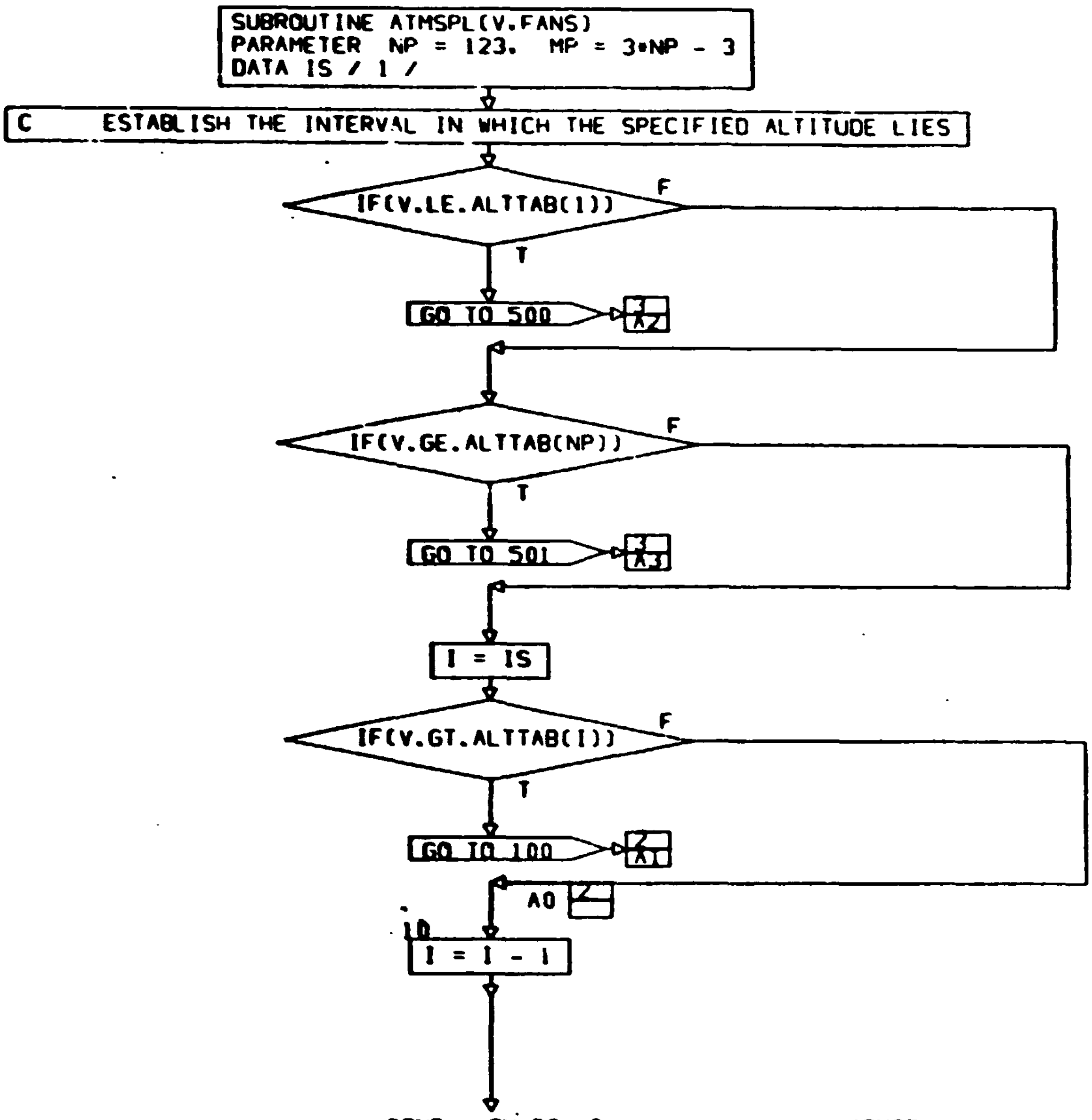


CONT. ON PG 5

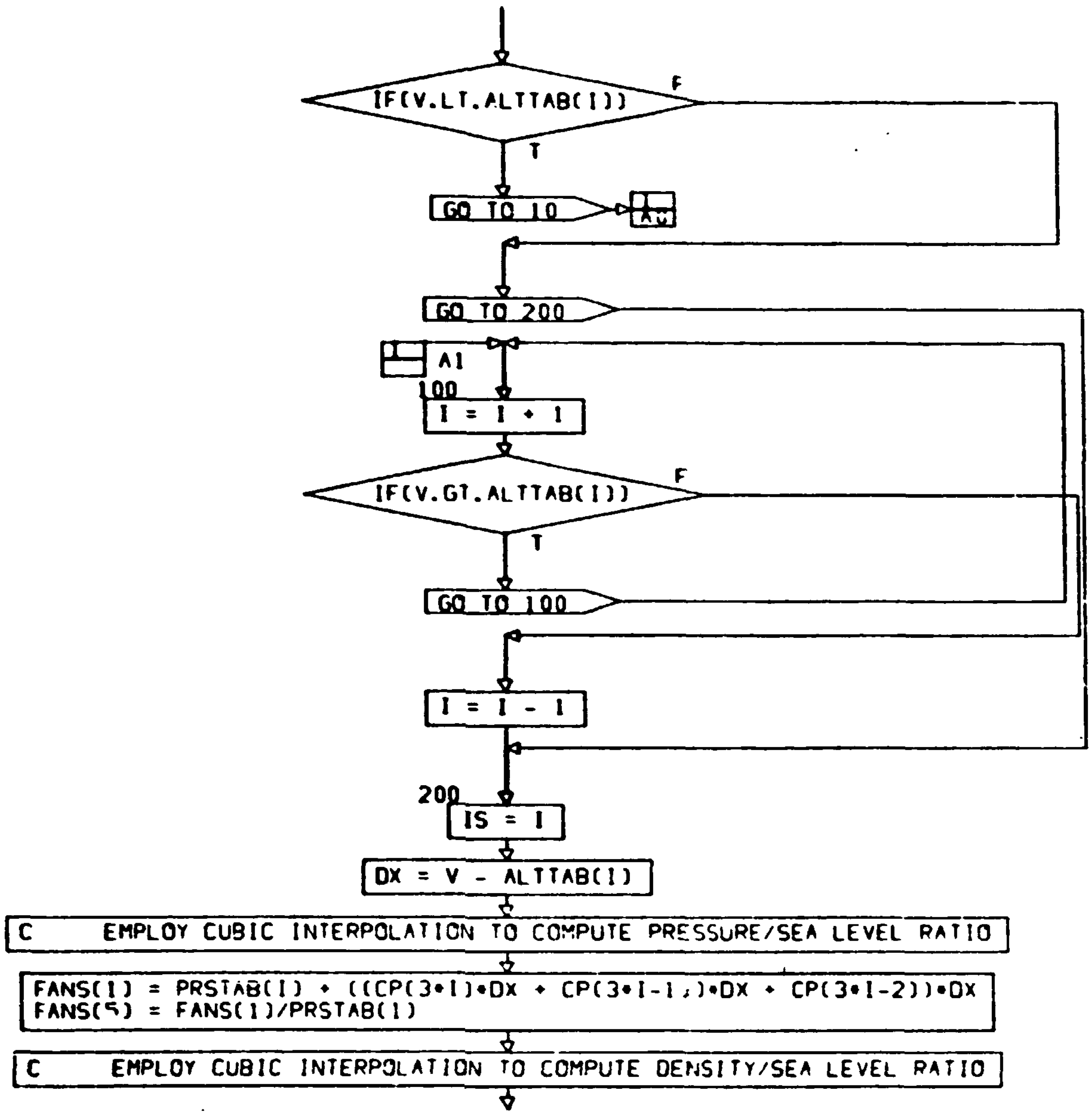
SPLN1
PG 4 OF 5



SPLN1
PG 5 FINAL


SUBROUTINE ATMSPL(V,FANS)
PARAMETER NP = 123, MP = 3*NP - 3
DATA IS / 1 /
C ESTABLISH THE INTERVAL IN WHICH THE SPECIFIED ALTITUDE LIES
IF(V.LE.ALTTAB(1))
F
T
GO TO 500
3
A2
IF(V.GE.ALTTAB(NP))
F
T
GO TO 501
3
A3
I = IS
IF(V.GT.ALTTAB(I))
F
T
GO TO 100
2
A1
A0
2
10
I = I - 1

CONT. ON PG 2


IF(V.LT.ALTTAB(I))
F
T
GO TO 10
A2
GO TO 200
A1
100
I = I + 1
IF(V.GT.ALTTAB(I))
F
T
GO TO 100
I = I - 1
200
IS = I
DX = V - ALTTAB(I)
C EMPLOY CUBIC INTERPOLATION TO COMPUTE PRESSURE/SEA LEVEL RATIO
FANS(1) = PRSTAB(I) + ((CP(3*I)*DX + CP(3*I-1))*DX + CP(3*I-2))*DX
FANS(5) = FANS(1)/PRSTAB(1)
C EMPLOY CUBIC INTERPOLATION TO COMPUTE DENSITY/SEA LEVEL RATIO

CONT. ON PG 3

```
FANS(2) = RHOTAB(I) + ((CR(3*I)*DX + CR(3*I-1))*DX + CR(3*I-2))*DX
FANS(6) = FANS(2)/RHOTAB(1)

C      EMPLOY CUBIC INTERPOLATION TO COMPUTE SPEED OF SOUND/SEA LEVEL
C      RATIO

FANS(3) = SONTAB(I) + ((CS(3*I)*DX + CS(3*I-1))*DX + CS(3*I-2))*DX
FANS(7) = FANS(3)/SONTAB(1)

C      EMPLOY CUBIC INTERPOLATION TO COMPUTE COEFFICIENT OF VISCOSITY/SEA
C      LEVEL RATIO

FANS(4) = VISTAB(I) + ((CV(3*I)*DX + CV(3*I-1))*DX + CV(3*I-2))*DX
FANS(8) = FANS(4)/VISTAB(1)

RETURN

C      INITIAL BOUNDARY VALUES - FUNCTIO/SEA LEVEL RATIO

A2
500
FANS(1) = PRSTAB(1)

FANS(2) = RHOTAB(1)
FANS(3) = SONTAB(1)
FANS(4) = VISTAB(1)
FANS(5) = 1.0
FANS(6) = 1.0
FANS(7) = 1.0
FANS(8) = 1.0

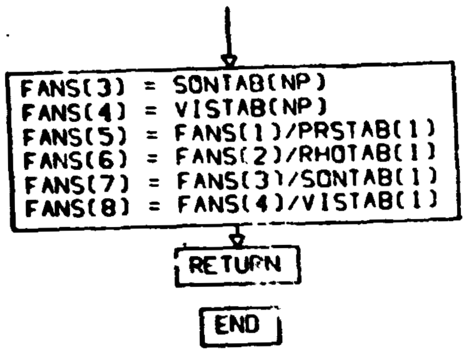
RETURN

C      TERMINAL BOUNDARY VALUES - FUNCTION/SEA LEVEL RATIO

A3
501
FANS(1) = PRSTAB(NP)

FANS(2) = RHOTAB(NP)
```

CONT. ON PG 4



ATMSPL
PG 4 FINAL

```
BLOCK DATA
PARAMETER NP = 123
PARAMETER NP11 = 1, NP12 = 114, NP13 = 115, NP14 = NP
PARAMETER NP21=NP11+NP, NP22=NP12+NP, NP23=NP13+NP, NP24=NP14+NP
PARAMETER NP31=NP21+NP, NP32=NP22+NP, NP33=NP23+NP, NP34=NP24+NP
PARAMETER NP41=NP31+NP, NP42=NP32+NP, NP43=NP33+NP, NP44=NP34+NP
PARAMETER NP51=NP41+NP, NP52=NP42+NP, NP53=NP43+NP, NP54=NP44+NP
PARAMETER NP61=NP51+NP, NP62=NP54+95, NP63=NP54+96, NP64=NP54+NP

C                     ALTITUDE TABULATION IN METERS

DATA (ALTLST(I),I=NP11,NP12)/

C        1           2           3           4           5           6
  0.0E0,      2.5E2,      5.0E2,      7.5E2,      1.0E3,      1.25E3,
C        7           8           9          10          11          12
  1.5E3,      1.75E3,     2.0E3,      2.25E3,     2.5E3,      2.75E3,
C       13          14          15          16          17          18
  3.0E3,      3.5E3,      4.0E3,      4.5E3,      5.0E3,      6.0E3,
C       19          20          21          22          23          24
  7.0E3,      8.0E3,      9.0E3,      1.0E4,      1.1E4,      1.2E4,
C       25          26          27          28          29          30
  1.3E4,      1.4E4,      1.5E4,      1.6E4,      1.7E4,      1.8E4,
C       31          32          33          34          35          36
  1.9E4,      2.0E4,      2.2E4,      2.4E4,      2.6E4,      2.8E4,
C       37          38          39          40          41          42
```

CONT. ON PG 2

	3.0E4.	3.2E4.	3.4E4.	3.6E4.	3.8E4.	4.0E4.
C	43	44	45	46	47	48
	4.2E4.	4.4E4.	4.6E4.	4.8E4.	5.0E4.	5.2E4.
C	49	50	51	52	53	54
	5.4E4.	5.6E4.	5.8E4.	6.0E4.	6.2E4.	6.4E4.
C	55	56	57	58	59	60
	6.6E4.	6.8E4.	7.0E4.	7.2E4.	7.4E4.	7.6E4.
C	61	62	63	64	65	66
	7.8E4.	8.0E4.	8.2E4.	8.4E4.	8.6E4.	8.8E4.
C	67	68	69	70	71	72
	9.0E4.	9.2E4.	9.4E4.	9.6E4.	9.[illegible]4.	1.0E5.
C	73	74	75	76	77	78
	1.02E5.	1.04E5.	1.06E5.	1.08E5.	1.1E5.	1.12E5.
C	79	80	81	82	83	84
	1.14E5.	1.16E5.	1.18E5.	1.20E5.	1.22E5.	1.24E5.
C	85	86	87	88	89	90
	1.26E5.	1.28E5.	1.3E5.	1.32E5.	1.34E5.	1.36E5.
C	91	92	93	94	95	96
	1.38E5.	1.4E5.	1.42E5.	1.44E5.	1.46E5.	1.48E5.

CONT. ON PG 3

```
C        97        98        99        100       101       102
1.5E5.   1.52E5.   1.54E5.   1.56E5.   1.58E5.   1.60E5.
C        103       104       105       106       107       108
1.64E5.  1.68E5.   1.72E5.   1.76E5.   1.80E5.   1.84E5.
C        109       110       111       112       113       114
1.88E5.  1.92E5.   1.96E5.   2.0E5.    2.04E5.   2.05E5/
DATA (ALTLST(I),I=NP13,NP14)/
C        115       116       117       118       119       120
8.5E3.   1.15E4.   2.3E4.    4.9E4.    5.1E4.    5.3E4.
C        121       122       123
8.1E4.   8.3E4.    8.9E4/
C                  1962 - STANDARD ATMOSPHERE
C             PRESSURE VALUES TABULATED IN MILLIBARS
DATA (PRSLST(I),I=NP11,NP12)/
C        1           2           3           4           5           6
1.01325E3. 9.83576E2. 9.54612E2. 9.26349E2. 8.98762E2. 8.71850E2.
C        7           8           9           10          11          12
8.45596E2. 8.19988E2. 7.95014E2. 7.70661E2. 7.46917E2. 7.23771E2.
C        13          14          15          16          17          18
7.01211E2. 6.57803E2. 6.16604E2. 5.77525E2. 5.40482E2. 4.72176E2.
```

CONT. ON PG 4

C 19 20 21 22 23 24

4.11052E2. 3.56516E2. 3.08007E2. 2.64999E2. 2.26999E2. 1.93994E2.

C 25 26 27 28 29 30

1.65796E2. 1.41704E2. 1.21118E2. 1.03528E2. 8.84971E1. 7.56522E1.

C 31 32 33 34 35 36

6.46748E1. 5.52930E1. 4.04749E1. 2.97174E1. 2.18837E1. 1.61619E1.

C 37 38 39 40 41 42

1.19703E1. 8.89063E0. 6.63412E0. 4.98522E0. 3.77138E0. 2.87143E0.

C 43 44 45 46 47 48

2.19967E0. 1.69496E0. 1.31340E0. 1.02296E0. 7.97790E-1.6.22263E-1.

C 49 50 51 52 53 54

4.84917E-1.3.76572E-1.2.91373E-1.2.24606E-1.1.72457E-1.1.31504E-1.

C 55 56 57 58 59 60

9.94067E-2.7.44483E-2.5.52047E-2.4.05013E-2.2.93758E-2.2.1045E-2.

C 61 62 63 64 65 66

1.4877E-2. 1.0366E-2. 7.1691E-3. 4.9592E-3. 3.4313E-3. 2.374[illegible]-3.

C 67 68 69 70 71 72

1.6436E-3. 1.1449E-3. 8.0683E-4. 5.7403E-4. 4.1377E-4. 3.0075E-4.

C 73 74 75 76 77 78

CONT. ON PG 5

```
2.2123E-4, 1.6500E-4, 1.2462E-4, 9.5225E-5, 7.3544E-5, 5.7623E-5,
C         79          80          81          82          83          84
4.5919E-5, 3.7137E-5, 3.0426E-5, 2.5217E-5, 2.1210E-5, 1.8139E-5,
C         85          86          87          88          89          90
1.5726E-5, 1.3791E-5, 1.2214E-5, 1.0909E-5, 9.8151E-6, 8.8882E-6,
C         91          92          93          94          95          96
8.0950E-6, 7.4194E-6, 6.8148E-6, 6.2931E-6, 5.8331E-6, 5.4252E-6,
C         97          98          99         100         101         102
5.0617E-6, 4.7345E-6, 4.4375E-6, 4.1671E-6, 3.9202E-6, 3.6943E-6,
C        103         104         105         106         107         108
3.2932E-6, 2.9475E-6, 2.6479E-6, 2.3851E-6, 2.1536E-6, 1.9491E-6,
C        109         110         111         112         113         114
1.7680E-6, 1.6070E-6, 1.4630E-6, 1.3339E-6, 1.2179E-6, 1.1907E-6/
DATA (PRSLST(I),I=NP13,NP14)/
C        115         116         117         118         119         120
3.31541E2, 2.09848E2, 3.46686E1, 9.03367E-1,7.04580E-1,5.49540E-1,
C        121         122         123
8.6204E-3, 5.9624E-3, 1.9756E-3/
C           DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
```

CONT. ON PG 6

```
DATA (RHOLST(I),I=NP11,NP12)/
C          1          2          3          4          5          6
1.2250E0,  1.1959E0,  1.1673E0,  1.1392E0,  1.1117E0,  1.0846E0,
C          7          8          9          10         11         12
1.0581E0,  1.0321E0,  1.0066E0,  9.8151E-1, 9.5695E-1, 9.3287E-1,
C          13         14         15         16         17         18
9.0925E-1, 8.6340E-1, 8.1935E-1, 7.7704E-1, 7.3643E-1, 6.6011E-1,
C          19         20         21         22         23         24
5.9002E-1, 5.2579E-1, 4.6706E-1, 4.1351E-1, 3.6480E-1, 3.1194E-1,
C          25         26         27         28         29         30
2.6660E-1, 2.2786E-1, 1.9475E-1, 1.6647E-1, 1.4230E-1, 1.2165E-1,
C          31         32         33         34         35         36
1.0400E-1, 8.8910E-2, 6.4510E-2, 4.6936E-2, 3.4257E-2, 2.5076E-2,
C          37         38         39         40         41         42
1.8410E-2, 1.3555E-2, 9.8874E-3, 7.2579E-3, 5.3666E-3, 3.9957E-3,
C          43         44         45         46         47         48
2.9948E-3, 2.2589E-3, 1.7141E-3, 1.3167E-3, 1.0269E-3, 8.0097E-4,
C          49         50         51         52         53         54
6.3137E-4, 4.9762E-4, 3.9086E-4, 3.0592E-4, 2.3931E-4, 1.8837E-4,
```

CONT. ON PG 7

C	55	56	57	58	59	60
	1.4713E-4,	1.1399E-4,	8.7535E-5,	6.6593E-5,	5.0151E-5,	3.736E-5,
C	61	62	63	64	65	66
	2.750E-5,	1.999E-5,	1.382E-5,	9.563E-6,	6.617E-6,	4.579E-6,
C	67	68	69	70	71	72
	3.170E-6,	2.137E-6,	1.459E-6,	1.008E-6,	7.044E-7,	4.974E-7,
C	73	74	75	76	77	78
	3.493E-7,	2.492E-7,	1.804E-7,	1.323E-7,	9.829E-8,	7.153E-8,
C	79	80	81	82	83	84
	5.321E-8,	4.035E-8,	3.112E-8,	2.436E-8,	1.844E-8,	1.434E-8,
C	85	86	87	88	89	90
	1.140E-8,	9.226E-9,	7.589E-9,	6.327E-9,	5.337E-9,	4.549E-9,
C	91	92	93	94	95	96
	3.913E-9,	3.394E-9,	2.965E-9,	2.608E-9,	2.307E-9,	2.053E-9,
C	97	98	99	100	101	102
	1.836E-9,	1.665E-9,	1.515E-9,	1.382E-9,	1.264E-9,	1.159E-9,
C	103	104	105	106	107	108
	9.970E-10,	8.624E-10,	7.532E-10,	6.633E-10,	5.858E-10,	5.189E-10,
C	109	110	111	112	113	114

CONT. ON PG 8

```
4.608E-10, 4.115E-10, 3.692E-10, 3.318E-10, 2.986E-10, 2.910E-10/
DATA (RHOLST(I),I=NP13,NP14)/
C        115        116        117        118        119        120
4.9576E-1, 3.3743E-1, 5.5006E-2, 1.1628E-3, 9.0690E-4, 7.1029E-4,
C        121        122        123
1.662E-5,  1.15E-5,   3.810E-6/
C          SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
DATA (SONLST(I),I=NP11,NP12)/
C        1          2          3          4          5          6
340.294,   339.333,   338.370,   337.403,   336.435,   335.463,
C        7          8          9          10         11         12
334.489,   333.511,   332.532,   331.549,   330.563,   329.575,
C        13         14         15         16         17         18
328.583,   326.592,   324.589,   322.573,   320.545,   316.452,
C        19         20         21         22         23
312.306,   308.105,   303.848,   299.532,   295.154,
C                                           24 - 32
                                 9*295.069,
C                                33         34         35         36
```

CONT. ON PG 9

```
          296.377,   297.720,   299.056,   300.386,
C      37        38        39        40        41        42
 301.709,  303.025,  306.489,  310.099,  313.665,  317.189,
C      43        44        45                      46 - 48
 320.672,  324.116,  327.521,                   3*329.799,
C      49        50        51        52        53        54
 327.911,  325.492,  323.058,  320.606,  317.630,  312.628,
C      55        56        57        58        59        60
 307.549,  302.387,  297.139,  291.800,  286.365,  280.83,
C      61                                       62 - 114
 275.18,                                      53*269.44/
DATA (SONLST(I),I=NP13,NP14)/
C      115       116       117            118 - 119       120
 305.984,  295.069,  297.049,           2*329.799,    329.114,
C                   121 - 123
             3*269.44/
C                   VISCOSITY COEFFICIENT
C         VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
DATA (VISLST(I),I=NP11,NP12)/
C      1         2         3         4         5         6
```

CONT. ON PG 10

```
1.7894E-5, 1.7815E-5, 1.7737E-5, 1.7658E-5, 1.7579E-5, 1.7499E-5,
C       7        8        9        10        11        12
1.7420E-5, 1.7340E-5, 1.7260E-5, 1.7180E-5, 1.7099E-5, 1.7019E-5,
C       13       14       15       16        17        18
1.6938E-5, 1.6775E-5, 1.6612E-5, 1.6448E-5, 1.6282E-5, 1.5949E-5,
C       19       20       21       22        23
1.5612E-5, 1.5271E-5, 1.4926E-5, 1.4577E-5, 1.4223E-5,
C                                 24 - 32
                            9*1.4216E-5,
C                         33        34        35        36
                 1.4322E-5, 1.4430E-5, 1.4538E-5, 1.4646E-5,
C       37       38       39       40        41        42
1.4753E-5, 1.4859E-5, 1.5140E-5, 1.5433E-5, 1.5723E-5, 1.6009E-5,
C       43       44       45                 46   48
1.6293E-5, 1.6573E-5, 1.6851E-5,            3*1.7037E-5,
C       49       50       51       52        53        54
1.6883E-5, 1.6686E-5, 1.6487E-5, 1.6287E-5, 1.6045E-5, 1.5636E-5,
C       55       56       57       58        59        60
1.5226E-5, 1.4808E-5, 1.4393E-5, 1.3953E-5, 1.3515E-5, 1.307E-5,
```

CONT. ON PG 11

```
C       61                                   62 - 114
 1.262E-5.                           53*1.216E-5/
           DATA (VISLST(I),I=NP13,NP14)/
C        115        116        117        118 - 119        120
 1.5099E-5, 1.4216E-5, 1.4376E-5,     2*1.7037E-5,    1.6981E-5,
C                     121 - 123
                    3*1.216E-5/
C      1966 STANDARD ATMOSPHERE FOR JULY AT 30-DEGREES NORTH LATITUDE
C                PRESSURE VALUES TABULATED IN MILLIBARS
           DATA (PRSLST(I),I=NP21,NP22)/
C          1          2          3          4          5          6
 1.01350E3, 9.854E2,  9.579E2,  9.310E2,  9.046E2,  8.786E2,
C          7          8          9         10         11         12
 8.536E2,   8.291E2,  8.051E2,  7.817E2,  7.588E2,  7.365E2,
C         13         14         15         16         17         18
 7.148E2,   6.729E2,  6.331E2,  5.953E2,  5.593E2,  4.929E2,
C         19         20         21         22         23         24
 4.331E2,   3.791E2,  3.307E2,  2.873E2,  2.486E2,  2.141E2,
C         25         26         27         28         29         30
 1.836E2,   1.566E2,  1.329E2,  1.125E2,  9.525E1,  8.081E1,
```

CONT. ON PG 12

```
C          31          32          33          34          35          36
6.867E1.    5.846E1.    4.258E1.    3.121E1.    2.300E1.    1.705E1.
C          37          38          39          40          41          42
1.270E1.    9.513E0.    7.163E0.    5.425E0.    4.131E0.    3.162E0.
C          43          44          45          46          47          48
2.433E0.    1.881E0.    1.461E0.    1.140E0.    8.908E-1.   6.959E-1.
C          49          50          51          52          53          54
5.424E-1.   4.212E-1.   3.259E-1.   2.512E-1.   1.924E-1.   1.462E-1.
C          55          56          57          58          59          60
1.102E-1.   8.226E-2.   6.083E-2.   4.45[illegible]-2.   3.224E-2.   2.306E-2.
C          61          62          63          64          65          66
1.629E-2.   1.135E-2.   7.792E-3.   5.301E-3.   3.607E-3.   2.455E-3.
C          67          68          69          70          71          72
1.671E-3.   1.142E-3.   7.877E-4.   5.488E-4.   3.859E-4.   2.737E-4.
C          73          74          75          76          77          78
1.958E-4.   1.427E-4.   1.065E-4.   8.104E-5.   6.276E-5.   4.935E-5.
C          79          80                      81 - 114
3.955E-5.   3.240E-5.               34*2.702E-5/
DATA (PRSLST(I),I=NP23,NP24)/
```

CONT. ON PG 13

```
C        115        116        117        118        119        120
3.542E2.   2.308E2.   3.643E1.   1.008E0.   7.874E-1.   6.146E-1.
C          121        123        123
9.423E-3.   6.427E-3.   2.025E-3/
C          DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
DATA (RHOLST(I).I=NP21.NP22)/
C          1          2          3          4          5          6
1.159E0.   1.135E0.   1.112E0.   1.089E0.   1.066E0.   1.041E0.
C          7          8          9          10         11         12
1.016E0.   9.923E-1.   9.666E-1.   9.452E-1.   9.222E-1.   8.997E-1.
C          13         14         15         16         17         18
8.776E-1.   8.348E-1.   7.937E-1.   7.540E-1.   7.159E-1.   6.443E-1.
C          19         20         21         22         23         24
5.814E-1.   5.232E-1.   4.694E-1.   4.199E-1.   3.742E-1.   3.324E-1.
C          25         26         27         28         29         30
2.941E-1.   2.592E-1.   2.275E-1.   1.929E-1.   1.617E-1.   1.357E-1.
C          31         32         33         34         35         36
1.142E-1.   9.618E-2.   6.870E-2.   4.944E-2.   3.579E-2.   2.607E-2.
C          37         38         39         40         41         42
```

CONT. ON PG 14

```
1.909E-2,  1.406E-2,  1.038E-2,  7.709E-3,  5.759E-3,  4.326E-3,
C          43         44         45         46         47         48
3.268E-3,  2.482E-3,  1.894E-3,  1.460E-3,  1.140E-3,  8.942E-4,
C          49         50         51         52         53         54
7.071E-4,  5.573E-4,  4.378E-4,  3.435E-4,  2.710E-4,  2.123E-4,
C          55         56         57         58         59         60
1.651E-4,  1.273E-4,  9.739E-5,  7.380E-5,  5.539E-5,  4.113E-5,
C          61         62         63         64         65         66
3.020E-5,  2.190E-5,  1.568E-5,  1.070E-5,  7.282E-6,  4.956E-6,
C          67         68         69         70         71         72
3.374E-6,  2.256E-6,  1.516E-6,  1.030E-6,  7.065E-7,  4.892E-7,
C          73         74         75         76         77         78
3.392E-7,  2.288E-7,  1.588E-7,  1.130E-7,  8.213E-8,  6.087E-8,
C          79         80                    81 - 114
4.388E-8,  3.259E-8,            34*2.486E-8/
DATA (RHOLST(I),I=NP23,NP24)/
C          115        116        117        118        119        120
4.958E-1,  3.529E-1,  5.823E-2,  1.290E-3,  1.008E-3,  7.955E-4,
C          121        122        123
```

CONT. ON PG 15

```
1.856E-5,  1.298E-5,  4.089E-6/

C          SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND

DATA (SONLST(I),I=NP21,NP22)/

C        1          2          3          4          5          6
  349.9,     348.6,     347.3,     346.0,     344.7,     343.8,
C        7          8          9          10         11         12
  342.9,     342.0,     341.1,     340.3,     339.4,     338.5,
C        13         14         15         16         17         18
  337.7,     335.9,     334.2,     332.5,     330.7,     327.3,
C        19         20         21         22         23         24
  322.9,     318.5,     314.0,     309.5,     304.9,     303.3,
C        25         26         27         28         29         30
  295.6,     290.9,     286.0,     285.7,     287.2,     288.7,
C        31         32         33         34         35         36
  290.2,     291.7,     294.6,     297.3,     299.9,     302.6,
C        37         38         39         40         41         42
  305.2,     307.8,     310.8,     313.9,     316.9,     319.9,
C        43         44         45         46 - 47               48
  322.8,     325.8,     328.7,         2*330.7,              330.1,
```

CONT. ON PG 16

```
C        49          50          51          52          53          54
  327.7.      325.3.      322.8.      320.0.      315.3.      310.5.
C        55          56          57          58          59          60
  305.7.      300.7.      295.7.      290.6.      285.5.      280.2.
C        61          62          63                      64 - 67
  274.8.      269.4.      263.8.                  4*263.3.
C                    68          69          70          71          72
              266.2.      269.7.      273.1.      276.5.      279.9.
C        73          74          75          76          77          78
  284.2.      295.5.      306.4.      316.9.      327.1.      336.9.
C        79          80                      81 - 114
  355.2.      373.1.                  34*390.1/
DATA (SONLST(I),I=NP23,NP24)/
C        115         116         117         118 - 119               120
  316.3.      302.6.      295.9.              2*330.7.        328.9.
C        121         122 - 123
  266.6.      2*263.3/
C                        VISCOSITY COEFFICIENT
C           VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
DATA (VISLST(I),I=NP21,NP22)/
```

CONT. ON PG 17

C	1	2	3	4	5	6
	1.868E-5.	1.857E-5.	1.846E-5.	1.836E-5.	1.825E-5.	1.818E-5.
C	7	8	9	10	11	12
	1.811E-5.	1.803E-5.	1.796E-5.	1.789E-5.	1.782E-5.	1.775E-5.
C	13	14	15	16	17	18
	1.768E-5.	1.754E-5.	1.739E-5.	1.725E-5.	1.711E-5.	1.683E-5.
C	19	20	21	22	23	24
	1.648E-5.	1.612E-5.	1.575E-5.	1.539E-5.	1.501E-5.	1.464E-5.
C	25	26	27	28	29	30
	1.426E-5.	1.388E-5.	1.349E-5.	1.346E-5.	1.358E-5.	1.370E-5.
C	31	32	33	34	35	36
	1.3[illegible]2E-5.	1.395E-5.	1.418E-5.	1.439E-5.	1.461E-5.	1.482E-5.
C	37	38	39	40	41	42
	1.504E-5.	1.525E-5.	1.549E-5.	1.574E-5.	1.599E-5.	1.623E-5.
C	43	44	45		46 - 47	48
	1.647E-5.	1.671E-5.	1.694E-5.		2*1.711E-5.	1.706E-5.
C	49	50	51	52	53	54
	1.687E-5.	1.677E-5.	1.647E-5.	1.624E-5.	1.585E-5.	1.547E-5.
C	55	56	57	58	59	60

CONT. ON PG 18

```
1.507E-5,  1.467E-5,  1.427E-5,  1.386E-5,  1.344E-5,  1.302E-5,
C          61         62         63                    64 - 67
1.259E-5,  1.216E-5,  1.172E-5,                4*1.168E-5,
C                     68         69         70         71         72
           1.190E-5,  1.218E-5,  1.245E-5,  1.273E-5,  1.299E-5,
C          73         74         75         76         77         78
1.335E-5,  1.425E-5,  1.513E-5,  1.599E-5,  1.681E-5,  1.762E-5,
C          79         80                    81 - 114
1.912E-5,  2.037E-5,                 34*2.197E-5/
DATA (VISLST(I),I=NP23,NP24)/
C          115        116        117        118 - 119             120
1.593E-5,  1.483E-5,  1.429E-5,             2*1.711E-5,   1.696E-5,
C          121        122 - 123
1.194E-5,       2*1.160E-5/
C                          1966 STANDARD ATMOSPHERE FOR
C                     JANUARY AT 30-DEGREES NORTH LATITUDE
C                   PRESSURE VALUES TABULATED IN MILLIBARS
DATA (PRSLST(I),I=NP31,NP32)/
C          1          2          3          4          5          6
1.021E3,   9.912E2,   9.622E2,   9.340E2,   9.065E2,   8.798E2,
```

CONT. ON PG 19

C	7	8	9	10	11	12
	8.538E2.	8.285E2.	8.038E2.	7.798E2.	7.564E2.	7.335E2.
C	13	14	15	16	17	18
	7.112E2.	6.682E2.	6.274E2.	5.886E2.	5.517E2.	4.837E2.
C	19	20	21	22	23	24
	4.226E2.	3.679E2.	3.191E2.	2.757E2.	2.372E2.	2.032E2.
C	25	26	27	28	29	30
	1.734E2.	1.478E2.	1.257E2.	1.067E2.	9.040E1.	7.650E1.
C	31	32	33	34	35	36
	6.479E1.	5.499E1.	3.984E1.	2.907E1.	2.134E1.	1.575E1.
C	37	38	39	40	41	42
	1.169E1.	8.723E0.	6.544E0.	4.939E0.	3.748E0.	2.860E0.
C	43	44	45	46	47	48
	2.194E0.	1.691E0.	1.310E0.	1.019E0.	7.941E-1.	6.187E-1.
C	49	50	51	52	53	54
	4.808E-1.	3.723E-1.	2.872E-1.	2.207E-1.	1.687E-1.	1.281E-1.
C	55	56	57	58	59	60
	9.659E-2.	7.231E-2.	5.372E-2.	3.959E-2.	2.893E-2.	2.095E-2.
C	61	62	63	64	65	66

CONT. ON PG 20

```
1.503E-2,  1.068E-2,  7.538E-3,  5.323E-3,  3.760E-3,  2.657E-3,
C          67         68         69         70         71         72
1.879E-3,  1.341E-3,  9.683E-4,  7.066E-4,  5.209E-4,  3.876E-4,
C          73         74         75         76         77         78
2.910E-4,  2.210E-4,  1.699E-4,  1.322E-4,  1.039E-4,  8.239E-5,
C          79         80                    81 - 114
6.606E-5,  5.[illegible]59E-5,              34*4.394E-5/
DATA (PRSLST(I),I=NP33,NP34)/
C          115        116        117        118        119        120
3.428E2,   2.196E2,   3.401E1,   8.997E-1,  7.010E-1,  5.457E-1,
C          121        122        123
8.970E-3,  6.334E-3,  2.233E-3/
C          DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
DATA (RHOLST(I),I=NP31,NP32)/
C          1          2          3          4          5          6
1.233E0,   1.200E0,   1.168E0,   1.137E0,   1.107E0,   1.078E0,
C          7          8          9          10         11         12
1.049E0,   1.021E0,   9.934E-1,  9.695E-1,  9.461E-1,  9.231E-1,
C          13         14         15         16         17         18
```

CONT. ON PG 21

	9.005E-1.	8.565E-1.	8.142E-1.	7.733E-1.	7.340E-1.	6.599E-1.
C	19	20	21	22	23	24
	5.916E-1.	5.288E-1.	4.713E-1.	4.187E-1.	3.707E-1.	3.270E-1.
C	25	26	27	28	29	30
	2.828E-1.	2.439E-1.	2.101E-1.	1.805E-1.	1.549E-1.	1.312E-1.
C	31	32	33	34	35	36
	1.099E-1.	9.213E-2.	6.520E-2.	4.669E-2.	3.365E-2.	2.440E-2.
C	37	38	40	40	41	42
	1.780E-2.	1.306E-2.	9.603E-3.	7..05E-3.	5.289E-3.	3.960E-3.
C	43	44	45	46	47	48
	2.981E-3.	2.257E-3.	1.717E-3.	1.319E-3.	1.028E-3.	8.038E-4.
C	49	50	51	52	53	54
	6.340E-4.	4.983E-4.	3.903E-4.	3.051E-4.	2.389E-4.	1.860E-4.
C	55	56	57	58	59	60
	1.439E-4.	1.106E-4.	8.441E-5.	6.396E-5.	4.809E-5.	3.596E-5.
C	61	62	63	64	65	66
	2.651E-5.	1.942E-5.	1.374E-5.	9.702E-6.	6.853E-6.	4.842E-6.
C	67	68	69	70	71	72
	3.386E-6.	2.335E-6.	1.630E-6.	1.152E-6.	8.231E-7.	5.942E-7.

CONT. ON PG 22

```
C        73         74         75         76         77         78
 4.322E-7,  3.133E-7,  2.305E-7,  1.710E-7,  1.296E-7,  9.887E-8,
C        79         80                   81 - 114
 7.508E-8,  5.780E-8,              34*4.509E-8/
      DATA (RHOLST(I),I=NP33,NP34)/
C       115        116        117        118        119        120
 4.994E-1,  3.483E-1,  5.512E-2,  1.165E-3,  9.073E-4,  7.142E-4,
C       121        122        123
 1.635E-5,  1.154E-5,  4.070E-6/
C           SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
      DATA (SONLST(I),I=NP31,NP32)/
C         1          2          3          4          5          6
 340.5,     340.0,     339.5,     339.1,     338.6,     338.1,
C         7          8          9         10         11         12
 337.6,     337.1,     336.6,     335.6,     334.6,     333.5,
C        13         14         15         16         17         18
 332.5,     330.5,     328.5,     326.4,     324.4,     320.3,
C        19         20         21         22         23         24
 316.2,     312.1,     307.9,     303.6,     299.3,     294.9,
```

CONT. ON PG 23

C	25	26	27	28	29	30
	293.0.	291.3.	289.5.	287.7.	285.9.	285.7.
C	31	32	33	34	35	36
	287.3.	289.1.	292.5.	295.2.	297.9.	300.6.
C	37	38	39	40	41	42
	303.2.	305.8.	308.9.	311.9.	315.0.	318.0.
C	43	44	45	46 - 47		48
	321.0.	323.9.	326.8.	2*328.9.		328.3.
C	49	50	51	52	53	54
	325.8.	323.4.	321.0.	318.3.	314.4.	310.5.
C	55	56	57	58	59	60
	306.5.	302.5.	298.5.	294.4.	29[illegible].2.	286.0.
C	61	62		63 - 66		
	281.7.	277.4.		4*277.2.		
C	67	68	69	70	71	72
	278.7.	283.6.	288.4.	293.0.	297.7.	302.2.
C	73	74	75	76	77	78
	307.0.	314.3.	321.3.	328.2.	335.0.	341.6.
C	79	80		81 - 114		

CONT. ON PG 24

```
351.0,      360.3,                34*369.3/
DATA (SONLST(I),I=NP33,NP34)/
C        115        116        117        118 - 119        120
308.9,      297.1,      293.9,            2*328.9,      327.1,
C                   121 - 123
3*277.2/
C                     VISCOSITY COEFFICIENT
C              VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
DATA (VISLST(I),I=NP31,NP32)/
C          1          2          3          4          5          6
1.791E-5,  1.787E-5,  1.783E-5,  1.779E-5,  1.775E-5,  1.771E-5,
C          7          8          9         10         11         12
1.767E-5,  1.763E-5,  1.759E-5,  1.751E-5,  1.742E-5,  1.734E-5,
C         13         14         15         16         17         18
1.726E-5,  1.709E-5,  1.693E-5,  1.676E-5,  1.660E-5,  1.626E-5,
C         19         20         21         22         23         24
1.593E-5,  1.559E-5,  1.525E-5,  1.491E-5,  1.456E-5,  1.420E-5,
C         25         26         27         28         29         30
1.405E-5,  1.391E-5,  1.376E-5,  1.362E-5,  1.347E-5,  1.346E-5,
C         31         32         33         34         35         36
```

CONT. ON PG 25

```
1.359E-5,  1.373E-5,  1.401E-5,  1.423E-5,  1.445E-5,  1.466E-5,
C      37        38        39        40        41        42
1.488E-5,  1.509E-5,  1.533E-5,  1.558E-5,  1.583E-5,  1.607E-5,
C      43        44        45           46 - 47          48
1.632E-5,  1.656E-5,  1.679E-5,      2*1.696E-5,      1.691E-5,
C      49        50        51        52        53        54
1.671E-5,  1.652E-5,  1.632E-5,  1.610E-5,  1.578E-5,  1.547E-5,
C      55        56        57        58        59        60
1.514E-5,  1.482E-5,  1.449E-5,  1.416E-5,  1.383E-5,  1.349E-5,
C      61        62                      63 - 66
1.314E-5,  1.280E-5,                 4*1.278E-5,
C      67        68        69        70        71        72
1.290E-5,  1.329E-5,  1.368E-5,  1.405E-5,  1.443E-5,  1.475E-5,
C      73        74        75        76        77        78
1.518E-5,  1.577E-5,  1.634E-5,  1.691E-5,  1.746E-5,  1.800E-5,
C      79        80                81 - 114
1.877E-5,  1.953E-5,            34*2.027E-5/
DATA (VISLST(I),I=NP33,NP34)/
C      115       116       117        118 - 119          120
```

CONT. ON PG 26

```
1.542E-5,  1.438E-5,  1.412E-5,              2*1.696E-5,     1.681E-5,
C              121 - 123
      3*1.278E-5/
C       1966 STANDARD ATMOSPHERE FOR JULY AT 60-DEGREES NORTH LATITUDE
C                PRESSURE VALUES TABULATED IN MILLIBARS
DATA (PRSLST(I),I=NP41,NP42)/
C       1          2          3          4          5          6
 1.010E3,   9.804E2,   9.516E2,   9.234E2,   8.960E2,   8.692E2,
C       7          8          9         10         11         12
 8.432E2,   8.177E2,   7.930E2,   7.686E2,   7.453E2,   7.224E2,
C      13         14         15         16         17         18
 7.000E2,   6.571E2,   6.164E2,   5.779E2,   5.414E2,   4.740E2,
C      19         20         21         22         23         24
 4.134E2,   3.592E2,   3.108E2,   2.677E2,   2.301E2,   1.978E2,
C      25         26         27         28         29         30
 1.700E2,   1.461E2,   1.256E2,   1.080E2,   9.285E1,   7.983E1,
C      31         32         33         34         35         36
 6.864E1,   5.902E1,   4.364E1,   3.229E1,   2.398E1,   1.788E1,
C      37         38         39         40         41         42
 1.338E1,   1.005E1,   7.593E0,   5.773E0,   4.421E0,   3.406E0,
```

CONT. ON PG 27

```
C       43          44          45          46          47          48
 2.640E0,    2.057E0,    1.607E0,    1.259E0,    9.872E-1,   7.742E-1,
C       49          50          51          52          53          54
 6.072E-1,   4.751E-1,   3.704E-1,   2.877E-1,   2.218E-1,   1.694E-1,
C       55          56          57          58          59          60
 1.281E-1,   9.576E-2,   7.075E-2,   5.160E-2,   3.710E-2,   2.627E-2,
C       61          62          63          64          65          66
 1.829E-2,   1.249E-2,   8.380E-3,   5.536E-3,   3.667E-3,   2.430E-3,
C       67          68          69          70          71          72
 1.610E-3,   1.075E-3,   7.297E-4,   5.027E-4,   3.512E-4,   2.485E-4,
C       73          74          75          76          77          78
 1.782E-4,   1.310E-4,   9.889E-5,   7.633E-5,   6.004E-5,   4.801E-5,
C       79          80                      81 - 114
 3.903E-5,   3.224E-5,               34*2.700E-5/
 DATA (PRSLST(I),I=NP43,NP44)/
C       115         116         117         118         119         120
 3.343E2,    2.133E2,    3.753E1,    1.115E0,    8.742E-1,   6.857E-1,
C       121         122         123
 1.025E-2,   6.803E-3,   1.978E-3/
```

CONT. ON PG 28

```
C            DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
      DATA (RHOLST(I),I=NP41,NP42)/
C        1           2           3           4           5           6
     1.220E0,    1.190E0,    1.161E0,    1.132E0,    1.104E0,    1.077E0,
C        7           8           9          10          11          12
     1.050E0,    1.023E0,    9.971E-1,   9.716E-1,   9.467E-1,   9.223E-1,
C       13          14          15          16          17          18
     8.984E-1,   8.521E-1,   8.077E-1,   7.651E-1,   7.244E-1,   6.519E-1,
C       19          20          21          22          23          24
     5.849E-1,   5.231E-1,   4.683E-1,   4.142E-1,   3.560E-1,   3.060E-1,
C       25          26          27          28          29          30
     2.631E-1,   2.261E-1,   1.944E-1,   1.671E-1,   1.437E-1,   1.235E-1,
C       31          32          33          34          35          36
     1.062E-1,   9.132E-2,   6.753E-2,   4.965E-2,   3.639E-2,   2.678E-2,
C       37          38          39          40          41          42
     1.979E-2,   1.469E-2,   1.083E-2,   8.041E-3,   6.013E-3,   4.528E-3,
C       43          44          45          46     [illegible]      48
     3.431E-3,   2.630E-3,   2.039E-3,   1.584E-3,   1.241E-3,   [illegible].732E-4,
C       49          50          51          52          53          54
```

CONT. ON PG 29

```
 7.667E-4,   6.085E-4,   4.814E-4,   3.815E-4,   3.049E-4,   2.416E-4,
C        55          56          57          58          59          60
 1.898E-4,   1.477E-4,   1.138E-4,   8.666E-5,   6.521E-5,   4.842E-5,
C        61          62          63          64          65          66
 3.543E-5,   2.551E-5,   1.800E-5,   1.192E-5,   7.898E-6,   5.233E-6,
C        67          68          69          70          71          72
 3.468E-6,   2.229E-6,   1.454E-6,   9.640E-7,   6.491E-7,   4.434E-7,
C        73          74          75          76          77          78
 3.019E-7,   2.023E-7,   1.403E-7,   1.001E-7,   7.324E-8,   5.461E-8,
C        79          80                    81 - 114
 4.091E-8,   3.132E-8,                 34*2.444E-8/
DATA (RHOLST(I),I=NP43,NP44)/
C        115         116         117         118         119         120
 4.941E-1,   3.301E-1,   5.807E-2,   1.401E-3,   1.099E-3,   8.619E-4,
C        121         122         123
 2.150E-5,   1.465E-5,   4.260E-6/
C             SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
DATA (SONLST(I),I=NP41,NP42)/
C        1           2           3           4           5           6
```

CONT. ON PG 30

340.5. 339.6. 338.8. 337.9. 337.0. 336.2.

C 7 8 9 10 11 12

335.4. 334.5. 333.7. 332.8. 332.0. 331.1.

C 13 14 15 16 17 18

330.3. 328.6. 326.9. 325.2. 323.5. 319.0.

C 19 20 21

314.6. 310.0. 305.5.

C 22 - 33

12*300.8.

C 34 35 36

301.7. 303.7. 305.7.

C 37 38 39 40 41 42

307.6. 309.6. 313.3. 317.1. 320.8. 324.5.

C 43 44 45 46 47 - 48

328.2. 330.9. 332.2. 333.5. 2*333.7.

C 49 50 51 52 53 54

333.0. 330.6. 328.2. 324.9. 319.2. 313.3.

C 55 56 57 58 59 60

307.3. 301.3. 295.0. 288.7. 282.2. 275.6.

CONT. ON PG 31

```
C          61          62                                  63 - 67
     268.8,      261.9,                          5*255.0,
C                      68          69          70          71          72
            259.9,      265.1,      270.2,      275.2,      280.1,
C          73          74          75          76          77          78
     287.5,      301.1,      314.2,      326.7,      338.8,      350.8,
C          79          80                           81 - 114
     365.5,      379.6,                        34*393.2/
DATA (SONLST(I),I=NP43,NP44)/
C          115         116 - 117                         118 - 120
     307.8,            2*300.8,                          3*333.7,
C          121         122 - 123
     258.3,            2*255.0/
C                      VISCOSITY COEFFICIENT
C               VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
DATA (VISLST(I),I=NP41,NP42)/
C          1           2           3           4           5           6
     1.791E-5,   1.784E-5,   1.777E-5,   1.770E-5,   1.763E-5,   1.756E-5,
C          7           8           9           10          11          12
     1.749E-5,   1.742E-5,   1.735E-5,   1.728E-5,   1.721E-5,   1.715E-5,
```

CONT. ON PG 32

C 13 14 15 16 17 18

1.708E-5, 1.694E-5, 1.680E-5, 1.666E-5, 1.652E-5, 1.616E-5,

C 19 20 21

1.580E-5, 1.543E-5, 1.506E-5,

C 22 - 33

12*1.468E-5,

C 34 35 36

1.476E-5, 1.492E-5, 1.507E-5,

C 37 38 39 40 41 42

1.523E-5, 1.539E-5, 1.569E-5, 1.600E-5, 1.631E-5, 1.661E-5,

C 43 44 45 46 47 - 48

1.690E-5, 1.713E-5, 1.723E-5, 1.734E-5, 2*1.736E-5,

C 49 50 51 52 53 54

1.730E-5, 1.710E-5, 1.691E-5, 1.664E-5, 1.617E-5, 1.569E-5,

C 55 56 57 58 59 60

1.521E-5, 1.472E-5, 1.421E-5, 1.370E-5, 1.318E-5, 1.265E-5,

C 61 62 63 - 67

1.211E-5, 1.156E-5, 5*1.102E-5,

C 68 69 70 71 72

CONT. ON PG 33

```
      1.141E-5,  1.182E-5,  1.222E-5,  1.262E-5,  1.302E-5,
C        73        74        75        76        77        78
 1.360E-5, 1.470E-5, 1.576E-5, 1.679E-5, 1.777E-5, 1.875E-5,
C        79        80                 81 - 114
 1.995E-5,  2.111E-5,            34*2.222E-5/
DATA (VISLST(I),I=NP43,NP44)/
C        115         116 - 117                118 - 120
 1.524E-5,        2*1.468E-5,             3*1.736E-5,
C        121         122 - 123
 1.129E-5,        2*1.102E-5/
C                  1966 STANDARD ATMOSPHERE FOR
C                JANUARY AT 60-DEGREES NORTH LATITUDE
C            PRESSURE VALUES TABULATED IN MILLIBARS
DATA (PRSLST(I),I=NP51,NP52)/
C        1         2         3         4         5         6
 1.01350E3, 9.804E2,  9.484E2,  9.176E2,  8.878E2,  8.590E2,
C        7         8         9         10        11        12
 8.310E2,   8.038E2,  7.775E2,  7.519E2,  7.271E2,  7.031E2,
C        13        14        15        16        17        18
 6.798E2,   6.352E2,  5.932E2,  5.534E2,  5.158E2,  4.467E2,
```

CONT. ON PG 34

C	19	20	21	22	23	24
	3.853E2.	3.308E2.	2.829E2.	2.418E2.	2.067E2.	1.766E2.
C	25	26	27	28	29	30
	1.510E2.	1.291E2.	1.103E2.	9.431E1.	8.058E1.	6.882E1.
C	31	32	33	34	35	36
	5.875E1.	5.014E1.	3.647E1.	2.649E1.	1.922E1.	1.398E1.
C	37	38	39	40	41	42
	1.020E1.	7.464E0.	5.479E0.	4.041E0.	3.001E0.	2.243E0.
C	43	44	45	46	47	48
	1.687E0.	1.277E0.	9.714E-1.	7.434E-1.	5.719E-1.	4.414E-1.
C	49	50	51	52	53	54
	3.408E-1.	2.629E-1.	2.021E-1.	1.548E-1.	1.184E-1.	9.050E-2.
C	55	56	57	58	59	60
	6.909E-2.	5.271E-2.	4.017E-2.	3.051E-2.	2.306E-2.	1.735E-2.
C	61	62	63	64	65	66
	1.298E-2.	9.661E-3.	7.152E-3.	5.263E-3.	3.851E-3.	2.800E-3.
C	67	68	69	70	71	72
	2.022E-3.	1.460E-3.	1.061E-3.	7.762E-4.	5.715E-4.	4.234E-4.
C	73	74	75	76	77	78

CONT. ON PG 35

PARTS
PG 34 OF 52

```
3.155E-4,  2.375E-4,  1.807E-4,  1.389E-4,  1.078E-4,  8.435E-5,
C          79          80                      81 - 114
6.691E-5,  5.391E-5,              34*4.402E-5/
DATA (PRSLST(I),I=NP53,NP54)/
C          115         116         117         118         119         120
3.060E2,   1.911E2,   3.109E1,   6.516E-1,  5.024E-1,  3.879E-1,
C          121         122         123
8.318E-3,  6.140E-3,  2.381E-3/
C          DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
DATA (RHOLST(I),I=NP51,NP52)/
C          1           2           3           4           5           6
1.372E0,   1.325E0,   1.279E0,   1.235E0,   1.193E0,   1.158E0,
C          7           8           9           10          11          12
1.123E0,   1.090E0,   1.058E0,   1.026E0,   9.955E-1,  9.656E-1,
C          13          14          15          16          17          18
9.366E-1,  8.808E-1,  8.339E-1,  7.868E-1,  7.457E-1,  6.646E-1,
C          19          20          21          22          23          24
5.904E-1,  5.226E-1,  4.539E-1,  3.879E-1,  3.315E-1,  2.834E-1,
C          25          26          27          28          29          30
```

CONT. ON PG 36

2.422E-1, 2.071E-1, 1.770E-1, 1.517E-1, 1.300E-1, 1.113E-1,

C 31 32 33 34 35 36

9.530E-2, 8.156E-2, 5.966E-2, 4.357E-2, 3.157E-2, 2.275E-2,

C 37 38 39 40 41 42

1.645E-2, 1.193E-2, 8.676E-3, 6.264E-3, 4.551E-3, 3.330E-3,

C 43 44 45 46 47 48

2.453E-3, 1.819E-3, 1.357E-3, 1.018E-3, 7.682E-4, 5.911E-4,

C 49 50 51 52 53 54

4.564E-4, 3.559E-4, 2.774E-4, 2.150E-4, 1.651E-4, 1.266E-4,

C 55 56 57 58 59 60

9.708E-5, 7.435E-5, 5.701E-5, 4.408E-5, 3.392E-5, 2.599E-5,

C 61 62 63 64 65 66

1.981E-5, 1.503E-5, 1.134E-5, 8.516E-6, 6.357E-6, 4.717E-6,

C 67 68 69 70 71 72

3.480E-6, 2.467E-6, 1.757E-6, 1.260E-6, 9.093E-7, 6.607E-7,

C 73 74 75 76 77 78

4.805E-7, 3.479E-7, 2.550E-7, 1.891E-7, 1.417E-7, 1.067E-7,

C 79 80 81 - 114

7.890E-8, 5.950E-8, 34*4.567E-8/

CONT. ON PG 37

```
DATA (RHOLST(I),I=NP53,NP51)/
C         115        116        117        118        119        120
 4.909E-1,  3.065E-1,  5.100E-2,  8.837E-4,  6.728E-4,  5.194E-4,
C         121        122        123
 1.307E-5,  9.835E-6,  4.055E-6/
C         SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
DATA (SONLST(I),I=NP51,NP52)/
C          1          2          3          4          5          6
 321.6,     321.9,     322.2,     322.5,     322.8,     322.3,
C          7          8          9         10         11         12
 321.8,     321.3,     320.8,     320.3,     319.8,     319.3,
C         13         14         15         16         17         18
 318.8,     317.7,     315.6,     313.4,     311.2,     306.8,
C         19         20                               21 - 27
 302.3,     297.7,                                  7*295.4,
C                                          28         29         30
                                       295.0,     294.6,     294.2,
C         31         32         33         34         35         36
 293.8,     293.4,     292.6,     291.7,     291.9,     293.3,
```

CONT. ON PG 38

```
C      37      38      39      40      41      42
294.7.  296.0.  297.4.  300.5.  303.8.  307.1.
C      43      44      45      46      47      48
310.3.  313.5.  316.6.  319.7.  322.8.  323.3.
C      49      50      51      52      53      54
323.3.  321.6.  319.3.  317.5.  316.9.  316.3.
C      55      56      57      58      59      60
315.7.  315.0.  314.1.  311.3.  308.5.  305.7.
C      61      62      63      64      65      66
302.8.  300.0.  297.1.  294.2.  291.2.  288.2.
C      67      68      69      70      71      72
285.2.  287.8.  290.8.  293.7.  296.6.  299.5.
C      73      74      75      76      77      78
303.2.  309.2.  315.0.  320.7.  326.4.  332.6.
C      79      80              81 - 114
344.6.  356.1.          34*367.3/
DATA (SONLST(I),I=NP53,NP54)/
C      115 - 116      117      118      119 - 120
2*295.4.       292.1.   321.3.   2*323.3.
```

CONT. ON PG 39

```
C              121                122                123
      298.5,          295.6,            286.7/
C                   VISCOSITY COEFFICIENT
C              VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
      DATA (VISLST(I),I=NPS1,NPS2)/
C           1           2           3           4           5           6
     1.636E-5,  1.639E-5,  1.642E-5,  1.644E-5,  1.647E-5,  1.643E-5,
C           7           8           9          10          11          12
     1.639E-5,  1.634E-5,  1.630E-5,  1.626E-5,  1.622E-5,  1.618E-5,
C          13          14          15          16          17          18
     1.614E-5,  [illegible],  1.588E-5,  1.570E-5,  1.552E-5,  1.516E-5,
C          19          20                                   21 - 27
     1.480E-5,  1.443E-5,                               7*1.424E-5,
C                                              28          29          30
                                          1.421E-5,  1.418E-5,  1.415E-5,
C          31          32          33          34          35          36
     1.411E-5,  1.408E-5,  1.401E-5,  1.395E-5,  1.396E-5,  1.407E-5,
C          37          38          39          40          41          42
     1.418E-5,  1.429E-5,  1.440E-5,  1.466E-5,  1.492E-5,  1.519E-5,
C          43          44          45          46          47          48
```

CONT. ON PG 40

```
1.545E-5,  1.571E-5,  1.596E-5,  1.622E-5,  1.647E-5,  1.651E-5,
C          49         50         51         52         53         54
1.651E-5,  1.637E-5,  1.618E-5,  1.604E-5,  1.599E-5,  1.594E-5,
C          55         56         57         58         59         60
1.589E-5,  1.583E-5,  1.575E-5,  1.553E-5,  1.530E-5,  1.507E-5,
C          61         62         63         64         65         66
1.484E-5,  1.461E-5,  1.438E-5,  1.414E-5,  1.391E-5,  1.367E-5,
C          67         68         69         70         71         72
1.343E-5,  1.363E-5,  1.367E-5,  1.411E-5,  1.434E-5,  1.450E-5,
C          73         74         75         76         77         78
1.487E-5,  1.536E-5,  1.583E-5,  1.630E-5,  1.676E-5,  1.727E-5,
C          79         80                   81 - 114
1.824E-5,  1.919E-5,               34*2.011E-5/
DATA (VISLST(I),I=NP53,NP54)/
C          115 - 116        117        118        119 - 120
      2*1.424E-5,      1.398E-5,  1.634E-5,       2*1.651E-5,
C          121        122        123
1.450E-5,  1.426E-5,  1.355E-5/
C               1963 PATRICK AFB REFERENCE ATMOSPHERE
C           PRESSURE VALUES TABULATED IN MILLIBARS
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CONT. ON PG 41

```
DATA (PRSLST(I),I=NP61,NP62)/
C             1            2            3            4            5
1.0170147E+3,9.8829373E+2,9.6022651E+2,9.3280664E+2,9.0603418E+2,
C             6            7            8            9           10
8.7989596E+2,8.5428573E+2,8.2949430E+2,8.0521168E+2,7.8152728E+2,
C            11           12           13           14           15
7.5843002E+2,7.3590840E+2,7.1395065E+2,6.7167869E+2,6.3151745E+2,
C            16           17           18           19           20
5.9337050E+2,5.5714348E+2,4.9009912E+2,4.2967959E+2,3.7532040E+2,
C            21           22           23           24           25
3.2649869E+2,2.8277555E+2,2.4373144E+2,2.0909281E+2,1.7861068E+2,
C            26           27           28           29           30
1.5199026E+2,1.2892856E+2,1.0911841E+2,9.2252642E+1,7.8097365E+1,
C            31           32           33           34           35
6.6260092E+1,5.6315652E+1,4.0899191E+1,2.9918759E+1,2.2038159E+1,
C            36           37           38           39           40
1.6327363E+1,1.2146273E+1,9.0905080E+0,6.8429914E+0,5.1807184E+0,
C            41           42           43           44           45
3.9447995E+0,3.0209180E+0,2.3262411E+0,1.8004513E+0,1.3994781E+0,
```

CONT. ON PG 42

```
C        46        47        48        49        50
1.0910568E+0.8.5180215E-1.6.6393197E-1.5.1553130E-1.3.9852059E-1.
C        51        52        53        54        55
3.0651143E-1.2.3442082E-1.1.7818466E-1.1.3454170E-1.1.0086976E-1.
C        56        57        58        59        60
7.5059128E-2.5.5414297E-2.4.0576003E-2.2.94587[illegible]8E-2.2.1200623E-2.
C        61        62        63        64        65
1.5119831E-2.1.0684305E-2.7.4793850E-3.5.1678215E-3.3.5914714E-3.
C        66        67        68        69        70
2.4869045E-3.1.7224435E-3.1.2003841E-3.8.4635721E-4.6.0330423E-4.
C        71        72        73        74        75
4.3449711E-4.3.1597170E-4.2.3253935E-4.1.7351148E-4.1.3111039E-4.
C        76        77        78        79        80
1.0022554E-4.7.7438980E-5.6.0696757E-5.4.8366073E-5.3.9145232E-5.
C        81        82        83        84        85
3.2082435E-5.2.6597710E-5.2.2377934E-5.1.9141913E-5.1.6599345E-5.
C        86        87        88        89        90
1.4560872E-5.1.2898417E-5.1.1522650E-5.1.0369626E-5.9.3925204E-6.
C        91        92        93        94        95
```

CONT. ON PG 43

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8.5563661E-6,7.8345911E-6,7.2066944E-6,6.6566336E-6,6.1717079E-6/
DATA (PRSLST(I),I=NP63,NP64)/
C          96          97          98          99          100
5.7417393E-6,5.3584943E-6,5.0126367E-6,4.6986357E-6,4.4127423E-6,
C          101         102         103         104         105
4.1517377E-6,3.9128496E-6,3.4886099E-6,3.1230234E-6,2.8059993E-6,
C          106         107         108         109         110
2.5279174E-6,2.2829452E-6,2.0665225E-6,1.8747980E-6,1.7043719E-6,
C          111         112         113         114
1.5518716E-6,1.4150844E-6,1.2921892E-6,1.2634456E-6,
C          115         116         117         118         119
3.5024639E+2,2.2567459E+2,3.4949304E+1,9.6365027E-1,7.5234920E-1,
C          120         121         122         123
5.8534791E-1,8.9499401E-3,6.2355810E-3,2.0696155E-3/
C          DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
DATA (RHOLST(I),I=NP61,NP62)/
C          1           2           3           4           5
1.1835467E+0,1.1573534E+0,1.1312045E+0,1.1051789E+0,1.0793462E+0,
C          6           7           8           9           10
```

CONT. ON PG 44

```
1.0537666E+0.1.0284922E+0.1.0035670E+0.9.7902601E-1.9.549[illegible]E-1.
C              11              12              13              14              15
9.3122447E-1.9.0800345E-1.8.8525681E-1.8.4122243E-1.7.9915662E-1.
C              16              17              18              19              20
7.5904647E-1.7.2084275E-1.6.4983435E-1.5.8535153E-1.5.2651817E-1.
C              21              22              23              24              25
4.7249382E-1.4.2255460E-1.3.7638429E-1.3.3302120E-1.2.9232218E-1.
C              26              27              28              29              30
2.5432637E-1.2.1920326E-1.1.8717665E-1.1.5845601E-1.1.3239218E-1.
C              31              32              33              34              35
1.1096236E-1.9.3193799E-2.6.6193250E-2.4.7478898E-2.3.4382489E-2.
C              36              37              38              39              40
2.5119029E-2.1.8334060E-2.1.3457797E-2.9.9301028E-3.7.3654170E-3.
C              41              42              43              44              45
5.4934199E-3.4.1220200E-3.3.1134715E-3.2.3684559E-3.1.8151546E-3.
C              46              47              48              49              50
1.4015768E-3.1.0965534E-3.8.6526723E-4.6.8253221E-4.5.3756684E-4.
C              51              52              53              54              55
4.2227457E-4.3.3046920E-4.2.5745233E-4.1.9944483E-4.1.5352539E-4.
```

CONT. ON PG 45

```
C             56            57            58            59            60
1.1734[illegible]E-4,8.69979[illegible]E-5,6.6949356E-5,4.9935490E-5,3.6923403E-5,
C             61            62            63            64            65
2.7667389E-5,1.9577466E-5,1.4194402E-5,1.0[illegible]E-5,6.92[illegible]E-6,
C             66            67            68            69            70
4.7957760E-6,3.3215805E-6,2.2404228E-6,1.5304616E-6,1.0579997E-6,
C             71            72            73            74            75
7.3962724E-7,5.2254595E-7,3.6173880E-7,2.6206711E-7,1.8979684E-7,
C             76            77            78            79            80
1.3929915E-7,1.0349983E-7,7.5342182E-8,5.6055657E-8,4.2529020E-8,
C             81            82            83            84            85
3.2809278E-8,2.5691890E-8,1.9457746E-8,1.5133149E-8,1.2030946E-8,
C             86            87            88            89            90
9.7426983E-9,8.0146089E-9,6.6829568E-9,5 6387136E-9,4.8072428E-9,
C             91            92            93            94            95
4.1362113E-9,3.56613[illegible]E-9,3.1356758E-9,2.7585267E-9,2.4414047E-9/
DATA (RHOLST(I),I=NP63,NP64)/
C             96            97            98            99           100
2.1726345E-9,1.9431903E-9,1.7627216E-9,1.6037353E-9,1.4631480E-9,
```

CONT. ON PG 46

```
C              101            102            103            104
1.3383896E-9,1.2273083E-9,1.0562018E-9,9.1375313E-10,
C              105            106            107            108
7.9820295E-10, 7.0302521E-10, 6.2101602E-10, 5.5011615E-10,
C              109            110            111            112
4.8862371E-10, 4.3637082E-10, 3.9157048E-10, 3.5195770E-10,
C              113            114            115            116
3.1686683E-10, 3.0873182E-10, 4.9895351E-1, 3.5436502E-1,
C              117            118            119            120
5.5991186E-2,  1.2347674E-3,  9.7403572E-4, 7.6857816E-4,
C              121            122            123
1.6728017E-5,  1.2023779E-5,  3.9910710E-6/
C           SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
DATA (SONLST(I),I=NP61,NPS2)/
C            1            2            3            4            5
3.4685752E2, 3.4577091E2, 3.4474100E2, 3.4375977E2, 3.4281972E2,
C            6            7            8            9            10
3.4191375E2, 3.4103527E2, 3.4017814E2, 3.3933664E2, 3.3850555E2,
C            11           12           13           14           15
```

CONT. ON PG 47

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	34	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	41
[illegible]	[illegible]	[illegible]	[illegible]	3.[illegible]E2.
41	42	43	44	45
[illegible]	3.[illegible]E2.	3.[illegible]47E2.	3.2622854E2.	3.2954145E2.
46	47	48	49	50
[illegible]	[illegible]	3.277[illegible]E2.	3.2518452E2.	3.2216108E2.
51	52	53	54	55
[illegible]	3.1[illegible]E2.	3.1127350E2.	3.0731304E2.	3.0328738E2.
56	57	58	59	60
[illegible]	2.[illegible]E2.	2.9128385E2.	2.8738653E2.	2.8351977E2.

CONT. ON PG 48

```
C            61            62            63                    64 - 67
2.7964961E2, 2.7570998E2, 2.7160535E2,           4*2.6944122E2,
C                                        68            69            70
                           2.7387919E2, 2.7824640E2, 2.8254611E2,
C            71            72            73            74            75
2.8678136E2, 2.9095497E2, 2.9778102E2, 3.0445407E2, 3.1098395E2,
C            76            77            78            79            80
3.1737952E2, 3.2364874E2, 3.3583625E2, 3.4753671E2, 3.5897208E2,
C            81            82            83            84            85
3.6999789E2, 3.8070451E2, 4.0126162E2, 4.2081570E2, 4.3950065E2,
C            86            87            88            89            90
4.5742298E2, 4.7466910E2, 4.9131021E2, 5.0740585E2, 5.2300637E2,
C            91            92            93            94            95
5.3815483E2, 5.5288841E2, 5.6723942E2, 5.8123620E2, 5.9490377E2/
                DATA (SCNLST(I),I=NP63,NP64)/
C            96            97            98            99           100
6.0826430E2, 6.2133762E2, 6.3096486E2, 6.4047440E2, 6.4979159E2,
C           101           102           103           104           105
6.5900326E2, 6.6809798E2, 6.8001215E2, 6.9173079E2, 7.0153775E2,
```

CONT. ON PG 49

```
C         106          107          108          109          110
 7.0951229E2. 7.1739818E2. 7.2519835E2. 7.3291548E2. 7.3946609E2.
C         111          112          113          114          115
 7.4488092E2. 7.5025666E2. 7.5559417E2. 7.5692267E2. 3.1349187E2.
C         116          117          118          119          120
 2.9879332E2. 2.9577557E2. 3.3054537E2. 3.2884119E2. 3.2653283E2.
C                      121          122          123
 2.7368549E2. 2.6945229E2. 2.6944122E2/
C                       VISCOSITY COEFFICIENT
C              VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
      DATA (VISLST(I),I=NP61,NP62)/
C          1            2            3            4            5
 1.8302431E-5,1.8224157E-5,1.8149999E-5,1.8079299E-5,1.8011441E-5,
C          6            7            8            9           10
 1.7945850E-5,1.7881991E-5,1.7819367E-5,1.7757524E-5,1.7696042E-5,
C         11           12           13           14           15
 1.7634541E-5,1.7572676E-5,1.7510139E-5,1.7381977E-5,1.7248245E-5,
C         16           17           18           19           20
 1.7107621E-5,1.6959239E-5,1.6637781E-5,1.6284601E-5,1.5905319E-5,
C         21           22           23           24           25
```

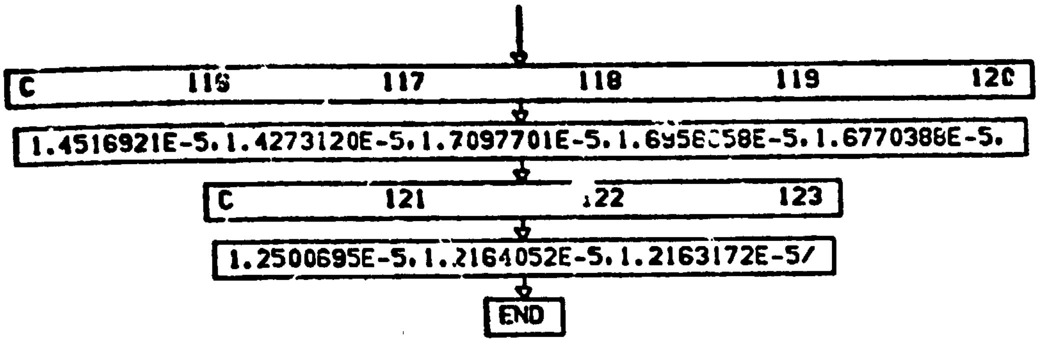
CONT. ON PG 50

```
1.5509244E-5,1.5108096E-5,1.4707842E-5,1.4335282E-5,1.4008886E-5,
C              26            27              28            29              30
1.3745403E-5,1.3558590E-5,1.3457958E-5,1.3447579E-5,1.3585386E-5,
C              31            32              33            34              35
1.3724675E-5,1.3867977E-5,1.4145944E-5,1.4389370E-5,1.4587102E-5,
C              36            37              38            39              40
1.4748972E-5,1.4982730E-5,1.5223539E-5,1.5474160E-5,1.5734080E-5,
C              41            42              43            44              45
1.5999574E-5,1.6263778E-5,1.6516764E-5,1.6745577E-5,1.6934206E-5,
C              46            47              48            49              50
1.7063446E-5,1.7034883E-5,1.6870136E-5,1.6660460E-5,1.6414072E-5,
C              51            52              53            54              55
1.6138668E-5,1.5841407E-5,1.5528854E-5,1.5206865E-5,1.4880579E-5,
C              56            57              58            59              60
1.4554073E-5,1.4230412E-5,1.3911371E-5,1.3597275E-5,1.3286809E-5,
C              61            62              63                       64 - 67
1.2976813E-5,1.2662082E-5,1.2335131E-5,             4*1.2163172E-5,
C                                            68            69              70
                          1.2516126E-5,1.2864314E-5,1.3208747E-5,
```

CONT. ON PG 51

```
C          71          72          73          74          75
1.3548638E-5,1.3884397E-5,1.4435101E-5,1.4975097E-5,1.5504842E-5,
C          76          77          78          79          80
1.6024767E-5,1.6535285E-5,1.7529632E-5,1.8490756E-5,1.9421230E-5,
C          81          82          83          84          85
2.0323355E-5,2.1199197E-5,2.2879253E-5,2.4474125E-5,2.5994216E-5,
C          86          87          88          89          90
2.7448117E-5,2.8842997E-5,3.0184890E-5,3.1478926E-5,3.2729499E-5,
C          91          92          93          94          95
3.3940400E-5,3.5114925E-5,3.6255956E-5,3.7366033E-5,3.8447399E-5/
DATA (VISLST(I),I=NP63,NP64)/
C          96          97          98          99          100
3.9502050E-5,4.0531768E-5,4.1288666E-5,4.2033057E-5,4.2765514E-5,
C          101         102         103         104         105
4.3486565E-5,4.4196706E-5,4.5127375E-5,4.6040463E-5,4.6803460E-5,
C          106         107         108         109         110
4.7423142E-5,4.8035293E-5,4.8640170E-5,4.9238014E-5,4.9745032E-5,
C          111         112         113         114         115
5.0163831E-5,5.0579335E-5,5.0991617E-5,5.1094193E-5,1.5708689E-5,
```

CONT. ON PG 52



PARTS
PG 52 FINAL

```
@ FOR SDAT,SDAT                                                                 11 FEB 79          20:52:1 9. 02
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A -FIELDATA LEVEL E1201001?A)
THIS COMPILATION WAS DC    ON 11 FEB 79 AT 20:52:09

   SUBROUTINE SDAT      ENTRY POINT 000275

   STORAGE USED: CODE(1) 000341; DATA(0) 000059; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   ATDATA 004200
    0004   SPLDAT 004037

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005   SPLN1
    0006   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000010 113G      0001   000040 125G      0001   00005C 132G      0003 R 005410 ALTLST    0004 R 000000 ALTTAB
    0004 R 001147 CP        0004 R 001725 CR        0004 R 002503 CS        0004 R 003261 CV        0003 R 076174 D
    0000 I 000003 I         0000 I 000004 IJ        0000   000027 INJP$     0000 I 000002 IOP1      0000 I 000007 J
    0000 I 000001 JM        0000 I 000000 JI        0000 I 000005 K         0000 I 000004 N         0003 R 000000 PRSLST
    0004 R 000173 PRSTAB    0003 R 001342 RHOLST    0004 R 000366 RHOTAB    0003 R 002704 SONLST    0004 R 000561 SONTAB
    0003 R 004264 VISLST    0004 R 000754 VISTAB    0003 R 006003 WORK      0000 R 000010 XS        0000 R 000011 YS1
    0000 R 000012 YS2       0000 R 000013 YS3       0000 R 000014 YS4


00101          SUBROUTINE SDAT(IOP)
00101    C
00103          PARAMETER NP = 123,  NPA4 = 4*NP,  NP3C = 3*NP - 3
00103    C
00104          COMMON/ATDATA/
00104         1PRSLST(NPA4),    RHOLST(NPA4),    SONLST(NPA4),    VISLST(NPA4),
00104         2ALTLST(NP),      WORK(NP),        D(2)
00104    C
00105          COMMON /SPLDAT/
00105         1ALTTAB(NP)  ,PRSTAB(NP)  ,RHOTAB(NP)  ,SONTAB(NP)  ,VISTAB(NP)  ,
00105         *CP(NP3C)    ,CR(NP3C)    ,CS(NP3C)    ,CV(NP3C)
00105    C
00106          DATA JI,JM /1,1/
00106    C
00106    C
00106    C
00106    C   IOP.........AN INTEGER VARIABLE RANGING FROM 0 TO 5 USED TO DESIGNATE
00106    C             THE ATMOSPHERE MODEL TO BE USED
00106    C
00106    C               IOP = 0 - 1962 STANDARD ATMOSPHERE
00106    C
00106    C               IOP = 1 - 1966 STANDARD FOR JULY AT 30 DEG. N. LATITUDE
00106    C
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C 2

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00106      C              IOP = 2 - 1966 STANDARD FOR JAN. AT 30 DEG. N. LATITUDE
00106      C
00106      C              IOP = 3 - 1966 STANDARD FOR JULY AT 60 DEG. N. LATITUDE
00106      C
00106      C              IOP = 4 - 1966 STANDARD FOR JAN. AT 60 DEG. N. LATITUDE
00106      C
00106      C              IOP = 5 - 1963 PATRICK AFB REFERENCE STANDARD
00106      C
00106      C
00106      C
00106      C     SELECT DESIRED ATMOSPHERE INDEX ADJUSTOR
00106      C
00111            IOP1 = IOP*NP
00111      C
00111      C     TRANSFER PERTINENT ATMOSPHERE DATA FROM STORAGE ARRAY TO WORKING
00111      C     ARRAY AND CONVERT TO DESIRED WORKING UNITS (BRITISH ENGINEERING)
00111      C
00112            DO 1 I = 1,NP
00112      C
00112      C     TRANSFER ALTITUDE VALUES LIST TO WORKING ARRAY
00112      C
00115            ALTTAB(I) = ALTLST(I)/0.3048
00115      C
00115      C     TRANSFER PRESSURE VALUES LIST TO WORKING ARRAY
00115      C
00116            PRSTAB(I) = PRSLST(IOP1 + I)*2.11622/1.01325
00116      C
00116      C     TRANSFER DENSITY VALUES LIST TO WORKING ARRAY
00116      C
00117            RHOTAB(I) = RHOLST(IOP1 + I)*7.6979E-2/(1.225*32.174049)
00117      C
00117      C     TRANSFER SPEED OF SOUND VALUES LIST TO WORKING ARRAY
00117      C
00120            SONTAB(I) = SONLST(IOP1 + I)/0.3048
00120      C
00120      C     TRANSFER COEFFICIENT OF VISCOSITY VALUES LIST TO WORKING ARRAY
00120      C
00121          1 VISTAB(I) = VISLST(IOP1 + I)*1.2029/(1.7894*32.1741)
00123            M = NP - 1
00123      C
00123      C     REARRANGE DATA IN ACCORDANCE WITH ASCENDING VALUES OF THE
00123      C     INDEPENDENT VARIABLE - ALTITUDE
00123      C
00124            DO 300 I = 1,M
00127            K = I
00130            IJ = I + 1
00131            DO 200 J = IJ,NP
00134            IF(ALTTAB(K).GT.ALTTAB(J))K = J
00136        200 CONTINUE
00140            XS = ALTTAB(K)
00141            YS1 = PRSTAB(K)
00142            YS2 = RHOTAB(K)
00143            YS3 = SONTAB(K)
00144            YS4 = VISTAB(K)
00145            ALTTAB(K) = ALTTAB(I)
00146            PRSTAB(K) = PRSTAB(I)
00147            RHOTAB(K) = RHOTAB(I)
00150            SONTAB(K) = SONTAB(I)
```

```
00151              VISTAB(K) = VISTAB(I)
00152              ALTTAB(I) = XS
00153              PRSTAB(I) = YS1
00154              RHOTAB(I) = YS2
00155              SONTAB(I) = YS3
00156          300 VISTAB(I) = YS4
00156        C
00156        C
00156        C
00156        C     APPROXIMATE THE FIRST DERIVATIVE OF THE FUNCTION(S) BY FORMING THE
00156        C     FORWARD DIFFERENCE QUOTIENT OF THE INITIAL AND TERMINAL TABULATED
00156        C     BOUNDARIES.  THESE SLOPES ARE STORED IN D(1) AND D(2),
00156        C     RESPECTIVELY.
00156        C
00156        C
00156        C
00160              D(1) = (PRSTAB(2) - PRSTAB(1))/(ALTTAB(2) - ALTTAB(1))
00161              D(2) = (PRSTAB(NP) - PRSTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
00161        C
00161        C     COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR PRESSURE (CP)
00161        C
00162              CALL SPLN1(NP,ALTTAB,PRSTAB,J1,JN,D,CP,WORK)
00162        C
00162        C
00163              D(1) = (RHOTAB(2) - RHOTAB(1))/(ALTTAB(2) - ALTTAB(1))
00164              D(2) = (RHOTAB(NP) - RHOTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
00164        C
00164        C     COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR DENSITY (CR)
00164        C
00165              CALL SPLN1(NP,ALTTAB,RHOTAB,J1,JN,D,CR,WORK)
00165        C
00165        C
00166              D(1) = (SONTAB(2) - SONTAB(1))/(ALTTAB(2) - ALTTAB(1))
00167              D(2) = (SONTAB(NP) - SONTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
00167        C
00167        C     COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR SPEED OF SOUND
00167        C     (CS)
00167        C
00170              CALL SPLN1(NP,ALTTAB,SONTAB,J1,JN,D,CS,WORK)
00170        C
00170        C
00171              D(1) = (VISTAB(2) - VISTAB(1))/(ALTTAB(2) - ALTTAB(1))
00172              D(2) = (VISTAB(NP) - VISTAB(NP-1))/(ALTTAB(NP) - ALTTAB(NP-1))
00172        C
00172        C     COMPUTE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR COEFFICIENT OF
00172        C     VISCOSITY (CV)
00172        C
00173              CALL SPLN1(NP,ALTTAB,VISTAB,J1,JN,D,CV,WORK)
00173        C
00173        C
00174              RETURN
00175              END

   END OF COMPILATION:        NO  DIAGNOSTICS.
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@FOR ATMSPL,ATMSPL                                                    11 FEB 74           20:52:11. 13
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  (EXEC8 LEVEL E1201060108)
THIS COMPILATION WAS DONE ON 11 FEB 74 AT 20:52:11

   SUBROUTINE ATMSPL     ENTRY POINT 000211

   STORAGE USED: CODE(1) 000227; DATA(0) 000021; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   SPLDAT 004037

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000023 10L      0001   000035 100L     0001   000050 200L     0001   000131 500L     0001   000151 501L
    0003 R 000000 ALTTAB   0003 R 001147 CP       0003 R 001726 CR       0003 R 002503 CS       0003 R 003262 CV
    0000 R 000002 DI       0000 I 000001 I        0000   000004 INJP$    0000 I 000000 IS       0003 R 000173 PRSTAB
    0003 R 000346 RHOTAB   0003 R 000561 SGMTAB   0003 R 000754 VISTAB


00101            SUBROUTINE ATMSPL(V,FANS)
00101      C
00103            PARAMETER  NP = 123,  MP = 3*NP + 3
00103      C
00104            DIMENSION
00104           1FANS(8)
00104      C
00105            COMMON /SPLDAT/
00105           1ALTTAB(NP)  ,PRSTAB(NP)  ,RHOTAB(NP)  ,SGMTAB(NP)  ,VISTAB(NP)  ,
00105           2CP(MP)      ,CR(MP)      ,CS(MP)      ,CV(MP)
00105      C
00106            DATA IS / 1 /
00106      C
00106      C
00106      C     ESTABLISH THE INTERVAL IN WHICH THE SPECIFIED ALTITUDE LIES
00106      C
00106      C
00110            IF(V.LE.ALTTAB(1))GO TO 500
00112            IF(V.GE.ALTTAB(NP))GO TO 501
00114            I = IS
00115            IF(V.GT.ALTTAB(I))GO TO 100
00117         10 I = I - 1
00120            IF(V.LT.ALTTAB(I))GO TO 10
00122            GO TO 200
00123        100 I = I + 1
00124            IF(V.GT.ALTTAB(I))GO TO 100
00126            I = I - 1
00127        200 IS = I
```

```
00130              DX = V - ALTTAB(I)
00130        C
00130        C     EMPLOY CUBIC INTERPOLATION TO COMPUTE PRESSURE/SEA LEVEL RATIO
00130        C
00131              FANS(1) = PRSTAB(I) + ((CP(3*I)*DX + CP(3*I-1))*DX + CP(3*I-2))*DX
00132              FANS(5) = FANS(1)/PRSTAB(1)
00132        C
00132        C     EMPLOY CUBIC INTERPOLATION TO COMPUTE DENSITY/SEA LEVEL RATIO
00132        C
00133              FANS(2) = RHOTAB(I) + ((CR(3*I)*DX + CR(3*I-1))*DX + CR(3*I-2))*DX
00134              FANS(6) = FANS(2)/RHOTAB(1)
00134        C
00134        C     EMPLOY CUBIC INTERPOLATION TO COMPUTE SPEED OF SOUND/SEA LEVEL
00134        C     RATIO
00134        C
00135              FANS(3) = SONTAB(I) + ((CS(3*I)*DX + CS(3*I-1))*DX + CS(3*I-2))*DX
00136              FANS(7) = FANS(3)/SONTAB(1)
00136        C
00136        C     EMPLOY CUBIC INTERPOLATION TO COMPUTE COEFFICIENT OF VISCOSITY/SEA
00136        C     LEVEL RATIO
00136        C
00137              FANS(4) = VISTAB(I) + ((CV(3*I)*DX + CV(3*I-1))*DX + CV(3*I-2))*DX
00140              FANS(8) = FANS(4)/VISTAB(1)
00141              RETURN
00141        C
00141        C
00141        C     INITIAL BOUNDARY VALUES - FUNCTIO/SEA LEVEL RATIO
00141        C
00142          500 FANS(1) = PRSTAB(1)
00143              FANS(2) = RHOTAB(1)
00144              FANS(3) = SONTAB(1)
00145              FANS(4) = VISTAB(1)
00146              FANS(5) = 1.0
00147              FANS(6) = 1.0
00150              FANS(7) = 1.0
00151              FANS(8) = 1.0
00152              RETURN
00152        C
00152        C
00152        C     TERMINAL BOUNDARY VALUES - FUNCTION/SEA LEVEL RATIO
00152        C
00153          501 FANS(1) = PRSTAB(NP)
00154              FANS(2) = RHOTAB(NP)
00155              FANS(3) = SONTAB(NP)
00156              FANS(4) = VISTAB(NP)
00157              FANS(5) = FANS(1)/PRSTAB(1)
00160              FANS(6) = FANS(2)/RHOTAB(1)
00161              FANS(7) = FANS(3)/SONTAB(1)
00162              FANS(8) = FANS(4)/VISTAB(1)
00162        C
00162        C
00163              RETURN
00164              END

       END OF COMPILATION:        NO  DIAGNOSTICS.
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@ FOR SPLN1,SPLN1                                                          11 FEB 79          20152112.667
UNIVAC 1100 FORTRAN V LIBC 11 LEVEL 26A -(EXEC8 LEVEL E1201001OA)
THIS COMPILATION WAS DONE ON 11 FEB 79 AT 20:52:12

   SUBROUTINE SPLN1     ENTRY POINT 000476

   STORAGE USED: CODE(1) 000737; DATA(0) 000110; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003   NERR2$
    0004   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000134 1L       0001   000236 117G      0001   000341 135G      0001   000361 143G      0001   000473 161G
    0001   000557 167G     0001   000574 174G      0001   000152 2L        0001   000205 2NL       0001   000616 201G
    0001   000161 3L       0001   000367 4L        0001   000329 40L*      0001   000540 5NL       0001   000131 70L
    0001   000569 71L      0000 I 000003 I         0000   000019 INJP$     0000 I 000000 N         0000 I 000002 NM

00101      SUBROUTINE SPLN1(N,X,Y,J1,JN,D,C,E)
00101   C
00103      DIMENSION X(1),Y(1),D(2),E(1),C(1)
00103   C
00103   C
00103   C  N  -  AN INTEGER DENOTING THE NUMBER OF DATA POINTS USED TO
00103   C        REPRESENT THE FUNCTION IN THE REGION OF DEFINITION
00103   C
00103   C  X  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY N CONTAINING THE
00103   C        VALUES OF THE INDEPENDENT VARIABLE IN ASCENDING ORDER
00103   C
00103   C  Y  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY N CONTAINING THE
00103   C        VALUES OF THE DEPENDENT VARIABLE CORRESPONDING IN
00103   C        SEQUENCE TO THE VALUES IN THE X ARRAY
00103   C
00103   C  J1,JN - INTEGERS DEFINED AS FOLLOWS
00103   C
00103   C  J1 = 1 - FIRST DERIVATIVE OF THE FUNCTION AT THE FIRST TABULATED
00103   C           DATA POINT IS SUPPLIED IN D(1)
00103   C
00103   C  J1 = 2 - SECOND DERIVATIVE OF THE FUNCTION AT THE FIRST TABULATED
00103   C           DATA POINT IS SUPPLIED IN D(1)
00103   C
00103   C  J1 = 3 - FIRST AND SECOND DERIVATIVES OF THE FUNCTION AT THE FIRST
00103   C           DATA POINT ARE SUPPLIED IN D(1) AND D(2), RESPECTIVELY
00103   C
00103   C  J1 = 4 - FIRST AND SECOND DERIVATIVES OF THE FUNCTION AT THE LAST
00103   C           DATA POINT ARE SUPPLIED IN D(1) AND D(2), RESPECTIVELY
00103   C
00103   C  JN = 1 - FIRST DERIVATIVE OF THE FUNCTION AT THE LAST TABULATED
00103   C           DATA POINT IS SUPPLIED IN D(2)
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00103      C
00103      C      JN = 2 - SECOND DERIVATIVE OF THE FUNCTION AT THE LAST TABULATED
00103      C              DATA POINT IS SUPPLIED IN D(2)
00103      C
00103      C      D  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY 2 CONTAINING THE
00103      C            VALUES OF THE DERIVATIVES OF THE FUNCTION SPECIFIED IN
00103      C            ACCORDANCE WITH J2 AND JN
00103      C      C  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY 3*(N-1) CONTAINING
00103      C            THE CUBIC SPLINE INTERPOLATING COEFFICIENTS FOR EACH
00103      C            INTERVAL
00103      C
00103      C      W  -  A ONE-DIMENSIONAL ARRAY DIMENSIONED BY N USED AS A WORKING
00103      C            ARRAY ONLY
00103      C
00103      C
00103      C      COMPUTE THE INITIAL VALUES OF THE RECURSIVE RELATIONS IN
00103      C      ACCORDANCE WITH THE SPCIFIED PROPERTY OF THE FUNCTION AT THE
00103      C      INITIAL BOUNDARY
00103      C
00103      C
00104             GO TO (1,2,3,4),J1
00105           1 W(1) = -0.5
00106             C(1) = 3.0/(X(2) - X(1))*((Y(2) - Y(1))/(X(2) - X(1)) - D(1))
00107             GO TO 20
00110           2 W(1) = 0.0
00111             C(1) = D(1)
00112             GO TO 20
00113           3 W(1) = 1.0
00114             C(1) = 3.0*D(2) + 6.0/(X(2) - X(1))*(D(1) - (Y(2) - Y(1))/(X(2) -
00114            XX(1)))
00115          20 M = N - 1
00115      C
00115      C      COMPUTE ALL INTERMIDIATE RECURSIVE RELATION VALUES
00115      C
00116             DO 30 I = 2,M
00121             W(I) = -(X(I+1) - X(I))/(2.0*(X(I+1) - X(I-1)) + (X(I) - X(I-1)).*W
00121            X(I-1))
00122          30 C(I) = W(I)/(X(I+1) - X(I))*(6.0*((Y(I) - Y(I-1))/(X(I) - X(I-1))
00122            X- (Y(I+1) - Y(I))/(X(I+1) - X(I))) + (X(I) - X(I-1))*C(I-1))
00122      C
00122      C      COMPUTE THE TERMINAL VALUES OF THE RECURSIVE RELATION IN
00122      C      ACCORDANCE WITH THE SPECIFIED PROPERTY OF THE FUNCTION AT THE
00122      C      TERMINAL BOUNDARY
00122      C
00124             IF(J1.GT.2)GO TO 70
00126             IF(JN.EQ.2)GO TO 40
00130             C(N) = (6.0/(X(N) - X(N-1))*(D(2) - (Y(N) - Y(N-1))/(X(N) - X(N-1)
00130            X)) - C(M))/(2.0 + W(M))
00130      C
00131             GO TO 50
00132          40 C(N) = D(2)
00132      C
00132      C      COMPUTE THE APPROXIMATE SECOND DERIVATIVE VALUES OF THE FUNCTION
00132      C      AT THE SPECIFIED DATA POINTS
00132      C
00133             GO TO 50
00134          70 DO 72 I = 1,N
00137          72 C(I+N) = C(I)
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ORIGINAL PAGE
OF POOR QUALITY

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00141           C(1) = D(2)
00142           DO 73 I = 1,M
00145        73 C(I+1) = (C(I) - C(I+N))/W(I)
00147           GO TO 71
00150         4 M = N - 1
00151           W(M) = 1.0
00152           C(N) = D(2)
00153           C(M) = 6.0/(X(N) - X(M))*(D(1) - (Y(N) - Y(M))/(X(N) - X(M))) -
00153          X3.0*D(2)
00154           MM = M - 1
00155           IF(MM),50,
00160           DO 80 I = MM,1,-1
00163           W(I) = -1.0/(X(I+1) - X(I))*((X(I+2) - X(I+1))/W(I+1) + 2.0*(X(I+2
00163          X) - X(I)))
00164        80 C(I) = 1.0/(X(I+1) - X(I))*(C(I+1)*(X(I+2) - X(I+1))/W(I+1) - 6.0*
00164          X((Y(I+1) - Y(I))/(X(I+1) - X(I)) - (Y(I+2) - Y(I+1))/(X(I+2) - X(I
00164          X+1))))
00166        50 DO 60 I = M,1,-1
00171        60 C(I) = C(I) + W(I)*C(I+1)
00173        71 DO 61 I = 1,N
00176        61 W(I) = C(I)
00176     C
00176     C     COMPUTE THE CUBIC SPLINE INTERPOLATION COEFFICIENTS FOR THE 1-ST,
00176     C     2-ND, AND 3-RD DEGREE TERMS, IN THAT ORDER
00176     C
00200           DO 62 I = 1,M
00203           C(3*I-2) = (Y(I+1) - Y(I))/(X(I+1) - X(I)) - (W(I+1) + 2.0*W(I))*(
00203          1X(I+1) - X(I))/6.0  ,
00204           C(3*I-1) = 0.5*W(I),
00205        62 C(3*I) = (W(I+1) - W(I))/(6.0*(X(I+1) - X(I)))
00205     C
00207           RETURN
00210           END

     END OF COMPILATION:        NO  DIAGNOSTICS.
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@ FOR SPARE.PARTS.BI.                                           12 DEC 73            13: 4150.22
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  (FIELDATA LEVEL E1201001DA)
THIS COMPILATION WAS DONE ON 12 DEC 73 AT 13:04:58

   BLOCK DATA

   STORAGE USED: CODE(1) 000000; DATA(0) 000001; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   ATDATA 004200

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0003 R 005410 ALTLST    0003   004174 D          0000 I 000000 I        0003 R 000000 PRSLST    0003 R 001342 RHOLST
    0003 R 002704 SONLST    0003 R 004246 VISLST     0003   004003 WORK


00101          BLOCK DATA
00101    C
00102          PARAMETER NP = 123
00103          PARAMETER NP11 = 1, NP12 = 119, NP13 = 115, NP14 = NP
00104          PARAMETER NP21=NP11+NP, NP22=NP12+NP, NP23=NP13+NP, NP24=NP14+NP
00105          PARAMETER NP31=NP21+NP, NP32=NP22+NP, NP33=NP23+NP, NP34=NP24+NP
00106          PARAMETER NP41=NP31+NP, NP42=NP32+NP, NP43=NP33+NP, NP44=NP34+NP
00107          PARAMETER NP51=NP41+NP, NP52=NP42+NP, NP53=NP43+NP, NP54=NP44+NP
00110          PARAMETER NP61=NP51+NP, NP62=NP54+95, NP63=NP54+96, NP64=NP54+NP
00110    C
00111          COMMON/ATDATA/
00111         1PRSLST(NP41),   RHOLST(NP41),   SONLST(NP41),   VISLST(NP41),
00111         2ALTLST(NP),     WORK(NP),       D(2)
00111    C
00111    C
00111    C               ALTITUDE TABULATION IN METERS
00111    C
00112          DATA (ALTLST(I),I=NP11,NP12)/
00112    C       1          2          3          4          5          6
00112         10.0E0,     2.5E2,     5.0E2,     7.5E2,     1.0E3,     1.25E3,          1
00112    C       7          8          9          10         11         12
00112         21.5E3,     1.75E3,    2.0E3,     2.25E3,    2.5E3,     2.75E3,          2
00112    C       13         14         15         16         17         18
00112         33.0E3,     3.5E3,     4.0E3,     4.5E3,     5.0E3,     6.0E3,           3
00112    C       19         20         21         22         23         24
00112         47.0E3,     8.0E3,     9.0E3,     1.0E4,     1.1E4,     1.2E4,           4
00112    C       25         26         27         28         29         30
00112         51.3E4,     1.4E4,     1.5E4,     1.6E4,     1.7E4,     1.8E4,           5
00112    C       31         32         33         34         35         36
00112         61.9E4,     [illegible],  2.2E4,  2.4E4,     2.6E4,     2.8E4,           6
00112    C       37         38         39         40         41         42
00112         73.0E4,     3.2E4,     3.4E4,     3.6E4,     3.8E4,     4.0E4,           7
00112    C       43         44         45         46         47         48
00112         84.2E4,     4.4E4,     4.6E4,     4.8E4,     5.0E4,     5.2E4,           8
00112    C       49         50         51         52         53         54
00112         95.4E4,     5.6E4,     5.8E4,     6.0E4,     6.2E4,     6.4E4,           9
00112    C       55         56         57         58         59         60
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00112              X6.6E4,    6.8E4,    7.0E4,    7.2E4,    7.4E4,    7.6E4,          10
00112      C         61         62        63        64        65        66
00112              X7.8E4,    8.0E4,    8.2E4,    8.4E4,    8.6E4,    8.8E4,          11
00112      C         67         68        69        70        71        72
00112              X9.0E4,    9.2E4,    9.4E4,    9.6E4,    9.8E4,    1.0E5,          12
00112      C         73         74        75        76        77        78
00112              X1.02E5,   1.04E5,   1.06E5,   1.08E5,   1.1E5,    1.12E5,         13
00112      C         79         80        81        82        83        84
00112              X1.14E5,   1.16E5,   1.18E5,   1.20E5,   1.22E5    1.24E5,         14
00112      C         85         86        87        88        89        90
00112              X1.26E5,   1.28E5,   1.3E5,    1.32E5,   1.34E5,   1.36E5,         15
00112      C         91         92        93        94        95        96
00112              X1.38E5,   1.4E5,    1.42E5,   1.44E5,   1.46E5,   1.48E5,         16
00112      C         97         98        99       100       101       102
00112              X1.5E5,    1.52E5,   1.54E5,   1.56E5,   1.58E5,   1.60E5,         17
00112      C        103        104       105       106       107       108
00112              X1.64E5,   1.68E5,   1.72E5,   1.76E5,   1.80E5,   1.84E5,         18
00112      C        109        110       111       112       113       114
00112              X1.88E5,   1.92E5,   1.96E5,   2.0E5,    2.04E5,   2.05E5/         19
00112      C
00114              DATA (ALTLST(I),I=NP13,NP14)/
00114      C        115        116       117       118       119       120
00114              X8.5E3,    1.15E4,   2.3E4,    4.9E4,    5.1E4,    5.3E4,
00114      C        121        122       123
00114              X8.1E4,    8.3E4,    8.9E4/
00114      C
00114      C                    1962 - STANDARD ATMOSPHERE
00114      C
00114      C               PRESSURE VALUES TABULATED IN MILLIBARS
00114      C
00116              DATA (PRSLST(I),I=NP11,NP12)/
00116      C         1          2         3         4         5         6
00116              X1.01325E3, 9.83576E2, 9.54612E2, 9.26346E2, 8.98762E2, 8.71850E2,
00116      C         7          8         9        10        11        12
00116              X8.45596E2, 8.19988E2, 7.95014E2, 7.70661E2, 7.46917E2, 7.23771E2,
00116      C        13         14        15        16        17        18
00116              X7.01211E2, 6.57803E2, 6.16604E2, 5.77525E2, 5.40482E2, 4.72176E2,
00116      C        19         20        21        22        23        24
00116              X4.11052E2, 3.56516E2, 3.08007E2, 2.64999E2, 2.26999E2, 1.93999E2,
00116      C        25         26        27        28        29        30
00116              X1.65796E2, 1.41704E2  1.21110E2, 1.03528E2, 8.84971E1, 7.56522E1,
00116      C        31         32        33        34        35        36
00116              X6.46748E1, 5.52930E1, 4.04749E1, 2.97174E1, 2.18837E1, 1.61619E1,
00116      C        37         38        39        40        41        42
00116              X1.19703E1, 8.89063E0, 6.63412E0, 4.98522E0, 3.77138E0, 2.87143E0,
00116      C        43         44        45        46        47        48
00116              X2.19967E0, 1.69496E0, 1.31340E0, 1.02296E0  7.97790E-1,6.22283E-1,
00116      C        49         50        51        52        53        54
00116              X4.84917E-1,3.78572E-1,2.91373E-1,2.24606E-1,1.72457E-1,1.31504E-1,
00116      C        55         56        57        58        59        60
00116              X9.94067E-2,7.44483E-2,5.52047E-2,4.05013E-2,2.93758E-2,2.1045E-2,
00116      C        61         62        63        64        65        66
00116              X1.4877E-2, 1.0366E-2, 7.1691E-3, 4.9592E-3, 3.4313E-3, 2.3796E-3,
00116      C        67         68        69        70        71        72
00116              X1.6438E-3, 1.1949E-3, 8.0683E-4, 5.7483E-4, 4.1377E-4, 3.0075E-4,
00116      C        73         74        75        76        77        78
00116              X2.2123E-4, 1.6590E-4, 1.2462E-4, 9.5225E-5, 7.3544E-5, 5.7623E-5,
00116      C        79         80        81        82        83        84
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00116        X4.5919E-5, 3.7137E-5, 3.0426E-5, 2.5217E-5, 2.1210E-5, 1.8139E-5,
00116   C       85         86         87         88         89         90
00116        X1.5726E-5, 1.3791E-5, 1.2214E-5, 1.0909E-5, 9.8151E-6, 8.8882E-6,
00116   C       91         92         93         94         95         96
00116        X8.0950E-6, 7.4104E-6, 6.8148E-6, 6.2931E-6, 5.8331E-6, 5.4252E-6,
00116   C       97         98         99         100        101        102
00116        X5.0617E-6, 4.7345E-6, 4.4375E-6, 4.1671E-6, 3.9202E-6, 3.6943E-6,
00116   C       103        104        105        106        107        108
00116        X3.2932E-6, 2.9475E-6, 2.6479E-6, 2.3851E-6, 2.1536E-6, 1.9491E-6,
00116   C       109        110        111        112        113        114
00116        X1.7 80E-6, 1.6070E-6, 1.4630E-6, 1.3339E-6, 1.2179E-6, 1.1907E-6/
00116   C
00120         DATA (PRSLST(I),I=NP13,NP14)/
00120   C       115        116        117        118        119        120
00120        X3.31541E2, 2.09848E2, 3.46686E1, 9.03367E-1,7.04580E-1,5.49540E-1,
00120   C       121        122        123
00120        X8.6204E-3, 5.9624E-3, 1.9756E-3/
00120   C
00120   C
00120   C           DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
00120   C
00122         DATA (RHOLST(I),I=NP11,NP12)/
00122   C       1          2          3          4          5          6
00122        X1.2250E0,  1.1959E0,  1.1673E0,  1.1392E0,  1.1117E0,  1.0846E0,
00122   C       7          8          9          10         11         12
00122        X1.0581E0,  1.0321E0,  1.0066E0,  9.8151E-1, 9.5695E-1, 9.3287E-1,
00122   C       13         14         15         16         17         18
00122        X9.0925E-1, 8.6340E-1, 8.1935E-1, 7.7704E-1, 7.3643E-1, 6.6011E-1,
00122   C       19         20         21         22         23         24
00122        X5.9002E-1, 5.2579E-1, 4.6706E-1, 4.1351E-1, 3.6480E-1, 3.1194E-1,
00122   C       25         26         27         28         29         30
00127        X2.6660E-1, 2.278 E-1, 1.9475E-1, 1.6647E  , 1.4230E-1, 1.2165E-1,
00122   C       31         32         33         34         35         36
00122        X1.0400E-1, 8.8910E-2, 6.4510E-2, 4.6938E-2, 3.4257E-2, 2.5076E-2,
00122   C       37         38         39         40         41         42
00122        X1.8410E-2, 1.3555E-2, 9.8874E-3, 7.7579E-3, 5.3666E-3, 3.9957E-3,
00122   C       43         44         45         46         47         48
00122        X2.9948E-3, 2.2589E-3, 1.7141E-3, 1.3167E-3, 1.0269E-3, 8.0097E-4,
00122   C       49         50         51         52         53         54
00122        X6.3137E-4, 4.9762E-4, 3.9086E-4, 3.0592E-4, 2.3931E-4, 1.8837E-4,
00122   C       55         56         57         58         59         60
00122        X1.4713E-4, 1.1397E-4, 8.7535E-5, 6.6593E-5, 5.0151E-5, 3.736E-5,
00122   C       61         62         63         64         65         66
00122        X2.750E-5,  1.999E-5,  1.382E-5,  9.563E-6,  6.617E-6,  4.579E-6,
00122   C       67         68         69         70         71         72
00122        X3.170E-6,  2.137E-6,  1.459E-6,  1.008E-6,  7.044E-7,  4.974E-7,
00122   C       73         74         75         76         77         78
00122        X3.493E-7,  2.492E-7,  1.804E-7,  1.323E-7,  9.827E-8,  7.153E-8,
00122   C       79         80         81         82         83         84
00122        X5.321E-8,  4.035E-8,  3.112E-8,  2.436E-8,  1.844E-8,  1.434E-8,
00122   C       85         86         87         88         89         90
00122        X1.140E-8,  9.223E-9,  7.589E-9,  6.327E-9,  5.337E-9,  4.549E-9,
00122   C       91         92         93         94         95         96
00122        X3.913E-9,  3.394E-9,  2.965E-9,  2.608E-9,  2.307E-9,  2.053E-9,
00122   C       97         98         99         100        101        102
00122        X1.836E-9,  1.665E-9,  1.515E-9,  1.382E-9,  1.264E-9,  1.159E-9,
00122   C       103        104        105        106        107        108
00122        X9.9  -10,  8.624E-10, 7.532E-10, 6.633E-10, 5.650E-10, 5.189E-10,
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00122  C        109         110         111         112         113         114
00122       X4.608E-10, 4.115E-10, 3.692E-10, 3.318E-10, 2.986E-10, 2.910E-10/
00122  C
00124       DATA (RHOLST(I),I=NP13,NP14)/
00124  C      115          116          117         118          119          120
00124       X4.9576E-1, 3.3743E-1, 5.5006E-2, 1.1628E-3, 9.0690E-4, 7.1029E-4,
00124  C      121         122         123
00124       X1.662E-5,  1.15E-5,    3.810E-6/
00124  C
00124  C
00124  C           SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
00124  C
00126       DATA (SONLST(I),I=NP11,NP12)/
00126  C       1           2           3           4           5           6
00126       X340.294,   339.333,    338.370,    337.403,    336.435,    335.463,
00126  C       7           8           9           10          11          12
00126       X334.489,   333.511,    332.532,    3.  549,    330.563,    329.575,
00126  C       13          14          15          16          17          18
00126       X328.583,   326.592,    324.589,    322.573,    320.545,    318.452,
00126  C       19          20          21          22          23
00126       X312.306,   308.105,    303.848,    299.532,    295.154,
00126  C                               24 - 32
00126       X                         9*295.069,
00126  C                               33          34          35          36
00126       X                           296.377,    297.720,    299.056,    300.386,
00126  C       37          38          39          40          41          42
00126       X301.709,   303.025,    306.489,    310.099,    313.665,    317.189,
00126  C       43          44          45                      46 - 48
00126       X320.672,   324.116,    327.521,                3*329.799,
00126  C       49          50          51          52          53          54
00126       X327.911,   325.492,    323.058,    320.606,    317.630,    312.628,
00126  C       55          56          57          58          59          60
00126       X307.549,   302.387,    297.139,    291.800,    286.365,    280.83,
00126  C       61                                  62 - 114
00126       X275.18,                            53*269.44/
00126  C
00130       DATA (SONLST(I),I=NP13,NP14)/
00130  C      115         116         117                 118 - 119           120
00130       X305.984,   295.069,    297.049,            2*329.799,          329.114,
00130  C          121 - 123
00130       X         3*269.44/
00130  C
00130  C
00130  C                              VISCOSITY COEFFICIENT
00130  C                 VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
00130  C
00132       DATA (VISLST(I),I=NP11,NP12)/
00132  C       1           2           3           4           5           6
00132       X1.7894E-5, 1.7815E-5, 1.7737E-5, 1.7658E-5, 1.7579E-5, 1.7499E-5,
00132  C       7           8           9           10          11          12
00132       X1.7420E-5, 1.7340E-5, 1.7260E-5, 1.7180E-5, 1.7099E-5, 1.7019E-5,
00132  C       13          14          15          16          17          18
00132       X1.6938E-5, 1.6775E-5, 1.6612E-5, 1.6448E-5, 1.6282E-5, 1.5949E-5,
00132  C       19          20          21          22          23
00132       X1.5612E-5, 1.5271E-5, 1.4926E-5, 1.4577E-5, 1.4223E-5,
00132  C                               24 - 32
00132       X                         9*1.4216E-5,
00132  C                               33          34          35          36
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00132      X                          1.4322E-5, 1.4430E-5, 1.4538E-5, 1.4646E-5,
00132    C      37         38         39         40         41         42
00132      X1.4753E-5, 1.4859E-5, 1.5140E-5, 1.5433E-5, 1.5723E-5, 1.6009E-5,
00132    C      43         44         45                    46 - 48
00132      X1.6293E-5, 1.6573E-5, 1.6851E-5,            3*1.7037E-5,
00132    C      49         50         51         52         53         54
00132      X1.6883E-5, 1.6686E-5, 1.6487E-5, 1.6287E-5, 1.6045E-5, 1.5638E-5,
00132    C      55         56         57         58         59         60
00132      X1.5226E-5, 1.4806E-5, 1.4383E-5, 1.3953E-5, 1.3515E-5, 1.307E-5,
00132    C      61                              62 - 114
00132      X1.262E-5,                           53*1.216E-5/
00132    C
00134       DATA (VISLST(I),I=NP13,NP14)/
00134    C     115        116        117              118 - 119        120
00134      X1.5099E-5, 1.4216E-5, 1.4376E-5,        2*1.7037E-5,    1.6981E-5,
00134    C        12  - 123
00134      X        3*1.216E-5/
00134    C
00134    C
00134    C . 1966 STANDARD ATMOSPHERE FOR JULY AT 30-DEGREES NORTH LATITUDE
00134    C
00134    C              PRESSURE VALUES TABULATED IN MILLIBARS
00134    C
00136       DATA (PRSLST(I),I=NP21,NP22)/
00136    C      1          2          3          4          5          6
00136      X1.0135OE3, 9.354E2,   9.579E2,   7.310E2,   9.046E2,   8.788E2,
00136    C      7          8          9          10         11         12
00136      X8.136E2,   8.291E2,   8.051E2,   7.817E2,   7.588E2,   7.365E2,
00136    C      13         14         15         16         17         18
00136      X7.148E2,   6.729E2,   6.331E2,   5.953E2,   5.593E2,   4.929E2,
00136    C      19         20         21         22         23         24
00136      X4.331E2,   3.791E2,   3.307E2,   2.873E2,   2.486E2,   2.141E2,
00136    C      25         26         27         28         29         30
00136      X1.836E2,   1.565E2,   1.329E2,   1.125E2,   9.525E1,   8.081E1,
00136    C      31         32         33         34         35         36
00136      X6.867E1,   5.846E1,   4.258E1,   3.121E1,   2.300E1,   1.705E1,
00136    C      37         38         39         40         41         42
00136      X1.270E1,   9.513E0,   7.163E0,   5.425E0,   4.13.E0,   3.162E0,
00136    C      43         44         45         46         47         48
00136      X2.433E0,   1.881E0,   1.461E0,   1.140E0,   8.908E-1,  6.959E-1,
00136    C      49         50         51         52         53         54
00136      X5.424E-1,  4.212E-1,  3.259E-1,  2.512E-1,  1.921E-1,  1.462E-1,
00134    C      55         56         57         58         59         60
00136      X1.102E-1,  8.226E-2,  6.083E-2,  4.453E-2,  3.224E-2,  2.306E-2,
00136    C      61         62         63         64         65         66
00136      X1.629E-2,  1.135E-2,  7.792E-3,  5.301E-3,  3.607E-3,  2.455E-3,
00136    C      67         68         69         70         71         72
00136      X1.671E-3,  1.149E-3,  7.877E-4,  5.488E-4,  3.859E-4,  2.737E-4,
00136    C      73                    75         76         77         78
00136      X1.948E-4,  1.427E-4,  1.065E-4,  8.104E-5,  6.276E-5,  4.935E-5,
00136    C      79         80                   81 - 114
00136      X3.955E-5,  3.240E-5,            34*2.702E-5/
00136    C
00140       DATA (PRSLST(I),I=NP23,NP24)/
00140    C     115        116        117        118        119        120
00140      X3.542E2,   2.309E2,   3.043E1,   1.004E0,   7.874E-1,  6.146E-1,
00140    C     121        123        123
00140      X9.423E-3,  6.427E-3,  2.075E-3/
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00140   C
00140   C
00140   C        DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
00140   C
00142         DATA (RHOLST(I),I=NP21,NP22)/
00142   C         1          2          3          4          5          6
00142        X1.159E0,  1.135E0,  1.112E0,  1.089E0,  1.066E0,  1.041E0,
00142   C         7          8          9          10         11         12
00142        X1.016E0,  9.923E-1,  9.686E-1,  9.452E-1,  9.222E-1,  8.997E-1,
00142   C         13         14         15         16         17         18
00142        X8.776E-1,  8.348E-1,  7.937E-1,  7.540E-1,  7.159E-1,  6.443E-1,
00142   C         19         20         21         22         23         24
00142        X5.814E-1,  5.232E-1,  4.694E-1,  4.194E-1,  3.742E-1,  3.324E-1,
00142   C         25         26         2?         28         29         30
00142        X2.941E-1,  2.592E-1,  2.275E-1,  1.929E-1,  1.617E-1,  1.357E-1,
00142   C         31         32         33         34         35         36
00142        X1.142E-1,  9.618E-2,  6.870E-2,  4.944E-2,  3.579E-2,  2.607E-2,
00142   C         37         38         39         40         41         42
00142        X1.909E-2,  1.406E-2,  1.038E-2,  7.709E-3,  5.759E-3,  4.326E-3,
00142   C         43         44         45         46         47         48
00142        X3.268E-3,  2.482E-3,  1.894E-3,  1.460E-3,  1.140E-3,  8.942E-4,
00142   C         49         50         51         52         53         54
00142        X7.071E-4,  5.573E-4,  4.378E-4,  3.435E-4,  2.710E-4,  2.123E-4,
00142   C         55         56         57         58         59         60
00142        X1.651E-4,  1.273E-4,  9.739E-5,  7.380E-5,  5.539E-5,  4.113E-5,
00142   C         61         62         63         64         65         66
00142        X3.020E-5,  2.190E-5,  1.568E-5,  1.070E-5,  7.282E-6,  4.956E-6,
00142   C         67         68         69         70         71         72
00142        X3.374E-6,  2.256E-6,  1.516E-6,  1.030E-6,  7.065E-7,  4.892E-7,
00142   C         73         74         75         76         77         78
00142        X3.392E-7,  2.288E-7,  1.588E-7,  1.130E-7,  8.213E-8,  6.087E-8,
00142   C         79         80              81 - 114
00142        X4.388E-8,  3.259E-8,          34[illegible]2.486E-8/
00142   C
00144         DATA (RHOLST(I),I=NP23,NP24)/
00144   C         115        116        117        11?        119        120
00144        X4.958E-1,  3.529E-1,  5.823E-2,  1.290E-3,  1.008E-3,  7.955E-4,
00144   C         121        122        123
00144        X1.456E-5,  1.298E-5,  4.089E-6/
00144   C
00144   C
00144   C        SPEE? ?? SOUND VALUES TABULATED IN METERS PER SECOND
00144   C
00146         DATA (SONLST(I),I=NP21,NP22)/
00146   C         1          2          3          4          5          6
00146        X349.9,     348.6,     347.3,     346.0,     344.7,     343.4,
00146   C         7          8          9          10         11         12
00146        X342.9,     342.0,     341.1,     340.3,     339.4,     338.5,
00146   C         13         14         15         16         17         18
00146        X337.7,     335.9,     334.2,     332.5,     330.7,     327.3,
00146   C         19         20         21         22         23         24
00146        X322.9,     318.5,     314.0,     309.5,     304.9,     303.3,
00146   C         25         26         27         28         29         30
00146        X295.6,     290.9,     [illegible],     285.7,     287.2,     288.7,
00146   C         31         32         33         34         35         36
00146        X290.2,     291.7,     294.6,     297.3,     299.9,     302.6,
00146   C         37         38         3?         40         41         42
00146        X305.2,     307.8,     310.8,     313.9,     316.9,     319.9,
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00146   C       43          44          45              46 - 47              48
00146           X322.8,     325.8,      324.7,          2*330.7,             330.1,
00146   C       49          50          51          52          53          54
00146           X327.7,     325.3,      322.8,      320.0,      315.3,      310.5,
00146   C       55          56          57          58          59          60
00146           X305.7,     300.7,      295.7,      290.6,      285.5,      280.2,
00146   C       61          62          63                      64 - 67
00146           X274.8,     269.4,      263.8,                  4*263.3,
00146   C                   68          69          70          71          72
00146           X           266.2,      269.7,      273.1,      276.5,      279.9,
00146   C       73          74          75          76          77          78
00146           X284.2,     295.5,      306.?,      316.9,      327.1,      336.9,
00146   C       79          80                  81 - 114
00146           X355.2,     373.1,              34*390.1/
00146   C
00150           DATA (SONLST(I),I=NP23,NP24)/
00150   C       115         116         117             118 - 119            120
00150           X316.3,     302.6,      295.9,          2*330.7,             328.9,
00150   C       121         122 - 123
00150           X266.6,     2*263.3/
00150   C
00150   C
00150   C                           VISCOSITY COEFFICIENT
00150   C                 VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
00150   C
00152           DATA (VISLST(I),I=NP21,NP22)/
00152   C       1           2           3           4           5           6
00152           X1.868E-5,  1.857E-5,   1.846E-5,   1.836E-5,   1.825E-5,   1.818E-5,
00152   C       7           8           9           10          11          12
00152           X1.811E-5,  1.803E-5,   1.796E-5,   1.789E-5,   1.782E-5,   1.775E-5,
00152   C       13          14          15          16          17          18
00152           X1.768E-5,  1.754E-5,   1.739E-5,   1.725E-5,   1.711E-5,   1.683E-5,
00152   C       19          20          21          22          23          24
00152           X1.648E-5,  1.612E-5,   1.575E-5,   1.539E-5,   1.501E-5,   1.464E-5,
00152   C       25          26          27          28          29          30
00152           X1.426E-5,  1.388E-5,   1.349E-5,   1.346E-5,   1.358E-5,   1.370E-5,
00152   C       31          32          33          34          35          36
00152           X1.382E-5,  1.395E-5,   1.418E-5,   1.439E-5,   1.461E-5,   1.482E-5,
00152   C       37          38          39          40          41          42
00152           X1.504E-5,  1.525E-5,   1.549E-5,   1.574E-5,   1.599E-5,   1.623E-5,
00152   C       43          44          45                  46 - 47          48
00152           X1.647E-5,  1.671E-5,   1.694E-5,           2*1.711E-5,      1.706E-5,
00152   C       49          50          51          52          53          54
00152           X1.687E-5,  1.677E-5,   1.647E-5,   1.624E-5,   1.585E-5,   1.547E-5,
00152   C       55          56          57          58          59          60
00152           X1.507E-5,  1.467E-5,   1.427E-5,   1.386E-5,   1.344E-5,   1.302E-5,
00152   C       61          62          63                  64 - 67
00152           X1.259E-5,  1.216E-5,   1.172E-5,           4*1.168E-5,
00152   C                   68          69          70          71          72
00152           X           1.190E-5,   1.218E-5,   1.245E-5,   1.273E-5,   1.299E-5,
00152   C       73          74          75          76          77          78
00152           X1.335E-5,  1.425E-5,   1.513E-5,   1.599E-5,   1.681E-5,   1.762E-5,
00152   C       79          80                  81 - 114
00152           X1.912E-5,  2.057E-5,           34*2.197E-5/
00152   C
00154           DATA (VISLS (I),I=NP23,NP24)/
00154   C       115         116         117             118 - 119            120
00154           X1.593E-5,  1.403E-5,   1.429E-5,       2*1.711E-5,          1.696E-5,
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00154   C        121          122 - 123
00154          &1.199E-5,      2*1.168E-5/
00154   C
00154   C
00154   C                  1966 STANDARD ATMOSPHERE FOR
00154   C                JANUARY AT 30-DEGREES NORTH LATITUDE
00154   C
00154   C            PRESSURE VALUES TABULATED IN MILLIBARS
00154   C
00156           DATA (PRSLST(I),I=NP31,NP32)/
00156   C        1          2          3          4          5          6
00156          &1.021E3,   9.912E2,   9.622E2,   9.340E2,   9.065E2,   8.798E2,
00156   C        7          8          9          10         11         12
00156          &8.538E2,   8.285E2,   8.038E2,   7.798E2,   7.564E2,   7.335E2,
00156   C        13         14         15         16         17         18
00156          &7.112E2,   6.682E2,   6.274E2,   5.886E2,   5.517E2,   4.837E2,
00156   C        19         20         21         22         23         24
00156          &4.226E2,   3.679E2,   3.191E2,   2.757E2,   2.372E2,   2.032E2,
00156   C        25         26         27         28         29         30
00156          &1.734E2,   1.478E2,   1.257E2,   1.067E2,   9.040E1,   7.650E1,
00156   C        31         32         33         34         35         36
00156          &6.479E1,   5.494E1,   3.784E1,   2.907E1,   2.134E1,   1.575E1,
00156   C        37         38         39         40         41         42
00156          &1.169E1,   8.723E0,   6.544E0,   4.939E0,   3.748E0,   2.860E0,
00156   C        43         44         45         46         47         48
00156          &2.194E0,   1.691E0,   1.310E0,   1.019E0,   7.941E-1,  6.187E-1,
00156   C        49         50         51         52         53         54
00156          &4.808E-1,  3.723E-1,  2.872E-1,  2.207E-1,  1.687E-1,  1.281E-1,
00156   C        55         56         57         58         59         60
00156          &9.659E-2,  7.231E-2,  5.372E-2,  3.959E-2,  2.893E-2,  2.095E-2,
00156   C        61         62         63         64         65         66
00156          &1.503E-2,  1.068E-2,  7.538E-3,  5.323E-3,  3.760E-3,  2.657E-3,
00156   C        67         68         69         70         71         72
00156          &1.879E-3,  1.341E-3,  9.683E-4,  7.066E-4,  5.209E-4,  3.876E-4,
00156   C        73         74         75         76         77         78
00156          &2.910E-4,  2.210E-4,  1.699E-4,  1.322E-4,  1.039E-4,  8.239E-5,
00156   C        79         80              81 - 114
00156          &6.606E-5,  5.359E-5,         34*4.394E-5/
00156   C
00160           DATA (PRSLST(I),I=NP33,NP34)/
00160   C        115        116        117        118        119        120
00160          &3.428E2,   2.196E2,   3.401E1,   8.997E-1,  7.010E-1,  5.457E-1,
00160   C        121        122        123
00160          &8.970E-3,  6.334E-3,  2.233E-3/
00160   C
00160   C
00160   C          DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
00160   C
00162           DATA (RHOLST(I),I=NP31,NP32)/
00162   C        1          2          3          4          5          6
00162          &1.233E0,   1.200E0,   1.168E0,   1.137E0,   1.107E0,   1.078E0,
00162   C        7          8          9          10         11         12
00162          &1.049E0,   1.021E0,   9.934E-1,  9.695E-1,  9.461E-1,  9.231E-1,
00162   C        13         14         15         16         17         18
00162          &9.005E-1,  8.565E-1,  8.142E-1,  7.733E-1,  7.340E-1,  6.599E-1,
00162   C        19         20         21         22         23         24
00162          &5.916E-1,  5.288E-1,  4.713E-1,  4.187E-1,  3.707E-1,  3.270E-1,
00162   C        25         26         27         28         29         30
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00132          X2.428E-1, 2.439E-1, 2.101E-1, 1.805E-1, 1.549E-1, 1.312E-1,
00162     C       31         32         33         34         35         36
00162          X1.099E-1, 9.213E-2, 6.520E-2, 4.669E-2, 3.365E-2, 2.440E-2,
00162     C       37         38         4C         40         41         42
00162          X1.780E-2, 1.306E-2, 9.603E-3, 7.105E-3, 5.289E-3, 3.960E-3,
00162     C       43         44         45         46         47         48
00162          X2.981E-3, 2.257E-3, 1.717E-3, 1.319E-3, 1.028E-3, 8.038E-4,
00162     C       49         50         51         52         53         54
00162          X6.340E-4, 4.983E-4, 3.903E-4, 3.051E-4, 2.389E-4, 1.860E-4,
00162     C       55         56         57         58         59         60
00162          X1.439E-4, 1.136E-4, 8.441E-5, 6.396E-5, 4.809E-5, 3.586E-5,
00162     C       61         62         63         64         65         66
00162          X2.651E-5, 1.942E-5, 1.374E-5, 9.702E-6, 6.853E-6, 4.842E-6,
00162     C       67         68         69         70         71         72
00162          X3.386E-6, 2.335E-6, 1.630E-6, 1.152E-., 8.231E-7, 5.942E-7,
00162     C       73         74         75         76         77         78
00162          X4.322E-7, 3.133E-7, 2.305E-7, 1.718E-7, 1.296E-7, 9.887E-8,
00162     C       79         80              81 - 114
00162          X7.509E-8, 5.780E-8,          34*4.509E-8/
00162     C
00164           DATA (RHOLST(I),I=NP33,NP34)/
00164     C       115        116        117        118        119        120
00164          X4.994E-1, 3.483E-1, 5.512E-2, 1.165E-3, 9.073E-4, 7.142E-4,
00164     C       121        122 ,      123
00164          X1.635E-5, 1.154E-5, 4.070E-6/
00164     C
00164     C
00164     C          SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
00164     C
00166           DATA (SONLST(I),I=NP31,NP32)/
00166     C       1          2          3          4          5          6
00166          X340.5,    340.0,     339.5,     339.1,     334.6,     338.1,
00166     C       7          8          9          10         11         12
00166          X337.6,    337.1,     336.6,     335.6,     334.6,     333.5,
00166     C       13         14         15         16         17         18
00166          X332.5,    330.5,     328.5,     326.4,     324.4,     320.3,
00166     C       19         20         21         22         23         24
00166          X316.2,    312.1,     307.9,     303.6,     299.3,     294.9,
00166     C       25         26         27         28         29         30
00166          X293.0,    291.3,     289.5,     287.7,     285.9,     285.7,
00166     C       31         32         33         34         35         36
00166          X287.3,    289.1,     292.5,     295.2,     297.9,     300.6,
00166     C       37         38         39         40         41         42
00166          X303.2,    305.9,     308.9,     311.9,     315.0,     318.0,
00166     C       43         44         45              46 - 47         48
00166          X321.0,    323.9,     326.8,          2*328.9,        328.3,
00166     C       49         50         51         52         53         54
00166          X325.8,    323.4,     321.0,     318.3,     314.9,     310.5,
00166     C       55         56         57         58         59         60
00166          X306.5,    302.5,     298.5,     294.4,     290.2,     286.0,
00166     C       61         62                    63 - 66
00166          X281.7,    277.4,                4*277.2,
00166     C       67         68         69         70         71         72
00166          X278.7,    283.6,     288.4,     293.0,     297.7,     302.2,
00166     C       73         74         75         76         77         78
00166          X307.0,    314.3,     321.3,     328.2,     335.0,     341.6,
00166     C       79         80              81 - 114
00166          X351.0,    360.3,          34*369.3/
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C
      DATA (SONLST(I),I=NP33,NP34)/
C         115          116          117                118 - 119         120
     X308.9,       297.1,       293.9,              2*328.9,          327.1,
C            121 - 123
     X         3*277.2/
C
C
C                          VISCOSITY COEFFICIENT
C                VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
C
      DATA (VISLST(I),I=NP31,NP32)/
C          1            2            3            4            5            6
     X1.791E-5,   1.787E-5,    1.783E-5,    1.779E-5,    1.775E-5,    1.771E-5,
C          7            8            9            10           11           12
     X1.767E-5,   1.763E-5,    1.759E-5,    1.751E-5,    1.742E-5,    1.734E-5,
C          13           14           15           16           17           18
     X1.726E-5,   1.709E-5,    1.693E-5,    1.676E-5,    1.660E-5,    1.626E-5,
C          19           20           21           22           23           24
     X1.593E-5,   1.559E-5,    1.525E-5,    1.491E-5,    1.456E-5,    1.420E-5,
C          25           26           27           28           29           30
     X1.405E-5,   1.391E-5,    1.376E-5,    1.362E-5,    1.347E-5,    1.346E-5,
C          31           32           33           34           35           36
     X1.359E-5,   1.373E-5,    1.401E-5,    1.423E-5,    1.445E-5,    1.466E-5,
C          37           38           39           40           41           42
     X1.488E-5,   1.509E-5,    1.533E-5,    1.558E-5,    1.583E-5,    1.607E-5,
C          43           44           45              46 - 47                48
     X1.632E-5,   1.656E-5,    1.679E-5,          2*1.696E-5,             1.691E-5,
C          49           50           51           52           53           54
     X1.671E-5,   1.652E-5,    1.632E-5,    1.610E-5,    1.578E-5,    1.547E-5,
C          55           56           57           58           59           60
     X1.514E-5,   1.482E-5,    1.449E-5,    1.416E-5,    1.383E-5,    1.349E-5,
C          61           62                        63 - 66
     X1.319E-5,   1.280E-5,                     4*1.278E-5,
C          67           68           69           70           71           72
     X1.290E-5,   1.329E-5,    1.368E-5,    1.405E-5,    1.443E-5,    1.479E-5,
C          73           74           75           76           77           78
     X1.518E-5,   1.577E-5,    1.634E-5,    1.691E-5,    1.746E-5,    1.800E-5,
C          79           80                  81 - 114
     X1.877E-5,   1.953E-5,              34*2.027E-5/
C
      DATA (VISLST(I),I=NP33,NP34)/
C         115          116          117                118 - 119         120
     X1.542E-5,   1.438E-5,    1.412E-5,             2*1.696E-5,      1.681E-5,
C            121 - 123
     X         3*1.278E-5/
C
C
C       1966 STANDARD ATMOSPHERE FOR JULY AT 60-DEGREES NORTH LATITUDE
C
C                    PRESSURE VALUES TABULATED IN MILLIBARS
C
      DATA (PRSLST(I),I=NP41,NP42)/
C          1            2            3            4            5            6
     X1.010E3,    9.834E2,     9.516E2,     9.234E2,     8.960E2,     8.692E2,
C          7            8            9            10           11           12
     X8.432E2,    8.177E2,     7.930E2,     7.688E2,     7.453E2,     7.224E2,
C          13           14           15           16           17           18
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00176          X7.000E2,   6.571E2,   6.164E2,   5.779E2,   5.414E2,   4.740E2,
00176     C       19          20         21         22         23         24
00176          X4.134E2,   3.592E2,   3.108E2,   2.677E2,   2.301E2,   1.978E2,
00176     C       25          26         27         28         29         30
00176          X1.700E2,   1.461E2,   1.256E2,   1.080E2,   9.285E1,   7.983E1,
00176     C       31          32         33         34         35         36
00176          X6.864E1,   5.902E1,   4.364E1,   3.229E1,   2.394E1,   1.788E1,
00176     C       37          38         39         40         41         42
00176          X1.338E1,   1.005E1,   7.593E0,   5.775E0,   4.421E0,   3.406E0,
00176     C       43          44         45         46         47         48
00176          X2.640E0,   2.057E0,   1.607E0,   1.259E0,   9.872E-1,  7.742E-1,
00176     C       49          50         51         52         53         54
00176          X6.072E-1,  4.751E-1,  3.704E-1,  2.877E-1,  2.218E-1,  1.694E-1,
00176     C       55          56         57         58         59         60
00176          X1.281E-1,  9.576E-2,  7.075E-2,  5.160E-2,  3.710E-2,  2.627E-2,
00176     C       61          62         63         64         65         66
00176          X1.829E-2,  1.249E-2,  8.360E-3,  5.530E-3,  3.[illegible]47E-3,  2.430E-3,
00176     C       67          68         69         70                    72
00176          X1.610E-3,  1.075E-3,  7.292E-4,  5.027E-4,  3.5[illegible]2E-4,  2.485E-4,
00176     C       73          [illegible]  75         76         77         78
00176          X1.782E-4,  1.310E-4,  9.889E-5,  7.633E-5,  6.004E-5,  4.801E-5,
00176     C       79          80               81 - 114
00176          X3.903E-5,  3.224E-5,           34*2.700E-5/
00176     C
00200          DATA (PRSLST(I),I=NP43,NP44)/
00200     C      115         116        117        118        119        120
00200          X3.343E2,   2.133E2,   3.753E1,   1.115E0,   8.742E-1,  6.857E-1,
00200     C      121         122        123
00200          X1.025E-2,  6.803E-3,  1.978E-3/
00200     C
00200     C
00200     C         DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
00200     C
00202          DATA (RHOLST(I),I=NP41,NP42)/
00202     C        1           2          3          4          5          6
00202          X1.220E0,   1.190E0,   1.161E0,   1.132E0,   1.104E0,   1.077E0,
00202     C        7           8          9         10         11         12
00202          X1.050E0,   1.023E0,   9.971E-1,  9.716E-1,  9.467E-1,  9.223E-1,
00202     C       13          14         15         16         17         18
00202          X8.984E-1,  8.521E-1,  8.077E-1,  7.651E-1,  7.244E-1,  6.519E-1,
00202     C       19          20         21         22         23         24
00202          X5.849E-1,  5.231E-1,  4.663E-1,  4.142E-1,  3.560E-1,  3.060E-1,
00202     C       25          26         27         28         29         30
00202          X2.631E-1,  2.261E-1,  1.944E-1,  1.671E-1,  1.437E-1,  1.235E-1,
00202     C       31          32         33         34         35         36
00202          X1.062E-1,  9.132E-2,  6.753E-2,  4.965E-2,  3.639E-2,  2.678E-2,
00202     C       37          38         39         40         41         42
00202          X1.979E-2,  1.469E-2,  1.083E-2,  8.041E-3,  6.013E-3,  4.528E-3,
00202     C       43          44         45         46         47         48
00202          X3.431E-3,  2.620E-3,  2.039E-3,  1.584E-3,  1.241E-3,  9.732E-4,
00202     C       49          50         51         52         53         54
00202          X7.667E-4,  6.085E-4,  4.814E-4,  3.815E-4,  3.049E-4,  2.416E-4,
00202     C       55          56         57         58         59         60
00202          X1.898E-4,  1.477E-4,  1.138E-4,  8.666E-5,  6.521E-5,  4.842E-5,
00202     C       61          62         63         64         65         66
00202          X3.543E-5,  2.551E-5,  1.800E-5,  1.192E-5,  7.998E-6,  5.233E-6,
00202     C       67          68         69         70         71         72
00202          X3.468E-6,  2.229E-6,  1.454E-6,  9.640E-7,  6.491E-7,  4.434E-7,
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ORIGINAL PAGE IS OF POOR QUALITY

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00202   C       73          74          75          76          77          78
00202          &3.319E-7,  2.023E-7,  1.403E-7,  1.001E-7,  7.324E-8,  5.461E-8,
00202   C       79          80                81 - 119
00202          &4.091E-8,  3.132E-8,        34*2.444E-8/
00202   C
00204          DATA (RHOLST(I),I=NP43,NP44)/
00204   C      115         116         117         118         119         120
00204          &4.941E-1,  3.301E-1,  5.807E-2,  1.401E-3,  1.099E-3,  8.619E-4,
00204   C      121         122         123
00204          &2.150E-5,  1.465E-5,  4.263E-6/
00204   C
00204   C
00204   C            SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
00204   C
00206          DATA (SONLST(I),I=NP41,NP42)/
00206   C        1          2           3           4           5           6
00206          &340.5,     339.6,      338.8,      337.9,      337.0,      336.2,
00206   C        7          8           9          10          11          12
00206          &335.4,     334.5,      333.7,      332.8,      332.0,      331.1,
00206   C       13         14          15          16          17          18
00206          &330.3,     328.6,      326.9,      325.2,      323.5,      319.0,
00206   C       19         20          21
00206          &314.6,     310.0,      305.5,
00206   C                                   22 - 33
00206          &                          12*300.0,
00206   C                                              34          35          36
00206          &                                      301.7,      303.7,      305.7,
00206   C       37         38          39          40          41          42
00206          &307.6,     309.6,      313.3,      317.1,      320.8,      324.5,
00206   C       43         44          45          46             47 - 48
00206          &328.2,     330.9,      332.2,      333.5,         2*333.7,
00206   C       49         50          51          52          53          54
00206          &333.0,     330.6,      328.2,      324.9,      319.2,      313.3,
00206   C       55         56          57          58          59          60
00206          &307.3,     301.3,      295.0,      288.7,      282.2,      275.6,
00206   C       61         62                      63 - 67
00206          &268.8,     261.9,                 5*255.0,
00206   C                  68          69          70          71          72
00206          &           259.9,      265.1,      270.2,      275.2,      280.1,
00206   C       73         74          75          76          77          78
00206          &287.5,     301.1,      314.2,      326.7,      338.8,      350.8,
00206   C       79         80                81 - 119
00206          &365.5,     379.6,          34*393.2/
00206   C
00210          DATA (SONLST(I),I=NP43,NP44)/
00210   C      115          116 - 117                  118 - 120
00210          &307.8,       2*300.8,                   3*333.7,
00210   C      121          122 - 123
00210          &258.3,       2*255.0/
00210   C
00210   C
00210   C                          VISCOSITY COEFFICIENT
00210   C             VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
00210   C
00212          DATA (VISLST(I),I=NP41,NP42)/
00212   C        1          2           3           4           5           6
00212          &1.791E-5,  1.784E-5,  1.777E-5,  1.770E-5,  1.763E-5,  1.756E-5,
00212   C        7          8           9          10          11          12
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         X1.749E-5,  1.742E-5,  1.735E-5,  1.728E-5,  1.721E-5,  1.715E-5,
C            13         14         15         16         17         18
         X1.708E-5,  1.694E-5,  1.680E-5,  1.666E-5,  1.652E-5,  1.616E-5,
C            19         20         :
         X1.580E-5,  1.543E-5,  1.506E-5,
C                                   22 - 33
         X                        12*1.468E-5,
C                                              34         35         36
         X                                  1.476E-5,  1.492E-5,  1.507E-5,
C            37         38         39         40         41         42
         X1.523E-5,  1.539E-5,  1.569E-5,  1.600E-5,  1.631E-5,  1.661E-5,
C            43         44         45         46            47 - 48
         X1.690E-5,  1.713E-5,  1.723E-5,  1.734E-5,       2*1.736E-5,
C            49         50         51         52         53         54
         X1.730E-5,  1.710E-5,  1.691E-5,  1.664E-5,  1.617E-5,  1.569E-5,
C            55         56         57         58         59         60
         X1.521E-5,  1.472E-5,  1.421E-5,  1.370E-5,  1.318E-5,  1.265E-5,
C            61         62                     63 - 67
         X1.211E-5,  1.156E-5,               5*1.102E-5,
C                       68         69         70         71         72
         X           1.141E-5,  1.182E-5,  1.222E-5,  1.262E-5,  1.302E-5,
C            73         74         75         76         77         78
         X1.360E-5,  1.470E-5,  1.576E-5,  1.679E-5,  1.777E-5,  1.875E-5,
C            79         80  .           81 - 114
         X1.995E-5,  2.111E-5,        34*2.222E-5/
C
          DATA (VISLST(I),I=NP43,NP44)/
C            115        116 - 117            118 - 120
         X1.524E-5,      2*1.468E-5,          3*1.736E-5,
C            121        122 - 123
         X1.129E-5,      2*1.102E-5/
C
C
C                   1966 STANDARD ATMOSPHERE FOR
C                 JANUARY AT 60-DEGREES NORTH LATITUDE
C
C             PRESSURE VALUES TABULATED IN MILLIBARS
C
          DATA (PRSLST(I),I=NPS1,NPS2)/
C            1          2          3          4          5          6
         X1.01350E3, 9.804E2,   9.484E2,   9.176E2,   8.878E2,   8.590E2,
C            7          8          9          10         11         12
         X8.310E2,   8.038E2,   7.775E2,   7.519E2,   7.271E2,   7.031E2,
C            13         14         15         16         17         18
         X6.798E2,   6.352E2,   5.932E2,   5.534E2,   5.158E2,   4.467E2,
C            19         20         21         22         23         24
         X3.853E2,   3.308E2,   2.829E2,   2.418E2,   2.067E2,   1.766E2,
C            25         26         27         28         29         30
         X1.510E2,   1.291E2,   1.103E2,   9.431E1,   8.058E1,   6.882E1,
C            31         32         33         34         35         36
         X5.875E1,   5.014E1,   3.647E1,   2.649E1,   1.922E1,   1.398E1,
C            37         38         39         40         41         42
         X1.020E1,   7.464E0,   5.479E0,   4.041E0,   3.001E0,   2.243E0,
C            43         44         45         46         47         48
         X1.687E0,   1.277E0,   9.714E-1,  7.434E-1,  5.719E-1,  4.414E-1,
C            49         50         51         52         53         54
         X3.408E-1,  2.629E-1,  2.021E-1,  1.548E-1,  1.184E-1,  9.050E-2,
C            55         56         57         58         59         60
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00216              X6.909E-2,  5.271E-2,  4.017E-2,  3.051E-2,  2.396E-2,  1.735E-2,
00216        C        61          62          63          64          65          66
00216              X1.298E-2,  9.661E-3,  7.152E-3,  5.263E-3,  3.851E-3,  2.800E-3,
00216        C        67          68          69          70          71          72
00216              X2.022E-3,  1.460E-3,  1.061E-3,  7.762E-4,  5.715E-4,  4.234E-4,
00216        C        73          74          75          76          77          78
00216              X3.156E-4,  2.375E-4,  1.807E-4,  1.389E-4,  1.078E-4,  8.435E-5,
00216        C        79          80                 81 - 114
00216              X6.691E-5,  5.391E-5,           34*4.402E-5/
00216        C
00220               DATA (PRSLST(I),I=NPS3,NPS4)/
00220        C        115         116         117         118         119         120
00220              X3.060E2,   1.911E2,    3.109E1,    6.516E-1,   5.024E-1,   3.879E-1,
00220        C        121         122         123
00220              X8.318E-3,  6.190E-3,   2.381E-3/
00220        C
00220        C
00220        C           DENSITY VALUES   TABULATED IN KILOGRAMS PER CUBIC METER
00220        C
00222               DATA (RHOLST(I),I=NPS1,NPS2)/
00222        C        1           2           3           4           5           6
00222              X1.372E0,   1.325E0,    1.279E0,    1.235E0,    1.193E0,    1.158E0,
00222        C        7           8           9           10          11          12
00222              X1.123E0,   1.090E0,    1.058E0,    1.026E0,    9.955E-1,   9.656E-1,
00222        C        13          14          15          16          17          18
00222              X9.366E-1,  8.808E-1,   8.339E-1,   7.888E-1,   7.457E-1,   6.646E-1,
00222        C        19          20          21          22          23          24
00222              X5.904E-1,  5.226E-1,   4.539E-1,   3.879E-1,   3.315E-1,   2.834E-1,
00222        C        25          26          27          28          29          30
00222              X2.422E-1,  2.071E-1,   1.770E-1,   1.517E-1    1.300E-1,   1.113E-1,
00222        C        31          32          33          34          35          36
00222              X9.530E-2,  8.156E-2,   5.966E-2,   4.357E-2,   3.157E-2,   2.275E-2,
00222        C        37          38          39          40          41          42
00222              X1.645E-2,  1.193E-2,   8.676E-3,   6.264E-3,   4.551E-3,   3.330E-3,
00222        C        43          44          45          46          47          48
00222              X2.453E-3,  1.819E-3,   1.357E-3,   1.018E-3,   7.682E-4,   5.911E-4,
00222        C        49          50          51          52          53          54
00222              X4.564E-4,  3.559E-4,   2.774E-4,   2.150E-4,   1.651E-4,   1.266E-4,
00222        C        55          56          57          58          59          60
00222              X9.708E-5,  7.435E-5,   5.701E-5,   4.408E-5,   3.392E-5,   2.599E-5,
00222        C        61          62          63          64          65          66
00222              X1.981E-5,  1.503E-5,   1.134E-5,   8.516E-6,   6.357E-6,   4.717E-6,
00222        C        67          68          69          70          71          72
00222              X3.480E-6,  2.467E-6,   1.757E-6,   1.260E-6,   9.093E-7,   6.607E-7,
00222        C        73          74          75          76          77          78
00222              X4.805E-7,  3.479E-7,   2.550E-7,   1.891E-7,   1.417E-7,   1.047E-7,
00222        C        79          80                 81 - 114
00222              X7.890E-8,  5.950E-8,           34*4.567E-8/
00222        C
00224               DATA (RHOLST(I),I=NPS3,NPS4)/
00224        C        115         116         117         118         119         120
00224              X4.909E-1,  3.065E-1,   5.100E-2,   8.837E-4,   6.728E-4,   5.194E-4,
00224        C        121         122         123
00224              X1.307E-5,  9.835E-6,   4.055E-6/
00224        C
00224        C
00224        C           SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
00224        C
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00226          DATA (SONLST(I),I=NPS1,NPS2)/
00226     C        1          2          3          4          5          6
00226          X321.6,     321.9,     322.2,     322.5,     322.8,     322.3,
00226     C        7          8          9         10         11         12
00226          X321.8,     321.3,     320.8,     320.3,     319.8,     319.3,
00226     C       13         14         15         16         17         18
00226          X318.8,     317.7,     315.6,     313.4,     311.2,     308.8,
00226     C       19         20                          21 - 27
00226          X302.3,     297.7,                        7*295.4,
00226     C                                       28         29         30
00226          X                                  295.0,     294.6,     294.2,
00226     C       31         32         33         34         35         36
00226          X293.8,     293.4,     292.6,     291.7,     291.9,     293.3,
00226     C       37         38         39         40         41         42
00226          X294.7,     296.0,     297.4,     300.5,     303.8,     307.1,
00226     C       43         44         45         46         47         48
00226          X310.3,     313.5,     316.6,     319.7,     322.8,     323.3,
00226     C       49         50         51         52         53         54
00226          X323.3,     321.6,     319.3,     317.5,     316.9,     316.3,
00226     C       55         56         57         58         59         60
00226          X315.7,     315.0,     314.1,     311.3,     308.5,     305.7,
00226     C       61         62         63         64         65         66
00226          X302.8,     300.0,     297.1,     294.2,     291.2,     288.2,
00226     C       67         68         69         70         71         72
00226          X285.2,     287.8,     290.8,     293.7,     296.6,     299.5,
00226     C       73         74         75         76         77         78
00226          X303.2,     309.2,     315.0,     320.7,     325.4,     332.6,
00226     C       79         80                81 - 114
00226          X344.6,     356.1,              34*367.3/
00226     C
00230          DATA (SONLST(I),I=NPS3,NPS4)/
00230     C         115 - 116         117        118              119 - 120
00230          X      2*295.4,        292.1,     321.3,             2*323.3,
00230     C       121        122        123
00230          X298.5,     295.6,     286.7/
00230     C
00230     C
00230     C                       VISCOSITY COEFFICIENT
00230     C             VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
00230     C
00232          DATA (VISLST(I),I=NPS1,NPS2)/
00232     C        1          2          3          4          5          6
00232          X1.636E-5,  1.639E-5,  1.642E-5,  1.644E-5,  1.647E-5,  1.643E-5,
00232     C        7          8          9         10         11         12
00232          X1.639E-5,  1.634E-5,  1.630E-5,  1.626E-5,  1.622E-5,  1.618E-5,
00232     C       13         14         15         16         17         18
00232          X1.614E-5,  1.605E-5,  1.588E-5,  1.570E-5,  1.552E-5,  1.516E-5,
00232     C       19         20                         21 - 27
00232          X1.480E-5,  1.443E-5,                    7*1.424E-5,
00232     C                                       28         29         30
00232          X                                  1.421E-5,  1.418E-5,  1.415E-5,
00232     C       31         32         33         34         35         36
00232          X1.411E-5,  1.408E-5,  1.401E-5,  1.395E-5,  1.396E-5,  1.407E-5,
00232     C       37         38         39         40         41         42
00232          X1.418E-5,  1.429E-5,  1.440E-5,  1.466E-5,  1.492E-5,  1.519E-5,
00232     C       43         44         45         46         47         48
00232          X1.545E-5,  1.571E-5,  1.596E-5,  1.622E-5,  1.647E-5,  1.651E-5,
00232     C       49         50         51         52         53         54
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00232            X1.651E-5, 1.637E-5, 1.618E-5, 1.604E-5, 1.599E-5, 1.594E-5,
00232    C        55         56         57         58         59         60
00232            X1.599E-5, 1.583E-5, 1.575E-5, 1.553E-5, 1.530E-5, 1.507E-5,
00232    C        61         62         63         64         65         66
00232            X1.484E-5, 1.461E-5, 1.438E-5, 1.414E-5, 1.391E-5, 1.367E-5,
00232    C        67         68         69         70         71         72
00232            X1.343E-5, 1.363E-5, 1.387E-5, 1.411E-5, 1.434E-5, 1.458E-5,
00232    C        73         74         75         76         77         78
00232            X1.487E-5, 1.536E-5, 1.583E-5, 1.630E-5, 1.676E-5, 1.727E-5,
00232    C        79         80                   81 - 114
00232            X1.824E-5, 1.919E-5,             34*2.011E-5/
00232    C
00234             DATA (VISLST(I),I=NP53,NP54)/
00234    C          115 - 116         117        118           119 - 120
00234            X        2*1.424E-5,    1.398E-5, 1.634E-5,       2*1.651E-5,
00234    C        121        122        123
00234            X1.450E-5, 1.426E-5, 1.355E-5/
00234    C
00234    C
00234    C                  1963 PATRICK AFB REFERENCE ATMOSPHERE
00234    C
00234    C                PRESSURE VALUES TABULATED IN MILLIBARS
00234    C
00236             DATA (PRSLST(I),I=NP61,NP62)/
00236    C          1              2              3              4              5
00236            X1.0170147E+3,9.8829373E+2,9.6022651E+2,9.3280864E+2,9.0603418E+2,
00236    C          6              7              8              9              10
00236            X8.7989596E+2,8.5438573E+2,8.2949430E+2,8.0521168E+2,7.8152728E+2,
00236    C          11             12             13             14             15
00236            X7.5843002E+2,7.3590840E+2,7.1395065E+2,6.7167869E+2,6.3151745E+2,
00236    C          16             17             18             19             20
00236            X5.9337050E+2,5.5714348E+2,4.9008912E+2,4.2967959E+2,3.7532040E+2,
00236    C          21             22             23             24             25
00236            X3.2649869E+2,2.8277555E+2,2.4373144E+2,2.0909281E+2,1.7861068E+2,
00236    C          26             27             28             29             30
00236            X1.5199026E+2,1.2852856E+2,1.0911341E+2,9.2252642E+1,7.8097365E+1,
00236    C          31             32             33             34             35
00236            X6.6260092E+1,5.6315652E+1,4.0899191E+1,2.9918759E+1,2.2038159E+1,
00236    C          36             37             38             39             40
00236            X1.6327363E+1,1.2146273E+1,9.0905300E+0,6.8429914E+0,5.1807184E+0,
00236    C          41             42             43             44             45
00236            X3.9447995E+0,3.0209180E+0,2.3262411E+0,1.8004513E+0,1.3994781E+0,
00236    C          46             47             48             49             50
00236            X1.0910568E+0,8.5180215E-1,6.6393197E-1,5.1553130E-1,3.9852059E-1,
00236    C          51             52             53             54             55
00236            X3.0651143E-1,2.3442082E-1,1.7818466E-1,1.3454170E-1,1.0086976E-1,
00236    C          56             57             58             59             60
00236            X7.5059128E-2,5.5414297E-2,4.0576003E-2,2.9458748E-2,2.1200623E-2,
00236    C          61             62             63             64             65
00236            X1.5119831E-2,1.0684305E-2,7.4793850E-3,5.1878215E-3,3.5914714E-3,
00236    C          66             67             68             69             70
00236            X2.4869345E-3,1.7224435E-3,1.2003841E-3,8.4635721E-4,6.0330423E-4,
00236    C          71             72             73             74             75
00236            X4.3449711E-4,3.1597170E-4,2.3253935E-4,1.7351148E-4,1.3111039E-4,
00236    C          76             77             78             79             80
00236            X1.0022554E-4,7.7438980E-5,6.0696757E-5,4.8286073E-5,3.9145232E-5,
00236    C          81             82             83             84             85
00236            X3.2082435E-5,2.6597710E-5,2.2377934E-5,1.9141913E-5,1.6599345E-5,
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00236        C           86             87             88             89             90
00236         X1.4560872E-5,1.2898417E-5,1.1522650E-5,1.0369626E-5,9.3925204E-6,
00236        C           91             92             93             94             95
00236         X8.5563661E-6,7.8345911E-6,7.2066944E-6,6.6566336E-6,6.1717079E-6/
00236        C
00240         DATA (PRSLST(I),I=NP63,NP64)/
00240        C           96             97             98             99            100
00240         X5.7417393E-6,5.3584943E-6,5.0126367E-6,4.6986357E-6,4.4127423E-6,
00240        C          101            102            103            104            105
00240         X4.1517377E-6,3.9128496E-6,3.4886099E-6,3.1230234E-6,2.8059993E-6,
00240        C          106            107            108            109            110
00240         X2.5279174E-6,2.2829452E-6,2.0665225E-6,1.8747980E-6,1.7043719E-6,
00240        C          111            112            113            114
00240         X1.5518716E-6,1.4150844E-6,1.2921892E-6,1.2634456E-6,
00240        C          115            116            117            118            119
00240         X3.5024639E+2,2.2587459E+2,3.4949304E+1,9.6365027E-1,7.5234920E-1,
00240        C          120            121            122            123
00240         X5.8534791E-1,8.9499401E-3,6.2355810E-3,2.0696155E-3/
00240        C
00240        C
00240        C         DENSITY VALUES TABULATED IN KILOGRAMS PER CUBIC METER
00240        C
00242         DATA (RHOLST(I),I=NP61,NP62)/
00242        C            1              2              3              4              5
00242         X1.1835467E+0,1.1573534E+0,1.1312045E+0,1.1051789E+0,1.0793462E+0,
00242        C            6              7              8              9             10
00242         X1.0537666E+0,1.0284922E+0,1.0035670E+0,9.7902801E-1,9.5490568E-1,
00242        C           11             12             13             14             15
00242         X9.3122447E-1,9.0800345E-1,8.8525681E-1,8.4122243E-1,7.9915662E-1,
00242        C           16             17             18             19             20
00242         X7.5904647E-1,7.2084275E-1,6.4983435E-1,5.8535153E-1,5.2651817E-1,
00242        C           21             22             23             24             25
00242         X4.7249382E-1,4.2255460E-1,3.7638429E-1,3.3302120E-1,2.9232218E-1,
00242        C           26             27             28             29             30
00242         X2.5432637E-1,2.1920326E-1,1.8717685E-1,1.5845601E-1,1.3239218E-1,
00242        C           31             32             33             34             35
00242         X1.1096236E-1,9.3193799E-2,6.6193250E-2,4.7478898E-2,3.4382489E-2,
00242        C           36             37             38             39             40
00242         X2.5119029E-2,1.8334060E-2,1.3457797E-2,9.9301028E-3,7.3654170E-3,
00242        C           41             42             43             44             45
00242         X5.4934199E-3,4.1220200E-3,3.1134715E-3,2.3684559E-3,1.8151546E-3,
00242        C           46             47             48             49             50
00242         X1.4015768E-3,1.0965534E-3,8.6526723E-4,6.8253221E-4,5.3756684E-4,
00242        C           51             52             53             54             55
00242         X4.2227457E-4,3.3048920E-4,2.5745233E-4,1.9944483E-4,1.5352539E-4,
00242        C           56             57             58             59             60
00242         X1.1734236E-4,8.8997983E-5,6.6949356E-5,4.9935490E-5,3.6923403E-5,
00242        C           61             62             63             64             65
00242         X2.7067389E-5,1.9677466E-5,1.4194402E-5,1.0004256E-5,6.9258360E-6,
00242        C           66             67             68             69             70
00242         X4.7957760E-6,3.3215805E-6,2.2404228E-6,1.5304616E-6,1.0579997E-6,
00242        C           71             72             73             74             75
00242         X7.3962724E-7,5.2254595E-7,3.6173880E-7,2.6206711E-7,1.8979684E-7,
00242        C           76             77             78             79             80
00242         X1.3929915E-7,1.0349963E-7,7.5342182E-8,5.6065657E-8,4.2529020E-8,
00242        C           81             82             83             84             85
00242         X3.2809278E-8,2.5491890E-8,1.9457748E-8,1.5133149E-8,1.2030946E-8,
00242        C           86             87             88             89             90
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00242        X9.7426983E-9,8.0144089E-9,6.6029566E-9,5.639713      .6372426E-9,
00242   C        91          92          93          94          95
00242        X4.1362113E-9,3.5081306E-9,3.1356758E-9,2.7585267      .14047E-9/
00242   C
00244         DATA (HHOLST(I),I=NP63,NP64)/
00244   C        96          97          98          99          100
00244        X2.1726345E-9,1.9431903E-9,1.7627216E-9,1.6037353E-9,1.4631520E-9,
00244   C        101         102         103         104
00244        X1.3383898E-9,1.2273083E-9,1.0562018E-9,9.1375313E-10,
00244   C        105         106         107         108
00244        X7.9820295E-10, 7.0302521E-10, 6.2101602E-10, 5.5011615E-10,
00244   C        109         110         111         112
00244        X4.8362371E-10, 4.3637082E-10, 3.9157098E-10, 3.5195770E-10,
00244   C        113         114         115         116
00244        X3.1696683E-10, 3.0873182E-10, 4.9895351E-1, 3.5436502E-1,
00244   C        117         118         119         120
00244        X5.5991186E-2, 1.2347674E-3, 9.7403572E-4, 7.6857846E-4,
00244   C        121         122         123
00244        X1.6728017E-5, 1.2023770E-5, 3.9910710E-6/
00244   C
00244   C
00244   C          SPEED OF SOUND VALUES TABULATED IN METERS PER SECOND
00244   C
00246         DATA (SONLST(I),I=NP61,NP62)/
00246   C        1           2           3           4           5
00246        X3.4685752E2, 3.4577091E2, 3.4474100E2, 3.4375977E2, 3.4281972E2,
00246   C        6           7           8           9           10
00246        X3.4191375E2, 3.4103527E2, 3.4017814E2, 3.3933664E2, 3.3850555E2,
00246   C        11          12          13          14          15
00246        X3.3768001E2, 3.3685564E2, 3.3602846E2, 3.3435175E2, 3.3262585E2,
00246   C        16          17          18          19          20
00246        X3.3083264E2, 3.2891940E2, 3.2494679E2, 3.2057962E2, 3.1591021E2,
00246   C        21          22          23          24          25
00246        X3.1103836E2, 3.0609732E2, 3.0115374E2, 2.9659590E2, 2.9250004E2,
00246   C        26          27          28          29          30
00246        X2.8922838E2, 2.8690521E2, 2.8565248E2, 2.8552323E2, 2.8723862E2,
00246   C        31          32          33          34          35
00246        X2.8897076E2, 2.9075108E2, 2.9419972E2, 2.9721502E2, 2.9966127E2,
00246   C        36          37          38          39          40
00246        X3.0166194E2, 3.0454826E2, 3.0751834E2, 3.1060615E2, 3.1380529E2,
00246   C        41          42          43          44          45
00246        X3.1706789E2, 3.2031579E2, 3.2342147E2, 3.2622854E2, 3.2654145E2,
00246   C        46          47          48          49          50
00246        X3.3012557E2, 3.2977550E2, 3.2775595E2, 3.2518452E2, 3.2216108E2,
00246   C        51          52          53          54          55
00246        X3.1877907E2, 3.1512538E2, 3.1129960E2, 3.0731304E2, 3.0328736E2,
00246   C        56          57          58          59          60
00246        X2.9925283E2, 2.9524650E2, 2.9128985E2, 2.8738653E2, 2.8351977E2,
00246   C        61          62          63             64 - 67
00246        X2.7964961E2, 2.7570998E2, 2.7160535E2,      4*2.6944122E2,
00246   C                                68          69          70
00246        X                         2.7387919E2, 2.7824640E2, 2.8254611E2,
00246   C        71          72          73          74          75
00246        X2.8679136E2, 2.9095497E2, 2.9778102E2, 3.0445407E2, 3.1098395E2,
00246   C        76          77          78          79          80
00246        X3.1737952E2, 3.2364874E2, 3.3583625E2, 3.4759671E2, 3.5897208E2,
00246   C        81          82          83          84          85
00246        X3.6999789E2, 3.8070451E2, 4.0126162E2, 4.2081570E2, 4.3950065E2,
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00246  C          86             87             88             89             90
00246       X4.5742298E2, 4.7466910E2, 4.9131021E2, 5.0740585E2, 5.2300637E2,
00246  C          91             92             93             94             95
00246       X5.3815483E2, 5.5288841E2, 5.67  942E2, 5.8123 20E2, 5.9480377E2/
00246  C
00250        DATA (SONLST(I),I=NP63,NP64)/
00250  C          96             97             98             99             100
00250       X6.0826  0E2, 6.2133762E2, 6.3096486E2, 6.404  40E2, 6.4979159E2,
00250  C          101            102            103            104            105
00250       X6.5900328E2, 6.6 0  98E2, 6.8001215E2, 6.9173079E2, 7.0153775E2,
00250  C          106            107            108            109            110
00250       X7.0951229E2, 7.1739818E2, 7.2519835E2, 7.3291548E2, 7.3946609E2,
00250  C          111            112            113            114            115
00250       X7.4488092E2, 7.5025666E2  7.5559417E2, 7.5692267E2, 3.1349187E2,
00250  C          116            117            118            119            120
00250       X2.9579332E2, 2.9577557E2, 3.3054537E2, 3.2884119E2, 3.2653783E2,
00250  C          121            122            123
00250       X2.7368549E2, 2.6545229E2, 2.6944122E2/
00250  C
00250  C
00250  C                   VISCOSITY COEFFICIENT
00250  C         VALUES TABULATED IN KILOGRAMS PER METER PER SECOND
00250  C
00252        DATA (VISLST(I),I=NP61,NP62)/
00252  C          1              2              3              4              5
00252       X1.8302431E-5,1.8224157E-5,1.8149999E-5,1.8079299E-5,1.8011441E-5,
00252  C          6              7              8              9              10
00252       X1.7745850E-5,1.7881991E-5,1.7819367E-5,1.7757524E-5,1.7696042E-5,
00252  C          11             12             13             14             15
00252       X1.7634541E-5,1.7572676E-5,1.7510139E-5,1.7381977E-5,1.7248245E-5,
00252  C          16             17             18             19             20
00252       X1.7107621E-5,1.6959239E-5,1.6637791E 5,1.6284601E-5,1.5905319E-5,
00252  C          21             22             23             24             25
00252       X1.5509244E-5,1.5108096E-5,1.4707842E-5,1.4335282E-5,1.4008886E-5,
00252  C          26             27             28             29             30
00252       X1.3745403E-5,1.3553590E-5,1.3457958E-5,1.3447579E-5,1.3585386E-5,
00252  C          31             32             33             34             35
00252       X1.3724675E-5,1.3867977E-5,1.4145944E-5,1.4389370E-5,1.4587102E-5,
00252  C          36             37             38             39             40
00252       X1.4748972E-5,1.4982730E-5,1.5223539E-5,1.5474160E-5,1.5734080E-5,
00252  C          41             42             43             44             45
00252       X1.5999574E-5,1.6263778E-5,1.6516764E-5,1.6745577E-5,1.6934206E-5,
00252  C          46             47             48             49             50
00252       X1.7063446E-5,1.7034883E-5,1.6870136E-5,1.6660460E-5,1.6414072E-5,
00252  C          51             52             53             54             55
00252       X1.  38668E-5,1.5841407E-5,1.552885 E-5,1.5206885E-5,1.4860579E-5,
00252  C          56             57             58             59             60
00252       X1.4554073E-5,1.4230412E-5,1.3911371E-5,1.3597275E-5,1.3286809E-5,
00252  C          61             62             63                 64 - 67
00252       X1.2976813E-5,1.2662082E-5,1.2335131E-5,          4*1.216312E-5,
00252  C                                         68             69             70
00252       X                                  1.2516126E-5,1.2846614E-5,1.3208747E-5,
00252  C          71             72             73             74             75
00252       X1.3548638E-5,1.3884397E-5,1.4435101E-5,1.4975097E-5,1.5504842E-5,
00252  C          76             77             78             79             80
00252       X1.6024767E-5,1.6535285E-5,1.7529632E-5,1.8490755E-5,1.942 230E-5,
00252  C          81             82             83             84             85
00252       X2.0323355E-5,2.1199197E-5,2.2879253E-5,2.4474125E-5,2.5994216E-5,
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00252    1082*     C          86              87              88              89              90
00252    1083*          X2.7[illegible]981177E-5,2.8842997E-5,3.0184890E-5,3.1478926E-5,3.2729499E-5,
00252    1084*     C          91              92              93              94              95
00252    1085*          X3.3990900E-5,3.5114925E-5,3.625[illegible]E-5,3.7366033E-5,3.8447399E-5/
00252    1086*     C
00254    1087*           DATA (VISLST(I),I=NP63,NP64)/
00254    1088*     C          96              97              98              99              100
00254    1089*          X3.9502050E-5,4.0531768E-5,4.1283666E-5,4.2033057E-5,4.2765514E-5,
00254    1090*     C          101             102             103             104             105
00254    1091*          X4.3486565E-5,4.4196700E-5,4.5127[illegible]75E-5,4.6090465E-5,4.6803460E-5,
00254    1092*     C          106             107             108             109             110
00254    1093*          X4.7423143E-5,4.8335293E-5,4.8640170E-5,4.9238014E-5,4.9745032E-5,
00254    1094*     C          111             112             113             114             115
00254    1095*          X5.0163431E-5,5.0579335E-5,5.0991617E-5,5.1099193E-5,1.5708489E-5,
00254    1096*     C          116             117             118             119             120
00254    1097*          X1.4516921E-5,1.4273120E-5,1.7097701E-5,1.6958658E-5,1.6770388E-5,
00254    1098*                121             122             123
00254    1099*          X1.2500495E-5,1.2144052E-5,1.2163172E-5/
00254    1100*     C
00256    1101*           END

      END OF COMPILATION:        NO  DIAGNOSTICS.
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