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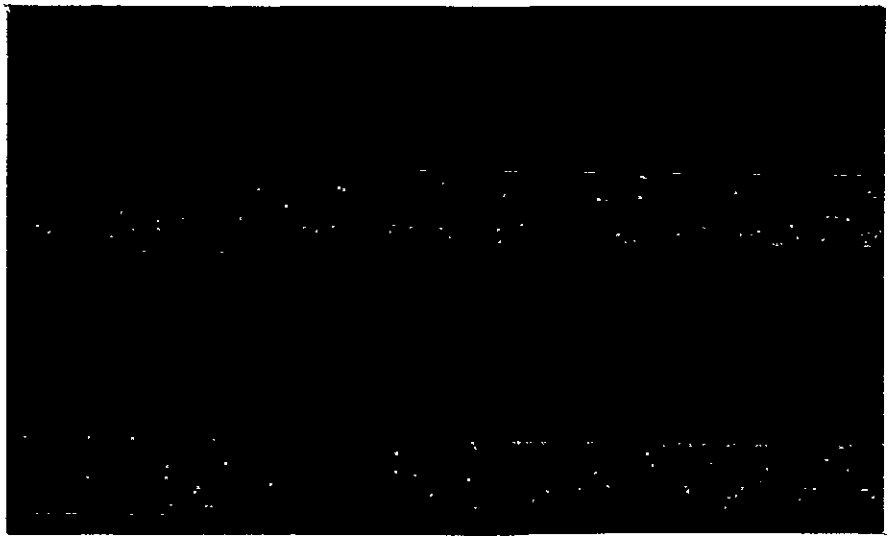

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NIELSEN ENGINEERING AND RESEARCH, INC.

OFFICES 510 CLYDE AVENUE / MOUNTAIN VIEW, CALIFORNIA 94043 / TELEPHONE (415) 968-9457

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NASA CR-137862

USERS MANUAL FOR SPACE-SHUTTLE COMPUTER PROGRAMS

By Gary D. Kuhn, Frederick K. Goodwin
and Stanley C. Perkins, Jr.
Nielsen Engineering & Research, Inc.

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FOREWORD

The major computational computer programs described in this manual were developed by NASA/Ames Research Center personnel. The Finite-Volume Unsteady Blunt-Body program and the Finite-Difference Shock-Capture program were each coded in the CFD language by Ames personnel for use on the ILLIAC IV computer. The Finite-Volume Steady Blunt-Body program was coded in FORTRAN by Ames personnel and then translated into CFD by the authors of this manual. The Coordinate Transformation Interface program was also developed by the authors to allow the main space-shuttle programs to be run in sequence. All CFD coded programs have been translated back into FORTRAN by the CFDX translator for the CDC 7600 at Ames.

The assistance and cooperation of the Technical Monitor, Dr. Harry E. Bailey, in providing access to the programs and data needed to accomplish the task of combining the required programs to develop a complete space-shuttle computation method is gratefully acknowledged. The assistance of Dr. Walter Reinhardt, Mr. William Davy and Mr. John Rakich in developing the interfaces between the various programs is also gratefully acknowledged.

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COMPUTER PROGRAMS

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INTRODUCTION

The purpose of this report is to describe and present instructions for using the computer programs developed by NASA/Ames Research Center personnel for calculation of the flow field about space-shuttle vehicle (SSV) configurations (refs. 1 to 3). The programs as described in this report are coded in FORTRAN for the CDC 7600 computer. The main programs and most subroutines are in a form resulting from translation from the special FORTRAN-like language (CFD) developed at NASA/Ames Research Center for use on the ILLIAC IV computer. The use of the CFD language results in a FORTRAN code which is more efficient when run on the CDC 7600 than the pure FORTRAN code in which the programs were originally developed. However, the FORTRAN code as translated from the CDC language may prove difficult to read. A few subroutines such as input and output routines and a subroutine for calculating the body geometry have been coded directly in FORTRAN so that these programs cannot be run as they exist on the ILLIAC IV computer. The programs could be run, with minor modifications, on other serial processing computers such as the IBM 360 or other computers with sufficient memory capacity. The largest of the five programs requires approximately 650,000 octal words (220,000 decimal words) of core storage. A total of seven permanent tape or disc files are required by the programs for input and output in addition to punched card input data.

The programs described in this report are:

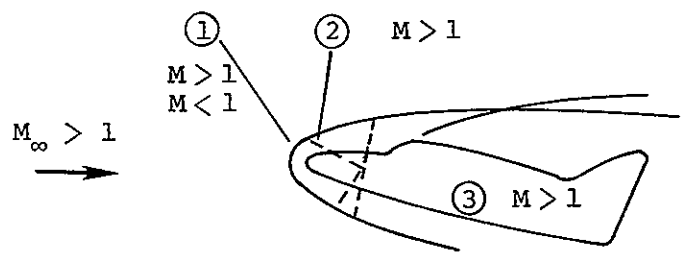
1. Finite-Volume Time Marching Code (FVTM)
   (ref. 1)
2. Finite-Volume Space Marching Code (FVSM)
   (ref. 2)
3. Finite-Difference Space Marching Code (FDSM)
   (ref. 3)
4. Streamline Coordinate Metric Coefficient Code (CHAOS)
   (ref. 4)
5. Coordinate Transformation Interface Code (CTI)

The first program provides starting conditions for the second program which in turn provides starting conditions for the third program. The fifth program transforms the results of the first two programs into the coordinate system and computational mesh required by the third and fourth programs.

The next sections of this report will describe in more detail the general use of the programs and then present instructions for preparing the input data and interpreting the output

DESCRIPTION OF PROGRAMS

Because of the rather complicated nature of the flow about the space-shuttle vehicle, several individual codes have been developed rather than one overall code in order that the several different regions of the flow which occur can be handled with numerical efficiency. The three regions of applicability of the programs described in this report are shown in the sketch below.



The individual programs listed previously will now be described briefly.

Finite-Volume Time Marching Code

This program is based on a second-order accurate, time-dependent, finite volume numerical algorithm that solves the unsteady flow equations for a perfect gas or a chemically reacting flow in integral conservation law form (ref 1). The program is used to determine the structure of the flow field and the distribution of chemical species in the region of the blunt nose of the vehicle It carries the calculation through the subsonic portion of the field and continues to points just beyond the sonic surface where it terminates. This code is applicable to a variety of blunt-body shapes and flows at supersonic Mach numbers up to 22 and angles of attack up to 40°. The computational mesh for the program is determined by a series of nested cones as shown in figures 1 and 2. The surfaces defined by the cones shown in figure 1 are intercepted by a plane rotated about the cone axis in specific angular increments as shown in figure 2. Finally, a third set of surfaces which divide the region between the body and the shock into a specific number of layers produces a set of finite volume hexahedra to which a finite-difference computational scheme is applied to solve the flow equations in integral conservation law form. The flow field is calculated as the asymptotic solution of an unsteady flow started from arbitrary initial conditions.

Finite-Volume Space Marching Code

The second code is based on a second-order accurate, steady, hyperbolic finite-volume algorithm that solves the flow equations in integral conservation law form for supersonic flow (ref. 2). This code uses initial data determined by the previous program which are supplied on a curved surface just downstream of the sonic surface (fig. 3). The basic computational surface is circular conical as for the previous program, defined at each step of the calculations by the location of the apex of the cone, the cone vertex angle and the cone axis orientation with the body axis. In the present version of the program, the location of the apex of the cone is held fixed while the cone vertex angle, θ, increases monotonically toward 90° and the axis orientation angle, β, approaches zero so that at the final step the surface degenerates into a plane normal to the body axis

Finite-Difference Space Marching Code

The third program is based on a second-order accurate, hyperbolic, finite-difference algorithm that solves the flow equations for a perfect gas or a chemically reacting flow in differential conservation law form for supersonic flow (ref. 3) This program accepts initial data from the previous program on a plane normal to the body axis and then carries the calculation back over the remainder of the vehicle or until the Mach number becomes less than one in the marching direction (fig. 4). The governing equations are solved between the body and the outer most shock wave which is treated as a sharp discontinuity. Secondary shocks which form between these boundaries are captured automatically.

Streamline Coordinate Metric Coefficient Code

The fourth program is based upon the partial differential equations relating the metric coefficients for the three-dimensional streamline coordinates to body geometry and the three-dimensional inviscid solution Consequently, this program requires input data from all of the previous three codes. It determines the surface streamlines and then by using the axisymmetric analogy, estimates the heat transfer to the vehicle (ref. 4). This program is not described in detail in this users manual. However, a list of the punched card input required is included in the Appendix.

Coordinate Transformation Interface

A fifth program is used to transform the data from the first two programs to the coordinate system and computational mesh required by the third and fourth programs. The program employs linear interpolations of the data of the first two programs to obtain data at user-specified axial stations and equispaced values of the meridional angle, ϕ, and the radius, r (fig. 4). The data on the body surface are adjusted to satisfy the conditions of constant total energy and flow tangent to the surface. No attempt is made to maintain the surface entropy at a constant value for the perfect gas case.

PROGRAM ORGANIZATION

In this section, the general organization of the program will be described Specific information on data required for input and data developed for output will be described in subsequent sections.

A general flow chart of the overall program organization is shown in figure 5. Each program requires some punched card input and some input data from disc or tape data files. Each program in turn produces new disc or tape data files, and printed output.

Program 1 (FVTM) requires, initially, data from cards describing the free-stream conditions and the computational mesh. In addition, input are required describing the vehicle geometry. It is most expedient to store the geometrical input data on a separate disc file since the same data are required by program 2 and by the interface program. The specific construction of this file will be described in a subsequent section. Program 1 produces as output lists of the appropriate flow field quantities plus a disc or tape data file (data file 1, P1DATA) which has three possible uses.

1. To restart program 1 for continuation of an unfinished calculation.

2. To start program 2 (FVSM)

3. As input to the interface program (CTI)

Program 2 requires some card input data describing certain print options, certain output options, and telling the program whether it is starting from program 1 or continuing an unfinished calculation. Program 2 also requires the same geometry input file as did program 1. Program 2 produces printed output and two data files. One file (data file 2, P2RS) is used to restart program 2 in case of premature termination. That file is replaced every tenth step of the integration. The other file (data file 3, P2DATA) is used by the interface program both for producing a combined file from the results of programs 1 and 2 for the entire nose region and to produce a data set to start program 3. Data file 3 consists of the flow variables, chemical species concentrations, computational mesh coordinates and certain parameters for every tenth step of the integration. The interface code transforms the accummulated data from programs 1 and 2 to a body-axis oriented cylindrical coordinate system and interpolates the data to planes normal to the body axis at specified axial locations. The program then produces a data file (data file 4, CHAOS) to be used by program 4, the steamline metric program, and another (data file 5, BBDATA) for program 3, the steady shock-capture code Program 3 continues the calculation from where program 2 terminated, calculating downstream over the remainder of the vehicle. Program 3 produces a data file (data file 6) to be used to restart in the case of a premature termination. Data file 6 is not produced in a form that is immediately capable of being used by program 4 To do so will require development of an interface program to convert the data to that required by program 4 as is done by program 5 for the data of programs 1 and 2.

INPUT TO THE PROGRAMS

Tabular Form

The input data required for calculating the flow field about a space-shuttle vehicle consists of several punched cards containing parameters describing the free-stream flow conditions, the computational mesh, and certain options that are available in the programs. A dictionary of the input data is presented in the next section. The data required to describe the body geometry are included since the data must be prepared on punched cards and then loaded on a disk or tape file for use by the programs. Figure 6 shows the input variables as they are to be punched on the data cards for each program Further explanation of the proper preparation of input data is given in the section "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA."

Dictionary of Input Variables

The variables required for input on punched cards are defined in this section in the order in which they are required Additional details on the format of the punched data are given in figure 6.

Program 1 (FVTM)

DISKIN — logical variable indicating whether input is from disk file (T) or cards (F)

DISKOT — logical variable indicating whether an output disk file is to be written (T) or not (F)

NDEND — integer indicating the number of iteration steps to be computed in present calculation

NPRNT — integer indicating whether final flow field results are to be printed
0 - no
1 - yes

NPRT — integer indicating whether initial computational mesh parameters are to be printed
0 - no
1 - yes

NEND — integer indicating number of iteration steps to be calculated in first calculation

IE — integer, total number of latitudinal mesh points, maximum 16

JE — integer, total number of shock layer mesh points, maximum 192/IE

KE — integer, total number of meridional mesh points, maximum 20

JSHK — integer indicating location of shock, usually JSHK = JE-2

NGAS	integer indicating type of gas being calculated NGAS = 0, nonequilibrium air = -1, perfect gas
RMACH	free-stream Mach number, M_∞
PINF	free-stream static pressure, dynes/cm^2
RINF	free-stream density, gm/cm^3
GAMMA	free-steam ratio of specific heats, γ
SDO	initial estimate of shock standoff distance, nose radii (fig. 7), see "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA"
C2,S3	parameters describing shock shape, see "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA:
ALPHA	angle of attack, degrees

For information on how to determine the following input quantities for program 1, see "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA"

ZFOCNL	axial location of vertex of largest cone of computational mesh, nose radii (fig. 7)
THWL	angle between the free-stream velocity and the windward intersection of the largest cone of the computational mesh with the pitch plane, degrees (fig. 7)
THLL	angle between the free-stream velocity and a line drawn from the axial location of the first computational mesh cone vertex denoting the point of intersection of the leeward limit of the computational mesh with the body, degrees (fig. 7)
RBX	axial location of first mesh cone vertex, nose radii (fig. 7)

<u>Program 2</u> (FVSM)

NRSTRT	integer indicating source of input data 0 - data are obtained from the file produced by program 1 (FVUBB, data file 1) 1 - data are obtained from the restart file produced by program 2 (data file 2)

NPFLOW,NPAREA NPXYZ,NPFLUX — integers indicating whether output is to be printed for flow variables, mesh areas, mesh coordinates and fluxes, respectively

0 - no output printed

1 - output printed

DTHETP — angular interval for output, degrees

<u>Program 3</u> (FDSM)

GRFCS — logical variable indicating whether CRT display is to be used.

FALSE - no

TRUE - yes

Note: The present version of program 3 does not include the capability of employing the CRT display so the variable GRFCS should always be input as FALSE

MODIN,LTIN, MODOUT,LTOUT — integers indicating input and output mode, source of input data and disposition of output data. MODIN, MODOUT, LTIN and LTOUT are used to control the following options:

MODIN = 1, LTIN = 1 read from disk, logical unit 20

MODIN = 1, LTIN = 2 read from disk, logical unit 21

MODIN = 1, LTIN = 3 read binary version of file "BBDATA"

MODOUT = 2, LTOUT = 1 write on disk, logical unit 20

MODOUT = 2, LTOUT = 2 write on disk, logical unit 21

MODIN = 3 read cards, unit 31, LTIN ignored

MODOUT = 4 punch cards, unit 30, LTOUT ignored

MODOUT = 5 write on disk, unit 22, LTOUT ignored, continueous storage of results

MODIN = 6 LTIN = 0 read from last entry of continuous storage file, unit 22

MODIN = 6, LTIN > 0 read from the first entry of the continuous storage file at which the integration step number is greater than or equal to LTIN, unit 22

NIT	integer, upper limit on number of integration steps for current calculation
MODCFO	axial increment at which complete flow field is to be printed, cm
MODBSO	integer number of integration steps between output of body and shock data
CRASHZ	axial increment between output for storage file (Data file 6)
NUMDUM	integer number of mesh data cards to be inputted
ZRMSH	axial locations at which the computational mesh will be revised, cm. See "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA-Clustering Parameters".
BETTA, PHIZRO, AR, BR	parameters for clustering the computational mesh, see "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA - Clustering Parameters".
ZFACT	axial locations for changing weighting factor on integration step size, cm, see "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA - Step Size for Program 3"
FCTROW	weighting factor on integration step size, may range from 0.5 to 1.2 depending on rate of change of solution
NMPTS	integer number of data cards to be inputted for meridional damping
ZDMPM	axial location at which meridional damping factor will be changed, cm
DCM	meridional damping factor, see "SPECIAL INSTUCTIONS FOR PREPARING INPUT DATA - Damping Parameter"
NRPTS	integer number of data cards to be inputted for radial damping
ZDMPR	axial location at which radial damping factor will be changed, cm
DCR	radial damping factor

Program 4 (CHAOS)

A dictionary of input data for program 4 taken from reference 4 is presented in the Appendix.

Program 5 (CTI)

JLIMIT — integer, number of shock layer locations at which data are to be calculated for program 4 (CHAOS), including the body surface, but not the shock wave, maximum 24

JL3 — integer, number of shock layer locations at which data are to be calculated for program 3 (FDSM), including the body surface and the shock wave, maximum 22.

NUMK — integer, number of meridional (ϕ_k) locations at which data are to be calculated for programs 3 and 4. May be different from (KE-1) used in programs 1 and 2, maximum 20

IOPT — integer, indicates which output is to be produced
3 - output is produced only for program 3
4 - output is produced only for program 4
43 - output is produced for both programs 3 and 4
If any number besides one of these three is inputted, the program stops after printing an error message.

NPRNT — integer, indicates whether output of the calculated flow field data produced for programs 3 and 4 is to be printed
0 - no
1 - yes

IZ — integer, total number of axial stations at which data are to be requested for program 4, maximum 40

ZMTRC(I) — array of axial stations at which data are requested for program 4, in fractions of the length (ZMAX) of the region covered by programs 1 and 2. Up to 40 values are allowed. Values larger than 1.0 and smaller than Z(1,1,1)/ZMAX of the computational mesh will be rejected.

Body Geometry Data

"See "SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA - Body Geometry"

RNOSE	radius of nose, inches
CONANG	angle of nose cone frustum, degrees
NSC(N)	integer, number of segments used to define curve fit for variable N, maximum NSC(N) = 13
NS	integer, segment number corresponding to a particular set of coefficients of a curve fit
K	integer, order of the polynomial used for the curve fit, maximum K = 9
NCF(NS,N)	integer, number of coefficients in curve fit for variable N in segment NS, maximum NCF(NS,N) = 10
YP1	slope at forward end of segment NS
YP2	slope at aft end of segment NS
ZL(NS,N,1)	axial location of forward end of curve fit for variable N, in segment NS
ZL(NS,N,2)	axial location of aft end of curve fit for variable N, in segment NS
CF(I,NS,N) I=1,2, NCF(NS,N)	coefficients of curve fit for variable N in segment NS

SPECIAL INSTRUCTIONS FOR PREPARING INPUT DATA

Units

Nondimensional quantities have been used for the input data where convenient. However, the free-stream density and pressure and the quantities describing the body geometry must be input in dimensional units. The user's attention is called to the fact that the FREE STREAM CONDITIONS are required in CGS UNITS while the GEOMETRY PARAMETERS are input in ENGLISH UNITS (inches) Angles are input in degrees.

Shock Shape Parameters

The initial estimate of the shock shape is specified by the three input parameters SD0, C2 and S3. The initial shock surface is generated by a quadratic function of the latitudinal angle, θ, and the meridional angle, ϕ (fig. 2) and is positioned at an estimated standoff distance, Δ_o. The input parameter SDO is the nondimensional standoff distance

$$SDO = \frac{\Delta_o}{R_n}$$

where R_n is the nose radius. Experience has indicated that the initial estimate of the standoff distance should be larger than the converged value. Exactly how much larger it must be and what is the exact effect on the convergence has not been thoroughly investigated. For spheres, the shock standoff distance is a weak function of Mach number for hypersonic Mach numbers. For bodies with spherical noses, a reasonable value for SDO is

$$SDO \approx 0.25$$

Different values may be used if desired for specific cases

Since the real shock is not expected to conform to the shape of the body, the remaining parameters are used to describe the distance between the shock and the body surface along rays of the computational mesh (fig. 2). Thus, the following expression describes the shock shape,

$$S_{ik} = SDO\,[1 + \theta_{ik}^2 (C2) + \theta_{ik}^4 (2 + \cos\phi_i) S3]$$

The parameters C2 and S3 can be adjusted to provide a desired degree of expansion of the shock layer. Values of C2 and S3 of 0.5 and 0.0 respectively have been found to yield good results for bodies with sphere-cone noses Those values are used in the sample calculation to be presented subsequently. Those values should also yield good results for other cases. Nevertheless, the quantities are required as input in order to provide the user with the ability to adjust the initial conditions.

Computational Mesh Parameters

The computational mesh is constructed from the input values of ALPHA, ZFOCNL, THWL, THLL and RBX. The definitions of these quantities are illustrated in figure 7 where a sketch of a typical sphere-cone body at an angle of attack is shown. The various parameters are necessary in order to define the computational mesh to account for the asymmetry of the flow. The objective is to define the computational mesh to enclose all of the subsonic flow in the nose region plus supersonic flow with Mach numbers less than approximately 1.2 Thus, the limits of the mesh should be in supersonic flow slightly downstream of the sonic surface. For a discussion of the asymmetry of the sonic surface, see reference 5. For a sphere, or a sphere-cone at zero angle of attack, the value of RBX should be 1.0, ZFOCNL should be 1.0, and the angles THWL and THLL should be equal and of the order of 50° for hypersonic Mach numbers. The exact value used can vary with the free-stream Mach number. The reader is again referred to reference 5 for examples of the shape of the sonic surface on spheres.

For sphere-cone bodies at nonzero angles of attack, the value of RBX should be 1 0, and ZFOCNL should be greater than 1.0, the exact amount being dependent on the angle of attack. The value of ZFOCNL is also somewhat dependent on the value chosen for THWL. The sum of THWL and ALPHA must not exceed 90° in order to allow program 2 (FVSBB to operate. A rule of thumb is to limit the values so that

$$\text{THWL} + \text{ALPHA} < 80^{\circ}$$

This means that for angles of attack less than about 30°, THWL can be specified as 50° as for a sphere but should be decreased slightly for higher angles of attack.

The values of ZFOCNL and THLL must be increased as angle of attack is increased to accommodate the downstream shift of the sonic surface on the windward side of the body as described in reference 5. For THWL around 50° a first approximation to ZFOCNL can be obtained from figure 8. Since the exact shape of the sonic surface is dependent on the body shape and the free-stream Mach number as well as the angle of attack, the value obtained from figure 8 may require some adjustment for specific cases.

On the leeward side of the body, the sonic surface is usually situated such that the parameter THLL can be specified in the range 50° to 90°.

A test is made in program 1 at the end of each iteration to determine if any Mach numbers less than 1.2 occur at the exit boundaries of the computational mesh. If any low Mach number flow is present, the user is so advised by a printed message "LOW MACH NUMBERS AT EXIT BOUNDARY." If the condition persists for many iterations, the computational mesh should be expanded by adjusting the parameters ZFOCNL, THLL, or THWL. The calculation must then be re-initialized with the quantity DISKIN = F and the remaining cards of figure 6(a) supplied as input. The values of the meridional index, K, at which subsonic Mach numbers were found are listed along with the above message as well as the number of the particular layer in the shock layer in which the Mach numbers were found. These values aid in determining how the input parameters should be changed. If low Mach numbers are found for low values of K, the mesh needs expanding on the leeward side of the body. If the low Mach numbers are found for high values of K (near K = KE), then the mesh needs expanding on the windward side. In either case, developing the optimum mesh may require adjustment of all three of the parameters ZFOCNL, THWL, and THLL.

Interface Input Data

The interface program (CTI) is designed to produce disk or tape data files for use by programs 3 and 4 (fig. 5). The interface program converts the data in the coordinate systems of programs 1 and 2 into the body axis oriented coordinate systems of programs 3 and 4 and then interpolates to calculate the flow properties at equispaced meridional angles and at equispaced radial positions across the shock layer. The number of meridional angles at which data are to be calculated, NUMK, is arbitrary, up to a maximum limit of 20. However, if data for programs 3 and 4 are being calculated in the same job, both use the same value of NUMK. On the other hand, the number of radial positions across the shock at which data are to be calculated may be different for each program. If only the surface streamline data are required for program 4, JLIMIT may be input as 1. If more values are desired, JLIMIT may be as large as 24. For program 3, the number of radial positions is specified by the parameter JL3 This parameter may be as large as 22.

If data are being calculated for both programs 3 and 4 (IOPT = 43), or for program 4 alone (IOPT = 4), the final input for program CTI is the number of axial stations at which data are to be calculated and a list of the required stations. The required stations are input as fractions of the length of the nose region. The length of the nose region is calculated in the program from the coordinates of the computational mesh. The final value of the list should be 1.0 if data are to be calculated for program 3.

If data are being calculated for program 3 alone (IOPT = 3), the input for the interface program consists entirely of the single card containing JLIMIT, JL3, NUMK, IOPT, and NPRNT. In that case, it is automatically assumed that the required data will be calculated at the axial station corresponding to the end of the nose region (ZMTRC = 1.0).

Body Geometry

The simulation of an actual aircraft or spacecraft geometry is done by analytical approximations. A typical cross section of the body at a given longitudinal coordinate z is composed of the analytic functions illustrated in figure 9. These six segments require specification of the eleven geometrical parameters listed in the figure as a function of the longitudinal distance z. To completely describe a typical vehicle, some segments can have zero length.

The longitudinal variation of the eleven geometrical parameters and their derivatives with respect to z are required by the program. The analytic approximation of the body is arbitrarily required to be single valued, continuous, and have continuous first derivatives. To ensure this requirement, discreet values of each of the parameters and their first derivatives are obtained at various stations along the body from working drawings of a particular vehicle or spacecraft configuration (these parameters need not be defined at the same z coordinates). Then for each of these parameters, a cubic polynomial which is determined so as to maintain the continuity requirements at the end points, is used to describe the variation between the points.

Note that it is assumed that the curve fits are obtained for the various length parameters in ENGLISH UNITS (inches).

Input data forms for the body geometry data are presented in figure 6(e). The first card required contains the nose radius and the nose cone angle (card no. 1 in fig. 6(e)). That card is followed by eleven groups of cards representing the curve fits for the eleven variables shown in figure 9. The first card in each group contains the variable NSC, the number of segments in the curve fit for that variable (card no. 2 in fig. 6(e)). That card is followed by two or three cards for each segment. The first card of each segment contains the information defining the curve fit in that segment, the slopes of the variable at the ends of the segment, and the axial locations of the ends of the segment (card no. 3 in fig. 6(e)). The second card contains the first five coefficients of the curve fit in the segment (card no. 4 in fig. 6(e)). The third card contains the remaining coefficients if a high order polynomial is being used. Only four coefficients are used in the sample case discussed herein so only one coefficient card is required for the sample case for each segment. Up to thirteen segments may be used to described the variation of a particular variable over the total length of the vehicle. A sample input geometry card deck is listed in Table I. A computer program for obtaining these data is described in reference 6.

Clustering Parameters

In program 3 (FDSM) the radial coordinate is normalized to allow for a reclustering of computational mesh points in the meridional direction at specified axial stations, ZRMSH (see Dictionary of Input Variables, Program 3) The reclustering is accomplished by introducing the independent variable transformations given by (ref. 3)

$$z = z$$

$$\xi(z,r,\phi) = (r - r_b)/(r_s - r_b)$$

$$\left.\begin{aligned} \eta(\phi) &= \pi\left\{B + \sinh^{-1}\left[\left(\frac{\phi}{\phi_o} - 1\right)\sin(B)\right]\right\}/\beta \\ B(\beta,\phi_o) &= 0.5\ \ln\left[\frac{1 + (e^{\beta} - 1)\phi_o/\pi}{1 + (e^{-\beta} - 1)\phi_o/\pi}\right] \end{aligned}\right\} \quad \beta > 0$$

$$\eta(\phi) = \phi \qquad\qquad \beta = 0$$

where β and ϕ_o (BETTA and PHIZRO) are arbitrary parameters that control the degree and location of clustering. No clustering occurs when β is zero. As β increases, the degree of clustering increases with the greatest density of points appearing about the ray defined by the angle ϕ_o.

Another set of parameters controls the reclustering of the computational mesh points in the radial direction. The equations for this transformation are (ref 7)

$$\bar{r} = \frac{r - r_b}{r_s - r_b}$$

$$\xi = \alpha + (1 - \alpha)\frac{\ln\left[\frac{\beta + \bar{r}(2\alpha + 1) - 2\alpha}{\beta - \bar{r}(2\alpha + 1) + 2\alpha}\right]}{\ln\left[\frac{\beta + 1}{\beta - 1}\right]}$$

This transformation permits the mesh to be refined near the body alone (α = AR = 0) or to be refined equally near both the body and the shock (α = AR = 0.5). The effects of different values of α and β (AR and BR) are shown in figure 10.

Step Size for Program 3

In program 3, the length of the step to be taken at each integration is determined to satisfy the mathematical requirements for stability. However, experience has shown that the mathematical requirements alone are not sufficient for accurate and efficient operation of the program. Therefore, a weighting factor (FCTROW) is provided so that the user may vary the step size. In regions where steep gradients are to be expected such as around canopies or wings, or other regions where the body radius may change rapidly with axial distance, the step size should be even smaller than dictated by the mathematical stability criteria (FCTROW $<$ 1.0). On the other hand, in regions where the solution changes gradually the step size can be even larger than the stability criterion allows (FCTROW $>$ 1.0) The exact variation of the weighting factor (FCTROW) that can be allowed must be determined by experience.

Damping Parameters

In order to avoid instabilities due to severe pressure changes in the numerical solution of the finite-difference equations, program 3 employs a fourth-order damping term which requires input of the axial location where the damping is to be changed and the new value of the damping coefficient to be used. The use of such damping is described in reference 8. Damping coefficients are input for the meridional and the radial directions. The exact values to be used must be determined from experience. According to reference 8, destabilization is avoided if the damping factor is less than or equal to 0.5.

Restart

Due to the long times required, programs 1, 2, and 3, have the capability of restarting at an intermediate step in the calculation.

The general procedure for running the programs is the same for restarting as for the initial start. However, some of the input data may require changes if the calculation is being restarted.

In program 1, only the first card shown in figure 6(a) is needed for restarting, but the disk or tape file created by the previous unfinished calculation must be made available for input. A file of the required data is created every 25 iteration steps. The input quantity that must be different from the initial calculation is the logical variable DISKIN which is input as F for input of the initial data from cards and T for input of the restart file. In addition, the quantity NDEND must be input as the number of iteration steps to be calculated in the present calculation. (Note that NDEND is NOT the total number of steps to be calculated. The total number of steps is the number of steps that were calculated in the previous calculation, NEND, plus NDEND).

In program 2, both data cards shown in figure 6(b) are always required. For starting initially, the first quantity on card no. 1, NRSTRT is 0. For restarting, it is 1. The remaining quantities may be left the same or changed as desired. If DTHETP is changed on restarting, the printed output will be produced according to the previous value of DTHETP the first time and then will be produced at the new interval. A file of data for restarting is produced every ten integration steps.

In program 3, only the first card shown in figure 6(c) is required for restarting. The quantity MODIN should be six for restarting. The quantity LTIN can be arbitrarily specified. As indicated in "Dictionary of Input Variables," if LTIN is zero, the input data will be read from the last entry of the storage file from logical unit number 22. Otherwise, if LTIN is greater than zero, the data will be read from the first entry of the storage file at which the integration step number is greater than or equal to LTIN.

OPERATING PROCEDURE

In this section, the construction of card decks for operation of the computer programs is described. First, a general description of the operations required is given. Then the specific Job Control cards needed for operation on the CDC 7600 computer at NASA/Ames Research Center are listed.

General Job Control Sequence

The following list is the general Job Control procedure that would be required to run programs 1, 2, 3, and 5 in sequence without stopping or restarting. The reader is referred to figure 5.

1. Attach geometry input file
2. Load program 1 (FVTM)
3. Execute program 1, providing required card input data
4. Store data file 1 produced by execution of program 1
5. Load program 2 (FVSM)
6. Execute program 2, providing required card input data
7. Store data file 2 produced by execution of program 2
8. Store data file 3 produced by execution of program 2
9. Load program 5 (CTI)
10. Execute program 5, providing required card input data
11. Store data file 4 produced by execution of program 5
12. Store data file 5 produced by execution of program 5
13. Load program 3 (FDSM)
14. Execute program 3, providing required card input data
15. Store data file 6 produced by execution of program 3

For continuing an unfinished calculation, the Job Control Sequence would be basically the same as in the previous list except that the appropriate restart data file would be attached and the part of the sequence that was already completed would be omitted with the exception that the geometry input file would be attached as before (step 1).

Logical unit numbers required for input and output are given names to avoid confusion in setting up the Job Control Card deck These names denote the files actually used by the programs and are listed in Table II. Permanent storage files may be labeled at the user's convenience. Normally, tape 5 is used for input from punched cards and tape 6 is used for printed output. In program 3, tape 31 may be used for punched card input and tape 20 is used for punched card output. Other logical unit numbers are used for input or output from the permanent disk or tape files.

Job Control on the CDC 7600

Sets of Job Control Cards required to use the computer programs on the CDC 7600 computer at Ames Research Center are listed in Tables III, IV, V, VI and VII. It is assumed that the programs in binary form will be stored on a disk or tape file. The reader is referred to the CDC SCOPE 2 Reference Manual for explanation of specific parameters used on the cards.

In Table III, the Job Control cards necessary to run program 1 from an initial start are listed. The usual procedure for running program 1 will be to do a complete calculation in at least two steps. The first step might run only a few iterations to verify that input quantities are correct and that the solution may be expected to converge. The next step would restart from the previous step and run a larger number of iterations. Criteria for convergence of the solution are discussed in the next section.

In Table IV, the Job Control cards necessary to restart program 1 and then run all programs except program 4 in a single job are listed. Such a job could require more than 1 hour for a perfect gas case, depending upon how many iterations were required from program 1. Substantially longer times will be required if a real gas is calculated. Also, the storage file for program 3 (CONTOU) may become very large. If it is desired to store that file on a tape instead of disk storage, the cards 32 and 33 should be replaced with the appropriate cards for transferring the file to tape.

In Table V, the Job Control cards necessary to restart program 2 and then run all remaining programs except program 4 are listed. See the previous discussion of Table IV for an alternate procedure for program 3.

In Table VI, the Job Control cards necessary to restart program 3 are listed. See the previous discussion of Table IV for an alternate procedure for program 3.

In Table VII, the Job Control cards necessary to run program 4 (CHAOS) are listed.

Convergence Criteria

In program 1, the calculation is controlled by the user-specified quantities NEND and NDEND, defining the number of iterations to be executed. No convergence criteria are built into the program. As an aid in determining the degree of convergence of the solution, several quantities are printed at each iteration. The most informative of those quantities are the x-coordinates and the pressure at the shock at points near the downstream boundary on the windward and leeward sides of the body in the pitch plane. The coordinates appear as the quantities X(1,IL,JSHK) and X(KL,IL,JSHK) while the pressures are P(1,M), and P(KL-1,M) where M=(IL-2)×JL+JSHK-1. (See the output described in the section entitled "NUMERICAL EXAMPLE"). For a converging solution, those coordinates and pressures will reach a steady-state, nearly constant, value after many iterations. For a solution that is not converging, one or all of the values may oscillate with significant, possibly increasing amplitude. Another quantity printed each iteration is the shock standoff distance (printed as the z-coordinate of the computational mesh at K=1, I=1, J=JSHK, Z(1,1,JSHK). That quantity alone is not a valid indication of convergence since it converges rapidly to a steady-state value while quantities in other parts of the computational mesh converge more slowly. Even more dangerous, it may appear to converge and then at the last step diverge suddenly. The shape of the shock near the downstream boundaries of the computational mesh appears to be a more sensitive indication of convergence than the shape in the stagnation region.

Since the total energy is not constrained in the calculation to be constant, the approach of the total energy to the free-stream value is another, perhaps the most important, indicator of convergence. A series of quantities related to the relative error between the calculated total energy at each point in the computational mesh and the freestream value is printed each iteration. The quantities are the maximum relative error, and the total numbers of errors less than 10 percent, 1 percent, and 0.1 percent of the freestream energy. As for the shock standoff distance, the maximum energy error alone is not a sufficient indicator of convergence. However, a converging solution should have all the energy errors less than 10 percent, most errors less than 1 percent and the number less than 0.1 percent should show an increasing trend.

At the end of a specified number of iterations, the solution for all flow field quantities is printed. Included in that output is the Mach number distribution. That distribution is an excellent indicator of the quality of the solution since the Mach number should increase monotonically and smoothly from the stagnation region (I=1) to the downstream boundary (I=IL-1) in the latitudinal direction.

Clearly, the determination of convergence is a subjective problem. The primary concern is that the flow field quantities and shock shape approach a steady state. Approximately 400 to 600 iterations are usually sufficient to achieve a reasonable degree of convergence if the solution is converging, as indicated by the total energy error. Examples of converging and nonconverging solutions are presented subsequently in the section "NUMERICAL EXAMPLE."

MESSAGES PRINTED BY THE PROGRAM

This section lists the messages given by the programs and tells what to do when they are encountered.

Messages from Program 1

(1) READ FROM TAPE (11) ITERATION NO =

This message is printed if program 1 is being restarted from a data set. It shows the iteration number at which the calculation is started.

(2) WRITE TO TAPE (10) ITERATION NO =

This message is printed every 25 iterations of program 1 as a restart data set is written to the disk (or tape) file associated with the unit number 10.

(3) NERR=n IN SERCH

This statement may be printed by the subroutine GEOM3 during a calculation of the body surface gwometry if an error condition is encountered. It probably means that one or more of the curve fits representing the body geometry was input in error. Check the body geometry input data or the quantities ZFOCNL, THWL, THLL, or RBX.

(4) WAVE ANGLE LESS THAN MACH ANGLE

This statement is printed if the shock wave angle is less than the Mach angle. It is most likely to occur at the initial step for low Mach numbers. Check the geometry input data and the input shock shape parameters.

(5) THIS WAVE IS A MACH WAVE

This statement is printed if the shock angle is equal to the Mach angle. Check the geometry input data and the input shock shape parameters.

(6) ERROR IN SHOCK

This statement is printed if difficulty is encountered in calculating the pressure at the shock wave at the initial step. Check the geometry input data and the input shock shape parameters.

(7) MORE THAN 200 ITERATIONS

This message is printed if the initial condition subroutine START in program 1 is unable to locate a computational mesh point compatible with the input geometry parameter curve fits. Check the geometry input and the computational mesh input. Note carefully the units required for dimensional quantities.

(8) ***LOW MACH NUMBERS AT EXIT BOUNDARIES***

$J=n \quad K=n_1, n_2, n_3 \ldots$

This message is printed if the computational mesh does not enclose all of the flow with Mach numbers less than 1.2. The points in the last cone of the computational mesh at layer J=n are listed to aid in determining how the mesh should be modified. If low values of K are printed, the mesh needs expanding on the leeward side of the body. If high values of K (near K=KE) are printed, the mesh should be expanded on the windward side. In either case, the best mesh may require adjustment of all three of the parameters ZFOCNL, THWL, and THLL.

Messages from Program 2

(1) ***ERROR-INTEGRATION STEP ZERO OR NEGATIVE

This message is printed if the subroutine which calculates the integration step size produces a negative or zero value. One possible cause of such a condition is the occurrence of unity or subsonic Mach numbers in the calculated flow field. Such a situation can occur if the computational mesh of program 1 did not enclose all the subsonic flow. The situation can also occur when the solution obtained from program 1 is not adequately converged or does not extend sufficiently far into the supersonic region. In that case, program 2 may integrate several steps before the error condition is encountered. The probable remedy in all these cases is to expand the computational mesh and rerun program 1.

Messages from Program 3

(1) DATA READ FROM CONTINUOUS FILE-UNIT 22? NSTEP=n
Z = ...

This statement is printed when the data have been read from the restart file at step n. This corresponds to the input option MODIN=6, LTIN=n.

(2) DATA WRITTEN ON CONTINUOUS FILE-UNIT 23?
NSTEP=n, Z=

This statement is written each time the data are written to the storage file (every CRASHZ cm, see "Dictionary of Input Variables").

Messages from Program 5

(1) INPUT ERROR IOPT MUST BE 3 OR 4 OR 43

See Dictionary of Input Variables for Program 5.

(2) UNSTEADY BLUNT-BODY TAPE READ. n STATIONS ON IT.

This statement is printed when the file from program 1 has been completely read. The number of stations refers to the number of computational mesh cone surfaces.

(3) STEADY BLUNT-BODY TAPE READ. n STATIONS ON IT.
TOTAL NO OF STATIONS=m.

This statement is printed when the file from program 2 has been completely read. The number of stations refers to the number of times data were stored in the calculations done by program 2. The total is n plus the previous number of stations read from program 1.

(4) SUBSCRIPT LIMIT MISMATCH. KEM1=k, KLM1=n, I2=m

This statement is printed after comparing the value of KEM1 from the program 2 interface file (data file 3) with that of KLM1 from data file 1. These values are the number of mesh cells in the meridional direction. The two values should be the same. If not, the two data sets being read are not compatible. The value of I2 is the total number of computational mesh points at each meridional position.

(5) SUBSCRIPT LIMIT MISMATCH JSHK2=k, JSHK=n, I2=m.

This message is printed if the number of computational mesh points across the shock layer do not agree between data sets 1 and 3 (fig. 5). See message (4).

(6) I2=n. TOO BIG

This message is printed if the total number of mesh points in the shock layer at each meridional position for the combined data sets produced by the data from programs 1 and 2 exceeds 300. The remedy is to redo the calculation, using a coarser grid of points in program 1 by either using smaller values of JSHK and/or IL or by expanding the computational mesh so that the last mesh cone is more nearly planar and normal to the body axis.

(7) MORE THAN 40 AXIAL STATIONS REQUESTED EXCESS IGNORED

This statement is printed if there are more than 40 values in the input array of axial stations, ZMTRC(I), at which data are to be calculated for program 4

(8) ALL Z-LOCATIONS. GT. NO. n IGNORED. TOO BIG.

This statement is printed if some of the input z values are aft of the most aft station of the computational mesh

(9) THE FIRST n Z-LOCATIONS IGNORED AS TOO SMALL

This statement is printed for those input z stations which are forward of z_{111} of the computational mesh.

(10) ERROR IN BODY SURFACE DATA STATION ... DISREGARDED.

This statement is printed whenever the interpolation and extrapolation of data from programs 1 and 2 is unable to satisfy the conditions of tangency and constant total energy. That problem may arise at stations near the nose where certain points of the computational mesh would have small velocities which must be calculated as a difference between large approximate quantities. In such a case, the calculation may produce a negative result from the expression

$$V^2 = 2\left(H_t - \frac{\gamma}{\gamma - 1}\frac{p}{\rho}\right)$$

when such an error occurs the data for the z station is not printed and is not placed on the data set.

NUMERICAL EXAMPLE

Input Data

A list of the punched card input data for a sample calculation on a space shuttle configuration is shown in figure 11(a). The case being calculated is for a Mach number of 10, angle of attack of 30° at an altitude of 50 kilometers in air treated as a perfect gas with ratio of specific heats equal to 1 4.

The punched card geometry input data are listed in Table I. Those data are stored on a disk or tape file as described previously.

Printed Output

As can be noted in the input shown in figure 11, all output option parameters were input so that all output would be printed. Only selected pages of the output will be presented herein. Figures are presented subsequently to illustrate the results of the calculations.

Program 1 - The first printed output (fig. 12) from program 1 is a list of the important input quantities plus other free-stream quantities calculated from the input data Those additional quantities are:

VINF	free-stream velocity
AINF	free stream speed of sound
HINF	total energy
RMZ	$\rho_{\infty}V_{\infty}$
EINF	total energy per unit volume
EIINF	specific internal energy
TINF	free-stream temperature

The next list of output is a table of the x-coordinate, RFOC(K,1,I), and the z-coordinate, RFOC(K,2,I), of the computational mesh cone vertices listed with the meridional variation, K, down the page and the axial variation, I, across the page. Next, a table of the body radii associated with the rays of the computational mesh is printed with the meridional variation, K, down the page and the axial variation, I, across. These tables may be omitted by letting NPRT=0

The next output is printed at the first integration step. It is basically a reprint of the input data with dimensionless input quantities converted to dimensional quantities.

The next output is always printed. No options are provided for omitting it Two groups of data are printed at each iteration step to aid in monitoring the progress of the iteration.

The first group of data are values of eigenvalues and other parameters related to the numerical solution of the finite-difference equations: The x-coordinates of certain points in the computational mesh and the pressure at those points are printed along with the shock standoff distance, Z(1,1,JSHK). These quantities have been discussed previously in the section entitled "Convergence Criteria."

The second group of data are a measure of the accuracy of calculation of the total energy. The maximum total energy error relative to the free-stream total enthalpy is printed along with the indices, i,j,k, of the computational mesh at which it occurs. In addition, all the energy errors are counted and the number of errors less than 10 percent, 1 percent, and 0.1 percent are printed. The total number of errors being counted is ((IL-1)×(JL-1)×(KL-1)).

The remaining output from the program is selected with the input parameter NPRNT on the first input data card. First is a list of all the energy errors relative to the free-stream total energy. They are listed in groups of (IL-1)×(JSHK-1) values for each meridional position, K.

Next is printed the flow variables, ρ, u, v, w, p, Mach number, and e and, if a chemically reacting gas is being calculated, the chemical species concentrations. Finally, the coordinates of all the computational mesh points are printed.

If NPRT and NPRNT are input as zero, only the input data and the iteration step data are printed.

The results produced by program 1 for the sample case are presented graphically in figures 13 through 17. In figure 13, the shock stand-off distance is seen to converge rapidly to a steady value within 200 iterations while the maximum energy error (fig 14) takes much longer. The energy error count shown in figure 15 indicates a converging solution with the number of small errors increasing with iteration. The shock shape shown in figure 16 is smooth at 200, 400 and 600 iterations, but moves slightly as the calculation proceeds. Clearly in this particular case, the shock shape alone is not a sufficient indicator of convergence since it is smooth and contains no perceptible perturbations even after only 200 iterations. A better indicator of the quality of the solution is the Mach number distribution, a sample of which is presented in figure 17. In that figure, the Mach number distribution at the shock in the plane of symmetry is plotted as a function of the nondimensional latitudinal index, I. At 200 iterations considerable roughness exists in the distributions which is gradually smoothed out as more iterations are calculated. Finally, the output quantities which seem to best serve to indicate the trend of the solution are shown in figure 18. Those quantities are the x-coordinates of the ends of the shock in the symmetry plane. The shock is seen to initially oscillate markedly on both the windward and the leeward side but to eventually reach a steady state.

To illustrate the behavior of the calculated results when convergence is not achieved, figures 19-24 are presented. The calculations are for the same sample case as figures 13-18, but with ZFOCNL=5.0. The most notable features of these figures are that the solution for early iterations follows similar trends to those of the convergent solution shown previously. In particular, the shock stand-off distance (fig. 19) converges rapidly in both cases and remains converged. Other quantities appear to converge and then diverge.

Program 2 - The first output from program 2 (fig. 25) is the iteration step of program 1 at which the solution was obtained followed by a list of the parameters and constants obtained from program 1. Included in that list are the location of the vertex of the computational cone (x_o, z_o), the initial angle of the cone axis from the horizontal (z) axis, BETAO and the initial cone half angle, THETAO. Other data in the list are the same as output initially from program 1.

The initial output is followed, if NPFLOW=1, by the list of densities, velocities, pressures and Mach numbers obtained from program 1. However, the quantities in this list do not correspond exactly to values from program 1. A linear interpolation is performed to go from the finite volumes of the program 1 computational mesh wherein the flow quantities are known at the center of the mesh hexahedra to the finite areas of the program 2 computational mesh wherein the quantities are known at the center of the finite areas.

Since the total energy is not constant in the solution from program 1, an adjustment is made in the initial data of program 2 to ensure that the total energy equals the free-stream value throughout the flow. The next output is the adjusted initial data, followed, if NPFLUX=1, by the calculated initial fluxes of mass and momentum. After the fluxes are calculated, the flow quantities are calculated and printed to verify the accuracy of the decoding procedure.

The next output, if NPXYZ=1, is the list of mesh coordinates at the N^{th} step, followed immediately by those at the $(N + 1)^{th}$ step. Next, if NPAREA=1, is a list of the areas of the projections of the mesh cell faces on the coordinate planes at the initial step.

Subsequent output is dependent upon the quantity DTHETP as well as the option parameters. In the case shown in figure 25, the output was required every 5^{o}. At every integration step, the current value of the cone angle, THETA and the integration step size are printed along with a list of the body and shock radii at each meridional position. Every DTHETP degrees, other data are printed as determined by the input option parameters.

Program 5 - The interface program prints first the free-stream quantities, and the input and adjusted arrays of the axial stations at which data are to be calculated from programs 3 and 4. In the example shown, the input stations were all within acceptable limits, so the adjusted list of axial stations is not printed. Next, the values of the flow quantities which are calculated at each z station (fig. 26) are printed. In addition, a list of the body radii as computed from the exact relations and from interpolation is printed at each station, along with the relative error, the derivatives of the body radius with respect to z and ϕ and the shock radius. When all the data for program 4 have been printed, a message is printed, saying

CHAOS TAPE WRITTEN

This refers to the generation of data set number 4 in figure 5. Next, the data for program 3 are printed. Note that the output for program 4 is in ENGLISH UNITS (inches) while that for program 3 is in CGS UNITS as for programs 1 and 2. The required unit conversions are done in the interface program (CTI). Since program 3 makes use of the shock radius and its derivative with respect to z and ϕ, those quantities are added to the final output list. The final output is a message saying

SHOCK-CAPTURE CODE STARTING TAPE WRITTEN

which refers to the generation of data set number 5 in figure 5. That data set contains the results of the blunt-body calculations to initialize the calculation for the remainder of the vehicle.

Program 3 - The first page of output from program 3 (fig. 27) is a list of the quantities input from punched cards. This is followed by a list of some of the quantities provided by the data set produced by program 5. Next, the calculated quantities for the entire computational mesh at the initial axial station are printed. After that, the flow quantities are printed for the body surface and the outer shock at every second integration step.

Additional Calculations

In addition to the sample case discussed herein, perfect gas calculations have also been made with programs 1, 2, and 5, for Mach numbers of 5.0 and 7.0 at an angle of attack of 30° and for Mach numbers of 5.0, 7.0, and 10.0 at an angle of attack of 35°. A calculation for a real gas at a Mach number of 27.5 and an angle of attack of 41.4° has also been completed. The results appear to converge in all those cases in the same manner as described herein. The upper and lower limits of applicability of the programs with regard to Mach number and angle of attack have not been investigated.

TABLE I

BODY GEOMETRY INPUT DATA

```
28.
 11
  1    3    4 -0.2144500E 01 -0.9489599E 00  0.2620000E 01  0.7250000E 01
-0.1183000E 02 -0.2144500E 01  0.1978716E 00 -0.9901192E-02
  2    3    4 -0.9489599E 00 -0.3541200E 00  0.7250000E 01  0.3500000E 02
-0.1850000E 02 -0.9489599E 00  0.1979591E-01 -0.2180920E-03
  3    3    4 -0.3541200E 00 -0.2262800E 00  0.3500000E 02  0.6500000E 02
-0.3425000E 02 -0.3541200E 00  0.2817327E-02 -0.1525912E-04
  4    3    4 -0.2262800E 00 -0.1227800E 00  0.6500000E 02  0.1150000E 03
-0.4275000E 02 -0.2262800E 00  0.1606797E-02 -0.7623965E-05
  5    3    4 -0.1227800E 00 -0.7869995E-01  0.1150000E 03  0.1650000E 03
-0.5100000E 02 -0.1227800E 00  0.4851967E-03 -0.5919579E-06
  6    3    4 -0.7869995E-01 -0.2000000E-01  0.1650000E 03  0.2650000E 03
-0.5600000E 02 -0.7869995E-01 -0.1239992E-03  0.1130003E-05
  7    3    4 -0.2000000E-01 -0.2000000E-01  0.2650000E 03  0.6650000E 03
-0.6150000E 02 -0.2000000E-01 -0.1788139E-10  0.2980232E-13
  8    3    4 -0.2000000E-01 -0.2000000E-01  0.6650000E 03  0.9650000E 03
-0.6950000E 02 -0.2000000E-01 -0.3178911E-10  0.7064249E-13
  9    3    4 -0.2000000E-01  0.1256055E-01  0.9650000E 03  0.1072000E 04
-0.7550000E 02 -0.2000000E-01  0.5991964E-04  0.5746570E-06
 10    3    4  0.1256055E-01  0.6120000E-01  0.1072000E 04  0.1165000E 04
-0.7625000E 02  0.1256055E-01  0.2563422E-04  0.1690452E-05
 11    3    4  0.6120000E-01  0.1180000E 00  0.1165000E 04  0.1293300E 04
-0.7350000E 02  0.6120000E-01  0.4043977E-03 -0.9511132E-06
  2
  1    3    4  0.0000000      0.0000000       0.2620000E 01  0.1650000E 03
 0.0000000      0.0000000      0.0000000      0.0000000
  2    3    4  0.0000000      0.0000000       0.1650000E 03  0.1293300E 04
 0.0000000      0.0000000      0.0000000      0.0000000
 11
  1    3    4  0.0000000      0.0000000       0.2620000E 01  0.7250000E 01
 0.0000000      0.0000000     -0.0000000      0.0000000
  2    3    4  0.0000000     -0.1033400E 00  0.7250000E 01  0.3500000E 02
 0.0000000      0.0000000     -0.2119718E-02  0.6191885E-05
  3    3    4 -0.1033400E 00 -0.1298770E 00  0.3500000E 02  0.6500000E 02
-0.1500000E 01 -0.1033400E 00 -0.4481035E-03  0.1293452E-06
  4    3    4 -0.1298770E 00 -0.9276694E-01  0.6500000E 02  0.1150000E 03
-0.5000000E 01 -0.1298770E 00 -0.1495825E-03  0.6942437E-05
  5    3    4 -0.9276694E-01 -0.5375000E-01  0.1150000E 03  0.1650000E 03
-0.1100000E 02 -0.9276694E-01 -0.7643213E-03  0.1539321E-04
  6    3    4 -0.5375000E-01 -0.5375000E-01  0.1650000E 03  0.6650000E 03
-0.1562500E 02 -0.5375000E-01 -0.1831054E-09  0.2441406E-12
  7    3    4 -0.5375000E-01 -0.1745500E-01  0.6650000E 03  0.7650000E 03
-0.4250000E 02 -0.5375000E-01  0.4995491E-03 -0.2120494E-05
  8    3    4 -0.1745500E-01  0.4803300E-01  0.7650000E 03  0.9650000E 03
-0.4500000E 02 -0.1745500E-01  0.3093849E-03 -0.4855502E-06
  9    3    4  0.4803300E-01  0.0000000       0.9650000E 03  0.1072000E 04
```

TABLE I (Continued)

-0.4000000E 02			0.4803300E-01	0.6743763E-03	-0.5600185E-05	
10	3	4	0.0000000	0.0000000	0.1072000E 04	0.1165000E 04
-0.3400000E 02			0.0000000	0.0000000	0.0000000	
11	3	4	0.0000000	0.0000000	0.1165000E 04	0.1293300E 04
-0.3400000E 02			0.0000000	0.0000000	0.0000000	
12						
1	3	4	0.2144500E 01	0.1000000E 01	0.2620000E 01	0.7250000E 01
0.1183000E 02			0.2144500E 01	-0.2438816E 00	0.1731974E-01	
2	3	4	0.1000000E 01	0.5095200E 00	0.7250000E 01	0.3500000E 02
0.1825000E 02			0.1000000E 01	-0.9595554E-02	0.1821216E-04	
3	3	4	0.5095200E 00	0.3983499E 00	0.3500000E 02	0.6500000E 02
0.3900000E 02			0.5095200E 00	-0.2246330E-02	0.8744358E-05	
4	3	4	0.3983499E 00	0.2914700E 00	0.6500000E 02	0.1150000E 03
0.5250000E 02			0.3983499E 00	-0.1363396E-02	0.3927955E-05	
5	3	4	0.2914700E 00	0.2171200E 00	0.1150000E 03	0.1650000E 03
0.6950000E 02			0.2914700E 00	-0.7011979E-03	-0.5640276E-06	
6	3	4	0.2171200E 00	0.1641000E 00	0.1650000E 03	0.2300000E 03
0.8225000E 02			0.2171200E 00	0.5580829E-03	-0.9906965E-05	
7	3	4	0.1641000E 00	0.1644000E 00	0.2300000E 03	0.7055000E 03
0.9600000E 02			0.1641000E 00	-0.1022857E-05	0.1876347E-08	
8	3	4	0.1644000E 00	0.4040000E 00	0.7055000E 03	0.7650000E 03
0.1740000E 03			0.1644000E 00	0.1666098E-02	0.3891848E-05	
9	3	4	0.4040000E 00	0.1000000E 01	0.7650000E 03	0.8650000E 03
0.1905000E 03			0.4040000E 00	0.3970001E-02	-0.6600013E-05	
10	3	4	0.1000000E 01	0.1000000E 01	0.8650000E 03	0.1029000E 04
0.2640000E 03			0.1000000E 01	0.0000000	0.0000000	
11	3	4	0.1000000E 01	0.2034000E 00	0.1029000E 04	0.1092000E 04
0.4280000E 03			0.1000000E 01	-0.1229886E-01	0.6324489E-04	
12	3	4	0.2034000E 00	0.0000000	0.1092000E 04	0.1293300E 04
0.4580000E 03			0.2034000E 00	-0.1255360E-02	0.2484331E-05	
11						
1	3	4	0.0000000	0.0000000	0.2620000E 01	0.7250000E 01
0.0000000			0.0000000	0.0000000	0.0000000	
2	3	4	0.0000000	-0.1033400E 00	0.7250000E 01	0.3500000E 02
0.0000000			0.0000000	-0.2119718E-02	0.6191885E-05	
3	3	4	-0.1033400E 00	-0.1298770E 00	0.3500000E 02	0.6500000E 02
-0.1500000E 01			-0.1033400E 00	-0.4481035E-03	0.1293452E-05	
4	3	4	-0.1298770E 00	-0.9276694E-01	0.6500000E 02	0.1150000E 03
-0.5000000E 01			-0.1298770E 00	-0.1495825E-03	0.6942437E-05	
5	3	4	-0.9276694E-01	-0.5375000E-01	0.1150000E 03	0.1650000E 03
-0.1100000E 02			-0.9276694E-01	-0.7643213E-03	0.1539321E-04	
6	3	4	-0.5375000E-01	-0.5375000E-01	0.1650000E 03	0.6650000E 03
-0.1562500E 02			-0.5375000E-01	-0.1831054E-09	0.2441406E-12	
7	3	4	-0.5375000E-01	-0.1745500E-01	0.6650000E 03	0.7650000E 03
-0.4250000E 02			-0.5375000E-01	0.4995491E-03	-0.2120494E-05	
8	3	4	-0.1745500E-01	0.4803300E-01	0.7650000E 03	0.9650000E 03
-0.4500000E 02			-0.1745500E-01	0.3093849E-03	-0.4855502E-06	

TABLE I (Continued)

9	3	4	0.4803300E-01	0.0000000	0.9650000E 03	0.1072000E 04
-0.4000000E 02			0.4803300E-01	0.6743763E-03	-0.5600185E-05	
10	3	4	0.0000000	0.0000000	0.1072000E 04	0.1165000E 04
-0.3400000E 02			0.0000000	0.0000000	0.0000000	
11	3	4	0.0000000	0.0000000	0.1165000E 04	0.1293300E 04
-0.3400000E 02			0.0000000	0.0000000	0.0000000	
2						
1	3	4	0.0000000	0.0000000	0.2620000E 01	0.1650000E 03
0.9000000E 02			0.0000000	0.0000000	0.0000000	
2	3	4	0.0000000	0.0000000	0.1650000E 03	0.1293300E 04
0.9000000E 02			0.0000000	0.0000000	0.0000000	
10						
1	3	4	0.2144500E 01	0.1000000E 01	0.2620000E 01	0.7250000E 01
0.1183000E 02			0.2144500E 01	-0.2438816E 00	-0.1731974E-01	
2	3	4	0.1000000E 01	0.5095200E 00	0.7250000E 01	0.3500000E 02
0.1825000E 02			0.1000000E 01	-0.9595554E-02	0.1821216E-04	
3	3	4	0.5095200E 00	0.3983499E 00	0.3500000E 02	0.6500000E 02
0.3900000E 02			0.5095200E 00	-0.2246330E-02	0.8744358E-05	
4	3	4	0.3983499E 00	0.2914700E 00	0.6500000E 02	0.1150000E 03
0.5250000E 02			0.3983499E 00	-0.1363396E-02	0.3927955E-05	
5	3	4	0.2914700E 00	0.2171200E 00	0.1150000E 03	0.1650000E 03
0.6950000E 02			0.2914700E 00	-0.7011979E-03	-0.5640276E-06	
6	3	4	0.2171200E 00	0.1220000E 00	0.1650000E 03	0.2300000E 03
0.8225000E 02			0.2171200E 00	0.1205775E-02	-0.1987146E-04	
7	3	4	0.1220000E 00	0.7999998E-01	0.2300000E 03	0.2650000E 03
0.9600000E 02			0.1220000E 00	0.2987758E-02	-0.6833824E-04	
8	3	4	0.7999998E-01	0.4500000E-01	0.2650000E 03	0.3000000E 03
0.1010000E 03			0.7999998E-01	0.3938776E-02	-0.8454810E-04	
9	3	4	0.4500000E-01	0.0000000	0.3000000E 03	0.3650000E 03
0.1050000E 03			0.4500000E-01	0.7455617E-03	-0.1119708E-04	
10	3	4	0.0000000	0.0000000	0.3650000E 03	0.1293300E 04
0.1080000E 03			0.0000000	0.0000000	0.0000000	
11						
1	3	4	0.0000000	0.0000000	0.2620000E 01	0.7250000E 01
0.0000000			0.0000000	0.0000000	0.0000000	
2	3	4	0.0000000	-0.1033400E 00	0.7250000E 01	0.3500000E 02
0.0000000			0.0000000	-0.2119718E-02	0.6191885E-05	
3	3	4	-0.1033400E 00	-0.1298770E 00	0.3500000E 02	0.6500000E 02
-0.1500000E 01			-0.1033400E 00	-0.4481035E-03	0.1293452E-06	
4	3	4	-0.1298770E 00	-0.9276694E-01	0.6500000E 02	0.1150000E 03
-0.5000000E 01			-0.1298770E 00	-0.1495825E-03	0.6942437E-05	
5	3	4	-0.9276694E-01	-0.5375000E-01	0.1150000E 03	0.1650000E 03
-0.1100000E 02			-0.9276694E-01	-0.7643213E-03	0.1539321E-04	
6	3	4	-0.5375000E-01	-0.4999999E-02	0.1650000E 03	0.2300000E 03
-0.1562500E 02			-0.5375000E-01	-0.1375739E-02	0.1795629E-04	
7	3	4	-0.4999999E-02	0.9999996E-01	0.2300000E 03	0.3650000E 03
-0.2000000E 02			-0.4999999E-02	-0.4855967E-03	-0.4775719E-06	

TABLE I (Concluded)

8	3	4	0.9999996E-01	0.1479999E 00	0.3650000E 03	0.4650000E 03
-0.1300000E 02			0.9999996E-01	-0.7799980E-03	0.6799986E-05	
9	3	4	0.1479999E 00	0.1059999E 00	0.4650000E 03	0.5650000E 03
-0.4000000E 01			0.1479999E 00	-0.1800015E-03	-0.2600010E-05	
10	3	4	0.1059999E 00	0.0000000	0.5650000E 03	0.7650000E 03
0.1000000E 02			0.1059999E 00	0.6500068E-04	-0.1100001E-05	
11	3	4	0.0000000	0.0000000	0.7650000E 03	0.1293300E 04
0.2500000E 02			0.0000000	0.0000000	0.0000000	
2						
1	3	4	0.0000000	0.0000000	0.2620000E 01	0.1650000E 03
0.9000000E 02			0.0000000	0.0000000	0.0000000	
2	3	4	0.0000000	0.0000000	0.1650000E 03	0.1293300E 04
0.9000000E 02			0.0000000	0.0000000	0.0000000	
6						
1	3	4	0.0000000	0.0000000	0.2620000E 01	0.3500000E 02
0.0000000			0.0000000	0.0000000	0.0000000	
2	3	4	0.0000000	0.1605999E 00	0.3500000E 02	0.6500000E 02
0.0000000			0.0000000	0.5980000E-02	-0.7340743E-04	
3	3	4	0.1605999E 00	0.3425000E 00	0.6500000E 02	0.1650000E 03
0.3400000E 01			0.1605999E 00	0.8930024E-03	0.1099845E-06	
4	3	4	0.3425000E 00	0.3425000E 00	0.1650000E 03	0.3650000E 03
0.2850000E 02			0.3425000E 00	0.1144408E-08	-0.3814695E-11	
5	3	4	0.3425000E 00	0.0000000	0.3650000E 03	0.4350000E 03
0.9700000E 02			0.3425000E 00	-0.3663260E-02	0.1158888E-04	
6	3	4	0.0000000	0.0000000	0.4350000E 03	0.1293300E 04
0.1070000E 03			0.0000000	0.0000000	0.0000000	
10						
1	3	4	0.2144500E 01	0.9656900E 00	0.2620000E 01	0.7250000E 01
0.1183000E 02			0.2144500E 01	-0.2014851E 00	0.1068164E-01	
2	3	4	0.9656900E 00	0.5095299E 00	0.7250000E 01	0.3500000E 02
0.1850000E 02			0.9656900E 00	-0.3227283E-02	-0.1199235E-03	
3	3	4	0.5095299E 00	0.3983499E 00	0.3500000E 02	0.6500000E 02
0.4025000E 02			0.5095299E 00	0.7752996E-02	-0.2134667E-03	
4	3	4	0.3983499E 00	0.2914700E 00	0.6500000E 02	0.1150000E 03
0.5675000E 02			0.3983499E 00	0.5236596E-02	-0.8407197E-04	
5	3	4	0.2914700E 00	0.2171200E 00	0.1150000E 03	0.1650000E 03
0.7925000E 02			0.2914700E 00	-0.8238789E-02	-0.1197639E-03	
6	3	4	0.2171200E 00	0.3939100E 00	0.1650000E 03	0.1950000E 03
0.9945000E 02			0.2171200E 00	0.7561672E-02	-0.1025595E-03	
7	3	4	0.3939100E 00	0.9489650E 00	0.1950000E 03	0.1995000E 03
0.1100000E 03			0.3939100E 00	0.2066403E 00	-0.2147668E-01	
8	3	4	0.9489650E 00	0.9489650E 00	0.1995000E 03	0.2345000E 03
0.1140000E 03			0.9489650E 00	-0.5234943E-03	-0.9971324E-05	
9	3	4	0.9489650E 00	0.0000000	0.2345000E 03	0.2790000E 03
0.1470000E 03			0.9489650E 00	-0.1841072E-01	0.1160779E-03	
10	3	4	0.0000000	0.0000000	0.2790000E 03	0.1293300E 04
0.1630000E 03			0.0000000	0.0000000	0.0000000	

TABLE II

Labels for logical unit numbers used for input and output of data from disk or tape files:

Program 1 (FVTM)

Label	Unit No.	Purpose
INPUT	5	input from punched cards
OUTPUT	6	output on printer
GEOM	9	body geometry data
P1DATA	10	storage output
P1IN	11	restart input

Program 2 (FVSM)

Label	Unit No.	Purpose
INPUT	5	input from punched cards
OUTPUT	6	output on printer
GEOM	9	body geometry data
P1DATA	10	input of program 1 storage file
P2RSIN	11	restart input
P2IFIN	12	unfinished interface storage file input
P2RS	13	restart output
P2DATA	14	interface storage file output

TABLE II (Concluded)

Program 3 (FDSM)

Label	Unit No.	Purpose
INPUT	5	input from punched cards
OUTPUT	6	output on printer
DATA20	20	input or output on disk (binary)
DATA21	21	input or output on disk (binary)
CONTIN	22	input from continuous storage file on disk
CONTOU	23	output of continuous storage file on disk
PUNCH	30	punched card output
BBDATA	31	input from program 5 (blunt body data)

Program 5 (CTI)

Label	Unit No.	Purpose
INPUT	5	input from punched cards
OUTPUT	6	output on printer
GEOM	9	body geometry data
P1DATA	10	input of program 1 storage file
CHAOS	11	output for program 4 (CHAOS)
BBDATA	12	output for program 3 (FDSM)
P2DATA	14	input of program 2 interface storage file

TABLE III

JOB CONTROL CARDS TO RUN PROGRAM 1 FROM AN INITIAL START

Card	
1	JOBNAME, T_ _ _, P_.
2	ACCOUNT, ID NAME, ACCOUNT #.
3	ATTACH, LGO, PROGRAM1, ID=AAAAAA,PW=BBBBBBBB.
4	ATTACH, GEOM, SHUTGEOM, ID=AAAAAA, PW=BBBBBBBB.
5	REQUEST, P1DATA, *PF.
6	LGO
7	EXIT, U.
8	CATALOG, P1DATA, DATA1, ID=AAAAAA, MR=1, RP=120.

$^{7}8_{9}$

INPUT FOR PROGRAM1 (initial start)

$^{6}7_{8}9$

TABLE IV

JOB CONTROL CARDS TO RESTART PROGRAM 1 AND RUN ALL SHUTTLE FLOW FIELD PROGRAMS

Card	
1	JOBNAME, T___, P_.
2	ACCOUNT, ID NAME, ACCOUNT #.
3	ATTACH, LGO, PROGRAM1, ID=AAAAAA, PW=BBBBBBBB.
4	ATTACH, GEOM, SHUTGEOM, ID=AAAAAA, PW=BBBBBBBB.
5	ATTACH, P1IN, DATA1, ID=AAAAAA.
6	REQUEST, P1DATA, *PF.
7	LGO.
8	EXIT, U.
9	CATALOG, P1DATA, DATA1, ID=AAAAAA, MR=1, RP=120.
10	RETURN, LGO.
11	RETURN, P1IN
12	ATTACH, LGO, PROGRAM2, ID=AAAAAA, PW=BBBBBBBB.
13	REQUEST, P2RS, *PF.
14	REQUEST, P2DATA, *PF.
15	LGO.
16	EXIT, U.
17	CATALOG, P2RS, DATA2, ID=AAAAAA, MR=1, RP=120.
18	CATALOG, P2DATA, DATA3, ID=AAAAAA, MR=1, RP=120.
19	RETURN, LGO.
20	ATTACH, LGO, PROGRAM5, ID=AAAAAA, PW=BBBBBBBB.
21	REQUEST, CHAOS, *PF.
22	REQUEST, BBDATA, *PF
23	LGO.

TABLE IV (Concluded)

```
EXIT, U.
CATALOG, CHAOS, DATA4, ID=AAAAAA, MR=1, RP=120
CATALOG, BBDATA, DATA5, ID=AAAAAA, MR=1, RP=120.
RETURN, LGO.
ATTACH, LGO, PROGRAM3, ID=AAAAAA, PW=BBBBBBBB.
REWIND, BBDATA.
LGO.
EXIT, U.
REQUEST, CONTOU, *PF.
CATALOG, CONTOU, DATA6, ID=AAAAAA, MR=1, RP=120.
789
INPUT FOR PROGRAM1 (restart)
789
INPUT FOR PROGRAM2
789
INPUT FOR PROGRAM5
789
INPUT FOR PROGRAM3
6789
```

TABLE V

JOB CONTROL CARDS TO RESTART PROGRAM 2 AND
RUN REMAINING SHUTTLE FLOW FIELD PROGRAMS

Card	
1	JOBNAME, T___, P_.
2	ACCOUNT, ID NAME, ACCOUNT #.
3	ATTACH, LGO, PROGRAM2, ID=AAAAAA, PW=BBBBBBBB.
4	ATTACH, GEOM, SHUTGEOM, ID=AAAAAA, PW=BBBBBBBB.
5	ATTACH, P2RSIN, DATA2, ID=AAAAAA.
6	ATTACH, P2IFIN, DATA3, ID=AAAAAA.
7	REQUEST, P2DATA, *PF.
8	LGO.
9	EXIT, U.
10	CATALOG, P2DATA, DATA3, ID=AAAAAA, MR=1, RP=120.
11	RETURN, LGO.
12	ATTACH, LGO, PROGRAM5, ID=AAAAAA, PW=BBBBBBBB.
13	ATTACH, P1DATA, DATA1, ID=AAAAAA.
14	REQUEST, CHAOS, *PF.
15	REQUEST, BBDATA, *PF
16	LGO.
17	EXIT, U
18	CATALOG, CHAOS, DATA4, ID=AAAAAA, MR=1, RP=120.
19	CATALOG, BBDATA, DATA5, ID=AAAAAA, MR=1, RP=120.
20	EXIT, U.
21	RETURN, LGO.
22	ATTACH, LGO, PROGRAM3, ID=AAAAAA, PW=BBBBBBBB.
23	REWIND, BBDATA.
24	LGO.

TABLE V (Concluded)

Card	
25	EXIT, U.
26	REQUEST, CONTOU, *PF.
27	CATALOG, CONTOU, DATA6, ID=AAAAAA, MR=1, RP=120.
$^{7}8_{9}$	
	INPUT FOR PROGRAM2 (restart)
$^{7}8_{9}$	
	INPUT FOR PROGRAM5
$^{7}8_{9}$	
	INPUT FOR PROGRAM3
$^{6}7_{8_{9}}$	

TABLE VI

JOB CONTROL CARDS TO RESTART
PROGRAM 3

Card	
1	JOBNAME, T___, P_.
2	ACCOUNT, ID NAME, ACCOUNT #.
3	ATTACH, LGO, PROGRAM3, ID=AAAAAA, PW=BBBBBBBB.
4	ATTACH, CONTIN, DATA6, ID=AAAAAA.
5	LGO.
6	EXIT, U.
7	REQUEST, CONTOU, *PF
8	CATALOG, CONTOU, DATA6, ID=AAAAAA, MR=1, RP=120.
7 8 9	
	INPUT FOR PROGRAM3
6 7 8 9	

TABLE VII

JOB CONTROL CARDS TO RUN PROGRAM 4 (CHAOS) FROM A DATA SET PRODUCED BY PROGRAM 5(CTI)

<u>Card</u>	
1	JOBNAME, T___, P_.
2	ACCOUNT, ID NAME, ACCOUNT #.
3	ATTACH, LGO, CHAOS, ID=AAAAAA, PW=BBBBBBBB
4	ATTACH, TAPE8, DATA4, ID=AAAAAA.
5	LGO.
$^{7}8_{9}$	
	INPUT FOR CHAOS
$^{6}{}^{7}8_{9}$	

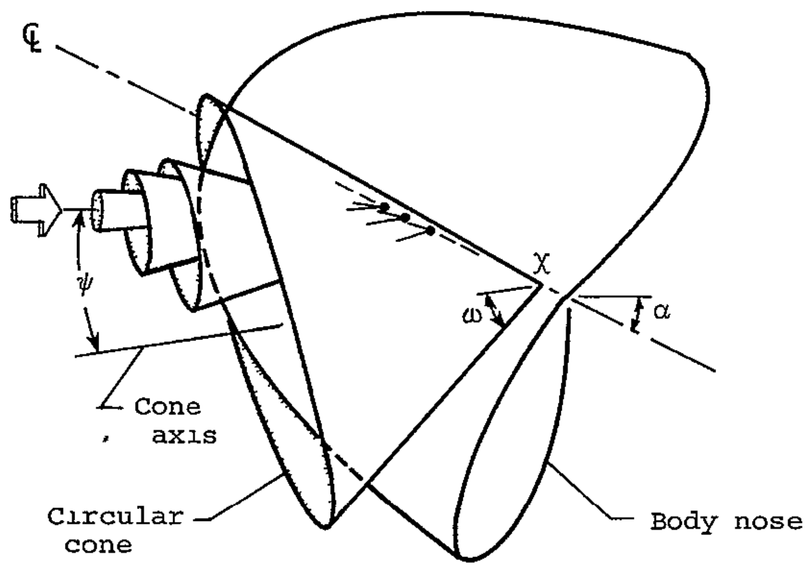


Figure 1.- Mesh geometry for program 1 (FVTM) determined by series of nested cones.

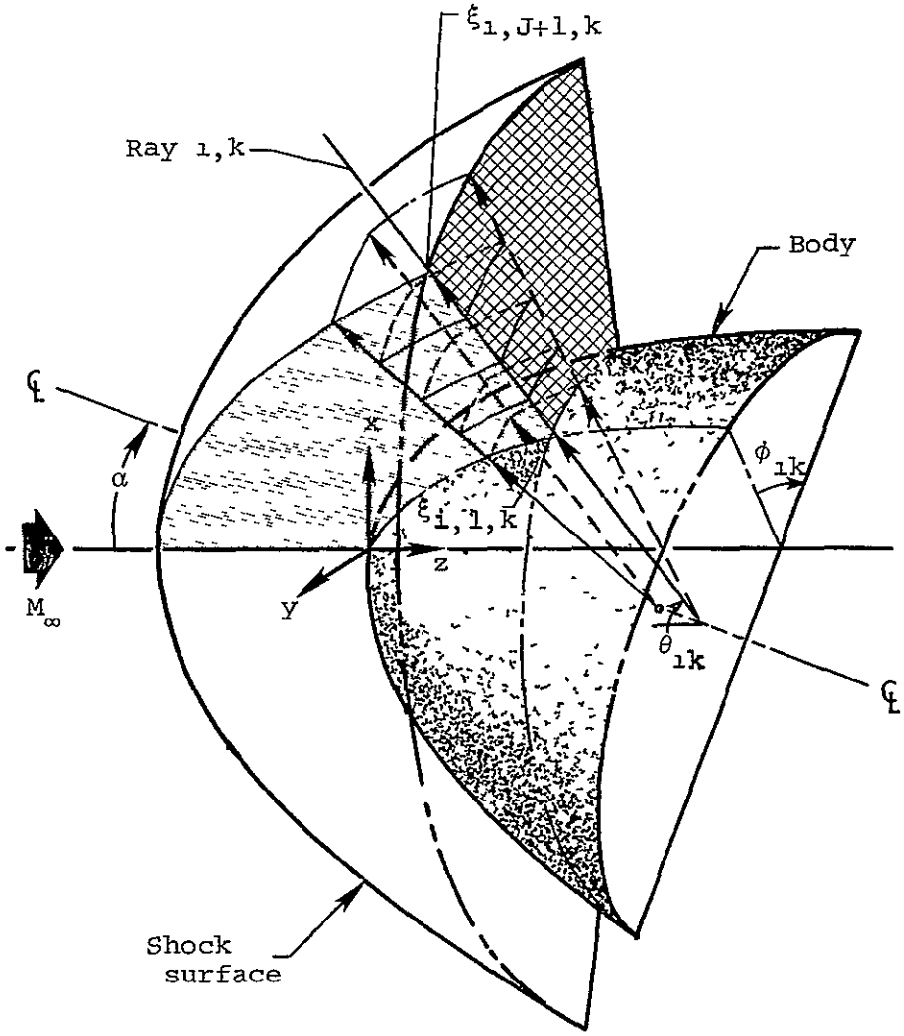


Figure 2 - Partitioning of the shock layer into finite volumes.

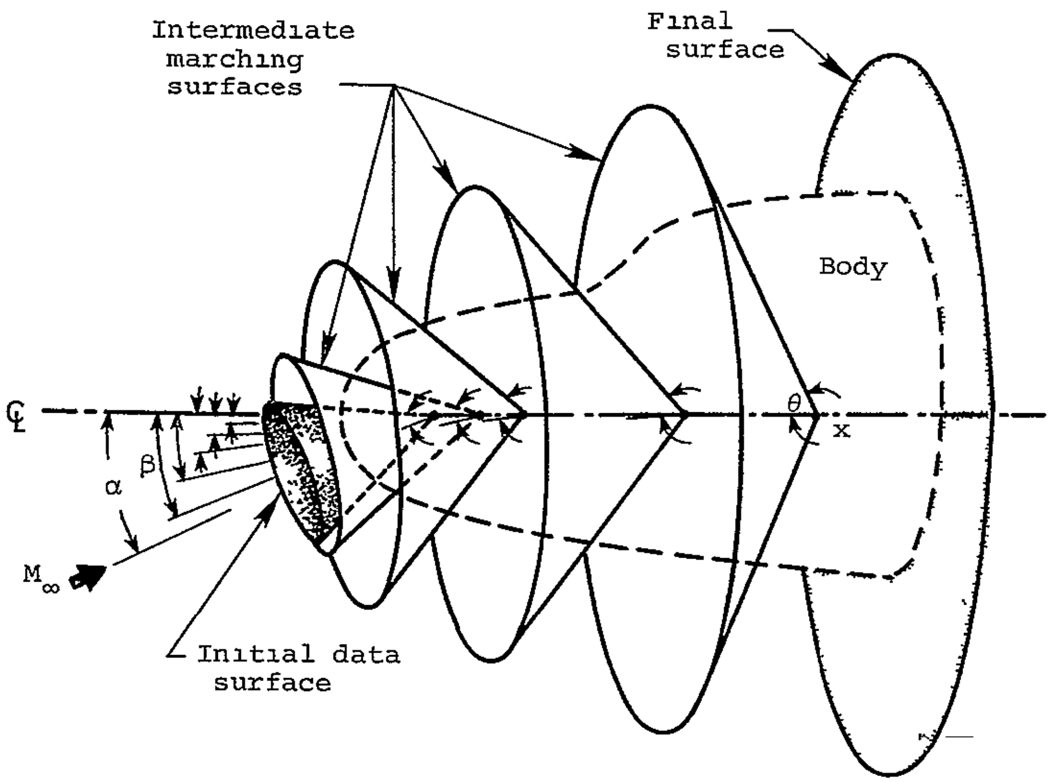


Figure 3.- Illustration of position, orientation, and vertex angle of conical data surfaces for successive steps (program 2, FVSM).

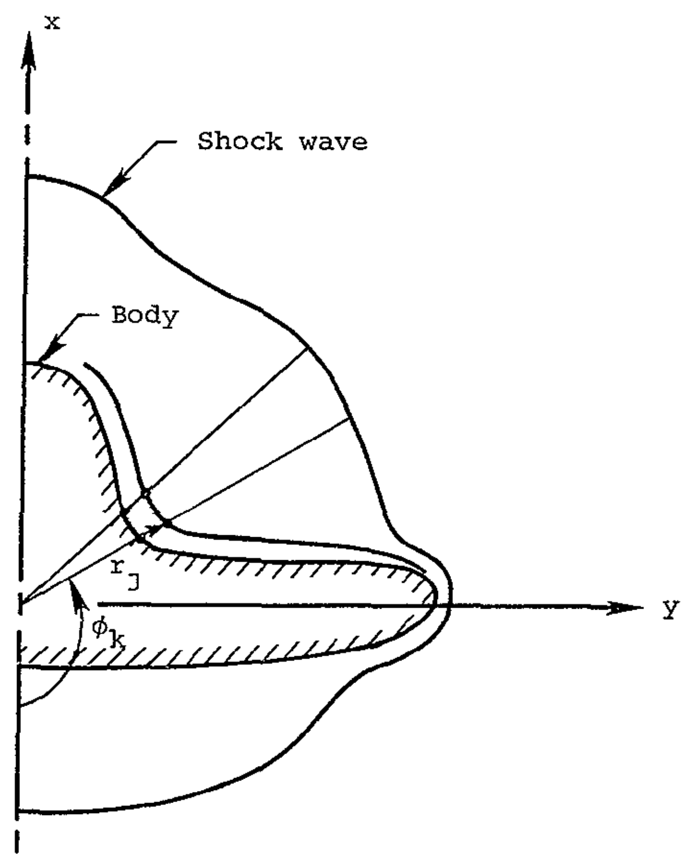


Figure 4 - Coordinate system and computational mesh in axis normal plane for program 3.

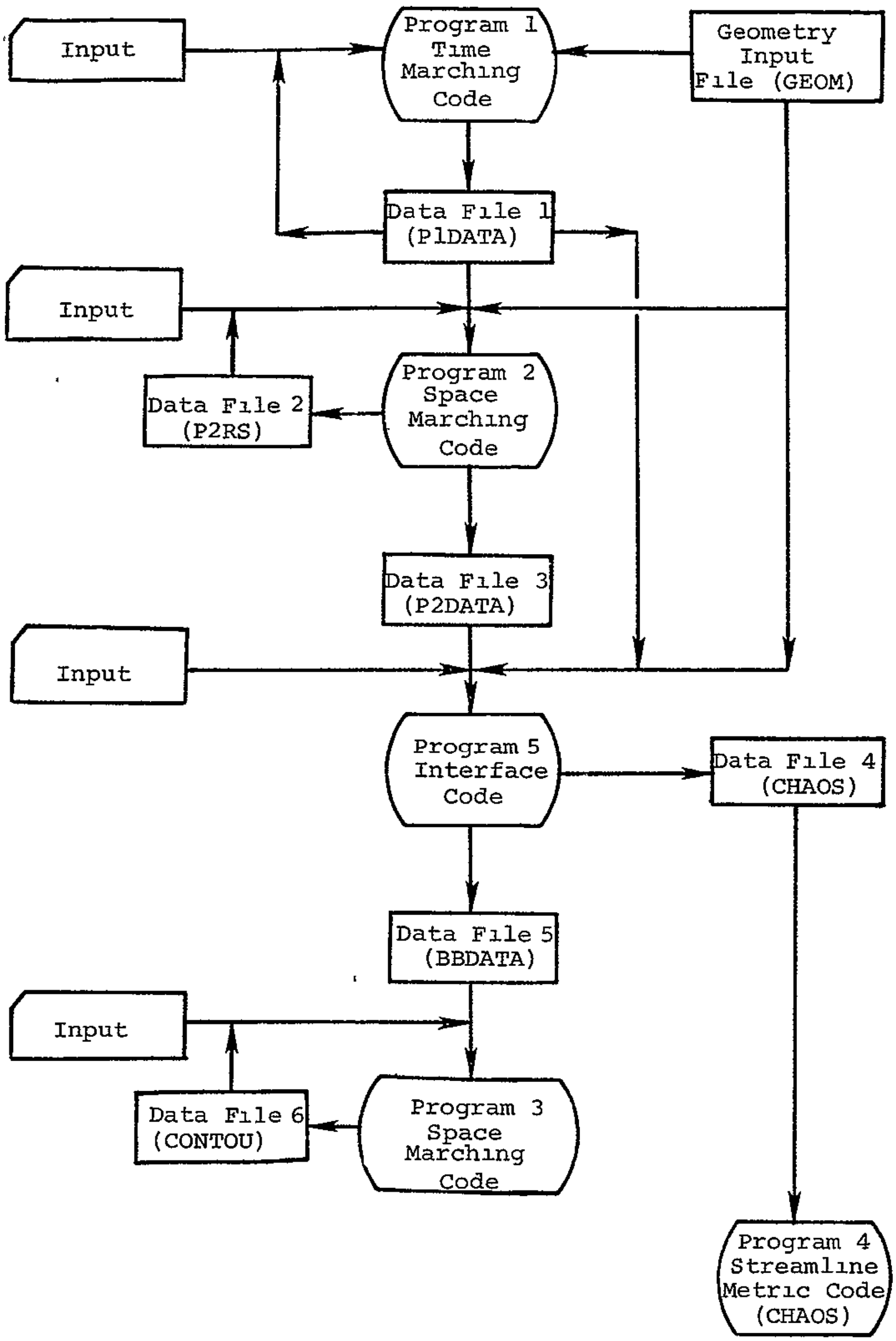


Figure 5.- General space-shuttle computer program and data file interdependence.

Card No 1 LOGICAL VARIABLES AND INTEGERS

Format (2L1,3X,I5,I1)

Variable	DISKIN	DISKOT		NDEND	NPRNT
Card Column No	1	2	XXX	10	11
Data			XXX		

Card No. 2 INTEGERS-RIGHT ADJUSTED - 5 column fields

Format (12I5)

Variable	NPRT	NEND	IE	JE	KE	JSHK	NGAS
Card Column No	5	10	15	20	25	30	35
Data							

Card No 3 REAL NUMBERS - 10 column fields, decimal point required

Format (8F10 0)

Variable	RMACH	PINF	RINF	GAMMA	SD0	C2	S3
Card Column No	10	20	30	40	50	60	70
Data							

Card No. 4 REAL NUMBERS - 10 column fields, decimal point required

Format (8F10 0)

Variable	ALPHA	ZFOCNL	THWL	THLL	RBX
Card Column No	10	20	30	40	50
Data					

(a) Program 1 (FVUBB)

Figure 6 - Input data form

<u>Card No 1</u> INTEGERS - 1 column fields

Format (5I1)

Variable	NRSTRT	NPFLOW	NPAREA	NPXYZ	NPFLUX
Card Column No	1	2	3	4	5
Data					

<u>Card No 2</u> REAL NUMBER - 10 *column field*, decimal point required

Format (F10 0)

Variable	DTHETP
Card Column No	10
Data	

(b) Program 2 (FVSBB)

Figure 6 - Continued

Card No 1 LOGICAL VARIABLES, INTEGERS (RIGHT ADJUSTED) AND REAL NUMBERS

Format (L5,5I5,F10 0,I5,F10 0)

Variable	GRFCS	MODIN	LTIN	MODOUT	LTOUT	NIT	MODCFO	MODBSO	CRASHZ
Card Column No									
Data									

Card No 2 INTEGER-RIGHT ADJUSTED - 5 column field

Format (I5)

Variable	NUMDUM
Card Column No	5
Data	

Card Nos 3 to (NUMDUM + 2) REAL NUMBERS - 10 column fields, decimal point required

Format (7E10 0)

Variable	ZRMSH	BETTA	PHIZRO	AR	BR	ZFACT	FCTROW
Card Column No	10	20	30	40	50	60	70
Data							

Card No (NUMDUM + 3) INTEGER-RIGHT ADJUSTED - 5 column field

Format (I5)

Variable	NMPTS
Card Column No	5
Data	

(c) Program 3

Figure 6 - Continued

Card Nos (NUMDUM + 4) to (NUMDUM + NMPTS + 4) REAL NUMBERS, 10 column fields, decimal point required

Format (2E10 0)

Variable	ZDMPM	DCM
Card Column No	10	20
Data		

Card No (NUMDUM + NMPTS + 5) INTEGER-RIGHT ADJUSTED - 5 column field

Format (I5)

Variable	NRPTS
Card Column No	5
Data	

Card Nos (NUMDUM + NMPTS + 6) to (NUMDUM + NMPTS + NRPTS + 6) REAL NUMBERS 10 column fields, decimal point required

Format (2E10 0)

Variable	ZDMPR	DCR
Card Column No	10	20
Data		

(c) Program 3 - Concluded

Figure 6 - Continued

Card No 1 INTEGERS-RIGHT ADJUSTED - 5 column fields

Format (10I5)

Variable	JLIMIT	JL3	NUMK	IOPT	NPRNT
Card Column No	5	10	15	20	25
Data					

Card No 2 INTEGER-RIGHT ADJUSTED - 5 column field

Format (I5)

Variable	IZ
Card Column No	5
Data	

Card Nos 3 to 7 as needed for up to 40 values REAL NUMBERS - 10 column fields, decimal point required

Format (8F10 0)

Variable	ZMTRC							
Card Column No	10	20	30	40	50	60	70	80
Data								

(d) Program 5 (CTI)

Figure 6 - Continued

Card No 1 REAL NUMBERS - 15 column fields, decimal point required

Format (2E15 7)

Variable	RNOSE	CONANG
Card Column No	15	30
Data		

Card No 2 INTEGER-RIGHT ADJUSTED - 5 column field

Format (I5)

Variable	NSC
Card Column No	5
Data	

Card No 3 INTEGERS AND REAL NUMBERS

Format (3I5,4E15 7)

Variable	NS	N	NCF	YP1	YP2	ZL(NS,N,1)	ZL(NS,N,2)
Card Column No	5	10	15	30	45	60	75
Data							

Card Nos 4 to 6 REAL NUMBERS - 15 column fields, decimal point required

Format (5E15 7)

Variable	CF				
Card Column No	15	30	45	60	75
Data					

(e) Body geometry input data

Figure 6 - Concluded

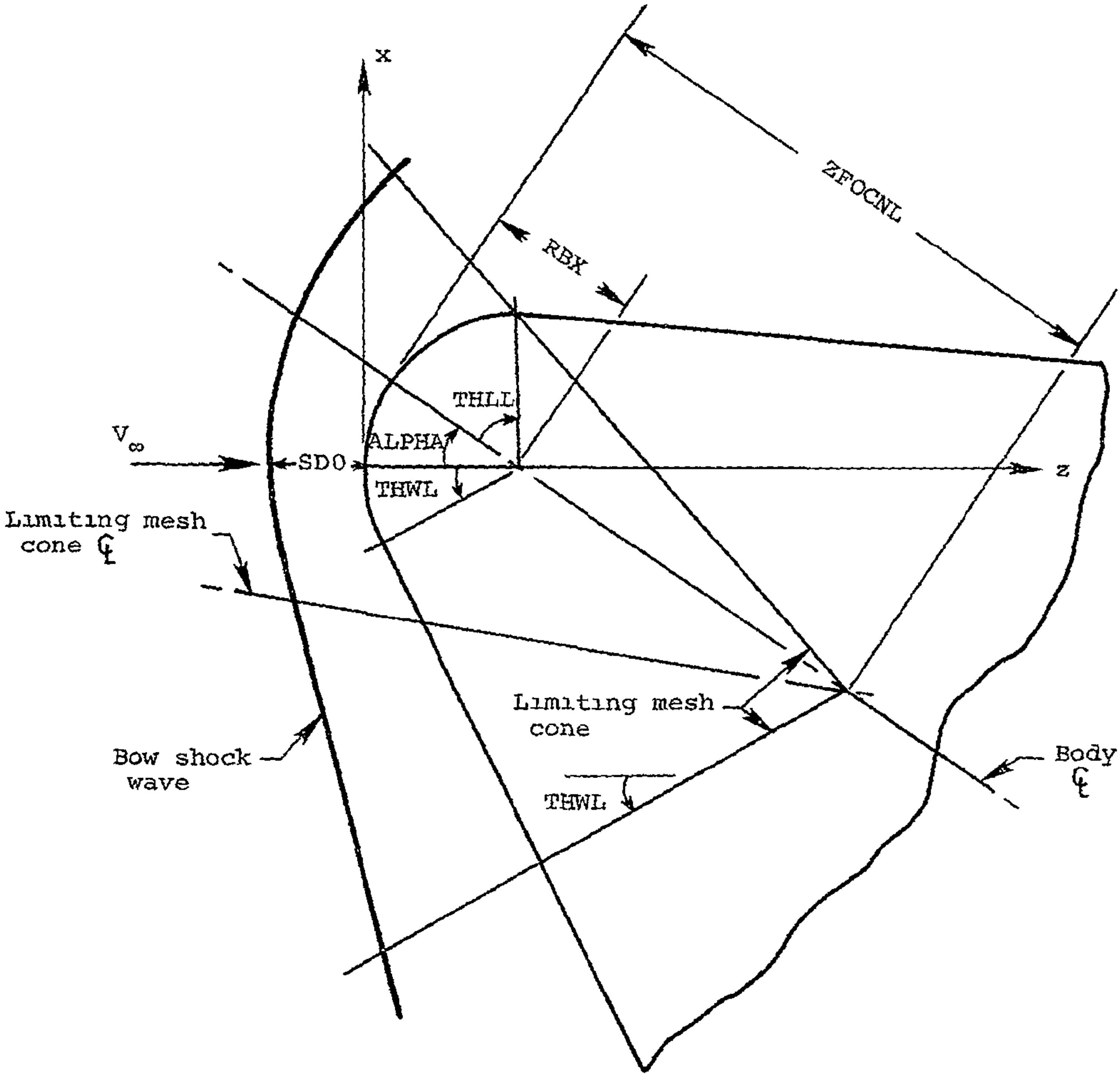


Figure 7.- Body and shock geometry in pitch plane showing definition of computational mesh input parameters.

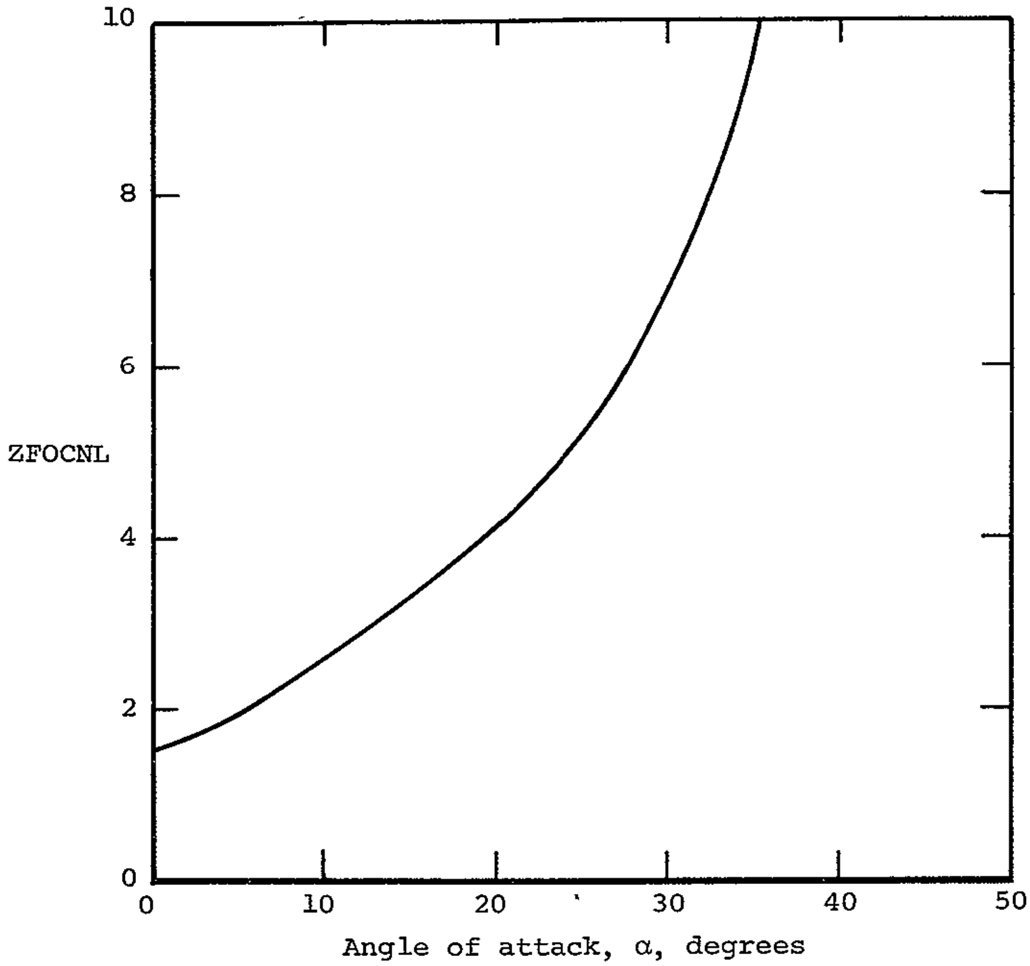


Figure 8.- Estimated axial location of last mesh cone vertex for program 1 (see figure 7).

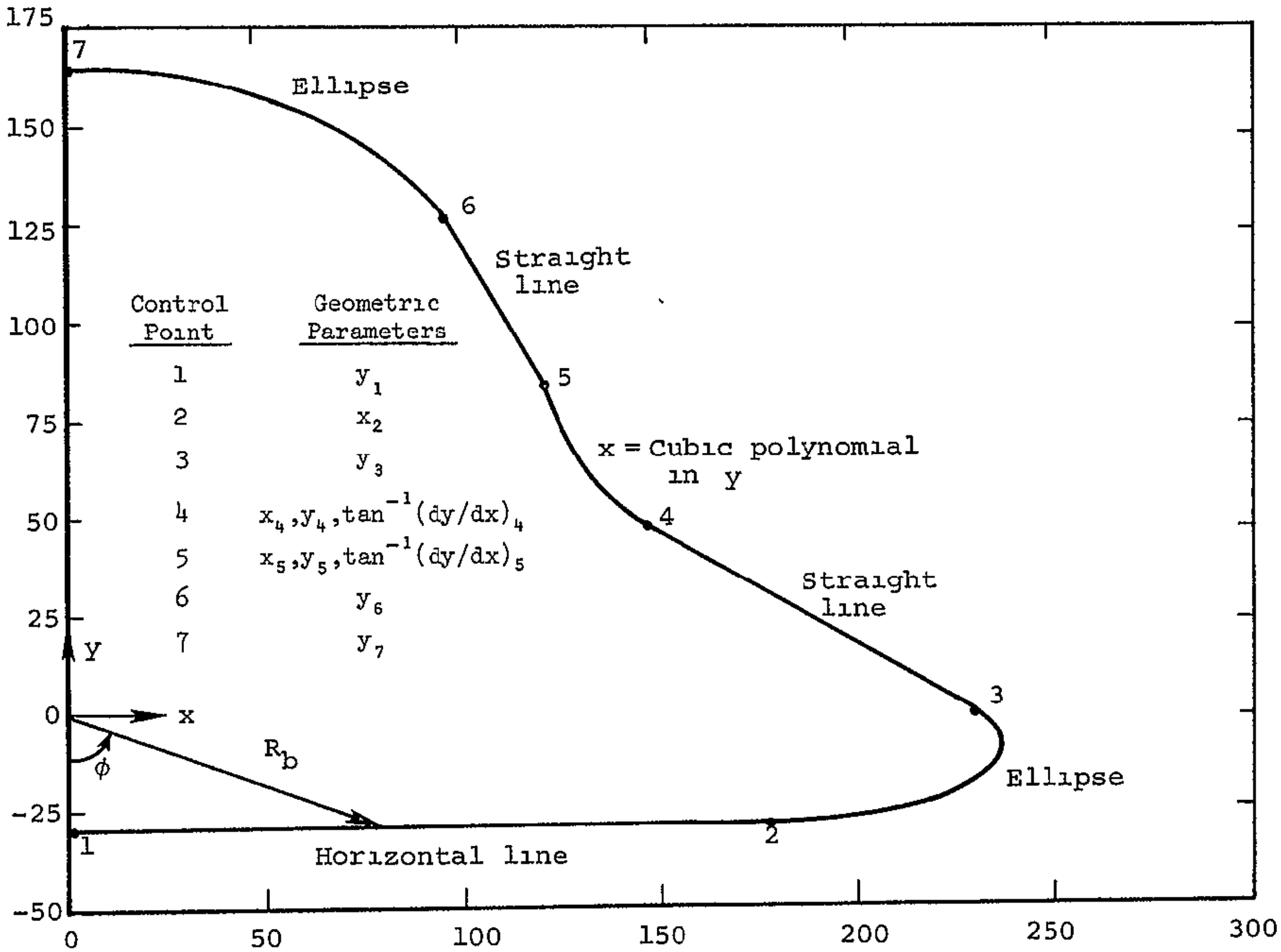
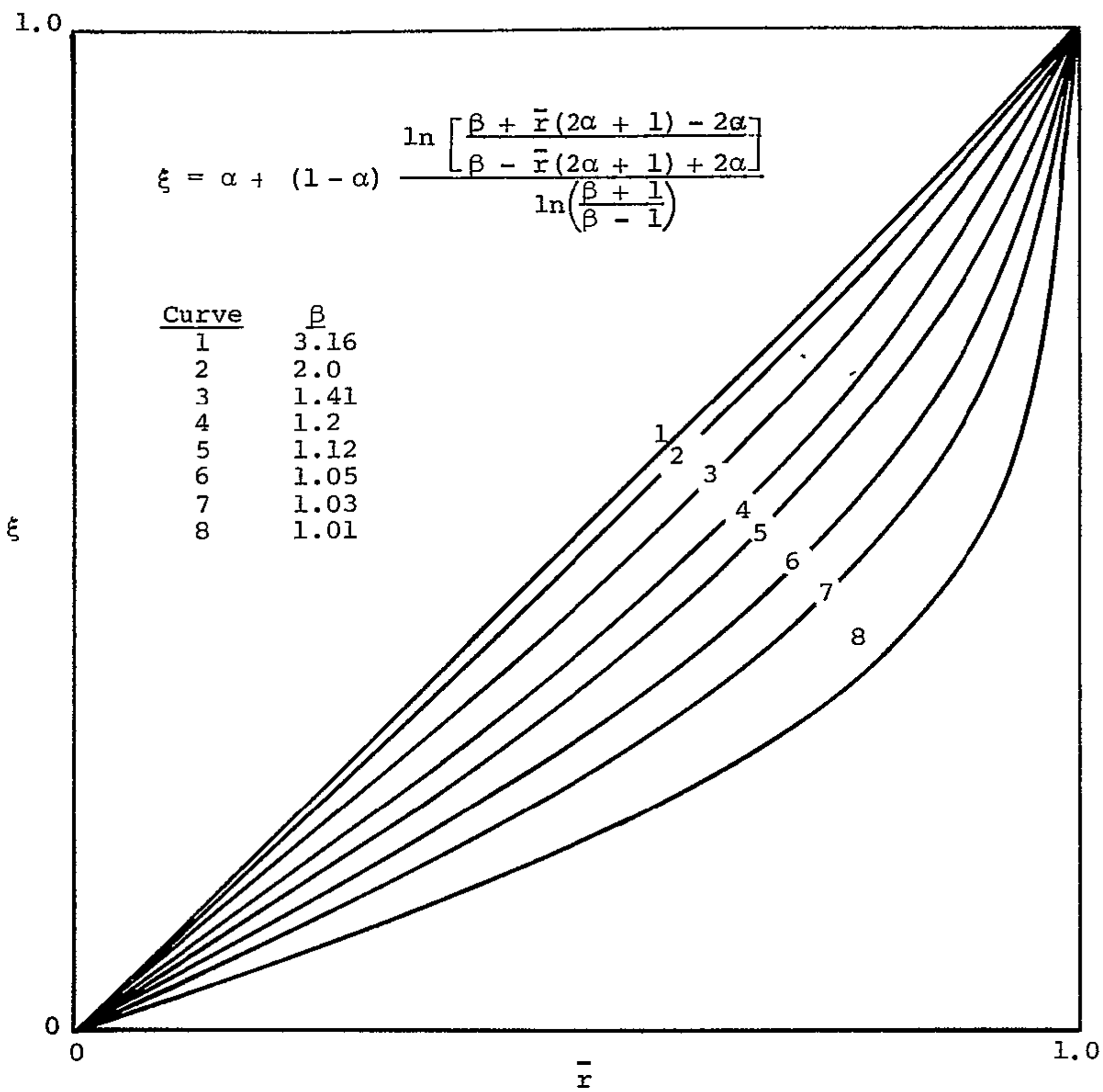
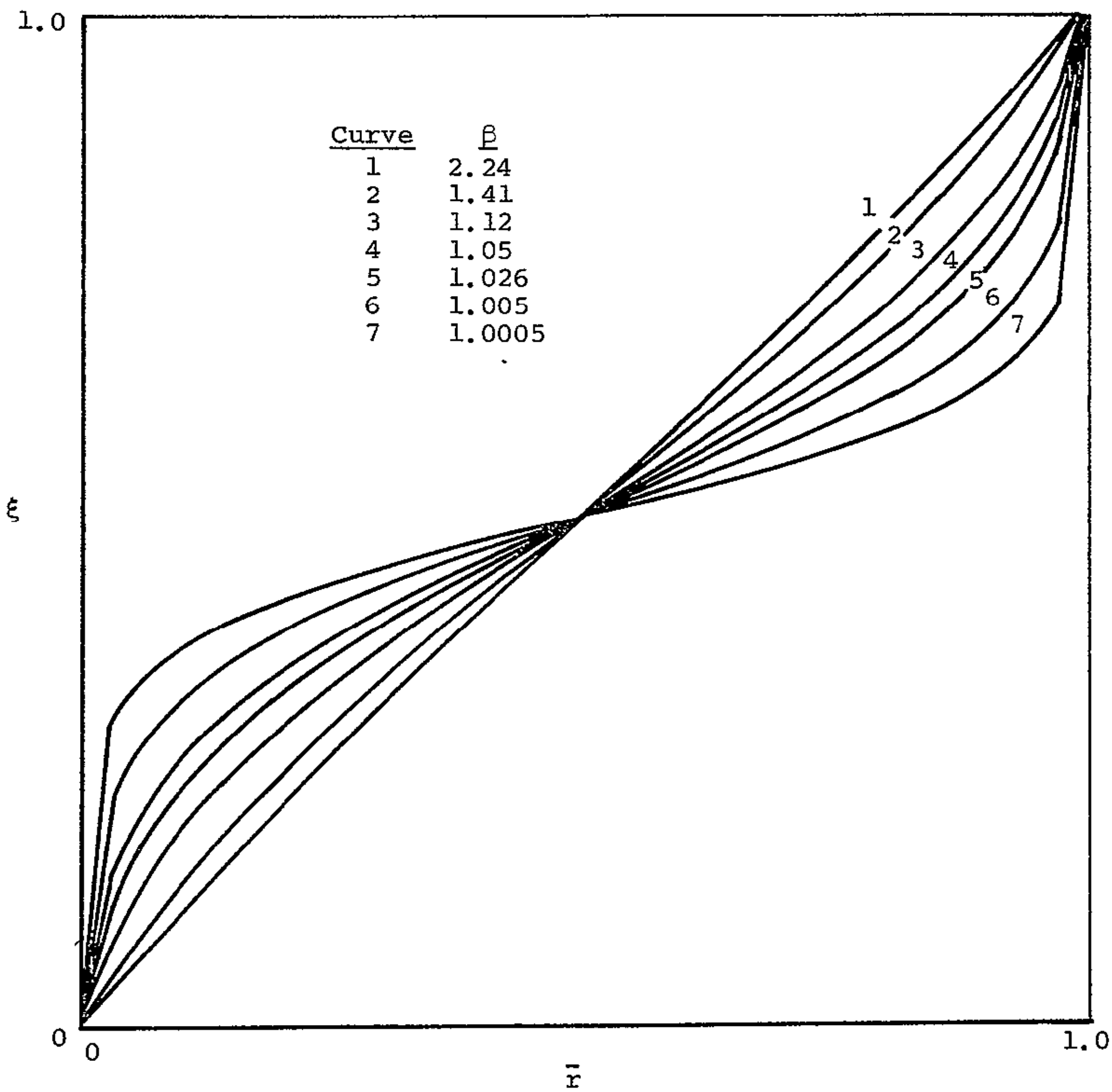


Figure 9.- Control points and geometric parameters for the body geometry.



(a) $\alpha = 0$.

Figure 10.- Radial clustering function.



(b) $\alpha = 1/2$

Figure 10.- Concluded.

```
FT       01
  1  200   16   12   18   10  -1
 10 0    797.7905  1 0269E-06  1.4       .26       .5        0.0
 30.0      7.0       40.        90.       1.0
```

(a) Input data for program 1. (FVUBB)

```
01111
   5.
```

(b) Input data for program 2. (FVS'BB)

```
  11   22   17   43    1
  40
 .025     .05      .075     .10      .125     .15      .175     .20
 .225     .25      .275     .30      .325     .35      .375     .40
 .425     .45      .475     .50      .525     .55      .575     .60
 .625     .65      .675     .70      .725     .75      .775     .80
 .825     .85      .875     .90      .925     .95      .975     1.0
```

(c) Input data for program 5 (CTI)

```
FALSE    1     3     0     0    50    200.        5     10.
    5
     5.0E.2     0.0E.0     0.0E.0     0.0E.0     0.0E.0
     5.3E.2     0 0E.0     0.0E.0     0.0E.0     1.1E.0
     5.7E.2     3.0E.01.30899E.0      0.0E.0     1.1E.0
     6.0E.2     3.0E.01.30889E.0      0 0E.0     1.1E.0
     3.0E.3     5.0E.01.30899E.0      0 0E.0     1.1E.0
     2
     2.5E.2     0.0E.0
     3.0E.3     4.0E-1
     2
     4.5E.2     0.0E.0
     3.0E 3     1.0E-1
```

(d) Input data for program 3 (FDSC)

Figure 11.- Input data for numerical example.

```
014
00008017
003002
020010
000000
000000
000000000
107.3      90
 40 2      2 333
1.4        1.4        1716.
1.3639E-011.9701E-07 21700.
 89.056       0.0        0.0        0.0      1.5
180.         0.0      0.0
179.8        0 0      0.0
179.6        0.0      0.0
179.4        0.0      0.0
179.         0.0      0 0
178.5        0.0      0.0
178          0.0      0.0
177.5        0.0      0.0
177.         0.0      0.0
176.         0.0      0.0
175.         0.0      0.0
174.         0.0      0.0
172.         0 0      0.0
170          0.0      0.0
168.         0.0      0.0
165.         0.0      0.0
160.         0.0      0.0
150.         0.0      0.0
130.         0.0      0.0
0.0          0.0      0.0
    SHUTTLE 147
PERFECT GAS
000
000
.0726      109       .145       .182       .218       .254       .29
```

(e) Input data for program 4 (CHAOS)

Figure 11.- Concluded.

```
3-DIMENSIONAL BLUNT BODY FLOW

   MACH=1,000000E+01    PRES=7,977905E+02    RHO=1,026900E-06    GAMMA=1,400000E+00

 SDO=2,600000E-01  C2=5,000000E-01   S3=0,            ALFA=3,000000E+01 ZFOCNL=7,000000E+00

NPRT=  1      NEND= 20      IE= 16      JE= 12      KE= 18      JSHK= 10      NGAS= -1
       THW1 =      ,400000E+02      THL1 =      ,900000E+02      RBX =      ,100000E+01

 VINF= 3,29705E+05 AINF= 3,29705E+04 HINF= 2,71912E+09 RHZ= 3,38667E-01 EINF= 5,78398E+04 EIINF= 1,94223E+09 TINF= 2,69567E+02

RFOC(K,1,I) CONSTANT VALUES
      1          2          3          4          5          6          7          8          9          10         11
      12         13         14         15         16
 1  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 2  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 3  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 4  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 5  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 6  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 7  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 8  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
 9  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,330E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
10  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
11  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
12  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
13  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
14  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
15  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
16  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
17  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02
18  0,         0,        -1,089E+00 -4,354E+00 -9,797E+00 -1,742E+01 -2,721E+01 -3,919E+01 -5,334E+01 -6,967E+01 -8,817E+01
   -1,089E+02 -1,317E+02 -1,568E+02 -1,840E+02 -2,134E+02

RFOC(K,2,I) CONSTANT VALUES
      1          2          3          4          5          6          7          8          9          10         11
      12         13         14         15         16
 1  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 2  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 3  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 4  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 5  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 6  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 7  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
 8  7,114E+01  7,114E+01  7,303E+01  7,868E+01  8,811E+01  1,013E+02  1,183E+02  1,390E+02  1,635E+02  1,918E+02  2,239E+02
    2,597E+02  2,993E+02  3,426E+02  3,898E+02  4,407E+02
```

Figure 12 - Selected sample output data from program 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
9	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
10	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
11	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
12	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
13	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
14	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
15	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
16	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
17	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02
18	7,114E+01	7,114E+01	7,303E+01	7,868E+01	8,811E+01	1,013E+02	1,183E+02	1,390E+02	1,635E+02	1,918E+02	2,239E+02	2,597E+02	2,993E+02	3,426E+02	3,898E+02	4,407E+02

RBODY(K,T) CONSTANT VALUES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	7,114E+01	7,112E+01	7,319E+01	7,966E+01	9,063E+01	1,060E+02	1,254E+02	1,487E+02	1,757E+02	2,064E+02	2,406E+02	2,783E+02	3,192E+02	3,641E+02	4,136E+02	4,678E+02
2	7,114E+01	7,112E+01	7,319E+01	7,964E+01	9,057E+01	1,058E+02	1,251E+02	1,482E+02	1,748E+02	2,048E+02	2,379E+02	2,734E+02	3,124E+02	3,553E+02	4,022E+02	4,527E+02
3	7,114E+01	7,112E+01	7,318E+01	7,958E+01	9,040E+01	1,054E+02	1,243E+02	1,467E+02	1,721E+02	1,997E+02	2,291E+02	2,618E+02	2,975E+02	3,356E+02	3,756E+02	4,163E+02
4	7,114E+01	7,112E+01	7,317E+01	7,949E+01	9,013E+01	1,048E+02	1,230E+02	1,442E+02	1,669E+02	1,915E+02	2,188E+02	2,484E+02	2,794E+02	3,107E+02	3,426E+02	3,755E+02
5	7,114E+01	7,112E+01	7,314E+01	7,937E+01	8,976E+01	1,039E+02	1,212E+02	1,401E+02	1,607E+02	1,837E+02	2,086E+02	2,346E+02	2,603E+02	2,862E+02	3,126E+02	3,391E+02
6	7,114E+01	7,113E+01	7,312E+01	7,922E+01	8,930E+01	1,028E+02	1,186E+02	1,357E+02	1,551E+02	1,765E+02	1,991E+02	2,215E+02	2,438E+02	2,667E+02	2,898E+02	3,127E+02
7	7,114E+01	7,113E+01	7,309E+01	7,905E+01	8,878E+01	1,014E+02	1,156E+02	1,318E+02	1,502E+02	1,699E+02	1,900E+02	2,096E+02	2,298E+02	2,503E+02	2,707E+02	2,907E+02
8	7,114E+01	7,114E+01	7,307E+01	7,887E+01	8,814E+01	9,966E+01	1,130E+02	1,285E+02	1,457E+02	1,636E+02	1,811E+02	1,989E+02	2,170E+02	2,351E+02	2,526E+02	2,691E+02
9	7,114E+01	7,114E+01	7,303E+01	7,865E+01	8,735E+01	9,797E+01	1,108E+02	1,255E+02	1,413E+02	1,573E+02	1,729E+02	1,889E+02	2,048E+02	2,263E+02	2,347E+02	2,479E+02
10	7,114E+01	7,114E+01	7,299E+01	7,838E+01	8,647E+01	9,658E+01	1,089E+02	1,227E+02	1,371E+02	1,512E+02	1,653E+02	1,794E+02	1,931E+02	2,059E+02	2,174E+02	2,279E+02
11	7,114E+01	7,113E+01	7,293E+01	7,807E+01	8,563E+01	9,541E+01	1,071E+02	1,200E+02	1,329E+02	1,455E+02	1,581E+02	1,704E+02	1,819E+02	1,923E+02	2,014E+02	2,097E+02
12	7,114E+01	7,112E+01	7,286E+01	7,774E+01	8,495E+01	9,443E+01	1,056E+02	1,174E+02	1,290E+02	1,403E+02	1,515E+02	1,621E+02	1,717E+02	1,801E+02	1,875E+02	1,939E+02
13	7,114E+01	7,110E+01	7,278E+01	7,741E+01	8,441E+01	9,359E+01	1,041E+02	1,150E+02	1,254E+02	1,357E+02	1,456E+02	1,548E+02	1,629E+02	1,707E+02	1,758E+02	1,809E+02
14	7,114E+01	7,109E+01	7,270E+01	7,713E+01	8,399E+01	9,288E+01	1,029E+02	1,129E+02	1,224E+02	1,318E+02	1,406E+02	1,486E+02	1,555E+02	1,613E+02	1,664E+02	1,706E+02
15	7,114E+01	7,107E+01	7,262E+01	7,692E+01	8,366E+01	9,230E+01	1,018E+02	1,111E+02	1,200E+02	1,286E+02	1,367E+02	1,438E+02	1,498E+02	1,549E+02	1,593E+02	1,630E+02
16	7,114E+01	7,105E+01	7,256E+01	7,678E+01	8,343E+01	9,187E+01	1,010E+02	1,098E+02	1,182E+02	1,263E+02	1,338E+02	1,403E+02	1,457E+02	1,503E+02	1,543E+02	1,577E+02
17	7,114E+01	7,105E+01	7,252E+01	7,669E+01	8,330E+01	9,161E+01	1,005E+02	1,090E+02	1,171E+02	1,249E+02	1,320E+02	1,382E+02	1,433E+02	1,486E+02	1,514E+02	1,546E+02
18	7,114E+01	7,104E+01	7,251E+01	7,667E+01	8,325E+01	9,152E+01	1,003E+02	1,087E+02	1,167E+02	1,244E+02	1,315E+02	1,375E+02	1,425E+02	1,467E+02	1,505E+02	1,535E+02

Figure 12 - Continued

```
THREE-DIMENSIONAL BLUNT-BODY FLOW (CFD.CODED)

INITIAL CONDITIONS   MACH NO= 10.00000  P-INF= 7.97791E+02  RHO-INF= 1.02690E-06  GAMMA-INF=  1.40000

         ALPHA= 3.00000E+01(DEG)  AINF= 3.59795E+04  QINF= 3.29795E+05

NITER=    0  NEND=   20  NGAS= -1  IL= 192  JL=  12  KL=  18  JSHK=  10

SDO= 1.8491E+01  C2= 5.0000E-01  S3= 0.          ZFOCNL= 4.9784E+02

NITER=  1  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.5208E-05,I= 15,J=  1,K=  1)( 9.8915E-06,I=  1,J=  9,K=  9)( 4.5480E-06,I=  1,J=  1,K= 17)
THE MAX= 2.1988E+05  CFL= 5.6312E-01  DTC= 4.5480E-06  DR= 2.0546E+00  DT= 5.6635E-06
X(1,IL,JSHK)= 9.6905E+01  X(KL,IL,JSHK)=-3.8402E+02  Z(1,1,JSHK)=-1.8491E+01
P(1,M)= 2.6685E+03  P(KL-1,M)= 2.5119E+03  P(1,1)= 1.0181E+05  M=177

  MAX ENTHALPY ERROR =  -6.533E-02  IC=  15  JC=   4  KC=   1
  NO. OF ERRORS < 10.0 % = 2205
  NO. OF ERRORS < 1.0 % = 1226
  NO. OF ERRORS < 0.1 % =  124

NITER=  2  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.4001E-05,I= 15,J=  5,K=  1)( 9.8364E-06,I=  1,J=  9,K=  1)( 4.5739E-06,I=  1,J=  1,K=  1)
THE MAX= 2.1863E+05  CFL= 5.6477E-01  DTC= 4.5739E-06  DR= 2.0566E+00  DT= 5.6691E-06
X(1,IL,JSHK)= 9.6199E+01  X(KL,IL,JSHK)=-3.8305E+02  Z(1,1,JSHK)=-1.8509E+01
P(1,M)= 5.4425E+03  P(KL-1,M)=-1.6422E+03  P(1,1)= 9.7458E+04  M=177

  MAX ENTHALPY ERROR =  -7.623E-02  IC=  15  JC=   4  KC=   1
  NO. OF ERRORS < 10.0 % = 2205
  NO. OF ERRORS < 1.0 % =  623
  NO. OF ERRORS < 0.1 % =   56

NITER=  3  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.3523E-05,I= 15,J=  7,K=  1)( 9.7222E-06,I=  1,J=  9,K=  1)( 4.6017E-06,I=  1,J=  1,K=  6)
THE MAX= 2.1731E+05  CFL= 5.6609E-01  DTC= 4.6017E-06  DR= 2.0530E+00  DT= 5.6602E-06
X(1,IL,JSHK)= 9.5947E+01  X(KL,IL,JSHK)=-3.8210E+02  Z(1,1,JSHK)=-1.8481E+01
P(1,M)= 7.6279E+03  P(KL-1,M)= 1.6017E+03  P(1,1)= 9.3351E+04  M=177

  MAX ENTHALPY ERROR =  -8.947E-02  IC=  14  JC=   5  KC=   2
  NO. OF ERRORS < 10.0 % = 2205
  NO. OF ERRORS < 1.0 % =  413
  NO. OF ERRORS < 0.1 % =   43

NITER=  4  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.3193E-05,I= 15,J=  8,K=  1)( 9.5859E-06,I=  1,J=  9,K=  1)( 4.6255E-06,I=  1,J=  1,K=  3)
THE MAX= 2.1619E+05  CFL= 5.7197E-01  DTC= 4.6255E-06  DR= 2.0465E+00  DT= 5.6411E-06
X(1,IL,JSHK)= 9.5734E+01  X(KL,IL,JSHK)=-3.8113E+02  Z(1,1,JSHK)=-1.8418E+01
P(1,M)= 9.9286E+03  P(KL-1,M)=-1.5766E+03  P(1,1)= 8.9537E+04  M=177

  MAX ENTHALPY ERROR =  -1.040E-01  IC=  14  JC=   4  KC=   2
  NO. OF ERRORS < 10.0 % = 2203
  NO. OF ERRORS < 1.0 % =  344
  NO. OF ERRORS < 0.1 % =   26

NITER=  5  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2952E-05,I= 15,J=  8,K=  1)( 9.4325E-06,I=  2,J=  9,K= 17)( 4.6499E-06,I=  1,J=  1,K= 17)
THE MAX= 2.1506E+05  CFL= 5.8016E-01  DTC= 4.6499E-06  DR= 2.0353E+00  DT= 5.6105E-06
X(1,IL,JSHK)= 9.5606E+01  X(KL,IL,JSHK)=-3.8016E+02  Z(1,1,JSHK)=-1.8318E+01
P(1,M)= 1.2673E+04  P(KL-1,M)= 1.5667E+03  P(1,1)= 8.6295E+04  M=177

NITER=596  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2168E-05,I= 15,J=  9,K=  1)( 4.5079E-06,I=  1,J=  1,K=  2)( 3.7339E-06,I=  1,J=  2,K= 17)
THE MAX= 2.6782E+05  CFL= 9.0219E-01  DTC= 3.7339E-06  DR= 1.0510E+00  DT= 2.8970E-06
X(1,IL,JSHK)= 9.4632E+01  X(KL,IL,JSHK)=-3.4752E+02  Z(1,1,JSHK)=-9.4588E+00
P(1,M)= 2.8807E+04  P(KL-1,M)= 3.6609E+04  P(1,1)= 9.5158E+04  M=177

  MAX ENTHALPY ERROR =   4.447E-02  IC=   1  JC=   2  KC=  11
  NO. OF ERRORS < 10.0 % = 2205
  NO. OF ERRORS < 1.0 % = 2230
  NO. OF ERRORS < 0.1 % = 1036
```

Figure 12 - Continued

```
NITER=597  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2189E-05,I= 15 J=  8,K=  1)( 4 5085E-06,I=  1,J=  1,K=  2)( 3 7334E-06,I=  1,J=  2,K= 17)
THE MAX= 2.6785E+05  CFL= 9 0180E-01  DTC= 3.7334E-06  DR= 1 0512E+00  DT= 2 8977E-06
X(1,IL,JSHK)= 9.4600E+01  X(KL,IL,JSHK)=-3.4752E+02  Z(1,1,JSHK)=-9.4606E+00
P(1,M)= 2.8531E+04  P(KL-1,M)= 3 6607E+04  P(1,1)= 9 5258E+04  M=177

  MAX ENTHALPY ERROR =   4 402E-02  IC=   1  JC=   2  KC=  11
  NO. OF ERRORS < 10 0 % = 2205
  NO. OF ERRORS < 1 0 % = 2227
  NO. OF ERRORS < 0 1 % = 1053

NITER=598  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2192E-05,I= 15 J=  8,K=  1)( 4 5102E-06,I=  1,J=  1,K=  2)( 3.7337E-06,I=  1,J=  2,K= 17)
THE MAX= 2.6783E+05  CFL= 9.0165E-01  DTC= 3.7337E-06  DR= 1.0516E+00  DT= 2.8986E-06
X(1,IL,JSHK)= 9 4564E+01  X(KL,IL,JSHK)=-3.4752E+02  Z(1,1,JSHK)=-9.4640E+00
P(1,M)= 2.8293E+04  P(KL-1,M)= 3 6604E+04  P(1,1)= 9.5198E+04  M=177

  MAX ENTHALPY ERROR =   4 363E-02  IC=   1  JC=   2  KC=  11
  NO. OF ERRORS < 10 0 % = 2205
  NO  OF ERRORS < 1 0 % = 2232
  NO. OF ERRORS < 0 1 % = 1045

NITER=599  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2197E-05,I= 15,J=  8,K=  1)( 4.5116E-06,I=  1,J=  1,K=  2)( 3.7339E-06,I=  1,J=  2,K= 17)
THE MAX= 2.6782E+05  CFL= 9.0150E-01  DTC= 3.7339E-06  DR= 1.0520E+00  DT= 2.9000E-06
X(1,IL,JSHK)= 9.4525E+01  X(KL,IL,JSHK)=-3.4751E+02  Z(1,1,JSHK)=-9.4683E+00
P(1,M)= 2.8104E+04  P(KL-1,M)= 3 6602E+04  P(1,1)= 9.5054E+04  M=177

  MAX ENTHALPY ERROR =   4.376E-02  IC=   1  JC=   2  KC=  11
  NO. OF ERRORS < 10 0 % = 2205
  NO. OF ERRORS < 1.0 % = 2235
  NO. OF ERRORS < 0 1 % = 1046

NITER=600  EIGENVALUE INFO: (REC EIG-MAX,I,J,K)
( 1.2205E-05,I= 15,J=  8,K=  1)( 4 5139E-06,I=  1,J=  1,K=  2)( 3.7339E-06,I=  1,J=  2,K= 17)
THE MAX= 2.6782E+05  CFL= 9 0084E-01  DTC= 3.7339E-06  DR= 1.0526E+00  DT= 2.9014E-06
X(1,IL,JSHK)= 9.4487E+01  X(KL,IL,JSHK)=-3.4751E+02  Z(1,1,JSHK)=-9.4731E+00
P(1,M)= 2.7972E+04  P(KL-1,M)= 3.6599E+04  P(1,1)= 9.5136E+04  M=177
```

Figure 12 - Continued

K= 1 ENTHALPY ERRORS (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9
1	2.657E-02	-6.367E-03	-1.245E-03	-2.434E-03	1.047E-03	4.902E-04	1.240E-04	-2.036E-03	-3.908E-03
2	7.468E-03	-8.256E-03	-5.495E-04	-2.498E-03	-9.786E-04	-1.784E-03	1.378E-03	-2.588E-03	4.236E-03
3	3.222E-03	-3.039E-03	1.272E-03	-3.799E-04	-2.945E-04	1.626E-04	1.118E-03	1.770E-03	-1.537E-03
4	3.691E-03	-6.962E-04	1.671E-03	2.052E-03	5.143E-04	-1.551E-03	1.496E-04	1.601E-03	-9.496E-04
5	-9.607E-04	-2.742E-03	-1.443E-03	-4.808E-04	1.631E-03	-1.456E-03	-4.514E-03	-2.275E-03	-6.234E-03
6	-7.357E-04	-1.822E-03	-2.958E-03	-5.647E-03	-1.398E-03	8.516E-04	1.955E-03	-3.767E-03	-1.828E-03
7	1.328E-03	1.052E-03	1.745E-03	-1.615E-03	-1.345E-03	-1.859E-03	7.251E-03	-1.099E-03	1.454E-02
8	5.917E-03	4.858E-03	6.474E-03	5.690E-03	9.678E-04	-8.706E-04	1.959E-03	8.355E-05	1.334E-02
9	2.289E-03	2.366E-03	9.391E-04	7.602E-03	1.258E-03	3.164E-03	-6.963E-03	4.778E-03	-7.627E-03
10	-2.053E-04	-5.994E-05	-2.838E-03	3.073E-03	2.536E-03	5.804E-03	-1.030E-02	-5.170E-03	-1.784E-02
11	-6.386E-03	-5.459E-03	-6.734E-03	-3.704E-03	-6.986E-04	7.479E-03	-4.278E-04	-9.575E-03	-1.736E-02
12	-5.994E-03	-6.662E-03	-5.576E-03	-7.965E-03	-6.369E-03	-2.693E-04	5.920E-03	-4.846E-03	-8.809E-03
13	-1.244E-03	-3.366E-03	-7.120E-05	-6.812E-03	-4.808E-03	-8.232E-03	5.674E-03	1.041E-04	1.701E-03
14	4.568E-03	1.240E-03	4.993E-03	-3.083E-03	1.951E-03	-9.549E-03	1.675E-03	-4.329E-04	1.077E-02
15	5.689E-03	2.724E-03	7.154E-03	-1.916E-04	6.546E-03	-6.047E-03	1.100E-03	-2.500E-03	1.502E-02

K= 2 ENTHALPY ERRORS (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9
1	-2.196E-02	3.656E-02	3.841E-03	-3.790E-03	7.169E-04	-2.391E-03	1.934E-04	-1.343E-03	-3.850E-03
2	-5.962E-03	9.035E-03	-3.280E-03	-2.937E-03	-1.446E-03	-1.240E-03	2.113E-03	-3.153E-03	4.513E-03
3	-1.930E-03	4.298E-03	-1.607E-03	1.518E-03	-1.303E-03	-9.721E-04	8.220E-04	3.339E-03	-1.189E-03
4	-1.270E-03	2.000E-03	-2.203E-03	-3.532E-04	-1.084E-03	-2.074E-03	-3.606E-03	-3.556E-03	-3.716E-03
5	-1.227E-03	-4.399E-05	-3.085E-03	-2.260E-03	-1.108E-03	-6.774E-04	9.141E-04	-4.580E-03	1.882E-03
6	2.183E-03	2.239E-03	4.017E-04	1.570E-03	1.419E-03	1.609E-03	3.790E-03	-1.396E-03	7.691E-03
7	2.041E-03	1.996E-03	2.324E-04	1.664E-03	-3.762E-04	2.878E-03	-1.732E-03	7.076E-03	-2.724E-03
8	3.623E-04	2.293E-04	-1.188E-03	-9.140E-04	-2.000E-03	-2.691E-04	-5.533E-03	2.888E-03	-5.652E-03
9	-1.076E-03	-1.106E-03	-3.297E-04	-9.188E-04	-9.675E-04	-6.848E-04	-1.153E-03	-5.532E-03	-4.452E-03
10	-4.488E-04	-8.107E-04	7.941E-04	4.360E-04	1.618E-03	-1.432E-03	5.976E-03	-7.165E-03	2.597E-03
11	5.458E-04	-6.068E-04	8.376E-04	-5.035E-04	3.880E-03	-3.526E-03	5.120E-03	-3.024E-03	3.093E-03
12	1.976E-03	1.369E-03	-2.740E-05	1.097E-03	2.289E-03	4.284E-04	3.323E-04	2.715E-03	-1.539E-03
13	2.820E-04	9.579E-04	-2.469E-03	1.074E-03	-1.657E-03	2.785E-03	-2.784E-03	3.255E-03	-3.586E-03
14	8.575E-04	1.691E-03	-2.004E-03	1.914E-03	-3.557E-03	2.294E-03	-3.716E-03	2.887E-03	-5.656E-03
15	5.606E-04	1.647E-03	-1.586E-03	2.645E-03	-3.213E-03	1.889E-03	-3.285E-03	2.713E-03	-2.841E-03

K= 3 ENTHALPY ERRORS (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9
1	8.920E-03	2.927E-02	-6.386E-04	-4.610E-03	2.599E-03	-2.914E-03	3.555E-03	8.138E-04	-2.244E-03
2	4.374E-03	7.738E-03	-5.211E-03	-1.291E-03	-1.867E-03	-1.554E-03	2.032E-03	-2.090E-03	4.202E-03
3	2.938E-03	1.965E-03	-1.573E-03	9.433E-04	-1.023E-04	-5.104E-04	-1.726E-03	2.657E-03	-5.508E-03
4	1.049E-03	-6.278E-04	-8.336E-04	-1.217E-03	-1.750E-03	-1.746E-03	-1.209E-04	-2.720E-03	2.181E-03
5	4.156E-03	1.684E-03	1.996E-03	2.081E-03	1.195E-03	3.778E-05	1.079E-03	-1.468E-03	7.139E-03
6	1.085E-03	-2.090E-04	4.767E-04	1.614E-03	1.751E-03	1.875E-03	-2.900E-03	7.314E-03	-1.045E-02
7	-1.356E-03	-3.011E-03	-3.311E-03	-3.048E-03	1.516E-04	-2.017E-04	-6.258E-03	-1.637E-03	-8.123E-03
8	-2.938E-03	-3.010E-03	-2.651E-03	-5.031E-03	-1.807E-03	1.574E-03	2.896E-03	-4.646E-03	-3.862E-03
9	7.920E-04	-2.984E-04	2.508E-03	-2.579E-03	3.508E-04	-5.093E-03	9.364E-03	-3.514E-03	1.027E-02
10	2.732E-03	1.861E-03	2.395E-03	1.982E-03	2.216E-03	-1.655E-03	1.835E-03	3.037E-03	6.561E-03
11	9.154E-04	8.092E-04	-1.033E-03	2.484E-03	2.768E-04	3.433E-03	-2.661E-03	4.409E-03	-2.846E-03
12	5.061E-04	4.818E-04	-1.609E-03	1.433E-03	-9.541E-04	4.770E-03	-2.359E-03	3.318E-03	-9.170E-03
13	-1.614E-04	2.506E-05	-1.486E-04	1.065E-04	-3.903E-04	1.874E-03	-4.112E-04	2.288E-03	-7.887E-03
14	1.565E-03	2.037E-04	1.647E-03	-7.845E-04	1.938E-03	-1.830E-03	1.167E-03	4.218E-04	-1.602E-03
15	1.984E-03	6.906E-04	2.193E-03	-1.566E-04	2.547E-03	-1.807E-03	1.507E-03	2.582E-04	2.803E-04

K= 4 ENTHALPY ERRORS (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9
1	2.596E-02	-2.450E-02	2.826E-04	-3.155E-03	-3.633E-04	-1.986E-03	1.405E-03	9.372E-04	-5.395E-03
2	2.972E-03	-6.885E-03	5.093E-04	-2.139E-03	-9.187E-04	-2.156E-03	1.562E-03	-2.941E-03	5.342E-03
3	4.518E-03	-1.921E-03	3.220E-04	-1.483E-03	-3.891E-04	-1.513E-03	-1.154E-03	3.843E-04	-5.790E-03
4	4.038E-03	-1.494E-03	1.267E-03	4.833E-04	1.400E-03	3.444E-06	1.411E-03	-1.862E-03	9.025E-03
5	1.649E-03	5.673E-04	2.449E-03	3.717E-03	2.060E-03	4.762E-04	-7.382E-04	7.436E-03	-9.951E-03
6	-2.292E-03	-3.273E-03	-3.453E-03	-3.276E-03	5.609E-04	-4.435E-04	-7.760E-03	-1.973E-03	-9.916E-03
7	-1.818E-03	-2.220E-03	-2.681E-03	-5.050E-03	-8.146E-04	2.576E-03	4.154E-03	-7.832E-03	-2.331E-03
8	1.755E-03	9.814E-04	1.399E-03	-5.692E-04	3.619E-05	-3.073E-03	7.609E-03	-2.309E-03	9.065E-03
9	1.286E-03	1.032E-03	-4.234E-04	1.332E-03	-4.855E-04	2.253E-04	-1.106E-03	4.164E-03	2.940E-03
10	-7.897E-04	-2.652E-04	-2.030E-03	1.290E-03	-1.091E-03	4.034E-03	-3.495E-03	4.146E-03	-4.177E-03

Figure 12 - Continued

STEP NUMBER= 600 IPESH= 0 TIME= 9.06837E-03 DT= 3.73387E-06 DTC= 0.

RHO VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

RHO VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	6.088E-06	6.157E-06	6.396E-06	6.285E-06	6.221E-06	6.158E-06	6.111E-06	6.033E-06	5.916E-06	1.027E-06	1.027E-06
2	6.050E-06	6.165E-06	6.200E-06	6.126E-06	6.130E-06	6.097E-06	5.997E-06	6.066E-06	5.594E-06	1.027E-06	1.027E-06
3	5.855E-06	5.958E-06	6.018E-06	5.972E-06	6.000E-06	5.973E-06	5.980E-06	5.897E-06	5.953E-06	1.027E-06	1.027E-06
4	5.567E-06	5.647E-06	5.712E-06	5.721E-06	5.760E-06	5.768E-06	5.808E-06	5.799E-06	5.823E-06	1.027E-06	1.027E-06
5	5.173E-06	5.284E-06	5.381E-06	5.457E-06	5.512E-06	5.596E-06	5.654E-06	5.750E-06	5.815E-06	1.027E-06	1.027E-06
6	4.731E-06	4.865E-06	4.988E-06	5.099E-06	5.220E-06	5.387E-06	5.406E-06	5.686E-06	5.558E-06	1.027E-06	1.027E-06
7	4.187E-06	4.319E-06	4.470E-06	4.636E-06	4.816E-06	5.044E-06	5.164E-06	5.536E-06	5.399E-06	1.027E-06	1.027E-06
8	3.602E-06	3.802E-06	4.001E-06	4.200E-06	4.447E-06	4.638E-06	4.984E-06	5.121E-06	5.618E-06	1.027E-06	1.027E-06
9	3.018E-06	3.252E-06	3.509E-06	3.729E-06	4.065E-06	4.221E-06	4.783E-06	4.776E-06	5.686E-06	1.027E-06	1.027E-06
10	2.504E-06	2.783E-06	3.060E-06	3.355E-06	3.697E-06	4.014E-06	4.405E-06	4.873E-06	4.819E-06	1.027E-06	1.027E-06
11	1.821E-06	2.156E-06	2.466E-06	2.800E-06	3.161E-06	3.672E-06	3.977E-06	4.786E-06	4.464E-06	1.027E-06	1.027E-06
12	1.389E-06	1.659E-06	1.941E-06	2.345E-06	2.642E-06	3.235E-06	3.542E-06	4.486E-06	4.594E-06	1.027E-06	1.027E-06
13	1.168E-06	1.362E-06	1.605E-06	1.965E-06	2.257E-06	2.825E-06	3.190E-06	4.177E-06	4.376E-06	1.027E-06	1.027E-06
14	1.064E-06	1.227E-06	1.411E-06	1.725E-06	1.997E-06	2.514E-06	2.906E-06	3.916E-06	4.248E-06	1.027E-06	1.027E-06
15	9.416E-07	1.119E-06	1.260E-06	1.557E-06	1.803E-06	2.280E-06	2.669E-06	3.678E-06	4.306E-06	1.027E-06	1.027E-06

U VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

U VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	4.146E+03	-1.196E+03	1.070E+04	7.791E+03	1.096E+04	1.103E+04	1.257E+04	1.285E+04	1.535E+04	0.	0.
2	2.528E+04	2.400E+04	3.788E+04	3.124E+04	3.568E+04	3.390E+04	3.434E+04	3.526E+04	3.418E+04	0.	0.
3	4.661E+04	5.001E+04	5.400E+04	5.171E+04	5.480E+04	5.491E+04	5.607E+04	5.646E+04	5.740E+04	0.	0.
4	6.909E+04	7.049E+04	7.087E+04	7.041E+04	7.281E+04	7.457E+04	7.666E+04	7.765E+04	7.933E+04	0.	0.
5	8.289E+04	8.438E+04	8.538E+04	8.675E+04	8.807E+04	8.961E+04	9.276E+04	9.465E+04	9.771E+04	0.	0.
6	9.687E+04	9.724E+04	9.820E+04	9.999E+04	1.006E+05	1.015E+05	1.024E+05	1.066E+05	1.078E+05	0.	0.
7	1.032E+05	1.036E+05	1.045E+05	1.065E+05	1.085E+05	1.112E+05	1.107E+05	1.158E+05	1.126E+05	0.	0.
8	1.074E+05	1.071E+05	1.082E+05	1.099E+05	1.134E+05	1.162E+05	1.185E+05	1.207E+05	1.217E+05	0.	0.
9	1.050E+05	1.052E+05	1.081E+05	1.085E+05	1.134E+05	1.151E+05	1.236E+05	1.211E+05	1.327E+05	0.	0.
10	9.864E+04	1.007E+05	1.049E+05	1.071E+05	1.113E+05	1.150E+05	1.231E+05	1.266E+05	1.274E+05	0.	0.
11	8.056E+04	8.895E+04	9.493E+04	1.010E+05	1.057E+05	1.112E+05	1.164E+05	1.273E+05	1.219E+05	0.	0.
12	6.003E+04	7.529E+04	8.056E+04	9.147E+04	9.696E+04	1.053E+05	1.082E+05	1.226E+05	1.202E+05	0.	0.
13	4.710E+04	6.381E+04	6.771E+04	8.229E+04	8.756E+04	9.986E+04	1.020E+05	1.176E+05	1.133E+05	0.	0.
14	4.122E+04	5.507E+04	5.900E+04	7.405E+04	7.887E+04	9.449E+04	9.689E+04	1.138E+05	1.089E+05	0.	0.
15	3.466E+04	4.784E+04	5.294E+04	6.697E+04	7.180E+04	8.825E+04	9.136E+04	1.088E+05	1.067E+05	0.	0.

V VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

V VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	-4.466E+03	7.716E+03	-5.967E+03	-2.247E+03	9.684E+02	9.050E+02	8.648E+02	1.037E+03	4.529E+02	0.	0.
2	-6.886E+03	1.005E+04	1.374E+03	4.633E+03	3.915E+03	3.638E+03	3.848E+03	3.301E+03	3.395E+03	0.	0.
3	-2.547E+03	7.864E+03	4.010E+03	5.158E+03	5.036E+03	5.174E+03	4.936E+03	5.255E+03	5.015E+03	0.	0.
4	2.871E+03	8.504E+03	5.940E+03	6.755E+03	6.165E+03	6.514E+03	7.368E+03	7.413E+03	8.754E+03	0.	0.
5	6.079E+03	1.010E+04	8.565E+03	1.002E+04	9.197E+03	8.541E+03	9.069E+03	9.564E+03	1.079E+04	0.	0.
6	9.735E+03	1.219E+04	1.054E+04	1.160E+04	1.183E+04	1.182E+04	1.065E+04	1.172E+04	1.085E+04	0.	0.
7	1.159E+04	1.360E+04	1.224E+04	1.287E+04	1.366E+04	1.502E+04	1.389E+04	1.492E+04	1.229E+04	0.	0.
8	1.508E+04	1.640E+04	1.547E+04	1.567E+04	1.558E+04	1.642E+04	1.733E+04	1.722E+04	1.805E+04	0.	0.
9	1.722E+04	1.812E+04	1.783E+04	1.805E+04	1.772E+04	1.762E+04	2.046E+04	1.904E+04	2.220E+04	0.	0.
10	2.010E+04	2.091E+04	2.063E+04	2.110E+04	2.119E+04	2.008E+04	2.147E+04	2.126E+04	2.155E+04	0.	0.
11	1.647E+04	1.970E+04	2.015E+04	2.180E+04	2.256E+04	2.278E+04	2.193E+04	2.434E+04	2.364E+04	0.	0.
12	1.037E+04	1.630E+04	1.703E+04	2.057E+04	2.136E+04	2.421E+04	2.288E+04	2.747E+04	2.933E+04	0.	0.
13	6.306E+03	1.303E+04	1.403E+04	1.914E+04	1.968E+04	2.445E+04	2.435E+04	3.075E+04	3.284E+04	0.	0.
14	5.351E+03	1.145E+04	1.298E+04	1.844E+04	1.930E+04	2.481E+04	2.584E+04	3.363E+04	3.499E+04	0.	0.
15	3.430E+03	9.986E+03	1.266E+04	1.816E+04	1.970E+04	2.543E+04	2.711E+04	3.546E+04	3.799E+04	0.	0.

Figure 12 - Continued

W VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

W VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	-3,761E+04	8,690E+03	2,367E+04	1,723E+04	2,629E+04	3,346E+04	4,030E+04	4,654E+04	5,607E+04	3,298E+05	3,298E+05
2	-4,734E+03	1,253E+04	2,085E+04	2,513E+04	3,309E+04	3,876E+04	4,701E+04	5,029E+04	6,764E+04	3,298E+05	3,298E+05
3	1,127E+04	2,290E+04	2,966E+04	3,459E+04	4,134E+04	4,736E+04	5,386E+04	6,090E+04	6,720E+04	3,298E+05	3,298E+05
4	2,630E+04	3,636E+04	4,213E+04	4,773E+04	5,453E+04	6,070E+04	6,740E+04	7,397E+04	8,228E+04	3,298E+05	3,298E+05
5	4,416E+04	5,207E+04	5,860E+04	6,423E+04	7,065E+04	7,647E+04	8,344E+04	8,884E+04	9,725E+04	3,298E+05	3,298E+05
6	6,615E+04	7,223E+04	7,774E+04	8,322E+04	8,883E+04	9,337E+04	1,015E+05	1,047E+05	1,170E+05	3,298E+05	3,298E+05
7	8,757E+04	9,266E+04	9,695E+04	1,019E+05	1,076E+05	1,127E+05	1,188E+05	1,221E+05	1,339E+05	3,298E+05	3,298E+05
8	1,128E+05	1,160E+05	1,187E+05	1,227E+05	1,265E+05	1,328E+05	1,349E+05	1,435E+05	1,439E+05	3,298E+05	3,298E+05
9	1,372E+05	1,391E+05	1,396E+05	1,424E+05	1,439E+05	1,512E+05	1,520E+05	1,640E+05	1,593E+05	3,298E+05	3,298E+05
10	1,676E+05	1,638E+05	1,623E+05	1,616E+05	1,631E+05	1,654E+05	1,713E+05	1,722E+05	1,867E+05	3,298E+05	3,298E+05
11	1,997E+05	1,907E+05	1,860E+05	1,811E+05	1,822E+05	1,787E+05	1,866E+05	1,811E+05	2,043E+05	3,298E+05	3,298E+05
12	2,206E+05	2,119E+05	2,076E+05	1,993E+05	2,003E+05	1,934E+05	2,001E+05	1,925E+05	2,130E+05	3,298E+05	3,298E+05
13	2,300E+05	2,245E+05	2,206E+05	2,125E+05	2,129E+05	2,056E+05	2,100E+05	2,024E+05	2,225E+05	3,298E+05	3,298E+05
14	2,357E+05	2,319E+05	2,294E+05	2,227E+05	2,227E+05	2,160E+05	2,210E+05	2,119E+05	2,291E+05	3,298E+05	3,298E+05
15	2,414E+05	2,368E+05	2,340E+05	2,288E+05	2,289E+05	2,226E+05	2,277E+05	2,194E+05	2,330E+05	3,298E+05	3,298E+05

ENG VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

ENG VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	3,918E+10	4,100E+10	4,058E+10	4,076E+10	4,045E+10	4,032E+10	4,015E+10	4,004E+10	3,974E+10	1,942E+09	1,942E+09
2	4,023E+10	4,083E+10	4,014E+10	4,031E+10	3,998E+10	3,991E+10	3,951E+10	3,954E+10	3,856E+10	1,942E+09	1,942E+09
3	3,983E+10	3,981E+10	3,937E+10	3,941E+10	3,911E+10	3,889E+10	3,857E+10	3,824E+10	3,805E+10	1,942E+09	1,942E+09
4	3,864E+10	3,854E+10	3,828E+10	3,810E+10	3,780E+10	3,753E+10	3,704E+10	3,659E+10	3,613E+10	1,942E+09	1,942E+09
5	3,764E+10	3,735E+10	3,701E+10	3,661E+10	3,614E+10	3,586E+10	3,538E+10	3,483E+10	3,421E+10	1,942E+09	1,942E+09
6	3,585E+10	3,557E+10	3,526E+10	3,492E+10	3,436E+10	3,391E+10	3,324E+10	3,292E+10	3,178E+10	1,942E+09	1,942E+09
7	3,414E+10	3,378E+10	3,341E+10	3,304E+10	3,244E+10	3,183E+10	3,100E+10	3,064E+10	2,921E+10	1,942E+09	1,942E+09
8	3,181E+10	3,159E+10	3,123E+10	3,078E+10	3,036E+10	2,961E+10	2,909E+10	2,813E+10	2,744E+10	1,942E+09	1,942E+09
9	2,992E+10	2,971E+10	2,950E+10	2,891E+10	2,863E+10	2,765E+10	2,722E+10	2,561E+10	2,558E+10	1,942E+09	1,942E+09
10	2,714E+10	2,743E+10	2,742E+10	2,708E+10	2,660E+10	2,591E+10	2,515E+10	2,452E+10	2,311E+10	1,942E+09	1,942E+09
11	2,439E+10	2,506E+10	2,522E+10	2,541E+10	2,478E+10	2,448E+10	2,336E+10	2,347E+10	2,107E+10	1,942E+09	1,942E+09
12	2,232E+10	2,291E+10	2,319E+10	2,379E+10	2,319E+10	2,327E+10	2,188E+10	2,211E+10	1,948E+10	1,942E+09	1,942E+09
13	2,114E+10	2,141E+10	2,170E+10	2,238E+10	2,191E+10	2,226E+10	2,078E+10	2,088E+10	1,806E+10	1,942E+09	1,942E+09
14	2,014E+10	2,040E+10	2,049E+10	2,112E+10	2,064E+10	2,110E+10	1,969E+10	1,973E+10	1,693E+10	1,942E+09	1,942E+09
15	1,931E+10	1,980E+10	1,974E+10	2,038E+10	1,983E+10	2,032E+10	1,898E+10	1,902E+10	1,620E+10	1,942E+09	1,942E+09

PRES VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

PRES VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	9,542E+04	1,010E+05	1,038E+05	1,012E+05	1,007E+05	9,901E+04	9,813E+04	9,662E+04	9,404E+04	7,978E+02	7,978E+02
2	9,735E+04	1,007E+05	9,970E+04	9,877E+04	9,801E+04	9,733E+04	9,479E+04	9,594E+04	8,627E+04	7,978E+02	7,978E+02
3	9,329E+04	9,487E+04	9,479E+04	9,414E+04	9,385E+04	9,292E+04	9,227E+04	9,020E+04	9,061E+04	7,978E+02	7,978E+02
4	8,605E+04	8,707E+04	8,746E+04	8,719E+04	8,709E+04	8,660E+04	8,606E+04	8,488E+04	8,417E+04	7,978E+02	7,978E+02
5	7,789E+04	7,894E+04	7,966E+04	7,991E+04	8,012E+04	8,027E+04	8,002E+04	8,011E+04	7,958E+04	7,978E+02	7,978E+02
6	6,786E+04	6,922E+04	7,036E+04	7,124E+04	7,175E+04	7,306E+04	7,189E+04	7,486E+04	7,065E+04	7,978E+02	7,978E+02
7	5,663E+04	5,836E+04	5,985E+04	6,130E+04	6,249E+04	6,421E+04	6,403E+04	6,785E+04	6,307E+04	7,978E+02	7,978E+02
8	4,583E+04	4,804E+04	4,997E+04	5,171E+04	5,400E+04	5,494E+04	5,798E+04	5,762E+04	6,165E+04	7,978E+02	7,978E+02
9	3,613E+04	3,865E+04	4,140E+04	4,312E+04	4,656E+04	4,669E+04	5,207E+04	4,893E+04	5,817E+04	7,978E+02	7,978E+02
10	2,719E+04	3,053E+04	3,356E+04	3,633E+04	3,934E+04	4,160E+04	4,431E+04	4,780E+04	4,455E+04	7,978E+02	7,978E+02
11	1,777E+04	2,159E+04	2,483E+04	2,887E+04	3,133E+04	3,596E+04	3,716E+04	4,493E+04	3,763E+04	7,978E+02	7,978E+02
12	1,240E+04	1,520E+04	1,810E+04	2,231E+04	2,451E+04	3,012E+04	3,100E+04	3,967E+04	3,579E+04	7,978E+02	7,978E+02
13	9,879E+03	1,166E+04	1,393E+04	1,759E+04	1,978E+04	2,515E+04	2,652E+04	3,488E+04	3,126E+04	7,978E+02	7,978E+02
14	8,570E+03	1,001E+04	1,156E+04	1,457E+04	1,649E+04	2,122E+04	2,288E+04	3,091E+04	2,876E+04	7,978E+02	7,978E+02
15	7,274E+03	8,862E+03	1,002E+04	1,269E+04	1,431E+04	1,853E+04	2,026E+04	2,761E+04	2,790E+04	7,978E+02	7,978E+02

Figure 12 - Continued

MACH VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

MACH VAR K= 1 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	2.572E-01	7.710E-02	1.768E-01	1.261E-01	1.893E-01	2.345E-01	2.816E-01	3.225E-01	3.897E-01	1.000E+01	1.000E+01
2	1.774E-01	1.910E-01	2.885E-01	2.686E-01	3.263E-01	3.453E-01	3.922E-01	4.133E-01	5.162E-01	1.000E+01	1.000E+01
3	3.215E-01	3.721E-01	4.157E-01	4.202E-01	4.651E-01	4.926E-01	5.300E-01	5.686E-01	6.064E-01	1.000E+01	1.000E+01
4	5.079E-01	5.430E-01	5.646E-01	5.844E-01	6.207E-01	6.640E-01	7.106E-01	7.510E-01	8.058E-01	1.000E+01	1.000E+01
5	6.509E-01	6.891E-01	7.198E-01	7.571E-01	7.963E-01	8.334E-01	8.887E-01	9.320E-01	9.991E-01	1.000E+01	1.000E+01
6	8.319E-01	8.627E-01	8.946E-01	9.339E-01	9.711E-01	1.005E+00	1.059E+00	1.104E+00	1.195E+00	1.000E+01	1.000E+01
7	9.825E-01	1.015E+00	1.046E+00	1.087E+00	1.138E+00	1.191E+00	1.237E+00	1.290E+00	1.372E+00	1.000E+01	1.000E+01
8	1.172E+00	1.193E+00	1.226E+00	1.260E+00	1.308E+00	1.376E+00	1.413E+00	1.500E+00	1.526E+00	1.000E+01	1.000E+01
9	1.341E+00	1.359E+00	1.381E+00	1.415E+00	1.454E+00	1.533E+00	1.595E+00	1.710E+00	1.742E+00	1.000E+01	1.000E+01
10	1.586E+00	1.561E+00	1.568E+00	1.584E+00	1.627E+00	1.681E+00	1.787E+00	1.833E+00	1.996E+00	1.000E+01	1.000E+01
11	1.847E+00	1.784E+00	1.772E+00	1.748E+00	1.799E+00	1.808E+00	1.932E+00	1.942E+00	2.201E+00	1.000E+01	1.000E+01
12	2.048E+00	1.990E+00	1.960E+00	1.908E+00	1.962E+00	1.940E+00	2.065E+00	2.066E+00	2.358E+00	1.000E+01	1.000E+01
13	2.158E+00	2.135E+00	2.098E+00	2.043E+00	2.086E+00	2.059E+00	2.181E+00	2.183E+00	2.504E+00	1.000E+01	1.000E+01
14	2.254E+00	2.232E+00	2.214E+00	2.165E+00	2.205E+00	2.181E+00	2.311E+00	2.310E+00	2.630E+00	1.000E+01	1.000E+01
15	2.345E+00	2.296E+00	2.293E+00	2.238E+00	2.284E+00	2.257E+00	2.394E+00	2.397E+00	2.720E+00	1.000E+01	1.000E+01

RHO VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

RHO VAR K= 2 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	6.197E-06	5.819E-06	6.666E-06	6.150E-06	6.269E-06	6.161E-06	6.122E-06	6.009E-06	5.925E-06	1.027E-06	1.027E-06
2	6.097E-06	6.094E-06	6.199E-06	6.127E-06	6.112E-06	6.098E-06	5.984E-06	6.063E-06	5.581E-06	1.027E-06	1.027E-06
3	5.943E-06	5.963E-06	6.007E-06	6.006E-06	5.992E-06	5.965E-06	5.983E-06	5.881E-06	5.953E-06	1.027E-06	1.027E-06
4	5.612E-06	5.680E-06	5.728E-06	5.773E-06	5.792E-06	5.826E-06	5.814E-06	5.899E-06	5.760E-06	1.027E-06	1.027E-06
5	5.215E-06	5.306E-06	5.381E-06	5.465E-06	5.530E-06	5.629E-06	5.624E-06	5.832E-06	5.562E-06	1.027E-06	1.027E-06
6	4.690E-06	4.814E-06	4.931E-06	5.055E-06	5.191E-06	5.327E-06	5.437E-06	5.604E-06	5.577E-06	1.027E-06	1.027E-06
7	4.125E-06	4.287E-06	4.451E-06	4.615E-06	4.822E-06	4.949E-06	5.307E-06	5.235E-06	5.852E-06	1.027E-06	1.027E-06
8	3.543E-06	3.754E-06	3.966E-06	4.198E-06	4.418E-06	4.667E-06	4.940E-06	5.230E-06	5.422E-06	1.027E-06	1.027E-06
9	2.827E-06	3.093E-06	3.321E-06	3.663E-06	3.878E-06	4.316E-06	4.462E-06	5.124E-06	5.035E-06	1.027E-06	1.027E-06
10	2.182E-06	2.444E-06	2.692E-06	3.058E-06	3.298E-06	3.780E-06	4.020E-06	4.710E-06	5.326E-06	1.027E-06	1.027E-06
11	1.786E-06	1.994E-06	2.247E-06	2.523E-06	2.853E-06	3.182E-06	3.741E-06	4.133E-06	5.634E-06	1.027E-06	1.027E-06
12	1.596E-06	1.755E-06	2.014E-06	2.206E-06	2.605E-06	2.850E-06	3.551E-06	3.848E-06	5.395E-06	1.027E-06	1.027E-06
13	1.451E-06	1.595E-06	1.842E-06	1.989E-06	2.398E-06	2.644E-06	3.389E-06	3.682E-06	4.846E-06	1.027E-06	1.027E-06
14	1.322E-06	1.498E-06	1.735E-06	1.865E-06	2.280E-06	2.553E-06	3.253E-06	3.750E-06	4.338E-06	1.027E-06	1.027E-06
15	1.112E-06	1.341E-06	1.567E-06	1.741E-06	2.101E-06	2.389E-06	3.016E-06	3.613E-06	4.495E-06	1.027E-06	1.027E-06

U VARIABLES (POLAR-ANGLE, THETA (I); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, (J))

U VAR K= 2 (I=ROW; J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11
1	1.923E+03	8.901E+03	7.878E+03	7.412E+03	1.093E+04	1.052E+04	1.215E+04	1.216E+04	1.472E+04	0.	0.
2	2.242E+04	2.955E+04	3.500E+04	3.235E+04	3.476E+04	3.372E+04	3.362E+04	3.452E+04	3.332E+04	0.	0.
3	4.761E+04	4.865E+04	5.143E+04	5.043E+04	5.247E+04	5.310E+04	5.428E+04	5.487E+04	5.648E+04	0.	0.
4	6.672E+04	6.691E+04	6.884E+04	6.906E+04	7.046E+04	7.192E+04	7.374E+04	7.536E+04	7.632E+04	0.	0.
5	8.138E+04	8.168E+04	8.274E+04	8.355E+04	8.484E+04	8.654E+04	8.779E+04	9.140E+04	9.002E+04	0.	0.
6	9.177E+04	9.186E+04	9.264E+04	9.366E+04	9.575E+04	9.766E+04	9.886E+04	1.019E+05	1.017E+05	0.	0.
7	9.805E+04	9.786E+04	9.887E+04	1.000E+05	1.024E+05	1.033E+05	1.072E+05	1.066E+05	1.134E+05	0.	0.
8	9.939E+04	9.895E+04	1.008E+05	1.026E+05	1.047E+05	1.065E+05	1.100E+05	1.117E+05	1.154E+05	0.	0.
9	9.183E+04	9.421E+04	9.612E+04	9.954E+04	1.018E+05	1.066E+05	1.076E+05	1.148E+05	1.119E+05	0.	0.
10	7.782E+04	8.462E+04	8.547E+04	9.172E+04	9.331E+04	1.009E+05	1.007E+05	1.110E+05	1.115E+05	0.	0.
11	6.787E+04	7.484E+04	7.570E+04	6.197E+04	8.472E+04	9.103E+04	9.499E+04	9.970E+04	1.116E+05	0.	0.
12	6.330E+04	6.707E+04	6.950E+04	7.328E+04	7.769E+04	8.123E+04	9.018E+04	9.035E+04	1.076E+05	0.	0.
13	6.074E+04	6.185E+04	6.491E+04	6.658E+04	7.224E+04	7.324E+04	8.482E+04	8.345E+04	9.856E+04	0.	0.
14	5.768E+04	5.884E+04	6.119E+04	6.126E+04	6.759E+04	6.764E+04	7.893E+04	7.891E+04	8.866E+04	0.	0.

Figure 12 - Continued

VARIABLE R VECTOR ([illegible], THETA (J); MERIDIONAL ANGLE, PHI (K); RADIAL DISTANCE, I))

K= 1 X-COORDINATE (I=ROW, J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	7.432E+00	7.542E+00	7.653E+00	7.764E+00	7.874E+00	7.985E+00	8.096E+00	8.206E+00	8.317E+00	8.427E+00	8.538E+00	8.649E+00
3	1.478E+01	1.502E+01	1.525E+01	1.548E+01	1.572E+01	1.595E+01	1.618E+01	1.642E+01	1.665E+01	1.689E+01	1.712E+01	1.735E+01
4	2.197E+01	2.234E+01	2.271E+01	2.308E+01	2.345E+01	2.382E+01	2.419E+01	2.456E+01	2.492E+01	2.529E+01	2.566E+01	2.603E+01
5	2.892E+01	2.942E+01	2.992E+01	3.042E+01	3.091E+01	3.141E+01	3.191E+01	3.241E+01	3.291E+01	3.341E+01	3.391E+01	3.441E+01
6	3.555E+01	3.617E+01	3.678E+01	3.740E+01	3.801E+01	3.863E+01	3.925E+01	3.986E+01	4.048E+01	4.109E+01	4.171E+01	4.233E+01
7	4.179E+01	4.252E+01	4.325E+01	4.397E+01	4.470E+01	4.543E+01	4.616E+01	4.688E+01	4.761E+01	4.834E+01	4.907E+01	4.979E+01
8	4.758E+01	4.842E+01	4.927E+01	5.011E+01	5.095E+01	5.179E+01	5.264E+01	5.348E+01	5.432E+01	5.516E+01	5.601E+01	5.685E+01
9	5.284E+01	5.381E+01	5.478E+01	5.575E+01	5.671E+01	5.768E+01	5.865E+01	5.962E+01	6.058E+01	6.155E+01	6.252E+01	6.349E+01
10	5.753E+01	5.864E+01	5.974E+01	6.085E+01	6.196E+01	6.307E+01	6.417E+01	6.528E+01	6.639E+01	6.750E+01	6.861E+01	6.971E+01
11	6.160E+01	6.288E+01	6.417E+01	6.546E+01	6.674E+01	6.803E+01	6.932E+01	7.060E+01	7.189E+01	7.318E+01	7.447E+01	7.575E+01
12	6.490E+01	6.641E+01	6.793E+01	6.945E+01	7.097E+01	7.248E+01	7.400E+01	7.552E+01	7.704E+01	7.855E+01	8.007E+01	8.159E+01
13	6.722E+01	6.900E+01	7.078E+01	7.257E+01	7.435E+01	7.614E+01	7.792E+01	7.970E+01	8.149E+01	8.327E+01	8.506E+01	8.684E+01
14	6.901E+01	7.107E+01	7.313E+01	7.518E+01	7.724E+01	7.930E+01	8.135E+01	8.341E+01	8.546E+01	8.752E+01	8.958E+01	9.163E+01
15	7.061E+01	7.290E+01	7.519E+01	7.748E+01	7.977E+01	8.206E+01	8.435E+01	8.664E+01	8.892E+01	9.121E+01	9.350E+01	9.579E+01
16	7.199E+01	7.449E+01	7.698E+01	7.948E+01	8.198E+01	8.447E+01	8.697E+01	8.946E+01	9.196E+01	9.445E+01	9.695E+01	9.944E+01

K= 1 Y-COORDINATE (I=ROW, J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

K= 1 Z-COORDINATE (I=ROW, J=COLUMN)

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.	-1.053E+00	-2.106E+00	-3.160E+00	-4.213E+00	-5.266E+00	-6.319E+00	-7.373E+00	-8.426E+00	-9.479E+00	-1.053E+01	-1.159E+01
2	4.121E-01	-6.409E-01	-1.694E+00	-2.747E+00	-3.800E+00	-4.853E+00	-5.906E+00	-6.959E+00	-8.012E+00	-9.064E+00	-1.012E+01	-1.117E+01
3	1.575E+00	5.229E-01	-5.295E-01	-1.582E+00	-2.635E+00	-3.687E+00	-4.740E+00	-5.792E+00	-6.844E+00	-7.897E+00	-8.949E+00	-1.000E+01
4	3.501E+00	2.446E+00	1.392E+00	3.370E-01	-7.177E-01	-1.772E+00	-2.827E+00	-3.882E+00	-4.937E+00	-5.991E+00	-7.046E+00	-8.101E+00
5	6.167E+00	5.111E+00	4.054E+00	2.998E+00	1.942E+00	8.853E-01	-1.710E-01	-1.227E+00	-2.284E+00	-3.340E+00	-4.397E+00	-5.453E+00
6	9.545E+00	8.478E+00	7.411E+00	6.343E+00	5.276E+00	4.209E+00	3.141E+00	2.074E+00	1.007E+00	-6.043E-02	-1.128E+00	-2.195E+00
7	1.360E+01	1.249E+01	1.136E+01	1.029E+01	9.185E+00	8.082E+00	6.979E+00	5.876E+00	4.773E+00	3.670E+00	2.567E+00	1.463E+00
8	1.828E+01	1.711E+01	1.594E+01	1.476E+01	1.359E+01	1.242E+01	1.124E+01	1.007E+01	8.898E+00	7.725E+00	6.552E+00	5.379E+00
9	2.354E+01	2.227E+01	2.099E+01	1.972E+01	1.844E+01	1.717E+01	1.589E+01	1.462E+01	1.334E+01	1.206E+01	1.079E+01	9.513E+00
10	2.933E+01	2.791E+01	2.650E+01	2.508E+01	2.367E+01	2.225E+01	2.084E+01	1.942E+01	1.801E+01	1.659E+01	1.518E+01	1.376E+01
11	3.555E+01	3.394E+01	3.232E+01	3.070E+01	2.908E+01	2.746E+01	2.585E+01	2.423E+01	2.261E+01	2.099E+01	1.937E+01	1.775E+01
12	4.229E+01	4.039E+01	3.849E+01	3.659E+01	3.469E+01	3.279E+01	3.090E+01	2.900E+01	2.710E+01	2.520E+01	2.330E+01	2.140E+01
13	4.967E+01	4.743E+01	4.520E+01	4.296E+01	4.072E+01	3.848E+01	3.624E+01	3.400E+01	3.177E+01	2.953E+01	2.729E+01	2.505E+01
14	5.703E+01	5.443E+01	5.183E+01	4.923E+01	4.663E+01	4.402E+01	4.142E+01	3.882E+01	3.622E+01	3.362E+01	3.102E+01	2.842E+01
15	6.384E+01	6.091E+01	5.797E+01	5.504E+01	5.211E+01	4.918E+01	4.625E+01	4.332E+01	4.039E+01	3.746E+01	3.453E+01	3.160E+01
16	6.996E+01	6.674E+01	6.350E+01	6.026E+01	5.702E+01	5.378E+01	5.053E+01	4.729E+01	4.405E+01	4.081E+01	3.757E+01	3.433E+01

Figure 12 - Concluded

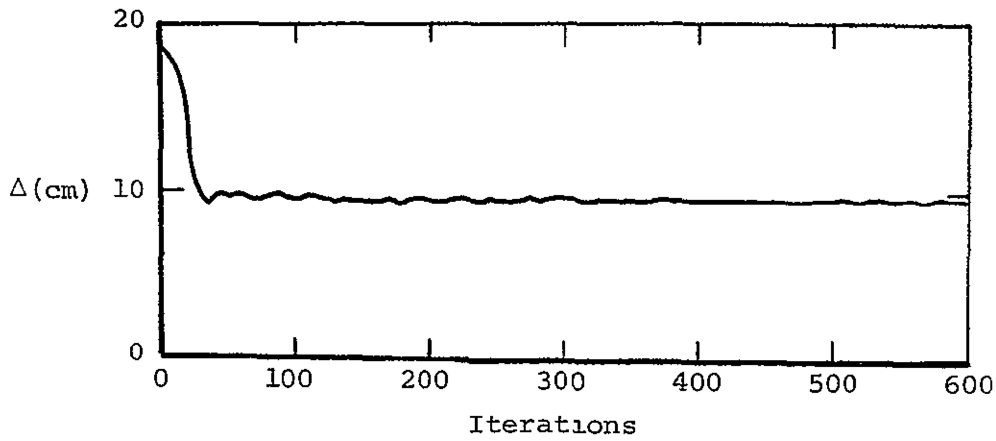


Figure 13.- Shock stand-off distance $M_\infty = 10$, $\alpha = 30^\circ$, ZFOCNL = 7.

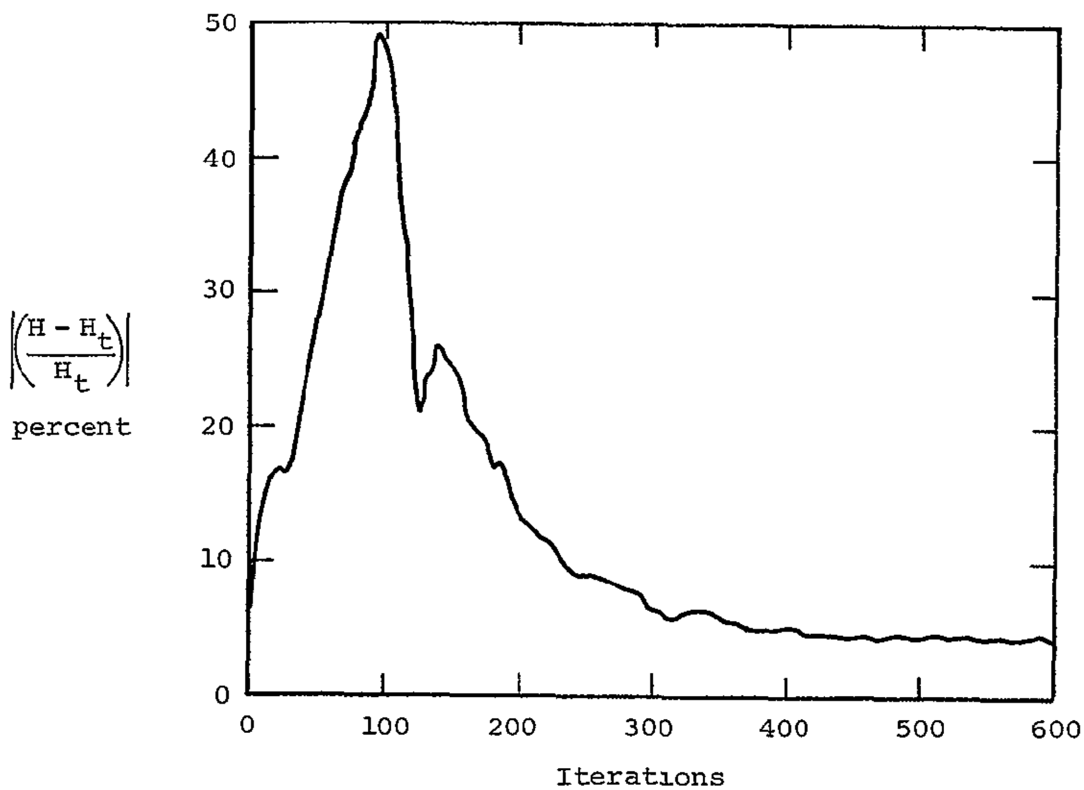


Figure 14.- Magnitude of maximum energy error, $M_\infty = 10$, $\alpha = 30^\circ$,ZFOCNL = 7.

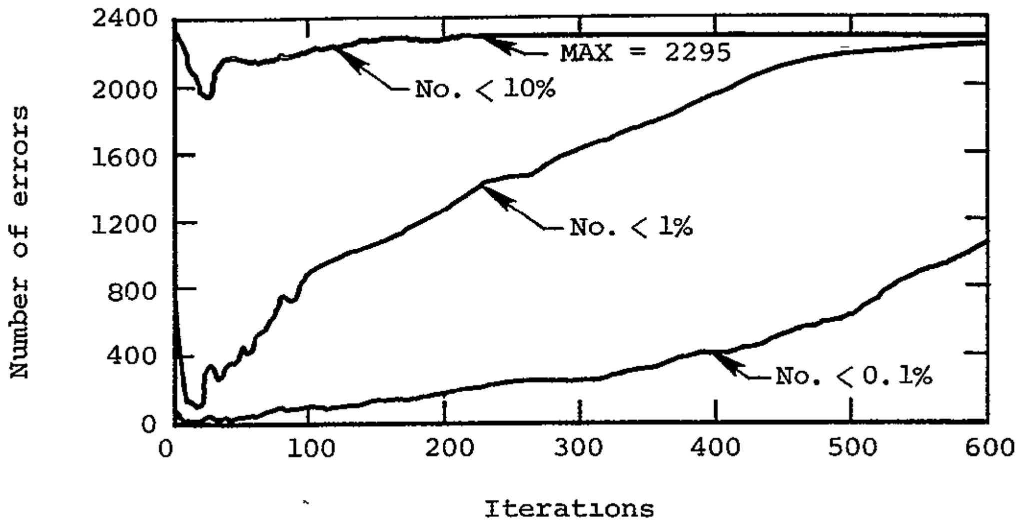


Figure 15.- Energy error count
$M_\infty = 10$, $\alpha = .30^0$, ZFOCNL = 7.

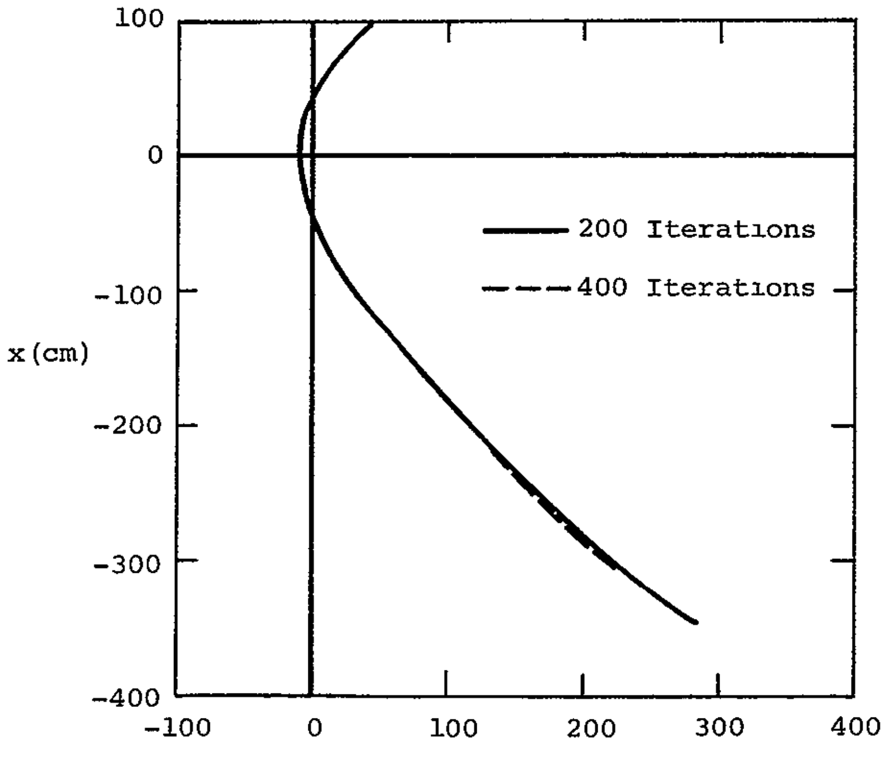


Figure 16.- Shock shape in symmetry plane.
$M_\infty = 10$, $\alpha = 30^0$, ZFOCNL = 7.

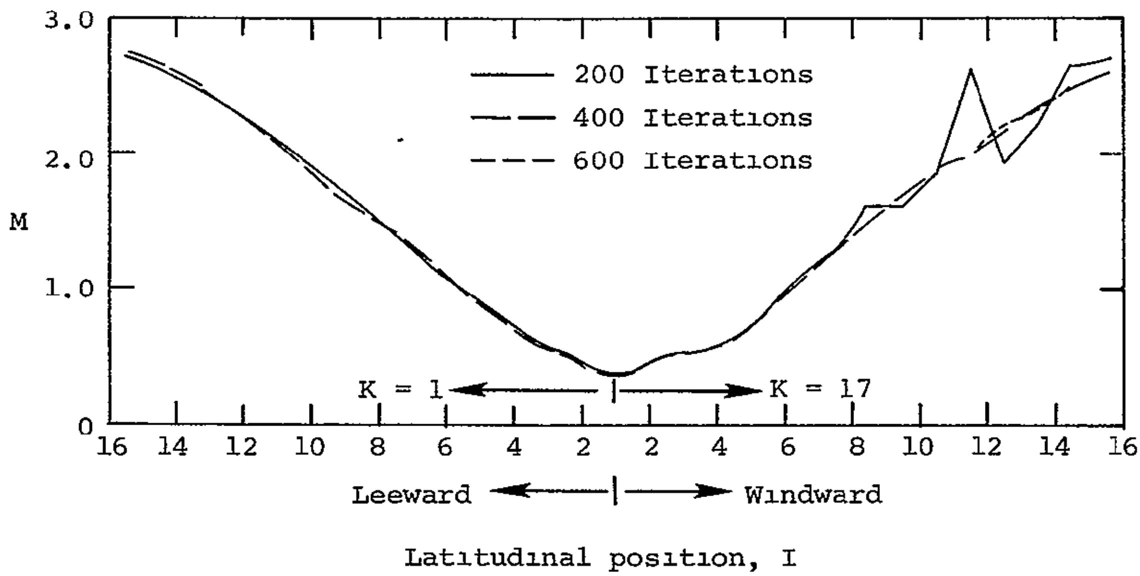


Figure 17.- Mach number distribution at the shock in the symmetry plane. $M_\infty = 10$, $\alpha = 30^\circ$, ZFOCNL = 7.

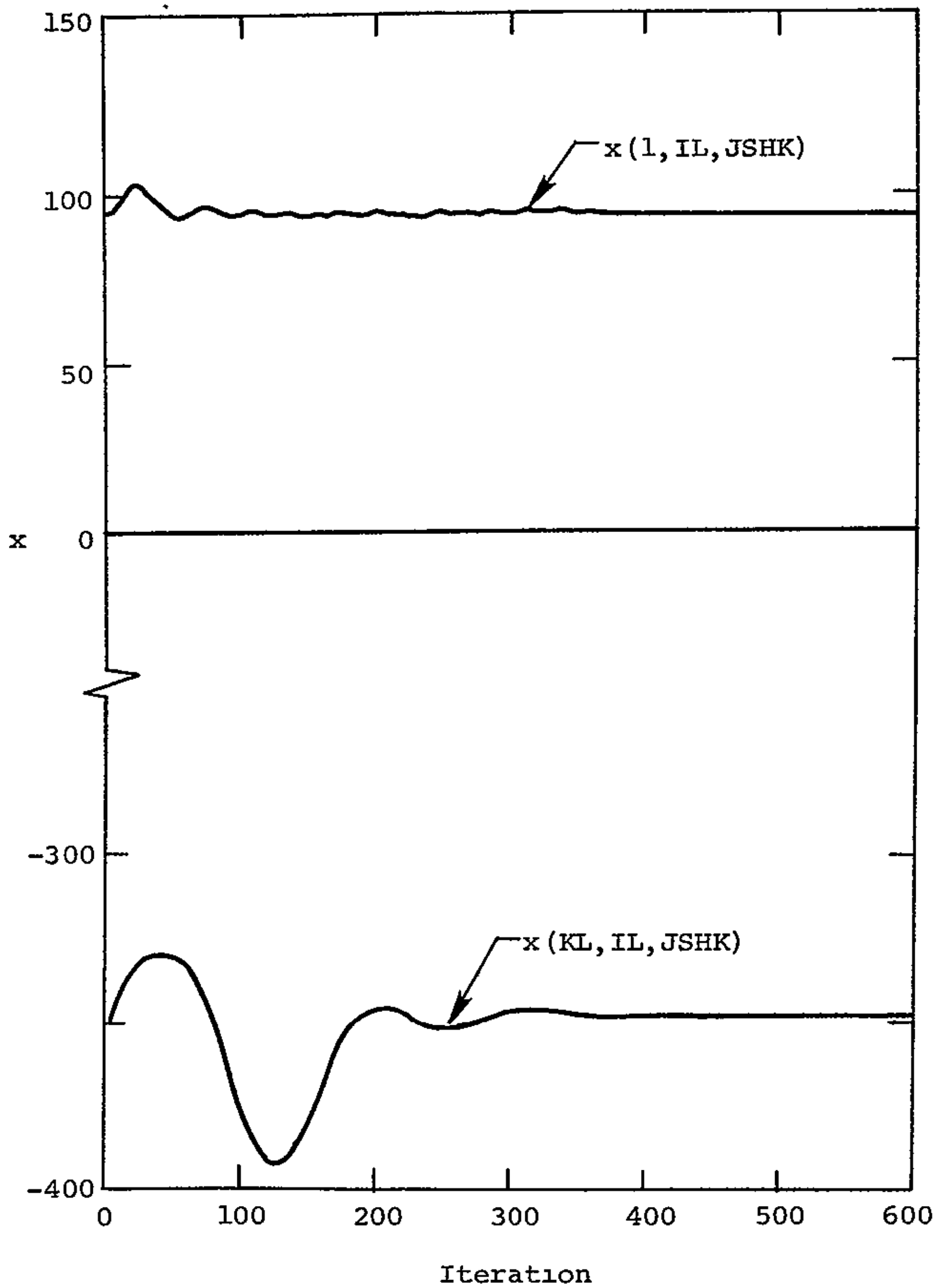


Figure 18.- Shock x-coordinates at exit boundary in symmetry plane. $M_\infty = 10$, $\alpha = 30^\circ$, ZFOCNL = 7.

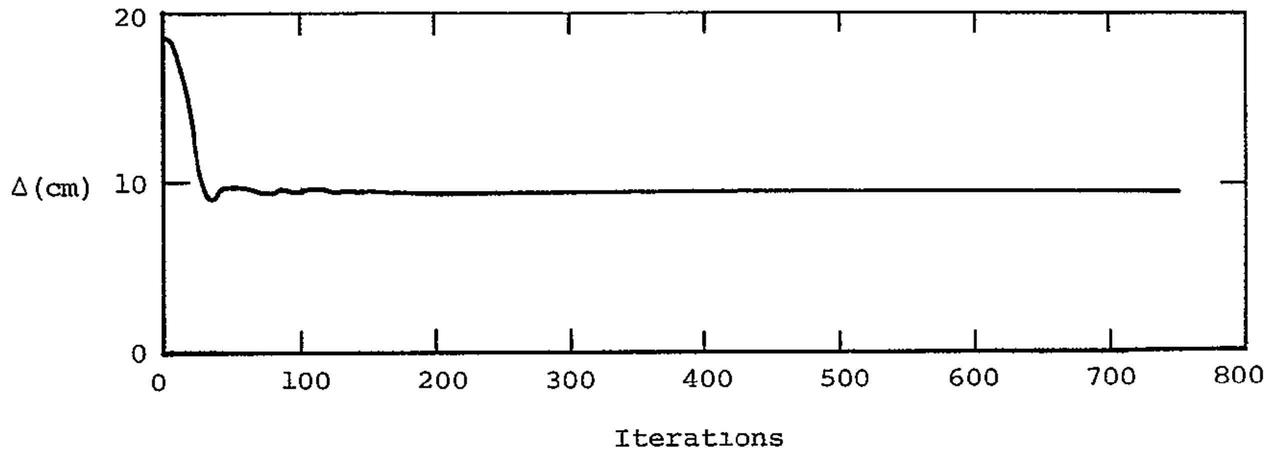


Figure 19.- Shock stand-off distance, $M_{\infty} = 10$, $\alpha = 30^{\circ}$, ZFOCNL = 5.

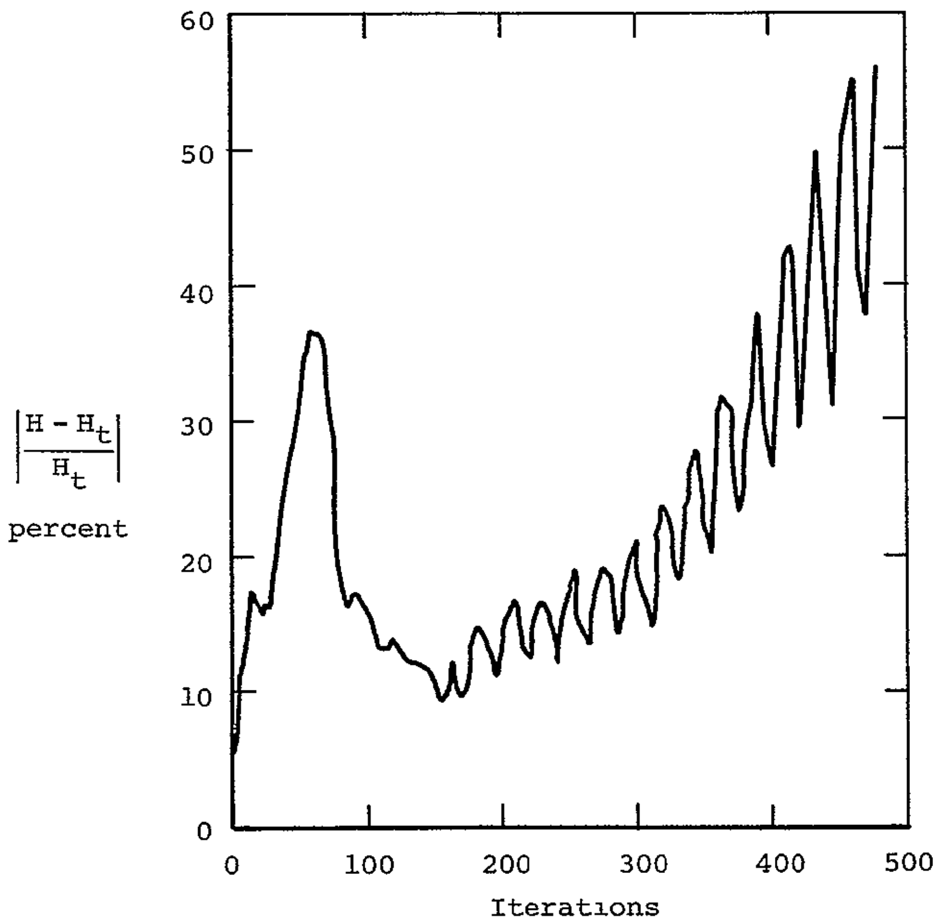


Figure 20.- Magnitude of maximum energy error. M = 10, $\alpha = 30^{\circ}$, ZFOCNL = 5.

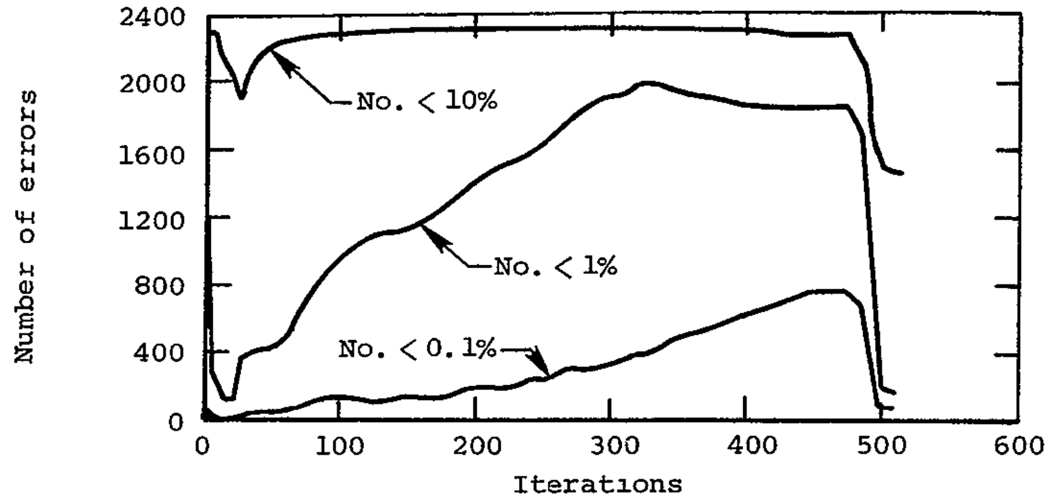


Figure 21.- Energy error count.
M = 10, α = 30°, ZFOCNL = 5.

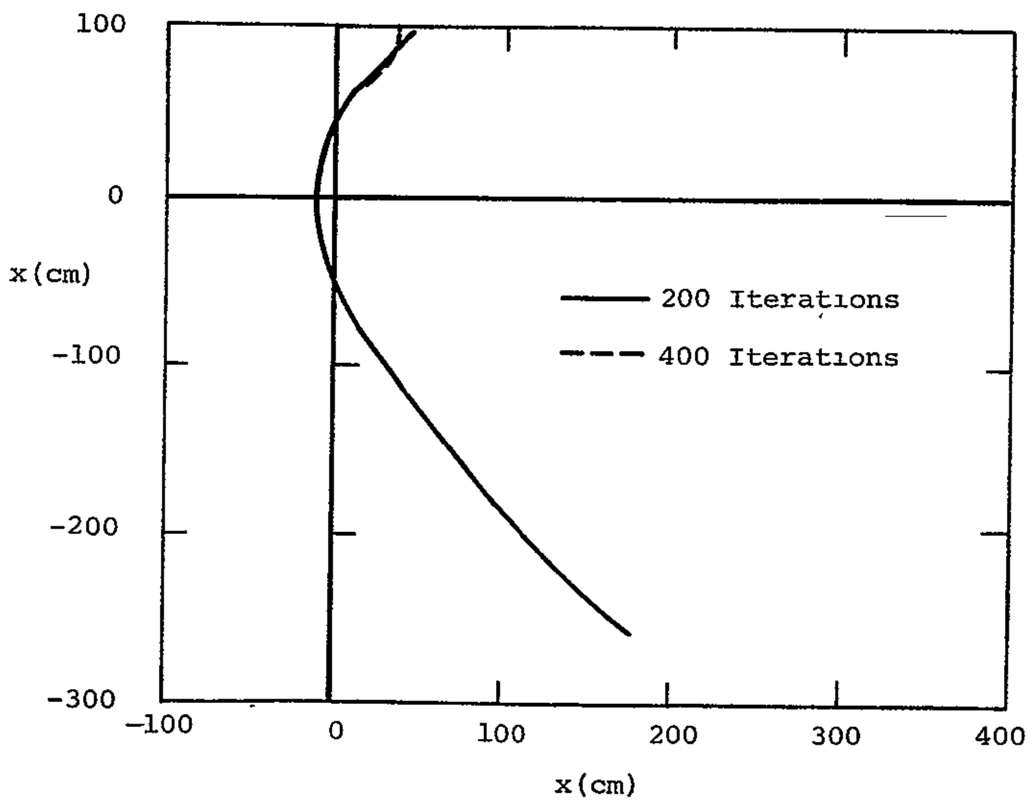


Figure 22.- Shock shape in symmetry plane.
M = 10, α = 30°, ZFOCNL = 5.

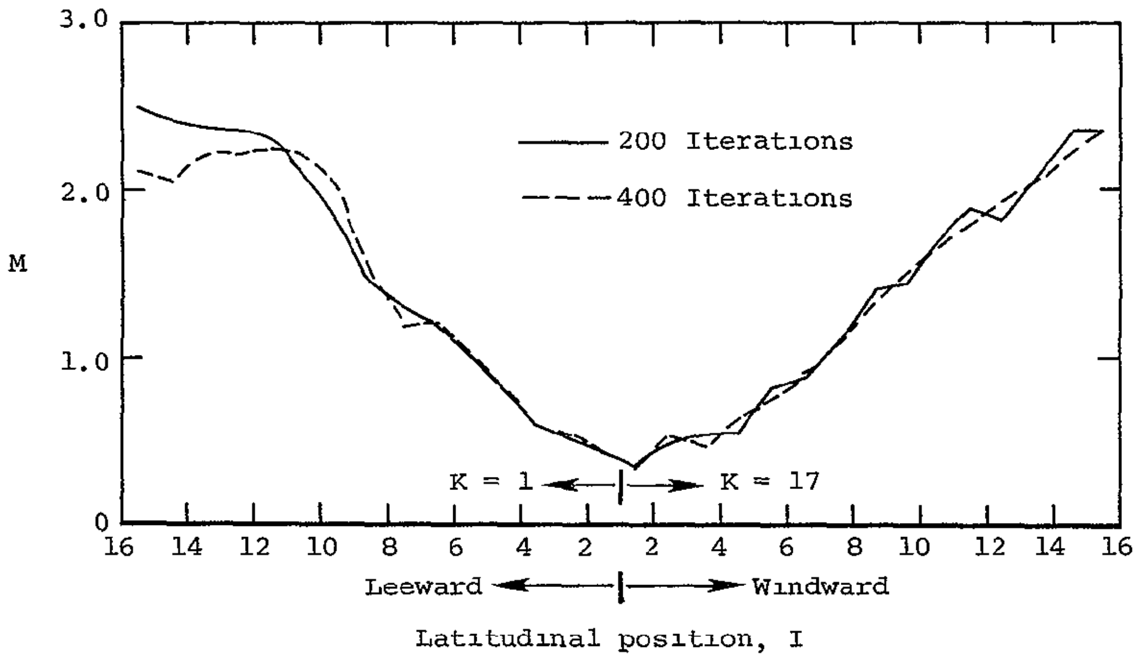


Figure 23.- Mach number distribution at shock
$M = 10$, $\alpha = 30^{\circ}$, ZFOCNL = 5,
in the symmetry plane.

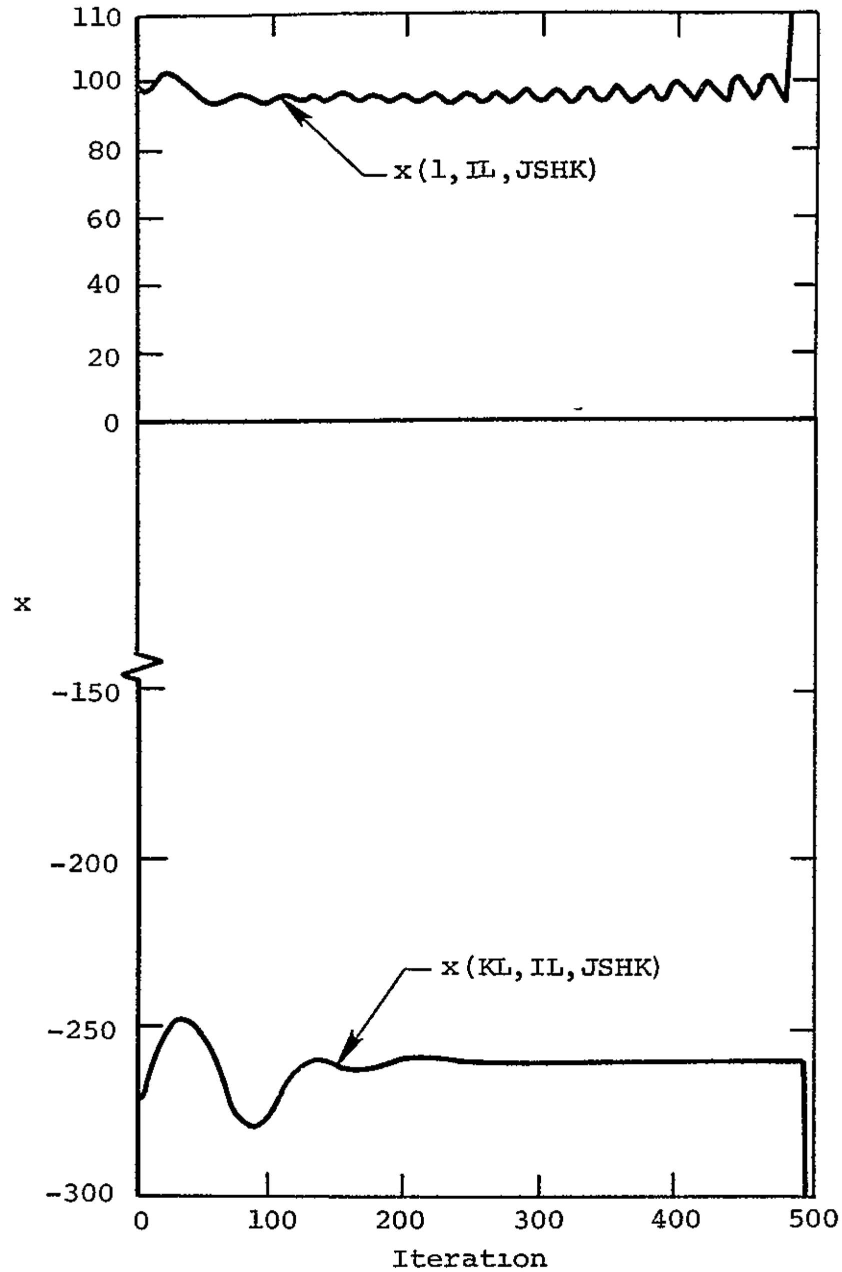


Figure 24.- Shock x-coordinates at exit boundary in symmetry plane, $M_\infty = 10$, $\alpha = 30^o$, ZFOCNL = 5.

GENERALIZED THREE DIMENSIONAL STEADY FLOW PROGRAM

DATA FROM UNSTEADY CODE NITER = 600

MACH=1.000000E+01 PINF=7 979000E+02 RINF=1.026900E-06 GAMMA=1.400000E+00

JL= 12 KL= 18 JSHK= 10

XO= -198 6643 ZC= 415.2391 BETAO= -30.5175 THETAO= 38.2948 ALFA= 30.0000

VINF= 3 29795E+05 AINF= 3 29795E+04 HINF= 2 71912E+09 RNZ= 3.38667E-01 EINF= 5.78398E+04 EIINF= 1.94223E+09 TINF= 2.69567E+02

INITIAL DATA

CON VARIABLES, NADV EQUALS 0

DENSITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	3.467E-06	3.468E-06	3 474E-06	3 482E-06	3.496E-06	3.516E-06	3.510E-06	3.471E-06	3.302E-06	3.003E-06	2.528E-06	1 946E-06	1.533E-06	1.498E-06	1.301E-06	1.112E-06	9.416E-07
2	3 975E-06	3 980E-06	3.982E-06	3 992E-06	4.006E-06	4.009E-06	4.013E-06	3.952E-06	3.785E-06	3.481E-06	3.004E-06	2.338E-06	1.809E-06	1.648E-06	1.493E-06	1.341E-06	1.119E-06
3	4.315E-06	4.317E-06	4.325E-06	4 335E-06	4 347E-06	4.370E-06	4.350E-06	4.293E-06	4.099E-06	3.763E-06	3.317E-06	2.667E-06	2 099E-06	1.890E-06	1 687E-06	1.567E-06	1.269E-06
4	4 580E-06	4 580E-06	4.582E-06	4.577E-06	4 583E-06	4 564E-06	4 548E-06	4.472E-06	4.321E-06	4.067E-06	3.672E-06	3.077E-06	2 381E-06	2.080E-06	1 950E-06	1.741E-06	1.557E-06
5	4.795E-06	4.799E-06	4.804E-06	4.818E-06	4.824E-06	4.847E-06	4.831E-06	4.763E-06	4.590E-06	4.245E-06	3.843E-06	3.323E-06	2.760E-06	2.488E-06	2.273E-06	2.101E-06	1.803E-06
6	5.040E-06	5.036E-06	5.038E-06	5.014E-06	5.012E-06	4.954E-06	4.910E-06	4.840E-06	4.725E-06	4.607E-06	4.296E-06	3.859E-06	3.078E-06	2 694E-06	2.686E-06	2.389E-06	2.280E-06
7	5.110E-06	5.115E-06	5 211E-06	5.134E-06	5.141E-06	5.176E-06	5.195E-06	5.144E-06	5.021E-06	4.653E-06	4.315E-06	3.926E-06	3.733E-06	3.516E-06	3.218E-06	3.016E-06	2.669E-06
8	5.389E-06	5 385E-06	5.391E-06	5 363E-06	5.357E-06	5.270E-06	5.188E-06	5.135E-06	5.085E-06	5.190E-06	5.078E-06	4.873E-06	3.801E-06	3 450E-06	3.691E-06	3 613E-06	3.628E-06
9	5 307E-06	5.310E-06	5 292E-06	5 318E-06	5.321E-06	5 383E-06	5.460E-06	5.412E-06	5.364E-06	4.887E-06	4.320E-06	4.465E-06	5.731E-06	5 978E-06	5.342E-06	4.495E-06	4.306E-06
10	1.027E-06	1 027E-06	1.027E-06	1 027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
11	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1 027E-06	1.027E-06	1 027E-06	1.027E-06	1.027E-06

UX VELOCITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	-1.148E+05	-1 145E+05	-1.139E+05	-1.130E+05	-1.110E+05	-1.087E+05	-1.028E+05	-9.422E+04	-7.800E+04	-5.382E+04	-2.293E+04	8.239E+03	2.164E+04	2 853E+04	4.779E+04	5.315E+04	3.466E+04
2	-1.256E+05	-1.247E+05	-1.238E+05	-1.223E+05	-1.202E+05	-1.164E+05	-1.111E+05	-1.022E+05	-8.787E+04	-6.746E+04	-4.166E+04	-1.080E+04	6 272E+03	1.930E+04	3.960E+04	5.086E+04	4.784E+04
3	-1 293E+05	-1 288E+05	-1 279E+05	-1 265E+05	-1 240E+05	-1 205E+05	-1.142E+05	-1.051E+05	-9.015E+04	-7.038E+04	-4.677E+04	-2.148E+04	-2.510E+03	1 255E+04	3 666E+04	5.696E+04	5.294E+04
4	-1.311E+05	-1.306E+05	-1.294E+05	-1.274E+05	-1.246E+05	-1.201E+05	-1.138E+05	-1.045E+05	-9.052E+04	-7.289E+04	-5.084E+04	-2.614E+04	-8.718E+03	9.913E+03	3.430E+04	5.502E+04	6.097E+04
5	-1.321E+05	-1.316E+05	-1 305E+05	-1.286E+05	-1.257E+05	-1.215E+05	-1.148E+05	-1.046E+05	-9.039E+04	-7.118E+04	-5.022E+04	-2 933E+04	-1.239E+04	8.689E+03	3.425E+04	6.190E+04	7.180E+04
6	-1.331E+05	-1 325E+05	-1.311E+05	-1 286E+05	-1.252E+05	-1.196E+05	-1.125E+05	-1.025E+05	-8.940E+04	-7.252E+04	-5.232E+04	-2 944E+04	-1.291E+04	8 616E+03	3.645E+04	6.079E+04	8.825E+04
7	-1.321E+05	-1.314E+05	-1 300E+05	-1 279E+05	-1.246E+05	-1 201E+05	-1 129E+05	-1 023E+05	-8.780E+04	-6.835E+04	-4.847E+04	-3.055E+04	-1.221E+04	1 304E+04	3.879E+04	7 152E+04	9 136E+04
8	-1.332E+05	-1 325E+05	-1 310E+05	-1 282E+05	-1.243E+05	-1.179E+05	-1 096E+05	-9.921E+04	-8.632E+04	-7 063E+04	-5.129E+04	-2.738E+04	-6.946E+03	1 345E+04	4.328E+04	7 149E+04	1.088E+05
9	-1.305E+05	-1.298E+05	-1.280E+05	-1 257E+05	-1.220E+05	-1.173E+05	-1 098E+05	-9 830E+04	-8.272E+04	-6.178E+04	-4.068E+04	-2.683E+04	-1.144E+03	2 653E+04	5.082E+04	8 107E+04	1 067E+05
10	0.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
11	0.	0	0	0.	0.	0.	0.	0	0.	0.	0.	0.	0.	0.	0.	0	0

Figure 25 - Selected sample output from program 2

8

UY VELOCITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	3.422E+03	1.05[illegible]E+04	1.794E+04	2.591E+04	3.514E+04	4.558E+04	5.846E+04	7.296E+04	8.827E+04	1.009E+05	1.031E+05	8.853E+04	7.483E+04	6.899E+04	5.155E+04	2.69[illegible]E+04	3.430E+03
2	3.946E+03	1.190E+04	2.018E+04	2.905E+04	3.883E+04	4.958E+04	6.256E+04	7.643E+04	9.127E+04	1.032E+05	1.078E+05	9.832E+04	8.008E+04	7.610E+04	5.901E+04	[illegible].450E+04	9.986E+03
3	4.209E+03	1.285E+04	2.175E+04	3.125E+04	4.147E+04	5.319E+04	6.584E+04	7.964E+04	9.299E+04	1.033E+05	1.071E+05	1.002E+05	9.231E+04	8.225E+04	6.921E+04	4.802E+04	1.266E+04
4	4.464E+03	1.350E+04	2.267E+04	3.265E+04	4.[illegible]39E+04	5.466E+04	6.756E+04	8.042E+04	9.416E+04	1.049E+05	1.107E+05	1.076E+05	9.410E+04	8.646E+04	7.521E+04	5.361E+04	1.818E+04
5	4.613E+03	1.399E+04	2.301E+04	3.385E+04	4.470E+04	5.698E+04	6.979E+04	8.345E+04	9.584E+04	1.052E+05	1.093E+05	1.073E+05	1.057E+05	9.463E+04	8.432E+04	6.387E+04	1.976E+04
6	4.785E+03	1.447E+04	2.454E+04	3.490E+04	4.633E+04	5.794E+04	7.050E+04	8.335E+04	9.587E+04	1.074E+05	1.144E+05	1.157E+05	1.040E+05	9.522E+04	8.950E+04	6.844E+04	2.543E+04
7	4.829E+03	1.469E+04	2.469E+04	3.545E+04	4.672E+04	5.924E+04	7.271E+04	8.643E+04	9.902E+04	1.074E+05	1.115E+05	1.1[illegible]7E+05	1.148E+05	1.091E+05	9.823E+04	7.763E+04	2.711E+04
8	5.015E+03	1.513E+04	2.571E+04	3.666E+04	4.861E+04	6.051E+04	7.298E+04	8.565E+04	9.783E+04	1.112E+05	1.207E+05	1.253E+05	1.084E+05	9.955E+04	9.849E+04	8.248E+04	3.546E+04
9	4.961E+03	1.515E+04	2.536E+04	3.649E+04	4.780E+04	6.079E+04	7.516E+04	3.907E+04	1.025E+05	1.085E+05	1.076E+05	1.123E+05	1.322E+05	1.340E+05	1.167E+05	8.719E+04	3.799E+04
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.
11	0.	0.	0.	0.	0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0.	0

UZ VELOCITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.673E+05	1.673E+05	1.670E+05	1.666E+05	1.658E+05	1.653E+05	1.645E+05	1.655E+05	1.686E+05	1.769E+05	1.907E+05	2.066E+05	2.174E+05	2.181E+05	2.225E+05	2.326E+05	2.414E+05
2	1.857E+05	1.857E+05	1.853E+05	1.851E+05	1.844E+05	1.839E+05	1.836E+05	1.843E+05	1.873E+05	1.940E+05	2.047E+05	2.143E+05	2.250E+05	2.251E+05	2.260E+05	2.295E+05	2.368E+05
3	1.953E+05	1.951E+05	1.948E+05	1.941E+05	1.934E+05	1.928E+05	1.923E+05	1.934E+05	1.961E+05	2.026E+05	2.135E+05	2.218E+05	2.256E+05	2.289E+05	2.265E+05	2.264E+05	2.349E+05
4	2.011E+05	2.011E+05	2.007E+05	2.005E+05	1.998E+05	1.997E+05	1.996E+05	2.005E+05	2.03[illegible]E+05	2.073E+05	2.156E+05	2.230E+05	2.305E+05	2.329E+05	2.304E+05	2.297E+05	2.288E+05
5	2.069E+05	2.067E+05	2.063E+05	2.056E+05	2.049E+05	2.040E+05	2.036E+05	2.047E+05	2.071E+05	2.131E+05	2.214E+05	2.292E+05	2.300E+05	2.324E+05	2.312E+05	2.278E+05	2.289E+05
6	2.102E+05	2.101E+05	2.097E+05	2.094E+05	2.089E+05	2.091E+05	2.093E+05	2.104E+05	2.126E+05	2.151E+05	2.208E+05	2.272E+05	2.363E+05	2.386E+05	2.353E+05	2.349E+05	2.226E+05
7	2.149E+05	2.146E+05	2.143E+05	2.134E+05	2.128E+05	2.117E+05	2.111E+05	2.122E+05	2.144E+05	2.210E+05	2.279E+05	2.350E+05	2.349E+05	2.355E+05	2.358E+05	2.326E+05	2.277E+05
8	2.156E+05	2.155E+05	2.150E+05	2.150E+05	2.146E+05	2.152E+05	2.162E+05	2.173E+05	2.191E+05	2.194E+05	2.227E+05	2.293E+05	2.458E+05	2.506E+05	2.423E+05	2.387E+05	2.194E+05
9	2.211E+05	2.209E+05	2.208E+05	2.201E+05	2.196E+05	2.185E+05	2.173E+05	2.186E+05	2.208E+05	2.298E+05	2.405E+05	2.450E+05	2.354E+05	2.315E+05	2.378E+05	2.397E+05	2.330E+05
10	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05
11	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05	3.298E+05

Figure 25 - Continued

PRESSURE

	1 / 12	2 / 13	3 / 14	4 / 15	5 / 16	6 / 17	7	8	9	10	11
1	3.612E+04	3.644E+04	3.622E+04	3.630E+04	3.651E+04	3.664E+04	3.668E+04	3.600E+04	3.394E+04	2.996E+04	2.406E+04
	1.169E+04	1.330E+04	1.304E+04	1.106E+04	8.973E+03	7.274E+03					
2	3.636E+04	3.640E+04	3.649E+04	3.655E+04	3.675E+04	3.684E+04	3.681E+04	3.608E+04	3.411E+04	3.052E+04	2.526E+04
	1.956E+04	1.476E+04	1.348E+04	1.237E+04	1.103E+04	8.862E+03					
3	3.657E+04	3.662E+04	3.671E+04	3.688E+04	3.706E+04	3.727E+04	3.721E+04	3.647E+04	3.458E+04	3.096E+04	2.604E+04
	2.075E+04	1.640E+04	1.482E+04	1.362E+04	1.267E+04	1.002E+04					
4	3.701E+04	3.701E+04	3.710E+04	3.709E+04	3.724E+04	3.709E+04	3.693E+04	3.617E+04	3.453E+04	3.196E+04	2.775E+04
	2.299E+04	1.772E+04	1.551E+04	1.513E+04	1.375E+04	1.269E+04					
5	3.689E+04	3.697E+04	3.707E+04	3.732E+04	3.750E+04	3.780E+04	3.775E+04	3.704E+04	3.538E+04	3.191E+04	2.783E+04
	2.337E+04	1.985E+04	1.822E+04	1.694E+04	1.643E+04	1.461E+04					
6	3.766E+04	3.766E+04	3.777E+04	3.767E+04	3.778E+04	3.734E+04	3.697E+04	3.622E+04	3.498E+04	3.371E+04	3.052E+04
	2.674E+04	2.074E+04	1.839E+04	1.908E+04	1.721E+04	1.853E+04					
7	3.690E+04	3.700E+04	3.704E+04	3.741E+04	3.758E+04	3.807E+04	3.831E+04	3.769E+04	3.639E+04	3.263E+04	2.918E+04
	2.544E+04	2.435E+04	2.356E+04	2.173E+04	2.125E+04	2.026E+04					
8	3.845E+04	3.846E+04	3.863E+04	3.847E+04	3.855E+04	3.784E+04	3.707E+04	3.643E+04	3.565E+04	3.622E+04	3.470E+04
	3.184E+04	2.255E+04	1.983E+04	2.314E+04	2.322E+04	2.761E+04					
9	3.660E+04	3.668E+04	3.659E+04	3.696E+04	3.709E+04	3.775E+04	3.849E+04	3.784E+04	3.694E+04	3.199E+04	2.639E+04
	2.572E+04	2.412E+04	3.641E+04	3.163E+04	2.755E+04	2.790E+04					
10	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02
	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02					
11	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02
	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.973E+02	7.978E+02					

MACH NUM

	1 / 12	2 / 13	3 / 14	4 / 15	5 / 16	6 / 17	7	8	9	10	11
1	1.680E+00	1.660E+00	1.680E+00	1.680E+00	1.676E+00	1.681E+00	1.675E+00	1.693E+00	1.715E+00	1.783E+00	1.888E+00
	1.994E+00	2.096E+00	2.088E+00	2.139E+00	2.259E+00	2.345E+00					
2	1.978E+00	1.979E+00	1.975E+00	1.977E+00	1.972E+00	1.968E+00	1.972E+00	1.983E+00	[illegible]	2.075E+00	2.167E+00
	2.181E+00	2.235E+00	2.228E+00	2.200E+00	2.214E+00	2.296E+00					
3	2.151E+00	2.148E+00	2.147E+00	2.142E+00	2.136E+00	2.137E+00	2.130E+00	2.147E+00	2.162E+00	2.218E+00	2.322E+00
	2.341E+00	2.331E+00	2.325E+00	2.253E+00	2.224E+00	2.293E+00					
4	2.256E+00	2.257E+00	2.253E+00	2.251E+00	2.245E+00	2.244E+00	2.246E+00	2.255E+00	2.283E+00	2.320E+00	2.408E+00
	2.434E+00	2.441E+00	2.434E+00	2.349E+00	2.304E+00	2.238E+00					
5	2.366E+00	2.363E+00	2.360E+00	2.351E+00	2.344E+00	2.337E+00	2.332E+00	2.344E+00	2.363E+00	2.419E+00	2.502E+00
	2.567E+00	2.517E+00	2.480E+00	2.432E+00	2.337E+00	2.284E+00					
6	2.433E+00	2.431E+00	2.426E+00	2.421E+00	2.413E+00	2.412E+00	2.414E+00	2.427E+00	2.453E+00	2.481E+00	2.548E+00
	2.605E+00	2.661E+00	2.630E+00	2.550E+00	2.511E+00	2.257E+00					
7	2.509E+00	2.505E+00	2.500E+00	2.489E+00	2.481E+00	2.468E+00	2.462E+00	2.478E+00	2.501E+00	2.574E+00	2.655E+00
	2.751E+00	2.739E+00	2.683E+00	2.658E+00	2.572E+00	2.394E+00					
8	2.536E+00	2.534E+00	2.527E+00	2.524E+00	2.517E+00	2.521E+00	2.531E+00	2.547E+00	2.574E+00	2.589E+00	2.643E+00
	2.748E+00	2.949E+00	3.010E+00	2.031E+00	2.767E+00	2.397E+00					
9	2.613E+00	2.609E+00	2.607E+00	2.596E+00	2.589E+00	2.576E+00	2.565E+00	2.585E+00	2.619E+00	2.736E+00	2.883E+00
	3.015E+00	2.957E+00	2.911E+00	2.962E+00	2.890E+00	2.720E+00					
10	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01
	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01					
11	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01
	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01					

Figure 25 - Continued

MARCH MACH

	1	2	3	4	5	6	7	8	9	10	11
	12	[illegible]	[illegible]	[illegible]	16	17					
1	1.607E+00	1.595E+00	1.573E+00	1.543E+00	1.524E+00	1.474E+00	1.435E+00	1.428E+00	1.444E+00	1.515E+00	1.614E+00
	1.660E+00	1.710E+00	1.770E+00	1.724E+00	1.773E+00	1.683E+00					
2	1.886E+00	1.875E+00	1.847E+00	1.813E+00	1.768E+00	1.720E+00	1.683E+00	1.658E+00	1.665E+00	1.708E+00	1.779E+00
	1.782E+00	1.757E+00	1.739E+00	1.736E+00	1.737E+00	1.734E+00					
3	2.046E+00	2.03[illegible]E+00	2.005E+00	1.965E+00	1.9[illegible]E+00	1.873E+00	1.822E+00	1.797E+00	1.783E+00	1.810E+00	1.874E+00
	1.861E+00	1.824E+00	1.766E+00	1.775E+00	1.793E+00	1.776E+00					
4	2.143E+00	2.130E+00	2.101E+00	2.063E+00	2.016E+00	1.966E+00	1.924E+00	1.887E+00	1.882E+00	1.886E+00	1.936E+00
	1.936E+00	1.675E+00	1.858E+00	1.839E+00	1.844E+00	1.815E+00					
5	2.239E+00	2.223E+00	2.196E+00	2.153E+00	2.104E+00	2.053E+00	2.003E+00	1.972E+00	1.953E+00	1.970E+00	2.005E+00
	2.018E+00	1.940E+00	1.903E+00	1.911E+00	1.913E+00	1.878E+00					
6	2.300E+00	2.285E+00	2.255E+00	2.215E+00	2.167E+00	2.118E+00	2.074E+00	2.042E+00	2.026E+00	2.024E+00	2.052E+00
	2.076E+00	2.043E+00	2.012E+00	2.017E+00	2.037E+00	1.944E+00					
7	2.360E+00	2.[illegible]44E+00	2.[illegible]15E+00	2.272E+00	2.224E+00	2.171E+00	2.124E+00	2.098E+00	2.084E+00	2.110E+00	2.138E+00
	2.165E+00	2.137E+00	2.108E+00	2.121E+00	2.148E+00	2.067E+00					
8	2.386E+00	2.373E+00	2.344E+00	2.307E+00	2.262E+00	2.218E+00	2.182E+00	2.153E+00	2.138E+00	2.132E+00	2.155E+00
	2.229E+00	2.204E+00	2.332E+00	2.279E+00	2.299E+00	2.154E+00					
9	2.442E+00	2.427E+00	2.40[illegible]E+00	2.359E+00	2.313E+00	2.264E+00	2.220E+00	2.203E+00	2.206E+00	2.263E+00	2.326E+00
	2.386E+00	2.416E+00	2.465E+00	2.442E+00	2.451E+00	2.407E+00					
10	6.251E+00	6.249E+00	6.244E+00	6.238E+00	6.229E+00	6.219E+00	6.207E+00	6.195E+00	6.182E+00	6.169E+00	6.156E+00
	6.144E+00	6.134E+00	6.125E+00	6.117E+00	6.112E+00	6.110E+00					
11	6.251E+00	6.249E+00	6.244E+00	6.238E+00	6.229E+00	6.219E+00	6.207E+00	6.195E+00	6.182E+00	6.169E+00	6.156E+00
	6.144E+00	6.134E+00	6.125E+00	6.117E+00	6.112E+00	6.110E+00					

ENTHALPY ADJUSTED ON INITIAL DATA

Figure 25 - Continued

FLOW VARIABLES, NADV LEVELS

DENSITY

	1	2	3	4	5	6	7	8	9	10	11
1	3.464E-06	3.466E-06		3.481E-06	3.495E-06	3.516E-06	3.519E-06	3.471E-06	3.304E-06	3.004E-06	2.527E-06
2	3.979E-06	3.979E-06		3.991E-06	4.004E-06	4.008E-06	4.012E-06	3.951E-06	3.786E-06	3.481E-06	3.002E-06
3	4.315E-06	4.316E-06		4.335E-06	4.347E-06	4.371E-06	4.351E-06	4.295E-06	4.101E-06	3 765E-06	3.316E-06
4	4.581E-06	4 581E-06		4 577E-06	4.584E-06	4.563E-06	4.248E-06	4.472E-06	4.323E-06	4.069E-06	3.673E-06
5	4.793E-06	4.797E-06		4.817E-06	4.823E-06	4.847E-06	4.832E-06	4.764E-06	4.590E-06	4.244E-06	3.841E-06
6	5 042E-06	5.037E-06		5.014E-06	5.013E-06	4.951E-06	4.908E-06	4.836E-06	4.724E-06	4.611E-06	4.301E-06
7	5 109E-06	5 114E-06		5.132E-06	5.139E-06	5.177E-06	5.196E-06	5.147E-06	5.022E-06	4.649E-06	4.308E-06
8	5.389E-06	5.385E-06		5.363E-06	5.357E-06	5.266E-06	5.183E-06	5.128E-06	5.079E-06	5.199E-06	5.102E-06
9	5.307E-06	5.310E-06		2 318E-06	5 320E-06	5.387E-06	5.464E-06	5.419E-06	5.370E-06	4.882E-06	4.302E-06
10	1.027E-06	1.027E-06		1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
11	1.027E-06	1.027E-06		1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06

	12	13	14	15	16	17
1	1 947E-06	1.531E-06	6	1 298E-06	1 111E-06	9.360E-07
2	2.339E-06	1.808E-06	6	1.492E-06	1 338E-06	1.116E-06
3	2.667E-06	2 098E-06	6	1.683E-06	1.569E-06	1.260E-06
4	3.079E-06	2 381E-06	6	1.950E-06	1 737E-06	1 556E-06
5	3.320E-06	2 759E-06	6	2.267E-06	2 108E-06	1.791E-06
6	3 866E-06	3 071E-06	6	2 691E-06	2.384E-06	2 294E-06
7	3.918E-06	3.732E-06	6	3.212E-06	3.028E-06	2.665E-06
8	4.904E-06	3.779E-06	6	3.690E-06	3.600E-06	3 637E-06
9	4.435E-06	5.756E-06	6	5 340E-06	4.513E-06	4.227E-06
10	1.027E-06	1.027E-06	6	1.027E-06	1.027E-06	1 027E-06
11	1.027E-06	1 027E-06	6	1.027E-06	1.027E-06	1 027E-06

UX VELOCITY

	1	2	3	4	5	6	7	8	9	10	11
1	-1 146E+05	-1.145E+05	-1.139E+05	-1.130E+05	-1.110E+05	-1.087E+05	-1.028E+05	-9.422E+04	-7.800E+04	-5.382E+04	-2.293E+04
2	-1.250E+05	-1 247E+05	-1.236E+05	-1.223E+05	-1.202E+05	-1.164E+05	-1.111E+05	-1.022E+05	-8.787E+04	-6.746E+04	-4.166E+04
3	-1.293E+05	-1.288E+05	-1.279E+05	-1.265E+05	-1 240E+05	-1.205E+05	-1.142E+05	-1.051E+05	-9.015E+04	-7.038E+04	-4.677E+04
4	-1.311E+05	-1 306E+05	-1.294E+05	-1.274E+05	-1.245E+05	-1.201E+05	-1.138E+05	-1.045E+05	-9.052E+04	-7.289E+04	-5.084E+04
5	-1.321E+05	-1.316E+05	-1 305E+05	-1.286E+05	-1.257E+05	-1.215E+05	-1.148E+05	-1.046E+05	-4.039E+04	-7.18E+04	-5.022E+04
6	-1.331E+05	-1.325E+05	-1 311E+05	-1 286E+05	-1 252E+05	-1.196E+05	-1.125E+05	-1.025E+05	-8.940E+04	-7.252E+04	-5.232E+04
7	-1 321E+05	-1.314E+05	-1 300E+05	-1 279E+05	-1.246E+05	-1.201E+05	-1.129E+05	-1 023E+05	-8.780E+04	-6.835E+04	-4.847E+04
8	-1 332E+05	-1.325E+05	-1.310E+05	-1 282E+05	-1.243E+05	-1 179E+05	-1 096E+05	-9.921E+04	-8.632E+04	-7.063E+04	-5.129E+04
9	-1 305E+05	-1 298E+05	-1 280E+05	-1 257E+05	-1 220E+05	-1 173E+05	-1.098E+05	-9.830E+04	-8.272E+04	-6.178E+04	-4.068E+04
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.	0.	0	0.	0.	0.

	12	13	14	15	16	17
1	8.239E+03	2.164E+04	2.853E+04	4.779E+04	5.315E+04	3.466E+04
2	-1.060E+04	6.272E+03	1.930E+04	3.960E+04	5.086E+04	4.784E+04
3	-2.148E+04	-2.510E+03	1.255E+04	3 666E+04	5.696E+04	5.294E+04
4	-2.614E+04	-8.718E+0	9.913E+03	3.430E+04	5 502E+04	6.697E+04
5	-2.933E+04	-1.239E+04	8.689E+03	3 425E+04	6.190E+04	7.180E+04
6	-2 944E+04	-1.291E+04	8.616E+03	3.645E+04	6.079E+04	8.825E+04
7	-3.055E+04	-1.221E+04	1.304E+04	3.879E+04	7.152E+04	9.136E+04
8	-2 738E+04	-6.946E+03	1 345E+04	4 328E+04	7.149E+04	1 088E+05
9	-2.683E+04	-1.144E+03	2.653E+04	5.082E+04	8.07E+04	1.067E+05
10	0.	0.	0.	0.	0.	0.
11	0.	0.	0	0.	0.	0.

Figure 25 - Continued

PRESSURE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	3.614E+04	3.615E+04	2.623E+04	3.631E+04	3.652E+04	3.665E+04	3.669E+04	3.609E+04	3.393E+04	2.996E+04	2.607E+04	1.769E+04	1.331E+04	1.306E+04	1.108E+04	8.478E+03	7.318E+03
2	3.639E+04	3.640E+04	3.649E+04	3.656E+04	3.676E+04	3.685E+04	3.682E+04	3.609E+04	3.410E+04	3.052E+04	2.527E+04	1.955E+04	1.476E+04	1.349E+04	1.238E+04	1.104E+04	8.887E+03
3	3.657E+04	3.662E+04	3.671E+04	3.658E+04	3.708E+04	3.726E+04	3.720E+04	3.645E+04	3.456E+04	3.094E+04	2.604E+04	2.076E+04	1.641E+04	1.482E+04	1.365E+04	1.285E+04	1.009E+04
4	3.700E+04	3.701E+04	3.709E+04	3.709E+04	3.724E+04	3.710E+04	3.693E+04	3.617E+04	3.452E+04	3.195E+04	2.774E+04	2.297E+04	1.773E+04	1.554E+04	1.512E+04	1.378E+04	1.269E+04
5	3.690E+04	3.699E+04	3.708E+04	3.733E+04	3.751E+04	3.780E+04	3.775E+04	3.703E+04	3.538E+04	3.192E+04	2.784E+04	2.339E+04	1.988E+04	1.820E+04	1.699E+04	1.638E+04	1.440E+04
6	3.765E+04	3.764E+04	3.776E+04	3.766E+04	3.777E+04	3.736E+04	3.699E+04	3.625E+04	3.499E+04	3.368E+04	3.049E+04	2.670E+04	2.079E+04	1.845E+04	1.904E+04	1.724E+04	1.842E+04
7	3.690E+04	3.701E+04	3.705E+04	3.742E+04	3.759E+04	3.807E+04	3.830E+04	3.767E+04	3.639E+04	3.265E+04	2.923E+04	2.550E+04	2.436E+04	2.350E+04	2.177E+04	2.117E+04	2.028E+04
8	3.845E+04	3.845E+04	3.863E+04	3.847E+04	3.854E+04	3.786E+04	3.710E+04	3.648E+04	3.569E+04	3.616E+04	3.454E+04	3.164E+04	2.266E+04	2.210E+04	2.314E+04	2.330E+04	2.758E+04
9	3.660E+04	3.666E+04	3.659E+04	3.695E+04	3.710E+04	3.773E+04	3.846E+04	3.779E+04	3.690E+04	3.193E+04	2.650E+04	2.569E+04	3.397E+04	3.612E+04	3.164E+04	2.744E+04	2.843E+04
10	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02
11	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02	7.978E+02

MACH NUM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.679E+00	1.680E+00	1.679E+00	1.680E+00	1.675E+00	1.681E+00	1.675E+00	1.693E+00	1.715E+00	1.783E+00	1.888E+00	1.994E+00	2.093E+00	2.086E+00	2.135E+00	2.257E+00	2.331E+00
2	1.976E+00	1.979E+00	1.975E+00	1.976E+00	1.971E+00	1.968E+00	1.972E+00	1.982E+00	2.014E+00	2.075E+00	2.166E+00	2.182E+00	2.234E+00	2.226E+00	2.198E+00	2.210E+00	2.289E+00
3	2.151E+00	2.148E+00	2.147E+00	2.142E+00	2.136E+00	2.138E+00	2.131E+00	2.148E+00	2.163E+00	2.220E+00	2.321E+00	2.341E+00	2.330E+00	2.325E+00	2.248E+00	2.228E+00	2.276E+00
4	2.258E+00	2.258E+00	2.254E+00	2.251E+00	2.245E+00	2.244E+00	2.246E+00	2.255E+00	2.283E+00	2.322E+00	2.409E+00	2.436E+00	2.440E+00	2.429E+00	2.349E+00	2.297E+00	2.239E+00
5	2.365E+00	2.362E+00	2.359E+00	2.351E+00	2.343E+00	2.337E+00	2.332E+00	2.344E+00	2.363E+00	2.418E+00	2.501E+00	2.565E+00	2.516E+00	2.483E+00	2.426E+00	2.345E+00	2.269E+00
6	2.434E+00	2.432E+00	2.427E+00	2.421E+00	2.414E+00	2.410E+00	2.413E+00	2.425E+00	2.453E+00	2.483E+00	2.551E+00	2.610E+00	2.655E+00	2.621E+00	2.556E+00	2.505E+00	2.271E+00
7	2.509E+00	2.504E+00	2.500E+00	2.488E+00	2.480E+00	2.469E+00	2.463E+00	2.479E+00	2.501E+00	2.572E+00	2.650E+00	2.745E+00	2.738E+00	2.690E+00	2.653E+00	2.582E+00	2.392E+00
8	2.537E+00	2.534E+00	2.527E+00	2.524E+00	2.518E+00	2.519E+00	2.529E+00	2.543E+00	2.571E+00	2.594E+00	2.655E+00	2.765E+00	2.932E+00	2.970E+00	2.830E+00	2.757E+00	2.404E+00
9	2.613E+00	2.609E+00	2.607E+00	2.596E+00	2.588E+00	2.578E+00	2.567E+00	2.588E+00	2.622E+00	2.733E+00	2.871E+00	2.995E+00	2.970E+00	2.935E+00	2.961E+00	2.901E+00	2.670E+00
10	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01
11	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01	1.000E+01

Figure 25 - Continued

MARCH MACH

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17					
1	1.606E+00	1.595E+00	1.573E+00	1.543E+00	1.504E+00	1.471E+00	1.435E+00	1.426E+00	1.445E+00	1.515E+00	1.613E+00
	1.681E+00	1.706E+00	1.668E+00	1.721E+00	1.772E+00	1.673E+00					
2	1.886E+00	1.872E+00	1.847E+00	1.813E+00	1.767E+00	1.719E+00	1.683E+00	1.657E+00	1.666E+00	1.708E+00	1.778E+00
	1.763E+00	1.757E+00	1.738E+00	1.735E+00	1.734E+00	1.734E+00					
3	2.046E+00	2.031E+00	2.004E+00	1.966E+00	1.918E+00	1.873E+00	1.823E+00	1.798E+00	1.784E+00	1.811E+00	1.873E+00
	1.861E+00	1.822E+00	1.786E+00	1.771E+00	1.796E+00	1.756E+00					
4	2.144E+00	2.130E+00	2.101E+00	2.063E+00	2.016E+00	1.966E+00	1.924E+00	1.887E+00	1.882E+00	1.887E+00	1.937E+00
	1.937E+00	1.874E+00	1.855E+00	1.839E+00	1.839E+00	1.816E+00					
5	2.238E+00	2.222E+00	2.195E+00	2.153E+00	2.103E+00	2.053E+00	2.003E+00	1.973E+00	1.953E+00	1.970E+00	2.004E+00
	2.016E+00	1.939E+00	1.905E+00	1.906E+00	1.919E+00	1.865E+00					
6	2.300E+00	2.286E+00	2.256E+00	2.215E+00	2.168E+00	2.117E+00	2.073E+00	2.040E+00	2.026E+00	2.025E+00	2.054E+00
	2.080E+00	2.038E+00	2.005E+00	2.021E+00	2.033E+00	1.956E+00					
7	2.360E+00	2.343E+00	2.315E+00	2.271E+00	2.223E+00	2.171E+00	2.124E+00	2.099E+00	2.084E+00	2.108E+00	2.134E+00
	2.161E+00	2.136E+00	2.113E+00	2.117E+00	2.156E+00	2.065E+00					
8	2.388E+00	2.374E+00	2.344E+00	2.307E+00	2.262E+00	2.217E+00	2.180E+00	2.150E+00	2.136E+00	2.136E+00	2.165E+00
	2.243E+00	2.291E+00	2.301E+00	2.278E+00	2.291E+00	2.160E+00					
9	2.442E+00	2.427E+00	2.400E+00	2.359E+00	2.312E+00	2.266E+00	2.222E+00	2.206E+00	2.209E+00	2.261E+00	2.317E+00
	2.370E+00	2.426E+00	2.424E+00	2.442E+00	2.460E+00	2.363E+00					
10	6.251E+00	6.249E+00	6.244E+00	6.238E+00	6.229E+00	6.219E+00	6.207E+00	6.195E+00	6.182E+00	6.169E+00	6.156E+00
	6.144E+00	6.134E+00	6.125E+00	6.117E+00	6.112E+00	6.110E+00					
11	6.251E+00	6.249E+00	6.244E+00	6.238E+00	6.229E+00	6.219E+00	6.207E+00	6.195E+00	6.182E+00	6.169E+00	6.156E+00
	6.144E+00	6.134E+00	6.125E+00	6.117E+00	6.112E+00	6.110E+00					

FLUX VARIABLES, NADV EQUALS 0

HRHO

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17					
1	6.964E+01	6.916E+01	6.995E+01	7.191E+01	7.317E+01	7.491E+01	7.610E+01	7.778E+01	7.839E+01	7.923E+01	7.723E+01
	6.905E+01	6.080E+01	6.254E+01	5.570E+01	4.513E+01	3.309E+01					
2	9.123E+01	9.180E+01	9.257E+01	9.391E+01	9.535E+01	9.654E+01	9.819E+01	9.881E+01	9.912E+01	9.902E+01	9.690E+01
	8.601E+01	7.291E+01	7.063E+01	6.452E+01	5.436E+01	4.164E+01					
3	1.071E+02	1.076E+02	1.087E+02	1.101E+02	1.117E+02	1.137E+02	1.143E+02	1.150E+02	1.136E+02	1.121E+02	1.110E+02
	1.006E+02	8.742E+01	8.283E+01	7.445E+01	6.644E+01	4.825E+01					
4	1.204E+02	1.209E+02	1.219E+02	1.230E+02	1.244E+02	1.251E+02	1.260E+02	1.255E+02	1.256E+02	1.257E+02	1.270E+02
	1.206E+02	1.013E+02	9.387E+01	8.674E+01	7.491E+01	6.271E+01					
5	1.327E+02	1.333E+02	1.345E+02	1.362E+02	1.376E+02	1.396E+02	1.402E+02	1.401E+02	1.387E+02	1.365E+02	1.370E+02
	1.338E+02	1.215E+02	1.160E+02	1.065E+02	9.488E+01	7.425E+01					
6	1.459E+02	1.464E+02	1.474E+02	1.479E+02	1.493E+02	1.485E+02	1.482E+02	1.476E+02	1.480E+02	1.531E+02	1.583E+02
	1.620E+02	1.402E+02	1.297E+02	1.319E+02	1.108E+02	1.006E+02					
7	1.539E+02	1.546E+02	1.555E+02	1.575E+02	1.590E+02	1.612E+02	1.628E+02	1.632E+02	1.633E+02	1.605E+02	1.640E+02
	1.685E+02	1.784E+02	1.794E+02	1.635E+02	1.483E+02	1.211E+02					
8	1.683E+02	1.688E+02	1.701E+02	1.705E+02	1.718E+02	1.698E+02	1.681E+02	1.677E+02	1.699E+02	1.841E+02	2.002E+02
	2.216E+02	1.886E+02	1.802E+02	1.969E+02	1.821E+02	1.740E+02					
9	1.716E+02	1.723E+02	1.727E+02	1.749E+02	1.762E+02	1.796E+02	1.832E+02	1.837E+02	1.871E+02	1.806E+02	1.753E+02
	2.049E+02	3.070E+02	3.437E+02	3.005E+02	2.400E+02	2.103E+02					
10	2.935E+01	2.959E+01	3.005E+01	3.067E+01	3.137E+01	3.203E+01	3.266E+01	3.330E+01	3.431E+01	3.634E+01	4.014E+01
	4.560E+01	5.104E+01	5.406E+01	5.307E+01	4.899E+01	4.528E+01					
11	3.017E+01	3.041E+01	3.087E+01	3.147E+01	3.215E+01	3.280E+01	3.337E+01	3.396E+01	3.493E+01	3.696E+01	4.079E+01
	4.634E+01	5.185E+01	5.484E+01	5.372E+01	4.947E+01	4.567E+01					

Figure 25 - Continued

HMJMX

	1	2	3	4	5	6	7	8	9	10	11
1	-1.090E+07	-1.0[illegible]3E+07	-1.064E+07	-1.263E+07	-1.133E+07	[illegible]	-9.103E+06	-7.960E+06	-6.[illegible]8E+06	-3.602E+06	-6.277E+05
2	-1.445E+07	-1.442E+07	-1.429E+07	-1.404E+07	-1.375E+07	-1.310E+07	-1.222E+07	-1.076E+07	-8.684E+06	-5.992E+06	-2.813E+06
3	-1.701E+07	-1.695E+07	-1.[illegible]5E+07	[illegible]	-1.622E+07	-1.564E+07	-1.442E+07	-1.278E+07	-1.021E+07	-7.178E+06	-3.906E+06
4	-1.910E+07	-1.902E+07	-1.865E+07	-1.849E+07	-1.798E+07	-1.700E+07	-1.573E+07	-1.382E+07	-1.134E+07	-8.416E+06	-5.062E+06
5	-2.095E+07	-2.089E+07	-2.072E+07	-2.044E+07	-1.985E+07	-1.903E+07	-1.754E+07	-1.539E+07	-1.250E+07	-8.454E+06	-5.456E+06
6	-2.303E+07	-2.290E+07	-2.267E+07	-2.207E+07	-2.13[illegible]E+07	-1.987E+07	-1.814E+07	-1.587E+07	-1.321E+07	-1.028E+07	-6.695E+06
7	-2.397E+07	-2.388E+07	-2.359E+07	-2.326E+07	-2.251E+07	-2.156E+07	-1.993E+07	-1.748E+07	-1.430E+07	-1.016E+07	-6.398E+06
8	-2.633E+07	-2.616E+07	-2.590E+07	-2.515E+07	-2.420E+07	-2.226E+07	-1.997E+07	-1.741E+07	-1.464E+07	-1.209E+07	-8.407E+06
9	-2.622E+07	-2.609E+07	-2.564E+07	-2.523E+07	-2.431E+07	-2.335E+07	-2.173E+07	-1.887E+07	-1.545E+07	-1.034E+07	-5.677E+06
10	-8.595E+04	-8.371E+04	-7.914E+04	-7.201E+04	-6.217E+04	-4.958E+04	-3.452E+04	-1.759E+04	7.248E+02	2.082E+04	4.447E+04
11	-8.836E+04	-8.604E+04	-8.129E+04	-7.391E+04	-6.373E+04	-5.074E+04	-3.527E+04	-1.794E+04	7.380E+02	2.117E+04	4.520E+04

	12	13	14	15	16	17
1	1.757E+06	2.617E+06	3.658E+06	4.454E+06	3.872E+06	2.312E+06
2	6.353E+05	2.1[illegible]3E+06	3.331E+06	4.586E+06	4.597E+06	3.420E+06
3	-4.701E+05	1.700E+06	3.237E+06	4.999E+06	5.940E+06	4.191E+06
4	-1.245E+06	1.227E+06	3.272E+06	5.591E+06	6.458E+06	6.276E+06
5	-1.950E+06	8.998E+05	3.793E+06	6.547E+06	8.678E+06	7.710E+06
6	-2.475E+06	7.504E+05	3.985E+06	8.099E+06	9.722E+06	1.194E+07
7	-2.916E+06	8.732E+05	6.049E+06	1.015E+07	1.431E+07	1.447E+07
8	-3.255E+06	1.[illegible]76E+06	5.643E+06	1.262E+07	1.714E+07	2.360E+07
9	-3.157E+06	4.046E+06	1.499E+07	2.095E+07	2.435E+07	2.730E+07
10	7.333E+04	1.049E+05	1.316E+05	1.450E+05	1.438E+05	1.376E+05
11	7.452E+04	1.066E+05	1.335E+05	1.467E+05	1.452E+05	1.388E+05

HNJMY

	1	2	3	4	5	6	7	8	9	10	11
1	5.096E+05	1.534E+06	2.600E+06	3.768E+06	5.012E+06	6.359E+06	7.808E+06	9.299E+06	1.057E+07	1.141E+07	1.085E+07
2	6.438E+05	1.944E+06	3.289E+06	4.713E+06	6.240E+06	7.827E+06	9.605E+06	1.127E+07	1.280E+07	1.376E+07	1.354E+07
3	7.462E+05	2.270E+06	3.843E+06	5.509E+06	7.270E+06	9.210E+06	1.111E+07	1.300E+07	1.445E+07	1.524E+07	1.514E+07
4	8.466E+05	2.559E+06	4.332E+06	6.161E+06	8.131E+06	1.008E+07	1.217E+07	1.400E+07	1.579E+07	1.701E+07	1.759E+07
5	9.311E+05	2.824E+06	4.771E+06	6.839E+06	8.985E+06	1.134E+07	1.361E+07	1.578E+07	1.743E+07	1.829E+07	1.858E+07
6	1.034E+06	3.124E+06	5.293E+06	7.480E+06	9.852E+06	1.204E+07	1.429E+07	1.640E+07	1.837E+07	2.066E+07	2.213E+07
7	1.083E+06	3.292E+06	5.5[illegible]2E+06	7.952E+06	1.043E+07	1.315E+07	1.591E+07	1.845E+07	2.060E+07	2.140E+07	2.220E+07
8	1.209E+06	3.645E+06	6.190E+06	8.756E+06	1.151E+07	1.395E+07	1.631E+07	1.866E+07	2.105E+07	2.517E+07	2.889E+07
9	1.209E+06	3.682E+06	6.151E+06	8.857E+06	1.155E+07	1.466E+07	1.805E+07	2.090E+07	2.385E+07	2.382E+07	2.253E+07
10	8.019E+03	2.359E+04	3.971E+04	5.485E+04	6.889E+04	8.112E+04	9.085E+04	9.783E+04	1.028E+05	1.072E+05	1.126E+05
11	8.244E+03	2.466E+04	4.079E+04	5.630E+04	7.062E+04	8.303E+04	9.282E+04	9.978E+04	1.046E+05	1.090E+05	1.144E+05

	12	13	14	15	16	17
1	6.325E+06	6.179E+06	5.716E+06	3.756E+06	1.632E+06	2.206E+05
2	1.095E+07	7.678E+06	6.848E+06	4.810E+06	2.392E+06	5.471E+05
3	1.278E+07	1.015E+07	8.457E+06	6.273E+06	3.839E+06	7.614E+05
4	1.601E+07	1.182E+07	9.868E+06	7.932E+06	4.675E+06	1.331E+06
5	1.750E+07	1.521E+07	1.307E+07	1.041E+07	6.851E+06	1.686E+06
6	2.240E+07	1.736E+07	1.449E+07	1.343E+07	8.428E+06	2.840E+06
7	2.237E+07	2.379E+07	2.235E+07	1.794E+07	1.259E+07	3.597E+06
8	3.226E+07	2.359E+07	2.035E+07	2.141E+07	1.618E+07	6.599E+06
9	2.674E+07	4.535E+07	5.045E+07	3.786E+07	2.231E+07	8.435E+06
10	1.168E+05	1.138E+05	9.846E+04	7.157E+04	4.057E+04	1.265E+04
11	1.167E+05	1.156E+05	9.988E+04	7.244E+04	4.097E+04	1.276E+04

Figure 25 - Continued

HP342

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.399E+07	1.391E+07	1.408E+07	1.444E+07	1.475E+07	1.512E+07	1.536E+07	1.578E+07	1.609E+07	1.674E+07	1.716E+07	1.630E+07	1.494E+07	[illegible]	1.394E+07	1.160E+07	8.891E+06
2	1.939E+07	1.9[illegible]2E+07	1.966E+07	2.03[illegible]E+07	2.03[illegible]E+07	2.[illegible]29E+07	2.096E+07	2.120E+07	2.152E+07	2.204E+07	2.244E+07	2.072E+07	1.834E+07	1.761E+07	1.633E+07	1.394E+07	1.096E+07
3	2.347E+07	2.357E+07	2.381E+07	2.411E+07	2.443E+07	2.486E+07	2.501E+07	2.533E+07	2.533E+07	2.564E+07	2.662E+07	2.460E+07	2.192E+07	2.109E+07	1.882E+07	1.677E+07	1.260E+07
4	2.686E+07	2.700E+07	2.721E+07	2.748E+07	2.779E+07	2.799E+07	2.825E+07	2.830E+07	2.862E+07	2.915E+07	3.034E+07	2.967E+07	2.578E+07	2.413E+07	2.264E+07	1.908E+07	1.596E+07
5	3.021E+07	3.034E+07	3.060E+07	3.093E+07	3.124E+07	3.163E+07	3.178E+07	3.195E+07	3.197E+07	3.222E+07	3.336E+07	3.366E+07	3.070E+07	2.967E+07	2.712E+07	2.387E+07	1.884E+07
6	3.357E+07	3.367E+07	3.390E+07	3.404E+07	3.433E+07	3.425E+07	3.428E+07	3.435E+07	3.475E+07	3.630E+07	3.834E+07	4.017E+07	[illegible].607E+07	[illegible].372E+07	3.387E+07	2.843E+07	2.476E+07
7	3.600E+07	3.614E+07	3.634E+07	3.673E+07	3.70[illegible]E+07	3.748E+07	3.782E+07	3.811E+07	3.849E+07	3.878E+07	4.066E+07	4.286E+07	4.541E+07	4.564E+07	4.184E+07	3.747E+07	3.022E+07
8	3.943E+07	3.954E+07	3.981E+07	3.995E+07	4.024E+07	3.947E+07	3.977E+07	3.989E+07	4.071E+07	4.415E+07	4.856E+07	5.494E+07	4.972E+07	4.829E+07	5.125E+07	4.678E+07	4.178E+07
9	4.101E+07	4.116E+07	4.129E+07	4.176E+07	4.204E+07	4.272E+07	4.343E+07	4.380E+07	4.499E+07	4.488E+07	4.524E+07	5.362E+07	7.730E+07	8.527E+07	7.634E+07	6.146E+07	5.276E+07
10	9.748E+06	9.828E+06	9.980E+06	1.019E+07	1.042E+07	1.065E+07	1.085E+07	1.106E+07	1.140E+07	1.207E+07	1.333E+07	1.515E+07	1.695E+07	1.796E+07	1.763E+07	1.627E+07	1.504E+07
11	1.[illegible]2E+07	1.010E+07	1.025E+07	1.045E+07	1.068E+07	1.090E+07	1.109E+07	1.128E+07	1.160E+07	1.228E+07	1.355E+07	1.539E+07	1.722E+07	1.822E+07	1.784E+07	1.643E+07	1.517E+07

DECODED INITIAL DATA

Figure 25 - Continued

FLOW VARIABLES, WALL EQUALS

DENSITY

	1 / 12	2 / 13	3 / 14	4 / 15	5 / 16	6 / 17	7	8	9	10	11
1		3.466E-06		3.491E-06	3.495E-06	3.511E-06	3.510E-06	3.471E-06	3.304E-06	3.024E-06	2.527E-06
		1.531E-06		1.298E-06	1.111E-06	9.360E-07					
2		3.979E-06		3.991E-06	4.004E-06	4.008E-06	4.012E-06	3.951E-06	3.786E-06	3.481E-06	3.002E-06
		1.808E-06		1.492E-06	1.338E-06	1.116E-06					
3		4.316E-06		4.335E-06	4.347E-06	4.371E-06	4.351E-06	4.295E-06	4.101E-06	3.762E-06	3.316E-06
		2.098E-06		1.603E-06	1.569E-06	1.260E-06					
4		4.561E-06		4.577E-06	4.584E-06	4.563E-06	4.558E-06	4.572E-06	4.323E-06	4.969E-06	3.673E-06
		2.381E-06		1.950E-06	1.737E-06	1.508E-06					
5		4.797E-06		4.817E-06	4.823E-06	4.847E-06	4.832E-06	4.764E-06	4.596E-06	4.244E-06	3.841E-06
		2.759E-06		2.267E-06	2.102E-06	1.791E-06					
6		5.037E-06		5.014E-06	5.013E-06	4.951E-06	4.908E-06	4.836E-06	4.724E-06	4.611E-06	4.301E-06
		3.071E-06		2.691E-06	2.384E-06	2.294E-06					
7		5.114E-06		5.132E-06	5.139E-06	5.177E-06	5.126E-06	5.147E-06	5.022E-06	4.649E-06	4.308E-06
		3.732E-06		3.212E-06	3.020E-06	2.665E-06					
8		5.385E-06		5.363E-06	5.357E-06	5.266E-06	5.183E-06	5.128E-06	5.079E-06	5.199E-06	5.102E-06
		3.779E-06		3.690E-06	3.600E-06	3.637E-06					
9		5.310E-06		5.318E-06	5.320E-06	5.387E-06	5.464E-06	5.419E-06	5.370E-06	4.882E-06	4.302E-06
		5.756E-06		5.340E-06	4.513E-06	4.227E-06					
10		1.027E-06		1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
		1.027E-06		1.027E-06	1.027E-06	1.027E-06					
11		1.027E-06		1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
		1.027E-06		1.027E-06	1.027E-06	1.027E-06					

UX VELOCITY

	1 / 12	2 / 13	3 / 14	4 / 15	5 / 16	6 / 17	7	8	9	10	11
1	-1.148E+05	-1.145E+05	-1.139E+05	-1.130E+05	-1.110E+05	-1.087E+05	-1.028E+05	-9.422E+04	-7.800E+04	-5.382E+04	-2.293E+04
	8.239E+03	2.164E+04	2.853E+04	4.779E+04	5.315E+04	3.466E+04					
2	-1.250E+05	-1.247E+05	-1.238E+05	-1.223E+05	-1.202E+05	-1.164E+05	-1.111E+05	-1.022E+05	-8.787E+04	-6.746E+04	-4.166E+04
	-1.080E+04	6.272E+03	1.930E+04	3.960E+04	5.086E+04	4.784E+04					
3	-1.298E+05	-1.288E+05	-1.279E+05	-1.265E+05	-1.240E+05	-1.205E+05	-1.142E+05	-1.051E+05	-9.015E+04	-7.038E+04	-4.677E+04
	-2.148E+04	-2.610E+03	1.255E+04	3.666E+04	5.696E+04	5.294E+04					
4	-1.311E+05	-1.306E+05	-1.294E+05	-1.274E+05	-1.246E+05	-1.201E+05	-1.138E+05	-1.045E+05	-9.052E+04	-7.289E+04	-5.084E+04
	-2.614E+04	-8.716E+03	9.913E+03	3.430E+04	5.502E+04	6.697E+04					
5	-1.321E+05	-1.316E+05	-1.305E+05	-1.286E+05	-1.257E+05	-1.215E+05	-1.148E+05	-1.046E+05	-9.039E+04	-7.118E+04	-5.022E+04
	-2.933E+04	-1.239E+04	8.669E+03	3.425E+04	6.190E+04	7.180E+04					
6	-1.331E+05	-1.325E+05	-1.311E+05	-1.286E+05	-1.252E+05	-1.196E+05	-1.125E+05	-1.025E+05	-8.940E+04	-7.252E+04	-5.232E+04
	-2.944E+04	-1.291E+04	8.616E+03	3.645E+04	6.079E+04	8.825E+04					
7	-1.321E+05	-1.314E+05	-1.300E+05	-1.279E+05	-1.246E+05	-1.201E+05	-1.129E+05	-1.023E+05	-8.766E+04	-6.835E+04	-4.847E+04
	-3.055E+04	-1.221E+04	1.304E+04	3.879E+04	7.152E+04	9.136E+04					
8	-1.332E+05	-1.325E+05	-1.310E+05	-1.282E+05	-1.243E+05	-1.179E+05	-1.096E+05	-9.921E+04	-8.632E+04	-7.063E+04	-5.129E+04
	-2.738E+04	-6.946E+03	1.345E+04	4.328E+04	7.149E+04	1.088E+05					
9	-1.305E+05	-1.298E+05	-1.280E+05	-1.257E+05	-1.220E+05	-1.173E+05	-1.098E+05	-9.830E+04	-8.272E+04	-6.178E+04	-4.060E+04
	-2.683E+04	-1.144E+03	2.653E+04	5.082E+04	8.107E+04	1.007E+05					
10	8.410E-10	4.092E-10	-4.929E-10	4.403E-10	1.262E-10	-5.085E-11	9.979E-11	2.447E-11	-5.302E-12	-2.883E-11	6.381E-11
	-2.553E-10	-1.004E-09	-2.929E-10	-1.316E-09	4.753E-10	5.965E-10					
11	4.785E-10	-3.216E-10	1.207E-10	7.909E-10	2.390E-10	5.676E-11	-3.488E-11	3.428E-11	-3.333E-12	-1.243E-10	9.703E-11
	3.216E-10	-5.389E-10	-3.397E-10	9.467E-10	5.271E-10	1.631E-10					

Figure 25 - Continued

MESH GEOMETRY, FACE EQUAL

X COORD AT N CELL FACE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	[illegible]	[illegible]	[illegible]	-2.493E+02	-2.417E+02	-2.313E+02	-2.177E+02	-2.006E+02	-1.796E+02	-1.549E+02	-1.270E+02	-9.687E+01	-6.544E+01	-3.275E+01	[illegible]	3.477E+01	5.929E+01	6.981E+01
2	-2.618E+02	-2.606E+02	-2.574E+02	-2.519E+02	-2.439E+02	-2.331E+02	-2.190E+02	-2.013E+02	-1.798E+02	-1.546E+02	-1.262E+02	-9.551E+01	-6.393E+01	-3.040E+01	4.297E+00	3.721E+01	6.194E+01	7.199E+01
3	-2.647E+02	-2.636E+02	-2.603E+02	-2.545E+02	-2.461E+02	-2.348E+02	-2.202E+02	-2.020E+02	-1.800E+02	-1.543E+02	-1.254E+02	-9.415E+01	-6.162E+01	-2.805E+01	6.814E+00	3.964E+01	6.420E+01	7.416E+01
4	-2.679E+02	-2.667E+02	-2.634E+02	-2.571E+02	-2.484E+02	-2.366E+02	-2.215E+02	-2.027E+02	-1.802E+02	-1.540E+02	-1.245E+02	-9.260E+01	-5.970E+01	-2.570E+01	9.531E+00	[illegible]	6.645E+01	7.633E+01
5	-2.710E+02	-2.698E+02	-2.661E+02	-2.597E+02	-2.505E+02	-2.384E+02	-2.228E+02	-2.035E+02	-1.804E+02	-1.536E+02	-1.237E+02	-9.144E+01	-5.779E+01	-2.336E+01	1.185E+01	4.450E+01	6.871E+01	7.850E+01
6	-2.741E+02	-2.728E+02	-2.690E+02	-2.624E+02	-2.529E+02	-2.402E+02	-2.240E+02	-2.042E+02	-1.806E+02	-1.533E+02	-1.229E+02	-9.008E+01	-5.588E+01	-2.101E+01	1.437E+01	4.694E+01	7.097E+01	8.068E+01
7	-2.772E+02	-2.759E+02	[illegible]	-2.650E+02	-2.551E+02	-2.419E+02	-2.253E+02	-2.049E+02	-1.808E+02	-1.530E+02	-1.221E+02	-8.872E+01	-5.396E+01	[illegible]	1.689E+01	4.937E+01	7.322E+01	8.285E+01
8	-2.803E+02	-2.790E+02	-2.747E+02	-2.676E+02	-2.573E+02	-2.437E+02	-2.266E+02	-2.057E+02	-1.810E+02	-1.527E+02	-1.213E+02	-8.736E+01	-5.205E+01	-1.632E+01	1.940E+01	5.180E+01	7.548E+01	8.502E+01
9	-2.835E+02	-2.820E+02	-2.776E+02	-2.702E+02	-2.596E+02	-2.455E+02	-2.278E+02	-2.064E+02	-1.812E+02	-1.524E+02	-1.205E+02	-8.600E+01	-5.014E+01	-1.397E+01	2.192E+01	5.424E+01	7.773E+01	8.719E+01
10	-2.866E+02	-2.851E+02	-2.805E+02	-2.728E+02	-2.618E+02	-2.473E+02	-2.291E+02	-2.071E+02	-1.814E+02	-1.521E+02	-1.196E+02	-8.464E+01	-4.822E+01	-1.162E+01	2.443E+01	5.667E+01	7.999E+01	8.937E+01
11	-2.897E+02	-2.881E+02	-2.834E+02	-2.754E+02	-2.640E+02	-2.491E+02	-2.303E+02	-2.078E+02	-1.816E+02	-1.518E+02	-1.188E+02	-8.328E+01	-4.631E+01	-9.277E+00	2.695E+01	5.910E+01	8.225E+01	9.154E+01
12	-2.928E+02	-2.912E+02	-2.863E+02	-2.781E+02	-2.663E+02	-2.508E+02	-2.316E+02	-2.086E+02	-1.818E+02	-1.515E+02	-1.180E+02	-8.192E+01	-4.440E+01	-6.931E+00	2.947E+01	6.154E+01	8.450E+01	9.371E+01

Y COORD AT N CELL FACE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	-3.117E-05	1.664E+01	3.332E+01	5.008E+01	6.685E+01	8.349E+01	9.965E+01	1.147E+02	1.276E+02	1.372E+02	1.420E+02	1.413E+02	1.345E+02	1.222E+02	1.042E+02	7.783E+01	4.216E+01	0.
2	-3.228E-05	1.722E+01	3.447E+01	5.174E+01	6.895E+01	8.593E+01	1.023E+02	1.174E+02	1.304E+02	1.399E+02	1.447E+02	1.439E+02	1.369E+02	1.243E+02	1.057E+02	7.875E+01	4.256E+01	0.
3	-3.338E-05	1.781E+01	3.562E+01	5.340E+01	7.105E+01	8.837E+01	1.050E+02	1.202E+02	1.331E+02	1.426E+02	1.474E+02	1.465E+02	1.394E+02	1.263E+02	1.072E+02	7.968E+01	4.299E+01	0.
4	-3.448E-05	1.839E+01	3.676E+01	5.505E+01	7.315E+01	9.081E+01	1.076E+02	1.230E+02	1.359E+02	1.453E+02	1.500E+02	1.491E+02	1.418E+02	1.284E+02	1.087E+02	8.060E+01	4.340E+01	0.
5	-3.559E-05	1.898E+01	3.791E+01	5.671E+01	7.525E+01	9.324E+01	1.103E+02	1.257E+02	1.387E+02	1.481E+02	1.527E+02	1.517E+02	1.443E+02	1.305E+02	1.103E+02	8.152E+01	4.382E+01	0.
6	-3.669E-05	1.956E+01	3.906E+01	5.837E+01	7.734E+01	9.568E+01	1.129E+02	1.285E+02	1.414E+02	1.508E+02	1.554E+02	1.543E+02	1.468E+02	1.326E+02	1.118E+02	8.244E+01	4.423E+01	0.
7	-3.780E-05	2.015E+01	4.020E+01	6.003E+01	7.944E+01	9.812E+01	1.156E+02	1.312E+02	1.442E+02	1.535E+02	1.581E+02	1.569E+02	1.492E+02	1.347E+02	1.133E+02	8.337E+01	4.464E+01	0.
8	-3.890E-05	2.073E+01	4.135E+01	6.169E+01	8.154E+01	1.006E+02	1.183E+02	1.340E+02	1.470E+02	1.562E+02	1.607E+02	1.595E+02	1.517E+02	1.368E+02	1.148E+02	8.429E+01	4.506E+01	0.
9	-4.000E-05	2.132E+01	4.249E+01	6.335E+01	8.364E+01	1.030E+02	1.209E+02	1.368E+02	1.497E+02	1.589E+02	1.634E+02	1.621E+02	1.541E+02	1.388E+02	1.164E+02	8.521E+01	4.547E+01	0.
10	-4.111E-05	2.190E+01	4.364E+01	6.501E+01	8.574E+01	1.054E+02	1.236E+02	1.395E+02	1.525E+02	1.616E+02	1.661E+02	1.648E+02	1.566E+02	1.409E+02	1.179E+02	8.614E+01	4.588E+01	0.
11	-4.221E-05	2.249E+01	4.479E+01	6.667E+01	8.783E+01	1.079E+02	1.262E+02	1.423E+02	1.553E+02	1.644E+02	1.687E+02	1.674E+02	1.590E+02	1.430E+02	1.194E+02	8.706E+01	4.630E+01	0.
12	-4.332E-05	2.307E+01	4.593E+01	6.833E+01	8.993E+01	1.103E+02	1.289E+02	1.450E+02	1.580E+02	1.671E+02	1.714E+02	1.700E+02	1.615E+02	1.451E+02	1.209E+02	8.798E+01	4.671E+01	0.

Figure 25 - Continued

Z COORD AT N CELL FACE

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17	18				
1	2.	2.459E+02		2.430E+02	2.347E+02	2.275E+02	2.192E+02	2.091E+02	1.977E+02	1.854E+02	1.729E+02
	1	2 1.464E+02	1	2 1.069E+02	8.032E+01	6.830E+01	6.043E+01				
2	2.	2 417E+02	2	2.358E+02	2.306E+02	2.238E+02	2.153E+02	2.053E+02	1 940E+02	1 819E+02	1.692E+02
	1	2 1.424E+02	1	2 1.051E+02	8 300E+01	6 538E+01	5.767E+01				
3	2.	2	2.	2 315E+02	2 265E+02	2 197E+02	2 114E+02	2.015E+02	1 904E+02	1 783E+02	1.656E+02
	1	2 1	2 1	2 1.014E+02	7 968E+01	6.246E+01	5.490E+01				
4	2.	2.	2.	2 275E+02	2.223E+02	2.157E+02	2.075E+02	1.977E+02	1.867E+02	1 747E+02	1.620E+02
	1	2 1	2 1	2 9.761E+01	7.636E+01	5.953E+01	5.214E+01				
5	2.	2	2.	2.233E+02	2.182E+02	2 116E+02	2.035E+02	1 940E+02	1.831E+02	1.711E+02	1.583E+02
	1	2 1	2 1	2 9 385E+01	7.304E+01	5.661E+01	4.937E+01				
6	2.	2.	2.	2 191E+02	2 141E+02	2 076E+02	1.996E+02	1.902E+02	1 794E+02	1 675E+02	1 547E+02
	1	2 1	2 1	2 9.039E+01	6.972E+01	5 369E+01	4 660E+01				
7	2	2.	2.	2 149E+02	2 100E+02	2 036E+02	1.957E+02	1.864E+02	1 758E+02	1 639E+02	1.511E+02
	1	2 1	2 1	2 8.632E+01	6 643E+01	5.077E+01	4.384E+01				
8	2.	2.	2.	2 107E+02	2.058E+02	1 995E+02	1.918E+02	1.826E+02	1.721E+02	1.604E+02	1.474E+02
	1	2 1	2 1	2 8.256E+01	6 308E+01	4.785E+01	4.107E+01				
9	2.	2	2.	2 065E+02	2 017E+02	1 955E+02	1.878E+02	1.788E+02	1.685E+02	1.568E+02	1.438E+02
	1	2 1	2 9	1 7 880E+01	5 976E+01	4.493E+01	3.831E+01				
10	2	2	2.	2.024E+02	1.976E+02	1.914E+02	1.839E+02	1.751E+02	1.648E+02	1.532E+02	1.402E+02
	1	2 1	2 9	1 7.503E+01	5.644E+01	4.201E+01	3.554E+01				
11	2.	2.	2.	1.982E+02	1 935E+02	1.874E+02	1.800E+02	1.713E+02	1.612E+02	1.496E+02	1.365E+02
	1	2 1	2 8	1 7.127E+01	5.312E+01	3 908E+01	3 277E+01				
12	2.	1.	1.	1 940E+02	1 893E+02	1.834E+02	1.761E+02	1.675E+02	1.575E+02	1.460E+02	1.329E+02
	1	2 1	2 8	1 6.751E+01	4.980E+01	3.616E+01	3.001E+01				

MESH GEOMETRY, NADV EQUALS 0

X COORD AT N+1 CELL FACE

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17	18				
1	-2.939E+02	-2.929E+02	-2.904E+02	-2.847E+02	-2.770E+02	-2.665E+02	-2.627E+02	-2.350E+02	-2.130E+02	-1.866E+02	-1.563E+02
	-1.231E+02	-8.830E+01	-5.176E+01	-1.204E+01	2.732E+01	5.868E+01	7.131E+01				
2	-2.976E+02	-2 965E+02	-2.933E+02	-2 878E+02	-2.797E+02	-2.687E+02	-2.543E+02	-2.359E+02	-2.133E+02	-1.863E+02	-1.554E+02
	-1.217E+02	-8.619E+01	-4.910E+01	-9.139E+00	3 011E+01	6.121E+01	7.370E+01				
3	-3.012E+02	-3.001E+02	-2.967E+02	-2.909E+02	-2.824E+02	-2.708E+02	-2.558E+02	-2.369E+02	-2.136E+02	-1.861E+02	-1.546E+02
	-1.202E+02	-8.406E+01	-4.644E+01	-6.236E+00	3 29[illegible]E+01	6.373E+01	7 609E+01				
4	-3.049E+02	-3 037E+02	-3.001E+02	-2 940E+02	-2.851E+02	-2.730E+02	-2.574E+02	-2.378E+02	-2.140E+02	-1.858E+02	-1.538E+02
	-1 188E+02	-8.197E+01	-4.378E+01	-3.333E+00	3.570E+01	6 626E+01	7 648E+01				
5	-3.085E+02	-3 073E+02	-3.035E+02	-2.971E+02	-2.877E+02	-2.752E+02	-2.590E+02	-2.388E+02	-2.143E+02	-1.856E+02	-1.529E+02
	-1.173E+02	-7.985E+01	-4.112E+01	-4.303E-01	3.849E+01	6.879E+01	8.087E+01				
6	-3.122E+02	-3.109E+02	-3.069E+02	-3.002E+02	-2.904E+02	-2.773E+02	-2.605E+02	-2.397E+02	-2.146E+02	-1.853E+02	-1.521E+02
	-1.158E+02	-7.774E+01	-3.846E+01	2.473E+00	4.128E+01	7.132E+01	8.327E+01				
7	-3.159E+02	-3 145E+02	-3.104E+02	-3.033E+02	-2.931E+02	-2.795E+02	-2.621E+02	-2.406E+02	-2.150E+02	-1.851E+02	-1.513E+02
	-1.144E+02	-7.563E+01	-3.580E+01	5.376E+00	4.407E+01	7.385E+01	8 566E+01				
8	-3.195E+02	-3.181E+02	-3 138E+02	-3 064E+02	-2.958E+02	-2.816E+02	-2.637E+02	-2.416E+02	-2.153E+02	-1.848E+02	-1.504E+02
	-1.129E+02	-7.351E+01	-3.314E+01	8.279E+00	4 686E+01	7.638E+01	8.805E+01				
9	-3 232E+02	-3.217E+02	-3.172E+02	-3.095E+02	-2.985E+02	-2.838E+02	-2.652E+02	-2.425E+02	-2.156E+02	-1.845E+02	-1.496E+02
	-1.115E+02	-7 140E+01	-3.047E+01	1.118E+01	4.965E+01	7 891E+01	9.044E+01				
10	-3.268E+02	-3 253E+02	-3.206E+02	-3.126E+02	-3.011E+02	-2.859E+02	-2.668E+02	-2.435E+02	-2.160E+02	-1.843E+02	-1.488E+02
	-1.100E+02	-6.929E+01	-2.781E+01	1.408E+01	5.244E+01	8.144E+01	9.283E+01				
11	-3.305E+02	-3.289E+02	-3.240E+02	-3.157E+02	-3 038E+02	-2.881E+02	-2.684E+02	-2.444E+02	-2.163E+02	-1.840E+02	-1.480E+02
	-1.086E+02	-6.717E+01	-2 515E+01	1.699E+01	5 524E+01	8.396E+01	9.522E+01				
12	-3.3[illegible]2E+02	-3.325E+02	-3.274E+02	-3.188E+02	-3.065E+02	-2.903E+02	-2.699E+02	-2.454E+02	-2.166E+02	-1.838E+02	-1.471E+02
	-1.071E+02	-6.506E+01	-2.249E+01	1.989E+01	5.803E+01	8.649E+01	9.762E+01				

Figure 25 - Continued

MESH AREAS, NAJV FLOALS (

AREA AIX AT N CELL FACE

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17					
1	+01	6.976E+01	6.675E+01	6.074E+01	5.395E+01	4.356E+01	3.084E+01	1.675E+01	1.026E+00	-1.653E+01	-3.714E+01
	E+01	-9.730E+01	-1.092E+02	-1.217E+02	-1.240E+02	-1.22[illegible]E+02					
2	+01	7.2[illegible]	6.645E+01	6.267E+01	5.462E+01	4.423E+01	3.161E+01	1.713E+01	1.076E+00	-1.685E+01	-3.783E+01
	E+01	-9.[illegible]E+01	-1.109E+02	-1.235E+02	-1.253E+02	-1.23[illegible]E+02					
3	+01	7.453E+01	7.065E+01	6.459E+01	5.620E+01	4.541E+01	3.238E+01	1.751E+01	1.099E+00	-1.716E+01	-3.851E+01
	E+01	-9.635E+01	-1.126E+02	-1.248E+02	-1.267E+02	-1.244E+02					
4	+01	7.692E+01	7.285E+01	6.652E+01	5.779E+01	4.660E+01	3.316E+01	1.788E+01	1.121E+00	-1.748E+01	-3.920E+01
	E+01	-9.788E+01	-1.143E+02	-1.264E+02	-1.280E+02	-1.255E+02					
5	+01	7.930E+01	[illegible]	6.845E+01	5.937E+01	4.778E+01	3.393E+01	1.826E+01	1.143E+00	-1.779E+01	-3.989E+01
	E+01	-[illegible]40E+01	-1.160E+02	-1.280E+02	-1.295E+02	-1.267E+02					
6	+01	8.169E+01	7.724E+01	7.036E+01	6.095E+01	4.895E+01	3.470E+01	1.864E+01	1.164E+00	-1.811E+01	-4.057E+01
	E+01	-9.492E+01	-1.177E+02	-1.296E+02	-1.306E+02	-1.278E+02					
7	+01	8.407E+01	7.944E+01	7.230E+01	6.253E+01	5.015E+01	3.547E+01	1.902E+01	1.186E+00	-1.842E+01	-4.126E+01
	E+01	-9.645E+01	-1.194E+02	-1.312E+02	-1.319E+02	-1.290E+02					
8	+01	8.646E+01	8.164E+01	7.423E+01	6.411E+01	5.133E+01	3.624E+01	1.939E+01	1.207E+00	-1.874E+01	-4.194E+01
	E+01	-9.798E+01	-1.211E+02	-1.328E+02	-1.333E+02	-1.301E+02					
9	+01	8.884E+01	8.384E+01	7.616E+01	6.569E+01	5.252E+01	3.701E+01	1.977E+01	1.229E+00	-1.906E+01	-4.263E+01
	E+01	-9.950E+01	-1.228E+02	-1.343E+02	-1.346E+02	-1.312E+02					
10	+01	9.122E+01	8.604E+01	7.808E+01	6.727E+01	5.370E+01	3.778E+01	2.015E+01	1.251E+00	-1.937E+01	-4.331E+01
	E+01	-1.010E+02	-1.245E+02	-1.359E+02	-1.359E+02	-1.324E+02					
11	+01	9.361E+01	6.824E+01	8.001E+01	6.885E+01	5.488E+01	3.855E+01	2.053E+01	1.272E+00	-1.969E+01	-4.400E+01
	E+01	-1.026E+02	-1.262E+02	-1.375E+02	-1.372E+02	-1.335E+02					

AREA ANY AT N CELL FACE

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17					
1	-6.544E+00	-1.961E+01	-3.255E+01	-4.519E+01	-5.718E+01	-6.799E+01	-7.710E+01	-8.421E+01	-8.967E+01	-9.445E+01	-9.906E+01
	-1.015E+02	-9.742E+01	-8.363E+01	-6.135E+01	-3.569E+01	-1.144E+01					
2	-6.771E+00	-2.028E+01	-3.363E+01	-4.663E+01	-5.888E+01	-6.986E+01	-7.902E+01	-8.610E+01	-9.150E+01	-9.625E+01	-1.009E+02
	-1.034E+02	-9.912E+01	-8.494E+01	-6.215E+01	-3.607E+01	-1.155E+01					
3	-6.998E+00	-2.095E+01	-3.471E+01	-4.806E+01	-6.059E+01	-7.173E+01	-8.095E+01	-8.800E+01	-9.334E+01	-9.805E+01	-1.027E+02
	-1.052E+02	-1.008E+02	-8.625E+01	-6.295E+01	-3.645E+01	-1.165E+01					
4	-7.224E+00	-2.162E+01	-3.580E+01	-4.950E+01	-6.229E+01	-7.360E+01	-8.288E+01	-8.990E+01	-9.518E+01	-9.986E+01	-1.045E+02
	-1.071E+02	-1.025E+02	-8.755E+01	-6.374E+01	-3.683E+01	-1.176E+01					
5	-7.451E+00	-2.229E+01	-3.688E+01	-5.093E+01	-6.399E+01	-7.547E+01	-8.480E+01	-9.180E+01	-9.701E+01	-1.017E+02	-1.064E+02
	-1.089E+02	-1.042E+02	-8.885E+01	-6.454E+01	-3.721E+01	-1.187E+01					
6	-7.678E+00	-2.296E+01	-3.796E+01	-5.236E+01	-6.570E+01	-7.734E+01	-8.673E+01	-9.370E+01	-9.885E+01	-1.035E+02	-1.082E+02
	-1.108E+02	-1.059E+02	-9.017E+01	-6.534E+01	-3.759E+01	-1.198E+01					
7	-7.905E+00	-2.363E+01	-3.904E+01	-5.380E+01	-6.740E+01	-7.921E+01	-8.866E+01	-9.560E+01	-1.007E+02	-1.053E+02	-1.100E+02
	-1.126E+02	-1.076E+02	-9.147E+01	-6.614E+01	-3.797E+01	-1.208E+01					
8	-8.132E+00	-2.430E+01	-4.012E+01	-5.523E+01	-6.911E+01	-8.108E+01	-9.059E+01	-9.750E+01	-1.025E+02	-1.071E+02	-1.119E+02
	-1.145E+02	-1.093E+02	-9.278E+01	-6.694E+01	-3.836E+01	-1.219E+01					
9	-8.359E+00	-2.497E+01	-4.120E+01	-5.667E+01	-7.081E+01	-8.295E+01	-9.251E+01	-9.940E+01	-1.044E+02	-1.089E+02	-1.137E+02
	-1.163E+02	-1.110E+02	-9.409E+01	-6.774E+01	-3.874E+01	-1.230E+01					
10	-8.586E+00	-2.564E+01	-4.228E+01	-5.810E+01	-7.251E+01	-8.482E+01	-9.444E+01	-1.013E+02	-1.062E+02	-1.107E+02	-1.155E+02
	-1.182E+02	-1.127E+02	-9.539E+01	-6.853E+01	-3.912E+01	-1.240E+01					
11	-8.813E+00	-2.631E+01	-4.336E+01	-5.953E+01	-7.422E+01	-8.669E+01	-9.637E+01	-1.032E+02	-1.080E+02	-1.125E+02	-1.174E+02
	-1.200E+02	-1.144E+02	-9.670E+01	-6.933E+01	-3.950E+01	-1.251E+01					

Figure 25 - Continued

STEP 30 DTHETA 2.C51E+00 DEG THETA 87 2.7 DEG

SHOCK RADIUS

2.023E+02 2.[illegible]E+02 2.394E+02 [illegible] 2.319E+02 2.484E+02 2.670E+02 2.864E+02 3.057E+02 3.251E+02 3.484E+02
3.763E+02 4.[illegible]E+02 4.494E+02 4.867E+02 [illegible]E+02 5.313E+02 5.359E+02

BODY RADIUS

[illegible]E+02 1.475E+02 1.527E+02 1.618E+02 1.730E+02 1.922E+02 2.108E+02 2.228E+02 2.192E+02 2.189E+02 2.262E+02
2.406E+02 2.515E+02 2.577E+02 2.606E+02 2.617E+02 2.619E+02 2.619E+02

STEP 31 DTHETA 2.051E+00 DEG THETA 89.268 DEG

SHOCK RADIUS

2.024E+02 2.043E+02 2.099E+02 2.194E+02 2.328E+02 2.496E+02 2.687E+02 2.887E+02 3.089E+02 3.296E+02 3.544E+02
3.843E+02 4.194E+02 4.596E+02 4.990E+02 5.334E+02 5.565E+02 5.618E+02

BODY RADIUS

1.459E+02 1.477E+02 1.529E+02 1.621E+02 1.754E+02 1.928E+02 2.119E+02 2.242E+02 2.207E+02 2.207E+02 2.283E+02
2.436E+02 2.555E+02 2.622E+02 2.654E+02 2.664E+02 2.666E+02 2.666E+02

FLOW VARIABLES, NADV EQUALS 31

DENSITY

	1	2	3	4	5	6	7	8	9	10	11
	12	13	14	15	16	17					
1	3.481E-06	3.466E-06	3.470E-06	3.503E-06	3.482E-06	3.324E-06	2.570E-06	1.485E-06	1.152E-06	1.025E-06	9.457E-07
	6.863E-07	4.538E-07	3.113E-07	2.350E-07	2.068E-07	2.338E-07					
2	3.920E-06	3.967E-06	3.982E-06	3.936E-06	3.960E-06	3.837E-06	3.039E-06	1.951E-06	1.436E-06	1.188E-06	1.049E-06
	8.224E-07	6.120E-07	4.558E-07	3.472E-07	2.924E-07	2 917E-07					
3	4.265E-06	4.278E-06	4.243E-06	4.203E-06	4.212E-06	4.028E-06	3.254E-06	2.186E-06	1.660E-06	1.374E-06	1.223E-06
	9.745E-07	7.323E-07	5.548E-07	4.302E-07	3.578E-07	3.279E-07					
4	4.592E-06	4.573E-06	4.520E-06	4.445E-06	4 377E-06	4.190E-06	3.471E-06	2.490E-06	1.954E-06	1.641E-06	1.450E-06
	1.200E-06	9 342E-07	7.230E-07	5 671E-07	4.677E-07	4.379E-07					
5	4.820E-06	4.865E-06	4.782E-06	4.681E-06	4.532E-06	4.334E-06	3.705E-06	2.792E-06	2.239E-06	1.909E-06	1.684E-06
	1 456E-06	1.176E-06	9.443E-07	7.704E-07	6.517E-07	5.669E-07					
6	5.035E-06	5.021E-06	4.995E-06	4.904E-06	4.722E-06	4.484E-06	3.986E-06	3.177E-06	2.616E-06	2.250E-06	2.029E-06
	1.784E-06	1.494E-06	1.248E-06	1.060E-06	9 195E-07	8.009E-07					
7	5 160E-06	5 161E-06	5.160E-06	5.122E-06	4.967E-06	4.713E-06	4.264E-06	3.531E-06	3.015E-06	2.721E-06	2.521E-06
	2.278E-06	1.980E-06	1 710E-06	1.500E-06	1.323E-06	1.168E-06					
8	5.297E-06	5.293E-06	5 287E-06	5.266E-06	5.168E-06	4.965E-06	4.596E-06	4.019E-06	3.569E-06	3.319E-06	3.132E-06
	2 893E-06	2.607E-06	2.316E-06	2.087E-06	1.889E-06	1.733E-06					
9	5.415E-06	5 408E-06	5 396E-06	5 373E-06	5.327E-06	5 180E-06	5.008E-06	4.588E-06	4.402E-06	4.186E-06	3.958E-06
	3.725E-06	3 398E-06	3.148E-06	2.913E-06	2.709E-06	2.540E-06					
10	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06					
11	1 027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06	1.027E-06
	1.027E-06	1.027E-06	1.027E-06	1.027L-06	1.027E-06	1.027E-06					

Figure 25 - Concluded

```
RESULTS OF INTERFACE BETWEEN BLUNT BODY CODES
AND STREAMLINE METRIC PROGRAM

UNSTEADY BLUNT-BODY TAPE READ.    16 STATIONS ON IT.

STEADY BLUNT-BODY TAPE READ.    4 STATIONS ON IT. TOTAL NO. OF STATIONS = 19

ALPHA =      30.0000 DEG
RINF  =     .1993E-05 SLUGS/FT**3
PINF  =     .1666E+01 LB/FT**2
MINF  =      10.0000
GAMMA =      1.4000

 Z/ZMAX-LOCATIONS REQUESTED

 1     .0250
 2     .0500
 3     .0750
 4     .1000
 5     .1250
 6     .1500
 7     .1750
 8     .2000
 9     .2250
10     .2500

23     .5750
24     .6000
25     .6250
26     .6500
27     .6750
28     .7000
29     .7250
30     .7500
31     .7750
32     .8000
33     .8250
34     .8500
35     .6750
36     .9000
37     .9250
38     .9500
39     .9750
40    1.0000

            ERROR IN BODY SURFACE DATA.STATION    .384 DISREGARDED
```

Figure 26 - Selected sample output from interface program

Z-STATION NO. 2 Z= .768

J= 1

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	1.9632E+02	1.1370E-05	1.0628E+03	9.4574E+02	0.
2	1.1250E+01	1.9427E+02	1.1329E-05	1.2591E+03	1.1037E+03	2.9885E+02
3	2.2500E+01	1.8431E+02	1.0975E-05	1.3812E+03	1.2201E+03	1.4072E+03
4	3.3750E+01	1.7191E+02	1.0447E-05	1.6035E+03	1.4382E+03	1.7790E+03
5	4.5000E+01	1.[illegible]546E+02	9.7324E-06	1.67[illegible]7E+03	1.5285E+03	2.4438E+03
6	5.6250E+01	1.3641E+02	8.8215E-06	1.8375E+03	1.7077E+03	2.8963E+03
7	6.7500E+01	1.1687E+02	7.9398E-06	2.1802E+03	2.0614E+03	3.2991E+03
8	7.8750E+01	9.7330E+01	6.9709E-06	2.5218E+03	2.4134E+03	3.6066E+03
9	9.0000E+01	7.[illegible]067E+01	[illegible].9880E-06	2.9230E+03	2.8131E+03	3.7470E+03
10	1.0125E+02	6.2967E+01	5.0727E-06	3.3782E+03	3.2641E+03	3.7339E+03
11	1.1250E+02	4.9492E+01	4.2666E-06	3.8540E+03	3.7288E+03	3.6016E+03
12	1.2375E+02	3.9513E+01	3.6175E-06	4.2933E+03	4.1487E+03	3.2901E+03
13	1.3500E+02	3.1629E+01	3.0799E-06	4.7134E+03	4.5403E+03	2.8654E+03
14	1.4625E+02	2.6615E+01	2.6950E-06	5.029[illegible]E+03	4.8247E+03	2.2857E+03
15	1.5750E+02	2.1600E+01	2.3101E-06	5.3406E+03	5.1031E+03	1.7060E+03
16	1.6875E+02	2.0629E+01	2.2355E-06	5.4930E+03	5.2328E+03	8.8235E+02
17	1.8000E+02	2.0629E+01	2.2355E-06	5.5329E+03	5.2650E+03	1.7975E-05

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2813E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
9	9.0000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
10	1.0125E+02	7.2813E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2813E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2813E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2813E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2813E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2813E-03	2.7377E-02	0.	0.	0.
16	1.6875E+02	7.2813E-03	2.7377E-02	0.	0.	0.
17	1.8000E+02	7.2813E-03	2.7377E-02	0.	0.	0.

J= 2

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	1.9562E+02	1.1485E-05	1.3964E+03	9.7818E+02	0.
2	1.1250E+01	1.9339E+02	1.1399E-05	1.5030E+03	1.0739E+03	6.7681E+02
3	2.2500E+01	1.8470E+02	1.1041E-05	1.5600E+03	1.1431E+03	1.3293E+03
4	3.3750E+01	1.7212E+02	1.0526E-05	1.6670E+03	1.2903E+03	1.9366E+03
5	4.5000E+01	1.5612E+02	9.6555E-06	1.8499E+03	1.4854E+03	2.4944E+03
6	5.6250E+01	1.3744E+02	9.0062E-06	2.0536E+03	1.7604E+03	2.9827E+03
7	6.7500E+01	1.1674E+02	8.1529E-06	2.3425E+03	2.0829E+03	3.3462E+03
8	7.8750E+01	9.9379E+01	7.2164E-06	2.6944E+03	2.4833E+03	3.6320E+03
9	9.0000E+01	8.1130E+01	6.2815E-06	3.1062E+03	2.9458E+03	3.7762E+03
10	1.0125E+02	6.5154E+01	5.4038E-06	3.5478E+03	3.4274E+03	3.7690E+03
11	1.1250E+02	5.1679E+01	4.6018E-06	3.9753E+03	3.8860E+03	3.6328E+03
12	1.2375E+02	4.3041E+01	4.0679E-06	4.3856E+03	4.3369E+03	3.2942E+03
13	1.3500E+02	3.5759E+01	3.5713E-06	4.7543E+03	4.6913E+03	2.8356E+03
14	1.4625E+02	3.0722E+01	3.2191E-06	5.0969E+03	4.9848E+03	2.2413E+03
15	1.5750E+02	2.4814E+01	2.7354E-06	5.4319E+03	5.2060E+03	1.6534E+03

Figure 26 - Continued

J= 11

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	1.8093E+02	1.1306E-05	3.3173E+03	8.2296E+02	0.
2	1.1250E+01	1.7911E+02	1.1604E-05	3.3265E+03	8.7407E+02	3.8947E+02
3	2.2500E+01	1.7391E+02	1.1537E-05	3.3711E+03	1.0455E+03	1.7260E+03
4	3.3750E+01	1.6525E+02	1.1257E-05	3.4062E+03	1.3133E+03	2.5341E+03
5	4.5000E+01	1.5402E+02	1.1130E-05	3.5889E+03	1.7049E+03	3.2228E+03
6	5.6250E+01	1.4076E+02	1.0972E-05	3.7602E+03	2.1720E+03	3.7713E+03
7	6.7500E+01	1.2713E+02	1.0806E-05	3.9500E+03	2.7066E+03	4.1883E+03
8	7.8750E+01	1.1264E+02	1.0540E-05	4.1706E+03	3.3144E+03	4.4235E+03
9	9.0000E+01	9.6772E+01	1.0144E-05	4.4876E+03	3.9686E+03	4.5013E+03
10	1.0125E+02	8.2083E+01	9.7144E-06	4.7978E+03	4.6357E+03	4.3725E+03
11	1.1250E+02	7.0484E+01	9.2333E-06	5.0705E+03	5.2809E+03	4.0680E+03
12	1.2375E+02	5.6540E+01	8.4706E-06	5.3536E+03	5.8056E+03	3.5898E+03
13	1.3500E+02	5.5691E+01	6.2447E-06	5.3419E+03	6.1312E+03	2.9566E+03
14	1.4625E+02	5.4853E+01	6.2334E-06	5.2928E+03	6.4515E+03	2.3033E+03
15	1.5750E+02	5.3920E+01	6.1834E-06	5.2358E+03	6.7643E+03	1.6453E+03
16	1.6875E+02	5.3671E+01	6.2837E-06	5.2195E+03	6.9435E+03	8.7752E+02
17	1.8000E+02	5.3438E+01	6.3033E-06	5.2208E+03	6.9477E+03	1.7877E-05

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2813E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
9	9.0000E+01	7.2813E-03	2.7377E-02	0.	0	0.
10	1.0125E+02	7.2813E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2813E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2813E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2813E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2813E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2813E-03	2.7377E-02	0.	0.	0.
16	1.6875E+02	7.2813E-03	2.7377E-02	0.	0.	0.
17	1.8000E+02	7.2813E-03	2.7377E-02	0.	0.	0.

RB FROM GEOM3,RB FROM INTERPOLATION,THE RELATIVE ERROR,DERIVATIVES W.R.T. Z AND PHI + RS

K	RB	PX	RBD	RBZ	RBPHI	RS
1	1.6913E+00	1.6827E+00	5.1093E-03	8.7345E-01	0.	2.1862E+00
2	1.6910E+00	1.6838E+00	4.2370E-03	8.7705E-01	-3.4462E-03	2.1919E+00
• 3	1.6900E+00	1.6798E+00	6.0439E-03	8.8725E-01	-6.3721E-03	2.2065E+00
4	1.6885E+00	1.6760E+00	7.3985E-03	9.0238E-01	-8.3423E-03	2.2268E+00
5	1.6868E+00	1.6721E+00	8.7172E-03	9.2001E-01	-9.0746E-03	2.2658E+00
6	1.6850E+00	1.6713E+00	6.1712E-03	9.3730E-01	-6.4797E-03	2.3070E+00
7	1.6835E+00	1.6644E+00	1.1349E-02	9.5150E-01	-6.6681E-03	2.3672E+00
8	1.6825E+00	1.6613E+00	1.2560E-02	9.6035E-01	-3.9274E-03	2.4335E+00
9	1.6820E+00	1.6530E+00	1.7263E-02	9.6238E-01	2.2393E-08	2.5141E+00
10	1.6827E+00	1.6451E+00	2.2323E-02	9.6198E-01	6.4792E-03	2.6120E+00
11	1.6845E+00	1.6454E+00	2.3222E-02	9.6085E-01	1.2011E-02	2.7339E+00
12	1.6873E+00	1.6252E+00	3.6807E-02	9.5914E-01	1.5771E-02	2.8828E+00
13	1.6905E+00	1.6075E+00	4.9137E-02	9.5709E-01	1.7170E-02	2.8312E+00
14	1.6938E+00	1.5672E+00	7.4785E-02	9.5501E-01	1.5956E-02	2.8727E+00
15	1.6966E+00	1.5896E+00	6.3082E-02	9.5321E-01	1.2273E-02	3.0295E+00
16	1.6985E+00	1.5327E+00	9.7614E-02	9.5200E-01	6.6642E-03	3.0854E+00
17	1.6992E+00	1.5015E+00	1.1635E-01	9.5157E-01	1.2517E-10	3.0244E+00

Figure 26 - Continued

Z-STATION NO. 40 Z= 15.369

J= 1

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	7.2836E+01	6.3215E-06	6.4845E+03	4.7079E+02	0.
2	1.1250E+01	7.2318E+01	6.2720E-06	6.4711E+03	5.1984E+02	2.6400E+02
3	2.2500E+01	7.0974E+01	6.2363E-06	6.5219E+03	6.7492E+02	5.2084E+02
4	3.3750E+01	7.1042E+01	6.3231E-06	6.5400E+03	9.6117E+02	3.4244E+02
5	4.5000E+01	7.0545E+01	6.3053E-06	6.3994E+03	1.4118E+03	1.2899E+03
6	5.6250E+01	6.7553E+01	6.0179E-06	6.0867E+03	1.9523E+03	1.8680E+03
7	6.7500E+01	5.1594E+01	4.6698E-06	5.7740E+03	2.2154E+03	2.7695E+03
8	7.8750E+01	2.5603E+01	2.6101E-06	6.4991E+03	9.4582E+02	3.3360E+03
9	9.0000E+01	1.7272E+01	1.9602E-06	6.7676E+03	1.6342E+03	3.6605E+03
10	1.0125E+02	1.4299E+01	1.6342E-06	6.8707E+03	2.4640E+03	3.8830E+03
11	1.1250E+02	1.2280E+01	1.6890E-06	6.6665E+03	3.3706E+03	4.0286E+03
12	1.2375E+02	7.5334E+00	1.1336E-06	6.8132E+03	3.4120E+03	4.2835E+03
13	1.3500E+02	4.0172E+00	6.7934E-07	7.2231E+03	3.3447E+03	4.2630E+03
14	1.4625E+02	2.3334E+00	4.4275E-07	7.7234E+03	3.3061E+03	3.9313E+03
15	1.5750E+02	1.6781E+00	3.4540E-07	8.2001E+03	3.3338E+03	3.2500E+03
16	1.6875E+02	1.7327E+00	3.5750E-07	8.5392E+03	3.3903E+03	2.1420E+03
17	1.8000E+02	1.9793E+00	3.9916E-07	8.7362E+03	3.4491E+03	6.2652E-05

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2813E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
9	9.0000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
10	1.0125E+02	7.2813E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2813E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2813E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2813E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2813E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2813E-03	2.7377E-02	0.	0.	0.
16	1.6875E+02	7.2813E-03	2.7377E-02	0.	0.	0.
17	1.8000E+02	7.2813E-03	2.7377E-02	0.	0.	0.

J= 2

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	7.2233E+01	7.0758E-06	7.1313E+03	4.6120E+02	0.
2	1.1250E+01	7.2304E+01	7.0856E-06	7.1220E+03	5.3413E+02	3.0275E+02
3	2.2500E+01	7.2000E+01	7.1072E-06	7.1269E+03	6.8567E+02	5.9966E+02
4	3.3750E+01	7.1219E+01	7.1290E-06	7.1302E+03	9.4845E+02	9.4089E+02
5	4.5000E+01	7.0349E+01	7.1638E-06	7.0530E+03	1.4101E+03	1.4075E+03
6	5.6250E+01	6.6754E+01	7.0108E-06	6.9555E+03	1.8846E+03	1.9427E+03
7	6.7500E+01	5.0893E+01	5.6260E-06	7.0307E+03	2.0935E+03	2.6946E+03
8	7.8750E+01	2.8381E+01	3.5668E-06	7.2354E+03	1.8624E+03	3.2998E+03
9	9.0000E+01	1.6019E+01	2.4397E-06	7.3425E+03	1.9396E+03	3.6118E+03
10	1.0125E+02	1.3940E+01	2.0937E-06	7.4738E+03	2.4620E+03	3.7472E+03
11	1.1250E+02	1.1392E+01	1.6751E-06	7.4781E+03	3.1790E+03	3.7551E+03
12	1.2375E+02	7.6666E+00	1.3659E-06	7.5268E+03	3.5231E+03	3.8506E+03
13	1.3500E+02	4.8759E+00	9.5104E-07	7.6677E+03	3.6929E+03	3.7806E+03
14	1.4625E+02	3.2200E+00	6.7090E-07	7.9059E+03	3.8206E+03	3.4558E+03
15	1.5750E+02	2.3737E+00	5.1734E-07	8.2053E+03	3.8899E+03	2.8211E+03

Figure 26 - Continued

RB FROM GEOM3,RX FROM INTERPOLATION,THE RELATIVE ERROR,DERIVATIVES W.R.T. Z AND PHI + RS

K	RB	RX	RBD	RBZ	RBPHI	RS
1	4.7895E+00	4.7766E+00	2.7025E-03	7.2602E-02	0.	6.6188E+00
2	4.8534E+00	4.8403E+00	2.6963E-03	7.4828E-02	6.5466E-01	6.6880E+00
3	5.0497E+00	5.0358E+00	2.7605E-03	8.2026E-02	1.3569E+00	6.8967E+00
4	5.3914E+00	5.3742E+00	3.1946E-03	9.5914E-02	2.1368E+00	7.2406E+00
5	5.8914E+00	5.8638E+00	4.6640E-03	1.1977E-01	2.9477E+00	7.7345E+00
6	6.5315E+00	6.4757E+00	8.5341E-03	1.5735E-01	3.4666E+00	8.3400E+00
7	7.1664E+00	7.0516E+00	1.6032E-02	2.0776E-01	2.6282E+00	9.0193E+00
8	7.3579E+00	7.2717E+00	1.1711E-02	2.3228E-01	-1.2435E+00	9.7312E+00
9	7.2315E+00	7.2316E+00	-2.1303E-05	2.4147E-01	8.3554E-08	1.0462E+01
10	7.3732E+00	7.3727E+00	5.4771E-05	2.4620E-01	1.4666E+00	1.1208E+01
11	7.8268E+00	7.7771E+00	6.3490E-03	2.6494E-01	3.1169E+00	1.2245E+01
12	8.3277E+00	8.2315E+00	1.1552E-02	3.5056E-01	1.9900E+00	1.3419E+01
13	8.6205E+00	8.5270E+00	1.0851E-02	3.9173E-01	1.0418E+00	1.4772E+01
14	8.7587E+00	8.6719E+00	9.9174E-03	4.0353E-01	4.2231E-01	1.6173E+01
15	8.8065E+00	8.7261E+00	9.1230E-03	4.0170E-01	1.0780E-01	1.7410E+01
16	8.8146E+00	8.7388E+00	8.6214E-03	3.9694E-01	2.6990E-03	1.8243E+01
17	8.8142E+00	8.7397E+00	8.4527E-03	3.9481E-01	-2.5743E-10	1.8517E+01

CHAOS TAPE WRITTEN

Figure 26 - Continued

Z-STATION NO. 40 Z=46 449

J= 1

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	3.4675E+04	3.2580E-06	1.9755E+05	1.4550E+04	0.
2	1.1250E+01	3.4626E+04	3.2325E-06	1.9724E+05	1.5845E+04	8.0468E+03
3	2.2500E+01	3.3982E+04	3.2140E-06	1.9879E+05	2.0572E+04	1.5875E+04
4	3.3750E+01	3.4015E+04	3.2634E-06	1.9934E+05	2.9290E+04	2.5675E+04
5	4.5000E+01	3.3777E+04	3.2496E-06	1.9505E+05	4.3032E+04	3.9315E+04
6	5.6250E+01	3.2545E+04	3.1015E-06	1.8552E+05	5.9535E+04	5.6935E+04
7	6.7500E+01	2.4704E+04	2.4170E-06	1.7599E+05	6.7526E+04	8.4414E+04
8	7.8750E+01	1.2259E+04	1.3452E-06	1.9809E+05	2.6628E+04	1.0168E+05
9	9.0000E+01	8.2700E+03	1.0266E-06	2.0628E+05	4.9610E+04	1.1157E+05
10	1.0125E+02	6.6445E+03	9.4530E-07	2.0942E+05	7.5102E+04	1.1835E+05
11	1.1250E+02	5.8798E+03	8.7049E-07	2.0320E+05	1.0273E+05	1.2279E+05
12	1.2375E+02	3.6670E+03	5.8425E-07	2.0767E+05	1.0490E+05	1.3056E+05
13	1.3500E+02	1.9234E+03	3.5012E-07	2.2016E+05	1.0195E+05	1.2994E+05
14	1.4625E+02	1.1172E+03	2.2619E-07	2.3541E+05	1.0077E+05	1.1963E+05
15	1.5750E+02	8.0348E+02	1.7801E-07	2.4994E+05	1.0161E+05	9.9059E+04
16	1.6875E+02	5.2962E+02	1.8425E-07	2.6028E+05	1.0333E+05	6.5288E+04
17	1.9000E+02	9.4769E+02	2.0572E-07	2.6628E+05	1.0013E+05	1.9096E-03

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2613E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2613E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2613E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2613E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2613E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2613E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2613E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2613E-03	2.7377E-02	0.	0	0
9	9.0000E+01	7.2613E-03	2.7377E-02	0.	0.	0.
10	1.0125E+02	7.2613E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2613E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2613E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2613E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2613E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2613E-03	2.7377E-02	0.	0	0.
16	1.6875E+02	7.2613E-03	2.7377E-02	0.	0	0.
17	1.8000E+02	7.2613E-03	2.7377E-02	0.	0	0.

J= 2

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	3.4713E+04	3.4750E-06	2.0985E+05	1.5408E+04	0.
2	1.1250E+01	3.4622E+04	3.4666E-06	2.0959E+05	1.6972E+04	8.7064E+03
3	2.2500E+01	3.4258E+04	3.4655E-06	2.1033E+05	2.1424E+04	1.7221E+04
4	3.3750E+01	3.4063E+04	3.4969E-06	2.1066E+05	2.6970E+04	2.7362E+04
5	4.5000E+01	3.3722E+04	3.5112E-06	2.0789E+05	4.3213E+04	4.1434E+04
6	5.6250E+01	3.2112E+04	3.4364E-06	2.0423E+05	5.7743E+04	5.8378E+04
7	6.7500E+01	2.4514E+04	2.8644E-06	2.0709E+05	6.3659E+04	8.2352E+04
8	7.8750E+01	1.3172E+04	1.6757E-06	2.1402E+05	5.5187E+04	1.0092E+05
9	9.0000E+01	8.4572E+03	1.1445E-06	2.1732E+05	5.6238E+04	1.1080E+05
10	1.0125E+02	6.7563E+03	1.0154E-06	2.2132E+05	7.2437E+04	1.1618E+05
11	1.1250E+02	5.6348E+03	9.2574E-07	2.2059E+05	9.5204E+04	1.1799E+05
12	1.2375E+02	3.6456E+03	6.6301E-07	2.2308E+05	1.0468E+05	1.2257E+05
13	1.3500E+02	2.1669E+03	4.3502E-07	2.2463E+05	1.0665E+05	1.2123E+05
14	1.4625E+02	1.3627E+03	2.9617E-07	2.3899E+05	1.1158E+05	1.1145E+05
15	1.5750E+02	9.9270E+02	2.2636E-07	2.4992E+05	1.1290E+05	9.1632E+04

Figure 26 - Continued

10	1.0125E+02	1.3317E+04	4.1 45E-06	2.5046E+05	1.1733E+05	1.2446E+05
11	1.1250E+02	1.0676E+04	4.2[illegible]2E-06	2.5157E+05	1.3561E+05	1.1716E+05
12	1.2375E+02	[illegible]	[illegible]9E-06	2.5271E+05	1.5295E+05	1.0517E+05
13	1.3500E+02	6.5965E+03	3.5443E-06	2.5372E+05	1.6743E+05	[illegible].9295E+04
14	1.4625E+02	5.4294E+03	3.0[illegible]E-06	2.5393E+05	1.8024E+05	7.0818E+04
15	1.5750E+02	4.4902E+03	2.9177E-06	2.5464E+05	1.8961E+05	4.9169E+04
16	1.6875E+02	3.7859E+03	2.[illegible]E-06	2.5640E+05	1.9445E+05	2.5670E+04
17	1.8000E+02	3.45[illegible]E+03	2.5143E-06	2.5765E+05	1.9543E+05	5.6640E-04

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2813E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
9	9.0000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
10	1.0125E+02	7.2813E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2813E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2813E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2813E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2813E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2813E-03	2.7377E-02	0.	0.	0.
16	1.6875E+02	7.2813E-03	2.7377E-02	0.	0.	0.
17	1.8000E+02	7.2813E-03	2.7377E-02	0.	0.	0.

J= 22

K	PHI	PRESSURE	DENSITY	U-VEL	V-VEL	W-VEL
1	0.	3.5907E+04	5.4568E-06	2.6104E+05	-1.1896E+02	0.
2	1.1250E+01	3.5819E+04	5.4552E-06	2.6016E+05	2.4702E+03	2.3519E+04
3	2.2500E+01	3.5528E+04	5.4502E-06	2.5889E+05	9.2549E+03	3.8204E+04
4	3.3750E+01	3.4951E+04	5.4398E-06	2.5695E+05	1.9948E+04	5.2986E+04
5	4.5000E+01	3.3759E+04	5.4175E-06	2.5450E+05	3.4072E+04	6.8191E+04
6	5.6250E+01	3.1009E+04	5.3604E-06	2.5305E+05	4.9776E+04	8.4833E+04
7	6.7500E+01	2.6616E+04	5.2541E-06	2.5204E+05	6.6462E+04	1.0264E+05
8	7.8750E+01	2.0989E+04	5.0490E-06	2.5344E+05	8.1169E+04	1.1950E+05
9	9.0000E+01	1.6876E+04	4.6378E-06	2.5124E+05	9.9489E+04	1.2946E+05
10	1.0125E+02	1.3634E+04	4.6048E-06	2.4991E+05	1.1849E+05	1.3032E+05
11	1.1250E+02	1.0542E+04	4.3384E-06	2.5071E+05	1.3677E+05	1.2241E+05
12	1.2375E+02	8.7333E+03	4.0406E-06	2.5192E+05	1.5375E+05	1.0941E+05
13	1.3500E+02	6.9042E+03	3.7088E-06	2.5351E+05	1.6842E+05	9.2423E+04
14	1.4625E+02	5.6210E+03	3.4064E-06	2.5431E+05	1.8100E+05	7.2257E+04
15	1.5750E+02	4.6662E+03	3.1261E-06	2.5530E+05	1.9010E+05	4.9443E+04
16	1.6875E+02	3.9470E+03	2.6783E-06	2.5700E+05	1.9482E+05	2.4474E+04
17	1.8000E+02	3.6107E+03	2.7468E-06	2.5813E+05	1.9588E+05	5.9195E-04

K	PHI	CO2	CN2	CNO	CO	CN
1	0.	7.2813E-03	2.7377E-02	0.	0.	0.
2	1.1250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
3	2.2500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
4	3.3750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
5	4.5000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
6	5.6250E+01	7.2813E-03	2.7377E-02	0.	0.	0.
7	6.7500E+01	7.2813E-03	2.7377E-02	0.	0.	0.
8	7.8750E+01	7.2813E-03	2.7377E-02	0.	0.	0.
9	9.0000E+01	7.2813E-03	2.7377E-02	0.	0.	0.
10	1.0125E+02	7.2813E-03	2.7377E-02	0.	0.	0.
11	1.1250E+02	7.2813E-03	2.7377E-02	0.	0.	0.
12	1.2375E+02	7.2813E-03	2.7377E-02	0.	0.	0.
13	1.3500E+02	7.2813E-03	2.7377E-02	0.	0.	0.
14	1.4625E+02	7.2813E-03	2.7377E-02	0.	0.	0.
15	1.5750E+02	7.2813E-03	2.7377E-02	0.	0.	0.
16	1.6875E+02	7.2813E-03	2.7377E-02	0.	0.	0.
17	1.8000E+02	7.2813E-03	2.7377E-02	0.	0.	0.

Figure 26 - Continued

RB FROM GEOM., RB FROM INTERPOLATION, THE RELATIVE ERROR, DERIVATIVES W.R.T. Z AND PHI + RS AND ITS DERIVATIVES

K	RB	RX	RBU	RBZ	RBPHI	RS	RSZ	RSPHI
1	1.4596E+02	1.4559E+02	2.7025E-03	7.2602E-02	0.	2.0174E+02	1.4913E-01	0.
2	1.4753E+02	1.4753E+02	2.6903E-03	7.4828E-02	1.9954E+01	2.0385E+02	1.5501E-01	1.0740E+01
3	1.53[illegible]+02	1.5349E+02	2.7605E-03	8.2026E-02	4.1358E+01	2.1021E+02	1.6532E-01	3.2389E+01
4	1.6433E+02	1.6381E+02	3.1946E-03	9.5914E-02	6.5131E+01	2.2058E+02	1.8249E-01	5.4323E+01
5	1.7957E+02	1.7873E+02	4.6640E-03	1.1977E-01	8.9645E+01	2.3575E+02	2.0645E-01	7.5743E+01
6	1.9968E+02	1.9735E+02	8.8341E-03	1.5764E-01	1.0566E+02	2.5420E+02	2.3028E-01	9.3985E+01
7	2.1840E+02	2.1493E+02	1.6032E-02	2.0778E-01	6.0107E+01	2.7491E+02	2.5912E-01	1.0546E+02
8	2.2427E+02	2.2164E+02	1.1711E-02	2.3228E-01	-3.7903E+01	2.9661E+02	2.8381E-01	1.1051E+02
9	2.2042E+02	2.2042E+02	-2.1303E-05	2.4147E-01	2.5407E-06	3.1690E+02	3.4551E-01	1.1351E+02
10	2.2473E+02	2.2472E+02	5.4771E-05	2.4620E-01	4.4702E+01	3.4344E+02	4.1358E-01	1.2498E+02
11	2.3856E+02	2.3705E+02	6.3490E-03	2.6494E-01	9.5004E+01	3.7322E+02	4.7371E-01	1.5167E+02
12	2.5383E+02	2.5090E+02	1.1552E-02	3.5056E-01	6.0655E+01	4.0901E+02	5.4223E-01	1.8227E+02
13	2.5275E+02	2.5990E+02	1.0651E-02	3.9173E-01	3.1754E+01	4.5026E+02	6.1956E-01	2.1009E+02
14	2.6697E+02	2.6432E+02	9.9174E-03	4.0353E-01	1.2872E+01	4.9294E+02	7.1329E-01	2.1739E+02
15	2.6642E+02	2.6597E+02	9.1230E-03	4.0170E-01	3.2657E+00	5.3064E+02	8.0283E-01	1.9201E+02
16	2.6679E+02	2.6636E+02	8.6214E-03	3.9694E-01	6.2256E-02	5.5603E+02	8.6459E-01	1.2932E+02
17	2.6606E+02	2.6639E+02	8.4527E-03	3.9481E-01	-7.8464E-09	5.6439E+02	8.8688E-01	0.

SHOCK-CAPTURE CODE STARTING DATA TAPE WRITTEN

Figure 26 - Concluded

```
 GRFCS=   F      MODIN=  1     LTIM=  3     MODOUT=  0     LTOUT=  0     UNIT=-50     MODEFO=-    -200.000     MODBSO=- 5
 CRASHZ=  10.000

 REMESH AND CONTROL PARAMETERS
 NO     ZRMSH          BETTA          PHIZRO        AR             BR            ZFACT          FCTROW
  1    .50000E+03     0.             0.            0.             0.            -0.            -0.
  2    .60000E+03     .30000E+01     .13090E+01    0.             0.            -0.            -0.
  3    .70000F+03     .30000E+01     .13090E+01    0.             0.            -0.            -0.
  4    .30000F+04     .30000E+01     .13090E+01    0.             0.            -0.            -0.

 DISSIPATTON (DAMPING) PARAMETFRS
 NO     ZDMPM         DCM
  1    .28000E+03     0.
  2    .30000F+04     .40000E+00

 NO     ZDMPR         DCR
  1    .45000F+03     0.
  2    .30000F+04     .10000E+00

 FREE STRFAM QUANTITIFS
 P-INF=  7.97700E+02 RHO-INF=  1.02690E-06 Q-INF=  3.29795E+05 MACH NO= 10.0000
 TOT. ENTHALPY=  5.71015E+10
 NDUM=
      1     1     2    18     3    24     4  1000     5    -1     6     2     7     1     8     0     9     1    10     0
     11     0    12     0    13     0    14     0    15     0    16     0    17     0    18   176    19     1    20     0
 ADUM=
      1  .4684E+03     2  .5236F+00     3  .5710E+11     4  0.         5  .7978E+03     6  .1027E-05     7  .1000E+02     8  .3298E+06
      9  .2886F+02    10  .5000E+00    11 -.1000E+01    12  0.        13  0.           14  0.          15  .3285E+04    16  0.
     17  0.           18  0.           19  0.           20  0.
```

Figure 27 - Selected sample output from program 3

FIELD QUANTITIES (NCASE =1 NPHI= 18 J12= 24)

NSTEP= 1 Z= .4688E+03 DZ= 0 DZETA= 0. DZDRH= 0. FACT= .50000 FIFACT= 1.00000
BETTA= 0.0000 PHIZRO= 0.0000 NFMSH= 1

EIGENVALUE INFO* DT*FACT/SIG12= 0. J= 0 K= 0
DETA*FACT/SIG34= 0. J= 0 K= 0

SHELL I= 3 XI= 0.00000

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1460E+03	.3487E+05	.3258E-05	.3715E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1479E+03	.3463E+05	.3232E-05	.3717E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1539E+03	.3396E+05	.3214E-05	.3669E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1643E+03	.3401E+05	.3264E-05	.3616E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.1796E+03	.3378E+05	.3250E-05	.3607E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.1991E+03	.3234E+05	.3101E-05	.3619E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2184E+03	.2470E+05	.2417E-05	.3547E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2243E+03	.1276E+05	.1345E-05	.3162E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2204E+03	.8270E+04	.1021E-05	.2812E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2247E+03	.6846E+04	.9453E-06	.2513E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.2386E+03	.5880E+04	.8705E-06	.2344E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.2538E+03	.3607E+04	.5842E-06	.2142E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.2628E+03	.1923E+04	.3501E-06	.1906E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.2670E+03	.1117E+04	.2282E-06	.1699E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.2684E+03	.8035E+03	.1780E-06	.1566E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.2687E+03	.8296E+03	.1842E-06	.1563E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.2687E+03	.9477E+03	.2057E-06	.1599E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	1.6145	.1172	0.0000	.1224E+06	0.	.1976E+06	.1435E+05	0.	.7281E-02	.2738E-01
3	11.25	1.6106	.1294	.0657	.1225E+06	0.	.1972E+06	.1584E+05	.8047E+04	.7281E-02	.2738E-01
4	22.50	1.6339	.1691	.1305	.1217E+06	0.	.1988E+06	.2057E+05	.1588E+05	.7281E-02	.2738E-01
5	33.75	1.6503	.2425	.2126	.1208E+06	0.	.1993E+06	.2930E+05	.2568E+05	.7281E-02	.2738E-01
6	45.00	1.6169	.3567	.3259	.1206E+06	0.	.1951E+06	.4303E+05	.3932E+05	.7281E-02	.2738E-01
7	56.25	1.5354	.4925	.4712	.1208E+06	0.	.1855E+06	.5951E+05	.5694E+05	.7281E-02	.2738E-01
8	67.50	1.4717	.5645	.7057	.1196E+06	0.	.1760E+06	.6753E+05	.8441E+05	.7281E-02	.2738E-01
9	78.75	1.7538	.2552	.9002	.1130E+06	0.	.1981E+06	.2883E+05	.1017E+06	.7281E-02	.2738E-01
10	90.00	1.9367	.4676	1.0475	.1065E+06	0.	.2063E+06	.4981E+05	.1116E+06	.7281E-02	.2738E-01
11	101.25	2.0797	.7458	1.1754	.1007E+06	0.	.2094E+06	.7510E+05	.1184E+06	.7281E-02	.2738E-01
12	112.50	2.0895	1.0565	1.2627	.9724E+05	0.	.2032E+06	.1027E+06	.1228E+06	.7281E-02	.2738E-01
13	123.75	2.2337	1.1186	1.4043	.9297E+05	0.	.2077E+06	.1040E+06	.1306E+06	.7281E-02	.2738E-01
14	135.00	2.5104	1.1625	1.4816	.8770E+05	0.	.2202E+06	.1019E+06	.1299E+06	.7281E-02	.2738E-01
15	146.25	2.8434	1.2172	1.4473	.8279E+05	0.	.2354E+06	.1008E+06	.1198E+06	.7281E-02	.2738E-01
16	157.50	3.1442	1.2783	1.2461	.7949E+05	0.	.2499E+06	.1016E+06	.9906E+05	.7281E-02	.2738E-01
17	168.75	3.2782	1.3015	.8223	.7940E+05	0.	.2603E+06	.1033E+06	.6529E+05	.7281E-02	.2738E-01
18	180.00	3.3152	1.3091	0.0000	.8031E+05	0.	.2663E+06	.1051E+06	0.	.7281E-02	.2738E-01

Figure 27 - Continued.

SHELL I= 4 XI= .04762

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1486F+03	.3471F+05	.3475E-05	.3467E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1506E+03	.3462E+05	.3467E-05	.3466E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1566F+03	.3426F+05	.3466E-05	.3430E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1670E+03	.3406E+05	.3497E-05	.3380E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.1822E+03	.3372F+05	.3511F-05	.3333E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2017E+03	.3211E+05	.3436E-05	.3243F+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2211F+03	.2451E+05	.2864E-05	.2970E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2272E+03	.1317E+05	.1679E-05	.2723E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2251F+03	.8457F+04	.1145E-05	.2564E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2304E+03	.6756E+04	.1015E-05	.2309E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.2450F+03	.5635E+04	.9257E-06	.2112E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.2612E+03	.3646E+04	.6630E-06	.1908E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.2717F+03	.2167F+04	.4330E-06	.1737E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.2777E+03	.1363F+04	.2962E-06	.1597E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.2809F+03	.9927E+03	.2284E-06	.1509E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.2824F+03	.9644F+03	.2199E-06	.1522E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.2827F+03	.1053F+04	.2337E-06	.1564E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	1.7749	.1303	0.0000	.1183E+06	0.	.2098E+06	.1541E+05	0.	.7281E-02	.2738E-01
3	11.25	1.7728	.1435	.0736	.1182E+06	0.	.2096E+06	.1697E+05	.8706E+04	.7281E-02	.2738E-01
4	22.50	1.7879	.1821	.1464	.1176E+06	0.	.2103E+06	.2142E+05	.1722E+05	.7281E-02	.2738E-01
5	33.75	1.8039	.2481	.2345	.1168E+06	0.	.2107E+06	.2897E+05	.2738E+05	.7281E-02	.2738E-01
6	45.00	1.7929	.3727	.3573	.1160E+06	0.	.2079E+06	.4321E+05	.4143E+05	.7281E-02	.2738E-01
7	56.25	1.7055	.5048	.5104	.1144E+06	0.	.2042E+06	.5774E+05	.5838E+05	.7281E-02	.2738E-01
8	67.50	1.8919	.5810	.7523	.1095E+06	0.	.2071E+06	.6386E+05	.8235E+05	.7281E-02	.2738E-01
9	78.75	2.0419	.5265	.9628	.1048E+06	0.	.2140E+06	.5519E+05	.1009E+06	.7281E-02	.2738E-01
10	90.00	2.1367	.5529	1.0893	.1017E+06	0.	.2173E+06	.5624E+05	.1108E+06	.7281E-02	.2738E-01
11	101.25	2.2932	.7505	1.2038	.9652E+05	0.	.2213E+06	.7244E+05	.1162F+06	.7281E-02	.2738E-01
12	112.50	2.3896	1.0313	1.2781	.9231E+05	0.	.2206E+06	.9520E+05	.1180E+06	.7281E-02	.2738E-01
13	123.75	2.5426	1.1931	1.3970	.8774E+05	0.	.2231E+06	.1047E+06	.1226E+06	.7281E-02	.2738E-01
14	135.00	2.7439	1.2981	1.4484	.8370E+05	0.	.2296E+06	.1087E+06	.1212E+06	.7281E-02	.2738E-01
15	146.25	2.9778	1.3915	1.3886	.8026E+05	0.	.2390E+06	.1117E+06	.1114E+06	.7281E-02	.2738E-01
16	157.50	3.2036	1.4472	1.1746	.7801E+05	0.	.2499E+06	.1129E+06	.9163E+05	.7281E-02	.2738E-01
17	168.75	3.3036	1.4371	.7615	.7835E+05	0.	.2588E+06	.1126E+06	.5966E+05	.7281E-02	.2738E-01
18	180.00	3.2992	1.4021	0.0000	.7944E+05	0.	.2621E+06	.1114E+06	0.	.7281E-02	.2738E-01

Figure 27 - Continued

SHELL J=8 XT= .23810

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1593E+03	.3458E+05	.4160E-05	.2885E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1612E+03	.3465E+05	.4173E-05	.2881E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1673E+03	.3453E+05	.4173E-05	.2871E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1778E+03	.3381E+05	.4139E-05	.2834E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.1929E+03	.3307E+05	.4139E-05	.2772E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2122E+03	.3096E+05	.4020E-05	.2673E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2319E+03	.2376E+05	.3367E-05	.2449E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2415E+03	.1440E+05	.2249E-05	.2222E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2439E+03	.9288E+04	.1600E-05	.2014E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2530E+03	.6843E+04	.1311E-05	.1811E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.2706E+03	.5470E+04	.1155E-05	.1643E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.2908E+03	.3948E+04	.9080E-06	.1509E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.3074E+03	.2758E+04	.6697E-06	.1429E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.3208E+03	.1963E+04	.4971E-06	.1370E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.3309E+03	.1484E+04	.3861E-06	.1334E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.3371E+03	.1312E+04	.3332E-06	.1366E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.3391E+03	.1308E+04	.3205E-06	.1416E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.1873	.1082	0.0000	.1079E+06	0.	.2360E+06	.1167E+05	0.	.7281E-02	.2738E-01
3	11.25	2.1868	.1247	.1002	.1078E+06	0.	.2358E+06	.1345E+05	.1080E+05	.7281E-02	.2738E-01
4	22.50	2.1847	.1724	.1983	.1076E+06	0.	.2351E+06	.1856E+05	.2135E+05	.7281E-02	.2738E-01
5	33.75	2.1933	.2569	.3064	.1069E+06	0.	.2345E+06	.2748E+05	.3276E+05	.7281E-02	.2738E-01
6	45.00	2.1992	.3864	.4508	.1058E+06	0.	.2326E+06	.4086E+05	.4768E+05	.7281E-02	.2738E-01
7	56.25	2.2188	.5298	.6059	.1038E+06	0.	.2304E+06	.5502E+05	.6291E+05	.7281E-02	.2738E-01
8	67.50	2.3361	.6294	.8336	.9939E+05	0.	.2322E+06	.6255E+05	.8285E+05	.7281E-02	.2738E-01
9	78.75	2.4879	.6468	1.0585	.9467E+05	0.	.2355E+06	.6124E+05	.1002E+06	.7281E-02	.2738E-01
10	90.00	2.6537	.7400	1.2009	.9014E+05	0.	.2392E+06	.6671E+05	.1082E+06	.7281E-02	.2738E-01
11	101.25	2.8367	.9495	1.2895	.8547E+05	0.	.2424E+06	.8115E+05	.1102E+06	.7281E-02	.2738E-01
12	112.50	2.9818	1.2359	1.3367	.8141E+05	0.	.2428E+06	.1006E+06	.1088E+06	.7281E-02	.2738E-01
13	123.75	3.1098	1.4708	1.3742	.7802E+05	0.	.2426E+06	.1147E+06	.1072E+06	.7281E-02	.2738E-01
14	135.00	3.2124	1.6327	1.3288	.7593E+05	0.	.2439E+06	.1240E+06	.1009E+06	.7281E-02	.2738E-01
15	146.25	3.3273	1.7539	1.1995	.7435E+05	0.	.2474E+06	.1304E+06	.8918E+05	.7281E-02	.2738E-01
16	157.50	3.4389	1.8371	.9603	.7336E+05	0.	.2523E+06	.1348E+06	.7045E+05	.7281E-02	.2738E-01
17	168.75	3.4413	1.8537	.5837	.7423E+05	0.	.2555E+06	.1376E+06	.4333E+05	.7281E-02	.2738E-01
18	180.00	3.3859	1.8302	0.0000	.7559E+05	0.	.2559E+06	.1383E+06	0.	.7281E-02	.2738E-01

Figure 27 - Continued.

SHELL 1012 XI= .42857

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1699E+03	.3521E+05	.4676E-05	.2613E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1719E+03	.3508E+05	.4668E-05	.2608E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1780E+03	.3462E+05	.4637E-05	.2591E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1886E+03	.3362E+05	.4567E-05	.2555E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.2036E+03	.3206E+05	.4472E-05	.2488E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2227E+03	.2959E+05	.4302E-05	.2387E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2426E+03	.2350E+05	.3715E-05	.2195E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2553E+03	.1548E+05	.2716E-05	.1978E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2676E+03	.1068E+05	.2062E-05	.1797E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2756E+03	.8024E+04	.1729E-05	.1611E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.2963E+03	.6267E+04	.1525E-05	.1426E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.3203E+03	.4619E+04	.1262E-05	.1270E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.3431E+03	.3317E+04	.9895E-06	.1163E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.3638E+03	.2408E+04	.7696E-06	.1086E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.3808E+03	.1835E+04	.6154E-06	.1035E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.3918E+03	.1541E+04	.5169E-06	.1034E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.3954E+03	.1453E+04	.4770E-06	.1057E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.4117	.0904	0.0000	.1027E+06	0.	.2476E+06	.9284E+04	0.	.7281E-02	.2738E-01
3	11.25	2.4128	.1077	.1191	.1026E+06	0.	.2475E+06	.1104E+05	.1221E+05	.7281E-02	.2738E-01
4	22.50	2.4153	.1593	.2396	.1022E+06	0.	.2469E+06	.1629E+05	.2449E+05	.7281E-02	.2738E-01
5	33.75	2.4238	.2438	.3684	.1015E+06	0.	.2461E+06	.2475E+05	.3740E+05	.7281E-02	.2738E-01
6	45.00	2.4405	.3691	.5233	.1002E+06	0.	.2445E+06	.3698E+05	.5243E+05	.7281E-02	.2738E-01
7	56.25	2.4701	.5220	.6919	.9812E+05	0.	.2424E+06	.5122E+05	.6789E+05	.7281E-02	.2738E-01
8	67.50	2.5766	.6513	.9119	.9410E+05	0.	.2425E+06	.6129E+05	.8582E+05	.7281E-02	.2738E-01
9	78.75	2.7339	.7403	1.1359	.8933E+05	0.	.2442E+06	.6613E+05	.1015E+06	.7281E-02	.2738E-01
10	90.00	2.8866	.8857	1.2731	.8514E+05	0.	.2458E+06	.7541E+05	.1084E+06	.7281E-02	.2738E-01
11	101.25	3.0729	1.1185	1.3636	.8061E+05	0.	.2477E+06	.9016E+05	.1099E+06	.7281E-02	.2738E-01
12	112.50	3.2793	1.4296	1.4241	.7586E+05	0.	.2488E+06	.1085E+06	.1080E+06	.7281E-02	.2738E-01
13	123.75	3.4901	1.7349	1.4388	.7158E+05	0.	.2498E+06	.1242E+06	.1030E+06	.7281E-02	.2738E-01
14	135.00	3.6719	1.9920	1.3525	.6851E+05	0.	.2516E+06	.1365E+06	.9266E+05	.7281E-02	.2738E-01
15	146.25	3.8437	2.2047	1.1643	.6619E+05	0.	.2544E+06	.1459E+06	.7706E+05	.7281E-02	.2738E-01
16	157.50	3.9845	2.3649	.8773	.6460E+05	0.	.2574E+06	.1528E+06	.5668E+05	.7281E-02	.2738E-01
17	168.75	4.0001	2.4402	.4895	.6460E+05	0.	.2584E+06	.1576E+06	.3162E+05	.7281E-02	.2738E-01
18	180.00	3.9492	2.4459	0.0000	.6530E+05	0.	.2579E+06	.1597E+06	0.	.7281E-02	.2738E-01

Figure 27.- Continued.

SHELL 1=16 XI= .61905

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1805E+03	.3569E+05	.5028E-05	.2463E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1825E+03	.3560E+05	.5023E-05	.2459E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1888E+03	.3531E+05	.5007E-05	.2447E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1993E+03	.3443E+05	.4947E-05	.2415E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.2143E+03	.3247E+05	.4802E-05	.2346E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2332E+03	.2944E+05	.4581E-05	.2230E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2534E+03	.2423E+05	.4124E-05	.2039E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2690E+03	.1722E+05	.3293E-05	.1815E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2814E+03	.1238E+05	.2657E-05	.1617E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2982E+03	.9455E+04	.2308E-05	.1422E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.3219E+03	.7370E+04	.2087E-05	.1225E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.3499E+03	.5608E+04	.1828E-05	.1064E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.3788E+03	.4109E+04	.1528E-05	.9422E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.4069E+03	.3122E+04	.1275E-05	.8495E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.4307E+03	.2419E+04	.1085E-05	.7733E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.4466E+03	.1952E+04	.9395E-06	.7209E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.4517E+03	.1754E+04	.8703E-06	.6994E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.5459	.0657	0.0000	.9968E+05	0.	.2538E+06	.6553E+04	0.	.7281E-02	.2738E-01
3	11.25	2.5452	.0851	.1326	.9961E+05	0.	.2535E+06	.8477E+04	.1321E+05	.7281E-02	.2738E-01
4	22.50	2.5430	.1441	.2677	.9936E+05	0.	.2527E+06	.1432E+05	.2660E+05	.7281E-02	.2738E-01
5	33.75	2.5470	.2384	.4107	.9871E+05	0.	.2514E+06	.2353E+05	.4054E+05	.7281E-02	.2738E-01
6	45.00	2.5685	.3624	.5722	.9729E+05	0.	.2499E+06	.3525E+05	.5567E+05	.7281E-02	.2738E-01
7	56.25	2.6151	.5194	.7585	.9485E+05	0.	.2480E+06	.4927E+05	.7194E+05	.7281E-02	.2738E-01
8	67.50	2.7244	.6868	.9910	.9070E+05	0.	.2471E+06	.6229E+05	.8988E+05	.7281E-02	.2738E-01
9	78.75	2.8946	.8378	1.2288	.8557E+05	0.	.2477E+06	.7169E+05	.1051E+06	.7281E-02	.2738E-01
10	90.00	3.0784	1.0359	1.3879	.8078E+05	0.	.2487E+06	.8368E+05	.1121E+06	.7281E-02	.2738E-01
11	101.25	3.3020	1.3141	1.4971	.7574E+05	0.	.2501E+06	.9952E+05	.1134E+06	.7281E-02	.2738E-01
12	112.50	3.5756	1.6734	1.5697	.7031E+05	0.	.2514E+06	.1177E+06	.1104E+06	.7281E-02	.2738E-01
13	123.75	3.8558	2.0531	1.5652	.6553E+05	0.	.2527E+06	.1345E+06	.1026E+06	.7281E-02	.2738E-01
14	135.00	4.1265	2.4086	1.4575	.6165E+05	0.	.2544E+06	.1485E+06	.8986E+05	.7281E-02	.2738E-01
15	146.25	4.3835	2.7305	1.2341	.5854E+05	0.	.2566E+06	.1599E+06	.7225E+05	.7281E-02	.2738E-01
16	157.50	4.6399	3.0124	.9101	.5586E+05	0.	.2592E+06	.1683E+06	.5084E+05	.7281E-02	.2738E-01
17	168.75	4.8441	3.2164	.4824	.5393E+05	0.	.2612E+06	.1735E+06	.2602E+05	.7281E-02	.2738E-01
18	180.00	4.9339	3.2986	0.0000	.5312E+05	0.	.2621E+06	.1752E+06	0.	.7281E-02	.2738E-01

Figure 27 - Continued

SHELL 1=20 XI= .80952

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1911E+03	.3576E+05	.5260E-05	.2357E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1932E+03	.3571E+05	.5265E-05	.2354E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1995E+03	.3550E+05	.5260E-05	.2342E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.2101E+03	.3493E+05	.5239E-05	.2313E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.2250E+03	.3333E+05	.5148E-05	.2247E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2437E+03	.3025E+05	.4955E-05	.2118E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2642E+03	.2544E+05	.4617E-05	.1912E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2828E+03	.1907E+05	.3997E-05	.1656E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.3001E+03	.1443E+05	.3494E-05	.1434E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.3208E+03	.1142E+05	.3219E-05	.1231E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.3476E+03	.9076E+04	.3019E-05	.1043E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.3794E+03	.7107E+04	.2764E-05	.8922E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.4145E+03	.5465E+04	.2448E-05	.7746E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.4499E+03	.4270E+04	.2165E-05	.6859E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.4807E+03	.3434E+04	.1936E-05	.6156E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.5013E+03	.2820E+04	.1745E-05	.5608E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.5081E+03	.2544E+04	.1654E-05	.5337E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.6466	.0341	0.0000	.9751E+05	0.	.2581E+06	.3326E+04	0.	.7281E-02	.2738E-01
3	11.25	2.6452	.0550	.1455	.9744E+05	0.	.2578E+06	.5361E+04	.1418E+05	.7281E-02	.2738E-01
4	22.50	2.6420	.1181	.2916	.9720E+05	0.	.2568E+06	.1148E+05	.2834E+05	.7281E-02	.2738E-01
5	33.75	2.6418	.2227	.4455	.9661E+05	0.	.2552E+06	.2151E+05	.4304E+05	.7281E-02	.2738E-01
6	45.00	2.6609	.3612	.6155	.9520E+05	0.	.2533E+06	.3438E+05	.5860E+05	.7281E-02	.2738E-01
7	56.25	2.7198	.5314	.8200	.9245E+05	0.	.2514E+06	.4913E+05	.7580E+05	.7281E-02	.2738E-01
8	67.50	2.8494	.7297	1.0786	.8783E+05	0.	.2499E+06	.6409E+05	.9474E+05	.7281E-02	.2738E-01
9	78.75	3.0591	.9384	1.3567	.8174E+05	0.	.2500E+06	.7670E+05	.1109E+06	.7281E-02	.2738E-01
10	90.00	3.2870	1.2031	1.5674	.7605E+05	0.	.2500E+06	.9150E+05	.1192E+06	.7281E-02	.2738E-01
11	101.25	3.5591	1.5519	1.6957	.7047E+05	0.	.2508E+06	.1094E+06	.1195E+06	.7281E-02	.2738E-01
12	112.50	3.8848	1.9724	1.7596	.6488E+05	0.	.2520E+06	.1280E+06	.1142E+06	.7281E-02	.2738E-01
13	123.75	4.2221	2.4179	1.7283	.6000E+05	0.	.2533E+06	.1451E+06	.1037E+06	.7281E-02	.2738E-01
14	135.00	4.5544	2.8593	1.5936	.5590E+05	0.	.2546E+06	.1598E+06	.8908E+05	.7281E-02	.2738E-01
15	146.25	4.8617	3.2723	1.3473	.5260E+05	0.	.2557E+06	.1721E+06	.7088E+05	.7281E-02	.2738E-01
16	157.50	5.1636	3.6340	.9891	.4984E+05	0.	.2573E+06	.1811E+06	.4929E+05	.7281E-02	.2738E-01
17	168.75	5.4957	3.9075	.5293	.4757E+05	0.	.2595E+06	.1859E+06	.2518E+05	.7281E-02	.2738E-01
18	180.00	5.6928	4.0300	0.0000	.4640E+05	0.	.2609E+06	.1870E+06	0.	.7281E-02	.2738E-01

Figure 27.- Continued.

SHELL I=24 XI= 1.00000

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.2017F+03	.3591E+05	.5457E-05	.2284E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.2039F+03	.3582F+05	.5455E-05	.2279E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.2102E+03	.3553E+05	.5450E-05	.2262E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.2209F+03	.3495E+05	.5440E-05	.2230E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.2357E+03	.3376E+05	.5418E-05	.2162E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2542E+03	.3101F+05	.5360E-05	.2007E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2749F+03	.2682F+05	.5254E-05	.1771E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2966F+03	.2099F+05	.5049E-05	.1443E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.3189F+03	.1688F+05	.4838E-05	.1211E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.3434E+03	.1363F+05	.4605E-05	.1027E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.3732E+03	.1094F+05	.4338E-05	.8753E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.4090E+03	.8733E+04	.4041E-05	.7501E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.4503E+03	.6904F+04	.3709E-05	.6460E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.4929E+03	.5621F+04	.3406E-05	.5726E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.5306F+03	.4666E+04	.3128E-05	.5177E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.5560E+03	.3947E+04	.2878E-05	.4759E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.5644F+03	.3611F+04	.2747E-05	.4562E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.7197	-.0012	0.0000	.9598E+05	0.	.2610E+06	-.1190E+03	0.	.7281E-02	.2738E-01
3	11.25	2.7138	.0258	.2453	.9588E+05	0.	.2602E+06	.2470E+04	.2352E+05	.7281E-02	.2738E-01
4	22.50	2.7100	.0969	.3999	.9553E+05	0.	.2589E+06	.9255E+04	.3820E+05	.7281E-02	.2738E-01
5	33.75	2.7092	.2103	.5587	.9484E+05	0.	.2569E+06	.1995E+05	.5299E+05	.7281E-02	.2738E-01
6	45.00	2.7248	.3648	.7301	.9340E+05	0.	.2545E+06	.3407E+05	.6819F+05	.7281E-02	.2738E-01
7	56.25	2.8119	.5531	.9427	.8999E+05	0.	.2531E+06	.4978E+05	.8483E+05	.7281E-02	.2738E-01
8	67.50	2.9816	.7862	1.2143	.8453E+05	0.	.2520E+06	.6646E+05	.1026F+06	.7281E-02	.2738E-01
9	78.75	3.3222	1.0640	1.5664	.7629E+05	0.	.2534E+06	.8117E+05	.1195F+06	.7281E-02	.2738E-01
10	90.00	3.5950	1.4236	1.8528	.6988E+05	0.	.2512E+06	.9949E+05	.1295E+06	.7281E-02	.2738E-01
11	101.25	3.8817	1.8404	2.0241	.6438E+05	0.	.2499E+06	.1185E+06	.1303E+06	.7281E-02	.2738E-01
12	112.50	4.2192	2.3016	2.0599	.5942E+05	0.	.2507E+06	.1368E+06	.1224E+06	.7281E-02	.2738E-01
13	123.75	4.5796	2.7951	1.9890	.5501E+05	0.	.2519E+06	.1538E+06	.1094E+06	.7281E-02	.2738E-01
14	135.00	4.9657	3.2989	1.8104	.5105E+05	0.	.2535E+06	.1684E+06	.9242E+05	.7281E-02	.2738E-01
15	146.25	5.2909	3.7657	1.5033	.4806E+05	0.	.2543E+06	.1810E+06	.7226E+05	.7281E-02	.2738E-01
16	157.50	5.5866	4.1598	1.0819	.4570E+05	0.	.2553E+06	.1901E+06	.4944E+05	.7281E-02	.2738E-01
17	168.75	5.8656	4.4463	.5586	.4382E+05	0.	.2570E+06	.1948E+06	.2447E+05	.7281E-02	.2738E-01
18	180.00	6.0172	4.5661	0.0000	.4290E+05	0.	.2581E+06	.1959E+06	0.	.7281E-02	.2738E-01

DATA WRITTEN ON CONT FILE-UNIT 23 NSTEP= 2 Z= .46957E+03

Figure 27 - Continued

BODY- AND SHOCK- SURFACE QUANTITIES (NGAS= -1 NPHI= 18 NT2= 24)

NSTEP= 2 Z= .4696E+03 DZ= -.11208E+01 DZDT= .2354E+02 DZDRH= .5708E+01 FACT= .50000 FIFACT= 1.00000
BETTA= 0.0000 PHIZRO= 0.0000 NRMSH= 1

EIGENVALUE INFO* DT*FACT/SIG12= .11208E+01 J= 25 K= 8
DETA*FACT/SIG34= .10728E+02 J= 25 K= 8

SHELL J= 3 XI= 0.00000

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.1461E+03	.3466E+05	.3244E-05	.3091E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.1480E+03	.3447E+05	.3222E-05	.3094E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.1540E+03	.3397E+05	.3214E-05	.3057E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.1644E+03	.3408E+05	.3269E-05	.3015E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.1797E+03	.3383E+05	.3254E-05	.3006E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.1993E+03	.3269E+05	.3128E-05	.3023E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2187E+03	.2563E+05	.2490E-05	.2977E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2245E+03	.1167E+05	.1300E-05	.2596E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.2207E+03	.8367E+04	.1024E-05	.2363E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.2250E+03	.6912E+04	.9493E-06	.2106E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.2389E+03	.5915E+04	.8746E-06	.1956E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.2542E+03	.3636E+04	.5879E-06	.1789E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.2632E+03	.1929E+04	.3510E-06	.1590E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.2674E+03	.1132E+04	.2302E-06	.1423E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.2689E+03	.8198E+03	.1802E-06	.1316E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.2691E+03	.8363E+03	.1845E-06	.1314E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.2691E+03	.9574E+03	.2072E-06	.1336E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	1.6188	.1173	0.0000	.1223E+06	0.	.1980E+06	.1434E+05	0.	.7281E-02	.2738E-01
3	11.25	1.6139	.1293	.0655	.1224E+06	0.	.1975E+06	.1583E+05	.8015E+04	.7281E-02	.2738E-01
4	22.50	1.6347	.1687	.1301	.1216E+06	0.	.1989E+06	.2053E+05	.1583E+05	.7281E-02	.2738E-01
5	33.75	1.6499	.2420	.2118	.1208E+06	0.	.1993E+06	.2923E+05	.2559E+05	.7281E-02	.2738E-01
6	45.00	1.6173	.3562	.3251	.1206E+06	0.	.1951E+06	.4297E+05	.3922E+05	.7281E-02	.2738E-01
7	56.25	1.5289	.4930	.4737	.1210E+06	0.	.1849E+06	.5963E+05	.5730E+05	.7281E-02	.2738E-01
8	67.50	1.4572	.5596	.6999	.1200E+06	0.	.1749E+06	.6716E+05	.8402E+05	.7281E-02	.2738E-01
9	78.75	1.7857	.2612	.9121	.1121E+06	0.	.2002E+06	.2928E+05	.1022E+06	.7281E-02	.2738E-01
10	90.00	1.9222	.4641	1.0374	.1069E+06	0.	.2056E+06	.4962E+05	.1109E+06	.7281E-02	.2738E-01
11	101.25	2.0706	.7422	1.1685	.1010E+06	0.	.2091E+06	.7493E+05	.1180E+06	.7281E-02	.2738E-01
12	112.50	2.0870	1.0568	1.2611	.9730E+05	0.	.2031E+06	.1028E+06	.1227E+06	.7281E-02	.2738E-01
13	123.75	2.2308	1.1185	1.4011	.9305E+05	0.	.2076E+06	.1041E+06	.1304E+06	.7281E-02	.2738E-01
14	135.00	2.5106	1.1638	1.4783	.8773E+05	0.	.2202E+06	.1021E+06	.1297E+06	.7281E-02	.2738E-01
15	146.25	2.8333	1.2152	1.4416	.8299E+05	0.	.2351E+06	.1008E+06	.1196E+06	.7281E-02	.2738E-01
16	157.50	3.1276	1.2747	1.2336	.7981E+05	0.	.2496E+06	.1017E+06	.9846E+05	.7281E-02	.2738E-01
17	168.75	3.2613	1.2987	.8238	.7965E+05	0.	.2598E+06	.1034E+06	.6561E+05	.7281E-02	.2738E-01
18	180.00	3.3074	1.3099	0.0000	.8043E+05	0.	.2660E+06	.1054E+06	0.	.7281E-02	.2738E-01

Figure 27.- Continued.

SHELL I=24 XI= 1.00000

*	ANG	R	P	RHO	T	GAMMA	O2	N2	NO	OXY	NIT
2	0.00	.2019E+03	.3589E+05	.5457E-05	.2283E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
3	11.25	.2040E+03	.3583E+05	.5455E-05	.2279E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
4	22.50	.2104E+03	.3555E+05	.5451E-05	.2263E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
5	33.75	.2211E+03	.3497E+05	.5440E-05	.2231E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
6	45.00	.2360E+03	.3377E+05	.5418E-05	.2163E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
7	56.25	.2545E+03	.3103E+05	.5361E-05	.2008E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
8	67.50	.2752E+03	.2684E+05	.5255E-05	.1770E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
9	78.75	.2969E+03	.2107E+05	.5053E-05	.1443E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
10	90.00	.3193E+03	.1688E+05	.4838E-05	.1211E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
11	101.25	.3439E+03	.1366E+05	.4607E-05	.1029E+04	1.4000	.7281E-02	.2738E-01	0.	0.	0.
12	112.50	.3737E+03	.1096E+05	.4541E-05	.8761E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
13	123.75	.4096E+03	.8749E+04	.4043E-05	.7507E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
14	135.00	.4509E+03	.6917E+04	.3711E-05	.6464E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
15	146.25	.4937E+03	.5626E+04	.3408E-05	.5733E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
16	157.50	.5315E+03	.4669E+04	.3129E-05	.5183E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
17	168.75	.5570E+03	.3951E+04	.2880E-05	.4766E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.
18	180.00	.5654E+03	.3609E+04	.2746E-05	.4561E+03	1.4000	.7281E-02	.2738E-01	0.	0.	0.

*	ANG	M-U	M-V	M-W	SOUND	ENTROPY	U	V	W	O2-MASS	N2-MASS
2	0.00	2.7204	-.0015	0.0000	.9597E+05	0.	.2611E+06	-.1481E+03	0.	.7281E-02	.2738E-01
3	11.25	2.7194	.0199	.1548	.9589E+05	0.	.2608E+06	.1911E+04	.1484E+05	.7281E-02	.2738E-01
4	22.50	2.7204	.0838	.3140	.9556E+05	0.	.2600E+06	.8013E+04	.3000E+05	.7281E-02	.2738E-01
5	33.75	2.7238	.1932	.4829	.9487E+05	0.	.2584E+06	.1832E+05	.4581E+05	.7281E-02	.2738E-01
6	45.00	2.7410	.3489	.6729	.9341E+05	0.	.2560E+06	.3259E+05	.6286E+05	.7281E-02	.2738E-01
7	56.25	2.8230	.5440	.9101	.9002E+05	0.	.2541E+06	.4897E+05	.8193E+05	.7281E-02	.2738E-01
8	67.50	2.9858	.7831	1.2005	.8457E+05	0.	.2525E+06	.6623E+05	.1015E+06	.7281E-02	.2738E-01
9	78.75	3.3179	1.0633	1.5554	.7641E+05	0.	.2535E+06	.8125E+05	.1189E+06	.7281E-02	.2738E-01
10	90.00	3.6084	1.4195	1.8274	.6990E+05	0.	.2522E+06	.9922E+05	.1277E+06	.7281E-02	.2738E-01
11	101.25	3.9071	1.8329	1.9726	.6442E+05	0.	.2517E+06	.1181E+06	.1271E+06	.7281E-02	.2738E-01
12	112.50	4.2425	2.2935	2.0103	.5946E+05	0.	.2523E+06	.1364E+06	.1195E+06	.7281E-02	.2738E-01
13	123.75	4.5950	2.7882	1.9516	.5504E+05	0.	.2529E+06	.1535E+06	.1074E+06	.7281E-02	.2738E-01
14	135.00	4.9656	3.2967	1.8009	.5108E+05	0.	.2536E+06	.1684E+06	.9199E+05	.7281E-02	.2738E-01
15	146.25	5.2807	3.7685	1.5246	.4808E+05	0.	.2539E+06	.1812E+06	.7330E+05	.7281E-02	.2738E-01
16	157.50	5.5722	4.1645	1.1287	.4571E+05	0.	.2547E+06	.1903E+06	.5159E+05	.7281E-02	.2738E-01
17	168.75	5.8547	4.4495	.6165	.4383E+05	0.	.2566E+06	.1950E+06	.2702E+05	.7281E-02	.2738E-01
18	180.00	6.0181	4.5664	0.0000	.4289E+05	0.	.2581E+06	.1959E+06	0.	.7281E-02	.2738E-01

Figure 27.- Concluded

APPENDIX

CARD INPUT DATA FOR PROGRAM 4

The input data for program 4 (called CHAOS, ref 4), are described below. The data produced by programs 1 and 2 and processed by program 5 are read by a subroutine called FVDAT, while the data produced by program 3 are read by a subroutine called SCDAT Note that ENGLISH UNITS are used in these data.

CARD INPUT DATA DEFINITIONS

CARD INPUT DECK

Card	Format	Input Parameter
1	(I3)	JTOTAL
2	(3I3)	NMTAPE,NSTAPE,DIMENSION
3	(2I3)	NI,IOUT
4	(2I3)	NPHI,NREC
5	(2I3)	IN(5),IN(6)
6	(2I3)	JJR,NPSASF
7	(3I3)	NPRINT,NPLOT,NPUNCH
8	(2F10.3)	PSCALE,PHIMAX
9	(2F10.3)	ALPHA,SCALE
10	(3F10.3)	FS(13),FS(3),FS(2)
11	(3F10.3)	FS(5),FS(6),FS(8)
12[a]	(3F10.3)	(PHIAO(J),CDEL(J),CEX(J),J=1,NPHI)
13	(3I3)	NMTAPE,NSTAPE,DIMENSION
14	(2I3)	NI,IOUT
15	(2I3)	NPHI,NREC
13A[b]	(3I3)	NMTAPE,NSTAPE,DIMENSION
14A	(2I3)	NI,IOUT
15A	(2I3)	NPHI,NREC
⋮	⋮	⋮
16	(A30)	HEAD1
17	(A30)	HEAD2
18	(I3)	NUM
19	(8(I3,7X))	(J1(J),J=1,NUM)
20	(I3)	NO
21	(8F10.4)	(ZL(J),J=1,NO)

[a] NPHI cards are read.

[b] Cycle back to card 13 as many times as required for ΣNREC = JTOTAL - 4

DATA DEFINITIONS

Name	Typical Value	Description
ALPHA	30.	FS(1) angle of attack (deg.)
CDEL	0.0	C1 = boundary layer thickness parameter for delta = C1*S**C2
CEX	0.0	C2 = boundary layer thickness parameter for delta = C1*S**C2
DIMENSION	17	index giving array size for input data read in MCDAT (= NUMK from CTI)
FS(2)	1716.	gas constant
FS(3)	1.4	gamma, specific heat ratio
FS(5)		PINF, free stream pressure, psf
FS(6)		RHOINF, free stream density, slug/ft^3
FS(8)		VINF, free stream velocity, fps
FS(13)	1.4	gamma-INF, free stream specific heat ratio
HEAD1	'SHUTTLE 147'	plot heading
HEAD2	'PERFECT GAS'	plot heading
IN(5)	0	gas type index, 0 for perfect, and -1 for equilibrium gas, and 1 for nonequilibrium (note that this is different from programs 1, 2 and 3)
IN(6)	0	gas file number for equilibrium gas, 2 for air
IOUT	2	output control index for boundary layer data
J1(J)		array of station numbers for heat transfer crossplots, J_{max} = 20

Name	Typical Value	Description
JJR	0	number of points above the body surface used for edge conditions
JTOTAL		total number of points to be calculated, four plus the number read from various tape files
NI		index to control type of input data, 1 for SCDAT, 2 for MCDAT data, and 3 for FVDAT data
NMTAPE		number assigned to the tape drive for input data from MCDAT
NO		total number of interpolated stations at constant span locations, ZL
NPHI	19	number of streamlines
NPLOT		index to control type of data plotted, 0 = no plot, 1 = print plot only, 2 = print plot, calcomp, 3 = print plot, calcomp with dash lines, 4 = print plot, calcomp, data printout, 5 = contour plot
NPSASF		0 to fill Newtonian streamlines to stag point, and 1 to start directly from input data
NPUNCH		0 for no cards punched and 1 for punching cards for boundary layer input data
NREC		number of records of data to be read in for the present file on tape drive NMTAPE

DATA DEFINITIONS (Concluded)

Name	Typical Value	Description
NSTAPE		number assigned to the tape drive for input from SCDAT or FVDAT
NUM		number of values for J1
PHIAO		initial circumferential position of streamlines, deg. from leeward
PHIMAX	90.	value of Φ for terminating plots of streamlines
NPRINT		0 for debug print, 1 for standard, and 2 for special print in CHAOS
PSCALE		used for scaling of length dimensions for plotting
SCALE		used for scaling boundary layer data, not used now
ZL		location for interpolated data at constant span, number of values = NO

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