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YAQUI User's Manual for Fireball Calculations

by

J. L. Norton

H. M. Ruppel

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los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87545

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ABSTRACT

Recent modifications and additions made to the YAQUI code are described. This code, which was written to simulate nuclear explosions in the atmosphere, has been improved to include the effects of turbulence. In addition, it now allows input data to be obtained by direct interpolation in the one-dimensional results of early time radiation codes. This new version also makes most of the input free-format (namelist) and is composed of modules for easier modification and isolation of computer system dependence.

1. DESCRIPTION OF CODE

The YAQUI code is a combination of two fluid-dynamical techniques, ALE and ICE. ALE is an acronym for Arbitrary-Lagrangian-Eulerian; using this method the finite difference mesh points can be moved with the fluid (Lagrangian), held stationary (Eulerian), or moved by some prescribed rezone algorithm (Arbitrary). ICE stands for Implicit Continuous-fluid Eulerian; because the hydrodynamic equations are solved implicitly, the technique can be used to solve for flow at all speeds. The analyses of these techniques were presented by Harlow and Amsden¹ and by Hirt et al.,² and an initial version of the code was described by Amsden and Hirt.³

This section will examine the differences between the initial version of the code and the modified version used to do the calculations in this report.

A. Initial Zoning

An initial YAQUI zoning setup is shown in Fig. 1. The initial grid is determined by the parameters DR, DZ, IBAR, JBAR, and YB. First, a uniform grid of IBAR zones in the r-direction and JBAR zones in the z-direction with the bottom at $z = YB$ is generated. The zones are all DR cm wide by DZ cm high. Then the parameters FREZXR, FREZYB, and FREZYT are examined.

If any one of them is larger than 1, it is assumed that a region of nonuniform zoning will surround the uniform region. The parameters that describe the nonuniform region are IUNF, JUNF, JCEN, and REZYO. IUNF is the number of zones starting at the left that are to remain uniform. To the right of this region, the zone widths are related by

$$DR(I+1) = DR(I) * FREZXR,$$

where I increases to the right. Likewise, JUNF is the number of zones in the z-direction that will remain uniform. Referring to Fig. 1, one can see that the region of uniform zoning will be centered on the line JCEN zones above the bottom of the grid with half the uniform zones above the top of the JCENth zone and half below. The heights of the zones above the region of uniform zoning will be related by the equation

$$DZ(J+1) = DZ(J) * FREZYT,$$

where J increases toward the top. The heights of the zones below the region of uniform zoning will be related by the equation

Fig. 1. Sample initial zoning setup.

$$DZ(J+1) = DZ(J) * FREZYB.$$

The top of the $JCEN^{\text{th}}$ zone is redefined to be at the point $z = REZYO$. Because $FREZYB$ will move the bottom of the mesh, it is necessary to recalculate YB based on $JUNF$, $JCEN$, $REZYO$, and $FREZYB$. In defining grids for problems with the ground at the bottom, care must be taken to calculate $FREZYB$ so that the bottom of the $J = 2$ zone coincides with $y = 0$.

The grid is surrounded on three sides by layers of fictitious cells, shown as dotted lines in Fig. 1. These allow a variety of boundary conditions to be applied. The bottom layer of fictitious cells causes the first row of real zones to be at $J = 2$ rather than at $J = 1$. This fact can be confusing if one is not aware of the convention. The grid lines are known as I and J lines; $I = 1$ is at the extreme left; $I = IBAR + 2$ is at the extreme right of the dummy column; $J = 1$ is at the bottom of the bottom fictitious cells; and $J = JBAR + 3$ is at the top of the top fictitious cells. The zone whose lower left corner is at the intersection of the lines I and J is known as zone (I, J) .

B. Fireball Initialization

The initial version of the code read in data that had been interpolated from one-dimensional spherical form to a two-dimensional grid with velocities centered at cell edges as in MAC. However, in YAQUI, velocities appear at vertices; therefore, a second interpolation was required. To avoid this unnecessary step and the resultant smoothing, the code was modified to permit inputting data in one-dimensional form. The data is then interpolated directly onto the YAQUI grid.

The interpolation technique is as follows. The 1D data is input one zone per card. Card i contains the radius of the outer boundary of zone i (r_i), the velocity of the outer boundary ($\dot{r}_i$), and the specific internal energy and density of the zone (e_i and ρ_i , respectively) in the format 4E15.0. Cards are read until a blank card or an end-of-file is encountered. The inner radius of the first zone is assumed to be zero ($r_0 = 0$) as is the velocity at the center ($\dot{r}_0 = 0$). The density and energy are cell-centered quantities. A sample 1D setup is shown in Fig. 2. The 1D data is superimposed on the 2D YAQUI grid as shown in Fig. 3.

To carry out the interpolation, one divides each spherical shell into subzones using both radial and angular segments. Consider a portion of a 1D zone as shown in Fig. 4. Of course, in practice

Fig. 2. Sample 1D fireball initial data configuration.

Fig. 3. Superposition of 1D fireball data on the 2D YAQUI grid.

θ_1 is 0° and θ_2 is 180° . θ_0 is determined from $180^\circ/\text{NTH}$, where NTH is an input quantity; Δr is determined from $\frac{r_i - r_{i-1}}{\text{NRAD}}$, where NRAD is also an input quantity. NTH and NRAD are held constant for all zones. The center of a subzone is defined as shown in Fig. 5. The interpolation procedure, then, is as follows. Consider a single subzone of a spherical shell. Find into which YAQUI zone the center of the subzone falls. Assign all the mass, momentum, and internal energy of the subzone to the YAQUI zone. One can estimate the accuracy of the procedure by accumulating the volumes of the subzones that are assigned to an individual YAQUI zone. When all of the subzones have been assigned, the volume of the YAQUI zone and the sum of the volumes of the subzones assigned to the YAQUI zone should be nearly the same except for those YAQUI zones only partially within the outermost spherical shell.

Fig. 4. Division of 1D fireball data into subzones for interpolation purposes.

Fig. 5. A typical 1D interpolation subzone.

To handle the latter, the sum of the subzone volumes is also used as a flag. If the volume error $[(\text{sum of subzone volumes} - \text{YAQUI zone volume}) / \text{YAQUI zone volume}]$ is greater than 1%, then the five nearest cells on the top, bottom, and right are examined to see if any are within the fireball. (See Fig. 6.) If the YAQUI zone falls only partially within the fireball, at least one of the five neighbors will not be within the fireball at all. If all of the five neighbors are fireball cells, then there is an internal volume inaccuracy and the interpolation must be made finer (Δr and $\Delta \theta$ must be decreased). If a nonfireball neighbor is found, then the specific internal energy and density of this neighbor are used to establish the mass and internal energy of the part of the YAQUI zone that is not within the fireball.

To understand this better, consider the example shown in Fig. 6. Let r_{max} be the outer radius of the last 1D zone. The horizontally crosshatched portion of zone (i,j) is within the fireball and the vertically crosshatched portion is outside of the fireball. The relative volume error will certainly be greater than 1%. Of the five neighbors shown, cell $(i+1,j-1)$ is completely outside of the fireball; its specific internal energy and density would be used to establish the internal energy and mass of the vertically crosshatched portion.

Once the internal energy, mass, and momentum components are established for all YAQUI zones that fall completely or partially within the fireball data, the specific internal energy is determined by dividing the zone internal energy by the zone

mass. The zone density is determined by dividing the zone mass by the zone volume. The velocities are vertex quantities and are determined as follows. The cells containing a particular vertex are examined to see if all are fireball cells, i.e., if the vertex lies within the fireball. If any are not, then the vertex velocity is set to zero. If all are fireball cells, then the vertex takes $\frac{1}{N}$ of the momentum of each neighbor (for central cells, $N = 4$; for boundary cells, $N = 2$).

C. Particle Setup

The particle setup has two options: a rectangular particle region and a circular particle region.

Rectangular Region

The lower left-hand corner of the particle region is at (XC,YC) and the upper right-hand corner is at (XD,YD) . The actual location of the particles is determined by superimposing a uniform grid of zones, which are DRPAR wide by DZPAR high starting at (XC,YC) and placing a particle at the center of each zone if the particle falls within the rectangular region. See Fig. 7.

Circular Region

A circular particle region is more useful for fireball problems. This option is initiated by setting $YD = 0$. The circular region's center is at $(0,YC)$, its radius is XD (XC is not used). Particles are placed as in the rectangular region except that the uniform grid starts at $(0,YC-XD)$ and only particles that fall within the circle are used.

Fig. 6. Technique for handling YAQUI zones only partially within the fireball.

Fig. 7. Particle generation scheme.

D. Particle Movement

Calculating with nonrectangular cells poses some additional problems in the movement of marker particles. The approach used in the initial version of YAOI was to define a grid of particle cells with constant Δx and Δy to overlay the calculational mesh. Masses and momenta were obtained by linear interpolation in the values assigned to the calculational grid for each vertex of the particle grid. The final step was to interpolate in these particle grid values to find the particle velocity with which it was to be moved. In addition to requiring two interpolations each cycle, this method tends to break down when a disparity exists between the size of calculation and particle cells. If the variable resolution causes large cells in one region of space and small cells in another, accuracy will be severely restricted. For such a situation there may be many fluid cells for one particle cell, or vice-versa. The former will cause smoothing of the velocity field as applied to the particles, the latter, to an uncertain determination.

To take advantage of the greater resolution that variable cells allow, we dispensed with the concept of an overlay grid, and interpolated directly in the fluid field. For this approach, two points must be considered: you must know in which cell a marker particle lies, and you must implement a reasonable scheme for interpolation in a skewed mesh. Consider first the method of searching for the values with which to do the interpolation. This is done by drawing vectors in succession from the particle to each of the vertices of a calculational cell. If these proceed in order and the angles between successive vectors are less than π for each of the four vectors, the particle lies within the cell. This may be seen more clearly in Fig. 8. In Fig. 8(a) the particle lies inside the cell. In Fig. 8(b), taking the vectors in order, the vector to vertex 4 lies between the vectors to vertices 2 and 3, and hence the particle lies outside the cell. In Fig. 8(c) the angle between the vectors to vertices 4 and 3 is greater than π , and the particle lies outside the cell.

Fig. 8. Determination of particle positions.

The numbering of vertices is arbitrary and may be clockwise or counter-clockwise, but must be conservative. The rationale for this seemingly complicated criterion is that it avoids precise knowledge of any angles and hence requires no reference to trigonometric subroutines. Improved methods for which this is also true have since been found, one of which we will mention later. However, in the current version of the code, the above approach is used. To increase efficiency a one-dimensional array holds the number of the cell containing a particle at the beginning of a calculational cycle.

If a particle is no longer in the cell in which it began the cycle, an efficient search is undertaken to find the new location. For skewed cells, the particle can move more than one cell away, and hence determining an optimum trajectory along which to search is useful. This minimizes

the number of tests that must be made.

Two criteria are imposed in selecting the interpolation scheme once the appropriate cell has been identified:

1. The interpolated velocity must be bounded by the vertex values — that is, its value must lie between the smallest and largest of the four velocities.
2. The interpolated values must be continuous across cell boundaries.

An efficient method is to map the (x, y) space to the logical (τ, η) space by the transformation

$$\vec{x} = (1-\tau)(1-\eta)\vec{x}_1 + (1-\tau)\eta\vec{x}_2 + \tau\eta\vec{x}_3 + (1-\tau)(1-\eta)\vec{x}_4. \quad (1)$$

The vectors $\vec{x}_1, \dots, \vec{x}_4$ are drawn from any convenient origin to the vertices of the cell. The vector $\vec{x}$ points to the position for which interpolated velocities are desired. From the knowledge of the coordinates $\vec{x}_1, \dots, \vec{x}_4$, and $\vec{x}$, we can invert Eq. (1) to obtain the values of τ and η corresponding to the point (x, y) . In the (τ, η) space we then do a bilinear interpolation, using for any scalar the form

$$s(\tau, \eta) = (1-\tau)(1-\eta)s_1 + (1-\tau)\eta s_2 + \tau\eta s_3 + (1-\tau)(1-\eta)s_4. \quad (2)$$

We search for the new location of a particle by drawing a line from the center of the cell in which the particle began the cycle to its present location. This defines a trajectory that may pass through several cells and along which we perform our test for particle in cell. Although this is somewhat cumbersome, it requires testing very few cells, usually just one or two. An improved approach used by Pracht⁴ eliminates the separate testing and automatically defines the direction of search. If the particle lies in the cell in question, the values of τ and η obtained from Eq. (1) will both lie between 0 and 1. If either does not, the cell indicated by the values of τ and η is examined. For example, if $\tau = 1.2$, increase τ by one and recalculate τ and η . This approach is neater and more efficient. In future versions of the particle transport, we plan to incorporate such a scheme into YAQUI.

An additional component of particle displacement is required when the effects of turbulence are being calculated. This is described in the next section.

E. Turbulence

A significant new feature in the present version of YAQUI is the addition of a one equation transport model for turbulence. The modified equations, which we now solve are

$$\text{the mass equation} \quad \frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{u}) = \nabla \cdot (\rho \vec{v}), \quad (3)$$

the momentum equation

$$\frac{\partial \rho \vec{u}}{\partial t} + \nabla \cdot (\rho \vec{u} \vec{u}) = \nabla \cdot (\rho \vec{u} \vec{u}) + \nabla \cdot (\rho \vec{v} \vec{v}) + \rho \vec{g}, \quad (4)$$

the internal energy equation

$$\frac{\partial \rho E}{\partial t} = -p \nabla \cdot \vec{u} + \frac{\partial \rho q}{\partial t} + \nabla \cdot (\rho \vec{v} E), \quad (5)$$

and the turbulence energy equation

$$\begin{aligned} \frac{\partial \rho k}{\partial t} = & - \nabla \cdot (\rho \vec{u} k) + p \nabla \cdot \vec{u} + \left(\frac{2}{3} \rho \vec{u} \cdot \vec{u} \otimes \frac{\partial \vec{u}}{\partial x} \right) \cdot \vec{q} \\ & - \frac{2}{3} \rho \vec{u} \cdot \vec{u} (\nabla \cdot \vec{u})^2 + \rho \nabla \cdot (\vec{v} k). \end{aligned} \quad (6)$$

The turbulence viscosity is given by

$$\nu = \rho s^2 q. \quad (7)$$

For conciseness we have used the following definitions:

$$\begin{aligned} \vec{v}_{ij} = & (\vec{u} \cdot \vec{v}) e_{ij} + v_{ij} + v_{ij} \left[\left(\frac{-2}{3} \vec{u} \cdot \vec{u} \right) \frac{u_k}{x_k} \right. \\ & \left. + \left(p + \frac{2}{3} \rho \vec{u} \cdot \vec{u} \right) \right], \end{aligned} \quad (8)$$

$$v_{ij} = u_i \frac{\partial v_j}{\partial x_i} + u_j \frac{\partial v_i}{\partial x_j}, \quad (9)$$

$$\vec{v} = e_{ij} \frac{\partial u_i}{\partial x_j}, \quad \text{and} \quad (10)$$

$$e_{ij} = \frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}. \quad (11)$$

The parameters of the model are β and the scale, s . Values are obtained phenomenologically from fits to experiment. For β we use the constant, $\beta = 0.02$. For the scale, constant values over the mesh and the more complicated phenomenological form

$$s = 0.14 d(z) \left(2 - \frac{v(r,z)}{v(0,z)} \right) \quad v(r,z) \neq 0 \quad (12a)$$

$$s = 0.28 d(z) \quad v(r,z) = 0 \quad (12b)$$

have been used. The function $d(z)$ is the radial distance to the point at which the velocity changes sign, and $v(0,z)$ is the axial component of the velocity on the axis, $r = 0$. In a skewed mesh Eq. (12) requires considerable logic and interpolation. Because s is only crudely known, we generally approximate the above form by

$$s = 0.14d \left(2 - \frac{v(r,z)}{v(0,z)_{\max}} \right) ; \quad (13)$$

In this simplified relation, d is a constant, usually taken to be 1, and $v(0,z)_{\max}$ is the maximum value of v along the axis. This expression may overestimate the scale for fireballs and cut down on the rate of decay of the turbulence energy. Erring in this direction gives us an upper bound on the effect of the turbulence. In the latest version of the code, we simply incorporate a constant scale throughout the mesh, though provision exists in the code for a more general treatment.

In differencing the turbulence additions, we can take advantage of much of the existing framework of the basic YAQUI program. Because small time-level inconsistencies in the turbulence equations are insignificant, economy is a major criterion in establishing the order in which the several additions are included. For example, looking at the structure of the modified stress tensor, we are led to replace $\bar{u} \rightarrow \bar{u} + \rho \bar{u}$, $\bar{v} \rightarrow \bar{v} + \frac{2}{3} \rho \bar{v}$ and $\bar{p} \rightarrow \bar{p} + \frac{2}{3} \rho q$. Similarly H_{ij} is calculated from $\bar{p}$ and $\bar{u}$ at the old time level; this allows the stress tensor to be handled explicitly in Phase I simplifying the addition.

The term $\frac{\partial}{\partial t} \rho \bar{u}_i$ in the momentum equation is modeled,

using the flux approximation, as $-\frac{\partial}{\partial t} \sigma \frac{\partial \bar{u}_i}{\partial x_i}$; this

requires saving the two components of $\sigma \frac{\partial \bar{u}_i}{\partial x_i}$ for each cell from the previous time step. Clearly such an approach centers the time derivative about $t - \frac{\delta t}{2}$ and not at the same time level as H_{ij} . For reasonable time variations, the inconsistency should not be important.

Three more diffusion terms must be differenced: one in the mass equation, one in the internal energy equation, and one in the turbulence energy equation. Each of these is added explicitly in Phase I with derivatives from time level n .

The transport equation for the turbulence energy q is mainly handled explicitly. However we can include some advanced time information by writing Eq. (6) in the form

$$(c, q)^{n+1} \left[1 + \frac{2}{3} \bar{u} \cdot \bar{u} + \frac{2\bar{v}}{3s} \right] = (c, q)^n - \sigma \tau \left[\frac{\bar{v} \cdot \nabla p}{\bar{v}} - \bar{c} \right. \\ \left. + \frac{2}{3} (\bar{u} \cdot \bar{u})^2 \right] + (\bar{c} \cdot \nabla \tau q)^n. \quad (14)$$

In cylindrical geometry τ takes the form

$$\tau = 2 \left[\left(\frac{\partial u}{\partial r} \right)^2 + \left(\frac{\partial v}{\partial z} \right)^2 + \frac{1}{2} \left(\frac{\partial u}{\partial z} + \frac{\partial v}{\partial r} \right)^2 + \left(\frac{u}{r} \right)^2 \right]. \quad (15)$$

All the terms on the right-hand side of Eq. (14) are evaluated at time level n as cell-centered quantities. For most of the terms this proceeds naturally; but for the buoyancy creation, $\frac{\sigma}{\bar{v}} \nabla \bar{c} \cdot \nabla p$, a small reach is necessary. In the notation of Fig. 9 we could evaluate the derivatives directly at the

Fig. 9. Quantities involved in YAQUI derivative evaluation.

vertices 1-4 and then average to obtain $(\nabla \rho \cdot \nabla p)_o$. This uses information at nine cells and is unnecessarily smoothing. For this reason we use cells a, b, c, and d and obtain the derivatives at the center of cell o in terms of these. For example,

$$\frac{\partial \rho}{\partial r} = \frac{1}{2A} \left\{ (\rho_a - \rho_c) (z_b - z_d) + (\rho_b - \rho_d) (z_c - z_a) \right\}, \quad (16)$$

where A is the area of the quadrilateral abcd. We are particularly concerned about smoothing out derivatives because the sensitivity of the turbulence energy and the level of turbulence that can be supported depend on the size of gradients of various quantities. Derivatives of vertex quantities are calculated at cell centers by the equations

$$\frac{\partial u}{\partial r} = \frac{1}{2A} \left\{ (z_2 - z_4) (u_1 - u_3) + (z_3 - z_1) (u_2 - u_4) \right\} \quad (17a)$$

and

$$\frac{\partial u}{\partial z} = \frac{1}{2A} \left\{ (r_2 - r_4) (u_j - u_1) + (r_1 - r_3) (u_2 - u_4) \right\}, \quad (17b)$$

where A is the area of the cell.

If we expand the derivatives about the center of the cell, we find that the error is proportional to second and higher derivatives. In a similar fashion we can obtain derivatives of cell-centered quantities at cell centers (as discussed above) by appropriate choice of configurations. The necessity to optimize the calculation of gradients implies that high-resolution calculations are important in evaluating turbulence models.

Similar problems arise for the Laplacian or diffusion-like terms. Again, several approaches are possible and in this case optimization is much less crucial, because the level of turbulence is only indirectly affected. The criteria applied to select an approach for differencing such terms were: that an equation of the form

$$\frac{\partial c}{\partial t} + \vec{u} \cdot \nabla c = \nabla \cdot \sigma \nabla c$$

could not lead to negative c anywhere in the mesh, and that the difference form of $\nabla \cdot \sigma \nabla c$ should reduce to the expected form for the case of a uniform rectangular mesh. For example, if c represents the concentration of a chemical species,

$$\frac{1}{V_o} \sum_{j=1}^4 \frac{c_j - c_o}{\frac{1}{2}(A_j + A_o)} d_{jo}^2 \langle r_{jo} \rangle < \sigma_{jo} \rangle = (\nabla \sigma \nabla c)_o, \quad (18)$$

where c_j is the concentration in cell j, d_{jo} is the length of the cell side between cells o and j, $\langle r_{jo} \rangle$ is the distance between the centers of cells o and j, A_j is the area of cell j, V_o is the volume of cell o,

and $\langle \sigma_{jo} \rangle$ is $\frac{\sigma_o + \sigma_j}{2}$. See Fig. 10 for examples. In Cartesian coordinates for a uniform rectangular mesh with sides δx , δy , and constant σ , this reduces to

$$\sigma \left(\frac{c_1 + c_3 - 2c_o}{\delta x^2} + \frac{c_2 + c_4 - 2c_o}{\delta y^2} \right) \quad (19)$$

as we would wish. The vertices of this quadrilateral are at the center of their respective cells.

In the finite difference approach with finite time steps it is possible for the turbulence energy to become negative in certain cells. If, for example, $\delta t \frac{\sigma}{\rho} \nabla \rho \cdot \nabla p$ is positive and greater than ρq in a given cell, more energy will be subtracted from the cell than it contains. One could reduce the time step, but this would never really solve the problem. The assumption we make is that since, numerically, turbulence can go negative in regions in which it is decaying, if $q < 0$, we set q to zero. Experience has shown for the fireball calculations that less than 1% of the turbulence energy is lost by this procedure.

Fig. 10. Definition of quantities used in differencing of turbulence part of the concentration equation.

As far as convection is concerned, the quantity ρq is convected and, because the difference equations for the convection conserve the convected quantity identically, the turbulence energy is conserved in Phase III. The total energy, however, is not. In the initial code version³ an equation for the total energy is written, and this is the quantity that is convected. Momentum is also convected, and hence conserved; the internal energy is obtained by subtracting the kinetic energy from the total energy. This places all the uncertainty in the internal energy, which if it is a small part of the total energy, can lead to large fractional errors in the internal energy.

With the introduction of the equation for turbulence energy, it has seemed convenient to deal directly with the internal energy. In the code the equation for the internal energy follows the pressure iteration, allowing us to calculate the $p dV$ work with a time-advanced pressure. The quantities that are convected in Phase III, then, are the internal energy, the turbulence energy, and the momentum, which are individually conserved. In general, this means that the kinetic energy and, thus, the total energy, $E = \rho I + \rho u^2 + \rho q$, will not be conserved. This lack of energy conservation does not seem to be significant and is ignored in actual calculations.

A small change has been made in the energy equation related to the smoothing of the velocity field for computational stability. If alternate mesh vertices are not coupled in some way (see Ref. 3), an instability arises. The approach we elect is to couple the alternate nodes only when a local minimum or maximum in the velocity field occurs. We apply a restoring acceleration to vertex 4 of the form

$$\frac{1}{a_{nc}} \frac{1}{\delta t} \left[\frac{1}{4} \left(\vec{u}_1 + \vec{u}_3 + \vec{u}_6 + \vec{u}_8 \right) - \vec{u}_4 \right] \quad (20)$$

(See Fig. 2 of Ref. 3).

In Ref. 3 this is applied to each vertex each cycle to control the instability. In our version we apply the restoring force only to those components of $\vec{u}$ at vertex 4 that have values larger than or smaller than any of the neighbors (1,3,6, and 8). That is, a local maximum or minimum in the r -

component of $\vec{u}$ is smoothed by a restoring acceleration in the r -direction and similarly for the z -component. This is less diffusive than the approach that applies it everywhere each cycle. The intent is that when no instability threatens, this will not smooth gradients.

This node coupler clearly reduces the kinetic energy of the system, acting like a viscous dissipation. If this loss is ignored, it will lend to a gradual diminishing of the system's energy. On the other hand, to include the energy in the internal energy equation as viscous heating really has no basis in physical reality. However, in our version, we choose the latter option and include the energy removed by the node coupler in the equation for the internal energy. In the original version of the code the other choice was made.

One can see by examining the model equations for turbulence that no mechanism has been built in to initiate the turbulence spontaneously. That is if there is no turbulence present, i.e. $q=0$, none can be created or can grow. For this reason, the turbulence must be seeded initially and allowed to equilibrate with the mean flow through the creation and decay terms in the equation for the turbulence energy. Several alternative seedings have been tried and found to lead to the same turbulent configurations after a fairly short time. A very reasonable approach is to seed the turbulence proportional to the vorticity of the mean flow field. This is done after the field has been established, that is, shortly before torus formation time. This timing is not crucial. It can be seeded earlier and find its way to a similar level and distribution in a short time. We miss any high-intensity early time turbulence, likely initiated by Taylor instabilities as the device case and the very hot debris decelerate. We assume that the fluctuations decay in a few seconds because nothing appears to be present to support them. The equilibrium turbulence we calculate really only has meaning at later times.

Because the measured properties of the fireball, rate of rise and radial expansion, depend on the positions of the marker particles, it was felt that their motion should be coupled directly into the turbulence. This is done by adding a random turbulent diffusion velocity to the particle motion by

the following technique.

The diffusion of mass as a function of time from a point source of unit mass at position $\vec{r}_0$ is described by the diffusion equation

$$\frac{\partial \rho}{\partial t} = \lambda \nabla^2 \rho + \delta(\vec{r} - \vec{r}_0), \quad (21)$$

where ρ is the density and λ is a constant diffusion coefficient. Define the quantities $\delta\vec{r} = \vec{r} - \vec{r}_0$, $\delta x = x - x_0$, $\delta y = y - y_0$, and $\delta z = z - z_0$. If $\rho(\delta\vec{r}, t)$ is written as $\rho(\delta\vec{r}, t) = X(\delta x, t) Y(\delta y, t) Z(\delta z, t)$, it can be shown that

$$X(\delta x, t) = \frac{1}{\sqrt{4\pi\lambda t}} e^{-(\delta x)^2/4\lambda t}, \quad (22)$$

with similar expressions for Y and Z .

In calculating the additional particle motion due to turbulence, consider the particle at time $t_0 = 0$ to be a massless point at $\vec{r}_0$ and use Eq. (22) as a probability distribution function for determining the position of the particle at time $t = t_0 + \delta t$. The turbulence viscosity then serves as the diffusion coefficient λ . In cylindrical coordinates one should solve Eq. (21) in a cylindrical basis

$$\rho(\delta\vec{r}) = R(\delta r) Z(\delta z).$$

However, R cannot be determined in closed form and for small δt and δx , with $\delta x > \frac{\lambda \delta t}{x_0}$, R reduces to the form of X in Eq. (22). Thus, Eq. (22) can be used with confidence in cylindrical geometry as long as it is applied in its region of validity. Furthermore, δx must be small compared with a cell dimension so that the turbulence viscosity being used as the diffusion coefficient remains constant in the region and during the time considered.

The general Gaussian (normal) distribution is

$$f(y) = \frac{1}{\sqrt{2\pi}\sigma} e^{-y^2/2\sigma^2}, \quad (23)$$

where σ is the standard deviation. Equation (22) can be put in this form by setting

$$\sigma = \sqrt{2\lambda\delta t} \quad \text{and} \quad (24)$$

$$y = \delta x, \quad (24a)$$

where we have replaced t by δt .

The standard probability distribution function (random number generator) available on most computers is the uniform distribution $p(x)$,

$$p(x) = 1, \quad 0 \leq x \leq 1 \\ = 0, \quad \text{elsewhere.} \quad (25)$$

What we need is the distribution given by Eq. (23) with σ given by Eq. (24). To accomplish this Eq. (25) is mapped on to Eq. (23) (see Fig. 11) with the expression

$$p(x) dx = 2 f(y) dy, \quad (26)$$

because the probability of finding x in dx is equal to the sum of the probabilities of finding both y and $-y$ in their respective dy 's. Therefore,

Fig. 11. (a) Uniform distribution, (b) Gaussian distribution.

$$\int_0^x f(x') dx' = 2 \int_0^y f(y') dy' ,$$

$$\text{or } \int_0^x dx' = \frac{2}{\sqrt{2\pi}\sigma} \int_0^y e^{-y'^2/2\sigma^2} dy' .$$

With the variable transformation $z' = \frac{y'}{\sigma\sqrt{2}}$,

$$x = \frac{2}{\sqrt{\pi}} \int_0^{y/\sigma\sqrt{2}} e^{-z'^2} dz' .$$

By definition, the standard error function is

$$\text{erf}(t) \equiv \frac{2}{\sqrt{\pi}} \int_0^t e^{-t'^2} dt' ;$$

therefore,

$$x = \text{erf}\left(\frac{y}{\sigma\sqrt{2}}\right) , \quad (27)$$

and from Eq. (24),

$$y = \sqrt{4\lambda\sigma t} \text{erf}^{-1}(x) . \quad (28)$$

The above is the mapping from Eq. (25) to Eq. (23) that is desired.

In principle, then, one determines a random number using Eq. (25) and maps it onto Eq. (23) using Eq. (28). One can see that the y in Eq. (28) is the required particle displacement due to turbulent diffusion if he remembers that the diffusion coefficient λ in Eq. (21) is replaced by the local turbulence viscosity.

One problem remains, namely, making the procedure efficient enough computationally so that one can afford to use it. The major difficulty is the calculation of inverse error functions. To do this without undue cost the following interpolation procedure was established.

The error function is monotonic increasing on the interval $[0,1]$; $\text{erf}(0) = 0$; and $|\text{erf}(y)|$ approaches 1 asymptotically (see Fig. 12). Care must be taken in using $\text{erf}^{-1}(x)$ for $x \sim 1$, for in this region $\text{erf}^{-1}(x)$ is very large which could lead to an abnormally large particle displacement. To

Fig. 12. Standard error function.

handle this, one selects a number WMAXEF and distributes NERFV points equally spaced on the interval $[0, WMAXEF]$ with point 1 located at 0 and point NERFV at WMAXEF. Thus, the equal spacing DX will be

$$DX = \frac{WMAXEF}{NERFV-1} , \quad (29)$$

and the position of point i , denoted by x_i , will be

$$x_i = (i-1)DX . \quad (30)$$

Now, let $R(i) \equiv \text{erf}(x_i)$. Then,

$$x_i = \text{erf}^{-1}(R(i)) \quad (31)$$

(see Fig. 12). Our problem is to find $\text{erf}^{-1}(t) \equiv z$ given an arbitrary t . To do this, we see that $t = \text{erf}(z)$. Find an i such that

$$R(i-1) < t \leq R(i) \quad \text{or} \quad \text{erf}(x_{i-1}) < t \leq \text{erf}(x_i) .$$

Therefore, $x_{i-1} < \text{erf}^{-1}(t) \leq x_i$. One linearly interpolates to get

$$\text{erf}^{-1}(t) \cong x_{i-1} + \frac{(t-R(i-1))}{(R(i) - R(i-1))} (x_i - x_{i-1}) ,$$

or

$$\text{erf}^{-1}(t) \cong \left[(i-2) + \frac{(t-R(i-1))}{(R(i) - R(i-1))} \right] DX \quad (32)$$

using Eq. (30). One selects another random

number t if $t > R(\text{NERFV})$. Because $R(1) = 0$ and $R(\text{NERFV}) = \text{WMAXEF}$ using Eq. (26), y is limited to the range

$$0 \leq y \leq \text{WMAXEF} * \sqrt{4\lambda\lambda t} = \text{WMAXEF} * \sqrt{2}.$$

Thus, y is limited to $\text{WMAXEF} * \sqrt{2}$ standard deviations.

Because Eq. (22) is invalid near the axis of symmetry, another cutoff parameter RMINEF has been added. If the r -coordinate of the particle is $\leq \text{RMINEF}$, the turbulent diffusion effect is not applied. In most cases, RMINEF can be considerably less than the Δr 's of the zones on the axis.

The current version of the code can be run easily with turbulence by-passed because the turbulence must be seeded initially. Most of the coding related to turbulence is excluded and no efficiency is lost if this version is used for turbulence-free calculations.

For a discussion of the output relevant to turbulence, see the sample calculation in Sec. III.

F. REZONE TECHNIQUES

The convection phase is appended to a Lagrangian calculation in a way that provides maximum flexibility for the continuous rezone. This is achieved by including the convective fluxes as functions of difference velocities,

$$\vec{u}_d = \vec{u}_{\text{fluid}} - \vec{u}_g,$$

where $\vec{u}_g$ is the grid velocity with which the mesh is moved in a given calculation cycle. For an Eulerian calculation $\vec{u}_g = 0$; for a Lagrangian calculation $\vec{u}_g = \vec{u}_{\text{fluid}}$, the difference velocity vanishes, and there is no fluxing. In general the prescription to determine $\vec{u}_g$ is at the discretion of the user. A general form that we have found useful and incorporated in the present version of the code is to write

$$\vec{u}_g = \vec{u}_{\text{fluid}} + \frac{f}{\delta t} (\langle \vec{x} \rangle - \vec{x})$$

for each vertex. That is, the grid velocity is composed of two components: the fluid velocity and a term to relax the mesh such that each vertex is at the average position of its nearest neighbors.

The latter term prevents the mesh from distorting excessively. A typical value for f might be 0.05, which would relax the mesh in approximately 20 calculational cycles if there were no fluid motion. Many variations of the relaxation component are possible. The important point is to run as near to Lagrangian as possible to minimize the smoothing, but still to maintain some degree of regularity in the mesh.

G. MIXED EQUATION OF STATE

To model more accurately the atmospheric detonation of a Mylar balloon filled with methane, it was necessary to incorporate two equations of state in one problem, one for the combustion products and one for ambient air. The method was to divide the cells into two groups at $t = 0$, those inside the fireball and those outside. This division was done on the basis of the specific internal energy (e): those cells with $e \geq 10^{10}$ erg/g were considered inside the fireball and all others, outside.

Define the concentration c_i as the ratio of the mass of constituent i in a given cell to the total mass of the cell. Obviously, if there are n constituents, $\sum_i c_i = 1$ in a given cell. For a problem like ours with only two constituents (exploded methane and ambient air), $c_{\text{meth}} + c_{\text{air}} = 1$ so that one only needs to keep track of c_{meth} . Here we use c_{meth} to refer to the concentration of combustion products and y_{meth} to refer to the effective γ for the combustion products.

Initially, c_{meth} is defined to be 1 in all fireball zones and 0 elsewhere. As the problem proceeds, the concentration is convected into the ambient region using

$$\frac{\partial c_i}{\partial t} + \vec{u} \cdot \nabla c_i = 0.$$

Note that this is just the Lagrangian form of the continuity equation.

To determine the effective γ in a given zone, we write

$$\gamma_{\text{eff}} = c_{\text{meth}} \gamma_{\text{meth}} + (1 - c_{\text{meth}}) \gamma_{\text{air}}.$$

The pressure is then obtained from

$$p = (c_{\text{eff}} - 1) \cdot c$$

II. SYSTEM IMPROVEMENTS

Because YAQUI is a rather large computer code, because many modifications have been made to it in the course of investigating various techniques, and because the Los Alamos Scientific Laboratory began the switch from batch to time-shared computing in the course of this research, considerable effort went into making YAQUI a convenient and flexible research tool. The various efforts involved are summarized below.

1. The original code was written in large blocks, which made it difficult to modify and also severely taxed the compilers and loaders. Thus, the code was divided into numerous smaller subroutines to avoid these problems. The concept of modularity was followed as closely as possible.
2. Because of rapidity shifting operating systems at LASL, it was important to make the code as system-independent as possible so that it could be easily switched from old to new systems. The code will now run on any of the three systems available at LASL, in either batch or time-sharing mode. It could be brought up on any other system with minimal difficulty, assuming sufficient small- and large-core storage were available.
3. Fixed format input is prone to error, whereas NAMELIST input tends to be system dependent. Thus, a NAMELIST input package was written that is system-independent for the most part, and can be easily modified for other systems.
4. Error checking within the code is meticulous. The code never assumes anything on the part of the user but monitors for errors, particularly in the setup phase, as though the user were completely unfamiliar with the code.
5. Because YAQUI runs often take several hours of CDC-7600 time, a problem may have to be run in several smaller pieces. For this reason, a flexible restart procedure was developed to allow the user to restart a problem at any point and change input parameters without having to actually modify the code itself.

6. The original YAQUI was very well documented externally in LASL report LA-5100.³ However, a code that is under heavy development is much easier to modify if it is carefully annotated internally. Work has been proceeding on this and is largely completed.

III. DESCRIPTION OF INPUT

The input to the code, except for the problem title and the ID fireball initialization data, is in NAMELIST form. The basic rules are:

- * Each input record begins with a \$ in card column (cc) 2 followed immediately by the namelist name.

- * Input values are of the form

NAME = NUMBER,

where blanks may not occur within NAME or an individual number but are ignored elsewhere. NUMBER may be a single constant or a series of comma-delimited constants. Multipliers of the form N*NUMBER are allowed but not grouping with parentheses (e.g., N*(N1, N2, N3) is illegal).

- * Continuation cards are legal. NAMELIST variable names and constants may not be split across card boundaries but hollerith fields may if they end in cc80 of one card and begin again in ccl of the next card.

- * An input record is terminated by a \$ anywhere on the card except for ccl and 2.

- * Variables are stored without regard to type. If one has I = 5., I will contain a floating point 5. rather than an integer 5; likewise X = 2 will cause an integer 2 to be stored in X which will most likely be interpreted as a floating point 0.

- * If a "P" is punched in ccl of the first card of a namelist record, the entire record will be printed as part of the code output.

For most information about the namelist conventions, see the internal documentation at the beginning of the routine NAMELIST in the listing of the code in Sec. V.

From here on, each input record will be described, the namelist name given, and the variable names listed and discussed.

Record 1: Namelist name = START

Namelist variables

NAME	TYPE (units)	Possible values	Default
RESTART	LOGICAL	.TRUE., .FALSE.	.TRUE.
FILM	LOGICAL	.TRUE., .FALSE.	.TRUE.
PAPER	LOGICAL	.TRUE., .FALSE.	.FALSE.
WRAPUP	REAL (s)	0.<WRAPUP<∞	20.0

(a) RESTART = .TRUE. is the run will be a pickup from a previous dump tape. Otherwise it is an initial setup.

(b) FILM = .TRUE. if all output will go to film.

(c) PAPER = .TRUE. if all output with the exception of plots will go to paper.

(d) WRAPUP = time to allow for the last cycle dumps, plots, printouts, and general termination procedure. If the time limit is TLM, then the calculation will be stopped and termination begun as soon as the run time exceeds TLM-WRAPUP.

Example: SCARDN RESTART = .TRUE., FILM = .TRUE.,
PAPER = .FALSE., WRAPUP = 30.5

The next input depends on whether RESTART is .TRUE. or .FALSE. Input based on RESTART = .FALSE. (problem generation) will be considered first.

*** INITIAL PROBLEM SETUP ***

Record 2: Problem title, cc2=80 on one data card.

Record 1: Namelist name = CARDN

Namelist variables

NAME	TYPE (units)	Possible values	Default
AO	Real (none)	0.<AO<1.	0.1
AOFAC	Real (none)	0.<AOFAC<.5	0.2
AOM	Real (none)	0.<AOM<1.	1.0
ANC	Real (none)	0.<ANC<.2	0.05
BO	Real (none)	0., 2.	0.0
CYL	Real (none)	0., 1.	1.0
DK	Real (cm)	0.<DK<∞	Must be specified
DT	Real (s)	0.<DT<∞	10 ⁻³
DT0	Real (s)	0.<DT0<∞	1.0
DT0C	Real (s)	0.<DT0C<∞	10 ³⁰
DZ	Real (cm)	0.<DZ<∞	Must be specified
EPS	Real (none)	0.<EPS<1.	10 ⁻⁵
FREZXR	Real (none)	1.<FREZXR<∞	1.0
FREZYB	Real (none)	1.<FREZYB<∞	1.0
FREZYT	Real (none)	1.<FREZYT<∞	1.0
GR	Real (cm/s ²)	∞<GR<∞	0.0
GRDVEL	Real (none)	0., 1., 2.	2.0
GZ	Real (cm/s ²)	∞<GZ<∞	-980.0

NAME	TYPE (units)	Possible values	Default
GZP	Real (cm/s ²)	∞<GZP<∞	0.0
IBAR	Integer (none)	1<IBAR<Storage	Must be specified
IEOF	Integer (none)	0, 1	0
INT	Integer (none)	-1, 1<INT<storage	-1
IUNF	Integer (none)	0<IUNF<IBAR	Must be specified
JBAR	Integer (none)	1<JBAR<Storage	Must be specified
JCFX	Integer (none)	1<JCFX<IBAR	Must be specified
JDUMP	Integer (none)	1<JDUMP<∞	999999
JUNF	Integer (none)	0<JUNF<JBAR	Must be specified
KXI	Integer (none)	-1, 0, 1	-1
LAM	Real (see Ref. 1)	0.<LAM<∞	0.6
MU	Real	0.<MU<∞	0.0
NCLST	Integer (none)	1<NCLST<∞	999999
NOQ	Integer (none)	-∞<NOQ<∞	-1
OM	Real (none)	0., 1., 2.	1.0
QLEVEL	Real (none)	.02	0.02
REXRON	Real (gm/cm ³)	0.<REXRON<∞	0.001
REZSIE	Real (cm ² /s ²)	0.<REZSIE<∞	2x10 ¹⁰
REZYU	Real (cm)	YB<REZYU<∞	0.0
RMINEF	Real (cm)	0.<RMINEF<∞	50.0
T	Real (s)	0.<T<∞	0.0
TQ	Real (s)	0.<TQ<∞	0.0
TSTRTD	Real (s)	0.<TSTRTD<∞	1.0
TUQI	Real (cm ² /s)	0.<TUQI<∞	0.0
TUSI	Real (cm)	0.<TUSI<fireball radius	0.0
TWFIN	Real (s)	0.<TWFIN<∞	1.E30
WMAXEF	Real (none)	0.<WMAXEF<∞	2.0
YB	Real (cm)	0.<YB<∞	0.0
ZORIG	Real (none)	0.<ZORIG<∞	6.0

- AO - Amount of donor cell in momentum fluxing (0. is centered differencing; 1. is full donor cell).
- AOFAC - Stability condition u.t./x<AOFAC.
- AOM - Amount of donor cell in mass fluxing (see AO).
- ANC - Amount of node coupler (see Ref. 2).
- BO - Interpolated donor cell coefficients; allows for partial cancellation of truncation errors in the convection terms.
- CYL - Geometry-type switch. If CYL = 1., the calculation is done in cylindrical

- geometric if $GR = 0$, it is done in slab geometry.
- DR - Initial value of the width of the zones in the region of uniform zoning (see Sec. 1.A).
- DT - Initial time step.
- DTO, DTQC - Two arrays that determine when plots and long prints (edits) will occur as a function of problem time. Edits will generally occur every $DTO(1)$ seconds in the interval $DTQC(1-1) \leq t \leq DTQC(1)$. $DTQC(0) = 0$.
- DZ - Same as DR except zone height (see Sec. 1.A).
- EPS - Convergence criterion in the pressure iteration (see Ref. 2).
- FREZZR - Geometric ratio of zone 'r's in the right region of nonuniform zoning (see Sec. 1.A).
- FREZZB - Geometric ratio of zone 'z's in the bottom region of nonuniform zoning (see Sec. 1.A).
- FREZZT - Geometric ratio of zone 'z's in the top region of nonuniform zoning (see Sec. 1.A).
- GR - Body force acceleration in the radial direction.
- GRDVEL - Type of rezone. GRDVEL = 0, is Eulerian, = 1, is Lagrangian, and = 2, causes the rezone subroutine to be called.
- GZ - Body force acceleration in the axial direction (usually gravity).
- GZP - Particle acceleration in the axial direction (not applied unless particles have mass.)
- IBAR - Number of real zones in the radial direction (see Sec. 1.A).
- IEOF - Input of the record 3 section is terminated by inputting a record with IEOF = 1.
- IST - Number of particles whose positions are to be plotted as a function of time. If $IST \leq 0$, no particles are followed.
- JUNF - Number of zones in the radial direction in the region of uniform zoning (see Sec. 1.A).
- JBAR - Number of real zones in the axial direction (see Sec. 1.A).
- JCEN - Number of real zones from bottom of the problem to center of region of uniform zoning (see Sec. 1.A).
- JDUMP - Frequency of dumps based on cycles. Dumps will occur when the cycle number is an even multiple of JDUMP.
- JUNF - Number of zones in the axial direction in region of uniform zoning; must be an even number because $JUNF/2$ zones will occur above and below the point defined by JCEN (see Sec. 1.A).
- KXI - Viscosity flag (see Ref. 3).
- LAM - Viscosity parameter (see Ref. 3).
- MR - Viscosity parameter (see Ref. 3).
- NCENT - Cycle number after which to terminate the run.
- NCQ - Cycle number after which to seed the turbulence; if $NCQ \neq 0$, the turbulence is disabled; if $NCQ = 0$, seeding will occur based on problem time instead of cycle number, i.e. when $T=TQ$ (see TQ).
- PM - Relaxation parameter in the pressure iteration.
- QLFVEL - Phenomenological turbulence viscosity parameter relating to specific turbulence energy (see Ref. 5).
- REZRON - Initial density of the ambient atmosphere at $y = REZYO$; the density of the atmosphere above and below REZYO is determined by the condition that the entire atmosphere initially be in hydrostatic equilibrium.
- REZSIE - Specific internal energy of the entire ambient atmosphere.
- REZYO - Center of y-coordinate of the region of uniform zoning (see Sec. 1.A).
- RMINEF - Particles with $r \leq RMINEF$ are not subject to turbulent diffusion.
- T - Time at which the problem begins.
- TQ - Time at which to seed the turbulence if $NCQ = 0$ (see NCQ).
- TSTRTD - Time at which to start turbulent particle diffusion if the turbulence is on.
- TUQ1 - Proportionality constant for seeding turbulence energy. Should be chosen such that turbulence energy is a few percent of kinetic energy in any cell.
- TUSI - Turbulence scale (constant over mesh). (Code could be easily changed to allow scale variation throughout mesh).
- TWFIN - Time at which to terminate the run.
- WMAXEF - If the turbulence and particle turbulent

diffusion are on, a particle can be moved no more than $WMAXEF \cdot \sqrt{4 \cdot \sigma \cdot DT}$ because of turbulent diffusion in any one cycle (see Sec. E).

YB - Bottom of the problem mesh if the zoning is entirely uniform. If the zoning is nonuniform, YB will be calculated internally and need not be specified.

ZORIG - Number of fireball radii away from the fireball that the right problem boundary is kept.

Example: SCARDN DR = 200. \$
 SCARDN DZ = 200. \$
 SCARDN IBAR = 30 \$
 SCARDN IUNF = 5 \$
 SCARDN JBAR = 45 \$
 SCARDM JCEN = 15 \$
 SCARDN JUNF = 10 \$
 SCAPDN REZYQ = 4300. \$
 SCARDN REZRQ = 1.E-3 \$
 SCARDN REZSE = 1.95E9 \$
 SCARDN T = .0083 \$
 SCARDN TWFIN = 30. \$
 SCARDN DTQ = .1, 1., 5. \$
 SCARDN DTQC = 1., 10., 30. \$
 SCARDN FREZYB = 1.089359 \$
 SCARDN FREZYT = 1.089359 \$
 SCARDN FREZXR = 1.089359 \$
 SCARDN IEOF = 1 \$

Again assuming RESTRT = .FALSE., the next record will be to define marker particles.

Record 4: Namelist name - PARTN

Namelist variables

NAME	TYPE (units)	Possible values	Default
DRPAR	Real (cm)	0. <DRPAR>	Must be specified
DZPAR	Real (cm)	0. <DZPAR>	0.
XC	Real (cm)	0. <XC>	0.
XD	Real (cm)	0. <XD>	Must be specified
YC	Real (cm)	0. <YC>	0.
YD	Real (cm)	0. <YD>	0.

(a) DRPAR - Spacing between particles in the radial direction. Particle definition cards are read until one is input with DRPAR = 0.

(b) DZPAR - Spacing between particles in the axial direction.

(c) XC - (See Sec. 1.C)

(d) XD - (See Sec. 1.C)

(e) YC - (See Sec. 1.C)

(f) YD - (See Sec. 1.C)

Example:

SPARTN DRPAR = 100., DZPAR = 100., YC = 4300.,

XD = 1000., YD = 0., SL = 0. \$

SPARTN DRPAR = 0. \$

The final input will be the fireball initialization data. One namelist record is needed:

Record 5: Namelist name - FIRE

Namelist variables

NAME	TYPE (units)	Possible values	Default
FBFILE	Logical	.TRUE., .FALSE.	.FALSE.
NRAD	Integer	1 <NRAD>	5
NTH	Integer	1 <NTH>	180

(a) FBFILE - If .TRUE., the fireball initialization input will be found on logical unit 3. Otherwise, the input will follow the SFIRE namelist card.

(b) NRAD - (See Sec. 1.B).

(c) NTH - (See Sec. 1.B).

Example: SFIRE FBFILE = .TRUE.\$

For the form of the fireball initialization data, see the section Sec. 1.B.

This completes the input for an initial setup. Restart dumps are written on each edit cycle as determined by DTO and DTOC or as specified by JDUMP and go out to logical unit 8.

*** PROBLEM RESTART ***

To restart, a restart dump tape must be present on logical unit 7. Input record 1 must have RESTRT = .TRUE. Next follows a namelist record telling from which dump to restart.

SRCYCLE INTCYC = N \$

where N is either the cycle on the dump tape from which one wishes to restart or -1. In the latter case, restart occurs from the last dump on logical unit 7. Last, records of the type described under input record 3 may appear if one desires to override any of the parameter values in effect at the time the problem is being restarted. This section is terminated by SCARDN IEOF = 1 \$.

Example:

SSTART RESTART = .TRUE., PAPER = .FALSE.,

FILM = .TRUE., WRAPUP = 60. \$

SRCYCLE INTCYC = -1 \$

SCARDN TWFIN = 30. \$

SCARDN NCLST = 99999 \$
SCARDN IEQF = 1 \$

A. Initial Conditions

III. RESULTS OF A SAMPLE CALCULATION

A careful comparison of a YAQUI calculation with experiment was made and has been reported in Ref. 6, Fig. 1(c). In that simulation the mixed equation-of-state, turbulence, and turbulent particle diffusion options were all used. To help the user to understand the output options and to provide a comparison calculation, we include detailed results of a sample calculation, patterned after the simulation in Ref. 6.

In Sec. A the input parameters are listed along with the detailed one-dimensional fireball input data. Also given are the initial marker particle configurations, the initial grid for the complete mesh and for a smaller region surrounding the fireball, and the initial velocities.

In Sec. B contour plots of the vorticity and the specific turbulence energy ϵ ; $t = .5$ s (immediately following the seeding of the turbulence) are given. Note that the general shapes of the two contour plots are similar because the turbulence energy is seeded proportional to the vorticity.

In Sec. C the positions of the marker particles and contour plots of the specific internal energy and the specific turbulence energy are given at $t = 3$ s at which time all memory of the seeding is gone. Note that the regions of greatest specific internal energy closely coincide with the regions of greatest specific turbulence energy. Also note the toroidal form of these contour plots, remembering that the left side of the mesh is an axis of cylindrical symmetry.

In Sec. D complete graphical output at $t = 10$ s is given. This is a moderately late time because torus formation occurs at $\sim t = 1.25$ s.

```
BALLOON= 30 # 45 : CONV (MKS.. PARTICLE TYPB. DIFF. FIA IN TBCOR
THERE WILL BE TURBULENCE
CLEVEL= 2.0000E-02
TUD1= 5.0000E+00
TUS1= 1.0000E+03
NCD= 0
TD= 5.0000E-01
TSPRTO= 1.0000E+00
MNAEF= 2.0000E+00
RMINEF= 5.0000E-01
ISAR= 30
JBAR= 45
JURF= 5
JURF= 10
JURF= 15
JURF= 15
DR= 2.0000E+02
DZ= 2.0000E+02
CYL= 1.0000E+00
CARVEL= 2.0000E+00
AB= 1.0000E-01
AD= 1.0000E+00
BE= 0.
KCI= -1
PU= 0.
LAP= 0.0000E-01
GM= 1.0000E+00
EPS= 1.0000E-04
GM= 0.
GZ= 9.8000E-02
FREZIR= 1.00936E+00
FREZYT= 1.00936E-01
FREZYB= 1.00936E+00
ZURIG= 6.0000E-01
VU= 0.
REZIR= 4.3000E-03
REZIR= 1.0000E-03
REZIR= 1.99930E-09
GZ= 9.8000E-02
T= 0.3000E-03
DT= 1.0000E-03
NCLST= 1
TUPIN= 3.0000E-01
PAPER= 0
FILN= 1
MNC= 2.0000E-01
ASAC= 2.0000E-01
IST= 10
DTOT(1:10)= 1.0000E-01 1.0000E+00 5.0000E-01 0.
0. 0. 0. 0.
DTOT(1:10)= 1.0000E-00 1.0000E-01 5.0000E-01 0.
0. 0. 0. 0.
0. 0.
PEPARTH DPMAR=100 DTPAR=100 VC=5.50 RD=1000 VD=0 MC=0
DPMAR= 1.0000E+02 DTPAR= 1.0000E+02 MC= 0
VC= 5.5000E+03 RD= 1.0000E+03 VD= 0.
PEPARTH DPMAR=0
150 PARTICLES GENERATED. WITH TOTAL MASS= 0
PFFIR FFFILE= FILE 5
FIREBALL INPUT WILL BE FROM FILE 5
```

U	E	RIO	I	P	PR-C
3.742474E+03	7.1150827E+10	1.8895935E+09	8.561114E+00	1.987865E+06	1.987865E+06
1.872718E+03	6.5310351E+10	2.0751980E+09	1.603271E+01	1.633271E+06	1.633271E+06
1.1817913E+03	6.5310351E+10	2.2051980E+09	2.085660E+01	1.6234271E+06	1.6234271E+06
1.1597079E+03	6.5310351E+10	2.2570703E+09	3.3018635E+01	1.6076463E+06	1.6076463E+06
1.6224794E+03	6.5310351E+10	2.2653017E+09	4.1125711E+01	1.6116280E+06	1.6116280E+06
2.0522261E+03	6.5310351E+10	2.2683715E+09	5.9262863E+01	1.6222339E+06	1.6222339E+06
2.3398177E+03	6.5310351E+10	2.2752965E+09	7.7399511E+01	1.6312426E+06	1.6312426E+06
2.8837835E+03	6.5310351E+10	2.2857219E+09	8.9516712E+01	1.6401362E+06	1.6401362E+06
3.2100000E+03	6.5310351E+10	2.2948264E+09	7.3659620E+01	1.6477521E+06	1.6477521E+06
3.5124515E+03	6.5310351E+10	2.3038191E+09	8.1727652E+01	1.6549134E+06	1.6549134E+06
3.7004370E+03	6.5310351E+10	2.3026153E+09	8.8836791E+01	1.6539651E+06	1.6539651E+06
4.0391666E+03	6.5310351E+10	2.2985509E+09	9.7868650E+01	1.6503087E+06	1.6503087E+06
4.2650180E+03	6.5310351E+10	2.2889916E+09	1.0813888E+02	1.6422730E+06	1.6422730E+06
4.4720316E+03	6.5310351E+10	2.2750352E+09	1.1437128E+02	1.6300991E+06	1.6300991E+06
4.6867565E+03	6.5310351E+10	2.2566190E+09	1.2262187E+02	1.6159344E+06	1.6159344E+06
4.8844773E+03	6.5310351E+10	2.2345126E+09	1.3095664E+02	1.6010955E+06	1.6010955E+06
5.0198018E+03	6.5310351E+10	2.2093044E+09	1.393614E+02	1.5751189E+06	1.5751189E+06
5.1870222E+03	6.5310351E+10	2.1804896E+09	1.4784309E+02	1.5523834E+06	1.5523834E+06
5.3482964E+03	6.5310351E+10	2.1536178E+09	1.5600135E+02	1.5280966E+06	1.5280966E+06
5.5040004E+03	6.5310351E+10	2.1281419E+09	1.6503797E+02	1.5026044E+06	1.5026044E+06
5.6568111E+03	6.5310351E+10	2.1039350E+09	1.7376264E+02	1.4764793E+06	1.4764793E+06
5.8052348E+03	6.5310351E+10	2.0813250E+09	1.8208181E+02	1.4500911E+06	1.4500911E+06
5.9495217E+03	6.5310351E+10	2.0621073E+09	1.9155544E+02	1.4231017E+06	1.4231017E+06
6.0876553E+03	6.5310351E+10	1.99949170E+09	2.0044101E+02	1.3957321E+06	1.3957321E+06
6.2266493E+03	6.5310351E+10	1.9604025E+09	2.0952238E+02	1.3673251E+06	1.3673251E+06
6.3716637E+03	6.5310351E+10	1.9244442E+09	2.1870822E+02	1.3378075E+06	1.3378075E+06
6.5175153E+03	6.5310351E+10	1.8880388E+09	2.2799877E+02	1.3078883E+06	1.3078883E+06
6.6618302E+03	6.5310351E+10	1.8520864E+09	2.3739724E+02	1.2773904E+06	1.2773904E+06
6.8052348E+03	6.5310351E+10	1.8178435E+09	2.4689187E+02	1.2463055E+06	1.2463055E+06
6.9456217E+03	6.5310351E+10	1.7857991E+09	2.5648738E+02	1.2151141E+06	1.2151141E+06
7.0848811E+03	6.5310351E+10	1.7557756E+09	2.6628051E+02	1.1837881E+06	1.1837881E+06
7.2224425E+03	6.5310351E+10	1.7267051E+09	2.761025E+02	1.1522935E+06	1.1522935E+06
7.3593665E+03	6.5310351E+10	1.6976201E+09	2.8605948E+02	1.1205254E+06	1.1205254E+06
7.4953417E+03	6.5310351E+10	1.6685351E+09	2.9613877E+02	1.0884765E+06	1.0884765E+06
7.6301944E+03	6.5310351E+10	1.6394504E+09	3.0633955E+02	1.0560354E+06	1.0560354E+06
7.7640471E+03	6.5310351E+10	1.6103657E+09	3.1666270E+02	1.0231941E+06	1.0231941E+06
7.8978998E+03	6.5310351E+10	1.5812810E+09	3.2710825E+02	9.899555E+05	9.899555E+05
8.0317525E+03	6.5310351E+10	1.5521963E+09	3.3767570E+02	9.561886E+05	9.561886E+05
8.1656052E+03	6.5310351E+10	1.5231116E+09	3.4836514E+02	9.219271E+05	9.219271E+05
8.2994579E+03	6.5310351E+10	1.4940269E+09	3.5917658E+02	8.871606E+05	8.871606E+05
8.4333106E+03	6.5310351E+10	1.4649422E+09	3.7010902E+02	8.518991E+05	8.518991E+05
8.5671633E+03	6.5310351E+10	1.4358575E+09	3.8116246E+02	8.161321E+05	8.161321E+05
8.7010160E+03	6.5310351E+10	1.4067728E+09	3.9233590E+02	7.798596E+05	7.798596E+05
8.8348687E+03	6.5310351E+10	1.3776881E+09	4.0362934E+02	7.430871E+05	7.430871E+05
8.9687214E+03	6.5310351E+10	1.3486034E+09	4.1504278E+02	7.058146E+05	7.058146E+05
9.1025741E+03	6.5310351E+10	1.3195187E+09	4.2657622E+02	6.680421E+05	6.680421E+05
9.2364268E+03	6.5310351E+10	1.2904340E+09	4.3822966E+02	6.297696E+05	6.297696E+05
9.3702795E+03	6.5310351E+10	1.2613493E+09	4.5000310E+02	5.909971E+05	5.909971E+05
9.5041322E+03	6.5310351E+10	1.2322646E+09	4.6188654E+02	5.517246E+05	5.517246E+05
9.6379849E+03	6.5310351E+10	1.2031799E+09	4.7388098E+02	5.119521E+05	5.119521E+05
9.7718376E+03	6.5310351E+10	1.1740952E+09	4.8598542E+02	4.716796E+05	4.716796E+05
9.9056903E+03	6.5310351E+10	1.1450105E+09	4.9820986E+02	4.309071E+05	4.309071E+05
10.0395430E+03	6.5310351E+10	1.1159258E+09	5.1055430E+02	3.896346E+05	3.896346E+05
10.1733957E+03	6.5310351E+10	1.0868411E+09	5.2302874E+02	3.478621E+05	3.478621E+05
10.3072484E+03	6.5310351E+10	1.0577564E+09	5.3563318E+02	3.055896E+05	3.055896E+05
10.4411011E+03	6.5310351E+10	1.0286717E+09	5.4836762E+02	2.629171E+05	2.629171E+05
10.5749538E+03	6.5310351E+10	1.0000000E+09	5.6123206E+02	2.198446E+05	2.198446E+05
10.7088065E+03	6.5310351E+10	9.7133333E+08	5.7422650E+02	1.763721E+05	1.763721E+05
10.8426592E+03	6.5310351E+10	9.4266667E+08	5.8734094E+02	1.325000E+05	1.325000E+05
10.9765119E+03	6.5310351E+10	9.1400000E+08	6.0057538E+02	8.82278E+04	8.82278E+04
11.1103646E+03	6.5310351E+10	8.8533333E+08	6.1392982E+02	4.40000E+04	4.40000E+04
11.2442173E+03	6.5310351E+10	8.5666667E+08	6.2740426E+02	0.00000E+00	0.00000E+00

3 5115795E+00	4 0395768E+00	1 3504440E+03	7 9736111E+02	2 1952814E+06	2 1952814E+06
3 5115795E+00	3 9827655E+00	1 3797760E+03	7 9820512E+02	2 1864264E+06	2 1864264E+06
3 5115795E+00	3 9315757E+00	1 3978757E+03	8 0105938E+02	2 1878755E+06	2 1878755E+06
3 5115795E+00	3 8867985E+00	1 4162048E+03	8 0250700E+02	2 1710593E+06	2 1710593E+06
3 5115795E+00	3 8461391E+00	1 4356627E+03	8 0476857E+02	2 1776156E+06	2 1776156E+06
3 5115795E+00	3 8071720E+00	1 4548187E+03	8 0683944E+02	2 1810339E+06	2 1810339E+06
3 5115795E+00	3 7716837E+00	1 4742378E+03	8 0895001E+02	2 1878866E+06	2 1878866E+06
3 5115795E+00	3 7388261E+00	1 4938768E+03	8 1103359E+02	2 1989978E+06	2 1989978E+06
3 5115795E+00	3 7093946E+00	1 5137908E+03	8 1296388E+02	2 2034835E+06	2 2034835E+06
3 5115795E+00	3 6827985E+00	1 5340208E+03	8 1482708E+02	2 2071738E+06	2 2071738E+06
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3 5115795E+00	3 6343516E+00	1 5752851E+03	8 1835704E+02	2 2204286E+06	2 2204286E+06
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3 5115795E+00	3 5895218E+00	1 6176971E+03	8 2170567E+02	2 2380425E+06	2 2380425E+06
3 5115795E+00	3 5677562E+00	1 6393711E+03	8 2331394E+02	2 2392717E+06	2 2392717E+06
3 5115795E+00	3 5461818E+00	1 6613908E+03	8 2491778E+02	2 2459495E+06	2 2459495E+06
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3 5115795E+00	3 4616957E+00	1 7526604E+03	8 3178035E+02	2 2708127E+06	2 2708127E+06
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3 5115795E+00	3 4002127E+00	1 8226758E+03	8 3731414E+02	2 2931083E+06	2 2931083E+06
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3 5115795E+00	2 6962642E+00	3 4737964E+03	9 8864903E+02	2 9669311E+06	2 9669311E+06
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3 5115795E+00	2 6830842E+00	3 5533264E+03	9 9743893E+02	3 0095685E+06	3 0095685E+06
3 5115795E+00	2 6769367E+00	3 5936014E+03	1 0000138E+03	3 0450929E+06	3 0450929E+06
3 5115795E+00	2 6710842E+00	3 6342264E+03	1 0046383E+03	3 0791244E+06	3 0791244E+06
3 5115795E+00	2 6654367E+00	3 6751914E+03	1 0092628E+03	3 1209374E+06	3 1209374E+06
3 5115795E+00	2 6600842E+00	3 7164964E+03	1 0138873E+03	3 1615208E+06	3 1615208E+06
3 5115795E+00	2 6549367E+00	3 7581414E+03	1 0185118E+03	3 2018938E+06	3 2018938E+06
3 5115795E+00	2 6500842E+00	3 8001264E+03	1 0231363E+03	3 2420572E+06	3 2420572E+06
3 5115795E+00	2 6454367E+00	3 8424514E+03	1 0277608E+03	3 2819206E+06	3 2819206E+06
3 5115795E+00	2 6409842E+00	3 8851264E+03	1 0323853E+03	3 3214840E+06	3 3214840E+06
3 5115795E+00	2 6367367E+00	3 9281514E+03	1 0369098E+03	3 3607474E+06	3 3607474E+06
3 5115795E+00	2 6326842E+00	3 9715264E+03	1 0414243E+03	3 3997108E+06	3 3997108E+06
3 5115795E+00	2 6288367E+00	4 0152514E+03	1 0459288E+03	3 4383742E+06	3 4383742E+06
3 5115795E+00	2 6251842E+00	4 0603764E+03	1 0504233E+03	3 4767376E+06	3 4767376E+06
3 5115795E+00	2 6217367E+00	4 1058014E+03	1 0549078E+03	3 5148010E+06	3 5148010E+06
3 5115795E+00	2 6184842E+00	4 1516264E+03	1 0593823E+03	3 5525644E+06	3 5525644E+06
3 5115795E+00	2 6154367E+00	4 1978514E+03	1 0638468E+03	3 5899278E+06	3 5899278E+06
3 5115795E+00	2 6125842E+00	4 2444764E+03	1 0683013E+03	3 6268912E+06	3 6268912E+06
3 5115795E+00	2 6099367E+00	4 2915014E+03	1 0727458E+03	3 6634546E+06	3 6634546E+06
3 5115795E+00	2 6074842E+00	4 3389264E+03	1 0771803E+03	3 7006180E+06	3 7006180E+06
3 5115795E+00	2 6052367E+00	4 3867514E+03	1 0816048E+03	3 7373814E+06	3 7373814E+06
3 5115795E+00	2 6031842E+00	4 4349764E+03	1 0860193E+03	3 7737448E+06	3 7737448E+06
3 5115795E+00	2 6013367E+00	4 4836014E+03	1 0904238E+03	3 8097082E+06	3 8097082E+06
3 5115795E+00	2 5995842E+00	4 5326264E+03	1 0948183E+03	3 8452716E+06	3 8452716E+06
3 5115795E+00	2 5979367E+00	4 5820514E+03	1 0992028E+03	3 8805350E+06	3 8805350E+06
3 5115795E+00	2 5964842E+00	4 6318764E+03	1 1035773E+03	3 9154984E+06	3 9154984E+06
3 5115795E+00	2 5952367E+00	4 6821014E+03	1 1079418E+03	3 9501618E+06	3 9501618E+06
3 5115795E+00	2 5941842E+00	4 7327264E+03	1 1122963E+03	3 9845252E+06	3 9845252E+06
3 5115795E+00	2 5933367E+00	4 7837514E+03	1 1166408E+03	4 0185886E+06	4 0185886E+06
3 5115795E+00	2 5926842E+00	4 8351764E+03	1 1209753E+03	4 0523520E+06	4 0523520E+06
3 5115795E+00	2 5922367E+00	4 8869014E+03	1 1253098E+03	4 0858154E+06	4 0858154E+06
3 5115795E+00	2 5919842E+00	4 9390264E+03	1 1296343E+03	4 1189788E+06	4 1189788E+06
3 5115795E+00	2 5919367E+00	4 9915514E+03	1 1339488E+03	4 1518422E+06	4 1518422E+06
3 5115795E+00	2 5920842E+00	5 0444764E+03	1 1382533E+03	4 1844056E+06	4 1844056E+06
3 5115795E+00	2 5924367E+00	5 0978014E+03	1 1425478E+03	4 2166690E+06	4 2166690E+06
3 5115795E+00	2 5929842E+00	5 1516264E+03	1 1468323E+03	4 2486324E+06	4 2486324E+06
3 5115795E+00	2 5937367E+				

ALL FIREBALL INPUT DATA READ

CELL 1 12 HAS A RELATIVE VOLUME ERROR OF $-4.03703E-02$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 2 12 HAS A RELATIVE VOLUME ERROR OF $-2.57207E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 3 12 HAS A RELATIVE VOLUME ERROR OF $-6.99058E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 4 13 HAS A RELATIVE VOLUME ERROR OF $-4.72253E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 5 14 HAS A RELATIVE VOLUME ERROR OF $-7.02923E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 6 15 HAS A RELATIVE VOLUME ERROR OF $-2.60044E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 7 16 HAS A RELATIVE VOLUME ERROR OF $-3.06379E-02$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 8 17 HAS A RELATIVE VOLUME ERROR OF $-3.06379E-02$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 9 18 HAS A RELATIVE VOLUME ERROR OF $-2.60044E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 10 19 HAS A RELATIVE VOLUME ERROR OF $-7.02923E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 11 20 HAS A RELATIVE VOLUME ERROR OF $-4.72253E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 12 21 HAS A RELATIVE VOLUME ERROR OF $-4.03703E-02$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 13 21 HAS A RELATIVE VOLUME ERROR OF $-2.57207E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 CELL 14 21 HAS A RELATIVE VOLUME ERROR OF $-6.99058E-01$ IT WILL BE TREATED AS A FIREBALL BOUNDARY CELL
 ***** CYCLE 0. T= 0.30000E-03. DT= 1.00000E-04. CPA= 2.25698E-01
 GRINDS= 1.63043E-02. MUNIT= 0. CIRC= 3.12142E-02
 DTIV= 0. IDIV= 0. JDIV= 0
 DTIC= 0. IDIC= 0. JDIC= 0
 TMAX= 6.04503E-10. ITM= 2. JTM= 14. RTMAX= 0. RTMAX= 0.
 TGRM= 2.47279E-08. ITG= 3. JTG= 18
 PRIT= 1.000E-03. PIPO= 9.300E-03. PRIO= 3.300E-03. POIAM= 2.000E-03. PAYM= 4.300E-03
 TOTAL INTERNAL ENERGY = 8.5132171E+18
 TOTAL KINETIC ENERGY = 2.2074742E+14
 TOTAL GRAV. POTENTIAL ENERGY = 4.9657320E+16
 TOTAL RADIAL MOMENTUM = 1.1257218E+10
 TOTAL AXIAL MOMENTUM = 2.1868846E-04
 000000000000000000 000000000000000000
 WMAX = 4.88465E-04 AT VERTIC 2 17

PARTICLES

PM= 1.92794E-04 PYB= 1.89538E-03 PYT= 2.35794E-04
 VAQU= LTSS BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TURN. DIFF., FIX IN TMROR

T= 0.30000E-03 CYCLE 3

ALL ZONES

DIRIN= 2.0000E+02 DIRAR= 1.6994E+03 DZIN= 2.0000E+02

DZPA= 1.6994E+03 AR= 1.6279E+04 YB= 1.3853E+03 YI= 2.3579E+04

YADUI-1755 BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TURB. DIFF., FIA IN TRACOR

T= 8.3000E-03 CYCLE= 3

FLUID VELOCITY VECTORS SCALED TO MAXIMUM VELOCITY

VMAX = 4.88455E+04

YAGUI-LTSS BALLOON - 3D X=5 - CONC. CHGS., PARTICLE TURB. DIFF., FIX IN TBRCOR

T = 0.30000E-03 CYCLE = 0

ZONES IN THE FIREBALL REGION
 DPMIN= 2.00000E+02 DPMAX= 1.6994E+03 DZMIN= 2.00000E+02
 DZMAX= 1.6994E+03 XE= 1.9279E+04 YE= 1.39538E+05 XT= 2.3579E+04
 YAUQU-LTSS BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TURB. DIFF., FIX IN TRBCOP

T= 0.30000E-03 CYCLE= 2

FLUID VELOCITY VECTORS SCALED TO MAXIMUM VELOCITY

U_{MAX} = 4.86E-04

VAQUIL-1755 BALLON - 30 X 45 - CONC. CHGS., PARTICLE TURN. DIFF., FIX IN TABCOR

T = 0.30000E-03 CYCLE = 0

B. Turbulence Seeding Conditions

A -2.250E+00
 B -2.000E+00
 C -1.750E+00
 D -1.500E+00
 E -1.250E+00
 F -1.000E+00
 G -7.500E-01
 H -5.000E-01
 I -2.500E-01
 J 0.
 K 2.500E-01
 L 5.000E-01
 OPN -2.025E+00
 UNK 3.103E-01

T= 5.13512E-01 CYCLE= 01

A 0
B 1.000E+00
C 2.000E+00
D 3.000E+00
E 4.000E+00
F 5.000E+00
G 6.000E+00
H 7.000E+00
I 8.000E+00
J 9.000E+00
K 1.000E+01
L 1.100E+01
OPN 0
QMS 1.013E+01

TAQUIL-LTSS BALLOON - SO A -9 - CONC. CHOS. PARTICLE TURB DIFF. FTH IN THROPH

$$A_{\text{eff}} = \frac{A_{\text{ref}}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

10 1 2000-01-01 - 1000

A 1.07E+00
 B 2.14E+09
 C 3.22E+09
 D 4.29E+09
 E 5.36E+09
 F 6.43E+09
 G 7.50E+09
 H 8.57E+09
 I 9.64E+09
 J 1.07E+10
 K 1.18E+10
 L 1.29E+10
 M 1.40E+10
 N 1.51E+10
 O 1.62E+10
 QPA 1.95E+09
 QPB 1.54E+00

T= 5.00000E+00 CYCLE = 46

1.00000E+00 CYCLE = 460

D. Moderately Late-Time Conditions (Eight Torus-
Formation Times)

CYCLE 1546 FOUND
CYCLE 1803 FOUND
CYCLE 2050 FOUND
CYCLE 2289 FOUND

RESTARTING FROM CYCLE 2289

BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TURB. DIFF., FIA IN TBCOR
I = 1.0000E+01

***** CYCLE 2289, I = 1.0000E+01, DT = 1.5410E-03, CP = 2.9787E+02
GRINDS = 1.2976E+04, NUMI = 3, CIRC = 1.0916E+03
DTM = 4.2553E-03, JDT = 1, JDTM = 22
DTG = 1.1020E-01, JDTG = 1, JDTG = 23
FMAX = 3.1492E+09, JTM = 2, JTM = 18, KTRM = 2, KTRM = 0
TDM = 2.8517E+06, JTG = 1, JTG = 34
PRIT = 2.435E+03, PTOP = 1.455E+04, PBOI = .358E+04, POIAM = 4.871E+03, PAIM = 1.257E+04
TOTAL INTERNAL ENERGY = 1.057570E+19
TOTAL KINETIC ENERGY = 7.159175E+12
TOTAL GRAV. POTENTIAL ENERGY = 5.890674E+16
TOTAL RADIAL MOMENTUM = 4.670745E+09
TOTAL AXIAL MOMENTUM = -2.5562275E+10
I710427106761670223 I710427106761670223
VMAX = 1.12413E+03 AT VERTEX 5 15

PARTICLES
PWR = 1.9279E+04 PYB = 0, BYT = 2.9210E+04
YACU-LISS BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TURB. DIFF., FIA IN TBCOR

I = 1.0000E+01 CYCLE = 2289

TIME-DEPEN. N° PARTICLES
 VAGUET-LISS BALLOON - 30 x 45 - CONC. CHOS. PARTICLE TURB. DIFF. FIR IN "MSCOP"

* : 0000000001 CYCLE = 2299

ALL ZONES
 DZM1= 1 5000E-02 DZM2= 1 1000E-03 DZM3= 0 0350E+01
 DZM4= 2 0000E-03 DZM5= 1 0000E+00 DZM6= 0 0000E+00
 YAGUI-LISS BALLOON - 30 0 05 - CONE CH'S , PARTICLE TURN DIFF , F10 IN *RBCOR

F= 1 0000E+01 CYCLE= 2249

FLUID VELOCITY VECTORS SCALED TO MAXIMUM VELOCITY

WRAH = 1.2E+03

YAGUI-UTSS BALLOON - 35 H +5 - CONC ENDS - PARTICLE TURN DIFF. FIB IN TBCOR

T = 1.00000E+01 CYCLE = 2299

ZONES IN THE FIREBALL REGION
 ORPHIN= 1.5938E+02 ORPHAN= 1.1865E+03 ORPHIN= 8.0352E+01
 ORPHAN= 2.9907E+03 ORPHAN= 1.9279E+04 YB= 0 YF= 2.9210E+04
 YAGUI-LTSS BALLOON - 30 X 45 - CONC. CHGS., PARTICLE TUBS, DIFF., FIX IN THRCOR

T= 1.0000E+01 CYC.E= 2299

FLUID VELOCITY VECTORS SCALED TO MAXIMUM VELOCITY

VMAX = 1.12413E+03

VAQU1-L755 BALLOON - 30 X 45 - CONIC. CHOS. PARTICLE TURB. DIFF. FIK IN TRACOR

T = 1.00000E+01 CYCLE = 2289

UNSCALED FLUID VELOCITY VECTORS
 MAX= 1.12E+03
 YAGUI-LISS BALLOON - 30 X 45 - CONC CHOS... PARTICLE TURN. DIFF.. FIN IN IMBCOR

T= 1.00000E+01 CYCLE= 2299

A 6.12E-02
 B 6.42E-02
 C 6.71E-02
 D 7.01E-02
 E 7.32E-02
 F 7.62E-02
 G 7.92E-02
 H 8.22E-02
 I 8.52E-02
 J 8.82E-02
 K 9.12E-02
 L 9.42E-02
 M 9.72E-02
 N 1.00E-01
 OPA 6.31E-02
 OPT 6.36E-02

T= 1.00000E+01 CYCLE= 2299

A 1.94E+09
B 2.019E+09
C 2.082E+09
D 2.147E+09
E 2.215E+09
F 2.282E+09
G 2.349E+09
H 2.416E+09
I 2.483E+09
J 2.550E+09
K 2.617E+09
L 2.684E+09
M 2.751E+09
N 2.818E+09
O 2.885E+09
P 2.952E+09
Q 3.020E+09
R 3.087E+09
S 3.154E+09
QNH 1.951E+09
QNH 3.14E+09

1 = 1.0000E+01 CYCLE = 2369

A -2.750E+00
 B -2.500E+00
 C -2.250E+00
 D -2.000E+00
 E -1.750E+00
 F -1.500E+00
 G -1.250E+00
 H -1.000E+00
 I -7.500E+01
 J -5.000E+01
 K -2.500E+01
 L 0
 M 2.500E+01
 OPM -2.575E+00
 QPM 2.575E+01

T = 1.00000E+01 CYCLE = 2200

1 0.00
2 0.00
3 0.00
4 0.00
5 0.00
6 0.00
7 0.00
8 0.00
9 0.00
10 0.00
11 0.00
12 0.00
13 0.00
14 0.00
15 0.00
16 0.00
17 0.00
18 0.00
19 0.00
20 0.00
21 0.00
22 0.00
23 0.00
24 0.00
25 0.00
26 0.00
27 0.00
28 0.00
29 0.00
30 0.00
31 0.00
32 0.00
33 0.00
34 0.00
35 0.00
36 0.00
37 0.00
38 0.00
39 0.00
40 0.00
41 0.00
42 0.00
43 0.00
44 0.00
45 0.00
46 0.00
47 0.00
48 0.00
49 0.00
50 0.00
51 0.00
52 0.00
53 0.00
54 0.00
55 0.00
56 0.00
57 0.00
58 0.00
59 0.00
60 0.00
61 0.00
62 0.00
63 0.00
64 0.00
65 0.00
66 0.00
67 0.00
68 0.00
69 0.00
70 0.00
71 0.00
72 0.00
73 0.00
74 0.00
75 0.00
76 0.00
77 0.00
78 0.00
79 0.00
80 0.00
81 0.00
82 0.00
83 0.00
84 0.00
85 0.00
86 0.00
87 0.00
88 0.00
89 0.00
90 0.00
91 0.00
92 0.00
93 0.00
94 0.00
95 0.00
96 0.00
97 0.00
98 0.00
99 0.00
100 0.00

1 0.000000-0: CYCLE 2289

A 3
 B 1.250E-01
 C 2.500E-01
 D 3.750E-01
 E 5.000E-01
 F 6.250E-01
 G 7.500E-01
 H 8.750E-01
 I 1.000E-00
 J 1.125E-00
 K 1.250E-00
 L 1.375E-00
 M 1.500E-00
 QPM 0
 QPN 1.463E-00

* 1 00000E+01 CYCLE= 2289

A 2.
 B 5.120E+02
 C 1.02E+03
 D 1.556E+03
 E 2.048E+03
 F 2.560E+03
 G 3.072E+03
 H 3.584E+03
 I 4.096E+03
 J 4.608E+03
 K 5.120E+03
 QM 0
 QM 4.925E+03

* 1.00000E+01 CYCLE 2289

A C
 B 8.000E+01
 C 1.600E+01
 D 2.400E+01
 E 3.200E+01
 F 4.000E+01
 G 4.800E+01
 H 5.600E+01
 I 6.400E+01
 J 7.200E+01
 K 8.000E+01
 L 8.800E+01
 M 9.600E+01
 N 1.040E+02
 O 1.120E+02
 P 1.200E+02
 Q 1.280E+02
 R 1.360E+02
 S 1.440E+02
 T 1.520E+02
 U 0
 V 1.440E+02

T= 1.00000E+01 CYCLE= 2289

IV. FLOW DIAGRAM

V. CODE LISTING

I.D. LP-0174

A. LTSS-Dependent Code

```

1      PROGRAM MAIN(TAPE1,TAPE5=TAPE1,DTAPE1,TAPE6=DTAPE1,TAPE63=1000,
2      1 TAPE3)
3      C
4      C      LTSS MAIN ROUTINE FOR YAGUI
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T=3,1975
7      C
8      CALL YAGUI
9      END

```

```

1      INTEGER AND
2      FUNCTION AND(I,J)
3      C
4      C      LTSS ROUTINE TO TAKE THE BOOLEAN INTERSECTION OF TWO VARIABLES
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T=3,1975
7      C
8      AND=I.INT.J
9      RETURN
10     END

```

```

1      INTEGER ANDR
2      FUNCTION ANDR(Y,J)
3      C
4      C      LTSS INTERSECTION ROUTINE RETURNED IN A FLOATING-POINT VARIABLE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T=3,1975
7      C
8      ANDR=Y.INT.J
9      RETURN
10     END

```

```

1      SUBROUTINE CLOSIT(I)
2      C
3      C      LTSS/7600 ROUTINE TO CLOSE A DISK FILE
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T=3,1975
6      C
7      CALL TPGEN(I,ITP)

```

```

8      CALL ASSIGN(I,0,ITP,-2)
9      RETURN
10     END

```

```

1      INTEGER COMP
2      FUNCTION COMP(I)
3      C
4      C      LTSS ROUTINE TO TAKE THE COMPLEMENT OF A VARIABLE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      COMP=.COMP.I
9      RETURN
10     END

```

```

1      INTEGER COMPR
2      FUNCTION COMPR(I)
3      C
4      C      LTSS COMPLEMENT ROUTINE RETURNED IN A FLOATING-POINT VARIABLE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      COMPR=.COMP.I
9      RETURN
10     END

```

```

1      SUBROUTINE ECRD(SCARR,IADDLC,NW,IERROR)
2      C
3      C      LTSS/7600 ROUTINE TO COPY DATA FROM LARGE CORE TO SMALL CORE
4      C
5      C      SCARR = SMALL CORE ARRAY INTO WHICH DATA IS TO BE COPIED
6      C      IADDLC = LARGE CORE ADDRESS FROM WHICH DATA IS TO BE COPIED
7      C      NW = NO. OF WORDS TO BE COPIED
8      C      IERROR = ERROR FLAG (DUMMY)
9      C
10     C      WRITTEN BY J.L.NORTON,LASL T-3,1975
11     C
12     LCM FWLCMC
13     COMMON/FWLCMC/AA1(1)

```

```

14      IERROR=0
15      CALL BLOCKCOPY(AA1(IADDLC+2),SCARR,NW)
16      RETURN
17      END

```

```

1      SUBROUTINE ECHR(SCARR,IADDLC,NW,IERROR)
2      C
3      C      LYSS/7640 ROUTINE TO COPY DATA FROM SMALL CORE TO LARGE CORE
4      C
5      C      SCARR = SMALL CORE ARRAY FROM WHICH DATA IS TO BE COPIED
6      C      IADDLC = LARGE CORE ADDRESS INTO WHICH DATA IS TO BE COPIED
7      C      NW = NO. OF WORDS TO BE COPIED
8      C      IERROR = ERROR FLAG (DUMMY)
9      C
10     C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
11     C
12     C      LCM FWLCMC
13     C      COMMON/FWLCMC/AA1(1)
14     C      IERROR=0
15     C      CALL BLOCKCOPY(SCARR,AA1(IADDLC+2),NW)
16     C      RETURN
17     C      END

```

```

1      INTEGER GETIT
2      FUNCTION GETIT(I)
3      C
4      C      LYSS ROUTINE TO ALLOW FETCHING CONTENTS OF A WORD GIVEN ITS
5      C      ABSOLUTE ADDRESS
6      C
7      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
8      C
9      C      ABSOLUTE IADDR(1)
10     C      DIMENSION IADDR(1)
11     C      GETIT=IADDR(I)
12     C      RETURN
13     C      END

```

```

1      SUBROUTINE GETJOB(JOBID)
2      C

```

```

3      C      LTSS ROUTINE FOR RETURNING THE JOB ID
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      C      JOHID=1AHYAQHI=LTSS
8      C      RETURN
9      C      END

```

```

1      C      SUBROUTINE GETJTL(TL)
2      C
3      C      LTSS ROUTINE FOR RETURNING THE JOB TIME LIMIT IN SECONDS
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      C      CALL DRTIME(I,J,K,L)
8      C      TL=FLOAT(J)+1.E-6
9      C      RETURN
10     C      END

```

```

1      C      SUBROUTINE GETLCM(IFLLCM)
2      C
3      C      LTSS/7600 ROUTINE TO RETURN THE AMOUNT OF LCM AVAILABLE TO THE
4      C      USER
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      C      COMMON/GOHCNM/IDUM(1)
9      C      IFLLCM=IDUM(16)-IDUM(15)
10     C      RETURN
11     C      END

```

```

1      C      SUBROUTINE GETTPE(IDUM)
2      C
3      C      LTSS ROUTINE TO DUMMY UP TAPE FETCHING AVAILABLE ON CROS/7600
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      C      RETURN
8      C      END

```

```

1      SUBROUTINE LCHUFF(FWA,NWRDS,IFILE,IFLAG,IRET,IERROR)
2      C
3      C      LYSS/7600 ROUTINE TO READ OR WRITE LCM FROM OR TO A DISK FILE
4      C
5      C      FWA      = FIRST LCM ADDRESS
6      C      NWRDS    = NO. OF WORDS TO TRANSFER
7      C      IFILF    = LOGICAL UNIT NO. OF DISK FILE
8      C      IFLAG    = READ OR WRITE FLAG
9      C                  = 0 = READ DISK
10     C                  = 1 = WRITE DISK
11     C      IPET     = RETURN FLAG
12     C                  = 0 = RETURN IMMEDIATELY AFTER ISSUING THE I/O REQUEST
13     C                  = 1 = WAIT UNTIL I/O IS COMPLETED BEFORE RETURNING
14     C      IERROR   = ERROR FLAG
15     C                  = 0 = NO ERROR
16     C                  = 1 = ERROR
17     C                  = -1 = END-OF-FILE ON INPUT
18     C
19     C      WRITTEN BY J.L. MORTON, IASL T-3, 1975
20     C
21     C      LCM FWCNC
22     C      COMMON/FWCNC/AA1(1)
23     C      INTEGER FWA
24     C
25     C      CLEAR ERROR FLAG
26     C
27     C      IERROR=0
28     C
29     C      SEE WHETHER REQUEST IS READ INTO OR WRITE FROM LCM
30     C
31     C      IF(IFLAG.NE.0) GO TO 10
32     C
33     C      REQUEST IS WRITE LCM (READ DISK)
34     C
35     C      BUFFER IN(IFILE,1)(AA1(FWA+2),AA1(FWA+NWRDS+1))
36     C      GO TO 20
37     C
38     C      REQUEST IS READ LCM (WRITE DISK)
39     C
40     C      10 CONTINUE
41     C      BUFFER OUT(IFILE,1)(AA1(FWA+2),AA1(FWA+NWRDS+1))
42     C
43     C      SEE IF USER WISHES TO WAIT UNTIL I/O IS COMPLETE
44     C
45     C      20 CONTINUE
46     C      IF(IRET.EQ.0) RETURN
47     C
48     C      YES, WAIT FOR I/O TO COMPLETE
49     C
50     C      30 IF(UNIT,IFILE) 30,00,50,60
51     C
52     C      I/O SUCCESSFULLY COMPLETED. ALL DONE.
53     C
54     C      40 CONTINUE

```

```

55      RETURN
56      C
57      C      END=OF=FILE, SET ERROR FLAG AND RETURN.
58      C
59      50 CONTINUE
60      IERROR=1
61      RETURN
62      C
63      C      I/O ERROR, SET ERROR FLAG AND RETURN.
64      C
65      60 CONTINUE
66      IERROR=1
67      RETURN
68      END

```

```

1      FUNCTION LOCF(I)
2      C
3      C      LTSS ROUTINE TO HANDLE LOCATION FUNCTION
4      C
5      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
6      C
7      LOCF=LOC,I
8      RETURN
9      END

```

```

1      SUBROUTINE NCODE(NC,IFORM,INTAB,NIN,OUTTAB)
2      C
3      C      LTSS ROUTINE TO SIMULATE CDC ENCODE STATEMENT
4      C
5      C      ENCODE(NC,IFORM,OUTTAB) (INTAB(I),I=1,NIN)
6      C
7      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
8      C
9      DIMENSION INTAB(NIN),OUTTAB(1),ITEMP(10),IFORM(1)
10     DO 10 I=1,10
11     ITEMP(I)=IFORM(I)
12     REWIND 63
13     N=NC/10+1
14     IF(MOD(NC,10).EQ.0) N=N-1
15     WRITE(63,ITEMP)(INTAB(I),I=1,NIN)
16     READ(63,20)(OUTTAB(I),I=1,N)
17     RETURN
18     C
19     20 FORMAT(15A10)
20     END

```

```

1      SUBROUTINE OPENIT(IFILE,MODE)
2      C
3      C      LTSS/7600 ROUTINE TO OPEN A FILE
4      C
5      C      IFILE = LOGICAL UNIT NO. OF THE FILE
6      C      MODE  = TYPE OF FILE
7      C              = 0 = BCD
8      C              = 1 = BINARY
9      C
10     C      WRITTEN BY J.L.NORTON,LASL T-3,1975
11     C
12     C      IF(MODE.EQ.0) RETURN
13     C      LENGTH=1000000
14     C      IOC=0
15     C      CALL TPGEN(IFILE,ITP)
16     C      10 CONTINUE
17     C      CALL CREATE(ITP,LENGTH,IOC)
18     C      IF(IOC.GE.0) GO TO 20
19     C      LENGTH=FLOAT(LENGTH)*.9
20     C      GO TO 10
21     C      20 CONTINUE
22     C      CALL ASSIGN(IFILE,0,ITP)
23     C      RETURN
24     C      END

```

```

1      INTEGER OR
2      FUNCTION OR(I,J)
3      C
4      C      LTSS ROUTINE TO TAKE THE BOOLEAN UNION OF TWO VARIABLES
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      C      OR=I.UN.J
9      C      RETURN
10     C      END

```

```

1      INTEGER ORF
2      FUNCTION ORF(I,J)
3      C
4      C      LTSS FUNCTION TO RETURN THE UNION IN A FLOATING POINT VARIABLE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975

```



```

7      C
8      ORR=I,UN,J
9      RETURN
10     END

```

```

1      FUNCTION RNUMF(X)
2      C
3      C      LTSS/7600 ROUTINE TO RETURN RANDOM NOS. UNIFORMLY DISTRIBUTED
4      C      ON THE INTERVAL (0,,1.)
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      RNUMF=RNFL(X)
9      RETURN
10     END

```

```

1      SUBROUTINE SCBUFF(FWA,NWRDS,IFILE,IFLAG,IRET,IERROR)
2      C
3      C      LTSS/7600 ROUTINE TO READ OR WRITE SCM FROM OR TO A DISK FILE
4      C
5      C      SEE LCHUFF FOR ARGUMENT DOCUMENTATION
6      C
7      C      FWA = BEGINNING OF SCM BLOCK TO BE WRITTEN
8      C
9      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
10     C
11     DIMENSION FWA(1)
12     LCM FWLCMC
13     COMMON/FWLCMC/AA1(1)
14     COMMON/LCSCRC/ILSIZE,IFWASC
15     C
16     C      CLEAR ERROR FLAG
17     C
18     IERROR=0
19     C
20     C      SEE IF THE LCM SCRATCH AREA IS LARGE ENOUGH TO HOLD THE
21     C      SCM BLOCK
22     C
23     IF(NWRDS.GT.ILSIZE) CALL UNCLE(4,6HSCBUFF,25,
24     I 25HNOT ENOUGH LCM FOR BUFFER)
25     C
26     C      YES.  SEE IF DISK IS TO BE READ OR WRITTEN.
27     C
28     IF(IFLAG.NE.0) GO TO 60
29     C

```

```

30      C      READ DISK INTO THE LCM SCRATCH AREA
31      C
32      BUFFER IN(IFILE,1)(AA1(IFWASC+2),AA1(IFWASC+NWRDS+1))
33      C
34      C      WAIT FOR I/O TO COMPLETE
35      C
36      10 IF(UNIT,IFILE) 10,20,30,40
37      20 CONTINUE
38      C
39      C      COPY LCM INTO SCM
40      C
41      CALL BLOCKCOPY(AA1(IFWASC+2),FMA,NWRDS)
42      RETURN
43      C
44      C      EOF ENCOUNTERED, SET THE ERROR FLAG,
45      C
46      30 CONTINUE
47      IERROR=1
48      RETURN
49      C
50      C      DISK ERROR OR INPUT RECORD WAS SHORTER THAN EXPECTED
51      C
52      40 CONTINUE
53      C
54      C      GET THE LENGTH OF THE RECORD AND IF NOT ZERO,COPY IT TO SCM
55      C
56      L=LENGTH(IFILE)
57      IF(L.NE.0) CALL BLOCKCOPY(AA1(IFWASC+2),FMA,L)
58      C
59      C      SET THE ERROR FLAG
60      C
61      50 CONTINUE
62      IERROR=1
63      RETURN
64      C
65      C      DISK IS TO BE WRITTEN
66      C
67      60 CONTINUE
68      C
69      C      FIRST COPY SCM BLOCK TO LCM SCRATCH AREA
70      C
71      CALL BLOCKCOPY(FMA,AA1(IFWASC+2),NWRDS)
72      C
73      C      WRITE LCM TO DISK
74      C
75      BUFFER OUT(IFILE,1)(AA1(IFWASC+2),AA1(IFWASC+NWRDS+1))
76      C
77      C      WAIT FOR I/O TO COMPLETE IF SO REQUESTED
78      C
79      IF(IRET.EQ.0) RETURN
80      70 IF(UNIT,IFILE) 70,80,30,50
81      80 CONTINUE
82      RETURN
83      END

```

```

1      SUBROUTINE SDG(X)
2      C
3      C      LISS/7600 ROUTINE TO FIND SINES AND COSINES
4      C      OF ARGUMENTS IN DEGREES
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      DATA DEGRAD/,M17453292519943/
9      Y=X*DEGRAD
10     SDG=SIN(Y)
11     RETURN
12     ENTRY CDG(X)
13     Y=X*DEGRAD
14     SDG=COS(Y)
15     RETURN
16     END

```

```

1      INTEGER SHIFT
2      FUNCTION SHIFT(IX,N)
3      C
4      C      LISS ROUTINE TO PERFORM BIT SHIFTING
5      C
6      C      IX IS THE QUANTITY TO BE SHIFTED
7      C      N IS THE NO. OF BITS TO SHIFT, N POSITIVE MEANS LEFT END=AROUND
8      C      SHIFT AND N NEGATIVE MEANS RIGHT END=OFF SHIFT.
9      C
10     C      WRITTEN BY J.L.NORTON,LASL T-3,1975
11     C
12     IF(N.GE.0) GO TO 10
13     NP=-N
14     SHIFT=IX,SHR,NP
15     RETURN
16     10 CONTINUE
17     SHIFT=IX,SHL,N
18     RETURN
19     END

```

```

1      SUBROUTINE STORIT(IVAR,IADD)
2      C
3      C      LISS ROUTINE TO ALLOW STORING INTO A WORD GIVEN ITS ABSOLUTE
4      C      ADDRESS
5      C

```

```

6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      ABSOLUTE IADDR(1)
9      DIMENSION IADDR(1)
10     IADDR(IADD)=IVAR
11     RETURN
12     END

```

```

-----
1      SUBROUTINE SYINIT
2      C
3      C      LTSS/7600 ROUTINE TO DO SYSTEM-DEPENDENT INITIALIZATION
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      LCM FWLCMC,YLC1,YLC2,YLC3,(FILMLB),LCMSCR
8      COMMON/FWLCMC/FWLCM
9      COMMON/YLC1/AA1(72300)/YLC2/AA2(5000)
10     COMMON/YLC3/PAXY(10,200)/FILMLB/FLMBUF(4000)
11     COMMON/LCMSCR/SCRITCH(1000)
12     *      ----- BEGIN COMDECK PARAM -----
13     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
14     I NLCP3,NLCP4,IFLMSZ
15     *      ----- END COMDECK PARAM -----
16     COMMON/LCSCRC/TLSIZE,IFWASC
17     C
18     C      CHANGE THE DROPPFILE NAME TO +YAQUIB
19     C
20     CALL CHANGE(7H+YAQUIB)
21     C
22     C      INITIALIZE THE FILM ROUTINES.  THE ARGUMENTS ARE AS FOLLOWS --
23     C      FOR IDENT80 =
24     C          (1) LOGICAL UNIT NO. OF THE FILM FILE
25     C          (2) ARRAY IN LCM TO BE USED AS A FILM BUFFER
26     C          (3) SIZE OF THE FILM BUFFER
27     C          (4) SIZE OF DISK FILE FOR FILM
28     C          (5) TYPE OF MICROFILM OUTPUT
29     C              = 35 FOR 35 MM
30     C              = 105 FOR MICROFICHE
31     C          (6) NOT USED
32     C      - FOR HEAD80 =
33     C          (1) LOGICAL UNIT NO. OF THE FILM FILE
34     C          (2) NO. OF CHARACTERS IN THE HEADER (60 MAXIMUM)
35     C          (3) THE HEADER ARRAY
36     C          (4) FILM IDENTIFICATION ARRAY
37     C      FOR KEEPFLM =
38     C          (1) LOGICAL UNIT NO. OF THE FILM FILE NOT TO BE GIVEN
39     C              TO THE SYSTEM
40     C
41     CALL FILMH0
42     CALL IDENT80(12,FLMBUF,IFLMSZ,1000000,105,10UM)
43     CALL HEAD80(12,10,10HT3JLNYAQUI,9HBOX T3JLN)

```

```

44      CALL KEEPFLM(12)
45      C
46      C      INITIALIZE THE SIZE OF THE LCM SCRATCH AREA
47      C
48      JLSIZE=NLCPU
49      C
50      C      SET THE ADDRESS OF THE FIRST WORD OF THE SCRATCH AREA
51      C
52      IFWASC=.LOC,SCRATCH(1)=.LOC,FNLCH
53      RETURN
54      END

```

```

-----
1      SUBROUTINE TPGEN(IFILE,ITP)
2      C
3      C      LYSS/7620 ROUTINE TO TAKE AN INTEGER LOGICAL UNIT NO, IFILE
4      C      AND CONVERT IT INTO A DISK FILE NAME OF THE FORM YAPEN
5      C      OR YAPEND WHICH IS RETURNED LEFT-JUSTIFIED IN ITP
6      C
7      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
8      C
9      C      INTEGER OR,SHIFT,AND
10     DIMENSION INUM(10)
11     DATA INUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
12     C
13     C      INITIALIZE
14     C
15     IFILEP=IFILE
16     IC=24
17     ITP=4HTAPE
18     MASK=777777777777B
19     C
20     C      SEE IF LOGICAL UNIT NO. IS ONE OR TWO DIGITS
21     C
22     IF(IFILEP.LE.9) GO TO 10
23     C
24     C      TWO DIGITS. ISOLATE THE FIRST DIGIT.
25     C
26     IT=IFILEP/10+1
27     IF(MOD(IFILEP,10).EQ.0) IT=IT-1
28     C
29     C      PUT THE FIRST DIGIT INTO PLACE
30     C
31     ITP=OR(AND(SHIFT(INUM(IT),IC),MASK),ITP)
32     C
33     C      MODIFY PARAMETERS FOR SECOND DIGIT
34     C
35     IC=IC+4
36     MASK=7777777777B
37     IF(IFILEP=10*(IT-1))
38     10 CONTINUE
39     C

```

```

40      C      PUT THE LAST DIGIT INTO PLACE
41      C
42      ITP=OR(AND(SHIFT(INUM(IFILEP+1),IC),MASK),ITP)
43      RETURN
44      END

```

```

1          SUBROUTINE TRAP(IARG)
2      C
3      C      LTSS ROUTINE TO HANDLE ERROR INTERCEPTION
4      C
5      C      WRITTEN BY J.L. NORTON, LAST T=3, 1975
6      C
7      COMMON/YS05/RESTRY,FILM,PAPER,IPD,IFD
8      COMMON/OPERR/IERR(121)
9      COMMON/GORCOM/IG(1)
10     ABSOLUTE TWO(2)
11     INTEGER TWO,SHIFT
12     LOGICAL FILM
13     COMMON/IEDMP/IDUMP(16)
14     C
15     C      SET UP ABSOLUTE LOCATION 2 WITH A JUMP TO STATEMENT IRETA
16     C      AND SET THE EXCHANGE PACKAGE DUMP AREA TO IDUMP
17     C
18     TWO=2,SHL,54,UN.(,LOC,IRETA,SHL,30),UN.(,LOC,IDUMP)
19     C
20     C      SET UP ORDERLIB ERROR INTERCEPTION
21     C
22     DO 10 I=1,99
23     10 CALL CONTROL(I,TORDL,IER)
24     RETURN
25     C
26     C      ORDERLIB ERROR HAS OCCURRED, LET THE USER KNOW.
27     C
28     IORDL CONTINUE
29     DO 20 IPX=6,IFD,6
30     20 WRITE(IPX,50)(IERR(I),I=117,119)
31     IDUMP(1)=SHIFT(IERR(1:8),36)
32     CALL POMPPK
33     IFLS=IG(15)
34     IF(FILM) GO TO 30
35     GO TO 40
36     C
37     C      PROGRAM HAS ABORTED
38     C
39     IRETA CONTINUE
40     C      DUMP THE EXCHANGE PACKAGE AND SMALL CORE ON EITHER SIDE
41     C      OF THE LOCATION OF THE ERROR
42     C
43     CALL PABORT
44     C
45     C      DUMP ALL OF SMALL CORE TO FILM IF FILM IS ENABLED

```

```

46      C
47      IF(.NOT.FILM) GO TO 40
48      C
49      PICK THE SMALL CORE FIELD LENGTH OUT OF THE EXCHANGE PACKAGE
50      C
51      IFLS=(IDUMP(3).INT.(.COMP,7777777777B)),SHR,36
52      30 CONTINUE
53      IFLS=IFLS+1
54      CALL DMP(0,IFLS,12)
55      40 CONTINUE
56      C
57      C      TERMINATE BUT SAVE THE DROFFILE
58      C
59      CALL EXIT(2)
60      RETURN
61      C
62      50 FORMAT(/1H ,14HORDERLIB ERROR,I3,21H OCCURRED AT LOCATION,07,
63      1 29H WHICH IS THE CALL TO ROUTINE,A10)
64      END

```

```

1      SUBROUTINE TTYTST(IFLAG)
2      C
3      C      LTSS ROUTINE TO SEE IF DROFFILE VARIABLE HAS BEEN CHANGED TO
4      C      SIGNAL JOB TERMINATION
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      COMMON/OFFC/ISWTCN
9      DATA ISWTCN/=1/
10     IFLAG=0
11     IF(ISWTCN.EQ.0) IFLAG=1
12     RETURN
13     END

```

B. CROS-Dependent Code

```
1      PROGRAM MAIN(INP,OUT,FILM,FSET7,FSET8,FSET5=INP,FSET6=OUT,FSET12=
2      1 FILM,FSET3,FSET15=OUT)
3      C
4      C      CROS/7600 MAIN ROUTINE FOR YAQUI
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      CALL YAQUI
9      END
```

.....

```
1      SUBROUTINE CLOSIT(I)
2      C
3      C      CROS/7600 ROUTINE FOR DESTROYING DISK FILES
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      CALL AFSREL(I,0,0,0)
8      RETURN
9      END
```

.....

```
1      SUBROUTINE GETJOB(JOBID)
2      C
3      C      CROS/7600 ROUTINE FOR RETURNING THE JOB ID
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      CALL GETQ(4LKJBN,JOBID)
8      RETURN
9      END
```

.....

```
1      SUBROUTINE GETJTL(TL)
2      C
3      C      CROS/7600 ROUTINE TO RETURN THE JOB TIME LIMIT IN SECONDS
4      C
5      CALL GETQ(4LKJLM,II)
6      TL=27.5E-9*FLOAT(II)
7      RETURN
8      END
```



```

-----
1      SUBROUTINE GETLCM(ISIZE)
2      C
3      CROS/7600 ROUTINE TO RETURN THE AMOUNT OF LARGE CORE MEMORY
4      C      AVAILABLE TO THE JOB FOR DATA STORAGE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      CALL GETQ(3LKMA,ISIZE)
9      RETURN
10     END

```

```

-----
1      SUBROUTINE GETTPE(TAPE)
2      C
3      CROS/7600 ROUTINE FOR CHECKING TAPE LABEL AND STAGING TAPE
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      C      INTEGER TAPE,AND
8      C
9      C      TAPE WAS READ, SEE IF IT WAS LEGAL.
10     C
11     IF(AND(TAPE,77777700000000000000),NE,3LXX0) CALL UNCLE(4,6HGETTPE
12     I ,20,20HTAPE NO, INPUT ERROR)
13     C
14     C      GO TO STAGE IN THE TAPE
15     C
16     CALL STAGE(7,TAPE,IEFLAG)
17     C
18     C      SEE IF STAGE WAS SUCCESSFUL
19     C
20     IF(IEFLAG,NE,0) CALL UNCLE(4,6HGETTPE,23,
21     I 23HUNSUCCESSFUL TAPE STAGE)
22     C
23     C      YES, ALL DONE,
24     C
25     RETURN
26     END

```

```

-----
1      SUBROUTINE OPENIT(TFILE,MODE)
2      C
3      CROS/7600 ROUTINE TO OPEN A FILE
4      C

```

```

5      C      IFILF = LOGICAL UNIT NO. OF THE FILE
6      C      MODE  = TYPE OF FILE
7      C           = 0 = BCD
8      C           = 1 = BINARY
9      C
10     C      WRITTEN BY J.L.NORTON,LASL T-3,1975
11     C
12     C      CALL OPEN(IFILE,0,0,0,0,0,10000,0,0)
13     C      RETURN
14     C      END

```

```

1      C      SUBROUTINE STAGE(IF,LABEL,IFLAG)
2      C
3      C      ROUTINE TO STAGE IN A TAPE WITH LABEL=XX0NNNNN INTO FILESET IF
4      C
5      C      WRITTEN BY J.L.NORTON,LASL TD-3,1973
6      C
7      C      COMMON/YSC5/RESTRY,FILM,PAPER,IPD,IFD
8      C      DIMENSION IMDISP(5)
9      C      DATA IMDISP/4,0,0,0,0/
10     C
11     C      IFLAG IS RETURNED ZERO IF THE TAPE WAS SUCCESSFULLY STAGED, IT IS
12     C      RETURNED ONE IF FOUR STAGE ATTEMPTS FAILED.
13     C
14     C      IFLAG=0
15     C
16     C      OPEN THE FILE TO A LARGE TRACK SECTOR LIMIT
17     C
18     C      CALL OPEN(IF,0,0,0,0,0,10000,0,0)
19     C
20     C      ZERO OUT THE LAST TWO CHARACTERS OF THE TAPE LABEL
21     C
22     C      IMDISP(5)=LABEL.AND.(.NOT,77770)
23     C
24     C      INITIALIZE THE NO. OF STAGE ATTEMPTS
25     C
26     C      ICNT=0
27     C
28     C      GET JOB CLASSIFICATION
29     C
30     C      CALL GETQ(4LKCLA,JCLASS)
31     C      KCLASS=1LG
32     C      IF(JCLASS,NE,5) KCLASS=1LU
33     C
34     C      INITIATE THE STAGE
35     C
36     C      10 CALL CREATE(IF,KCLASS,2LST,0,0,0,IMDISP,0,0,10000,0)
37     C
38     C      INCREMENT THE STAGE COUNT
39     C
40     C      ICNT=ICNT+1

```

```

01      C
02      C      SEE IF THERE WERE ANY PARITY ERRORS
03      C
04      C      CALL PARITY(IF,ICHECK)
05      C      IF(ICHECK.NE.0) GO TO 30
06      C
07      C      NO, PRINT MESSAGE AND RETURN.
08      C
09      C      ON 20 IPX=IPD,IFD,0
10      20 WRITE(IPX,50) LABEL,IF,IF
11      C      RETURN
12      30 CONTINUE
13      C
14      C      YES, SEE IF THIS WAS THE FOURTH STAGE,
15      C
16      C      IF(ICNT.LT.4) GO TO 40
17      C
18      C      YES, SET THE ERROR FLAG AND RETURN.
19      C
20      C      IFLAG=1
21      C      RETURN
22      40 CONTINUE
23      C
24      C      NO, RELEASE THE FILE AND TRY AGAIN.
25      C
26      C      CALL JFSREL(IF,U,R,P)
27      C      GO TO 10
28      C
29      50 FORMAT(1H0,5HTAPE ,A2,35H HAS BEEN SUCCESSFULLY STAGED INTO ,
30      1 ANFILESET ,I2,2H (,A5,1H))
31      C      END

```

```

1      SUBROUTINE SYINIT
2
3      C      CROSS/T600 ROUTINE TO PERFORM YAOUI SYSTEM INITIALIZATION
4      C
5      C      WRITTEN BY J.L.MORTON,LASL T-3,1975
6      C
7      C
8      C      CALL SETQ(4LNOPX,0)
9      C      CALL OPEN(3LOUT,0,0,0,0,10000,0,0)
10     C      CALL OPEN(4FILM,0,0,0,0,10000,0,0)
11     C      CALL OPEN(7,0,0,0,0,10000,0,0)
12     C      CALL OPEN(3,0,0,0,0,10000,0,0)
13     C      CALL MEMREQ(400000,1)
14     C      RETURN
15     C      END

```

```

1      SUBROUTINE TRAP(RECOVER)
2      C
3      C      CROSS/7600 ROUTINE TO INITIALIZE FOR RECOVERY FROM FATAL EXECUTION
4      C      ERRORS
5      C
6      C      RECOVER IS A SUBROUTINE TO CALL AFTER INTERCEPTING THE ERROR
7      C
8      C      WRITTEN BY J.L. NORTON, LASL T-3, 1975
9      C
10     DIMENSION IDUMP(16)
11     COMMON/VSC5/NESTRT,FILM,PAPER,IPD,IFD
12     INTEGER SHIFT,AND,COMP
13     LOGICAL FILM
14     ASSIGN 14 TO IGCXIT
15     CALL EXIT(IGCXIT)
16     C
17     C      IABORT IS THE NO. OF ABORT TRAPS THAT HAVE OCCURRED
18     C
19     IABORT=0
20     RETURN
21     IF CONTINUE
22     CALL GETMPK(IDUMP)
23     CALL PABORT(IDUMP)
24     IF(.NOT.FILM) GO TO 24
25     IFLS=SHIFT(AND(IDUMP(4),COMP(777777777B)),-36)
26     IF1S=IFLS-1
27     CALL DMP(1,IFLS,12)
28     IF CONTINUE
29     C
30     C      CODE WAS ABORTED. INCREMENT THE ABORT COUNT.
31     C
32     IABORT=IABORT+1
33     C
34     C      CALL THE RECOVERY ROUTINE
35     C
36     CALL RECOVER(IABORT)
37     RETURN
38     END

```

.....

C. KRONOS-Dependent Code

```
1      PROGRAM MAIN(INPUT,TAPES=INPUT,YOUT,TAPE6=YOUT,TAPES9=YOUT,TAPE7,  
2      1 TAPE8,FILM,TAPE12=FILM,TAPE3)  
3      C  
4      C      KRONOS/6608 MAIN ROUTINE FOR YAGUI  
5      C  
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975  
7      C  
8      CALL YAGUI  
9      END
```

```
1      SUBROUTINE CLOSIT(I)  
2      C  
3      C      KRONOS/6602 ROUTINE TO CLOSE FILES  
4      C  
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975  
6      C  
7      RETURN  
8      END
```

```
1      SUBROUTINE GETJOB(JOBID)  
2      C  
3      C      KRONOS/6604 ROUTINE TO RETURN THE JOB ID  
4      C  
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975  
6      C  
7      CALL GETJN(JOBID)  
8      RETURN  
9      END
```

```
1      SUBROUTINE GETJTL(TL)  
2      C  
3      C      KRONOS/6602 ROUTINE TO RETURN THE JOB TIME LIMIT IN SECONDS  
4      C      AS A FLOATING POINT NO.  
5      C  
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975  
7      C  
8      CALL GETTL(TL)  
9      TL=ITL  
10     RETURN
```

11 END

```
1           SUBROUTINE GETLCM(IFLLCM)
2           C
3           C       KRONOS/6600 ROUTINE TO RETURN THE AMOUNT OF LCM AVAILABLE TO
4           C       THE USER
5           C
6           C       WRITTEN BY J.L.NORTON, LASL T-3, 1975
7           C
8           C       IFLLCM=500000
9           C       RETURN
10          C       END
```

```
1           SUBROUTINE GETTPE(IDUM)
2           C
3           C       KRONOS/6600 DUMMY ROUTINE
4           C
5           C       WRITTEN BY J.L.NORTON, LASL T-3, 1975
6           C
7           C       RETURN
8           C       END
```

```
1           SUBROUTINE OPENIT(IFILE,MODE)
2           C
3           C       KRONOS/6600 ROUTINE TO OPEN A FILE (DUMMY)
4           C
5           C       WRITTEN BY J.L.NORTON, LASL T-3, 1975
6           C
7           C       RETURN
8           C       END
```

```
1           SUBROUTINE SYINIT
2           C
```

```

3      C      KRONOS/6600 ROUTINE TO PERFORM ANY NECESSARY SYSTEM INITIALIZATION
4      C
5      C      WRITTEN BY J.L.NORTON,LASL 1-3,1975
6      C
7      C      RETURN
8      C      END

```

```

1          IDENT  TRAP
2
3
4
5      *
6      *      KRONOS/6600 ROUTINE TO INTERCEPT HARDWARE OR SOFTWARE ABORTS
7      *
8      *      REGISTERS AND SMALL CORE ARE DUMPED TO OUTPUT, A MESSAGE IS PUT
9      *      IN THE SYSTEM DAYFILE, AND THE EXTERNAL SUPPLIED IN THE CALL
10     *      TO TRAP (CALL TRAP(RECOVER)) IS CALLED WHENEVER AN ERROR
11     *      IS DETECTED
12     *
13     *      WRITTEN BY J.L.NORTON,LASL 1-3,1975
14     *
15     ENTRY  TRAP
16     TRAP   DATA  0
17           SX6    R1
18           SAG    SAVA
19           EREXIT RECOVER
20           JP     TRAP
21     RECOVER SYSTEM DMP,R,0,0
22           SYSTEM DMP,R,1350000,0
23           MESSAGE MESS,3,R
24           SAI    SAVA
25           SR1    X1+1
26           JP     R1
27     MESS   DATA  17L--- JOB ABORT ---
28           DATA  0
29     SAVA   DATA  0
30           END

```

D. KRONOS/CROS-Dependent Code

```
1      FUNCTION AND(I,J)
2      C
3      C      KRONOS/6600 AND CROS/7600 ROUTINE TO DO BOOLEAN INTERSECTION
4      C
5      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
6      C
7      INTEGER AND
8      AND=I.AND.J
9      RETURN
10     END
```

```
1      FUNCTION ANDRT(I,J)
2      C
3      C      KRONOS/6600 AND CROS/7600 ROUTINE TO DO BOOLEAN INTERSECTION
4      C      AND RETURN THE RESULT IN A FLOATING POINT VARIABLE
5      C
6      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
7      C
8      INTEGER ANDR
9      ANDR=I.AND.J
10     RETURN
11     END
```

```
1      FUNCTION COMP(I)
2      C
3      C      KRONOS/6600 AND CROS/7600 ROUTINE TO COMPLEMENT A WORD
4      C
5      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
6      C
7      INTEGER COMP
8      COMP=.NOT.I
9      RETURN
10     END
```

```
1      FUNCTION COMPR(I)
2      C
3      C      KRONOS/6600 AND CROS/7600 ROUTINE TO COMPLEMENT A WORD
4      C
5      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
```



```

6      C
7      INTEGER COMPR
8      COMMON,NOT,1
9      RETURN
10     END

```

```

1      IDENT  GETIT
2
3      *
4      *      CROS/7600 AND KRONOS/6600 FUNCTION GETIT(IADD) TO PICK UP THE
5      *      CONTENTS OF ABSOLUTE LOCATION IADD
6      *
7      ENTRY  GETIT
8      VFD    42/PHGETIT,10/1
9      GETIT  DATA  2
10     S41    R1      PICK UP THE ADDRESS IN X1
11     S42    X1      PICK UP C(IADD)
12     R46    X2      PUT INTO X6 FOR FUNCTION
13     JP     GETIT
14     END

```

```

1      SUBROUTINE LCMUFF(F&A,N&RDS,I&FILE,I&FLAG,I&RET,I&ERROR)
2      C
3      C      KRONOS/6600 AND CROS/7600 ROUTINE TO READ OR WRITE LCM FROM
4      C      OR TO A DISK FILE
5      C
6      C      F&A = FIRST LCM ADDRESS
7      C      N&RDS = NO. OF WORDS TO TRANSFER
8      C      I&FILE = LOGICAL UNIT NO. OF DISK FILE
9      C      I&FLAG = READ OR WRITE FLAG
10     C      = 0 = READ DISK
11     C      = 1 = WRITE DISK
12     C      I&RET = RETURN FLAG
13     C      = 0 = RETURN IMMEDIATELY AFTER ISSUING THE I/O REQUEST
14     C      = 1 = WAIT UNTIL I/O IS COMPLETED BEFORE RETURNING
15     C      (NOT FUNCTIONAL ON CROS/7600 OR KRONOS/6600)
16     C      I&ERROR = ERROR FLAG
17     C      = 0 = NO ERROR
18     C      = 1 = ERROR
19     C      = -1 = END-OF-FILE ON INPUT
20     C
21     C      WRITTEN BY J.L. NORTON, LASL T-3, 1975
22     C
23     *      ----- BEGIN COMDECK PARAM -----
24     COMMON/PCOM/NSCP1,ITARP,ITARXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,

```

```

25      1 ALCP3,NICP4,IFLMSZ
26      *      ----- END COMPOCK PARAM -----
27      COMMON/YSO1/AASC(1)
28      INTEGER FAP,FAP
29      C
30      C      CLEAR ERROR FLAG
31      C
32      IERROR=0
33      C
34      C      FAP IS THE BEGINNING LCM ADDRESS OF THE PORTION OF LCM BEING
35      C      READ OR WRITTEN
36      C
37      FAP=FAP
38      C
39      C      NWORDS IS THE TOTAL NO. OF WORDS OF LCM THAT HAVE BEEN READ
40      C      OR WRITTEN.
41      C
42      NWORDS=0
43      C
44      C      LOOP FOR READING TO OR WRITING FROM LCM FROM OR TO DISK IN BLOCKS
45      C
46      10 CONTINUE
47      C
48      C      N IS THE NO. OF LCM WORDS TO TRANSFER THIS TIME. IT IS EQUAL
49      C      TO THE SIZE OF THE SCM BUFFER UNLESS THE NO. OF LCM WORDS
50      C      LEFT TO TRANSFER IS LESS THAN THE BUFFER SIZE. IN THE LATTER
51      C      CASE, N IS JUST SET TO THE NO. OF REMAINING WORDS.
52      C
53      N=NWORDS
54      N=MIN(N,NWORDS)
55      IF(N=0) N=NWORDS
56      C
57      C      SEE WHETHER REQUEST IS READ INTO OR WRITE FROM LCM
58      C
59      IF(IFLAG,NE,0) GO TO 20
60      C
61      C      REQUEST IS WRITE LCM (READ DISK)
62      C
63      BUFFER IN(1,1)(AASC(1),AASC(NW))
64      C
65      C      WAIT FOR I/O TO COMPLETE
66      C
67      20 IF(UNIT,IFILE) 20,50,40,30
68      C
69      C      ERROR OCCURRED IN DISK TRANSFER (EITHER UNEXPECTED EOF,PARITY
70      C      ERROR,OR RECORD SHORTER THAN EXPECTED). SET THE ERROR FLAG
71      C      AND RETURN.
72      C
73      30 CONTINUE
74      IERROR=1
75      RETURN
76      40 CONTINUE
77      IERROR=-1
78      RETURN
79      50 CONTINUE
80      CALL ECHR(AASC,FAP,NW,IOW)
81      C

```

```

82      C      BLOCK TRANSFER COMPLETED. UPDATE NAKDSO AND SEE IF THERE IS
83      C      MORE DATA LEFT TO TRANSFER.
84      C
85      C      62 CONTINUE
86      C      63 CROSS=NAKDSO+NA
87      C      IF(IFLAG,NE,NA) GO TO 70
88      C      64 LENGTH=(IFILE)
89      C      IF(NA,NE,NA) GO TO 34
90      C      71 CONTINUE
91      C      IF(NAKDSO,GE,NAKDS) RETURN
92      C      65 AASC=NA+NA
93      C      GO TO 13
94      C
95      C      REQUEST IS READ LCM (WRITE DISK)
96      C
97      C      66 CONTINUE
98      C      CALL SCMD(AASC,FWAP,NA,1000)
99      C      BUFFER OUT(IFILE,1)(AASC(1),AASC(NH))
100
101      C
102      C      WAIT FOR I/O TO COMPLETE
103      C
104      C      67 IF(UNIT,IFILE) 90,60,40,30
105      C      68

```

```

1      SUBROUTINE ENCODE(NC,IFORM,INTAB,NTA,OUTTAB)
2      C
3      C      KRDOS/6600 AND CRDS/7600 ROUTINE TO SIMULATE THE CDC ENCODE
4      C      STATEMENT
5      C
6      C      ENCODE(NC,IFORM,OUTTAB) (INTAB(I),I=1,NIN)
7      C
8      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
9      C
10     C
11     C      DIMENSION INTAB(NIN)
12     C      INTEGER OUTTAB
13     C      ENCODE(NC,IFORM,OUTTAB) INTAB
14     C      RETURN
15     C      END

```

```

1      FUNCTION OR(I,J)
2      C
3      C      KRDOS/6600 AND CRDS/7600 ROUTINE TO DO BOOLEAN UNION
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C

```

```

7      INTEGER ORP
8      ORP=I,OR,J
9      RETURN
10     END

```

```

1      FUNCTION ORR(I,J)
2      C
3      C  KRONOS/66PM AND CROS/76PM ROUTINE TO DO BOOLEAN UNION
4      C  AND RETURN THE RESULT IN A FLOATING POINT VARIABLE
5      C
6      C  WRITTEN BY J.L.NORTON, LAST T-3, 1975
7      C
8      INTEGER ORP
9      ORP=I,OR,J
10     RETURN
11     END

```

```

1      FUNCTION RANMF(X)
2      C
3      C  KRONOS/66PM AND CROS/76PM ROUTINE TO RETURN RANDOM NOS. WITH
4      C  UNIFORM DISTRIBUTION ON THE INTERVAL (0.,1.)
5      C
6      C  WRITTEN BY J.L.NORTON, LAST T-3, 1975
7      C
8      RANMF=RANF(X)
9      RETURN
10     END

```

```

1      SUBROUTINE SCHWFF(EVA,NARDS,TEFILE,IFLAG,IFET,IEFERR)
2      C
3      C  KRONOS/66PM AND CROS/76PM ROUTINE TO READ OR WRITE SCH FROM
4      C  OR TO A DISK FILE
5      C
6      C  SEE LENSEE FOR ARGUMENT DOCUMENTATION
7      C
8      C  EVA = BEGINNING OF SCH BLOCK TO BE WRITTEN
9      C
10     C  WRITTEN BY J.L.NORTON, LAST T-3, 1975
11     C

```

```

12      DIMENSION FWA(1)
13      ERROR=0
14      IF(IFLAG,NE,M) GO TO 10
15      BUFFER IN(IFILE,1)(FWA(1),FWA(NWRDS))
16      GO TO 20
17  10 CONTINUE
18      BUFFER OUT(IFILE,1)(FWA(1),FWA(NWRDS))
19  20 CONTINUE
20      IF(TRET,EQ,M) RETURN
21  30 IF(UNIT,IFILE) 30,40,50,60
22  40 CONTINUE
23      IF(IFLAG,NE,M) RETURN
24      N=LENGTH(IFILE)
25      IF(N,NE,NWRDS) GO TO 60
26      RETURN
27  50 CONTINUE
28      ERROR=1
29      RETURN
30  60 CONTINUE
31      ERROR=1
32      RETURN
33      END

```

```

-----
1          IDENT  SHIFT
2
3
4
5          ENTRY  SHIFT
6
7  *
8  *  KRCHOS/7600 AND CHOS/7600 ROUTINE TO REPLACE THE LAST RUN
9  *  COMPILER IN-LINE SHIFT FUNCTION. THIS IS NECESSARY BECAUSE
10 *  OF THE NEED TO INCLUDE SHIFT IN AN INTEGER STATEMENT FOR
11 *  LTSS COMPATIBILITY. HOWEVER, DRING 50 FORCES A CALL TO AN
12 *  EXTERNAL FUNCTION.
13 *  WRITTEN BY J.L.NORTON, LASL T-3, 1975
14 *
15          VFD      42/VMSHIFT,18/2
16  SHIFT  DATA    0
17          SA1      R2
18          SA2      R1
19          ZF       Y1,ZERO
20          PL       X1,LEFT
21          RX3      -X1
22          SX3      X3
23          AX6      R3,X2
24          JP       SHIFT
25  LEFT   SB3      X1
26          LX6      R3,X2
27          JP       SHIFT
28  ZERO   RX6      X2

```

```

29      JP      SHIFT
30      END

```

```

1          IDENT  STORIT
2
3      *
4      *      CRDS/7600 AND KRONOS/6600 SUBROUTINE STORIT(IWORD,IADD) WHICH
5      *      PUTS IWORD INTO ABSOLUTE SCN LOCATION IADD
6      *
7          ENTRY  STORIT
8          VFD    42/2HSTORIT,1H/2
9      STORIT    DATA  0
10             S41    B1          PICK UP IWORD IN X1
11             S42    R2          PICK UP IADD IN X2
12             R46    X1          STORE IWORD INTO IADD
13             S46    X2
14             JP     STORIT
15             END

```

```

1          SUBROUTINE TTYTST(IFLAG)
2      C
3      C      KRONOS/6600 AND CRDS/7600 ROUTINE TO DUMMY UP CAPABILITY OF
4      C      LTSS TO MODIFY THE PROFILE
5      C
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      IFLAG=0
9      RETURN
10     END

```

E. System-Independent Code

```

1      SUBROUTINE YAQUI
2
3      C      YAQUI IS A TWO-DIMENSIONAL FLUID DYNAMICS CODE THAT COMBINES
4      C      THE ICE (IMPLICIT CONTINUOUS EULERIAN) AND ALE (ARBITRARY
5      C      LAGRANGIAN-EULERIAN) METHODS, ALLOWING CALCULATION OF FLOWS
6      C      AT ALL SPEEDS.
7
8      C      ORIGINALLY WRITTEN BY A.A. AMSDEN, HANS RUPPEL, AND C.W. HIRT, LABL T-3
9      C      MODIFIED AND DOCUMENTED BY J.L. NORTON, LABL T-3, 1974
10
11     *      ***** BEGIN COMDECK PARAM *****
12     COMMON/PCOM/NSCP1, ITABP, ITABXP, ITABYP, IPFB, NP1, NP2, NLCP1, NLCP2,
13     1 NLCP3, NLCP4, IPLMSZ
14     *      ***** END COMDECK PARAM *****
15     C      *****
16     C      LCM IS SET UP IN THE FOLLOWING FASHION ==
17     C      BLOCK 1, NLCP1 WORDS LONG, ARRAY DATA
18     C      BLOCK 2, NLCP2 WORDS LONG, PARTICLE POSITIONS AND MASSES
19     C      BLOCK 3, NLCP3 WORDS LONG, TIME-DEPENDENT PARTICLE POSITIONS
20     C      BLOCK 4, IPLMSZ WORDS LONG, FILM FILE BUFFER FOR LTSS
21     C      BLOCK 5, NLCP4 WORDS LONG, SCRATCH AREA
22     C      *****
23
24     *      ***** BEGIN COMDECK YAGSC *****
25     LOGICAL RESTRY, FILM, PAPER, TURB
26     REAL LAM, MU
27     C      COMMON/YSC1/AASC(NSCP1)
28     COMMON/YSC1/AASC(9600)
29     COMMON/YSC2/AA(1), ANC, AB, ABFAC, ABM, BB, COLAMU, CYL, DR, DY, DYC, DTFAC,
30     1 DTC(10), DTC(10), DTC2, DTOS, DTPOS, DTV, DZ, EM10, EPS, FIPXL, FIPXR,
31     2 FIPYB, FIPYT, FIXL, FIXR, FIYB, FIYT, FREZXR, GR, GROVEL, GZ, GZP, I, IBAR,
32     3 IDTO, IJ, IJM, IJP, IM, IPXL, IPXR, IPYB, IPYT, IP1, IP2, ISC2, ISC3, ITV,
33     4 IUNF, IXL, IXR, IYB, IYT, J, JBAR
34     COMMON/YSC2/JCEN, JP1, JP2, JPA, JUNF, JUNF02, KX1, LAM, LPB, MU, NAME(8),
35     1 NCYC, NLC, NPS, NPT, NQ, NQ1, NQ1B, NQ1Z, NSC, NUMIT, ZORIG, OM, OMCYL, PXCONV
36     2 , PXL, PXR, PYB, PYCONV, PYT, RDT, REZRON, REZSIE, REZYB, RIBAR, P:BJB,
37     3 FREZYT, FREZYB, ROMFR, T, THIR, NCLST, TOUT, TWFIN
38     COMMON/YSC2/TUGI, TUSI, NCO, TNEG, TNEGSV, TUSV, TURB, PTO, PRIE, PBO, TH,
39     1 ILNG, NILNG, TPS, TUPOT, TOSAV, TK, TI, TUGENG, EPI, SAV1, BLEVEL, T0, IST,
40     2 VV, XCONV, XL, XR, YB, YCONV, YT, PTPOLD, DTSV, DTLAST, FIYBO, IYBO, YCNVLD,
41     3 XCNVLD, FIXRO, FIXLO, IXRO, IXLO, ISVW, JSVW, QMN, QMX, WMAX, JNM, T2, TLM,
42     4 ROMFXR, ROMFYT, ROMFYB, JDUMP, TWTHRD, TE, DTR, TMASS, DTVSAV, DTCSAV, IDTV
43     5 , JDTV, IDTC, JDTC, CIRC, TIS, POTE, UMON, VMON, TMAX, TGMX, ITM, JTM, IT0, JTB
44     6 , TMASSV, WMAXEF, RMINEF, TSTRTO
45     COMMON/YSC2/ZZ
46     C      COMMON/YSC4/ITAB(ITABP)
47     COMMON/YSC4/ITAB(1000)
48     COMMON/YSC5/RESTRY, FILM, PAPER, IPD, IPD
49     *      ***** END COMDECK YAGSC *****
50     COMMON/PTAB/PTAB(2)
51     INTEGER AA1
52     EXTERNAL YEXIT
53     DATA PTAB/6, 12/
54     DATA NSCP1/9600/, ITABP/1000/, ITABXP/101/, ITABYP/151/
55     DATA IPFB/200/, NP1/10/, NP2/200/, NLCP1/72300/, NLCP2/5000/
56     DATA NLCP3/2000/, NLCP4/1000/, IPLMSZ/4000/
57     DATA TP/0./

```

```

58      C
59      C      DO ANY NECESSARY SYSTEM INITIALIZATION
60      C
61      C      CALL SYINIT
62      C
63      C      INITIALIZE THE ERROR RECOVERY ROUTINE
64      C
65      C      CALL TRAP(YEXIT)
66      C
67      C      GET THE CP TIME AT JOB STARTUP
68      C
69      C      CALL SECOND(TP)
70      C      WRITE(59,38) TP
71      C
72      C      INITIALIZE
73      C
74      C      CALL YINIT
75      C
76      C      CHECK TYPE OF RUN
77      C
78      C      IF(RESTRT) GO TO 18
79      C
80      C      RUN IS A NEW PROBLEM. GO GENERATE IT.
81      C
82      C      CALL YASET
83      C      GO TO 28
84      C
85      C      RUN IS A PROBLEM RESTART. READ THE DUMP TAPE.
86      C
87      18 CONTINUE
88      C      CALL YAR8RT
89      C
90      C      GET RID OF THE DUMP FILE
91      C
92      C      CALL CLOSIT(7)
93      28 CONTINUE
94      C
95      C      EXECUTE THE MAIN CODE
96      C
97      C      CALL YAGUI2
98      C
99      C      RUN TERMINATION. EXIT.
100     C
101     C      CALL UNCLE(2,5HYAGUI,15,15MRUN TERMINATION)
102     C
103     38 FORMAT(1H ,29HBEGIN CODE EXECUTION AT CP = ,F10.4)
104     END

```

```

1      SUBROUTINE AIR
2      C
3      C      SEMI-PHYSICAL FIT TO THE EQUATION OF STATE OF AIR

```



```

4      C
5      C   DENSITIES FROM 10**2 TO 10**(-7) NORMAL DENSITY
6      C   PRESSURE=(GAMMA-1)*RHO*E, WHERE GAMMA IS A FUNCTON OF
7      C   DENSITY AND ENERGY
8      C   RHO=MATERIAL DENSITY
9      C   EJLN=MATERIAL SPECIFIC INTERNAL ENERGY
10     C   GMONE=GAMMA-1,
11     C   CONCJ=RELATIVE CONCENTRATION, SEE NOTE BELOW,
12     C
13     C   ALL UNITS ARE CGS FOR INPUT QUANTITIES
14     C
15     C   ORIGINALLY OBTAINED FROM THE AIR FORCE WEAPONS LAB
16     C   MODIFIED BY J.L.NORTON, LABL T-3, 1974
17     C
18     C   COMMON/EQNST/RHO,EJLN,GMONE,CONCJ
19     C
20     C   IN THIS VERSION OF THE CODE,TWO EQNS OF STATE ARE BEING USED,AIR
21     C   AND METHANE. THE FINAL VALUE OF GMONE IS DETERMINED BY
22     C   THE RELATION  GMONE(FINAL)=CONCJ*GMONE(METHANE)
23     C   +((1.-CONCJ)*GMONE(AIR),
24     C   THUS,CONCJ=1, YIELDS A METHANE GAMMA AND CONCJ=0,,AIR,
25     C   ANYTHING IN BETWEEN USES A LINEAR COMBINATION OF THE TWO.
26     C
27     C   CHECK TO MAKE SURE CONCJ DOES NOT EXCEED 1. IF IT DOES,SET IT TO 1
28     C
29     C   IF(CONCJ.GT.1,) CONCJ=1.
30     C
31     C   IFLAG=1 SIGNALS AIR TO DO THE GAMMA LINEAR COMBINATION. IF
32     C   CONCJ=0,,THIS IS UNNECESSARY.
33     C
34     C   IFLAG=0
35     C
36     C   IF CONCJ=0,,SKIP THE METHANE CALCULATION ENTIRELY
37     C
38     C   IF(CONCJ.EQ.0,) GO TO 10
39     C
40     C   GO GET THE METHANE GAMMA
41     C
42     C   CALL MTHANE
43     C
44     C   IF CONCJ=1,,WE ARE ALL DONE
45     C
46     C   IF(CONCJ.EQ.1,) RETURN
47     C
48     C   TURN ON THE LINEAR COMBINATION FLAG,SAVE THE METHANE GMONE,AND
49     C   CONTINUE ON WITH THE AIR EOS CALCULATION
50     C
51     C   IFLAG=1
52     C   GMM=GMONE
53     C
54     C   CALCULATE GAMMA=1. FOR AIR
55     C
56     C   10 CONTINUE
57     C
58     C   RHOZ IS THE NORMAL AIR DENSITY
59     C
60     C   RHOZ=1.293E-3

```

```

61      C
62      C      RHOT IS THE COMPRESSION
63      C
64      C      RHOT=RHO/RHOZ
65      C
66      C      MAKE E POSITIVE AND CONVERT TO SI UNITS (TJ/MG)
67      C
68      C      E=1,E=10*ABS(EJLN)
69      C
70      C      THE ENERGY AT WHICH OXYGEN AND NITROGEN DISSOCIATE IS A
71      C      FUNCTION OF DENSITY
72      C
73      C      E1=(0.5+E)/.975
74      C
75      C      THE FERMI-DIRAC FUNCTION IS ONLY COMPUTED WITHIN 5.*DELTA E OF
76      C      EACH TRANSITION, OTHERWISE IT IS ZERO OR ONE.
77      C
78      C      IF(ABS(E1)=5.)50,20,20
79      20 IF(E1) 40,40,30
80      30 F0=EXP(-E/4.46)
81      F0=0.
82      NS=1.
83      GO TO 60
84      40 F0=0.
85      F0=EXP(-E/6.63)
86      NS=0.
87      GO TO 60
88      50 DE1=.975*RHOT*.05
89      EE1=.5+.357*ALOG10(RHOT)
90      E1=(EE1-E)/DE1
91      NS=1./(EXP(-E1)+1.)
92      F0=EXP(-E/4.46)*NS
93      F0=EXP(-E/6.63)*(1.-NS)
94      C
95      C      THE DENSITY DEPENDENCE ONLY OCCURS ABOVE E=1., AND IT IS OF
96      C      THE FORM (RHO/RHOZ** (CONSTANT*LOG(E))). THE CONSTANT
97      C      MAKES A TRANSITION FROM .048 TO .029 AS THE OXYGEN
98      C      DISSOCIATES AND THE DENSITY SPREAD BECOMES CONSTANT BEYOND
99      C      THE SECOND PEAK.
100     C
101     60 IF(E=1.)70,70,00
102     70 BET=0.
103     GO TO 90
104     80 BET=(.048*NS+.032*(1.-NS))*ALOG10(E)
105     90 E2=(E-40.)/3.
106     IF(ABS(E2)=5.)130,100,100
107     100 IF(E2) 110,110,120
108     110 FN=0.
109     NS=0.
110     GO TO 140
111     120 FN=EXP(-E/25.5)
112     NS=1.
113     GO TO 100
114     130 DE2=.048*RHOT*.085
115     EE2=.45+.0197
116     E2=(EE2-E)/DE2
117     NS=1./(EXP(-E2)+1.)

```

```

1  SUBROUTINE BC(FLAG)
2
3  IF FLAG = 1 INDEX INDICATING WHICH VELOCITY ARRAYS ARE TO BE SET
4
5  IF FLAG = 1 = UT,VTL
6
7  IF FLAG = 2 = UL,VL
8
9  IF FLAG = 3 = UP,VP
10
11  WRITTEN BY J.L. MCINTON, LABL T-3, 1975
12
13  BEGIN COMDECK YSTORE
14  -----
15  DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
16  1),V(1),VG(1),MO(1),SIE(1),MP(1),HCB(1),E(1),ETIL(1),NVL
17  2),M(1),RM(1),VP(1),P(1),UP(1),UTIL(1),UL(1),CB(1),VTIL(1),
18  3),VL(1),MOL(1),AVXSV(1),AVVAV(1),DLBRO(1),DLBROB(1),CB(1),VTIL(1),
19  4),SIE(1),TUB(1),GMRD(1),GMRDZ(1),GMRD(1),TUBOVC(1),MTIL(1),
20  5 CONC(1),CTEMP(1),ANGU(1),ANGV(1),GRBV(1),GRBV(1),XZK(1),XZK(1),
21  6 YZK(1),YZK(1),XN13K(1),XN2K(1),DKLSM(1),AREA(1)
22  -----
23  BEGIN COMDECK YASBC
24  -----
25  LOGICAL RESTRY,FILM,PAPER,TURB
26  REAL LAM,MU
27  COMMON/YBC1/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DN,DT,DTAC,
28  COMMON/YBC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DN,DT,DTAC,
29  1 DTG(1),DTGC(1),DTG(1),DTG(1),DTG(1),DTG(1),DTG(1),DTG(1),DTG(1),
30  2 FIPV0,FIPV1,FIXL,FIXM,FIV0,FIV1,FREZZN,GRDVEL,GZ,GZF,I,IBAN,
31  3 IDT0,IJ,IJM,IJP,IM1,IPXL,IPXM,IPY0,IPY1,IP1,IP2,IP3,IP3,IPV,
4  IUNP,IXL,IXR,IY0,IY1,IJBAN

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```

116  FNEEXP(E/25.5)*MS
117  E3=(E-169.)/6.
118  DETABDETAB(1.0-N3)+.005*MS
119  IF(E3+5.)/150,160,160
120  FEN=0.
121  GO TO 170
122  FEN1/(EXP(-E3)+1.)
123  RHOFACGRHOFAC+0.87A
124  GMONER(1.01+.255*FO+.280*FON+.137*FN+.050*FE)*RHOFAC
125  IF FLAG IS ZERO, ONLY AIR IS DESIRED AND WE ARE ALL DONE
126  IF(FLAG.EQ.0) RETURN
127  CALCULATE THE GAMMA-1, LINEAR COMBINATION
128  GMONERCONJ=GMM+(1.-CONJ)*GMONER
129  RETURN
130  END

```

```

32      COMMON/YSC2/JCEN,JP1,JP2,JP3,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
33      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ10,NQ12,NSC,NUMIT,ZONIS,OM,OMCYL,PXCONV
34      2 ,PXL,PXR,PYB,PYCONV,PYT,ROT,REZRON,REZSTE,REZYB,RIDAR,RJBID,
35      3 PREZYT,PREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUSI,TUSI,NCO,THEG,THEGBV,TUSV,TURB,PTOP,PRITE,PBOTH,
37      1 ILNG,NILNG,TP3,TUPOT,YDSSAV,TK,TI,TUSENG,EPI,SAVI,OLEVEL,TB,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,OTSV,OTLAST,FIYBO,IYBO,YCNVLO,
39      3 XCNVLO,FXRO,FXLO,IXRO,IXLO,ISVH,JSVH,OMN,OMX,WMAX,JNH,T2,TLM,
40      4 ROMFR,ROMPYT,ROMPYB,JDUMP,TYTHRD,TE,DTR,TMAB,DTVSAV,DTCSAV,ISV
41      5 ,JDTV,JDTC,JDTC,CIRC,TIS,POTE,UMON,VMON,TMAX,TGMX,ITH,JTH,ITG,JTG
42      6 ,TMABSV,WMAXEP,RMINEP,TSTRD
43      COMMON/YSC2/ZZ
44      C      COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
47      *      ----- END COMDECK YASC -----
48      *      ----- BEGIN COMDECK YAGEO -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RD),(AASC(7),DELSH,RCSD,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIF),(AASC(16),PHS,DKLSH,RMP),(AASC(9
53      3 ),RVOL),(AASC(10),M,RH,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PHX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),G,CG,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUD),(AASC(19),SIG),(AASC(20),TUD),(AASC(
56      6 21),GROR),(AASC(22),GROR),(AASC(23),DLROIZ,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLROB,V8),(AASC(26),GRSV),(AASC(27),GROR,TUDVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      *      ----- END COMDECK YAGEO -----
63      *      ----- END COMDECK YSTORE -----
64      C      SET UP THE LOOP OVER CELLS
65      C
66      CALL START
67      C
68      C      SET THE BOTTOM BOUNDARY VELOCITIES
69      C
70      IJSV=IJ
71      DO 40 I=1,IP1
72      GO TO (16,20,30),IFLAG
73      10 CONTINUE
74      VTIL(IJ)=0.
75      GO TO 40
76      20 CONTINUE
77      VL(IJ)=0.
78      GO TO 40
79      30 CONTINUE
80      VF(IJ)=0.
81      40 IJ=IJ+NO
82      IJ=IJSV
83      C
84      C      SET THE LEFT AND RIGHT BOUNDARIES
85      C
86      DO 90 J=2,JP1
87      GO TO (50,60,70),IFLAG
88      50 CONTINUE

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```

89      UTIL(IJ)=0,
90      UTIL(IJ+NDIB)=0,
91      GO TO 88
92  65 CONTINUE
93      UL(IJ)=0,
94      UL(IJ+NDIB)=0,
95      GO TO 88
96  75 CONTINUE
97      UP(IJ)=0,
98      UP(IJ+NDIB)=0,
99      85 CONTINUE
100     CALL LOOP
101     95 CONTINUE
102
103  C      SET THE TOP BOUNDARY
104  C
105      DO 130 I=1,IP1
106      GO TO (100,110,120),IPLAG
107  100 CONTINUE
108      VTIL(IJ)=0,
109      GO TO 130
110  110 CONTINUE
111      VL(IJ)=0,
112      GO TO 130
113  120 CONTINUE
114      VP(IJ)=0,
115  130 IJ=IJ+ND
116
117  C      SET THE UPPER RIGHTHAND CORNER U
118  C
119      IJ=IJ+ND
120      GO TO (140,150,160),IPLAG
121  140 CONTINUE
122      UTIL(IJ)=0,
123      GO TO 170
124  150 CONTINUE
125      UL(IJ)=0,
126      GO TO 170
127  160 CONTINUE
128      UP(IJ)=0,
129  170 CONTINUE
130      CALL DONE
131      RETURN
132      END

```

```

1      SUBROUTINE CINIT
2  C
3  C      ROUTINE TO CALCULATE QUANTITIES FOR THE CYCLE PRINT AND
4  C      INITIALIZE FOR THE NEXT CYCLE
5  C
6  C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3

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7      C      MODIFIED AND DOCUMENTED BY J.L.NORTON, LABL T-3, 1975
8      C
9      *
10     ***** BEGIN COMDECK PARAM *****
11     COMMON/PCOM/NBCP1, ITABP, ITABXP, ITABYP, IPFB, NP1, NP2, NLCP1, NLCP2,
12     1 NLCP3, NLCP4, IFLMSZ
13     *      ***** END COMDECK PARAM *****
14     *      ***** BEGIN COMDECK YSTORE *****
15     *      ***** BEGIN COMDECK YAQDIM *****
16     DIMENSION X(1), XPAR(1), R(1), YPAR(1), Y(1), HPAR(1), U(1), UG(1), DELSM(
17     1 1), V(1), VG(1), RO(1), SIE(1), HP(1), RHP(1), RCBQ(1), E(1), ETIL(1), RVOL
18     2 (1), M(1), RM(1), VP(1), P(1), PL(1), UP(1), UTIL(1), UL(1), CQ(1), VTIL(1)
19     3 , VL(1), ROL(1), AVXSV(1), AVYSV(1), DLSROI(1), DLSROB(1), CAPGAM(1), TUB
20     4 (1), SIG(1), TUB(1), GRROR(1), GRRDZ(1), GRRDP(1), TUBVEC(1), MTIL(1),
21     5 CONC(1), CTEMP(1), ANCU(1), ANCV(1), GRBV(1), GZBV(1), X13K(1), X24K(1),
22     6 Y13K(1), Y24K(1), XR13K(1), XR24K(1), DKLSM(1), AREA(1)
23     *      ***** END COMDECK YAQDIM *****
24     *      ***** BEGIN COMDECK YAQSC *****
25     LOGICAL RESTRT, FILM, PAPER, TURB
26     REAL LAM, MU
27     C      COMMON/YSC1/AASC(NBCP1)
28     COMMON/YSC1/AASC(9688)
29     COMMON/YSC2/AA(1), ANC, AB, ABFAC, ABM, BB, COLAMU, CYL, DR, DT, DYC, DTFAC,
30     1 DTC(10), DTC(10), DT02, CT08, DT08, DTV, DZ, EM10, EP8, FIPXL, FIPXR,
31     2 FIPYB, FIPYT, FIXL, FIXR, FIYB, FIYT, FREZXR, GR, GROVEL, GZ, GZP, I, I0AR,
32     3 I0TD, IJ, IJM, IJP, IM1, IPXL, IPXR, IPYB, IPYT, IP1, IP2, ISC2, ISC3, ITV,
33     4 IUNF, IXL, IXR, IYB, IYT, J, J0AR
34     COMMON/YSC2/JCEN, JP1, JP2, JP4, JUNF, JUNF02, KXI, LAM, LPS, MU, NAME(8),
35     1 NCYC, NLC, NP8, NPT, N8, N01, N01B, N01Z, N8C, NUMIT, ZORIG, OM, OMCYL, PXCONV
36     2 , PXL, PXR, PYB, PYCONV, PYT, RDT, REZRON, REZBIE, REZYB, R10AR, R10JB,
37     3 FREZYT, FREZYB, ROMFR, T, THIR, NCLST, TOUT, TNFIN
38     COMMON/YSC2/TUB1, TUB1, NCB, YNEB, YNEGBV, TUBV, TURB, PTOP, PRITE, PBOOTH,
39     1 ILNG, NILNG, TP3, TUPOT, TD08AV, TK, TI, TUGENG, EP1, SAV1, QLEVEL, T0, IST,
40     2 VV, XCONV, XL, XR, YB, YCONV, YT, PTPOLD, DTSV, DTLAST, FIYBO, IYBO, YCNVLD,
41     3 XCNVLD, FIXRO, FIXLO, IXRO, IXLO, ISVH, JSVH, OMN, OMX, NHAX, JNM, T2, TLIH,
42     4 ROMFXR, ROMPYT, ROMFYB, JDUMP, TWTNRD, TE, DTR, TMASS, DTVSAV, DTC9AV, I0TV
43     5 , J0TV, I0TC, J0TC, CIRC, TIS, POTE, UMOM, VMOM, TMAX, TGMX, ITM, JTM, ITG, JTG
44     6 , TMASSV, NMAXEF, RMINEF, TSTRTD
45     C      COMMON/YSC2/ZZ
46     COMMON/YSC4/ITAB(ITABP)
47     COMMON/YSC4/ITAB(1000)
48     COMMON/YSC5/RESTRT, FILM, PAPER, IPD, IPD
49     *      ***** END COMDECK YAQSC *****
50     *      ***** BEGIN COMDECK YAGEQ *****
51     EQUIVALENCE(AASC(1), X, XPAR), (AASC(2), R, YPAR), (AASC(3), Y, HPAR), (
52     1 AASC(4), U), (AASC(5), V), (AASC(6), RO), (AASC(7), DELSM, RCBQ, MF), (AASC
53     2 (8), E, ETIL, AREA, XR13K),
54     3 (AASC(15), SIE), (AASC(16), PM8, DKLSM, RHP), (AASC(9
55     4 ), RVOL), (AASC(10), M, RM, VP), (AASC(11), P, PL, EP, UP), (AASC(12), UTIL,
56     5 UL, PMX, PU), (AASC(13), VTIL, VL, PMY, PV), (AASC(14), Q, CQ, ROL), (AASC(17
57     6 21), GRROR), (AASC(22), GRRDZ), (AASC(23), DLSROI, Y13K), (AASC(24), GZBV
58     7 ), (AASC(25), DLSROB, VG), (AASC(26), GRBV), (AASC(27), GRRDP, TUBVEC,
59     8 Y24K), (AASC(28), MTIL), (AASC(29), CONC), (AASC(30), CTEMP, XR24K), (
60     9 AASC(31), ANCU), (AASC(32), ANCV), (AASC(33), AVXSV, X13K), (AASC(34),
61     1 AVYSV, X24K)
62     REAL M, MP, HPAR, MTIL
63     *      ***** END COMDECK YAGEQ *****

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64 *      ---- END COMDECK YSTORE      ----
65 COMMON/EQNST/ROTMP,ETMP,GMONE,CONCJ
66 C
67 C      INITIALIZE LOOP VARIABLES
68 C
69      POTE=0.
70      TK=0.
71      TI=0.
72      UMON=0.
73      VMON=0.
74      TMASSV=TMASS
75      TMASS=0.
76      TJDENG=0.
77      CIRC=0.
78      TMAX=0.
79      TGMX=0.
80      ITM=0
81      JTG=0
82      JTM=0
83      JTG=0
84 C
85 C      LOOP OVER ALL REAL ZONES IN THE MESH
86 C
87      CALL START
88      DO 60 J=2,JP1
89      DO 50 I=1,IBAR
90      IPJ=IJ+NQ
91      IJP=IJP+NQ
92 C
93 C      TMAX IS THE MAXIMUM SIE OF ANY CELL IN THE MESH, IT IS FOUND
94 C      IN CELL ITM,JTM,
95 C
96      IF(SIE(IJ).LE.TMAX) GO TO 10
97      ITM=I
98      JTM=J
99      TMAX=SIE(IJ)
100 C
101 C      TGMX IS THE MAXIMUM SIE GRADIENT AND (ITG,JTG) IS THE CELL
102 C      IN WHICH IT OCCURS
103 C
104      10 CONTINUE
105      SAVAX=(X(IJP)-X(IJ))*2+(Y(IJP)-Y(IJ))*2
106      SAVB=(X(IJP)-X(IJ))*2+(Y(IJP)-Y(IJ))*2
107      SAVAX=ABS(SIE(IJ)-SIE(IJP))/SQRT(SAVAX)
108      SAVB=ABS(SIE(IJ)-SIE(IJP))/SQRT(SAVB)
109      SAV=AMAX1(SAVAX,SAVB)
110      IF(SAV.LT.TGMX) GO TO 20
111      ITG=I
112      JTG=J
113      TGMX=SAV
114      20 CONTINUE
115 C
116 C      CALCULATE THE CIRCULATION AROUND THE PROBLEM BOUNDARIES
117 C
118      IF(I.EQ.1) CIRC=CIRC+0.5*(V(IJ)+V(IJP))*(Y(IJP)-Y(IJ))
119      IF(I.EQ.IM1) CIRC=CIRC-0.5*(V(IJ)+V(IJP))*(Y(IJP)-Y(IJ))
120      IF(J.EQ.3) CIRC=CIRC-0.5*(U(IJ)+U(IJP))*(X(IJP)-X(IJ))

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121      IF(J.EQ,JBAR) CIRC=CIRC+0.5*(U(IJ)+U(IPJ))*(X(IPJ)-X(IJ))
122      C
123      XMSENG IS THE MASS IN CELL I,J
124      C
125      C
126      XMSENG=RO(IJ)/RVOL(IJ)
127      YMASS=YMASS+XMSENG
128      C
129      C
130      C
131      SPENK=0.125*(U(IPJ)**2+U(IPJP)**2+U(IJP)**2+U(IJ)**2+V(IPJ)**2+V(
132      I IPJP)**2+V(IJP)**2+V(IJ)**2)
133      C
134      C
135      C
136      TK IS THE TOTAL KINETIC ENERGY IN THE PROBLEM
137      C
138      C
139      C
140      TK=TK+SPENK*XMSENG
141      C
142      C
143      C
144      C
145      TI IS THE TOTAL INTERNAL ENERGY IN THE PROBLEM
146      C
147      C
148      C
149      C
150      C
151      TI=TI+XMSENG*STC(IJ)
152      C
153      C
154      C
155      UMON AND VMON ARE THE RADIAL AND AXIAL TOTAL MOMENTA,
156      C
157      C
158      C
159      C
160      C
161      UMON=UMON+0.25*XMSENG*(U(IPJ)+U(IPJP)+U(IJP)+U(IJ))
162      VMON=VMON+0.25*XMSENG*(V(IPJ)+V(IPJP)+V(IJP)+V(IJ))
163      C
164      C
165      C
166      C
167      C
168      POTE IS THE TOTAL GRAVITATIONAL POTENTIAL ENERGY (WITH G=1.),
169      C
170      C
171      C
172      C
173      C
174      POTE=POTE+Y(IJ)/RM(IJ)
175      C
176      C
177      C
178      C
179      C
180      ADD THE J=JP2 VERTEX INTO THE POTENTIAL ENERGY
181      C
182      C
183      C
184      C
185      C
186      IF(J.EQ,JP1) POTE=POTE+V(IJP)/RM(IJP)
187      IF(TURB) TUBENG=TUBENG+TUB(IJ)*XMSENG
188      C
189      C
190      C
191      C
192      C
193      NEW PRESSURE MUST BE CALCULATED, P ARRAY CURRENTLY HOLDS
194      C
195      C
196      C
197      C
198      C
199      VELOCITIES DUE TO EQUIVALENCING OF P WITH UP.
200      C
201      C
202      C
203      C
204      C
205      PUT A LOWER BOUND OF ZERO ON THE SIE
206      C
207      C
208      C
209      C
210      C
211      SIE=AMAX1(SIE(IJ),0.)
212      C
213      C
214      C
215      C
216      C
217      GO GET THE CELL GAMMA=1
218      C
219      C
220      C
221      C
222      C
223      ROTMP=RO(IJ)
224      ETMP=SIE
225      CONCJ=CONC(IJ)
226      CALL AIR
227      GM1=GMONE
228      C
229      C
230      C
231      C
232      C
233      COMPUTE PRESSURE
234      C
235      C
236      C
237      C
238      C
239      P(IJ)=GM1*ROTMP*SIE
240      C
241      C
242      C
243      C
244      C
245      SET PRESSURE OF BOTTOM FICTITIOUS ROW USING GAMMA OF CELLS ABOVE

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178 C
179 IF(J.EQ,2) P(IJM)=GM1+RO(IJM)*SIE(IJM)
180 C
181 SET PRESSURE OF TOP FICTITIOUS ROW USING GAMMA OF CELLS BELOW
182 C
183 IF(J.EQ,JP1) P(IJP)=GM1+RO(IJP)*SIE(IJP)
184 C
185 SEE IF WE ARE PROCESSING THE RIGHTMOST REAL COLUMN
186 C
187 IF(I.NE,IBAR) GO TO 40
188 C
189 YES,
190 C
191 SET PRESSURE OF RIGHT FICTITIOUS COLUMN USING GAMMA OF CELLS
192 C TO THE LEFT
193 C
194 P(IPJ)=GM1+RO(IPJ)*SIE(IPJ)
195 C
196 SEE IF WE ARE PROCESSING THE BOTTOM REAL ROW
197 C
198 IF(J.NE,2) GO TO 30
199 C
200 YES,
201 C
202 SET PRESSURE OF BOTTOM CELL IN RIGHT FICTITIOUS COLUMN USING
203 C GAMMA OF CELL (IBAR,2)
204 C
205 IPJM=IJM+NG
206 P(IPJM)=GM1+RO(IPJM)*SIE(IPJM)
207 GO TO 40
208 30 CONTINUE
209 C
210 NO, SEE IF WE ARE PROCESSING THE TOP REAL ROW,
211 C
212 IF(J.NE,JP1) GO TO 40
213 C
214 YES,
215 C
216 SET PRESSURE OF UPPER CELL IN RIGHT FICTITIOUS COLUMN USING
217 C GAMMA OF CELL (IBAR,JP1)
218 C
219 P(IPJP)=GM1+RO(IPJP)*SIE(IPJP)
220 40 CONTINUE
221 IJ=IPJ
222 IJP=IJP+NG
223 IJM=IJM+NG
224 50 CONTINUE
225 C
226 ADD THE I=IP1 VERTEX INTO THE POTENTIAL ENERGY
227 C
228 POTE=POTE+Y(IJ)/RM(IJ)
229 C
230 ADD THE (IP1,JP2) VERTEX INTO THE POTENTIAL ENERGY
231 C
232 IF(J.EQ,JP1) POTE=POTE+Y(IJP)/RM(IJP)
233 CALL LOOP
234 60 CONTINUE

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235      CALL DONE
236      RETURN
237      END

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1      SUBROUTINE CONTOUR(ILOG,ITITLE,NWT)
2      C
3      C      ROUTINE FOR DOING CONTOUR PLOTS IN YAGUI
4      C
5      C      ILOG IS 0 IF LINEAR CONTOUR INCREMENTS ARE TO BE USED
6      C      ILOG IS 1 FOR LOGARITHMIC CONTOUR INCREMENTS
7      C      ITITLE IS THE HOLLERITH TITLE TO BE USED ON THE PLOT
8      C      NWT IS THE NO. OF COMPUTER WORDS IN THE TITLE
9      C
10     C      THE QUANTITY TO BE PLOTTED IS FOUND IN CQ
11     C
12     C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
13     C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1975
14     C
15     *      ----- BEGIN COMDECK PARAM -----
16     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
17     1 NLCP3,NLCP4,IFLMBZ
18     *      ----- END COMDECK PARAM -----
19     *      ----- BEGIN COMDECK YSTORE -----
20     *      ----- BEGIN COMDECK YAQDIM -----
21     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DEL8M(
22     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RC8Q(1),E(1),ETIL(1),QVOL
23     2 1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
24     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROB(1),CAPGAM(1),TUG
25     4 1),SIG(1),TUS(1),GRROR(1),GRRORZ(1),GRRORP(1),TUOVEC(1),MTIL(1),
26     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
27     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
28     *      ----- END COMDECK YAQDIM -----
29     *      ----- BEGIN COMDECK YAQSC -----
30     LOGICAL RESTRY,FILM,PAPER,TURB
31     REAL LAM,MU
32     C      COMMON/YSC1/AASC(NSCP1)
33     COMMON/YSC1/AASC(9699)
34     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ASH,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
35     1 DTC(16),DTC(16),DT02,DY0B,DTPOS,DTV,DZ,EN1B,EP9,FIPXL,FIPXR,
36     2 FIPYB,FIPYT,FIXL,FIKR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,ICAR,
37     3 IDTO,IJ,IJH,IJP,IMI,IPKL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,TV,
38     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
39     COMMON/YSC2/JCEN,JP1,JP2,JP3,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
40     1 NCYC,NLC,NPB,NPT,NQ,NQ1,NQ1B,NQ1Z,NBC,NUMIT,ZORIG,OM,OMCYL,PXCONV
41     2 ,PKL,PKR,PYB,PYCONV,PYT,ROT,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
42     3 PREZYT,FREZYB,ROMFR,T,THIRD,NCLST,YOUT,TMFIN
43     COMMON/YSC2/TUQ1,TUS1,NCQ,TNEG,TNEGSV,TUSV,TUR3,PTOP,PRITE,PBOTH,
44     1 ILNG,MILNG,TP3,TUPOT,TQSAV,TX,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
45     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,OTSV,OTLAST,FIYBO,IYBO,YCNVLO,
46     3 XCNVLO,FIKRO,FIKLO,IXRO,IXLO,ISVH,JSVH,QMN,QMX,NMAX,JNH,TZ,TLIM,
47     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAV,DTCSAV,IDTV

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48      5 , JDTV, IDTC, JDTC, CIRC, TIS, POTE, UMOM, VMOM, TMAX, TGMX, ITM, JTM, ITG, JTG
49      6 , THASSV, WHAXEF, RMINEF, TSTRTO
50      COMMON/YSC2/ZZ
51      C      COMMON/YSC4/ITAB(ITABP)
52      COMMON/YSC4/ITAB(1000)
53      COMMON/YSC5/RESTRY, FILM, PAPER, IPD, IFD
54      *      ***** END COMDECK YAGSC *****
55      *      ***** BEGIN COMDECK YAQEQ *****
56      EQUIVALENCE(AASC(1), X, XPAR), (AASC(2), R, YPAR), (AASC(3), Y, MPAR), (
57      1 AASC(4), U), (AASC(5), V), (AASC(6), RO), (AASC(7), DELSM, RCSEQ, MP), (AASC
58      1 (8), E, ETIL, AREA, XR13K),
59      2 (AASC(15), SIE), (AASC(16), PHO, DKLSM, RMP), (AASC(9
60      3 ), RVOL), (AASC(10), H, RM, VP), (AASC(11), P, PL, EP, UP), (AASC(12), UTIL,
61      4 UL, PMX, PU), (AASC(13), VTIL, VL, PMY, PV), (AASC(14), Q, CQ, ROL), (AASC(17
62      5 ), CAPGAM, UG), (AASC(18), TUQ), (AASC(19), SIG), (AASC(20), TUS), (AASC(
63      6 21), GNROR), (AASC(22), GNR0Z), (AASC(23), DLSROI, Y13K), (AASC(24), GZSV
64      7 ), (AASC(25), DLSROI, VG), (AASC(26), GRSV), (AASC(27), GRR0P, TUQVEC,
65      8 Y24K), (AASC(28), MTIL), (AASC(29), CONC), (AASC(30), CTEMP, XR24K), (
66      9 AASC(31), ANCU), (AASC(32), ANCV), (AASC(33), AVXSV, X13K), (AASC(34),
67      1 AVYSV, X24K)
68      REAL M, MP, MPAR, MTIL
69      *      ***** END COMDECK YAQEQ *****
70      *      ***** END COMDECK YSTORE *****
71      *      ***** BEGIN COMDECK ASTORE *****
72      COMMON/ASTC/AT(100), FY(100)
73      DIMENSION IX1(1), IY1(1), IX2(1), IY2(1), XCO(1), YCO(1), CON(1)
74      EQUIVALENCE(AT, IX1), (AT(2), IX2), (AT(3), IY1), (AT(4), IY2), (AT(9), XCO
75      1 ), (AT(9), YCO), (FY, CON)
76      *      ***** END COMDECK ASTORE *****
77      *      ***** BEGIN COMDECK PCALL *****
78      COMMON/PCALLC/XCONVP, YCONVP, YUP, YLB
79      *      ***** END COMDECK PCALL *****
80      DIMENSION BCD(2), ITITLE(1)
81      DIMENSION ILABEL(26), IPLBL(26)
82      DATA ILABEL/1HA, 1HB, 1HC, 1HD, 1HE, 1HF, 1HG, 1HH, 1HI, 1HJ, 1HK, 1HL, 1HM,
83      1 1HN, 1HO, 1HP, 1HQ, 1HR, 1HS, 1HT, 1HU, 1HV, 1HW, 1HX, 1HY, 1HZ/
84      DATA IPLBL/17, 18, 19, 20, 21, 22, 23, 24, 25, 33, 34, 35, 36, 37, 38, 39, 40, 41,
85      1 50, 51, 52, 53, 54, 55, 56, 57/
86      DATA BCD/1H /
87      C
88      C      FIND THE MINIMUM AND MAXIMUM (GMN AND GMX) OF THE QUANTITY
89      C      TO BE PLOTTED
90      C
91      GMN=1.E30
92      GMX=GMN
93      CALL START
94      DO 20 J=2, JP1
95      DO 10 I=1, IBAR
96      GMN=AMIN1(CB(IJ), GMN)
97      GMX=AMAX1(CB(IJ), GMX)
98      10 IJ=IJ+NQ
99      CALL LOOP
100     20 CONTINUE
101     C
102     C      SET THE CONTOUR INCREMENT. THE BASIC ALGORITHM IS BASED ON
103     C      THE DESIRE TO HAVE THE CONTOUR INCREMENT AN INTEGRAL POWER
104     C      OF TWO AND THE CONTOURS THEMSELVES INTEGRAL MULTIPLES OF

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105 C      THIS POWER OF TWO, THESE FACTS INSURE THAT TWO PLOTS
106 C      VERY NEARLY THE SAME WILL HAVE EXACTLY THE SAME CONTOUR
107 C      VALUES. FIRST MAKE AN INITIAL GUESS FOR THE CONTOUR
108 C      INCREMENT (DQ) SO THAT THERE ARE AT LEAST TEN CONTOURS,
109 C
110 C      DQ=(GMX-OMN)/10,
111 C
112 C      IF THE INCREMENT IS ZERO OR NEGATIVE, BYPASS THE PLOT
113 C
114 C      IF(DQ,LE,0,) RETURN
115 C
116 C      FIND A POWER OF TWO JUST LESS THAN DQ BUT AT LEAST 2***33
117 C      (WHICH IS ABOUT 10***10)
118 C
119 C      TEST=2,**(=-32)
120 C      30 CONTINUE
121 C      IF(TEST,GE,DQ) GO TO 40
122 C      TEST=2,*TEST
123 C      GO TO 30
124 C      40 CONTINUE
125 C
126 C      SET THE CONTOUR INCREMENT TO IT
127 C
128 C      DQ=.5*TEST
129 C
130 C      NOW DETERMINE THE CONTOUR VALUES. K WILL BE THE FINAL NO.
131 C      OF CONTOURS, THE FIRST CONTOUR IS THE NEAREST INTEGRAL
132 C      MULTIPLE OF DQ LESS THAN OMN,
133 C
134 C      50 CONTINUE
135 C      ITEST=OMN/DQ
136 C      IF(ITEST,LT,0) ITEST=ITEST+1
137 C      CON(1)=FLOAT(ITEST)*DQ
138 C      DO 60 K=2,27
139 C      IF(CON(K-1),GT,GMX) GO TO 70
140 C      IF(K,EQ,27) GO TO 60
141 C      CON(K)=CON(K-1)+DQ
142 C      60 CONTINUE
143 C
144 C      TOO MANY CONTOURS, GO INCREASE DQ AND TRY AGAIN,
145 C
146 C      GO TO 80
147 C      70 CONTINUE
148 C      K=K+1
149 C
150 C      IF THERE ARE MORE THAN 20 CONTCURS, INCREASE DQ AND GO CALCULATE
151 C      THE CONTOURS AGAIN,
152 C
153 C      IF(K,LE,20) GO TO 90
154 C      80 CONTINUE
155 C      DQ=2,*DQ
156 C      GO TO 50
157 C      90 CONTINUE
158 C
159 C      ADVANCE THE FILM TO THE NEXT FRAME
160 C
161 C      CALL ADV(1)

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162 C
163 C SET THE HEIGHT OF THE FIRST LINE OF THE CONTOUR LABELS
164 C
165 CALL LINCNT(6)
166 C
167 C LIST THE CONTOURS ON THE PLOT
168 C
169 DO 188 KK=1,K
170 WRITE(IPD,258) ILABEL(KK),CON(KK)
171 188 CONTINUE
172 WRITE(IPD,268) QMN,QMX
173 C
174 C LABEL THE TYPE OF PLOT
175 C
176 CALL LINCNT(58)
177 WRITE(IPD,278)(ITITLE(I),I=1,NMT)
178 WRITE(IPD,298) JNM,NAME,T,NCYC
179 C
180 C PUT CONTOUR INFORMATION OUT TO CYCLE SUMMARY
181 C
182 IPDX=6
183 WRITE(IPDX,288)(ITITLE(I),I=1,NMT)
184 WRITE(IPDX,308) QMN,QMX,CON(1),CON(K=1),DO
185 C
186 C LOOP TO DO THE ACTUAL PLOT
187 C
188 C CALL START PULLS IN ROWS 1,2,AND 3 AND LEAVES IJ POINTING AT
189 C ROW 2
190 C
191 CALL START
192 DO 248 J=2,JBAR
193 C
194 C CALL LOOP AT THIS POINT SHIFTS THE ROWS IN SCM UP ONE SO THAT
195 C IJ POINTS AT ROW J+1 INSTEAD OF ROW J
196 C
197 CALL LOOP
198 DO 238 I=1,IM1
199 IPJ=IJ+NQ
200 IPJM=IJM+NQ
201 C
202 C N=0 SIGNIFIES THAT XCO AND YCO HAVE NOT BEEN COMPUTED FOR THIS
203 C I AND J
204 C
205 N=0
206 C
207 C LOOP OVER ALL OF THE CONTOUR VALUES
208 C
209 DO 228 KK=1,K
210 C
211 C SET FLAGS.
212 C
213 C CONSIDER THE FOUR CELLS (I,J),(I+1,J),(I,J+1), AND (I+1,J+1)
214 C AND LET THEM BE DENOTED CELLS 1,2,3,AND 4,RESPECTIVELY.
215 C THEN,KN IS ZERO IF THE QUANTITY TO BE PLOTTED IN CELL N
216 C IS GREATER THAN THE CURRENT CONTOUR VALUE, AND 1 IF
217 C THE QUANTITY TO BE PLOTTED IS LESS THAN OR EQUAL TO
218 C THE CURRENT CONTOUR VALUE.

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219 C
220 C NOTE THAT WHAT IS BEING CONSIDERED IS THE QUADRILATERAL FORMED BY
221 C CONNECTING THE CENTERS OF THE FOUR CELLS IN THE ORDER
222 C 1=2-4=3=1, LET THIS BE KNOWN AS THE CURRENT CONTOUR AREA,
223 C
224 K1=0
225 K2=0
226 K3=0
227 K4=0
228 IF(CQ(IJM),LE,CON(KK)) K1=1
229 IF(CQ(IPJM),LE,CON(KK)) K2=1
230 IF(CQ(IJ),LE,CON(KK)) K3=1
231 IF(CQ(IPJ),LE,CON(KK)) K4=1
232 C
233 C IF ALL THE FLAGS ARE 1 OR 0, THEN THE CURRENT CONTOUR IS EITHER
234 C GREATER THAN OR LESS THAN OR EQUAL TO THE PLOT QUANTITIES
235 C AT ALL FOUR CORNERS OF THE CURRENT CONTOUR AREA, THUS, THE
236 C CURRENT CONTOUR DOES NOT CROSS THE CURRENT CONTOUR AREA,
237 C GO ON TO THE NEXT CONTOUR,
238 C
239 IF(K1=K2=K3=K4,NE,0,OR,K1+K2+K3+K4,EQ,0) GO TO 220
240 C
241 C CALCULATE THE CENTERS OF CELLS 1,2,3,AND 4 (THE VERTICES OF THE
242 C CURRENT CONTOUR AREA) IF THIS HAS NOT ALREADY BEEN DONE,
243 C
244 IF(N,GT,0) GO TO 130
245 IJB=IJM
246 IJA=IJ
247 DO 120 JJ=1,2
248 DO 110 II=1,2
249 IPJB=IJB+NQ
250 IPJA=IJA+NQ
251 N=N+1
252 XCO(N)=.25*(X(IPJB)+X(IPJA)+X(IJA)+X(IJB))
253 YCO(N)=.25*(Y(IPJB)+Y(IPJA)+Y(IJA)+Y(IJB))
254 IJA=IPJA
255 110 IJB=IPJB
256 IJB=IJ
257 120 IJA=IJP
258 130 CONTINUE
259 C
260 C DETERMINE WHICH SIDES OF THE CURRENT CONTOUR AREA THE CURRENT
261 C CONTOUR CROSSES,
262 C LI COUNTS HOW MANY SIDES THAT HAVE BEEN FOUND TO BE CROSSED
263 C
264 LL=0
265 C
266 C SEE IF THE LEFT SIDE IS CROSSED
267 C
268 IF(K1+K3,NE,1) GO TO 140
269 C
270 C YES, IC1 AND IC2 ARE THE VERTEX NUMBERS OF THE CURRENT CONTOUR
271 C AREA THAT BOUND THE SIDE CROSSED, IJ1 AND IJ2 ARE THE INDICES
272 C OF THE MESH CELLS CONTAINING THESE VERTICES,
273 C
274 IC1=1
275 IC2=3

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276      IJ1=IJM
277      IJ2=IJ
278      C
279      C      GO SET UP PLOT COORDINATES FOR THIS CROSSING
280      C
281      GO TO 170
282      C
283      C      SEE IF THE BOTTOM IS CROSSED BY THE CONTOUR
284      C
285      140 IF(K1+K2,NE,1) GO TO 150
286      C
287      C      YES
288      C
289      IC1=1
290      IC2=2
291      IJ1=IJM
292      IJ2=IPJM
293      GO TO 170
294      C
295      C      SEE IF RIGHT IS CROSSED
296      C
297      150 IF(K2+K4,NE,1) GO TO 160
298      IC1=2
299      IC2=4
300      IJ1=IPJM
301      IJ2=IPJ
302      GO TO 170
303      C
304      C      SEE IF TOP IS CROSSED
305      C
306      160 IF(K3+K4,NE,1) GO TO 220
307      IC1=3
308      IC2=4
309      IJ1=IJ
310      IJ2=IPJ
311      C
312      C      INCREMENT THE NO. OF SIDES CROSSED
313      C
314      170 LL=LL+1
315      C
316      C      CONTOUR LIES BETWEEN CQ(IJ1) AND CQ(IJ2). CALCULATE HOW FAR
317      C      ALONG THE LINE CONNECTING VERTICES IC1 AND IC2 THE
318      C      INTERSECTION SHOULD ACTUALLY LIE,
319      C
320      XX=(CON(KK)-CQ(IJ1))/(CQ(IJ2)-CQ(IJ1))
321      C
322      C      IX1(LL) AND IY1(LL) ARE THE RASTER COORDINATES OF THE POINT OF
323      C      INTERSECTION OF THE CONTOUR AND THE CONTOUR AREA SIDE
324      C      FOR INTERSECTION LL
325      C
326      IX1(LL)=FIXL+(XCO(IC1)+XX*(XCO(IC2)-XCO(IC1))-XL)*XCONV
327      IY1(LL)=FIYB+(YCO(IC1)+XX*(YCO(IC2)-YCO(IC1))-YLB)*YCONV
328      C
329      C      IF FOR SOME REASON THE INTERSECTION POINT LIES OUTSIDE OF THE
330      C      PLOTTING RECTANGLE, IGNORE THE INTERSECTION
331      C
332      IF(IY1(LL).GT.IVB.OR,IY1(LL).LT.IYT) GO TO 210

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333      IF (IX1(LL).LT.IXL.OR.(IX1(LL).GT.IXR)); GO TO 210
334      C
335      C      IF ONLY ONE INTERSECTION HAS BEEN LOCATED, GO BACK AND LOOK
336      C      FOR ANOTHER
337      C
338      IF (LL.GE.2) GO TO 200
339      100 CONTINUE
340      C
341      C      IF IC1=2, RIGHT SIDE WAS INTERSECTED LAST. GO BACK AND GET
342      C      THE TOP SIDE. IF IC1=3, TOP SIDE WAS INTERSECTED LAST.
343      C      ALL SIDES HAVE BEEN CHECKED, GO ON TO NEXT CONTOUR.
344      C
345      GO TO (190,160,220), IC1
346      C
347      C      IC1=1. EITHER LEFT OR BOTTOM WAS LAST INTERSECTED. IF BOTTOM
348      C      (IC2=2), GO BACK AND CHECK THE RIGHT. IF LEFT (IC2=3),
349      C      GO BACK AND CHECK THE BOTTOM.
350      C
351      190 CONTINUE
352      IF (IC2.EQ.2) GO TO 150
353      GO TO 140
354      200 CONTINUE
355      C
356      C      TWO SIDES HAVE BEEN CROSSED, CONNECT THE POINTS OF
357      C      INTERSECTION.
358      C
359      CALL ORV (IX1, IY1, IX2, IY2)
360      C
361      C      PLOT THE LABEL ON THE FIRST INTERSECTION POINT
362      C
363      CALL PLT (IX1, IY1, IPLBL(KK))
364      210 CONTINUE
365      C
366      C      START ON A NEW INTERSECTION PAIR IF BOTTOM WAS LAST SIDE
367      C      CHECKED. OTHERWISE, THERE ARE NOT TWO POSSIBLE INTERSECTIONS
368      C      LEFT SO WE ARE DONE.
369      C
370      LL=0
371      IF (IJ2.EQ.IPJN) GO TO 180
372      220 CONTINUE
373      IJM=IPJM
374      IJ=IPJ
375      230 IJP=IJP+NO
376      240 CONTINUE
377      C
378      C      DRAW THE PLOT FRAME AND LABEL IT
379      C
380      CALL TICBOX
381      RETURN
382      C
383      250 FORMAT(100XA1, 2X1PE10, 3)
384      260 FORMAT(90X3HOMN, 2X1PE10, 3/90X3HOMX, 2XE10, 3)
385      270 FORMAT(1H , 6A10)
386      280 FORMAT(1H , 16HCONTOUR PLOT OF , 6A10)
387      290 FORMAT(1H , 4XA10, 8A10, 3X2HT=, 1PE12, 9, 1X6NCYCLE=, 39)
388      300 FORMAT(5H MIN=1PE12, 5, 5H MAX=E12, 5, 3H L=E12, 5, 3H H=E12, 5, /1H , 16X
389      1 4H DQ=E12, 9)

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1      SUBROUTINE DEFINE
2      C
3      C      ROUTINE TO INITIALIZE PROBLEM INPUT VARIABLES
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1974
6      C
7      *      ----- BEGIN COMDECK PARAM -----
8      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
9      1 NLCP3,NLCP4,IFLMSZ
10     *      ----- END COMDECK PARAM -----
11     *      ----- BEGIN COMDECK YAGSC -----
12     LOGICAL RESTRY,FILM,PAPER,TURB
13     REAL LAM,MU
14     C      COMMON/YSC1/AASC(NSCP1)
15     COMMON/YSC1/AASC(9688)
16     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DR,DT,DTFAC,
17     1 DTC(10),DTOC(10),DT02,DT08,DT0S,DTV,DZ,EM10,EP5,FIPXL,FIPXR,
18     2 FIPYB,FIPYT,FIXL,FIXR,FIY3,FIYT,FREIXR,GR,GRDVEL,GZ,GZP,I,IBAR,
19     3 IDTQ,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
20     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
21     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
22     1 NCYC,NLC,NPS,NPT,NO,NQ1,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
23     2 ,PXL,PXR,PYB,PYCONV,PYT,RDY,REZRDN,REZSIE,REZYB,RIBAR,RIBJB,
24     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
25     COMMON/YSC2/TUOI,TUSI,NCQ,NEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
26     1 ILHG,NILNG,TP3,TUPQT,TQSAV,TX,TI,TUDENG,EPI,SAVI,QLEVEL,TQ,IST,
27     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLO,DTSV,DTLAST,FIY80,IY80,YCNVLD,
28     3 XCNVLD,FIY80,FIYLO,IXRO,IXLO,ISVH,JSVH,QMN,QMX,NMAX,JNM,T2,TLM,
29     4 ROMFXR,ROMFYI,ROMFYB,JDUMP,TMYMD,TE,DTK,THASS,DTVSAV,DTCSAV,IDTV
30     5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITC,JTC
31     6 ,THASSV,WMAXEF,RHINEF,TSTRTO
32     COMMON/YSC2/ZZ
33     C      COMMON/YSC4/ITAB(ITABP)
34     COMMON/YSC4/ITAB(1000)
35     COMMON/YSC5/RESTRY,FILM,PAPER,IPD,IPD
36     *      ----- END COMDECK YAGSC -----
37     C      MU AND LAM ARE THE VISCOSITY COEFFICIENTS
38     C
39     MU=0.
40     LAM=.6
41     C
42     C      OM IS THE PHASE TWO ITERATION RELAXATION PARAMETER OMEGA
43     C
44     OM=1.
45     C
46     C      EP5 IS THE PRESSURE ITERATION CONVERGENCE CRITERION
47     C
48     EP5=.1,E=5
49     C

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50      C      GR IS THE RADIAL COMPONENT OF THE BODY FORCE FELT BY THE ENTIRE
51      C      PROBLEM
52      C
53      C      GR=0.
54      C
55      C      GZ IS THE AXIAL COMPONENT OF THE BODY FORCE FELT BY THE ENTIRE
56      C      PROBLEM (USUALLY GRAVITY IN THE -Z DIRECTION)
57      C
58      C      GZ=980.
59      C
60      C      FREZXR IS THE RATIO OF ZONE DR=0 AS ONE MOVES AWAY FROM
61      C      THE REGION OF CONSTANT ZONING TOWARD THE RIGHT BOUNDARY
62      C
63      C      FREZXR=1.
64      C
65      C      FREZYT IS THE RATIO OF ZONE DZ=0 AS ONE MOVES AWAY FROM
66      C      THE REGION OF CONSTANT ZONING TOWARD THE TOP BOUNDARY
67      C
68      C      FREZYT=1.
69      C
70      C      FREZYB IS THE RATIO OF ZONE DZ=0 AS ONE MOVES AWAY FROM
71      C      THE REGION OF CONSTANT ZONING TOWARD THE BOTTOM BOUNDARY
72      C
73      C      FREZYB=1.
74      C
75      C      YB IS THE ACTUAL BOTTOM OF THE GRID
76      C
77      C      YB=0.
78      C
79      C      REZYB IS THE CENTER OF THE REGION OF UNIFORM ZONING, EITHER YB OR
80      C      REZYB MAY BE SPECIFIED.
81      C
82      C      REZYB=0.
83      C
84      C      REZR000 IS THE INITIAL DENSITY OF THE AMBIENT ATMOSPHERE AT Z=REZYB
85      C
86      C      REZR000=.001
87      C
88      C      REZSIE IS THE SPECIFIC INTERNAL ENERGY OF THE AMBIENT ATMOSPHERE4
89      C
90      C      REZSIE=2.210
91      C
92      C      IBAR IS THE NUMBER OF REAL ZONES IN THE RADIAL DIRECTION
93      C
94      C      IBAR=0
95      C
96      C      JBAR IS THE NUMBER OF REAL ZONES IN THE AXIAL DIRECTION
97      C
98      C      JBAR=0
99      C
100     C      IUNF IS THE NUMBER OF UNIFORM ZONES IN THE RADIAL DIRECTION
101     C
102     C      IUNF=0
103     C
104     C      JUNF IS THE NUMBER OF UNIFORM ZONES IN THE AXIAL DIRECTION
105     C
106     C      JUNF=0

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107 C
108 C JCN IS THE J VALUE ABOVE AND BELOW WHICH THERE ARE AN EQUAL
109 C NUMBER OF UNIFORM ZONES
110 C
111 C JCN=0
112 C
113 C DR IS THE UNIFORM RADIAL MESH SPACING
114 C
115 C DR=0.
116 C
117 C DZ IS THE UNIFORM AXIAL MESH SPACING
118 C
119 C DZ=0.
120 C
121 C CYL IS THE GEOMETRY INDICATOR, CYL=1, FOR CYLINDRICAL GEOMETRY
122 C 00, FOR PLANE (SLAB) GEOMETRY
123 C
124 C CYL=1.
125 C
126 C GROVEL IS THE REZONE INDICATOR, GROVEL=0, FOR EULERIAN
127 C 01, FOR LAGRANGIAN
128 C 02, FOR ALE
129 C
130 C GROVEL=2.
131 C
132 C ANC IS THE NODE COUPLER CONSTANT
133 C
134 C ANCO=05
135 C
136 C ARFAC IS A FACTOR USED IN CALCULATING THE COURANT TIMESTEP
137 C
138 C ARFAC=2
139 C
140 C AB, AM, AND AN ARE REZONE COEFFICIENTS WHICH DETERMINE THE TYPE OF
141 C DIFFERENCING USED IN CALCULATING THE FLUXING TERMS, AB APPLIED
142 C TO THE MOMENTUM EQN, AM TO THE MASS AND ENERGY EQNS, AND
143 C AN TO ALL THREE. SOME EXAMPLES OF THEIR SIGNIFICANCE ARE
144 C AB=0,0000, CENTERED DIFFERENCING
145 C AB=1,0000, FULL DONOR CELL
146 C AM=0,0002, INTERPOLATED DONOR CELL.
147 C NOTE THAT THE EQNS ARE UNSTABLE IN THE FIRST CASE.
148 C
149 C AB=1
150 C AM=1,
151 C AN=0.
152 C
153 C KX IS A PARAMETER GOVERNING THE TREATMENT OF VISCOSITY.
154 C KX=1 ALLOWS MU AND LAM TO BE TREATED AS NUMERICAL
155 C VISCOSITY COEFFICIENTS
156 C KX=0 ALLOWS MU AND LAM TO BE TREATED AS TRUE PHYSICAL
157 C VISCOSITY COEFFICIENTS
158 C KX=-1 CAUSES TO CODE TO CALCULATE ITS OWN NUMERICAL
159 C VISCOSITY COEFFICIENTS BASED ONLY UPON THE
160 C RESTRICTION THAT THE RATIO OF THE MU AND LAM
161 C COMPUTED INTERNALLY BY THE CODE IS EQUAL TO
162 C THE RATIO C" THE MU AND LAM READ IN
163 C

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164      NXI=1
165      C
166      GZP IS THE BODY FORCE FELT BY THE PARTICLES, IT IS NOT NECESSARILY
167      C      EQUAL TO GZ,
168      C
169      GZP=988,
170      C
171      ZORIG IS THE NO. OF FIREBALL RADII TO HOLD THE OUTER BOUNDARY
172      C      AWAY FROM THE FIREBALL
173      C
174      ZORIG=6,
175      C
176      T IS THE PROBLEM START TIME
177      C
178      T=0,
179      C
180      DT IS THE INITIAL TIMESTEP
181      C
182      DT=.001
183      C
184      NCLST IS THE CYCLE NO, AT WHICH TO HALT THE RUN
185      C
186      NCLST=99999
187      C
188      TWFN IS THE REAL TIME AT WHICH TO TERMINATE THE RUN
189      C
190      TWFN=1.E30
191      C
192      DTO AND DTOC ARE OUTPUT FREQUENCY CONTROL ARRAYS. IF T.LE.DTOC(I),
193      C      EDITS AND PLOTS OCCUR EVERY DTO(I) PROBLEM SECONDS. IF
194      C      DTOC(I)=1,LT.T.LE.DTOC(I),THEN OUTPUT OCCURS EVERY DTO(I)
195      C      PROBLEM SECONDS, A MAXIMUM OF 10 DTO,DTOC PAIRS MAY BE
196      C      SPECIFIED,
197      C
198      DTO(I)=1,
199      DTOC(I)=1.E30
200      DO 10 II=2,10
201      DTO(II)=0,
202      10 DTOC(II)=0,
203      C
204      NCO IS THE CYCLE ON WHICH TURBULENCE IS TO BE SEEDED, IF NCO IS
205      C      LESS THAN 0, THERE IS NO TURBULENCE,
206      C
207      NCO=1
208      C
209      IF TURB IS ,FALSE,,THE TURBULENCE IS CURRENTLY OFF
210      C
211      TURB=,FALSE,
212      C
213      QLEVEL,TUQI,TUSI,AND TO ARE ALL TURBULENCE QUANTITIES
214      C
215      QLEVEL=.02
216      TUQI=0,
217      TUSI=0,
218      TO=0,
219      C
220      A PARTICLE CAN BE MOVED NO NO X THAN

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221      C          SQRT(2,)*WMAXEF*SQRT(2,*(SIGMA*DT)) DUE TO THE TURBULENT
222      C          DIFFUSION EFFECT DURING ANY ONE CYCLE
223      C
224      C          WMAXEF=2,
225      C
226      C          ANY PARTICLE WITH XJ,LE,RMINEF WILL NOT BE SUBJECT
227      C          TO TURBULENT DIFFUSION
228      C
229      C          RMINEF=50,
230      C
231      C          TSTRTD IS THE TIME AT WHICH TO START TURBULENT DIFFUSION
232      C
233      C          TSTRTD=1,
234      C
235      C          IST IS THE NUMBER OF PARTICLES TO FOLLOW AS A FUNCTION OF TIME,
236      C          IF IST,LT,0,NO PARTICLES WILL BE FOLLOWED,
237      C
238      C          IST=1
239      C
240      C          JDUMP IS THE FREQUENCY OF DUMP CYCLES
241      C
242      C          JDUMP=999999
243      C          RETURN
244      C          END

```

```

1      SUBROUTINE DMP(FWA,LWA,IFILE)
2      C
3      C          ROUTINE TO DUMP SCM FROM FWA TO LWA WITH THE OUTPUT DIRECTED
4      C          TO LOGICAL UNIT IFILE
5      C
6      C          WRITTEN BY J.L.NORTON,LASL 7-3,1975
7      C
8      C          INTEGER FWA,GETIT
9      C          DIMENSION IDUMP(4)
10     C
11     C          CHECK FOR ERRORS
12     C
13     C          IF(FWA,LE,LWA) GO TO 10
14     C
15     C          YES, PRINT MESSAGE AND QUIT,
16     C
17     C          WRITE(IFILE,100) FWA,LWA
18     C          RETURN
19     C          10 CONTINUE
20     C
21     C          ALL O.K. PRINT DUMP HEADER,
22     C
23     C          WRITE(IFILE,110) FWA,LWA
24     C
25     C          IFW IS THE ADDRESS OF THE FIRST WORD TO BE PRINTED ON THE
26     C          CURRENT LINE

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27 C      ILW IS THE ADDRESS OF THE WORD CURRENTLY BEING PROCESSED
28 C
29 C      IFW=FWA
30 C      ILW=FWA
31 C
32 C      ICLW IS THE CONTENTS OF THE WORD WHOSE ADDRESS IS ILW
33 C
34 C      ICLW=GETIT(ILW)
35 C
36 C      IDUMP CONTAINS THE WORDS TO BE PRINTED ON THE CURRENT LINE
37 C      (A MAXIMUM OF FOUR).
38 C      ISUB IS THE NO. OF THE LAST LOCATION OF IDUMP THAT WAS FILLED.
39 C
40 C      ISUB=1
41 C      IDUMP(1)=ICLW
42 C      20 CONTINUE
43 C
44 C      EXAMINE THE NEXT WORD
45 C
46 C      ILW=ILW+1
47 C
48 C      SEE IF WE ARE DONE
49 C
50 C      IF(ILW,LE,LWA) GO TO 30
51 C
52 C      YES, FLUSH IDUMP IF NECESSARY AND QUIT.
53 C
54 C      IF(ISUB,LE,0) RETURN
55 C      WRITE(IPFILE,120) IFW,(IDUMP(I),I=1,ISUB)
56 C      RETURN
57 C      30 CONTINUE
58 C
59 C      NO, SAVE THE CONTENTS OF THE NEXT-TO-THE-LAST WORD AND
60 C      GO GET THE CONTENTS OF THE CURRENT WORD.
61 C
62 C      ICNLW=ICLW
63 C      ICLW=GETIT(ILW)
64 C
65 C      SEE IF THE LAST WORD AND THE NEXT-TO-THE-LAST WORD ARE THE SAME
66 C
67 C      IF(ICLW,NE,ICNLW) GO TO 23
68 C
69 C      YES, WE WILL GO INTO REPETITION MODE, FIRST FLUSH IDUMP
70 C      IF NECESSARY.
71 C
72 C      ISUB=ISUB+1
73 C      IF(ISUB,LE,0) GO TO 40
74 C      WRITE(IPFILE,120) IFW,(IDUMP(I),I=1,ISUB)
75 C      ISUB=0
76 C      40 CONTINUE
77 C
78 C      IFW IS NOW THE ADDRESS OF THE FIRST WORD OF THE REPETITION GROUP
79 C
80 C      IFW=ILW+1
81 C
82 C      SCAN FORWARD UNTIL THE END OF THE REPETITION GROUP IS LOCATED
83 C

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84      IFW=IFW+2
85      DO 50 I=IFW,LWA
86      ICLW=GETIT(I)
87      IF(ICLW,NE,ICNLW) GO TO 60
88      50 CONTINUE
89      C
90      C      ALL THE REST OF THE REQUESTED DUMP REGION LIES WITHIN THE
91      C      REPETITION GROUP
92      C
93      ILW=LWA
94      GO TO 70
95      60 CONTINUE
96      C
97      C      ILW IS THE ADDRESS OF THE LAST WORD IN THE REPETITION GROUP
98      C
99      ILW=I-1
100     70 CONTINUE
101     C
102     C      WRITE OUT THE REPETITION GROUP
103     C
104     WRITE(IFILE,138) IFW,ILW,ICNLW
105     C
106     C      GO BACK AND CONTINUE PROCESSING UNLESS WE ARE DONE
107     C
108     ILW=ILW+1
109     IF(ILW,GT,LWA) RETURN
110     IFW=ILW
111     ISUB=1
112     IDUMP(I)=ICLW
113     GO TO 20
114     80 CONTINUE
115     C
116     C      LAST AND NEXT-TO-THE-LAST WORD ARE DIFFERENT, SEE IF THE IDUMP
117     C      BUFFER IS FULL.
118     C
119     IF(ISUB,LT,4) GO TO 90
120     C
121     C      YES, FLUSH IT,
122     C
123     WRITE(IFILE,120) IFW,(IDUMP(I),I=1,4)
124     IFW=ILW
125     ISUB=0
126     90 CONTINUE
127     C
128     C      ADD THE CURRENT WORD TO THE IDUMP BUFFER AND CONTINUE
129     C
130     ISUB=ISUB+1
131     IDUMP(ISUB)=ICLW
132     GO TO 20
133     C
134     106 FORMAT(1H ,50HERROR IN DMP ARGUMENTS, DMP BYPASSED, FWA AND LWA ,
135     1 5HARE ,2I10)
136     110 FORMAT(1H1,17HDUMP OF SCH FROM ,06,4H TO ,06,4H)
137     120 FORMAT(1H ,06,5X4025)
138     130 FORMAT(1H ,06,6H THRU ,06,13H ALL CONTAIN ,020)
139     END

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1      SUBROUTINE DMPPN(N,PACK)
2      C
3      C ROUTINE TO DUMP EXCHANGE PACKAGE
4      C
5      C WRITTEN BY LARRY RUDBINSKI AND JERRY MELENDEZ; LABEL C=6
6      C MODIFIED TO CORRECTLY PICK UP C(A6) = C(A7) BY J.L. NORTON, LABEL T03
7      C
8      DIMENSION PAC(1),PARCEL(4)
9      DIMENSION ISAVE(8)
10     DIMENSION NPC(8),NAC(8),NBC(8),NXC(8)
11     DIMENSION IAA(4),IA1(8),IA3(2)
12     INTEGER PACK,PARCEL
13     INTEGER PACK1
14     INTEGER GETIT,SHIFT,AND
15     DATA NPC/1MP,3MRAB,3MPLB,3MPBD,3MRAL,3MPLL,3MNEA,3MNEA/
16     DATA NAC/2MA2,2MA1,2MA2,2MA3,2MA4,2MA5,2MA6,2MA7/
17     DATA NBC/3MBPA,2MB1,2MB2,2MB3,2MB4,2MB5,2MB6,2MB7/
18     DATA NXC/2MXB,2MX1,2MX2,2MX3,2MX4,2MX5,2MX6,2MX7/
19     DATA IA1/5MC(A6),5MC(A1),5MC(A2),5MC(A3),5MC(A4),5MC(A5),5MC(A6),
20     I 5MC(A7)/
21     DATA IA3/7M OUT OF,6M RANGE/
22     IF(N.EQ.0) N=6
23     C
24     C PRINT CAUSE OF ABORT
25     C
26     IARG=SHIFT(PACK(4),-36)
27     CALL MODE(IARG,4)
28     C
29     C GET THE FIELD LENGTH
30     C
31     IAA(4)=SHIFT(PACK(3),-36)
32     C
33     C IF FIELD LENGTH IS GARBAGED, SET TO MAXIMUM
34     C
35     IF(IAA(4).GT.1508778) IAA(4)=1508778
36     C
37     C PICK UP AND PRINT REGISTERS, ETC.
38     C
39     DO 30 I=1,8
40     C
41     C PICK UP B REGISTER I=1
42     C
43     NB=AND(PACK(I),7777778)
44     C
45     C PICK UP A REGISTER I=1
46     C
47     NA=AND(SHIFT(PACK(I),-16),7777778)
48     C
49     C GET C(AN)
50     C
51     IF(NA.GE.1AA(4)) GO TO 10
52     ISAVE(I)=GETIT(NA)
53     10 CONTINUE
54     C

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55      C      PICK UP DATA IN THE TOP OF EXCHANGE PACKAGE WORDS
56      C
57      NPUSH(FT(PACK(I),-3b)
58
59      C      PICK UP X REGISTER I=1 AND PREPARE TO PRINT IT IN 8 PIECES
60      C
61      K=8
62      DO 20 J=1,4
63      PARCEL(K) = AND(SHIFT(PACK(I+8),-(J-1)*15),77777b)
64      K=K-1
65      20 CONTINUE
66      IAA(I) = NA
67      WRITE(N,70) NPC(I),NP,NAC(I),NA,NBC(I),NB,NXC(I),PARCEL(1),PARCEL(
68      1 2),PARCEL(3),PARCEL(4),PACK(I+8),PACK(I+8)
69      30 CONTINUE
70      C
71      C      PRINT C(AN)
72      C
73      DO 40 I=1,8
74      C
75      C      CHECK FOR A REGISTER OUT OF RANGE
76      C
77      IF(IAA(I).GE.1AA(9)) GO TO 50
78      PACH=ISAVE(I)
79      K=8
80      DO 40 J=1,4
81      PARCEL(K) = AND(SHIFT(PACK),-(J-1)*15),77777b)
82      K=K-1
83      40 CONTINUE
84      WRITE(N,80) IAS(I),PARCEL(1),PARCEL(2),PARCEL(3),PARCEL(4),PACH,
85      1 PACH)
86      GO TO 60
87      C
88      C      A REGISTER IS OUT OF RANGE
89      C
90      50 WRITE(N,90) NAC(I),IAS(1),IAS(2)
91      60 CONTINUE
92      WRITE(N,100)
93      RETURN
94      C
95      70 FORMAT(1M ,A4,2X,08,2X,A2,2X,06,2X,A3,2X,06,7X,A2,2X,05,2X,03,2X,
96      1 05,2X,05,E25,13,0X,A10)
97      80 FORMAT(45X,A5,3(1X,05,1X),1X,05,E25,13,0X,A10)
98      90 FORMAT(87X,A2,1X,A7,A6)
99      100 FORMAT(1M ,//)
100     END

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1      SUBROUTINE DYMH(VMAX,IVM,JVM,ORMIN,OZMIN,ORMAX,OZMAX)
2      C
3      C      ROUTINE TO CALCULATE MAXIMUM VELOCITY AND MAXIMUM AND MINIMUM
4      C      ZONE SIZES

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5 C
6 C      ORIGINALLY WRITTEN C. A. J. AMSDEN, LASL T-3
7 C      MODIFIED AND DOCUMENTED BY J. L. NORTON, LASL T-3, 1975
8 C
9 C
10 C      ***** BEGIN COMDECK PARAM *****
11 C      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPER,NP1,NP2,NLCP1,NLCP2,
12 1 NLCP3,NLCP4,IFLMSZ
13 C      ***** END COMDECK PARAM *****
14 C      ***** BEGIN COMDECK YSTORE *****
15 C      ***** BEGIN COMDECK YADDIM *****
16 DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
17 1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
18 2 1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CG(1),VTIL(1)
19 3 1),VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUQ
20 4 1),SIG(1),TUS(1),GRROR(1),GRRORZ(1),GRRORP(1),TUQVEC(1),MTIL(1),
21 5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
22 6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),ARFA(1)
23 C      ***** END COMDECK YADDIM *****
24 C      ***** BEGIN COMDECK YAQSC *****
25 LOGICAL RESTRT,FILM,PAPER,TURB
26 REAL LAM,MU
27 C      COMMON/YSC1/AASC(NSCP1)
28 C      COMMON/YSC1/AASC(9600)
29 COMMON/YSC2/AA(1),ANC,AP,ARFAC,ARM,BP,COLAMU,CYL,DR,DT,DTC,DTFAC,
30 1 DTC(10),DTDC(10),DTC2,DTC6,DTCOS,DTV,OZ,EMIB,EPS,FIPXL,FIPXR,
31 2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
32 3 DTCO,IJ,IJM,IJP,IMJ,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITY,
33 4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
34 COMMON/YSC2/JCEN,JP1,JP2,JF4,JUNF,JUNF02,KXI,LAM,LPS,MU,NAME(8),
35 1 NCYC,NLC,NPS,NP1,NQ,NQ1,NQ12,NSC,NUMIT,ZORIG,OM,OMCVL,PXCONV
36 2 ,PXL,PXR,PYB,PYCONV,PYT,ROT,REZRON,REZSIE,REZYR,RIBAR,RIBJB,
37 3 FREZYT,FREZYB,ROWER,T,THIRD,NCLST,TOUT,TWFIN
38 COMMON/YSC2/TUQ1,TUS1,NCR,TNEG,TNEGSV,TUBV,TURB,PTOP,PRITE,PBOTH,
39 1 ILNG,NILNG,TP1,TUPOT,TQSAV,TX,TI,TUGENG,EPI,SAV1,QLEVEL,TQ,IST,
40 2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,OTSV,DTLAST,FIYBO,IYBO,YCNVLD,
41 3 XCNVLD,FIYRO,FIYLO,IXRO,IXLO,ISVW,JSVW,QMW,QMX,WMAX,JNN,T2,TLM,
42 4 ROWFXR,ROWFYT,ROWFYB,JOUMP,TWTHRD,TE,DTR,THAB8,DTVSAV,DTCSAV,IDTV
43 5 ,JDTV,IDTC,JDTG,CIRC,TIS,POTE,UMOM,VNOM,TMAX,TGKX,ITW,JTW,ITG,JTG
44 6 ,THABSV,HMAXEF,WMINEF,TSTRTD
45 COMMON/YSC2/ZZ
46 C      COMMON/YSC4/ITAB(ITABP)
47 COMMON/YSC4/ITAB(1000)
48 COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
49 C      ***** END COMDECK YAQSC *****
50 C      ***** BEGIN COMDECK YAQEQ *****
51 EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
52 1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
53 2 10),E,ETIL,AREA,XR13K),
54 2 (AASC(15),SIE),(AASC(16),PMB,DKLSM,RMP),(AASC(19
55 3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
56 4 UL,PWX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CG,ROL),(AASC(17
57 5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
58 6 21),GRROR),(AASC(22),GRRORZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
59 7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVC,
60 8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
61 9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
62 1 AVYSV,X24K)

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62      REAL M,MP,MPAR,MTIL
63      *      ----- END COMDECK YAREQ      -----
64      *      ----- END COMDECK YSTORE      -----
65      C      DR(Z)MIN(MAX) IS THE MINIMUM (MAXIMUM) OF THE MAGNITUDES OF
66      C      CELL SIDES IN THE R (Z) COORDINATE DIRECTION
67      C
68      DRMIN=1.E+20
69      DZMIN=1.E+20
70      DRMAX=0.
71      DZMAX=0.
72      C
73      C      VMAX IS THE MAXIMUM GRID VELOCITY MAGNITUDE ALONG EITHER
74      C      COORDINATE AXIS
75      C
76      VMAX=0.
77      IVM=0
78      JVM=0
79      CALL START
80      C
81      C      LOOP OVER ALL REAL ZONES
82      C
83      DO 30 J=2,JPI
84      DO 20 I=1,IBAR
85      IP=IJ+NQ
86      IJP=IJP+NQ
87      VMAXP=AMAX1(VMAX,ABS(U(IJ)),ABS(V(IJ)))
88      IF(VMAXP.EQ.VMAX) GO TO 10
89      IVM=I
90      JVM=J
91      VMAX=VMAXP
92      10 CONTINUE
93      C
94      C      DETERMINE THE FOUR VERTICES OF CELL (I,J)
95      C
96      C      (X1,Y1) IS VERTEX (I+1,J)      (VERTEX 1)
97      C      (X2,Y2) IS VERTEX (I+1,J+1)  (VERTEX 2)
98      C      (X3,Y3) IS VERTEX (I,J+1)    (VERTEX 3)
99      C      (X4,Y4) IS VERTEX (I,J)      (VERTEX 4)
100     C
101     X1=X(IPJ)
102     X2=X(IPJP)
103     X3=X(IJP)
104     X4=X(IJ)
105     Y1=Y(IPJ)
106     Y2=Y(IPJP)
107     Y3=Y(IJP)
108     Y4=Y(IJ)
109     C
110     C      DETERMINE THE SQUARE OF THE LENGTH OF EACH SIDE
111     C
112     C      X(Y)NM IS THE SQUARE OF THE LENGTH OF THE SIDE BOUNDED BY
113     C      VERTICES N AND M
114     C
115     X14=(X1-X4)**2+(Y1-Y4)**2
116     X23=(X2-X3)**2+(Y2-Y3)**2
117     Y21=(X2-X1)**2+(Y2-Y1)**2
118     Y34=(X3-X4)**2+(Y3-Y4)**2

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```

119      DRMIN=AMIN1(DRMIN,X14,X23)
120      DRMAX=AMAX1(DRMAX,X14,X23)
121      DZMIN=AMIN1(DZMIN,Y21,Y34)
122      DZMAX=AMAX1(DZMAX,Y21,Y34)
123      IJ=IPJ
124      20 IJP=IPJP
125      CALL LOOP
126      30 CONTINUE
127      DRMIN=SQRT(DRMIN)
128      DRMAX=SQRT(DRMAX)
129      DZMIN=SQRT(DZMIN)
130      DZMAX=SQRT(DZMAX)
131      RETURN
132      END

```

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.....
1      FUNCTION ERF(Z)
2      C
3      C      ROUTINE TO CALCULATE THE STANDARD ERROR FUNCTION
4      C
5      C      STANDARD LIBRARY SUBPROGRAM - LOS ALAMOS SCIENTIFIC LABORATORY
6      C      DOCUMENTED BY J.L.NORTON, LANS TO-3, 1972
7      C
8      DIMENSION P(7,2), Q(6,2)
9      DIMENSION A(14), B(12)
10     EQUIVALENCE(A,P), (B,Q)
11     X=ABS(Z)
12     C
13     C      IF ARGUMENT IS ZERO, ERF IS ZERO
14     C
15     ERF=0.
16     IF(X.EQ.0.) RETURN
17     DATA (A(I), I=1, 14)/1., 1283791670955, .34197505591854,
18     1 .86290601455206E-1, 12382023274723E-1, 11986242418302E-2,
19     2 .76537302607825E-4, .25365482058342E-5, .99999707603738,
20     3 .1, 4731794832805, .1, 8573449601594, .44078839213875,
21     4 .10684197950781, .12636031836273E-1, .1149393366616E-8/
22     DATA (B(I), I=1, 12)/.36359916427762, .52205830591727E-1,
23     1 .30613035688519E-2, .46856639020338E-4, .15601995561434E-4,
24     2 .62143556409287E-6, 2.6015349994799, 2.9929556755308,
25     3 1.9684584582884, .79250795276064, .18937020051337,
26     4 .22396882835053E-1/
27     C
28     C      IF ARGUMENT IS GREATER THAN 5, 5, ERF IS UNITY
29     C
30     10 ERF=SIGN(1., Z)
31     C
32     C      USE RATIONAL APPROXIMATION TO COMPUTE ERF
33     C
34     IF(X.GE.5.5) RETURN
35     J=1
36     IF(X.GT.1.5) J=2

```

```

37      FJ=J-1
38      D=X*(2-J)
39      U=D*X
40
41      C      TWO SEPARATE RATIONAL APPROXIMATIONS ARE USED, BOTH HAVE BEEN
42      C      DERIVED USING A PROGRAM BASED ON MAEHLER'S SECOND DIRECT
43      C      METHOD DESCRIBED IN JOURNAL OF THE ACM, VOL. 10, NO. 3
44      C
45      C      ERF=(D*EXP(-X*X))*(P(1,J)+U*(P(2,J)+U*(P(3,J)+U*(P(4,J)+U*(P(5,J)+U
46      C      1*(P(6,J)+U*(P(7,J)))))))/(1+U*(Q(1,J)+U*(Q(2,J)+U*(Q(3,J)+U*(Q(4,
47      C      2 J)+U*(Q(5,J)+U*(Q(6,J)))))))+FJ)*SIGN(1,2)
48      RETURN
49      END

```

```

-----
1      SUBROUTINE FILMCO
2
3      C      ROUTINE TO UPDATE GRID LIMITS AND PARTICLE QUANTITIES
4
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1974
7
8      *      ***** BEGIN COMDECK PARAM *****
9      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
10     1 NLCP3,NLCP4,IFLMSZ
11      *      ***** END COMDECK PARAM *****
12      *      ***** BEGIN COMDECK YSTORE *****
13      *      ***** BEGIN COMDECK YAQDIM *****
14      DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
15     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSB(1),E(1),ETIL(1),RVOL
16     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
17     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUG
18     4 (1),SIG(1),TUS(1),GRROR(1),GRRQZ(1),GRROR(1),TUQVEC(1),MTIL(1),
19     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
20     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21      *      ***** END COMDECK YAQDIM *****
22      *      ***** BEGIN COMDECK YAQSC *****
23      LOGICAL RESTRT,FILM,PAPER,TURB
24      REAL LAM,MU
25      C      COMMON/YSC1/AASC(NSCP1)
26      COMMON/YSC1/AASC(9600)
27      COMMON/YSC2/AA(1),ANC,A0,A0FAC,A0M,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
28     1 DTC(10),DTC(10),DTC2,DTC0,DTC0S,DIV,DZ,EM10,EPS,FIPXL,FIPXR,
29     2 FIPYB,FIPYT,FIPL,FIPLR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
30     3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
32      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
33     1 NCYC,NLC,NPS,NPT,NG,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
34     2 ,PXL,PXR,PYB,PYCONV,PYT,RT,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
35     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTHM,
37     1 ILNG,NILNG,TP3,TUPOT,TQGS4V,TK,TI,TUGENG,EPI,SAVI,QLEVEL,TQ,IST,

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38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DYLAST,FIYB,ITYB,YCNVLD,
39      3 XCNVLD,FXRRO,FXKLO,IXRO,IKLO,ISVM,JSVM,QNM,QMX,WMAX,JNM,TZ,TLIM,
40      4 ROMFXR,ROMFYT,ROMFYB,JCUMP,TNTHRD,TE,DTR,TMASS,DTSYAV,DTCYAV,IDTV
41      5 ,JDTV,JDTC,JDTC,CIRC,TIS,POTE,UMOM,VHOM,YMAX,YGMX,ITM,JTM,ITG,JYG
42      6 ,TMASS,WMAXEF,RMINF,TSTRTD
43      COMMON/YSC2/ZZ
44      C      COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRY,FILM,PAPER,IPD,IFD
47      *      ----- END COMDECK YAGSC -----
48      *      ----- BEGIN COMDECK YAGEQ -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PMO,DKLSM,RMP),(AASC(9
53      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PMX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRROZ),(AASC(23),DLSRO,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      *      ----- END COMDECK YAGEQ -----
63      *      ----- END COMDECK YSTORE -----
64      C      FIND THE GRID LIMITS. MAX(X)=XR,MAX(Y)=YT,MIN(X)=XL=0.,MIN(Y)=YB.
65      C
66      XL=0.0
67      YB=1.E+20
68      XR=YT=YB
69      CALL START
70      DO 20 J=2,JP2
71      DO 10 I=1,IP1
72      XR=AMAX1(XR,X(IJ))
73      YB=AMIN1(YB,Y(IJ))
74      YT=AMAX1(YT,Y(IJ))
75      10 IJ=IJ+NQ
76      CALL LOOP
77      20 CONTINUE
78      C
79      C      VV IS USED IN SCALING VELOCITY VECTOR PLOTS.
80      C      VV = .9*MAX(X)/IBAR
81      C
82      VV=0.9*XR*IBAR
83      C
84      C      FIYB IS THE LOCATION OF MIN(Y) IN RASTER COUNTS
85      C
86      FIYB=916.0
87      C
88      C      XD IS THE RATIO OF GRID WIDTH TO HEIGHT
89      C
90      XD=XR/(YT-YB)
91      C
92      C      ONE WISHES TO MAKE THE PLOTS FILL THE FILM FRAME AS NEARLY AS
93      C      POSSIBLE, AT MOST THE PLOT CAN BE 1022 RASTER POINTS WIDE AND
94      C      900 RASTER POINTS TALL (LEAVING ROOM FOR LABELS AT THE BOTTOM

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95      C      AND A 16 POINT MARGIN AT THE TOP,) AN IDEAL GRID, THEN, WOULD
96      C      HAVE XD=1022/900=1.13556. IF XD.GT.1.13556, THE GRID IS DEFINED
97      C      AS WIDER THAN HIGH. IF XD.LE.1.13556, THE GRID IS DEFINED AS
98      C      HIGHER THAN WIDE. IN THE FORMER CASE, THE X COORDINATE RASTER
99      C      BOUNDS ARE SET TO (0,1022) AND THE Y COORDINATE RASTER BOUNDS
100     C      TO (PIYT,916) WHERE PIYT IS DETERMINED SUCH THAT THE X AND Y
101     C      SCALES ARE THE SAME. IN THE LATTER CASE, THE Y COORDINATE
102     C      RASTER BOUNDS ARE SET TO (16,916) AND THE X COORDINATE RASTER
103     C      BOUNDS ARE DETERMINED SUCH THAT THE X AND Y SCALES ARE EQUAL
104     C      AND THE LEFT AND RIGHT MARGINS ARE THE SAME.
105     C
106     C      IF(XD.LE.1.13556) GO TO 30
107     C
108     C      GRID WIDER THAN HIGH, THE X RASTER BOUNDS ARE (FIXL,FXR), THE
109     C      Y RASTER BOUNDS ARE (FIYT,FIYB),
110     C
111     C      FIXL=0.
112     C      FXR=1022.
113     C      FIYT=916,=1022,/XD
114     C      GO TO 40
115     C
116     C      GRID HIGHER THAN WIDE
117     C
118     C      30 CONTINUE
119     C      FIXL=MAX(0,511,=450,*XD)
120     C      FXR=511,=450,*XD
121     C      FIYT=16.
122     C      40 CONTINUE
123     C
124     C      XCONV AND YCONV ARE FACTORS TO CONVERT FROM X AND Y CARTESIAN
125     C      COORDINATES TO RASTER COORDINATES
126     C
127     C      XCONV=(FXR-FIXL)/(XR-XL)
128     C      YCONV=(FIYT-FIYB)/(YT-YB)
129     C
130     C      PROVIDE FIXED POINT VALUES OF THE RASTER BOUNDS
131     C
132     C      IXL=FIXL
133     C      IXR=FXR
134     C      IYB=FIYB
135     C      IYT=FIYT
136     C
137     C      IF THERE ARE NO PARTICLES, WE ARE DONE
138     C
139     C      IF(NPT.EQ.0) RETURN
140     C
141     C      THERE ARE PARTICLES. CALCULATE THE CARTESIAN PARTICLE BOUNDS
142     C      FROM THE GRID BOUNDS,
143     C
144     C      PXL=0.0
145     C      PYB=YB
146     C      PXR=XR
147     C      PYT=YT
148     C      PIPYB=916.0
149     C      FIPXL=FIXL
150     C      FIPXR=FXR
151     C      FIPYT=FIYT

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152 C
153 C   CONVERSION FACTORS FROM PARTICLE COORDINATES TO RASTER COORDINATES
154 C
155 C   PXCONV=(FIPXR-FIPXL)/(PXR-PXL)
156 C   PYCONV=(FIPYT-FIPYB)/(PYT-PYB)
157 C
158 C   PROVIDE FIXED POINT RASTER BOUNDS
159 C
160 C   IPXL=FIXL
161 C   IPXR=FIXR
162 C   IPYB=FIYB
163 C   IPYT=FIYT
164 C   RETURN
165 C   END

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1 SUBROUTINE GETOMG
2 C
3 C   ROUTINE TO CALCULATE VORTICITY
4 C
5 C   ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
6 C   MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1978
7 C
8 C
9 C   ***** BEGIN COMDECK PARAM *****
10 C   COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABVP,IPFB,NP1,NP2,NLCP1,NLCP2,
11 C   1 NLCP3,NLCP4,IFLMSZ
12 C   ***** END COMDECK PARAM *****
13 C   ***** BEGIN COMDECK YSTORE *****
14 C   ***** BEGIN COMDECK YADDIM *****
15 C   DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSH(
16 C   1 1),V(1),VG(1),RG(1),SIE(1),MP(1),RMP(1),RCBQ(1),E(1),ETIL(1),RVOL
17 C   2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
18 C   3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSDI(1),DLSDO(1),CAPGAN(1),TUG
19 C   4 (1),SIG(1),TUS(1),GRROR(1),GRRDZ(1),GRRDP(1),TUGVEC(1),MTIL(1),
20 C   5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
21 C   6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
22 C   ***** END COMDECK YADDIM *****
23 C   ***** BEGIN COMDECK YARSC *****
24 C   LOGICAL RESTRY,FILM,PAPER,TURN
25 C   REAL LAM,MU
26 C   COMMON/YSC1/AASC(NSCP1)
27 C   COMMON/YSC1/AASC(9600)
28 C   COMMON/YSC2/AA(1),ANC,AG,AGFAC,AGM,BB,COLAMU,CYL,DR,DT,DTC,DYFAC,
29 C   1 DT0(10),DT0C(10),DT02,DT08,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
30 C   2 FIPYB,FIPYT,FIKL,FIKR,FIYB,FIYT,FREZIR,GR,GROVEL,GZ,GZP,I,ISAR,
31 C   3 IOT0,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
32 C   4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
33 C   COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPS,MU,NAME(8),
34 C   1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ10,NQ12,NSC,NUMIT,ZORIG,NH,OMCYL,PXCONV
35 C   2 ,PKL,PXR,PYB,PYCONV,PYT,RTD,REZRON,REZSIE,REZYR,RIBAR,RIBJB,
36 C   3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
37 C   COMMON/YSC2/TUG1,TUS1,NCQ,INEG,INEGSV,TUSV,TURN,PTOP,PRITE,REZTM,

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37      1 TLNG,NILNG,TP3,TUPOT,YOCSAV,YK,YI,TUQENG,EP1,SAV1,OLEVEL,TO,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTFOLD,DTBV,DTLAST,FIYBO,IYBO,YCNVLO,
39      3 XCNVLO,PIXRO,PIXLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,MMAX,JNM,T2,YLIN,
40      4 ROMFIR,ROMFYT,ROMFYB,JDUMP,TMTWRD,TE,DTR,TMASS,DTVSAY,DTCSAV,ISYV
41      5 ,JDTV,ISYC,JOTC,CIRC,YIS,POTE,UMOM,VMOM,TMAX,TGME,ITM,JTM,ITG,JTB
42      6 ,TMASSV,MMAXEF,MMINEF,TSTRTO
43      COMMON/YSC2/ZZ
44      C      COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(I000)
46      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
47      *      ----- END COMDECK YAQSC -----
48      *      ----- BEGIN COMDECK YAQEQ -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),P,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RC8Q,MP),(AASC
51      1 (8),F,ETIL,AREA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PMB,DKLSM,RMP),(AASC(1
53      3 ),RVOL),(AASC(18),M,RM,VP),(AASC(11),P,PL,2P,UP),(AASC(12),UTIL,
54      4 UL,PBX,PU),(AASC(13),VTIL,VL,PV,PV),(AASC(14),Q,CQ,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),OLSR0I,Y13K),(AASC(24),GZ3V
57      7 ),(AASC(25),OLSR0Q,VG),(AASC(26),GR3V),(AASC(27),GRR0P,TUQVEC,
58      8 V24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVVSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      *      ----- END COMDECK YAQEQ -----
63      *      ----- END COMDECK YSTORE -----
64      10 CALL START
65      MMAX=EM10
66      QMN=1,E30
67      QMX=QMN
68      DO 30 J=2,JP1
69      DO 20 I=1,IBAR
70      IPJ=IJ+NO
71      IPJP=IPJ+NO
72      IF(J.EQ.2) CO(IJM)=0.
73      IF(J.EQ.JP1) CO(IPJ)=0.
74      IF(I.EQ,IBAR) CO(IPJ)=0.
75      X1=X(IPJ)
76      Y1=Y(IPJ)
77      U1=U(IPJ)
78      V1=V(IPJ)
79      X2=X(IPJP)
80      Y2=Y(IPJP)
81      U2=U(IPJP)
82      V2=V(IPJP)
83      X3=X(IJP)
84      Y3=Y(IJP)
85      U3=U(IJP)
86      V3=V(IJP)
87      X4=X(IJ)
88      Y4=Y(IJ)
89      U4=U(IJ)
90      V4=V(IJ)
91      R1=.125*(RVOL(IJ)*(R(IPJ)+R(IPJP)+R(IJP)+R(IJ))
92      CO(IJ)=R1*((U1+U4)*(X1-X4)+(V1+V4)*(Y1-Y4)+(U2+U1)*(X2-X1)+(V2+V1)
93      1 *(Y2-Y1)+(U3+U2)*(X3-X2)+(V3+V2)*(Y3-Y2)+(U4+U3)*(X4-X3)+(V4+V3)*

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94      2 (Y4=Y3))
95      QMNBAMIN1(CQ(IJ),QMNB)
96      QMNBAMAX1(CQ(IJ),QMNB)
97      NSAV=NMNAX
98      NMNAX=AMAX1(N=MAX,ABS(CQ(IJ)))
99      IF(N=SAV,NE,NMAX) JSVNB=I
100     IF(N=SAV,NE,NMAX) JSVNB=J
101     IJM=IJM+NQ
102     IJ=IPJ
103     20 IJP=IPJP
104     CALL LOOP
105     30 CONTINUE
106     CALL DONE
107     RETURN
108     END

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.....

1      SUBROUTINE MODE(IARG,NARG)
2      C
3      C      ROUTINE TO ANALYZE THE PROGRAM STATUS DESIGNATION
4      C
5      C      WRITTEN BY J.L.NORTON,LASL TD-3,1973
6      C
7      DIMENSION ITROUB(12),ICAUSE(2,12)
8      LOGICAL ITROUB
9      INTEGER AND,COMP
10     DATA ICAUSE/9HUNDERFLOW,1H,8HOVERFLOW,1H,18HINDEFINITE,1H,
11     1 4HSTEP,1H,18HBREAKPOINT,1H,18HPROGRAM R4,3HNGE,18HSCN DIRECT,
12     2 6H RANGE,18HLCN DIRECT,6H RANGE,18HSCN BLOCK,5H RANGE,
13     3 18HLCN BLOCK,5H RANGE,18HSCN PARITY,1H,18HLCN PARITY,1H /
14     ITEST=AND(IARG,COMP(7777778))
15     IF(ITEST.NE,0) RETURN
16     ITEST=1
17     DO 10 IJ=1,12
18     ITROUB(IJ)=.FALSE.
19     IF(AND(IARG,ITEST).NE,0) ITROUB(IJ)=.TRUE.
20     ITEST=2+ITEST
21     10 CONTINUE
22     DO 20 IJ=1,12
23     IF(.NOT.ITROUB(IJ)) GO TO 20
24     WRITE(NARG,30) ICAUSE(1,IJ),ICAUSE(2,IJ)
25     20 CONTINUE
26     RETURN
27     C
28     30 FORMAT(1H 5;THE FOLLOWING CONDITION EXISTED AT THE TIME OF THE ,
29     1 7HABORT--,2A10)
30     END

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1      SUBROUTINE MSHMKR
2      C
3      C ROUTINE TO GENERATE THE INITIAL PROBLEM MESH AND SET THE
4      C INITIAL QUANTITIES
5      C
6      C ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
7      C MODIFIED AND DOCUMENTED BY J.L.MORTON,LASL T-3,1974
8      C
9      C
10     C ***** BEGIN COMDECK PARAM *****
11     COMMON/PCOM/NSCPI,ITABP,ITABXP,ITABYP,IPFB,MP1,MP2,NLCP1,NLCP2,
12     1 NLCP3,NLCP4,IFLMSZ
13     C ***** END COMDECK PARAM *****
14     C ***** BEGIN COMDECK LCMATH *****
15     COMMON/YSC3/UFIRE(IPFB),EFIRE(IPFB),RHOFIR(IPFB),XFIRE(IPFB)
16     COMMON/YSC3/UFIRE(200),EFIRE(200),RHOFIR(200),XFIRE(200)
17     C ***** END COMDECK LCMATH *****
18     COMMON/EQNST/ROTMP,ETMP,GMONE,CONCJ
19     C ***** BEGIN COMDECK YSTORE *****
20     C ***** BEGIN COMDECK YAQOIN *****
21     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
22     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
23     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
24     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),OLSRQI(1),OLSRQO(1),CAPGAM(1),TUQ
25     4 (1),SIGI(1),TUS(1),GRROZ(1),GRROP(1),TUOVEC(1),MTIL(1),
26     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
27     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
28     C ***** END COMDECK YAQOIN *****
29     C ***** BEGIN COMDECK YAQSC *****
30     LOGICAL RESTR7,FILM,PAPER,TURB
31     REAL LAM,MU
32     C
33     COMMON/YSC1/AASC(NSCPI)
34     COMMON/YSC1/AASC(9600)
35     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BO,COLAMU,CYL,DR,DY,DT,DTFAC,
36     1 DTC(10),DTDC(10),DTDZ,DTDB,DTPOB,DTV,DZ,EM10,EP3,FIPXL,FIPXR,
37     2 FIPYB,FIPYT,FIXL,FIKR,FIYB,FIYT,FREZXR,GR,GRUVEL,GZ,GZP,I,ISAR,
38     3 IDTO,IJ,IJM,IJP,IM,IPLX,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITY,
39     4 IUNF,IXL,IXR,IYB,IYT,J,JSAR
40     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KX1,LAM,LPS,MU,NAME(8),
41     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ10,NQ12,NBC,NUMIT,ZORIG,OM,OMCYL,PXCONV
42     2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
43     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
44     COMMON/YSC2/TUOI,TUOI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PROTM,
45     1 ILNG,NILNG,TP3,TUPOT,TQSAV,TN,TI,TUGENG,EP1,SAV1,OLEVEL,TD,IST,
46     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLO,DTSV,DTLAST,FIYBO,IYBO,YCNVLO,
47     3 XCNVLO,FIKRO,FIKLO,IKRO,IKLO,ISVH,JSVH,OMH,QMH,WMAN,WMH,T2,TLIM,
48     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TWASS,DTVSAY,DTCSAY,IDTV
49     5 ,JDTV,IDTC,JDTG,CIRC,TIS,ROTE,UMOH,VMOH,TMAX,TGMH,ITH,JTH,ITG,JTG
50     6 ,THASSV,WMAXEF,RNINEF,YSTRYD
51     COMMON/YSC2/ZZ
52     C
53     COMMON/YSC4/ITAB(ITABP)
54     COMMON/YSC4/ITAB(1000)
55     COMMON/YSC5/RESTR7,FILM,PAPER,IPO,IFD
56     C ***** END COMDECK YAQSC *****
57     C ***** BEGIN COMDECK YAQEQ *****
58     EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
59     1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC

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57      1 (8),E,ETIL,AREA,XR13K),
58      2 (AASC(15),SIG),(AASC(16),PMO,DKLSM,RMP),(AASC(9
59      3 ),RVOL),(AASC(18),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
60      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),C,CQ,ROL),(AASC(17
61      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUB),(AASC(
62      6 21),GRROH),(AASC(22),GRROZ),(AASC(23),DLSROI,Y13K),(AASC(24),G28V
63      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROF,TUQVEC,
64      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
65      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
66      1 AVYSV,X24K)
67      REAL N,MP,MPAR,MTIL
68      * ----- END COMDECK YADEQ -----
69      * ----- END COMDECK YSTORE -----
70      DIMENSION MESH(3,4)
71      LOGICAL FBFILE
72      DATA (MESH(II),II=1,12)/12*0/
73      DATA IEFLAG/0/
74      DATA PJLN/0,/
75      C
76      C      SET UP THE NAMELIST INPUT TABLE
77      C
78      ASSIGN 530 TO IERRT
79      CALL TABDEF(MESH,4MPIRE,4,IERRT)
80      CALL TABSET(MESH,4MNRAD,NRAD,IEFLAG,0,0,0,0)
81      CALL TABSET(MESH,3MNTM,NTH,IEFLAG,0,0,0,0)
82      CALL TABSET(MESH,6MPBFIL,FBFILE,IEFLAG,0,0,0,0)
83      C
84      C      INITIALIZE, NQIM IS THE NO. OF WORDS OF MEMORY NEEDED TO STORE
85      C      ONE ROW OF DATA (LESS 1).
86      C
87      NQIM=NQI=1
88      IF(.NOT.TURB) GO TO 10
89      TNEG=0.
90      TNEGSV=0.
91      10 CONTINUE
92      C
93      C      DEFINE THE CELL VERTICES AS THOUGH THE ENTIRE MESH WERE UNIFORM
94      C
95      XX=0.0
96      YY=0.0
97      CALL START
98      DO 50 J=2,JP2
99      DO 40 I=1,IP1
100      X(IJ)=XX
101      Y(IJ)=YY
102      R(IJ)=XX*CYL+OMCYL
103      U(IJ)=0.
104      V(IJ)=0.
105      IF(J.NE.2) GO TO 20
106      Y(IJM)=YY+DZ
107      X(IJM)=XX
108      R(IJM)=R(IJ)
109      U(IJM)=0.
110      V(IJM)=0.
111      20 IF(J.NE.JP2) GO TO 30
112      Y(IJP)=YY+DZ
113      X(IJP)=XX

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114      R(IJP)=R(IJ)
115      U(IJP)=0,
116      V(IJP)=0,
117      30 IJP=IJP+NQ
118      IJM=IJM+NQ
119      XX=XX+OR
120      40 IJ=IJ+NQ
121      XX=0,
122      YY=YY+DZ
123      CALL LOOP
124      50 CONTINUE
125      CALL DONE
126      C
127      C      SEE IF THE ENTIRE MESH ACTUALLY IS UNIFORM
128      C
129      C      IF(FREZXR,EQ,1.,AND,FREZYT,EQ,1.,AND,FREZYB,EQ,1.) GO TO 130
130      C
131      C      NO, DO THE NON-UNIFORM GENERATION,
132      C
133      C      CONVERT JCEN TO AN ACTUAL VERTEX NO, JCEN IS THE J-LINE THAT
134      C      GOES THROUGH THE CENTER OF THE UNIFORM REGION,
135      C
136      JCEN=JCEN+2
137      C
138      C      JTOP AND JBOT ARE THE J-LINES AT THE TOP AND BOTTOM OF THE
139      C      UNIFORM REGION
140      C
141      JTOP=JCEN+JUNFO2
142      JBOT=JCEN-JUNFO2
143      C
144      C      TJ IS THE DISTANCE FROM THE CENTER TO THE TOP (OR BOTTOM) OF
145      C      THE UNIFORM REGION
146      C
147      TJ=FLOAT(JUNFO2)*DZ
148      C
149      C      LOOP TO SET THE NON-UNIFORM VERTICES
150      C
151      CALL START
152      DO 110 J=2,JP2
153      DO 100 I=1,IP1
154      IMJ=IJ-NQ
155      IF(FREZXR,EQ,1.) GO TO 62
156      C
157      C      SEE IF WE ARE WITHIN THE UNIFORM X REGION
158      C
159      C      IF(I.LE,IUNF+1) GO TO 60
160      C
161      C      NO, GENERATE THE NON-UNIFORM X USING GEOMETRIC PROGRESSION,
162      C
163      X(IJ)=X(IMJ)+FREZXR*(X(IMJ)-X(IMJ-NQ))
164      R(IJ)=X(IJ)*CYL+OMCYL
165      60 CONTINUE
166      C
167      C      JDT IS THE NO. OF J LINES THAT THE CURRENT J IS ABOVE THE TOP
168      C      OF THE UNIFORM REGION
169      C
170      JDT=J-JTOP

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171 C
172 C   JDB IS THE NO. OF J LINES THAT THE CURRENT J IS BELOW THE BOTTOM
173 C   OF THE UNIFORM REGION
174 C
175 C   JDB=JBOT-J
176 C
177 C   SEE IF THE CURRENT J IS BELOW THE UNIFORM REGION
178 C
179 C   IF(JDB,GT,0) GO TO 70
180 C
181 C   NO, SEE IF IT IS ABOVE THE UNIFORM REGION,
182 C
183 C   IF(JDT,GT,0) GO TO 80
184 C
185 C   NO, J IS IN UNIFORM REGION, SET IT AS SUCH,
186 C
187 C   Y(IJ)=REZYB+FLOAT(J-JCEN)*DZ
188 C   GO TO 90
189 C 70 CONTINUE
190 C
191 C   J IS BELOW THE UNIFORM REGION, CALCULATE ITS POSITION USING
192 C   FORMULA FOR SUM OF GEOMETRIC PROGRESSION, THE FORMULA IS
193 C    $SUM=A*(1-F**N)/(1-F)$ 
194 C   WHERE A IS THE FIRST TERM, N IS THE NO. OF TERMS, AND F IS
195 C   THE RATIO OF THE MTH TERM TO THE (M+1)TH TERM, IN THIS CASE
196 C    $A=DZ*FREQ$ ,  $N=JDB$ , AND  $F=FREQ$ , THE POSITION OF JBOT IS
197 C   AT  $Y=REZYB-TJ$ , J IS SUM BELOW THIS OR
198 C    $Y(J)=REZYB-TJ+DZ*FREQ*(1-FREQ**JDB)/(1-FREQ)$ ,
199 C
200 C   IF(FREZYB,GT,1.) Y(IJ)=REZYB-TJ+DZ*FREZYB*(1-FREZYB**JDB)*ROMFYB
201 C   GO TO 90
202 C 80 CONTINUE
203 C
204 C   J IS ABOVE THE UNIFORM REGION, USE GEOMETRIC PROGRESSION SUM TO
205 C   CALCULATE ITS VALUE ALSO,
206 C
207 C   IF(FREZYT,GT,1.) Y(IJ)=REZYB+TJ+DZ*FREZYT*(1-FREZYT**JDT)*ROMFYT
208 C 90 CONTINUE
209 C
210 C   SEE IF J IS 2
211 C
212 C   IF(J,NE,2) GO TO 100
213 C
214 C   YES, SET YB (BOTTOM Y),
215 C
216 C   YB=Y(IJ)
217 C
218 C   MAKE THE FICTITIOUS CELLS AT THE BOTTOM AS THOUGH THERE WERE
219 C   ANOTHER REAL ROW OF CELLS
220 C
221 C   X(IJM)=X(IJ)
222 C   IJM=IJM+NG
223 C   IJP=IJP+NG
224 C 100 IJ=IJ+NG
225 C   CALL LOOP
226 C 110 CONTINUE
227 C   CALL DONE

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220 C
229 C CALCULATE Y FOR J=1 FICTITIOUS CELLS
230 C
231 C CALL START
232 DO 120 I=1,IP1
233 Y(IJM)=Y(IJ)=(Y(IJP)-Y(IJ))*FREZYB
234 IJ=IJ+NQ
235 IJM=IJM+NQ
236 IJP=IJP+NQ
237 120 CONTINUE
238 CALL DONE
239 C
240 C MESH IS GENERATED
241 C
242 130 CONTINUE
243 C
244 C *****
245 C GENERATE AN INITIAL FIREBALL AND ITS AMBIENT ATMOSPHERE
246 C *****
247 C
248 C FIRST SET UP THE AMBIENT ATMOSPHERE
249 C
250 C GET GAMMA=1 AT REZYB
251 C
252 ETMP=REZSIE
253 ROTH=REZRON
254 CONCJ=0.
255 CALL AIR
256 C
257 C XX IS THE ISOTHERMAL CONSTANT IN THE PRESSURE
258 C
259 C XX=GMONE*REZSIE
260 C
261 C NOTE THAT A NEGATIVE GRAVITATIONAL FORCE IS ASSUMED HERE
262 C
263 YY=.5*ABS(GZ)
264 C
265 C BRING IN THE FIRST THREE ROWS
266 C
267 C CALL START
268 C
269 C PROCESS J=1 AND 2 ROWS. YJC2 IS THE Y COORDINATE OF CENTERS OF
270 C CELLS IN THE ROW J=2
271 C
272 YJC2=.5*(Y(IJP)+Y(IJ))
273 C
274 C ROSAV IS THE DENSITY OF THE CELLS IN ROW J=2 ASSUMING AN
275 C ISOTHERMAL, IDEAL GAS ATMOSPHERE
276 C
277 ROSAV=REZRON*EXP(=GZ*(REZYB-YJC2)/XX)
278 C
279 C CALCULATE THE DENSITY OF CELLS IN ROW J=1 USING THE DIFFERENCE
280 C FORM FOR HYDROSTATIC EQUILIBRIUM
281 C
282 FNUM=(Y(IJP)-Y(IJ))*YY
283 FDEN=FNUM*FREZYB
284 ROJ1=ROSAV*(XX+FNUM)/(XX+FDEN)

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285      C
286      C      SET AMBIENT QUANTITIES IN ROWS J=1 AND 2
287      C
288      DO 140 I=1,IP1
289      RO(IJ)=ROSAV
290      RO(IJM)=ROJ1
291      E(IJ)=REZSIE
292      SIE(IJ)=REZSIE
293      E(IJM)=REZSIE
294      SIE(IJM)=REZSIE
295      IJ=IJ+NQ
296      140 IJM=IJM+NQ
297      C
298      C      BRING IN THE NEXT ROW
299      C
300      CALL LOOP
301      C
302      C      LOOP OVER ALL THE OTHER REAL ROWS, BOOTSTRAP DENSITIES UPWARD
303      C      FROM ROW J=2.
304      C
305      DO 160 J=3,JP1
306      FDEN=(Y(IJP)-Y(IJ))*YY
307      FNUM=(Y(IJ)-Y(IJM))*YY
308      ROSAV=ROSAV*(XX=FNUM)/(XX+FDEN)
309      DO 150 I=1,IP1
310      RO(IJ)=ROSAV
311      E(IJ)=REZSIE
312      SIE(IJ)=REZSIE
313      150 IJ=IJ+NQ
314      CALL LOOP
315      160 CONTINUE
316      C
317      C      SET THE TOP FICTITIOUS ROW
318      C
319      FNUM=FNUM+FREZYT
320      FDEN=FDEN+FREZYT
321      ROJP2=ROSAV*(XX=FNUM)/(XX+FDEN)
322      DO 170 I=1,IP1
323      RO(IJ)=ROJP2
324      E(IJ)=REZSIE
325      SIE(IJ)=REZSIE
326      170 IJ=IJ+NQ
327      CALL DONE
328      C
329      C      THE AMBIENT ATMOSPHERE IS NOW SET, READ IN THE DATA TO GENERATE
330      C      THE FIREBALL. ISUB IS THE DATA POINT SUBSCRIPT, INTERPOLATION
331      C      TABLES ARE READ STARTING WITH ENTRY 2.
332      C
333      ISUB=1
334      C
335      C      READ INFORMATION ABOUT THE FINENESS OF THE FIREBALL
336      C      INTERPOLATION AND FROM WHERE THE FIREBALL INPUT DATA
337      C      WILL COME
338      C
339      IFILE=5
340      NRAD=5
341      NTH=180

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342         FBFILE=FALSE,
343         CALL NAMELIST(MESH,5,IEFLAG)
344         IF(IEFLAG.NE.0) CALL UNCLE(4,6HMSHMKR,25,
345         1 25HMFIRE NAMELIST INPUT ERROR)
346     C
347     C     SEE IF INPUT WILL BE FROM SPECIAL FILE
348     C
349     C     IF(,NOT,FBFILE) GO TO 200
350     C
351     C     YES, PRINT A MESSAGE TELLING THE USER SO.
352     C
353     C     DO 180 IPX=6,IFD,6
354     180 WRITE(IPX,540)
355     C     IFILE=3
356     C
357     C     PRINT THE DATA TABLE HEADER
358     C
359     C     DO 190 IPX=IPD,IFD,6
360     190 WRITE(IPX,570)
361     C
362     C     LOOP TO READ DATA POINTS
363     C
364     200 CONTINUE
365     C     ISUB=ISUB+1
366     C
367     C     SEE IF NEXT READ WILL OVERFLOW THE TEMPORARY STORAGE
368     C
369     C     IF(ISUB.GT,IPFB) CALL UNCLE(4,6HMSHMKR,29,
370     1 29HTOO MANY FIREBALL INPUT CARDS)
371     C
372     C     FIREBALL DATA IS IN SPHERICAL LAGRANGIAN FORM, INPUT IS
373     C     PRESSURE,RADIAL VELOCITY,SPECIFIC INTERNAL ENERGY,AND
374     C     DENSITY,IN CGS UNITS. THE VELOCITY IS DEFINED AT THE GIVEN
375     C     RADIUS. THE SPECIFIC INTERNAL ENERGY AND DENSITY FOR THE
376     C     CELL BETWEEN XFIRE(K-1) AND XFIRE(K) IS READ IN WITH
377     C     XFIRE(K). THE FIREBALL IS ASSUMED TO BE
378     C     CENTERED AT REZY0. THE PRESSURE IS ONLY INFORMATIVE, IT IS
379     C     NOT USED IN THE CALCULATION BUT RATHER IS RECALCULATED FROM
380     C     THE INPUT ENERGY AND DENSITY USING THE EQN=OF=STATE.
381     C
382     C     READ(IBFILE,580) PJLN,UFIRE(ISUB),EFIRE(ISUB),RHOFIR(ISUB),XFIRE(
383     1 ISUB)
384     C
385     C     CHECK FOR EOF ON INPUT. IF SO,CONSIDER END OF INPUT.
386     C
387     C     IF(E0F,IBFILE) 230,210
388     210 CONTINUE
389     C
390     C     CALCULATE THE PRESSURE FROM THE EQN=OF=STATE TO BE USED IN THE
391     C     PRINTOUT TO COMPARE WITH THE INPUT PRESSURE. A ZERO DENSITY
392     C     INDICATES THAT ALL THE DATA CARDS HAVE BEEN READ. (A BLANK
393     C     CARD TERMINATES THE INPUT.)
394     C
395     C     ROTMP=RHOFIR(ISUB)
396     C     IF(ROTMP.EQ.0.) GO TO 230
397     C
398     C     GO GET GAMMA=1 FROM THE EOS. IF S1E,GE.1,E10,METHANE IS

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399      C          ASSUMED (CONCJ=1.), OTHERWISE, AIR IS USED (CONCJ=0.).
400      C
401      ETMP=EFIRE(ISUB)
402      CONCJ=0.
403      IF(ETMP.GE.1.E10) CONCJ=1.
404      CALL AIR
405      PRHO=GMONE+ROTMP+ETMP
406      C
407      C          PRINT OUT THE INPUT DATA AND THE COMPARISON PRESSURES FOR
408      C          THIS DATA POINT
409      C
410      DO 220 IPX=IPD,IFD,6
411      220 WRITE(IPX,590) UFIRE(ISUB),EFIRE(ISUB),RHO FIR(ISUB),XFIRE(ISUB),
412      ! PJLN,PRHO
413      C
414      C          SEE IF RADIUS IS MONOTONIC INCREASING UNLESS FIRST DATA POINT.
415      C          IN THE LATTER CASE, GO ON AND PROCESS THE NEXT POINT.
416      C
417      IF(ISUB.EQ.2) GO TO 200
418      IF(XFIRE(ISUB).LE.XFIRE(ISUB-1)) CALL UNCLE(4,6,SHMKR,40,
419      1 40HINPUT RADII ARE NOT MONOTONIC INCREASING)
420      C
421      C          GO BACK AND PROCESS THE NEXT POINT
422      C
423      GO TO 200
424      230 CONTINUE
425      DO 240 IPX=6,IFD,6
426      240 WRITE(IPX,550)
427      C
428      C          GET RID OF THE FIREBALL INPUT DATA FILE IF ONE EXISTS
429      C
430      IF(FBFILE) CALL CLOSIT(3)
431      C
432      C          ALL DONE READING INPUT, SET THE DATA POINT COUNT TO THE TRUE NO.
433      C
434      ISUB=ISUB-1
435      C
436      C          SET THE QUANTITIES AT THE CENTER OF THE SPHERE, THE ENERGY AND
437      C          DENSITY ARE SET TO THOSE AT THE FIRST DATA POINT READ, THE
438      C          VELOCITY IS ZERO, OF COURSE.
439      C
440      UFIRE(1)=0.
441      EFIRE(1)=EFIRE(2)
442      RHO FIR(1)=RHO FIR(2)
443      XFIRE(1)=0.
444      C
445      C          LOOP OVER ALL ZONES AND INTERPOLATE THE CELL QUANTITIES
446      C
447      CALL START
448      DO 300 J=2,JP1
449      DO 290 I=1,IBAR
450      C
451      C          FIND THE VERTICES OF THE CELL OF INTEREST
452      C
453      VXL=X(IJ)
454      IFJ=IJ+NG
455      VXR=X(IPJ)

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456      VYB=Y(IJ)
457      VYT=Y(IJP)
458      C
459      C      CONC(IJ)=0, INDICATES NOTHING HAS BEEN SET IN THE
460      C      ZONE YET
461      C
462      CONC(IJ)=0,
463      C
464      C      LOOP OVER ALL 1-D ZONES
465      C
466      DO 280 K=2,ISUB
467      C
468      C      SEE IF ZONE COULD NOT POSSIBLY FALL WITHIN THE YAQUI ZONE
469      C
470      RVRT=VXR*VXR+(VYT-REZY0)**2
471      RVRB=VXR*VXR+(VYB-REZY0)**2
472      RFIRE=XFIRE(K=1)**2
473      IF(RFIRE,GT,RVRT,AND,RFIRE,GT,RVRB) GO TO 280
474      RVLT=VXL*VXL+(VYT-REZY0)**2
475      RVLB=VXL*VXL+(VYB-REZY0)**2
476      RFIRE=XFIRE(K)**2
477      IF(RFIRE,LT,RVLT,AND,RFIRE,LT,RVLB) GO TO 280
478      C
479      C      LOOP OVER ANGULAR INCREMENTS
480      C
481      THETA2=0,
482      DNTM=180,/FLOAT(NTM)
483      DO 270 IT=1,NTM
484      THETA1=THETA2
485      THETA2=THETA1+DNTM
486      CTMETHA=.5*(THETA1+THETA2)
487      SINT=SDG(CTMETHA)
488      COST=CCG(CTMETHA)
489      C
490      C      LOOP OVER RADIAL INCREMENTS
491      C
492      R2=XFIRE(K=1)
493      DR=(XFIRE(K)-R2)/FLOAT(NRAD)
494      DO 260 IR=1,NRAD
495      R1=R2
496      R2=R2+DR
497      CR=.5*(R1+R2)
498      XCEN=CR+SINT
499      C
500      C      SEE IF THE X-COORDINATE OF THE CENTER OF THE LAGRANGIAN
501      C      PIECE LIES IN THE YAQUI CELL OF INTEREST
502      C
503      IF(XCEN,LT,VXL,OR,XCEN,GT,VXR) GO TO 260
504      C
505      C      YES, CHECK THE Y-COORDINATE
506      C
507      YCEN=CR+COST+REZY0
508      IF(YCEN,LT,VYB,OR,YCEN,GT,VYT) GO TO 260
509      C
510      C      CONSIDER THE PIECE IN THE YAQUI CELL, SEE IF ANY PIECES
511      C      HAVE PREVIOUSLY BEEN FOUND,
512      C

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513      IF (CONC(IJ),NE,0.) GO TO 250
514      C
515      C      NO. INITIALIZE.
516      C
517      RO(IJ)=0.
518      U(IJ)=0.
519      V(IJ)=0.
520      SIE(IJ)=0.
521      250 CONTINUE
522      C
523      C      COMPUTE THE MASS OF THE PIECE, ACCUMULATE THE VOLUME
524      C      IN CONC.
525      C
526      VOL=THIRD*(CDG(THETA1)-CDG(THETA2))*(R2**3-R1**3)
527      CONC(IJ)=CONC(IJ)+VOL
528      XMASS=VOL*RHOFFIR(K)
529      C
530      C      COMPUTE THE VELOCITIES OF THE PIECE
531      C
532      RATIO=(CR-XFIRE(K-1))/(XFIRE(K)-XFIRE(K-1))
533      RDOT=UFIRE(K-1)+RATIO*(UFIRE(K)-UFIRE(K-1))
534      XDOT=RDOT*SINT
535      YDOT=RDOT*COST
536      C
537      C      DEPOSIT MASS, MOMENTUM, AND ENERGY IN THE YAQUI ZONE
538      C
539      U(IJ)=U(IJ)+XDOT*XMASS
540      V(IJ)=V(IJ)+YDOT*XMASS
541      SIE(IJ)=SIE(IJ)+EFIRE(K)*XMASS
542      RO(IJ)=RO(IJ)+XMASS
543      260 CONTINUE
544      270 CONTINUE
545      280 CONTINUE
546      IJ=IJ+NG
547      IJP=IJP+NG
548      290 CONTINUE
549      CALL LOOP
550      300 CONTINUE
551      CALL DONE
552      C
553      C      LOOP OVER ALL CELLS AND CHECK FOR FIREBALL CELLS
554      C
555      CALL START
556      DO 300 J=2,JP1
557      DO 300 I=1,IBAR
558      IF (CONC(IJ),EQ,0.) GO TO 370
559      C
560      C      FIREBALL CELL FOUND, SEE IF ITS VOLUME IS VERY FAR OFF.
561      C
562      IPJ=IJ+NG
563      VOL=.5*(Y(IJP)-Y(IJ))*(X(IPJ)**2-X(IJ)**2)
564      RERROR=(CONC(IJ)-VOL)/VOL
565      IF (ABS(RERROR).LT,.01) GO TO 370
566      C
567      C      ERROR IS LARGE, INFORM THE USER AND CONSIDER CELL AS
568      C      FIREBALL BOUNDARY CELL.
569      C

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570      DO 310 IPX=6,IPD,4
571      310 WRITE(IPX,560) I,J,ERROR
572      C
573      C      USE VALUES FROM NEIGHBORING CELL FOR DETERMINING
574      C      CONTRIBUTION OF PART OF CELL OUTSIDE OF THE FIREBALL
575      C
576      IF(CONC(IPJ),NE,0,) GO TO 320
577      C
578      C      USE CELL TO RIGHT
579      C
580      INDEX=IPJ
581      GO TO 360
582      320 CONTINUE
583      IF(CONC(IJP),NE,0,) GO TO 330
584      C
585      C      USE CELL ABOVE
586      C
587      INDEX=IJP
588      GO TO 360
589      330 CONTINUE
590      IF(CONC(IJM),NE,0,) GO TO 340
591      C
592      C      USE CELL BELOW
593      C
594      INDEX=IJM
595      GO TO 360
596      340 CONTINUE
597      IPJP=IJP+40
598      IF(CONC(IPJP),NE,0,) GO TO 350
599      C
600      C      USE CELL TO UPPER RIGHT
601      C
602      INDEX=IPJP
603      GO TO 360
604      350 CONTINUE
605      IPJM=IJM+40
606      IF(CONC(IPJM),NE,0,) CALL UNCLE(1,6HMSHMKR,50,
607      1 50HERROR IN PROCESSING CELL WITH LARGE RELATIVE ERROR)
608      C
609      C      USE CELL TO LOWER RIGHT
610      C
611      INDEX=IPJM
612      360 CONTINUE
613      C
614      C      ADD IN CONTRIBUTION FROM PART OF CELL OUTSIDE OF THE FIREBALL
615      C
616      DV=VOL=CONC(IJ)
617      DM=DV*RO(INDEX)
618      RO(IJ)=RO(IJ)+DM
619      SIE(IJ)=SIE(IJ)+DM*SIE(INDEX)
620      370 CONTINUE
621      IJ=IJ+40
622      IJP=IJP+40
623      IJM=IJM+40
624      380 CONTINUE
625      CALL LOOP
626      390 CONTINUE

```

```

627 C
628 C ALL FIREBALL CELLS ARE NOW COMPLETELY DEFINED,
629 C GO BACK AND DEFINE THE VELOCITIES, STORE THEM
630 C TEMPORARILY IN UG,VG,
631 C
632 CALL START
633 DO 440 J=2,JP1
634 DO 430 I=1,IBAR
635 UG(IJ)=0.
636 VG(IJ)=0.
637 IPJ=IJ+NQ
638 C
639 C SEE IF THE CURRENT CELL IS A FIREBALL CELL
640 C
641 IF(CONC(IJ),EQ,0.) GO TO 420
642 C
643 C YFS, ALL NEIGHBORING CELLS OF THE LOWER LEFTHAND VERTEX
644 C MUST ALSO BE FIREBALL CELLS OR VELOCITY IS SET TO ZERO,
645 C
646 IF(I,EQ,1) GO TO 400
647 IMJ=IJ+NQ
648 IF(CONC(IMJ),EQ,0.) GO TO 420
649 IMJM=IJM+NQ
650 IF(CONC(IMJM),EQ,0.) GO TO 420
651 400 CONTINUE
652 IF(CONC(IJM),EQ,0.) GO TO 420
653 C
654 C ALL NEIGHBORS ARE FIREBALL CELLS, DIVIDE UP THE MOMENTUM,
655 C
656 XMASS=RO(IJ)+RO(IJM)
657 UG(IJ)=UG(IJ)+U(IJM)
658 VG(IJ)=VG(IJ)+V(IJM)
659 IF(I,EQ,1) GO TO 410
660 IMJ=IJ+NQ
661 IMJM=IJM+NQ
662 XMASS=XMASS+RO(IMJ)+RO(IMJM)
663 UG(IJ)=UG(IJ)+U(IMJ)+U(IMJM)
664 VG(IJ)=VG(IJ)+V(IMJ)+V(IMJM)
665 410 CONTINUE
666 UG(IJ)=UG(IJ)/XMASS
667 VG(IJ)=VG(IJ)/XMASS
668 420 CONTINUE
669 IJ=IJ+NQ
670 IJP=IJP+NQ
671 IJM=IJM+NQ
672 430 CONTINUE
673 CALL LOOP
674 440 CONTINUE
675 CALL DONE
676 C
677 C NOW WE HAVE VERTEX VELOCITIES IN UG,VG, STORE THEM IN U,V
678 C AND CONVERT MASSES TO DENSITIES AND INTERNAL ENERGIES
679 C TO SPECIFIC INTERNAL ENERGIES,
680 C
681 CALL START
682 DO 470 J=2,JP1
683 DO 460 I=1,IBAR

```

```

684         IF(CONC(IJ),EQ,0.) GO TO 450
685         U(IJ)=UG(IJ)
686         V(IJ)=VG(IJ)
687         IPJ=IJ+NQ
688         VOLW,5*(Y(IPJ)-Y(IJ))*(X(IPJ)**2-X(IJ)**2)
689         SIE(IJ)=SIE(IJ)/RO(IJ)
690         RO(IJ)=RO(IJ)/VOL
691     450 CONTINUE
692         IJ=IJ+NQ
693         IJP=IJP+NQ
694     460 CONTINUE
695         CALL LOOP
696     470 CONTINUE
697         CALL DONE
698
699     C
700     C     SET CONCENTRATIONS, CONCI=1, INDICATES METHANE, CONCI=0, IS AIR,
701     C     EVERYTHING WITH SIE,GE,1,E10 IS CONSIDERED METHANE, ALL ELSE
702     C     IS AIR,
703     C     CALL START
704     C
705     C     SET THE BOTTOM FICTITIOUS ROW
706     C
707         DO 480 I=1,IP1
708         CONC(IJM)=0,
709         IJM=IJM+NQ
710     480 CONTINUE
711     C
712     C     SET THE REAL ROWS AND THE RIGHT FICTITIOUS COLUMN
713     C
714         DO 500 J=2,JP1
715         DO 490 I=1,IP1
716         CONC(IJ)=0,
717         IF(SIE(IJ),GE,1,E10,AND,I,NE,IP1) CONC(IJ)=1,
718         IJ=IJ+NQ
719     490 CONTINUE
720         CALL LOOP
721     500 CONTINUE
722     C
723     C     SET THE TOP FICTITIOUS ROW
724     C
725         DO 510 I=1,IP1
726         CONC(IJ)=0,
727         IJ=IJ+NQ
728     510 CONTINUE
729         CALL DONE
730     C
731     C     ZERO OUT U AND V IN THE BOTTOM FICTITIOUS ROW
732     C
733         CALL START
734         DO 520 I=1,IP1
735         U(IJM)=0,
736         V(IJM)=0,
737         IJM=IJM+NQ
738     520 CONTINUE
739         CALL DONE
740         RETURN

```

```

741      530 CONTINUE
742      CALL UNCLE(4,6HMSHMKR,34,34HMESH NAMELIST INITIALIZATION ERROR)
743      C
744      540 FORMAT(/1H ,34HFIREFBALL INPUT WILL BE FROM FILE 3)
745      550 FORMAT(1H /1H ,28HALL FIREBALL INPUT DATA READ/1H )
746      560 FORMAT(1H ,5HCELL ,21S,32H HAS A RELATIVE VOLUME ERROR OF ,1PE12.5
747      1 ,1H.,2X,46HIT WILL BE TREATED AS A FIREBALL BOUNDARY CELL)
748      570 FORMAT(1H1,22HMESHMKR FIREBALL INPUT//1H ,13X1HU,19X1HE,18X3HRMO,
749      1 17X1HX,19X1MP,17X4HPRMO/1H )
750      580 FORMAT(5E15,0)
751      590 FORMAT(1H ,1P6E19,7)
752      END

```

```

1      SUBROUTINE MTHANE
2      C
3      C ROUTINE TO CALCULATE THE FACTOR GAMMA=1 FOR METHANE
4      C
5      C UNITS ARE ALL CGS
6      C
7      C ORIGINALLY OBTAINED FROM THE AIR FORCE WEAPONS LAB
8      C MODIFIED BY J.L.NORTON,LASL T=3,1974
9      C
10     COMMON/EQNST/RHO,E,GMONE
11     DIMENSION A(8)
12     DATA A/3,21782E=1,-1.56848E=4,-8.78899E=2,1.25271E=3,1.46612E=2,
13     1 1.72460E=6,-7.72322E=4,-8.63413E=6/
14     U=E*1,E=10
15     R=ALOG(RHO)
16     GMONE=A(1)+R*(A(2)+U*(A(4)+U*(A(6)+A(8)+U)))+U*(A(3)+U*(A(5)+A(7)+
17     1 U))
18     RETURN
19     END

```

```

1      SUBROUTINE NAMELIST(TABLE,IF,IEFLAG)
2      C
3      C ROUTINE TO REPLACE COMPILER/SYSTEM DEPENDENT NAMELIST INPUT,
4      C HERE,AN ATTEMPT HAS BEEN MADE TO ELIMINATE AS MANY
5      C COMPILER= AND/OR SYSTEM=DEPENDENT FEATURES AS POSSIBLE, THOSE
6      C STILL REMAINING ARE BOOLEAN ALGEBRA,60 BIT WORD ASSUMPTION,
7      C INLINE SHIFT FUNCTION (CAN BE REPLACED BY ASSEMBLY=LANGUAGE
8      C FUNCTION IF IT IS TYPED INTEGER),AND TWO ASSEMBLY=LANGUAGE
9      C ROUTINES TO FETCH AND STORE WORDS FROM AND INTO ABSOLUTE
10     C MEMORY LOCATIONS.
11     C
12     C TABLE = NAMELIST DATA TABLE

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13 C IF = INPUT FILESET
14 C IEFLAG = ERROR FLAG
15 C   • 0 = NO ERROR
16 C   • -1 = END-OF-FILE ON FILESET IF
17 C   • N (,NE,0 OR -1) = ERROR EXIT
18 C     (ERROR MESSAGE WILL BE PRINTED BY MESSOT)
19 C     (IF ,LT,0,EOF ALSO OCCURRED)
20 C
21 C LIMITATIONS = CURRENTLY, ONLY SMALL CORE VARIABLES MAY BE READ,
22 C   ARRAYS OF UP TO FOUR SUBSCRIPTS CAN BE INPUT ALTHOUGH MANY
23 C   COMPILERS CAN HANDLE A MAXIMUM OF ONLY THREE SUBSCRIPTS.
24 C
25 C INPUT RULES = DATA MAY BE INPUT IN ANY OF THREE GENERAL FORMS ==
26 C   V=D1
27 C   A=D1,D2,...,DN
28 C   A(SUB)=D1,D2,...,DN
29 C   WHERE V IS A NON-SUBSCRIPTED VARIABLE,
30 C   A IS AN ARRAY,
31 C   SUB REPRESENTS FROM 1 TO 4 SUBSCRIPTS (INTEGER CONSTANT)
32 C   AND DN REPRESENTS A DATA ELEMENT.
33 C   THE DATA ELEMENTS MAY BE OF A NUMBER OF TYPES ==
34 C   INTEGER = BASE 10 (EXAMPLE,=13569)
35 C   • BASE 8 (FOLLOW CONSTANT WITH B) (7765B)
36 C   REAL = FIXED (13.25)
37 C   • FLOATING (3.265E29)
38 C   COMPLEX = (-13.50,3.14E=7)
39 C   DOUBLE = 3.1415926535897932384603
40 C   LOGICAL = ,TRUE,,FALSE,,T,,F,
41 C   HOLLERITH = LEFT=JUSTIFIED,BLANK=HILL (5HTHING)
42 C   • LEFT=JUSTIFIED,ZERO=HILL (3LOUT)
43 C   • RIGHT=JUSTIFIED,ZERO=HILL (4RWORD)
44 C   MULTIPLIERS ARE ALLOWED,BUT ONLY FOR ONE ELEMENT AT A TIME.
45 C   FOR EXAMPLE,5*23,6*15,3,21*27,3E7,5*4HTEST ARE ALL
46 C   LEGAL. 6*(13,,21,7) WOULD WORK,BUT ONLY BECAUSE THE
47 C   QUANTITY INSIDE THE PARENTHESES IS INTERPRETED AS A
48 C   SINGLE COMPLEX CONSTANT. 22*(1,2,3,4,5,6) WOULD BE
49 C   FLAGGED AS AN ERROR. 5*13HABCDEFGHJKLM IS ALSO ILLEGAL
50 C   AS THE CONSTANT IS MORE THAN ONE WORD LONG.
51 C   INTEGERS WITH MORE THAN 14 DIGITS AND REAL CONSTANTS OF
52 C   MORE THAN 14 DIGITS NOT INDICATED AS DOUBLE PRECISION
53 C   ARE ILLEGAL. FOR EXAMPLE,PI=3.1415926535897932 IS WRONG
54 C   BUT PI=3.1415926535897932D IS O.K.
55 C
56 C *****
57 C NOTE CAREFULLY = NO CONVERSIONS OF DATA TYPE ARE MADE, THIS GIVES
58 C   ONE THE CAPABILITY OF STORING REAL CONSTANTS INTO INTEGER
59 C   VARIABLES, FOR EXAMPLE, HOWEVER, IF ONE FORGETS TO PUNCH A
60 C   DECIMAL POINT (X=5), THE CONSTANT WILL BE STORED AS AN
61 C   INTEGER.
62 C *****
63 C
64 C OTHER CONVENTIONS AND CAPABILITIES ARE AS FOLLOWS ==
65 C   ANY CARD WITH CS IN CC1=2 WILL BE PRINTED OUT AND IGNORED,
66 C   ANY CARD WITH PS IN CC1=2 WILL TURN ON A PRINT SWITCH AND
67 C   EACH CARD OF THE NAMELIST INPUT RECORD (UP TO THE NEXT $)
68 C   WILL BE PRINTED BEFORE PROCESSING.
69 C   AN ISOLATED = IS ILLEGAL. =E=-1,EO, =D=-1,DO, =,TRUE,,FALSE,

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70 C      AND =.FALSE.,.TRUE.,. =B=PB, A MINUS SIGN IN FRONT OF AN
71 C      OCTAL CONSTANT CAUSES THE CONSTANT TO BE COMPLEMENTED,
72 C      A MINUS SIGN IN FRONT OF A HOLLERITH CONSTANT IS IGNORED.
73 C      AN R HOLLERITH CONSTANT CANNOT BE MORE THAN 10 CHARACTERS
74 C      LONG.
75 C      THE TERMINATION $ MUST NOT OCCUR IN CC1 OR 2, IF IT OCCURS
76 C      IN CC1, IT WILL BE IGNORED, AN ERROR WILL BE RETURNED IF
77 C      IT IS IN CC2.
78 C      A NAMELIST RECORD MAY BE OF ANY LENGTH, BLANKS ARE SIGNIFICANT
79 C      AND MAY OCCUR ONLY AROUND NON=NUMERIC CHARACTERS OTHER
80 C      THAN EXPONENTS, FOR EXAMPLE, LEGAL BLANKS ARE X = 5.,
81 C      Y = - 10,3, L = ,TRUE.,, C = ( 5. , 6. ), I= 13.
82 C      ILLEGAL BLANKS WOULD INCLUDE X=5, E 6, L= . 7 ., Y=, 5 .
83 C      THE NAMELIST RECORD IS TREATED AS ONE LONG STRING OF
84 C      CHARACTERS, ALL 80 CHARACTERS OF EACH CARD BEING SCANNED,
85 C      EXCEPT THAT CC2 OF EACH CARD MAY NOT BE A $ UNLESS IT IS
86 C      PART OF A HOLLERITH FIELD.
87 C      BECAUSE OF THE UNLIMITED LENGTH OF A NAMELIST RECORD, A
88 C      HOLLERITH CONSTANT MAY BE OF UNLIMITED LENGTH,
89 C      BECAUSE TYPE IS NOT CHECKED, STORING A DOUBLE=PRECISION
90 C      CONSTANT INTO A SINGLE=PRECISION VARIABLE WILL Clobber
91 C      THE FOLLOWING LOCATION, (X=5,D WILL STORE A ZERO INTO
92 C      THE LOCATION FOLLOWING X ASSUMING X IS NOT DOUBLE OR
93 C      COMPLEX), A SIMILAR WARNING CAN BE GIVEN FOR X=(1.,2.),
94 C
95 C      *****
96 C      EXAMPLE OF USAGE =
97 C
98 C      SUPPOSE ONE WISHED TO REPLACE THE STATEMENTS
99 C
100 C      DIMENSION A(20),B(5,3),X(5,10,15)
101 C      NAMELIST/CARDN/I,J,K,A,B,X
102 C      READ(5,CARDN)
103 C
104 C      WITH SYSTEM=INDEPENDENT INPUT, FURTHERMORE, SUPPOSE ONE WISHED
105 C      TO HAVE PS AND CS CARDS COME OUT ON BOTH PAPER AND FILM
106 C      AND ERROR MESSAGES COME OUT ON FILE 59, THEN ONE WOULD
107 C      NEED THE FOLLOWING =
108 C
109 C      DIMENSION A(20),B(5,3),X(5,10,15),ITAB(2),TABLE(3,7)
110 C
111 C      SET UP FILE TABLE FOR MESSAGES
112 C
113 C      DATA ITAB/3LOUT,4LFILM/,JTAB/59/
114 C      CALL NAMPRT(2,ITAB)
115 C      CALL ERPRPT(1,JTAB)
116 C
117 C      DEFINE THE NAMELIST TABLE, IF THERE ARE TO BE N UNIQUE
118 C      INPUT VARIABLE NAMES, THEN 3*(N+1) TABLE LOCATIONS
119 C      ARE NEEDED, THUS, FOR SIX VARIABLES, 3*7 LOCATIONS
120 C      MUST BE SET ASIDE, THE THIRD ARGUMENT IS THE
121 C      SECOND SUBSCRIPT OF TABLE, IF ANY ERRORS OCCUR IN
122 C      SUBSEQUENT CALLS TO TABSET, TRANSFER WILL OCCUR TO
123 C      THE STATEMENT NO, ASSIGNED TO IERR, THIS ELIMINATES
124 C      ERROR CHECKING AFTER EACH CALL TO TABSET, IEFLAG CAN
125 C      THEN BE EXAMINED TO DETERMINE WHAT TYPE OF ERROR
126 C      OCCURRED.

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127 C C
128 C C ASSIGN 999 TO IERRY
129 C C CALL TABDEF(TABLE,5MCARDN,7,IERRY)
130 C C
131 C C ENTER EACH VARIABLE INTO THE TABLE, IF THERE IS SOME
132 C C ERROR,IEFLAG IS RETURNED NON=ZERO,
133 C C
134 C C CALL TABSET(TABLE,1MI,I,IEFLAG,0,0,0,0)
135 C C
136 C C (THE 0 DENOTES A NON-SUBSCRIPTED VARIABLE)
137 C C
138 C C CALL TABSET(TABLE,1MJ,J,IEFLAG,0,0,0,0)
139 C C CALL TABSET(TABLE,1MK,K,IEFLAG,0,0,0,0)
140 C C CALL TABSET(TABLE,1MA,A,IEFLAG,1,0,0,0)
141 C C
142 C C (THE 1 DENOTES A SUBSCRIPTED VARIABLE BUT THE SUBSCRIPT
143 C C NEED NOT BE GIVEN FOR A SINGLY-SUBSCRIPTED VARIABLE)
144 C C
145 C C CALL TABSET(TABLE,1MB,B,IEFLAG,2,5,0,0)
146 C C
147 C C (THE VARIABLE IS DOUBLY-SUBSCRIPTED BUT ONLY THE FIRST
148 C C SUBSCRIPT NEED BE GIVEN)
149 C C
150 C C CALL TABSET(TABLE,1MX,X,IEFLAG,3,5,10,0)
151 C C
152 C C (THE VARIABLE IS TRIPLY-SUBSCRIPTED BUT ONLY THE FIRST
153 C C TWO SUBSCRIPTS NEED BE GIVEN)
154 C C
155 C C NOTE THAT TABSET IS CALLED WITH THE FULL NO. OF ARGUMENTS
156 C C WHETHER THEY ARE USED OR NOT, THIS IS NOT STRICTLY
157 C C NECESSARY ON MOST COMPILERS, CHECK YOUR LOCAL
158 C C CONVENTIONS.
159 C C
160 C C READ IN A NAMELIST CARD, IF IEFLAG RETURNS 0, ALL WAS OK,
161 C C IF IEFLAG RETURNS -1, A NORMAL EOF WAS ENCOUNTERED,
162 C C FOR ALL OTHER VALUES OF IEFLAG, AN ERROR OCCURRED,
163 C C IF IEFLAG.LT.0, AN EOF ALSO OCCURRED,
164 C C
165 C C CALL NAMLIST(TABLE,5,IEFLAG)
166 C C
167 C C (5 IS THE INPUT FILE NO.)
168 C C
169 C C IF(IEFLAG.EQ.0) GO TO 10
170 C C IF(IEFLAG.EQ.(-1)) GO TO 20
171 C C
172 C C A NAMELIST ERROR OCCURRED
173 C C
174 C C STOP 7
175 C C
176 C C A NAMELIST TABLE INITIALIZATION ERROR OCCURRED
177 C C
178 C C 999 CONTINUE
179 C C * * *
180 C C
181 C C AN EOF OCCURRED
182 C C
183 C C 20 CONTINUE

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184 C      * * *
185 C      C
186 C      C      NORMAL EXIT
187 C      C
188 C      10 CONTINUE
189 C      * * *
190 C      *****
191 C
192 C      WRITTEN BY J.L.NORTON, LABL T-3, 1974
193 C
194 C      THIS VERSION RUNS ON A CDC 6600 OR 7600 USING THE RUN COMPILER
195 C
196 C      DIMENSION TABLE(3,1),IDSTR(80)
197 C      INTEGER TABLE,AND,OR,COMP,SHIFT
198 C      LOGICAL LIST,CMPLX,DIM,DELIM,FIX,MULT,CFRST,MOLLER,DOUBLE
199 C      LOGICAL SAVE,FIRST,DONE,EXPN,PERIOD,LCONT,LCONF,COONE,CPPND
200 C      COMMON/ARRCON/ICAR(80),ISUB,ITEST,NSUB,NSUBV(4),IENTRY,ISBSPY,
201 C      1 CREAL,CIMAG,CMPLX,DIM,MULTSV,IVSUM,MULT,LIST,MOLLER,DOUBLE
202 C      COMMON/ERRORC/IERRT
203 C      COMMON/CSHIFT/XLEFT,XRIGHT,XDUM
204 C      DOUBLE PRECISION DB,DBP,DCONST,DTEMP,DZERO
205 C      EQUIVALENCE(DB,CREAL)
206 C      EQUIVALENCE(IVSUM,XSUM)
207 C      DATA LCONT,LCONF/,TRUE.,FALSE./
208 C      DATA IAF,IAL/1A,1R2/
209 C      DATA INF,INL/1R0,1R9/
210 C      DATA DCONST/10.,0./,DZERO/0.,0./
211 C      DATA IEMIN,IEMAX/-294,322/
212 C      DATA NDSP,NDDP/14,28/
213 C      DATA INAME/0/
214 C
215 C      LIST = IF TRUE,EACH NAMELIST CARD INPUT WILL BE LISTED
216 C
217 C      LIST=.FALSE.,
218 C
219 C      BEGINNING OF CODE FOR PROCESSING A NAMELIST RECORD
220 C
221 C      10 CONTINUE
222 C
223 C      RESET THE ERROR FLAG
224 C
225 C      IEFLAG=0
226 C
227 C      READ A CARD
228 C
229 C      CALL READIT(IF,IEFLAG)
230 C
231 C      IF AN END-OF-FILE WAS ENCOUNTERED,QUIT
232 C
233 C      IF(IEFLAG.LT.0) RETURN
234 C
235 C      ISUB IS THE POINTER TO THE COLUMN BEING PROCESSED OF THE CARD
236 C      LAST READ, BEGIN LOOKING AT CC2,
237 C
238 C      ISUB=2
239 C
240 C      IF CC2 IS NOT A DOLLAR,IGNORE THE CARD AND GO BACK AND READ

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241      C          ANOTHER ONE
242      C
243      C      IF(ICHAR(2),NE,1H$) GO TO 18
244      C
245      C      CC2 WAS A DOLLAR, IF CC1 IS A -P-,TURN ON THE LIST FLAG.
246      C
247      C      IF(ICHAR(1),EQ,1HP) LIST=.TRUE.
248      C
249      C      IF CC1 IS A C,PRINT THE CARD AND GO READ ANOTHER
250      C
251      C      IF(ICHAR(1),NE,1HC) GO TO 28
252      C      CALL MESSOT(1)
253      C      GO TO 18
254      C
255      C      CARD IS TO BE PROCESSED.
256      C
257      C      20 CONTINUE
258      C
259      C      IVNUM IS THE NO. OF CHARACTERS READ IN THE CURRENT STRING
260      C
261      C      IVNUM=0
262      C
263      C      *****
264      C      DECODE THE NAMELIST NAME
265      C      *****
266      C
267      C      30 CONTINUE
268      C
269      C      GO TO THE NEXT COLUMN
270      C
271      C      ISUB=ISUB+1
272      C
273      C      ITEST IS THE CHARACTER IN CC ISUB,LEFT=JUSTIFIED,BLANK FILL
274      C
275      C      ITEST=ICHAR(ISUB)
276      C
277      C      CHECK FOR A BLANK
278      C
279      C      IF(ITEST,EQ,1H ) GO TO 78
280      C
281      C      NO. UP THE CHARACTER COUNT, IF MORE THAN SIX,FATAL ERROR.
282      C
283      C      IVNUM=IVNUM+1
284      C      IF(IVNUM,LE,6) GO TO 40
285      C      CALL MESSOT(2)
286      C      IFLAG=2
287      C      RETURN
288      C      40 CONTINUE
289      C
290      C      ITEMP IS THE CHARACTER IN CC ISUB,RIGHT=JUSTIFIED,ZERO FILL
291      C
292      C      ITEMP=AND(SHIFT(ITEST,-54),778)
293      C
294      C      CHECK FOR THE FIRST CHARACTER OF THE STRING
295      C
296      C      IF(IVNUM,GT,1) GO TO 50
297      C

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298 C YES, IF NON-ALPHABETIC,FATAL ERROR.
299 C
300 IF(ITEMP,GE,IAF,AND,ITEMP,LE,IAL) GO TO 60
301 CALL MESSOT(23)
302 IEFLAG=23
303 RETURN
304 50 CONTINUE
305 C
306 C IF ANY CHARACTER IS NOT A LETTER OR A NUMBER,FATAL ERROR.
307 C
308 IF((ITEMP,GE,INF,AND,ITEMP,LE,INL),OR,(ITEMP,GE,IAF,AND,ITEMP,LE,
309 1 IAL)) GO TO 60
310 CALL MESSOT(24)
311 IEFLAG=24
312 RETURN
313 60 CONTINUE
314 C
315 C STORE THE CHARACTER AND GO LOOK AT THE NEXT
316 C
317 IDSTR(IVNUM)=ITEST
318 GO TO 30
319 C
320 C A BLANK CHARACTER HAS BEEN FOUND
321 C
322 70 CONTINUE
323 C
324 C IF IT IS THE FIRST CHARACTER AFTER THE $,FATAL ERROR
325 C
326 IF(IVNUM,GT,0) GO TO 80
327 CALL MESSOT(11)
328 IEFLAG=11
329 RETURN
330 80 CONTINUE
331 C
332 C GO PUT THE STRING INTO ONE WORD (INAME),LEFT=JUSTIFIED,BLANK FILL
333 C
334 CALL MASH(IDSTR,IVNUM,INAME,IEFLAG)
335 IF(IEFLAG,NE,0) RETURN
336 C
337 C SEE IF IT MATCHES THE NAME IN THE NAMELIST TABLE. IF NOT,GO BACK
338 C AND READ THE NEXT CARD.
339 C
340 IF(TABLE(1,1),NE,INAME) GO TO 10
341 C
342 C NAME MATCHES. INE IS THE NUMBER OF VARIABLES REPRESENTED IN THE
343 C TABLE +1. DELIM=FALSE. INDICATES THAT A DELIMITER (, OR $)
344 C IS NOT EXPECTED AS THE NEXT CHARACTER. FIRST=TRUE. INDICATES
345 C THAT A VARIABLE NAME MUST BE FOUND BEFORE A CONSTANT.
346 C
347 INE=TABLE(3,1)+1
348 DELIM=FALSE.
349 FIRST=TRUE.
350 C
351 C LIST THE CARD IF THE FLAG IS ON
352 C
353 IF(LIST) CALL MESSOT(1)
354 GO TO 100

```

```

355 C
356 C *****
357 C MAIN LOOP FOR DECODING VARIABLE NAMES AND CONSTANTS
358 C *****
359 C
360 C 90 CONTINUE
361 C
362 C ONE VARIABLE NAME AND CONSTANT HAVE ALREADY BEEN PROCESSED,
363 C EITHER A VARIABLE OR A CONSTANT CAN OCCUR NEXT,
364 C
365 C FIRST=.FALSE.
366 C
367 C -----
368 C SUBLOOP TO DETERMINE WHETHER NEXT STRING IS VARIABLE NAME OR
369 C CONSTANT
370 C -----
371 C
372 C 100 CONTINUE
373 C
374 C NXTCOL PUTS THE CONTENTS OF THE NEXT CARD COLUMN INTO ITEST,ALSO
375 C UPDATING ISUB, IF NECESSARY,ANOTHER CARD IS READ AND ERROR
376 C CHECKS ARE PERFORMED,
377 C
378 C CALL NXTCOL(7F,IEFLAG)
379 C
380 C IF ANY ERRORS,QUIT RIGHT HERE
381 C
382 C IF(IEFLAG,NE,0) RETURN
383 C
384 C NO ERRORS, SEE IF NEXT CHARACTER IS A BLANK, IF IT IS,GO ON TO
385 C THE NEXT COLUMN,
386 C
387 C IF(ITEST,EQ,1H ) GO TO 100
388 C
389 C NOT A BLANK, SEE IF IT IS A DOLLAR, IF SO,WE ARE ALL DONE,
390 C
391 C IF(ITEST,EQ,1H$) RETURN
392 C
393 C NOT A DOLLAR, SEE IF A DELIMITER IS EXPECTED,
394 C
395 C IF(,NOT,DELIM) GO TO 110
396 C
397 C YES, IF CHARACTER IS NOT A COMMA,FATAL ERROR,
398 C
399 C IF(ITEST,NE,1H,) GO TO 260
400 C
401 C CHARACTER IS A COMMA, REMOVE DELIMITER FLAG AND GO EXAMINE
402 C THE NEXT COLUMN,
403 C
404 C DELIM=.FALSE.
405 C GO TO 90
406 C 110 CONTINUE
407 C
408 C SEE IF CHARACTER IS ALPHABETIC
409 C
410 C ITEMP=AND(SHIFT(ITEST,-54),77B)
411 C IF(ITEMP,GE,1AF,AND,ITEMP,LE,1AL) GO TO 130

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412 C
413 C NO, IF A NAME IS EXPECTED, FATAL ERROR,
414 C
415 C IF (FIRST) GO TO 120
416 C
417 C A NAME IS NOT NECESSARILY EXPECTED, LEGAL CHARACTERS ARE NUMBERS,
418 C +, -, ., OR (, IF NONE OF THESE, FATAL ERROR, IF ONE OF THESE,
419 C PROCEED TO SECTION WHICH DECODES CONSTANTS,
420 C
421 C IF (ITEMP, GE, INF, AND, ITEMP, LE, INL) GO TO 400
422 C IF (ITEST, EQ, 1H+, OR, ITEST, EQ, 1H-, OR, ITEST, EQ, 1H., OR, ITEST, EQ, 1H())
423 C GO TO 400
424 C 120 CONTINUE
425 C CALL MESS07(13)
426 C IEFLAG=13
427 C RETURN
428 C
429 C -----
430 C SUBLOOP TO DECODE VARIABLE NAMES
431 C -----
432 C
433 C 130 CONTINUE
434 C
435 C STORE THE FIRST CHARACTER
436 C
437 C IVNUM=1
438 C IDSTR(1)=ITEST
439 C
440 C ++++++
441 C SUBLOOP TO GET CHARACTERS OF VARIABLE NAME
442 C ++++++
443 C
444 C 140 CONTINUE
445 C
446 C GET THE NEXT CHARACTER AND CHECK FOR ERRORS
447 C
448 C CALL NXTCOL(IF, IEFLAG)
449 C IF (IEFLAG, NE, 0) RETURN
450 C
451 C SEE IF CHARACTER IS ALPHANUMERIC, IF NOT, ASSUME THAT THE END OF
452 C THE NAME HAS BEEN REACHED,
453 C
454 C ITEMP=AND(SHIFT(ITEST, =54), 770)
455 C IF ((ITEMP, GE, IAF, AND, ITEMP, LE, IAL), OR, (ITEMP, GE, INF, AND, ITEMP, LE,
456 C INL)) GO TO 150
457 C GO TO 170
458 C 150 CONTINUE
459 C
460 C CHARACTER IS ALPHANUMERIC, SEE IF IT IS NO. 7, IF SO, FATAL ERROR,
461 C
462 C IF (IVNUM, GE, 6) GO TO 140
463 C
464 C NOT CHARACTER 7, STORE AND GO ON TO THE NEXT,
465 C
466 C IVNUM=IVNUM+1
467 C IDSTR(IVNUM)=ITEST
468 C GO TO 140

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469      160 CONTINUE
470      CALL MESSOT(3)
471      IEFLAG=3
472      RETURN
473      C
474      C      ++++++
475      C
476      170 CONTINUE
477      C
478      C      NAME HAS BEEN DECODED, PUT INTO ONE WORD,
479      C
480      CALL MASH(IDSTR,IVNUM,INAME,IEFLAG)
481      IF(IEFLAG,NE,P) RETURN
482      C
483      C      SCAN THE TABLE TO SEE IF IT IS A LEGAL VARIABLE, IF NOT,
484      C      FATAL ERROR,
485      C
486      DO 180 I=2,INE
487      180 IF(INAME,EQ,TABLE(I,I)) GO TO 190
488      CALL MESSOT(4)
489      IEFLAG=4
490      RETURN
491      C
492      C      LEGAL VARIABLE NAME HAS BEEN FOUND, INITIALIZE FOR SUBSEQUENT
493      C      SCAN,
494      C
495      190 CONTINUE
496      C
497      C      FIRST HERE DENOTES THAT A CONSTANT HAS NOT YET BEEN FOUND FOR
498      C      THIS VARIABLE
499      C
500      FIRST=.TRUE.
501      C
502      C      IENTRY IS THE SECOND SUBSCRIPT OF THE TABLE ENTRY FOR THIS
503      C      VARIABLE
504      C
505      IENTRY=I
506      C
507      C      ISBSPT IS THE STORAGE OFFSET FOR THE VARIABLE, IF THE VARIABLE
508      C      IS LOCATED BEGINNING IN MEMORY LOCATION N, THEN THE NEXT
509      C      CONSTANT WILL BE STORED STARTING IN LOCATION N+ISBSPT-1,
510      C
511      ISBSPT=1
512      C
513      C      NSUBV(I) IS THE VALUE OF THE ITH SUBSCRIPT
514      C
515      DO 200 I=1,4
516      200 NSUBV(I)=0
517      C
518      C      NSUB IS THE NUMBER OF SUBSCRIPTS
519      C
520      NSUB=0
521      C
522      C      DIM IS ,TRUE, IF THE VARIABLE IS DIMENSIONED
523      C
524      DIM=.FALSE.
525      C

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526 C .....
527 C DETERMINE ANY SUBSCRIPTING INFORMATION
528 C .....
529 C
530 C 210 CONTINUE
531 C
532 C CHECK THE FIRST CHARACTER AFTER THE VARIABLE NAME, IF IT IS AN
533 C EQUALS, NO SUBSCRIPTING INFORMATION, PROCEED TO CONSTANT SCAN.
534 C OTHER LEGAL CHARACTERS ARE BLANK AND LEFT PAREN, IF NEITHER
535 C OF THESE, FATAL ERROR.
536 C
537 C IF(ITEST.EQ,1H ) GO TO 220
538 C IF(ITEST.EQ,1H) GO TO 230
539 C IF(ITEST.EQ,1H=) GO TO 400
540 C CALL MESS07(5)
541 C IEFLAG=5
542 C RETURN
543 C
544 C CHARACTER WAS BLANK, FETCH NEXT COLUMN AND CONTINUE.
545 C
546 C 220 CONTINUE
547 C CALL NXTCOL(IF,IEFLAG)
548 C IF(IEFLAG.NE,0) RETURN
549 C GO TO 210
550 C
551 C CHARACTER WAS LEFT PAREN, BEGIN SUBSCRIPT DECODING.
552 C
553 C 230 CONTINUE
554 C
555 C INITIALIZE, IVSUM IS THE CURRENT VALUE OF THE NUMBER BEING DECODED
556 C AND IVSIGN IS ITS SIGN (+1 OR -1).
557 C
558 C DIM=.TRUE.,
559 C NSUB=1
560 C IVNUM=0
561 C IVSUM=0
562 C IVSIGN=1
563 C DELIM=.FALSE.
564 C
565 C NOSGN IS THE NO. OF SIGNS ENCOUNTERED IN THE FIELD
566 C
567 C NOSGN=0
568 C
569 C *** SUBLOOP TO DECODE A SUBSCRIPT
570 C
571 C 240 CONTINUE
572 C
573 C GET THE NEXT CHARACTER
574 C
575 C CALL NXTCOL(IF,IEFLAG)
576 C IF(IEFLAG.NE,0) RETURN
577 C
578 C SEE IF IT IS NUMERIC
579 C
580 C ITEM=AND(SHIFT(ITEST,-56),770)
581 C IF(ITEM.GE,INF.AND,ITEM.LE,INL) GO TO 250
582 C

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583 C NO, CHECK FOR BLANK,
584 C
585 IF(ITEST,EQ,14) GO TO 310
586 C
587 NO, CHECK FOR COMMA,
588 C
589 IF(ITEST,EQ,14,) GO TO 340
590 C
591 NO, CHECK FOR RIGHT PAREN,
592 C
593 IF(ITEST,EQ,14)) GO TO 360
594 C
595 CHECK FOR SIGN OF SUBSCRIPT
596 C
597 IF(ITEST,EQ,14+,OR,ITEST,EQ,14-) GO TO 240
598 C
599 NONE OF THESE, FATAL ERROR,
600 C
601 CALL MESS07(6)
602 IEFLAG=6
603 RETURN
604 C
605 CHARACTER WAS NUMERIC, SEE IF A DELIMITER WAS EXPECTED, IF IT WAS,
606 C FATAL ERROR,
607 C
608 250 CONTINUE
609 IF(,NOT,DELIM) GO TO 270
610 260 CONTINUE
611 CALL MESS07(7)
612 IEFLAG=7
613 RETURN
614 270 CONTINUE
615 C
616 SEE IF THE SUBSCRIPT IS TOO LONG, IF MORE THAN 5 DIGITS,FATAL
617 C ERROR,
618 C
619 IF(IVNUM,LT,5) GO TO 280
620 CALL MESS07(8)
621 IEFLAG=8
622 RETURN
623 280 CONTINUE
624 C
625 SUBSCRIPT IS OK SO FAR, UPDATE ITS VALUE AND CONTINUE,
626 C
627 IVNUM=IVNUM+1
628 IVSUM=IVSUM+10+ITEMP*INF
629 GO TO 240
630 290 CONTINUE
631 C
632 A SIGN HAS BEEN FOUND, MAKE SURE THERE IS ONLY ONE,
633 C
634 IF(NOSGN,EQ,0) GO TO 320
635 CALL MESS07(44)
636 IEFLAG=44
637 RETURN
638 300 CONTINUE
639 C

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640 C      SIGN IS OK, UP THE COUNT, SET THE SIGN VARIABLE, AND CONTINUE SCAN.
641 C
642 C      NOSGN=1
643 C      IF(ITEST, EQ, 1) IVSIGN=-1
644 C      GO TO 240
645 C      310 CONTINUE
646 C
647 C      CHARACTER IS A BLANK. IF NO NUMBERS HAVE BEEN FOUND YET, GO ON TO
648 C      THE NEXT CHARACTER.
649 C
650 C      IF(IVNUM, EQ, 0) GO TO 240
651 C
652 C      BLANK CONSIDERED FIELD TERMINATOR, TURN ON THE DELIMITER SWITCH.
653 C
654 C      DELIM=TRUE.
655 C      320 CONTINUE
656 C
657 C      SUBSCRIPT DECODED, MAKE SURE THERE ARE NO MORE THAN 4.
658 C
659 C      IF(NSUB, GT, 4) GO TO 330
660 C
661 C      SUBSCRIPT IS OK, STORE THE SIGNED VALUE IN THE SUBSCRIPT ARRAY.
662 C
663 C      NSUBV(NSUB)=ISIGN(IVSUM, IVSIGN)
664 C
665 C      REINITIALIZE AND GO SEARCH FOR NEXT SUBSCRIPT
666 C
667 C      IVSUM=0
668 C      IVNUM=0
669 C      IVSIGN=1
670 C      NOSGN=0
671 C      NSUB=NSUB+1
672 C      GO TO 240
673 C
674 C      MORE THAN FOUR SUBSCRIPTS, FATAL ERROR.
675 C
676 C      330 CONTINUE
677 C      CALL MESSOT(14)
678 C      IEFLAG=14
679 C      RETURN
680 C      340 CONTINUE
681 C
682 C      COMMA ENCOUNTERED, SEE IF A DELIMITER IS EXPECTED.
683 C
684 C      IF(DELIM) GO TO 350
685 C
686 C      NO, SEE IF A FIELD HAS BEGUN. IF NOT, FATAL ERROR. IF SO, CONSIDER
687 C      FIELD TERMINATED AND GO FINISH PROCESSING FOR THIS SUBSCRIPT.
688 C
689 C      IF(IVNUM, NE, 0) GO TO 320
690 C      CALL MESSOT(8)
691 C      IEFLAG=8
692 C      RETURN
693 C
694 C      DELIMITER EXPECTED AND FOUND, TURN OFF FLAG AND CONTINUE SCAN.
695 C
696 C      350 CONTINUE

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697      DELIM=FALSE.
698      GO TO 240
699
700      360 CONTINUE
701      C      RIGHT PAREN FOUND, TERMINATE SUBSCRIPT PROCESSING, CHECK IF PAREN
702      C      IS FIELD TERMINATOR,
703      C
704      IF(IVNUM,NE,0) GO TO 370
705      C
706      C      NO, CHECK FOR ISOLATED SIGN, IF SO, FATAL ERROR,
707      C
708      IF(NOSGN,EQ,0) GO TO 380
709      CALL MESSOT(30)
710      IEFLAG=30
711      RETURN
712      370 CONTINUE
713      C
714      C      YES, STORE THE SUBSCRIPT AND PRETEND LIKE ANOTHER IS TO BE
715      C      DECODED,
716      C
717      NSUBV(NSUB)=ISIGN(IVSUM,IVSIGN)
718      NSUB=NSUB+1
719      C
720      C      ++++++
721      C
722      380 CONTINUE
723      C
724      C      LAST SUBSCRIPT COMPLETED, SET NSUB TO THE ACTUAL NO. OF SUBSCRIPTS
725      C
726      NSUB=NSUB-1
727      C
728      C      -----
729      C
730      390 CONTINUE
731      C
732      C      SCAN CHARACTERS UNTIL AN = IS FOUND, ONLY OTHER VALID CHARACTER
733      C      IS A BLANK,
734      C
735      CALL MESSOT(9)
736      IF(IEFLAG,NE,0) RETURN
737      IF(ITEST,EQ,1H ) GO TO 390
738      IF(ITEST,EQ,1H=) GO TO 400
739      CALL MESSOT(9)
740      IEFLAG=9
741      RETURN
742      C
743      C      *****
744      C      SECTION TO DECODE CONSTANTS
745      C      *****
746      C
747      400 CONTINUE
748      C
749      C      RESET ALL FLAGS
750      C
751      C      CMPLX = ,TRUE, IF A COMPLEX CONSTANT IS BEING DECODED
752      C      CDONE = ,TRUE, IF THE SECONO HALF OF A COMPLEX CONSTANT HAS
753      C      BEEN DECODED BUT THE CLOSING PARENTHESIS HAS NOT

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754 C          BEEN FOUND
755 C      CPFND = ,TRUE, IF THE CLOSING PARENTHESIS OF A COMPLEX CONSTANT
756 C          HAS BEEN FOUND
757 C      DB = STORAGE FOR DOUBLE PRECISION CONSTANT
758 C      MULT = ,TRUE IF A MULTIPLIER HAS BEEN FOUND
759 C      DELIM = ,TRUE, IF A DELIMITER IS EXPECTED
760 C
761 C      CMPLX=,FALSE,
762 C      CDONE=,FALSE,
763 C      CPFND=,FALSE,
764 C      DR=0,
765 C      MULT=,FALSE,
766 C      DELIM=,FALSE,
767 C
768 C      ONE RETURNS TO HERE IF THE FIRST NO. OF A COMPLEX CONSTANT HAS
769 C          BEEN PROCESSED AND STORED
770 C
771 C      410 CONTINUE
772 C
773 C      HOLLER = ,TRUE, IF A HOLLERITH CONSTANT IS BEING PROCESSED
774 C      IC = CHARACTER COUNT OF CONSTANT STRING
775 C      DOBLE = ,TRUE, IF A DOBLE PRECISION CONSTANT IS BEING PROCESSED
776 C      FIX = ,TRUE, IF A FIXED POINT CONSTANT IS BEING DECODED
777 C      IVSUM = CURRENT VALUE OF FIXED POINT FIELD
778 C      IVNUM = CURRENT NO. OF DIGITS IN THE FIXED POINT FIELD
779 C      EXPN = ,TRUE, IF AN EXPONENT IS BEING DECODED
780 C      XLEFT = VALUE OF FLOATING POINT CONSTANT TO LEFT OF DECIMAL POINT
781 C      XRIGHT = VALUE OF FLOATING POINT CONSTANT TO RIGHT OF DECIMAL
782 C      NOSGN = NO. OF + OR - SIGNS FOUND IN CONSTANT SO FAR
783 C      DONE = ,TRUE, IF A DOLLAR SIGN HAS BEEN FOUND
784 C      IVSIGN = VALUE OF THE LAST SIGN FOUND (+1 OR -1)
785 C      PERIOD = ,TRUE, IF THE LAST CHARACTER FOUND WAS AN ISOLATED PERIOD
786 C
787 C      HOLLER=,FALSE,
788 C      IC=0
789 C      DOBLE=,FALSE,
790 C      FIX=,TRUE,
791 C      IVSUM=0
792 C      IVNUM=0
793 C      EXPN=,FALSE,
794 C      XLEFT=0,
795 C      XRIGHT=0,
796 C      NOSGN=0
797 C      DONE=,FALSE,
798 C      IVSIGN=1
799 C      PERIOD=,FALSE,
800 C
801 C      IF THIS IS THE FIRST CONSTANT TO BE PROCESSED AFTER AN = SIGN
802 C          (FIRST=,TRUE,) OR A COMPLEX CONSTANT IS BEING DECODED,
803 C          ONE MUST FETCH THE NEXT CHARACTER, OTHERWISE, IT HAS PREVIOUSLY
804 C          BEEN READ,
805 C
806 C      IF(,NOT,FIRST,AND,,NOT,CMPLX) GO TO 430
807 C      420 CONTINUE
808 C
809 C      GET THE NEXT CHARACTER AND CHECK FOR ERRORS
810 C

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811          CALL NXTCOL(IF,IEFLAG)
812          IF(IEFLAG,NE,0) RETURN
813      430  CONTINUE
814      C
815      C -----
816      C  DECIDE WHAT TO DO BASED UPON WHAT CHARACTER WAS LAST READ
817      C  -----
818      C
819      C  CHECK FOR A BLANK
820      C
821      IF(ITEST,EQ,1H ) GO TO 470
822      C
823      NO, CHECK FOR A NUMBER.
824      C
825      ITEMP=AND(SHIFT(ITEST,-54),77B)
826      IF(ITEMP,GE,INF,AND,ITEMP,LE,INL) GO TO 450
827      C
828      NO, CHECK FOR A COMMA.
829      C
830      IF(ITEST,EQ,1H,) GO TO 1050
831      C
832      NO, CHECK FOR A PERIOD.
833      C
834      IF(ITEST,EQ,1H,) GO TO 1140
835      C
836      NO, CHECK FOR A PLUS OR MINUS.
837      C
838      IF(ITEST,EQ,1H+) GO TO 990
839      IF(ITEST,EQ,1H-) GO TO 990
840      C
841      NO, CHECK FOR A DOLLAR SIGN.
842      C
843      IF(ITEST,EQ,1HS) GO TO 1000
844      C
845      NO, CHECK FOR A T OR F.
846      C
847      IF(ITEST,EQ,1HT) GO TO 1170
848      IF(ITEST,EQ,1HF) GO TO 1170
849      C
850      NO, CHECK FOR AN E.
851      C
852      IF(ITEST,EQ,1HE) GO TO 1100
853      C
854      NO, CHECK FOR AN ASTERISK.
855      C
856      IF(ITEST,EQ,1H*) GO TO 600
857      C
858      NO, CHECK FOR AN H.
859      C
860      IF(ITEST,EQ,1HH) GO TO 770
861      C
862      NO, CHECK FOR A B.
863      C
864      IF(ITEST,EQ,1HB) GO TO 930
865      C
866      NO, CHECK FOR AN L OR AN R.
867      C

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868      IF(ITEST,EQ,1HL) GO TO 770
869      IF(ITEST,EQ,1HR) GO TO 770
870      C
871      C      NO, CHECK FOR A D,
872      C
873      IF(ITEST,EQ,1HD) GO TO 1130
874      C
875      C      NO, CHECK FOR A LEFT PARENTHESIS,
876      C
877      IF(ITEST,EQ,1H()) GO TO 720
878      C
879      C      NO, CHECK FOR A RIGHT PARENTHESIS,
880      C
881      IF(ITEST,EQ,1H)) GO TO 750
882      C
883      C      LEGAL CHARACTER NOT FOUND, FATAL ERROR,
884      C
885      440 CONTINUE
886      CALL MESS0T(12)
887      IEFLAG=12
888      RETURN
889      C
890      C      =====
891      C      CHARACTER WAS A NUMBER
892      C      =====
893      C
894      450 CONTINUE
895      C
896      C      SEE IF A DELIMITER WAS EXPECTED, IF SO, FATAL ERROR,
897      C
898      IF(DELM) GO TO 260
899      C
900      C      RESET ISOLATED PERIOD FLAG
901      C
902      PERIOD=.FALSE,
903      C
904      C      UPDATE THE VALUE OF THE NUMERIC FIELD
905      C
906      IVSUM=IVSUM*10+ITEMP=INF
907      C
908      C      UPDATE THE DIGIT COUNT
909      C
910      IVNUM=IVNUM+1
911      C
912      C      UPDATE THE CHARACTER COUNT
913      C
914      IC=IC+1
915      C
916      C      SEE IF THIS IS THE THIRTIETH CHARACTER
917      C
918      IF(IC,LT,30) GO TO 460
919      C
920      C      YES, FATAL ERROR,
921      C
922      GO TO 1160
923      C
924      C      NO, STORE THE CHARACTER AND GO ON TO THE NEXT,

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925      C
926      460 CONTINUE
927      IDSTR(IC)=ITEST
928      GO TO 420
929      C
930      C .....
931      C CHARACTER WAS A BLANK
932      C .....
933      C
934      470 CONTINUE
935      C
936      C IF THE BEGINNING OF A CONSTANT HAS NOT YET BEEN FOUND,GO ON TO
937      C THE NEXT CHARACTER
938      C
939      C IF(FIX,AND,IVNUM,EQ,0) GO TO 420
940      C
941      C NOT THE BEGINNING OF A CONSTANT. BLANK IS CONSIDERED FIELD
942      C TERMINATOR. TURN ON THE FLAG WHICH SAYS STORE THE CONSTANT.
943      C
944      C SAVE=.TRUE.
945      C
946      C SEE IF CURRENT FIELD IS FIXED OR FLOATING
947      C
948      C IF(,NOT,FIN) GO TO 490
949      C
950      C FIXED. DO NOT STORE NOW BUT TURN ON DELIMITER FLAG AND CONTINUE
951      C CHARACTER SCAN.
952      C
953      C DELIM=.TRUE.
954      C GO TO 420
955      C
956      C ENTRY POINT FOR STORING FLOATING POINT NO. IF FIELD IS TERMINATED
957      C BY A , OR A $
958      C
959      480 CONTINUE
960      C SAVE=.TRUE.
961      490 CONTINUE
962      C
963      C CHECK FOR ISOLATED PERIOD
964      C
965      C IF(,NOT,PERIOD) GO TO 500
966      C
967      C YES, FATAL ERROR.
968      C
969      C CALL MESS07(29)
970      C IEFLAG=29
971      C RETURN
972      500 CONTINUE
973      C
974      C NO. SEE IF WE ARE PROCESSING AN EXPONENT.
975      C
976      C IF(,NOT,EXP) GO TO 530
977      C
978      C YES, SEE IF IT IS ZERO.
979      C
980      C IF(IVSUM,EQ,0) GO TO 630
981      C

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982      C      NO, GIVE IT THE PROPER SIGN,
983      C
984      C      IVSUM=ISIGN(IVSUM,IVSIGN)
985      C
986      C      SEE IF IT IS WITHIN BOUNDS
987      C
988      C      IF(IVSUM.GT.IEMIN.AND.IVSUM.LT.IEMAX) GO TO 510
989      C
990      C      NO, FATAL ERROR,
991      C
992      C      CALL MESS07(26)
993      C      IFLAG=26
994      C      RETURN
995      C      510 CONTINUE
996      C
997      C      YES, ADJUST THE NO. BASED ON THE EXPONENT AND PROCEED ON
998      C      TO THE GENERAL STORING CODE, USE INTERMEDIATE DOUBLE
999      C      PRECISION IN ALL CASES,
1000     C
1001     C      IF(DOUBLE) GO TO 520
1002     C      XLEFT=XLEFT+DCONST**IVSUM
1003     C      GO TO 630
1004     C      520 CONTINUE
1005     C      DB=DB+DCONST**IVSUM
1006     C      GO TO 630
1007     C
1008     C      CODE TO PROCESS FLOATING POINT NO. WITH NO EXPONENT
1009     C
1010     C      530 CONTINUE
1011     C
1012     C      CHECK FOR FIELD LONGER THAN 15 CHARACTERS BUT NOT DECLARED
1013     C      DOUBLE PRECISION, IF SO,FATAL ERROR,
1014     C
1015     C      IF(IC.GT.NDSP+1.AND..NOT.DOUBLE) GO TO 600
1016     C
1017     C      CHECK FOR DOUBLE PRECISION FIELD
1018     C
1019     C      IF(.NOT.DOUBLE) GO TO 540
1020     C
1021     C      YES, CHECK FOR FIELD LONGER THAN 29 CHARACTERS, IF SO,FATAL ERROR,
1022     C
1023     C      IF(IC.GT.NDDP+1) GO TO 1160
1024     C
1025     C      ALL O.K, INITIALIZE FOR EVALUATION, ICP IS THE NO. OF THE FIELD
1026     C      CHARACTER CURRENTLY BEING PROCESSED,
1027     C
1028     C      DB=0.
1029     C      ICP=0
1030     C
1031     C      *****
1032     C      LOOP TO EVALUATE DOUBLE PRECISION CONSTANTS
1033     C      *****
1034     C
1035     C      INCREMENT THE CHARACTER COUNT
1036     C
1037     C      540 ICP=ICP+1
1038     C

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1039 C CHECK FOR END OF THE FIELD
1040 C
1041 C IF(ICP,GT,IC) GO TO 580
1042 C
1043 C NO, PICK UP THE NEXT CHARACTER,
1044 C
1045 C ITEST=IDSTR(ICP)
1046 C
1047 C SEE IF IT IS A DECIMAL POINT
1048 C
1049 C IF(ITEST,EQ,IM,) GO TO 550
1050 C
1051 C NO, ISOLATE THE CHARACTER LOW ORDER IN THE WORD,
1052 C
1053 C ITEMP=AND(SHIFT(ITEST,=54B),77B)
1054 C
1055 C ADD IT INTO THE CONSTANT
1056 C
1057 C DBP=ITEMP=INF
1058 C DB=DB+DCONST+DBP
1059 C
1060 C CONTINUE LOOPING
1061 C
1062 C GO TO 540
1063 550 CONTINUE
1064 C
1065 C A DECIMAL POINT HAS BEEN LOCATED, PREPARE TO EVALUATE THAT PORTION
1066 C OF THE CONSTANT TO THE RIGHT OF THE DECIMAL, ICPD IS THE NO,
1067 C OF DIGITS TO THE RIGHT OF THE DECIMAL,
1068 C
1069 C DBP=0,
1070 C ICPD=0
1071 C
1072 C LOOP TO EVALUATE PORTION TO THE RIGHT OF THE DECIMAL
1073 C
1074 560 ICP=ICP+1
1075 C
1076 C CHECK FOR THE END OF THE FIELD
1077 C
1078 C IF(ICP,GT,IC) GO TO 570
1079 C
1080 C NO, PICK UP THE CHARACTER,ADD IT INTO THE SUM,AND CONTINUE,
1081 C
1082 C ITEST=IDSTR(ICP)
1083 C ITEMP=AND(SHIFT(ITEST,=54),77B)
1084 C DTEMP=ITEMP=INF
1085 C DBP=DBP+DCONST+DTEMP
1086 C ICPD=ICPD+1
1087 C GO TO 560
1088 570 CONTINUE
1089 C
1090 C END OF THE FIELD ENCOUNTERED, SEE IF THERE WAS ANYTHING NON=ZERO
1091 C TO THE RIGHT OF THE DECIMAL,
1092 C
1093 C ITEMPA=DBP=DZERO
1094 C IF(ITEMPA,EQ,0) GO TO 580
1095 C

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1096 C      YES. SHIFT THE DECIMAL TO THE LEFT AND ADD IT INTO THE PORTION
1097 C      OF THE ENTIRE CONSTANT TO THE LEFT OF THE DECIMAL.
1098 C
1099 C      DBP=DBP+DCONST*(-ICPD)
1100 C      DB=DB+DBP
1101 C
1102 C      NUMBER IS ENTIRELY DECODED. AFFIX THE PROPER SIGN.
1103 C
1104 C      580 IF(IVSIGN,LT,0) DB=-DB
1105 C
1106 C      ++++++
1107 C
1108 C      GO SEE IF THE NO. IS TO BE STORED
1109 C
1110 C      GO TO 630
1111 C      590 CONTINUE
1112 C
1113 C      NO. IS SINGLE PRECISION. SEE IF IT IS ZERO.
1114 C
1115 C      IF(IVSUM,EQ,0) GO TO 620
1116 C
1117 C      NO. SEE IF IT IS TOO LONG.
1118 C
1119 C      IF(IVNUM,LE,NDSP) GO TO 610
1120 C
1121 C      YES. FATAL ERROR.
1122 C
1123 C      600 CONTINUE
1124 C      CALL MESS07(28)
1125 C      IFLAG=28
1126 C      RETURN
1127 C      610 CONTINUE
1128 C
1129 C      NO. STORE IT.
1130 C
1131 C      XRIGHT=IVSUM
1132 C
1133 C      SHIFT THE DECIMAL POINT OF THE RIGHTHAND SIDE TO THE FAR LEFT
1134 C
1135 C      XRIGHT=XRIGHT*10,*(-IVNUM)
1136 C
1137 C      ADD THE LEFT AND RIGHT PARTS
1138 C
1139 C      XLEFT=XLEFT+XRIGHT
1140 C      620 CONTINUE
1141 C
1142 C      AFFIX THE SIGN
1143 C
1144 C      IF(IVSIGN,LT,0) XLEFT=-XLEFT
1145 C
1146 C      IF DOUBLE PRECISION, CONVERT TO THAT FORM
1147 C
1148 C      IF(DUBLE) DB=XLEFT
1149 C      630 CONTINUE
1150 C
1151 C      DECODING FOR BOTH SINGLE AND DOUBLE PRECISION FINISHED.
1152 C      REINITIALIZE.

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1153      C
1154      IVNUM=0
1155      IVSUM=0
1156      IVSIGN=1
1157      C
1158      IF THE SAVE FLAG IS NOT SET,GO BACK AND EXAMINE THE NEXT
1159      CHARACTER
1160      C
1161      IF(,NOT,SAVE) GO TO 420
1162      C
1163      SEE IF A COMPLEX CONSTANT IS BEING PROCESSED
1164      C
1165      IF(,NOT,CMPLX) GO TO 670
1166      C
1167      YES, SEE IF THIS IS THE FIRST OR SECOND PART,
1168      C
1169      IF(CFRST) GO TO 660
1170      C
1171      SECOND PART, SEE IF THE SECOND PART HAS ALREADY BEEN STORED,
1172      C
1173      IF(,NOT,CDONE) GO TO 650
1174      C
1175      YES, FATAL ERROR,
1176      C
1177      640 CONTINUE
1178      CALL MESS07(42)
1179      IEFLAG=42
1180      RETURN
1181      C
1182      NO, SAVE THE SECOND PART AND SET THE FLAG,
1183      C
1184      650 CONTINUE
1185      CIMAGE=XLEFT
1186      CDONE=,TRUE,
1187      GO TO 670
1188      660 CONTINUE
1189      C
1190      FIRST PART, CHECK FOR NO SECOND PART, IF SO,FATAL ERROR,
1191      C
1192      IF(CPFND) GO TO 640
1193      C
1194      SET FLAG TO INDICATE SECOND PART WILL BE PROCESSED NEXT
1195      C
1196      CFRST=,FALSE,
1197      C
1198      SAVE THE FIRST PART
1199      C
1200      CREAL=XLEFT
1201      C
1202      IF THE LAST CHARACTER FOUND WAS NOT A COMMA,TURN ON THE
1203      DELIMITER=EXPECTED FLAG
1204      C
1205      IF(ITEST,NE,IM,) DELIM=,TRUE,
1206      C
1207      GO BACK AND BEGIN PROCESSING THE SECOND PART
1208      C
1209      GO TO 410

```

```

1210      670 CONTINUE
1211      C
1212      C   READY TO STORE CONSTANT, IF IT IS NOT DOUBLE PRECISION OR COMPLEX,
1213      C   SHIFT IT INTO STORAGE KNOWN TO THE ROUTINE STORE.
1214      C
1215      C   IF(,NOT,DOUBLE,AND,,NOT,CMPLX) XSUM=XLEFT
1216      C
1217      C   STORE THE CONSTANT
1218      C
1219      C   CALL STORE(TABLE,IEFLAG)
1220      C
1221      C   IF ANY ERRORS,QUIT RIGHT HERE
1222      C
1223      C   IF(IEFLAG,NE,0) RETURN
1224      C
1225      C   IF THE CLOSING $ HAS BEEN FOUND,WE ARE ALL DONE
1226      C
1227      C   IF(DONE) RETURN
1228      C
1229      C   IF A COMPLEX CONSTANT IS BEING PROCESSED AND THE CLOSING
1230      C   PARENTHESIS HAS NOT YET BEEN FOUND,CONTINUE ON TO NEXT
1231      C   CHARACTER
1232      C
1233      C   IF(CMPLX,AND,,NOT,CPFND) GO TO 420
1234      C
1235      C   IF THE LAST CHARACTER FOUND WAS NOT A COMMA,TURN ON THE
1236      C   DELIMITER FLAG
1237      C
1238      C   IF(ITEST,NE,1M,) DELIM=TRUE,
1239      C
1240      C   GO BACK AND HUNT FOR THE BEGINNING OF ANOTHER VARIABLE NAME
1241      C   OR CONSTANT
1242      C
1243      C   GO TO 90
1244      C
1245      C   .....
1246      C   CHARACTER IS AN ASTERISK
1247      C   .....
1248      C
1249      680 CONTINUE
1250      C
1251      C   MUST HAVE BEEN PRECEDED BY A FIXED POINT NO, IF NOT,FATAL ERROR,
1252      C
1253      C   IF(FIX) GO TO 690
1254      C   CALL MESS07(17)
1255      C   IEFLAG=17
1256      C   RETURN
1257      690 CONTINUE
1258      C
1259      C   SEE IF AN ASTERISK HAS PREVIOUSLY BEEN ENCOUNTERED, IF SO,
1260      C   FATAL ERROR,
1261      C
1262      C   IF(,NOT,MULT) GO TO 700
1263      C   CALL MESS07(18)
1264      C   IEFLAG=18
1265      C   RETURN
1266      700 CONTINUE

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1267 C
1268 C IF PROCESSING OF A COMPLEX NO. HAS BEGUN,FATAL ERROR
1269 C
1270 IF(.NOT.COMPLEX) GO TO 710
1271 CALL MESSOT(19)
1272 IFLAG=19
1273 RETURN
1274 710 CONTINUE
1275 C
1276 C ALL CONDITIONS O.K. TURN ON THE FLAG,SAVE THE MULTIPLIER,
1277 C REINITIALIZE,AND GO ON TO THE NEXT CHARACTER,
1278 C
1279 MULT=.TRUE.
1280 MULTSV=IVSUM
1281 IVNUM=0
1282 IVSUM=0
1283 IVSIGN=1
1284 DELIM=.FALSE.
1285 GO TO 420
1286 C
1287 C .....
1288 C CHARACTER IS A LEFT PARENTHESIS
1289 C .....
1290 C
1291 720 CONTINUE
1292 C
1293 C IF A DELIMITER WAS EXPECTED,FATAL ERROR
1294 C
1295 IF(DELIM) GO TO 260
1296 C
1297 C SEE IF ANY OTHER FIELD CHARACTERS HAVE BEEN READ. IF SO,FATAL
1298 C ERROR,
1299 C
1300 IF(IVNUM.EQ.0) GO TO 730
1301 CALL MESSOT(20)
1302 IFLAG=20
1303 RETURN
1304 730 CONTINUE
1305 C
1306 C SEE IF A SIGN HAS BEEN ENCOUNTERED. IF SO,FATAL ERROR,
1307 C
1308 IF(NOSGN.EQ.0) GO TO 740
1309 CALL MESSOT(39)
1310 IFLAG=39
1311 RETURN
1312 740 CONTINUE
1313 C
1314 C EVERYTHING CHECKS, TURN ON THE COMPLEX FLAG,INDICATE THAT THE
1315 C FIRST HALF OF THE CONSTANT IS BEING PROCESSED,AND GO ON TO
1316 C THE NEXT CHARACTER,
1317 C
1318 COMPLEX=.TRUE.
1319 CFRST=.TRUE.
1320 GO TO 420
1321 C
1322 C .....
1323 C CHARACTER IS A RIGHT PARENTHESIS

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```

1324 C .....
1325 C
1326 C 750 CONTINUE
1327 C
1328 C IF NOT PROCESSING A COMPLEX CONSTANT,FATAL ERROR
1329 C
1330 C IF(,NOT,CMPLX) GO TO 440
1331 C
1332 C IF A RIGHT PARENTHESIS HAS PREVIOUSLY BEEN FOUND,FATAL ERROR
1333 C
1334 C IF(CPFND) GO TO 440
1335 C
1336 C SEE IF THE COMPLEX CONSTANT HAS ALREADY BEEN STORED
1337 C
1338 C IF(,NOT,CDONE) GO TO 760
1339 C
1340 C YES, TURN OFF THE COMPLEX FLAG,TURN ON THE DELIMITER=EXPECTED
1341 C FLAG,AND GO LOOK FOR THE BEGINNING OF ANOYHER VARIABLE
1342 C OR CONSTANT,
1343 C
1344 C CMPLX=,FALSE,
1345 C DELIM=,TRUE,
1346 C GO TO 90
1347 C 760 CONTINUE
1348 C
1349 C IF STILL PROCESSING THE FIRST PART,OR EXPECTING A DELIMITER,
1350 C OR WORKING ON A FIX POINT PART,FATAL ERROR
1351 C
1352 C IF(CFRST,OR,DELIM,OR,FIX) GO TO 640
1353 C
1354 C ALL CHECKS PASSED, INDICATE CLOSING PARENTHESIS FOUND AND GO
1355 C STORE THE RESULTS,
1356 C
1357 C CPFND=,TRUE,
1358 C GO TO 480
1359 C
1360 C .....
1361 C CHARACTER WAS AN H,AN L,OR AN R
1362 C .....
1363 C
1364 C 770 CONTINUE
1365 C
1366 C IF A DELIMITER IS EXPECTED,FATAL ERROR
1367 C
1368 C IF(DELIM) GO TO 260
1369 C
1370 C IF PROCESSING A FLOATING POINT NO, OR A COMPLEX CONSTANT,
1371 C FATAL ERROR
1372 C
1373 C IF(FIX,AND,,NOT,CMPLX) GO TO 780
1374 C CALL MESSOT(34)
1375 C IFLAG=34
1376 C RETURN
1377 C 780 CONTINUE
1378 C
1379 C IF NO CHARACTER COUNT HAS BEEN PREVIOUSLY FOUND,FATAL ERROR
1380 C

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1381         IF(IVNUM.NE.0) GO TO 790
1382         CALL MESSOT(35)
1383         IEFLAG=35
1384         RETURN
1385     790 CONTINUE
1386 C
1387 C         IF CHARACTER COUNT IS MORE THAN 10, A MULTIPLIER CANNOT BE USED.
1388 C         IF 80, FATAL ERROR.
1389 C
1390         IF(.NOT.MULT.OR.IVNUM.LE.10) GO TO 800
1391         CALL MESSOT(36)
1392         IEFLAG=36
1393         RETURN
1394     800 CONTINUE
1395 C
1396 C         EVERYTHING CHECKS. TURN ON THE HOLLERITH FLAG.
1397 C
1398         HOLLER=.TRUE.
1399 C
1400 C         THE CHARACTER COUNT IS STORED IN IVNUM AND THE TYPE OF FIELD
1401 C         IN ISAVE (H,L,OR R)
1402 C
1403         IVNUM=IVSUM
1404         ISAVE=ITEST
1405 C
1406 C         SPECIAL PROCESSING IF MORE THAN A WORDS WORTH OF CHARACTERS
1407 C
1408         IF(IVNUM.GT.10) GO TO 900
1409 C
1410 C         TEN OR LESS CHARACTERS TO PROCESS
1411 C
1412     810 CONTINUE
1413 C
1414 C         PICK UP THE REMAINING CHARACTERS AND STORE IN IDSTR
1415 C
1416         DO 820 I=1,IVNUM
1417         CALL NXTCOL(IF,IEFLAG)
1418         IF(IEFLAG.NE.0) RETURN
1419         IDSTR(I)=ITEST
1420     820 CONTINUE
1421 C
1422 C         IF TEN CHARACTERS, NO DISTINCTION BETWEEN H,L,AND R
1423 C
1424         IF(IVNUM.EQ.10) GO TO 860
1425 C
1426 C         CHECK FOR H
1427 C
1428         IF(ISAVE.NE.1HH) GO TO 830
1429 C
1430 C         YES. PAD END OF WORD WITH BLANKS.
1431 C
1432         IPAD=1H
1433         GO TO 840
1434     830 CONTINUE
1435 C
1436 C         NO. CHECK FOR R.
1437 C

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1438             IF(ISAVE.EQ,1HR) GO TO 870
1439 C
1440 C     NO. ASSUME L. PAD END OF WORD WITH ZEROS.
1441 C
1442             IPAD=0
1443 840 CONTINUE
1444             IVP=IVNUM+1
1445             DO 850 I=IVP,10
1446 850 IDSTR(I)=IPAD
1447 C
1448 C     UP CHARACTER COUNT TO FULL WORD
1449 C
1450             IVNUM=10
1451 860 CONTINUE
1452 C
1453 C     TAKE INDIVIDUAL CHARACTERS AND PUT INTO A SINGLE WORD (IVSUM)
1454 C
1455             CALL WASH(IDSTR,IVNUM,IVSUM,IEFLAG)
1456             IF(IEFLAG.NE.0) RETURN
1457 C
1458 C     TURN ON THE DELIMITER FLAG,STORE THE WORD,AND GO ON TO NEXT
1459 C     VARIABLE NAME OR CONSTANT
1460 C
1461             DELIM=.TRUE.
1462             CALL STORE(TABLE,IEFLAG)
1463             IF(IEFLAG.NE.0) RETURN
1464             GO TO 90
1465 C
1466 C     R FIELD. RIGHT JUSTIFY CHARACTERS AND PAD UPPER PART WITH ZEROS.
1467 C
1468 870 CONTINUE
1469             IDIFF=10-IVNUM
1470             II=11
1471             IIP=IVNUM+1
1472             DO 880 I=1,IVNUM
1473             II=II-1
1474             IIP=IIP-1
1475 880 IDSTR(II)=IDSTR(IIP)
1476             DO 890 I=1,IDIFF
1477 890 IDSTR(I)=0
1478             IVNUM=10
1479 C
1480 C     PUT THE CHARACTERS INTO ONE WORD AND STORE IT
1481 C
1482             GO TO 860
1483 C
1484 C     FIELD IS LONGER THAN 10 CHARACTERS
1485 C
1486 900 CONTINUE
1487 C
1488 C     CHECK FOR R FIELD. IF SO,FATAL ERROR.
1489 C
1490             IF(ITEST.NE,1HR) GO TO 910
1491             CALL MESSOT(37)
1492             IEFLAG=37
1493             RETURN
1494 910 CONTINUE

```

```

1495 C
1496 C PICK UP A WORDS WORTH OF CHARACTERS
1497 C
1498 DO 920 I=1,10
1499 CALL NXTCOL(IF,IEFLAG)
1500 IF(IEFLAG.NE.0) RETURN
1501 920 IDSTR(I)=ITEST
1502 C
1503 C PUT THEM INTO ONE WORD AND STORE THEM
1504 C
1505 CALL MASH(IDSTR,10,IVSUM,IEFLAG)
1506 IF(IEFLAG.NE.0) RETURN
1507 CALL STORE(TABLE,IEFLAG)
1508 IF(IEFLAG.NE.0) RETURN
1509 C
1510 C REDUCE THE CHARACTER COUNT BY 10 AND SEE IF IT IS NOW LE,10.
1511 C IF SO,GO FINISH PROCESSING THE FIELD. IF NOT,GO BACK AND
1512 C PICK UP THE NEXT 10 CHARACTERS.
1513 C
1514 IVNUM=IVNUM-10
1515 IF(IVNUM.LE.10) GO TO 810
1516 GO TO 910
1517 C
1518 C *****
1519 C CHARACTER IS A B
1520 C *****
1521 C
1522 930 CONTINUE
1523 C
1524 C INSURE THAT PREVIOUS FIELD WAS FIXED POINT, IF NOT,FATAL ERROR.
1525 C
1526 IF(FIX) GO TO 940
1527 CALL MESSOT(21)
1528 IEFLAG=21
1529 RETURN
1530 940 CONTINUE
1531 C
1532 C SEE IF PREVIOUS FIELD WAS ZERO, IF SO,NO CONVERSION NECESSARY.
1533 C
1534 IF(IVNUM.EQ.0) GO TO 970
1535 C
1536 C SEE IF PREVIOUS FIELD WAS 20 CHAR OR LESS, IF NOT,FATAL ERROR.
1537 C
1538 IF(IVNUM.LE.20) GO TO 950
1539 CALL MESSOT(40)
1540 IEFLAG=40
1541 RETURN
1542 950 CONTINUE
1543 C
1544 C *****
1545 C LOOP TO DECODE OCTAL NUMBERS
1546 C *****
1547 C
1548 IVSUM WILL BE THE RESULTING NO.
1549 C 18MPT IS THE NO. OF BITS TO SHIFT THE CURRENT DIGIT TO THE LEFT
1550 C BEFORE OR-ING IT INTO IVSUM
1551 C

```



```

1609         IEFLAG=22
1610         RETURN
1611     1010 CONTINUE
1612     C
1613     C     SET IVSIGN BASED ON + OR -, PLUS IS THE DEFAULT,
1614     C
1615     IF(I TEST,EQ,1H-) IVSIGN=-1
1616     C
1617     C     INDICATE A SIGN HAS BEEN FOUND AND GO LOOK AT THE NEXT
1618     C     CHARACTER
1619     C
1620     NOBGN=1
1621     GO TO 420
1622     1020 CONTINUE
1623     C
1624     C     SIGN FOUND BUT FLOATING POINT NO. BEING PROCESSED, EXPONENT FLAG
1625     C     BETTER BE SET OR FATAL ERROR,
1626     C
1627     IF(EXPN) GO TO 1040
1628     1030 CONTINUE
1629     CALL MESSOT(27)
1630     IEFLAG=27
1631     RETURN
1632     1040 CONTINUE
1633     C
1634     C     EXPONENT FLAG SET, SEE IF ANY CHARACTERS HAVE BEEN ENCOUNTERED
1635     C     AFTER THE E OR D, IF SO,FATAL ERROR,
1636     C
1637     IF(IVNUM,NE,0) GO TO 1030
1638     C
1639     C     ALL O.K, GO SET THE SIGN AND CONTINUE,
1640     C
1641     GO TO 1010
1642     C
1643     C     .....
1644     C     CHARACTER IS A COMMA
1645     C     .....
1646     C
1647     1050 CONTINUE
1648     C
1649     C     SEE IF THE DELIMITER-EXPECTED FLAG IS SET
1650     C
1651     IF(DELM) GO TO 1090
1652     C
1653     C     NO. SEE IF THE FIXED POINT FLAG IS SET, IF NOT,COMMA SIGNALS
1654     C     TERMINATION OF FLOATING POINT FIELD, GO FINISH DECODING THE
1655     C     NO. AND STORE IT,
1656     C
1657     IF(,NOT,PIX) GO TO 400
1658     1060 CONTINUE
1659     C
1660     C     FIXED POINT FLAG IS SET, CHECK FOR MORE THAN 14 CHARACTERS IN THE
1661     C     FIELD, IF SO,FATAL ERROR,
1662     C
1663     IF(IVNUM,GT,NOSP) GO TO 600
1664     C
1665     C     CHECK FOR NO CHARACTERS FOUND, IF SO,FATAL ERROR,

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1666 C      IF(IVNUM,NE,0) GO TO 1070
1667      CALL MESSOT(30)
1668      IEFLAG=30
1669      RETURN
1670 1070 CONTINUE
1671
1672 C      SEE IF COMPLEX FLAG IS SET. IF SO, INTEGER FIELD IN COMPLEX
1673 C      CONSTANT = FATAL ERROR.
1674 C
1675 C      IF(CMPLEX) GO TO 640
1676
1677 C      ALL IS O.K. AFFIX THE SIGN AND STORE THE CONSTANT.
1678 C
1679 C      IF(IVSIGN,LT,0) IVSUM=-IVSUM
1680      CALL STORE(TABLE,IEFLAG)
1681      IF(IEFLAG,NE,0) RETURN
1682
1683 C      IF DOLLAR SIGN WAS LAST CHARACTER ENCOUNTERED, ALL DONE. IF NOT,
1684 C      GO ON AND LOOK FOR BEGINNING OF NEXT CONSTANT OR VARIABLE
1685 C      NAME.
1686 C
1687 C      IF(DONE) RETURN
1688      GO TO 90
1689
1690 C      -----
1691 C      CHARACTER IS S
1692 C      -----
1693 C
1694 C      1080 CONTINUE
1695
1696 C      SET THE DONE FLAG. IF FLOATING POINT NO. IS BEING PROCESSED,
1697 C      VIEW S AS FIELD TERMINATOR AND GO FINISH PROCESSING THE NO.
1698 C      IF FIXED POINT, GO PERFORM CHECKS AND STORE THE CONSTANT.
1699 C
1700 C      DONE=,TRUE,
1701      IF(,NOT,FIX) GO TO 480
1702      GO TO 1060
1703
1704 C      ++++++
1705 C      JUMP TO HERE IF DELIMITER EXPECTED AND FOUND
1706 C      ++++++
1707 C
1708 C      1090 CONTINUE
1709
1710 C      RESET THE DELIMITER-EXPECTED FLAG
1711 C
1712 C      DELIM=,FALSE,
1713
1714 C      SEE IF COMPLEX CONSTANT IS BEING PROCESSED. IF NOT, ONE CAN ONLY
1715 C      GET TO HERE WHILE PROCESSING A FIXED POINT NO. GO STORE IT.
1716 C
1717 C      IF(,NOT,CMPLEX) GO TO 1060
1718
1719 C      COMPLEX CONSTANT BEING PROCESSED. IF CHARACTERS FOUND BEFORE
1720 C      DELIMITER, FATAL ERROR.
1721 C
1722 C

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```

1723      IF(IVNUM.NE.0) GO TO 640
1724      C
1725      C      EVERYTHING O.K. GO ON AND LOOK AT NEXT CHARACTER.
1726      C
1727      GO TO 420
1728      C
1729      C      -----
1730      C      CHARACTER IS AN E
1731      C      -----
1732      C
1733      1100 CONTINUE
1734      C
1735      C      IF A DELIMITER WAS EXPECTED,FATAL ERROR
1736      C
1737      IF(DELM) GO TO 260
1738      C
1739      C      SEE IF MORE THAN 19 CHARACTERS HAVE BEEN FOUND IN THE PRECEDING
1740      C      FIELD. IF SO,E SHOULD HAVE BEEN D, FATAL ERROR.
1741      C
1742      IF(IC.GT.NDSP+1) GO TO 600
1743      1110 CONTINUE
1744      C
1745      C      ALL O.K. TURN ON THE EXPONENT FLAG AND RESET THE SIGN COUNT.
1746      C
1747      EXPN=.TRUE.
1748      NOSGN=0
1749      C
1750      C      SEE IF THE FIELD CURRENTLY BEING PROCESSED IS FIXED POINT
1751      C
1752      IF(.NOT.FIX) GO TO 1120
1753      C
1754      C      YES. SEE IF ANY CHARACTERS HAVE PREVIOUSLY BEEN FOUND.
1755      C
1756      IF(IVNUM.NE.0) GO TO 1150
1757      C
1758      C      NO. DEFAULT TO 1. (AND USE A SIGN IF ONE WAS FOUND)
1759      C
1760      IVNUM=1
1761      IVSUM=1
1762      IF(IVSIGN.LT.0) IVSUM=-IVSUM
1763      C
1764      C      RESET THE SIGN
1765      C
1766      IVSIGN=1
1767      C
1768      C      GO FINISH PROCESSING PART TO LEFT OF THE EXPONENT
1769      C
1770      GO TO 1150
1771      1120 CONTINUE
1772      C
1773      C      FLOATING POINT FIELD. GO FINISH PROCESSING PART TO THE LEFT OF
1774      C      THE EXPONENT.
1775      C
1776      C      SAVE=.FALSE.
1777      GO TO 530
1778      C
1779      C      -----

```

```

1780 C CHARACTER IS A D
1781 C -----
1782 C
1783 1130 CONTINUE
1784 C
1785 C IF A DELIMITER WAS EXPECTED,FATAL ERROR
1786 C
1787 IF(DELIM) GO TO 260
1788 C
1789 C SEE IF COMPLEX CONSTANT IS BEING PROCESSED, IF SO,FATAL ERROR,
1790 C
1791 IF(CMPLEX) GO TO 640
1792 C
1793 C EVERYTHING CHECKS, SET THE DOUBLE PRECISION FLAG AND GO FINISH
1794 C INITIALIZING FOR THE EXPONENT,
1795 C
1796 DOBLE=.TRUE.
1797 GO TO 1110
1798 C
1799 C -----
1800 C CHARACTER IS A PERIOD
1801 C -----
1802 C
1803 1140 CONTINUE
1804 C
1805 C SEE IF DELIMITER WAS EXPECTED, IF SO,FATAL ERROR,
1806 C
1807 IF(DELIM) GO TO 260
1808 C
1809 C IF FLOATING POINT FLAG IS ALREADY SET,FATAL ERROR
1810 C
1811 IF(FIX) GO TO 1150
1812 CALL MESSOT(25)
1813 IFLAG=25
1814 RETURN
1815 1150 CONTINUE
1816 C
1817 C IF MORE THAN 20 CHARACTERS PREVIOUSLY FOUND,FATAL ERROR
1818 C
1819 IF(IVNUM.GT.NDDP) GO TO 1160
1820 C
1821 C IF THE PERIOD IS THE FIRST CHARACTER IN THE FIELD,SET THE
1822 C ISOLATED PERIOD FLAG
1823 C
1824 IF(IVNUM.EQ.0) PERIOD=.TRUE.
1825 C
1826 C NO PROBLEMS, STORE THE PART TO THE LEFT OF THE PERIOD AS A
1827 C FLOATING POINT NO.
1828 C
1829 XLEFT=IVSUM
1830 IVSUM=0
1831 C
1832 C RESET THE FIELD FLAG?
1833 C
1834 IVNUM=0
1835 C
1836 C TURN ON THE FLOATING POINT FLAG

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1837 C
1838     FIX=.FALSE.
1839 C
1840 C     STORE THE CHARACTER FOR LATER DOUBLE PRECISION PROCESSING IF
1841 C     NECESSARY
1842 C
1843     IC=IC+1
1844     IDSTR(IC)=IH.
1845 C
1846 C     IF THE DOUBLE PRECISION FLAG IS ON,STORE PART TO LEFT OF DECIMAL
1847 C     IN DOUBLE PRECISION FORM
1848 C
1849     IF(DOUBLE) DB=XLEFT
1850 C
1851 C     GO ON AND LOOK AT THE NEXT CHARACTER
1852 C
1853     GO TO 420
1854 C
1855 C     FATAL ERROR, TOO MANY DIGITS IN CONSTANT.
1856 C
1857     1160 CONTINUE
1858     CALL MESSDT(38)
1859     IEFLAG=38
1860     RETURN
1861 C
1862 C     .....
1863 C     CHARACTER IS Y OR F
1864 C     .....
1865 C
1866     1170 CONTINUE
1867 C
1868 C     IF DELIMITER IS EXPECTED,FATAL ERROR
1869 C
1870     IF(DELM) GO TO 260
1871 C
1872 C     A PERIOD SHOULD HAVE PRECEDED EITHER Y OR F, IF NOT,FATAL ERROR,
1873 C
1874     IF(PERIOD) GO TO 1180
1875     CALL MESSDT(31)
1876     IEFLAG=31
1877     RETURN
1878     1180 CONTINUE
1879 C
1880 C     SAVE THE CHARACTER AND GO GET THE NEXT ONE
1881 C
1882     ISAVE=ITEST
1883     CALL NXTCOL(IF,IEFLAG)
1884     IF(IEFLAG,NE,0) RETURN
1885 C
1886 C     SEE IF IT WAS A PERIOD
1887 C
1888     IF(ITEST,NE,IH.) GO TO 1210
1889 C
1890 C     YES, SHORTENED FORM OF LOGICAL CONSTANT BEING USED
1891 C
1892     1190 CONTINUE
1893 C

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1894 C      SET THE DELIMITER=EXPECTED FLAG
1895 C
1896 C      DELIM=.TRUE.
1897 C
1898 C      PICK UP EITHER A TRUE OR FALSE CONSTANT
1899 C
1900 C      IVSUM=LCONT
1901 C      IF(ISAVE,EQ,1HF) IVSUM=LCONF
1902 C
1903 C      IF THE CONSTANT IS SIGNED,INTERPRET = TO MEAN COMPLEMENT
1904 C
1905 C      IF(IVSIGN,GE,0) GO TO 1200
1906 C      IF(IVSUM,EQ,LCONF) IVTEMP=LCONT
1907 C      IF(IVSUM,EQ,LCONT) IVTEMP=LCONF
1908 C      IVSUM=IVTEMP
1909 C      1200 CONTINUE
1910 C
1911 C      STORE THE CONSTANT AND PROCEED ON TO NEXT VARIABLE OR CONSTANT
1912 C
1913 C      CALL STORE(TABLE,IEFLAG)
1914 C      IF(IEFLAG,NE,0) RETURN
1915 C      GO TO 90
1916 C      1210 CONTINUE
1917 C
1918 C      LONG FORM OF LOGICAL CONSTANT BEING USED. CHECK FOR BEGINNING
1919 C      OF TRUE OR FALSE CONSTANT.
1920 C
1921 C      IF(ISAVE,EQ,1HF) GO TO 1250
1922 C
1923 C      TRUE. NEXT CHARACTER BETTER BE R OR FATAL ERROR.
1924 C
1925 C      IF(ITEST,EQ,1HR) GO TO 1230
1926 C      1220 CONTINUE
1927 C      CALL MESSOT(10)
1928 C      IEFLAG=10
1929 C      RETURN
1930 C      1230 CONTINUE
1931 C
1932 C      TR FOUND. GET NEXT CHARACTER AND CHECK FOR U. IF NOT,FATAL ERROR.
1933 C
1934 C      CALL NXTCOL(IF,IEFLAG)
1935 C      IF(IEFLAG,NE,0) RETURN
1936 C      IF(ITEST,NE,1HU) GO TO 1220
1937 C      1240 CONTINUE
1938 C
1939 C      ALL BUT E. SUCCESSFULLY FOUND. CHECK FOR THESE. IF NOT FOUND,
1940 C      FATAL ERROR. IF FOUND,GO SET UP AND STORE CONSTANT.
1941 C
1942 C      CALL NXTCOL(IF,IEFLAG)
1943 C      IF(IEFLAG,NE,0) RETURN
1944 C      IF(ITEST,NE,1HE) GO TO 1220
1945 C      CALL NXTCOL(IF,IEFLAG)
1946 C      IF(IEFLAG,NE,0) RETURN
1947 C      IF(ITEST,NE,1H.) GO TO 1220
1948 C      GO TO 1190
1949 C      1250 CONTINUE
1950 C

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1951      C      FALSE BEING PROCESSED, CHECK FOR ALB,
1952      C
1953      IF(ITEST,NE,1MA) GO TO 1220
1954      CALL NHTCOL(IP,IEFLAG)
1955      IF(IEFLAG,NE,0) RETURN
1956      IF(ITEST,NE,1ML) GO TO 1220
1957      CALL NHTCOL(IP,IEFLAG)
1958      IF(IEFLAG,NE,0) RETURN
1959      IF(ITEST,NE,1MS) GO TO 1220
1960      C
1961      C      ALL SUCCESSFULLY FOUND, GO CHECK REST OF CONSTANT,
1962      C
1963      GO TO 1240
1964      END

```

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.....
1      SUBROUTINE MESSOT(IEFLAG)
2      C
3      C      ROUTINE TO DO PRINTING FOR NAHLST
4      C
5      C      IEFLAG IS THE ERROR FLAG (SEE NAHLST)
6      C
7      C      WRITTEN BY J.L.NORTON, LASL T-3, 1974
8      C
9      COMMON/ARRCON/ICAR(80),ISUB,ITEST,NSUB,NSUBY(4),IENTRY,ISSPT,
10      I CREAL,CIMAG,CMPLX,DIM,MULTSV,IVSUM,MULT,LIST,MOLLER,DORLE
11      COMMON/IOTAB/NP,IFTAB
12      COMMON/JOTAB/NFE,IFTABE
13      INTEGER GETIT,SHIFT,OR,AND,COMP
14      DIMENSION ILINE(8)
15      DATA IPT/IR, /
16      C
17      C      LOOP OVER ALL OUTPUT FILES
18      C
19      IF(IEFLAG,NE,1) GO TO 2
20      NFP=NP
21      IFT=IFTAB
22      GO TO 3
23      2 CONTINUE
24      NFP=NFE
25      IFT=IFTABE
26      3 CONTINUE
27      IF(NFP,EQ,0) NFP=1
28      DO 500 I=1,NFP
29      C
30      C      IF NO. OF FILES IS 0, GO DEFAULT TO OUT
31      C
32      IF(IFT,NE,0) GO TO 10
33      IPX=6
34      GO TO 20
35      10 CONTINUE
36      C

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```

37      C      PICK UP THE NEXT FILE NAME
38      C      I=I+1
39      C      IXX=GETI(I)
40      C      20 CONTINUE
41      C      PRINT A ROW OF ASTERISKS UNLESS JUST PRINTING THE CARD
42      C      IF (IFLAG,EO,1) GO TO 30
43      C      I=I+1
44      C      IXX=GETI(I)
45      C      WRITE(IPX,970)
46      C      30 CONTINUE
47      C      PRINT THE CARD ITSELF
48      C      40
49      C      WRITE(IPX,510) ICHAR
50      C      ALL DONE IF JUST PRINTING THE CARD
51      C      50
52      C      IF (IFLAG,EO,1) GO TO 500
53      C      50
54      C      *****
55      C      SET UP POINTER TO AREA OF CARD CAUSING ERROR
56      C      *****
57      C      BLANK OUT THE POINTER LINE
58      C      60
59      C      DO 60 J=1,8
60      C      60 ILINE(J)=1
61      C      60
62      C      APPLY 60 AS UPPER BOUND ON CARD COLUMN NO.
63      C      60
64      C      ISUBX=ISUB
65      C      IF (ISUBX,CT,60) ISUBX=60
66      C      60
67      C      DETERMINE WORD COUNT (L) AND CHARACTER COUNT WITHIN WORD (K)
68      C      OF CARD WORD CONTAINING THE ERROR
69      C      70
70      C      K=MOD(ISUBX,10)
71      C      L=ISUBX/10
72      C      IF (K,NE,0) L=L+1
73      C      IF (K,EO,0) K=10
74      C      70
75      C      SHIFT THE POINTER TO THE PROPER COLUMN POSITION
76      C      70
77      C      K=10-K
78      C      IXX=IXX+K
79      C      ICGH=I(IPT,IXX)
80      C      MASK OUT THE PROPER POSITION IN THE LINE AND INSERT THE POINTER
81      C      I=I+1
82      C      IXX=I(IPT,IXX)
83      C      IXX=I(IPT,IXX)
84      C      IXX=I(IPT,IXX)
85      C      IXX=I(IPT,IXX)
86      C      IXX=I(IPT,IXX)
87      C      IXX=I(IPT,IXX)
88      C      IXX=I(IPT,IXX)
89      C      IXX=I(IPT,IXX)
90      C      IXX=I(IPT,IXX)
91      C      IXX=I(IPT,IXX)
92      C      IXX=I(IPT,IXX)
93      C      IXX=I(IPT,IXX)

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94      C      GO PRINT THE PROPER ERROR MESSAGE
95      C
96      GO TO (500,50,60,70,80,90,100,110,120,130,140,150,160,170,180,190,
97      1 200,210,220,230,240,250,260,270,280,290,300,310,320,330,340,350,
98      2 360,370,380,390,400,410,420,430,440,450,460,470,480),IEFLAG
99      50 WRITE(IPX,530)
100     GO TO 490
101     60 WRITE(IPX,540)
102     GO TO 490
103     70 WRITE(IPX,550)
104     GO TO 490
105     80 WRITE(IPX,560)
106     GO TO 490
107     90 WRITE(IPX,570)
108     GO TO 490
109     100 WRITE(IPX,580)
110     GO TO 490
111     110 WRITE(IPX,590)
112     GO TO 490
113     120 WRITE(IPX,600)
114     GO TO 490
115     130 WRITE(IPX,610)
116     GO TO 490
117     140 WRITE(IPX,620)
118     GO TO 490
119     150 WRITE(IPX,630)
120     GO TO 490
121     160 WRITE(IPX,640)
122     GO TO 490
123     170 WRITE(IPX,650)
124     GO TO 490
125     180 WRITE(IPX,660)
126     GO TO 490
127     190 WRITE(IPX,670)
128     GO TO 490
129     200 WRITE(IPX,680)
130     GO TO 490
131     210 WRITE(IPX,690)
132     GO TO 490
133     220 WRITE(IPX,700)
134     GO TO 490
135     230 WRITE(IPX,710)
136     GO TO 490
137     240 WRITE(IPX,720)
138     GO TO 490
139     250 WRITE(IPX,730)
140     GO TO 490
141     260 WRITE(IPX,740)
142     GO TO 490
143     270 WRITE(IPX,750)
144     GO TO 490
145     280 WRITE(IPX,760)
146     GO TO 490
147     290 WRITE(IPX,770)
148     GO TO 490
149     300 WRITE(IPX,780)
150     GO TO 490

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151      310 WRITE(IPX,790)
152      GO TO 490
153      320 WRITE(IPX,800)
154      GO TO 490
155      330 WRITE(IPX,810)
156      GO TO 490
157      340 WRITE(IPX,820)
158      GO TO 490
159      350 WRITE(IPX,830)
160      GO TO 490
161      360 WRITE(IPX,840)
162      GO TO 490
163      370 WRITE(IPX,850)
164      GO TO 490
165      380 WRITE(IPX,860)
166      GO TO 490
167      390 WRITE(IPX,870)
168      GO TO 490
169      400 WRITE(IPX,880)
170      GO TO 490
171      410 WRITE(IPX,890)
172      GO TO 490
173      420 WRITE(IPX,900)
174      GO TO 490
175      430 WRITE(IPX,910)
176      GO TO 490
177      440 WRITE(IPX,920)
178      GO TO 490
179      450 WRITE(IPX,930)
180      GO TO 490
181      460 WRITE(IPX,940)
182      GO TO 490
183      470 WRITE(IPX,950)
184      GO TO 490
185      480 WRITE(IPX,960)
186      490 CONTINUE
187
188      C      PRINT ANOTHER ROW OF ASTERISKS
189
190      C      WRITE(IPX,970)
191      500 CONTINUE
192      RETURN
193
194      C
195      510 FORMAT(1H ,80A1)
196      520 FORMAT(1H ,8A10)
197      530 FORMAT(1H ,41MMORE THAN SIX CHARACTERS IN NAMELIST NAME)
198      540 FORMAT(1H ,45MMORE THAN SIX CHARACTERS IN NAMELIST VARIABLE)
199      550 FORMAT(1H ,39NAMELIST VARIABLE NOT IN NAMELIST TABLE)
200      560 FORMAT(1H ,50ILLEGAL CHARACTER FOLLOWING NAMELIST VARIABLE NAME)
201      570 FORMAT(1H ,30ILLEGAL CHARACTER IN SUBSCRIPT)
202      580 FORMAT(1H ,10DELIMITER EXPECTED)
203      590 FORMAT(1H ,20MUNEXPECTED DELIMITER)
204      600 FORMAT(1H ,20M= EXPECTED,NOT FOUND)
205      610 FORMAT(1H ,24ILLEGAL LOGICAL VARIABLE)
206      620 FORMAT(1H ,43NAMELIST NAME NOT FOUND IMMEDIATELY AFTER 8)
207      630 FORMAT(1H ,34ILLEGAL CHARACTER IN THIS POSITION)
208      640 FORMAT(1H ,44MFIRST CHARACTER OF NAMELIST VARIABLE ILLEGAL)

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200      650 FORMAT(1H ,19H100 MANY SUBSCRIPTS)
209      660 FORMAT(1H ,49HATTEMPT TO USE UNDIMENSIONED VARIABLE AS AN ARRAY)
210      670 FORMAT(1H ,37H100 MANY SUBSCRIPTS FOR THIS VARIABLE)
211      680 FORMAT(1H ,20HMULTIPLIER IS NOT AN INTEGER)
212      690 FORMAT(1H ,24HMORE THAN ONE MULTIPLIER)
213      700 FORMAT(1H ,34HMULTIPLIER WITHIN COMPLEX CONSTANT)
214      710 FORMAT(1H ,25HIMPROPER LEFT PARENTHESIS)
215      720 FORMAT(1H ,23HIMPROPER OCTAL CONSTANT)
216      730 FORMAT(1H ,31HMORE THAN TWO SIGNS IN CONSTANT)
217      740 FORMAT(1H ,40HFIRST CHARACTER OF NAMELIST NAME ILLEGAL)
218      750 FORMAT(1H ,34HILLEGAL CHARACTER IN NAMELIST NAME)
219      760 FORMAT(1H ,48HMORE THAN ONE DECIMAL POINT IN A FLOATING POINT ,
220      1 8HCONSTANT)
221      770 FORMAT(1H ,21HEXPONENT OUT OF RANGE)
222      780 FORMAT(1H ,35HIMPROPER SIGN IN FLOATING POINT NO,)
223      790 FORMAT(1H ,48H100 MANY CHARACTERS IN SINGLE PRECISION CONSTANT)
224      800 FORMAT(1H ,15HISOLATED PERIOD)
225      810 FORMAT(1H ,19HZERO WIDTH CONSTANT)
226      820 FORMAT(1H ,34HILLEGAL CHARACTER FOLLOWING PERIOD)
227      830 FORMAT(1H ,14HUNEXPECTED EOF)
228      840 FORMAT(1H ,27HUNEXPECTED CARD TERMINATION)
229      850 FORMAT(1H ,27HILLEGAL M,L,OR R OCCURRENCE)
230      860 FORMAT(1H ,23HHOLLERITH COUNT MISSING)
231      870 FORMAT(1H ,50HMULTIPLIER NOT ALLOWED FOR HOLLERITH CONSTANTS OF ,
232      1 23HMORE THAN 10 CHARACTERS)
233      880 FORMAT(1H ,44HFIELD CANNOT BE GREATER THAN 10 CHARACTERS)
234      890 FORMAT(1H ,17HCONSTANT TOO LONG)
235      900 FORMAT(1H ,36H5IGN CANNOT PRECEDE COMPLEX CONSTANT)
236      910 FORMAT(1H ,33H100 MANY DIGITS IN OCTAL CONSTANT)
237      920 FORMAT(1H ,50HTHE DIGIT 8 OR 9 CANNOT OCCUR IN AN OCTAL CONSTANT)
238      930 FORMAT(1H ,25HIMPROPER COMPLEX CONSTANT)
239      940 FORMAT(1H ,19H5UBSCRIPT TOO LARGE)
240      950 FORMAT(1H ,41HMORE THAN ONE SIGN IN AN INTEGER CONSTANT)
241      960 FORMAT(1H ,13HEERROR IN MASH)
242      970 FORMAT(1H ,60(1H*))
243      END

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.....

1      SUBROUTINE STORE(TABLE,IEFLAG)
2      C
3      C      ROUTINE TO STORE THE CONSTANT LAST DECODED
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1970
6      C
7      COMMON/ARRCON/ICAR(80),ISUB,ITEST,NSUB,NSUBV(4),IENTRY,ISOSPT,
8      1 CREAL,CIMAG,CMPLX,DIM,MULTSV,IVSUM,MULT,LIST,HOLLER,DOBLE
9      LOGICAL MULT,CMPLX,DIM,DOBLE
10     DIMENSION TABLE(3,1)
11     INTEGER TABLE,SHIFT,AND,OR,COMP
12     DATA CREAL/0,/
13     C
14     C      GET THE VARIABLE SUBSCRIPT INFORMATION

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15      C
16      IARENT=TABLE(3,IENTRY)
17      C
18      GET THE ABSOLUTE ADDRESS OF THE VARIABLE
19      C
20      IARADD=TABLE(2,IENTRY)
21      C
22      ISBSPT IS THE MEMORY OFFSET (+1) FOR THE VARIABLE BEING READ, IT
23      IS 1 UPON THE ENTRY TO STORE FOR A GIVEN VARIABLE NAME, SOME
24      CHECKING IS DONE ONLY UPON THE FIRST ENTRY, SEE IF THIS IS SO,
25      C
26      IF(ISBSPT.LE.1) GO TO 10
27      C
28      NOT THE FIRST ENTRY, SEE IF THE VARIABLE IS SUBSCRIPTED, IF NOT,
29      FATAL ERROR FOR TRYING TO STORE MORE THAN ONE DATA ELEMENT
30      INTO A NON-SUBSCRIPTED VARIABLE.
31      C
32      IF(IARENT.EQ.0) GO TO 60
33      C
34      EVERYTHING CHECKS, CONTINUE ON WITH THE STORE,
35      C
36      GO TO 20
37      10 CONTINUE
38      C
39      FIRST ENTRY, SEE IF A MULTIPLIER IS IN EFFECT OR VARIABLE HAS
40      SUBSCRIPTS.
41      C
42      IF(MULT.OR.DIM) GO TO 50
43      C
44      NEITHER CONDITION HOLDS, CONTINUE ON WITH THE STORE,
45      C
46      20 CONTINUE
47      C
48      SET THE MULTIPLIER COUNT, IF NO MULTIPLIER,USE 1.
49      C
50      IF(.NOT.MULT) MULTSV=1
51      C
52      LOOP FOR MULTIPLE STORING
53      C
54      DO 40 I=1,MULTSV
55      C
56      GET THE ACTUAL ABSOLUTE ADDRESS OF THE LOCATION INTO WHICH THE
57      STORE IS TO OCCUR
58      C
59      IADD=IARADD+ISBSPT*1
60      C
61      SPECIAL HANDLING FOR DOUBLE OR COMPLEX
62      C
63      IF(CMPLE.OR.DORLE) GO TO 30
64      C
65      ORDINARY ONE ELEMENT VARIABLE, CARRY OUT THE STORE.
66      C
67      CALL STORIT(IVSUM,IADD)
68      C
69      INCREMENT THE POINTER AND GO TO THE END OF THE LOOP
70      C
71      ISBSPT=ISBSPT+1

```



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72      GO TO 40
73      30 CONTINUE
74      C
75      C      EITHER DOUBLE OR COMPLEX, STORE TWO WORDS,
76      C
77      CALL STORIT(CREAL,IADD)
78      CALL STORIT(CIMAG,IADD+1)
79      ISBSPT=ISBSPT+2
80      40 CONTINUE
81      C
82      C      ALL DONE
83      C
84      RETURN
85      50 CONTINUE
86      C
87      C      VARIABLE HAS SUBSCRIPTS OR CONSTANT HAS A MULTIPLIER, VARIABLE
88      C      MUST BE DIMENSIONED, IF NOT, FATAL ERROR,
89      C
90      IF(IARENT.NE.0) GO TO 70
91      60 CONTINUE
92      CALL MESSOT(15)
93      IEFLAG=15
94      RETURN
95      70 CONTINUE
96      C
97      C      IF VARIABLE IS NOT SUBSCRIPTED, ALL IS O.K, CARRY OUT THE STORE,
98      C
99      IF(.NOT.DIM) GO TO 20
100     C
101     C      VARIABLE IS SUBSCRIPTED, GET THE TABLE DIMENSION INFORMATION,
102     C
103     ISUB1=AND(IARENT,777777B)
104     ISUB2=AND(SHIFT(IARENT,-10),777777B)
105     ISUB3=AND(SHIFT(IARENT,-36),777777B)
106     C
107     C      CHECK FOR SUBSCRIPTING ERRORS, IS THERE A FOURTH SUBSCRIPT BUT
108     C      NO THIRD DIMENSION,
109     C
110     IF(NSUB.EQ.4.AND.ISUB3.EQ.0) GO TO 80
111     C
112     C      IS THERE A THIRD SUBSCRIPT BUT NO SECOND DIMENSION
113     C
114     IF(NSUB.EQ.3.AND.ISUB2.EQ.0) GO TO 80
115     C
116     C      IS THERE A SECOND SUBSCRIPT BUT EITHER NO FIRST DIMENSION OR A
117     C      FIRST DIMENSION INDICATING A SINGLY-SUBSCRIPTED ARRAY
118     C
119     IF(NSUB.EQ.2.AND.(ISUB1.EQ.1.OR.ISUB1.EQ.0)) GO TO 80
120     C
121     C      IS THERE A SINGLE SUBSCRIPT BUT NO SUBSCRIPTING INFORMATION GIVEN
122     C
123     IF(NSUB.EQ.1.AND.ISUB1.EQ.0) GO TO 80
124     C
125     C      IF N SUBSCRIPTS ARE GIVEN, DIMENSIONAL INFORMATION IS USED FOR
126     C      THE FIRST N-1
127     C
128     IF(NSUBV(4).EQ.0) ISUB3=0

```



```

28 C      DO 20 I=1,IVNUM
29
30 C
31 C      SHIFT MASK INTO PROPER POSITION
32 C
33 C      ITEMPM=SHIFT(77R,60=6*I)
34 C
35 C      SHIFT CHARACTER INTO PROPER POSITION
36 C
37 C      ITEM=SHIFT(IDSTR(I),-6*(I-1))
38 C
39 C      DROP CHARACTER INTO INAME, FIRST MASK OUT THE BLANK, THEN ISOLATE
40 C      THE CHARACTER AND DROP IT INTO THE PREPARED SLOT,
41 C
42 C      20 INAME=OR(AND(INAME,COMP(ITEMPM)),AND(ITEM,ITEMPM))
43 C
44 C      ALL DONE
45 C
46 C      RETURN
47 C      END

```

```

1 SUBROUTINE NAMPRY(NFX,FTABX)
2 C
3 C ROUTINE TO SET THE FILES ON WHICH THE NAMLST ROUTINE WILL WRITE
4 C WHENEVER ITS DOES OUTPUT OTHER THAN ERROR MESSAGES (PS OR CS),
5 C THE CALLING SEQUENCE IS CALL NAMPRY(N,TABLE: WHERE
6 C N = NO. OF TABLE ENTRIES
7 C TABLE = ARRAY OF FILE NAMES,EITHER IN THE FORM OF
8 C LEFT=JUSTIFIED,ZERO=FILLED HOLLERITH
9 C CONSTANTS OR INTEGERS,
10 C
11 C FOR EXAMPLE,IF ONE WANTED TO WRITE BOTH ON FILM AND PAPER,
12 C THE TABLE WOULD APPEAR AS
13 C DATA TABLE/4LFILM,3LOUT/,
14 C IF FILM WAS EQUIVALENCED TO FSET12 AND OUT TO FSET6,
15 C AN ALTERNATE FORM WOULD BE
16 C DATA TABLE/12,6/
17 C AND THE CALL WOULD BE
18 C CALL NAMPRY(2,TABLE),
19 C
20 C IF NAMPRY IS NOT CALLED BEFORE NAMLST,THE LATTER WILL
21 C DEFAULT ALL OUTPUT TO OUT,
22 C
23 C WRITTEN BY J.L.NORTON,LASL T-3,1974
24 C
25 COMMON/IOTAB/NF,IFLOC
26 INTEGER FTABX(1)
27 DATA NF,IFLOC/0,0/
28 IF(NFX,LE,0) RETURN
29 NF=NFX
30 IFLOC=LOCFT(FTABX)

```

```
31      RETURN
32      END
```

```
.....

1      SUBROUTINE ERRPRY(NFX,FTABX)
2      C
3      C      ROUTINE ANALOGOUS TO NAMPRY EXCEPT FOR PRINTING ERROR MESSAGES
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T=3,1975
6      C
7      COMMON/JOTAB/NF,IFLOC
8      INTEGER FTABX(1)
9      DATA NF,IFLOC/0,0/
10     IF(NFX.LE,0) RETURN
11     NF=NFX
12     IFLOC=LOCF(FTABX)
13     RETURN
14     END
```

```
.....

1      SUBROUTINE TABDEF(TABLE,NAME,ITSIZE,IERRT)
2      C
3      C      ROUTINE TO INITIALIZE A NAMEDLIST TABLE
4      C
5      C      TABLE = ARRAY WHICH WILL BE USED TO STORE NAMEDLIST DATA NAMES
6      C                  AND RELATED INFORMATION. IT MUST BE 3*(N+1) ELEMENTS
7      C                  LONG WHERE N IS THE NUMBER OF DISTINCT NAMEDLIST
8      C                  VARIABLES TO BE READ UNDER THIS NAME.
9      C      NAME = NAMEDLIST NAME,LEFT-JUSTIFIED,BLANK-FILLED HOLLERITH, IF
10     C                  ONE WERE GOING TO READ CARDS OF THE FORM PSCODEIN,,
11     C                  NAME=6HCODEIN.
12     C      ITSIZE = SECOND SUBSCRIPT OF THE TABLE ARRAY
13     C                  (MAXIMUM NO. OF TABLE ENTRIES+1)
14     C      IERRT = VARIABLE SET BY ASSIGNED GO TO AS RETURN POINT IF TABLE
15     C                  INITIALIZATION ENCOUNTERS AN ERROR CONDITION
16     C
17     C      WRITTEN BY J.L.NORTON,LASL T=3,1974
18     C
19     INTEGER TABLE
20     DIMENSION TABLE(3,1)
21     COMMON/ERRORC/IERRTP
22     TABLE(1,1)=NAME
23     TABLE(2,1)=ITSIZE
24     TABLE(3,1)=0
25     IERRTP=IERRT
26     RETURN
27     END
```

```

1      SUBROUTINE TABSET(TABLE,NAME,LOCA,IEFLAG,NSUB,NSUB1,NSUB2,NSUB3)
2      C
3      C ROUTINE TO ADD A VARIABLE TO A NAMELIST TABLE
4      C
5      C TABLE = AN ARRAY WHICH HAS BEEN INITIALIZED BY A CALL TO TABDEF
6      C NAME = NAME OF VARIABLE TO BE ADDED, AS A HOLLERITH CONSTANT
7      C LOCA = THE VARIABLE ITSELF
8      C IEFLAG= ERROR INDICATOR
9      C = RETURNED ZERO IF NO ERROR WAS FOUND
10     C = RETURNED WITH THE CONTENTS OF THE VARIABLE =NAME=
11     C LEFT=JUSTIFIED (LEFT 6 CHARACTERS) AND THE ERROR NO.
12     C RIGHT=JUSTIFIED IF AN ERROR OCCURRED
13     C NSUB = NUMBER OF SUBSCRIPTS (0,1,2,3,OR 4)
14     C NSUB1 = FIRST ARRAY DIMENSION
15     C NSUB2 = SECOND ARRAY DIMENSION
16     C NSUB3 = THIRD ARRAY DIMENSION
17     C = (IF THE NAMELIST VARIABLE HAS N SUBSCRIPTS (N,LE,4),
18     C THEN NSUB1,NSUB2,...,NSUBN=1 ARE NEEDED)
19     C
20     C THE ACTUAL FORM OF THE TABLE IS AS FOLLOWS ==
21     C WORD 1 = THE TABLE NAME (LEFT=JUSTIFIED,BLANK=FILLED
22     C HOLLERITH)
23     C WORD 2 = UNUSED
24     C WORD 3 = NO. OF ENTRIES IN THE TABLE
25     C NEXT FOLLOW TRIPLETS OF WORDS FOR EACH NAMELIST VARIABLE =
26     C WORD 1 = VARIABLE NAME (SAME AS TABLE NAME)
27     C WORD 2 = VARIABLE LOCATION (RIGHT JUSTIFIED,RELATIVE
28     C TO BEGINNING OF CODE FIELD=LENGTH)
29     C WORD 3 = SUBSCRIPT INFORMATION
30     C = IF ZERO,THE VARIABLE IS SINGLY SUBSCRIPTED
31     C = IF NON=ZERO,THE WORD IS INTERPRETED AS BEING
32     C MADE UP OF THREE 18 BIT FIELDS, DENOTING
33     C THE RIGHTMOST BIT AS 0, THE THREE FIELDS ARE
34     C BITS 0=17,18=35,AND 36=53,RESPECTIVELY,
35     C THESE THREE FIELDS CONTAIN NSUB1,NSUB2,AND
36     C NSUB3,RESPECTIVELY.
37     C THE LENGTH OF THE TABLE SHOULD BE 3*(WORD(3)+1) LOCATIONS,
38     C
39     C WRITTEN BY J.L.NORTON,LASL T=3,1974
40     C
41     C INTEGER TABLE,SHIFT,AND,OR,COMP
42     C DIMENSION TABLE(3,1),FMT(10)
43     C COMMON/ERRORC/IERRT
44     C IEFLAG=0
45     C
46     C GET NUMBER OF ENTRIES CURRENTLY IN THE TABLE
47     C
48     C NENTRY=TABLE(3,1)
49     C
50     C COMPUTE SUBSCRIPT FOR NEW TABLE ENTRY
51     C
52     C ISUB=NENTRY+2
53     C
54     C MAKE SURE THERE IS STILL TABLE SPACE LEFT

```

```

55      C
56      IF(ISUB,LE,TABLE(2,1)) GO TO 10
57      C
58      NO. FATAL ERROR,
59      C
60      IFLAG=5
61      GO TO 999
62      10 CONTINUE
63      C
64      SET UP TABLE ENTRY
65      C
66      TABLE(1,ISUB)=NAME
67      TABLE(2,ISUB)=LOC(LOCA)
68      TABLE(3,ISUB)=0
69      C
70      COMPOSE SUBSCRIPT WORD IF VARIABLE IS AN ARRAY
71      C
72      IF(NSUB,EQ,0) GO TO 30
73      C
74      SET THE TABLE BASED UPON HOW MANY SUBSCRIPTS THE ARRAY HAS
75      C
76      IF(NSUB,GT,1) GO TO 20
77      C
78      ARRAY HAS ONLY ONE SUBSCRIPT, DENOTE THIS BY SETTING SUBSCRIPT
79      FIELD 1 TO 1 AND LEAVING ALL THE REST ZERO,
80      C
81      TABLE(3,ISUB)=1
82      GO TO 30
83      C
84      ARRAY HAS MORE THAN ONE SUBSCRIPT
85      C
86      20 CONTINUE
87      C
88      SEE IF AT LEAST THE FIRST SUBSCRIPT IS SPECIFIED, IF NOT,ERROR,
89      C
90      IF(NSUB1,LE,0) GO TO 40
91      C
92      FIRST SUBSCRIPT PRESENT, STORE IT AND SEE IF ARRAY HAS MORE THAN
93      TWO SUBSCRIPTS,
94      C
95      TABLE(3,ISUB)=NSUB1
96      IF(NSUB,EQ,2) GO TO 30
97      C
98      YES, THE SECOND SUBSCRIPT MUST BE SPECIFIED, IF NOT,ERROR,
99      C
100     IF(NSUB2,LE,0) GO TO 50
101     C
102     SECOND SUBSCRIPT PRESENT, STORE IT AND SEE IF ARRAY HAS MORE THAN
103     THREE SUBSCRIPTS,
104     C
105     TABLE(3,ISUB)=OR(TABLE(3,ISUB),SHIFT(NSUB2,16))
106     IF(NSUB,EQ,3) GO TO 30
107     C
108     YES, THE THIRD SUBSCRIPT MUST BE SPECIFIED, IF NOT,ERROR,
109     C
110     IF(NSUB3,LE,0) GO TO 60
111     C

```

```

112 C      THIRD SUBSCRIPT PRESENT, STORE IT AND MAKE SURE THE TOTAL NO.
113 C      OF SUBSCRIPTS DOES NOT EXCEED FOUR,
114 C
115 C      TABLE(3,ISUB)=OR(TABLE(3,ISUB),SHIFT(NSUB3,36))
116 C      IF(NSUB,NE,4) GO TO 70
117 C      30 CONTINUE
118 C
119 C      ALL DONE, INCREMENT THE NO. OF ENTRIES AND RETURN,
120 C
121 C      TABLE(3,1)=NENTRY+1
122 C      RETURN
123 C
124 C      ERROR = MORE THAN ONE SUBSCRIPT INDICATED BUT NSUB1 NOT GIVEN OR
125 C      IN ERROR (ZERO OR NEGATIVE)
126 C
127 C      40 IEFLAG=IEFLAG+1
128 C
129 C      ERROR = MORE THAN TWO SUBSCRIPTS INDICATED BUT NSUB2 NOT GIVEN OR
130 C      IN ERROR
131 C
132 C      50 IEFLAG=IEFLAG+1
133 C
134 C      ERROR = MORE THAN THREE SUBSCRIPTS INDICATED BUT NSUB3 NOT GIVEN
135 C      OR IN ERROR
136 C
137 C      60 IEFLAG=IEFLAG+1
138 C
139 C      ERROR = MORE THAN FOUR SUBSCRIPTS INDICATED
140 C
141 C      70 IEFLAG=IEFLAG+1
142 C      999 CONTINUE
143 C      IEFLAG=OR(IEFLAG,AND(NAME,77777777777700000000B))
144 C      GO TO IERRT
145 C      END

```

```

1      SUBROUTINE NXTCOL(IF,IEFLAG)
2      C
3      C      ROUTINE TO GET THE NEXT CHARACTER FROM THE CURRENT NAMELIST CARD
4      C      AND, IF NECESSARY, READ ANOTHER CARD FROM FILE IF
5      C
6      C      WRITTEN BY J.L.NORTON, LASL T-3, 1974
7      C
8      C      COMMON/ARRCON/ICHAR(80),ISUB,ITEST,NSUB,NSUBV(4),IENTRY,ISBSPT,
9      C      1 CREAL,CIMAG,CMPLEX,DIM,MULTSV,IVSUM,MULT,LIST,HOLLER,DOBLE
10     C      LOGICAL LIST,HOLLER
11     C
12     C      INCREMENT THE COLUMN NO.
13     C
14     C      ISUB=ISUB+1
15     C
16     C      PICK UP THE CHARACTER IN COLUMN ISUB

```

```

17      C
18      ITEST=ICHAR(ISUB)
19
20      C      IF ISUB HAS NOT MOVED ACROSS A CARD BOUNDARY, WE ARE ALL DONE
21      C
22      IF(ISUB,LE,80) GO TO 30
23
24      C      MUST READ NEXT CARD. IEFLAG WILL BE RETURNED NON-ZERO ONLY IF
25      C      AN EOF WAS ENCOUNTERED.
26      C
27      CALL READIT(IF,IEFLAG)
28      IF(IEFLAG,EQ,0) GO TO 10
29
30      C      AN EOF WAS READ, WE ARE ALL THROUGH.
31      C
32      CALL MESSOT(32)
33      IEFLAG=-32
34      RETURN
35      10 CONTINUE
36
37      C      READ WAS SUCCESSFUL, RESET COLUMN AND CHARACTER.
38      C
39      ISUB=2
40      ITEST=ICHAR(ISUB)
41
42      C      IF PROCESSING A HOLLERITH FIELD, NO MORE CHECKING
43      C
44      IF(HOLLER) GO TO 20
45
46      C      CHECK FOR $ IN CC2, IF NOT, ALL FINISHED CHECKING.
47      C
48      IF(ITEST,NE,1MS) GO TO 20
49
50      C      $ IN CC2, PROBABLY BEGINNING OF NEXT NAMELIST STATEMENT. MUST
51      C      HAVE HAD MISSING TERMINAL $ ON PREVIOUS CARD, GO BACK AND
52      C      READ THE CARD IN ERROR.
53      C
54      BACKSPACE IF
55      BACKSPACE IF
56      CALL READIT(IF,IEFLAG)
57
58      C      SET THE COLUMN POINTER TO CC80, GO PRINT ERROR MESSAGE, AND QUIT
59      C
60      ISUB=80
61      CALL MESSOT(33)
62      IEFLAG=33
63      RETURN
64      20 CONTINUE
65
66      C      EVERYTHING CHECKED OUT, SET COLUMN TO 1 AND PICK UP THE
67      C      CHARACTER IN CC1.
68      C
69      ISUB=1
70      ITEST=ICHAR(ISUB)
71
72      C      IF FLAG IS SET, PRINT THE LAST CARD READ
73      C

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74      IF(LIST) CALL MESS0T(1)
75      30 CONTINUE
76      RETURN
77      END

```

```

1      SUBROUTINE READIT(IF,IEFLAG)
2      C
3      C ROUTINE TO READ THE NEXT CARD ON FILE IF
4      C
5      C WRITTEN BY J.L.NORTON,LASL T-3,1974
6      C
7      COMMON/ARRCON/ICHAR(80),ISUB,ITEST,NSUB,NSUBV(4),IENTRY,ISBSPT,
8      1 CREAL,CIMAG,CMPLEX,DIM,MULTBV,IVSUM,MULT,LIST,HOLLER,DOBLE
9      C
10     C READ THE NEXT CARD
11     C
12     READ(IF,30) ICHAR
13     C
14     C CHECK FOR END-OF-FILE
15     C
16     IF(EOF,IF) 10,20
17     C
18     C YES, SET THE FLAG,
19     C
20     10 CONTINUE
21     IEFLAG=1
22     20 CONTINUE
23     RETURN
24     C
25     30 FORMAT(80A1)
26     END

```

```

1      SUBROUTINE OPDMP(FWA,LWA,IFILE)
2      C
3      C ROUTINE TO DUMP SMALL CORE MEMORY IN CDC COMPASS MNEUMONICS
4      C
5      C FWA = FIRST WORD TO BE DUMPED
6      C LWA = LAST WORD TO BE DUMPED
7      C IFILE = FILE TO WHICH TO DIRECT OUTPUT
8      C
9      C WRITTEN BY J.L.NORTON,LASL T-3,1975
10     C
11     INTEGER FWA,FWAP,GETIT,SHIFT,AND,OR
12     DIMENSION IDIGIT(20),ICODE(4),IREG(4),IOPRN(13,4),IDNAME(8)
13     DIMENSION IOP(42),INREG(20)

```

```

14      DATA IOP/2HPS,2HRL,2HNL,2HMJ,2HRX,2HXX,2HRI,2HTB,2HIB,2HRO,2HOB,
15      1 2HRJ,2HJP,2HZR,2HNZ,2HPL,2HNG,2HIR,2HOR,2HDF,2HID,2HEQ,2HNE,2HGE,
16      2 2HLT,2HBX,2HLX,2MAX,2MMX,2HXX,2HZX,2HUX,2HPX,2HFX,2MDX,2HRX,2HIX,
17      3 2HNO,2HCX,2HSA,2MSB,2MSX/
18      DATA IDNAME/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7/
19      C
20      C      IF FWA,GT,LWA, IGNORE THE CALL
21      C
22      IF(FWA,GT,LWA) RETURN
23      FWAP=FWA
24      C
25      C      LOOP OVER ALL WORDS TO BE DUMPED
26      C
27      10 CONTINUE
28      C
29      C      GET THE CONTENTS OF THE CURRENT ADDRESS (FWAP) TO BE DUMPED
30      C
31      IWORD=GETIT(FWAP)
32      C
33      C      BREAK THE WORD UP INTO INDIVIDUAL DIGITS
34      C
35      DO 20 I=1,20
36      IOGIT(I)=AND(SHIFT(IWORD,3*I),7B)
37      20 CONTINUE
38      C
39      C      COMPUTE HOLLERITH EQUIVALENT OF DIGITS
40      C
41      DO 30 I=1,20
42      ISUB=IDIGIT(I)+1
43      30 IHEQ(I)=IDNAME(ISUB)
44      C
45      C      IDN IS THE CURRENT DIGIT NO. OF THE WORD BEING PROCESSED
46      C
47      IDN=1
48      C
49      C      IPART IS THE NO. OF THE INSTRUCTION (1=4) BEING PROCESSED
50      C      FOR THE CURRENT WORD
51      C
52      IPART=1
53      C
54      C      INITIALIZE THE OUTPUT FIELDS
55      C
56      DO 50 I=1,4
57      ICODE(I)=2H
58      IREG(I)=1H
59      DO 40 J=1,13
60      IOPRN(J,I)=1H
61      40 CONTINUE
62      50 CONTINUE
63      C
64      C      LOOP OVER ALL DIGITS
65      C
66      60 CONTINUE
67      C
68      C      IOPNO IS THE NO. OF THE CHARACTER OF THE OPERAND FIELD CURRENTLY
69      C      BEING FILLED
70      C

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71      IOPNO=1
72      IGOY=IDIGIT(IDN)+1
73      GO TO (70,360,440,500,520,620,620,620),IGOY
74      C
75      C      FIRST DIGIT OF OP IS 0
76      C
77      70 CONTINUE
78      IDN=IDN+1
79      IGOY=IDIGIT(IDN)+1
80      GO TO (80,100,330,340,350,350,350,350),IGOY
81      C
82      C      OP IS PS (00)
83      C
84      80 CONTINUE
85      ITYPE=1
86      C
87      C      CHECK FOR ERRORS
88      C
89      IF(IDN,LE,12) GO TO 100
90      C
91      C      SEE IF THIS IS END OF WORD PADDED WITH ZEROS. IF SO,
92      C      PROCESS LIKE NO.
93      C
94      IF(IDN,EO,17) GO TO 400
95      C
96      C      WORD IS IN ERROR, MUST NOT BE INSTRUCTION, PRINT MESSAGE AND GO ON
97      C      TO NEXT WORD.
98      C
99      90 CONTINUE
100     WRITE(IFILE,760) FWAR, IWORD
101     GO TO 100
102     100 CONTINUE
103     ITYPE=1
104     C
105     C      PROCESS INSTRUCTION OF THE FORM OP K
106     C
107     IDN=IDN+2
108     C
109     C      PROCESS K
110     C
111     110 CONTINUE
112     ISUM=0
113     DO 120 I=1,6
114     IDN=IDN+1
115     ISUM=OR(ISUM,SHIFT(IDIGIT(IDN),3*(6-I)))
116     120 CONTINUE
117     ISUM=SHIFT(SHIFT(ISUM,42),=42)
118     IF(ISUM,GE,0) GO TO 130
119     ISUM=-ISUM
120     IOPRN(IOPNO,IPART)=IH+
121     GO TO 140
122     130 CONTINUE
123     IOPRN(IOPNO,IPART)=IH+
124     140 CONTINUE
125     IOPNO=IOPNO+1
126     DO 150 I=1,6
127     ID=AND(SHIFT(ISUM,-3*(6-I)),70)

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128      IOPRN(IOPNO,IPART)=IDNAME(ID+1)
129      IOPNO=IOPNO+1
130 150 CONTINUE
131  C
132  C      FINISH PARCEL
133  C
134 160 CONTINUE
135      ICODE(IPART)=IOP(IITYPE)
136      IF(IDN,GE,20) GO TO 170
137      IPART=IPART+1
138      IDN=IDN+1
139      IF(IDN,GT,16) GO TO 90
140      GO TO 80
141  C
142  C      WORD IS FINISHED. PRINT THE LINE.
143  C
144 170 CONTINUE
145      WRITE(FILE,778) FWAP,IWORD,(ICODE(I),IREG(I),(IOPRN(J,I),J=1,13),
146      I I=1,IPART)
147  C
148  C      SEE IF THIS WAS THE LAST WORD
149  C
150 180 CONTINUE
151      IF(FWAP,GE,LWA) RETURN
152  C
153  C      NO. CONTINUE.
154  C
155      FWAP=FWAP+1
156      GO TO 10
157  C
158  C      FIRST TWO DIGITS OF OP ARE 01
159  C
160 190 CONTINUE
161      IDN=IDN+1
162      IGOY=IDIGIT(IDN)+1
163      GO TO (200,210,230,240,250,310),IGOT
164  C
165  C      OP IS RJ (010)
166  C
167 200 CONTINUE
168      ITYPE=12
169      IDN=IDN+1
170      GO TO 110
171  C
172  C      OP IS 011 OR 012
173  C
174 210 CONTINUE
175      ITYPE=IGOT
176  C
177  C      PROCESS INSTRUCTION OF THE FORM  OP 0J+K
178  C
179 220 CONTINUE
180      IF(IDN,GT,13) GO TO 90
181      IDN=IDN+1
182      IOPRN(1,IPART)=IMB
183      IOPRN(2,IPART)=IMEG(IDN)
184      IOPNO=3

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185          GO TO 110
186      C
187      C      OP IS MJ
188      C
189      230 CONTINUE
190          ITYPE=4
191          IF(IDIGIT(IDN+1).NE.0.OR.IDIGIT(IDN+2).NE.0) GO TO 220
192          IF(IDN.GT.13) GO TO 90
193          IDN=IDN+7
194          GO TO 160
195      C
196      C      OP IS 014 OR 015
197      C
198      240 CONTINUE
199          ITYPE=IGOT
200      C
201      C      PROCESS INSTRUCTION OF THE FORM  OPJ  XK
202      C
203          IDN=IDN+1
204          IREG(IPART)=INEQ(IDN)
205          IDN=IDN+1
206          IOPRN(1,IPART)=IMX
207          IOPRN(2,IPART)=INEQ(IDN)
208          GO TO 160
209      C
210      C      OP IS 016
211      C
212      250 CONTINUE
213          IF(IDIGIT(IDN+1).NE.0) GO TO 280
214          ITYPE=7
215      C
216      C      PROCESS INSTRUCTION OF THE FORM  OP  BK
217      260 CONTINUE
218          IDN=IDN+2
219      270 CONTINUE
220          IOPRN(1,IPART)=IMB
221          IOPRN(2,IPART)=INEQ(IDN)
222          GO TO 160
223      280 CONTINUE
224          IF(IDIGIT(IDN+2).NE.0) GO TO 290
225          ITYPE=8
226      C
227      C      PROCESS INSTRUCTION OF THE FORM  OPJ
228      C
229          IDN=IDN+1
230          IREG(IPART)=INEQ(IDN)
231          IDN=IDN+1
232          GO TO 160
233      290 CONTINUE
234          ITYPE=9
235      C
236      C      PROCESS INSTRUCTION OF THE FORM  OPJ  BK
237      C
238      300 CONTINUE
239          IDN=IDN+1
240          IREG(IPART)=INEQ(IDN)
241          IDN=IDN+1

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242          GO TO 270
243      C
244      C      OP IS 017
245      C
246      310 CONTINUE
247          IF(IDIGIT(IDN+1),NE,0) GO TO 320
248          ITYPE=10
249          GO TO 260
250      320 CONTINUE
251          ITYPE=11
252          GO TO 300
253      C
254      C      OP IS JP (02)
255      C
256      330 CONTINUE
257          ITYPE=13
258      C
259      C      PROCESS INSTRUCTION OF THE FORM OP   BJ,K
260      C
261          IF(IDN,GT,12) GO TO 90
262          IDN=IDN+1
263          IOPRN(1,IPART)=1HB
264          IOPRN(2,IPART)=IHFQ(IDN)
265          IDN=IDN+1
266          IOPNO=3
267          GO TO 110
268      C
269      C      FIRST TWO DIGITS OF OP ARE 03
270      C
271      340 CONTINUE
272          IF(IDN,GT,12) GO TO 90
273          IDN=IDN+1
274          IGOT=IDIGIT(IDN)
275          ITYPE=IGOT+14
276      C
277      C      PROCESS INSTRUCTION OF THE FORM OP   XJ,K
278      C
279          IDN=IDN+1
280          IOPRN(1,IPART)=1HX
281          IOPRN(2,IPART)=IMEQ(IDN)
282          IOPRN(3,IPART)=1H,
283          IOPNO=4
284          GO TO 110
285      C
286      C      FIRST TWO DIGITS OF OP ARE 04,05,06,OR 07
287      C
288      350 CONTINUE
289          IF(IDN,GT,12) GO TO 90
290          ITYPE=IGOT+17
291      C
292      C      PROCESS INSTRUCTION OF THE FORM OP   B1,BJ,K
293      C
294          IDN=IDN+1
295          IOPRN(1,IPART)=1HB
296          IOPRN(2,IPART)=IMEQ(IDN)
297          IOPRN(3,IPART)=1H,
298          IOPRN(4,IPART)=1HB

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299 ION=ION+1
300 IOPRN(5,I PART)=IMEQ(IDN)
301 IOPRN(6,I PART)=IM,
302 IOPNO=7
303 GO TO 110
304
305 FIRST DIGIT OF OP IS 1. OP IS BXI.
306
307 360 CONTINUE
308 ITYPE=26
309 IDN=IDN+1
310 IGOT=IDIGIT(IDN)+1
311 GO TO (370,370,370,370,430,430,430),IGOT
312
313 PROCESS INSTRUCTION OF THE FORM OPI XJ
314 XJ=XK
315 XJ=XK
316 XJ=XK
317 XJ/XK
318
319 (IGOT=1,2,3,4,OR 5)
320 CONTINUE
321 IDN=IDN+1
322 IREG(I PART)=IMEQ(IDN)
323 IDN=IDN+1
324 IOPRN(1,I PART)=IMX
325 IOPRN(2,I PART)=IMEQ(IDN)
326 IDN=IDN+1
327 IF(IGOT.EQ.1) GO TO 160
328 KREG=IMEQ(IDN)
329 IOPNO=3
330 IGOT=IGOT+1
331 GO TO (380,400,410,420),IGOT
332
333 ADD ON *XK
334
335 380 CONTINUE
336 IOPRN(IOPNO,I PART)=IM+
337 CONTINUE
338 IOPRN(IOPNO+1,I PART)=IMX
339 IOPRN(IOPNO+2,I PART)=KREG
340 GO TO 160
341
342 ADD ON +XK
343
344 400 CONTINUE
345 IOPRN(IOPNO,I PART)=IM+
346 GO TO 350
347
348 ADD ON *XK
349
350 410 CONTINUE
351 IOPRN(IOPNO,I PART)=IM+
352 GO TO 390
353
354 ADD ON /XK
355
356
357

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```

356      428 CONTINUE
357      IOPRN(IOPNO,IPART)=IH/
358      GO TO 398
359      C
360      C      PROCESS INSTRUCTION OF THE FORM OPI      =XK
361      C      =XK+XJ
362      C      =XK+XJ
363      C      =XK+XJ
364      C      (IGOT=5,6,7,OR 8)
365      C
366      438 CONTINUE
367      IDN=IDN+1
368      IREG(IPART)=IMEQ(IDN)
369      IDN=IDN+1
370      KREG=IMEQ(IDN)
371      IOPRN(1,IPART)=IH=
372      IOPRN(2,IPART)=IMX
373      IDN=IDN+1
374      IOPRN(3,IPART)=IMEQ(IDN)
375      IF(IGOT,EQ,5) GO TO 168
376      IGOT=IGOT+5
377      IOPNO=4
378      GO TO (388,488,418),IGOT
379      C
380      C      FIRST DIGIT OF OP IS 2
381      C
382      448 CONTINUE
383      IDN=IDN+1
384      IGOT=IDIGIT(IDN)+1
385      GO TO (458,488,498,488,498,498,498),IGOT
386      C
387      C      OP IS LXI
388      C
389      458 CONTINUE
390      ITYPE=27
391      IF(IGOT,EQ,1) GO TO 478
392      C
393      C      PROCESS INSTRUCTION OF THE FORM OPI      BJ,XK
394      C
395      468 CONTINUE
396      IDN=IDN+1
397      IREG(IPART)=IMEQ(IDN)
398      IDN=IDN+1
399      IOPRN(1,IPART)=IH=
400      IOPRN(2,IPART)=IMEQ(IDN)
401      IDN=IDN+1
402      IOPRN(3,IPART)=IM,
403      IOPRN(4,IPART)=IMX
404      IOPRN(5,IPART)=IMEQ(IDN)
405      GO TO 168
406      C
407      C      PROCESS INSTRUCTION OF THE FORM OPI      JK
408      C
409      478 CONTINUE
410      IDN=IDN+1
411      IREG(IPART)=IMEQ(IDN)
412      IDN=IDN+1

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413      IOPRN(1,IPART)=IMEQ(IDN)
414      IDN=IDN+1
415      IOPRN(2,IPART)=IMEQ(IDN)
416      IOPRN(3,IPART)=IHB
417      GO TO 160
418
419      C      OP IS AXI
420      C
421      480 CONTINUE
422      ITYPE=20
423      IF(IGOT,EQ,2) GO TO 470
424      GO TO 460
425
426      C      OP IS NXI,ZXI,UXI,OR PXI
427      C
428      490 CONTINUE
429      ITYPE=IGOT+25
430      GO TO 460
431
432      C      FIRST DIGIT OF OP IS 3
433      C
434      500 CONTINUE
435      IDN=IDN+1
436      IGOTP=IDIGIT(IDN)
437      ITYPE=IGOTP/2+30
438      IF(MOD(IGOTP,2).NE,0) GO TO 510
439      IGOT=3
440      GO TO 370
441      510 CONTINUE
442      IGOT=4
443      GO TO 370
444
445      C      FIRST DIGIT OF OP IS 4
446      C
447      520 CONTINUE
448      IDN=IDN+1
449      IGOT=IDIGIT(IDN)+1
450      GO TO (530,540,550,570,580,500,590,570),IGOT
451
452      C      OP IS FLOATING MULTIPLY
453      C
454      530 CONTINUE
455      ITYPE=34
456      GO TO 560
457      540 CONTINUE
458      ITYPE=36
459      GO TO 560
460      550 CONTINUE
461      ITYPE=35
462      560 CONTINUE
463      IGOT=2
464      GO TO 370
465
466      C      OP IS MXI OR CXI
467      C
468      570 CONTINUE
469      ITYPE=20

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```

470             IF(IGOT,EQ,7) ITYPE=39
471             GO TO 470
472 C
473 C         OP IS FLOATING DIVIDE
474 C
475         580 CONTINUE
476             ITYPE=34
477             IF(IGOT,EQ,5) ITYPE=36
478             IGOT=5
479             GO TO 370
480 C
481 C         OP IS NO
482 C
483         590 CONTINUE
484             ITYPE=35
485 C
486 C         PROCESS IS BIT INSTRUCTION OF THE FORM OP N
487 C
488         600 CONTINUE
489             IDN=IDN+1
490             IF(IDIGIT(IDN).NE.0.OR.IDIGIT(IDN+1).NE.0.OR.IDIGIT(IDN+2).NE.0)
491             1 GO TO 610
492             IDN=IDN+2
493             GO TO 160
494         610 CONTINUE
495             IOPRN(1,IPART)=IMEQ(IDN)
496             IOPRN(2,IPART)=IMEQ(IDN+1)
497             IOPRN(3,IPART)=IMEQ(IDN+2)
498             IOPRN(4,IPART)=IMB
499             IDN=IDN+2
500             GO TO 160
501 C
502 C         OP BEGINS WITH 5,6,OR 7
503 C
504         620 CONTINUE
505             ITYPE=IGOT+34
506             IDN=IDN+1
507             IGOT=IDIGIT(IDN)+1
508             IF(IGOT,LT,4,AND.IDN,GT,12) GO TO 90
509             IDN=IDN+1
510             IREG(IPART)=IMEQ(IDN)
511             IDN=IDN+1
512             JREG=IMEQ(IDN)
513             IF(IGOT,LT,4) GO TO 630
514             IDN=IDN+1
515             KREG=IMEQ(IDN)
516         630 CONTINUE
517             GO TO (640,660,670,680,700,710,730,750),IGOT
518         640 CONTINUE
519             IOPRN(1,IPART)=IMA
520         650 CONTINUE
521             IOPRN(2,IPART)=JREG
522             IOPNO=3
523             GO TO 110
524         660 CONTINUE
525             IOPRN(1,IPART)=IMB
526             GO TO 650

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527      670 CONTINUE
528      IOPRN(1,IPART)=1HX
529      GO TO 650
530      680 CONTINUE
531      IOPRN(1,IPART)=1HX
532      IOPRN(3,IPART)=1H+
533      690 CONTINUE
534      IOPRN(2,IPART)=JREG
535      IOPRN(4,IPART)=1HB
536      IOPRN(5,IPART)=KREG
537      GO TO 160
538      700 CONTINUE
539      IOPRN(3,IPART)=1H+
540      GO TO 720
541      710 CONTINUE
542      IOPRN(3,IPART)=1H=
543      720 CONTINUE
544      IOPRN(1,IPART)=1HA
545      GO TO 690
546      730 CONTINUE
547      IOPRN(3,IPART)=1H+
548      740 CONTINUE
549      IOPRN(1,IPART)=1HB
550      GO TO 690
551      750 CONTINUE
552      IOPRN(3,IPART)=1H=
553      GO TO 740
554      C
555      760 FORMAT(1H ,06,3X020,3X8(1H=),
556      1 54HWORD CONTAINS ILLEGAL INSTRUCTION'D), MUST BE DATA OR ,
557      2 10HCL0BBERED,,8(1H=))
558      770 FORMAT(1H ,06,3X020,4(3XA2,A1,3X13A1))
559      END

```

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-----
1      SUBROUTINE PABORT
2      C
3      C      ROUTINE TO HANDLE ABORT EXCHANGE PACKAGE DUMPS
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T=3,1974
6      C
7      C      INTEGER SHIFT
8      C      LOGICAL FILM
9      C      COMMON/YBC5/RESTRY,FILM,PAPER,IPD,IFD
10     C      COMMON/IEDMP/IDUMP(16)
11     C
12     C      PRINT CP TIME AT ABORT SO A TIME LIMIT ABORT IS EASILY
13     C      DISTINGUISHABLE
14     C
15     C      CALL SECOND(TJLN)
16     C      DO 10 IPX=6,IFD,6
17     C      10 WRITE(IPX,30) TJLN

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18      C
19      C      PRINT THE HARDWARE EXCHANGE PACKAGE
20      C
21      DO 20 IPX=6,IFD,6
22      20 WRITE(IPX,40)
23      CALL DMPPK(6,IDUMP)
24      C
25      C      SEND IT TO FILM IF FILM IS ,TRUE,
26      C
27      IF(FILM) CALL DMPPK(12,IDUMP)
28      ENTRY POMPPK
29      C
30      C      GET THE P COUNTER FOR THE ABORT
31      C
32      IFW=SHIFT(IDUMP,-36)
33      C
34      C      SUBTRACT 32 (40 OCTAL) FROM IT. IF RESULT IS NEGATIVE,SET IT
35      C      TO ZERO,
36      C
37      IFW=IFW-32
38      IF(IFW,LT,0) IFW=0
39      C
40      C      ADD 37 OCTAL (IFW=408+778) TO P COUNTER, IF RESULT IS OUT OF
41      C      RANGE,SET IT TO 778,
42      C
43      IFWB=IFW+778
44      IF(IFW,GT,1500778) IFW=0
45      IF(IFWB,GT,1500778) IFWB=778
46      C
47      C      PRINT OP CODE DUMP AROUND ABORT ADDRESS
48      C
49      CALL OPDMP(IFW,IFWB,6)
50      C
51      C      SEND OP CODE DUMP TO FILM IF FILM IS ,TRUE,
52      C
53      IF(FILM) CALL OPDMP(IFW,IFWB,12)
54      RETURN
55      C
56      30 FORMAT(1H1,21HCP TIME AT ABORT WAS ,F9,3)
57      40 FORMAT(//1H ,10(1H+),25HHARDWARE EXCHANGE PACKAGE,10(1H+))
58      END

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```

1      SUBROUTINE PARPLY
2      C
3      C      ROUTINE TO PLOT PARTICLES
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1975
7      C
8      *      ----- BEGIN COMDECK PARAM -----
9      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,

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10      1 NLC3P,NLC34,IFLMSZ
11      *      ----- END COMDECK PARAM          -----
12      *      ----- BEGIN COMDECK YSTORE          -----
13      *      ----- BEGIN COMDECK YAQDIM          -----
14      DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
15      1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
16      2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CG(1),VTIL(1)
17      3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUQ
18      4 (1),SIG(1),TUS(1),GRROZ(1),GRROP(1),GRROV(1),MTIL(1),
19      5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1)
20      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21      *      ----- END COMDECK YAQDIM          -----
22      *      ----- BEGIN COMDECK YAQSC          -----
23      LOGICAL RESTRT,FILM,PAPER,TURB
24      REAL LAM,MU
25      C      COMMON/YSC1/AASC(NSCP1)
26      COMMON/YSC /AASC(9600)
27      COMMON/YSC2/AA(1),ANC,A0,A0FAC,AGM,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
28      1 DTC(10),DTC(10),DTC2,DTC8,DTC05,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
29      2 FIPYR,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
30      3 IDTO,IJ,IJM,IJP,M,I,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
32      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
33      1 NCYC,NLC,NPS,NPT,NG,NQ1,NQ10,NQ12,NQ18,NQ19,NQ12,NSC,NUMIT,ZORIG,QM,DMCYL,PXCONV
34      2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
35      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUGI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
37      1 ILNG,NILNG,TP3,TUPOD,TQSAV,TK,TI,TUGENG,EP1,SAV1,OLEVEL,TQ,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DYLAST,FIYBO,IYBO,YCNVLD,
39      3 XCNVLD,FIKRO,FIKLO,IKRO,IKLO,ISV,JSVH,QMN,GMX,WMAX,JNM,TZ,TLIM,
40      4 ROMFXR,ROMFYT,ROMFYB,JOUMP,TWTHRD,TE,DTR,THASS,DTVSAV,DTCSAV,IDTV
41      5 ,JDTV,JDTC,JDTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITG,JTG
42      6 ,THASSV,WMAXEF,RMINEF,TSTRTD
43      COMMON/YSC2/ZZ
44      C      COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
47      *      ----- END COMDECK YAQSC          -----
48      *      ----- BEGIN COMDECK YAQEQ          -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PM0,DKLSM,RMP),(AASC(19
53      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PMU,PX),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CG,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROZ),(AASC(22),GRROZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROP,TUQVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      ! AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      *      ----- END COMDECK YAQEQ          -----
63      *      ----- END COMDECK YSTORE          -----
64      *      ----- BEGIN COMDECK PCALL          -----
65      COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
66      *      ----- END COMDECK PCALL          -----

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67      COMMON/XTENC/XTEN,YTEN
68      DATA RCD/1H /
69      C
70      C      ADVANCE FILM TO NEXT FRAME
71      C
72      CALL ADV(1)
73      C
74      C      INITIALIZE PLOT VALUES
75      C
76      IPXL=65
77      IPXR=660
78      IPYB=900
79      FIPXL=65.
80      FIPXR=660.
81      FIPYB=900.
82      YUP=PTOP+2.*PRITE
83      YLB=PROTM-3.*PRITE
84      PYCNVP=FLOAT(IPYT-IPYB)/(YUP-YLB)
85      PXCONV=PXCONV+PYCNVP/PYCONV
86      PYCONV=PYCNVP
87      C
88      C      SET UP CALL TO TICHOX
89      C
90      XCONVP=PXCONV
91      YCONVP=PYCONV
92      IXL SV=IXL
93      IXRSV=IXR
94      IYBSV=IYB
95      IYTSV=IYT
96      IXL=IPXL
97      IXR=IPXR
98      IYB=IPYB
99      IYT=IPYT
100     FIYRSV=FIYB
101     FIXLSV=FIXL
102     FIYB=FIYB
103     FIXL=FIXL
104     C
105     C      DRAW AND LABEL THE PLOT FRAME
106     C
107     CALL TICHOX
108     C
109     C      LABEL THE PARTICLE PLOT
110     C
111     CALL LINENT(60)
112     *WRITE(1FD,100) PXR,PYB,PYT
113     WRITE(1FD,113) JNM,NAME,T,NCYC
114     C
115     C      LOOP OVER ALL THE PARTICLES AND PLOT THEM
116     C
117     C      IFCP IS THE LCM INDEX
118     C      NPPT IS THE PARTICLE COUNTER
119     C
120     IFCP=1
121     NPPT=0
122     C
123     C      BRING A BUFFER=LOAD OF PARTICLE DATA FROM LCM INTO SCM

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124 C
125 10 CALL ECRD(AASC,NLCP1+IECP-1,LPH,IDUM)
126 C
127 C KP IS THE SCM INDEX
128 C
129 KP=1
130 C
131 C SKIP THE PARTICLE IF ITS X=COORDINATE IS NEGATIVE
132 C
133 20 IF(XPAR(KP),LT,0.) GO TO 30
134 C
135 C CALCULATE THE RASTER COORDINATES OF THE PARTICLE
136 C
137 IX1=FIXXL+(XPAR(KP)-PXL)*PXCONV
138 IY1=FIXYH+(YPAR(KP)-YLR)*PYCONV
139 C
140 C PLOT IT UNLESS IT IS OUTSIDE OF THE PLOTTING RECTANGLE
141 C
142 IF((IX1.GT,IXR.OR,IX1.LT,IXL) GO TO 30
143 IF((IY1.GT,IYH).OR,(IY1.LT,IYB)) GO TO 30
144 CALL PLT(IX1,IY1,42)
145 CALL PLT(IX1,IY1,42)
146 CALL PLT(IX1,IY1,42)
147 C
148 C INCREMENT THE PARTICLE COUNTER AND SEE IF ALL HAVE BEEN PLOTTED
149 C
150 30 NPPT=NPPT+1
151 IF(NPPT,EQ,NPT) GO TO 40
152 C
153 C NO, INCREMENT THE SCM POINTER AND SEE IF THE BUFFER NEEDS TO
154 C BE REFILLED.
155 C
156 KP=KP+1
157 IF(KP,LT,LPH) GO TO 20
158 C
159 C YES, INCREMENT THE LCM INDEX AND GO REFILL THE SCM BUFFER.
160 C
161 IFCP=IECP+LPH
162 GO TO 10
163 C
164 C ALL PARTICLES HAVE BEEN PLOTTED, SEE IF ANY TIME-DEPENDENT
165 C PLOTTING IS DESIRED.
166 C
167 40 CONTINUE
168 IF(IST,LF,0) GO TO 60
169 C
170 C YES, SEE IF THERE HAVE BEEN AT LEAST TWO TIME PERIODS SAVED.
171 C
172 IF(NILNG,LT,2) GO TO 60
173 C
174 C YES, PREPARE TO DO THE TIME-DEPENDENT PARTICLE PLOT.
175 C
176 CALL ADV(1)
177 CALL TICH0X
178 NIST=NPPT/IST
179 NTOT=NPPT/NIST
180 DO 70 I=1,NTOT

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181      DO A2 J=1,NILNG
182      C
183      C      SAVE THE LAST POSITION IN TIME
184      C
185      IX3=IX2
186      IY3=IY2
187      IOK3=IOK2
188      IREFGIN=NLCPI+NLCPI2+2*(NP1*(J-1)+I-1)
189      CALL ECRD(XTEN,IREFGIN,2,I0UM)
190      C      IX2=FITPXL*(PAX(I,J)-XL)*PXCONV
191      IY2=FITPXL*(XTEN-XL)*PYCONV
192      C      IY2=FITPYH*(PAY(I,J)-YLB)*PYCONV
193      IY2=FITPYR*(VTEN-YLB)*PYCONV
194      IOK2=P
195      IF((IX2.GT.IXR.OR.IY2.LT.IXL.OR.IY2.GT.IYR.OR.IY2.LT.IYT) IOK2=1
196      C
197      C      MARK THE INITIAL POSITION WITH A STAR
198      C
199      IF(J.NE.1) GO TO 50
200      IF(IOK2.EQ.0) CALL PLT(IX2,IY2,40)
201      GO TO 60
202      50 CONTINUE
203      C
204      C      MARK PARTICLES WITH A DOT
205      C
206      IF(IOK2.EQ.0) CALL PLT(IX2,IY2,27)
207      C
208      C      CONNECT THE PARTICLE WITH ITS NEIGHBOR IN TIME
209      C
210      IF(IOK2.EQ.0.AND.IOK3.EQ.0) CALL DRV(IX2,IY2,IX3,IY3)
211      60 CONTINUE
212      70 CONTINUE
213      C
214      C      LABEL THE PLOT
215      C
216      CALL LINENT(60)
217      WRITE(1FD,40)
218      WRITE(1FD,110) JNM,NAME,T,WCYC
219      80 CONTINUE
220      C
221      C      RESTORE THE PLOT INDICES
222      C
223      IXL=IXLSV
224      IXR=IXRSV
225      IYB=IYBSV
226      IYT=IYTSV
227      FIVB=FIYBSV
228      FIXL=FIXLSV
229      RETURN
230      C
231      90 FORMAT(25H TIME-DEPENDENT PARTICLES)
232      100 FORMAT(10H PARTICLES/11X5H PXR=1PE12,5,5H PYR=1PE12,5,5H PYT=1PE12,5)
233      110 FORMAT(1H ,4X1H,5A1P,3X2HT=,1PE12,5,1X6HWCYC=,15)
234      END

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1      SUBROUTINE PCHECK
2      C
3      C      ROUTINE TO CHECK THE YAGUI LARGE AND SMALL CORE PARAMETERS
4      C
5      C      WRITTEN BY J.L.NORTON, LASL T-3, 1975
6      C
7      *
8      *      ----- BEGIN COMDECK PARAM -----
9      COMMON/PCOM/NSCP1,ITARP,ITARXP,ITARYP,IPFR,NP1,NP2,NLCP1,NLCP2,
10      1 NLCP3,NLCP4,IFLMSZ
11      *      ----- END COMDECK PARAM -----
12      *      ----- BEGIN COMDECK YAGSC -----
13      LOGICAL HESTRT,FILM,PAPER,TURR
14      REAL LAM,MU
15      C      COMMON/YSC1/AASC(NSCP1)
16      COMMON/YSC1/AASC(9600)
17      COMMON/YSC2/AA(1),ANC,AP,APFAC,APM,BR,COLAMU,CYL,DR,DT,DTC,DTFAC,
18      1 DTD(10),DTC(10),DT02,DT0A,DTP0S,DTV,DZ,EM10,EP3,FIPXL,FIPXM,
19      2 FIPYR,FIPYT,FIXL,FIXR,FIVR,FIVY,FREZXR,GH,GHDFL,GZ,GZP,I,IBAR,
20      3 IDTD,IJ,IJM,IJP,IM,IPL,IPXR,IPYR,IPYT,IP1,IP2,ISC2,ISC3,ITY,
21      4 IUNF,IXL,IXR,IYR,IYT,J,JBAR
22      COMMON/YSC2/JCFN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPH,MU,NAME(A),
23      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
24      2 ,PYL,PXR,PYR,PYCONV,PYT,PUT,REZMON,REZSI,REZYH,RIRAR,RIRJH,
25      3 FREZYT,FREZYR,ROMFY,1,THIRD,NCLST,TOUT,TWFIN
26      COMMON/YSC2/TUN1,TUSI,NCQ,NEG,TNEGSV,TUSV,TUWA,PTOP,PRITE,PHOTM,
27      1 ILNG,NILNG,TP3,TUPNT,TOSAV,TK,TI,TUDENG,EP1,SAV1,3LEVFL,TD,IST,
28      2 VV,XCONV,XL,XR,YR,YCONV,YT,PTPOL,DTSV,DLAST,FIVRO,IYRO,YCNULD,
29      3 YCNULD,FIXRO,FIXLO,IXRO,IXLO,ISV,JSV,OM,OMK,OMAX,JNM,T2,TLTM,
30      4 ROMFYR,ROMFYT,ROMFYB,JUMP,TWTHR,TE,DTR,THASS,DTVSAY,DTCAY,DTV
31      5 ,JDTV,DTTC,DTTC,CIRC,TIS,PTF,UMOM,VOM,THAX,TGMX,ITH,JTH,ITG,JTG
32      6 ,THASSV,WHAXFF,WHINEF,T3HTD
33      COMMON/YSC2/ZZ
34      C      COMMON/YSC4/ITAP(IT4BP)
35      COMMON/YSC4/ITAN(1000)
36      COMMON/YSC5/HESTRY,FILM,PAPER,IPD,IFD
37      *      ----- END COMDECK YAGSC -----
38      C      CHECK TO MAKE SURE THE SCM BUFFER WILL BE LARGE ENOUGH
39      C
40      C      IF(3*NG1.GT.NSCP1) CALL UNCLE(4,5MPCHECK,33,
41      1 33NOT ENOUGH SMALL CORE FOR BUFFERS)
42      C
43      C      MAKE SURE LCM IS LARGE ENOUGH TO HOLD ALL THE ARRAYS
44      C
45      C      IF(NLC.GT.NLCP1) CALL UNCLE(4,5MYAST,14,33NOT ENOUGH LCM)
46      RETURN
47      END

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1      SUBROUTINE PRIGEN

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116 C          VMAY AND VMIN ARE COMPUTED IN A SIMILAR FASHION.
117 C
118 C          IF (FREZXR.GT.1.) XMAX=(FLOAT(JUNF)+FREZXR*(1.-FREZXH*((BAR-JUNF)
119 1  +RD*FXR)+DD
120 C          IF (FREZYT.GT.1.) YMAX=REZYR*(FLOAT(JUNFQ2)+FREZYT*(1.-FREZYT*((
121 1  JPAR-JCEN-JUNFQ2))+RD*FYR)+DZ
122 C          IF (FREZYR.GT.1.) YMIN=REZYR*(FLOAT(JUNFQ2)+FREZYR*(1.-FREZYH*((
123 1  JCEN-JUNFQ2))+RD*FYR)+DZ
124 C
125 C          READ IN QUANTITIES FOR ONE PARTICLE REGION, FIRST SET DEFAULT
126 C          VALUES.
127 C
128 C          IN CONTINUE
129 C
130 C          ORPAR IS THE R DIMENSION OF THE RECTANGLE IN THE MIDDLE OF WHICH
131 C          ONE PARTICLE WILL BE PLACED
132 C
133 C          ORPARM*,
134 C
135 C          OZPAR IS THE Z RECTANGULAR DIMENSION
136 C
137 C          OZPARM*,
138 C
139 C          XC,YC,XD,AND YD ARE THE DIMENSIONS OF THE ENTIRE PARTICLE REGION,
140 C          IF THE REGION IS RECTANGULAR,(XC,YC) IS THE LOWER LEFT-HAND
141 C          CORNER AND (XD,YD) IS THE UPPER RIGHT-HAND CORNER. IF THE
142 C          REGION IS CIRCULAR,ORPAR,YC IS UNUSED,YC IS THE Z VALUE OF
143 C          THE CENTER OF THE CIRCLE (ASSUMED TO BE ON THE AXIS OF
144 C          SYMMETRY),AND XD IS THE RADIUS OF THE CIRCLE.
145 C
146 C          XC*,
147 C          YC*,
148 C          XD*,
149 C          YD*,
150 C
151 C          ON THE ACTUAL READ
152 C
153 C          CALL NAMELIST(PARTN,5,(FLAG))
154 C
155 C          CHECK FOR INPUT ERRORS
156 C
157 C          IF (FLAG.NE.0) CALL UNCLE(4,AMPHIGH,2*,
158 1  2NDPARTN,NAMELIST INPUT ERROR)
159 C
160 C          SEE IF THIS WAS THE LAST PARTICLE REGION, IF SO,WE ARE ALL DONE.
161 C
162 C          IF (ORPAR.LE.0.) GO TO 168
163 C
164 C          NO, CHECK FOR INPUT ERRORS.
165 C
166 C          IF (OZPAR.LE.0.) CALL UNCLE(4,AMPHIGH,10,1+ERROR IN OZPAR)
167 C          IF (XD.LE.0. AND YD.LE.0.) CALL UNCLE(4,AMPHIGH,11,1+ERROR IN YD)
168 C
169 C          NO ERRORS, PRINT OUT THE INPUT VARIABLES.
170 C
171 C          DO 20 IPAR,1,0,6
172 C          20 WRITE(10,100) ORPAR,OZPAR,XC,YC,XD,YD

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173 C
174 C SEE IF PARTICLE REGION IS RECTANGULAR OR CIRCULAR
175 C
176 C IF (YD,EQ,D,) GO TO 40
177 C
178 C REGION IS RECTANGULAR, SET PARTICLE REGION BOUNDS, IF VARIABLE
179 C ZONING IS BEING USED, PARTICLE REGION BOUNDS ARE SET TO
180 C PROBLEM BOUNDS.
181 C
182 C IF (FREZXX,EQ,1.,AND,FREZYT,EQ,1.,AND,FREZYR,EQ,1.) GO TO 30
183 C
184 C VARIABLE ZONING
185 C
186 C PRTOP=MAX
187 C PROTH=MIN
188 C PRITE=MAX
189 C PLEFT=0,
190 C GO TO 50
191 C
192 C UNIFORM ZONING
193 C
194 C 30 CONTINUE
195 C PTOP=YD
196 C PROTH=YC
197 C PRITE=XD
198 C PLEFT=XC
199 C GO TO 50
200 C
201 C REGION IS CIRCULAR
202 C
203 C 40 CONTINUE
204 C PTOP=YC=XD
205 C PROTH=YC=XD
206 C PRITE=XD
207 C PLEFT=XR,
208 C R2=XD**2
209 C 50 CONTINUE
210 C
211 C INITIALIZE THE OLD PTOP
212 C
213 C PTOPOLD=PTOP
214 C
215 C BEGIN LOOP OVER PARTICLES
216 C
217 C INITIALIZE THE Y COORDINATE
218 C
219 C YTE=PROTH+.5*OZPAR
220 C 60 CONTINUE
221 C
222 C INITIALIZE THE X-COORDINATE
223 C
224 C XTE=PLEFT+.5*ORPAR
225 C 70 CONTINUE
226 C
227 C IF PARTICLE REGION IS CIRCULAR,AN EXTRA CHECK MUST BE MADE TO
228 C SEE IF THE PARTICLE IS IN THE REGION
229 C

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230      IF(YD,NE,N.) GO TO 80
231      IF((YTE+YC)**2+XTE**2,GT,R2) GO TO 100
232      80 CONTINUE
233      C
234      C      STORE THE PARTICLE COORDINATES AND THE PARTICLE MASS
235      C
236      XPAR(KP)=XTE
237      YPAR(KP)=YTE
238      MPAR(KP)=0.
239      C
240      C      INCREMENT THE SCM BUFFER SUBSCRIPT AND THE PARTICLE COUNT
241      C
242      KP=KP+3
243      NPT=NPT+1
244      C
245      C      SEE IF THE SCM BUFFER NEEDS TO BE FLUSHED
246      C
247      IF(KP,GT,LPR) GO TO 110
248      C
249      C      NO. INCREMENT THE PARTICLE X-COORDINATE.
250      C
251      90 XTE=XTE+DXPAR
252      C
253      C      SEE IF WE HAVE GONE OUTSIDE OF THE PARTICLE REGION
254      C
255      IF(XTE,LE,PRITE) GO TO 70
256      C
257      C      YES. INCREMENT THE PARTICLE Y-COORDINATE.
258      C
259      100 YTE=YTE+DZPAR
260      C
261      C      SEE IF Y HAS GONE OUTSIDE THE PARTICLE REGION
262      C
263      IF(YTE,LE,PTOP) GO TO 60
264      C
265      C      YES. WE ARE DONE WITH THIS PARTICLE REGION. GO READ IN ANOTHER
266      C      CARD.
267      C
268      GO TO 10
269      C
270      C      FLUSH THE BUFFER TO LCM IF THERE IS ROOM
271      C
272      110 CONTINUE
273      IF(IJCP+LPR,LE,NLCP2+NLCP1) GO TO 130
274      120 CALL UNCLE(4,6,MPRTGEN,25,25,MPARTICLE ARRAY OVERFLOWED)
275      130 CONTINUE
276      CALL ECHW(AASC,NLCP1+IJCP-1,LPR,IDUM)
277      C
278      C      INCREMENT THE LCM ADDRESS, RESET THE SCM SUBSCRIPT, AND PROCEED
279      C
280      IJCP=IJCP+LPR
281      KP=1
282      GO TO 90
283      C
284      C      ALL DONE. FLUSH THE SCM BUFFER TO LCM IF THERE IS ROOM.
285      C
286      140 CONTINUE

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```

287      NMAXP=1
288      IF(NM.EQ.0) GO TO 150
289      IF((IECP+NM.GT.NLCP2+NLCP1) GO TO 120
290      CALL FCNR(AASC,NLCP1+IECP+1,N=1000)
291      150 CONTINUE
292      C
293      C      NPS IS THE NO. OF WORDS OF PARTICLE STORAGE
294      C
295      NPS=3+NPT
296      C
297      C      PRINT OUT THE NO. OF PARTICLES GENERATED AND THEIR TOTAL MASS
298      C
299      DO 160 (PX=6,IFD,6
300      160 WRITE(IPX,100) NPT,MT
301      RETURN
302      170 CONTINUE
303      CALL UNCLE(0.4,MPRTGEN,35,35,MPARTN,NAMFLIST,INITIALIZATION ERROR)
304      C
305      180 FORMAT(AH,DPAR=1P12.5,AH,DZPAR=12.5,5M,XC=12.5/5M,YC=12.5
306      1,5M,XDE=12.5,5M,YDE=12.5)
307      190 FORMAT(4X16,30M,PARTICLES GENERATED, WITH TOTAL MASS=1P12.5)
308      END

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1      SUBROUTINE PRTHOV
2      C
3      C      ROUTINE TO MOVE PARTICLES
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T=3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T=3,1975
7      C
8      *
9      *      ***** BEGIN COMDECK PARAM *****
10     COMMON/PCOM/NSCP1,ITARP,ITARXP,ITABYP,IPFR,NP1,NP2,NLCP1,NLCP2,
11     1 NLCP3,NLCP4,IFLMSZ
12     *
13     *      ***** END COMDECK PARAM *****
14     *
15     *      ***** BEGIN COMDECK YSTORE *****
16     *
17     *      ***** BEGIN COMDECK YADIM *****
18     *
19     *      DIMENSION X(1),XPAR(1),R(1),VPAR(1),Y(1),MPAR(1),U(1),UG(1),DELISM(
20     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSO(1),F(1),ETIL(1),RVOL
21     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
22     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),OLSRQI(1),OLSRQO(1),CAPGAM(1),TUO
23     4 (1),SIG(1),TUS(1),GRRO(1),GRROZ(1),GRROP(1),TUQVEC(1),MTIL(1),
24     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
25     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
26     *
27     *      ***** END COMDECK YADIM *****
28     *
29     *      ***** BEGIN COMDECK YAQSC *****
30     *
31     *      LOGICAL RESTR7,FILM,PAPER,TUOR
32     *
33     *      REAL LAM,MU
34     *
35     *      COMMON/YSC1/AASC(NSCP1)
36     *
37     *      COMMON/YSC1/AASC(9600)
38     *
39     *      COMMON/YSC2/AA(1),ANC,AP,AGFAC,ADM,B0,COLAMU,CYL,DR,DT,DTC,DTPAC,
40     1 DTC(10),DTC(10),DT02,DT08,DTPQS,DIV,OZ,EM10,EPS,FIPXL,FIPXR,

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29      2 FIPYB,FIPYT,FIYL,FIYR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IHAR,
30      3 IOTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYR,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31      4 IUNF,IXL,IXR,IYR,IYT,J,JHAR
32      COMMON/YS2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,XX1,LAM,LPH,MU,NAME(6),
33      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIR,NQI2,NSC,NUMIT,ZOWIG,OM,OMCYL,PXCONV
34      2 ,PXL,PXR,PYR,PYCONV,PYT,POT,REZRON,REZSIE,REZYR,RHAR,RHJB,
35      3 FREZYT,FREZYR,ROMFR,T,TMPO,NCLST,TOUT,TWFIN
36      COMMON/YS2/TU02,TUSI,NCO,TNEG,TNEG5V,TUSV,TUHR,PTOP,PRITE,PROTH,
37      1 TLNG,NILNG,TP3,TUPOT,TQSAV,TX,TI,TUGENG,EP1,SAV1,QLFVEL,TC,IST,
38      2 VV,XCONV,XL,XH,YH,YCONV,YT,PTPOLD,DTSV,DLAST,FIVRO,IYNO,YCONVL0,
39      3 XCONVL0,FXRO,FXLO,IXRO,IXLO,ISVH,JSVH,QMH,QMX,WHAX,JNH,T2,TLIN,
40      4 ROMFXR,ROMFYT,ROMFYH,JDUMP,TWYHRD,TE,DTR,TMASS,DTSVAV,DTC SAV,IDIV
41      5 ,JOTV,JDTC,JDTC,CIRC,TIS,POTF,UMOM,VHOM,TMAX,TGMX,ITM,JTM,ITG,JTG
42      6 ,TMASSV,MAXFZ,RHINEF,YSTOTD
43      COMMON/YS2/ZZ
44      C      COMMON/YS4/ITAH(ITARP)
45      C      COMMON/YS4/ITAP(1772)
46      C      COMMON/YS5/ISTOT,FTLM,PAPER,IPD,IPC
47      *      ***** END COMDECK YAGSE *****
48      *      ***** BEGIN COMDECK YAGE *****
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),M,MPAR),(AASC(3),Y,YPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),W),(AASC(7),DLSM,RCSO,MP),(AASC
51      1 (8),F,FTIL,AMEA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PMH,DLSM,HMP),(AASC(9
53      3 ),PVOL),(AASC(10),M,PM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),VTIL,
54      4 NL,PNX,PU),(AASC(13),VTIL,VL,PMV,PV),(AASC(14),Q,CO,FOL),(AASC(17
55      5 ),PARGAN,UG),(AASC(18),THO),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROO,VR),(AASC(26),GHSV),(AASC(27),GRROR,TUGVEC,
58      8 YP0K),(AASC(28),MTIL),(AASC(29),CONE),(AASC(30),CTEMP,XR20K),(
59      9 AASC(31),ANGU),(AASC(32),ANGV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X20K)
61      REAL M,MP,MPAR,MTIL
62      *      ***** END COMDECK YAUER *****
63      *      ***** END COMDECK YSTORE *****
64      *      ***** BEGIN COMDECK PCOM *****
65      COMMON/XTEC/XTEH,YTEH,YTE,YTE,X1(4),Y1(4),XX1,VY1,XX2,VY2
66      EQUIVALENCE(X1(2),X2),(X1(3),X3),(X1(4),X4)
67      EQUIVALENCE(Y1(2),Y2),(Y1(3),Y3),(Y1(4),Y4)
68      *      ***** END COMDECK PCOM *****
69      DATA TDUM/R/
70      PTPOLD=PTOP
71      MIST=NPT/IST
72      C
73      C      DECIDE WHETHER TO ADD ANOTHER PRINT TO THE TIME-DEPENDENT
74      C      PARTICLE DATA
75      C
76      IFLAG=0
77      IF(NCYC,IE,1) GO TO 10
78      IF(TOPIC,LT,TOUT) GO TO 20
79      10 CONTINUE
80      C
81      C      YES
82      C
83      NILNG=NILNG+1
84      IFLAG=1
85      20 CONTINUE

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86      IECP=1
87      NPPT=0
88      JOLDS=0
89      PROTM=1.E+10
90      PRITE=1.E+10
91      PTOP=1.E+10
92      30 CALL ECRD(AASC,NLCP(1+IECP-1,LPR,IPUM)
93      KP=1
94      40 NPPT=NPPT+1
95      NPSTS=0
96      XTE=XPAP(KP)
97      IF(XTE,LY,0.) GO TO 130
98      YTE=YPAP(KP)
99      ICFL=ITAB(NPPT)
100     J=ICFL/IP1+1
101     I=ICFL-(J-1)*IP1
102     IF(J,EQ,JOLD) GO TO 50
103     JOLD=J
104     IFC=(J-1)*NQ1
105     CALL ECRD(AASC(ISC2),IEC,NQ12,IPUM)
106     50 IJ=(I-1)*NQ+ISC2
107     IPJ=IJ+NQ
108     IJP=IJ+NQ1
109     IPJP=IPJ+NQ1
110     X1=X(IPJ)
111     Y1=Y(IPJ)
112     X2=X(IPJP)
113     Y2=Y(IPJP)
114     X3=X(IJP)
115     Y3=Y(IJP)
116     X4=X(IJ)
117     Y4=Y(IJ)
118     60 XTEN=XTE
119     YTEN=YTE
120     CALL PSUB1(IN)
121     IF(IN,NE,0) GO TO 70
122     XTE=0.25*(X1+X2+X3+X4)
123     YTE=0.25*(Y1+Y2+Y3+Y4)
124     GO TO 160
125     70 U1=X(IPJ)
126     V1=Y(IPJ)
127     U2=X(IPJP)
128     V2=Y(IPJP)
129     U3=X(IJP)
130     V3=Y(IJP)
131     U4=X(IJ)
132     V4=Y(IJ)
133     X12=X1-XTE
134     X41=X4-X1
135     Y21=Y2-Y1
136     X3421=X3+X4+X21
137     Y12=Y1-YTE
138     Y41=Y4-Y1
139     Y21=Y2-Y1
140     Y3421=Y3+Y4-Y21
141     XMU=Y3421+X21-Y21+X41+Y3421+X12+Y12+X3421
142     XMU=Y41+X21-Y21+X41+Y3421+X12+Y12+X3421

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143      XL=V41+X1Z-V1Z+X41
144      IF(XMU,NE,0.) GO TO 80
145      THE=XLA/XMU
146      IF(X41,NE,0.) GO TO 90
147      ETA=V1Z/V41
148      GO TO 100
149      80 THE=(XNU+SQRT(XNU*XNU+4.*XMU+XLA))/(2.*XMU)
150      90 ETA=(X1Z+X21+THE)/(X41+X3421+THE)
151      100 OME=1.-ETA
152      OMTA1.=THE
153      UK=OME*OMT+U1+OMF*THE+U2*OMT+FTA+U4+ETA*THE+U3
154      VK=OME*OMT+V1+OMF*THE+V2*OMT+FTA+V4+ETA*THE+V3
155      IF(MPTST,EQ,1) GO TO 110
156      UKSV=UK
157      VKSV=VK
158      XTESV=XTE
159      YTESV=YTF
160      XTE=XTE+DT*UK
161      YTE=YTE+DT*VK
162      MPTST=1
163      GO TO 80
164      110 UK=0.5*(UK+UKSV)
165      VK=0.5*(VK+VKSV)
166      XTE=XTESV
167      YTE=YTESV
168      XTEN=XTE+DT*UK
169      YTEN=YTE+DT*VK
170      IF(TERR,AND,T,GT,TSTRID) CALL PTHDF(XTEN,YTEN)
171      XPAR(KP)=XTEN
172      YPAR(KP)=YTEN
173      C
174      C SEE IF TIME-DEPENDENT PARTICLE DATA IS TO BE COLLECTED THIS CYCLE
175      C
176      IF(TFLAGP,EQ,0) GO TO 120
177      C
178      C YES, SEE IF THE CURRENT PARTICLE IS TO BE SAVED.
179      C
180      IF(MOD(NPPT,NIST),NE,0) GO TO 120
181      C
182      C YES, SAVE IT.
183      C
184      NN=NPPT/NIST
185      IREGIN=NLCP1+NLCP2+2*(NP1+(NILNG-1)+NN-1)
186      C PAX(NN,NILNG)=XTEN
187      C PAY(NN,NILNG)=YTE
188      CALL ECHR(XTEN,IREGIN,2,IDUM)
189      120 CONTINUE
190      PROTMA=MIN1(YTEN,PROTM)
191      PRITE=AMAX1(XTEN,PRITE)
192      PTOP=AMAX1(YTEN,PTOP)
193      130 IF(NPPT,EQ,NPT) GO TO 140
194      KPEKP=3
195      IF(KP,LT,LPR) GO TO 40
196      CALL ECHR(AASC,NLCP1+IECP-1,LPR,IDUM)
197      IECP=IECP+LPR
198      GO TO 30
199      140 CALL ECHR(AASC,NLCP1+IECP-1,LPR,IDUM)

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200      IF(NCYC, EQ, 1) PTPOLD=PTCP
201      RETURN
202 150 CONTINUE
203      IF(IFLAG, EQ, 2) GO TO 130
204 160 XX1=X1
205      YY1=Y1
206      XX2=X2
207      YY2=Y2
208      CALL PSUB2(IT, IFLAG)
209      IF(IFLAG, NE, 0) GO TO 150
210      IF(IT, EQ, 2) GO TO 170
211      IF(IT, EQ, 180) GO TO 250
212      I=I+1
213      GO TO 210
214 170 XX1=X4
215      YY1=Y4
216      XX2=X3
217      YY2=Y3
218      CALL PSUB2(IT, IFLAG)
219      IF(IFLAG, NE, 0) GO TO 150
220      IF(IT, EQ, 0) GO TO 180
221      IF(IT, EQ, 1) GO TO 250
222      I=I+1
223      GO TO 210
224 180 XX1=X3
225      YY1=Y3
226      XX2=X2
227      YY2=Y2
228      CALL PSUB2(IT, IFLAG)
229      IF(IFLAG, NE, 0) GO TO 150
230      IF(IT, EQ, 0) GO TO 180
231      IF(J, EQ, JP1) GO TO 250
232      J=J+1
233      GO TO 200
234 190 XX1=X4
235      YY1=Y4
236      XX2=X1
237      YY2=Y1
238      CALL PSUB2(IT, IFLAG)
239      IF(IFLAG, NE, 0) GO TO 150
240      IF(IT, EQ, 0) GO TO 230
241      IF(J, EQ, 2) GO TO 250
242      J=J+1
243 200 IEC=(J-1)*NQI
244      JOLD=J
245      CALL ECRD(AASC(ISC2), IEC, NQI2, IDUM)
246      GO TO 220
247 210 IJ=(I-1)*NQ+ISC2
248      IPJ=IJ+NQ
249      IJP=IJ+NQI
250      IPJP=IPJ+NQI
251 220 X1=X(IPJ)
252      Y1=Y(IPJ)
253      X2=X(IPJP)
254      Y2=Y(IPJP)
255      X3=X(IJP)
256      Y3=Y(IJP)

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257      X4=X(IJ)
258      Y4=Y(IJ)
259      CALL PSUB1(IN)
260      IF(IN.EQ.0) GO TO 160
261      XTE=XTEN
262      YTE=YTEN
263      ITAB(NPPT)=(J-1)*IP1+I
264      GO TO 70
265 230 CONTINUE
266      DO 240 IPX=IPD,IFD,6
267 240 WRITE(IPX,280) NPPT,ITAB(NPPT),XTE,YTE,XTEN,YTEN,X1,Y1
268      ITAB(NPPT)=(J-1)*IP1+I
269      GO TO 130
270 250 XPAR(KP)=1,E+1
271      DO 260 IPX=IPD,IFD,6
272 260 WRITE(IPX,270) NPPT,ITAB(NPPT)
273      GO TO 130
274  C
275 270 FORMAT(5X,8HPARTICLE,I10,25HTOSSED OUT, CELL NUMBER,I10)
276 280 FORMAT(5X,14HEPERROR PARTICLE,I5,6H CFL,I5,12F7,4)
277      END

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-----
1      SUBROUTINE PSUB1(IN)
2  C
3  C      ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL,LASL T-3
4  C      MODIFIED BY J.L.NORTON,LASL T-3,1975
5  C
6  *      ----- BEGIN COMDECK YSTORE -----
7  *      ----- BEGIN COMDECK YAGDIM -----
8
9      DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
10 1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
11 2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
12 3 ,VI(1),ROL(1),AVXSV(1),AVYSV(1),OLSHOI(1),OLSR00(1),CAPGAM(1),TUQ
13 4 (1),SIG(1),TUS(1),GRROR(1),GRROZ(1),GRROP(1),TURVFC(1),MTIL(1),
14 5 CONC(1),CTFMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
15 6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DELSM(1),AREA(1)
16 *      ----- END COMDECK YAGDIM -----
17 *      ----- BEGIN COMDECK YAGSC -----
18 LOGICAL RSTRT,FILM,PAPER,TURH
19 REAL LAM,MU
20 C
21 COMMON/YSC1/AASC(NSCP1)
22 COMMON/YSC1/AASC(9600)
23 COMMON/YSC2/AA(1),ANC,AR,ARFAC,ADM,BW,COLAMU,CYL,DR,DY,DTC,DTFAC,
24 1 DTC(10),DTC(10),DT02,DT08,DTP05,DTV,DZ,EMU,EPS,FIPXL,FIPXR,
25 2 FIPYP,FIPYT,FTXL,FTXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,INAR,
26 3 I0T0,I,IJ,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
27 4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
28 COMMON/YSC2/JCFN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPH,MU,NAME(R),
29 1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1R,NQ12,NSC,NUMIT,ZORIG,OM,QMCYL,PXCONV
30 2 ,PXL,PXR,PYB,PYCONV,PYT,PDT,REZRON,REZSIF,REZYB,RIBAR,RIBJB,
31 3 FREZYT,FREZYB,POWER,T,THIRD,NCLST,TOUT,TWFIN

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30      COMMON/YS2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
31      1 ILNG,NILNG,TP3,TUPOT,TDQSAV,TK,TI,TUQENG,EPI,SAVI,QLEVEL,TQ,IST,
32      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DLAST,FIYBO,IYBO,YCNVLD,
33      3 XCNVLD,FXRD,FXLO,IXRD,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,T2,TLIM,
34      4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,OTVSAV,DTCSAV,IDTV
35      5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMON,VMON,TMAX,TGMX,ITM,JTM,ITG,JTG
36      6 ,TMASSV,WMAXFF,RMINEF,TSTRTD
37      COMMON/YS2/ZZ
38      C      COMMON/YS4/ITAB(ITAP)
39      COMMON/YS4/ITAB(1000)
40      COMMON/YS5/RESTRT,FILM,PAPER,IPD,IFD
41      *      ----- END COMDECK YAQSC -----
42      *      ----- BEGIN COMDECK YAQEQ -----
43      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
44      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
45      1 (8),E,ETIL,AREA,XR13K),
46      2 (AASC(15),SIF),(AASC(16),PMO,DKLSM,RMP),(AASC(9
47      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,JP),(AASC(12),UTIL,
48      4 UL,PMX,PII),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
49      5 ),CARGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
50      6 21),GRROR),(AASC(22),GRRORZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
51      7 ),(AASC(25),DLSROI,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
52      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
53      9 AASC(31),ANCU),(AASC(32),ANCU),(AASC(33),AVXSV,X13K),(AASC(34),
54      1 AVYSV,X24K)
55      REAL M,MP,MPAR,MTIL
56      *      ----- END COMDECK YAQEQ -----
57      *      ----- END COMDECK YSTORE -----
58      *      ----- BEGIN COMDECK PCOM -----
59      COMMON/XTENC/XTEN,YTEN,XTF,YTF,X1(4),Y1(4),XX1,YY1,XX2,YY2
60      EQUIVALENCE(X1(2),X2),(X1(3),X3),(X1(4),X4)
61      EQUIVALENCE(Y1(2),Y2),(Y1(3),Y3),(Y1(4),Y4)
62      *      ----- END COMDECK PCOM -----
63      DIMENSION AMZ(7)
64      DATA PI/3.1415926535897932384626/
65      DATA PI02/1.5707963267948966192313/
66      DATA PI02M1/0.5707963267948966192313/
67      DATA PI2/6.2831853071795864769252/
68      10 AMZMIN=1.E+10
69      DO 60 K=1,4
70      IF(X1(K).EQ.XTEN) GO TO 40
71      XX=(Y1(K)-YTEN)/(X1(K)-XTEN)
72      YY=ABS(XX)
73      IF(YY.GT.1.) GO TO 20
74      SLOPE=PI02M1*XX
75      GO TO 30
76      20 SLOPE=SIGN(PI02*1./YY,XX)
77      30 IF(XTEN.GT.X1(K)) SLOPE=SLOPE+PI
78      IF(XTEN.LT.X1(K).AND.SLOPE.LT.0.) SLOPE=SLOPE+PI2
79      GO TO 50
80      SLOPE=SIGN(PI02,Y1(K)-YTEN)
81      50 AMZ(K)=SLOPE
82      60 AMZMIN=AMIN1(AMZMIN,AMZ(K))
83      AMZ(5)=AMZ(1)-AMZMIN
84      AMZ(1)=AMZ(5)
85      AMZ(6)=AMZ(2)-AMZMIN
86      AMZ(2)=AMZ(6)

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87      AMZ(7)=AMZ(3)=AMZMIN
88      AMZ(3)=AMZ(7)
89      AMZ(4)=AMZ(4)=AMZMIN
90      IF (AMZ(1),EQ,0.) K=1
91      IF (AMZ(2),EQ,0.) K=2
92      IF (AMZ(3),EQ,0.) K=3
93      IF (AMZ(4),EQ,0.) K=4
94      INTE=0
95      IN=0
96      IF (AMZ(K+3),GT,AMZ(K+2),AND,AMZ(K+2),GT,AMZ(K+1),AND,AMZ(K+1),GT,
97      1 AMZ(K)) INTE=1
98      IF (INTE,EQ,0) RETURN
99      IN=1
100     DO 100 K=1,4
101     AMZ1=AMZ(K)
102     AMZ2=AMZ(K+1)
103     AMZ3=AMZ(K+2)
104     IF (AMZ1+AMZ2,NE,0.) GO TO 70
105     AMX2=AMAX1(AMZ1,AMZ2)
106     IF (AMZ3,LT,AMX2) GO TO 80
107     70 PH1=ARS(AMZ1=AMZ2)
108     GO TO 90
109     80 PH1=PI2-AMX2
110     90 IF (PH1,GT,PI) IN=0
111     IF (IN,EQ,0) RETURN
112     100 CONTINUE
113     RETURN
114     END

```

```

1      SUBROUTINE PSUB2(IT,IFLAG)
2
3      C
4      C      ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL,LASL T-3
5      C      MODIFIED BY J.L.NORTON,LASL T-3,1975
6
7      *
8      *      ----- BEGIN COMDECK YSTORE -----
9      *      ----- BEGIN COMDECK YAQDIM -----
10     *      DIMENSION X(1),XPAR(1),R(1),YPAR(1),V(1),MPAR(1),U(1),UG(1),DELSM(
11     *      1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSO(1),E(1),ETIL(1),RVOL
12     *      2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CO(1),VTIL(1)
13     *      3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUG
14     *      4 (1),SIG(1),TUS(1),GRROR(1),GRRORZ(1),GRRORP(1),TUQVEC(1),MTIL(1),
15     *      5 CONG(1),CTEMP(1),ANGU(1),ANGV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
16     *      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
17     *      ----- END COMDECK YAQDIM -----
18     *      ----- BEGIN COMDECK YAQSC -----
19     *      LOGICAL RESTRT,FILM,PAPER,TURB
20     *      REAL LAM,MU
21     *      COMMON/YSC1/AASC(NSCP1)
22     *      COMMON/YSC1/AASC(9600)
23     *      COMMON/YSC2/AA(1),ANG,AR,ARFAC,ARM,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
24     *      1 DTC(10),DTQC(10),DTC2,DTC0,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,

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23 2 F1PVB,F1PVT,F1XL,F1XR,F1YB,F1YT,FREZER,G9,GRIVEL,GZ,GZP,1,1HAR,
24 3 1DT0,1J,1JM,1JP,1N1,1PXL,1PXR,1PYB,1PYT,1P1,1P2,1SC2,1SC3,1TV,
25 4 1JMF,1XL,1XR,1YB,1YT,1J,1HAR
26 COMMON/VSC2/JCEN,JP1,JP2,JP3,JUNF,JUNF02,X11,LAM,LPA,MU,NAME(R),
27 1 NCVC,NLC,NPS,NPT,NQ,NO1,NO1B,NO1Z,NBC,MUMIT,ZORIG,OM,OMCVL,PXCNOV
28 2 ,PXL,PXR,PYB,PYCONV,PYT,POT,REZRON,REZBIE,REZVR,R1BAR,R1GBA,
29 3 FREZVT,FREZVR,R0MFR,T,TMIRO,NCLST,TOUT,TWFIN
30 COMMON/VSC2/TUQ1,TUS1,NCO,TNEG,TNEGVS,TUSV,TURB,PTOP,PRIFE,PROTH,
31 1 1LNG,NILNG,TP3,TUPOT,TOOSAV,TX,T1,TUGENG,EP1,SAV1,QLEVEL,TQ,1ST,
32 2 VV,XCONV,XL,XR,YB,YCONV,YT,BTPOLO,DTSV,DYLAST,F1YB0,1YB0,YCNULD,
33 3 XCNULD,F1XRD,F1XL0,XRD,1XLO,1SV4,J8VN,QHN,QH1,QH2,JH1,T2,TL1M,
34 4 R0MFR,R0MFRY,R0MFR,JOUMP,T1THRD,TE,DTR,THASS,DYTSV,DYCSAV,1DTV
35 5 ,1DTV,1DTC,1DTC,CIRC,1IS,POTE,UMOM,VOM,THX,TGHX,1TH,1TM,1TG,1TG
36 6 ,THASSV,MMAKEF,MJINEF,TSTRD
37
38 C COMMON/VSC4/ITAH(1TABP)
39 COMMON/VSC4/ITAR(1000)
40 COMMON/VSC5/RESTRY,FILM,PAPER,1PD,1FD
41 * ----- END COMDECK YAQSC -----
42 * ----- BEGIN COMDECK YADEG -----
43 EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR1,(
44 1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RC8Q,MP),(AASC
45 1 (8),F,ETIL,ARFA,XR13K),
46 2 (AASC(15),SIF),(AASC(16),PM0,DKLSM,RMP),(AASC(9
47 3 ),RVDL),(AASC(10),M,RH,VR),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
48 4 UL,PMX,PU),(AASC(13),V1IL,V1,PHY,PV),(AASC(14),Q,CN,ROL),(AASC(17
49 5 ),CAPGM,HG),(AASC(18),YUO),(AASC(19),SIG),(AASC(20),TUS),(AASC(
50 6 21),GR0W),(AASC(22),GR0Z),(AASC(23),DLSRO,Y13K),(AASC(24),GZSV
51 7 ),(AASC(25),DLSROQ,V6),(AASC(26),GR0V),(AASC(27),GR0P,TUOV6C,
52 8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
53 9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
54 1 AVYSV,X24K)
55 REAL M,MP,MPAR,MTIL
56 * ----- END COMDECK YADEG -----
57 * ----- END COMDECK YSTORE -----
58 * ----- BEGIN COMDECK PCOM -----
59 COMMON/XTEN/XTEN,YTEN,XTE,YTE,X1(4),Y1(4),XX1,YV1,XX2,YV2
60 EQUIVALENCE(X1(2),X2),(X1(3),X3),(X1(4),X4)
61 EQUIVALENCE(Y1(2),Y2),(Y1(3),Y3),(Y1(4),Y4)
62 * ----- END COMDECK PCOM -----
63 DATA ALF,ALF2/0,001,1,00000001/
64
65 10 ITA=0
66 IFLAG=0
67 IF((YTEN=YY2)*(XTEN=XX1).EQ.(YTEN=YY1)*(XTEN=XX2)) GO TO 30
68 IF(ABS(XTEN-XTE).LT.FM10) GO TO 50
69 PSL=(YTEN-YTE)/(XTEN-XTE)
70 IF(ABS(XX1-XX2).LT.EM10) GO TO 60
71 GSL=(YY2-YY1)/(XX2-XX1)
72 IF(PSL.EQ.GSL) RETURN
73 XINS=(YY1-YTE+PSL*XTE+GSL*XX1)/(PSL-GSL)
74 YINS=YY1+GSL*(XINS-XX1)
75
76 20 ITA=0
77 IF((XX1+XINS)*(XX2-XINS).LE.0.).AND.((YV1+YINS)*(YV2-YINS).LE.0.)
78 1 ) ITA=1
79 IF(((XTE=XINS)*(XTEN=XINS).LE.0.).AND.((YTE=YINS)*(YTEN=YINS).LE.
80 1 0.)) ITA=ITA+1
81 IF(ITA.EQ.2) GO TO 70

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ROUTINE TO ADD TURBULENT DIFFUSION EFFECTS TO THE PARTICLE MOTION
SUBROUTINE PDIFF(XJ,VJ)
ROUTINE TO ADD TURBULENT DIFFUSION EFFECTS TO THE PARTICLE MOTION
(XJ,VJ) IS THE POSITION OF THE PARTICLE AFTER
THE EFFECTS OF CONVECTION HAVE BEEN ADDED, THE POSITION
WILL BE RETURNED WITH THE TURBULENT DIFFUSION CORRECTION
ADDED.
WRITTEN BY J.L. MORFITT, LAST 1-3, 1975

[illegible]

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75      IF(XJ,LE,RMINER) GO TO 5P
76      C
77      C      GET A RANDOM NO. FROM A UNIFORM DISTRIBUTION
78      C      ON THE INTERVAL (0.,1.)
79      C
80      1P CONTINUE
81      XINPUT=R.
82      ETAINUMF(XINPUT)
83      C
84      C      MAP EACH HALF OF THE INTERVAL (0.,1.) INTO (0.,1.)
85      C
86      ETARABS(1.,2.,ETA1)
87      C
88      C      FIND THE ERROR FUNCTION BOUNDS ON THE RANDOM NO.
89      C
90      DO 2P L=2,NERFV
91      2P IF(ETA,LE,ERFV(L)) GO TO 3P
92      C
93      C      IF NO BOUNDS WRE FOUND,THE RANDOM NO. IS TOO CLOSE TO 1.
94      C      GO BACK AND TRY ANOTHER ONE.
95      C
96      GO TO 1P
97      3P CONTINUE
98      C
99      C      BOUNDS HAVE BEEN FOUND. INTERPOLATE THE ERROR FUNCTION INVERSE,
100     C
101     ERFINVERNEF=(FLOAT(L-2)*(ETA-ERFV(L-1))/(ERFV(L)-ERFV(L-1)))
102     C
103     CALCULATE THE CORRECTION
104     C
105     CORR=ERFINV*2.*SQRT(DT*SIG(IJ))
106     C
107     ADD ON THE SIGN OF THE CORRECTION
108     C
109     IF(ETA1,GT,.5) CORR=-CORR
110     C
111     GO CORRECT THE PROPER COORDINATE
112     C
113     GO TO (4P,6P),IPASS
114     C
115     C      X (R) COORDINATE
116     C
117     4P CONTINUE
118     XJ=XJ+CORR
119     5P CONTINUE
120     C
121     C      GO BACK AND DO THE Y (Z) COORDINATE
122     C
123     IPASS=2
124     GO TO 1P
125     6P CONTINUE
126     C
127     C      Y (Z) COORDINATE
128     C
129     YJ=YJ+CORR
130     RETURN
131     END

```

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1      SUBROUTINE REZONE
2      C
3      C ROUTINE TO CALCULATE THE GRID VELOCITIES, NEW GRID POSITIONS,
4      C AND RESTORE THE AMBIENT ATMOSPHERE TO HYDROSTATIC
5      C EQUILIBRIUM
6      C
7      C ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL, LASL T-3
8      C MODIFIED BY J.L.NORTON, LASL T-3, 1975
9      C
10     *
11     * ----- BEGIN COMDECK PARAM -----
12     * COMMON/PCOM/NSCP1, ITABP, ITABXP, ITABYP, IPFB, NP1, NP2, NLCP1, NLCP2,
13     * 1 NLCP3, NLCP4, IFLMSZ
14     * ----- END COMDECK PARAM -----
15     * ----- BEGIN COMDECK YSTNRE -----
16     * ----- BEGIN COMDECK YAQDIM -----
17     * DIMENSION X(1), XPAR(1), R(1), YPAR(1), Y(1), HPAR(1), U(1), UG(1), DELSM(
18     * 1 1), V(1), VG(1), RO(1), STE(1), MP(1), RMP(1), RCSQ(1), E(1), ETIL(1), RVOL
19     * 2 (1), M(1), RM(1), VP(1), P(1), PL(1), UP(1), UTIL(1), UL(1), CQ(1), VTIL(1)
20     * 3 , VL(1), ROL(1), AVXSV(1), AVYSV(1), DL3ROI(1), DL3RQ(1), CAPGAM(1), TUG
21     * 4 (1), SIG(1), TUS(1), GRROR(1), GRRDZ(1), GRRDP(1), TURVEC(1), HTIL(1),
22     * 5 CONC(1), CTEMP(1), ANCH(1), ANCV(1), GRSV(1), GZSV(1), X13K(1), X24K(1),
23     * 6 Y13K(1), Y24K(1), X13K(1), X24K(1), DKLSM(1), AREA(1)
24     * ----- END COMDECK YAQDIM -----
25     * ----- BEGIN COMDECK YAQSC -----
26     * LOGICAL RESTRT, FILM, PAPER, TURB
27     * REAL LAM, MU
28     * C COMMON/YSC1/AASC(NSCP1)
29     * COMMON/YSC1/AASC(4000)
30     * COMMON/YSC2/AA(1), ANC, AB, ABFAC, ARH, HB, COLAMU, CYL, DR, UT, DTC, DTFAC,
31     * 1 DYO(10), DYN(10), DTN2, DT08, DTP03, DTV, DZ, E410, EPS, FIPXL, FIPXR,
32     * 2 FIPYB, FIPYT, FIXL, FIXR, FIVB, FIYT, FREZYR, GR, GRDVEL, GZ, GZP, I, IBAR,
33     * 3 IOT0, IJ, IJM, IJP, IM1, IPXL, IPXR, IPYB, IPYT, IP1, IP2, ISC2, ISC3, ITV,
34     * 4 IUNP, IXL, IXR, IYR, IYT, J, JBAR
35     * COMMON/YSC2/JCEN, JP1, JP2, JP4, JUNF, JUNF02, KX1, LAM, LPB, MU, NAME(8),
36     * 1 NCYC, NLC, NPS, NPT, NQ, NQ1, NQIR, NQ12, NSC, NUMIT, ZOMIG, OM, OMCYL, PXCONV
37     * 2 , PXL, PXR, PYR, PYCONV, PYT, RDT, REZRON, RFZSIE, REZYR, RIBAR, RIRJB,
38     * 3 RFZYT, FREZYR, ROMFR, Y, THIRO, NCLST, TOUT, TWFIN
39     * COMMON/YSC2/TUQ1, TUISI, NCQ, TNEG, TNEGSV, TUSV, TURB, PTOP, PHITE, PBOYM,
40     * 1 ILNG, NILNG, TP3, TUPOT, TQDSAV, TK, TI, TUGENG, EP1, SAV1, QLEVEL, TQ, IST,
41     * 2 VV, XCONV, XL, XR, YR, YCONV, YT, PTPOLD, DTSV, DTLAST, FIYB0, IYB0, YCNVLD,
42     * 3 XCNVLD, FIXR0, FIXL0, IXR0, IXL0, ISVH, JSVH, QMX, QMX, WMAX, JNH, T2, TLM,
43     * 4 ROMFXR, ROMFYT, ROMFYB, JDUMP, THTHRD, TE, DTR, TMASS, DTVSAV, DTC SAV, IDTV
44     * 5 , IDTV, IDTC, JDTC, CIRC, TIS, POTE, UMOM, VMOM, TMAX, YGMX, ITM, JTM, ITG, JTG
45     * 6 , TMASSV, WMAXEF, RMINEF, TSTRUD
46     * COMMON/YSC2/ZZ
47     * C COMMON/YSC4/ITAB(ITABP)
48     * COMMON/YSC4/ITAB(1000)
49     * COMMON/YSC5/RESTRT, FILM, PAPER, IPD, IFD
50     * ----- END COMDECK YAQSC -----
51     * ----- BEGIN COMDECK YAQEU -----
52     * FRII VALFNCE(AASC(1), X, XPAR), (AASC(2), R, YPAR), (AASC(3), Y, HPAR), (
53     * 1 AASC(4), U), (AASC(5), V), (AASC(6), RO), (AASC(7), DELSM, RCSQ, MP), (AASC
54     * 8 (8), E, ETIL, AREA, X13K),
55     * 2 (AASC(15), STE), (AASC(16), PM0, DKLSM, RMP), (AASC(9

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55      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
56      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CO,ROL),(AASC(17
57      5 ),CAPGAM,UG),(AASC(18),TUG),(AASC(19),SIG),(AASC(20),TUS),(AASC(
58      6 21),GRROR),(AASC(22),GRROR),(AASC(23),DL8RO1,Y13K),(AASC(24),GZ8V
59      7 ),(AASC(25),DL8ROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
60      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
61      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
62      1 AVYSV,X24K)
63      REAL M,MP,MPAR,MTIL
64      * ----- END COMDECK YAGEO -----
65      * ----- END COMDECK YSTORE -----
66      COMMOV/EQNSY/ROTMP,ETMP,GMONE,CONCJ
67      FSTF=0,01
68      ZRS=ZE+SUMRS+SUME=0,0
69      DMN=1,PE+20
70      CALL START
71      DO 20 J=2,JP1
72      DO 10 I=1,IBAR
73      DEL=(Y(IJP)-Y(IJ))*2+(X(IJP)-X(IJ))*2
74      DMN=AMIN1(DMN,DEL)
75      RDEL=1,0/DEL
76      DFLE=E(IJ)=0,156
77      SUME=SUME+DFLE
78      ZE=ZE+Y(IJ)*DEL
79      SUMRS=SUMRS+RDEL
80      ZRS=ZRS+Y(IJ)*RDEL
81      IJ=IJ+NQ
82      IJP=IJP+NQ
83      10 CONTINUE
84      CALL LOOP
85      20 CONTINUE
86      ZE=ZE/SUME
87      ZRS=ZRS/SUMRS
88      FCP3=FCX*FCP2=0,0
89      CALL START
90      DO 40 J=2,JP1
91      DO 30 I=1,IBAR
92      IF(J,LE,4) FCP3=AMAX1(FCP3,ABS(VL(IJ)))
93      IF(J,GE,JP1-1) FCP2=AMAX1(FCP2,ABS(VL(IJ)))
94      IF(I,GE,IBAR-3) FCX=AMAX1(FCX,ABS(UL(IJ)))
95      IJ=IJ+NQ
96      30 CONTINUE
97      CALL LOOP
98      40 CONTINUE
99      FCP2=AMAX1(0,,0,2*RT*(ZORIG=(Y(IJ)-PTOP)/PRITE)*PRITE)
100     FCX=AMAX1(0,,0,2*RT*(ZORIG=X(IJ+NQIB)/PRITE)*PRITE)
101     CALL START
102     DO 150 J=2,JP2
103     DO 140 I=1,IP1
104     IPJ=IJ+NQ
105     IMJ=IJ+NQ
106     IF(I,EQ,1,OR,I,EQ,IP1,OR,J,EQ,2,OR,J,EQ,JP2) GO TO 50
107     XAV=X(IPJ)+X(IMJ)+X(IJP)+X(IJM)
108     UG(IJ)=0,5*(UL(IJ)+U(IJ))+FSTF*(XAV=4,*X(IJ))*RT
109     YAV=Y(IPJ)+Y(IMJ)+Y(IJP)+Y(IJM)
110     VG(IJ)=0,5*(VL(IJ)+V(IJ))+FSTF*(YAV=4,*Y(IJ))*RT
111     IF(J,EQ,3) UG(IJM)=UG(IJ)

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112      IF(I.EQ,2) VG(IMJ)=VG(IJ)
113      GO TO 130
114      50 CONTINUE
115      IF(I.NE,1) GO TO 60
116      UG(IJ)=0,0
117      GO TO 70
118      60 IF(I.NE,IP1) GO TO 70
119      UG(IJ)=FCX
120      VG(IJ)=VG(IMJ)
121      70 IF(J.NE,2) GO TO 80
122      VG(IJ)=FC3
123      GO TO 90
124      80 IF(J.NE,JP2) GO TO 90
125      UG(IJ)=UG(IJM)
126      VG(IJ)=FCP2
127      90 IF(I.NE,1.OR,J.NE,2) GO TO 100
128      VG(IJ)=FC3
129      100 IF(I.NE,IP1.OR,J.NE,2) GO TO 110
130      UG(IJ)=FCX
131      VG(IJ)=FC3
132      110 IF(I.NE,1.OR,J.NE,JP2) GO TO 120
133      VG(IJ)=FCP2
134      120 IF(I.NE,IP1.OR,J.NE,JP2) GO TO 130
135      UG(IJ)=FCX
136      VG(IJ)=FCP2
137      130 CONTINUE
138      IJ=IPJ
139      IJP=IJP+NQ
140      IJM=IJM+NQ
141      140 CONTINUE
142      CALL LOOP
143      150 CONTINUE
144      CALL DONE
145      CALL START
146      DO 180 J=2,JP2
147      DO 170 I=1,IP1
148      X(IJ)=X(IJ)+UG(IJ)*DT
149      IF(J.NE,2) GO TO 160
150      IF(Y(IJ)+VG(IJ)=DT.LE,0,0) VG(IJ)=Y(IJ)+NDT
151      160 CONTINUE
152      Y(IJ)=Y(IJ)+VG(IJ)*DT
153      R(IJ)=X(IJ)*CYL+OMCYL
154      170 IJ=IJ+NQ
155      CALL LOOP
156      180 CONTINUE
157      CALL DONE
158      CALL FILMCO
159      CALL START
160      ETMP=REZSIE
161      ROT4P=REZRON
162      CONCJ=0,
163      CALL AIR
164      XX=GMONE+REZSIE
165      YY=ABS(GZ)/XX
166      DO 200 J=2,JP1
167      DO 190 I=1,IP1
168      IJP=IJP+NQ

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169      IJP=IJP+NQ
170      Y4JN,25*(Y(IJP)+Y(IJP)+Y(IJ)+Y(IPJ))
171      IF(J.EQ,2) ROL(IJM)=REZRON*EXP((REZYB=(Y(IJ)+Y(IPJ)-Y4))=YY)
172      IF(I.EQ,IHAR) ROL(IPJ)=REZRGH*EXP((REZYB=(Y(IPJ)+Y(IJP)-Y4))=YY)
173      IF(J.EQ,JP1) ROL(IJP)=REZRON*EXP((REZYB=(Y(IJP)+Y(IJP)-Y4))=YY)
174      IJM=IJM+NQ
175      IJP=IJP+NQ
176      19H IJ=IPJ
177      CALL LOOP
178      20H CONTINUE
179      CALL DONE
180      RETURN
181      END

```

```

1      SUBROUTINE RTAPE
2
3      C      ROUTINE TO READ IN ONE DUMP OF A YAQUI DUMP FILE (ALL BUT
4      C      THE HEADER RECORD)
5
6      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
7      C
8      *
9      *      ----- BEGIN COMDECK PARAM -----
10     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
11     1 NLCP3,NLCP4,IFLMSZ
12     *      ----- END COMDECK PARAM -----
13     *      ----- BEGIN COMDECK YASC -----
14     LOGICAL RESTRY,FILM,PAPER,TURB
15     REAL LAM,MU
16     C      COMMON/YSC1/AASC(NSCP1)
17     COMMON/YSC1/AASC(9600)
18     COMMON/YSC2/AA(1),ANC,AR,AFFAC,AB4,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
19     1 DTC(10),DTC(10),DTC2,DTC8,DTCOS,DTCV,DZ,EM10,EPS,FIPXL,FIPXR,
20     2 FIPYB,FIPYT,FXL,FXR,FIYB,FIYT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,
21     3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
22     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
23     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
24     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
25     2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
26     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
27     COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEG8V,TUSV,TURB,PTOP,PRITF,PBOTH,
28     1 ILNG,NILNG,TP3,TUPOT,TDSAV,YK,YI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
29     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB,IVB,YCNVLO,
30     3 XCNVLO,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,T2,TLM,
31     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTRD,TE,DTR,THASS,DTVSAV,DTC SAV,IDTV
32     5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOH,VMOH,THAX,TGMX,ITH,JTH,ITG,JTG
33     6 ,THASS,WMAXEF,MINDEF,TSTATD
34     COMMON/YSC2/ZZ
35     C      COMMON/YSC4/ITAB(ITABP)
36     COMMON/YSC4/ITAB(1000)
37     COMMON/YSC5/RESTRY,FILM,PAPER,IPO,IFD
38     *      ----- END COMDECK YASC -----

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38      C      READ REST OF DUMP, FIRST CHECK THE PARAMETERS.
39      C
40      C      CALL PCCHK
41      C
42      C      READ IN THE LCM ARRAY STORAGE
43      C
44      C      CALL LCBUFF(0,NLC,7,0,1,IERORR)
45      C      IF(IERORR,NE,0) GO TO 20
46      C      GO TO 30
47      10 CALL UNCLE(1,6MYARSRT,10,10HSCBUFF INPUT ERROR)
48      20 CALL UNCLE(4,6MYARSRT,10,10HLCBUFF INPUT ERROR)
49      30 CONTINUE
50      C
51      C      SEE IF THERE ARE ANY PARTICLES
52      C
53      C      IF(NPT,LE,0) GO TO 40
54      C
55      C      YES, READ THEIR RECORDS,
56      C
57      C      CALL LCBUFF(NLCP1,NPS,7,0,1,IERORR)
58      C      IF(IERORR,NE,0) GO TO 20
59      C      CALL SCBUFF(ITAB,ITABP,7,0,1,IERORR)
60      C      IF(IERORR,NE,0) GO TO 10
61      C
62      C      SEE IF THERE IS ANY TIME-DEPENDENT PARTICLE DATA
63      C
64      C      IF(NILNG,LE,0) GO TO 40
65      C
66      C      YES, READ IT IN,
67      C
68      C      CALL LCBUFF(NLCP1+NLCP2,2*NP1+NILNG,7,0,1,IERORR)
69      C      IF(IERORR,NE,0) GO TO 20
70      40 CONTINUE
71      RETURN
72      END

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-----
1      SUBROUTINE RIROW
2      C
3      C      ROUTINE TO READ ROW J FROM LCM TO SCM BUFFER ONE
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1974
7      C
8      *      ----- BEGIN COMDECK PARAM -----
9      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
10     1 NLCP3,NLCP4,IFLMSZ
11      *      ----- END COMDECK PARAM -----
12      *      ----- BEGIN COMDECK YAGSC -----
13      LOGICAL RESTRT,FILM,PAPER,TURB
14      REAL LAM,MU
15      C      COMMON/YSC1/AASC(NSCP1)

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16      COMMON/YSC1/AASC(9600)
17      COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
18      1 DTC(10),DTC(10),DT02,DT08,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
19      2 FIPYB,FIPYT,FIXL,FXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
20      3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
21      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
22      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPR,MU,NAME(8),
23      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ10,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
24      2 ,PXL,PXR,PYB,PVCONV,PYT,POT,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
25      3 FREZYT,FREZYB,POWER,T,THIRG,NCLST,TOUT,THFIN
26      COMMON/YSC2/TUOI,TUSI,NQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
27      1 ILNG,NILNG,TP3,TUPT,TDOSAV,TK,TI,TUGENG,EPI,SAV1,GLEVEL,TQ,IST,
28      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB0,IYB0,YCNVLD,
29      3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVH,JSVH,QMN,QMX,WMAX,JNH,T2,TLM,
30      4 ROMFXR,COMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,THASS,OTVSAY,DTCSAV,IDTV
31      5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VOM,THAX,TGMX,ITM,JTM,ITG,JTG
32      6 ,THASSV,WMAXEF,RHINEF,TSTRTO
33      COMMON/YSC2/ZZ
34      C      COMMON/YSC4/ITAB(ITABP)
35      COMMON/YSC4/ITAB(1000)
36      COMMON/YSC5/RESTR,FILM,PAPER,IPD,IFD
37      *      ----- END COMDECK YAGSC -----
38      DATA NE/0/
39      IEC=(J-1)*NQ1
40      CALL ECRD(AASC,IEC,NQ1,IDUM)
41      RETURN
42      END

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```

1      SUBROUTINE SETIJ
2      C
3      C      ROUTINE TO SET THE SCM POINTER TO THE ITH ELEMENT IN ROW J,
4      C      ASSUMING ROW J IS IN SCM BUFFER ONE
5      C
6      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
7      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1974
8      C
9      *      ----- BEGIN COMDECK PARAM -----
10     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFR,NP1,NP2,NLCP1,NLCP2,
11     1 NLCP3,NLCP4,IFLMSZ
12     *      ----- END COMDECK PARAM -----
13     *      ----- BEGIN COMDECK YAGSC -----
14     LOGICAL RESTR,FILM,PAPER,TURB
15     REAL LAM,MU
16     C      COMMON/YSC1/AASC(NSCP1)
17     COMMON/YSC1/AASC(9600)
18     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
19     1 DTC(10),DTC(10),DT02,DT08,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
20     2 FIPYB,FIPYT,FIXL,FXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
21     3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
22     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
23     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPR,MU,NAME(8),

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24      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
25      2 ,PXL,PXR,PYB,PYCONV,PYT,RDY,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
26      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
27      COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
28      1 ILNG,NILNG,TP3,TUPOT,TQSAV,TK,TI,TUGENG,EP1,SAV1,OLEVEL,TQ,IST,
29      2 VV,XCONV,XL,XR,YR,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB,IYB,YCNVLD,
30      3 XCNVLD,FIYRO,FIYLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,T2,TLM,
31      4 ROMFXR,ROMPYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAV,DTCSAV,IDTV
32      5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITG,JTG
33      6 ,TMASSV,WMAXEF,RMINEF,TSTRTO
34      COMMON/YSC2/ZZ
35      C      COMMON/YSC4/ITAB(ITABP)
36      COMMON/YSC4/ITAB(1000)
37      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
38      *      ----- END COMDECK YAGSC -----
39      IJ=(I-1)*NQ+1
40      RETURN
41      END

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-----
1      SURROUTINE START
2      C
3      C      ROUTINE TO TRANSFER DATA BETWEEN LARGE CORE AND SMALL CORE IN
4      C      ORDER TO MINIMIZE SMALL CORE REQUIREMENTS
5      C
6      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
7      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1974
8      C
9      *      ----- BEGIN COMDECK PARAM -----
10     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
11     1 NLCP3,NLCP4,IFLMSZ
12     *      ----- END COMDECK PARAM -----
13     *      ----- BEGIN COMDECK YAGSC -----
14     LOGICAL RESTRT,FILM,PAPER,TURB
15     REAL LAM,MU
16     C      COMMON/YSC1/AASC(NSCP1)
17     COMMON/YSC1/AASC(9600)
18     COMMON/YSC2/AA(1),ANC,AP,APFAC,APM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
19     1 DTC(10),DTC(10),DTC2,DTCB,DTCOS,DTV,DZ,EM10,EPS,FIYXL,FIYXR,
20     2 FIYB,FIYB,FIYX,FIYR,FIYB,FIYT,FREZXR,GR,GRDEL,GZ,GZP,I,IBAR,
21     3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
22     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
23     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
24     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
25     2 ,PXL,PXR,PYB,PYCONV,PYT,RDY,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
26     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
27     COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
28     1 ILNG,NILNG,TP3,TUPOT,TQSAV,TK,TI,TUGENG,EP1,SAV1,OLEVEL,TQ,IST,
29     2 VV,XCONV,XL,XR,YR,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB,IYB,YCNVLD,
30     3 XCNVLD,FIYRO,FIYLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,T2,TLM,
31     4 ROMFXR,ROMPYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAV,DTCSAV,IDTV
32     5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITG,JTG

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33      6 ,THASSV,WMAXEF,RMINEF,TSTRTD
34      COMMON/YSC2/ZZ
35      C      COMMON/YSC4/ITAB(ITARP)
36      COMMON/YSC4/ITAB(1000)
37      COMMON/YSC5/RESTR,FILM,PAPER,IPD,IFD
38      *      ----- END COMDECK YAGSC -----
39      DATA NE/0/
40      C
41      C      READ IN THE FIRST THREE ROWS
42      C
43      C      IJPS IS THE SCM POINTER TO WHERE THE NEXT ROW IS TO BE READ
44      C      INTO SCM, ONE NEEDS TO THINK OF THE SMALL CORE AREA AS BEING
45      C      DIVIDED INTO THREE BUFFERS,SAY A,B,AND C, INITIALLY,ROW J=1
46      C      IS READ INTO BUFFER A,ROW J=2 INTO BUFFER B,AND ROW J=3 INTO
47      C      BUFFER C, WHEN A REQUEST IS MADE FOR ROW J=4,BUFFER A WHICH
48      C      CURRENTLY HOLDS ROW J=1 IS WRITTEN OUT TO LCM AND ROW J=4 IS
49      C      READ INTO BUFFER A, THIS PROCESS CONTINUES WITH ONE ROW BEING
50      C      WRITTEN TO LCM AND ONE ROW REPLACING IT IN SCM SO THAT THREE
51      C      ROWS ARE ALWAYS AVAILABLE,ONE IN EACH BUFFER.
52      C      IECR IS THE LCM ADDRESS FROM WHICH DATA WILL BE READ TO SCM NEXT
53      C      IFCW IS THE LCM ADDRESS TO WHICH DATA WILL BE WRITTEN FROM SCM NXT
54      C
55      IJPS=1
56      IECR=0
57      IFCW=0
58      C
59      C      READ THE FIRST ROW INTO SCM INTO BUFFER ONE
60      C
61      C      AASC IS BEGINNING OF THE THREE SCM BUFFERS
62      C      NQI IS THE NUMBER OF WORDS COMPRISING ONE ROW OF DATA
63      C      NE IS AN ERROR FLAG WHICH IS UNUSED ON THE 7600
64      C
65      CALL ECRD(AASC(IJPS),IECR,NQI,NE)
66      C
67      C      INCREMENT THE LCM READ ADDRESS
68      C
69      IECR=IECR+NQI
70      C
71      C      SET THE BUFFER POINTER TO THE SECOND BUFFER, OBVIOUSLY,
72      C      ISC2=NQI+1
73      C
74      IJPS=ISC2
75      C
76      C      READ IN THE SECOND ROW
77      C
78      C      CALL FCRD(AASC(IJPS),IECR,NQI,NE)
79      C
80      C      INCREMENT THE LCM READ ADDRESS AGAIN
81      C
82      IECR=IECR+NQI
83      C
84      C      UPDATE THE POINTERS TO READ THE NEXT ROW INTO BUFFER THREE.
85      C
86      C      IJP IS THE POINTER TO THE ELEMENT (1,J+1)
87      C      IJ IS THE POINTER TO THE ELEMENT(1,J)
88      C      IJM IS THE POINTER TO (1,J-1)
89      C      IJMS IS THE SCM ADDRESS TO BE WRITTEN OUT NEXT

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90      C      IBUF IS THE NEXT BUFFER TO BE USED WHEN THE SUBROUTINE IS ENTERED
91      C
92      10 CONTINUE
93      IJP=ISC3
94      IJPS=ISC3
95      IJ=ISC2
96      IJM=1
97      IJMS=1
98      IBUF=1
99      C
100     C      FILL THE THIRD BUFFER
101     C
102     20 CALL ECRD(AASC(IJPS),IECR,NQI,NE)
103     C
104     C      UPDATE THE LCM POINTER FOR THE NEXT READ
105     C
106     IECR=IECR+NQI
107     RETURN
108     C
109     C      *****
110     C      ENTRY LOOP
111     C      *****
112     C
113     C      READ IN THE NEXT ROW. FIRST, FLUSH THE OLDEST BUFFER.
114     C
115     CALL ECWR(AASC(IJMS),IECW,NQI,IDUM)
116     C
117     C      UPDATE THE LCM POINTER FOR THE NEXT WRITE
118     C
119     IECW=IECW+NQI
120     C
121     C      PREPARE THE POINTERS FOR THE NEXT READ DEPENDING ON WHICH BUFFER
122     C      IS TO BE FILLED
123     C
124     GO TO (30,40,10),IBUF
125     C
126     C      PREPARE TO FILL BUFFER ONE
127     C
128     30 CONTINUE
129     IJP=1
130     IJPS=1
131     IJ=ISC3
132     IJM=ISC2
133     IJMS=ISC2
134     C
135     C      INDICATE THAT BUFFER TWO IS TO BE FILLED NEXT TIME
136     C
137     IBUF=2
138     C
139     C      GO FILL BUFFER ONE
140     C
141     GO TO 20
142     C
143     C      PREPARE TO FILL BUFFER TWO
144     C
145     40 CONTINUE
146     IJP=ISC2

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147      IJPS=ISC2
148      IJ=1
149      IJM=ISC3
150      IJMS=ISC3
151      C
152      C      INDICATE THAT RUFFER THREE IS TO BE FILLED NEXT TIME
153      C
154      IBUF#3
155      C
156      C      GO FILL BUFFER TWO
157      C
158      GO TO 20
159      C
160      C      *****
161      ENTRY DONE
162      C      *****
163      C
164      C      LOOP IS COMPLETED, WRITE OUT CONTENTS OF THE LAST TWO BUFFERS
165      C      THAT WERE LOADED, WRITE OUT BUFFER THAT WOULD HAVE BEEN
166      C      FILLED NEXT.
167      C
168      CALL ECHR(AASC(IJMS),IECW,NOI,IDUM)
169      IECH=IECH+NOI
170      C
171      C      DETERMINE WHICH IS THE OTHER BUFFER TO BE EMPTIED
172      C
173      GO TO (50,60,70),IBUF
174      C
175      C      BUFFER ONE HAS BEEN WRITTEN OUT, WRITE OUT BUFFER TWO.
176      C
177      50 IJMS=ISC2
178      GO TO 80
179      C
180      C      BUFFER TWO HAS BEEN WRITTEN OUT, WRITE OUT BUFFER THREE.
181      C
182      60 IJMS=ISC3
183      GO TO 80
184      C
185      C      BUFFER THREE HAS BEEN WRITTEN OUT, WRITE OUT BUFFER ONE.
186      C
187      70 IJMS=1
188      80 CALL ECHR(AASC(IJMS),IECW,NOI,IDUM)
189      RETURN
190      END

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-----
1      SUBROUTINE STARTD
2      C
3      C      THIS ROUTINE (AND ITS ENTRY POINT LOOPD) ALLOW ONE TO LOOP
4      C      BACKWARDS THROUGH THE MESH USING TWO SCM BUFFERS. ROWS J
5      C      AND J+1 ARE MADE AVAILABLE, THE CALL TO STARTD READS ROW JP2
6      C      INTO BUFFER TWO AND ROW JP1 INTO BUFFER ONE, AFTER STARTD,

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7      C      IJ POINTS TO CELL (IP1,JP2). SEE DOCUMENTATION IN SUBROUTINE
8      C      START FOR SOME OF THE VARIABLE DEFINITIONS.
9      C
10     C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
11     C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1974
12     C
13     *      ----- BEGIN COMDECK PARAM -----
14     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
15     1 NLCP3,NLCP4,IPLMSZ
16     *      ----- END COMDECK PARAM -----
17     *      ----- BEGIN COMDECK YAGSC -----
18     LOGICAL RESTR7,FILM,PAPER,TURB
19     REAL LAM,MU
20     C      COMMON/YSC1/AASC(NSCP1)
21     COMMON/YSC1/AASC(9688)
22     COMMON/YSC2/AA(1),ANC,AB,...,AC,ABH,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
23     1 DTC(10),DTC(10),DTC2,DTC8,DTC8,DTC8,DTC8,DTC8,DTC8,DTC8,DTC8,DTC8,DTC8,
24     2 FIPYB,FIPYT,FIXL,FIXR,FIVB,FIVT,FREZXR,GR,GROVEL,GZ,GZP,I,ISAR,
25     3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
26     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
27     COMMON/YSC2/JCEH,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPH,MU,NAME(8),
28     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ10,NQ12,NSC,NUMIT,ZORIG,QH,QM,CYL,PXCONV
29     2 ,PXL,PXR,PYB,PYCONV,PYT,PDY,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
30     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
31     COMMON/YSC2/TUQI,TUSI,NQ,TNEG,TNEGSV,TUSV,TURR,PTOP,PRITE,PBOTH,
32     1 ILNG,NILNG,TP3,TUPOT,TQSAV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,TC,IST,
33     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIVB0,IYB0,YCNVLD,
34     3 XCNVLD,FIXRO,FIXLO,IXRO,IXLO,ISVH,JSVH,QMH,QMX,WMAX,JNM,TZ,TLIM,
35     4 ROMFXR,ROMFYT,ROMFYB,JOUMP,TWTHRO,TE,DTR,THASS,DVSAV,DTC SAV,IDTV
36     5 ,JDTV,IDTC,JDTG,CIRC,TIS,POTE,UMOM,VHOM,THAX,TGMX,ITH,JTM,ITG,JTG
37     ,THASSV,WMAXEF,RHINEF,TSTRYC
38     COMMON/YSC2/ZZ
39     C      COMMON/YSC4/ITAB(ITABP)
40     COMMON/YSC4/ITAB(1008)
41     COMMON/YSC5/RESTR7,FILM,PAPER,IPD,IFD
42     *      ----- END COMDECK YAGSC -----
43     DATA NE/0/
44     C
45     C      SET INITIAL SCM READ ADDRESS (BUFFER TWO)
46     C
47     IJMS=ISC2
48     C
49     C      SET NEXT LCM READ AND WRITE ADDRESSES.
50     C
51     C      ITV IS JP1+NQ1 OR THE LCM ADDRESS OF THE BEGINNING OF ROW JP2
52     C
53     IECR=ITV
54     IECW=ITV
55     C
56     C      READ ROW JP2 INTO BUFFER TWO
57     C
58     CALL ECR0(AASC(IJMS),IECR,NQ1,IDUM)
59     C
60     C      DECREMENT THE READ ADDRESS
61     C
62     IECR=IECR-NQ1
63     C

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60      PREPARE TO READ IN ROW J-1 INTO BUFFER ONE
      C
65      JUM POINTS TO (IP1,J-1) (THE END OF BUFFER ONE)
      C
70      CONTINUE
      C
71      JUM=1
      C
72      INUF IN THIS ROUTINE IS THE LAST BUFFER THAT WAS FILLED
      C
73      INUF=1
      C
74      JUM=J+NOI
      C
75      JUM=J+NOI (THE LAST CELL OF BUFFER TWO)
      C
76      JUM=J+NOI
      C
77      JUM=J+NOI
      C
78      JUM=J+NOI
      C
79      JUM=19C2
      C
80      CHECK TO SEE IF THE BOTTOM OF THE MESM HAS BEEN REACHED
      C
81      IF (ICR,11,0) GO TO 50
      C
82      NO, GO AHEAD AND READ IN THE NEXT BUFFER
      C
83      CALL ECRD(AASC(IJMS),ICR,NOI,IOW)
      C
84      DECREMENT THE READ ADDRESS
      C
85      ICR=ICR-NOI
      C
86      RETURN
      C
93      BOTTOM OF THE MESM HAS BEEN REACHED, SET A FLAG (IUF=3), GO
      C
95      WRITE OUT ROW J-2, AND QUIT
      C
96      IUF=3
      C
97      GO TO 50
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121      C
122      C      PREPARE POINTERS TO FILL BUFFER TWO
123      C
124      60 CONTINUE
125          IRUF=2
126          IJ=ISC2=NO
127          IJPS=1
128          IJM=IJ+NOI
129          IJMS=ISC2
130      C
131      C      GO DO THE ACTUAL READ
132      C
133      GO TO 20
134      END

```

```

1      SURROUTINE TICBOX
2
3      C      ROUTINE TO DRAW A BOX AROUND THE GRID AREA DISPLAYED
4      C      AND LABEL THE AXES
5      C
6      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
7      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1975
8      C
9      *      ----- BEGIN COMDECK PARAM -----
10     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
11     1 NLCP3,NLCP4,IFLMSZ
12     *      ----- END COMDECK PARAM -----
13     *      ----- BEGIN COMDECK YARSC -----
14     LOGICAL RESTRT,FILM,PAPER,TURB
15     REAL LAM,MU
16     C      COMMON/YSC1/AASC(NSCP1)
17     COMMON/YSC1/AASC(9600)
18     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABW,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
19     1 DTC(10),DTC(12),DTC2,DTCB,DTCPS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
20     2 FIPYB,FIPYT,FXL,FXR,FIYB,FIYT,FREZXR,GR,GRDEL,GZ,GZP,I,IBAR,
21     3 IDTC,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
22     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
23     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
24     1 NCYC,NLC,NPS,NPT,NO,NOI,NOIB,NOI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
25     2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
26     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
27     COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
28     1 ILCG,NILNG,TP3,TUPOT,TDO9AV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,T0,IST,
29     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLO,DTSV,DTLAST,FIYB0,IYB0,YCNVLD,
30     3 XCNVLO,FXRO,FXLO,IXRO,IXLO,ISVM,JSVM,QMN,QHX,NMAX,JNH,T2,TLM,
31     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,THASS,DTVSAB,DTCSAV,IDTY
32     5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VMOM,THAX,TGMX,ITH,JTH,ITG,JTG
33     6 ,THASSV,WMAXEF,RMINEF,TSTRTD
34     COMMON/YSC2/ZZ
35     C      COMMON/YSC4/ITAB(ITABP)
36     COMMON/YSC4/ITAB(1200)

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37      COMMON/YSOS/RESTR7,FILM,PAPER,IPD,IFD
38      *      ----- END COMDECK YAOSE -----
39      *      ----- BEGIN COMDECK PCALL -----
40      COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
41      *      ----- END COMDECK PCALL -----
42      COMMON/NCODEC/IMSIGN,XMAN,IESIGN,IEXP
43      DATA BCD/1H /
44      C
45      C      DRAW THE PLOT FRAME
46      C
47      CALL DRV(IXL,IYT,IXR,IYT)
48      CALL DRV(IXR,IYT,IXR,IYB)
49      CALL DRV(IXR,IYB,IXL,IYB)
50      CALL DRV(IXL,IYB,IXL,IYT)
51      C
52      C      IX2,IX3,IY2,AND IY3 ARE THE RASTER COORDINATES OF THE ENDS OF
53      C      THE TIC MARKS TO BE DRAWN ON THE PLOTTING RECTANGLE
54      C
55      IX2=IXL+8
56      IX3=IXR-8
57      IY2=IYB-8
58      IY3=IYT+8
59      C
60      C      ESTABLISH TOP AND BOTTOM FOR PLOT INCREMENTS, ROUND TOP AND
61      C      BOTTOM GRID VALUES TO THE NEAREST POWER OF 10, (YUPI,YLBI).
62      C
63      IXX=ALOG10(YUP)
64      DTIC=10,**IXX
65      C
66      C      DETERMINE THE Y EXTREMA TO USE TO SET DTIC,THE TIC INCREMENT.
67      C      THE Y MINIMUM,YLBI,IS SET SUCH THAT IT IS LESS THAN YLB
68      C      AND EQUAL TO AN INTEGRAL MULTIPLE OF THE POWER OF TEN
69      C      NEAREST TO BUT LESS THAN YUP. THE Y MAXIMUM,YUPI,IS
70      C      DETERMINED SIMILARLY BUT SO THAT IT IS GREATER THAN YUP.
71      C
72      C      ASSUME THAT YLB IS .GE.0
73      C
74      YLBI=0.
75      IF(DTIC,GE,YLB) GO TO 20
76      DO 10 I=1,9
77      YLBI=YLBI+DTIC
78      IF(YLBI,LT,YLB) GO TO 10
79      YLBI=YLBI-DTIC
80      GO TO 20
81      10 CONTINUE
82      CALL UNCLE(1,6,DTIC*9,24,24HCOULD NOT DETERMINE YLBI)
83      20 CONTINUE
84      YUPI=DTIC
85      DO 30 I=2,10
86      YUPI=YUPI+DTIC
87      IF(YUPI,GE,YUP) GO TO 40
88      30 CONTINUE
89      CALL UNCLE(1,6,DTIC*9,24,24HCOULD NOT DETERMINE YUPI)
90      40 CONTINUE
91      C
92      C      ROUNDS ESTABLISHED, DETERMINE THE LABELLING INCREMENT BASED
93      C      ON 10 INCREMENTS.

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94      C
95      DTIC=(YUPI-VLBI)*.1
96      50 CONTINUE
97      C
98      C      COMPUTE HOW MANY TICS WILL BE DRAWN
99      C
100     ITIC=0
101     YTICT=VLBI
102     60 CONTINUE
103     IF(YTICT,GE,VLB) GO TO 70
104     YTICT=YTICT+DTIC
105     GO TO 60
106     70 CONTINUE
107     VLBI=YTICT+DTIC
108     80 CONTINUE
109     IF(YTICT,GE,YUP) GO TO 90
110     ITIC=ITIC+1
111     YTICT=YTICT+DTIC
112     GO TO 80
113     90 CONTINUE
114     C
115     C      MUST BE AT LEAST 6 TICS OR DTIC WILL BE REDUCED
116     C
117     IF(ITIC,GE,6) GO TO 100
118     DTIC=DTIC/2.
119     GO TO 50
120     100 CONTINUE
121     C
122     C      YTIC IS THE Y-COORDINATE OF THE LABEL
123     C
124     YTIC=VLBI
125     110 CONTINUE
126     IF(YTIC,GE,VLB) GO TO 120
127     YTIC=YTIC+DTIC
128     GO TO 110
129     C
130     C      COMPUTE RASTER COORDINATE FOR YTIC
131     C
132     120 CONTINUE
133     IY1=FIYB+(YTIC-VLB)*YCONVP
134     C
135     C      IF THIS LABEL WOULD PUT US OUTSIDE OF THE GRID, CONSIDER THE
136     C      Y-LABELING FINISHED
137     C
138     IF(IY1,LT,IY1) GO TO 210
139     C
140     C      DRAW TICS ON THE LEFT AND RIGHT SIDES OF THE FRAME
141     C
142     CALL DRV(IXL,IY1,IX2,IY1)
143     CALL DRV(IX3,IY1,IXR,IY1)
144     C
145     C      PREPARE AND OUTPUT THE LABEL ITSELF
146     C
147     IMSIGN=1H
148     IF(YTIC,GT,0.) GO TO 140
149     IF(YTIC,LT,0.) GO TO 130
150     IMSIGN=2H0.

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151      CALL NCODE(8,6H(6XA2),IMSIGN,1,BCD)
152      GO TO 200
153 130 CONTINUE
154      XLOG=ALOG10(ABS(YTIC))
155      IMSIGN=1H-
156      GO TO 150
157 140 CONTINUE
158      XLOG=ALOG10(YTIC)
159 150 CONTINUE
160      IEXP=XLOG
161      XMAN=XLOG-FLOAT(IEXP)
162      IF(XMAN,GE,0.) GO TO 160
163      XMAN=XMAN+1.
164      IEXP=IEXP+1
165 160 CONTINUE
166      XMAN=1.2002H1-XMAN
167      IF(XMAN,LT,1.) GO TO 170
168      XMAN=XMAN+1.
169      IEXP=IEXP+1
170 170 CONTINUE
171      XMAN=10.**XMAN
172      IESIGN=1H-
173      IF(IEXP,GE,0) GO TO 180
174      IEXP=-IEXP
175      IFSIGN=1H-
176 180 CONTINUE
177      IF(IEXP,GE,10) GO TO 190
178      CALL NCODE(8,17H(1XA1,F4,2,A1,11),IMSIGN,4,BCD)
179      GO TO 200
180 190 CONTINUE
181      CALL NCODE(8,15H(A1,F4,2,A1,12),IMSIGN,4,BCD)
182 200 CONTINUE
183      CALL TSP(1,IV1,A,BCD)
184      C
185      C      INCREMENT THE TIC VALUE AND PROCEED
186      C
187      YTIC=YTIC+DTIC
188      GO TO 120
189      C
190      C      SAME PROCEDURE AS FOR Y-AXIS
191      C
192 210 CONTINUE
193      C
194      C      USE THE SAME LABELLING INCREMENT FOR THE X-AXIS
195      C
196      XTIC=0,
197 220 CONTINUE
198      IX1=FJXL+(XTIC-XL)*XCONVP
199      IF(IX1,GT,IXR) RETURN
200      CALL DRV(IX1,IYB,IX1,IY2)
201      CALL DRV(IX1,IY3,IX1,IYT)
202      JRITE=IYB+9
203      IRITE=IX1+29
204      IMSIGN=1H
205      IF(XTIC,GT,0.) GO TO 240
206      IF(XTIC,LT,0.) GO TO 230
207      IMSIGN=2H0,

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15      1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
16      2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
17      3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAP6AM(1),TUQ
18      4 (1),SIG(1),TUS(1),GRROR(1),GRROR(1),GRROR(1),GRROR(1),TUQVEC(1),MTIL(1),
19      5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
20      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21      * ----- END COMDECK YAQOIN -----
22      * ----- BEGIN COMDECK YAQSC -----
23      LOGICAL RESTRY,FILM,PAPER,TIJB
24      REAL LAM,MU
25      C COMMON/YSC1/AASC(NSCP1)
26      COMMON/YSC1/AASC(9600)
27      COMMON/YSC2/AA(1),ANC,AN,ANFAC,ANM,BN,COLAMU,CYL,DR,DT,DTC,DYFAC,
28      1 DTC(10),UTOC(10),DT02,DT06,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
29      2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FHZXR,GR,GROVEL,GZ,GZP,I,IBAR,
30      3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
32      COMMON/YSC2/JCFN,JP1,JP2,JP4,JUNF,JUNP02,KXI,LAM,LPS,MU,NAME(8),
33      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
34      2 ,PKL,PKR,PYB,PYCONV,PYT,RT,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
35      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUQT,TUSI,NCQ,YNQ,YNQSV,TUSV,TURB,PTOP,PRITE,PBOTH,
37      1 ILNG,NILNG,TP3,TUPOT,TDOSAV,TK,TI,TUQENG,EP1,SAV1,QLEVL,TD,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLD,DTSV,DTLAST,FIYBO,IYBO,YCNVLD,
39      3 XCNVLD,FIKRO,FIKLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,T2,TLIM,
40      4 ROMFR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,THASS,DYVSAY,DTCSAV,IDTV
41      5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,IJHOM,VHOM,TMAX,TGMX,ITM,JTM,ITG,JTG
42      6 ,THASSV,WMAXEF,RMINEF,TSTRID
43      COMMON/YSC2/ZZ
44      C COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRY,FILM,PAPER,IPD,IFD
47      * ----- END COMDECK YARSC -----
48      * ----- BEGIN COMDECK YAQEQ -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DKLSM,RCSQ,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIF),(AASC(16),PM0,DKLSM,RMP),(AASC(9
53      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
55      5 ),CAP6AM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRROR),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      * ----- END COMDECK YAQEQ -----
63      * ----- END COMDECK YSTORE -----
64      CALL START
65      DO 20 J=2,JP1
66      DO 10 I=1,IBAR
67      IPJP=IJP+NO
68      IPJ=IJ+NO
69      IMJ=IJ+NO
70      XI=X(IPJ)
71      YI=Y(IPJ)

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72      X2=X(IPJP)
73      Y2=Y(IPJP)
74      X3=X(IJP)
75      Y3=Y(IJP)
76      X4=X(IJ)
77      Y4=Y(IJ)
78      Y21=Y2-Y1
79      Y32=Y3-Y2
80      Y43=Y4-Y3
81      Y14=Y1-Y4
82      X12=X1-X2
83      X23=X2-X3
84      X34=X3-X4
85      X41=X4-X1
86      AVXSV(IJ)=.25*(X1+X2+X3+X4)
87      AVYSV(IJ)=.25*(Y1+Y2+Y3+Y4)
88      R12=R(IPJ)+R(IPJP)
89      R23=R(IJP)+R(IPJP)
90      R34=R(IJP)+R(IJ)
91      R41=R(IJ)+R(IPJ)
92      C=CONC(IJ)
93      SN=SIG(IJ)
94      RC=RO(IJ)
95      RCD=RC*TUQ(IJ)
96      RCS=RC*SIE(IJ)
97      AC=AREA(IJ)
98      IF(I.EQ,1) IMJ=IJ
99      IF(I.EQ,IBAR) IPJ=IJ
100     IF(J.EQ,2) IJM=IJ
101     IF(J.EQ,JP1) IJP=IJ
102     Z1=R12*(Y21**2+X12**2)*(SIG(IPJ)+SN)/(AREA(IPJ)+AC)
103     Z2=R23*(Y32**2+X23**2)*(SIG(IJP)+SN)/(AREA(IJP)+AC)
104     Z3=R34*(Y43**2+X34**2)*(SIG(IMJ)+SN)/(AREA(IMJ)+AC)
105     Z4=R41*(Y14**2+X41**2)*(SIG(IJM)+SN)/(AREA(IJM)+AC)
106     CTEMP(IJ)=0.5*((CONC(IPJ)=C)*Z1+(CONC(IJP)=C)*Z2+(CONC(IMJ)=C)*Z3+
107     1 (CONC(IJM)=C)*Z4)
108     DLSROI(IJ)=0.
109     DLSROQ(IJ)=0.
110     R1=RO(IPJ)
111     R2=RO(IJP)
112     R3=RO(IMJ)
113     R4=RO(IJM)
114     RNL(IJ)=0.5*((R1-RC)*Z1+(R2-RC)*Z2+(R3-RC)*Z3+(R4-RC)*Z4)
115     DLSROQ(IJ)=.5*((R1+TUQ(IPJ)=RCQ)*Z1+(R2+TUQ(IJP)=RCQ)*Z2+(R3+TUQ(
116     1 IMJ)=RCQ)*Z3+(R4+TUQ(IJM)=RCQ)*Z4)
117     DLSROI(IJ)=0.5*((R1+SIE(IPJ)=RCS)*Z1+(R2+SIE(IJP)=RCS)*Z2+(R3+SIE(
118     1 IMJ)=RCS)*Z3+(R4+SIE(IJM)=RCS)*Z4)
119     IJ=IJ+NQ
120     IJM=IJM+NQ
121     IJP=IJP+NQ
122     10 CONTINUE
123     CALL LOOP
124     20 CONTINUE
125     CALL DONE
126     CALL START
127     DO 80 J=2,JP1
128     DO 70 I=1,IBAR

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```

129      IPJ=IJ+NQ
130      IMJ=IJ+NQ
131      X1=AVXSV(IPJ)
132      X2=AVXSV(IJP)
133      X3=AVXSV(IMJ)
134      X4=AVXSV(IJM)
135      Y1=AVYSV(IPJ)
136      Y2=AVYSV(IJP)
137      Y3=AVYSV(IMJ)
138      Y4=AVYSV(IJM)
139      P1=P(IPJ)
140      P2=P(IJP)
141      P3=P(IMJ)
142      P4=P(IJM)
143      R01=R0(IPJ)
144      R02=R0(IJP)
145      R03=R0(IMJ)
146      R04=R0(IJM)
147      IF(1,NE,1) GO TO 30
148      X3=X1
149      Y3=Y1
150      P3=P1
151      R03=R01
152      30 IF(J,NE,2) GO TO 40
153      X4=X2
154      Y4=Y2
155      P4=P2
156      R04=R02
157      40 IF(1,NE,IBAR) GO TO 50
158      X1=X3
159      Y1=Y3
160      P1=P3
161      R01=R03
162      50 IF(J,NE,JP1) GO TO 60
163      X2=X4
164      Y2=Y4
165      P2=P4
166      R02=R04
167      60 CONTINUE
168      RA=1./((X1-X3)*(Y2-Y4)-(X2-X4)*(Y1-Y3))
169      Y31=(Y3-Y1)*RA
170      Y42=(Y4-Y2)*RA
171      X13=(X1-X3)*RA
172      X24=(X2-X4)*RA
173      DPDR=(P2-P4)*Y31+(P3-P1)*Y42
174      DPDZ=(P2-P4)*X13+(P3-P1)*X24
175      DRODR=(R02-R04)*Y31+(R03-R01)*Y42
176      DRODZ=(R02-R04)*X13+(R03-R01)*X24
177      GRROR(IJ)=DRODR*DPDR+DRODZ*DPDZ
178      GRROR(IJ)=DRODR
179      GRROR(IJ)=DRODZ
180      IJ=IPJ
181      IMJ=IJ+NQ
182      IJP=IJP+NQ
183      70 CONTINUE
184      CALL LOOP
185      80 CONTINUE

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186      CALL DONE
187      CALL START
188      CALL LOOP
189      DO 120 J=3,JP1
190      DO 110 I=1,IBAR
191      IMJ=IJ+NO
192      IMJM=IJM+NO
193      IF(I.EQ.1) IMJ=IJ
194      IF(I.EQ.1) IMJM=IJM
195      SIJ=0.25*(SIG(IJ)+SIG(IMJ)+SIG(IMJM)+SIG(IJM))
196      VVA=0.25*(1./RVOL(IJ)+1./RVOL(IMJ)+1./RVOL(IMJM)+1./RVOL(IJM))*RM(
197      I,IJ)
198      X1=AVXSXV(IJM)
199      X2=AVXSXV(IJ)
200      X3=AVXSXV(IMJ)
201      X4=AVXSXV(IMJM)
202      Y1=AVYSXV(IJM)
203      Y2=AVYSXV(IJ)
204      Y3=AVYSXV(IMJ)
205      Y4=AVYSXV(IMJM)
206      IF(I.NE.1) GO TO 90
207      X3=X2
208      X4=X1
209      Y3=Y2
210      Y4=Y1
211      90 CONTINUE
212      RXXA=1./((X1-X3)*(Y2-Y4)+(X2-X4)*(Y3-Y1))
213      XXA=((RO(IJM)-RO(IMJ))*(Y2-Y4)+(RO(IJ)-RO(IMJM))*(Y3-Y1))*RXXA+SIJ
214      YYA=((RO(IJ)-RO(IMJM))*(X1-X3)+(RO(IMJ)-RO(IJM))*(X2-X4))*RXXA+SIJ
215      XXA=XXA+VVA
216      YYA=YYA+VVA
217      IF(NCYC.EQ.NCO+1) GO TO 100
218      UTIL(IJ)=UTIL(IJ)+XXA=GRSV(IJ)
219      VTIL(IJ)=VTIL(IJ)+YYA=GZSV(IJ)
220      100 CONTINUE
221      GRSV(IJ)=XXA
222      GZSV(IJ)=YYA
223      IJ=IJ+NO
224      IJM=IJM+NO
225      110 CONTINUE
226      CALL LOOP
227      120 CONTINUE
228      CALL DONE
229      CALL START
230      DO 140 J=2,JP1
231      DO 130 I=1,IBAR
232      IPJ=IJ+NO
233      IPJP=IPJ+NO
234      SIJ=SIG(IJ)
235      DALF=.25*DT+SIJ
236      X13=X(IPJ)=X(IJP)
237      X24=X(IPJP)=X(IJ)
238      Y13=Y(IPJ)=Y(IJP)
239      Y24=Y(IPJP)=Y(IJ)
240      U13=U(IPJ)+U(IJP)
241      U24=U(IPJP)+U(IJ)
242      V13=V(IPJ)+V(IJP)

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243      V24=V(IPJP)+V(IJ)
244      R13=(R(IPJ)+R(IPJ))*DALF
245      R24=(R(IPJP)+R(IJ))*DALF
246      ZZ=GRROZ(IJ)
247      ZR=GRROZ(IJ)
248      H13=0.5*(U13*ZZ+V13*ZR)
249      H24=0.5*(U24*ZZ+V24*ZR)
250      H1=(H24*Y24+V24*ZZ*X24)*R24
251      H2=(H13*Y13+V13*ZZ*X13)*R13
252      H3=(H24*X24+U24*ZR*Y24)*R24
253      H4=(H13*X13+U13*ZR*Y13)*R13
254      UTIL(IPJ)=UTIL(IPJ)+H3*RM(IPJ)
255      UTIL(IPJP)=UTIL(IPJP)+H4*RM(IPJP)
256      UTIL(IJP)=UTIL(IJP)+H3*RM(IJP)
257      UTIL(IJ)=UTIL(IJ)+H4*RM(IJ)
258      VTIL(IJ)=VTIL(IJ)+H2*RM(IJ)
259      VTIL(IJP)=VTIL(IJP)+H1*RM(IJP)
260      VTIL(IPJ)=VTIL(IPJ)+H1*RM(IPJ)
261      VTIL(IPJP)=VTIL(IPJP)+H2*RM(IPJP)
262      C *****TURBULENCE ENERGY EQUATION*****
263      RIJ=RO(IJ)
264      RECRHO=1./RIJ
265      D=DFLSM(IJ)
266      XPR1=2.*(SIJ/(TUS(IJ)+2*QLEVEL)
267      TUQ(IJ)=RIJ*TUQ(IJ)+DT*(SIJ*(CAPGAM(IJ)+RIJ*GRROP(IJ)+RECRHO)+
268      1 DLSROQ(IJ)*RVOL(IJ))
269      TUQ(IJ)=(TUQ(IJ)+TWTHRD*D*D*SIJ*RIJ*DT)/((1.+(XPR1+TWTHRD*D)*DT)*
270      1 RIJ)
271      IF(TUQ(IJ),LT,0.) TNEG=TNEG+TUQ(IJ)*RIJ/RVOL(IJ)
272      IF(TUQ(IJ),LT,0.) TUQ(IJ)=0.
273      C *****INTERNAL ENERGY EQUATION*****
274      SIE(IJ)=SIE(IJ)+DT*(DLSROQ(IJ)*RVOL(IJ)+RECRHO*XPR1*TUQ(IJ))
275      IJ=IJ+NO
276      IJM=IJ+NO
277      IJP=IJP+NO
278      130 CONTINUE
279      CALL LOOP
280      140 CONTINUE
281      CALL DONE
282      RETURN
283      END

```

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-----
1      SUBROUTINE TRBERF
2      C
3      C ROUTINE TO CALCULATE THE ERROR FUNCTION VALUES TO BE USED
4      C FOR INTERPOLATION TO COMPUTE THE PARTICLE TURBULENT
5      C DIFFUSION MOTION
6      C
7      C WRITTEN BY J.L. NORTON, LASL T-3, 1975
8      C
9      C ***** BEGIN COMDECK TRBDIF *****

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10      COMMON/CTDIF/ERFV(21),NERFV,DxEF
11      *      ----- END COMDECK TRBDIF -----
12      *      ----- BEGIN COMDECK YAQSC -----
13      LOGICAL RESTR1,FILM,PAPER,TUNB
14      REAL LAM,MU
15      C      COMMON/YSC1/AASC(NSCP1)
16      COMMON/YSC1/AASC(9600)
17      COMMON/YSC2/AA(1),ANC,AR,AQFAC,ABM,B0,CLAMU,CYL,DR,DT,DTC,DTFAC,
18      1 DTC(10),DTC(10),DTC2,DTC8,DTCOS,DTV,DZ,EM10,EP5,FIPXL,FIPXR,
19      2 FIPYB,FIPYT,FIPL,FIPL,FIYB,FIYT,FREZXR,GR,GRDEL,GZ,GZP,I,IBAR,
20      3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
21      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
22      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(3),
23      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
24      2 ,PXL,PXR,PYB,PYCONV,PYT,PDY,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
25      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TNFIN
26      COMMON/YSC2/TUQ1,TUS1,NCO,TNEG,TNEGSV,TUSV,TURR,PTOP,PRITE,PROTH,
27      1 ILNG,NILNG,TP3,TUPOY,TQ9AV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,T0,IST,
28      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLD,OTSV,DTLAST,FIYB,IYB,YCNVLD,
29      3 YCNVLD,FIYB,FIYB,IXR,IXLO,IXR,IXLO,ISV,JSV,OMN,OMX,WMAX,JM,T2,TLM,
30      4 HOMFXR,ROMFYT,ROMFYB,JUMP,TWTRD,TE,DTR,TNASS,DTVSAY,DTCSAY,ITV
31      5 ,JDTV,ITC,JDT,CIRC,TIS,POTE,UMON,VMON,TMAX,TGMK,ITM,JTM,ITG,JTG
32      6 ,TNASSV,WMAXFF,RMINEF,TSTRTD
33      COMMON/YSC2/ZZ
34      C      COMMON/YSC4/ITAB(1TABP)
35      COMMON/YSC4/ITAB(1000)
36      COMMON/YSC5/RESTR1,FILM,PAPER,IPD,IFD
37      *      ----- END COMDECK YAQSC -----
38      C      FIRST,INITIALIZE THE VARIOUS PARAMETERS
39      C
40      C      NERFV IS THE NO. OF VALUES OF ERF IN THE INTERPOLATION TABLES
41      C
42      C      NERFV=21
43      C
44      C      DxEF IS THE SPACING IN X BETWEEN THE ERF(X) TABLE ENTRIES
45      C
46      C      DxEF=WMAXEF/FLOAT(NERFV-1)
47      C
48      C      COMPUTE THE TABLE VALUES
49      C
50      XEF=DxEF
51      DO 10 I=1,NERFV
52      XEF=XEF+DxEF
53      ERFV(I)=ERF(XEF)
54      10 CONTINUE
55      IF(ERFV(NERFV).LE.0.) CALL UNCLE(4,6HTRBERF,26,
56      1 26HERRORS IN CALCULATING ERFV)
57      RETURN
58      END

```

1 SUBROUTINE UNCLE(ISFLAG,RNAME,NCHAR,CHAR)

```

2      C
3      C      ERROR PROCESSING ROUTINE
4      C
5      C      ISFLAG = TYPE OF CALL
6      C          = 1 = FATAL ERROR,DUMP ARRAYS (NOT IMPLEMENTED)
7      C          = 2 = NORMAL EXIT
8      C          = 3 = DUMP ARRAYS AND RETURN (NOT IMPLEMENTED)
9      C          = 4 = FATAL ERROR,NO DUMP
10     C      RNAME = NAME OF CALLING ROUTINE
11     C      NCHAR = NO. OF CHARACTERS IN ERROR MESSAGE
12     C      CHAR = ERROR MESSAGE
13     C
14     C      WRITTEN BY J.L.NORTON,LASL T-3,1974
15     C
16     *      ----- BEGIN COMDECK PARAM -----
17     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITARVP,IPFB,NP1,NP2,NLCP1,NLCP2,
18     1 NLCP3,NLCP4,IFLMSZ
19     *      ----- END COMDECK PARAM -----
20     *      ----- BEGIN COMDECK YASC -----
21     LOGICAL RESTRT,FILM,PAPER,TURB
22     REAL LAM,MU
23     C      COMMON/YSC1/AASC(NSCP1)
24     COMMON/YSC1/AASC(9688)
25     COMMON/YSC2/AA(1),ANC,AN,AUFAC,ARM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
26     1 DTC(10),DTC(10),DTC2,DTC8,DTCOS,DTCV,DZ,EM10,EPS,FIPXL,FIPXP,
27     2 FIPYM,FIPYT,FIXL,FXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
28     3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
29     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
30     COMMON/YSC2/JCEN,JP1,JP2,JPA,JUNF,JUNFD2,KXI,LAM,LPR,MU,NAME(8),
31     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
32     2 ,PXL,PXR,PYB,PYCONV,PYT,RTY,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
33     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
34     COMMON/YSC2/TUOI,TUSI,NCQ,TNEG,TNEGSU,TUSV,TURB,PTOP,PRITE,PROTH,
35     1 ILNG,NILNG,TP3,TUPOT,TOSAV,YK,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
36     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLD,DTSV,DTLAST,FIYBD,IYB,YCNVLD,
37     3 XCNVLD,FIYR0,FIYLO,IXR0,IXLO,ISVW,JSVM,QMH,QMX,WMAX,JMH,T2,TLIM,
38     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,THASS,DVSAV,DYCSAV,IDTV
39     5 ,JDTV,IDTC,JOTC,CIRC,VIS,POTE,UNOM,VNOM,THAX,TGMX,ITM,JTM,ITG,JTG
40     6 ,THASS,WMAXEF,RHINEF,TSTNTD
41     COMMON/YSC2/ZZ
42     C      COMMON/YSC4/ITAR(ITARP)
43     COMMON/YSC4/ITAR(1000)
44     COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
45     *      ----- END COMDECK YASC -----
46     DIMENSION CHAR(1)
47     DATA TP/0,/
48     DO 10 IPX=6,IFD,6
49     10 WRITE(IPX,100)
50     GO TO (60,20,40,60),ISFLAG
51     20 CONTINUE
52     DO 30 IPX=6,IFD,6
53     30 WRITE(IPX,150)
54     GO TO 80
55     40 CONTINUE
56     DO 50 IPX=6,IFD,6
57     50 WRITE(IPX,130)
58     GO TO 80

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59      60 CONTINUE
60      DO 70 IPX=6, IFD, 6
61      70 WRITE(IPX, 110)
62      60 CONTINUE
63      NWD5=NCHAR/10
64      IF(NCD(NCHAR, 10), NE, 0) NWD5=NWD5+1
65      DO 90 IPX=6, IFD, 6
66      90 WRITE(IPX, 120) RNAME, (CHAR(II), II=1, NWD5)
67      90 WRITE(IPX, 140)
68      CALL SECOND(TP)
69      WRITE(50, 100) TP
70      IF(ISFLAG, EQ, 2) CALL EXIT
71      IF(ISFLAG, EQ, 3) RETURN
72      CALL EXIT(2)
73
74      C
75      100 FORMAT(1H , 25MCODE TERMINATION AT CP = , F10, 4)
76      110 FORMAT(1H , 20MFATAL ERROR IN YAQUT)
77      120 FORMAT(1H , 20MUNCLE CALLED BY ROUTINE , 16, 10X9A10)
78      130 FORMAT(1H , 10MSTART UNCLE DUMP)
79      140 FORMAT(1H , 6R(1H-))
80      150 FORMAT(1H , 25MNORMAL EXIT THROUGH UNCLE)
      END

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-----
1      SUBROUTINE VELPLT(VMAX, IFLAG)
2      C
3      C ROUTINE TO DO VELOCITY PLOTS
4      C
5      C VMAX IS THE MAXIMUM OF THE VELOCITY CURRENTLY BEING PLOTTED
6      C IN ANY ONE DIRECTION.
7      C IFLAG IS 0 FOR FLUID VELOCITY PLOTS SCALED BY VMAX, IT IS 1 FOR
8      C UNSCALED FLUID VELOCITY PLOTS AND 2 FOR SCALED RELATIVE
9      C VELOCITY PLOTS.
10     C
11     C ORIGINALLY WRITTEN BY A.A.AMSDEN, LASL T-3
12     C MODIFIED AND DOCUMENTED BY J.L.NORTON, LASL T-3, 1975
13     C
14     * ----- BEGIN COMDECK PARAM -----
15     * COMMON/PCOM/NSCP1, IYARP, ITABXP, ITABYP, IPFR, NP1, NP2, NLCP1, NLCP2,
16     * 1 NLCP3, NLCP4, IFMSZ
17     * ----- END COMDECK PARAM -----
18     * ----- BEGIN COMDECK YSTORE -----
19     * ----- BEGIN COMDECK YAQDIM -----
20     * DIMENSION X(1), XPAR(1), R(1), YPAR(1), V(1), MPAR(1), U(1), UG(1), DELSM(
21     * 1 1), V(1), VG(1), RO(1), SIE(1), MP(1), RMP(1), RCSQ(1), E(1), ETIL(1), RVOL
22     * 2 (1), M(1), RM(1), VP(1), P(1), PL(1), UP(1), UTIL(1), UL(1), CO(1), VTIL(1)
23     * 3 , VL(1), ROL(1), AVYSV(1), AVYSV(1), DLSROI(1), DLSROQ(1), CAPGAM(1), TUQ
24     * 4 (1), SIG(1), TUS(1), GRROZ(1), GRROZ(1), GRROP(1), TUQVEC(1), MYIL(1),
25     * 5 CONC(1), CTEMP(1), ANCU(1), ANCV(1), GRSV(1), GZSV(1), X13K(1), X24K(1),
26     * 6 Y13K(1), Y24K(1), XR13K(1), XR24K(1), DKLSM(1), AREA(1)
27     * ----- END COMDECK YAQDIM -----
28     * ----- BEGIN COMDECK YARSC -----

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20 LOGICAL RESTRT,FILM,PAPER,TURN
30 RFAL,LAM,MU
31 C COMMON/VSC1/AASC(NSCF1)
32 COMMON/VSC1/AASC(9688)
33 COMMON/VSC2/AA(1),ANC,AR,ARFAC,ARM,BR,COLAMH,CVL,DR,DT,DTC,DTFAC,
34 1 DTQ(1R),DTQC(1R),DTQ2,DTQ3,DTQ3S,DTV,DZ,EM10,EP3,FIPXL,FIPXN,
35 2 FIPYR,FIPYT,FIXL,FIXR,FIVB,FIVY,FREZYR,GR,GRDVEL,GZ,GZP,I,IBAR,
36 3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYR,IPYT,IP1,IP2,ISC2,ISC3,ITV,
37 4 IUNF,IXL,IXR,IYR,IYT,J,JHAB
38 COMMON/VSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KX1,LAM,LPH,MU,NAME(R),
39 1 NCYC,NLC,NPS,NPT,NQ,NM1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCVL,PXCONV
40 2 ,PXL,PXR,PYB,PYCONV,PYT,ROT,REZRON,REZSIF,REZYR,RIBAR,RIBJB,
41 3 FREZYT,FREZYB,ROMFR,T,TMHRD,NCLST,TOUT,TAFIN
42 COMMON/VSC2/TIOI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TUPR,PTOP,PWITE,PBOTH,
43 1 ILNG,WILNG,TP3,TMROT,TQSSAV,TK,TI,TUOENG,EP1,SAV1,QLEVEL,TG,IST,
44 2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLO,DTSV,DTLAST,FIVB0,IYB0,YCNVLC,
45 3 XCNVLD,FIXR0,FIXL0,IXR0,IXL0,ISV4,JSV4,QM4,QM4,MMA4,JNM,T2,TLIM,
46 4 RCMFVR,ROMFYT,ROMFYR,JDUMP,TMHRD,TE,CTR,TMASS,DTVSAV,DTCSAV,IDTV
47 5 ,JDTV,IDTC,JDTC,CINC,TIS,POTE,UMOM,VCOM,TMAX,TGMV,ITH,JTM,ITG,JTG
48 6 ,TMASSV,MMA4EF,MNINEF,TSTRTO
49 COMMON/VSC2/ZZ
50 C COMMON/VSC4/ITAB(ITABP)
51 COMMON/VSC4/ITAB(1R3H)
52 COMMON/VSC5/RESTRT,FILM,PAPER,IPD,IFD
53 * ----- END COMDECK YAO5C -----
54 * ----- BEGIN COMDECK YAO5Q -----
55 EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),V,MPAR),(
56 1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
57 1 (8),F,ETIL,AREA,XR13K),
58 2 (AASC(15),SIE),(AASC(16),PMQ,DKLSM,RMP),(AASC(9
59 3 ),RVOL),(AASC(1R),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
60 4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CO,ROL),(AASC(17
61 5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
62 6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),OLSR0I,V13K),(AASC(24),GZSV
63 7 ),(AASC(25),DLSROO,VG),(AASC(26),GRSV),(AASC(27),GRR0P,TUQVEC,
64 8 V24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
65 9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
66 1 AVYSV,X24K)
67 REAL M,MP,MPAR,MTIL
68 * ----- END COMDECK YAOEQ -----
69 * ----- END COMDECK YSTORE -----
70 * ----- BEGIN COMDECK PCALL -----
71 COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
72 * ----- END COMDECK PCALL -----
73 DIMENSION ITITLE(5,3)
74 DIMENSION IJL2(5),IJL3(5)
75 EQUIVALENCE(ITITLE(4),IJL2),(ITITLE(11),IJL3)
76 DATA ITITLE/49HFUID VELOCITY VECTORS SCALED TO MAXIMUM VELOCITY/
77 DATA IJL2/31MUNSCALED FLUID VELOCITY VECTORS,1M /
78 DATA IJL3/3RMVELOCITY OF GRID REL. TO FLUID,
79 1 20M SCALED TO MAX. VEL./
80 C
81 C SET UP THE VELOCITY VECTOR SCALING FACTOR,
82 C VV IS .9 TIMES AN AVERAGE DR, THIS IS USED TO SCALE THE LENGTH
83 C OF THE VELOCITY VECTOR SO IT IS NOT LONGER THAN THE EXTENT
84 C OF AN AVERAGE CELL,
85 C

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86      DROU=VV/VMAX
87      C
88      C      SPACE FORWARD TO THE NEXT FILM FRAME
89      C
90      CALL ADV(1)
91      C
92      C      .DOO OVER ALL REAL ZONES
93      C
94      CALL START
95      DO 20 J=2,JP2
96      DO 10 I=1,IP1
97      IF(IFLAG,EQ,1) DROU=0.5*VV/SQRT(U(IJ)**2+V(IJ)**2+EM10)
98      C
99      C      (IX1,IY1) IS THE LOCATION OF THE VERTEX,
100     C      (IX2,IY2) IS THE LOCATION OF THE END OF THE VELOCITY VECTOR,
101     C      IF EITHER ARE OUTSIDE OF THE PLOTTING RECTANGLE,SKIP THIS VERTEX,
102     C
103     IY1=FIYB+(Y(IJ)-YLB)*YCONVP
104     IF(IY1.GT.IYB.OR.IY1.LT.IYT) GO TO 10
105     IY2=FIYB+(Y(IJ)+V(IJ)*DROU-YLB)*YCONVP
106     IF(IY2.GT.IYB.OR.IY2.LT.IYT) GO TO 10
107     IX1=FIXL+(X(IJ)-XL)*XCONVP
108     IF(IX1.GT.IXR) GO TO 10
109     IX2=FIXL+(X(IJ)+XL*U(IJ)*DROU)*XCONVP
110     IF(IX2.GT.IXR) GO TO 10
111     C
112     C      DRAW THE VECTOR
113     C
114     CALL DRV(IX1,IY1,IX2,IY2)
115     C
116     C      PLOT A PLUS (+) AT THE VERTEX POSITION
117     C
118     CALL PLT(IX1,IY1,16)
119     10 IJ=IJ+ND
120     CALL LOOP
121     20 CONTINUE
122     C
123     C      LABEL THE PLOT WITH VMAX
124     C
125     CALL LINCNT(60)
126     IFLGP=IFLAG+1
127     WRITE(IFD,40) (ITITLE(I,IFLGP),I=1,5),VMAX
128     WRITE(IFD,30) JNM,NAME,T,NCYC
129     RETURN
130     C
131     30 FORMAT(1H ,4XA10,6A10,3X2HT=,1PE12,5,1X6HCYCLE=,I5)
132     40 FORMAT(1H ,5A10/10X5HVMAX=,1PE12,5)
133     END

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1      SUBROUTINE WIRON
2      C

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3      C      ROUTINE TO WRITE ROW J FROM SCM BUFFER ONE TO LCM
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T=3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T=3,1974
7      C
8      *      ----- BEGIN COMDECK PARAM -----
9      COMMON/PCOM/NSCP1,ITARP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
10     1 NLCP3,NLCP4,IFLMSZ
11     *      ----- END COMDECK PARAM -----
12     *      ----- BEGIN COMDECK YAGSC -----
13     LOGICAL RESTRT,FILM,PAPER,TURB
14     REAL LAM,MU
15     C      COMMON/YSC1/AASC(NSCP1)
16     COMMON/YSC1/AASC(9600)
17     COMMON/YSC2/AA(1),ANC,AP,A0FAC,A0M,H0,COLAMU,CYL,DR,DT,OTC,DTFAC,
18     1 DTO(10),DTC(10),DTC2,DTC8,DTCPOS,DTV,DZ,EMIB,EP3,FIPXL,FIPXR,
19     2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GRDVEL,GZ,GZP,I,IHAR,
20     3 IDTD,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
21     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
22     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPR,MU,NAME(8),
23     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,QM,QMCYL,PXCONV
24     2 PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,RFZSIE,REZYB,RIBAR,RIBJB,
25     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
26     COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
27     1 ILNG,NILNG,TP3,TUPOT,TQSAV,TK,TI,TUENG,EP1,SAV1,QLEVEL,TO,IST,
28     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DYLAST,FIYB0,IYB0,YCNVLD,
29     3 XCNVLD,FXRRO,FXRLO,IXR0,IXLO,ISVM,JSVM,QMN,QMX,WMAX,JNM,T2,TLM,
30     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMAX,DYVSAV,DTCYSAV,IDTV
31     5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMON,VMON,TMAX,TGMX,ITM,JTM,ITG,JTG
32     6 ,TMASSV,WMAXEF,RNINEF,TSTRTD
33     COMMON/YSC2/ZZ
34     C      COMMON/YSC4/ITAB(ITABP)
35     COMMON/YSC4/ITAB(1000)
36     COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
37     *      ----- END COMDECK YAGSC -----
38     DATA NE/0/
39     IEC=(J-1)*NQ1
40     CALL ECHR(AASC,IEC,NQ1,IDUM)
41     RETURN
42     END

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1      SUBROUTINE YAQUI2
2      C
3      C      MAIN ROUTINE FOR RUNNING CODE PHYSICS
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL,LASL T=3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T=3,1974
7      C
8      *      ----- BEGIN COMDECK PARAM -----
9      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
10     1 NLCP3,NLCP4,IFLMSZ

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11      *      ----- END COMDECK PARAM -----
12      *      ----- BEGIN COMDECK YSTORE -----
13      *      ----- BEGIN COMDECK YAQDIM -----
14      DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
15      1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
16      2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
17      3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUG
18      4 (1),SIG(1),TUS(1),GRROR(1),GRRORZ(1),GRRORP(1),TUGVEC(1),MTIL(1),
19      5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
20      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21      *      ----- END COMDECK YAQDIM -----
22      *      ----- BEGIN COMDECK YAQSC -----
23      LOGICAL RESTRT,FILM,PAPER,TURB
24      REAL LAM,MU
25      C      COMMON/YSC1/AASC(NSCP1)
26      COMMON/YSC1/AASC(9600)
27      COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
28      1 DTC(10),DTC(10),DTC2,DTC2,DTPOS,DTV,DZ,EM10,EP,EPXL,EPXP,
29      2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,
30      3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
32      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPS,MU,NAME(8),
33      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCVL,PXCONV
34      2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZYQ,RIBAR,RIBJB,
35      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUQI,TUSI,NCQ,NEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
37      1 TLNG,NILNG,TP3,TUPOT,TQSAV,TX,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOL,DTSV,DTCST,FIYB,IVB,YCNVLD,
39      3 XCNVLD,FIKRO,FIKLO,IKRO,IKLO,ISVW,JSVW,QMN,QMX,JNM,TZ,TLIM,
40      4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTC SAV,DTC SAV,DTV
41      5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VNOM,TMAX,TGMX,ITM,JTM,ITG,JTG
42      6 ,TMASSV,WMAXEF,RMINEF,TSTRTD
43      COMMON/YSC2/ZZ
44      C      COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
47      *      ----- END COMDECK YAQSC -----
48      *      ----- BEGIN COMDECK YAQEQ -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PMB,OKLSM,RMP),(AASC(9
53      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PMX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUG),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRRORZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUGVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      *      ----- END COMDECK YAQEQ -----
63      *      ----- END COMDECK YSTORE -----
64      *      ----- BEGIN COMDECK ASTORE -----
65      COMMON/ASTC/AT(100),FT(100)
66      DIMENSION IX1(1),IY1(1),IX2(1),IY2(1),XCO(1),YCO(1),CON(1)
67      EQUIVALENCE(AT,IX1),(AT(2),IX2),(AT(3),IY1),(AT(4),IY2),(AT(5),XCO

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68      1 ),(AT(9),YCO),(FT,CON)
69      *      ----- END COMDECK ASTORE -----
70      *      ----- BEGIN COMDECK PCALL -----
71      COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
72      *      ----- END COMDECK PCALL -----
73      COMMON/EQNST/ROTNP,ETNP,GMONE,CONCJ
74      LOGICAL EDIT, LAST, DUMP
75      REAL LAMD
76      DATA IVM,JVM,DRMIN,DZMIN,DRMAX,DZMAX/0,0,4*0, /
77      DATA ISHTCH/-1/
78      C
79      C      INITIALIZE ON STARTUP OR RESTART
80      C
81      NUMIT=0
82      TE=0.
83      DTR=0.
84      TMASS=0.
85      DTVSAV=0.
86      DTCSAV=0.
87      C
88      C      INITIALIZE IF THE TURBULENCE IS ON
89      C
90      IF(.NOT.TURB) GO TO 10
91      TNEG=0.
92      TP3=0.
93      SAVI=0.
94      TUDENG=0.
95      TDQSAV=1.
96      10 CONTINUE
97      C
98      C      DO CERTAIN INITIALIZATION ONLY DURING RESTART
99      C
100     IF(.NOT.RESTART) GO TO 20
101     CALL CINIT
102     IF(TURB) CALL TRBERF
103     GO TO 30
104     20 CONTINUE
105     C
106     C      STARTUP, CONTINUE INITIALIZATION.
107     C
108     DTV=0.
109     IDTV=0
110     JDTV=0
111     DTC=0.
112     IDTC=0
113     JOTC=0
114     C
115     C      -----
116     C      BEGIN LOOP OVER CYCLES
117     C      -----
118     C
119     30 CONTINUE
120     C
121     C      INITIALIZE TURBULENCE QUANTITIES
122     C
123     IF(.NOT.TURB) GO TO 40
124     TNEGSV=TNEGSV+TNEG

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125      TNEG=0,
126      EP1=TK+TI+TP3+TUQENG
127      TIP=TI-(TMASS-TMASSV)*REZ8IE
128      40 CONTINUE
129      C
130      C      TOLD IS THE TIME AT THE END OF THE LAST CYCLE
131      C
132      TOLD=T2
133      C
134      C      IF JUST FINISHING INITIALIZATION,GO DO AN EDIT FIRST
135      C
136      IF(NCYC,EQ,0) GO TO 150
137      50 CONTINUE
138      C
139      C      READY TO BEGIN NEXT CYCLE, INCREMENT THE CYCLE NO,
140      C
141      NCYC=NCYC+1
142      C
143      C      SET THE NEW TIMESTEP, SAVE THE OLD ONE IN DTLAST,
144      C
145      DTLAST=DT
146      C
147      C      ON THE FIRST CYCLE,SET DEFAULT DTC AND DTV
148      C
149      IF(NCYC,NE,1) GO TO 60
150      DTC=DT
151      DTV=DT
152      60 CONTINUE
153      C
154      C      ON THE SECOND CYCLE,BOOST DT BY A FACTOR OF 10
155      C
156      IF(NCYC,NE,2) GO TO 70
157      DT=10.*DT
158      DTSV=DT
159      70 CONTINUE
160      C
161      C      EXCEPT ON THE FIRST AND SECOND CYCLES,SET DT BASED ON DTV AND DTC
162      C
163      IF(NCYC,GE,3) DT=AMINI(DTV,DTC)
164      C
165      C      DO NOT ALLOW THE TIMESTEP TO INCREASE BY MORE THAN 25 PER CENT
166      C      OVER THE LAST CYCLE
167      C
168      DTFAC=1.25
169      DT=AMINI(DTFAC*DTSV,DT)
170      C
171      C      IF WE WILL BE DOING AN EDIT AFTER THE NEXT CYCLE,ADJUST DT TO
172      C      MAKE T EXACTLY EQUAL TO THE EDIT TIME, DTPOS IS DT BEFORE
173      C      ANY SUCH ADJUSTMENT, DTSV IS THE TIMESTEP SAVED FOR FUTURE
174      C      REFERENCE,
175      C
176      DTPOS=DT
177      DTSV=DT
178      IF(T+DT,GT,TOUT) DT=TOUT-T
179      IF(DT,LT,1.E=8) DT=1.E=8
180      C
181      C      UPDATE T

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239      VMAX=AMAX1(VMAX,ABS(U(IJ)),ABS(V(IJ)))
240      IF(J.NE.JTM.OR.I.NE.ITM) GO TO 80
241      IPJ=IJ+NQ
242      IJP=IJP+NQ
243      XTMX=.25*(X(IJ)+X(IPJ)+X(IJP)+X(IJJP))
244      YTMX=.25*(Y(IJ)+Y(IPJ)+Y(IJP)+Y(IJJP))
245      80 CONTINUE
246      IF(I.EQ.IP1) GO TO 90
247      IPJ=IJ+NQ
248      IF(U(IJ).NE.0.AND.V(IJ).NE.0) DTR=AMIN1(DTR,ABS((X(IPJ)-X(IJ))/U
249      I(IJ)),ABS((Y(IJP)-Y(IJ))/V(IJ)))
250      90 CONTINUE
251      IJ=IJ+NQ
252      IJP=IJP+NQ
253      100 CONTINUE
254      CALL LOOP
255      110 CONTINUE
256      CALL DONE
257      DTR=.1+DTR
258      C
259      C      SEE IF THIS IS AN EDIT CYCLE
260      C
261      IF(ILNG.NE.1) GO TO 120
262      C
263      C      YES, PLOT VELOCITY OF GRID RELATIVE TO THE FLUID.
264      C
265      FIYB=FIYB0
266      IYB=IYB0
267      YCONVP=YCNVLD
268      XCONVP=XCNVLD
269      FIXR=FIXR0
270      FIXL=FIXL0
271      IXR=IXR0
272      IXL=IXL0
273      YLB=YB
274      CALL ADV(1)
275      CALL VELPLT(VMAX,2)
276      120 CONTINUE
277      C
278      C      STORE U,V,AND RM INTO THEIR FINAL LOCATIONS AND ZERO RMP
279      C
280      CALL START
281      TP3=0.
282      DO 140 J=2,JP2
283      DO 130 I=1,IP1
284      U(IJ)=UP(IJ)
285      V(IJ)=VP(IJ)
286      RM(IJ)=RMP(IJ)
287      TP3=TP3+GZ*Y(IJ)/RM(IJ)
288      RMP(IJ)=0.
289      130 IJ=IJ+NQ
290      CALL LOOP
291      140 CONTINUE
292      CALL DONE
293      C
294      C      MOVE THE PARTICLES IF THERE ARE ANY
295      C

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296      IF(NPT.GT,0) CALL PRYMDV
297      C
298      C      FINISH THE CYCLE (PRINTS,SUMMARIES,ETC)
299      C
300      150 CONTINUE
301      C
302      C      CALCULATE QUANTITIES TO BE USED IN AN EDIT AND FOR THE NEXT CYCLE
303      C
304      CALL CINIT
305      C
306      C      T2 IS THE TIME AT THE END OF THE THIS CYCLE
307      C
308      CALL SECOND(T2)
309      C
310      C      CALCULATE THE CP TIME USED PER ZONE (GRIND TIME)
311      C
312      XX=(T2-TOLD)*RIBJB
313      C
314      C      CONVERT POTE TO ACTUAL GRAVITATIONAL POTENTIAL ENERGY
315      C
316      EPOT=POTE*GZ
317      C
318      C      COMPUTE FIREBALL DIAMETER AND AVERAGE HEIGHT
319      C
320      PDIAM=2.*PRITE
321      PAVHT=.5*(PTOP+PBOTM)
322      C
323      C      PRINT OUT CYCLE SUMMARY
324      C
325      DO 160 IPX=6,IFD,6
326      160 WRITE(IPX,340) NCYC,T,DT,T2,XX,NUMIT,CIRC,DTV,ITV,JDTV,DTG,IDTC,
327      1 JDTG,TMAX,ITM,JTM,XTMAX,YTMAX,TGMX,ITG,JTG,PRITE,PTOP,PBOTM,PDIAM
328      2 ,PAVHT
329      DO 170 IPX=6,IFD,6
330      170 WRITE(IPX,300) TI,TK,EPOT,UMOM,VNOM
331      DO 180 IPX=6,IFD,6
332      180 WRITE(IPX,320) DTV,DTG
333      CALL DVHM(VMAX,IVM,JVM,DRMIN,DZMIN,DRMAX,DZMAX)
334      DO 190 IPX=6,IFD,6
335      190 WRITE(IPX,310) VMAX,IVM,JVM
336      C
337      C      SEE IF IT IS TIME TO TURN ON THE TURBULENCE BASED ON TIME
338      C
339      C      IF(NCQ,EQ,0,AND,T,GE,TG) GO TO 240
340      C
341      C      NO. SEE IF IT IS TIME BASED ON CYCLES,
342      C
343      C      IF(NCYC,NE,0,AND,NCQ,EQ,NCYC) GO TO 200
344      C
345      C      NO. SKIP TURBULENCE SEEDING,
346      C
347      GO TO 240
348      200 CONTINUE
349      C
350      C      YES. FLIP ON THE SWITCH,
351      C
352      TURB=.TRUE.

```

```

353      NCG=NCVC
354      C
355      C      GO GET THE VORTICITY
356      C
357      CALL GETOMG
358      C
359      C      INITIALIZE TUQ AND TUSV
360      C
361      TUSV=0.
362      CUTOFF=-.1+OMH*TUQ1
363      CALL START
364      DO 220 J=2,JP1
365      DO 210 I=1,IBAR
366      TEST=-TUQ1+CQ(IJ)
367      TUQ(IJ)=0.
368      IF(TEST.GT.CUTOFF) TUQ(IJ)=TEST
369      TUSV=TUSV+TUQ(IJ)*RO(IJ)/RVOL(IJ)
370      IJ=IJ+NO
371      210 IJP=IJP+NO
372      CALL LOOP
373      220 CONTINUE
374      CALL DONE
375      C
376      C      INITIALIZE THE PARTICLE TURBULENT DIFFUSION
377      C      INTERPOLATION TABLES
378      C
379      CALL TRBERF
380      C
381      C      INDICATE THAT THE TURBULENCE HAS BEEN SEEDED
382      C
383      DO 230 IPX=6,IPD,6
384      230 WRITE(IPX,330) NCG,TUQ1,TUSV
385      240 CONTINUE
386      C
387      C      SEE IF TURBULENCE IS ON
388      C
389      IF(.NOT.TURB) GO TO 270
390      C
391      C      YES. CALCULATE SIG AND TUS.
392      C
393      CALL START
394      DO 260 J=2,JP1
395      DO 250 I=1,IBAR
396      TUS(IJ)=TUS1
397      SIG(IJ)=0.1FVFL*TUS(IJ)*SQRT(2.*TUQ(IJ))
398      250 IJ=IJ+NO
399      CALL LOOP
400      260 CONTINUE
401      CALL DONE
402      270 CONTINUE
403      C
404      C      SEE IF IT IS TIME DO AN EDIT
405      C
406      EDIT=.FALSE.
407      IF(T*EMIN,LT.T*OUT) GO TO 280
408      C
409      C      YES, SET THE FLAG AND UPDATE OUTPUT TIME.

```

```

410      C
411          EDIT=.TRUE.
412          TOUT=TOUT+DT0(IDT0)
413          IF(T+EM10,LT,DT0C(IDT0)) GO TO 280
414          TOUT=DT0C(IDT0)+DT0(IDT0+1)
415          IDT0=IDT0+1
416      280 CONTINUE
417      C
418      C      IF TURBULENCE HAS BEEN SEEDED,DO AN EDIT
419      C
420          IF(NCYC,EQ,NCQ) EDIT=.TRUE.
421      C
422      C      IF THIS IS STARTUP OR THE FIRST CYCLE,DO AN EDIT
423      C
424          IF(NCYC,LE,1) EDIT=.TRUE.
425      C
426      C      IF THE ITERATION COUNT HAS BEEN EXCEEDED,DO AN EDIT FOR
427      C          DIAGNOSTIC PURPOSES
428      C
429          IF(NUNIT,GE,500) EDIT=.TRUE.
430      C
431      C      SEE IF THIS IS THE LAST CYCLE
432      C
433          LAST=.FALSE.
434      C
435      C      QUERY TTY
436      C
437          CALL TTYTST(IFLAG)
438          IF(IFLAG,NE,0) LAST=.TRUE.
439          IF(T,GE,TWFIN) LAST=.TRUE.
440          IF(T2,GE,TLIM) LAST=.TRUE.
441          IF(NCYC,GE,NCLST) LAST=.TRUE.
442          IF(LAST,AND,IFLAG,EQ,0) EDIT=.TRUE.
443      C
444      C      SEE IF IT IS TIME TO DUMP
445      C
446          DUMP=.FALSE.
447          IF(LAST) DUMP=.TRUE.
448          IF(MOD(NCYC,JDUMP),EQ,0,AND,NCYC,NE,0) DUMP=.TRUE.
449          IF(EDIT,AND,NCYC,GT,1) DUMP=.TRUE.
450      C
451      C      DO THE EDIT IF REQUIRED
452      C
453          IF(.NOT,EDIT) GO TO 290
454          IF(FILM) CALL YPLOT
455          CALL YEDIT
456      290 CONTINUE
457      C
458      C      DO THE DUMP IF REQUIRED
459      C
460          IF(DUMP) CALL YDUMP
461      C
462      C      QUIT IF THIS IS THE LAST CYCLE
463      C
464          IF(LAST) RETURN
465      C
466      C      IF THIS IS THE EDIT AFTER INITIALIZATION,IMMEDIATELY BEGIN

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467 C      CYCLE 1
468 C
469 IF(NCYC,EQ,4) GO TO 50
470 GO TO 30
471 C
472 300 FORMAT(1H ,20X24HTOTAL INTERNAL ENERGY = ,1PE14,7/1H ,20X
473 1 23HTOTAL KINETIC ENERGY = ,E14,7/1H ,20X
474 2 31HTOTAL GRAV. POTENTIAL ENERGY = ,E14,7/1H ,20X
475 3 24HTOTAL RADIAL MOMENTUM = ,E14,7/1H ,20X
476 4 23HTOTAL AXIAL MOMENTUM = ,E14,7)
477 310 FORMAT(1H ,20X7HVMAX = ,1PE12,5,11H AT VERTEX ,215)
478 320 FORMAT(1H ,20X020,025)
479 330 FORMAT(1H ,27HTURBULENCE SEEDS ON CYCLE ,14,13H WITH TUNI = ,E12
480 1 ,5,1X1H,1H ,5X33HTOTAL TURBULENCE ENERGY SEEDS = ,E12,5)
481 340 FORMAT(1H ,6(1H),7H CYCLE ,15,4H ,T=,1PE12,5,5H ,DT=,F12,5,
482 1 5H ,CP=,E12,5/1H ,20X7HGRINDS=,E12,5,8H ,NUMIT=,I3,7H ,CIRC=,E12
483 2 ,5/1H ,20X4HDTV=,E12,5,7H ,IDTV=,I3,7H ,JDTV=,I3/1H ,20X4HDTC=,
484 3 E12,5,7H ,IDTC=,I3,7H ,JIDTC=,I3/1H ,20X5HTMAX=,E12,5,6H ,ITH=,I3,
485 4 6H ,JTH=,I3,6H ,XTMAX=,E10,3,6H ,YTHAX=,E10,3/1H ,20X5HTGMAX=,E12
486 5 ,5,6H ,ITG=,I3,6H ,JTG=,I3/1H ,20X5HPRIT=,E10,3,7H ,PTOP=,E10,3,
487 6 7H ,PBOT=,E10,3,6H ,PDIAH=,E10,3,6H ,PAVHT=,E10,3)
488 END

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-----
1 SUBROUTINE YARSRT
2 C
3 C ROUTINE TO RESTART A YAOUI PROBLEM
4 C
5 C WRITTEN BY J.L.NORTON,LASL T-3,1975
6 C
7 *
8 *----- BEGIN COMDECK PARAM -----
9 COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
10 1 NLCP3,NLCP4,IFLMSZ
11 *----- END COMDECK PARAM -----
12 *----- BEGIN COMDECK YSTORE -----
13 *----- BEGIN COMDECK YAQDIM -----
14 DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
15 1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
16 2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
17 3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROB(1),CAPGAM(1),TUQ
18 4 (1),SIG(1),TUS(1),GRROR(1),GRRORZ(1),GRRORP(1),TUQVEC(1),HTIL(1),
19 5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
20 6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21 *----- END COMDECK YAQDIM -----
22 *----- BEGIN COMDECK YAQSC -----
23 LOGICAL RESTRY,FILM,PAPER,TURB
24 REAL LAM,MU
25 C
26 COMMON/YSC1/AA(1),ANC,AR,ARFAC,ARM,BB,COLAMU,CYL,DR,DT,DTC,DTFAC,
27 1 DTQ(10),DTQC(10),DTQ2,DTQ8,DTQOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
28 2 FIPYB,FIPYT,FIPL,FIPLR,FIVB,FIVT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,

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29 3 IDT0,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
30 4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
31 COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
32 1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
33 2 ,PXL,PXR,PYB,PYCONV,PYT,RDY,REZRON,REZSIE,REZYB,RIBAR,RIBJR,
34 3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
35 COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
36 1 ILNG,NILNG,TP3,TUPQT,TDQSAV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
37 2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB,LYB,YCNVLD,
38 3 XCNVLD,FIYB,FIYD,IXR,IXLO,ISVW,JSVW,DMN,QHX,WMAX,JNH,T2,TLM,
39 4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DVSAV,DYCSAV,IDTV
40 5 ,JOTV,IDTC,JOTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITG,JTG
41 6 ,TMASSV,WMAXEF,RMINEF,TSTRTD
42 COMMON/YSC2/ZZ
43 C COMMON/YSC4/ITAB(ITAB)
44 COMMON/YSC4/ITAB(1000)
45 COMMON/YSC5/RESTR,FILM,PAPER,IPD,IFD
46 * ----- END COMDECK YAGSC -----
47 * ----- BEGIN COMDECK YAGEQ -----
48 EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
49 1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
50 1 (8),E,ETIL,AREA,XR13K),
51 2 (AASC(15),SIE),(AASC(16),PMO,DKLSM,RMP),(AASC(9
52 3 ),RVOL),(AASC(10),M,RH,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
53 4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
54 5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
55 6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
56 7 ),(AASC(25),DLSROG,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
57 8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
58 9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
59 1 AVYSV,X24K)
60 REAL M,MP,MPAR,MTIL
61 * ----- END COMDECK YAGEQ -----
62 * ----- END COMDECK YSTORE -----
63 INTEGER TAPE,AA
64 DIMENSION RCYCLE(3,3)
65 DATA (RCYCLE(II),II=1,9)/9*0/
66 DATA IEFLAG/0/
67 TLIMSV=TLIM
68 C
69 C SET UP NAMELIST INPUT TABLE
70 C
71 C ASSIGN 120 TO IERRT
72 CALL TABDEF(RCYCLE,6HRCYCLE,3,IERRT)
73 CALL TABSET(RCYCLE,6HINTCYC,INTCYC,IEFLAG,0,0,0,0)
74 CALL TARSET(RCYCLE,4HTAPE,TAPE,IEFLAG,0,0,0,0)
75 C
76 C READ THE RESTART TAPE NO. AND THE RESTART CYCLE. INTCYC=1
77 C SIGNIFIES RESTART FROM THE LAST DUMP ON THE TAPE.
78 C
79 INTCYC=1
80 TAPE=0
81 CALL NAMELIST(RCYCLE,5,IEFLAG)
82 C
83 C CHECK FOR INPUT ERRORS
84 C
85 IF(IEFLAG,NE,0) CALL UNCLE(4,6HYARSRT,27,

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86      1 27MRCYCLE NAMELIST INPUT ERROR)
87      C
88      C   OPEN THE INPUT DUMP FILE
89      C
90      C   CALL OPENIT(7,1)
91      C
92      C   NO ERRORS, CALL ROUTINE TO GET TAPE IF TAPE NO. WAS READ.
93      C       (ONLY FUNCTIONAL ON CROS/7600)
94      C
95      C   IF(TAPE,NE,0) CALL GETTPE(TAPE)
96      C   REWIND 7
97      C   JNSC=LOC(22)-LOC(AA)+1
98      C
99      C   READ THE NEXT CYCLE ON THE TAPE
100     C
101     10 CONTINUE
102     CALL SCBUFF(AA,JNSC,7,0,1,IERRO)
103     C
104     C   CHECK FOR ERRORS
105     C
106     C   IF(IERRO,GE,0) GO TO 30
107     20 CALL UNCLE(1,6HYARSRT,10,10SCBUFF INPUT ERROR)
108     30 CONTINUE
109     C   IF(IERRO,EQ,0) GO TO 40
110     C
111     C   SEE IF TERMINAL DUMP RECORD WAS FOUND
112     C
113     C   IF(AA(1),EQ,666) GO TO 70
114     C   GO TO 20
115     40 CONTINUE
116     C
117     C   NO. PRINT CYCLE NO. OF DUMP LAST READ.
118     C
119     C   DO 50 IPX=6,IFD,6
120     50 WRITE(IPX,130) NCYC
121     C
122     C   SEE IF LAST CYCLE IS DESIRED
123     C
124     C   IF(INTCYC,EQ,(-1)) GO TO 60
125     C
126     C   NO. SEE IF WE HAVE FOUND THE CORRECT CYCLE.
127     C
128     C   IF(NCYC=INTCYC) 60,80,110
129     60 CONTINUE
130     C
131     C   CORRECT CYCLE NOT FOUND YET. SKIP REST OF DUMP AND GO READ NEXT.
132     C
133     C   CALL RTAPE
134     C   GO TO 10
135     70 CONTINUE
136     C
137     C   DUMP TAPE TERMINATION FOUND. FATAL UNLESS INTCYC IS =1.
138     C
139     C   IF(INTCYC,NE,(-1)) CALL UNCLE(4,6HYARSRT,17,17EOF ON INPUT TAPE)
140     C
141     C   O.K. DUMP WAS THE LAST ONE READ.
142     C

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143      GO TO 90
144      80 CONTINUE
145      CALL RTAPE
146      90 CONTINUE
147      C
148      C      PRINT THE CYCLE NO., PROBLEM NAME, AND PROBLEM TIME
149      C
150      DO 100 IPX=6, IFD, 6
151      WRITE(IPX, 140) NCYC
152      100 WRITE(IPX, 150) NAME, T
153      C
154      C      RESTART COMPLETED, SEE IF THERE ARE CHANGES TO INPUT VARIABLES.
155      C
156      CALL YINPUT
157      TLM=TLIMSV
158      C
159      C      CLOSE THE INPUT DUMP FILE
160      C
161      CALL CLOSIT(7)
162      C
163      C      REFRESH THE CP TIME
164      C
165      CALL SECOND(T2)
166      RETURN
167      C
168      C      DUMP NOT ON TAPE, FATAL ERROR,
169      C
170      110 CONTINUE
171      CALL UNCLE(4, 6HYARSRT, 23, 23HRESTART CYCLE NOT FOUND)
172      120 CONTINUE
173      CALL UNCLE(4, 6HYARSRT, 36, 36HRCYCLE NAMELIST INITIALIZATION ERROR)
174      C
175      130 FORMAT(1H , 6HCYCLE , 15, 6H FOUND)
176      140 FORMAT(1H , 21HRESTARTING FROM CYCLE, 15)
177      150 FORMAT(1H , 8A10/1H , 2HT=, 1PE12, 5/1H )
178      END

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-----
1      SUBROUTINE YASET
2      C
3      C      ROUTINE TO GENERATE A NEW PROBLEM
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN, LASL T-3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON, LASL T-3, 1974
7      C
8      *
9      *      ----- BEGIN COMDECK PARAM -----
10     *      COMMON/PCOM/NSCP1, ITABP, ITABXP, ITABYP, IPFB, NP1, NP2, NLCP1, NLCP2,
11     *      1 NLCP3, NLCP4, IFLMSZ
12     *      ----- END COMDECK PARAM -----
13     *      ----- BEGIN COMDECK YSTORE -----
14     *      ----- BEGIN COMDECK YAGDIM -----
15     *      DIMENSION X(1), XPAR(1), R(1), YPAR(1), Y(1), MPAR(1), U(1), UG(1), DELSM(

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15      1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
16      2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
17      3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUQ
18      4 (1),SIG(1),TUS(1),GRROR(1),GRROZ(1),GRROP(1),TUQVEC(1),MTIL(1),
19      5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
20      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
21      * ----- END COMDECK YADDIM -----
22      * ----- BEGIN COMDECK YAGSC -----
23      LOGICAL RESTRT,FILM,PAPER,TURB
24      REAL LAM,MU
25      C COMMON/YSC1/AASC(NSCP1)
26      COMMON/YSC1/AASC(9600)
27      COMMON/YSC2/AA(1),ANC,A0,A0FAC,A0M,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
28      1 DTO(10),DTOC(10),DT02,DT08,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
29      2 FIPYB,FIPYT,FXL,FXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
30      3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
31      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
32      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
33      1 NCYC,NLC,NPS,NPT,NQ,NQI,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
34      2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
35      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
36      COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
37      1 ILNG,NILNG,TP3,TUPOD,TDQSAV,TM,TI,TUENG,EP1,BAV1,QLEVEL,TQ,IST,
38      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB0,IYB0,YCNVLD,
39      3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,GMX,OMX,IMAX,JNM,T2,TLIM,
40      4 ROMFYR,ROMFYT,ROMFYB,JDUMP,TNTHRD,TE,DTR,THASS,CTVSAB,DTCSAV,IDTV
41      5 ,JDTV,IDTC,JOTC,CIRC,TIS,POTE,UMOM,VHOM,THAX,TGMX,ITH,JTH,ITG,JTG
42      6 ,THASSV,WMAXEF,RMINEF,YSTRTD
43      COMMON/YSC2/ZZ
44      C COMMON/YSC4/ITAB(ITABP)
45      COMMON/YSC4/ITAB(1000)
46      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
47      * ----- END COMDECK YAGSC -----
48      * ----- BEGIN COMDECK YAGEQ -----
49      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
50      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
51      1 (8),E,ETIL,AREA,XR13K),
52      2 (AASC(15),SIE),(AASC(16),PM0,DKLSM,RMP),(AASC(9
53      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
54      4 UL,PMX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
55      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
56      6 21),GRROR),(AASC(22),GRROZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
57      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROP,TUQVEC,
58      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
59      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
60      1 AVYSV,X24K)
61      REAL M,MP,MPAR,MTIL
62      * ----- END COMDECK YAGEQ -----
63      * ----- END COMDECK YSTORE -----
64      * ----- BEGIN COMDECK CTAB -----
65      C COMMON/CTABC/XTAB(ITABXP),YTAB(ITABYP)
66      COMMON/CTABC/XTAB(101),YTAB(151)
67      * ----- END COMDECK CTAB -----
68      DATA NE/0/
69      C
70      C READ THE PROBLEM TITLE
71      C

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72      READ(S,320) NAME
73      C
74      C      INITIALIZE THE PROBLEM VARIABLES
75      C
76      CALL DEFINE
77      C
78      C      READ THE INPUT VARIABLES
79      C
80      CALL YINPUT
81      C
82      C      OUTPUT THE PROBLEM TITLE
83      C
84      DO 10 IPX=6,IFD,6
85      10 WRITE(IPX,320) NAME
86      C
87      C      IF NCQ,LY,0,THERE WILL BE NO TURBULENCE
88      C
89      IF(NCQ,LY,0) GO TO 30
90      C
91      C      THERE WILL BE TURBULENCE, PRINT OUT THE INPUT QUANTITIES
92      C
93      DO 20 IPX=6,IFD,6
94      20 WRITE(IPX,290) QLEVEL,TUQI,TUSI,NCQ,TQ,TSTRTD,WMAXEF,RMINEF
95      GO TO 50
96      C
97      C      THERE WILL BE NO TURBULENCE, INDICATE SUCH,
98      C
99      30 CONTINUE
100     DO 40 IPX=6,IFD,6
101     40 WRITE(IPX,300)
102     50 CONTINUE
103     C
104     C      PRINT GENERAL INPUT VARIABLES
105     C
106     DO 60 KY=6,IFD,6
107     WRITE(KY,330) IBAR,JBAR,IUNF,JUNF,JCEN,DR,DZ,CYL,GRDVEL,AR,A0M,B0,
108     1 KXI
109     WRITE(KY,340) MU,LAM,OM,EPS,GR,GZ
110     WRITE(KY,350) FREZXR,FREZYT,FREZYR,ZORIG,YB,REZY0,REZR0N,REZSIE
111     WRITE(KY,360) GZP
112     WRITE(KY,370) T,DT,NCLST,TWFIN,PAPER,FILM
113     WRITE(KY,260) ANC,ARFAC
114     WRITE(KY,310) IST
115     WRITE(KY,380) (DTC(N),N=1,10)
116     WRITE(KY,390) (DTC(N),N=1,10)
117     60 CONTINUE
118     C
119     C      CALCULATE AND STORE PROBLEM CONSTANTS
120     C
121     IM1=IBAR-1
122     IP1=IBAR+1
123     IP2=IBAR+2
124     JP1=JBAR+1
125     JP2=JBAR+2
126     JP4=JBAR+4
127     RIBAR=1./FLOAT(IBAR)
128     RJBAR=1./FLOAT(JBAR+JBAR)

```

```

129      NOIB=NQ*IBAR
130      ONCYL=1,=CYL
131      ENIB=1,E=10
132      IF(FREZXR,NE.1,) ROMFXR=1,/(1,=FREZXR)
133      IF(FREZYT,NE.1,) ROMFYT=1,/(1,=FREZYT)
134      IF(FREZYB,NE.1,) ROMFYB=1,/(1,=FREZYB)
135      C
136      C      NQI IS THE NO. OF WORDS OF DATA NEEDED TO STORE ONE ROW, IT IS
137      C      THE SIZE OF A SMALL CORE BUFFER.
138      C
139      NQI=NQ*IP1
140      C
141      C      SEE ROUTINE =START= FOR DEFINITIONS
142      C
143      ISC2=NQI+1
144      ISC3=ISC2+NQI
145      C
146      C      SEE ROUTINE =STARTD= FOR DEFINITIONS
147      C
148      ITV=JP1+NQI
149      C
150      C      NSC IS THE NO. OF WORDS OF SMALL CORE IN COMMON YSC2
151      C
152      NSC=LOCF(ZZ)=LOCF(AA)+1
153      C
154      C      NLC IS THE NO. OF WORDS OF LARGE CORE USED IN COMMON YLC1. IT
155      C      SHOULD NOT EXCEED THE PARAMETER VALUE.
156      C
157      NLC=JP4+NQI
158      C
159      C      GO CHECK THE LARGE AND SMALL CORE PARAMETERS
160      C
161      CALL PCCHK
162      C
163      C      IDTO IS THE SUBSCRIPT IN THE DTOC ARRAY SUCH THAT
164      C      DTOC(IDTO=1),LT,T,LE,DTOC(IDTO)
165      C
166      IDTO=1
167      C
168      C      TOUT IS THE TIME AT WHICH OUTPUT SHOULD OCCUR NEXT
169      C
170      TOUT=DTOT(1)
171      IF(TOUT,GT,T) GO TO 90
172      70 CONTINUE
173      TOUT=TOUT+DTOT(IDTO)
174      IF(TOUT,LE,DTOC(IDTO)) GO TO 80
175      TOUT=DTOT(IDTO)
176      IDTO=IDTO+1
177      80 IF(TOUT,GT,T) GO TO 90
178      GO TO 70
179      90 CONTINUE
180      C
181      C      THE TIMESTEP FOR THE FIRST CYCLE IS REDUCED BY A FACTOR OF 10
182      C      FROM THE SPECIFIED INITIAL DT
183      C
184      DT=.1*DT
185      C

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186 C      DTPOS IS THE TIMESTEP THAT IS POSSIBLE BASED ON STABILITY
187 C      CRITERIA. THE ACTUAL TIMESTEP DT MAY BE LESS IF IT HAS BEEN
188 C      ADJUSTED ON AN OUTPUT CYCLE SO THAT T=TDUT EXACTLY.
189 C
190 C      DTPOS=DT
191 C
192 C      DTSV IS THE TIMESTEP FROM THE LAST CYCLE
193 C
194 C      DTSV=DT
195 C
196 C      NCYC IS THE CYCLE NO.
197 C
198 C      NCYC=0
199 C
200 C      COLAMU IS  $1/(2/3*(2*MU+LAM))$ 
201 C
202 C      COLAMU=1.5/(LAM+MU+MU*EM10)
203 C
204 C      NILNG IS THE NO. OF TIMES A PARTICLE HAS BEEN STORED FOR USE IN
205 C      MAKING TIME-DEPENDENT PARTICLE PLOTS
206 C
207 C      NILNG=0
208 C
209 C      IUNF MUST BE AT LEAST 1
210 C
211 C      IUNF=MAX0(IUNF,1)
212 C
213 C      JUNF MUST BE AT LEAST 2
214 C
215 C      JUNF=MAX0(JUNF,2)
216 C      JUNF02=JUNF/2
217 C
218 C      IF JCEN IS ZERO, SET IT TO JBAR/2
219 C
220 C      IF(JCEN.EQ.0) JCEN=JBAR/2
221 C
222 C      GO GENERATE THE PARTICLES
223 C
224 C      CALL PRGEN
225 C
226 C      GO GENERATE THE MESH
227 C
228 C      CALL MSHMKR
229 C
230 C      GO SET THE PLOT QUANTITIES
231 C
232 C      CALL FILMCO
233 C
234 C      *****
235 C      LOCATE WHICH CELL EACH PARTICLE IS IN IF THERE ARE ANY PARTICLES
236 C      *****
237 C
238 C      IF(NPT.LE.0) GO TO 210
239 C
240 C      ASSUMING THAT THE MESH IS STILL RECTANGULAR, STORE THE X AND Y
241 C      VALUES IN XTAB AND YTAB, MAKE SURE THE ARRAYS ARE LARGE
242 C      ENOUGH.

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```

243 C      IF(JP2,GT,ITABYP) CALL UNCLE(4,5HYASET,21,21MYTAB ARRAY OVERFLOWED
244 1 )
245      IF(IP1,GT,ITABXP) CALL UNCLE(4,5HYASET,21,21MYTAB ARRAY OVERFLOWED
246 1 )
247      CALL START
248      DO 120 J=2,JP2
249      YTAB(J)=Y(IJ)
250      IF(J,GT,2) GO TO 110
251      DO 100 I=1,IP1
252      XTAB(I)=X(IJ)
253      100 IJ=IJ+NQ
254      110 CALL LOOP
255      120 CONTINUE
256 C
257 C      INITIALIZE THE LCM ADDRESS AND THE PARTICLE COUNT
258 C
259 C      IECP=1
260      NPPT=0
261 C
262 C      BRING IN A BUFFER=FULL OF PARTICLE DATA
263 C
264 C      LPB IS SET IN PARTGEN
265 C
266 C      130 CALL ECPD(AASC,NLCP1+IECP=1,LPB,IDUM)
267      KP=1
268      140 CONTINUE
269 C
270 C      LOCATE THE I AND J OF THE CELL CONTAINING THE PARTICLE IN QUESTION
271 C
272 C      DO 150 J=2,JP2
273      IF(YTAB(J),GT,YPAR(KP)) GO TO 170
274      150 CONTINUE
275      DO 160 IPX=6,IPD,6
276      160 WRITE(IPX,270) YTAB(JP2),YPAR(KP),KP
277      CALL UNCLE(1,5HYASET,23,23HJ OF PARTICLE NOT FOUND)
278      170 DO 180 I=1,IP1
279      IF(XTAB(I),GT,XPAR(KP)) GO TO 200
280      180 CONTINUE
281      DO 190 IPX=6,IPD,6
282      190 WRITE(IPX,280) XTAB(IP1),XPAR(KP),KP
283      CALL UNCLE(1,5HYASET,23,23HI OF PARTICLE NOT FOUND)
284      200 CONTINUE
285 C
286 C      INCREMENT THE PARTICLE COUNT
287 C
288 C      NPPT=NPPT+1
289 C
290 C      I AND J OF CELL FOUND. CODE IT AND STORE IN ITAB. FIRST MAKE SURE
291 C      THAT STORAGE WILL NOT BE OVERFLOWED.
292 C
293 C      IF(NPPT,GT,ITABP) CALL UNCLE(4,5HYASET,21,21HITAB ARRAY OVERFLOWED
294 1 )
295      ITAB(NPPT)=(J-2)*IP1+I=J
296 C
297 C      SEE IF ALL PARTICLES HAVE BEEN PROCESSED
298 C
299 C

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```

300      IF(NPPT,GE,NPT) GO TO 210
301      C
302      C      NO. SEE IF THE BUFFER NEEDS TO BE RELOADED.
303      C
304      KP=KP+3
305      IF(KP,LT,LPH) GO TO 140
306      C
307      C      YES. INCREMENT THE LCM POINT AND REFILL THE BUFFER
308      C
309      IECP=IECP+LPB
310      GO TO 130
311      210 CONTINUE
312      C
313      C
314      C      *****
315      C      CALCULATE THE CELL-CENTERED VOLUMES (RECIPROCALLS),MASSES,AND
316      C      TOTAL ENERGIES FOR ALL CELLS
317      C      *****
318      C
319      CALL START
320      DO 230 J=2,JP1
321      DO 220 I=1,IBAR
322      IPJ=IJ+NQ
323      IPJP=IJP+NQ
324      X1=X(IPJ)
325      Y1=Y(IPJ)
326      R1=R(IPJ)
327      X2=X(IPJP)
328      Y2=Y(IPJP)
329      R2=R(IPJP)
330      X3=X(IJP)
331      Y3=Y(IJP)
332      R3=R(IJP)
333      X4=X(IJ)
334      Y4=Y(IJ)
335      R4=R(IJ)
336      RVOL(IJ)=0./((R1+R2+R3+R4)*((X1-X3)*(Y2-Y4)-(Y1-Y3)*(X2-X4)))
337      M(IJ)=RO(IJ)/RVOL(IJ)
338      GRROR(IJ)=0.
339      GRROR(IPJ)=0.
340      GRROR(IPJP)=0.
341      GRROR(IJP)=0.
342      GRROR(IJ)=0.
343      GRROR(IJP)=0.
344      GRROR(IPJP)=0.
345      E(IJ)=SIE(IJ)+.125*(U(IPJ)**2+U(IPJP)**2+U(IJP)**2+U(IJ)**2+V(IPJ)
346      1 **2+V(IPJP)**2+V(IJP)**2+V(IJ)**2)
347      IJ=IPJ
348      220 IJP=IPJP
349      CALL LOOP
350      230 CONTINUE
351      CALL DONE
352      C
353      C
354      C      *****
355      C      COMPUTE THE VERTEX MASSES,EXCEPT FOR BOUNDARY VERTICES,THE VERTEX
356      C      MASS IS JUST 1/4 OF THE MASSES OF ALL THE CELLS HAVING THE
357      C      VERTEX AS A CORNER.

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357 C *****
358 C
359 CALL STARTO
360 DU 250 JJ=2,JP2
361 J=JP4=JJ
362 DO 240 II=1,IP1
363 I=IP2=II
364 IMJ=IJ=NO
365 IMJM=IJM=NO
366 XX=0.0
367 IF(I.NE,IP1,AND,J.NE,2) XX=M(IJM)
368 IF(I.NE,IP1,AND,J.NE,JP2) XX=XX+M(IJ)
369 IF(I.NE,1,AND,J.NE,JP2) XX=XX+M(IMJ)
370 IF(I.NE,1,AND,J.NE,2) XX=XX+M(IMJM)
371 RM(IJ)=4./XX
372 IJ=IMJ
373 240 IJM=IMJM
374 CALL LOOPD
375 250 CONTINUE
376 RETURN
377 C
378 260 FORMAT(1H ,3X4HANC=,1PE12,5/1H ,1X6HABFAC=,E12,5)
379 270 FORMAT(1H,12HYTAB,YPAR,KP,2E20,7,I10)
380 280 FORMAT(1H,12HXTAB,XPAR,KP,2E20,7,I10)
381 290 FORMAT(1H ,24HTHERE WILL BE TURBULENCE/1X7HOLEVEL=,1PE12,5/3X
382 1 SHTUQI=,E12,5/3XSHTUSI=,E12,5/4X0HNCQ=,15/5X3HTQ=,E12,5/1H ,7HTST
383 1 E12,5/1H ,7HWMAXEP=,E12,5/1H ,7HRMINEF=,E12,5)
384 300 FORMAT(15H NO TURBULENCE)
385 310 FORMAT(1H ,3X,4HIST=,I4)
386 320 FORMAT(8A10)
387 330 FORMAT(3X,5HIBAR=I4/3X,5HJBAR=I4/3X,5HIUNF=I4/3X,5HJUNF=I4/3X,
388 1 5HJCEN=I4/5X,3HDR=1PE12,5/5X,3HDZ=1E12,5/4X,4HCYL=1E12,5/8H GRDVEL=
389 2 E12,5/5X,3HAB=1E12,5/4X,4HABH=1E12,5/5X,3HBB=1E12,5/4X,4HKKI=I3)
390 340 FORMAT(5X,3HMU=1PE12,5/4X,4HLAM=1E12,5/5X,3HOM=1E12,5/4X,4HEPS=1E12,5
391 1 /5X,3HGR=1E12,5/5X,3HGZ=1E12,5)
392 350 FORMAT(1H ,7HFREZXR=,1PE12,5/1H ,7HFREZYT=,E12,5/1H ,7HFREZYB=,E12
393 1 ,5/1H ,1X6HZORIG=,E12,5/1H ,4X3HYB=,E12,5/1H ,1X6HREZYR=,E12,5/
394 2 1H ,7HREZRDN=,E12,5/1H ,7HREZRIE=,E12,5)
395 360 FORMAT(4X,4HGZP=1E12,5)
396 370 FORMAT(1H ,5X2HT=,1PE12,5/1H ,4X3MDT=,E12,5/1H ,1X6HNCCLST=,I6/1H ,
397 1 1X6HTWFIN=,E12,5/1H ,1X6HPCPER=,I1/1H ,2X5HFILM=,I1)
398 380 FORMAT(12H DTD(1=10)=4(1PE14,5)/(12X,4E14,5))
399 390 FORMAT(12H DTOC(1=10)=4(1PE14,5)/(12X,4E14,5))
400 END

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-----
1 SUBROUTINE YDUMP
2 C
3 C ROUTINE TO DO A YAGUI DUMP
4 C
5 C WRITTEN BY J.L.NORTON,LASL T=3,1975
6 C

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7      *      ***** BEGIN COMDECK PARAM *****
8      COMMON/PCOM/NSCP1,ITABP,ITABNP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
9      1 NLCP3,NLCP4,IFLMSZ
10     *      ***** END COMDECK PARAM *****
11     *      ***** BEGIN COMDECK YSTORE *****
12     *      ***** BEGIN COMDECK YADDIM *****
13     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
14     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
15     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
16     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUG
17     4 (1),SIG(1),TUS(1),GRROR(1),GRRDZ(1),GRRORP(1),TUGVEC(1),MTIL(1),
18     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GPSV(1),GZSV(1),X13K(1),X24K(1),
19     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
20     *      ***** END COMDECK YADDIM *****
21     *      ***** BEGIN COMDECK YAQSC *****
22     LOGICAL RESTRT,FILM,PAPER,TURB
23     REAL LAM,MU
24     C      COMMON/YSC1/AA(1),ASC(NSCP1)
25     COMMON/YSC1/AA(1),ASC(9600)
26     COMMON/YSC2/AA(1),ANC,AR,A0FAC,A0M,B0,COLAMU,CYL,DR,DT,DTC,DTFAC,
27     1 DTC(10),DTC(10),DT02,DT08,DT05,DTV,DZ,EM10,EP3,FIPXL,FIPXR,
28     2 FIPYB,FIPYT,FXL,FXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,ISAR,
29     3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
30     4 JUNF,IXL,IXR,IYB,IYT,J,JBAR
31     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LFB,ML,NAME(8),
32     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
33     2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRG,REZSIE,REZY0,R1BAR,R1BJB,
34     3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
35     COMMON/YSC2/TUGI,TUSI,NCQ,TNEG,TNEGSV,TU9V,TURB,PTOP,PRITE,PBOTH,
36     1 ILNG,NILNG,TP3,TUPOT,TQSAV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
37     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOL,DTSV,DTLAST,FIYB,IBYB,YCNVLD,
38     3 XCNVLD,FXRO,FXLO,IXRO,IXLQ,ISVH,JSVH,GMN,GMX,WMAX,JNM,T2,TLM,
39     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TNTHRD,TE,DTR,THASS,DTVSAV,DTCSAV,IDTV
40     5 ,JDTV,JDTC,JDTC,CIRC,TIS,POTE,UMOM,VOM,THAX,TGMX,ITH,JTM,ITG,JTG
41     6 ,THASSV,WMAXEF,RMINEF,TSTRD
42     COMMON/YSC2/ZZ
43     C      COMMON/YSC4/ITAB(ITABP)
44     COMMON/YSC4/ITAB(1000)
45     COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
46     *      ***** END COMDECK YAQSC *****
47     *      ***** BEGIN COMDECK YAQEQ *****
48     EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
49     1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
50     1 (8),E,ETIL,AREA,XR13K),
51     2 (AASC(15),SIE),(AASC(16),PH0,DKLSM,RMP),(AASC(9
52     3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
53     4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
54     5 ),CAPGAM,UG),(AASC(18),TUG),(AASC(19),SIG),(AASC(20),TUS),(AASC(
55     6 21),GRROR),(AASC(22),GRRDZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
56     7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRRV),(AASC(27),GRRORP,TUGVEC,
57     8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
58     9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
59     1 AVYSV,X24K)
60     REAL M,MP,MPAR,MTIL
61     *      ***** END COMDECK YAQEQ *****
62     *      ***** END COMDECK YSTORE *****
63     INTEGER AA

```

```

64      DATA TP/R,/
65      C
66      C      PRINT TIMING FIGURE
67      C
68      CALL SECOND(TP)
69      WRITE(54,78) TP,T,NCYC
70
71      C
72      C      PRINT THE TIME AND CYCLE BEING DUMPED
73      C
74      DO 10 (PX=0,100,5)
75      10 WRITE(10X,90) T,NCYC
76      CALL OPENIT(R,1)
77      C
78      C      BACKSPACE OVER THE TRAILER RECORD WRITTEN BY THE LAST DUMP
79      C
80      C      BACKSPACE 0
81      C
82      C      WRITE OUT THE 3CM COMMON
83      C
84      JN5C=LOC(22)-LOC(44)+1
85      CALL SCBUFF(44,JN5C,8,1,1,1,ERROR)
86      IF(ERROR,EQ,0) GO TO 50
87      20 CALL UNCLE(4,5MYDUMP,10,10MSBUFF OUTPUT ERROR)
88      C
89      C      I/O SUCCESSFULLY COMPLETED
90      C
91      30 CONTINUE
92      C
93      C      WRITE OUT THE ARRAYS FROM LCM
94      C
95      CALL LCBUFF(R,NLC,8,1,1,1,ERROR)
96      C
97      C      CHECK FOR ERRORS IN LCBUFF
98      C
99      IF(ERROR,EQ,0) GO TO 50
100      C
101      C      LCBUFF ERROR, KILL THE RUN,
102      C
103      40 CALL UNCLE(4,5MYDUMP,10,10MLCBUFF OUTPUT ERROR)
104      C
105      C      NO ERRORS, CONTINUE
106      C
107      50 CONTINUE
108      C
109      C      SEE IF THERE ARE ANY PARTICLES
110      C
111      IF(NPT,LE,0) GO TO 60
112      C
113      C      YES, WRITE OUT THE PARTICLE ARRAYS FROM LCM,
114      C
115      CALL LCBUFF(NLCP1,NPS,8,1,1,1,ERROR)
116      IF(ERROR,NE,0) GO TO 40
117      C
118      C      WRITE OUT THE ITAB ARRAY FROM 3CM
119      C
120      CALL SCBUFF(ITAB,ITABF,8,1,1,1,ERROR)
121      IF(ERROR,NE,0) GO TO 20

```

Line	Code	Statement
121	C	
122	C	SEE IF THERE IS ANY TIME-DEPENDENT PARTICLE DATA
123	C	
124	C	IF(NLNG.LE,0) GO TO 48
125	C	
126	C	YES, WRITE IT OUT FROM LCM,
127	C	
128	C	CALL LCMUFF(NLCF1+NLCF2,Z+NP1=NLCG,0,1,1,ERROR)
129	C	IF(ERROR.NE,0) GO TO 48
130	C	68 CONTINUE
131	C	
132	C	TERMINATE THE DUMP WITH A SPECIAL TRAILER RECORD
133	C	
134	C	JUNK=666
135	C	CALL SCBUPF(JUNK,1,0,1,1,ERROR)
136	C	IF(ERROR.NE,0) GO TO 28
137	C	CALL SECOND(IP)
138	C	
139	C	PRINT TIMING FIGURE
140	C	
141	C	WRITE(50,80) IP
142	C	RETURN
143	C	
144	C	70 FORMAT(1M,20MBCIN ADUMP AT CP = ,F10.0,1M,5XISMPROBLEM TIME = ,
145	C	1 F10.2,5,1M,5XMCycle = ,15)
146	C	80 FORMAT(1M,10MEND ADUMP AT CP = ,F10.0)
147	C	90 FCMAAT(1M,15MADPE DUMP AT 1M,1PE12,5,0M,CYCLE=,15)
148	C	END

[illegible]

```

80      DO 90 I=1,IP1
81      C
82      C      SEE IF A HEADER NEEDS TO BE PRINTED
83      C
84      IF(LINESF,LT,50) GO TO 30
85      C
86      C      YES, RESET THE LINE COUNT,
87      C
88      LINESF=0
89      C
90      C      PRINT THE HEADER
91      C
92      DO 20 IPX=IPD,IFD,6
93      WRITE(IPX,140) JNM,NAME,T,NCYC
94      IF(TURB) GO TO 10
95      WRITE(IPX,150)
96      GO TO 20
97      10 CONTINUE
98      WRITE(IPX,160)
99      20 CONTINUE
100     30 CONTINUE
101     IPJM=IJM+NG
102     IPJ=IJ+NG
103     D=0.
104     PRM=0.
105     PRV=0.
106     IF(TURB) GO TO 60
107     TEST=RM(IJM)
108     IF(ITEST,EQ,INDEF) GO TO 40
109     IF(TEST,NE,0.) PRM=1./TEST
110     40 CONTINUE
111     TEST=RVOL(IJM)
112     IF(ITEST,EQ,INDEF) GO TO 50
113     IF(TEST,NE,0.) PRV=1./TEST
114     50 CONTINUE
115     D=CONC(IJM)
116     C *****
117     C      TEMPORARY PATCH FOR OUTPUTTING VORTICITY
118     C *****
119     PRM=CO(IJM)
120     GO TO 70
121     60 PRV=VUS(IJM)
122     D=CONC(IJM)
123     PRM=TUQ(IJM)
124     70 CONTINUE
125     DO 80 IPX=IPD,IFD,6
126     80 WRITE(IPX,170) I,J,X(IJM),Y(IJM),U(IJM),V(IJM),SIE(IJM),RO(IJM),
127     1 PRV,D,PRM,P(IJM)
128     LINESF=LINESF+1
129     IJ=IPJ
130     90 IJM=IPJM
131     CALL LOOP
132     100 CONTINUE
133     IF(.NOT,FILM) GO TO 110
134     FIYB=FIYB0
135     IYB=IYB0
136     YCONV=YCNVLD

```

```

137      XCONV=XCNVLD
138      FIXR=FIXRO
139      FIXL=FIXLO
140      IXR=IXRO
141      IXL=IXLO
142      CALL ADV(1)
143      110 CONTINUE
144      CALL SECOND(TP)
145      WRITE(59,130) TP
146      RETURN
147      C
148      120 FORMAT(1H ,2PHBEGIN YEDIT AT CP = ,F10,4)
149      130 FORMAT(1H ,10HEND YEDIT AT CP = ,F10,4)
150      140 FORMAT(1H1,A10,8A10,3X2H7=,1PE12,5,1X6MCYCLE=,15)
151      150 FORMAT(1H ,2X1HI,3X1HJ,6X1HX,10X1HY,10X1HU,10X1HV,9X3HSIE,8X3HRHO,
152      1 8X3HVOL,9X1HC,9X3HUTC,8X1HP)
153      160 FORMAT(1H ,2X1HI,3X1HJ,6X1HX,10X1HY,10X1HU,10X1HV,9X3HSIE,8X3HRHO,
154      1 8X4HSCAL,9X1HC,9X1HQ,10X1HP)
155      170 FORMAT(1X,13,1H,13,10(1X,1PE10,3))
156      END

```

```

-----
1      SUBROUTINE YFXIT(IAORT)
2      C
3      C      YAGUI ERROR RECOVERY ROUTINE
4      C
5      C      WRITTEN BY J.L.NORTON,LASL T-3,1975
6      C
7      CALL EXIT
8      END

```

```

-----
1      SUBROUTINE YFLUX
2      C
3      C      ROUTINE TO FLUX MASS,MOMENTUM,AND ENERGY IF THE GRID VELOCITY IS
4      C      NOT EQUAL TO THE FLUID VELOCITY
5      C
6      C      ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL,LASL T-3
7      C      MODIFIED BY J.L.NORTON,LASL T-3,1975
8      C
9      *
10     *
11     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
12     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
13     2 1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1)
14     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLORO(1),DESRQ(1),CAPGAN(1),TUQ
15     4 1),SIG(1),TUS(1),GRROR(1),GRRQZ(1),GRRQ(1),TUQVEC(1),MTIL(1),

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16      5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
17      6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
18      * ----- END COMDECK YAGDIM -----
19      * ----- BEGIN COMDECK YAQSC -----
20      LOGICAL RESTRT,FILM,PAPER,TURB
21      REAL LAM,MU
22      C COMMON/YSC1/AASC(NSCP1)
23      COMMON/YSC1/AASC(4600)
24      COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABM,BB,COLAMU,CYL,DR,DT,DYC,DTFAC,
25      1 DYO(10),DYOC(10),DYO2,DYOB,DYPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
26      2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,IBAR,
27      3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
28      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
29      COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KX1,LAM,LPB,MU,NAME(6),
30      1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
31      2 PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
32      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
33      COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
34      1 ILNG,NILNG,TP3,TUPOD,TQSAV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
35      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYBO,IYBO,YCNVLD,
36      3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,OMN,OMX,WMAX,JNM,TZ,TLIM,
37      4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMAB8,DTVSAV,DTCSAV,IDTV
38      5 ,JOTV,IDTC,JOTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITM,JTM,ITG,JTG
39      6 ,TMASV,WMAXEF,RMINEF,TSTRTO
40      COMMON/YSC2/ZZ
41      C COMMON/YSC4/ITAB(ITABP)
42      COMMON/YSC4/ITAB(1000)
43      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
44      * ----- END COMDECK YAQSC -----
45      * ----- BEGIN COMDECK YAGEQ -----
46      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
47      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
48      1 (8),E,ETIL,AREA,XR13K),
49      2 (AASC(15),SIE),(AASC(16),PM0,DKLSM,RMP),(AASC(9
50      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
51      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
52      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
53      6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
54      7 ),(AASC(25),DLSROO,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
55      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
56      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
57      1 AVYSV,X24K)
58      REAL M,MP,MPAR,MTIL
59      * ----- END COMDECK YAGEQ -----
60      * ----- END COMDECK YSTORE -----
61      * ----- BEGIN COMDECK PARAM -----
62      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
63      1 NLCP3,NLCP4,IPLMSZ
64      * ----- END COMDECK PARAM -----
65      * ----- BEGIN COMDECK ASTORE -----
66      COMMON/ASTC/AT(100),FT(100)
67      DIMENSION IX1(1),IY1(1),IX2(1),IY2(1),XCO(1),YCO(1),CON(1)
68      EQUIVALENCE(AT,IX1),(AT(2),IX2),(AT(3),IY1),(AT(4),IY2),(AT(5),XCO
69      1 ),(AT(9),YCO),(FT,CON)
70      * ----- END COMDECK ASTORE -----
71      DTC=1,E30
72      CALL START

```



```

73      DO 50 J=2,JP1
74      CO 40 I=1,IBAR
75      IMJ=IJ+NQ
76      IPJ=IJ+NQ
77      IPJP=IPJ+NQ
78      X1=X(IPJ)
79      Y1=Y(IPJ)
80      R1=R(IPJ)
81      X2=X(IPJP)
82      Y2=Y(IPJP)
83      R2=R(IPJP)
84      X3=X(IJP)
85      Y3=Y(IJP)
86      R3=R(IJP)
87      X4=X(IJ)
88      Y4=Y(IJ)
89      R4=R(IJ)
90      UL1=UL(IPJ)
91      VL1=VL(IPJ)
92      UL2=UL(IPJP)
93      VL2=VL(IPJP)
94      UL3=UL(IJP)
95      VL3=VL(IJP)
96      UL4=UL(IJ)
97      VL4=VL(IJ)
98      UD1=UG(IPJ)=0.5*(UL1+U(IPJ))
99      VD1=VG(IPJ)=0.5*(VL1+V(IPJ))
100     UN2=UG(IPJP)=0.5*(UL2+U(IPJP))
101     VN2=VG(IPJP)=0.5*(VL2+V(IPJP))
102     UD3=UG(IJP)=0.5*(UL3+U(IJP))
103     VN3=VG(IJP)=0.5*(VL3+V(IJP))
104     UD4=UG(IJ)=0.5*(UL4+U(IJ))
105     VN4=VG(IJ)=0.5*(VL4+V(IJ))
106     X12=X1-X2
107     X23=X2-X3
108     X34=X3-X4
109     X41=X4-X1
110     Y21=Y2-Y1
111     Y32=Y3-Y2
112     Y43=Y4-Y3
113     Y14=Y1-Y4
114     Y31=Y3-Y1
115     R12=R1-R2
116     R23=R2-R3
117     R34=R3-R4
118     R41=R4-R1
119     U12=UL1-UL2
120     U23=UL2-UL3
121     U34=UL3-UL4
122     U41=UL4-UL1
123     V12=VL1-VL2
124     V23=VL2-VL3
125     V34=VL3-VL4
126     V41=VL4-VL1
127     D=.25*RVOL(IJ)*(R12*(U12*Y21+V12*X12)+R23*(U23*Y32+V23*X23)+R34*(
128     1 U34*Y43+V34*X34)+R41*(U41*Y14+V41*X41))
129     VOLR=VOLT=VOLC=1./RVOL(IJ)

```

```

130 IF(I,NE,IBAR) VOLR=1./RVOL(IPJ)
131 IF(J,NE,JP1) VOLT=1./RVOL(IJP)
132 IF(I,EQ,1) GO TO 60
133 FL=FR
134 AL=AR
135 10 IF(J,EQ,2) GO TO 70
136 FB=FT(I)
137 AB=AT(I)
138 20 FR=DT08*R12*((UD1+UD2)*Y21+(VD1+VD2)*X12)
139 AR=A0M*SIGN(1.,FR)+B0*4.*FR/(VOLR+VOLC)
140 FT(I)=DT08*R23*((UD2+UD3)*Y32+(VD2+VD3)*X23)
141 AT(I)=A0M*SIGN(1.,FT(I))+B0*4.*FT(I)/(VOLT+VOLC)
142 XX=AMAX1(ABS(FB),ABS(FR),ABS(FT(I)),ABS(FL))
143 DTC=AMIN1(DTC,DTP03+A0PAC/(XX*RVOL(IJ)+DTP03*ABS(D)+EM10))
144 IF(DTCSAV,NE,DTC) IDTC=I
145 I>(DTCSAV,NE,DTC) JDTC=J
146 DTCSAV=DTC
147 MP(IJ)=ETIL(IJ)*VOLC+FR*((1,-AR)*ROL(IJ)+(1,+AR)*ROL(IPJ))+FT(I)*
148 1 (1,-AT(I))*ROL(IJ)+(1,+AT(I))*ROL(IJP))+FL*((1,-AL)*ROL(IJ)+(1,+
149 2 AL)*ROL(IMJ))+FB*((1,-AB)*ROL(IJ)+(1,+AB)*ROL(IJM))
150 ROE=RO(IJ)*ETIL(IJ)
151 SIE(IJ)=1./MP(IJ)*(ROE*VOLC+FR*((1,-AR)*ROE+(1,+AR)*RO(IPJ)*ETIL(
152 1 IPJ))+FT(I)*((1,-AT(I))*ROE+(1,+AT(I))*RO(IJP)*ETIL(IJP))+FL*((1,
153 2 -AL)*ROE+(1,+AL)*RO(IMJ)*ETIL(IMJ))+FB*((1,-AB)*ROE+(1,+AB)*RO(
154 3 IJM)*ETIL(IJM)))
155 IF(.NOT.TURB) GO TO 30
156 ROQ=RO(IJ)*TUQ(IJ)
157 TUQVEC(IJ)=1./MP(IJ)*(ROQ*VOLC+FR*((1,-AR)*ROQ+(1,+AR)*RO(IPJ)*TUQ
158 1 (IPJ))+FT(I)*((1,-AT(I))*ROQ+(1,+AT(I))*RO(IJP)*TUQ(IJP))+FL*((1,
159 2 -AL)*ROQ+(1,+AL)*RO(IMJ)*TUQ(IMJ))+FB*((1,-AB)*ROQ+(1,+AB)*RO(IJM
160 3 )*TUQ(IJM)))
161 30 CONTINUE
162 ROQ=CONC(IJ)
163 CTEMP(IJ)=VOLC*ROQ+FR*((1,-AR)*ROQ+(1,+AR)*CONC(IPJ))+FT(I)*((1,-
164 1 AT(I))*ROQ+(1,+AT(I))*CONC(IJP))+FL*((1,-AL)*ROQ+(1,+AL)*CONC(IMJ
165 2 ))+FB*((1,-AB)*ROQ+(1,+AB)*CONC(IJM))
166 CTEMP(IJ)=CTEMP(IJ)*RVOL(IJ)
167 RVOL(IJ)=8./((R1+R2+R3+R4)*((X1-X3)*(Y2-Y4)-(Y1-Y3)*(X2-X4)))
168 IJ=IPJ
169 IJP=IPJP
170 IJM=IJM+NQ
171 CALL LOOP
172 50 CONTINUE
173 CALL DONE
174 GO TO 80
175 FL=DT08*R34*((UD3+UD4)*Y43+(VD3+VD4)*X34)
176 AL=A0M*SIGN(1.,FL)+B0*2.*FL*RVOL(IJ)
177 GO TO 10
178 FB=DT08*R41*((UD4+UD1)*Y14+(VD4+VD1)*X41)
179 AB=A0M*SIGN(1.,FB)+B0*2.*FB*RVOL(IJ)
180 GO TO 20
181 60 CALL START
182 DO 110 J=2,JP1
183 DO 100 I=1,IBAR
184 RO(IJ)=MP(IJ)*RVOL(IJ)
185 CONC(IJ)=CTEMP(IJ)
186 IF(J,EQ,2) RO(IJM)=ROL(IJM)

```

```

187      IF(.NOT.TURB) GO TO 90
188      TUQ(IJ)=TUQVEC(IJ)
189      IF(TUQ(IJ).LT.0.) TNEG=TNEG+TUQ(IJ)+RO(IJ)/RVOL(IJ)
190      IF(TUQ(IJ).LT.0.) TUQ(IJ)=0.
191  90 CONTINUE
192      IF(J.EQ.JP1) RO(IJP)=ROL(IJP)
193      IF(I.EQ.IBAR) RO(IJ+NQ)=ROL(IJ+NQ)
194      IJM=IJM+NQ
195      IJP=IJP+NQ
196  100 IJ=IJ+NQ
197      CALL LOOP
198  110 CONTINUE
199      CALL DONE
200      CALL STARTD
201      DO 130 JJ=2,JP2
202      J=JP4+JJ
203      DO 120 II=1,IP1
204      I=IP2+II
205      IMJ=IJM+NQ
206      IMJM=IJM+NQ
207      XX=0.
208      IF(I,NE,IP1,AND,J,NE,2) XX=MP(IJM)
209      IF(I,NE,IP1,AND,J,NE,JP2) XX=XX+MP(IJ)
210      IF(I,NE,1,AND,J,NE,JP2) XX=XX+MP(IMJ)
211      IF(I,NE,1,AND,J,NE,2) XX=XX+MP(IMJM)
212      RMP(IJ)=4./XX
213      IJ=IMJ
214  120 IJM=IMJM
215      CALL LOOPD
216  130 CONTINUE
217      CALL START
218      DO 150 J=2,JP2
219      DO 140 I=1,IP1
220      XX=RMP(IJ)/RM(IJ)
221      UP(IJ)=XX*UL(IJ)
222      VP(IJ)=XX*VL(IJ)
223  140 IJ=IJ+NQ
224      CALL LOOP
225  150 CONTINUE
226      CALL DONE
227      CALL START
228      DO 260 J=2,JP1
229      DO 250 I=1,IBAR
230      IPJ=IJ+NQ
231      IPJP=IJP+NQ
232      X1=X(IPJ)
233      Y1=Y(IPJ)
234      R1=R(IPJ)
235      UL1=UL(IPJ)
236      UG1=UG(IPJ)
237      VL1=VL(IPJ)
238      VG1=VG(IPJ)
239      X2=X(IPJP)
240      Y2=Y(IPJP)
241      R2=R(IPJP)
242      UL2=UL(IPJP)
243      UG2=UG(IPJP)

```

```

244 VL2=VL(IJP)
245 VG2=VG(IJP)
246 X3=X(IJP)
247 Y3=Y(IJP)
248 R3=R(IJP)
249 UL3=UL(IJP)
250 UG3=UG(IJP)
251 VL3=VL(IJP)
252 VG3=VG(IJP)
253 X4=X(IJ)
254 Y4=Y(IJ)
255 R4=R(IJ)
256 UL4=UL(IJ)
257 UG4=UG(IJ)
258 VL4=VL(IJ)
259 VG4=VG(IJ)
260 XX=DT08+R0L(IJ)
261 UL13=0.5*(UL1+UL3+U(IJP)+U(IJP))
262 VL13=0.5*(VL1+VL3+V(IJP)+V(IJP))
263 UL24=0.5*(UL2+UL4+U(IJP)+U(IJ))
264 VL24=0.5*(VL2+VL4+V(IJP)+V(IJ))
265 F13=XX*(R1+R3)*((UG1+UG3=UL13)*(Y3=Y1)+(VG1+VG3=VL13)*(X1=X3))
266 F24=XX*(R2+R4)*((UG2+UG4=UL24)*(Y2=Y4)+(VG2+VG4=VL24)*(X4=X2))
267 FM1=F24+RMP(IJP)
268 FM2=F13+RMP(IJP)
269 FM3=F24+RMP(IJP)
270 FM4=F13+RMP(IJ)
271 XC=.25*(X1+X2+X3+X4)
272 YC=.25*(Y1+Y2+Y3+Y4)
273 UC=.25*(UL13+UL24)
274 VC=.25*(VL13+VL24)
275 UGC=.25*(UG1+UG2+UG3+UG4)
276 VGC=.25*(VG1+VG2+VG3+VG4)
277 UGCUC=UGC
278 VGCVC=VGC
279 A=UGCUC*(Y3=Y1)+VGCVC*(X1=X3)
280 B=UGCUC*(Y4=Y2)+VGCVC*(X2=X4)
281 IF(A) 160,180,170
282 160 IF(B) 230,220,220
283 170 IF(B) 210,200,200
284 180 IF(B) 210,190,200
285 190 W=0.5
286 GO TO 240
287 200 W=1.
288 W=((Y3=YC)*UGCUC+(X1=X3)*VGCVC)/((Y3=Y2)*UGCUC+(X2=X3)*VGCVC)
289 GO TO 240
290 210 W=1.
291 W=((YC=Y1)*UGCUC+(X1=XC)*VGCVC)/((Y2=Y1)*UGCUC+(X1=X2)*VGCVC)
292 GO TO 240
293 220 W=0.
294 W=((YC=Y4)*UGCUC+(X4=XC)*VGCVC)/((Y3=Y4)*UGCUC+(X4=X3)*VGCVC)
295 GO TO 240
296 230 W=0.
297 W=((YC=Y4)*UGCUC+(X4=XC)*VGCVC)/((Y1=Y4)*UGCUC+(X4=X1)*VGCVC)
298 240 OMW=1.=W
299 OMH=1.=W
300 UB=W*H*UL2+OMW*H*UL3+W*OMH*UL1+OMH*OMH*UL4

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301      VB=WB+VVL2+OMH+HVL3+WB+OMH+VVL1+OMH+OMH+VVL4
302      ALTE=AB+BB+(ABS(F13)+ABS(F24)+NRVOL(IJ)/ROL(IJ))
303      XY=(1.-ALTE)*UC+ALTE*UB
304      UP(IPJ)=UP(IPJ)+FM1+XX
305      UP(IJP)=UP(IJP)+FM3+XX
306      UP(IPJP)=UP(IPJP)+FM2+XX
307      UP(IJ)=UP(IJ)+FM4+XX
308      XX=(1.-ALTE)*VC+ALTE*VR
309      VP(IPJ)=VP(IPJ)+FM1+XX
310      VP(IJP)=VP(IJP)+FM3+XX
311      VP(IPJP)=VP(IPJP)+FM2+XX
312      VP(IJ)=VP(IJ)+FM4+XX
313      IJ=IPJ
314      250 IJP=IPJP
315      CALL LOOP
316      260 CONTINUE
317      CALL DONE
318
319      C
320      C      GO SET THE BOUNDARY CONDITIONS
321
322      C      CALL BC(3)
323      RETURN
324      END

```

```

1 SUBROUTINE YINIT
2 C
3 ROUTINE TO INITIALIZE THE CODE
4 C
5 C WRITTEN BY J.L.NORTON,LASL T-3,1974
6 C
7 * ----- BEGIN COMDECK PARAM -----
8 COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
9 1 NLCP3,NLCP4,IFLMSZ
10 * ----- END COMDECK PARAM -----
11 * ----- BEGIN COMDECK YSTORE -----
12 * ----- BEGIN COMDECK YAQDIM -----
13 DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
14 1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCBQ(1),E(1),ETIL(1),RVOL
15 2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CQ(1),VTIL(1),
16 3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUG
17 4 (1),SIG(1),TUS(1),GRRO(1),GRROZ(1),GRROP(1),TUGVEC(1),MTIL(1),
18 5 CONC(1),CYEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
19 6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
20 * ----- END COMDECK YAQDIM -----
21 * ----- BEGIN COMDECK YAQSC -----
22 LOGICAL RESTRT,FILM,PAPER,TURB
23 REAL LAM,MU
24 C COMMON/YSC1/AASC(NSCP1)
25 COMMON/YSC1/AASC(9600)
26 COMMON/YSC2/AA(1),ANC,A0,ABFAC,ABM,R0,COLAMU,CYL,DR,DT,DTIC,DTFAC,
27 1 DTIC(10),DTOC(10),DTOT,DT08,DTPOS,DTV,DZ,EM10,EPS,FIPXL,FIPXR.

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28 2 FIPYR,FIPYT,FXL,FXR,FIVB,FIVT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,
29 3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
30 4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
31 COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNFO2,KXI,LAM,LPB,MU,NAME(8),
32 1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQIB,NQI2,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
33 2 ,PXL,PXR,PYB,PYCONV,PYT,PTY,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
34 3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
35 COMMON/YSC2/TUQI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOYM,
36 1 ILNG,NILNG,TP3,TUPOT,TDQSAV,TK,TI,TUGENG,EP1,SAV1,QLEVEL,TQ,IST,
37 2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLD,DTSV,DTLAST,FIYBO,IYBO,YCNVLD,
38 3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,WMAX,JNM,TZ,TLIM,
39 4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAV,DTC SAV,
40 5 ,JDTV,IDTC,JDTC,CIRC,TIS,POTE,UMOM,VHOM,TMAX,TGMX,ITM,JTM,ITG,JTG
41 6 ,TMASSV,WMAXEF,WMINEF,TSTRTD
42 COMMON/YSC2/ZZ
43 C COMMON/YSC4/ITAB(1TAB)
44 COMMON/YSC4/ITAB(1000)
45 COMMON/YSC5/RESTRY,FILM,PAPER,IPD,IFD
46 * ----- END COMDECK YAQSC -----
47 * ----- BEGIN COMDECK YAQEQ -----
48 EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
49 1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
50 1 (8),E,ETIL,AREA,XR13K),
51 2 (AASC(15),SIE),(AASC(16),PM0,DKLSM,RMP),(AASC(9
52 3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
53 4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
54 5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
55 6 21),GRROR),(AASC(22),GRROZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
56 7 ),(AASC(25),DLSRO0,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
57 8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
58 9 AASC(31),ANCV),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
59 1 AVYSV,X24K)
60 REAL M,MP,MPAR,MTIL
61 * ----- END COMDECK YAQEQ -----
62 * ----- END COMDECK YSTORE -----
63 COMMON/FTABC/FTAB(2)
64 DIMENSION START(3,5)
65 DATA (START(II),II=1,15)/15*0/
66 DATA II,IDUM/0,0/
67 DATA IEFLAG/0/
68 DATA RESTRY,PAPER,FILM,WRAPUP/,TRUE,,FALSE,,TRUE,,20,/
69 C
70 C GET THE CP TIME AT JOB START
71 C
72 CALL SECOND(T2)
73 C
74 C MAKE SURE ENOUGH LCM IS AVAILABLE
75 C
76 INEED=NLCPI+NLCPI2+NLCPI3+IFLMSZ+NLCPI4+1
77 CALL GETLCM(ILSIZE)
78 IF(INEED,GT,ILSIZE) CALL UNCLE(4,5HYINIT,27,
79 1 27HNOT ENOUGH LCM IS AVAILABLE)
80 C
81 C NO IS THE NO. OF DISTINCT LCM ARRAYS ALLOCATED, ARRAYS CAN BE
82 C ADDED OR DELETED AS LONG AS NO IS CHANGED CONSISTENTLY,
83 C
84 NO=34

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85      C
86      C      READ THE JOB PARAMETERS. FIRST SET UP FOR NAMELIST INPUT.
87      C
88      C      ASSIGN 30 TO IERRT
89      C      CALL TABDEF(START,5HSTART,S,IERRT)
90      C      CALL TABSET(START,6HRESTRT,RESTRT,IEFLAG,0,0,0,0)
91      C      CALL TABSET(START,4HFILM,FILM,IEFLAG,0,0,0,0)
92      C      CALL TABSET(START,5HPAPER,PAPER,IEFLAG,0,0,0,0)
93      C      CALL TABSET(START,6HWRAPUP,WRAPUP,IEFLAG,0,0,0,0)
94      C
95      C      DO THE ACTUAL READ
96      C
97      C          RESTRT = IF .TRUE.,THE CODE WILL BE RESTARTED FROM A
98      C                      DUMP TAPE (DEFAULT)
99      C                      = IF .FALSE.,THE PROBLEM WILL BE GENERATED FROM INPUT
100     C                      DATA TO FOLLOW
101     C
102     C          PAPER = IF .TRUE.,OUTPUT WILL OCCUR ON PAPER (DEFAULT=FALSE)
103     C          FILM  = IF .TRUE.,OUTPUT WILL OCCUR ON FILM (DEFAULT=TRUE)
104     C          (IF PAPER AND FILM ARE BOTH FALSE,FILM IS SET TO .TRUE.)
105     C          WRAPUP = NO. OF CP SECONDS TO ALLOW FOR PROBLEM TERMINATION
106     C                      AFTER THE LAST CYCLE (DEFAULT=20.)
107     C
108     C      CALL NAMLIST(START,S,IEFLAG)
109     C
110     C      CHECK FOR ERRORS
111     C
112     C      IF(IEFLAG.NE.0) CALL UNCLE(4,5HYINIT,23,23HERROR IN START NAMELIST
113     C      1 )
114     C
115     C      NO ERRORS. SET THE OUTPUT DO LOOP INDICES.
116     C
117     C      IPD=6
118     C      IFD=12
119     C      IF(.NOT,PAPER.AND..NOT,FILM) FILM=.TRUE.
120     C      IF(.NOT,PAPER) IPD=12
121     C      IF(.NOT,FILM) IFD=6
122     C
123     C      SET UP THE CONSTANT 1/3
124     C
125     C      THIRD=1./3.
126     C
127     C      SET UP THE CONSTANT 2/3
128     C
129     C      TWTHRD=2.*THIRD
130     C
131     C      GET THE JOB ID
132     C
133     C      CALL GETJOB(JNM)
134     C
135     C      GET THE JOB TIME LIMIT
136     C
137     C      CALL GETJTL(TLIM)
138     C
139     C      GIVE A LITTLE TIME FOR WRAPUP
140     C
141     C      TLIM=TLIM-WRAPUP

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32      1 ILNG,NILNG,TP3,TUPOT,TDO SAV,TK,TI,TUQENG,EPI,SAV1,QLEVEL,TQ,IST,
33      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DYSV,DYLAST,FIYBO,IYBO,YCNVLD,
34      3 XCNVLD,FXRC,FXLO,IXRO,IXLO,ISVW,JSVW,QMN,QMX,HMAX,JNM,T2,TLIA,
35      4 ROMFXR,ROMFVT,ROMFYB,JDUMF,TNTHRD,TE,DTR,TMASS,DYVS AV,DYCSAV,IDTV
36      5 ,JDTV,JDTC,JDTC,CINC,TIS,POTE,UMOM,VOMH,TMAX,TGMX,ITH,JTM,ITQ,JTG
37      6 ,TMASSV,WMAXEF,RMINEF,TSTRTD
38      COMMON/YSC2/ZZ
39      C      COMMON/YSC4/ITAB(ITABP)
40      COMMON/YSC4/ITAB(1000)
41      COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IFD
42      *      ***** END COMDECK YAGSC *****
43      *      ***** BEGIN COMDECK YAGEQ *****
44      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
45      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSH,RCSQ,MP),(AASC
46      1 (8),E,ETIL,AREA,XR13K),
47      2 (AASC(15),SIE),(AASC(16),PMO,DKLSH,RMP),(AASC(9
48      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
49      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CQ,ROL),(AASC(17
50      5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
51      6 21),GRROR),(AASC(22),GRROR),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
52      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
53      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
54      9 AASC(31),ANCI),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
55      1 AVYSV,X24K)
56      REAL M,MP,MPAR,MTIL
57      *      ***** END COMDECK YAGEQ *****
58      *      ***** END COMDECK YSTORE *****
59      DIMENSION CARDN(3,49)
60      DATA (CARDN(II),II=1,147)/147*0/
61      DATA IEFLAG/0/
62      C
63      C      SET UP THE NAMELIST INPUT TABLE
64      C
65      ASSIGN 40 TO IERRT
66      CALL TABDEF(CARDN,5HCARDN,49,IERRT)
67      CALL TABSET(CARDN,2HMU,MU,IEFLAG,0,0,0,0)
68      CALL TABSET(CARDN,3HLAM,LAM,IEFLAG,0,0,0,0)
69      CALL TABSET(CARDN,2HOM,OM,IEFLAG,0,0,0,0)
70      CALL TABSET(CARDN,3HEPS,EPS,IEFLAG,0,0,0,0)
71      CALL TABSET(CARDN,2HGR,GR,IEFLAG,0,0,0,0)
72      CALL TABSET(CARDN,2HGZ,GZ,IEFLAG,0,0,0,0)
73      CALL TABSET(CARDN,6HFREZXR,FREZXR,IEFLAG,0,0,0,0)
74      CALL TABSET(CARDN,2HYB,YB,IEFLAG,0,0,0,0)
75      CALL TABSET(CARDN,5HREZY0,REZY0,IEFLAG,0,0,0,0)
76      CALL TABSET(CARDN,6HREZRON,REZRON,IEFLAG,0,0,0,0)
77      CALL TABSET(CARDN,6HREZSIE,REZSIE,IEFLAG,0,0,0,0)
78      CALL TABSET(CARDN,3HGZP,GZP,IEFLAG,0,0,0,0)
79      CALL TABSET(CARDN,1HT,T,IEFLAG,0,0,0,0)
80      CALL TABSET(CARDN,2HDT,DT,IEFLAG,0,0,0,0)
81      CALL TABSET(CARDN,5HNCLST,NCLST,IEFLAG,0,0,0,0)
82      CALL TABSET(CARDN,5HTWFIN,TWFIN,IEFLAG,0,0,0,0)
83      CALL TABSET(CARDN,3KNCO,NCQ,IEFLAG,0,0,0,0)
84      CALL TABSET(CARDN,6HQLEVEL,QLEVEL,IEFLAG,0,0,0,0)
85      CALL TABSET(CARDN,4HTUQI,TUQI,IEFLAG,0,0,0,0)
86      CALL TABSET(CARDN,4HTUSI,TUSI,IEFLAG,0,0,0,0)
87      CALL TABSET(CARDN,2HTQ,TQ,IEFLAG,0,0,0,0)
88      CALL TABSET(CARDN,3HIST,IST,IEFLAG,0,0,0,0)

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89      CALL TABSET(CARDN,4HIBAR,IBAR,IEFLAG,0,0,0,0)
90      CALL TABSET(CARDN,4HJBAR,JBAR,IEFLAG,0,0,0,0)
91      CALL TABSET(CARDN,4HIUNF,IUNF,IEFLAG,0,0,0,0)
92      CALL TABSET(CARDN,4HJUNF,JUNF,IEFLAG,0,0,0,0)
93      CALL TABSET(CARDN,4HJCEN,JCEN,IEFLAG,0,0,0,0)
94      CALL TABSET(CARDN,2HDR,DR,IEFLAG,0,0,0,0)
95      CALL TABSET(CARDN,2HDZ,DZ,IEFLAG,0,0,0,0)
96      CALL TABSET(CARDN,3HCYL,CYL,IEFLAG,0,0,0,0)
97      CALL TABSET(CARDN,6HGRDEL,GRDEL,IEFLAG,0,0,0,0)
98      CALL TABSET(CARDN,2H40,40,IEFLAG,0,0,0,0)
99      CALL TABSET(CARDN,3H40M,40M,IEFLAG,0,0,0,0)
100     CALL TABSET(CARDN,2H80,80,IEFLAG,0,0,0,0)
101     CALL TABSET(CARDN,3HKXI,KXI,IEFLAG,0,0,0,0)
102     CALL TABSET(CARDN,3HANC,ANC,IEFLAG,0,0,0,0)
103     CALL TABSET(CARDN,5H40FAC,40FAC,IEFLAG,0,0,0,0)
104     CALL TABSET(CARDN,3HOTO,OTO,IEFLAG,1,0,0,0)
105     CALL TABSET(CARDN,4HOTO,OTO,IEFLAG,1,0,0,0)
106     CALL TABSET(CARDN,6HFREZYT,FREZYT,IEFLAG,0,0,0,0)
107     CALL TABSET(CARDN,6HFREZYB,FREZYB,IEFLAG,0,0,0,0)
108     CALL TABSET(CARDN,5HZORIG,ZORIG,IEFLAG,0,0,0,0)
109     CALL TABSET(CARDN,5HJDUMP,JDUMP,IEFLAG,0,0,0,0)
110     CALL TABSET(CARDN,4HNAME,NAME,IEFLAG,1,0,0,0)
111     CALL TABSET(CARDN,6HWMAXEF,WMAXEF,IEFLAG,0,0,0,0)
112     CALL TABSET(CARDN,6HRMINEF,RMINEF,IEFLAG,0,0,0,0)
113     CALL TABSET(CARDN,6HTSTRTO,TSTRTO,IEFLAG,0,0,0,0)
114     CALL TABSET(CARDN,4HIEOF,IEOF,IEFLAG,0,0,0,0)
115     C
116     C      READ THE INPUT VARIABLES
117     C
118     10 CONTINUE
119     IEOF=0
120     CALL NAMLIST(CARDN,5,IEFLAG)
121     C
122     C      CHECK FOR INPUT ERRORS
123     C
124     IF(IEFLAG.NE.0) CALL UNCLE(4,6HYINPUT,26,
125     1 26HCARDN NAMELIST INPUT ERROR)
126     C
127     C      NO ERRORS, CHECK FOR EOF.
128     C
129     IF(IEOF.NE.0) GO TO 20
130     C
131     C      NO, CONTINUE READING.
132     C
133     GO TO 10
134     20 CONTINUE
135     C
136     C      CHECK THE VALUES OF THE INPUT PARAMETERS
137     C
138     IF(MU,LT.0.) CALL UNCLE(4,6HYINPUT,8,8MMU,LT.0.)
139     IF(LAM,LT.0.) CALL UNCLE(4,6HYINPUT,9,9MLAM,LT.0.)
140     IF(OM,LT.1.,OR.OM,GT.2.) CALL UNCLE(4,6HYINPUT,10,10HILLEGAL OM)
141     IF(EPS,LE.0.) CALL UNCLE(4,6HYINPUT,9,9HEPS,LE.0.)
142     IF(FREZXR,LT.1.) CALL UNCLE(4,6HYINPUT,12,12HFREZXR,LT.1.)
143     IF(FREZYT,LT.1.) CALL UNCLE(4,6HYINPUT,12,12HFREZYT,LT.1.)
144     IF(FREZYB,LT.1.) CALL UNCLE(4,6HYINPUT,12,12HFREZYB,LT.1.)
145     IF(REZRON,LE.0.) CALL UNCLE(4,6HYINPUT,12,12HREZRON,LE.0.)

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146      IF(REZSIE,LE,0.) CALL UNCLE(4,6MYINPUT,12,12HREZSIE,LE,0.)
147      IF(DT,LE,0.) CALL UNCLE(4,6MYINPUT,8,8MDT,LE,0.)
148      DO 30 II=2,10
149      IF(DTOC(II),EQ,0.,AND,DTO(II),EQ,0.) GO TO 30
150      IF(DTOC(II),LE,DTOC(II-1)) CALL UNCLE(4,6MYINPUT,22,
151      1 22MDTOC MUST BE MONOTONIC)
152      IF(DTO(II),LE,0.) CALL UNCLE(4,6MYINPUT,20,20MILLEGAL VALUE OF DTO
153      1 )
154      30 CONTINUE
155      IF(IBAR,LE,0) CALL UNCLE(4,6MYINPUT,9,9HIBAR,LE,0)
156      IF(JBAR,LE,0) CALL UNCLE(4,6MYINPUT,9,9HJBAR,LE,0)
157      IF(DR,LE,0.) CALL UNCLE(4,6MYINPUT,8,8MDR,LE,0.)
158      IF(DZ,LE,0.) CALL UNCLE(4,6MYINPUT,8,8MDZ,LE,0.)
159      IF(CYL,NE,1.,AND,CYL,NE,0.) CALL UNCLE(4,6MYINPUT,20,
160      1 20MILLEGAL VALUE OF CYL)
161      IF(GRDVEL,NE,0.,AND,GRDVEL,NE,1.,AND,GRDVEL,NE,2.) CALL UNCLE(4,
162      1 6MYINPUT,23,23MILLEGAL VALUE OF GRDVEL)
163      IF(A0,LT,0.,OR,A0,GT,1.) CALL UNCLE(4,6MYINPUT,10,10HAR ILLEGAL)
164      IF(B0,LT,0.,OR,B0,GT,2.) CALL UNCLE(4,6MYINPUT,10,10HB0 ILLEGAL)
165      IF(A0M,LT,0.,OR,A0M,GT,1.) CALL UNCLE(4,6MYINPUT,11,11HA0M ILLEGAL
166      1 )
167      IF(KXI,LT,(-1),OR,KXI,GT,1) CALL UNCLE(4,6MYINPUT,11,
168      1 11HKXI ILLEGAL)
169      IF(ANC,LE,0.) CALL UNCLE(4,6MYINPUT,9,9HANC,LE,0.)
170      IF(A0FAC,LT,0.,OR,A0FAC,GT,1.) CALL UNCLE(4,6MYINPUT,13,
171      1 13HA0FAC ILLEGAL)
172      RETURN
173      40 CONTINUE
174      CALL UNCLE(4,6MYINPUT,35,35HCARDN NAMELIST INITIALIZATION ERROR)
175      END

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1      SUBROUTINE YPHI
2      C
3      C      ROUTINE TO DO THE EXPLICIT LAGRANGIAN HYDRO (PHASE 1)
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMBDEN,LASL T-3
6      C      MODIFIED AND DOCUMENTED BY J.L.NORTON,LASL T-3,1975
7      *      ----- BEGIN COMDECK YSTORE -----
8      *      ----- BEGIN COMDECK YAQDIM -----
9      DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
10     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RC00(1),E(1),ETIL(1),RVOL
11     2 1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),C0(1),VTIL(1)
12     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSRO0(1),CAPGAM(1),TUQ
13     4 (1),SIG(1),TUS(1),GRRO(1),GRROZ(1),GRROP(1),TUQVEC(1),MTIL(1),
14     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRBV(1),QZBV(1),X13K(1),X24K(1),
15     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
16     *      ----- END COMDECK YAQDIM -----
17     *      ----- BEGIN COMDECK YAQSC -----
18     LOGICAL RESTRT,FILM,PAPER,TURB
19     REAL LAM,MU
20     C      COMMON/YSC1/AASC(NSCP1)

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21      COMMON/VSC1/AASC(9600)
22      COMMON/VSC2/AA(1),XNC,AB,ABFAC,ABM,DB,COLAMU,CYL,DR,DT,DTC,DTFAC,
23      1 DTC(10),DTC(10),DTC2,DTC6,DTC63,DTV,DZ,EN10,EP3,FIPXL,FIPXR,
24      2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,
25      3 IDTO,IJ,IJM,IJP,IM,IPL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
26      4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
27      COMMON/VSC2/JCEN,JP1,JP2,JP4,JUNF,JUNFO2,KXI,LAM,LPB,MU,NAME(8),
28      1 NCYC,NLC,NPS,NPT,NO,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
29      2 ,PXL,PXR,PYB,PYCONV,PYT,RTD,REZRON,REZSIE,REZYB,RIBAR,RIBJR,
30      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
31      COMMON/VSC2/TUDI,TUSI,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PROTH,
32      1 IING,NILNG,TP3,TUPOT,TDQ3AV,TK,TI,TUDENG,EP1,SAV1,QLEVEL,TQ,IST,
33      2 VL,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DTSV,DTLAST,FIYB,IYB,YCNVLD,
34      3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,OMX,OMAX,JNH,T2,TLM,
35      4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAB,DTCSAB,IDTV
36      5 ,JOTV,ITC,JOTC,CIRC,TIS,POTE,UMON,VMON,TMAX,TGMX,ITM,JTM,ITG,JTG
37      6 ,TMASSV,MMAXEF,MMINEF,TSTRTD
38      COMMON/VSC2/ZZ
39      C      COMMON/VSC4/ITAB(ITARP)
40      COMMON/VSC4/ITAB(1000)
41      COMMON/VSC5/RESTRY,FILM,PAPER,IPD,IFD
42      *      ***** END COMDECK YAQSC *****
43      *      ***** BEGIN COMDECK YAGEQ *****
44      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
45      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),OELSM,RCSQ,MP),(AASC
46      1 (8),E,ETIL,AREA,XR13K),
47      2 (AASC(15),SIE),(AASC(16),PMB,DKLSM,RMP),(AASC(9
48      3 ),RVLD),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
49      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMV,PV),(AASC(14),O,CQ,ROL),(AASC(17
50      5 ),CAPGAM,IG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
51      6 21),GRROR),(AASC(22),GRROR),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
52      7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRROR,TUQVEC,
53      8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
54      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
55      1 AVYSV,X24K)
56      REAL M,MP,MPAR,MTIL
57      *      ***** END COMDECK YAGEQ *****
58      *      ***** END COMDECK YSTORE *****
59      *      ***** BEGIN COMDECK PARAM *****
60      COMMON/PCOM/NSCP1,ITARP,ITARXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
61      1 NLCP3,NLCP4,IFLMSZ
62      *      ***** END COMDECK PARAM *****
63      *      ***** BEGIN COMDECK ASTORE *****
64      COMMON/ASTC/AT(100),FT(100)
65      DIMENSION IX1(1),IY1(1),IX2(1),IY2(1),XCO(1),YCO(1),CON(1)
66      EQUIVALENCE(AT,IX1),(AT(2),IX2),(AT(3),IY1),(AT(4),IY2),(AT(5),XCO
67      1 ),(AT(9),YCO),(FT,CON)
68      *      ***** END COMDECK ASTORE *****
69      REAL LAMD,MUO2
70      C
71      C      APPLY THE NODE COUPLER TO ALL VERTICES
72      C
73      CALL START
74      V1=ANCARDT
75      DO 100 J=2,JP2
76      DO 90 I=1,IP1
77      IMJ=IJ=NQ

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78      IPJ=IJ+NQ
79      C
80      C      XX IS ZERO IF I IS 1 OR IP1, 1 OTHERWISE
81      C      YY IS ZERO IF J IS 2 OR JP2, 1 OTHERWISE
82      C
83      XX=1.
84      YY=1.
85      C
86      C      U1,V1 ARE VELOCITIES AT VERTEX (I-1,J) UNLESS I=1 IN WHICH CASE
87      C      VERTEX (I,J) IS USED
88      C
89      IF(I.EQ.1) GO TO 10
90      U1=U(IMJ)
91      V1=V(IMJ)
92      GO TO 20
93      10 XX=0.0
94      U1=U(IJ)
95      V1=V(IJ)
96      C
97      C      U2,V2 ARE VELOCITIES AT VERTEX (I+1,J) UNLESS I=IP1 IN WHICH CASE
98      C      VERTEX (I,J) IS USED
99      C
100     20 IF(I.EQ.IP1) GO TO 30
101     U2=U(IPJ)
102     V2=V(IPJ)
103     GO TO 40
104     30 U2=U(IJ)
105     V2=V(IJ)
106     XX=0.0
107     C
108     C      U3,V3 ARE VELOCITIES AT VERTEX (I,J-1) UNLESS J=2 IN WHICH CASE
109     C      VERTEX (I,J) IS USED
110     C
111     40 IF(J.EQ.2) GO TO 50
112     U3=U(IJM)
113     V3=V(IJM)
114     GO TO 60
115     50 U3=U(IJ)
116     V3=V(IJ)
117     YY=0.0
118     C
119     C      U4,V4 ARE VELOCITIES AT VERTEX (I,J+1) UNLESS J=JP2 IN WHICH CASE
120     C      VERTEX (I,J) IS USED
121     C
122     60 IF(J.EQ.JP2) GO TO 70
123     U4=U(IJP)
124     V4=V(IJP)
125     GO TO 80
126     70 YY=0.0
127     U4=U(IJ)
128     V4=V(IJ)
129     C
130     C      U5,V5 ARE VELOCITIES AT VERTEX (I,J)
131     C
132     80 U5=U(IJ)
133     V5=V(IJ)
134     C

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135 C THE NODE COUPLER IS APPLIED TO THE U (V) VELOCITY IF FLAGU (V)
136 C IS 1.
137 C
138 C FLAGU=0,
139 C FLAGV=0,
140 C
141 C SET FLAGU AND FLAGV. THE TECHNIQUE IS TO EXAMINE THE THREE
142 C VERTICES (I-1,J), (I,J), AND (I+1), OR (I,J-1), (I,J), AND
143 C (I,J+1). IF THE VELOCITY OF VERTEX (I,J) IS THE MINIMUM OR
144 C MAXIMUM OF EITHER TRIPLET, THE NODE COUPLER WILL BE APPLIED.
145 C OTHERWISE, IT WILL NOT BE APPLIED.
146 C
147 C IF(U5.EQ.AMAX1(U1,U2,U5).OR.U5.EQ.AMIN1(U1,U2,U5)) FLAGU=1.0
148 C IF(V5.EQ.AMAX1(V1,V2,V5).OR.V5.EQ.AMIN1(V1,V2,V5)) FLAGV=1.0
149 C IF(U5.EQ.AMAX1(U3,U4,U5).OR.U5.EQ.AMIN1(U3,U4,U5)) FLAGU=1.0
150 C IF(V5.EQ.AMAX1(V3,V4,V5).OR.V5.EQ.AMIN1(V3,V4,V5)) FLAGV=1.0
151 C
152 C UAV,VAV ARE THE DIFFERENCES OF THE AVERAGE VELOCITIES OF THE
153 C NEIGHBORING VERTICES AND THE VELOCITIES OF VERTEX (I,J)
154 C ITSELF
155 C
156 C UAV=0.25*(U1+U2+U3+U4)-U5
157 C VAV=0.25*(V1+V2+V3+V4)-V5
158 C
159 C CALCULATE THE BODY FORCE ACCELERATIONS. THE SECOND TERM IS
160 C THE NODE COUPLER IF ONE IS TO BE APPLIED.
161 C
162 C ANCX=Y1*FLAGU*UAV
163 C ANCY=Y1*FLAGV*VAV
164 C AX=GR+ANCX
165 C AY=GZ+ANCY
166 C
167 C UPDATE THE VERTEX VELOCITIES DUE TO THE BODY FORCES AND THE
168 C NODE COUPLER. NOTE THAT THE WALLS ARE RIGID.
169 C
170 C UTIL(IJ)=(U(IJ)+DT*AX)*XX
171 C VTIL(IJ)=(V(IJ)+DT*AY)*YY
172 C
173 C SAVE THE PART OF THE VELOCITY CHANGE DUE TO THE NODE COUPLER
174 C
175 C ANCU(IJ)=ANCX*XX*DT
176 C ANCV(IJ)=ANCY*YY*DT
177 C IJ=IPJ
178 C IJP=IJP+NQ
179 C 90 IJM=IJM+NQ
180 C CALL LOOP
181 C 100 CONTINUE
182 C CALL DONE
183 C
184 C CALCULATE THE CHANGE TO THE VERTEX VELOCITIES DUE TO THE PRESSURE
185 C TERM IN THE MOMENTUM EQN. LOOP OVER ALL CELLS, NOT VERTICES.
186 C
187 C CALL START
188 C DO 100 J=2,JP1
189 C DO 150 I=1,IBAR
190 C ROL(IJ)=0.
191 C IPJ=IJ+NQ

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192      IPJP=IJP+ND
193
194      C      VERTEX (I+1,J) IS LABELLED 1, (I+1,J+1) IS 2, (I,J+1) IS 3,
195      C      AND (I,J) IS 4
196      C
197      X1=X(IPJ)
198      Y1=Y(IPJ)
199      R1=R(IPJ)
200      U1=U(IPJ)
201      V1=V(IPJ)
202      X2=X(IPJP)
203      Y2=Y(IPJP)
204      R2=R(IPJP)
205      U2=U(IPJP)
206      V2=V(IPJP)
207      X3=X(IJP)
208      Y3=Y(IJP)
209      R3=R(IJP)
210      U3=U(IJP)
211      V3=V(IJP)
212      X4=X(IJ)
213      Y4=Y(IJ)
214      R4=R(IJ)
215      U4=U(IJ)
216      V4=V(IJ)
217
218      C      X(Y)NM = X(Y)N=X(Y)M
219      C
220      X24=X2-X4
221      Y24=Y2-Y4
222      X31=X3-X1
223      Y31=Y3-Y1
224
225      C      UOR IS THE AVERAGE U VELOCITY DIVIDED BY THE AVERAGE X-POSITION
226      C      OF THE VERTICES, FOR CYLINDRICAL GEOMETRY, FOR SLAB GEOMETRY
227      C      UOR IS ZERO.
228      C
229      UOR=(U1+U2+U3+U4)/(R1+R2+R3+R4)*CYL
230
231      C      HRMN IS .5*(RM+RN)
232      C
233      HR13=.5*(R1+R3)
234      HR24=.5*(R2+R4)
235
236      C      DT02MN = DT02/(MASS OF VERTEX N)
237      C
238      DT02M1=DT02*RM(IPJ)
239      DT02M2=DT02*RM(IPJP)
240      DT02M3=DT02*RM(IJP)
241      DT02M4=DT02*RM(IJ)
242
243      C      XY IS THE CROSS PRODUCT OF THE DIAGONALS OF THE CELL
244      C
245      XY=X24*Y31-X31*Y24
246
247      C      CAREA IS THE CELL AREA WHICH IS JUST HALF OF THE CROSS PRODUCT
248      C      OF THE DIAGONALS

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249 C
250 CAREA=.5*XY
251 C
252 C SAVE THE AREA FOR USE IN THE TURBULENCE CALCULATION
253 C IN TRBCOR
254 C
255 AREA(IJ)=CAREA
256 C
257 C RXY IS THE RECIPROCAL OF XY (HALF THE RECIPROCAL OF THE CELL AREA)
258 C
259 RXY=1./XY
260 C
261 U(V)IJ=U(V)I=U(V)J
262 C
263 U24=U2=U4
264 U31=U3=U1
265 V24=V2=V4
266 V31=V3=V1
267 C
268 C DU(V)DR(Z) IS THE DIFFERENCE FORM FOR THE DERIVATIVE OF THE
269 C RADIAL (AXIAL) VELOCITY WITH RESPECT TO R (Z) AT THE
270 C CELL CENTER
271 C
272 DUDR=RXY*(U24+V31-U31+V24)
273 DU DY=RXY*(X24+U31-X31+U24)
274 DVD R=RXY*(V24+V31-V31+V24)
275 DV DY=RXY*(X24+V31-X31+V24)
276 C
277 C COMPUTE DIV(VELOCITY) = VOLUME DILATATION
278 C
279 D=(DUDR+DVDY)*(1.+UDR*DT)+UDR
280 C
281 C SAVE THE VELOCITY DIVERGENCE
282 C
283 UELSM(IJ)=D
284 C
285 C DEFINE THE CELL AREA AS BEING AN AVERAGE DX TIMES AN AVERAGE DY =
286 C CAREA = AVX * AVY, THEN DEFINE AVX(Y) AS THE SQUARE ROOT OF
287 C THE AVERAGE OF THE SQUARES OF THE CELL DIAGONAL X(Y)
288 C COMPONENTS. THEN, ONE WAY OF DETERMINING AVX(Y) GIVEN AVY(X)
289 C IS  $AVX(Y) = CAREA / ((Y(X)D1^{.5} + Y(X)D2^{.5})/2)^{.5}$  WHERE
290 C  $Y(X)D1^{.5}$  ARE THE CELL DIAGONAL Y(X) COMPONENTS, THUS,
291 C  $XXA(YYA)$  IS THE SQUARE OF THE AVERAGE CELL DX(Y)
292 C DETERMINED BY THE PRECEDING METHOD.
293 C
294  $XXA=2./((Y24^{.5}+Y31^{.5})*CAREA^{.5})$ 
295  $YYA=2./((X24^{.5}+X31^{.5})*CAREA^{.5})$ 
296 C
297 C DKLSM IS  $2.*DT*(1./AVX^{.5}+1./AVY^{.5})$  FOR USE IN THE PRESSURE
298 C ITERATION
299 C
300 DKLSM(IJ)=2.*DT*(XXA+YYA)/(XXA+YYA)
301 C
302 C XX AND YY ARE THE ACTUAL AVX AND AVY
303 C
304  $XX=SQRT(XXA)$ 
305  $YY=SQRT(YYA)$ 

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306 C
307 C CALCULATE THE EFFECTIVE VISCOSITY COEFFICIENTS.
308 C
309 C LAMBDA(MU) EFFECTIVE = LAM(MU) INPUT TIMES AK WHERE THE LATTER
310 C IS DEPENDENT ON THE VALUE OF KXI. IF KXI IS 0 OR 1,
311 C AK=1. OR RHO(IJ), RESPECTIVELY, IF KXI IS =1, AK IS
312 C DETERMINED FROM NUMERICAL STABILITY REQUIREMENTS,
313 C
314 C KP=KXI+2
315 C GO TO (130,110,120),KP
316 110 CONTINUE
317 C AK=1.
318 C GO TO 140
319 120 CONTINUE
320 C AK=RHO(IJ)
321 C GO TO 140
322 130 CONTINUE
323 C VELIJ=U4*U4+V4*V4
324 C VELMX=6.7*AMAX1(ABS(U4*XX),ABS(V4*YY))
325 C AK=RHO(IJ)*COLAMU*(DT02*VELIJ+VELMX)+EM10
326 140 CONTINUE
327 C
328 C DETERMINE LAMBDA+DIVERGENCE(VELOCITY)=THIS IS LAMD.
329 C NOTE THAT LAMD IS ALWAYS ,LE,0.
330 C
331 C ROSIG=0.
332 C IF(TURB) ROSIG=RO(IJ)*SIG(IJ)
333 C LAMD=AMINI(D,0.)*AK*LAM-TWTHRD*ROSIG*D
334 C
335 C MU02 IS HALF MU EFFECTIVE
336 C
337 C MU02=0.5*(AK*MU+ROSIG)
338 C IF(TURB) CAPGAM(IJ)=2.+(DUDR**2+DV DY**2+.5*(DUDY+DVOR)**2+UOR**2)
339 C
340 C PIXX,PIYY,PIXY,AND PITHA ARE COMPONENTS OF THE VISCOSITY
341 C STRESS TENSOR
342 C
343 C PIXX=4.*MU02*DUDR+LAMD
344 C PIYY=4.*MU02*DV DY+LAMD
345 C PIPY=2.*MU02*(DUDY+DVOR)
346 C PITHA=4.*MU02*UOR+LAMD*CYL
347 C
348 C PITH IS 1/4 OF THE CELL AREA * PITHA
349 C
350 C PITH=.25*XY*PITHA
351 C
352 C CALCULATE THE VELOCITY CORRECTIONS FOR THE FOUR CELL VERTICES
353 C USING THE EXPLICIT LAGRANGIAN FORM OF THE MOMENTUM EQN.
354 C NOTE THAT THE TILDE VELOCITIES WERE INITIALIZED ABOVE IN
355 C GOBEUCBUBLERE BODY FORCES AND THE EFFECTS OF THE
356 C TUQVY=P(IJ)
357 C IF(TURB) TUQVY=TUQVY+TWTHRD*RO(IJ)*TUR(IJ)
358 C YY=Y24+TUQVY
359 C XX=X24+(PIXY*X24+PIXX*Y24)
360 C UTIL(IPJ)=UTIL(IPJ)+DT02M1*(XX+R1*YY-PITH)
361 C
362 C

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363      UTIL(IJP)=UTIL(IJP)-DT02M3*(XX+R3+YY+PITH)
364      XX=HR13*(PIXY+X31-PIXX+Y31)
365      YY=Y31-TUQVY
366      UTIL(IPJP)=UTIL(IPJP)+DT02M2*(XX+R2+YY+PITH)
367      UTIL(IJ)=UTIL(IJ)-DT02M4*(XX+R4+YY+PITH)
368      PYVMP=PIVY-TUQVY
369      XX=HR24*(PYVMP+X24-PIXY+Y24)
370      VTIL(IPJ)=VTIL(IPJ)+DT02M1*XX
371      VTIL(IJP)=VTIL(IJP)-DT02M3*XX
372      XX=HR13*(PYVMP+X31-PIXY+Y31)
373      VTIL(IPJP)=VTIL(IPJP)+DT02M2*XX
374      VTIL(IJ)=VTIL(IJ)-DT02M4*XX
375      IJ=IPJ
376      150 IJP=IPJP
377      CALL LONP
378      160 CONTINUE
379      CALL DONE
380      C
381      C      GO SET THE BOUNDARY CONDITIONS
382      C
383      CALL BC(1)
384      RETURN
385      END

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1      SUBROUTINE YPM2
2      C
3      C      ROUTINE TO DO YAQUI PRESSURE ITERATION
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T-3
6      C      MODIFIED BY J.L.NORTON,LASL T-3,1975
7      C
8      *      ----- BEGIN COMDECK YSTORE -----
9      *      ----- BEGIN COMDECK YAQDIM -----
10     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPJR(1),U(1),UC(1),DELSM(
11     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
12     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CO(1),VTIL(1)
13     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),OLSRQI(1),OLSRQO(1),CAPGAM(1),TUQ
14     4 (1),SIG(1),TUS(1),GRROR(1),GRRQZ(1),GRRPO(1),TUQVEC(1),MTIL(1),
15     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X20K(1),
16     6 Y13K(1),Y24K(1),XR13K(1),XR24K(1),DKLSM(1),AREA(1)
17     *      ----- END COMDECK YAQDIM -----
18     *      ----- BEGIN COMDECK YAQSC -----
19     LOGICAL RESTRY,FILM,PAPER,TURB
20     REAL LAM,MU
21     C      COMMON/YSC1/AASC(NSCP1)
22     COMMON/YSC1/AASC(9600)
23     COMMON/YSC2/AA(1),ANC,AB,ABFAC,ABH,BB,COLAMU,CYL,DR,DT,DYC,DTFAC,
24     1 DT0(10),DT0C(10),DT02,DT08,DT0S,DTV,DZ,EM10,EPS,FIPXL,FIPXR,
25     2 FIPYB,FIPYT,FIPL,FIPLR,FIYB,FIYT,FREZXR,GR,GROVEL,GZ,GZP,I,ISAR,
26     3 IDTO,IJ,IJM,IJP,IM1,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
27     4 IUNP,IXL,IXR,IYB,IYT,J,JSAR

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28      COMMON/YS2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPR,MU,NAME(8),
29      1 NCYC,NLC,NPS,NPT,NO,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,OM,OMCYL,PXCONV
30      2 ,PXL,PXR,PYB,PYCONV,PYT,ROT,REZRON,REZSIE,REZY0,RIBAR,RIBJB,
31      3 FREZYT,FREZYB,ROMFR,T,THIRD,NCLST,TOUT,TWFIN
32      COMMON/YS2/TUQT,TUSI,NCQ,TNEG,TNEG8V,TUSV,TURB,PTOP,PRITE,PBO7M,
33      1 TLNG,NILNG,TB3,TUPOT,TDQSAV,YK,TI,TUGENG,EP1,SAV1,GLEVEL,TQ,IST,
34      2 VV,XCONV,XL,XR,YB,YCONV,YT,PTPOLD,DT3V,DTLAST,FIYB0,IYB0,YCNVLD,
35      3 XCNVLD,FXRO,FXLO,IXRO,IXLO,ISVW,JSVW,OMN,GMX,NMAX,JNM,T2,TLM,
36      4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DYR,TMASS,DTVSAV,DTCSAV,IDTV
37      5 ,JDTV,IDTC,JOTC,CIRC,TIS,POTE,UMOM,VOMH,TMAX,TGMX,ITM,JTM,ITG,JTG
38      6 ,TMASSV,WMAXEF,RHINEF,TSTKTD
39      COMMON/YS2/ZZ
40      C      COMMON/YS4/ITAB(ITA8P)
41      COMMON/YS4/ITAB(1000)
42      COMMON/YS5/RESTRY,FILM,PAPER,IPD,IFD
43      *      ----- END COMDECK YAQSC -----
44      *      ----- BEGIN COMDECK YAQEQ -----
45      EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
46      1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSH,RCSQ,MP),(AASC
47      1 (8),E,ETIL,AREA,XR13K),
48      2 (AASC(15),SIE),(AASC(16),PM0,DKLSH,RMP),(AASC(9
49      3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
50      4 UL,PMX,PU),(AASC(13),VTIL,VL,PMY,PV),(AASC(14),Q,CO,ROL),(AASC(17
51      5 ),CAPGAM,UG),(AASC(18),TUD),(AASC(19),SIG),(AASC(20),TUS),(AASC(
52      6 21),GRROR),(AASC(22),GRR0Z),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
53      7 ),(AASC(25),DLSROO,VG),(AASC(26),GR8V),(AASC(27),GRROR,TUQVEC,
54      8 Y24K),(AASC(28),M7IL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
55      9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
56      1 AVYSV,X24K)
57      REAL M,MP,MPAR,MTIL
58      *      ----- END COMDECK YAQEQ -----
59      *      ----- END COMDECK YSTORE -----
60      *      ----- BEGIN COMDECK PARAM -----
61      COMMON/PCOM/NSCP1,ITA8P,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,
62      1 NLCP3,NLCP4,IFLMSZ
63      *      ----- END COMDECK PARAM -----
64      *      ----- BEGIN COMDECK ASTORE -----
65      COMMON/ASTC/AT(100),FT(100)
66      DIMENSION IX1(1),IY1(1),IX2(1),IY2(1),XCO(1),YCO(1),CON(1)
67      EQUIVALENCE(AT,IX1),(AT(2),IX2),(AT(3),IY1),(AT(4),IY2),(AT(5),XCO
68      1 ),(AT(6),YCO),(FT,CON)
69      *      ----- END COMDECK ASTORE -----
70      COMMON/EQNST/ROTMP,ETMP,GMONE,CONCJ
71      C
72      C      IF THE TURBULENCE IS ON,GO COMPUTE CORRECTIONS DUE TO IT
73      C
74      IF(TURB) CALL TRBCOR
75      CALL START
76      DO 20 J=2,JP1
77      DO 10 I=1,IBAR
78      IMJ=IJ+NO
79      IPJ=IJ+NO
80      IJP=IJP+NO
81      ROTMP=RO(IJ)
82      ETMP=SIE(IJ)
83      CONCJ=CONC(IJ)
84      CALL AIR

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85      GM1=GMONE
86      GGM1=GM1*(GM1+1,0)
87      C      ***** SET DENSITY FOR START OF PRESSURE ITERATION *****
88      MTIL(IJ)=RO(IJ)+ROL(IJ)*RVOL(IJ)*DT
89      ROL(IJ)=MTIL(IJ)
90      RCSQ(IJ)=1./(EM10+GGM1*AMAX1(SIE(IJ),0.))
91      IF (TURB.AND.T.GT.TSTRTD) CONC(IJ)=CONC(IJ)+CTEMP(IJ)*RVOL(IJ)*DT
92      UG(IJ)=1./(R(IJ)+R(IJP)+R(IPJP)+R(IPJ))=CYL
93      X13=X(IPJ)-X(IJP)
94      X13K(IJ)=X13
95      X24=X(IPJP)-X(IJ)
96      X24K(IJ)=X24
97      Y13=Y(IPJ)-Y(IJP)
98      Y13K(IJ)=Y13
99      Y24=Y(IPJP)-Y(IJ)
100     Y24K(IJ)=Y24
101     VG(IJ)=1./(X13+Y24=X24+Y13)
102     XR13K(IJ)=0.5*(R(IPJ)+R(IJP))*X13
103     XR24K(IJ)=0.5*(R(IPJP)+R(IJ))*X24
104     IJ=IPJ
105     IJP=IPJP
106     10 IJM=IJM+NQ
107     CALL LOOP
108     20 CONTINUE
109     CALL DONE
110     NUMIT=0
111     MUSTIT=1
112     PLMAX=EM10
113     30 CALL START
114     DO 60 J=2,JP1
115     DO 50 I=1,IBAR
116     IPJ=IJ+NQ
117     IPJP=IPJ+NQ
118     X1=X(IPJ)
119     Y1=Y(IPJ)
120     R1=R(IPJ)
121     U1=UL(IPJ)
122     V1=VL(IPJ)
123     X2=X(IPJP)
124     Y2=Y(IPJP)
125     R2=R(IPJP)
126     U2=UL(IPJP)
127     V2=VL(IPJP)
128     X3=X(IJP)
129     Y3=Y(IJP)
130     R3=R(IJP)
131     U3=UL(IJP)
132     V3=VL(IJP)
133     X4=X(IJ)
134     Y4=Y(IJ)
135     R4=R(IJ)
136     U4=UL(IJ)
137     V4=VL(IJ)
138     UOR=(U1+U2+U3+U4)*UG(IJ)
139     RAR=VG(IJ)
140     DUDX=((U1-U3)*(Y2-Y4)-(U2-U4)*(Y1-Y3))*RAR
141     DUDY=((V2-V4)*(X1-X3)-(V1-V3)*(X2-X4))*RAR

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142      D=(DUDX+DUDY)*(1,+UOR=DT)+UOR
143      S=RDY*(ROL(IJ)=MTIL(IJ))+ROL(IJ)*D
144      H=RCQG(IJ)*(RDT+D)+DKLSM(IJ)
145      DP=DM*S/RA
146      ROL(IJ)=ROL(IJ)+RCQG(IJ)*DP
147      PLMAX=AMAX1(PLMAX,ABS(PL(IJ)))
148      IF(ABS(DP),LE,EP8*PLMAX) GO TO 40
149      MUSTIT=1
150      PL(IJ)=PL(IJ)+DP
151      Y24=Y2+Y4
152      Y31=Y3+Y1
153      XR13=.5*(R1+R3)*(X1=X3)
154      XR24=.5*(R2+R4)*(X2=X4)
155      XX=DT02*DP
156      DT02M1=XX*RM(IPJ)
157      DT02M2=XX*RM(IPJP)
158      DT02M3=XX*RM(IJP)
159      DT02M4=XX*RM(IJ)
160      UL(IPJ)=U1+DT02M1*R1+Y24
161      UL(IPJP)=U2+DT02M2*R2+Y31
162      UL(IJP)=U3+DT02M3*R3+Y24
163      UL(IJ)=U4+DT02M4*R4+Y31
164      VL(IPJ)=V1+DT02M1*X1+XR24
165      VL(IJ)=V4+DT02M4*X1+XR13
166      VL(IPJP)=V2+DT02M2*X1+XR13
167      VL(IJP)=V3+DT02M3*X1+XR24
168      40 IJ=IPJ
169      50 IJP=IPJP
170      CALL LUMP
171      60 CONTINUE
172      CALL DONE
173      C
174      C      GO SET THE BOUNDARY CONDITIONS
175      C
176      CALL BC(2)
177      NUMIT=NUMIT+1
178      IF(MUSTIT,EQ,0) GO TO 60
179      MUSTIT=0
180      IF(NUMIT,LT,500) GO TO 30
181      DO 70 IPX=IPD,IPD,6
182      70 WRITE(IPX,90)
183      80 CONTINUE
184      RETURN
185      C
186      90 FORMAT(42H ITERATION LIMIT EXCEEDED - RUN MAY ABORT,)
187      END

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1      SUBROUTINE YPH3
2      C
3      C      ROUTINE TO FINISH PHASE 1 AND CALCULATE GRID VELOCITIES
4      C

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5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN AND HANS RUPPEL,LASL T-3
6      C      MODIFIED BY J.L.NORTON,LASL T-3,1975
7      C
8      *
9      *      ----- BEGIN COMDECK YSTORE -----
10     *      ----- BEGIN COMDECK YAQDIM -----
11     DIMENSION X(1),XPAR(1),R(1),YPAR(1),Y(1),MPAR(1),U(1),UG(1),DELSM(
12     1 1),V(1),VG(1),RO(1),SIE(1),MP(1),RMP(1),RCSQ(1),E(1),ETIL(1),RVOL
13     2 (1),M(1),RM(1),VP(1),P(1),PL(1),UP(1),UTIL(1),UL(1),CO(1),VTIL(1)
14     3 ,VL(1),ROL(1),AVXSV(1),AVYSV(1),DLSROI(1),DLSROQ(1),CAPGAM(1),TUQ
15     4 (1),SIG(1),TUS(1),GRROR(1),GRRROZ(1),GRRROP(1),TUGVEC(1),MTIL(1),
16     5 CONC(1),CTEMP(1),ANCU(1),ANCV(1),GRSV(1),GZSV(1),X13K(1),X24K(1),
17     6 Y13K(1),Y24K(1),YR13K(1),XR24K(1),DKLSM(1),AREA(1)
18     *      ----- END COMDECK YAQDIM -----
19     *      ----- BEGIN COMDECK YAQSC -----
20     LOGICAL RESTRT,FILM,PAPER,TURB
21     REAL LAM,MU
22     C      COMMON/YSC1/AASC(NSCP1)
23     COMMON/YSC1/AASC(9600)
24     COMMON/YSC2/AA(1),ANC,AA0,A0FAC,ABM,B0,COLAMU,(YL,DR,DT,DTC,DTFAC,
25     1 DT0(10),DT0C(10),DT0Z,DT0B,DT0S,DTV,DZ,EM0,EP5,FIPXL,FIPXR,
26     2 FIPYB,FIPYT,FIXL,FIXR,FIYB,FIYT,FREZXR,GR,GRDVEL,GZ,GZP,I,IBAR,
27     3 IDTO,IJ,IJM,IJP,IMI,IPXL,IPXR,IPYB,IPYT,IP1,IP2,ISC2,ISC3,ITV,
28     4 IUNF,IXL,IXR,IYB,IYT,J,JBAR
29     COMMON/YSC2/JCEN,JP1,JP2,JP4,JUNF,JUNF02,KXI,LAM,LPB,MU,NAME(8),
30     1 NCYC,NLC,NPS,NPT,NQ,NQ1,NQ1B,NQ12,NSC,NUMIT,ZORIG,QM,QMCYL,PXCONV
31     2 ,PXL,PXR,PYB,PYCONV,PYT,ROD,REZRON,REZSIE,REZYB,RIBAR,RIBJB,
32     3 FREZYT,FREZYB,ROMFR,T,THIND,NCLST,TOUT,TWFIN
33     COMMON/YSC2/TUQ1,TUS1,NCQ,TNEG,TNEGSV,TUSV,TURB,PTOP,PRITE,PBOTH,
34     1 ILNG,NILNG,TP3,TUPOI,TQSAV,TK,TI,TUENG,EP1,SAV1,GLEVEL,YQ,IST,
35     2 VV,XCONV,XL,XR,YB,YCONV,YT,PTOLD,DTSV,DLAST,FIYB,IYB0,YCNVLD,
36     3 XCNVLD,FXRD,FXLO,IXNO,IXLO,ISVH,JSVH,QMN,QMX,WMAX,JNH,T2,TLM,
37     4 ROMFXR,ROMFYT,ROMFYB,JDUMP,TWTHRD,TE,DTR,TMASS,DTVSAV,DTCSAV,IDTV
38     5 ,JDTV,IDTC,CIRC,TIS,POTE,UMOM,VMOM,TMAX,TGMX,ITH,JTM,ITG,JTG
39     6 ,TMASSV,WMAEF,RMINEF,TSTRTD
40     COMMON/YSC2/ZZ
41     C      COMMON/YSC4/ITAB(ITABP)
42     COMMON/YSC4/ITAB(1000)
43     COMMON/YSC5/RESTRT,FILM,PAPER,IPD,IPD
44     *      ----- END COMDECK YAQSC -----
45     *      ----- BEGIN COMDECK YAQEQ -----
46     EQUIVALENCE(AASC(1),X,XPAR),(AASC(2),R,YPAR),(AASC(3),Y,MPAR),(
47     1 AASC(4),U),(AASC(5),V),(AASC(6),RO),(AASC(7),DELSM,RCSQ,MP),(AASC
48     8 (8),E,ETIL,AREA,XR13K),
49     2 (AASC(15),SIE),(AASC(16),PH0,DKLSM,RMP),(AASC(9
50     3 ),RVOL),(AASC(10),M,RM,VP),(AASC(11),P,PL,EP,UP),(AASC(12),UTIL,
51     4 UL,PMX,PU),(AASC(13),VTIL,VL,PHY,PV),(AASC(14),Q,CO,ROL),(AASC(17
52     5 ),CAPGAM,UG),(AASC(18),TUQ),(AASC(19),SIG),(AASC(20),TUS),(AASC(
53     6 21),GRROR),(AASC(22),GRRROZ),(AASC(23),DLSROI,Y13K),(AASC(24),GZSV
54     7 ),(AASC(25),DLSROQ,VG),(AASC(26),GRSV),(AASC(27),GRRROP,TUGVEC,
55     8 Y24K),(AASC(28),MTIL),(AASC(29),CONC),(AASC(30),CTEMP,XR24K),(
56     9 AASC(31),ANCU),(AASC(32),ANCV),(AASC(33),AVXSV,X13K),(AASC(34),
57     1 AVYSV,X24K)
58     REAL M,MP,MPAR,MTIL
59     *      ----- END COMDECK YAQEQ -----
60     *      ----- END COMDECK YSTORE -----
61     *      ----- BEGIN COMDECK PARAM -----
62     COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,IPFB,NP1,NP2,NLCP1,NLCP2,

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62      1 NLCP3,NLCP4,IFLMS2
63      * ----- END COMDECK PARAM -----
64      * ----- BEGIN COMDECK ASTORE -----
65      COMMON/ASTC/AT(100),FT(100)
66      DIMENSION IX1(1),IY1(1),IX2(1),IY2(1),XCO(1),YCO(1),CON(1)
67      EQUIVALENCE(AT,IX1),(AT(2),IX2),(AT(3),IY1),(AT(4),IY2),(AT(5),XCO
68      1 ),(AT(9),YCO),(FT,CON)
69      * ----- END COMDECK ASTORE -----
70      REAL LAMD,MUO2
71      DTV=1.E30
72      CALL START
73      DO 40 J=2,JP1
74      DO 30 I=1,IBAR
75          IMJ=IJ+NG
76          IPJ=IJ+NG
77          IPJP=IPJ+NG
78          X1=X(IPJ)
79          Y1=Y(IPJ)
80          R1=R(IPJ)
81          U1=U(IPJ)
82          V1=V(IPJ)
83          VL=VL(IPJ)
84          V1=V(IPJ)
85          X2=X(IPJP)
86          Y2=Y(IPJP)
87          R2=R(IPJP)
88          U2=U(IPJP)
89          V2=V(IPJP)
90          V2L=VL(IPJP)
91          V2=V(IPJP)
92          X3=X(IJP)
93          Y3=Y(IJP)
94          R3=R(IJP)
95          U3=U(IJP)
96          V3=V(IJP)
97          V3L=VL(IJP)
98          V3=V(IJP)
99          X4=X(IJ)
100         Y4=Y(IJ)
101         R4=R(IJ)
102         U4=U(IJ)
103         V4=V(IJ)
104         V4L=VL(IJ)
105         V4=V(IJ)
106         X12=X1-X2
107         X23=X2-X3
108         X34=X3-X4
109         X41=X4-X1
110         X24=X24K(IJ)
111         X31=X13K(IJ)
112         Y24=Y24K(IJ)
113         Y31=Y13K(IJ)
114         Y21=Y2-Y1
115         Y32=Y3-Y2
116         Y43=Y4-Y3
117         Y14=Y1-Y4
118         HR13=0.5*(R1+R3)

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119      HR24=0.5*(R2+R4)
120      U12=U1+U2
121      U23=U2+U3
122      U34=U3+U4
123      U41=U4+U1
124      U24=U2+U4
125      U13=U1+U3
126      V12=V1+V2
127      V23=V2+V3
128      V34=V3+V4
129      V41=V4+V1
130      V24=V2+V4
131      V13=V1+V3
132      XY=X24*Y31-X31*Y24
133      UOR=(U12+U34)*UG(IJ)
134      U24M=U2-U4
135      U13M=U1-U3
136      V24M=V2-V4
137      V13M=V1-V3
138      CAREA=0.5*XY
139      RXY=VG(IJ)
140      DUDX=RXY*(U24M+Y31+U13M+Y24)
141      DUDY=RXY*(X24+U13M+X31+U24M)
142      DVDX=RXY*(V24M+Y31+V13M+Y24)
143      DVDY=RXY*(X24+V13M+X31+V24M)
144      D=(DUDX+DVDY)*(1.+UOR*DT)+UOR
145      XX=SQRT(2./(Y24**2+Y31**2))*CAREA
146      YY=SQRT(2./(X24**2+X31**2))*CAREA
147      IF(KXI,LT,0) GO TO 18
148      AK=RO(IJ)**KXI
149      GO TO 28
150  18  UD4=UD**2+V4**2
151      VD4=AMAX1(ABS(U4+XX),ABS(V4+YY))
152      AK=RO(IJ)*COLAMU*(DT02+UD4+VD4**2,7)
153  28  ALAM=AK*LAM
154      AMU=AK*MU
155      LAMD=AMIN1(D,0.)*ALAM
156      MU02=.5*AMU
157      FMU02=.4*MU02
158      PIXX=FMU02*DUDX+LAMD
159      PIYY=FMU02*DVDY+LAMD
160      P1XY=2.*MU02*(DUDY+DVDX)
161      P1TH=.25*XY*(FMU02*UOR+LAMD*CYL)
162      XX1=HR24*(P1XY+X24=PIXX+Y24)
163      XX2=HR13*(P1XY+X31=PIXX+Y31)
164      XX3=HR24*P1XY+Y24
165      XX4=HR13*P1XY+Y31
166      XX=XX*XX
167      YY=YY*YY
168      TEMPJ=ALAM*2.*AMU
169      IF(TURR) TEMPJ=TEMPJ-RO(IJ)*SIG(IJ)*(THTHRD-2.)
170      DQ=RO(IJ)*(1.-ANC)*XX+YY/(2.*TEMPJ*(XX+YY)+EM10)
171      DQ=ARS(DQ)
172      DTV=AMIN1(.5*DQ,DTV)
173      IF(DTVSAV,NE,DTV) INTV=I
174      IF(DTVSAV,NE,DTV) JDTV=J
175      DTVSAV=DTV

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176      XR13=XR13K(IJ)
177      XR24=XR24K(IJ)
178      QX=Q(IJ)
179      RRO=1./RO(IJ)
180      RMC=RR0+RVOL(IJ)
181      QY=QX-P*Y
182      DELE=0.25+DT*RVOL(IJ)+((U1L+U1)*R1+V24+QX+(U2L+U2)*R2+V3)+QY*(U3L+
183      1 U3)+R3+V24+QX*(U4L+U4)+R4+V3)+QX*(V1L+V1)+XR24+QY*(V2L+V2)+XR13+
184      2 QY*(V3L+V3)+XR24+QY*(V4L+V4)+XR13+QY)
185      DELE=DELE+0.25+DT*RVOL(IJ)+((U1L+U1)*(XX1-P*ITM)+(U2L+U2)*(XX2-P*ITM
186      1 )+(U3L+U3)*(XX1+P*ITM)-(U4L+U4)*(XX2+P*ITM)+(V1L+V1)*XX3+(V2L+V2)*
187      2 XX4+(V3L+V3)*XX3-(V4L+V4)*XX4)
188      ETL(IJ)=SIF(IJ)+DELE+RRO
189      IJ=IPJ
190 50 IJP=IPJP
191      CALL LOOP
192 40 CONTINUE
193      CALL DONE
194      CALL START
195      IF(.NOT.TURN) GO TO 50
196      TNEG=TNEG
197      TK2=0.
198      YI2=0.
199      TP2=0.
200      TD2=0.
201      TUPOT=0.
202      TUPOTAB=0.
203 50 CONTINUE
204      DO 130 J=2,JP2
205      DO 120 I=1,IP1
206      IF(.NOT.TURN) GO TO 60
207      FF=0.5/RM(IJ)
208      TK2=TK2+FF*(UL(IJ)+2*VL(IJ)+0.2)
209      TP2=TP2+FF*GZ+DT*(VL(IJ)+V(IJ))
210 60 CONTINUE
211      IMJ=IJ+NG
212      IPJ=IJ+YQ
213      IMJ=IMJ+NG
214      VTEMP=0.125/RM(IJ)*(ANC(U(IJ))*(UTL(IJ)+U(IJ))+ANC(V(IJ))*(VTL(IJ)+V
215      1 (IJ)))
216      XX=0.
217      YY=0.
218      IF((I,EO,1),OR,(J,EO,IP1)) XX=0.
219      IF((J,EO,2),OR,(J,EO,JP2)) YY=0.
220      IF(XX+YY,EO,0.) GO TO 70
221      E(IJM)=E(IMJ)+VTEMP*RVOL(IMJ)/RO(IMJ)
222      E(IJM)=E(IJM)+VTEMP*RVOL(IJM)/RO(IJM)
223      E(IMJ)=E(IMJ)+VTEMP*RVOL(IMJ)/RO(IMJ)
224      E(IJ)=E(IJ)+VTEMP*RVOL(IJ)/RO(IJ)
225      GO TO 110
226 70 IF(I,NE,1) GO TO 80
227      IF((J,EO,2),OR,(J,EO,JP2)) GO TO 110
228      E(IJM)=E(IJM)+2.*VTEMP*RVOL(IJM)/RO(IJM)
229      E(IJ)=E(IJ)+2.*VTEMP*RVOL(IJ)/RO(IJ)
230      GO TO 110
231 80 IF(I,NE,IP1) GO TO 90
232      IF((J,EO,2),OR,(J,EO,JP2)) GO TO 110

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233      E(IJ)*E(IJ)+2,VTENP*RVOL(IJ)/RO(IJ)
234      E(IJM)*E(IJM)+2,VTENP*RVOL(IJM)/RO(IJM)
235      GO TO 110
236  ON  J,I,Q,2) GO TO 100
237      E(IJM)*E(IJM)+2,VTENP*RVOL(IJM)/RO(IJM)
238      E(IJ)*E(IJ)+2,VTENP*RVOL(IJ)/RO(IJ)
239      GO TO 110
240  100 F(IJ)*E(IJ)+2,VTENP*RVOL(IJ)/RO(IJ)
241      E(IJ)*E(IJ)+2,VTENP*RVOL(IJ)/RO(IJ)
242  110 CONTINUE
243      IJ=IPJ
244      IJP=IJP+NG
245  120 IJM=IJM+NG
246      CALL LOOP
247  130 CONTINUE
248      CALL DONT
249      CALL START
250      IFAKE=IJ
251      ON  IOR J,2,JP1
252      OR  IOR I,1,IQ,2
253      IPJ=IJP+NG
254      IJM=IJP+NG
255      IF(.NOT.T=RB) GO TO 100
256      FF=RO(IJ)/RVOL(IJ)
257      T12=T12+E(IJ)*FF
258      TQ2=TQ2+FF*TUG(IJ)
259      I=J=IJ=NG
260      SS=SIG(IJ)/RVOL(IJ)
261      TUPOT=THPOT+.25*SS*(GRROR(IJ)*(U(IJ)+U(IPJ)+U(IJP)+U(IJM))+GRROR(
262      I IJ)*(V(IJ)+V(IPJ)+V(IJP)+V(IJM)))
263      THPOT=THPOT+SS*GZ*DT*GRROR(IJ)
264  100 CONTINUE
265      IF(J.NE.2) GO TO 150
266  C      ***** SET BOTTOM FICTICIOUS ROW *****
267      ROL(IJM)=RO(IJM)
268      ETIL(IJM)=ETIL(IJ)
269      IF(TURB) TUG(IJM)=TUG(IJ)
270      CONC(IJM)=CONC(IJ)
271      IF(I.NE.IQ,2) GO TO 150
272  C      ***** SET LOWER RIGHT FICTICIOUS CORNER *****
273      ROL(IJM+NG)=RO(IJM+NG)
274      ETIL(IJM+NG)=ETIL(IFAKE)
275      IF(TURB) TUG(IJM+NG)=TUG(IFAKE)
276      CONC(IJM+NG)=CONC(IFAKE)
277      GO TO 100
278  150 IF(J.NE.JP1) GO TO 100
279  C      ***** SET TOP FICTICIOUS ROW *****
280      ROL(IJP)=RO(IJP)
281      IF(TURB) TUG(IJP)=TUG(IJ)
282      CONC(IJP)=CONC(IJ)
283  100 IF(I.NE.IQ,2) GO TO 170
284  C      ***** SET RIGHT HAND FICTICIOUS COLUMN *****
285      ROL(IPJ)=RO(IPJ)
286      ETIL(IPJ)=ETIL(IJ)
287      IF(TURB) TUG(IPJ)=TUG(IJ)
288      CONC(IPJ)=CONC(IJ)
289  170 IJ=IPJ

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200      IJP=IJPJ
201      IJM=IJM+NO
202      CALL LOOP
203      100 CONTINUE
204      CALL DONE
205      IF(.NOT.FURB) GO TO 200
206      TDD=I32+TUDENG
207      TERY=I1+TUDENG
208      OFLTAE=EPJ+TUPOT+TUPOTA
209      DELF=DELTAELAE
210      FIDEL=DELFM=SAV
211      IF(TOSSAV.NE.0.) (RATIO=FIDEL/TOSSAV
212      TOSSAV=TOO
213      SAV=DELTAELAE
214      200 CONTINUE
215      IF(GROVFL.GT.1.00) GO TO 250
216      CALL START
217      DO 220 J=2,JP2
218      DO 210 I=1,IP1
219      UG(IJ)=0.5+GROVFL*(UL(IJ)+U(IJ))
220      VG(IJ)=0.5+GROVFL*(VL(IJ)+V(IJ))
221      IJ=IJ+NO
222      CALL LOOP
223      220 CONTINUE
224      CALL DONE
225      CALL START
226      DO 240 J=2,JP2
227      DO 230 I=1,IP1
228      X(IJ)=X(IJ)+UG(IJ)*DT
229      Y(IJ)=Y(IJ)+VG(IJ)*DT
230      X(IJ)=X(IJ)+CVL*OM*CVL
231      230 IJ=IJ+NO
232      CALL LOOP
233      240 CONTINUE
234      CALL DONE
235      GO TO 260
236      250 CALL REZONE
237      260 CONTINUE
238      RETURN
239      END

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1      SUBROUTINE VPLOT
2      C
3      C      ROUTINE TO DO PLOTTING FOR YAGU1
4      C
5      C      ORIGINALLY WRITTEN BY A.A.AMSDEN, LASL Y-3
6      C      MODIFIED AND DOCUMENTED BY J.L.MORTON, LASL Y-3, 1979
7      C
8      C      ***** BEGIN COMMON PARAM *****
9      COMMON/PCOM/NSCP1,ITABP,ITABXP,ITABYP,ITABZ,MP1,MP2,NLCP1,NLCP2,
10      I,NLCP3,NLCP4,IFLMS2

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[illegible]

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68      *      ***** END COMDECK VARED *****
69      *      ***** END COMDECK YSTORE *****
70      *      ***** BEGIN COMDECK PCALL *****
71      *      COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
72      *      ***** END COMDECK PCALL *****
73      LOGICAL EULER
74      DIMENSION HCD(2)
75      DIMENSION IYITLE(6,8),INWT(8)
76      DIMENSION IJL1(6),IJL2(6),IJL3(6),IJL4(6),IJL5(6),IJL6(6)
77      DIMENSION IJL7(6),IJL8(6)
78      EQUIVALENCE(IYITLE,IJL1),(IYITLE(7),IJL2),(IYITLE(13),IJL3),(
79      1 IYITLE(19),IJL4),(IYITLE(25),IJL5),(IYITLE(31),IJL6),(IYITLE(37),
80      2 IJL7),(IYITLE(43),IJL8)
81      DATA IJL1/7MDENSITY,5*1M /
82      DATA IJL2/28MSPECIFIC INTERNAL ENERGY,3*1M /
83      DATA IJL3/9MVORTICITY,5*1M /
84      DATA IJL4/1MVVELOCITY MAGNITUDE,4*1M /
85      DATA IJL5/28MSPECIFIC TURBULENCE ENERGY,3*1M /
86      DATA IJL6/30MRATIO OF SPEC. TURB. ENERGY TO,
87      1 21M SPEC. KINETIC ENERGY/
88      DATA IJL7/28MTURBULENCE VISCOSITY (SIGMA),3*1M /
89      DATA IJL8/22MCONCENTRATION X RADIUS,3*1M /
90      DATA INWT/1,3,1,2,3,0,3,3/
91      DATA HCD/1M /
92      DATA VMAX,DMIN,DZMIN,DRMAX,DZMAX/5*8./,1VM,JVM/R,0/
93      DATA TP/R,/
94      CALL SECOND(TP)
95      WRITE(59,21P) TP
96
97      C
98      C      IF THERE ARE ANY PARTICLES, GO PLOT THEM
99      C
100      C      IF(INPT.GT,0) CALL PARPLY
101
102      C      EULER IS TRUE IF THE CALCULATION IS EULERIAN
103      C
104      C      EULER=FALSE.
105      C      IF(IGDVE,EO,P.) EULER=TRUE.
106
107      C      INITIALIZE COORDINATE-TO-RASTER CONVERSION FACTORS IN COMMON
108      C
109      C      YCONVP=YCONV
110      C      XCONVP=XCONV
111
112      C      INITIALIZE MINIMUM PLOT Y VALUE IN COMMON
113      C
114      C      YLB=YA
115      C
116      C      GO GET THE MAXIMUM VELOCITY ABSOLUTE VALUE ALONG THE COORDINATE
117      C      DIRECTIONS AND THE MINIMUM AND MAXIMUM ZONE SIZES
118      C
119      C      CALL DVM(VMAX,1VM,JVM,DMIN,DZMIN,DRMAX,DZMAX)
120      C      VTEST=.05*VMAX
121
122      C      IF DOING AN EULERIAN CALCULATION, ONLY DO ZONE PLOTS UPON
123      C      STARTUP, OTHERWISE, DO THEM EVERY OUTPUT CYCLE.
124      C
125      C      IF(EULER.AND,NEVE,NE,0) GO TO 2M

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125      CALL ADV(1)
126      CALL ZONPLT
127      C
128      C      PUT LABELS ON THE ZONE PLOT AND OUT TO THE CYCLE SUMMARY PRINT
129      C
130      CALL LINCNT(50)
131      WRITE(IFO,220)
132      DO 10 IPX=0,IFD,6
133      10 WRITE(IPX,250) DRMIN,DRMAX,DZMIN,DZMAX,XR,YB,YT
134      WRITE(IFO,260) JNM,NAME,T,NCYC
135      20 CONTINUE
136      C
137      C      SKIP VELOCITY PLOTS IF VELOCITIES ARE ESSENTIALLY ZERO,
138      C      OTHERWISE, PLOT VELOCITIES SCALED TO THE MAXIMUM VELOCITY.
139      C
140      IF(VMAX,GT,EM10) CALL VFLPLT(VMAX,0)
141      C
142      C      THE FULL PLOTS HAVE BEEN MADE. ADJUST PLOTS NOW SO THAT THE
143      C      REGION DISPLAYED INCLUDES THAT PART OF THE PROBLEM TWO
144      C      FIREBALL RADII ABOVE THE TOP OF THE FIREBALL TO THREE RADII
145      C      BELOW THE BOTTOM OF THE FIREBALL
146      C
147      YUP=PTOP*2,0PRITE
148      YLB=PBOT*3,0PRITE
149      IF(YUP,GT,YT) YUP=YT
150      IF(YLB,LT,YB) YLB=YB
151      C
152      C      READJUST THE CARTESIAN TO PASTER RATIOS TO ENCOMPASS THE NEW
153      C      REGION BUT SAVE THE OLD COORDINATES
154      C
155      FIYB=FIYR
156      IYB=IYB
157      FIYR=9999,
158      IYR=9999
159      YCONVP=FLOAT(IYT-IYR)/(YUP-YLB)
160      XCONVP=XCONV+YCONVP/YCONV
161      FIYLB=FIYL
162      IYLB=IYL
163      FIYRB=FIYR
164      IYRB=IYR
165      FIYL=65,
166      IYL=65
167      FIYR=660,
168      IYR=660
169      YCNVLD=YCONV
170      YCONV=YCONVP
171      XCNVLC=XCONV
172      XCONV=XCONVP
173      C
174      C      DO THE PLOTS AGAIN FOR THE SMALLER REGION
175      C
176      IF(FULER,AND,NCYC,NE,0) GO TO 30
177      CALL ADV(1)
178      CALL ZONPLT
179      C
180      C      PUT LABELS ON THE ZONE PLOT
181      C

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182      CALL LINCNT(50)
183      WRITE(IFO,230)
184      WRITE(IFO,250) DRMIN,DRMAX,DZMIN,DZMAX,XR,Y0,YT
185      WRITE(IFO,260) JNM,NAME,T,NCYC
186      C
187      C      DRAW THE PLOTTING RECTANGLE AND LABEL IT
188      C
189      CALL TICBOX
190      30 CONTINUE
191      C
192      C      SKIP VELOCITY PLOTS IF VELOCITIES ARE ESSENTIALLY ZERO
193      C
194      IF(VMAX,LT,EMIS) GO TO 40
195      C
196      C      PLOT VELOCITIES SCALED TO MAXIMUM VELOCITY
197      C
198      CALL VELPLY(VMAX,0)
199      CALL TICBOX
200      C
201      C      PLOT UNSCALED VELOCITIES
202      C
203      CALL VELPLY(VMAX,1)
204      CALL TICBOX
205      40 CONTINUE
206      C
207      C      SECTION TO DO CONTOUR PLOTS
208      C
209      C      L=1, DENSITY (ISOPYCNICS)
210      C      L=2, SPECIFIC INTERNAL ENERGY (ISOTHERMS)
211      C      L=3, VORTICITY
212      C      L=4, VELOCITY MAGNITUDE
213      C      L=5, SPECIFIC TURBULENCE ENERGY
214      C      L=6, RATIO OF SPEC. TURB. ENERGY TO SPEC. KINETIC ENERGY
215      C      L=7, TURBULENCE VISCOSITY (SIGMA)
216      C      L=8, CONCENTRATION X RADIUS
217      C
218      C      IF TURBULENCE IS NOT ON, DO NOT PLOT THE TURBULENCE QUANTITIES
219      C
220      C      LPAR
221      IF(,NOT,TURB) LPAR=4
222      C
223      C      PREPARE THE PLOTTING ARRAYS
224      C
225      DO 202 L=1,LP
226      C
227      C      CHECK FOR VORTICITY PLOT
228      C
229      IF(L.NE,3) GO TO 50
230      C
231      C      YES, SPECIAL SUBROUTINE PREPARES VORTICITY.
232      C
233      CALL GETOMG
234      GO TO 190
235      50 CONTINUE
236      CALL START
237      DO 100 J=2,JP1
238      DO 170 I=1,IBAR

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239      GO TO (60,70,200,60,62,60,140,60),L
240      60 CONTINUE
241      C
242      C      DENSITY
243      C
244      CQ(IJ)=RQ(IJ)
245      GO TO 160
246      70 CONTINUE
247      C
248      C      SPECIFIC INTERNAL ENERGY
249      C
250      CQ(IJ)=8IE(IJ)
251      GO TO 160
252      80 CONTINUE
253      IPJ=IJ+NG
254      IPJP=IPJ+NG
255      IF(L.EQ.5.OR.L.EQ.6) GO TO 90
256      XXA=(0.25*(U(IJ)+U(IPJ)+U(IPJP)+U(IJP)))**2+(0.25*(V(IJ)+V(IPJ)+V(
257      I IPJP)+V(IJP)))**2
258      GO TO 140
259      90 CONTINUE
260      RAV=0.25*(R(IJ)+R(IPJ)+R(IPJP)+R(IJP))
261      120 CONTINUE
262      LPX=L-3
263      GO TO (110,120,130,140,150),LPX
264      110 CONTINUE
265      C
266      C      VELOCITY MAGNITUDE
267      C
268      CQ(IJ)=SQRT(XXA)
269      GO TO 160
270      120 CONTINUE
271      C
272      C      SPECIFIC TURBULENCE ENERGY
273      C
274      CQ(IJ)=YTUR(IJ)
275      GO TO 160
276      130 CONTINUE
277      C
278      C      RATIO OF SPEC. TURB. ENERGY TO SPEC. KINETIC ENERGY
279      C
280      CQ(IJ)=YTUR(IJ)/(XXA*FMIX)**2,
281      TFST=AMAX1(ABS(U(IJ)),ABS(V(IJ)))
282      IF(TEST.LT.VTEST) CQ(IJ)=R.
283      GO TO 160
284      140 CONTINUE
285      C
286      C      TURBULENCE VISCOSITY (SIGMA)
287      C
288      CQ(IJ)=SIG(IJ)
289      GO TO 160
290      150 CONTINUE
291      C
292      C      CONCENTRATION X RADIUS
293      C
294      CQ(IJ)=CONC(IJ)*RAV
295      160 CONTINUE

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296         IF (ABS(CO(IJ)).LT.1.E-5H) CO(IJ)=0.
297         IJP=IJP+NG
298     177 IJ=IJ+NG
299         CALL LOOP
300     180 CONTINUE
301         CALL DONE
302     190 CONTINUE
303     C
304     C     DECIDE WHETHER TO REQUEST LOGARITHMIC OR LINEAR CONTOUR INCREMENTS
305     C
306     C     PLOTS 1 AND 2 ARE LOGARITHMIC - THE OTHERS LINEAR
307     C
308         ILOG=1
309         IF (L.GT.2) ILOG=0
310     C
311     C     GO DO THE PLOT
312     C
313     C     ITITLE IS THE PLOT TITLE
314     C     INWT IS THE NO. OF COMPUTER WORDS IN THE TITLE
315     C
316         CALL CONTOUR(ILOG,ITITLE(1,L),INWT(L))
317     200 CONTINUE
318     C
319     C     RESTORE THE OLD RASTER VALUES
320     C
321         FIYR=FIYB0
322         IYR=IYB0
323         YCONV=YCONVLD
324         XCONV=XCONVLD
325         FIXR=FIXB0
326         IXR=IXB0
327         IXL=IXL0
328         IYR=IYB0
329         CALL SECOND(TP)
330         WRITE(50,240) TP
331         RETURN
332     C
333     210 FORMAT(1H ,20HBEGIN VPLOT AT CP = ,F12,4)
334     220 FORMAT(10H ALL ZONES)
335     230 FORMAT(20H ZONES IN THE FIREBALL REGION)
336     240 FORMAT(1H ,10HEND VPLOT AT CP = ,F10,4)
337     250 FORMAT(7H DZMIN=1PE12,5,7H DZMAX=E12,5,7H DZMIN=E12,5,7H DZMAX=E12
338     1 ,5,4H XR=E12,5,4H YB=E12,5,4H YB=E12,5)
339     260 FORMAT(1H ,4XA10,0A10,3X2HT#,1PE12,5,1X6MCYCLES,15)
340     END

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1      SUBROUTINE ZONPLT
2      C
3      C     ROUTINE TO DO FULL AND PARTIAL ZONE PLOTS
4      C
5      C     ORIGINALLY WRITTEN BY A.A.AMSDEN,LASL T=3

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63 *      ***** END COMDECK YSTORE *****
64 *      ***** BEGIN COMDECK PCALL *****
65 COMMON/PCALLC/XCONVP,YCONVP,YUP,YLB
66 *      ***** END COMDECK PCALL *****
67 C      LOOP OVER ALL REAL ZONES
68 C
69      JR=0
70      CALL START
71      DO 60 J=2,JP1
72      DO 50 I=1,IARP
73      IPJ=IJ+NG
74      IPJP=IJP+NG
75 C
76 C      DETERMINE THE FOUR VERTICES OF CELL (I,J)
77 C
78 C      (X1,Y1) IS VERTEX (I+1,J)      (VERTEX 1)
79 C      (X2,Y2) IS VERTEX (I+1,J+1)    (VERTEX 2)
80 C      (X3,Y3) IS VERTEX (I,J+1)      (VERTEX 3)
81 C      (X4,Y4) IS VERTEX (I,J)        (VERTEX 4)
82 C
83      X1=X(IPJ)
84      X2=X(IPJP)
85      X3=X(IJP)
86      X4=X(IJ)
87      Y1=Y(IPJ)
88      Y2=Y(IPJP)
89      Y3=Y(IJP)
90      Y4=Y(IJ)
91 C
92 C      (IXN,IYN) ARE THE PLOT RASTER COORDINATES OF VERTEX N
93 C
94      IX1=FIXL+(X1-XL)*XCONVP
95      IX2=FIXL+(X2-XL)*XCONVP
96      IX3=FIXL+(X3-XL)*XCONVP
97      IX4=FIXL+(X4-XL)*XCONVP
98      IY1=FIYB+(Y1-YLB)*YCONVP
99      IY2=FIYB+(Y2-YLB)*YCONVP
100     IY3=FIYB+(Y3-YLB)*YCONVP
101     IY4=FIYB+(Y4-YLB)*YCONVP
102 C
103 C      IF VERTEX 1 OR 2 IS ABOVE THE TOP OR BELOW THE BOTTOM OF THE
104 C      PLOT REGION, DO NOT PLOT THIS ZONE
105 C
106     IF(IY1,GT,IYB,OR,IY1,LT,IYT) GO TO 40
107     IF(IY2,GT,IYB,OR,IY2,LT,IYT) GO TO 40
108 C
109 C      IF VERTEX 1 OR 2 IS TO THE RIGHT OF THE PLOT REGION, SKIP
110 C      THIS ZONE
111 C
112     IF(IX1,GT,IXR) GO TO 40
113     IF(IX2,GT,IXR) GO TO 40
114 C
115 C      IF THIS ZONE IS ON THE SYMMETRY AXIS, DRAW THE LEFT SIDE
116 C
117     IF(I,EQ,1) CALL DRV(IX3,IY3,IX4,IY4)
118 C
119 C      IF THIS ZONE IS IN THE BOTTOMMOST ROW TO BE PLOTTED, DRAW THE

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120      C          BOTTOM SIDE
121      C
122          IF(JB,NE,0) GO TO 10
123          JB=J
124          GO TO 20
125      10 CONTINUE
126          IF(J,NE,JB) GO TO 30
127      20 CONTINUE
128          CALL DRV(IX4,IV4,IX1,IV1)
129      30 CONTINUE
130      C
131      C          DRAW THE RIGHT SIDE
132      C
133          CALL DRV(IX1,IV1,IX2,IV2)
134      C
135      C          DRAW THE TOP SIDE
136      C
137          CALL DRV(IX2,IV2,IX3,IV3)
138      40 IJ=IPJ
139      50 IJP=IPJP
140          CALL LOOP
141      60 CONTINUE
142          RETURN
143          END

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