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(NASA-TM-78947) A COMPUTER PROGRAM FOR THE CALCULATION OF THE FLOW FIELD IN SUPERSONIC MIXED-COMPRESSION INLETS AT ANGLE OF ATTACK WING THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS WITH DISCRETE SHOCK WAVE N79-10023

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A COMPUTER PROGRAM FOR THE CALCULATION OF THE FLOW FIELD IN SUPERSONIC MIXED-COMPRESSION INLETS AT ANGLE OF ATTACK USING THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS WITH DISCRETE SHOCK WAVE FITTING

by Joseph Vadyak and Joe D. Hoffman
Purdue University
West Lafayette, Indiana

and

Allan R. Bishop
Lewis Research Center
Cleveland, Ohio

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Joseph Vadyak and Joe D. Hoffman
School of Mechanical Engineering
Purdue University, West Lafayette, Indiana 47907

and

Allan R. Bishop
Aerodynamics Analysis Section, Wind Tunnel and Flight Division
NASA Lewis Research Center, Cleveland, Ohio 44135

SUMMARY

A computer program has been developed which is capable of calculating the flow field in the supersonic portion of a mixed-compression aircraft inlet operating at angle of attack. The calculation procedure is based on the method of characteristics for steady three-dimensional flow. The bow shock wave and the internal shock wave system are computed using a discrete shock wave fitting procedure.

The computer program has the capability to compute the internal flow field with or without the discrete fitting of the internal shock wave system. The option in which the internal shock wave system is not fitted can be employed in situations in which the strength of the internal shock wave system is weak, and thereby an acceptable solution can be obtained by smearing the internal discontinuities.

The influence of molecular transport can be included in the computation of the external flow about the forebody, and in the computation of the internal flow in which the shock waves are not discretely fitted. This is accomplished by treating the viscous and thermal diffusion terms in the governing partial differential equations as forcing functions, or correction terms, in the method of characteristics scheme.

The thermodynamic model employed in the computer program is contained in a separate group of subroutines. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be employed by suitably modifying the existing subroutines or by replacing them.

The representations for the molecular transport properties, viscosity and thermal conductivity, are contained in a separate subroutine. Dynamic viscosity is represented by Sutherland's law. Thermal conductivity is represented as a

quadratic function of temperature. Alternative formulations for the transport properties may be employed by modifying the existing subroutine or by replacing it.

The contours of the centerbody and the cowl are represented by a separate subroutine. The existing subroutine has the capability to describe a variety of axisymmetric contours. Other geometries, such as those having elliptic or super-elliptic cross-sections, may be described by suitably modifying the existing subroutine or by replacing it.

A major assumption of the present analysis is that the cowl lip is contained in a plane of constant x. Moreover, it is assumed that both the centerbody contour and the cowl contour are smooth and have continuous first partial derivatives.

The computer program cannot:

1. compute subsonic flow,
2. compute the external flow field about the forebody if the bow shock wave does not exist entirely around the forebody, or
3. compute the internal flow field if the bow shock wave is ingested into the annulus

The computer program is written in Fortran IV for the CDC 6500 computer. The program can be easily modified to be compatible with other computers.

SECTION I

INTRODUCTION

A computer program has been developed for calculating the flow field in the supersonic portion of a mixed-compression aircraft inlet operating at angle of attack. The general features of the inlet geometry and the flow field are illustrated in Figure 1. The theoretical analysis on which the computer program is based is presented by Vadyak, Hoffman, and Bishop (1).

This report presents a discussion of the computer program organization, descriptions of the subroutines, a discussion of the input parameters, a brief interpretation of the output information, and five sample cases to illustrate the application of the computer program.

A detailed description of the theoretical analysis used in this program is given in NASA CR-135425, "The Flow Field Calculation in Supersonic Mixed-Compression Aircraft Inlets at Angle of Attack Using the Three-Dimensional Method of Characteristics with Discrete Shock Wave Fitting" by Joseph Vadyak and Joe D. Hoffman.

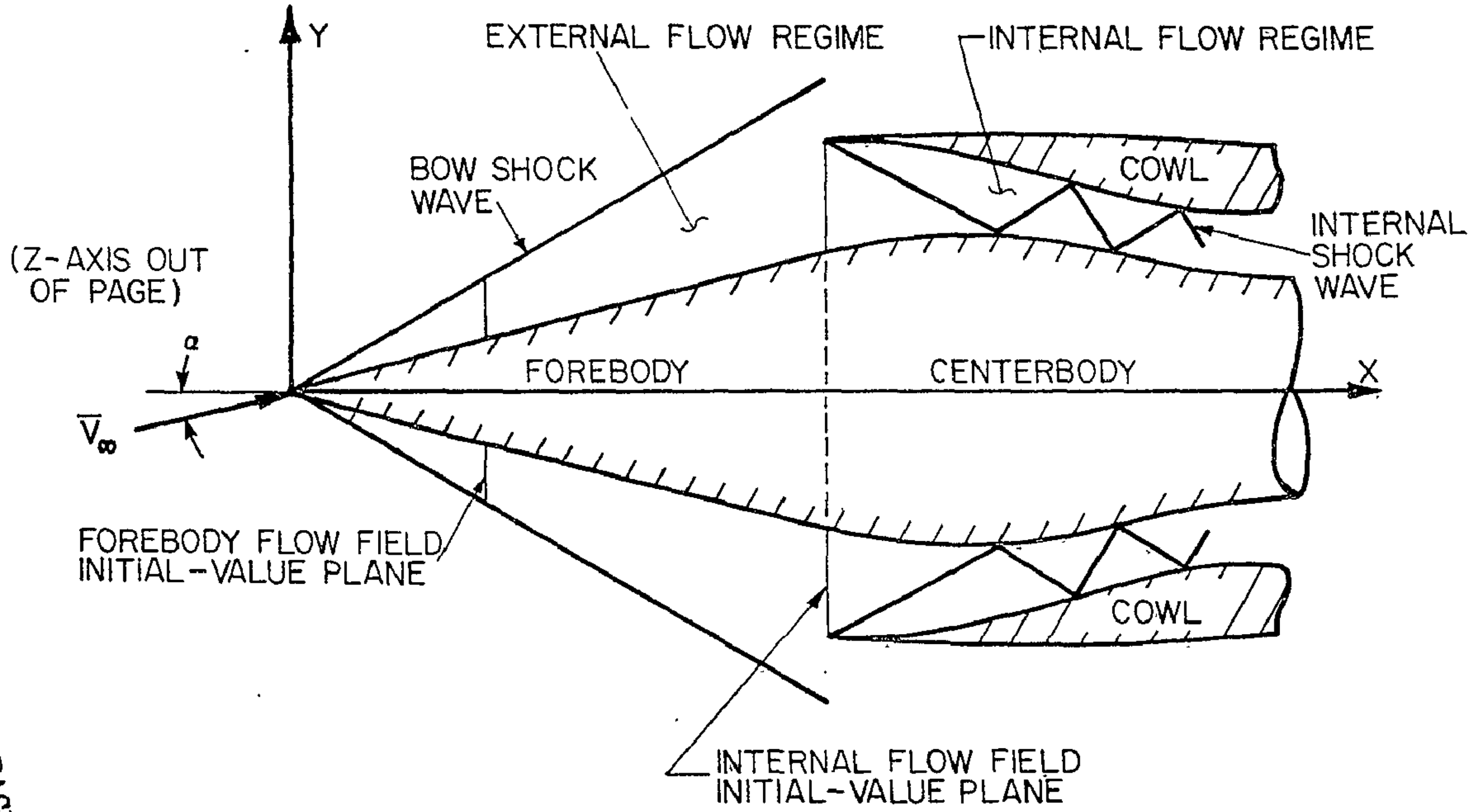


FIGURE 1. MIXED-COMPRESSION AIRCRAFT INLET

SECTION II

PROGRAM ORGANIZATION

1. INTRODUCTION

In this section, the program overlay structure is presented, and some general comments concerning program input and parameter initialization are made. The subroutines are identified which contain the thermodynamic model, the transport property representations, and the formulations used for representing the centerbody and the cowl contours. The flow field integration options are briefly discussed. Some comments concerning program output are presented.

2. INTEGRATION OPTIONS

The computational flow regime is divided into two subregimes: the external flow field and the internal flow field (see Figure 1). If desired, only the external flow field may be computed. Alternatively, if the solution is known at the axial station of the cowl lip, the internal flow field may be determined without employing the forebody flow integration option.

The program has the capability to compute the internal flow field with or without the discrete fitting of the internal shock wave system. The option in which shock waves are not discretely fitted might be employed if the strength of the internal shock wave system is relatively weak, and thereby an acceptable solution can be obtained by smearing all internal discontinuities.

The analysis includes the influence of molecular transport in the computation by treating the viscous and thermal diffusion terms in the governing partial differential equations as forcing functions, or correction terms, in the method of characteristics scheme. At present, the program has the capability to include the influence of molecular transport in the computation of the external flow field about the forebody, and in the computation of the internal flow field in which the shock waves are not discretely fitted. The program option in which the internal shock waves are discretely fitted does not have the capability to include the influence of molecular transport in the computation, but rather assumes the flow to be inviscid and adiabatic.

3. PROGRAM OVERLAY STRUCTURE

The overall program consists of 61 routines (6 program routines and 55 subroutines). The program is too large to be stored continuously in computer memory, hence, an overlay scheme is employed. The overlay structure is presented in Figure 2. Three levels of overlaying are used: the resident

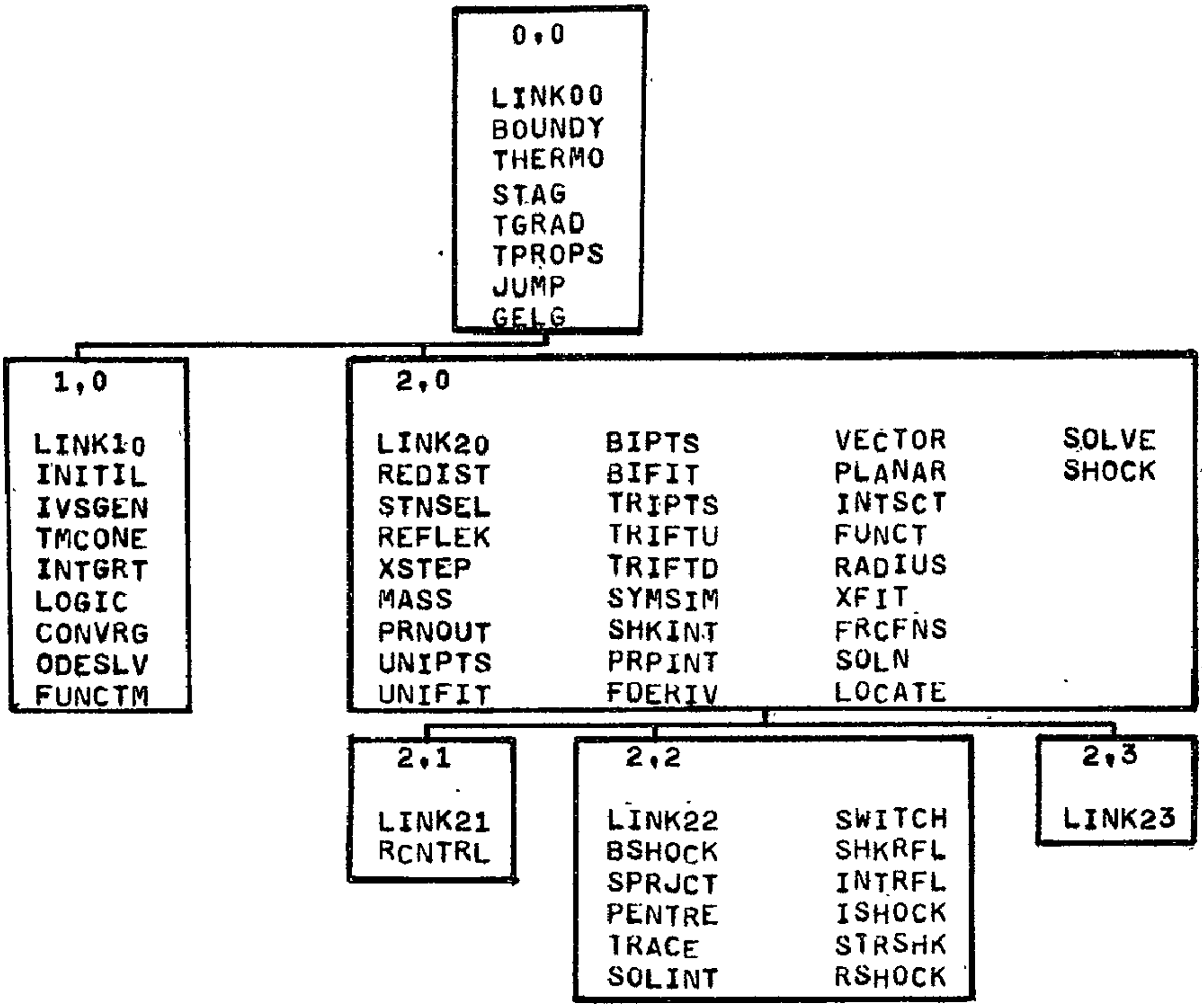


Figure 2. Program ØVERLAY structure.

overlay level, the primary overlay level, and the secondary overlay level. ØVERLAY (0,0) is the resident overlay and controls the overall execution of the program. This overlay contains many of the subroutines which describe the thermodynamic model, the molecular transport properties, and the centerbody and the cowl contours. ØVERLAY (0,0) calls the two primary level overlays, ØVERLAY (1,0) and ØVERLAY (2,0). ØVERLAY (1,0) performs data input, parameter initialization, and, if desired, internal generation of the initial-value plane. ØVERLAY (2,0) is used in conjunction with the secondary overlays, ØVERLAY (2,1), ØVERLAY (2,2), and ØVERLAY (2,3), to perform the actual flow field integration. The primary level overlay ØVERLAY (2,0) contains the preponderance of the unit processes and the interpolation schemes. ØVERLAY (2,1), which is a secondary level overlay, contains the control logic used in performing the integration for the external flow field about the forebody. The secondary level overlay ØVERLAY (2,2) contains the control logic used in determining the internal flow field in which shock waves are discretely fitted. The secondary level overlay ØVERLAY (2,3) contains the control logic used in determining the internal flow field in which shock waves are not discretely fitted.

Routine LINK00, the main control routine in ØVERLAY (0,0), first calls ØVERLAY (1,0) for data input, parameter initialization, and, if desired, internal generation of the initial-value plane. Control is then returned to the resident overlay, ØVERLAY (0,0). ØVERLAY (2,0) is then called from LINK00. The main control routine in ØVERLAY (2,0) is routine LINK20. If the forebody flow field is to be computed, LINK20 calls ØVERLAY (2,1). Then, if the internal flow field is to be computed with discrete fitting of the internal shock-wave system, ØVERLAY (2,2) is called. If the internal flow field is to be computed without the discrete fitting of the internal shock wave system, ØVERLAY (2,3) is called. It should be noted that ØVERLAY (2,2) and ØVERLAY (2,3) both cannot be used in the same computer run.

The computer program has a restart capability in which an internally generated restart file is retrieved from tape. When the restart option is used, control is returned to the integration control secondary level overlay which was in use at the time the initial execution was terminated [e.g., if the forebody flow was being computed, control is returned to ØVERLAY (2,1)].

4. DATA INPUT

The input data are entered through both namelist input and formatted read statements. Seven namelists must always be specified: namelists LIST1 to LIST7. Namelist LIST1 contains the input parameters which specify the flow field integration options, the number of planes of symmetry, the output options, etc. Namelist LIST2 contains the parameters which specify the free-stream conditions, the vehicle orientation, and parameters associated with the specification of the initial-value plane. Namelist LIST3 specifies the number of circumferential and radial stations used in the computational mesh. Namelist LIST4 specifies the thermodynamic model and the molecular transport properties. Namelist LIST5 contains the parameters which specify the centerbody and the cowl contours. Namelist LIST6 contains all convergence tolerances and iteration loop limits. Namelist LIST7 contains the parameters that specify whether or not any debug output is to be printed.

In addition to the namelist inputs, the two-dimensional initial-value plane is read in by a formatted read of file ITAPE. Alternatively, if the forebody is conical ahead of the axial location of the initial-value plane, the initial-value plane data may be generated internally in the computer program by an approximate technique.

All input data are read in within routine LINK10. After the data have been entered, selected input parameters are checked for errors and consistency. If any errors are detected, appropriate messages are printed and the execution of the program is aborted. The input parameters are tested in subroutine INITIL.

It should be noted that many input parameters have default values and do not have to be specified. The default values for most of the input parameters are specified in LINK00.

After all input parameters and data have been entered, parameter initialization (for most of the subroutines) is performed in subroutine INITIL.

5. INITIAL-VALUE PLANE

The initial data must be specified on a space-like plane of constant x (see Figure 1). The flow must be supersonic at every point on this plane. The x-coordinate axis constitutes the longitudinal axis of the centerbody and the cowl. Moreover, the mean flow direction is assumed to be in the x-coordinate direction.

If the forebody flow field is to be determined, the initial-value plane must be specified at an axial (x) station that is upstream of the forebody computational flow regime (see Figure 1). The solution is then found along the streamlines that pass through the data points specified on the initial-value plane, although some streamline addition and deletion are performed on the ensuing solution planes. The axial location of the last solution plane of the forebody flow field is adjusted to lie at the axial station of the cowl lip, and constitutes the initial-value plane for the internal flow field computation.

If only the internal flow field is to be determined, the initial-value plane must be specified at the axial station which corresponds to the x-position of the cowl lip (see Figure 1). The cowl lip is assumed to be contained in a plane of constant x. For the internal flow field integration, a point redistribution is performed on the initial-value plane. This point redistribution is required to define streamlines which lie in the stream surface formed by the cowl boundary. The solution is then found along the streamlines that pass through the redistributed points on the plane at the cowl lip axial station. It should be noted that the internal flow field cannot be computed if the bow shock wave is ingested into the annulus.

The initial-value plane may be specified externally by the user. The user supplied data is entered by a formatted read of the file ITAPE.

The solution obtained by Jones (3) for the flow about a circular cone at nonzero incidence has been well substantiated. Using a conversion algorithm, the results of that computer program can be made compatible with the input data required by the computer program developed in the present investigation. For situations in which the forebody is conical up to the axial station where the initial-value plane is located, the Jones program is the recommended source for the initial data.

Alternatively, if the forebody is conical ahead of the axial location of the initial-value plane, the flow property field on the initial-value plane can be generated internally in the computer program. The internally generated initial-value plane is obtained by an approximate technique which employs the Taylor-Maccoll solution for the flow about a circular cone at zero incidence. A superposition procedure is used to obtain an approximation to the flow about a circular cone at nonzero angle of attack by neglecting the cross flow effects. This superposition procedure effectively amounts to computing the flow turning angle in the meridional plane of the given solution point, and then obtaining the flow properties at that point by applying the Taylor-Maccoll solution for a cone half-angle equal to the flow turning angle. It must be emphasized that this is only an approximate technique, giving the well accepted Taylor-Maccoll solution at zero incidence, but becoming increasingly less accurate as the angle of attack is increased. Subroutines IVSGEN, TMCØNE, INTGRT, LØGIC, CØNVRG, ØDESLV, and FUNCTM are used to generate internally the initial-value plane flow property field.

6. THERMODYNAMIC MODEL

The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models can be incorporated into the computer program by suitably modifying or replacing subroutines THERMØ, STAG, TGRAD, JUMP, TMCØNE, LØGIC, and FUNCTM.

7. MOLECULAR TRANSPORT PROPERTIES

Both the dynamic viscosity and the thermal conductivity are assumed to be functions of the temperature only. The assumed functional form for the dynamic viscosity is given by Sutherland's law (2). The assumed functional form for the thermal conductivity is a quadratic function of temperature. Other representations for the dynamic viscosity and the thermal conductivity can be incorporated into the analysis by suitably modifying or replacing subroutine TPRØPS.

8. CENTERBODY AND COWL CONTOURS

The computer program developed in the present investigation assumes that both the centerbody contour and the cowl contour are axisymmetric. For the purposes of geometry description, the axial (x) domain is divided into a number of intervals. In any interval, the body radius may be specified by either tabular input, or by supplying the coefficients of a cubic polynomial written as a function of x. It is assumed that both the centerbody contour and the cowl contour are smooth and have continuous first derivatives. More arbitrary geometries, such as those having elliptic or super-elliptic cross-sections, can be incorporated into the analysis by suitably modifying or replacing subroutine BØUNDY.

9. FLOW SYMMETRY

Four flow symmetry options are incorporated into the computer program. The most general case is when no planes of symmetry exist. This option is used to compute the flow field for fully three-dimensional inlets at incidence. The second case is when one plane of flow symmetry exists. This option is used for computing the flow field for axisymmetric inlets at angles of attack. This second case of flow symmetry is the one most likely to arise in the class of problems being considered in the present investigation. The third case is when two planes of flow symmetry exist. This option is used to compute the flow field for three-dimensional inlets with two planes of geometric symmetry at zero angle of attack. The final option is when the flow is axisymmetric. This option is used to compute the flow field in axisymmetric inlets at zero incidence.

When determining the interpolation polynomial fit point stencils, solution point reflections must be performed when flow symmetry exists. Subroutines REFLEK and INTRFL are used for this purpose.

10. OUTPUT

Preliminary information is printed by LINK10. The initial-value plane and all solution planes are printed by subroutine PRNØUT. The solution points on the space curves defined by the intersection of the internal shock wave with the solid boundaries are output by subroutine SHKRFL. In addition to the position of and the dependent variables at a solution point, the Mach number, static temperature, velocity magnitude, stagnation pressure, and stagnation temperature are also printed. The mass flow rate across every solution plane, calculated by trapezoidal rule integration in subroutine MASS, is also printed.

The quantity of results which is printed is controlled by the input parameter KPRINT. Three printout options exist: body streamline points and shock wave points only, all solution points, and all solution points and the normal vector components and incident normal Mach numbers for the shock wave surface.

SECTION III

SUBROUTINE DESCRIPTIONS

1. INTRODUCTION

In this section, a brief description is given of the function of each subroutine in the computer program. This information supplements the information available in the the form of comment statements within the program.

2. ØVERLAY (0,0)

LINKOO. This program routine is the main control routine in ØVERLAY (0,0), the resident overlay. LINKOO first calls ØVERLAY (1,0) for data input, parameter initialization, and, if desired, internal generation of the flow property field on the initial-value plane. LINKOO then calls ØVERLAY (2,0) to perform the flow field integration. Most of the program constants and input parameters have their default values specified in LINKOO. Moreover, the reader and printer call numbers, denoted by IRE and IWR, respectively, are intialized in LINKOO.

BØUNDY. This subroutine is used for the specification of both the forebody/centerbody and cowl geometries. The version of BØUNDY supplied with the program assumes that both the forebody/centerbody and the cowl are axisymmetric. More arbitrary geometries can be described by suitably modifying or replacing this subroutine. If BØUNDY is replaced, the subroutine argument list must be identical to the existing list. The parameters in the argument list are defined as follows.

XABS	x-coordinate
Y	y-coordinate
Z	z-coordinate
ALPHA	polar angle defined by $\tan^{-1}(z/y)$
RBØDY	radius of either forebody/centerbody or cowl
BNX	x-component of outward body normal unit vector to forebody/centerbody or cowl
BNY	y-component of outward body normal unit vector to forebody/centerbody or cowl
BNZ	z-component of outward body normal unit vector to forebody/centerbody or cowl
J	If J=1, forebody/centerbody geometry is to be specified. If J=2, cowl geometry is to be specified.

K If K=0, read in XABS and ALPHA, and compute RBØDY and the corresponding Y and Z. If K=1, read in XABS and ALPHA, and compute RBØDY, Y, Z, BNX, BNY, and BNZ. If K=2, read in XABS, Y, and Z (coordinates of a point not on the body), and compute RBØDY, ALPHA, Y, Z, BNX, BNY, and BNZ at the point on the body where the projection of the body normal in the (y,z)-plane passes through the originally specified point.

THERMØ. This subroutine computes the temperature, sonic speed, and the thermodynamic parameter ξ. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying or replacing this subroutine. If subroutine THERMØ is replaced, the argument list must be identical to the existing list. The parameters in the argument list are defined as follows.

P pressure (p)

RØ density (ρ)

T temperature (t)

A sonic speed (a)

CØEFF $\xi=(1/\rho t)(\partial p/\partial s)_{\rho}$, where s is the entropy per unit mass

KT If KT = 1, compute T. If KT $\neq$ 1, do not compute T.

KA If KA = 1, compute A. If KA $\neq$ 1, do not compute A.

KC If KC = 1, compute CØEFF. If KC $\neq$ 1, do not compute CØEFF.

Thermodynamic property information is supplied to subroutine THERMØ through the named common block GAS1. This common block contains the following parameters: RUNIV (universal gas constant), TDT (temperature data array), WTMØL (molecular weight data array), CP (specific heat data array), NGAS1 (an integer to denote the number of elements in the TDT, WTMØL, and CP arrays), and KGAS1 (an integer to denote which gas model is to be used). These parameters are included for modifying subroutine THERMØ to include real gas effects.

STAG. This subroutine computes the Mach number, the stagnation pressure, and the stagnation temperature. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying or replacing this subroutine. If STAG is replaced, the argument list must be identical to the existing list. The parameters in the argument list are defined as follows.

P static pressure

RØ static density

T static temperature

A sonic speed

Q velocity magnitude

XM Mach number

PT stagnation pressure

TT stagnation temperature

Thermodynamic property information is supplied to subroutine STAG through the named common block GAS1.

TGRAD. This subroutine computes the spatial gradients of temperature by using an analytically differentiated form of the thermal equation of state so that temperature derivatives can be expressed in terms of the derivatives of pressure and density. The assumed thermodynamic model is that of a thermally perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying or replacing this subroutine. If TGRAD is replaced, the argument list must be identical to the existing list. The parameters in the argument list are defined as follows.

T	temperature
P	pressure
RØ	density
DPX,DPY,DPZ	first partial derivatives of pressure with respect to x, y, and z, respectively
DPXX,DPYY,DPZZ	second partial derivatives of pressure with respect to x, y, and z, respectively
DRØX,DRØY,DRØZ	first partial derivatives of density with respect to x, y, and z, respectively
DRØXX,DRØYY,DRØZZ	second partial derivatives of density with respect to x, y, and z, respectively
DTX,DTY,DTZ	first partial derivatives of temperature with respect to x, y, and z, respectively
DTXX,DTYY,DTZZ	second partial derivatives of temperature with respect to x, y, and z, respectively

Thermodynamic property information is supplied to subroutine TGRAD through the named common block GAS1.

TPRØPS. This subroutine computes the dynamic viscosity, the thermal conductivity, and their spatial gradients. The assumed functional form for dynamic viscosity is given by Sutherland's Law (2). The assumed functional form for thermal conductivity is a quadratic curve fit as a function of temperature. Other transport property formulations may be incorporated into the analysis by suitably modifying or replacing this subroutine. If TPRØPS is replaced, the argument list must be identical to the existing list. The parameters in the argument list are defined as follows.

T static temperature

P static pressure

VIS dynamic viscosity

CØN	thermal conductivity
DTX,DTY,DTZ	first partial derivatives of temperature with respect to x, y, and z, respectively
DPX,DPY,DPZ	first partial derivatives of pressure with respect to x, y, and z, respectively
DVISX,DVISY,DVISZ	first partial derivatives of viscosity with respect to x, y, and z, respectively
DCØNX,DCØNY,DCØNZ	first partial derivatives of thermal conductivity with respect to x, y, and z, respectively

Transport property information is supplied to subroutine TPRØPS through the named common block GAS2. This common block contains the following parameters: TDL (temperature data array), VISD (viscosity data array), CØND (thermal conductivity data array), NGAS2 (an integer to denote the number of elements in the TDL, VISD, and CØND arrays), and KGAS2 (an integer to denote which transport property model is to be used). These parameters are included for modifying TPRØPS to use tabular data.

JUMP. This subroutine employs the Rankine-Hugoniot relations to compute the downstream flow properties at a shock wave solution point. The shock wave surface normal unit vector components and the flow properties upstream of the shock wave are entered in the argument list. The computed downstream flow properties are also transmitted in the argument list. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying this subroutine. Thermodynamic property information is supplied to subroutine JUMP through the named common block GAS1.

GELG. This subroutine is used for solving a system of simultaneous linear equations. The system is solved using Gaussian elimination with complete pivoting. This subroutine is IBM library subroutine GELG.

3. ØVERLAY (1,0)

LINK10. This program routine is the main control routine in ØVERLAY (1,0). All input parameters and initial data are entered in LINK10. In all cases, the seven namelists LIST1 to LIST7 are entered. If the flow property field on the initial-value plane is externally specified, a formatted read of file ITAPE is used to enter this information. After the input data have been entered, subroutine INITIL is called for testing for input errors and performing parameter initialization. If the flow property field on the initial-value plane is to be internally generated, subroutine IVSGEN is then called from subroutine INITIL. After subroutine INITIL has been called, preliminary output is printed by LINK10.

INITIL. This subroutine is called from routine LINK10, and is used to test for errors on selected input parameters and to perform parameter initialization. If an input parameter error is found, an appropriate message is generated and the program execution is aborted. After the selected input parameters have been tested, parameter initialization is performed. If the flow property field on the initial-value plane is to be internally generated, subroutine IVSGEN is then called.

IVSGEN. This subroutine is used in conjunction with subroutines TMCØNE, INTGRT, LØGIC, CØNVRG, ØDESLV, and FUNCTM to internally generate the flow property field on the initial-value plane if the forebody is conical ahead of the initial-value plane. The internally generated initial-value plane is obtained by an approximate technique which employs the Taylor-Maccoll solution for the flow about a circular cone at zero incidence. A superposition procedure is used to obtain an approximation to the flow about a circular cone at nonzero angle of attack by neglecting the cross flow effects. This superposition procedure effectively amounts to computing the flow turning angle in the meridional plane of the given solution point, and then obtaining the flow properties at that point by applying the Taylor-Maccoll solution for a cone half-angle equal to the flow turning angle. The shock wave angle is then measured from the original streamline direction in the appropriate meridional plane. It must be emphasized that this is only an approximate technique, giving the well accepted Taylor-Maccoll solution at zero angle of attack, but becoming increasingly less accurate as the angle of attack is increased.

TMCØNE. This subroutine is one of the subroutines used for the internal generation of the initial-value plane. TMCØNE is called from subroutine IVSGEN, and performs initialization and post calculation storage of the Taylor-Maccoll solution used in computing the initial-value plane flow property field. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying this subroutine. Thermodynamic property information is supplied to subroutine TMCØNE through the named common block GAS1.

INTGRT. This subroutine is one of the subroutines used in internally generating the flow property field on the initial-value plane. INTGRT integrates the Taylor-Maccoll equation inward towards the forebody until a point is reached where the normal component of velocity is sufficiently small.

LØGIC. This subroutine is one of the subroutines used in internally generating the flow property field on the initial-value plane. LØGIC is used to control the computation of the Taylor-Maccoll solution in a particular meridional plane. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying this subroutine. Thermodynamic property information is supplied to subroutine LØGIC through the named common block GAS1.

CØNVRG. This subroutine is one of the subroutines used in internally generating the flow property field on the initial-value plane. CØNVRG is used in testing if the normal component of velocity has vanished at the body in the external flow field integration.

ØDESLV. This subroutine is one of the subroutines used in internally generating the flow property field on the initial-value plane. ØDESLV integrates the Taylor-Maccoll equation by employing a fourth-order Runge-Kutta method.

FUNCTM. This function is used in internally generating the flow property field on the initial-value plane. FUNCTM evaluates the Taylor-Maccoll equation. The assumed thermodynamic model is that of a thermally and calorically perfect gas. Other thermodynamic models may be incorporated into the analysis by suitably modifying this function. Thermodynamic property information is supplied to FUNCTM through the named common block GAS1.

4. ØVERLAY (2,0)

LINK20. This program routine is the main control routine in ØVERLAY (2,0). LINK20 calls the integration control overlays, ØVERLAY (2,1), ØVERLAY (2,2), and ØVERLAY (2,3). If a program restart is specified, the last secondary level overlay that was in use at the time the initial execution was terminated is called.

REDIST. This subroutine is used to perform point redistribution on the solution plane at the axial station of the cowl lip. This point redistribution is required to obtain a uniform point distribution and to obtain streamlines which lie in the stream surface formed by the cowl boundary. The redistributed points are arranged symmetrically in the computed sector. These points lie on rays which have equal angular increments from one another, with the points on each ray being spaced at equal radial increments. The flow properties at these points are obtained by bivariate interpolation. If the viscous flow option is specified and the internal flow field integration option in which shock waves are not discretely fitted is specified, point redistribution is also performed on the forebody flow field solution plane immediately upstream of the solution plane located at the cowl lip axial station.

STNSEL. This subroutine is employed to determine the solution point on a given solution plane that is nearest to an arbitrary point whose coordinates are supplied in the argument list. After the proper solution point has been determined by a search of the computed sector, it is used as the base point of the nine point stencil used in formulating the quadratic bivariate interpolation polynomial. STNSEL calls subroutine BIPTS in the course of determining the proper solution point and in formulating the interpolation polynomial coefficients.

REFLEK. This subroutine performs reflections, about the coordinate axes, of the solution points in the computed sector on a given solution plane when flow symmetry exists. The solution point reflections are required to obtain the appropriate fit point stencils used in formulating the univariate, bivariate, and trivariate interpolation polynomials. REFLEK is used to reflect points for the case of one plane of flow symmetry, the case of two planes of flow symmetry, and the axisymmetric flow case. Both streamline and shock wave points are reflected in REFLEK.

XSTEP. This subroutine determines the axial marching step allowed by the Courant-Friedrichs-Lewy (CFL) stability criterion. Except in the vicinity of an internal shock wave intersection with a solid boundary, the marching step computed by XSTEP is that used to regulate the distance between successive solution planes. In the vicinity of an internal shock wave-solid boundary intersection, special constraints are used to determine the marching step. XSTEP applies the CFL stability criterion to all streamline points in the computed sector. The actual marching step is taken as the allowable x-step at the most restrictive point. The stability criterion is not applied to the shock wave points. Moreover, the internal flow field shock wave points are ignored in defining the convex hull of the finite difference network when application of the stability criterion is made to a streamline point.

MASS. This subroutine is used to compute the mass flow rate across a given solution plane. The mass flow rate is numerically ascertained by a trapezoidal rule integration procedure in which the incremental mass flow rate is computed through an elemental triangle formed by three adjacent points. The total of these incremental mass flow rates is the total mass flow rate. If flow symmetry exists, only the mass flow rate in the computed sector is found by integration. The mass flow rate across the entire plane is then obtained by use of an appropriate multiplier. Special logic is used to trace the internal shock wave in the integration procedure when the mass flow rate across an internal flow field solution plane is being computed.

PRNØUT. This subroutine is used to print the integration results for all solution planes. Both the external flow field and the internal flow field solution planes are printed by PRNØUT. In addition, the initial-value plane, the redistributed data plane at the cowl lip axial station, and the restart plane are output by PRNØUT. Three print options (specified in the input by the input parameter KPRINT) are available: body streamline points and shock wave points, all solution points, and all solution points and shock wave parameters (incident normal Mach number and shock wave surface normal unit vector components). The solution points along the space curves formed by the intersections of the internal shock wave with the solid boundaries are not printed by subroutine PRNØUT. They are printed by subroutine SHKRFL.

UNIPTS. This subroutine selects the fit points used in formulating the univariate interpolation polynomials that are used to describe the shock wave radius and the shock wave angle along the curve defined by the intersection of the shock wave with a given solution plane. Three adjacent shock wave solution points constitute the fit point stencil in regions that are away from an internal shock wave-solid boundary intersection. In the region of an intersection, the fit point stencil may be appropriately expanded to be in accord with the Courant-Friedrichs-Lewy (CFL) stability criterion.

UNIFIT. This subroutine is used to determine the coefficients in the quadratic univariate interpolation polynomial. The three coefficients in this polynomial are determined by a fit to three data points which are supplied to UNIFIT through the call statement. Subroutine GELG is called to solve the system of simultaneous linear equations that determines the coefficients.

BIPTS. This subroutine selects the fit points used in formulating the quadratic bivariate interpolation polynomials that are used for intraplanar flow property determination. A base point and its eight immediate neighbors constitute the fit point array. Two types of fit point stencils are used: interior point and boundary point. A boundary point stencil is employed when the interpolation base point (the fit point nearest to the interpolated point) is on the shock wave. Special logic is used to insure that no point stencil bridges the shock wave.

BIFIT. This subroutine is used to determine the coefficients in the quadratic bivariate interpolation polynomial. The six coefficients in this polynomial are determined by a least squares fit of nine data points which are supplied to BIFIT through the named common block FITPTS. Subroutine SYMSIM is called to solve the system of simultaneous linear equations (normal equations) which determines the coefficients in the interpolation polynomial. This system of linear equations has a symmetric coefficient matrix.

TRIPTS. This subroutine selects the fit points used in formulating both the linear trivariate interpolation polynomial and the quadratic trivariate interpolation polynomial. Four solution points are used in formulating the linear trivariate interpolation polynomial. Fourteen solution points are used in formulating the quadratic trivariate interpolation polynomial. The linear polynomial is used for flow property interpolation on the upstream side of the shock wave surface. The quadratic polynomial is used for flow property interpolation on both the downstream side of the shock wave surface and on the stream surface formed by a solid boundary.

TRIFTU. This subroutine is used to determine the coefficients in the linear trivariate interpolation polynomial. The four coefficients in this polynomial are determined by a fit to four data points which are supplied to TRIFTU through the named common block FITPTS. Subroutine GELG is called to solve the system of simultaneous linear equations which determine the coefficients.

TRIFTD. This subroutine is used to determine the coefficients in the quadratic trivariate interpolation polynomial. The eight coefficients in this polynomial are determined by a least squares fit of fourteen data points which are supplied to TRIFTD through the named common block FITPTS. Subroutine SYMSIM is called to solve the system of simultaneous linear equations (normal equations) which determines the coefficients. This system of equations has a symmetric coefficient matrix.

SYMSIM. This subroutine solves a system of simultaneous linear equations with a symmetric coefficient matrix. The system is solved using Gaussian elimination with pivoting in the main diagonal. This subroutine is a modified version of IBM library subroutine GELS.

SHKINT. This subroutine is used to evaluate the univariate interpolation polynomials that are employed in describing the shock wave radius and the shock wave angle along the curve that is defined by the intersection of the shock wave with a given solution plane. The interpolation polynomial coefficients are supplied to SHKINT through the named common block SINTRP. The independent variable is the polar angle THETA, which is transmitted through the subroutine call statement.

PRPINT. This subroutine is used to evaluate the bivariate and trivariate interpolation polynomials that are used for flow property determination on solution planes, shock waves, and solid boundary stream surfaces. The interpolation polynomial coefficients are supplied to PRPINT through the named common block INTRP. The independent variables are the three position coordinates XA, Y, and Z, which are transmitted through the subroutine call statement.

FDERIV. This subroutine is used to compute the first partial derivatives of the flow properties on a solution plane, a shock wave, or a solid boundary stream surface. The derivatives are obtained by evaluating an analytically differentiated form of the appropriate interpolation polynomial. The interpolation polynomial coefficients are transmitted to FDERIV through the named common block INTRP. The independent variables are the three position coordinates XA, Y, and Z, which are transmitted through the subroutine call statement.

VECTØR. This subroutine is used in conjunction with subroutine SHØCK to determine the components of the unit vector $\hat{\beta}$ which is used in the parameterization of the wave surface compatibility relation. The unit vector $\hat{\beta}$ is orthogonal to the velocity vector that is downstream of the shock wave at the shock wave solution point, and has its projection on the (y,z)-plane lie in the meridional plane which passes through the shock wave solution point.

PLANAR. This subroutine is used to compute the parameters employed in the formulation that represents the shock wave surface. This formulation is then used in determining the intersection point of either a streamline or a bicharacteristic with the shock wave surface. Additionally, PLANAR initializes some parameters used in determining the intersection point of a bicharacteristic with the stream surface formed by a solid boundary.

INTSCT. This subroutine is used to compute the intersection point of either a streamline with the shock wave surface, or the intersection point of a bicharacteristic with either the shock wave surface or the stream surface formed by a solid boundary. The determination of the intersection point coordinates is performed in an iteration loop which uses the secant method to relax the difference in the radius of the point of intersection obtained from integration of the equation for a streamline or bicharacteristic and that obtained from the appropriate surface formulation.

FUNCT. This subroutine is used in conjunction with subroutine INTSCT to determine a streamline-shock wave intersection point, or the intersection point of a bicharacteristic with either a shock wave or a solid boundary. The axial position of the assumed intersection point is supplied to FUNCT through the subroutine call statement. From the given axial position, FUNCT computes the corresponding y and z coordinates of the assumed intersection point by both integrating the equation for a streamline or bicharacteristic, and by evaluating the appropriate surface formulation. The difference in the radius obtained from the streamline or bicharacteristic equation integration and that obtained from the surface formulation is reduced to within a specified tolerance of zero by the iteration method used in subroutine INTSCT.

RADIUS. This subroutine is used to compute the radius of a point on the shock wave surface or on the stream surface formed by a solid boundary. The axial position and the polar angle of the point are supplied to RADIUS through the subroutine call statement. To obtain the shock wave radius at the desired point, a linear interpolation is performed in the meridional plane of the point between two space curves which are defined by either a shock-wave solution plane intersection or by a shock wave-solid boundary intersection. To obtain the body radius at the desired point, subroutine BØUNDY is called.

XFIT. This subroutine is used to curve fit, as a function of the polar angle, the axial (x) position of an internal shock wave-solid boundary intersection. A quadratic polynomial expressed in terms of the polar angle is used for this representation.

FRCFNS. This subroutine is used to compute the molecular transport forcing terms used in both the governing equations and the compatibility relations. FRCFNS is called by subroutines SØLVE and SHØCK. The molecular transport terms can be included in the computation of the external flow field about the forebody or in the computation of the internal flow field in which shock waves are not discretely fitted. The program option in which internal shock waves are discretely fitted does not have the capability to include the influence of molecular diffusion in the computation, but rather assumes the flow to be inviscid and adiabatic.

SØLN. This subroutine calls subroutines LØCATE and SØLVE for computing either a solid boundary solution point or an interior solution point.

LØCATE. This subroutine is used to compute the locations of and the flow properties at the streamline and bicharacteristic intersection points for the standard interior point, standard solid boundary point, shock-modified interior point, and shock-modified solid boundary point unit processes. The point locations and flow properties at these points are transmitted to subroutine SØLVE through the named common blocks RELAY1 and RELAY2. Subroutine SØLVE then solves the system of compatibility relations to obtain the position of and the flow properties at the solution point.

SØLVE. This subroutine is used to solve the system of compatibility equations for the standard interior point, standard solid boundary point, shock-modified interior point, and shock-modified solid boundary point unit processes. If the viscous and thermal diffusion terms are to be included in the computation, SØLVE calls subroutine FRCFNS. The system of five compatibility relations is solved by calling subroutine GELG.

SHØCK. This subroutine is used to compute the solution for all field-shock wave points. For the bow shock wave points, the free-stream flow conditions are used for the upstream flow properties. For the internal flow field shock wave points, an interior point or solid boundary unit process is applied to obtain the upstream flow properties. Body solution points on the downstream side of the cowl lip shock wave or on the downstream side of a reflected internal shock wave are computed using the solid boundary-shock wave point unit process (subroutine BSHØCK).

5. ØVERLAY (2,1)

LINK21. This program routine contains the control logic used in the computation of the external flow field about the forebody. LINK21 is the main control routine in ØVERLAY (2,1). ØVERLAY (2,1) is a secondary level overlay which is called from routine LINK20.

RCNTRL. This subroutine is used to control the number of radial stations on successive solution planes in the forebody flow field integration. If a sufficient influx of mass across the bow shock wave has occured between the current solution plane and the last solution plane where point addition or deletion was performed, a new ring of interior field points is added between the ring of shock wave points and the outermost ring of existing interior field points. If, after a number of successive point additions, a specified number of radial stations has been reached, point deletion is performed. Here, selected interior field points are deleted from the storage arrays while the bow shock wave points and the body streamline points are retained.

6. ØVERLAY (2,2)

LINK22. This program routine contains the control logic used in the computation of the internal flow field in which shock waves are discretely fitted. LINK22 is the main control routine in ØVERLAY (2,2). ØVERLAY (2,2) is a secondary level overlay which is called from routine LINK20.

BSHØCK. This subroutine is used to compute the flow properties at a point on the body that is downstream of either the cowl lip shock wave or an internal reflected shock wave (solid body-shock wave point unit process). This subroutine is used only in the option where the internal flow field integration in which shock waves are discretely fitted is employed.

SPRJCT. This subroutine is used in the internal flow field integration to project the internal shock wave from the current initial-value plane to the current solution plane. The projected intersection of the internal shock wave with the solution plane is then used to determine which streamlines do and do not penetrate the shock wave.

PENTRE. This subroutine is used in the internal flow field integration to control the computation of an interior field point when the streamline has penetrated the internal shock wave. If the streamline-shock wave intersection point is sufficiently close to the current solution plane, an interior point unit process on the downstream side of the shock wave is not performed. Instead, in this case, a streamline projection onto the solution plane and subsequent flow property interpolation in this plane is performed. Alternatively, if the streamline-shock wave intersection point is sufficiently far from the solution plane, an interior point unit process is performed on the downstream side of the shock wave.

TRACE. This subroutine is used in conjuction with subroutine INTSCT to compute the intersection point of a streamline with an internal shock wave. With the intersection point coordinates determined, the trivariate interpolation polynomials are evaluated to obtain the flow properties at the intersection point.

SØLINT. This subroutine is used in the internal flow field integration to determine the intersection point coordinates of and the flow properties at an interior field point when the streamline penetrates an internal shock wave with the intersection point being sufficiently close to the current solution plane. SØLINT is called from subroutine PENTRE.

SWITCH. This subroutine is used in the internal flow field integration to perform the post computation interchange of indices when a streamline which initially appeared to intersect the internal shock wave ultimately did not. Consequently, a standard interior point unit process is used for this point instead of a shock-modified interior point unit process performed on the downstream side of the shock wave.

SHKRFL. This subroutine contains the control logic used for calculating an internal shock wave-solid boundary intersection.

INTRFL. This subroutine performs the necessary point reflections when flow symmetry exists for the solution points on the space curve defined by the intersection of the internal shock wave with a solid boundary.

ISHØCK. This subroutine is used in the internal flow field integration to compute the incident shock wave upstream and downstream flow properties at a point where the incident shock wave intersects a solid boundary.

STRSHK. This subroutine is used to compute the position of and the flow properties at the intersection point of a body streamline with the space curve defined by the intersection of the incident shock wave with a solid boundary.

RSHØCK. This subroutine is used with subroutine BSHØCK to compute the flow properties on the body downstream of an internal reflected shock wave.

7. ØVERLAY (2,3)

LINK23. This program routine contains the control logic used in the computation of the internal flow field in which shock waves are not discretely fitted. LINK23 is the main control routine in ØVERLAY (2,3). ØVERLAY (2,3) is a secondary level overlay which is called from routine LINK20.

SECTION IV

INPUT PARAMETERS

1. INTRODUCTION

The input data required for execution of the computer program are entered by both namelist input and formatted read statements. In all cases, the seven namelists LIST1, LIST2, LIST3, LIST4, LIST5, LIST6, and LIST7 are entered. In cases in which the user selects to specify the flow property field on the initial-value plane, that information is entered by a formatted read of either TAPE 5 (the input file) or TAPE 3.

In general, only those parameters and data pertinent to the particular problem being considered must be entered. Many input parameters have default values and do not need to be specified unless values other than the default values are to be entered.

In this section, each input parameter is defined. Where applicable, both the default value and the typical value of the input parameter are given.

2. TITLE CARD

The first card of each data deck is a title card on which 72 alphanumeric characters (any standard Fortran characters) of identifying information may be specified. This card must be the first card of the data deck even if no information is listed on it. The format of the card is (12A6).

3. NAMELIST LIST1

The parameters entered in namelist LIST1 control the overall execution of the program.

KUNIT An integer variable denoting whether English absolute units or SI units are to be used in the computation. If KUNIT = 1, English absolute units are employed. If KUNIT = 0, SI units are employed. A default value of 1 is specified for KUNIT.

KCALL A one-dimensional integer variable array consisting of three elements. Each element of KCALL specifies whether or not a particular flow field integration option is to be performed. If KCALL(I) = 1 (I=1,2,3), then the corresponding flow field integration option is performed. If KCALL(I) = 0, the integration option is not performed. The elements of KCALL control the flow field integration options and have specified default values as listed below.

KCALL(I)	Flow Field Integration Option	Default Value
KCALL(1)	forebody flow field	1
KCALL(2)	internal flow field with discrete shock wave fitting	1
KCALL(3)	internal flow field without discrete shock wave fitting	0

Specifying KCALL(2) = 1 and KCALL(3) = 1 simultaneously will cause an error message to be printed and the program execution to be aborted.

XEND A one-dimensional real variable array consisting of three elements. XEND(I) (I=1,2,3) denotes the x-position, in either feet or meters, at which the flow field integration specified by the corresponding element of KCALL is to be terminated. Each element of XEND denotes a flow field integration option termination point and has a default value as follows.

XEND(I)	Termination Point for	Default Value
XEND(1)	forebody flow field itegration	2.0 ft
XEND(2)	internal flow field integration with discrete shock wave fitting	3.5 ft
XEND(3)	internal flow field integration without discrete shock wave fitting	3.5 ft

If any element of XEND exceeds the x-position to which the centerbody geometry is specified, or if XEND(2) or XEND(3) exceeds the x-position to which the cowl geometry is specified, appropriate error messages are printed and the program execution is aborted. Each element of XEND must be positive. It should be noted that if KCALL(I) = 0, XEND(I) does not have to be specified.

RCAVG A positive real variable denoting the estimated average radius, in either feet or meters, of the bow shock wave at XEND(1). The specified value of RCAVG is used in estimating the captured mass flow rate at XEND(1). This mass flow rate is used in determining if point addition is to be performed in the forebody flow field integration. RCAVG must be specified only if the forebody flow field integration option is used [KCALL(1) = 1]. RCAVG must be specified even if the forebody integration option is the only integration option used [KCALL(2) = KCALL(3) = 0]. The cowl lip radius may be used for RCAVG. A default value of 0.8 ft is specified for RCAVG.

KVISCY — An integer variable denoting whether or not the viscous and thermal diffusion terms are to be included in the computation of the fore-body flow field or the internal flow field in which shock waves are not discretely fitted. If KVISCY = 1, these terms are included in the computation. If KVISCY = 0, these terms are not included in the computation. A default value of 0 is specified for KVISCY.

KSYM — An integer variable denoting the flow symmetry option to be employed in the computation. KSYM can have the values 0, 1, 2, and 3 corresponding to:

KSYM	Flow Symmetry Option
0	no planes of symmetry - computed sector is the entire solution plane
1	one plane of symmetry - computed sector is the half-plane bounded by the y-axis and containing the +z-axis
2	two planes of symmetry - computed sector is the quadrant bounded by the +y-axis and the +z-axis
3	axisymmetric flow - computed sector is the single circumferential station on the +y-axis

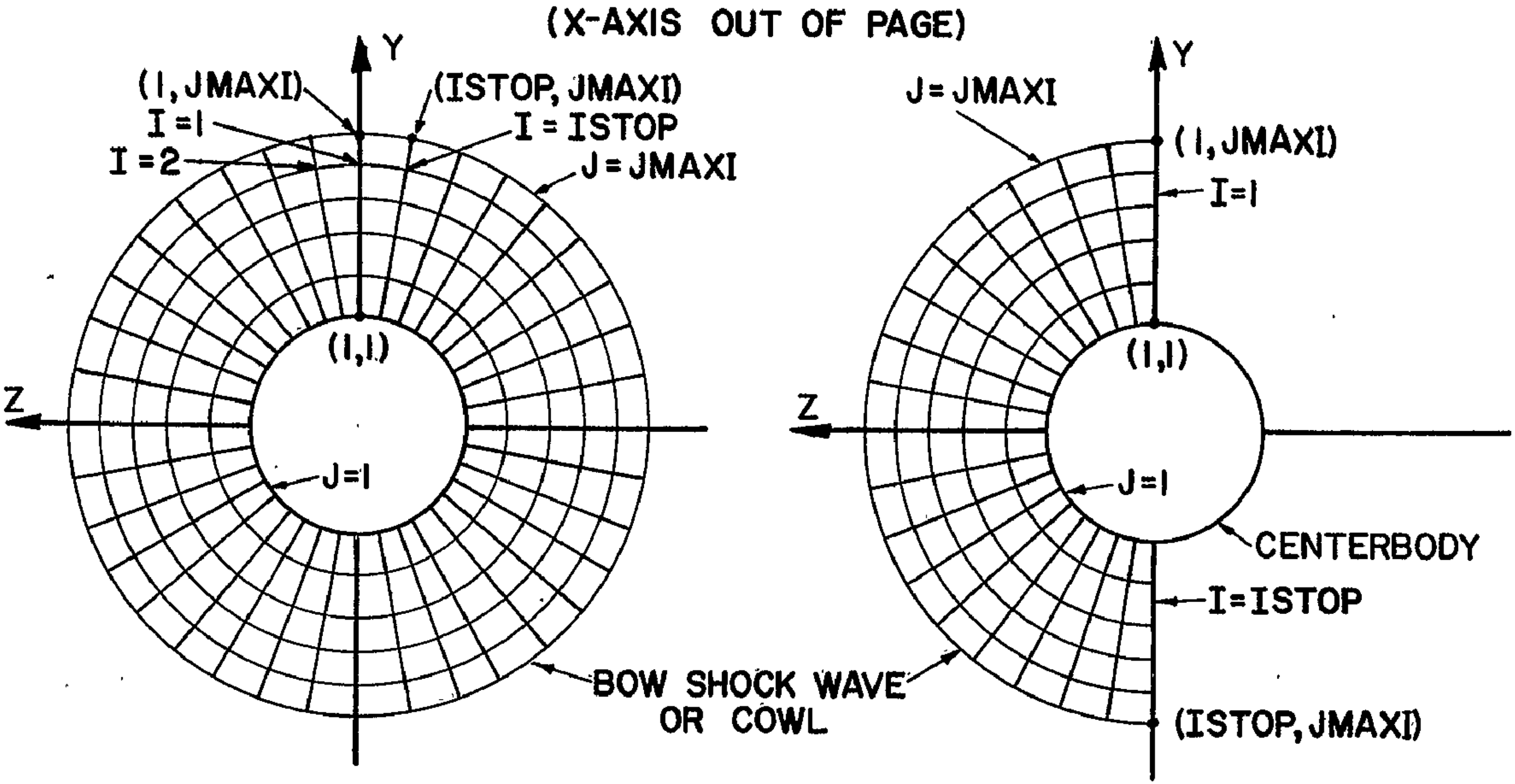
The point networks for the four flow symmetry options are illustrated in Figure 3. A default value of 3 is specified for KSYM.

KSGLØB — An integer variable denoting whether or not global correction is to be performed in obtaining the solution for the bow shock wave points. If KSGLØB = 1, global correction is performed. If KSGLØB = 0, global correction is not performed. Global correction can only be performed for the bow shock wave points and not for the internal flow field shock wave points. Hence, KSGLØB must be specified only if KCALL(1) = 1. A default value of 1 is specified for KSGLØB.

KPRINT — An integer variable denoting which of three print options is to be employed in the program execution. KPRINT can have the following values.

KPRINT	Print Option
0	print body solution points and shock wave solution points only
1	print all solution points
2	print all solution points and shock wave parameters (incident normal Mach number and shock wave surface normal unit vector components)

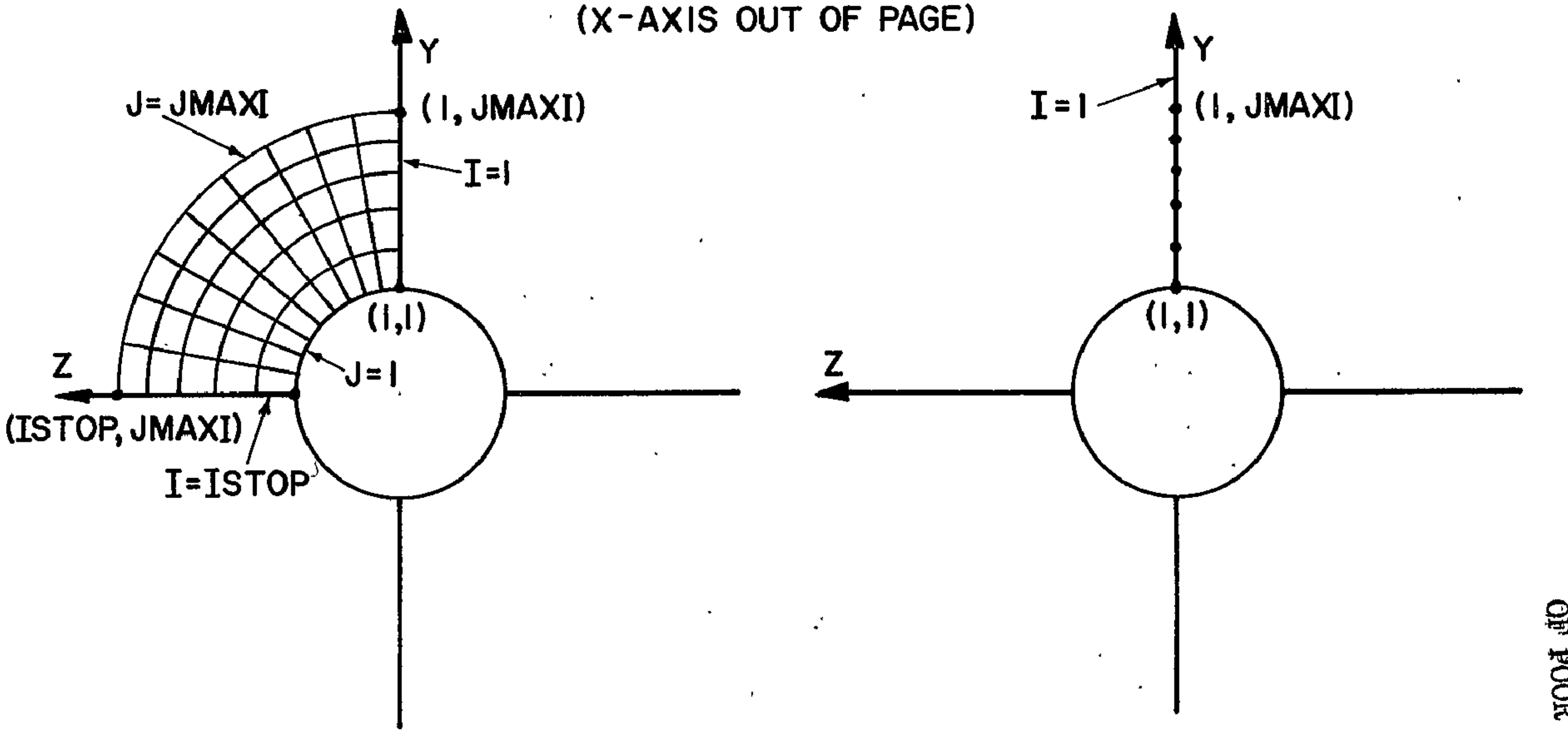
A default value of 1 is specified for KPRINT.



(a) NO PLANES OF SYMMETRY
(KSYM=0)

(b) ONE PLANE OF SYMMETRY
(KSYM=1)

FIGURE 3. COMPUTATIONAL POINT NETWORKS



(c) TWO PLANES OF SYMMETRY
(KSYM=2)

(d) AXISYMMETRIC FLOW
(KSYM=3)

FIGURE 3. (CONTINUED)

IPRSTP A positive integer variable denoting the plane number at which the program execution is to be terminated. This input parameter is typically employed when the execution is intended to be restarted at plane number (IPRSTP + 1). Specifying IPRSTP $\leq$ 0 has no effect on the execution of the program. A default value of 0 is specified for IPRSTP.

KSTART An integer variable used in controlling the file operations involved in the restarting of the program (if desired). KSTART controls the storage and retrieval of the restart file as follows.

KSTART	Control of Restart File
0	no file operations
1	write restart file on TAPE 4
2	read information for program restart from TAPE 4, and write ensuing solution planes on this tape

A default value of 0 is specified for KSTART. TAPE 4 is linked to the dummy file RESTRT in the PRØGRAM card.

4. NAMELIST LIST2

The parameters entered in namelist LIST2 specify the free-stream conditions, the inlet orientation, and the parameters which control the internal generation of the flow property field on the initial-value plane.

MFS A positive real variable denoting the free-stream Mach number. The specified value of MFS must be greater than 1.0. A default value of 3.0 is specified for MFS.

PFS A positive real variable denoting the free-stream absolute pressure, in either (lbf/ft^2) or (N/m^2). A default value of 242.2 (lbf/ft^2) is specified for PFS (this value is the pressure of the standard atmosphere at an altitude of 50,000 ft).

RØFS A positive real variable denoting the free-stream density, in either (slug/ft^3) or (kg/m^3). A default value of 0.0003622 (slug/ft^3) is specified for RØFS (this value is the density of the standard atmosphere at an altitude of 50,000 ft).

PITCH A real variable denoting the angle, in degrees, subtended by the free-stream velocity vector and the projection of the free-stream velocity vector on the (x,z)-plane, as illustrated in Figure 4. A default value of 0.0 degrees is specified for PITCH.

YAW A real variable denoting the angle, in degrees, subtended by the x-axis and the projection of the free-stream velocity vector on the (x,z)-plane, as illustrated in Figure 4. A default value of 0.0 degrees is specified for YAW.

$$u_\infty = |\overline{V}_\infty| \cos(\text{PITCH}) \cos(\text{YAW})$$

$$v_\infty = |\overline{V}_\infty| \sin(\text{PITCH})$$

$$w_\infty = |\overline{V}_\infty| \cos(\text{PITCH}) \sin(\text{YAW})$$

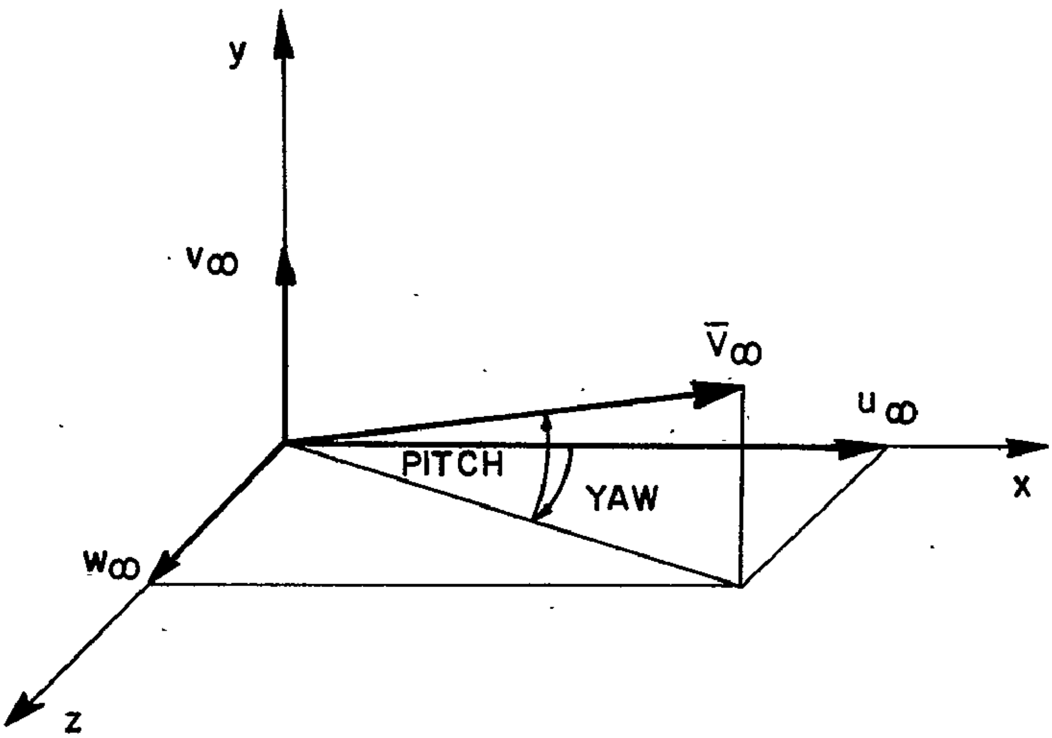


Figure 4. Pitch and yaw angles.

XI A positive real variable denoting the axial (x) position, in either feet or meters, of the initial-value plane. If the forebody flow field integration option is specified [KCALL(1) = 1], XI must be specified at the beginning of the forebody flow field computational regime (see Figure 1). If only the internal flow field integration option is specified [KCALL(1) = 0, KCALL(2) = 1 or KCALL(3) = 1], XI must be specified at the axial station of the cowl lip (see Figure 1). XI must not fall outside of the range of axial stations for which the centerbody geometry is specified. Also, XI must not be greater than the axial station up to which the cowl geometry is specified. A default value of 1.0 ft is specified for XI.

KIVS An integer variable denoting whether the initial-value plane is to be generated internally by the approximate technique described in Section II, or read in. If KIVS = 1, the initial-value plane is computed internally. If KIVS = 0, the initial-value plane must be supplied by the user through a formatted read of file ITAPE. The formatted read input is described at the end of this section. The internally generated initial-value plane option is applicable only to cases where the forebody is conical up to the axial station where the initial-value plane is located. Specifying KIVS = 1 requires that KSYM = 1,2, or 3and that YAW = 0.0. Furthermore, if KIVS = 1 and KSYM = 3, PITCH must be specified as 0.0. A default value of 1 is specified for KIVS.

KCØN An integer variable denoting whether or not the bow shock wave is conical. KCØN must be specified only if the forebody flow field integration option is employed [KCALL(1) = 1]. If KCØN = 1, the bow shock wave is conical. In this case, the angle at each initial-value plane bow shock wave point that is subtended by the shock wave and the x-axis in the meridional plane defined by the shock wave point is computed internally. If KCØN = 0, the bow shock wave is not conical, and the shock wave angles must be supplied by the user through a formatted read of file ITAPE. The formatted read input is described at the end of this section. If the initial-value plane is generated internally (KIVS = 1), a conical bow shock wave is assumed (KCØN = 1). A default value of 1 is specified for KCØN.

ITAPE A positive integer variable denoting the tape number from which the user supplied initial-value plane is to be entered by a formatted read. ITAPE must be specified only if the initial-value plane flow property field is to be supplied by the user (KIVS = 0). The default value assigned to ITAPE is 5 (the input file). The user may specify ITAPE = 3, in which case the initial-value plane is read from TAPE 3. TAPE 3 is linked to the dummy file IVS in the PRØGRAM card.

5. NAMELIST LIST3

The parameters entered in namelist LIST3 specify the number of circumferential and radial stations used in the computational point network.

ISTØP A positive integer variable denoting the number of circumferential stations used in the computed flow field sector. The value specified for ISTØP must correspond to the flow symmetry option specified by KSYM (see namelist LIST1) as follows (see Figure 3).

KSYM	Allowable Value(s) of ISTØP
0	$5 \leq$ ISTØP ≤ 40
1	$4 \leq$ ISTØP ≤ 21
2	$3 \leq$ ISTØP ≤ 11
3	ISTØP = 1

A default value of 1 is specified for ISTØP [this value corresponds to KSYM = 3 (axisymmetric flow)]. A value of ISTØP = 21 is recommended for KSYM = 1.

JMAXI A positive integer variable denoting the number of radial stations on the initial-value plane. Note that the initial-value plane input format is the same whether the computation is being started at an axial station upstream of the forebody computational flow regime or at the axial station of the cowl lip. The specified value for JMAXI must be at least 3 and no greater than 21. The default and recommended value for JMAXI is 11.

Whatever the value of JMAXI, the outermost radial station corresponds to the downstream bow shock wave points, and the remaining (JMAXI - 1) radial stations correspond to the streamline points.

JINLET A positive integer variable denoting the number of radial stations on each solution plane in the internal flow field integration. JINLET must be specified only if the internal flow field is to be computed. The specified value of JINLET must be at least 4 and no greater than 21. The recommended value and the default value of JINLET is 11. It should be noted that JINLET is independent of JMAXI.

For the internal flow field integration option in which shock waves are not discretely fitted [KCALL(2) = 0, KCALL(3) = 1], JINLET specifies the number of streamline points at each circumferential station. For the internal flow field integration option in which shock waves are discretely fitted [KCALL(2) = 1, KCALL(3) = 0], the number of streamline points at each circumferential station is equal to (JINLET - 2). The remaining two storage locations are assigned to the upstream and downstream shock wave solution points.

JLIMIT A one-dimensional integer variable array consisting of two elements. JLIMIT must be specified only if the forebody flow field integration option is employed [KCALL(1) = 1]. The elements of JLIMIT are used in controlling the number of interior field points which are added in the computation of the forebody flow field. The first element of JLIMIT [JLIMIT(1)] denotes the allowable maximum number of radial stations on a solution plane in the forebody flow field computation when the mass flow rate across that plane is less than a specified fraction [denoted by CRIT(7) in namelist LIST6] of the estimated mass flow rate at XEND(1), the axial location at which the forebody flow field integration is to be terminated. The second element of JLIMIT [JLIMIT(2)] denotes the allowable maximum number of radial stations when the mass flow rate exceeds the specified fraction of the estimated mass flow rate at XEND(1). Each element of JLIMIT must be positive, odd, and no less than 5 but no greater than 21. JLIMIT(1) should be less than or equal to JLIMIT(2). A default value of 13 is specified for JLIMIT(1), and a default value of 21 is specified for JLIMIT(2).

6. NAMELIST LIST4

The parameters entered in namelist LIST4 specify the thermodynamic model and the molecular transport properties.

R — A positive real variable denoting the gas constant, in either (ft-lbf)/(slug-R) or (J/kg-K). A default value of 1716.16116 (ft-lbf)/(slug-R) is specified for R.

GAMMA — A positive real variable denoting the specific heat ratio. A default value of 1.4 is specified for GAMMA.

If the influence of molecular transport is not to be included in the computation (KVISCY = 0), no other parameters must be specified in namelist LIST4. If the viscous and thermal diffusion terms are to be included in the computation, the parameters presented in the following discussion must be specified.

The dynamic viscosity is represented in the computer program by the Sutherland formula (2).

$$\mu = \mu_o \left(\frac{T}{T_o}\right)^{1.5} \left(\frac{T_o + B}{T + B}\right) \tag{1}$$

In equation (1), μ is the dynamic viscosity at the absolute temperature T, and B is a constant. For air, B has the value 198.6 R (110 K). The parameter μ_o is the viscosity at the reference temperature T_o. The constants μ_o, T_o, and B must be specified in the program input by entering the following three parameters.

VISØ A positive real variable denoting the reference viscosity μ_0 in equation (1). The units of VISØ are either ($lbf\text{-}sec/ft^2$) or ($N\text{-}s/m^2$). A default value of 3.5×10^{-7} ($lbf\text{-}sec/ft^2$) is specified for VISØ (this value is the dynamic viscosity of air at 492.0 R).

TØ A positive real variable denoting the reference absolute temperature T_0 in equation (1). The units of TØ are either R or K. The specified value of TØ must correspond to the specified value of VISØ. A default value of 492.0 R is specified for TØ.

B A positive real variable denoting the constant B in equation (1). The units for B are either R or K. A default value of 198.6 R is specified for B.

Thermal conductivity is represented in the computer program by a quadratic curve fit written as a function of absolute temperature. This quadratic polynomial is given by

$$\kappa = a_1 + a_2 T + a_3 T^2 \tag{2}$$

where κ is the thermal conductivity, T is the absolute temperature, and the coefficients a_i (i=1,2,3) are determined by fitting this expression to three data point sets. The curve fit coefficients are determined by entering the following two arrays.

TDL A one-dimensional real variable array consisting of three elements. Each element of TDL represents a temperature data point for the thermal conductivity of the working gas. The units of each element of TDL are either R or K. The successive elements of TDL must represent monotonically increasing temperatures. The default values for the elements of TDL are:

TDL(1) = 400.0 R

TDL(2) = 1400.0 R

TDL(3) = 2400.0 R

CØND A one-dimensional real variable array consisting of three elements. Each element of CØND denotes the working gas thermal conductivity at the absolute temperature specified by the corresponding element of TDL. The units of each element of CØND are either ($ft\text{-}slug)/(sec^3\text{-}R$) or ($m\text{-}kg)/(s^3\text{-}K$). The default values for the elements of CØND are:

CØND(1) = 2.550963×10^{-3} ($ft\text{-}slug)/(sec^3\text{-}R$)

CØND(2) = 7.566417×10^{-3} ($ft\text{-}slug)/(sec^3\text{-}R$)

CØND(3) = 1.145772×10^{-2} ($ft\text{-}slug)/(sec^3\text{-}R$)

The specified default values for the elements of CØND correspond to the thermal conductivity values of air at the temperatures specified by the elements of TDL.

7. NAMELIST LIST5

The input parameters entered in namelist LIST5 specify the contours of the centerbody and the cowl. It is assumed that both the centerbody and the cowl are axisymmetric. The x-coordinate axis is the longitudinal axis of both the centerbody and the cowl (see Figure 1). The forebody tip must be located at x = 0.0. The axial station of the cowl lip must be specified at x > 0.0.

For the purpose of geometry description, the axial (x) domain is divided into a number of intervals, as illustrated in Figure 5. The number of axial stations at which the centerbody geometry is specified is denoted by NCENT. The number of intervals on the centerbody is equal to (NCENT - 1). The number of axial stations at which the cowl geometry is specified is denoted by NCØWL. The number of intervals on the cowl is equal to (NCØWL - 1).

In any interval, the centerbody or cowl radius may be specified either by tabular input, or by supplying the coefficients in a cubic polynomial written as a function of x. For the tabular input option, the body radius r(x) at axial position x in the ith interval ($x_i \leq x < x_{i+1}$) is found by linear interpolation between point (x_i, r_i) and point (x_{i+1}, r_{i+1}). The local slope of the body for this interval in a given meridional plane is then given by the slope of the line segment joining these two points. Alternatively, employing the cubic polynomial

$$r(x) = a_i + b_i(x - x_i) + c_i(x - x_i)^2 + d_i(x - x_i)^3 \quad (x_i \leq x < x_{i+1}) \tag{3}$$

requires that the curve fit coefficients a_i, b_i, c_i, and d_i be supplied by the user. Since equation (3) is a cubic, slope and curvature can be matched at the junction point between two adjacent intervals employing this formulation. An option exists to employ the following cubic polynomial instead of equation (3).

$$r(x) = a_i + b_i x + c_i x^2 + d_i x^3 \quad (x_i \leq x < x_{i+1}) \tag{4}$$

When employing equation (3) or equation (4), the coefficients a_i, b_i, c_i and d_i must be specified for up to at most (NCENT - 1) and/or (NCØWL - 1)

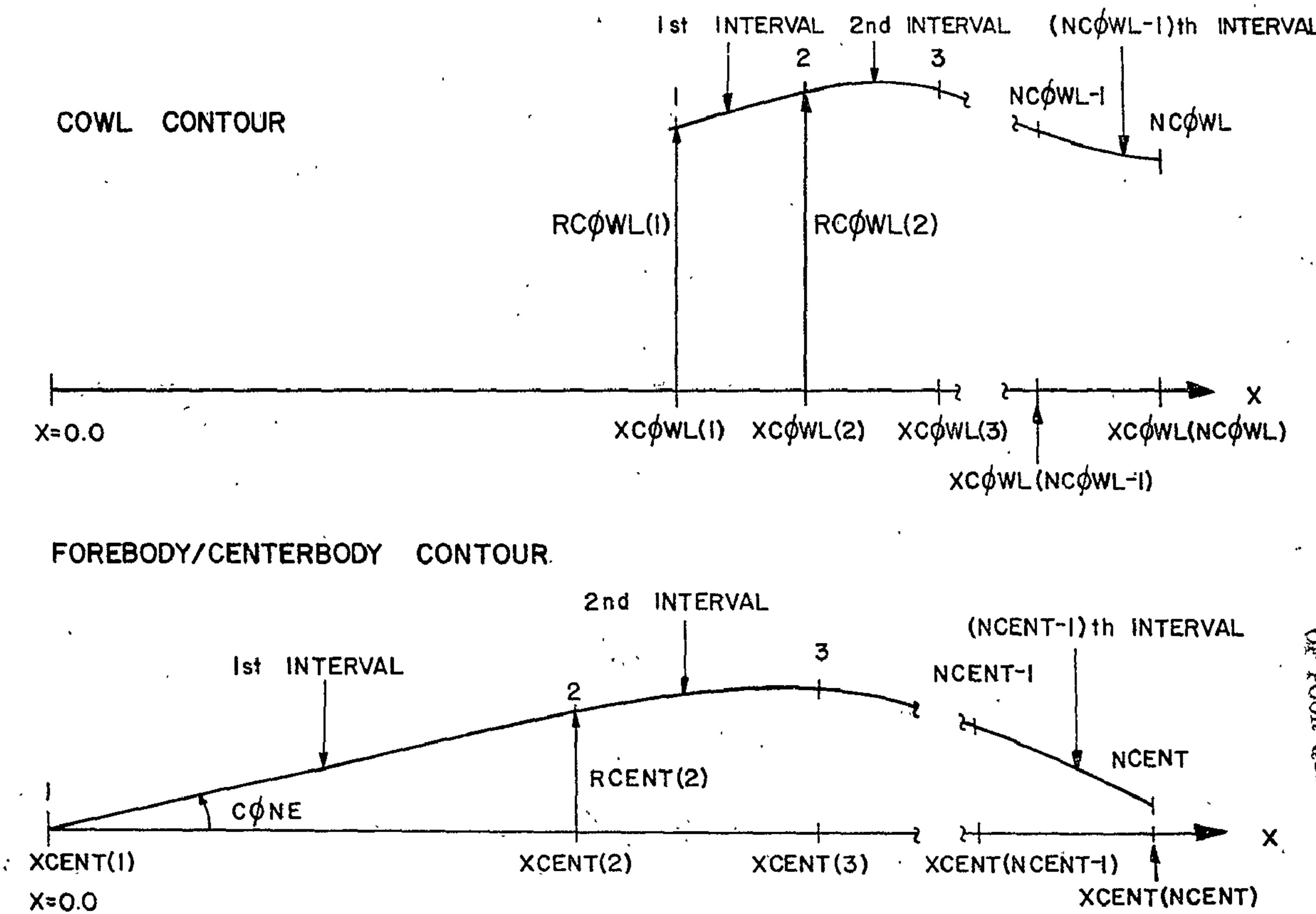


FIGURE 5. BOUNDARY CONTOUR DESCRIPTION

intervals. The axial location x_i must always be specified for NCENT and (if the internal flow field is to be computed) NCØWL axial stations, no matter which formulation is used.

If the forebody is conical ahead of a certain axial station, the forebody/centerbody geometry in this interval (1st interval) may be specified by entering the cone half-angle directly rather than by supplying the curve fit coefficients or entering the body radius by tabular input.

The geometry description option for a given interval is specified by the user and does not have to be the same for all intervals. For instance, the forebody/centerbody contour may have a conical tip, then a quadratic or cubic variation with x, then a linear variation with x, then again a quadratic or cubic variation with x. A way to describe this contour would be to input the cone half-angle for the first interval, the cubic curve fit coefficients for the second interval, the body radii at the ends of the third interval, and the cubic curve fit coefficients for the fourth interval. Alternatively, the appropriate cubic curve fit coefficients could be supplied for each of the four intervals. It should be noted that in the input of the geometry data, radius, slope, and curvature should be made compatible between adjacent intervals. The boundary contours are specified by entering the following parameters.

KBASE An integer variable denoting whether equation (3) or equation (4) is to be employed when at least one interval of the centerbody or cowl geometry is specified by either of these two cubic equations. If neither equation (3) nor equation (4) is used in the geometry description, then KBASE does not have to be specified. If a cubic equation is to be used, then entering KBASE = 0 specifies that equation (3) will be employed. If KBASE = 1, then equation (4) will be used. A default value of 0 is specified for KBASE. The specified value of KBASE applies to both the forebody/centerbody contour and the cowl contour.

NCENT A positive integer variable denoting the number of axial stations used in specifying the forebody/centerbody geometry. The number of intervals for the forebody/centerbody is equal to (NCENT - 1). The specified value for NCENT must be at least 2 and no greater than 100. A default value of 2 is specified for NCENT.

KDCENT A one-dimensional integer variable array (dimensioned at 100) consisting of (NCENT - 1) elements. Each element of KDCENT specifies the forebody/centerbody geometry description option to be used in the corresponding interval. Specifying KDCENT(I) = 1 for the ith interval selects the option in which the forebody/centerbody radius is described by equation (3) or equation (4) (depending on the value of KBASE). Specifying KDCENT(I) = 2 for the ith interval selects the option in which the forebody/centerbody radius is specified by tabular input. If the forebody tip is conical, the geometry in the first forebody/centerbody interval may be described by entering the cone half-angle directly and specifying KDCENT(1) = 3. The specified value for KDCENT(I) must be 1 or 2, except for the first interval (I = 1) in which case values of 1, 2, or 3 may be specified. Specifying other values than those allowed causes the program execution to be aborted. The default value for KDCENT(1) is 3, while all other elements of KDCENT have no default values specified.

XCENT — A one-dimensional real variable array (dimensioned at 100) consisting of NCENT elements. Each element of XCENT denotes the axial (x) position, in either feet or meters, of the beginning of a forebody/centerbody interval [XCENT(NCENT) denotes the axial position of the end of the last interval]. The elements of XCENT must be nonnegative and montonically increasing. The default values for XCENT(1) and XCENT(2) are 1.0 ft and 3.5 ft, respectively. The remaining elements of XCENT do not have default values specified.

RCENT — A one-dimensional real variable array (dimensioned at 100) consisting of up to NCENT elements. Each element of RCENT specifies the forebody/centerbody radius, in either feet or meters, at the axial location specified by the corresponding element of XCENT. If KDCENT(I) = 2, then RCENT(I) and RCENT(I + 1) must be specified. If KDCENT(I) = 1 or 3, then RCENT(I) and RCENT(I + 1) do not have to be specified. Each element of RCENT must be nonnegative. No default values are specified for the elements of RCENT.

ACENT
BCENT
CCENT
DCENT — One-dimensional real variable arrays (each array is dimensioned at 100), where each array consists of up to (NCENT - 1) elements. These arrays are used in conjunction with equation (3) or equation (4) for specification of the forebody/centerbody geometry. The elements of ACENT, BCENT, CCENT, and DCENT specify the coefficients a_i, b_i, c_i, and d_i, respectively, in equation (3) or equation (4). If KDCENT(I) = 1, then ACENT(I), BCENT(I), CCENT(I), and DCENT(I) must be specified for the <u>ith</u> interval. If KDCENT(I) = 2 or 3, then ACENT(I), BCENT(I), CCENT(I), and DCENT(I) do not have to be specified for that interval. The units for the elements of ACENT are either feet or meters. The elements of BCENT are dimensionless. The units for the elements of CCENT are either $(\text{feet})^{-1}$ or $(\text{meters})^{-1}$. The units for the elements of DCENT are $(\text{feet})^{-2}$ or $(\text{meters})^{-2}$. No default values are specified for the elements of ACENT, BCENT, CCENT, and DCENT.

CØNE — A real variable denoting the cone half-angle, in degrees, of the forebody tip if it is conical. If KDCENT(1) = 3, then CØNE must be specified. If KDCENT(1) = 1 or 2, then CØNE does not have to be specified. A default value of 10.0 degrees is specified for CØNE.

If only the external flow field about the forebody is to be computed [KCALL(1) = 1, KCALL(2) = 0, and KCALL(3) = 0], no further parameters must be specified in namelist LIST6. If the flow field in the annulus is to be determined, the following parameters must be entered.

NCØWL A positive integer variable denoting the number of axial stations used in specifying the cowl geometry. The number of intervals for the cowl is equal to (NCØWL - 1). The specified value for NCØWL must be at least 2 and no greater than 50. A default value of 2 is specified for NCØWL.

KDCØWL A one-dimensional integer variable array (dimensioned at 50) consisting of (NCØWL - 1) elements. Each element of KDCØWL specifies the cowl geometry description option to be used for the corresponding interval. Specifying KDCØWL(I) = 1 for the ith interval selects the option in which the cowl radius is described by equation (3) or equation (4) (depending on the value of KBASE). Specifying KDCØWL(I) = 2 for the ith interval selects the option in which the cowl radius is specified by tabular input. The specified value for KDCØWL(I) must be either 1 or 2. Specifying other values than those allowed causes the program execution to be aborted. The specified default value for KDCØWL(1) is 2, while all other elements of KDCØWL have no default values specified.

XCØWL A one-dimensional real variable array (dimensioned at 50) consisting of NCØWL elements. Each element of XCØWL specifies the axial (x) position, in either feet or meters, of the beginning of a cowl interval [XCØWL(NCØWL) denotes the axial position of the end of the last interval]. Each element of XCØWL must be nonnegative and monotonically increasing. The default values for XCØWL(1) and XCØWL(2) are 2.0 ft and 3.5 ft, respectively. The remaining elements of XCØWL do not have default values specified.

RCØWL A one-dimensional real variable array (dimensioned at 50) consisting of up to NCØWL elements. Each element of RCØWL specifies the cowl radius, in either feet or meters, at the axial location specified by the corresponding element of XCØWL. If KDCØWL(I) = 2, then RCØWL(I) and RCØWL(I + 1) must be specified. If KDCØWL(I) = 1, then RCØWL(I) and RCØWL(I + 1) do not have to be specified. Each element of RCØWL must be nonnegative. The default values for RCØWL(1) and RCØWL(2) are both 0.70 ft. The remaining elements of RCØWL do not have default values specified.

ACØWL
BCØWL
CCØWL
DCØWL One-dimensional real variable arrays (each array is dimensioned at 50), where each array consists of up to (NCØWL - 1) elements. These arrays are used in conjunction with equation (3) or equation (4) for specification of the cowl geometry. The elements of ACØWL, BCØWL, CCØWL, and DCØWL specify the coefficients a_i, b_i, c_i, and d_i, respectively, in equation (3) or equation (4). If KDCØWL(I) = 1, then ACØWL(I), BCØWL(I), CCØWL(I), and DCØWL(I) must be specified for the ith interval. If KDCØWL(I) = 2, then ACØWL(I), BCØWL(I), CCØWL(I), and DCØWL(I) do not have to be specified for that interval. The units of the elements of ACØWL are either feet or meters. The elements of BCØWL are dimensionless. The units for the elements of CCØWL are either $(\text{feet})^{-1}$ or $(\text{meters})^{-1}$. The units for the elements of DCØWL are either $(\text{feet})^{-2}$ or $(\text{meters})^{-2}$. No default values are

specified for the elements of ACØWL, BCØWL, CCØWL, and DCØWL.

DXTRAN A real variable denoting the centerbody translation from the design point position, or, equivalently, the amount the cowl has been translated with respect to the centerbody. The units of DXTRAN are either feet or meters. Translation occurs solely in the x-direction. Moreover, the origin of the coordinate system is maintained at the forebody tip when translation occurs. A positive value for DXTRAN corresponds to a forward centerbody translation or a rearward cowl translation. A default value of 0.0 is specified for DXTRAN.

8. NAMELIST LIST6

The parameters entered in namelist LIST6 specify the various convergence tolerances and iteration limits used in the numerical integration. All parameters in this namelist have specified default values. In general, the program is executed without changing the values of any of the parameters in this namelist.

SAFEIN A positive real variable denoting the ratio of the axial marching step taken to the axial marching step allowed by the Courant-Friedrichs-Lewy (CFL) stability criterion. This variable is used to determine the axial position of both the first solution plane in the forebody flow field integration [KCALL(1) = 1] and the first solution plane in the internal flow field integration in which shock waves are not discretely fitted [KCALL(3) = 1]. Ensuing solution planes for these integration options have their axial locations adjusted in accord with an internally computed value of SAFEIN. For the internal flow field integration option in which shock waves are discretely fitted [KCALL(2) = 1], the axial position of each solution plane (except in the vicinity of a shock wave reflection) is controlled by the input value of SAFEIN. The specified value of SAFEIN must be positive, and must be less than 1.0 to satisfy the CFL stability criterion. The default and recommended value of SAFEIN is 0.975.

CRIT A one-dimensional real variable array consisting of 16 elements. Each element of CRIT specifies a convergence tolerance or other parameter. The elements of CRIT have the following definitions and default values.

CRIT(1) A positive real variable denoting the tolerance, in either feet or meters, used to determine if a user supplied initial-value plane data point is sufficiently close to a plane of symmetry when the data point is supposed to lie on the plane of symmetry. CRIT(1) is also used to determine if a user supplied initial-value plane data point is sufficiently close to the solid boundary when that point is supposed to lie on the solid boundary. A default value of 0.1 ft (or 0.1 m) is specified for CRIT(1).

CRIT(2) A positive real variable denoting the relative tolerance used in testing for a loss of significance in IBM library subroutine GELG (GELG is used to solve a system of simultaneous linear equations). A default value of 10^{-7} is specified for CRIT(2).

CRIT(3) A positive real variable denoting the relative tolerance used in testing for convergence in the internal generation of the initial-value plane flow property field. A default value of 10^{-4} is specified for CRIT(3).

CRIT(4) A positive real variable denoting the relative tolerance used in testing for convergence of all three coordinates in the iterative scheme employed in computing a streamline-surface intersection or a bicharacteristic-surface intersection. A default value of 10^{-5} is specified for CRIT(4).

CRIT(5) A positive real variable denoting the relative tolerance used in testing for the convergence of the five flow properties u, v, w, P, and ρ in subroutine SØLVE. A default value of 10^{-4} is specified for CRIT(5).

CRIT(6) A positive real variable denoting the relative tolerance used in testing for the convergence of the static pressure in subroutine SHØCK. Convergence is attained in the local iteration loop if

$$|P(2) - P^*(2)|/P(2) \leq CRIT(6)$$

where P(2) is the solution point pressure obtained from the local Hugoniot relations, and P*(2) is the pressure obtained from the wave surface compatibility relation. A default value of 10^{-4} is specified for CRIT(6).

CRIT(7) A positive real variable denoting the mass flow rate ratio at which the maximum number of radial stations allowed in the forebody flow field computation is changed from JLIMIT(1) to JLIMIT(2). The mass flow rate ratio is the mass flow rate at a given forebody flow field solution plane divided by the estimated mass flow rate at the axial station corresponding to XEND(1). A default value of 0.5 is specified for CRIT(7).

CRIT(8) A positive real variable used as a multiplier of the mass flow ratio which is employed in determining whether or not point addition is to be performed on a solution plane in the forebody flow field integration. The mass flow rate ratio is the mass flow rate at the solution plane just computed divided by that at the last solution plane where point addition or deletion was performed. A default value of 1.0 is specified for CRIT(8).

CRIT(9) A positive real variable denoting the relative tolerance used in routine LINK21 for determining when the angle α calculated in the global correction for the bow shock wave points has converged. A default value of 10^{-4} is specified for CRIT(9).

CRIT(10) A positive real variable used in routine LINK21 for determining if a sufficient number of shock wave solution points have converged in global correction. Convergence is attained when

$$M/IST\emptyset P \geq CRIT(10)$$

where M is the number of shock wave solution points which have converged in global correction, and ISTØP is the number of circumferential stations in the computed sector. A default value of 0.8 is specified for CRIT(10).

CRIT(11) A positive real variable used in subroutine BSHØCK for determining if the velocity component downstream of the shock wave and normal to the surface of the solid boundary has converged to within a specified tolerance of zero. Convergence is attained when

$$|V_N| < CRIT(11)$$

where V_N is the velocity component normal to the solid boundary. A default value of 10^{-6} ft/sec (or 10^{-6} m/s) is specified for CRIT(11).

CRIT(12) A positive real variable used in routine LINK22 for determining if another solution plane is to be inserted between the last solution plane and the intersection of the incident internal shock wave with the solid boundary. Another solution plane is inserted if

$$\Delta x/\Delta x_{CFL} \geq CRIT(12)$$

where Δx is the axial (x) distance between the last computed plane and the nearest point on the space curve defined by the intersection of the incident internal shock wave with solid boundary, and Δx_{CFL} is the axial step allowed by the Courant-Friedrichs-Lewy

(CFL) stability criterion. A default value of 0.2 is specified for CRIT(12).

CRIT(13) Not presently employed.

CRIT(14) A positive real variable used in subroutine PENTRE for determining if a streamline-shock wave intersection point is sufficiently close to the current solution plane, so that an interior point unit process on the downstream side of the shock wave is not performed. Instead, a streamline projection onto the solution plane and subsequent flow property interpolation in this plane is performed. The application of the interior point unit process is not performed if

$$(x_s - x_{int})/\Delta x_{CFL} < \text{CRIT}(14)$$

where x_s is the axial position of the solution plane, x_{int} is the axial location of the streamline-shock wave intersection point, and Δx_{CFL} is the axial marching step allowed by the Courant-Friedrichs-Lewy stability criterion. A default value of 0.4 is specified for CRIT(14).

CRIT(15) A positive real variable used in subroutine STRSHK for determining if convergence has been obtained in calculating the intersection point of a body streamline with the space curve defined by the intersection of the incident internal shock wave with a solid boundary. Convergence is attained when

$$|\theta_{i+1} - \theta_i| \leq \text{CRIT}(15)$$

where θ_i is the polar angle of the intersection point on the ith iteration, and θ_{i+1} is the polar angle on the (i+1)th iteration. A default value of 10^{-4} radians is specified for CRIT(15).

CRIT(16) A positive real variable used in subroutine INTSCT for determining if convergence has been obtained in calculating the intersection point of a bicharacteristic with either a solid boundary or a shock wave, or the intersection point of a streamline with a shock wave. Convergence is attained when

$$|R_1 - R_s| \leq \text{CRIT}(16)$$

where R_1 is the radius of the intersection point obtained by integrating the equation for a streamline or bicharacteristic, and R_S is the intersection point radius obtained from the shock wave or boundary surface formulations. A default value of 10^{-6} ft (or 10^{-6} m) is specified for CRIT(16).

ITEND A one-dimensional integer variable array consisting of 6 elements. Each element of ITEND specifies a limit to the number of iterations permissible in a given iteration loop. The elements of ITEND have the following definitions and default values.

ITEND(1) A positive integer variable denoting the maximum number of inner iterations permissible in determining the intersection coordinates of either a streamline with a surface, or a bicharacteristic with a surface. ITEND(1) is used in conjunction with CRIT(4). A default value of 10 is specified for ITEND(1).

ITEND(2) A positive integer variable denoting the maximum number of outer iterations permissible in obtaining the five flow properties u, v, w, P, and ρ in all unit processes except the shock wave-solid boundary point unit process. A default value of 10 is specified for ITEND(2).

ITEND(3) Not presently employed.

ITEND(4) A positive integer variable denoting the maximum number of iterations permissible in the relaxation of the velocity component normal to the solid boundary and downstream of the reflected (cowl lip) shock wave in the shock wave-solid boundary point unit process (subroutine BSHØCK). A default value of 20 is specified for ITEND(4).

ITEND(5) Not presently employed.

ITEND(6) A positive integer variable denoting the maximum number of permissible subiterations in determining the intersection point of a line segment with a given three-dimensional surface (subroutine INTSCT). A default value of 10 is specified for ITEND(6).

9. NAMELIST LIST7

The parameters entered in namelist LIST7 specify if debug output is to be printed.

KDUMP A one-dimensional integer variable array consisting of four elements. Each element of KDUMP specifies whether or not a particular unit process is to have debug output printed. Specifying KDUMP(I) = 1 (I=1 to 4) activates the debug output option for the corresponding unit process. Specifying KDUMP(I) = 0 causes no debug output to be printed for the corresponding unit process. The elements of KDUMP activate the debug output option for the following unit processes and have the following default values.

KDUMP(I)	Activates Debug Output for	Default Value
KDUMP(1)	interior point scheme	0
KDUMP(2)	solid body point scheme	0
KDUMP(3)	field-shock wave point scheme	0
KDUMP(4)	solid body-shock wave point scheme	0

ISTART A positive integer variable denoting the solution plane number at which debug output is to be initiated. A default value of 1 is specified for ISTART.

10. FORMATTED READ OF THE INITIAL-VALUE PLANE FLOW PROPERTY FIELD

The user supplied initial-value plane flow property field is entered by a formatted read of file ITAPE after all seven namelists have been input. To enter the initial-value plane by tabular input, KIVS = 0 must be specified in namelist LIST2. The default value for ITAPE is 5(the input file). The initial-value plane may be read from TAPE 3 by specifying ITAPE = 3 in namelist LIST2. TAPE 3 is linked to the dummy file IVS in the PRØGRAM card.

The index limits for the initial-value plane, ISTØP and JMAXI, are entered in namelist LIST3. The initial-value plane point networks for the four flow symmetry options are illustrated in Figure 3.

The initial-value data are entered by the formatted read statement

```
READ (ITAPE,260) ((Y(I,J),Z(I,J),U(I,J),V(I,J),W(I,J),P(I,J),RØ(I,J),
                  J=1,JMAXI),I=1,ISTØP)
```

with the format (4E20.13/3E20.13). The parameters in the formatted read statement have the following definitions (see Figure 3).

I An integer denoting the circumferential index of the data point.

J An integer denoting the radial index of the data point.

Y A two-dimensional real variable array, each element of which denotes the y-position, in either feet or meters, of a data point. The Y array is dimensioned at (40,21). No default values are specified for the elements of Y.

Z A two-dimensional real variable array, each element of which denotes the z-position, in either feet or meters, of a data point. The Z array is dimensioned at (40,21). No default values are specified for the elements of Z.

U A two-dimensional real variable array, each element of which denotes the x-component of velocity, in either (ft/sec) or (m/s), at a data point. The U array is dimensioned at (40,21). No default values are specified for the elements of U.

V A two-dimensional real variable array, each element of which denotes the y-component of velocity, in either (ft/sec) or (m/s), at a data point. The V array is dimensioned at (40,21). No default values are specified for the elements of V.

W A two-dimensional real variable array, each element of which denotes the z-component of the velocity, in either (ft/sec) or (m/s), at a data point. The W array is dimensioned at (40,21). No default values are specified for the elements of W.

P A two-dimensional real variable array, each element of which denotes the pressure, in either (lbf/ft^2) or (N/m^2), at a data point. The P array is dimensioned at (40,21). No default values are specified for the elements of P.

RØ A two-dimensional real variable array, each element of which denotes the density, in either ($slug/ft^3$) or (kg/m^3), at a data point. The RØ array is dimensioned at (40,21). No default values are specified for the elements of RØ.

In all cases, the initial-value plane data points with J = 1 must lie (to a close approximation) on the surface of the forebody/centerbody. The initial-value plane data points with J = JMAXI correspond to the downstream bow shock wave points. If only the internal flow is to be computed, the initial-value plane is located at the cowl lip axial station. It is sufficient to specify the flow property field, in this case, to a point just outside of the cowl lip. If the bow shock wave radius is less than that of the cowl lip, the execution is aborted.

For the case of no planes of flow symmetry (KSYM = 0), the computed sector is the entire solution plane corresponding to ISTØP circumferential stations and JMAXI radial stations [see Figure 3(a)]. For the case of one plane of flow symmetry (KSYM = 1), the computed sector is the half-plane bounded by the y-axis and containing the +z-axis [see Figure 3(b)]. In this case, the data points with I = 1 must lie on the +y-axis, and the data points with I = ISTØP must lie on the -y-axis. For the case of two planes of flow symmetry (KSYM = 2), the computed sector is the quadrant bounded by the +y-axis and the +z-axis [see Figure 3(c)]. In this case, the data points with I = 1 must lie on the +y-axis, and the data points with I = ISTØP must lie on the +z-axis. For the axisymmetric flow case (KSYM = 3), the computed sector is limited to the single circumferential station lying on the +y-axis [see Figure 3(d)]. In this case, the data points with I = 1 must lie on the +y-axis.

If the forebody flow field is not being calculated [KCALL(1) = 0], or if it is being computed and the bow shock wave is conical (KCØN = 1), no other input parameters have to be entered. If, however, the forebody flow field is to be calculated [KCALL(1) = 1] and the bow shock wave is not conical (KCØN = 0), then the angle subtended by the bow shock wave and the x-axis in the meridional plane defined by the shock wave point for each shock wave point in the computed sector must be entered by the formatted read statement

```
READ (ITAPE,270) (BETA(I),I=1,ISTØP)
```

with the format (E20.13). The parameters in the formatted read statement have the following definitions (see Figure 3).

I — An integer denoting the circumferential index of the initial-value plane shock wave point.

BETA — A one-dimensional real variable array (dimensioned at 40), each element of which denotes the angle, in radians, subtended by the bow shock wave and the x-axis in the meridional plane defined by the corresponding initial-value plane downstream shock wave point. Each element of BETA must be positive. No default values are specified for the elements of BETA.

SECTION V

OUTPUT INTERPRETATION

The initial portion of the computer output comprises preliminary information. This preliminary output consists of information identifying the problem being considered, the specified computation options, the flow symmetry option, the thermodynamic model and the molecular transport properties, the vehicle orientation and the free-stream conditions, certain index parameters, the contours of the centerbody and the cowl, and the convergence tolerances and the iteration limits. The initial-value plane is then printed. Alternatively, if a program restart is specified, the last solution plane written on the restart file is printed. Each solution plane is then printed in a format similar to the initial-value plane printout. Additionally, the redistributed data plane at the cowl lip axial station is printed if the internal flow integration option is specified. Moreover, for the internal flow field computation, the solution points are printed which lie along the space curves defined by the intersection of the internal shock wave with the solid boundaries.

The output parameters listed on the computer printout are defined below.

I	circumferential index of the solution point
J	radial index of the solution point
X	axial position of the solution plane or the solution point
Y	y-position
Z	z-position
M	Mach number
Q	velocity magnitude
P	pressure
RØ	density
T	absolute temperature
U	x-component of velocity
V	y-component of velocity
W	z-component of velocity
PT	stagnation pressure
TT	stagnation temperature
ITG	number of global corrector applications
ITL	number of local iterations

Streamline solution points have both I and J indices which are numbers. An upstream shock wave solution point is denoted by a numerical I index and the J index is U. A downstream shock wave solution point is denoted by a numerical I index and the J index is D.

For the external flow field about the forebody, the body streamline solution points are denoted by J = 1. The outer bound to the computational flow regime is defined by the locus of downstream shock wave solution points, points with J = D. Since periodic point addition and deletion are performed in the external flow field integration, continuous streamlines throughout the computational flow regime are not available. Inserted solution points are noted by ITG = ITL = 0.

For the continuous internal flow field integration option, the body streamline points on the surface of the centerbody are denoted by J = 1, and the body streamline points on the surface of the cowl are denoted J = JINLET. The solution is found on the continuous streamlines which pass through the redistributed points on the solution plane at the cowl lip axial station.

For the internal flow field integration option in which shock waves are discretely fitted, the body streamline points on the surface of the center-body are denoted by J = 1. The body streamline points on the surface of the cowl are denoted by J = (JINLET - 2). The shock wave solution points float in the storage arrays as the internal shock wave travels between the center-body and the cowl on successive solution planes. The streamline points between the upstream side solid boundary (either centerbody or cowl) and the upstream shock wave points on a given solution plane lie in the upstream flow field sector on that solution plane. In a like manner, streamline points which lie between the other solid boundary and the downstream shock wave points on a given solution plane lie in the downstream flow field sector on that solution plane. A reversal of the upstream and downstream sectors occurs at an internal shock wave-solid boundary intersection. It should be noted that continuous streamlines are followed in the internal flow field integration.

The intersection of the incident internal shock wave with a solid boundary at a shock wave-solid boundary intersection defines a space curve. The solution is found on both the upstream and downstream sides of both the incident and reflected shock waves at points on this space curve.

At the end of a solution plane printout, the Courant number and the x-step regulation parameters are printed. The Courant number is the ratio of the axial step taken to the axial step allowed by the Courant-Friedrichs-Lewy stability criterion (based on immediate neighbors in the interpolation fit point stencils). The Courant number listed is that used in obtaining the solution plane that was just printed. Likewise, the x-step regulation parameters refer to the solution plane that was just printed.

SECTION VI

SAMPLE CASES

1. INTRODUCTION

Five sample cases are presented in this section to illustrate the application of the computer program for calculating the flow field in supersonic mixed-compression aircraft inlets. For each of the five sample cases, a discussion of the problem is given, the required input data are presented, and selected portions of the computer output are listed. The input parameter discussions follow the order in which the input parameters are presented in Section IV.

Sample Case No. 1 considers the computation of both the external flow field and the internal flow field for a simplified geometry mixed-compression inlet at zero angle of attack. Sample Case No. 2 considers the computation of the external flow field about the forebody of the inlet of Sample Case No. 1 when the angle of attack is 2.5 degrees. Sample Case No. 3 considers the calculation of the axisymmetric internal flow field in a simplified geometry annulus using the program options in which internal shock waves are not discretely fitted but the molecular transport terms are included. Sample Case No. 4 considers the computation of the axisymmetric internal flow field in the Mach 3.5 inlet, documented in Reference (4), at zero angle of attack. Sample Case No. 5 considers the computation of the internal flow field for the Mach 3.5 inlet for the off-design Mach number of 2.5, nonzero centerbody translation, and an angle of attack of 3.0 degrees.

2. SAMPLE CASE NO. 1

This sample case is concerned with the computation of both the external flow field and the internal flow field in a simplified geometry supersonic mixed-compression aircraft inlet. The inlet geometry is axisymmetric and the specified angle of attack is zero, hence the flow field is axisymmetric. This sample case represents the problem being considered when all program input parameters retain their default values.

The first card of the data deck for Sample Case No. 1, which is presented in Figure 6, is the title card. All input parameters in namelist LIST1 retain their default values. Thus, KUNIT = 1 and English units are used in the computation. The default values for KCALL(1), KCALL(2), and KCALL(3) are 1, 1, and 0, respectively. Consequently, the specified computation options are the forebody flow field integration option and the internal flow field integration option in which shock waves are discretely fitted. The default values for XEND(1) and XEND(2) are 2.0 ft and 3.5 ft, respectively. Hence, the forebody flow field integration terminates at x = 2.0 ft, and the internal flow field integration terminates at x = 3.5 ft. Note that since the internal flow field integration option in which shock waves are not discretely fitted is not used [KCALL(3) = 0], XEND(3) does not have to be specified. The default value of RCAVG = 0.8 ft is used for estimating the mass flow rate downstream of the

```
SAMPLE CASE NO. 1
 $LIST1 $
 $LIST2 $
 $LIST3 $
 $LIST4 $
 $LIST5 $
 $LIST6 $
 $LIST7 $
```

Figure 6. Data deck for Sample Case No. 1.

bow shock wave at the cowl lip axial station. The default value of KVISCY is 0, consequently the molecular tranport terms are not included in the computation. KSYM retains its default value of 3, hence the axisymmetric flow option is employed. The default value of KSGLØB = 1 specifies that global correction is to be performed in obtaining the solution for the bow shock wave points. KPRINT retains its default value of 1, consequently all solution points are printed. Since IPRSTP and KSTART are both 0, the execution is not terminated at a specified solution plane, nor are any restart file operations performed.

All input parameters in namelist LIST2 retain their default values. Consequently, the free-stream Mach number MFS, the free-stream pressure PFS, and the free-stream density RØFS have values of 3.0, 242.2 (lbf/ft^2), and 0.0003622 (slug/ft^3), respectively. PITCH and YAW retain their default values of 0.0, so the pitch and yaw angles are both 0.0. The axial position of the initial-value plane, specified by the default value of XI, is 1.0 ft. Since KIVS and KCØN are both 1, the initial-value plane is internally generated and the bow shock wave is assumed to be conical (the forebody is conical). The parameter ITAPE is not employed since the initial-value plane is generated internally (KIVS = 1).

All input parameters in namelist LIST3 retain their default values. Consequently, ISTØP, JMAXI, and JINLET have values of 1, 11, and 11, respectively, so that 1 circumferential station is employed, 11 radial stations on the initial-value plane are specified, and 11 radial stations in the internal flow field computation are specified. JLIMIT(1) and JLIMIT(2) retain their default values of 13 and 21 radial stations, respectively.

All input parameters in namelist LIST4 retain their default values. Thus, the specific heat ratio and gas constant, specified by GAMMA and R, respectively, have values of 1.4 and 1716.16116 (ft-lbf)/(slug-R), respectively. Since the molecular transport terms are not included in the computation (KVISCY = 0), the input parameters VISØ, TØ, B, TDL, and CØND are not employed.

All input parameters in namelist LIST5 retain their default values. The default inlet geometry has a conical forebody/centerbody with a cone half-angle of 10.0 degrees. The forebody tip is located at x = 0.0 ft, and the centerbody geometry is specified to x = 3.5 ft. Thus, NCENT = 2, KDCENT(1) = 3, XCENT(1) = 1.0, XCENT(2) = 3.5, and CØNE = 10.0. The cowl lip axial station is located at x = 2.0 ft and the cowl geometry is specified to x = 3.5 ft. The cowl radius, entered by tabular input, is constant at the value of 0.7 ft. Thus, NCØWL = 2, KDCØWL(1) = 2, XCØWL(1) = 2.0, XCØWL(2) = 3.5, RCØWL(1) = 0.7, and RCØWL(2) = 0.7. The remaining parameters in namelist LIST5 (RCENT, ACENT to DCENT, ACØWL to DCØWL, KBASE, and DXTRAN) are not employed.

All convergence tolerances and iteration limits retain their default values in namelist LIST6.

No debug output is to be printed, hence all input parameters in namelist LIST7 retain their default values.

Selected portions of the computer output for this sample case are presented in Figure 7. The first three pages of the program output present the job title, the specified computation options, the flow symmetry option, the thermodynamic model, the vehicle orientation and free-stream data, the type of initial-value plane, certain index parameters, the centerbody and the cowl contours, and the various convergence tolerances and iteration limits. The fourth page presents the internally generated initial-value plane flow property field. Pages five to seven present the first three solution planes on the forebody (planes No. 1 to No. 3), and page 8 presents the last forebody solution plane (plane No. 16), which is located at the cowl entrance. Page nine presents the redistributed flow property field at the cowl entrance, and page ten presents the first internal flow field solution plane (plane No. 17). Pages 11 to 13 present the internal flow field solution plane just upstream of the first shock wave intersection with the centerbody (plane No. 26), the interplanar results, and the solution plane just downstream of the shock wave-centerbody intersection (plane No. 27). Pages 14 to 16 present the corresponding results for the first shock wave intersection with the cowl. The last page presents the last solution plane (plane No. 78) before the flow becomes subsonic.

Sample Case No. 1 required approximately 95 seconds of central processor time on the CDC-6500 computer (using the Purdue University modified 6000-SCØPE compiler).

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-191 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 1

SPECIFIED COMPUTATION OPTIONS

1.) FOREBODY FLOW FIELD

2.) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

FLOW SYMMETRY

AXISYMMETRIC FLOW

GLOBAL CORRECTION

GLOBAL CORRECTION IS PERFORMED ON THE BOW SHOCK WAVE POINTS

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000   GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS

VISCOUS AND THERMAL DIFFUSION TERMS ARE NOT INCLUDED IN THE COMPUTATION - INVISCID AND ADIABATIC FLOW IS ASSUMED

ORIENTATION AND FREE STREAM DATA

ORIENTATION -   PITCH= 0.00000(DEGREES)   YAW= 0.00000(DEGREES)

Figure 7. Selected output from Sample Case No. 1.

FREE STREAM DATA - MACH NO.= 3.00000 PRESSURE= 2.422000E+02(LBF/FT**2) DENSITY= 3.622000E-04(SLUG/FT**3)

TEMPERATURE= 3.896437E+02(DEG R) SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 2.902673E+03(FT/SEC) Y-VELOCITY= 0. (FT/SEC) Z-VELOCITY= 0. (FT/SEC)

INITIAL VALUE SURFACE

AN INTERNALLY GENERATED INITIAL VALUE SURFACE IS SPECIFIED AS BEING LOCATED AT X= 1.000000E+00(FT)

A CONICAL BOW SHOCK WAVE IS SPECIFIED - THE INTERNALLY GENERATED SHOCK WAVE ANGLES ARE

BETA(1)= 3.789657E-01(RADIANS)

INDEX PARAMETERS

ISTOP= 1 IMAX=40 JMAXI=11

JLIMIT(1)=13 JLIMIT(2)=21

JINLET=11

INTEGRATION TERMINATION POINTS

FOREBODY FLOW FIELD INTEGRATION TERMINATES AT X= 2.000000E+00(FT)

INTERNAL FLOW FIELD INTEGRATION TERMINATES AT X= 3.500000E+00(FT)

FOR FOREBODY FLOW - RCAVG= 8.000000E-01(FT)

CENTERBODY GEOMETRY

CONE HALF ANGLE=10.00000(DEGREES)

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	3	1.000000E+00	0.	0.	0.	0.	0.
2	0	3.500000E+00	0.	0.	0.	0.	0.

COWL GEOMETRY

TRANSLATION FROM DESIGN POSITION= 0. (FT)

I	KDCOWL	XCOWL (FT)	RCOWL (FT)	ACOWL (FT)	BCOWL	CCOWL (FT**-1)	DCOWL (FT**-2)
1	2	2.000000E+00	7.000000E-01	0.	0.	0.	0.
2	0	3.500000E+00	7.000000E-01	0.	0.	0.	0.

Figure 7. Continued.

```
CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

     CONVERGENCE TOLERANCES AND OTHER PARAMETERS

          CRIT( 1)= 1.000000E-01
          CRIT( 2)= 1.000000E-07
          CRIT( 3)= 1.000000E-04
          CRIT( 4)= 1.000000E-05
          CRIT( 5)= 1.000000E-04
          CRIT( 6)= 1.000000E-04
          CRIT( 7)= 5.000000E-01
          CRIT( 8)= 1.000000E+00
          CRIT( 9)= 1.000000E-04
          CRIT(10)= 8.000000E-01
          CRIT(11)= 1.000000E-06
          CRIT(12)= 2.000000E-01
          CRIT(13)= 1.000000E-05
          CRIT(14)= 4.000000E-01
          CRIT(15)= 1.000000E-04
          CRIT(16)= 1.000000E-06

     ITERATION LIMITS

          ITEND(1)=10
          ITEND(2)=10
          ITEND(3)=10
          ITEND(4)=20
          ITEND(5)=10
          ITEND(6)=10

     INPUT SAFETY FACTOR= 9.750000E-01
```


Figure 7. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.1763	0.0000	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	484.7	0.0	8884.2	1091.0
1	2	.1985	0.0000	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	432.1	0.0	8884.2	1091.0
1	3	.2207	0.0000	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	389.3	0.0	8884.2	1091.0
1	4	.2429	0.0000	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	353.2	0.0	8884.2	1091.0
1	5	.2651	0.0000	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	321.6	0.0	8884.2	1091.0
1	6	.2873	0.0000	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	293.2	0.0	8884.2	1091.0
1	7	.3095	0.0000	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	267.0	0.0	8884.2	1091.0
1	8	.3316	0.0000	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	241.8	0.0	8884.2	1091.0
1	9	.3538	0.0000	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	216.7	0.0	8884.2	1091.0
1	10	.3760	0.0000	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	189.6	0.0	8884.2	1091.0
1	D	.3982	0.0000	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	156.5	0.0	8884.2	1091.0

MASS FLOW RATE FOR ENTIRE PLANE= 5.21424E-01(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT = I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 4.915339E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 1 X= 1.04915(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.1850	0.0000	2.711	2792.9	375.02	4.9477E-04	441.7	2750.5	485.0	0.0	8883.8	1091.0	1	2
1	2	.2062	-.0000	2.714	2793.9	373.65	4.9348E-04	441.2	2759.7	435.8	-.0	8884.3	1091.0	1	2
1	3	.2277	-.0000	2.719	2796.0	370.79	4.9078E-04	440.2	2767.9	395.6	-.0	8884.3	1091.0	1	2
1	4	.2492	-.0000	2.726	2799.0	366.71	4.8691E-04	438.8	2775.6	361.1	-.0	8884.3	1091.0	1	2
1	5	.2708	-.0000	2.735	2802.6	361.78	4.8223E-04	437.2	2783.0	330.8	.0	8884.3	1091.0	1	2
1	6	.2925	.0000	2.745	2806.8	356.23	4.7694E-04	435.2	2790.3	303.6	.0	8884.3	1091.0	1	3
1	7	.3142	.0000	2.756	2811.3	350.14	4.7109E-04	433.1	2797.5	278.4	.0	8884.3	1091.0	1	3
1	8	.3360	.0000	2.769	2816.4	343.51	4.6471E-04	430.7	2804.8	254.6	.0	8884.3	1091.0	1	3
1	9	.3577	-.0000	2.782	2821.9	336.27	4.5768E-04	428.1	2812.4	231.4	.0	8884.2	1091.0	1	3
1	10	.3795	-.0000	2.798	2828.1	328.33	4.4994E-04	425.2	2820.5	208.2	-.0	8884.1	1091.0	1	3
1	11	.3986	-.0000	2.816	2835.3	319.30	4.4106E-04	421.8	2829.3	183.9	-.0	8883.5	1091.0	0	0
1	D	.4178	-.0000	2.841	2844.8	307.58	4.2944E-04	417.3	2840.5	156.2	-.0	8884.3	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 5.73841E-01(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 1.000231E+00 DELTA-X= 4.831365E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 2 X= 1.09747(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.1935	-.0000	2.712	2793.2	374.56	4.9434E-04	441.5	2750.8	485.0	-.0	8883.4	1091.0	1	2
1	2	.2139	-.0000	2.714	2794.1	373.42	4.9326E-04	441.1	2759.4	439.3	-.0	8884.4	1091.0	1	2
1	3	.2346	-.0000	2.719	2796.0	370.77	4.9076E-04	440.2	2767.2	400.9	-.0	8884.4	1091.0	1	2
1	4	.2556	-.0000	2.725	2798.6	367.30	4.8748E-04	439.0	2774.3	368.1	-.0	8884.4	1091.0	1	2
1	5	.2767	-.0000	2.733	2801.8	363.00	4.8339E-04	437.6	2781.2	339.0	.0	8884.4	1091.0	1	2
1	6	.2979	.0000	2.741	2805.4	358.06	4.7868E-04	435.9	2787.9	312.7	.0	8884.4	1091.0	1	2
1	7	.3191	.0000	2.751	2809.5	352.61	4.7347E-04	434.0	2794.6	288.5	.0	8884.3	1091.0	1	3
1	8	.3405	.0000	2.762	2814.0	346.69	4.6777E-04	431.9	2801.4	265.8	.0	8884.3	1091.0	1	3
1	9	.3618	.0000	2.775	2818.9	340.26	4.6156E-04	429.6	2808.3	243.8	.0	8884.2	1091.0	1	3
1	10	.3832	-.0000	2.787	2823.9	333.72	4.5520E-04	427.2	2815.2	222.3	-.0	8884.1	1091.0	1	3
1	11	.4019	-.0000	2.801	2829.5	326.60	4.4823E-04	424.6	2822.2	203.4	-.0	8883.4	1091.0	1	3
1	12	.4195	-.0000	2.819	2836.1	318.20	4.3996E-04	421.4	2830.3	181.7	-.0	8882.8	1091.0	0	0
1	D	.4370	-.0000	2.841	2844.9	307.38	4.2924E-04	417.3	2840.7	155.8	-.0	8884.4	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 6.27819E-01(SLUG/SEC)

COURANT NUMBER= 1.00023

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=11 SAFETY FACTOR= 9.975888E-01 DELTA-X= 4.428461E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 3 X= 1.14175(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.2013	-.0000	2.713	2793.4	374.26	4.9406E-04	441.4	2751.0	485.1	-.0	8883.0	1091.0	1	2
1	2	.2411	-.0000	2.718	2796.0	370.90	4.9088E-04	440.3	2766.4	405.5	-.0	8884.5	1091.0	1	2
1	3	.2821	-.0000	2.731	2801.1	363.88	4.8423E-04	437.9	2779.7	345.8	-.0	6884.5	1091.0	1	2
1	4	.3238	.0000	2.748	2808.0	354.54	4.7532E-04	434.6	2792.3	297.0	.0	8884.4	1091.0	1	2
1	5	.3658	.0000	2.769	2816.4	346.49	4.6469E-04	430.7	2805.0	253.6	.0	8884.3	1091.0	1	3
1	6	.4052	-.0000	2.792	2825.6	331.56	4.5308E-04	426.4	2817.3	216.6	-.0	8883.4	1091.0	1	3
1	D	.4546	-.0000	2.842	2845.1	307.19	4.2906E-04	417.2	2840.9	155.4	-.0	8884.5	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 6.78815E-01(SLUG/SEC)

COURANT NUMBER= .99759

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.966240E-01 DELTA-X= 7.160804E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 16 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.3527	.0000	2.709	2791.5	376.28	4.9596E-04	442.1	2749.1	484.7	-.0	8877.5	1090.8	1	2
1	2	.3762	.0000	2.710	2792.4	375.89	4.9559E-04	442.0	2755.1	454.6	-.0	8885.2	1091.0	1	2
1	3	.4032	.0000	2.713	2793.6	374.28	4.9407E-04	441.4	2761.2	424.3	.0	8885.2	1091.0	1	2
1	4	.4325	.0000	2.717	2795.6	371.50	4.9145E-04	440.5	2767.6	394.8	.0	8885.3	1091.0	1	2
1	5	.4636	.0000	2.724	2798.2	367.92	4.8806E-04	439.3	2774.0	367.2	.0	8885.2	1091.0	1	2
1	6	.4939	.0000	2.730	2800.8	364.21	4.8454E-04	438.0	2779.7	343.4	.0	8883.8	1091.0	1	2
1	7	.5333	-.0000	2.741	2805.1	358.38	4.7893E-04	436.0	2787.4	314.6	.0	8881.6	1091.0	1	2
1	8	.5763	-.0000	2.755	2811.0	350.54	4.7137E-04	433.3	2796.6	284.4	.0	8879.3	1091.1	1	2
1	9	.6197	-.0000	2.768	2816.2	343.70	4.6475E-04	430.9	2804.3	258.7	.0	8877.8	1091.1	1	2
1	10	.6621	-.0000	2.777	2820.0	338.73	4.5993E-04	429.1	2809.8	239.2	-.0	8877.3	1091.1	1	2
1	11	.7030	-.0000	2.787	2823.9	333.64	4.5499E-04	427.3	2815.2	221.1	-.0	8877.5	1091.1	1	2
1	12	.7422	-.0000	2.803	2830.2	325.66	4.4721E-04	424.3	2823.2	199.0	-.0	8878.0	1091.1	1	3
1	D	.7960	-.0000	2.843	2845.6	306.62	4.2850E-04	417.0	2841.4	154.2	-.0	8884.8	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 2.08064E+00(SLUG/SEC)

COURANT NUMBER= .78781

Figure 7. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 2.00000(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.3527	0.0000	2.709	2791.5	376.28	4.9596E-04	442.1	2749.1	484.6	-.0	8877.3	1090.8
1	2	.3961	0.0000	2.712	2793.2	374.61	4.9457E-04	441.6	2759.6	431.7	-.0	8885.0	1091.0
1	3	.4395	0.0000	2.719	2796.2	370.74	4.9073E-04	440.2	2769.0	388.7	.0	8885.6	1091.0
1	4	.4829	0.0000	2.728	2799.8	365.66	4.8592E-04	438.5	2777.6	351.5	.0	8884.2	1091.0
1	5	.5263	0.0000	2.739	2804.3	359.53	4.8003E-04	436.4	2786.0	319.6	.0	8882.0	1091.0
1	6	.5697	0.0000	2.753	2810.2	351.65	4.7244E-04	433.7	2795.3	288.6	.0	8879.6	1091.1
1	7	.6132	0.0000	2.766	2815.5	344.60	4.6563E-04	431.2	2803.2	262.2	.0	8878.0	1091.1
1	8	.6566	0.0000	2.776	2819.5	339.40	4.6058E-04	429.4	2809.1	241.7	-.0	8877.3	1091.1
1	U	.7000	0.0000	2.786	2823.6	334.08	4.5542E-04	427.4	2814.8	222.6	-.0	8877.5	1091.1
1	D	.7000	0.0000	2.577	2734.4	459.68	5.7148E-04	468.7	2734.4	0.0	-.0	8848.1	1091.1
1	9	.7000	0.0000	2.577	2734.4	459.68	5.7148E-04	468.7	2734.4	0.0	-.0	8848.1	1091.1

MASS FLOW RATE FOR ENTIRE PLANE= 1.51746E+00(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 9.611184E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 17 X= 2.09611(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.3696	-.0000	2.709	2791.5	376.27	4.9595E-04	442.1	2749.1	484.7	-.0	8876.9	1090.7	1	2
1	2	.4112	-.0000	2.712	2793.3	374.68	4.9445E-04	441.5	2759.0	436.1	-.0	8885.2	1091.0	1	2
1	3	.4531	-.0000	2.717	2795.5	371.67	4.9161E-04	440.5	2767.4	395.4	-.0	8885.6	1091.1	1	2
1	4	.4952	.0000	2.725	2798.7	367.07	4.8726E-04	439.0	2775.4	360.5	.0	8884.3	1091.0	1	2
1	5	.5375	.0000	2.735	2802.7	361.71	4.8212E-04	437.2	2783.2	329.8	.0	8882.1	1091.0	1	3
1	6	.5799	.0000	2.746	2807.4	355.28	4.7592E-04	435.0	2791.2	301.3	.0	8879.6	1091.1	1	3
1	7	.6224	.0000	2.760	2813.3	347.51	4.6843E-04	432.3	2800.0	273.4	.0	8878.0	1091.1	1	3
1	8	.6650	-.0000	2.772	2818.1	341.17	4.6230E-04	430.0	2807.0	250.3	-.0	8877.4	1091.1	1	2
1	U	.6653	.0000	2.773	2818.1	341.13	4.6226E-04	430.0	2807.0	250.2	.0	8877.4	1091.1	1	3
1	D	.6653	.0000	2.538	2716.6	487.37	5.9564E-04	476.8	2716.6	-.2	-.0	8836.5	1091.1	1	1
1	9	.7000	-.0000	2.556	2725.0	474.55	5.8463E-04	473.0	2725.0	-.0	-.0	8848.2	1091.1	1	2

MASS FLOW RATE FOR ENTIRE PLANE= 1.51882E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=11 SAFETY FACTOR= 9.750000E-01 DELTA-X= 8.027141E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 26 X= 2.67582(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.4718	-.0000	2.709	2791.8	375.63	4.9555E-04	441.9	2749.4	484.8	-.0	8874.5	1090.7	1	2
1	U	.4730	-.0000	2.710	2791.9	375.55	4.9527E-04	441.8	2749.7	483.4	-.0	8875.0	1090.7	1	2
1	D	.4730	-.0000	2.418	2657.4	585.27	6.7823E-04	502.8	2652.6	159.6	-.0	8796.7	1090.7	1	3
1	2	.4973	.0000	2.419	2658.7	584.88	6.7807E-04	502.6	2654.9	141.2	.0	8814.0	1091.0	1	2
1	3	.5241	.0000	2.417	2657.5	587.62	6.8049E-04	503.2	2654.8	120.4	.0	8822.2	1091.1	1	2
1	4	.5519	.0000	2.418	2657.9	587.16	6.8025E-04	503.0	2656.0	100.3	.0	8826.7	1091.0	1	2
1	5	.5802	.0000	2.412	2655.0	592.81	6.8498E-04	504.3	2653.9	76.4	.0	8830.7	1091.0	1	2
1	6	.6094	.0000	2.410	2654.0	594.76	6.8663E-04	504.7	2653.5	53.4	.0	8832.9	1091.1	1	2
1	7	.6390	.0000	2.410	2654.0	594.95	6.8680E-04	504.8	2653.8	32.1	.0	8834.5	1091.1	1	2
1	8	.6692	.0000	2.411	2654.8	593.83	6.8597E-04	504.4	2654.7	15.4	.0	8838.7	1091.1	1	2
1	9	.7000	.0000	2.412	2655.2	594.01	6.8649E-04	504.2	2655.2	-.0	.0	8854.3	1091.0	1	2

MASS FLOW RATE FOR ENTIRE PLANE= 1.51677E+00(SLUG/SEC)

COURANT NUMBER= .36974

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 4 SAFETY FACTOR= 9.750000E-01 DELTA-X= 5.330174E-02(FT)

Figure 7. Continued.

INTERPLANAR RESULTS - REFLECTION WITH CENTERBODY

INCIDENT WAVE UPSTREAM AND DOWNSTREAM SHOCK POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	2.6783	.4723	-.0000	2.709	2791.7	375.69	4.9540E-04	441.9	2749.3	484.8	-.0	8874.5	1090.7
1	D	2.6783	.4723	-.0000	2.417	2657.0	585.87	6.7872E-04	503.0	2652.2	160.5	-.0	8795.8	1090.7

INCIDENT WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	2.6783	.4723	-.0000	2.709	2791.7	375.69	4.9540E-04	441.9	2749.3	484.8	-.0	8874.5	1090.7
1	D	2.6783	.4723	-.0000	2.417	2657.0	585.87	6.7872E-04	503.0	2652.2	160.5	-.0	8795.8	1090.7

REFLECTED WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	2.6783	.4723	-.0000	2.417	2657.0	585.87	6.7872E-04	503.0	2652.2	160.5	-.0	8795.8	1090.7
1	D	2.6783	.4723	-.0000	2.153	2510.7	879.22	9.0526E-04	565.9	2472.5	436.0	-.0	8736.2	1090.7

Figure 7. Continued.

SOLUTION PLANE NO. 27 X= 2.72912(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.4812	-.0000	2.146	2506.5	888.71	9.1222E-04	567.7	2468.4	435.3	.0	8736.2	1090.7	1	2
1	2	.5012	.0000	2.127	2495.3	915.96	9.3199E-04	572.7	2457.8	431.2	.0	8741.5	1091.0	1	1
1	D	.5054	-.0000	2.123	2493.0	921.68	9.3614E-04	573.7	2455.5	430.4	.0	8742.6	1091.0	1	1
1	U	.5054	-.0000	2.407	2652.3	596.72	6.8788E-04	505.5	2646.9	133.9	.0	8815.9	1091.0	1	3
1	3	.5265	.0000	2.407	2652.5	596.72	6.8800E-04	505.4	2649.0	119.5	.0	8822.1	1091.1	1	3
1	4	.5538	.0000	2.402	2649.8	601.94	6.9242E-04	506.6	2648.1	95.0	.0	8826.6	1091.0	1	3
1	5	.5817	.0000	2.399	2648.1	605.32	6.9527E-04	507.3	2647.1	73.0	.0	8830.3	1091.0	1	3
1	6	.6105	.0000	2.396	2647.0	607.61	6.9718E-04	507.8	2646.5	52.8	.0	8832.8	1091.1	1	3
1	7	.6397	.0000	2.398	2648.0	606.00	6.9589E-04	507.4	2647.7	34.0	.0	8834.6	1091.1	1	3
1	8	.6695	.0000	2.400	2649.0	604.38	6.9467E-04	507.0	2649.0	15.9	.0	8839.1	1091.1	1	3
1	9	.7000	.0000	2.402	2649.9	603.64	6.9445E-04	506.5	2649.9	-.0	.0	8855.2	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 1.51861E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 2 SAFETY FACTOR= 9.750000E-01 DELTA-X= 3.219069E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 38 X= 3.04446(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.5368	-.0000	2.077	2463.4	990.00	9.8537E-04	585.4	2425.9	427.8	-.0	8734.4	1090.6	1	2
1	2	.5538	-.0000	2.078	2464.1	990.20	9.8554E-04	585.5	2430.1	408.0	-.0	8744.0	1090.9	1	2
1	3	.5720	-.0000	2.080	2465.9	987.44	9.8376E-04	584.9	2435.3	386.8	-.0	8754.1	1091.0	1	2
1	4	.5913	-.0000	2.077	2464.2	992.66	9.8776E-04	585.6	2436.4	369.0	-.0	8764.1	1091.1	1	2
1	5	.6112	-.0000	2.074	2461.9	999.28	9.9273E-04	586.5	2436.7	351.6	-.0	8772.6	1091.1	1	2
1	6	.6322	-.0000	2.084	2468.5	984.07	9.8213E-04	583.8	2447.7	319.5	-.0	8779.9	1091.1	1	3
1	7	.6540	-.0000	2.095	2475.1	968.91	9.7154E-04	581.1	2458.2	299.3	-.0	8787.3	1091.1	1	2
1	8	.6766	-.0000	2.093	2474.3	972.15	9.7426E-04	581.4	2459.3	271.2	-.0	8798.7	1091.0	1	2
1	D	.6989	.0000	2.089	2471.2	981.50	9.8170E-04	582.6	2457.5	260.7	.0	8819.8	1090.9	1	3
1	U	.6989	.0000	2.326	2609.6	680.91	7.5712E-04	524.0	2609.6	.6	.0	8863.8	1090.9	1	2
1	9	.7000	.0000	2.326	2609.7	680.94	7.5717E-04	524.0	2609.7	-.0	.0	8864.7	1090.9	1	2

MASS FLOW RATE FOR ENTIRE PLANE= 1.51397E+00(SLUG/SEC)

COURANT NUMBER= .61953

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.643767E-02(FT)

Figure 7. Continued.

INTERPLANAR RESULTS - REFLECTION WITH COWL

INCIDENT WAVE UPSTREAM AND DOWNSTREAM SHOCK POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	3.0464	.7000	.0000	2.325	2609.4	681.37	7.5752E-04	524.1	2609.4	-.0	.0	8864.7	1090.9
1	D	3.0464	.7000	.0000	2.088	2470.6	983.22	9.8295E-04	582.9	2456.7	260.9	.0	8820.3	1090.9

INCIDENT WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	3.0464	.7000	.0000	2.325	2609.4	681.37	7.5752E-04	524.1	2609.4	-.0	.0	8864.7	1090.9
1	D	3.0464	.7000	.0000	2.088	2470.6	983.22	9.8295E-04	582.9	2456.7	260.9	.0	8820.3	1090.9

REFLECTED WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	3.0464	.7000	.0000	2.088	2470.6	983.22	9.8295E-04	582.9	2456.7	260.9	.0	8820.3	1090.9
1	D	3.0464	.7000	.0000	1.866	2319.7	1381.04	1.2515E-03	643.0	2319.7	.0	.0	8785.2	1090.9

Figure 7. Continued.

SOLUTION PLANE NO. 39 X= 3.07090(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.5415	-.0000	2.072	2460.2	997.57	9.9075E-04	586.7	2422.8	427.2	-.0	8734.2	1090.5	1	2
1	2	.5583	-.0000	2.072	2460.5	996.81	9.9166E-04	586.9	2426.4	408.6	-.0	8744.0	1090.9	1	2
1	3	.5762	-.0000	2.074	2462.0	996.06	9.9046E-04	586.5	2431.4	386.7	-.0	8754.1	1091.0	1	2
1	4	.5953	-.0000	2.074	2462.0	998.08	9.9160E-04	586.5	2434.7	365.6	-.0	8764.0	1091.1	1	2
1	5	.6150	-.0000	2.068	2457.9	1009.13	9.9971E-04	588.2	2432.6	351.3	-.0	8772.4	1091.1	1	3
1	6	.6357	-.0000	2.071	2460.1	1004.66	9.9677E-04	587.3	2438.1	327.9	-.0	8779.7	1091.1	1	3
1	7	.6572	-.0000	2.084	2466.6	984.72	9.8285E-04	583.8	2451.0	293.9	-.0	8787.5	1091.1	1	3
1	8	.6795	-.0000	2.090	2472.4	976.76	9.7758E-04	582.2	2457.7	269.3	-.0	8799.5	1091.0	1	2
1	U	.6871	.0000	2.090	2472.1	978.19	9.7884E-04	582.3	2457.9	264.5	-.0	8806.2	1091.0	1	3
1	D	.6871	.0000	1.864	2318.0	1363.70	1.2525E-03	643.7	2318.0	-1.9	-.0	8768.9	1091.0	1	1
1	9	.7000	.0000	1.867	2319.9	1380.59	1.2512E-03	642.9	2319.9	.0	-.0	8785.2	1090.9	1	2

MASS FLOW RATE FOR ENTIRE PLANE= 1.51389E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.601367E-02(FT)

Figure 7. Continued.

SOLUTION PLANE NO. 78 X= 3.48554(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.6146	-.0000	1.412	1932.7	2666.14	1.9932E-03	779.4	1903.4	335.6	-.0	8633.6	1090.3	1	2
1	U	.6148	-.0000	1.412	1932.7	2666.24	1.9933E-03	779.4	1903.4	335.4	-.0	8633.8	1090.4	1	2
1	D	.6148	-.0000	1.048	1535.7	4264.88	2.7796E-03	894.0	1535.3	33.1	-.0	8543.4	1090.4	1	3
1	2	.6230	-.0000	1.050	1538.0	4265.13	2.7612E-03	893.6	1537.7	29.7	-.0	8563.0	1090.5	1	3
1	3	.6321	-.0000	1.052	1541.1	4262.23	2.7813E-03	892.9	1540.8	26.5	-.0	8582.8	1090.6	1	2
1	4	.6419	-.0000	1.055	1545.0	4255.47	2.7797E-03	892.0	1544.8	23.5	-.0	8602.4	1090.7	1	2
1	5	.6522	-.0000	1.060	1550.9	4240.10	2.7742E-03	890.6	1550.8	19.8	-.0	8622.3	1090.8	1	2
1	6	.6634	-.0000	1.066	1557.3	4223.12	2.7681E-03	889.0	1557.2	15.2	-.0	8643.6	1090.8	1	2
1	7	.6750	-.0000	1.066	1558.3	4229.84	2.7734E-03	888.7	1558.2	11.3	-.0	8666.4	1090.8	1	2
1	8	.6872	-.0000	1.065	1556.9	4247.77	2.7843E-03	889.0	1556.9	6.8	-.0	8691.3	1090.8	1	3
1	9	.7000	-.0000	1.068	1560.2	4246.71	2.7865E-03	888.0	1560.2	-.0	-.0	8719.0	1090.7	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 1.51297E+00(SLUG/SEC)

COURANT NUMBER= .44224

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 4 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.460011E-03(FT)

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Figure 7. Continued.

3. SAMPLE CASE NO. 2

Sample Case No. 2 is concerned with the computation of the external flow field about the forebody of the inlet considered in Sample Case No. 1 when the angle of attack is 2.5 degrees. The initial-value plane flow property field is generated internally in the program by using the approximate technique described in Section II.

The first card of the data deck for this sample case, illustrated in Figure 8, is the title card. English units are used, so KUNIT retains its default value of 1 in namelist LIST1. Since only the forebody flow field is to be computed, KCALL(2) is specified as 0 in namelist LIST1, while KCALL(1) and KCALL(3) retain their default values of 1 and 0, respectively. The forebody flow field integration termination point, denoted by XEND(1), is 2.0 ft, the default value. Since one plane of flow symmetry exists, KSYM is specified as 1. The molecular transport terms are not to be included in the computation, and global correction is to be performed on the bow shock wave solution points. Hence, KVISCY and KSGLØB retain their default values of 0 and 1, respectively. All remaining parameters in namelist LIST1 (RCAVG, KPRINT, IPRSTP, and KSTART) are left at their default values.

In namelist LIST2, MFS, PFS, and RØFS are left at their default values of 3.0, 242.2 (lbf/ft^2), and 0.0003622 ($slug/ft^3$), respectively. Since the angle of attack is 2.5 degrees, PITCH is specified as 2.5. The remaining parameters in namelist LIST2 (YAW, XI, KIVS, KCØN, and ITAPE) retain their default values. Consequently, the forebody flow field integration starts at x = 1.0 ft, the initial-value plane is internally generated, and a conical bow shock wave is assumed.

In namelist LIST3, all input parameters retain their default values except for ISTØP. The number of circumferential stations is selected to be 21, hence ISTØP = 21.

All input parameters in namelist LIST4, which specifies the thermodynamic model, retain their default values.

In namelist LIST5, only the forebody geometry must be specified [up to XEND(1)] since the internal flow field is not being computed. The default forebody/centerbody geometry is again used, hence NCENT = 2, KDCENT(1) = 3, XCENT(1) = 1.0, XCENT(2) = 3.5, and CØNE = 10.0. No other parameters are used in namelist LIST5 for this sample case.

All convergence tolerances and iteration limits specified in namelist LIST6 retain their default values.

No debug output is to be printed, so all input parameters in namelist LIST7 are left at their default values.

Selected portions of the computer output for Sample Case No. 2 are presented in Figure 9. The preliminary information, the initial-value plane, and the first and last solution planes are presented. The execution of Sample Case No. 2 required 411 seconds of central processor time on the CDC-6500 computer.

```
SAMPLE CASE NO. 2
 $LIST1 KCALL(2)=0, KSYM=1 $
 $LIST2 PITCH=2.5 $
 $LIST3 ISTOP=21 $
 $LIST4 $
 $LIST5 $
 $LIST6 $
 $LIST7 $
```


Figure 8. Data deck for Sample Case No. 2.

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-151 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 2

SPECIFIED COMPUTATION OPTIONS

1.) FOREBODY FLOW FIELD

FLOW SYMMETRY

ONE PLANE OF SYMMETRY - COMPUTED SECTOR IS THE HALF-PLANE BOUNDED BY THE Y-AXIS AND CONTAINING THE +Z-AXIS

GLOBAL CORRECTION

GLOBAL CORRECTION IS PERFORMED ON THE BOW SHOCK WAVE POINTS

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000   GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS

VISCOUS AND THERMAL DIFFUSION TERMS ARE NOT INCLUDED IN THE COMPUTATION - INVISCID AND ADIABATIC FLOW IS ASSUMED

ORIENTATION AND FREE STREAM DATA

ORIENTATION -   PITCH= 2.50000(DEGREES)   YAW= 0.00000(DEGREES)

FREE STREAM DATA -   MACH NO.= 3.00000   PRESSURE= 2.422000E+02(LBF/FT**2)   DENSITY= 3.622000E-04(SLUG/FT**3)

Figure 9. Selected output for Sample Case No. 2.

TEMPERATURE= 3.896437E+02(DEG R) SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 2.899910E+03(FT/SEC) Y-VELOCITY= 1.266128E+02(FT/SEC) Z-VELOCITY= 0. (FT/SEC)

INITIAL VALUE SURFACE

AN INTERNALLY GENERATED INITIAL VALUE SURFACE IS SPECIFIED AS BEING LOCATED AT X= 1.000000E+00(FT)

A CONICAL BOW SHOCK WAVE IS SPECIFIED - THE INTERNALLY GENERATED SHOCK WAVE ANGLES ARE

BETA(1)= 4.006123E-01(RADIANS)
BETA(2)= 4.003646E-01(RADIANS)
BETA(3)= 3.996323E-01(RADIANS)
BETA(4)= 3.984479E-01(RADIANS)
BETA(5)= 3.968643E-01(RADIANS)
BETA(6)= 3.949524E-01(RADIANS)
BETA(7)= 3.927982E-01(RADIANS)
BETA(8)= 3.904973E-01(RADIANS)
BETA(9)= 3.881447E-01(RADIANS)
BETA(10)= 3.858412E-01(RADIANS)
BETA(11)= 3.836681E-01(RADIANS)
BETA(12)= 3.816879E-01(RADIANS)
BETA(13)= 3.799390E-01(RADIANS)
BETA(14)= 3.786021E-01(RADIANS)
BETA(15)= 3.774795E-01(RADIANS)
BETA(16)= 3.766270E-01(RADIANS)
BETA(17)= 3.760174E-01(RADIANS)
BETA(18)= 3.755867E-01(RADIANS)
BETA(19)= 3.753141E-01(RADIANS)
BETA(20)= 3.751656E-01(RADIANS)
BETA(21)= 3.751187E-01(RADIANS)

INDEX PARAMETERS

ISTOP=21 IMAX=40 JMAXI=11

JLIMIT(1)=13 JLIMIT(2)=21

INTEGRATION TERMINATION POINTS

FOREBODY FLOW FIELD INTEGRATION TERMINATES AT X= 2.000000E+00(FT)

FOR FOREBODY FLOW - RCAVG= 8.000000E-01(FT)

CENTERBODY GEOMETRY

CONE HALF ANGLE=10.00000(DEGREES)

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	3	1.000000E+00	0.	0.	0.	0.	0.
2	0	3.500000E+00	0.	0.	0.	0.	0.

Figure 9. Continued.

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CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

    CONVERGENCE TOLERANCES AND OTHER PARAMETERS

        CRIT( 1)= 1.000000E-01
        CRIT( 2)= 1.000000E-07
        CRIT( 3)= 1.000000E-04
        CRIT( 4)= 1.000000E-05
        CRIT( 5)= 1.000000E-04
        CRIT( 6)= 1.000000E-04
        CRIT( 7)= 5.000000E-01
        CRIT( 8)= 1.000000E+00
        CRIT( 9)= 1.000000E-04
        CRIT(10)= 8.000000E-01
        CRIT(11)= 1.000000E-06
        CRIT(12)= 2.000000E-01
        CRIT(13)= 1.000000E-05
        CRIT(14)= 4.000000E-01
        CRIT(15)= 1.000000E-04
        CRIT(16)= 1.000000E-06

    ITERATION LIMITS

        ITEND(1)=10
        ITEND(2)=10
        ITEND(3)=10
        ITEND(4)=20
        ITEND(5)=10
        ITEND(6)=10

    INPUT SAFETY FACTOR= 9.750000E-01
```

Figure 9. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.1763	0.0000	2.805	2830.8	325.42	4.4725E-04	424.0	2787.7	491.9	0.0	8895.5	1091.0
2	1	.1751	.0208	2.804	2830.4	325.83	4.4765E-04	424.1	2787.3	490.3	43.8	8895.4	1091.0
3	1	.1714	.0415	2.801	2829.5	327.05	4.4885E-04	424.6	2786.1	485.5	88.0	8895.3	1091.0
4	1	.1651	.0619	2.797	2827.8	329.11	4.5086E-04	425.3	2784.1	477.0	133.1	8895.2	1091.0
5	1	.1562	.0818	2.792	2825.6	332.01	4.5369E-04	426.4	2781.4	464.2	179.3	8894.9	1091.0
6	1	.1446	.1009	2.784	2822.6	335.77	4.5735E-04	427.8	2777.9	446.2	226.6	8894.4	1091.0
7	1	.1301	.1190	2.775	2819.0	340.69	4.6183E-04	429.5	2773.7	421.8	274.8	8893.8	1091.0
8	1	.1127	.1356	2.765	2814.8	345.89	4.6713E-04	431.5	2768.9	389.8	323.0	8892.9	1091.0
9	1	.0924	.1501	2.753	2810.0	352.22	4.7320E-04	433.7	2763.6	348.8	370.1	8891.6	1091.0
10	1	.0693	.1621	2.740	2804.6	359.62	4.7997E-04	436.2	2757.9	297.7	414.2	8889.8	1091.0
11	1	.0437	.1708	2.725	2798.8	367.10	4.8733E-04	438.9	2751.9	235.9	452.6	8887.4	1091.0
12	1	.0158	.1756	2.711	2792.7	375.40	4.9513E-04	441.8	2745.9	163.4	482.2	8884.4	1091.0
13	1	-.0135	.1758	2.696	2786.4	384.01	5.0315E-04	444.7	2740.0	81.3	499.6	8880.5	1091.0
14	1	-.0434	.1709	2.681	2780.1	392.73	5.1121E-04	447.6	2734.2	-8.4	502.6	8875.9	1091.0
15	1	-.0730	.1605	2.666	2774.0	401.20	5.1898E-04	450.5	2729.0	-102.2	486.6	8870.7	1091.0
16	1	-.1009	.1446	2.653	2768.3	409.12	5.2618E-04	453.1	2724.5	-195.6	450.2	8865.1	1091.0
17	1	-.1260	.1233	2.642	2763.3	416.16	5.3254E-04	455.4	2720.6	-283.0	392.7	8859.6	1091.0
18	1	-.1471	.0972	2.632	2759.2	422.02	5.3779E-04	457.3	2717.6	-358.8	315.2	8854.7	1091.0
19	1	-.1630	.0672	2.625	2756.1	426.41	5.4172E-04	458.7	2715.4	-417.5	220.6	8850.8	1091.0
20	1	-.1730	.0343	2.621	2754.2	429.14	5.4415E-04	459.5	2714.1	-454.7	113.6	8848.2	1091.0
21	1	-.1763	.0000	2.620	2753.6	430.06	5.4497E-04	459.8	2713.6	-467.4	.0	8847.3	1091.0
1	2	.2008	0.0000	2.808	2832.0	323.89	4.4575E-04	423.4	2798.2	435.8	0.0	8895.5	1091.0
2	2	.1993	.0246	2.807	2831.6	324.30	4.4615E-04	423.6	2797.8	434.5	38.6	8895.4	1091.0
3	2	.1946	.0490	2.805	2830.7	325.53	4.4736E-04	424.0	2796.7	430.4	77.6	8895.3	1091.0
4	2	.1868	.0729	2.800	2829.0	327.58	4.4937E-04	424.8	2794.7	423.3	117.5	8895.2	1091.0
5	2	.1758	.0960	2.795	2826.8	330.49	4.5221E-04	425.9	2792.0	412.4	158.5	8894.9	1091.0
6	2	.1615	.1179	2.787	2823.8	334.25	4.5567E-04	427.2	2788.6	396.9	200.6	8894.4	1091.0
7	2	.1441	.1382	2.778	2820.2	338.89	4.6037E-04	428.9	2784.4	375.7	243.6	8893.8	1091.0
8	2	.1234	.1566	2.767	2816.0	344.39	4.6568E-04	430.9	2779.6	347.7	286.9	8892.9	1091.0
9	2	.0997	.1723	2.755	2811.1	350.72	4.7176E-04	433.2	2774.3	311.7	329.2	8891.6	1091.0
10	2	.0729	.1849	2.742	2805.7	357.83	4.7855E-04	435.7	2768.6	266.6	368.9	8889.8	1091.0
11	2	.0437	.1937	2.728	2799.9	365.62	4.8593E-04	438.4	2762.5	211.7	403.7	8887.4	1091.0
12	2	.0123	.1979	2.713	2793.8	373.92	4.9373E-04	441.3	2756.4	147.2	430.7	8884.4	1091.0
13	2	-.0204	.1971	2.698	2787.4	382.53	5.0177E-04	444.2	2750.4	73.9	446.7	8880.5	1091.0
14	2	-.0535	.1907	2.683	2781.1	391.27	5.0985E-04	447.2	2744.5	-6.4	449.6	8875.9	1091.0
15	2	-.0859	.1783	2.669	2775.0	399.75	5.1763E-04	450.0	2739.1	-90.4	435.5	8870.7	1091.0
16	2	-.1164	.1601	2.656	2769.3	407.67	5.2485E-04	452.6	2734.3	-174.0	403.1	8865.1	1091.0
17	2	-.1437	.1361	2.644	2764.3	414.72	5.3122E-04	454.9	2730.2	-252.4	351.7	8859.6	1091.0
18	2	-.1664	.1070	2.635	2760.2	420.58	5.3648E-04	456.8	2727.0	-320.2	282.3	8854.7	1091.0
19	2	-.1836	.0738	2.628	2757.1	424.97	5.4041E-04	458.2	2724.6	-372.8	197.6	8850.8	1091.0
20	2	-.1943	.0377	2.623	2755.2	427.70	5.4284E-04	459.1	2723.2	-406.1	101.7	8848.2	1091.0
21	2	-.1979	.0000	2.622	2754.6	428.62	5.4366E-04	459.4	2722.7	-417.5	.0	8847.3	1091.0
1	3	.2253	0.0000	2.815	2834.6	320.53	4.4244E-04	422.1	2807.1	393.9	0.0	8895.5	1091.0
2	3	.2235	.0285	2.814	2834.3	320.94	4.4284E-04	422.3	2806.8	392.8	34.4	8895.4	1091.0
3	3	.2178	.0566	2.811	2833.3	322.16	4.4404E-04	422.8	2805.6	389.3	69.2	8895.3	1091.0
4	3	.2085	.0840	2.807	2831.7	324.20	4.4605E-04	423.5	2803.7	383.0	104.9	8895.2	1091.0
5	3	.1953	.1102	2.801	2829.4	327.09	4.4888E-04	424.6	2801.1	373.5	141.6	8894.9	1091.0
6	3	.1785	.1349	2.794	2826.5	330.84	4.5254E-04	426.0	2797.7	359.9	179.4	8894.4	1091.0
7	3	.1581	.1575	2.785	2822.9	335.45	4.5703E-04	427.7	2793.7	341.2	218.2	8893.8	1091.0
8	3	.1342	.1776	2.774	2818.6	340.93	4.6234E-04	429.7	2788.9	316.3	257.3	8892.9	1091.0
9	3	.1069	.1946	2.762	2813.7	347.25	4.6842E-04	432.0	2783.7	284.2	295.8	8891.6	1091.0
10	3	.0766	.2078	2.749	2808.3	354.34	4.7521E-04	434.5	2778.0	243.7	331.9	8889.8	1091.0
11	3	.0437	.2166	2.734	2802.5	362.10	4.8259E-04	437.2	2772.0	194.4	363.7	8887.4	1091.0
12	3	.0088	.2203	2.719	2796.3	370.39	4.9040E-04	440.1	2765.9	136.2	388.4	8884.4	1091.0
13	3	-.0273	.2184	2.704	2790.0	378.98	4.9843E-04	443.0	2759.8	70.0	403.2	8880.5	1091.0

Figure 9. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
14	3	-.0636	.2105	2.689	2783.6	387.71	5.0653E-04	446.0	2753.8	-2.6	406.2	8875.9	1091.0
15	3	-.0989	.1962	2.675	2777.5	396.17	5.1432E-04	448.8	2748.3	-78.7	393.8	8870.7	1091.0
16	3	-.1319	.1756	2.661	2771.8	404.06	5.2154E-04	451.5	2743.4	-154.4	364.6	8865.1	1091.0
17	3	-.1613	.1489	2.650	2766.8	411.13	5.2793E-04	453.8	2739.2	-225.4	318.2	8859.6	1091.0
18	3	-.1858	.1169	2.640	2762.6	416.97	5.3319E-04	455.7	2735.8	-286.9	255.5	8854.7	1091.0
19	3	-.2042	.0805	2.633	2759.5	421.36	5.3713E-04	457.1	2733.3	-334.6	178.9	8850.8	1091.0
20	3	-.2156	.0411	2.629	2757.6	424.08	5.3956E-04	458.0	2731.8	-364.8	92.1	8848.2	1091.0
21	3	-.2195	.0000	2.627	2757.0	425.01	5.4038E-04	458.3	2731.3	-375.1	.0	8847.3	1091.0
1	4	.2499	0.0000	2.823	2838.0	316.30	4.3826E-04	420.5	2815.0	360.7	0.0	8895.5	1091.0
2	4	.2477	.0323	2.823	2837.7	316.70	4.3866E-04	420.7	2814.6	359.7	30.9	8895.4	1091.0
3	4	.2411	.0642	2.820	2836.7	317.90	4.3984E-04	421.1	2813.5	356.7	62.2	8895.3	1091.0
4	4	.2302	.0950	2.816	2835.1	319.91	4.4183E-04	421.9	2811.7	351.2	94.2	8895.2	1091.0
5	4	.2150	.1245	2.810	2832.8	322.76	4.4463E-04	423.0	2809.2	342.7	127.3	8894.9	1091.0
6	4	.1956	.1519	2.803	2829.9	326.45	4.4825E-04	424.4	2805.9	330.6	161.5	8894.4	1091.0
7	4	.1721	.1768	2.793	2826.3	331.01	4.5270E-04	426.1	2801.9	314.0	196.7	8893.8	1091.0
8	4	.1449	.1987	2.783	2822.1	336.42	4.5797E-04	428.1	2797.3	291.7	232.3	8892.9	1091.0
9	4	.1141	.2168	2.771	2817.2	342.67	4.6400E-04	430.3	2792.2	262.7	267.3	8891.6	1091.0
10	4	.0802	.2307	2.757	2811.8	349.69	4.7075E-04	432.9	2786.6	226.2	300.4	8889.8	1091.0
11	4	.0437	.2395	2.743	2806.0	357.39	4.7809E-04	435.6	2780.6	181.6	329.6	8887.4	1091.0
12	4	.0052	.2427	2.728	2799.8	365.61	4.8587E-04	438.5	2774.6	128.7	352.5	8884.4	1091.0
13	4	-.0343	.2398	2.713	2793.5	374.14	4.9388E-04	441.4	2768.5	68.5	366.4	8880.5	1091.0
14	4	-.0737	.2303	2.697	2787.1	382.81	5.0195E-04	444.4	2762.5	2.3	369.5	8875.9	1091.0
15	4	-.1119	.2141	2.683	2781.0	391.22	5.0972E-04	447.2	2757.0	-67.1	358.4	8870.7	1091.0
16	4	-.1474	.1911	2.669	2775.3	399.09	5.1693E-04	449.9	2752.0	-136.3	332.0	8865.1	1091.0
17	4	-.1790	.1618	2.658	2770.2	406.10	5.2331E-04	452.2	2747.7	-201.2	289.9	8859.6	1091.0
18	4	-.2052	.1268	2.646	2766.1	411.91	5.2856E-04	454.1	2744.2	-257.4	232.9	8854.7	1091.0
19	4	-.2248	.0872	2.641	2763.0	416.28	5.3249E-04	455.5	2741.7	-300.9	163.1	8850.8	1091.0
20	4	-.2370	.0445	2.637	2761.1	418.99	5.3492E-04	456.4	2740.2	-328.5	84.0	8848.2	1091.0
21	4	-.2411	.0000	2.635	2760.4	419.91	5.3575E-04	456.7	2739.6	-338.0	.0	8847.3	1091.0
1	5	.2746	0.0000	2.833	2841.8	311.60	4.3360E-04	418.7	2822.2	333.2	0.0	8895.5	1091.0
2	5	.2720	.0362	2.832	2841.5	311.99	4.3399E-04	418.9	2821.9	332.3	27.8	8895.4	1091.0
3	5	.2645	.0718	2.830	2840.6	313.16	4.3515E-04	419.3	2820.8	329.6	55.9	8895.3	1091.0
4	5	.2520	.1061	2.826	2839.0	315.12	4.3709E-04	420.1	2819.1	324.7	84.9	8895.2	1091.0
5	5	.2346	.1388	2.820	2836.7	317.90	4.3983E-04	421.2	2816.6	317.2	114.8	8894.9	1091.0
6	5	.2126	.1690	2.813	2833.8	321.51	4.4339E-04	422.5	2813.4	306.5	145.8	8894.4	1091.0
7	5	.1862	.1962	2.804	2830.3	325.97	4.4777E-04	424.2	2809.6	291.5	177.8	8893.8	1091.0
8	5	.1557	.2198	2.793	2826.1	331.28	4.5295E-04	426.2	2805.1	271.5	210.2	8892.9	1091.0
9	5	.1214	.2392	2.781	2821.3	337.41	4.5890E-04	428.4	2800.1	245.4	242.4	8891.6	1091.0
10	5	.0838	.2536	2.767	2815.9	344.31	4.6557E-04	430.9	2794.6	212.3	272.8	8889.8	1091.0
11	5	.0437	.2625	2.753	2810.1	351.89	4.7283E-04	433.7	2788.8	171.7	299.8	8887.4	1091.0
12	5	.0017	.2652	2.738	2804.0	359.99	4.6053E-04	436.5	2782.8	123.5	321.0	8884.4	1091.0
13	5	-.0412	.2612	2.723	2797.6	368.41	4.6847E-04	439.5	2776.8	68.5	334.1	8880.5	1091.0
14	5	-.0838	.2502	2.707	2791.3	376.98	4.9648E-04	442.4	2770.8	7.9	337.3	8875.9	1091.0
15	5	-.1249	.2320	2.693	2785.2	385.30	5.0420E-04	445.3	2765.3	-55.8	327.5	8870.7	1091.0
16	5	-.1630	.2067	2.679	2779.5	393.09	5.1137E-04	447.9	2760.3	-119.3	303.7	8865.1	1091.0
17	5	-.1967	.1746	2.666	2774.4	400.03	5.1771E-04	450.2	2755.9	-178.9	265.4	8859.6	1091.0
18	5	-.2246	.1367	2.658	2770.3	405.79	5.2294E-04	452.2	2752.4	-230.6	213.2	8854.7	1091.0
19	5	-.2455	.0939	2.651	2767.2	410.12	5.2685E-04	453.6	2749.9	-270.6	149.4	8850.8	1091.0
20	5	-.2584	.0478	2.646	2765.3	412.80	5.2927E-04	454.5	2748.3	-296.0	76.9	8848.2	1091.0
21	5	-.2628	.0000	2.645	2764.6	413.71	5.3009E-04	454.8	2747.8	-304.7	.0	8847.3	1091.0
1	6	.2993	0.0000	2.844	2845.9	306.58	4.2860E-04	416.8	2829.1	309.3	0.0	8895.5	1091.0
2	6	.2964	.0400	2.843	2845.6	306.95	4.2897E-04	416.9	2828.7	308.6	25.0	8895.4	1091.0
3	6	.2879	.0794	2.841	2844.7	308.08	4.3010E-04	417.4	2827.7	306.2	50.3	8895.3	1091.0
4	6	.2738	.1173	2.837	2843.1	309.98	4.3199E-04	418.1	2826.0	301.9	76.4	8895.2	1091.0
5	6	.2543	.1531	2.831	2840.9	312.67	4.3466E-04	419.2	2823.7	295.3	103.4	8894.9	1091.0

Figure 9. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M .	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
6	6	.2297	.1861	2.824	2838.1	316.17	4.3812E-04	420.5	2820.6	285.7	131.5	8894.4	1091.0
7	6	.2003	.2156	2.815	2834.6	320.50	4.4238E-04	422.1	2816.9	272.4	160.6	8893.8	1091.0
8	6	.1664	.2410	2.804	2830.5	325.66	4.4745E-04	424.1	2812.6	254.4	190.3	8892.9	1091.0
9	6	.1286	.2615	2.792	2825.8	331.63	4.5328E-04	426.3	2807.7	230.8	219.8	8891.6	1091.0
10	6	.0875	.2766	2.779	2820.5	338.38	4.5982E-04	428.8	2802.4	200.8	247.8	8889.8	1091.0
11	6	.0437	.2855	2.764	2814.7	345.79	4.6696E-04	431.5	2796.7	163.9	272.8	8887.4	1091.0
12	6	-.0019	.2877	2.749	2808.6	353.73	4.7454E-04	434.3	2790.8	119.9	292.7	8884.4	1091.0
13	6	-.0482	.2827	2.734	2802.4	362.00	4.8238E-04	437.3	2784.8	69.5	305.1	8880.5	1091.0
14	6	-.0940	.2702	2.719	2796.0	370.42	4.9029E-04	440.2	2778.9	13.9	308.5	8875.9	1091.0
15	6	-.1379	.2500	2.704	2789.9	378.60	4.9793E-04	443.1	2773.4	-44.6	299.9	8870.7	1091.0
16	6	-.1786	.2222	2.691	2784.3	386.28	5.0502E-04	445.7	2768.4	-103.0	278.4	8865.1	1091.0
17	6	-.2144	.1875	2.679	2779.3	393.12	5.1130E-04	448.0	2764.1	-158.0	243.4	8859.6	1091.0
18	6	-.2440	.1466	2.669	2775.1	398.80	5.1649E-04	449.9	2760.6	-205.6	195.7	8854.7	1091.0
19	6	-.2662	.1007	2.662	2772.0	403.07	5.2037E-04	451.3	2758.0	-242.6	137.2	8850.8	1091.0
20	6	-.2799	.0512	2.658	2770.1	405.73	5.2277E-04	452.2	2756.4	-266.1	70.7	8848.2	1091.0
21	6	-.2845	.0000	2.656	2769.5	406.63	5.2359E-04	452.5	2755.9	-274.1	.0	8847.3	1091.0
1	7	.3240	0.0000	2.855	2850.3	301.26	4.2327E-04	414.7	2835.7	287.9	0.0	8895.5	1091.0
2	7	.3208	.0439	2.855	2850.0	301.62	4.2363E-04	414.9	2835.4	287.3	22.3	8895.4	1091.0
3	7	.3113	.0870	2.852	2849.1	302.70	4.2472E-04	415.3	2834.4	285.2	45.1	8895.3	1091.0
4	7	.2957	.1284	2.848	2847.6	304.52	4.2653E-04	416.0	2832.8	281.5	68.5	8895.2	1091.0
5	7	.2741	.1674	2.843	2845.5	307.10	4.2911E-04	417.0	2830.6	275.7	92.8	8894.9	1091.0
6	7	.2469	.2032	2.836	2842.7	310.46	4.3245E-04	418.3	2827.7	267.2	118.2	8894.4	1091.0
7	7	.2144	.2350	2.827	2839.3	314.63	4.3658E-04	419.9	2824.1	255.4	144.7	8893.8	1091.0
8	7	.1773	.2622	2.816	2835.3	319.61	4.4150E-04	421.8	2820.0	239.3	171.7	8892.9	1091.0
9	7	.1359	.2839	2.805	2830.7	325.39	4.4717E-04	424.0	2815.2	218.1	198.7	8891.6	1091.0
10	7	.0911	.2996	2.791	2825.5	331.93	4.5354E-04	426.5	2810.0	191.1	224.6	8889.8	1091.0
11	7	.0437	.3086	2.777	2819.8	339.14	4.6052E-04	429.1	2804.5	157.5	247.8	8887.4	1091.0
12	7	-.0055	.3102	2.762	2813.8	346.87	4.6795E-04	431.9	2798.7	117.5	266.4	8884.4	1091.0
13	7	-.0552	.3042	2.747	2807.6	354.94	4.7565E-04	434.8	2792.9	71.4	278.2	8880.5	1091.0
14	7	-.1042	.2901	2.732	2801.4	363.18	4.8343E-04	437.8	2787.1	20.4	281.8	8875.9	1091.0
15	7	-.1510	.2680	2.717	2795.3	371.19	4.9094E-04	440.6	2781.6	-33.4	274.4	8870.7	1091.0
16	7	-.1942	.2379	2.703	2789.7	378.72	4.9794E-04	443.2	2776.6	-87.2	255.1	8865.1	1091.0
17	7	-.2322	.2004	2.692	2784.7	385.43	5.0414E-04	445.5	2772.3	-137.9	223.3	8859.6	1091.0
18	7	-.2635	.1565	2.682	2780.6	391.02	5.0927E-04	447.4	2768.8	-182.0	179.7	8854.7	1091.0
19	7	-.2869	.1074	2.675	2777.5	395.22	5.1311E-04	448.8	2766.2	-216.2	126.0	8850.8	1091.0
20	7	-.3014	.0547	2.670	2775.6	397.83	5.1548E-04	449.7	2764.6	-237.9	65.0	8848.2	1091.0
21	7	-.3063	.0000	2.669	2775.0	398.71	5.1629E-04	450.0	2764.1	-245.3	.0	8847.3	1091.0
1	8	.3488	0.0000	2.868	2855.1	295.55	4.1753E-04	412.5	2842.5	267.9	0.0	8895.5	1091.0
2	8	.3453	.0478	2.867	2854.8	295.89	4.1788E-04	412.6	2842.2	267.3	19.8	8895.4	1091.0
3	8	.3348	.0946	2.865	2853.9	296.92	4.1891E-04	413.0	2841.2	265.6	40.0	8895.3	1091.0
4	8	.3176	.1396	2.861	2852.5	298.64	4.2064E-04	413.7	2839.7	262.4	60.8	8895.2	1091.0
5	8	.2939	.1818	2.856	2850.4	301.10	4.2310E-04	414.7	2837.6	257.4	82.5	8894.9	1091.0
6	8	.2640	.2204	2.849	2847.8	304.30	4.2631E-04	415.9	2834.8	250.1	105.3	8894.4	1091.0
7	8	.2286	.2545	2.840	2844.5	308.26	4.3027E-04	417.5	2831.4	239.7	129.2	8893.8	1091.0
8	8	.1881	.2834	2.830	2840.6	313.05	4.3500E-04	419.3	2827.4	225.6	153.7	8892.9	1091.0
9	8	.1432	.3064	2.818	2836.1	318.60	4.4048E-04	421.5	2822.9	206.7	178.4	8891.6	1091.0
10	8	.0948	.3227	2.805	2831.0	324.89	4.4666E-04	423.8	2817.9	182.5	202.2	8889.8	1091.0
11	8	.0437	.3317	2.791	2825.5	331.86	4.5344E-04	426.5	2812.5	152.3	223.8	8887.4	1091.0
12	8	-.0091	.3328	2.776	2819.6	339.35	4.6068E-04	429.2	2806.8	116.0	241.2	8884.4	1091.0
13	8	-.0622	.3257	2.761	2813.5	347.19	4.6820E-04	432.1	2801.1	74.0	252.6	8880.5	1091.0
14	8	-.1144	.3101	2.746	2807.3	355.19	4.7581E-04	435.0	2795.4	27.4	256.4	8875.9	1091.0
15	8	-.1641	.2860	2.731	2801.3	363.00	4.8318E-04	437.8	2790.0	-21.9	250.2	8870.7	1091.0
16	8	-.2099	.2535	2.718	2795.8	370.35	4.9006E-04	440.4	2785.1	-71.5	233.0	8865.1	1091.0
17	8	-.2500	.2134	2.706	2790.8	376.91	4.9616E-04	442.7	2780.8	-118.2	204.3	8859.6	1091.0
18	8	-.2831	.1665	2.696	2786.7	382.68	5.0121E-04	444.5	2777.3	-158.9	164.6	8854.7	1091.0

Figure 9. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
19	8	-.3077	.1142	2.689	2783.7	386.49	5.0499E-04	446.0	2774.8	-190.5	115.5	8850.8	1091.0
20	8	-.3230	.0581	2.685	2761.8	389.05	5.0735E-04	446.8	2773.2	-210.6	59.6	8848.2	1091.0
21	8	-.3281	.0000	2.683	2781.2	389.92	5.0812E-04	447.1	2772.6	-217.4	.0	8847.3	1091.0
1	9	.3737	0.0000	2.882	2860.4	289.23	4.1114E-04	409.9	2849.6	248.1	0.0	8895.5	1091.0
2	9	.3698	.0517	2.882	2860.1	289.55	4.1146E-04	410.1	2849.3	247.6	17.2	8895.4	1091.0
3	9	.3584	.1023	2.879	2859.3	290.51	4.1243E-04	410.4	2848.5	246.2	34.7	8895.3	1091.0
4	9	.3396	.1508	2.876	2857.9	292.13	4.1407E-04	411.1	2647.0	243.6	52.9	8695.2	1091.0
5	9	.3137	.1962	2.870	2856.0	294.43	4.1639E-04	412.0	2845.0	239.5	72.0	8894.9	1091.0
6	9	.2813	.2376	2.864	2853.4	297.45	4.1943E-04	413.2	2842.4	233.4	92.2	8894.4	1091.0
7	9	.2428	.2741	2.855	2850.3	301.21	4.2320E-04	414.7	2839.2	224.6	113.5	8893.8	1091.0
8	9	.1989	.3047	2.846	2646.5	305.73	4.2772E-04	416.5	2835.4	212.4	135.5	8892.9	1091.0
9	9	.1505	.3289	2.834	2842.2	311.01	4.3296E-04	418.6	2831.0	195.9	157.9	8891.6	1091.0
10	9	.0984	.3458	2.821	2837.3	317.03	4.3890E-04	420.9	2826.2	174.6	179.7	8889.8	1091.0
11	9	.0437	.3548	2.808	2831.9	323.70	4.4545E-04	423.4	2821.0	147.8	199.6	8887.4	1091.0
12	9	-.0126	.3555	2.793	2826.1	330.91	4.5247E-04	426.2	2815.5	115.2	216.0	8884.4	1091.0
13	9	-.0692	.3473	2.778	2820.1	338.48	4.5979E-04	429.0	2809.9	77.4	227.1	8880.5	1091.0
14	9	-.1246	.3302	2.763	2814.1	346.22	4.6720E-04	431.8	2804.3	35.1	231.3	8875.9	1091.0
15	9	-.1772	.3040	2.748	2808.2	353.81	4.7441E-04	434.6	2799.0	-9.9	226.4	8870.7	1091.0
16	9	-.2255	.2692	2.735	2802.7	360.95	4.8114E-04	437.1	2794.2	-55.2	211.3	8865.1	1091.0
17	9	-.2679	.2263	2.723	2797.8	367.33	4.8712E-04	439.4	2789.9	-96.1	185.6	8659.6	1091.0
18	9	-.3026	.1764	2.713	2793.8	372.67	4.9208E-04	441.3	2786.4	-135.5	149.8	8854.7	1091.0
19	9	-.3265	.1209	2.706	2790.7	376.68	4.9580E-04	442.7	2783.9	-164.7	105.3	8850.8	1091.0
20	9	-.3445	.0615	2.701	2788.8	379.18	4.9810E-04	443.6	2782.3	-183.2	54.3	8848.2	1091.0
21	9	-.3500	.0000	2.700	2786.2	380.02	4.9888E-04	443.9	2781.6	-189.5	.0	8847.3	1091.0
1	10	.3986	0.0000	2.900	2866.9	281.70	4.0346E-04	406.8	2857.9	226.7	0.0	8895.5	1091.0
2	10	.3944	.0556	2.899	2866.6	282.00	4.0376E-04	407.0	2857.6	226.4	14.3	8895.4	1091.0
3	10	.3820	.1099	2.897	2865.8	282.88	4.0466E-04	407.3	2856.8	225.4	28.9	8895.3	1091.0
4	10	.3616	.1620	2.893	2864.5	284.37	4.0618E-04	407.9	2855.5	223.5	44.2	8895.2	1091.0
5	10	.3336	.2106	2.888	2862.7	286.50	4.0835E-04	408.8	2853.6	220.4	60.4	8894.9	1091.0
6	10	.2985	.2548	2.882	2860.3	289.30	4.1119E-04	410.0	2851.1	215.6	77.7	8894.4	1091.0
7	10	.2570	.2936	2.874	2857.3	292.80	4.1473E-04	411.4	2848.1	208.6	96.2	8893.8	1091.0
8	10	.2098	.3261	2.864	2853.7	297.04	4.1900E-04	413.1	2644.5	198.6	115.6	8892.9	1091.0
9	10	.1579	.3514	2.853	2849.6	302.02	4.2398E-04	415.1	2840.3	185.0	135.6	8891.6	1091.0
10	10	.1021	.3690	2.841	2844.8	307.72	4.2966E-04	417.3	2835.7	166.8	155.3	8889.8	1091.0
11	10	.0437	.3781	2.827	2839.6	314.07	4.3595E-04	419.8	2830.6	143.7	173.7	8887.4	1091.0
12	10	-.0162	.3782	2.813	2834.0	320.97	4.4272E-04	422.5	2825.3	115.2	189.2	8884.4	1091.0
13	10	-.0762	.3689	2.798	2828.1	326.25	4.4961E-04	425.2	2819.8	81.8	200.0	8880.5	1091.0
14	10	-.1348	.3503	2.783	2822.1	335.70	4.5702E-04	428.0	2814.4	44.0	204.8	8875.9	1091.0
15	10	-.1904	.3221	2.768	2816.3	343.03	4.6404E-04	430.7	2809.1	3.5	201.4	8870.7	1091.0
16	10	-.2412	.2849	2.755	2810.9	349.96	4.7063E-04	433.3	2804.3	-37.5	188.7	8865.1	1091.0
17	10	-.2857	.2393	2.743	2806.1	356.16	4.7649E-04	435.5	2800.1	-76.5	166.3	8859.6	1091.0
18	10	-.3222	.1864	2.733	2802.1	361.35	4.8136E-04	437.4	2796.6	-110.7	134.5	8854.7	1091.0
19	10	-.3494	.1277	2.726	2799.1	365.26	4.8502E-04	438.8	2794.1	-137.3	94.7	8850.8	1091.0
20	10	-.3662	.0649	2.721	2797.2	367.70	4.8728E-04	439.7	2792.5	-154.3	48.9	8848.2	1091.0
21	10	-.3716	.0000	2.720	2796.6	368.52	4.8805E-04	440.0	2792.0	-160.1	.0	8847.3	1091.0
1	D	.4235	0.0000	2.927	2877.0	270.13	3.9156E-04	402.0	2870.3	196.7	0.0	8895.5	1091.0
2	D	.4190	.0595	2.927	2876.7	270.40	3.9183E-04	402.1	2870.0	196.6	10.1	8895.4	1091.0
3	D	.4057	.1176	2.925	2876.0	271.22	3.9268E-04	402.5	2869.2	196.4	20.6	8895.3	1091.0
4	D	.3837	.1732	2.921	2874.8	272.60	3.9410E-04	403.1	2867.9	195.7	31.8	8895.2	1091.0
5	D	.3535	.2251	2.917	2873.0	274.58	3.9614E-04	403.9	2866.1	194.4	44.0	8894.9	1091.0
6	D	.3158	.2721	2.910	2870.7	277.20	3.9885E-04	405.0	2863.7	191.9	57.6	8894.4	1091.0
7	D	.2712	.3132	2.902	2867.8	280.50	4.0221E-04	406.4	2860.8	187.8	72.5	8893.8	1091.0
8	D	.2207	.3475	2.893	2864.4	284.51	4.0630E-04	408.0	2857.2	181.2	88.8	8892.9	1091.0
9	D	.1652	.3740	2.882	2860.3	289.25	4.1111E-04	410.0	2853.1	171.5	106.1	8891.6	1091.0
10	D	.1058	.3922	2.869	2855.6	294.71	4.1661E-04	412.2	2848.5	157.8	123.8	8889.8	1091.0

Figure 9. Continued.

INITIAL DATA PLANE X= 1.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
11	D	.0437	.4013	2.856	2850.4	300.84	4.2274E-04	414.7	2843.5	139.5	140.9	8887.4	1091.0
12	D	-.0198	.4009	2.841	2844.8	307.52	4.2938E-04	417.3	2838.2	116.2	155.8	8884.4	1091.0
13	D	-.0832	.3906	2.826	2839.0	314.59	4.3636E-04	420.1	2832.7	88.0	167.0	8880.5	1091.0
14	D	-.1451	.3704	2.811	2833.0	321.84	4.4345E-04	422.9	2827.2	55.6	173.1	8875.9	1091.0
15	D	-.2035	.3403	2.796	2827.2	329.00	4.5040E-04	425.6	2821.9	20.3	171.9	8870.7	1091.0
16	D	-.2570	.3006	2.782	2821.8	335.77	4.5692E-04	428.2	2817.0	-16.0	162.4	8865.1	1091.0
17	D	-.3036	.2523	2.770	2816.9	341.85	4.6273E-04	430.5	2812.8	-50.7	144.1	8859.6	1091.0
18	D	-.3419	.1964	2.760	2812.9	346.94	4.6757E-04	432.4	2809.3	-81.4	117.1	8854.7	1091.0
19	D	-.3703	.1345	2.752	2809.9	350.78	4.7120E-04	433.8	2806.7	-105.4	82.7	8850.8	1091.0
20	D	-.3878	.0683	2.748	2808.0	353.17	4.7346E-04	434.7	2805.1	-120.8	42.8	8848.2	1091.0
21	D	-.3938	.0000	2.746	2807.3	353.99	4.7422E-04	435.0	2804.5	-126.0	.0	8847.3	1091.0

MASS FLOW RATE FOR ENTIRE PLANE= 5.43008E-01(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I=21, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 4.591958E-02(FT)

Figure 9. Continued.

SOLUTION PLANE NO. 1 X= 1.04592(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.1844	0.0000	2.797	2827.7	329.32	4.5108E-04	425.4	2784.7	491.0	0.0	8895.3	1091.0	1	2
2	1	.1832	.0215	2.796	2827.5	329.56	4.5133E-04	425.5	2784.5	489.4	42.4	8895.2	1091.0	1	3
3	1	.1794	.0429	2.795	2826.9	330.35	4.5208E-04	425.8	2783.8	484.3	85.2	8895.1	1091.0	1	2
4	1	.1729	.0640	2.792	2825.8	331.67	4.5336E-04	426.3	2782.5	475.6	128.6	8894.9	1091.0	1	2
5	1	.1638	.0847	2.788	2824.3	333.57	4.5521E-04	427.0	2780.8	462.5	173.0	8894.6	1091.0	1	3
6	1	.1519	.1046	2.783	2822.3	336.11	4.5768E-04	427.9	2778.6	444.5	218.4	8894.1	1091.0	1	3
7	1	.1370	.1234	2.777	2819.8	339.35	4.6082E-04	429.1	2775.7	420.4	264.6	8893.5	1091.0	1	3
8	1	.1191	.1408	2.769	2816.7	343.38	4.6471E-04	430.6	2772.3	389.2	311.0	8892.5	1091.0	1	3
9	1	.0982	.1561	2.760	2812.9	348.27	4.6941E-04	432.3	2768.2	349.5	356.8	8891.2	1091.0	1	3
10	1	.0743	.1688	2.749	2808.5	354.07	4.7495E-04	434.4	2763.6	300.4	400.2	8889.3	1091.0	1	3
11	1	.0476	.1782	2.737	2803.4	360.81	4.8135E-04	436.8	2758.3	240.8	439.1	8886.9	1091.0	1	3
12	1	.0186	.1835	2.723	2797.6	368.54	4.8865E-04	439.5	2752.5	170.5	470.5	8883.8	1091.0	1	3
13	1	-.0120	.1840	2.708	2791.4	376.91	4.9649E-04	442.4	2746.4	89.7	491.2	8879.8	1091.0	1	3
14	1	-.0435	.1792	2.692	2785.0	385.70	5.0466E-04	445.3	2740.2	.3	497.3	8875.2	1091.0	1	4
15	1	-.0746	.1687	2.677	2778.5	394.62	5.1289E-04	448.3	2734.1	-94.4	485.4	8869.9	1091.0	1	3
16	1	-.1042	.1522	2.662	2772.1	403.54	5.2104E-04	451.3	2728.3	-190.3	452.7	8864.3	1091.0	1	3
17	1	-.1308	.1300	2.649	2766.3	411.78	5.2853E-04	454.0	2723.0	-281.5	397.9	8858.8	1091.0	1	2
18	1	-.1532	.1026	2.637	2761.3	418.91	5.3496E-04	456.3	2718.5	-361.6	321.5	8853.8	1091.0	1	3
19	1	-.1702	.0710	2.628	2757.4	424.44	5.3993E-04	458.1	2715.1	-424.4	226.2	8849.8	1091.0	1	3
20	1	-.1808	.0363	2.623	2755.0	427.93	5.4306E-04	459.2	2713.0	-464.5	116.9	8847.3	1091.0	1	3
21	1	-.1844	.0000	2.621	2754.1	429.13	5.4412E-04	459.6	2712.3	-478.3	.0	8846.4	1091.0	1	3
1	2	.2080	.0000	2.800	2828.9	327.78	4.4957E-04	424.8	2794.4	440.6	.0	8895.5	1091.0	1	3
2	2	.2064	.0253	2.799	2828.6	328.20	4.4997E-04	425.0	2794.0	439.4	38.0	8895.4	1091.0	1	3
3	2	.2017	.0503	2.797	2827.6	329.45	4.5120E-04	425.5	2792.7	435.9	76.6	8895.3	1091.0	1	3
4	2	.1938	.0748	2.793	2825.9	331.54	4.5324E-04	426.2	2790.7	429.4	116.1	8895.1	1091.0	1	3
5	2	.1826	.0986	2.787	2823.7	334.45	4.5608E-04	427.3	2787.9	419.4	157.1	8894.8	1091.0	1	3
6	2	.1681	.1212	2.779	2820.8	338.19	4.5971E-04	428.7	2784.4	404.8	199.5	8894.4	1091.0	1	3
7	2	.1504	.1423	2.771	2817.2	342.73	4.6410E-04	430.3	2780.3	384.5	243.1	8893.7	1091.0	1	3
8	2	.1293	.1613	2.761	2813.2	348.02	4.6919E-04	432.2	2775.6	357.2	287.3	8892.8	1091.0	1	3
9	2	.1049	.1778	2.749	2808.6	354.01	4.7492E-04	434.3	2770.5	321.5	330.8	8891.5	1091.0	1	3
10	2	.0775	.1911	2.737	2803.7	360.61	4.8120E-04	436.7	2765.1	276.4	371.8	8889.8	1091.0	1	3
11	2	.0473	.2004	2.724	2798.4	367.68	4.8789E-04	439.1	2759.7	221.2	407.8	8887.4	1091.0	1	3
12	2	.0148	.2052	2.711	2792.9	375.08	4.9483E-04	441.7	2754.3	155.8	435.9	8884.4	1091.0	1	2
13	2	-.0191	.2046	2.698	2787.3	382.69	5.0192E-04	444.3	2749.1	81.4	452.9	8880.6	1091.0	1	2
14	2	-.0536	.1983	2.685	2781.9	390.20	5.0886E-04	446.8	2744.2	-.4	456.3	8876.0	1091.0	1	3
15	2	-.0874	.1857	2.673	2776.6	397.40	5.1546E-04	449.2	2739.8	-86.0	442.3	8870.9	1091.0	1	2
16	2	-.1193	.1669	2.661	2771.8	404.05	5.2151E-04	451.5	2736.1	-171.2	409.5	8865.4	1091.0	1	2
17	2	-.1479	.1421	2.652	2767.6	409.89	5.2680E-04	453.4	2733.0	-251.0	357.4	8860.0	1091.0	1	2
18	2	-.1718	.1118	2.644	2764.2	414.72	5.3113E-04	455.0	2730.6	-320.1	286.9	8855.1	1091.0	1	3
19	2	-.1899	.0772	2.638	2761.6	418.32	5.3435E-04	456.2	2728.8	-373.7	200.9	8851.2	1091.0	1	3
20	2	-.2011	.0394	2.634	2760.0	420.55	5.3635E-04	456.9	2727.8	-407.7	103.5	8848.7	1091.0	1	3
21	2	-.2049	.0000	2.633	2759.5	421.31	5.3703E-04	457.1	2727.4	-419.4	.0	8847.8	1091.0	1	3
1	3	.2318	.0000	2.809	2832.3	323.52	4.4539E-04	423.3	2803.8	400.1	.0	8895.5	1091.0	1	3
2	3	.2299	.0290	2.808	2831.9	323.94	4.4580E-04	423.4	2803.5	399.1	34.2	8895.5	1091.0	1	3
3	3	.2243	.0577	2.805	2830.9	325.19	4.4702E-04	423.9	2802.3	396.0	68.9	8895.3	1091.0	1	3
4	3	.2148	.0857	2.801	2829.3	327.27	4.4906E-04	424.7	2800.3	390.3	104.6	8895.2	1091.0	1	3
5	3	.2015	.1125	2.795	2827.0	330.19	4.5192E-04	425.7	2797.6	381.4	141.5	8894.9	1091.0	1	3
6	3	.1845	.1378	2.788	2824.0	333.95	4.5558E-04	427.1	2794.1	368.5	179.9	8894.4	1091.0	1	3
7	3	.1636	.1611	2.779	2820.5	338.53	4.6003E-04	428.8	2790.0	350.4	219.4	8893.8	1091.0	1	3
8	3	.1394	.1819	2.768	2816.3	343.90	4.6522E-04	430.7	2785.3	326.0	259.6	8892.8	1091.0	1	3
9	3	.1116	.1995	2.757	2811.7	350.01	4.7108E-04	432.9	2780.2	294.0	299.3	8891.6	1091.0	1	3
10	3	.0807	.2133	2.744	2806.5	356.77	4.7753E-04	435.3	2774.7	253.3	336.8	8889.8	1091.0	1	3
11	3	.0470	.2226	2.731	2801.1	364.05	4.8444E-04	437.9	2769.1	203.4	369.9	8887.4	1091.0	1	3
12	3	.0111	.2268	2.717	2795.4	371.69	4.9163E-04	440.5	2763.5	144.1	395.8	8884.4	1091.0	1	2
13	3	-.0261	.2252	2.703	2789.6	379.57	4.9899E-04	443.2	2758.0	76.5	411.5	8880.6	1091.0	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 1 X= 1.04592(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
14	3	-.0636	.2173	2.690	2783.8	387.38	5.0622E-04	445.9	2752.7	2.1	415.0	8876.0	1091.0	1	3
15	3	-.1002	.2028	2.677	2778.4	394.88	5.1313E-04	448.4	2748.0	-75.8	402.6	8870.8	1091.0	1	2
16	3	-.1345	.1817	2.665	2773.4	401.83	5.1946E-04	450.7	2743.9	-153.5	372.9	8865.4	1091.0	1	2
17	3	-.1651	.1543	2.655	2769.0	407.94	5.2500E-04	452.8	2740.5	-226.3	325.6	8859.9	1091.0	1	2
18	3	-.1906	.1212	2.647	2765.4	412.99	5.2955E-04	454.4	2737.7	-289.4	261.4	8855.0	1091.0	1	3
19	3	-.2098	.0836	2.640	2762.7	416.76	5.3293E-04	455.7	2735.8	-338.2	183.1	8851.1	1091.0	1	3
20	3	-.2216	.0426	2.637	2761.0	419.09	5.3501E-04	456.4	2734.6	-369.2	94.3	8848.6	1091.0	1	3
21	3	-.2258	.0000	2.635	2760.5	419.88	5.3572E-04	456.7	2734.2	-379.8	.0	8847.7	1091.0	1	3
1	4	.2559	.0000	2.818	2835.9	318.92	4.4085E-04	421.5	2812.0	367.7	.0	8895.5	1091.0	1	3
2	4	.2537	.0328	2.817	2835.6	319.33	4.4126E-04	421.7	2811.6	366.8	30.9	8895.5	1091.0	1	2
3	4	.2470	.0652	2.815	2834.6	320.56	4.4247E-04	422.1	2810.5	364.0	62.3	8895.4	1091.0	1	2
4	4	.2360	.0966	2.810	2833.0	322.61	4.4449E-04	422.9	2808.5	358.9	94.6	8895.2	1091.0	1	2
5	4	.2206	.1266	2.805	2830.7	325.50	4.4733E-04	424.0	2805.9	351.0	128.1	8894.9	1091.0	1	2
6	4	.2011	.1546	2.797	2827.7	329.23	4.5098E-04	425.4	2802.5	339.4	163.0	8894.4	1091.0	1	3
7	4	.1774	.1801	2.788	2824.1	333.60	4.5542E-04	427.1	2798.5	323.2	199.0	8893.8	1091.0	1	3
8	4	.1498	.2025	2.777	2820.0	339.17	4.6063E-04	429.0	2793.9	301.2	235.8	8892.9	1091.0	1	3
9	4	.1185	.2213	2.766	2815.2	345.30	4.6654E-04	431.3	2788.8	272.2	272.1	8891.6	1091.0	1	3
10	4	.0840	.2357	2.753	2810.0	352.11	4.7307E-04	433.7	2783.3	235.3	306.6	8889.8	1091.0	1	3
11	4	.0467	.2450	2.739	2804.4	359.47	4.8008E-04	436.3	2777.6	189.9	337.2	8887.5	1091.0	1	3
12	4	.0074	.2486	2.725	2798.6	367.24	4.8742E-04	439.0	2771.9	135.8	361.2	8884.4	1091.0	1	3
13	4	-.0331	.2460	2.711	2792.7	375.25	4.9493E-04	441.8	2766.3	74.0	376.0	8880.6	1091.0	1	2
14	4	-.0736	.2366	2.697	2786.8	383.24	5.0235E-04	444.5	2760.8	5.9	379.5	8876.0	1091.0	1	3
15	4	-.1130	.2201	2.683	2781.2	390.92	5.0945E-04	447.1	2755.9	-65.5	368.4	8870.8	1091.0	1	2
16	4	-.1497	.1967	2.671	2776.0	398.05	5.1597E-04	449.5	2751.5	-136.8	341.5	8865.3	1091.0	1	2
17	4	-.1824	.1667	2.661	2771.5	404.33	5.2168E-04	451.6	2747.8	-203.7	298.3	8859.9	1091.0	1	2
18	4	-.2095	.1307	2.652	2767.7	409.52	5.2637E-04	453.3	2744.9	-261.7	239.6	8855.0	1091.0	1	2
19	4	-.2299	.0900	2.646	2765.0	413.40	5.2986E-04	454.6	2742.8	-306.6	167.8	8851.0	1091.0	1	3
20	4	-.2426	.0459	2.642	2763.2	415.80	5.3201E-04	455.4	2741.5	-335.0	86.4	8848.5	1091.0	1	3
21	4	-.2469	.0000	2.640	2762.7	416.61	5.3274E-04	455.7	2741.1	-344.8	.0	8847.6	1091.0	1	3
1	5	.2801	.0000	2.828	2839.8	314.11	4.3610E-04	419.7	2819.3	340.6	.0	8895.5	1091.0	1	2
2	5	.2775	.0366	2.827	2839.5	314.51	4.3649E-04	419.9	2818.9	339.8	28.0	8895.5	1091.0	1	2
3	5	.2699	.0727	2.825	2838.5	315.71	4.3768E-04	420.3	2817.8	337.3	56.5	8895.4	1091.0	1	2
4	5	.2573	.1075	2.820	2836.9	317.72	4.3967E-04	421.1	2816.0	332.6	85.6	8895.2	1091.0	1	2
5	5	.2399	.1406	2.815	2834.6	320.56	4.4246E-04	422.2	2813.4	325.7	116.3	8894.9	1091.0	1	2
6	5	.2177	.1714	2.807	2831.7	324.22	4.4606E-04	423.5	2810.2	315.3	148.1	8894.4	1091.0	1	3
7	5	.1911	.1991	2.798	2828.1	328.71	4.5046E-04	425.2	2806.3	300.7	181.0	8893.8	1091.0	1	3
8	5	.1602	.2233	2.787	2823.9	334.02	4.5563E-04	427.2	2801.7	280.8	214.7	8892.9	1091.0	1	3
9	5	.1255	.2432	2.776	2819.2	340.11	4.6152E-04	429.4	2796.7	254.5	248.1	8891.6	1091.0	1	3
10	5	.0874	.2581	2.763	2814.0	346.89	4.6805E-04	431.9	2791.3	220.9	280.0	8889.8	1091.0	1	3
11	5	.0466	.2675	2.749	2808.3	354.26	4.7509E-04	434.5	2785.6	179.4	308.3	8887.5	1091.0	1	3
12	5	.0038	.2706	2.734	2802.4	362.05	4.8249E-04	437.2	2779.8	129.9	330.7	8884.4	1091.0	1	3
13	5	-.0400	.2668	2.720	2796.4	370.10	4.9007E-04	440.1	2774.1	73.2	344.7	8880.6	1091.0	1	3
14	5	-.0837	.2559	2.705	2790.4	378.16	4.9759E-04	442.8	2768.6	10.5	348.3	8876.0	1091.0	1	3
15	5	-.1258	.2375	2.692	2784.7	385.93	5.0479E-04	445.5	2763.5	-55.3	338.5	8870.8	1091.0	1	2
16	5	-.1650	.2118	2.679	2779.4	393.15	5.1143E-04	447.9	2759.0	-121.0	314.0	8865.3	1091.0	1	2
17	5	-.1997	.1791	2.668	2774.8	399.53	5.1724E-04	450.1	2755.1	-182.8	274.5	8859.8	1091.0	1	2
18	5	-.2285	.1403	2.659	2771.0	404.80	5.2203E-04	451.8	2752.1	-236.3	220.6	8854.9	1091.0	1	2
19	5	-.2501	.0965	2.653	2768.2	408.74	5.2559E-04	453.2	2749.8	-277.8	154.5	8851.0	1091.0	1	2
20	5	-.2634	.0492	2.649	2766.4	411.18	5.2778E-04	454.0	2748.5	-304.1	79.6	8848.4	1091.0	1	2
21	5	-.2680	.0000	2.648	2765.8	412.01	5.2852E-04	454.2	2748.0	-313.1	.0	8847.5	1091.0	1	2
1	6	.3044	.0000	2.838	2843.8	309.16	4.3117E-04	417.8	2826.1	317.2	.0	8895.5	1091.0	1	2
2	6	.3015	.0404	2.838	2843.5	309.54	4.3155E-04	418.0	2825.7	316.5	25.4	8895.5	1091.0	1	2
3	6	.2929	.0802	2.835	2842.5	310.70	4.3271E-04	418.4	2824.7	314.2	51.2	8895.4	1091.0	1	2
4	6	.2788	.1185	2.831	2841.0	312.66	4.3465E-04	419.2	2822.9	310.2	77.8	8895.2	1091.0	1	2
5	6	.2592	.1548	2.825	2838.7	315.41	4.3737E-04	420.2	2820.4	303.9	105.6	8894.9	1091.0	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 1 X= 1.04592(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	G (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
6	6	.2345	.1882	2.818	2835.8	318.98	4.4090E-04	421.6	2817.3	294.6	134.5	8894.4	1091.0	1	3
7	6	.2048	.2183	2.809	2832.3	323.37	4.4521E-04	423.2	2813.5	281.4	164.7	8893.8	1091.0	1	3
8	6	.1707	.2441	2.796	2828.2	328.57	4.5031E-04	425.2	2809.1	263.4	195.6	8892.9	1091.0	1	3
9	6	.1325	.2652	2.786	2823.5	334.56	4.5613E-04	427.4	2804.2	239.5	226.4	8891.6	1091.0	1	3
10	6	.0908	.2807	2.773	2818.3	341.25	4.6260E-04	429.8	2798.8	208.9	255.9	8889.8	1091.0	1	3
11	6	.0464	.2901	2.759	2812.6	348.54	4.6961E-04	432.5	2793.2	171.0	282.2	8887.5	1091.0	1	3
12	6	.0001	.2926	2.745	2806.7	356.29	4.7699E-04	435.2	2787.5	125.6	303.2	8884.4	1091.0	1	3
13	6	-.0470	.2878	2.730	2800.7	364.30	4.8457E-04	438.1	2781.8	73.4	316.5	8880.6	1091.0	1	3
14	6	-.0938	.2754	2.715	2794.6	372.36	4.9213E-04	440.9	2776.2	15.7	320.3	8876.0	1091.0	1	3
15	6	-.1387	.2550	2.701	2788.9	380.14	4.9937E-04	443.6	2771.0	-45.1	311.6	8870.8	1091.0	1	3
16	6	-.1803	.2270	2.689	2783.5	387.38	5.0605E-04	446.1	2766.4	-105.9	289.3	8865.3	1091.0	1	2
17	6	-.2171	.1916	2.678	2778.8	393.79	5.1193E-04	448.2	2762.5	-163.1	253.1	8859.8	1091.0	1	2
18	6	-.2475	.1499	2.669	2775.0	399.09	5.1676E-04	450.0	2759.3	-212.7	203.5	8854.9	1091.0	1	2
19	6	-.2703	.1030	2.662	2772.1	403.06	5.2036E-04	451.3	2757.0	-251.2	142.7	8850.9	1091.0	1	2
20	6	-.2844	.0524	2.658	2770.3	405.52	5.2258E-04	452.2	2755.6	-275.6	73.5	8848.4	1091.0	1	2
21	6	-.2892	.0000	2.656	2769.7	406.35	5.2333E-04	452.4	2755.1	-283.9	.0	8847.5	1091.0	1	2
1	7	.3207	.0000	2.849	2848.0	304.03	4.2606E-04	415.8	2832.6	296.3	.0	8895.5	1091.0	1	2
2	7	.3256	.0443	2.849	2847.7	304.41	4.2643E-04	416.0	2832.2	295.6	22.9	8895.5	1091.0	1	2
3	7	.3160	.0877	2.846	2846.8	305.52	4.2754E-04	416.4	2831.2	293.7	46.3	8895.4	1091.0	1	3
4	7	.3003	.1295	2.842	2845.2	307.40	4.2942E-04	417.1	2829.5	290.1	70.4	8895.2	1091.0	1	3
5	7	.2786	.1689	2.836	2843.1	310.06	4.3206E-04	418.2	2827.2	284.5	95.6	8894.9	1091.0	1	3
6	7	.2513	.2052	2.829	2840.2	313.51	4.3548E-04	419.5	2824.1	276.2	122.0	8894.4	1091.0	1	3
7	7	.2187	.2374	2.820	2836.8	317.77	4.3969E-04	421.1	2820.5	264.4	149.5	8893.8	1091.0	1	3
8	7	.1812	.2650	2.810	2832.7	322.83	4.4467E-04	423.0	2816.2	248.2	177.9	8892.9	1091.0	1	3
9	7	.1395	.2872	2.798	2828.1	328.67	4.5038E-04	425.2	2811.4	226.6	206.3	8891.6	1091.0	1	3
10	7	.0943	.3034	2.785	2822.9	335.22	4.5675E-04	427.7	2806.2	198.8	233.6	8889.8	1091.0	1	3
11	7	.0463	.3127	2.771	2817.3	342.39	4.6367E-04	430.3	2800.7	164.1	258.1	8887.5	1091.0	1	3
12	7	-.0035	.3147	2.756	2811.4	350.02	4.7098E-04	433.0	2795.0	122.5	277.8	8884.4	1091.0	1	3
13	7	-.0540	.3088	2.741	2805.4	357.94	4.7851E-04	435.9	2789.3	74.6	290.5	8880.6	1091.0	1	3
14	7	-.1038	.2949	2.727	2799.3	365.93	4.8604E-04	438.7	2783.7	21.3	294.5	8875.9	1091.0	1	3
15	7	-.1516	.2726	2.713	2793.5	373.66	4.9327E-04	441.4	2778.5	-34.9	286.9	8870.7	1091.0	1	3
16	7	-.1957	.2422	2.700	2788.2	380.87	4.9996E-04	443.9	2773.9	-91.2	266.7	8865.2	1091.0	1	3
17	7	-.2345	.2042	2.689	2783.4	387.26	5.0585E-04	446.1	2769.9	-144.2	233.6	8859.7	1091.0	1	3
18	7	-.2666	.1596	2.679	2779.5	392.55	5.1070E-04	447.9	2766.6	-190.3	188.0	8854.8	1091.0	1	3
19	7	-.2906	.1096	2.673	2776.6	396.52	5.1431E-04	449.2	2764.3	-226.1	131.8	8850.9	1091.0	1	2
20	7	-.3055	.0558	2.668	2774.8	398.96	5.1654E-04	450.1	2762.8	-248.7	67.9	8848.3	1091.0	1	2
21	7	-.3105	.0000	2.667	2774.2	399.81	5.1730E-04	450.4	2762.3	-256.5	.0	8847.4	1091.0	1	2
1	8	.3532	.0000	2.861	2852.4	298.69	4.2069E-04	413.7	2839.0	277.0	.0	8895.5	1091.0	1	3
2	8	.3497	.0481	2.860	2852.1	299.04	4.2104E-04	413.9	2838.6	276.4	20.6	8895.5	1091.0	1	3
3	8	.3392	.0953	2.858	2851.3	300.11	4.2212E-04	414.3	2837.7	274.7	41.5	8895.4	1091.0	1	3
4	8	.3219	.1406	2.854	2849.8	301.90	4.2392E-04	415.0	2836.1	271.6	63.3	8895.2	1091.0	1	3
5	8	.2981	.1832	2.848	2847.7	304.44	4.2646E-04	416.0	2833.8	266.7	86.0	8894.9	1091.0	1	3
6	8	.2682	.2221	2.841	2844.9	307.76	4.2976E-04	417.3	2830.9	259.4	109.9	8894.4	1091.0	1	3
7	8	.2326	.2567	2.833	2841.6	311.85	4.3383E-04	418.9	2827.4	248.9	135.0	8893.8	1091.0	1	3
8	8	.1918	.2860	2.822	2837.6	316.74	4.3866E-04	420.7	2823.3	234.5	160.9	8892.9	1091.0	1	3
9	8	.1466	.3094	2.811	2833.0	322.40	4.4422E-04	422.9	2818.7	215.0	187.1	8891.6	1091.0	1	3
10	8	.0978	.3261	2.798	2828.0	328.77	4.5045E-04	425.3	2813.6	189.9	212.3	8889.8	1091.0	1	3
11	8	.0462	.3354	2.784	2822.4	335.76	4.5724E-04	427.9	2808.2	158.4	235.2	8887.5	1091.0	1	3
12	8	-.0071	.3369	2.769	2816.6	343.23	4.6444E-04	430.6	2802.6	120.4	253.8	8884.4	1091.0	1	3
13	8	-.0609	.3300	2.754	2810.6	351.01	4.7188E-04	433.4	2796.9	76.4	266.0	8880.6	1091.0	1	3
14	8	-.1139	.3145	2.739	2804.6	358.87	4.7933E-04	436.3	2791.4	27.4	270.1	8875.9	1091.0	1	3
15	8	-.1645	.2902	2.725	2798.8	366.50	4.8651E-04	439.0	2786.2	-24.5	263.7	8870.7	1091.0	1	3
16	8	-.2111	.2575	2.712	2793.4	373.63	4.9316E-04	441.5	2781.5	-76.7	245.5	8865.2	1091.0	1	3
17	8	-.2520	.2168	2.701	2788.6	379.96	4.9902E-04	443.7	2777.5	-125.8	215.3	8859.7	1091.0	1	3
18	8	-.2858	.1693	2.692	2784.7	385.22	5.0386E-04	445.5	2774.2	-168.6	173.4	8854.8	1091.0	1	3

Figure 9. Continued.

SOLUTION PLANE NO. 1 X= 1.04592(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
19	8	-.3110	.1161	2.685	2781.8	389.16	5.0747E-04	446.8	2771.8	-201.9	121.7	8850.8	1091.0	1	3
20	8	-.3265	.0591	2.681	2780.0	391.60	5.0970E-04	447.7	2770.3	-223.0	62.7	8848.3	1091.0	1	3
21	8	-.3318	.0000	2.679	2779.4	392.43	5.1046E-04	448.0	2769.8	-230.2	.0	8847.4	1091.0	1	3
1	9	.3777	.0000	2.874	2857.2	292.99	4.1495E-04	411.4	2845.5	258.4	.0	8895.5	1091.0	1	3
2	9	.3739	.0519	2.873	2856.9	293.33	4.1528E-04	411.6	2845.2	258.0	18.2	8895.5	1091.0	1	3
3	9	.3625	.1028	2.871	2856.1	294.34	4.1630E-04	412.0	2844.3	256.6	36.9	8895.3	1091.0	1	3
4	9	.3436	.1517	2.867	2854.6	296.04	4.1802E-04	412.7	2842.8	253.9	56.2	8895.2	1091.0	1	3
5	9	.3177	.1974	2.862	2852.6	298.45	4.2044E-04	413.6	2840.6	249.7	76.5	8894.9	1091.0	1	3
6	9	.2851	.2391	2.855	2850.0	301.60	4.2361E-04	414.9	2837.9	243.4	98.0	8894.4	1091.0	1	3
7	9	.2465	.2759	2.846	2846.7	305.52	4.2751E-04	416.4	2834.5	234.3	120.7	8893.8	1091.0	1	3
8	9	.2025	.3070	2.836	2842.9	310.20	4.3217E-04	418.2	2830.6	221.6	144.3	8892.9	1091.0	1	3
9	9	.1538	.3315	2.824	2838.4	315.63	4.3755E-04	420.3	2826.1	204.4	168.2	8891.6	1091.0	1	3
10	9	.1013	.3488	2.812	2833.5	321.79	4.4360E-04	422.7	2821.1	181.9	191.5	8889.8	1091.0	1	3
11	9	.0461	.3582	2.798	2828.0	328.56	4.5022E-04	425.2	2815.9	153.5	212.8	8887.4	1091.0	1	3
12	9	-.0107	.3591	2.783	2822.3	335.83	4.5727E-04	428.0	2810.4	119.0	230.3	8884.4	1091.0	1	3
13	9	-.0679	.3511	2.768	2816.3	343.43	4.6457E-04	430.7	2804.8	76.9	242.1	8880.6	1091.0	1	3
14	9	-.1240	.3341	2.754	2810.4	351.11	4.7190E-04	433.5	2799.3	33.9	246.5	8875.9	1091.0	1	3
15	9	-.1774	.3079	2.739	2804.6	358.60	4.7899E-04	436.2	2794.2	-13.8	241.2	8870.7	1091.0	1	3
16	9	-.2265	.2728	2.726	2799.2	365.62	4.8558E-04	438.7	2789.5	-61.9	225.1	8865.1	1091.0	1	3
17	9	-.2695	.2295	2.715	2794.5	371.85	4.9139E-04	[illegible]	2785.4	-107.5	197.6	8859.6	1091.0	1	3
18	9	-.3050	.1790	2.706	2790.6	377.04	4.9620E-04	442.8	2782.1	-147.1	159.4	8854.7	1091.0	1	3
19	9	-.3314	.1227	2.699	2787.7	380.93	4.9978E-04	444.1	2779.7	-178.0	112.0	8850.7	1091.0	1	3
20	9	-.3477	.0624	2.694	2785.9	383.34	5.0200E-04	445.0	2778.2	-197.6	57.8	8848.2	1091.0	1	3
21	9	-.3532	.0000	2.693	2785.3	384.16	5.0275E-04	445.2	2777.7	-204.3	.0	8847.3	1091.0	1	3
1	10	.4023	-.0000	2.887	2862.3	286.97	4.0884E-04	409.0	2852.2	240.2	-.0	8895.4	1091.0	1	3
2	10	.3981	.0558	2.887	2862.1	287.26	4.0915E-04	409.1	2851.9	239.9	15.9	8895.4	1091.0	1	3
3	10	.3857	.1104	2.885	2861.3	288.22	4.1011E-04	409.5	2851.1	238.7	32.1	8895.3	1091.0	1	3
4	10	.3653	.1627	2.881	2859.9	289.81	4.1171E-04	410.2	2849.7	236.6	49.1	8895.1	1091.0	1	3
5	10	.3372	.2117	2.876	2858.0	292.06	4.1400E-04	411.1	2847.7	233.1	67.0	8894.8	1091.0	1	3
6	10	.3021	.2562	2.869	2855.5	295.02	4.1698E-04	412.3	2845.1	227.8	86.0	8894.4	1091.0	1	3
7	10	.2604	.2952	2.861	2852.4	298.71	4.2069E-04	413.7	2841.9	220.1	106.2	8893.7	1091.0	1	3
8	10	.2131	.3280	2.851	2848.7	303.14	4.2512E-04	415.5	2838.1	209.2	127.4	8892.8	1091.0	1	3
9	10	.1609	.3537	2.840	2844.4	308.31	4.3027E-04	417.5	2833.8	194.2	149.1	8891.5	1091.0	1	3
10	10	.1049	.3716	2.827	2839.6	314.19	4.3609E-04	419.8	2829.1	174.4	170.4	8889.8	1091.0	1	3
11	10	.0460	.3810	2.814	2834.3	320.70	4.4249E-04	422.3	2823.9	149.2	190.2	8887.4	1091.0	1	3
12	10	-.0143	.3814	2.799	2828.6	327.71	4.4934E-04	425.0	2818.6	118.3	206.7	8884.3	1091.0	1	3
13	10	-.0749	.3723	2.784	2822.8	335.07	4.5647E-04	427.7	2813.1	82.0	218.1	8880.5	1091.0	1	3
14	10	-.1341	.3538	2.770	2816.9	342.54	4.6364E-04	430.5	2807.7	41.2	222.9	8875.8	1091.0	1	3
15	10	-.1904	.3256	2.756	2811.2	349.84	4.7060E-04	433.2	2802.6	-2.5	218.8	8870.6	1091.0	1	4
16	10	-.2419	.2881	2.743	2805.8	356.70	4.7708E-04	435.7	2798.0	-46.6	204.7	8865.0	1091.0	1	3
17	10	-.2871	.2422	2.731	2801.1	362.81	4.8282E-04	437.9	2793.9	-88.6	180.2	8859.5	1091.0	1	3
18	10	-.3242	.1887	2.722	2797.2	367.90	4.8757E-04	439.7	2790.6	-125.2	145.6	8854.6	1091.0	1	3
19	10	-.3518	.1293	2.715	2794.3	371.72	4.9112E-04	441.0	2788.2	-153.8	102.4	8850.6	1091.0	1	3
20	10	-.3689	.0657	2.710	2792.5	374.10	4.9332E-04	441.9	2766.7	-172.0	52.9	8848.1	1091.0	1	3
21	10	-.3746	.0000	2.709	2791.9	374.90	4.9406E-04	442.2	2786.2	-178.2	.0	8847.2	1091.0	1	3
1	D	.4430	-.0000	2.928	2877.1	270.06	3.9148E-04	402.0	2870.3	196.5	-.0	8895.5	1091.0	2	1
2	D	.4364	.0614	2.927	2876.8	270.33	3.9175E-04	402.1	2870.1	196.3	10.5	8895.5	1091.0	2	1
3	D	.4247	.1216	2.925	2876.1	271.13	3.9258E-04	402.4	2869.3	195.9	21.2	8895.4	1091.0	2	1
4	D	.4022	.1792	2.922	2874.9	272.49	3.9399E-04	403.0	2868.1	194.9	32.7	8895.2	1091.0	2	1
5	D	.3713	.2331	2.917	2873.2	274.45	3.9600E-04	403.8	2866.3	193.2	45.1	8894.9	1091.0	2	1
6	D	.3326	.2820	2.911	2870.9	277.03	3.9866E-04	404.9	2864.0	190.4	58.6	8894.5	1091.0	2	1
7	D	.2868	.3251	2.903	2868.0	280.30	4.0200E-04	406.3	2861.1	185.9	73.4	8893.8	1091.0	2	1
8	D	.2346	.3612	2.893	2864.6	284.27	4.0605E-04	407.9	2857.6	179.2	89.4	8892.9	1091.0	2	1
9	D	.1771	.3894	2.883	2860.5	288.97	4.1082E-04	409.9	2853.5	169.4	106.3	8891.7	1091.0	2	3
10	D	.1154	.4090	2.870	2855.9	294.39	4.1629E-04	412.1	2848.9	155.9	123.6	8889.9	1091.0	2	3

Figure 9. Continued.

SOLUTION PLANE NO. 1.   X= 1.04592(FT)   FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
11	D	.0507	.4192	2.857	2850.7	300.48	4.2238E-04	414.5	2843.9	138.0	140.2	8887.6	1091.0	2	3
12	D	-.0158	.4195	2.842	2845.2	307.10	4.2897E-04	417.2	2838.6	115.4	154.9	8884.5	1091.0	2	3
13	D	-.0823	.4094	2.827	2839.3	314.17	4.3595E-04	419.9	2833.1	88.2	166.3	8880.7	1091.0	2	3
14	D	-.1474	.3809	2.812	2833.4	321.37	4.4300E-04	422.7	2827.6	56.7	172.5	8876.2	1091.0	2	3
15	D	-.2092	.3578	2.797	2827.6	328.54	4.4996E-04	425.5	2822.3	22.0	171.8	8871.0	1091.0	2	3
16	D	-.2659	.3166	2.783	2822.2	335.29	4.5646E-04	428.0	2817.4	-13.9	162.9	8865.6	1091.0	2	3
17	D	-.3154	.2661	2.771	2817.3	341.34	4.6224E-04	430.3	2813.2	-48.6	145.0	8860.2	1091.0	2	3
18	D	-.3561	.2073	2.761	2813.3	346.40	4.6706E-04	432.2	2809.7	-79.5	118.2	8855.3	1091.0	2	3
19	D	-.3864	.1421	2.753	2810.3	350.21	4.7067E-04	433.6	2807.1	-103.8	83.7	8851.4	1091.0	2	3
20	D	-.4051	.0722	2.749	2808.4	352.59	4.7290E-04	434.4	2805.6	-119.5	43.4	8848.9	1091.0	2	3
21	D	-.4115	.0000	2.747	2807.8	353.39	4.7366E-04	434.7	2805.0	-124.9	.0	8848.0	1091.0	2	3

MASS FLOW RATE FOR ENTIRE PLANE= 5.93176E-01(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I=21; J= 1   SAFETY FACTOR= 9.987241E-01   DELTA-X= 4.464629E-02(FT)

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.3527	.0000	2.769	2816.5	343.42	4.6479E-04	430.5	2773.7	489.1	.0	8891.6	1090.9	1	2
2	1	.3509	.0346	2.769	2816.4	343.51	4.6488E-04	430.6	2773.6	487.9	35.8	8891.5	1090.9	1	2
3	1	.3458	.0693	2.769	2816.2	343.78	4.6514E-04	430.7	2773.3	484.3	71.9	8891.3	1090.9	1	2
4	1	.3370	.1039	2.768	2815.8	344.25	4.6559E-04	430.8	2772.8	478.1	108.8	8890.8	1090.8	1	2
5	1	.3243	.1385	2.766	2815.2	344.96	4.6626E-04	431.1	2772.0	468.8	146.7	8890.1	1090.8	1	2
6	1	.3074	.1728	2.764	2814.4	345.94	4.6721E-04	431.5	2771.0	456.0	186.0	8889.1	1090.8	1	2
7	1	.2859	.2065	2.762	2813.3	347.27	4.6848E-04	431.9	2769.7	438.7	226.7	8887.3	1090.8	1	2
8	1	.2592	.2392	2.758	2811.9	349.02	4.7015E-04	432.6	2767.9	415.9	269.0	8885.6	1090.8	1	2
9	1	.2268	.2701	2.754	2810.0	351.30	4.7232E-04	433.4	2765.8	386.3	312.4	8882.8	1090.7	1	2
10	1	.1883	.2982	2.748	2807.7	354.22	4.7509E-04	434.5	2763.1	348.4	356.2	8879.2	1090.6	1	2
11	1	.1435	.3222	2.741	2804.7	357.91	4.7858E-04	435.8	2759.9	300.2	399.0	8874.6	1090.6	1	2
12	1	.0922	.3404	2.732	2801.0	362.47	4.8288E-04	437.4	2756.0	240.2	438.4	8868.9	1090.5	1	2
13	1	.0349	.3509	2.722	2796.7	367.96	4.8804E-04	439.3	2751.6	167.1	470.9	8862.5	1090.4	1	2
14	1	-.0272	.3516	2.710	2791.7	374.38	4.9401E-04	441.6	2746.8	80.8	492.0	8855.7	1090.3	1	2
15	1	-.0922	.3404	2.698	2786.3	381.53	5.0065E-04	444.1	2741.7	-16.9	496.3	8849.0	1090.3	1	2
16	1	-.1573	.3156	2.684	2780.6	389.17	5.0770E-04	446.7	2736.4	-122.1	478.2	8842.7	1090.3	1	2
17	1	-.2191	.2764	2.671	2775.0	396.83	5.1474E-04	449.2	2731.4	-228.5	433.4	8837.3	1090.2	1	2
18	1	-.2734	.2228	2.659	2770.0	403.69	5.2119E-04	451.6	2727.0	-327.2	359.7	8833.2	1090.3	1	2
19	1	-.3160	.1566	2.650	2766.0	409.64	5.2642E-04	453.4	2723.5	-407.9	258.4	8830.4	1090.3	1	2
20	1	-.3433	.0809	2.644	2763.4	413.41	5.2984E-04	454.7	2721.3	-461.1	135.2	8828.9	1090.3	1	2
21	1	-.3527	.0000	2.642	2762.5	414.73	5.3102E-04	455.1	2720.5	-479.7	.0	8828.4	1090.3	1	2
1	2	.3831	.0000	2.770	2817.1	342.89	4.6428E-04	430.4	2779.1	461.3	.0	8894.6	1091.0	1	2
2	2	.3809	.0408	2.770	2817.0	343.01	4.6438E-04	430.4	2779.0	460.3	33.9	8894.5	1091.0	1	2
3	2	.3741	.0813	2.770	2816.7	343.35	4.6472E-04	430.5	2778.6	457.1	68.2	8894.3	1091.0	1	2
4	2	.3627	.1215	2.768	2816.3	343.95	4.6529E-04	430.7	2777.9	451.6	103.3	8893.9	1091.0	1	2
5	2	.3465	.1610	2.767	2815.6	344.83	4.6614E-04	431.1	2776.9	443.4	139.5	8893.3	1091.0	1	2
6	2	.3252	.1994	2.764	2814.6	346.04	4.6730E-04	431.5	2775.7	431.6	177.2	8892.5	1090.9	1	2
7	2	.2986	.2364	2.761	2813.3	347.64	4.6884E-04	432.1	2774.0	415.6	216.4	8891.5	1090.9	1	2
8	2	.2664	.2712	2.757	2811.7	349.72	4.7082E-04	432.8	2772.0	394.3	257.1	8890.1	1090.9	1	2
9	2	.2282	.3031	2.752	2809.7	352.35	4.7333E-04	433.8	2769.6	366.2	298.9	8888.4	1090.9	1	2
10	2	.1840	.3309	2.746	2807.1	355.64	4.7645E-04	434.9	2766.7	329.9	340.9	8886.1	1090.9	1	2
11	2	.1336	.3534	2.738	2804.0	359.68	4.8027E-04	436.4	2763.4	283.8	381.7	8883.3	1090.9	1	2
12	2	.0773	.3690	2.729	2800.3	364.52	4.8483E-04	438.1	2759.5	226.5	418.7	8879.8	1090.9	1	2
13	2	.0160	.3758	2.719	2796.0	370.20	4.9015E-04	440.1	2755.3	156.8	448.9	8875.7	1090.8	1	2
14	2	-.0490	.3722	2.708	2791.2	376.63	4.9615E-04	442.3	2750.7	74.8	467.7	8871.1	1090.8	1	2
15	2	-.1157	.3564	2.695	2786.0	383.63	5.0264E-04	444.7	2746.0	-17.4	470.3	8866.1	1090.8	1	2
16	2	-.1814	.3271	2.683	2780.7	390.96	5.0939E-04	447.2	2741.2	-116.2	451.9	8861.0	1090.9	1	2
17	2	-.2426	.2839	2.670	2775.5	398.18	5.1600E-04	449.6	2736.8	-215.5	408.4	8856.0	1090.9	1	2
18	2	-.2957	.2272	2.659	2770.8	404.72	5.2196E-04	451.8	2732.9	-307.2	338.0	8851.6	1090.9	1	2
19	2	-.3370	.1588	2.651	2767.1	410.00	5.2674E-04	453.5	2729.8	-381.9	242.3	8848.2	1090.9	1	2
20	2	-.3632	.0817	2.645	2764.7	413.43	5.2985E-04	454.7	2727.9	-431.0	126.7	8846.0	1090.9	1	2
21	2	-.3722	.0000	2.643	2763.8	414.63	5.3093E-04	455.1	2727.2	-448.2	.0	8845.2	1090.9	1	2
1	3	.4176	.0000	2.773	2818.3	341.41	4.6284E-04	429.8	2784.3	436.5	.0	8895.0	1091.0	1	2
2	3	.4147	.0472	2.773	2818.2	341.55	4.6298E-04	429.9	2784.1	435.6	32.2	8895.0	1091.0	1	2
3	3	.4063	.0939	2.772	2817.8	341.97	4.6338E-04	430.0	2783.7	432.7	64.9	8894.8	1091.0	1	2
4	3	.3921	.1399	2.771	2817.3	342.69	4.6408E-04	430.3	2782.9	427.6	98.4	8894.4	1091.0	1	2
5	3	.3721	.1845	2.769	2816.4	343.74	4.6509E-04	430.7	2781.8	419.9	133.1	8894.0	1091.0	1	2
6	3	.3462	.2273	2.766	2815.3	345.17	4.6646E-04	431.2	2780.4	408.7	169.4	8893.3	1091.0	1	2
7	3	.3143	.2677	2.762	2813.9	347.02	4.6824E-04	431.8	2778.6	393.2	207.2	8892.5	1091.0	1	2
8	3	.2762	.3048	2.758	2812.1	349.37	4.7049E-04	432.7	2776.4	372.4	246.3	8891.5	1091.0	1	2
9	3	.2319	.3378	2.752	2809.8	352.30	4.7328E-04	433.7	2773.8	344.9	286.4	8890.1	1091.0	1	2
10	3	.1815	.3655	2.746	2807.1	355.88	4.7669E-04	435.0	2770.8	309.3	326.4	8888.4	1091.0	1	2
11	3	.1252	.3867	2.738	2803.8	360.18	4.8076E-04	436.6	2767.4	264.2	364.6	8886.3	1091.0	1	2
12	3	.0636	.3997	2.728	2800.1	365.22	4.8550E-04	438.3	2763.7	208.5	398.7	8883.7	1091.0	1	2
13	3	-.0023	.4030	2.718	2795.8	370.99	4.9091E-04	440.4	2759.6	141.5	425.4	8880.5	1091.0	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
14	3	-.0709	.3952	2.707	2791.1	377.37	4.9685E-04	442.6	2755.3	63.7	440.9	8876.9	1091.0	1	2
15	3	-.1399	.3747	2.695	2786.1	384.18	5.0316E-04	444.9	2750.9	-22.7	440.8	8872.7	1091.1	1	2
16	3	-.2067	.3409	2.683	2781.1	391.15	5.0957E-04	447.3	2746.6	-114.2	420.9	8868.2	1091.1	1	2
17	3	-.2681	.2934	2.671	2776.2	397.87	5.1572E-04	449.5	2742.7	-205.1	378.2	8863.7	1091.1	1	2
18	3	-.3206	.2333	2.661	2772.0	403.87	5.2117E-04	451.5	2739.3	-288.0	311.4	8859.6	1091.2	1	2
19	3	-.3610	.1622	2.653	2768.6	408.63	5.2548E-04	453.1	2736.8	-355.1	222.4	8856.3	1091.2	1	2
20	3	-.3864	.0832	2.648	2766.5	411.71	5.2826E-04	454.1	2735.1	-399.0	116.0	8854.1	1091.2	1	2
21	3	-.3952	.0000	2.647	2765.7	412.77	5.2922E-04	454.5	2734.6	-414.2	.0	8853.4	1091.2	1	2
1	4	.4544	.0000	2.778	2820.2	338.95	4.6046E-04	428.9	2789.7	413.9	.0	8895.6	1091.0	1	2
2	4	.4510	.0537	2.778	2820.1	339.12	4.6063E-04	429.0	2789.5	413.0	30.6	8895.5	1091.0	1	2
3	4	.4408	.1068	2.777	2819.7	339.65	4.6113E-04	429.2	2788.9	410.4	61.6	8895.4	1091.0	1	2
4	4	.4237	.1586	2.775	2819.0	340.53	4.6198E-04	429.5	2788.0	405.7	93.6	8895.1	1091.0	1	2
5	4	.3999	.2085	2.773	2818.0	341.78	4.6320E-04	430.0	2786.8	398.4	126.8	8894.6	1091.0	1	2
6	4	.3693	.2557	2.769	2816.7	343.45	4.6480E-04	430.6	2785.2	387.8	161.5	8894.1	1091.0	1	2
7	4	.3320	.2995	2.765	2815.1	345.56	4.6682E-04	431.3	2783.2	372.9	197.7	8893.3	1091.0	1	2
8	4	.2881	.3390	2.760	2813.1	348.16	4.6932E-04	432.3	2780.9	352.6	235.2	8892.3	1091.0	1	2
9	4	.2377	.3732	2.754	2810.6	351.32	4.7234E-04	433.4	2778.3	325.6	273.4	8891.0	1091.0	1	2
10	4	.1811	.4009	2.747	2807.8	355.08	4.7592E-04	434.7	2775.3	290.8	311.0	8889.4	1091.0	1	2
11	4	.1189	.4209	2.739	2804.4	359.49	4.8010E-04	436.3	2772.0	246.9	346.5	8887.3	1091.0	1	2
12	4	.0519	.4317	2.730	2800.6	364.55	4.8487E-04	438.1	2768.3	193.0	377.4	8884.7	1091.0	1	2
13	4	-.0187	.4318	2.719	2796.4	370.25	4.9021E-04	440.1	2764.5	129.0	400.8	8881.4	1091.0	1	2
14	4	-.0911	.4203	2.708	2791.8	376.43	4.9597E-04	442.3	2760.5	55.4	413.0	8877.7	1091.1	1	2
15	4	-.1630	.3956	2.697	2787.0	382.94	5.0199E-04	444.5	2756.5	-25.4	410.4	8873.3	1091.1	1	2
16	4	-.2317	.3574	2.686	2782.3	389.49	5.0802E-04	446.7	2752.7	-109.7	389.3	8868.7	1091.1	1	2
17	4	-.2940	.3058	2.675	2777.8	395.73	5.1373E-04	448.9	2749.2	-192.4	347.6	8864.1	1091.2	1	2
18	4	-.3468	.2419	2.666	2773.9	401.22	5.1872E-04	450.7	2746.3	-267.0	284.7	8859.9	1091.2	1	2
19	4	-.3871	.1676	2.658	2770.8	405.55	5.2264E-04	452.1	2744.0	-326.7	202.4	8856.6	1091.2	1	2
20	4	-.4123	.0857	2.654	2768.9	408.32	5.2514E-04	453.1	2742.6	-365.5	105.2	8854.4	1091.3	1	2
21	4	-.4209	.0000	2.652	2768.2	409.28	5.2600E-04	453.4	2742.1	-378.9	.0	8853.6	1091.3	1	2
1	5	.4927	.0000	2.784	2822.6	335.83	4.5744E-04	427.8	2795.1	393.5	.0	8896.2	1091.0	1	2
2	5	.4887	.0604	2.784	2822.5	336.02	4.5762E-04	427.9	2794.9	392.7	29.0	8896.1	1091.0	1	2
3	5	.4767	.1199	2.783	2822.0	336.59	4.5817E-04	428.1	2794.3	390.2	58.6	8895.9	1091.0	1	2
4	5	.4568	.1776	2.781	2821.3	337.56	4.5911E-04	428.4	2793.4	385.7	88.9	8895.6	1091.0	1	2
5	5	.4290	.2328	2.778	2820.2	338.95	4.6045E-04	428.9	2792.0	378.7	120.6	8895.2	1091.0	1	2
6	5	.3937	.2845	2.774	2818.8	340.79	4.6223E-04	429.6	2790.3	368.4	153.6	8894.5	1091.0	1	2
7	5	.3510	.3317	2.770	2816.9	343.12	4.6447E-04	430.5	2788.3	354.0	188.1	8893.7	1091.0	1	2
8	5	.3012	.3736	2.764	2814.7	345.96	4.6721E-04	431.5	2785.8	334.4	223.7	8892.6	1091.0	1	2
9	5	.2447	.4090	2.758	2812.1	349.36	4.7046E-04	432.7	2783.1	308.3	259.8	8891.1	1091.0	1	2
10	5	.1820	.4369	2.750	2809.1	353.33	4.7424E-04	434.1	2780.0	274.6	295.2	8889.3	1091.0	1	2
11	5	.1139	.4559	2.742	2805.6	357.87	4.7855E-04	435.8	2776.7	232.2	328.1	8887.0	1091.0	1	2
12	5	.0415	.4647	2.733	2801.8	362.96	4.8335E-04	437.6	2773.2	180.6	356.1	8884.1	1091.0	1	2
13	5	-.0338	.4620	2.722	2797.5	368.55	4.8860E-04	439.5	2769.5	119.7	376.5	8880.6	1091.0	1	2
14	5	-.1103	.4469	2.712	2793.1	374.47	4.9412E-04	441.6	2765.9	50.5	386.1	8876.5	1091.0	1	2
15	5	-.1854	.4183	2.701	2788.6	380.59	4.9979E-04	443.7	2762.3	-24.6	381.4	8871.8	1091.0	1	2
16	5	-.2564	.3759	2.690	2784.2	386.64	5.0536E-04	445.8	2758.9	-102.2	359.7	8866.9	1091.1	1	2
17	5	-.3203	.3202	2.680	2780.0	392.30	5.1054E-04	447.7	2755.9	-177.4	319.3	8862.0	1091.1	1	2
18	5	-.3740	.2523	2.672	2776.5	397.23	5.1503E-04	449.4	2753.4	-244.5	260.2	8857.6	1091.1	1	2
19	5	-.4147	.1743	2.665	2773.7	401.06	5.1850E-04	450.7	2751.5	-297.8	184.2	8854.0	1091.1	1	2
20	5	-.4402	.0890	2.661	2772.0	403.50	5.2071E-04	451.5	2750.4	-332.1	95.5	8851.7	1091.2	1	2
21	5	-.4488	.0000	2.660	2771.4	404.34	5.2146E-04	451.8	2750.0	-343.9	.0	8851.0	1091.2	1	2
1	6	.5352	.0000	2.789	2824.6	333.28	4.5493E-04	426.9	2799.5	375.8	.0	8894.9	1091.0	1	2
2	6	.5306	.0672	2.789	2824.5	333.44	4.5509E-04	426.9	2799.3	374.9	27.9	8894.9	1091.0	1	2
3	6	.5168	.1332	2.788	2824.1	333.93	4.5556E-04	427.1	2798.9	372.1	56.2	8894.7	1091.0	1	2
4	6	.4941	.1972	2.786	2823.4	334.77	4.5638E-04	427.4	2798.1	367.2	85.2	8894.5	1091.0	1	2
5	6	.4625	.2579	2.784	2822.4	336.01	4.5758E-04	427.9	2797.1	359.7	115.1	8894.1	1091.0	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
6	6	.4225	.3143	2.780	2821.1	337.68	4.5919E-04	428.5	2795.6	349.1	146.1	8893.5	1091.0	1	2
7	6	.3745	.3654	2.776	2819.4	339.84	4.6128E-04	429.3	2793.8	334.6	178.1	8892.8	1091.0	1	2
8	6	.3188	.4102	2.771	2817.3	342.53	4.6388E-04	430.3	2791.7	315.3	211.0	8891.8	1091.0	1	2
9	6	.2560	.4474	2.765	2814.8	345.80	4.6702E-04	431.5	2789.2	290.1	244.0	8890.4	1091.0	1	2
10	6	.1871	.4759	2.757	2811.8	349.66	4.7071E-04	432.9	2786.3	257.9	276.1	8888.6	1091.0	1	2
11	6	.1127	.4944	2.749	2808.4	354.11	4.7495E-04	434.4	2783.2	217.9	305.8	8886.2	1091.0	1	2
12	6	.0344	.5018	2.739	2804.6	359.09	4.7966E-04	436.2	2779.8	169.6	330.8	8883.2	1091.0	1	2
13	6	-.0464	.4967	2.729	2800.4	364.55	4.8480E-04	438.2	2776.3	113.1	348.5	8879.5	1091.0	1	2
14	6	-.1278	.4785	2.715	2796.1	370.27	4.9016E-04	440.2	2772.9	49.3	356.1	8875.1	1091.0	1	2
15	6	-.2071	.4462	2.708	2791.7	376.13	4.9561E-04	442.2	2769.5	-19.6	350.6	8870.1	1091.0	1	2
16	6	-.2816	.3996	2.698	2787.4	381.85	5.0089E-04	444.2	2766.4	-90.3	329.4	8864.8	1091.0	1	2
17	6	-.3483	.3394	2.689	2783.5	387.14	5.0574E-04	446.0	2763.7	-158.4	291.5	8859.6	1091.0	1	2
18	6	-.4041	.2668	2.681	2780.1	391.69	5.0990E-04	447.6	2761.4	-218.7	236.8	8854.9	1091.0	1	2
19	6	-.4462	.1840	2.675	2777.6	395.21	5.1310E-04	448.8	2759.7	-266.4	167.2	8851.2	1091.0	1	2
20	6	-.4725	.0939	2.671	2776.0	397.43	5.1511E-04	449.6	2758.7	-297.0	86.6	8848.8	1091.0	1	2
21	6	-.4814	.0000	2.670	2775.4	398.19	5.1580E-04	449.8	2758.3	-307.6	.0	8847.9	1091.0	1	2
1	7	.5815	.0000	2.797	2828.0	328.99	4.5067E-04	425.4	2805.5	356.1	.0	8892.1	1091.1	1	2
2	7	.5765	.0738	2.797	2827.8	329.17	4.5084E-04	425.4	2805.3	355.1	26.6	8892.1	1091.1	1	2
3	7	.5612	.1463	2.796	2827.4	329.72	4.5138E-04	425.6	2804.8	352.3	53.5	8892.0	1091.1	1	2
4	7	.5360	.2164	2.794	2826.7	330.63	4.5226E-04	426.0	2804.1	347.3	80.9	8891.8	1091.1	1	2
5	7	.5011	.2829	2.792	2825.7	331.91	4.5351E-04	426.5	2803.0	339.7	109.0	8891.5	1091.1	1	2
6	7	.4569	.3445	2.788	2824.4	333.57	4.5512E-04	427.1	2801.7	329.0	137.8	8891.0	1091.1	1	2
7	7	.4039	.4001	2.784	2822.7	335.63	4.5712E-04	427.8	2800.2	314.6	167.2	8890.4	1091.1	1	2
8	7	.3426	.4485	2.779	2820.8	338.11	4.5952E-04	428.7	2798.3	295.7	196.9	8889.6	1091.1	1	2
9	7	.2737	.4885	2.773	2818.5	341.06	4.6237E-04	429.8	2796.2	271.4	226.3	8888.5	1091.1	1	2
10	7	.1982	.5187	2.767	2815.8	344.50	4.6567E-04	431.1	2793.9	241.0	254.5	8886.9	1091.1	1	2
11	7	.1171	.5380	2.759	2812.7	348.45	4.6945E-04	432.5	2791.3	203.9	280.1	8884.7	1091.1	1	2
12	7	.0319	.5450	2.751	2809.3	352.68	4.7366E-04	434.1	2788.5	159.7	301.2	8881.9	1091.1	1	2
13	7	-.0556	.5385	2.742	2805.5	357.75	4.7828E-04	435.9	2785.6	108.5	315.7	8878.2	1091.1	1	2
14	7	-.1433	.5178	2.732	2801.5	362.90	4.8312E-04	437.7	2782.6	51.2	321.2	8873.8	1091.0	1	2
15	7	-.2286	.4819	2.722	2797.5	368.22	4.8809E-04	439.6	2779.6	-10.3	315.1	8868.8	1091.0	1	2
16	7	-.3084	.4308	2.713	2793.5	373.43	4.9293E-04	441.4	2776.9	-73.2	295.4	8863.4	1091.0	1	2
17	7	-.3796	.3653	2.704	2789.8	378.28	4.9741E-04	443.1	2774.4	-133.7	260.8	8858.1	1091.0	1	2
18	7	-.4390	.2868	2.696	2786.7	382.47	5.0126E-04	444.6	2772.3	-187.2	211.5	8853.3	1091.0	1	2
19	7	-.4838	.1976	2.690	2784.2	385.70	5.0423E-04	445.7	2770.8	-229.3	149.2	8849.5	1091.0	1	2
20	7	-.5117	.1008	2.687	2782.7	387.75	5.0610E-04	446.4	2769.8	-256.4	77.2	8847.0	1091.0	1	2
21	7	-.5212	.0000	2.686	2782.2	388.46	5.0674E-04	446.7	2769.5	-265.7	.0	8846.1	1091.0	1	2
1	8	.6235	-.0000	2.811	2833.4	322.17	4.4393E-04	422.9	2813.6	334.0	.0	8890.4	1091.1	1	2
2	8	.6180	.0796	2.810	2833.1	322.44	4.4420E-04	423.0	2813.4	333.2	24.8	8890.3	1091.1	1	2
3	8	.6014	.1579	2.809	2832.5	323.24	4.4499E-04	423.3	2812.7	330.9	50.0	8890.2	1091.1	1	2
4	8	.5741	.2335	2.806	2831.5	324.55	4.4627E-04	423.8	2811.5	326.6	75.8	8890.0	1091.1	1	2
5	8	.5363	.3050	2.803	2830.1	326.31	4.4799E-04	424.4	2810.1	319.9	102.4	8889.7	1091.1	1	2
6	8	.4885	.3713	2.798	2828.4	328.48	4.5010E-04	425.2	2808.3	310.2	129.7	8889.3	1091.1	1	2
7	8	.4311	.4311	2.793	2826.4	330.99	4.5256E-04	426.2	2806.3	296.7	157.5	8888.7	1091.1	1	2
8	8	.3649	.4829	2.787	2824.1	333.83	4.5531E-04	427.2	2804.2	278.8	185.3	8887.9	1091.1	1	2
9	8	.2906	.5256	2.781	2821.7	336.96	4.5834E-04	428.4	2802.0	255.7	212.4	8886.8	1091.1	1	2
10	8	.2092	.5577	2.775	2819.0	340.37	4.6163E-04	429.6	2799.7	226.9	237.9	8885.2	1091.1	1	2
11	8	.1220	.5779	2.767	2816.1	344.07	4.6518E-04	431.0	2797.4	192.1	260.4	8883.1	1091.1	1	2
12	8	.0306	.5849	2.760	2812.9	348.03	4.6896E-04	432.4	2795.1	151.0	276.3	8880.2	1091.1	1	2
13	8	-.0632	.5773	2.752	2809.6	352.26	4.7298E-04	434.0	2792.7	104.1	289.8	8876.6	1091.1	1	2
14	8	-.1570	.5545	2.743	2806.2	356.62	4.7709E-04	435.6	2790.4	52.1	293.0	8872.3	1091.1	1	2
15	8	-.2480	.5155	2.735	2802.7	361.06	4.8126E-04	437.2	2788.1	-3.0	285.7	8867.3	1091.1	1	2
16	8	-.3330	.4605	2.727	2799.4	365.38	4.8529E-04	438.7	2786.0	-58.9	266.4	8862.1	1091.0	1	2
17	8	-.4087	.3902	2.719	2796.2	369.38	4.8901E-04	440.2	2784.2	-112.2	234.2	8856.9	1091.0	1	2
18	8	-.4718	.3061	2.713	2793.6	372.84	4.9220E-04	441.4	2782.6	-159.2	189.4	8852.3	1091.0	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
19	8	-.5193	.2108	2.708	2791.5	375.51	4.9466E-04	442.3	2761.4	-196.2	133.3	8848.5	1091.0	1	2
20	8	-.5488	.1075	2.705	2790.2	377.21	4.9622E-04	442.9	2780.7	-219.8	68.9	8846.1	1091.0	1	2
21	8	-.5588	.0000	2.704	2789.8	377.78	4.9675E-04	443.1	2780.4	-228.0	-.0	8845.3	1091.0	1	2
1	9	.6643	-.0000	2.827	2839.6	314.32	4.3616E-04	419.9	2822.5	311.2	.0	8889.6	1091.1	1	2
2	9	.6584	.0852	2.826	2839.3	314.67	4.3651E-04	420.1	2822.2	310.7	22.9	8889.5	1091.1	1	2
3	9	.6407	.1689	2.824	2838.5	315.72	4.3755E-04	420.5	2821.3	308.9	46.1	8889.5	1091.1	1	2
4	9	.6114	.2497	2.821	2837.1	317.43	4.3923E-04	421.1	2819.8	305.6	70.2	8889.3	1091.2	1	2
5	9	.5709	.3262	2.816	2835.3	319.72	4.4149E-04	422.0	2817.8	300.1	95.1	8889.0	1091.2	1	2
6	9	.5196	.3970	2.810	2833.1	322.51	4.4423E-04	423.0	2815.4	291.8	121.0	8888.6	1091.2	1	2
7	9	.4581	.4607	2.804	2830.5	325.70	4.4735E-04	424.2	2812.8	279.9	147.5	8888.0	1091.2	1	2
8	9	.3873	.5159	2.797	2827.8	329.19	4.5076E-04	425.5	2810.0	263.7	174.1	8887.2	1091.2	1	2
9	9	.3076	.5613	2.789	2824.8	332.90	4.5437E-04	426.9	2807.3	242.3	199.9	8886.1	1091.2	1	2
10	9	.2209	.5954	2.782	2821.8	336.75	4.5810E-04	428.3	2804.6	215.3	223.9	8884.5	1091.1	1	2
11	9	.1278	.6168	2.774	2818.7	340.69	4.6189E-04	429.8	2802.1	182.5	244.7	8882.3	1091.1	1	2
12	9	.0302	.6240	2.766	2815.5	344.65	4.6569E-04	431.2	2799.7	144.0	260.7	8879.4	1091.1	1	2
13	9	-.0698	.6157	2.758	2812.4	348.63	4.6948E-04	432.7	2797.5	100.3	270.3	8875.8	1091.1	1	2
14	9	-.1697	.5911	2.751	2809.3	352.52	4.7316E-04	434.1	2795.6	52.4	271.8	8871.5	1091.1	1	2
15	9	-.2665	.5493	2.743	2806.2	356.32	4.7673E-04	435.5	2793.8	2.1	263.5	8866.7	1091.1	1	2
16	9	-.3569	.4905	2.736	2803.4	359.89	4.8007E-04	436.8	2792.3	-48.3	244.3	8861.7	1091.0	1	2
17	9	-.4374	.4154	2.730	2800.8	363.12	4.8308E-04	438.0	2791.0	-96.0	213.7	8856.7	1091.0	1	2
18	9	-.5043	.3258	2.725	2798.7	365.87	4.8562E-04	439.0	2790.0	-137.7	172.0	8852.3	1091.0	1	2
19	9	-.5547	.2243	2.721	2797.0	367.96	4.8755E-04	439.8	2789.2	-170.2	120.7	8848.8	1091.0	1	2
20	9	-.5860	.1143	2.719	2796.0	369.28	4.8876E-04	440.2	2788.7	-191.0	62.3	8846.5	1091.0	1	2
21	9	-.5966	.0000	2.718	2795.6	369.73	4.8918E-04	440.4	2788.6	-198.1	.0	8845.8	1091.0	1	2
1	10	.7033	-.0000	2.842	2845.3	307.33	4.2922E-04	417.2	2830.4	291.2	-.0	8889.5	1091.1	1	2
2	10	.6970	.0903	2.841	2845.0	307.71	4.2960E-04	417.4	2830.0	290.8	21.0	8889.5	1091.1	1	2
3	10	.6782	.1791	2.839	2844.1	308.85	4.3073E-04	417.8	2829.0	289.4	42.5	8889.4	1091.1	1	2
4	10	.6471	.2649	2.835	2842.5	310.71	4.3257E-04	418.5	2827.3	286.6	64.7	8889.3	1091.1	1	2
5	10	.6040	.3460	2.829	2840.5	313.24	4.3508E-04	419.5	2825.1	282.0	87.9	8889.0	1091.1	1	2
6	10	.5496	.4210	2.823	2838.0	316.37	4.3817E-04	420.7	2822.4	274.9	112.2	8888.6	1091.1	1	2
7	10	.4844	.4886	2.815	2835.0	319.99	4.4174E-04	422.1	2819.3	264.4	137.2	8888.0	1091.2	1	2
8	10	.4091	.5471	2.807	2831.6	324.00	4.4568E-04	423.6	2816.1	249.6	162.5	8887.2	1091.1	1	2
9	10	.3249	.5951	2.798	2828.4	328.26	4.4984E-04	425.2	2812.8	230.4	187.3	8886.0	1091.1	1	2
10	10	.2327	.6312	2.790	2824.9	332.66	4.5412E-04	426.8	2809.6	205.5	210.3	8884.3	1091.1	1	2
11	10	.1340	.6538	2.781	2821.4	337.06	4.5839E-04	428.5	2806.6	174.9	230.2	8882.1	1091.1	1	2
12	10	.0305	.6614	2.772	2818.0	341.42	4.6257E-04	430.1	2803.8	138.8	245.5	8879.2	1091.1	1	2
13	10	-.0754	.6526	2.764	2814.6	345.63	4.6659E-04	431.6	2801.4	97.7	254.4	8875.7	1091.1	1	2
14	10	-.1813	.6264	2.756	2811.5	349.57	4.7033E-04	433.1	2799.3	52.8	255.4	8871.4	1091.1	1	2
15	10	-.2838	.5821	2.749	2808.5	353.27	4.7382E-04	434.4	2797.6	5.9	247.0	8866.8	1091.0	1	2
16	10	-.3796	.5197	2.742	2805.8	356.63	4.7696E-04	435.7	2796.2	-40.8	228.4	8862.0	1091.0	1	2
17	10	-.4647	.4401	2.737	2803.5	359.56	4.7970E-04	436.8	2795.1	-84.7	199.2	8857.3	1091.0	1	2
18	10	-.5356	.3452	2.732	2801.5	361.99	4.8196E-04	437.7	2794.3	-122.8	159.9	8853.1	1091.0	1	2
19	10	-.5890	.2376	2.729	2800.1	363.82	4.8365E-04	438.3	2793.7	-152.4	112.0	8849.9	1091.0	1	2
20	10	-.6221	.1211	2.726	2799.2	364.95	4.8469E-04	438.7	2793.3	-171.3	57.7	8847.8	1091.0	1	2
21	10	-.6333	.0000	2.726	2798.8	365.34	4.8504E-04	438.9	2793.2	-177.7	.0	8847.1	1091.0	1	2
1	11	.7402	-.0000	2.855	2850.5	301.06	4.2296E-04	414.8	2837.3	273.6	-.0	8889.9	1091.1	1	2
2	11	.7335	.0952	2.855	2850.2	301.43	4.2332E-04	414.9	2837.0	273.2	19.3	8889.9	1091.1	1	2
3	11	.7137	.1887	2.852	2849.3	302.52	4.2441E-04	415.3	2836.0	271.9	39.0	8889.8	1091.1	1	2
4	11	.6809	.2790	2.848	2847.8	304.32	4.2622E-04	416.0	2834.4	269.3	59.4	8889.6	1091.1	1	2
5	11	.6355	.3645	2.843	2845.7	306.82	4.2871E-04	417.0	2832.2	265.2	80.7	8889.4	1091.1	1	2
6	11	.5781	.4435	2.836	2843.1	309.96	4.3183E-04	418.2	2829.4	258.9	103.0	8889.0	1091.1	1	2
7	11	.5094	.5147	2.828	2840.1	313.68	4.3552E-04	419.7	2826.3	249.6	126.2	8888.4	1091.1	1	2
8	11	.4302	.5763	2.820	2836.7	317.89	4.3968E-04	421.3	2822.8	236.6	149.9	8887.5	1091.1	1	2
9	11	.3414	.6269	2.810	2833.0	322.47	4.4417E-04	423.0	2819.2	219.1	173.3	8886.3	1091.1	1	2
10	11	.2443	.6649	2.800	2829.1	327.28	4.4887E-04	424.9	2815.5	196.5	195.4	8884.6	1091.1	1	2

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
11	11	.1404	.6888	2.790	2825.2	332.18	4.5364E-04	426.7	2812.0	168.3	214.8	8882.3	1091.1	1	2
12	11	.0314	.6968	2.781	2821.3	337.03	4.5832E-04	428.5	2808.7	134.8	229.8	8879.4	1091.1	1	2
13	11	-.0802	.6876	2.771	2817.6	341.72	4.6282E-04	430.2	2805.8	96.3	238.9	8875.9	1091.1	1	2
14	11	-.1917	.6601	2.763	2814.1	346.07	4.6697E-04	431.8	2803.3	54.1	240.3	8871.8	1091.0	1	2
15	11	-.2999	.6134	2.755	2810.9	350.07	4.7076E-04	433.3	2801.3	9.9	232.6	8867.4	1091.0	1	2
16	11	-.4008	.5477	2.748	2808.1	353.64	4.7412E-04	434.6	2799.6	-34.1	215.2	8862.8	1091.0	1	2
17	11	-.4905	.4639	2.742	2805.6	356.69	4.7698E-04	435.7	2798.3	-75.4	187.7	8858.3	1091.0	1	2
18	11	-.5653	.3638	2.737	2803.7	359.16	4.7928E-04	436.7	2797.4	-111.2	150.6	8854.5	1091.0	1	2
19	11	-.6215	.2504	2.734	2802.2	360.99	4.8098E-04	437.3	2796.8	-139.0	105.4	8851.4	1091.0	1	2
20	11	-.6564	.1277	2.732	2801.3	362.11	4.8202E-04	437.7	2796.4	-156.6	54.3	8849.5	1091.0	1	2
21	11	-.6682	.0000	2.731	2801.0	362.48	4.8237E-04	437.9	2796.3	-162.6	.0	8848.9	1091.0	1	2
1	12	.7750	-.0000	2.870	2856.1	294.26	4.1612E-04	412.1	2844.7	255.5	-.0	8890.3	1091.1	1	2
2	12	.7680	.0997	2.870	2855.8	294.59	4.1646E-04	412.2	2844.4	255.1	17.3	8890.3	1091.1	1	2
3	12	.7473	.1977	2.868	2855.0	295.59	4.1746E-04	412.6	2843.5	253.9	35.0	8890.2	1091.1	1	2
4	12	.7129	.2923	2.864	2853.6	297.25	4.1913E-04	413.3	2842.0	251.6	53.3	8890.1	1091.1	1	2
5	12	.6654	.3818	2.859	2851.7	299.58	4.2147E-04	414.2	2839.9	247.9	72.4	8889.8	1091.1	1	2
6	12	.6053	.4646	2.852	2849.2	302.58	4.2447E-04	415.4	2837.3	242.4	92.5	8889.4	1091.1	1	2
7	12	.5334	.5392	2.844	2846.2	306.21	4.2810E-04	416.8	2834.2	234.3	113.6	8888.6	1091.1	1	2
8	12	.4504	.6038	2.835	2842.7	310.42	4.3229E-04	418.4	2830.7	223.0	135.3	8887.9	1091.1	1	2
9	12	.3574	.6569	2.825	2838.6	315.13	4.3695E-04	420.3	2826.9	207.6	157.1	8886.7	1091.1	1	2
10	12	.2557	.6968	2.815	2834.7	320.22	4.4195E-04	422.2	2822.9	187.5	178.1	8885.0	1091.1	1	2
11	12	.1468	.7218	2.804	2830.4	325.52	4.4714E-04	424.2	2818.9	162.2	197.0	8882.7	1091.1	1	2
12	12	.0326	.7303	2.793	2826.1	330.88	4.5235E-04	426.2	2815.0	131.5	212.1	8879.8	1091.1	1	2
13	12	-.0844	.7208	2.782	2821.9	336.12	4.5741E-04	428.2	2811.5	96.0	221.7	8876.3	1091.0	1	2
14	12	-.2014	.6920	2.772	2818.0	341.02	4.6211E-04	430.0	2808.5	56.6	224.0	8872.4	1091.0	1	2
15	12	-.3147	.6432	2.764	2814.4	345.52	4.6640E-04	431.7	2805.9	15.0	217.8	8868.1	1091.0	1	2
16	12	-.4206	.5744	2.756	2811.2	349.50	4.7017E-04	433.1	2803.8	-26.6	202.1	8863.7	1091.0	1	2
17	12	-.5148	.4865	2.749	2808.5	352.86	4.7334E-04	434.4	2802.2	-65.7	176.6	8859.6	1091.0	1	2
18	12	-.5932	.3816	2.744	2806.4	355.56	4.7587E-04	435.4	2801.0	-99.7	141.9	8856.0	1091.0	1	2
19	12	-.6522	.2627	2.740	2804.8	357.52	4.7770E-04	436.1	2800.2	-126.0	99.4	8853.2	1091.0	1	2
20	12	-.6869	.1339	2.738	2803.9	358.72	4.7882E-04	436.5	2799.8	-142.7	51.2	8851.4	1091.0	1	2
21	12	-.7013	.0000	2.737	2803.6	359.12	4.7919E-04	436.7	2799.6	-148.4	.0	8850.8	1091.0	1	2
1	13	.8081	-.0000	2.891	2863.8	285.27	4.0701E-04	408.4	2854.3	232.8	-.0	8890.7	1091.1	1	2
2	13	.8008	.1040	2.890	2863.5	285.56	4.0731E-04	408.5	2854.0	232.5	14.6	8890.6	1091.1	1	2
3	13	.7792	.2061	2.888	2862.7	286.47	4.0823E-04	408.9	2853.2	231.6	29.5	8890.6	1091.1	1	2
4	13	.7434	.3048	2.885	2861.4	287.99	4.0977E-04	409.5	2851.8	229.9	44.9	8890.4	1091.1	1	2
5	13	.6939	.3982	2.880	2859.6	290.16	4.1197E-04	410.4	2849.9	227.1	61.3	8890.1	1091.1	1	2
6	13	.6313	.4846	2.873	2857.2	292.99	4.1483E-04	411.5	2847.4	222.8	78.7	8889.7	1091.1	1	2
7	13	.5563	.5624	2.865	2854.2	296.49	4.1836E-04	413.0	2844.3	216.4	97.2	8889.1	1091.1	1	2
8	13	.4698	.6299	2.856	2850.7	300.66	4.2254E-04	414.6	2840.8	207.3	116.6	8888.2	1091.1	1	2
9	13	.3729	.6854	2.846	2846.7	305.43	4.2731E-04	416.5	2836.8	194.7	136.7	8887.0	1091.1	1	2
10	13	.2668	.7271	2.834	2842.3	310.71	4.3255E-04	418.6	2832.5	177.7	156.4	8885.3	1091.1	1	2
11	13	.1531	.7533	2.822	2837.7	316.35	4.3811E-04	420.7	2828.0	155.8	174.6	8883.0	1091.1	1	2
12	13	.0340	.7623	2.810	2833.0	322.17	4.4382E-04	423.0	2823.7	128.7	189.8	8880.2	1091.0	1	2
13	13	-.0882	.7525	2.798	2828.3	327.95	4.4945E-04	425.2	2819.5	96.7	200.3	8876.8	1091.0	1	2
14	13	-.2103	.7226	2.787	2823.8	333.43	4.5475E-04	427.2	2815.8	60.7	204.0	8872.9	1091.0	1	2
15	13	-.3287	.6717	2.777	2819.8	338.50	4.5963E-04	429.1	2812.6	22.2	199.7	8868.8	1091.0	1	2
16	13	-.4393	.5999	2.768	2816.2	343.01	4.6394E-04	430.8	2810.0	-16.7	186.3	8864.7	1091.0	1	3
17	13	-.5377	.5082	2.760	2813.1	346.84	4.6757E-04	432.2	2807.9	-53.5	163.6	8860.8	1091.0	1	2
18	13	-.6197	.3986	2.754	2810.7	349.90	4.7047E-04	433.4	2806.3	-85.7	131.9	8857.5	1091.0	1	2
19	13	-.6814	.2744	2.750	2808.9	352.14	4.7258E-04	434.2	2805.2	-110.7	92.6	8854.9	1091.0	1	2
20	13	-.7197	.1399	2.748	2807.8	353.49	4.7385E-04	434.7	2804.6	-126.5	47.8	8853.2	1091.0	1	2
21	13	-.7327	.0000	2.747	2807.5	353.95	4.7428E-04	434.9	2804.4	-132.0	.0	8852.6	1091.0	1	2
1	D	.8467	-.0000	2.929	2877.5	269.60	3.9100E-04	401.8	2870.8	195.4	-.0	8895.5	1091.0	2	1
2	D	.8391	.1089	2.928	2877.2	269.87	3.9128E-04	401.9	2870.6	195.4	9.6	8895.5	1091.0	2	1

Figure 9. Continued.

SOLUTION PLANE NO. 20 X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
3	0	.8165	.2160	2.926	2876.5	270.70	3.9214E-04	402.2	2869.8	195.3	19.6	8895.4	1091.0	2	1
4	0	.7791	.3194	2.923	2875.2	272.11	3.9360E-04	402.8	2868.4	195.0	30.3	8895.2	1091.0	2	1
5	0	.7273	.4173	2.918	2873.4	274.14	3.9569E-04	403.7	2866.5	194.3	42.0	8894.9	1091.0	2	1
6	0	.6617	.5080	2.911	2871.1	276.83	3.9845E-04	404.8	2864.1	192.7	56.2	8894.5	1091.0	2	1
7	0	.5832	.5696	2.903	2868.1	280.22	4.0192E-04	406.3	2861.0	189.7	69.8	8893.9	1091.0	2	1
8	0	.4926	.6604	2.893	2864.5	284.34	4.0612E-04	408.0	2857.3	184.6	86.0	8892.9	1091.0	2	1
9	0	.3910	.7167	2.882	2860.3	289.16	4.1101E-04	409.9	2853.0	176.5	103.5	8891.6	1091.0	2	1
10	0	.2796	.7625	2.870	2855.7	294.63	4.1652E-04	412.2	2848.3	164.6	121.6	8889.8	1091.0	2	1
11	0	.1606	.7901	2.856	2850.6	300.61	4.2252E-04	414.6	2843.4	148.1	139.1	8887.5	1091.0	2	1
12	0	.0356	.7997	2.842	2845.3	306.94	4.2881E-04	417.1	2838.3	126.5	154.8	8884.6	1091.0	2	1
13	0	-.0925	.7895	2.828	2839.9	313.41	4.3520E-04	419.6	2833.3	100.0	166.8	8881.2	1091.0	2	1
14	0	-.2207	.7582	2.815	2834.8	319.70	4.4137E-04	422.1	2828.6	69.1	173.2	8877.3	1091.0	2	1
15	0	-.3450	.7049	2.803	2829.9	325.67	4.4718E-04	424.4	2824.4	35.0	172.3	8873.2	1091.0	2	1
16	0	-.4611	.6297	2.791	2825.5	331.10	4.5243E-04	426.4	2820.8	-.3	163.1	8869.0	1091.0	2	1
17	0	-.5645	.5335	2.782	2821.8	335.79	4.5694E-04	428.2	2817.8	-34.2	144.8	8865.1	1091.0	2	1
18	0	-.6306	.4165	2.774	2818.7	339.60	4.6058E-04	429.6	2815.5	-64.3	117.8	8861.6	1091.0	2	1
19	0	-.7155	.2801	2.769	2816.5	342.46	4.6326E-04	430.7	2813.9	-87.9	80.2	8859.2	1091.0	2	1
20	0	-.7557	.1469	2.765	2815.1	344.11	4.6486E-04	431.3	2812.9	-103.0	40.1	8857.5	1091.0	2	1
21	0	-.7694	.0000	2.764	2814.7	344.66	4.6540E-04	431.5	2812.6	-108.2	.0	8857.0	1091.0	2	1

MASS FLOW RATE FOR ENTIRE PLANE= 2.12553E+00(SLUG/SEC)

COURANT NUMBER= .36395

Figure 9. Continued.

4. SAMPLE CASE NO. 3

This sample case is concerned with the computation of the axisymmetric internal flow field for a simplified geometry inlet using the program option in which internal shock waves are not discretely fitted. For this sample case, the molecular transport terms are included in the computation of the internal flow field.

The data deck for this sample case is presented in Figure 10. The first card of the data deck is the title card. English units are used in the computation, hence KUNIT retains its default value of 1 in namelist LIST1. Since only the internal flow field integration option in which shock waves are not discretely fitted is to be used, KCALL(1) = 0, KCALL(2) = 0, and KCALL(3) = 1 are specified in namelist LIST1. XEND(3), which denotes the termination point of the internal flow field integration, is left equal to its default value of 3.5 ft. To illustrate the use of the flow symmetry option in which two planes of symmetry exist (even though the flow field is axisymmetric), KSYM = 2 is specified in namelist LIST1. Since the transport terms are to be included in the computation, KVISCY = 1 is specified in namelist LIST1. The remaining input parameters in namelist LIST1 are retained at their default values. Note that RCAVG and KSGLØB are not employed in this sample case.

All parameters in namelist LIST2 are left at their default values, except for XI, the axial location of the initial-value plane, which is specified as 2.0 ft (the axial position of the cowl lip). The initial-value plane flow property field is internally generated at x = 2.0 ft (a conical forebody is assumed).

In namelist LIST3, all input parameters retain their default values except for ISTØP. The desired number of circumferential stations in the computed sector (quadrant) is 11, hence ISTØP = 11. Both JMAXI and JINLET are 11, hence the number of radial stations on both the initial-value plane and on each of the internal flow field solution planes is 11. Note that JLIMIT is not employed in the computation of an internal flow field.

All parameters in namelist LIST4 are left at their default values. The default values of GAMMA = 1.4 and R = 1716.16116 (ft-lbf)/(slug-R) specify the thermodynamic model. The default values of VISØ = 3.5 x 10^{-7} (lbf-sec/ft^2), TØ = 492.0 R, and B = 198.6 R specify the parameters in Sutherland's law. The tabular values of TDL and CØND presented in Section IV.6 specify the thermal conductivity.

The centerbody geometry for this inlet is identical to that specified in Sample Cases No. 1 and No. 2. Hence, the default values of NCENT = 2, KDCENT(1) = 3, XCENT(1) = 1.0, XCENT(2) = 3.5, and CØNE = 10.0 are retained. The cowl geometry in this inlet is selected so that little or no flow turning occurs at the cowl lip. This requirement is met by specifying NCØWL = 2, KDCØWL(1) = 2, XCØWL(1) = 2.0, XCØWL(2) = 3.5, RCØWL(1)=0.7959, and RCØWL(2)= 0.8874 in namelist LIST5. Note that except for RCØWL(1) and RCØWL(2), these values are the default values. No other parameters are used in this namelist.

```
SAMPLE CASE NO, 3
 $LIST1 KCALL(1)=0, KCALL(2)=0, KCALL(3)=1, KSYM=2, KVISCY=1 $
 $LIST2 XI=2.0 $
 $LIST3 ISTOP=11 $
 $LIST4 $
 $LIST5 RCOWL(1)=.7959, RCOWL(2)=.8874 $
 $LIST6 $
 $LIST7 $
```


Figure 10. Data deck for Sample Case No. 3.

All convergence tolerances and iteration limits specified in namelist LIST6 retain their default values.

No debug output is to be printed, hence all input parameters in namelist LIST7 are left equal to their default values.

Selected portions of the computer output for Sample Case No. 3 are presented in Figure 11. The central processor time required to execute Sample Case No. 3 was 433 seconds on the CDC-6500 computer.

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-191 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 3

SPECIFIED COMPUTATION OPTIONS

1.) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

FLOW SYMMETRY

TWO PLANES OF SYMMETRY - COMPUTED SECTOR IS THE QUADRANT BOUNDED BY THE +Y-AXIS AND THE +Z-AXIS

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000   GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS

VISCOUS AND THERMAL DIFFUSION TERMS ARE INCLUDED IN THE COMPUTATION OF THE FOREBODY FLOW AND/OR SHOCKLESS INTERNAL FLOW

VISCOSITY IS REPRESENTED BY SUTHERLAND'S LAW WITH

REFERENCE VISCOSITY= 3.500000E-07(LBF-SEC/FT**2)   REFERENCE TEMPERATURE= 4.920000E+02(DEG R)

BASE TEMPERATURE= 1.986000E+02(DEG R)

THERMAL CONDUCTIVITY IS REPRESENTED BY A QUADRATIC CURVE FIT OF TEMPERATURE BASED ON THE FOLLOWING DATA

DATA POINT NO. 1   TEMPERATURE= 4.000000E+02(DEG R)   THERMAL CONDUCTIVITY= 2.550963E-03(FT-SLUG/SEC**3-DEG R)

DATA POINT NO. 2   TEMPERATURE= 1.400000E+03(DEG R)   THERMAL CONDUCTIVITY= 7.566417E-03(FT-SLUG/SEC**3-DEG R)

DATA POINT NO. 3   TEMPERATURE= 2.400000E+03(DEG R)   THERMAL CONDUCTIVITY= 1.145772E-02(FT-SLUG/SEC**3-DEG R)

Figure 11. Selected output for Sample Case No. 3.

ORIENTATION AND FREE STREAM DATA

ORIENTATION - PITCH= 0.00000(DEGREES) YAW= 0.00000(DEGREES)

FREE STREAM DATA - MACH NO.= 3.00000 PRESSURE= 2.422000E+02(LBF/FT**2) DENSITY= 3.622000E-04(SLUG/FT**3)

TEMPERATURE= 3.896437E+02(DEG R) SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 2.902673E+03(FT/SEC) Y-VELOCITY= 0. (FT/SEC) Z-VELOCITY= 0. (FT/SEC)

INITIAL VALUE SURFACE

AN INTERNALLY GENERATED INITIAL VALUE SURFACE IS SPECIFIED AS BEING LOCATED AT X= 2.000000E+00(FT)

INDEX PARAMETERS

ISTOP=11 IMAX=40 JMAXI=11

JINLET=11

INTEGRATION TERMINATION POINTS

INTERNAL FLOW FIELD INTEGRATION TERMINATES AT X= 3.500000E+00(FT)

CENTERBODY GEOMETRY

CONE HALF ANGLE=10.00000(DEGREES)

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	3	1.000000E+00	0.	0.	0.	0.	0.
2	0	3.500000E+00	0.	0.	0.	0.	0.

COWL GEOMETRY

TRANSLATION FROM DESIGN POSITION= 0. (FT)

I	KDCOWL	XCOWL (FT)	RCOWL (FT)	ACOWL (FT)	BCOWL	CCOWL (FT**-1)	DCOWL (FT**-2)
1	2	2.000000E+00	7.959000E-01	0.	0.	0.	0.
2	0	3.500000E+00	8.874000E-01	0.	0.	0.	0.

CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

CONVERGENCE TOLERANCES AND OTHER PARAMETERS

Figure 11. Continued.

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     CRIT( 1)= 1.000000E-01
     CRIT( 2)= 1.000000E-07
     CRIT( 3)= 1.000000E-04
     CRIT( 4)= 1.000000E-05
     CRIT( 5)= 1.000000E-04
     CRIT( 6)= 1.000000E-04
     CRIT( 7)= 5.000000E-01
     CRIT( 8)= 1.000000E+00
     CRIT( 9)= 1.000000E-04
     CRIT(10)= 8.000000E-01
     CRIT(11)= 1.000000E-06
     CRIT(12)= 2.000000E-01
     CRIT(13)= 1.000000E-05
     CRIT(14)= 4.000000E-01
     CRIT(15)= 1.000000E-04
     CRIT(16)= 1.000000E-06

ITERATION LIMITS

     ITEND(1)=10
     ITEND(2)=10
     ITEND(3)=10
     ITEND(4)=20
     ITEND(5)=10
     ITEND(6)=10

INPUT SAFETY FACTOR= 9.750000E-01
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Figure 11. Continued.

INITIAL DATA PLANE X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.3527	0.0000	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	484.7	0.0	8884.2	1091.0
2	1	.3483	.0552	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	478.8	75.8	8884.2	1091.0
3	1	.3354	.1090	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	461.0	149.8	8884.2	1091.0
4	1	.3142	.1601	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	431.9	220.1	8884.2	1091.0
5	1	.2853	.2073	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	392.2	284.9	8884.2	1091.0
6	1	.2494	.2494	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	342.8	342.8	8884.2	1091.0
7	1	.2073	.2853	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	284.9	392.2	8884.2	1091.0
8	1	.1601	.3142	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	220.1	431.9	8884.2	1091.0
9	1	.1090	.3354	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	149.8	461.0	8884.2	1091.0
10	1	.0552	.3483	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	75.8	478.8	8884.2	1091.0
11	1	.0000	.3527	2.710	2792.5	375.68	4.9539E-04	441.9	2750.1	.0	484.7	8884.2	1091.0
1	2	.3970	0.0000	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	432.1	0.0	8884.2	1091.0
2	2	.3921	.0621	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	426.8	67.6	8884.2	1091.0
3	2	.3776	.1227	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	410.9	133.5	8884.2	1091.0
4	2	.3538	.1802	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	385.0	196.2	8884.2	1091.0
5	2	.3212	.2334	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	349.6	254.0	8884.2	1091.0
6	2	.2807	.2807	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	305.5	305.5	8884.2	1091.0
7	2	.2334	.3212	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	254.0	349.6	8884.2	1091.0
8	2	.1802	.3538	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	196.2	385.0	8884.2	1091.0
9	2	.1227	.3776	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	133.5	410.9	8884.2	1091.0
10	2	.0621	.3921	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	67.6	426.8	8884.2	1091.0
11	2	.0000	.3970	2.713	2793.5	374.20	4.9400E-04	441.4	2759.9	.0	432.1	8884.2	1091.0
1	3	.4414	0.0000	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	389.3	0.0	8884.2	1091.0
2	3	.4360	.0691	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	384.5	60.9	8884.2	1091.0
3	3	.4198	.1364	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	370.3	120.3	8884.2	1091.0
4	3	.3933	.2004	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	346.9	176.7	8884.2	1091.0
5	3	.3571	.2595	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	315.0	228.8	8884.2	1091.0
6	3	.3121	.3121	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	275.3	275.3	8884.2	1091.0
7	3	.2595	.3571	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	228.8	315.0	8884.2	1091.0
8	3	.2004	.3933	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	176.7	346.9	8884.2	1091.0
9	3	.1364	.4198	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	120.3	370.3	8884.2	1091.0
10	3	.0691	.4360	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	60.9	384.5	8884.2	1091.0
11	3	.0000	.4414	2.719	2796.1	370.66	4.9066E-04	440.2	2768.9	.0	389.3	8884.2	1091.0
1	4	.4858	0.0000	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	353.2	0.0	8884.2	1091.0
2	4	.4798	.0760	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	348.8	55.2	8884.2	1091.0
3	4	.4620	.1501	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	335.9	109.1	8884.2	1091.0
4	4	.4328	.2205	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	314.7	160.3	8884.2	1091.0
5	4	.3930	.2855	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	285.7	207.6	8884.2	1091.0
6	4	.3435	.3435	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	249.7	249.7	8884.2	1091.0
7	4	.2855	.3930	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	207.6	285.7	8884.2	1091.0
8	4	.2205	.4328	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	160.3	314.7	8884.2	1091.0
9	4	.1501	.4620	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	109.1	335.9	8884.2	1091.0
10	4	.0760	.4798	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	55.2	348.8	8884.2	1091.0
11	4	.0000	.4858	2.727	2799.6	365.88	4.8613E-04	438.6	2777.2	.0	353.2	8884.2	1091.0
1	5	.5302	0.0000	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	321.6	0.0	8884.2	1091.0
2	5	.5236	.0829	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	317.7	50.3	8884.2	1091.0
3	5	.5042	.1638	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	305.9	99.4	8884.2	1091.0
4	5	.4724	.2407	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	286.6	146.0	8884.2	1091.0
5	5	.4289	.3116	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	260.2	189.0	8884.2	1091.0
6	5	.3749	.3749	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	227.4	227.4	8884.2	1091.0
7	5	.3116	.4289	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	189.0	260.2	8884.2	1091.0
8	5	.2407	.4724	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	146.0	286.6	8884.2	1091.0
9	5	.1638	.5042	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	99.4	305.9	8884.2	1091.0
10	5	.0829	.5236	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	50.3	317.7	8884.2	1091.0
11	5	.0000	.5302	2.737	2803.8	360.26	4.8079E-04	436.6	2785.3	.0	321.6	8884.2	1091.0

Figure 11. Continued.

INITIAL DATA PLANE X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	6	.5745	0.0000	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	293.2	0.0	8884.2	1091.0
2	6	.5675	.0899	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	289.6	45.9	8884.2	1091.0
3	6	.5464	.1775	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	278.9	90.6	8884.2	1091.0
4	6	.5119	.2608	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	261.3	133.1	8884.2	1091.0
5	6	.4648	.3377	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	237.2	172.4	8884.2	1091.0
6	6	.4063	.4063	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	207.4	207.4	8884.2	1091.0
7	6	.3377	.4648	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	172.4	237.2	8884.2	1091.0
8	6	.2608	.5119	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	133.1	261.3	8884.2	1091.0
9	6	.1775	.5464	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	90.6	278.9	8884.2	1091.0
10	6	.0899	.5675	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	45.9	289.6	8884.2	1091.0
11	6	.0000	.5745	2.749	2808.4	354.00	4.7480E-04	434.4	2793.1	.0	293.2	8884.2	1091.0
1	7	.6189	0.0000	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	267.0	0.0	8884.2	1091.0
2	7	.6113	.0968	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	263.7	41.8	8884.2	1091.0
3	7	.5886	.1913	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	253.9	82.5	8884.2	1091.0
4	7	.5515	.2810	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	237.9	121.2	8884.2	1091.0
5	7	.5007	.3638	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	216.0	156.9	8884.2	1091.0
6	7	.4376	.4376	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	188.8	188.8	8884.2	1091.0
7	7	.3638	.5007	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	156.9	216.0	8884.2	1091.0
8	7	.2810	.5515	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	121.2	237.9	8884.2	1091.0
9	7	.1913	.5886	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	82.5	253.9	8884.2	1091.0
10	7	.0968	.6113	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	41.8	263.7	8884.2	1091.0
11	7	.0000	.6189	2.762	2813.6	347.13	4.6820E-04	432.0	2800.9	.0	267.0	8884.2	1091.0
1	8	.6633	0.0000	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	241.8	0.0	8884.2	1091.0
2	8	.6551	.1038	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	238.8	37.8	8884.2	1091.0
3	8	.6308	.2050	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	230.0	74.7	8884.2	1091.0
4	8	.5910	.3011	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	215.5	109.8	8884.2	1091.0
5	8	.5366	.3899	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	195.6	142.1	8884.2	1091.0
6	8	.4690	.4690	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	171.0	171.0	8884.2	1091.0
7	8	.3899	.5366	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	142.1	195.6	8884.2	1091.0
8	8	.3011	.5910	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	109.8	215.5	8884.2	1091.0
9	8	.2050	.6308	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	74.7	230.0	8884.2	1091.0
10	8	.1038	.6551	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	37.8	238.8	8884.2	1091.0
11	8	.0000	.6633	2.776	2819.4	339.60	4.6092E-04	429.3	2809.0	.0	241.8	8884.2	1091.0
1	9	.7077	0.0000	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	216.7	0.0	8884.2	1091.0
2	9	.6990	.1107	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	214.0	33.9	8884.2	1091.0
3	9	.6730	.2187	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	206.1	67.0	8884.2	1091.0
4	9	.6305	.3213	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	193.1	98.4	8884.2	1091.0
5	9	.5725	.4160	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	175.3	127.4	8884.2	1091.0
6	9	.5004	.5004	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	153.2	153.2	8884.2	1091.0
7	9	.4160	.5725	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	127.4	175.3	8884.2	1091.0
8	9	.3213	.6305	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	98.4	193.1	8884.2	1091.0
9	9	.2187	.6730	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	67.0	206.1	8884.2	1091.0
10	9	.1107	.6990	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	33.9	214.0	8884.2	1091.0
11	9	.0000	.7077	2.792	2825.9	331.16	4.5271E-04	426.2	2817.6	.0	216.7	8884.2	1091.0
1	10	.7521	0.0000	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	189.8	0.0	8884.2	1091.0
2	10	.7428	.1176	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	187.5	29.7	8884.2	1091.0
3	10	.7152	.2324	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	180.5	58.7	8884.2	1091.0
4	10	.6701	.3414	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	169.1	86.2	8884.2	1091.0
5	10	.6084	.4420	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	153.6	111.6	8884.2	1091.0
6	10	.5318	.5318	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	134.2	134.2	8884.2	1091.0
7	10	.4420	.6084	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	111.6	153.6	8884.2	1091.0
8	10	.3414	.6701	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	86.2	169.1	8884.2	1091.0
9	10	.2324	.7152	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	58.7	180.5	8884.2	1091.0
10	10	.1176	.7428	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	29.7	187.5	8884.2	1091.0
11	10	.0000	.7521	2.812	2833.8	321.21	4.4295E-04	422.5	2827.4	.0	189.8	8884.2	1091.0

Figure 11. Continued.

INITIAL DATA PLANE X= 2.00000(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	D	.7964	0.0000	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	156.5	0.0	8884.2	1091.0
2	D	.7866	.1246	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	154.6	24.5	8884.2	1091.0
3	D	.7574	.2461	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	148.8	48.4	8884.2	1091.0
4	D	.7096	.3616	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	139.4	71.0	8884.2	1091.0
5	D	.6443	.4681	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	126.6	92.0	8884.2	1091.0
6	D	.5632	.5632	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	110.7	110.7	8884.2	1091.0
7	D	.4681	.6443	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	92.0	126.6	8884.2	1091.0
8	D	.3616	.7096	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	71.0	139.4	8884.2	1091.0
9	D	.2461	.7574	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	48.4	148.8	8884.2	1091.0
10	D	.1246	.7866	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	24.5	154.6	8884.2	1091.0
11	D	.0000	.7964	2.841	2844.6	307.74	4.2961E-04	417.4	2840.3	.0	156.5	8884.2	1091.0

MASS FLOW RATE FOR ENTIRE PLANE= 2.08570E+00(SLUG/SEC)

Figure 11. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 2.00000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.3527	0.0000	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	484.4	0.0	8883.8	1091.0
2	1	.3483	.0552	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	478.4	75.8	8883.8	1091.0
3	1	.3354	.1090	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	460.7	149.7	8883.8	1091.0
4	1	.3142	.1601	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	431.6	219.9	8883.8	1091.0
5	1	.2853	.2073	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	391.9	284.7	8883.8	1091.0
6	1	.2494	.2494	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	342.5	342.5	8883.8	1091.0
7	1	.2073	.2853	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	284.7	391.9	8883.8	1091.0
8	1	.1601	.3142	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	219.9	431.6	8883.8	1091.0
9	1	.1090	.3354	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	149.7	460.7	8883.8	1091.0
10	1	.0552	.3483	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	75.8	478.4	8883.8	1091.0
11	1	.0000	.3527	2.710	2792.4	375.69	4.9540E-04	441.9	2750.1	-.0	484.4	8883.8	1091.0
1	2	.3970	0.0000	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	432.1	0.0	8884.3	1091.0
2	2	.3921	.0621	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	426.7	67.6	8884.3	1091.0
3	2	.3775	.1227	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	410.9	133.5	8884.3	1091.0
4	2	.3537	.1802	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	385.0	196.2	8884.3	1091.0
5	2	.3212	.2333	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	349.5	254.0	8884.3	1091.0
6	2	.2807	.2807	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	305.5	305.5	8884.3	1091.0
7	2	.2333	.3212	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	254.0	349.5	8884.3	1091.0
8	2	.1802	.3537	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	196.2	385.0	8884.3	1091.0
9	2	.1227	.3775	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	133.5	410.9	8884.3	1091.0
10	2	.0621	.3921	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	67.6	426.7	8884.3	1091.0
11	2	.0000	.3970	2.713	2793.5	374.21	4.9401E-04	441.4	2759.9	.0	432.1	8884.3	1091.0
1	3	.4413	0.0000	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	389.4	0.0	8884.3	1091.0
2	3	.4359	.0690	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	384.6	60.9	8884.3	1091.0
3	3	.4197	.1364	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	370.3	120.3	8884.3	1091.0
4	3	.3932	.2003	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	346.9	176.8	8884.3	1091.0
5	3	.3570	.2594	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	315.0	228.9	8884.3	1091.0
6	3	.3120	.3120	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	275.3	275.3	8884.3	1091.0
7	3	.2594	.3570	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	228.9	315.0	8884.3	1091.0
8	3	.2003	.3932	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	176.8	346.9	8884.3	1091.0
9	3	.1364	.4197	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	120.3	370.3	8884.3	1091.0
10	3	.0690	.4359	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	60.9	384.6	8884.3	1091.0
11	3	.0000	.4413	2.719	2796.1	370.68	4.9067E-04	440.2	2768.9	.0	389.4	8884.3	1091.0
1	4	.4856	0.0000	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	353.3	0.0	8884.3	1091.0
2	4	.4796	.0760	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	349.0	55.3	8884.3	1091.0
3	4	.4619	.1501	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	336.0	109.2	8884.3	1091.0
4	4	.4327	.2205	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	314.8	160.4	8884.3	1091.0
5	4	.3929	.2854	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	285.8	207.7	8884.3	1091.0
6	4	.3434	.3434	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	249.8	249.8	8884.3	1091.0
7	4	.2854	.3929	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	207.7	285.8	8884.3	1091.0
8	4	.2205	.4327	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	160.4	314.8	8884.3	1091.0
9	4	.1501	.4619	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	109.2	336.0	8884.3	1091.0
10	4	.0760	.4796	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	55.3	349.0	8884.3	1091.0
11	4	.0000	.4856	2.727	2799.6	365.90	4.8615E-04	438.6	2777.2	.0	353.3	8884.3	1091.0
1	5	.5300	0.0000	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	321.8	0.0	8884.3	1091.0
2	5	.5234	.0829	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	317.9	50.3	8884.3	1091.0
3	5	.5040	.1638	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	306.1	99.4	8884.3	1091.0
4	5	.4722	.2406	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	286.7	146.1	8884.3	1091.0
5	5	.4287	.3115	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	260.4	189.2	8884.3	1091.0
6	5	.3747	.3747	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	227.6	227.6	8884.3	1091.0
7	5	.3115	.4287	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	189.2	260.4	8884.3	1091.0
8	5	.2406	.4722	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	146.1	286.7	8884.3	1091.0
9	5	.1638	.5040	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	99.4	306.1	8884.3	1091.0
10	5	.0829	.5234	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	50.3	317.9	8884.3	1091.0
11	5	.0000	.5300	2.737	2803.7	360.29	4.8081E-04	436.6	2785.2	.0	321.8	8884.3	1091.0

Figure 11. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 2.00000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	6	.5743	0.0000	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	293.5	0.0	8884.3	1091.0
2	6	.5672	.0898	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	289.9	45.9	8884.3	1091.0
3	6	.5462	.1775	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	279.1	90.7	8884.3	1091.0
4	6	.5117	.2607	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	261.5	133.2	8884.3	1091.0
5	6	.4646	.3376	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	237.4	172.5	8884.3	1091.0
6	6	.4061	.4061	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	207.5	207.5	8884.3	1091.0
7	6	.3376	.4646	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	172.5	237.4	8884.3	1091.0
8	6	.2607	.5117	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	133.2	261.5	8884.3	1091.0
9	6	.1775	.5462	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	90.7	279.1	8884.3	1091.0
10	6	.0898	.5672	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	45.9	289.9	8884.3	1091.0
11	6	.0000	.5743	2.749	2808.4	354.04	4.7483E-04	434.5	2793.0	-.0	293.5	8884.3	1091.0
1	7	.6186	0.0000	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	267.2	0.0	8884.3	1091.0
2	7	.6110	.0968	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	264.0	41.8	8884.3	1091.0
3	7	.5883	.1912	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	254.2	82.6	8884.3	1091.0
4	7	.5512	.2808	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	238.1	121.3	8884.3	1091.0
5	7	.5005	.3636	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	216.2	157.1	8884.3	1091.0
6	7	.4374	.4374	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	189.0	189.0	8884.3	1091.0
7	7	.3636	.5005	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	157.1	216.2	8884.3	1091.0
8	7	.2808	.5512	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	121.3	238.1	8884.3	1091.0
9	7	.1912	.5883	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	82.6	254.2	8884.3	1091.0
10	7	.0968	.6110	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	41.8	264.0	8884.3	1091.0
11	7	.0000	.6186	2.762	2813.6	347.18	4.6825E-04	432.0	2800.9	.0	267.2	8884.3	1091.0
1	8	.6629	0.0000	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	242.1	0.0	8884.3	1091.0
2	8	.6548	.1037	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	239.1	37.9	8884.3	1091.0
3	8	.6305	.2049	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	230.3	74.8	8884.3	1091.0
4	8	.5907	.3010	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	215.7	109.9	8884.3	1091.0
5	8	.5363	.3897	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	195.9	142.3	8884.3	1091.0
6	8	.4688	.4688	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	171.2	171.2	8884.3	1091.0
7	8	.3897	.5363	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	142.3	195.9	8884.3	1091.0
8	8	.3010	.5907	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	109.9	215.7	8884.3	1091.0
9	8	.2049	.6305	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	74.8	230.3	8884.3	1091.0
10	8	.1037	.6548	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	37.9	239.1	8884.3	1091.0
11	8	.0000	.6629	2.776	2819.3	339.66	4.6098E-04	429.3	2808.9	-.0	242.1	8884.3	1091.0
1	9	.7073	0.0000	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	217.0	0.0	8884.2	1091.0
2	9	.6985	.1106	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	214.3	33.9	8884.2	1091.0
3	9	.6726	.2186	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	206.4	67.1	8884.2	1091.0
4	9	.6302	.3211	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	193.3	98.5	8884.2	1091.0
5	9	.5722	.4157	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	175.5	127.5	8884.2	1091.0
6	9	.5001	.5001	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	153.4	153.4	8884.2	1091.0
7	9	.4157	.5722	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	127.5	175.5	8884.2	1091.0
8	9	.3211	.6302	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	98.5	193.3	8884.2	1091.0
9	9	.2186	.6726	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	67.1	206.4	8884.2	1091.0
10	9	.1106	.6985	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	33.9	214.3	8884.2	1091.0
11	9	.0000	.7073	2.792	2825.9	331.23	4.5278E-04	426.3	2817.5	.0	217.0	8884.2	1091.0
1	10	.7516	0.0000	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	190.1	0.0	8884.2	1091.0
2	10	.7423	.1176	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	187.8	29.7	8884.2	1091.0
3	10	.7148	.2322	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	180.8	58.7	8884.2	1091.0
4	10	.6697	.3412	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	169.4	86.3	8884.2	1091.0
5	10	.6080	.4418	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	153.8	111.7	8884.2	1091.0
6	10	.5314	.5314	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	134.4	134.4	8884.2	1091.0
7	10	.4418	.6080	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	111.7	153.8	8884.2	1091.0
8	10	.3412	.6697	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	86.3	169.4	8884.2	1091.0
9	10	.2322	.7148	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	58.7	180.8	8884.2	1091.0
10	10	.1176	.7423	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	29.7	187.8	8884.2	1091.0
11	10	.0000	.7516	2.812	2833.7	321.28	4.4302E-04	422.6	2827.3	.0	190.1	8884.2	1091.0

Figure 11. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 2.00000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	11	.7959	0.0000	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	156.7	0.0	8883.9	1091.0
2	11	.7861	.1245	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	154.8	24.5	8883.9	1091.0
3	11	.7569	.2459	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	149.1	48.4	8883.9	1091.0
4	11	.7092	.3613	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	139.6	71.2	8883.9	1091.0
5	11	.6439	.4678	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	126.8	92.1	8883.9	1091.0
6	11	.5628	.5628	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	110.8	110.8	8883.9	1091.0
7	11	.4678	.6439	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	92.1	126.8	8883.9	1091.0
8	11	.3613	.7092	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	71.2	139.6	8883.9	1091.0
9	11	.2459	.7569	2.641	2844.6	307.75	4.2961E-04	417.4	2840.3	48.4	149.1	8883.9	1091.0
10	11	.1245	.7861	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	24.5	154.8	8883.9	1091.0
11	11	.0000	.7959	2.841	2844.6	307.75	4.2961E-04	417.4	2840.3	-.0	156.7	8883.9	1091.0

MASS FLOW RATE FOR ENTIRE PLANE= 2.08241E+00(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I=10, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 9.819658E-02(FT)

Figure 11. Continued.

SOLUTION PLANE NO. 1 X= 2.09820(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.3700	0.0000	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	485.0	0.0	8883.3	1091.0	1	2
2	1	.3654	.0579	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	479.0	75.9	8883.3	1091.0	1	2
3	1	.3519	.1143	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	461.2	149.9	8883.3	1091.0	1	2
4	1	.3296	.1680	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	432.1	220.2	8883.3	1091.0	1	2
5	1	.2993	.2175	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	392.3	285.1	8883.3	1091.0	1	2
6	1	.2616	.2616	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	342.9	342.9	8883.3	1091.0	1	2
7	1	.2175	.2993	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	285.1	392.3	8883.3	1091.0	1	2
8	1	.1680	.3296	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	220.2	432.1	8883.3	1091.0	1	2
9	1	.1143	.3519	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	149.9	461.2	8883.3	1091.0	1	2
10	1	.0579	.3654	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	75.9	479.0	8883.3	1091.0	1	2
11	1	.0000	.3700	2.711	2792.8	375.11	4.9485E-04	441.7	2750.4	-.0	485.0	8883.3	1091.0	1	2
1	2	.4124	-.0000	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	435.7	-.0	8884.4	1091.0	1	2
2	2	.4073	.0645	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	430.4	68.2	8884.4	1091.0	1	2
3	2	.3922	.1274	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	414.4	134.6	8884.4	1091.0	1	2
4	2	.3675	.1872	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	388.2	197.8	8884.4	1091.0	1	2
5	2	.3337	.2424	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	352.5	256.1	8884.4	1091.0	1	2
6	2	.2916	.2916	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	308.1	308.1	8884.4	1091.0	1	2
7	2	.2424	.3337	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	256.1	352.5	8884.4	1091.0	1	2
8	2	.1872	.3675	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	197.8	388.2	8884.4	1091.0	1	2
9	2	.1274	.3922	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	134.6	414.4	8884.4	1091.0	1	2
10	2	.0645	.4073	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	68.2	430.4	8884.4	1091.0	1	2
11	2	.0000	.4124	2.714	2794.0	373.59	4.9342E-04	441.2	2759.8	.0	435.7	8884.4	1091.0	1	2
1	3	.4552	-.0000	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	395.6	-.0	8884.4	1091.0	1	2
2	3	.4496	.0712	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	390.8	61.9	8884.4	1091.0	1	2
3	3	.4329	.1407	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	376.3	122.3	8884.4	1091.0	1	2
4	3	.4056	.2067	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	352.5	179.6	8884.4	1091.0	1	2
5	3	.3683	.2676	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	320.1	232.6	8884.4	1091.0	1	2
6	3	.3219	.3219	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	279.8	279.8	8884.4	1091.0	1	2
7	3	.2676	.3683	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	232.6	320.1	8884.4	1091.0	1	2
8	3	.2067	.4056	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	179.6	352.5	8884.4	1091.0	1	2
9	3	.1407	.4329	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	122.3	376.3	8884.4	1091.0	1	2
10	3	.0712	.4496	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	61.9	390.8	8884.4	1091.0	1	2
11	3	.0000	.4552	2.719	2796.0	370.77	4.9076E-04	440.2	2767.9	.0	395.6	8884.4	1091.0	1	2
1	4	.4983	-.0000	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	361.2	-.0	8884.4	1091.0	1	2
2	4	.4921	.0779	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	356.8	56.5	8884.4	1091.0	1	2
3	4	.4739	.1540	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	343.6	111.6	8884.4	1091.0	1	2
4	4	.4440	.2262	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	321.9	164.0	8884.4	1091.0	1	2
5	4	.4031	.2929	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	292.3	212.3	8884.4	1091.0	1	2
6	4	.3523	.3523	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	255.4	255.4	8884.4	1091.0	1	2
7	4	.2929	.4031	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	212.3	292.3	8884.4	1091.0	1	2
8	4	.2262	.4440	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	164.0	321.9	8884.4	1091.0	1	2
9	4	.1540	.4739	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	111.6	343.6	8884.4	1091.0	1	2
10	4	.0779	.4921	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	56.5	356.8	8884.4	1091.0	1	2
11	4	.0000	.4983	2.726	2799.0	366.70	4.8691E-04	438.8	2775.6	.0	361.2	8884.4	1091.0	1	2
1	5	.5415	-.0000	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	331.0	.0	8884.4	1091.0	1	2
2	5	.5348	.0847	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	326.9	51.8	8884.4	1091.0	1	2
3	5	.5150	.1673	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	314.8	102.3	8884.4	1091.0	1	2
4	5	.4825	.2458	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	294.9	150.3	8884.4	1091.0	1	2
5	5	.4381	.3183	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	267.8	194.6	8884.4	1091.0	1	2
6	5	.3829	.3829	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	234.1	234.1	8884.4	1091.0	1	2
7	5	.3183	.4381	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	194.6	267.8	8884.4	1091.0	1	2
8	5	.2458	.4825	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	150.3	294.9	8884.4	1091.0	1	2
9	5	.1673	.5150	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	102.3	314.8	8884.4	1091.0	1	2
10	5	.0847	.5348	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	51.8	326.9	8884.4	1091.0	1	2
11	5	.0000	.5415	2.735	2802.6	361.80	4.8224E-04	437.2	2783.0	-.0	331.0	8884.4	1091.0	1	2

Figure 11. Continued.

SOLUTION PLANE NO. 1 X= 2.09820(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	6	.5848	-.0000	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	303.8	.0	8884.3	1091.0	1	2
2	6	.5776	.0915	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	300.0	47.5	8884.3	1091.0	1	2
3	6	.5562	.1807	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	288.9	93.9	8884.3	1091.0	1	2
4	6	.5210	.2655	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	270.7	137.9	8884.3	1091.0	1	2
5	6	.4731	.3437	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	245.8	178.6	8884.3	1091.0	1	2
6	6	.4135	.4135	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	214.8	214.8	8884.3	1091.0	1	2
7	6	.3437	.4731	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	178.6	245.8	8884.3	1091.0	1	2
8	6	.2655	.5210	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	137.9	270.7	8884.3	1091.0	1	2
9	6	.1807	.5562	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	93.9	288.9	8884.3	1091.0	1	2
10	6	.0915	.5776	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	47.5	300.0	8884.3	1091.0	1	2
11	6	.0000	.5848	2.745	2806.8	356.26	4.7696E-04	435.2	2790.3	-.0	303.8	8884.3	1091.0	1	2
1	7	.6282	.0000	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	278.6	.0	8884.3	1091.0	1	3
2	7	.6204	.0983	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	275.2	43.6	8884.3	1091.0	1	3
3	7	.5974	.1941	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	265.0	86.1	8884.3	1091.0	1	3
4	7	.5597	.2852	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	248.3	126.5	8884.3	1091.0	1	3
5	7	.5082	.3692	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	225.4	163.8	8884.3	1091.0	1	3
6	7	.4442	.4442	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	197.0	197.0	8884.3	1091.0	1	3
7	7	.3692	.5082	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	163.8	225.4	8884.3	1091.0	1	3
8	7	.2852	.5597	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	126.5	248.3	8884.3	1091.0	1	3
9	7	.1941	.5974	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	86.1	265.0	8884.3	1091.0	1	3
10	7	.0983	.6204	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	43.6	275.2	8884.3	1091.0	1	3
11	7	-.0000	.6282	2.756	2811.3	350.18	4.7113E-04	433.1	2797.5	-.0	278.6	8884.3	1091.0	1	3
1	8	.6716	.0000	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	254.9	.0	8884.3	1091.0	1	3
2	8	.6634	.1051	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	251.7	39.9	8884.3	1091.0	1	3
3	8	.6387	.2075	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	242.4	78.8	8884.3	1091.0	1	3
4	8	.5984	.3049	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	227.1	115.7	8884.3	1091.0	1	3
5	8	.5434	.3948	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	206.2	149.8	8884.3	1091.0	1	3
6	8	.4749	.4749	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	180.2	180.2	8884.3	1091.0	1	3
7	8	.3948	.5434	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	149.8	206.2	8884.3	1091.0	1	3
8	8	.3049	.5984	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	115.7	227.1	8884.3	1091.0	1	3
9	8	.2075	.6387	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	78.8	242.4	8884.3	1091.0	1	3
10	8	.1051	.6634	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	39.9	251.7	8884.3	1091.0	1	3
11	8	-.0000	.6716	2.768	2816.3	343.56	4.6475E-04	430.7	2804.8	-.0	254.9	8884.3	1091.0	1	3
1	9	.7151	-.0000	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	231.7	.0	8884.2	1091.0	1	3
2	9	.7063	.1119	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	228.9	36.2	8884.2	1091.0	1	3
3	9	.6801	.2210	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	220.4	71.6	8884.2	1091.0	1	3
4	9	.6371	.3246	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	206.5	105.2	8884.2	1091.0	1	3
5	9	.5785	.4203	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	187.5	136.2	8884.2	1091.0	1	3
6	9	.5056	.5056	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	163.8	163.8	8884.2	1091.0	1	3
7	9	.4203	.5785	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	136.2	187.5	8884.2	1091.0	1	3
8	9	.3246	.6371	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	105.2	206.5	8884.2	1091.0	1	3
9	9	.2210	.6801	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	71.6	220.4	8884.2	1091.0	1	3
10	9	.1119	.7063	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	36.2	228.9	8884.2	1091.0	1	3
11	9	.0000	.7151	2.782	2821.9	336.33	4.5775E-04	428.1	2812.4	-.0	231.7	8884.2	1091.0	1	3
1	10	.7585	-.0000	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	208.6	-.0	8884.1	1091.0	1	3
2	10	.7492	.1187	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	206.0	32.6	8884.1	1091.0	1	3
3	10	.7214	.2344	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	198.4	64.4	8884.1	1091.0	1	3
4	10	.6758	.3444	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	185.8	94.7	8884.1	1091.0	1	3
5	10	.6136	.4458	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	168.7	122.6	8884.1	1091.0	1	3
6	10	.5363	.5363	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	147.5	147.5	8884.1	1091.0	1	3
7	10	.4458	.6136	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	122.6	168.7	8884.1	1091.0	1	3
8	10	.3444	.6758	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	94.7	185.8	8884.1	1091.0	1	3
9	10	.2344	.7214	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	64.4	198.4	8884.1	1091.0	1	3
10	10	.1187	.7492	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	32.6	206.0	8884.1	1091.0	1	3
11	10	.0000	.7585	2.798	2828.1	328.39	4.5000E-04	425.2	2820.4	.0	208.6	8884.1	1091.0	1	3

Figure 11. Continued.

SOLUTION PLANE NO. 1 X= 2.09820(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	11	.8019	0.0000	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	172.5	0.0	8883.7	1091.0	1	3
2	11	.7920	.1254	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	170.3	27.0	8883.7	1091.0	1	3
3	11	.7626	.2478	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	164.0	53.3	8883.7	1091.0	1	3
4	11	.7145	.3641	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	153.7	78.3	8883.7	1091.0	1	3
5	11	.6487	.4713	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	139.5	101.4	8883.7	1091.0	1	3
6	11	.5670	.5670	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	122.0	122.0	8883.7	1091.0	1	3
7	11	.4713	.6487	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	101.4	139.5	8883.7	1091.0	1	3
8	11	.3641	.7145	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	78.3	153.7	8883.7	1091.0	1	3
9	11	.2478	.7626	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	53.3	164.0	8883.7	1091.0	1	3
10	11	.1254	.7920	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	27.0	170.3	8883.7	1091.0	1	3
11	11	-.0000	.8019	2.810	2832.7	322.58	4.4429E-04	423.1	2827.4	-.0	172.5	8883.7	1091.0	1	3

MASS FLOW RATE FOR ENTIRE PLANE= 2.08394E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I=11, J= 1 SAFETY FACTOR= 1.000153E+00 DELTA-X= 9.649107E-02(FT)

Figure 11. Continued.

ORIGINAL PAGE IS OF POOR QUALITY

SOLUTION PLANE NO. 22 X= 3.50000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.6171	.0000	2.493	2694.8	524.94	6.2912E-04	486.2	2653.9	468.0	.0	8876.4	1090.7	1	2
2	1	.6095	.0965	2.493	2694.8	524.94	6.2912E-04	486.2	2653.9	462.2	73.2	8876.4	1090.7	1	2
3	1	.5869	.1907	2.493	2694.8	524.94	6.2912E-04	486.2	2653.9	445.1	144.6	8876.4	1090.7	1	2
4	1	.5499	.2802	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	416.9	212.4	8876.4	1090.7	1	2
5	1	.4993	.3627	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	378.6	275.1	8876.4	1090.7	1	2
6	1	.4364	.4364	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	330.9	330.9	8876.4	1090.7	1	2
7	1	.3627	.4993	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	275.1	378.6	8876.4	1090.7	1	2
8	1	.2802	.5499	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	212.4	416.9	8876.4	1090.7	1	2
9	1	.1907	.5869	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	144.6	445.1	8876.4	1090.7	1	2
10	1	.0965	.6095	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	73.2	462.2	8876.4	1090.7	1	2
11	1	-.0000	.6171	2.493	2694.8	524.95	6.2912E-04	486.2	2653.9	-.0	468.0	8876.4	1090.7	1	2
1	2	.6383	.0000	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	438.6	.0	8882.6	1090.9	1	2
2	2	.6305	.0999	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	433.2	68.6	8882.6	1090.9	1	2
3	2	.6071	.1973	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	417.1	135.5	8882.6	1090.9	1	2
4	2	.5688	.2898	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	390.8	199.1	8882.6	1090.9	1	2
5	2	.5164	.3752	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	354.8	257.8	8882.6	1090.9	1	2
6	2	.4514	.4514	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	310.1	310.1	8882.6	1090.9	1	2
7	2	.3752	.5164	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	257.8	354.8	8882.6	1090.9	1	2
8	2	.2898	.5688	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	199.1	390.8	8882.6	1090.9	1	2
9	2	.1973	.6071	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	135.5	417.1	8882.6	1090.9	1	2
10	2	.0999	.6305	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	68.6	433.2	8882.6	1090.9	1	2
11	2	-.0000	.6383	2.493	2695.1	525.30	6.2942E-04	486.3	2659.2	-.0	438.6	8882.6	1090.9	1	2
1	3	.6613	.0000	2.496	2696.3	523.49	6.2786E-04	485.8	2665.2	408.3	.0	8884.4	1091.0	1	2
2	3	.6531	.1034	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	403.3	63.9	8884.4	1091.0	1	2
3	3	.6289	.2043	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	388.3	126.2	8884.4	1091.0	1	2
4	3	.5892	.3002	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	363.8	185.4	8884.4	1091.0	1	2
5	3	.5350	.3887	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	330.3	240.0	8884.4	1091.0	1	2
6	3	.4676	.4676	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	288.7	288.7	8884.4	1091.0	1	2
7	3	.3887	.5350	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	240.0	330.3	8884.4	1091.0	1	2
8	3	.3002	.5892	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	185.4	363.8	8884.4	1091.0	1	2
9	3	.2043	.6289	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	126.2	388.3	8884.4	1091.0	1	2
10	3	.1034	.6531	2.496	2696.3	523.49	6.2787E-04	485.8	2665.2	63.9	403.3	8884.4	1091.0	1	2
11	3	-.0000	.6613	2.496	2696.3	523.50	6.2787E-04	485.8	2665.2	-.0	408.3	8884.4	1091.0	1	2
1	4	.6857	.0000	2.498	2697.4	521.68	6.2631E-04	485.4	2670.6	379.4	.0	8884.4	1091.0	1	2
2	4	.6772	.1073	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	374.8	59.4	8884.4	1091.0	1	2
3	4	.6521	.2119	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	360.9	117.3	8884.4	1091.0	1	2
4	4	.6109	.3113	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	338.1	172.3	8884.4	1091.0	1	2
5	4	.5547	.4030	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	307.0	223.0	8884.4	1091.0	1	2
6	4	.4848	.4848	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	268.3	268.3	8884.4	1091.0	1	2
7	4	.4030	.5547	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	223.0	307.0	8884.4	1091.0	1	2
8	4	.3113	.6109	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	172.3	338.1	8884.4	1091.0	1	2
9	4	.2119	.6521	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	117.2	360.9	8884.4	1091.0	1	2
10	4	.1073	.6772	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	59.4	374.8	8884.4	1091.0	1	2
11	4	-.0000	.6857	2.498	2697.4	521.69	6.2631E-04	485.4	2670.6	-.0	379.4	8884.4	1091.0	1	2
1	5	.7113	.0000	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	347.6	.0	8883.9	1091.0	1	2
2	5	.7026	.1113	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	343.4	54.4	8883.9	1091.0	1	2
3	5	.6765	.2198	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	330.6	107.4	8883.9	1091.0	1	2
4	5	.6338	.3229	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	309.8	157.8	8883.9	1091.0	1	2
5	5	.5755	.4181	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	281.3	204.3	8883.9	1091.0	1	2
6	5	.5030	.5030	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	245.8	245.8	8883.9	1091.0	1	2
7	5	.4181	.5755	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	204.3	281.3	8883.9	1091.0	1	2
8	5	.3229	.6338	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	157.8	309.8	8883.9	1091.0	1	2
9	5	.2198	.6765	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	107.4	330.6	8883.9	1091.0	1	2
10	5	.1113	.7026	2.504	2700.5	516.46	6.2181E-04	484.0	2678.0	54.4	343.4	8883.9	1091.0	1	2
11	5	-.0000	.7113	2.504	2700.5	516.46	6.2182E-04	484.0	2678.0	-.0	347.6	8883.9	1091.0	1	2

Figure 11. Continued.

SOLUTION PLANE NO. 22 X= 3.50000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	6	.7382	.0000	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	305.7	.0	8883.8	1091.0	1	2
2	6	.7291	.1155	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	301.9	47.8	8883.8	1091.0	1	2
3	6	.7021	.2281	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	290.7	94.5	8883.8	1091.0	1	2
4	6	.6578	.3351	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	272.4	138.8	8883.8	1091.0	1	2
5	6	.5972	.4339	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	247.3	179.7	8883.8	1091.0	1	2
6	6	.5220	.5220	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	216.1	216.1	8883.8	1091.0	1	2
7	6	.4339	.5972	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	179.7	247.3	8883.8	1091.0	1	2
8	6	.3351	.6578	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	138.8	272.4	8883.8	1091.0	1	2
9	6	.2281	.7021	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	94.5	290.7	8883.8	1091.0	1	2
	6	.1155	.7291	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	47.8	301.9	8883.8	1091.0	1	2
11	6	-.0000	.7382	2.522	2708.9	502.44	6.0971E-04	480.2	2691.6	-.0	305.7	8883.8	1091.0	1	2
1	7	.7665	.0000	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	261.2	.0	8884.0	1091.0	1	2
2	7	.7571	.1199	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	258.0	40.9	8884.0	1091.0	1	2
3	7	.7290	.2369	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	248.4	80.7	8884.0	1091.0	1	2
4	7	.6830	.3480	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	232.7	118.6	8884.0	1091.0	1	2
5	7	.6201	.4505	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	211.3	153.5	8884.0	1091.0	1	2
6	7	.5420	.5420	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	184.7	184.7	8884.0	1091.0	1	2
7	7	.4505	.6201	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	153.5	211.3	8884.0	1091.0	1	2
8	7	.3480	.6830	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	118.6	232.7	8884.0	1091.0	1	2
9	7	.2369	.7290	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	80.7	248.4	8884.0	1091.0	1	2
10	7	.1199	.7571	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	40.9	258.0	8884.0	1091.0	1	2
11	7	-.0000	.7665	2.543	2718.8	486.21	5.9558E-04	475.7	2706.3	-.0	261.2	8884.0	1091.0	1	2
1	8	.7959	.0000	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	226.3	.0	8883.9	1091.0	1	2
2	8	.7861	.1245	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	223.5	35.4	8883.9	1091.0	1	2
3	8	.7570	.2460	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	215.2	69.9	8883.9	1091.0	1	2
4	8	.7092	.3613	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	201.6	102.7	8883.9	1091.0	1	2
5	8	.6439	.4678	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	183.0	133.0	8883.9	1091.0	1	2
6	8	.5628	.5628	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	160.0	160.0	8883.9	1091.0	1	2
7	8	.4678	.6439	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	133.0	183.0	8883.9	1091.0	1	2
8	8	.3613	.7092	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	102.7	201.6	8883.9	1091.0	1	2
9	8	.2460	.7570	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	69.9	215.2	8883.9	1091.0	1	2
10	8	.1245	.7861	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	35.4	223.5	8883.9	1091.0	1	2
11	8	-.0000	.7959	2.556	2724.8	476.50	5.8707E-04	472.9	2715.4	-.0	226.3	8883.9	1091.0	1	2
1	9	.8261	.0000	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	201.7	.0	8883.1	1091.0	1	2
2	9	.8159	.1292	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	199.2	31.5	8883.1	1091.0	1	2
3	9	.7856	.2553	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	191.8	62.3	8883.1	1091.0	1	2
4	9	.7360	.3750	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	179.7	91.6	8883.1	1091.0	1	2
5	9	.6683	.4856	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	163.2	118.5	8883.1	1091.0	1	2
6	9	.5841	.5841	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	142.6	142.6	8883.1	1091.0	1	2
7	9	.4856	.6683	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	118.5	163.2	8883.1	1091.0	1	2
8	9	.3750	.7360	2.561	2726.8	473.21	5.8417E-04	472.0	2719.4	91.6	179.7	8883.1	1091.0	1	2
9	9	.2553	.7856	2.561	2726.8	473.22	5.8417E-04	472.0	2719.4	62.3	191.8	8883.1	1091.0	1	2
10	9	.1292	.8159	2.561	2726.8	473.22	5.8417E-04	472.0	2719.4	31.5	199.2	8883.1	1091.0	1	2
11	9	-.0000	.8261	2.561	2726.8	473.22	5.8417E-04	472.0	2719.4	-.0	201.7	8883.1	1091.0	1	2
1	10	.8566	.0000	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	182.8	.0	8880.4	1090.9	1	2
2	10	.8461	.1340	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	180.5	28.6	8880.4	1090.9	1	2
3	10	.8147	.2647	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	173.8	56.5	8880.4	1090.9	1	2
4	10	.7632	.3889	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	162.8	83.0	8880.4	1090.9	1	2
5	10	.6930	.5035	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	147.9	107.4	8880.4	1090.9	1	2
6	10	.6057	.6057	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	129.2	129.2	8880.4	1090.9	1	2
7	10	.5035	.6930	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	107.4	147.9	8880.4	1090.9	1	2
8	10	.3889	.7632	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	83.0	162.9	8880.4	1090.9	1	2
9	10	.2647	.8147	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	56.5	173.8	8880.4	1090.9	1	2
10	10	.1340	.8461	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	28.6	180.5	8880.4	1090.9	1	2
11	10	-.0000	.8566	2.561	2726.9	472.79	5.8379E-04	471.9	2720.8	-.0	182.8	8880.4	1090.9	1	2

Figure 11. Continued.

SOLUTION PLANE NO. 22 X= 3.50000(FT) INTERNAL FLOW FIELD WITHOUT SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	11	.8874	.0000	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	166.0	.0	8872.5	1090.7	1	2
2	11	.8765	.1388	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	163.9	26.0	8872.5	1090.7	1	2
3	11	.8440	.2742	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	157.9	51.3	8872.5	1090.7	1	2
4	11	.7907	.4029	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	147.9	75.4	8872.5	1090.7	1	2
5	11	.7179	.5216	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	134.3	97.6	8872.5	1090.7	1	2
6	11	.6275	.6275	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	117.4	117.4	8872.5	1090.7	1	2
7	11	.5216	.7179	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	97.6	134.3	8872.5	1090.7	1	2
8	11	.4029	.7907	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	75.4	147.9	8872.5	1090.7	1	2
9	11	.2742	.8440	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	51.3	157.9	8872.5	1090.7	1	2
10	11	.1388	.8765	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	26.0	163.9	8872.5	1090.7	1	2
11	11	-.0000	.8874	2.560	2726.2	473.12	5.8404E-04	472.0	2721.1	-.0	166.0	8872.5	1090.7	1	2

MASS FLOW RATE FOR ENTIRE PLANE= 2.06889E+00(SLUG/SEC)

COURANT NUMBER= .33871

Figure 11. Continued.

5. SAMPLE CASE NO. 4

Sample Case No. 4 is concerned with the computation of the internal flow field in the Mach 3.5 mixed-compression inlet documented in Reference (4). In this computation, the internal shock wave system is discretely fitted. This sample case considers the calculation of the internal flow field at the design point conditions: free-stream Mach number of 3.5, zero centerbody translation, and zero angle of attack.

The data deck listing for this sample case is presented in Figure 12. The first card of the data deck is the title card. English units are to be used in the computation, hence KUNIT is left equal to its default value of 1 in namelist LIST1. To perform the internal flow field integration with discrete fitting of the internal shock wave system, both KCALL(2) and KCALL(3) are retained at their default values of 1 and 0, respectively, whereas KCALL(1) = 0 is specified in namelist LIST1. The internal flow field integration termination point is x = 6.9 ft, hence XEND(2) = 6.9. Since at zero incidence the flow field is axisymmetric, KSYM is left at its default value of 3. The parameters KVISCY, RCAVG, and KSGLØB in namelist LIST1 are not used in this flow field integration option. No restart file operations are to be performed, hence IPRSTP and KSTART are left at their default values of 0. In this computation, however, the shock wave surface normal unit vector components and the incident normal Mach number at each shock wave solution point are to be output, hence KPRINT = 2 is specified in namelist LIST1.

In namelist LIST2, the free-stream Mach number is specified as MFS = 3.5. The free-stream pressure and density, specified by PFS and RØFS, respectively, retain their default values. The flow is axisymmetric, so both PITCH and YAW retain their default values of 0.0. The cowl lip axial station at the design point is located at x = 2.86 ft, hence XI = 2.86 is specified in namelist LIST2. This inlet has a conical forebody. Consequently, the initial-value plane flow property field for the zero angle of attack case is internally generated in the computer program. Thus, KIVS and KCØN retain their default values of 1. The input parameter ITAPE in namelist LIST2 is not employed in this computation.

In namelist LIST3, ISTØP is left at its default value of 1 since KSYM = 3. The specified number of radial stations on both the initial-value plane and on each of the internal flow field solution planes is 21, hence JMAXI = 21 and JINLET = 21. The input parameter JLIMIT in namelist LIST3 is not used in the computation of an internal flow field.

In namelist LIST4, the thermodynamic properties GAMMA and R retain their default values. No other input parameters in namelist LIST4 are employed in this computation

The contours of the centerbody and the cowl are specified in namelist LIST5. For this inlet, the centerbody contour and the cowl contour are decribed by equation (3) applied to a number of intervals on each contour. Consequently, KBASE retains its default value of 0. The number of axial stations used for the geometry description of the centerbody and the cowl are 11 and 14, respectively; hence NCENT = 11 and NCØWL = 14. Thus, the number of intervals on the centerbody and the cowl are 10 and 13, respectively. Since

```
SAMPLE CASE NO. 4
 $LIST1 KCALL(1)=0, XEND(2)=6.9, KPRINT=2 $
 $LIST2 MFS=3.5, XI=2.86 $
 $LIST3 JMAXI=21, JINLET=21 $
 $LIST4 $
 $LIST5 NCENT=11, NCOWL=14, KDCENT(1)=11*1, KDCOWL(1)=14*1,
 XCENT(1)= 0.0, 2.798794, 4.0, 4.2, 4.4, 4.55, 4.7, 4.9, 5.5, 6.28, 6.9,
 RCENT(1)=11*0.0,
 ACENT(1)= 0.0, .493511, .70532, .7387, .759, .763, .7585, .7391,
 .6525, .4, 0.0,
 BCENT(1)= .17633, .17633, .17633, .144, .052, 0.0, -.0646, -.1295, -.153,
 0.0, 0.0,
 CCENT(1)= 0.0, 0.0, .02020035, -.1774997, -.1600005, -.1693327,
 -.1615001, -.03499995, .1651873, 0.0, 0.0,
 DCENT(1)= 0.0, 0.0, -.3367512, -.1750011, -.05925696, -.2044475,
 -2.499656E-03, .01712957, -.4923802, 0.0, 0.0,
 XCOWL(1)= 2.86, 3.1, 3.4, 4.0, 4.2, 4.3, 4.5, 4.6, 4.7, 5.1, 5.6, 6.1, 6.5,
 6.9,
 RCOWL(1)=14*0.0,
 ACOWL(1)=1.0, 1.004188, 1.0051, .9681, .9364, .9154, .8768, .864, .8572, .85,
 .85, .8839, .9227, 0.0,
 BCOWL(1)= .01745001, .01745, -.011, -.124, -.1942, -.213, -.163, -.093, -.0485,
 0.0, 0.0, .107, .0729, 0.0,
 CCOWL(1)= 0.0, -.04926635, -.06500001, -.1664999, -.2859976, .05000008,
 .3500018, .3049997, .1075002, 0.0, .1928, .01025012, -.01512487, 0.0,
 DCOWL(1)= 0.0, 4.110418E-03, -.03240740, -.0300005, 1.279984,
 .2499998, -1.251464E-05, -.5499974, -.07812535, 0.0, -.1144, -.08812521,
 8.74978E-03, 0.0,
 DXTRAN=0.0 $
 $LIST6 $
 $LIST7 $
```

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OF POOR QUALITY

Figure 12. Data deck for Sample Case No. 4.

equation (3) is used to specify the body radius for all intervals, KDCENT(I) = 1 (I = 1 to 11) and KDCØWL(I) = 1 (I = 1 to 14). Note that except for XCENT(11) and XCØWL(14), the specifications for the other input parameters for the last station on either the centerbody or the cowl are immaterial. That is, only the XCENT and XCØWL arrays must be specified for NCENT and NCØWL elements, respectively. The other arrays require that only (NCENT-1) or (NCØWL-1) elements be entered. The 11 elements of the XCENT array are thus entered. Although not used in the computation, the 11 elements of the RCENT array are specified, each element being 0.0. The arrays ACENT, BCENT, CCENT, and DCENT are then entered. For each of these arrays, the last (11th) element is arbitrarily specified as 0.0. In a like manner, the arrays XCØWL, RCØWL, ACØWL, BCØWL, CCØWL, and DCØWL are entered. Since this sample case is for the design point condition, the centerbody translation is 0.0 ft; hence, DXTRAN in namelist LIST5 retains its default value of 0.0.

All convergence tolerances and iteration limits specified in namelist LIST6 retain their default values.

No debug output is to be printed, consequently all input parameters in namelist LIST7 retain their default values.

Figure 13 presents selected portions of the output for Sample Case No. 4. Sample Case No. 4 required 566 seconds of central processor time on the CDC-6500 computer (the execution was terminated by a 10,000 line count limit).

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-191 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 4

SPECIFIED COMPUTATION OPTIONS

1.) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

FLOW SYMMETRY

AXISYMMETRIC FLOW

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000   GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS-

VISCOUS AND THERMAL DIFFUSION TERMS ARE NOT INCLUDED IN THE COMPUTATION - INVISCID AND ADIABATIC FLOW IS ASSUMED

ORIENTATION AND FREE STREAM DATA

ORIENTATION -   PITCH= 0.00000(DEGREES)   YAW= 0.00000(DEGREES)

FREE STREAM DATA -   MACH NO.= 3.50000   PRESSURE= 2.422000E+02(LBF/FT**2)   DENSITY= 3.622000E-04(SLUG/FT**3)

TEMPERATURE= 3.896437E+02(DEG R)   SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 3.386452E+03(FT/SEC)   Y-VELOCITY= 0.   (FT/SEC)   Z-VELOCITY= 0.   (FT/SEC)

Figure 13. Selected output for Sample Case No. 4.

INITIAL VALUE SURFACE

AN INTERNALLY GENERATED INITIAL VALUE SURFACE IS SPECIFIED AS BEING LOCATED AT X= 2.860000E+00(FT)

INDEX PARAMETERS

ISTOP= 1 IMAX=40 JMAXI=21

JINLET=21

INTEGRATION TERMINATION POINTS

INTERNAL FLOW FIELD INTEGRATION TERMINATES AT X= 6.900000E+00(FT)

CENTERBODY GEOMETRY

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	1	0.	0.	0.	1.763300E-01	0.	0.
2	1	2.798794E+00	0.	4.935110E-01	1.763300E-01	0.	0.
3	1	4.000000E+00	0.	7.053200E-01	1.763300E-01	2.020035E-02	-3.367512E-01
4	1	4.200000E+00	0.	7.387000E-01	1.440000E-01	-1.774997E-01	-1.750011E-01
5	1	4.400000E+00	0.	7.590000E-01	5.200000E-02	-1.600005E-01	-5.925696E-02
6	1	4.550000E+00	0.	7.630000E-01	0.	-1.693327E-01	-2.044475E-01
7	1	4.700000E+00	0.	7.585000E-01	-6.460000E-02	-1.615001E-01	-2.499656E-03
8	1	4.900000E+00	0.	7.391000E-01	-1.295000E-01	-3.499995E-02	1.712957E-02
9	1	5.500000E+00	0.	6.525000E-01	-1.530000E-01	1.651873E-01	-4.923802E-01
10	1	6.280000E+00	0.	4.000000E-01	0.	0.	0.
11	1	6.900000E+00	0.	0.	0.	0.	0.

COWL GEOMETRY

TRANSLATION FROM DESIGN POSITION= 0. (FT)

I	KDCOWL	XCOWL (FT)	RCOWL (FT)	ACOWL (FT)	BCOWL	CCOWL (FT**-1)	DCOWL (FT**-2)
1	1	2.860000E+00	0.	1.000000E+00	1.745001E-02	0.	0.
2	1	3.100000E+00	0.	1.004188E+00	1.745000E-02	-4.926635E-02	4.110418E-03
3	1	3.400000E+00	0.	1.005100E+00	-1.100000E-02	-6.500001E-02	-3.240740E-02
4	1	4.000000E+00	0.	9.681000E-01	-1.240000E-01	-1.664999E-01	-3.000050E-02
5	1	4.200000E+00	0.	9.364000E-01	-1.942000E-01	-2.859976E-01	1.279984E+00
6	1	4.300000E+00	0.	9.154000E-01	-2.130000E-01	5.000008E-02	2.499998E-01
7	1	4.500000E+00	0.	8.768000E-01	-1.630000E-01	3.500018E-01	-1.251464E-05
8	1	4.600000E+00	0.	8.640000E-01	-9.300000E-02	3.049997E-01	-5.499974E-01
9	1	4.700000E+00	0.	8.572000E-01	-4.850000E-02	1.075002E-01	-7.812535E-02
10	1	5.100000E+00	0.	8.500000E-01	0.	0.	0.
11	1	5.600000E+00	0.	8.500000E-01	0.	1.928000E-01	-1.144000E-01
12	1	6.100000E+00	0.	8.839000E-01	1.070000E-01	1.025012E-02	-8.812521E-02
13	1	6.500000E+00	0.	9.227000E-01	7.290000E-02	-1.512487E-02	8.749780E-03
14	1	6.900000E+00	0.	0.	0.	0.	0.

Figure 13. Continued.

```
CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

    CONVERGENCE TOLERANCES AND OTHER PARAMETERS

        CRIT( 1)= 1.000000E-01
        CRIT( 2)= 1.000000E-07
        CRIT( 3)= 1.000000E-04
        CRIT( 4)= 1.000000E-05
        CRIT( 5)= 1.000000E-04
        CRIT( 6)= 1.000000E-04
        CRIT( 7)= 5.000000E-01
        CRIT( 8)= 1.000000E+00
        CRIT( 9)= 1.000000E-04
        CRIT(10)= 8.000000E-01
        CRIT(11)= 1.000000E-06
        CRIT(12)= 2.000000E-01
        CRIT(13)= 1.000000E-05
        CRIT(14)= 4.000000E-01
        CRIT(15)= 1.000000E-04
        CRIT(16)= 1.000000E-06

    ITERATION LIMITS

        ITEND(1)=10
        ITEND(2)=10
        ITEND(3)=10
        ITEND(4)=20
        ITEND(5)=10
        ITEND(6)=10

    INPUT SAFETY FACTOR= 9.750000E-01
```

Figure 13. Continued.

INITIAL DATA PLANE   X= 2.86000(FT)   FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.5043	0.0000	3.127	3269.0	414.22	5.3079E-04	454.7	3219.3	567.9	0.0	18399.7	1344.3
1	2	.5293	0.0000	3.128	3269.2	413.65	5.3045E-04	454.6	3224.0	541.9	0.0	18399.7	1344.3
1	3	.5544	0.0000	3.130	3269.8	412.83	5.2952E-04	454.3	3228.5	518.1	0.0	18399.7	1344.3
1	4	.5794	0.0000	3.132	3270.7	411.29	5.2810E-04	453.8	3232.8	496.2	0.0	18399.7	1344.3
1	5	.6044	0.0000	3.136	3271.8	409.32	5.2630E-04	453.2	3237.0	475.9	0.0	18399.7	1344.3
1	6	.6295	0.0000	3.139	3273.2	407.01	5.2417E-04	452.4	3241.1	456.9	0.0	18399.7	1344.3
1	7	.6545	0.0000	3.144	3274.7	404.39	5.2176E-04	451.6	3245.1	439.0	0.0	18399.7	1344.3
1	8	.6796	0.0000	3.149	3276.4	401.52	5.1911E-04	450.7	3249.1	422.1	0.0	18399.7	1344.3
1	9	.7046	0.0000	3.154	3278.2	398.41	5.1624E-04	449.7	3253.0	406.0	0.0	18399.7	1344.3
1	10	.7296	0.0000	3.159	3280.2	395.09	5.1317E-04	448.6	3256.8	390.6	0.0	18399.7	1344.3
1	11	.7547	0.0000	3.166	3282.3	391.57	5.0990E-04	447.5	3260.7	375.7	0.0	18399.7	1344.3
1	12	.7797	0.0000	3.172	3284.5	387.85	5.0643E-04	446.3	3264.6	361.2	0.0	18399.7	1344.3
1	13	.8047	0.0000	3.179	3286.9	383.93	5.0277E-04	445.0	3268.5	347.1	0.0	18399.7	1344.3
1	14	.8296	0.0000	3.186	3289.4	379.80	4.9890E-04	443.6	3272.4	333.2	0.0	18399.7	1344.3
1	15	.8548	0.0000	3.194	3292.0	375.43	4.9479E-04	442.1	3276.5	319.5	0.0	18399.7	1344.3
1	16	.8799	0.0000	3.203	3294.9	370.79	4.9042E-04	440.6	3280.7	305.6	0.0	18399.7	1344.3
1	17	.9049	0.0000	3.212	3298.0	365.64	4.8573E-04	438.9	3285.1	291.6	0.0	18399.7	1344.3
1	18	.9299	0.0000	3.222	3301.3	360.48	4.8063E-04	437.0	3289.7	277.2	0.0	18399.7	1344.3
1	19	.9550	0.0000	3.233	3305.1	354.58	4.7501E-04	435.0	3294.7	262.1	0.0	18399.7	1344.3
1	20	.9800	0.0000	3.246	3309.3	347.93	4.6682E-04	432.6	3300.2	245.7	0.0	18399.7	1344.3
1	D	1.0050	0.0000	3.262	3314.5	340.04	4.6101E-04	429.8	3306.7	227.1	0.0	18399.7	1344.3

MASS FLOW RATE FOR ENTIRE PLANE= 3.87630E+00(SLUG/SEC)

Figure 13. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 2.86000(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.5043	0.0000	3.127	3269.0	414.22	5.3079E-04	454.7	3219.3	567.8	0.0	18399.3	1344.3
1	2	.5318	0.0000	3.128	3269.3	413.74	5.3036E-04	454.6	3224.4	539.8	0.0	18400.4	1344.3
1	3	.5594	0.0000	3.130	3270.0	412.53	5.2924E-04	454.2	3229.3	514.0	0.0	18400.4	1344.3
1	4	.5869	0.0000	3.133	3271.0	410.71	5.2758E-04	453.6	3234.1	490.4	0.0	18400.4	1344.3
1	5	.6145	0.0000	3.137	3272.4	408.41	5.2546E-04	452.9	3238.6	468.6	0.0	18400.4	1344.3
1	6	.6420	0.0000	3.142	3273.9	405.71	5.2298E-04	452.0	3243.1	448.3	0.0	18400.3	1344.3
1	7	.6695	0.0000	3.147	3275.7	402.70	5.2020E-04	451.1	3247.5	428.7	0.0	18399.7	1344.3
1	8	.6971	0.0000	3.152	3277.6	399.37	5.1712E-04	450.0	3251.8	410.8	0.0	18399.8	1344.3
1	9	.7246	0.0000	3.158	3279.8	395.77	5.1380E-04	448.8	3256.1	393.7	0.0	18399.8	1344.3
1	10	.7522	0.0000	3.165	3282.1	391.93	5.1023E-04	447.6	3260.3	377.3	0.0	18399.9	1344.3
1	11	.7797	0.0000	3.172	3284.5	387.85	5.0643E-04	446.3	3264.6	361.4	0.0	18399.9	1344.3
1	12	.8072	0.0000	3.180	3287.1	383.52	5.0239E-04	444.8	3268.9	345.9	0.0	18399.8	1344.3
1	13	.8348	0.0000	3.188	3289.9	378.94	4.9808E-04	443.3	3273.2	330.7	0.0	18399.8	1344.3
1	14	.8623	0.0000	3.197	3292.9	374.05	4.9349E-04	441.7	3277.7	315.5	0.0	18399.8	1344.3
1	15	.8898	0.0000	3.206	3296.1	368.83	4.8856E-04	439.9	3282.4	300.2	0.0	18399.7	1344.3
1	16	.9174	0.0000	3.217	3299.7	363.17	4.8319E-04	438.0	3287.4	284.6	0.0	18399.6	1344.3
1	17	.9449	0.0000	3.228	3303.5	357.03	4.7735E-04	435.8	3292.6	268.3	0.0	18399.8	1344.3
1	18	.9725	0.0000	3.242	3308.0	350.02	4.7063E-04	433.4	3298.5	250.9	0.0	18399.7	1344.3
1	U	1.0000	0.0000	3.259	3313.5	341.55	4.6247E-04	430.3	3305.4	230.8	0.0	18399.0	1344.3
1	D	1.0000	0.0000	3.092	3256.1	436.21	5.5053E-04	461.7	3255.7	56.6	-.0	18371.6	1344.3
1	19	1.0000	0.0000	3.092	3256.1	436.21	5.5053E-04	461.7	3255.7	56.6	-.0	18371.6	1344.3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.112451E+00	-2.750988E-01	-9.614160E-01	-9.748162E-16

MASS FLOW RATE FOR ENTIRE PLANE= 3.82787E+00(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 7.257106E-02(FT)

Figure 13. Continued.

SOLUTION PLANE NO. 1 X= 2.93257(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	G (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.5171	0.0000	3.129	3269.4	413.40	5.3004E-04	454.5	3219.7	567.7	0.0	18398.8	1344.3	1	2
1	2	.5440	-.0000	3.129	3269.5	413.36	5.3000E-04	454.5	3224.5	540.8	-.0	18400.8	1344.3	1	2
1	3	.5710	-.0000	3.131	3270.1	412.37	5.2910E-04	454.1	3229.1	516.2	-.0	18400.8	1344.3	1	2
1	4	.5980	-.0000	3.133	3271.0	410.75	5.2761E-04	453.6	3233.6	493.4	-.0	18400.8	1344.3	1	2
1	5	.6250	-.0000	3.137	3272.2	408.66	5.2569E-04	453.0	3238.0	472.3	-.0	18400.7	1344.3	1	2
1	6	.6521	-.0000	3.140	3273.6	406.35	5.2356E-04	452.2	3242.2	452.3	-.0	18400.6	1344.3	1	2
1	7	.6792	-.0000	3.145	3275.3	403.44	5.2089E-04	451.3	3246.4	433.7	-.0	18400.0	1344.3	1	2
1	8	.7063	-.0000	3.151	3277.1	400.25	5.1794E-04	450.3	3250.6	416.0	-.0	18400.0	1344.3	1	2
1	9	.7335	-.0000	3.156	3279.1	396.90	5.1484E-04	449.2	3254.7	399.3	-.0	18400.0	1344.3	1	2
1	10	.7606	-.0000	3.163	3281.2	393.31	5.1151E-04	448.0	3258.8	383.3	-.0	18400.0	1344.3	1	2
1	11	.7878	-.0000	3.169	3283.5	389.50	5.0797E-04	446.8	3262.8	367.9	-.0	18400.0	1344.3	1	2
1	12	.8150	-.0000	3.176	3285.9	385.47	5.0420E-04	445.5	3266.9	352.8	-.0	18399.9	1344.3	1	2
1	13	.8422	-.0000	3.184	3288.5	381.20	5.0020E-04	444.1	3271.1	338.1	-.0	18399.9	1344.3	1	2
1	14	.8694	-.0000	3.192	3291.3	376.67	4.9595E-04	442.5	3275.4	323.5	-.0	18399.8	1344.3	1	2
1	15	.8966	-.0000	3.201	3294.3	371.86	4.9142E-04	440.9	3279.7	308.9	-.0	18399.6	1344.3	1	2
1	16	.9238	-.0000	3.210	3297.4	366.74	4.8658E-04	439.2	3284.3	294.0	-.0	18399.5	1344.3	1	3
1	17	.9510	-.0000	3.220	3300.9	361.18	4.8130E-04	437.3	3289.1	279.0	-.0	18399.6	1344.3	1	3
1	18	.9781	-.0000	3.232	3304.7	355.17	4.7556E-04	435.2	3294.2	263.3	-.0	18399.3	1344.3	1	3
1	U	.9792	-.0000	3.232	3304.9	354.88	4.7528E-04	435.1	3294.4	262.6	-.0	18399.2	1344.3	1	3
1	D	.9792	-.0000	3.037	3236.1	472.67	5.8287E-04	472.5	3235.6	57.0	-.0	18355.1	1344.3	1	1
1	19	1.0013	-.0000	3.063	3245.6	455.41	5.6773E-04	467.4	3245.1	56.6	-.0	18371.6	1344.3	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.133364E+00	-2.750988E-01	-9.614160E-01	7.328386E-11

MASS FLOW RATE FOR ENTIRE PLANE= 3.83100E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=21 SAFETY FACTOR= 9.750000E-01 DELTA-X= 6.491595E-02(FT)

Figure 13. Continued.

SOLUTION PLANE NO. 2 X= 2.99749(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.5285	-.0000	3.129	3269.6	413.05	5.2972E-04	454.4	3219.9	567.8	-.0	18398.3	1344.2	1	2
1	2	.5549	-.0000	3.130	3269.8	412.90	5.2958E-04	454.3	3224.6	541.6	-.0	18401.2	1344.3	1	2
1	3	.5814	-.0000	3.131	3270.2	412.18	5.2892E-04	454.1	3228.9	518.0	-.0	18401.2	1344.3	1	2
1	4	.6079	-.0000	3.133	3271.0	410.76	5.2762E-04	453.6	3233.2	496.0	-.0	18401.2	1344.3	1	2
1	5	.6345	-.0000	3.136	3272.1	408.96	5.2597E-04	453.1	3237.4	475.2	-.0	18401.0	1344.3	1	2
1	6	.6612	-.0000	3.140	3273.4	406.69	5.2388E-04	452.3	3241.5	456.0	-.0	18400.9	1344.3	1	2
1	7	.6879	-.0000	3.144	3274.9	404.05	5.2145E-04	451.5	3245.5	437.9	-.0	18400.3	1344.3	1	2
1	8	.7147	-.0000	3.149	3276.7	401.03	5.1866E-04	450.5	3249.6	420.6	-.0	18400.2	1344.3	1	2
1	9	.7415	-.0000	3.155	3278.6	397.81	5.1569E-04	449.5	3253.6	404.2	-.0	18400.2	1344.3	1	2
1	10	.7683	-.0000	3.161	3280.6	394.44	5.1256E-04	448.4	3257.5	388.5	-.0	18400.2	1344.3	1	2
1	11	.7952	-.0000	3.167	3282.7	390.85	5.0922E-04	447.2	3261.4	373.4	-.0	18400.1	1344.3	1	2
1	12	.8221	-.0000	3.173	3285.0	387.05	5.0568E-04	446.0	3265.4	358.7	-.0	18400.0	1344.3	1	2
1	13	.8490	-.0000	3.180	3287.4	383.03	5.0192E-04	444.7	3269.3	344.3	-.0	18399.9	1344.3	1	2
1	14	.8759	-.0000	3.188	3290.0	378.79	4.9794E-04	443.3	3273.4	330.2	-.0	18399.8	1344.3	1	2
1	15	.9028	-.0000	3.196	3292.7	374.33	4.9375E-04	441.8	3277.5	316.0	-.0	18399.6	1344.3	1	2
1	16	.9297	-.0000	3.205	3295.7	369.53	4.8922E-04	440.1	3281.8	301.8	-.0	18399.5	1344.3	1	2
1	17	.9566	-.0000	3.214	3298.9	364.39	4.8435E-04	438.4	3286.3	287.4	-.0	18399.4	1344.3	1	2
1	U	.9608	-.0000	3.216	3299.4	363.54	4.8354E-04	438.1	3287.1	285.1	-.0	18399.3	1344.3	1	2
1	D	.9608	-.0000	3.021	3230.1	484.16	5.9295E-04	475.8	3229.1	78.6	-.0	18355.3	1344.3	1	4
1	18	.9797	-.0000	3.040	3237.1	470.81	5.8122E-04	472.0	3236.1	81.1	-.0	18355.0	1344.3	1	3
1	19	1.0024	-.0000	3.038	3236.5	472.43	5.8280E-04	472.3	3236.0	56.5	-.0	18371.6	1344.3	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.133305E+00	-2.702097E-01	-9.628015E-01	1.879732E-10

MASS FLOW RATE FOR ENTIRE PLANE= 3.83064E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=20 SAFETY FACTOR= 9.750000E-01 DELTA-X= 6.295111E-02(FT)

Figure 13. Continued.

SOLUTION PLANE NO. 3 X= 3.06044(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.5396	-.0000	3.130	3269.7	412.79	5.2948E-04	454.3	3220.1	567.8	-.0	18397.8	1344.2	1	2
1	2	.5655	-.0000	3.130	3270.0	412.59	5.2930E-04	454.2	3224.7	542.3	-.0	18401.5	1344.3	1	2
1	3	.5915	-.0000	3.131	3270.4	411.89	5.2866E-04	454.0	3228.9	519.4	-.0	18401.7	1344.3	1	2
1	4	.6176	-.0000	3.133	3271.0	410.82	5.2768E-04	453.7	3232.9	498.0	-.0	18401.5	1344.3	1	2
1	5	.6438	-.0000	3.136	3272.0	409.10	5.2610E-04	453.1	3236.9	478.1	-.0	18401.4	1344.3	1	2
1	6	.6701	-.0000	3.139	3273.2	406.98	5.2414E-04	452.4	3240.8	459.3	-.0	18401.1	1344.3	1	2
1	7	.6964	-.0000	3.143	3274.6	404.55	5.2191E-04	451.7	3244.7	441.7	-.0	18400.6	1344.3	1	2
1	8	.7229	-.0000	3.148	3276.3	401.75	5.1933E-04	450.8	3248.6	424.9	-.0	18400.5	1344.3	1	2
1	9	.7493	-.0000	3.153	3278.1	398.67	5.1648E-04	449.8	3252.5	408.7	-.0	18400.4	1344.3	1	2
1	10	.7759	-.0000	3.159	3280.0	395.45	5.1349E-04	448.7	3256.3	393.3	-.0	18400.4	1344.3	1	2
1	11	.8024	-.0000	3.165	3282.0	392.06	5.1034E-04	447.6	3260.1	378.5	-.0	18400.3	1344.3	1	2
1	12	.8290	-.0000	3.171	3284.2	388.47	5.0700E-04	446.5	3263.9	364.1	-.0	18400.2	1344.3	1	2
1	13	.8556	-.0000	3.178	3286.4	384.67	5.0346E-04	445.2	3267.7	350.1	-.0	18400.0	1344.3	1	2
1	14	.8823	-.0000	3.185	3288.8	380.70	4.9974E-04	443.9	3271.6	336.2	-.0	18399.8	1344.3	1	2
1	15	.9089	-.0000	3.192	3291.4	376.48	4.9577E-04	442.5	3275.6	322.6	-.0	18399.6	1344.3	1	2
1	16	.9355	-.0000	3.200	3294.2	372.00	4.9155E-04	441.0	3279.7	308.9	-.0	18399.5	1344.3	1	2
1	U	.9433	-.0000	3.203	3295.0	370.66	4.9029E-04	440.5	3280.9	304.9	-.0	18399.4	1344.3	1	2
1	D	.9433	-.0000	3.007	3224.7	494.48	6.0194E-04	478.7	3223.3	96.3	-.0	18354.6	1344.3	1	4
1	17	.9590	.0000	3.015	3227.9	488.38	5.9663E-04	477.0	3226.6	92.2	.0	18354.8	1344.3	1	3
1	18	.9812	-.0000	3.016	3228.3	487.53	5.9591E-04	476.7	3227.5	75.2	-.0	18356.7	1344.3	1	3
1	19	1.0035	-.0000	3.019	3229.4	485.87	5.9462E-04	476.1	3229.0	56.3	-.0	18374.2	1344.3	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.134162E+00	-2.660577E-01	-9.639571E-01	3.875343E-10

MASS FLOW RATE FOR ENTIRE PLANE= 3.83275E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=19 SAFETY FACTOR= 9.750000E-01 DELTA-X= 6.096683E-02(FT)

Figure 13. Continued.

SOLUTION PLANE NO. 26 X= 4.01118(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.7073	-.0000	3.128	3268.8	413.72	5.3034E-04	454.6	3218.9	568.6	-.0	18386.9	1344.0	1	2
1	U	.7079	-.0000	3.129	3269.1	413.14	5.2980E-04	454.4	3219.5	567.2	-.0	18387.4	1344.0	1	2
1	D	.7079	-.0000	2.852	3162.3	621.40	7.0775E-04	511.6	3151.5	260.3	-.0	18260.7	1344.0	1	3
1	2	.7225	.0000	2.836	3155.7	637.48	7.2088E-04	515.3	3147.6	226.0	.0	18280.3	1344.3	1	3
1	3	.7377	.0000	2.813	3146.1	660.53	7.3947E-04	520.5	3140.3	190.1	.0	18293.2	1344.4	1	3
1	4	.7530	.0000	2.787	3134.7	687.86	7.6126E-04	526.5	3131.0	151.6	.0	18301.2	1344.5	1	3
1	5	.7683	.0000	2.757	3121.1	720.75	7.8713E-04	533.6	3119.1	111.5	.0	18305.2	1344.5	1	3
1	6	.7835	.0000	2.726	3107.2	755.60	8.1415E-04	540.8	3106.5	66.4	.0	18306.6	1344.5	1	3
1	7	.7985	.0000	2.695	3092.9	792.44	8.4230E-04	548.2	3092.8	19.1	.0	18307.0	1344.5	1	3
1	8	.8135	.0000	2.662	3077.1	834.16	8.7373E-04	556.3	3077.0	-25.4	.0	18306.7	1344.5	1	3
1	9	.8281	.0000	2.630	3061.8	875.86	9.0472E-04	564.1	3061.1	-68.0	.0	18306.6	1344.5	1	3
1	10	.8426	.0000	2.603	3048.3	913.82	9.3256E-04	571.0	3046.3	-110.3	.0	18307.1	1344.5	1	3
1	11	.8569	.0000	2.577	3035.4	951.05	9.5955E-04	577.5	3031.8	-148.3	.0	18308.4	1344.5	1	3
1	12	.8711	.0000	2.551	3022.1	990.25	9.8769E-04	584.2	3016.7	-180.1	.0	18309.7	1344.5	1	3
1	13	.8852	.0000	2.527	3009.8	1027.43	1.0141E-03	590.4	3002.4	-210.3	.0	18311.6	1344.4	1	3
1	14	.8991	.0000	2.508	2999.6	1056.93	1.0363E-03	595.4	2989.8	-242.2	.0	18314.7	1344.4	1	3
1	15	.9128	.0000	2.490	2990.2	1086.47	1.0569E-03	600.1	2977.7	-273.6	.0	18319.9	1344.4	1	3
1	16	.9264	.0000	2.471	2979.9	1121.75	1.0800E-03	605.2	2964.7	-301.2	.0	18327.5	1344.4	1	3
1	17	.9400	.0000	2.451	2968.6	1159.30	1.1060E-03	610.8	2950.8	-324.6	.0	18338.5	1344.3	1	3
1	18	.9534	.0000	2.431	2957.8	1195.73	1.1310E-03	616.0	2937.4	-346.9	.0	18354.0	1344.3	1	3
1	19	.9667	.0000	2.413	2947.6	1231.13	1.1553E-03	621.0	2923.9	-373.5	.0	18375.2	1344.2	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.196695E+00	-2.163664E-01	-9.763122E-01	2.024162E-08

MASS FLOW RATE FOR ENTIRE PLANE= 3.84027E+00(SLUG/SEC)

COURANT NUMBER= .46887

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=21 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.642260E-02(FT)

Figure 13. Continued.

INTERPLANAR RESULTS - REFLECTION WITH CENTERBODY

INCIDENT WAVE UPSTREAM AND DOWNSTREAM SHOCK POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.0126	.7076	-.0000	3.128	3268.7	413.80	5.3041E-04	454.6	3218.9	568.7	-.0	18386.9	1344.0
1	D	4.0126	.7076	-.0000	2.851	3161.7	622.68	7.0879E-04	511.9	3150.8	261.3	-.0	18259.8	1344.0

INCIDENT WAVE SHOCK POINTS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.196944E+00	-2.161154E-01	-9.763678E-01	2.024277E-08

INCIDENT WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.0126	.7076	-.0000	3.128	3268.7	413.80	5.3041E-04	454.6	3218.9	568.7	-.0	18386.9	1344.0
1	D	4.0126	.7076	-.0000	2.851	3161.7	622.68	7.0879E-04	511.9	3150.8	261.3	-.0	18259.8	1344.0

REFLECTED WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.0126	.7076	-.0000	2.851	3161.7	622.68	7.0879E-04	511.9	3150.8	261.3	-.0	18259.8	1344.0
1	D	4.0126	.7076	-.0000	2.601	3047.1	908.41	9.2681E-04	571.1	3000.6	530.1	-.0	18160.0	1344.0

REFLECTED WAVE SHOCK POINTS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.180390E+00	-4.878679E-01	8.729175E-01	-1.815384E-08

ORIGINAL PAGE IS OF POOR QUALITY

Figure 13. Continued.

SOLUTION PLANE NO. 27 X= 4.03760(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.7120	-.0000	2.572	3032.3	950.59	9.5745E-04	578.6	2986.2	526.8	.0	18160.1	1344.0	1	3
1	D	.7215	-.0000	2.542	3017.5	993.80	9.8774E-04	586.3	2972.4	519.3	.0	18137.2	1344.2	1	1
1	U	.7215	-.0000	2.821	3149.1	652.38	7.3264E-04	518.7	3141.6	216.6	.0	16275.2	1344.2	1	3
1	2	.7243	.0000	2.817	3147.3	656.62	7.3625E-04	519.7	3140.3	209.5	.0	18277.4	1344.2	1	3
1	3	.7392	.0000	2.793	3137.2	681.31	7.5598E-04	525.1	3132.6	169.8	.0	18290.2	1344.4	1	3
1	4	.7542	.0000	2.764	3124.6	711.96	7.8017E-04	531.8	3122.0	128.1	.0	18297.8	1344.5	1	3
1	5	.7691	.0000	2.732	3109.9	748.62	8.0869E-04	539.4	3108.7	85.4	.0	18301.4	1344.5	1	3
1	6	.7840	.0000	2.698	3094.2	788.82	8.3948E-04	547.5	3093.9	39.7	.0	18302.5	1344.5	1	4
1	7	.7986	.0000	2.666	3079.2	828.48	8.6941E-04	555.3	3079.2	-8.2	.0	18302.7	1344.5	1	4
1	8	.8131	.0000	2.633	3063.6	870.94	9.0100E-04	563.3	3063.1	-53.7	.0	18302.6	1344.5	1	4
1	9	.8274	.0000	2.602	3048.1	914.23	9.3278E-04	571.1	3046.7	-94.3	.0	18302.9	1344.5	1	3
1	10	.8416	.0000	2.575	3034.4	953.84	9.6149E-04	578.1	3031.4	-134.1	.0	18303.8	1344.5	1	3
1	11	.8556	.0000	2.551	3022.3	989.48	9.8704E-04	584.1	3017.4	-171.7	.0	18305.5	1344.5	1	3
1	12	.8694	.0000	2.527	3009.8	1027.18	1.0138E-03	590.4	3002.9	-204.0	.0	18307.4	1344.5	1	3
1	13	.8832	.0000	2.503	2997.0	1066.72	1.0416E-03	596.7	2988.0	-232.2	.0	18309.5	1344.4	1	3
1	14	.8968	.0000	2.482	2985.7	1102.41	1.0665E-03	602.3	2974.3	-261.4	.0	18312.9	1344.4	1	3
1	15	.9103	.0000	2.464	2976.3	1133.05	1.0876E-03	607.0	2961.9	-292.7	.0	18318.3	1344.4	1	3
1	16	.9236	.0000	2.447	2966.9	1164.09	1.1090E-03	611.7	2949.4	-322.4	.0	18326.4	1344.4	1	3
1	17	.9370	.0000	2.428	2956.4	1199.79	1.1334E-03	616.8	2935.9	-347.0	.0	18337.9	1344.4	1	3
1	18	.9501	.0000	2.406	2943.9	1242.72	1.1626E-03	622.9	2920.5	-370.4	.0	18353.7	1344.3	1	3
1	19	.9632	.0000	2.386	2932.3	1284.09	1.1906E-03	628.5	2905.3	-397.0	.0	18374.9	1344.2	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.203569E+00	-4.878679E-01	8.729175E-01	-1.811537E-08

MASS FLOW RATE FOR ENTIRE PLANE= 3.84261E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J=21 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.537725E-02(FT)

Figure 13. Continued.

SOLUTION PLANE NO. 54 X= 4.41767(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.7599	-.0000	1.774	2497.4	3283.84	2.3209E-03	824.4	2494.8	115.5	-.0	18147.0	1343.6	1	3
1	2	.7654	-.0000	1.767	2491.0	3316.43	2.3367E-03	827.0	2489.8	75.2	-.0	18123.8	1343.5	1	3
1	3	.7711	-.0000	1.762	2486.3	3341.06	2.3486E-03	828.9	2486.0	37.4	-.0	18109.9	1343.5	1	3
1	4	.7770	-.0000	1.759	2484.1	3353.10	2.3542E-03	829.9	2484.1	1.8	-.0	18103.7	1343.6	1	3
1	5	.7831	-.0000	1.755	2480.5	3374.77	2.3648E-03	831.6	2480.4	-24.2	-.0	18102.4	1343.7	1	3
1	6	.7895	-.0000	1.747	2473.6	3416.28	2.3854E-03	834.5	2473.3	-39.2	-.0	18103.4	1343.8	1	3
1	7	.7960	-.0000	1.752	2478.4	3390.31	2.3725E-03	832.7	2477.6	-63.1	-.0	18108.0	1344.0	1	3
1	8	.8028	-.0000	1.770	2494.5	3299.10	2.3266E-03	826.3	2492.6	-97.9	-.0	18120.5	1344.3	1	2
1	9	.8099	.0000	1.774	2497.9	3282.36	2.3182E-03	825.0	2495.5	-108.8	-.0	18130.9	1344.4	1	2
1	10	.8170	.0000	1.764	2489.1	3335.97	2.3454E-03	828.8	2487.2	-97.3	-.0	18140.9	1344.6	1	3
1	11	.8245	.0000	1.773	2497.0	3293.20	2.3239E-03	825.7	2494.7	-107.8	-.0	18153.0	1344.8	1	3
1	12	.8319	.0000	1.804	2524.0	3142.28	2.2479E-03	814.5	2519.9	-143.9	-.0	18171.2	1344.8	1	2
1	13	.8399	.0000	1.821	2537.8	3067.65	2.2101E-03	808.8	2532.8	-158.8	-.0	18188.8	1344.9	1	2
1	14	.8479	.0000	1.816	2534.1	3092.01	2.2230E-03	810.5	2529.9	-144.7	-.0	18204.5	1345.0	1	2
1	15	.8559	.0000	1.820	2537.8	3074.88	2.2145E-03	809.1	2533.9	-140.5	-.0	18220.9	1345.2	1	3
1	16	.8642	.0000	1.852	2564.1	2931.81	2.1411E-03	797.9	2558.4	-169.8	.0	18240.3	1345.2	1	3
1	17	.8730	.0000	1.893	2597.3	2754.29	2.0490E-03	783.3	2588.8	-209.1	.0	18265.6	1344.8	1	3
1	18	.8821	.0000	1.922	2619.9	2636.68	1.9874E-03	773.1	2609.8	-230.2	.0	18288.8	1344.4	1	2
1	D	.8912	.0000	1.941	2634.3	2563.82	1.9469E-03	766.5	2623.8	-235.2	.0	18309.1	1344.2	1	3
1	U	.8912	.0000	2.153	2787.1	1850.22	1.5454E-03	697.6	2737.6	-522.7	.0	18373.9	1344.2	1	2
1	19	.8914	.0000	2.153	2787.2	1849.61	1.5451E-03	697.5	2737.8	-522.5	.0	18374.5	1344.2	1	2

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.153509E+00	-3.679747E-01	9.298358E-01	2.492908E-06

MASS FLOW RATE FOR ENTIRE PLANE= 3.83453E+00(SLUG/SEC)

COURANT NUMBER= .52878

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 7.582123E-03(FT)

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Figure 13. Continued.

INTERPLANAR RESULTS - REFLECTION WITH COWL

INCIDENT WAVE UPSTREAM AND DOWNSTREAM SHOCK POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.4181	.8913	.0000	2.153	2787.3	1849.21	1.5448E-03	697.5	2738.0	-522.2	.0	18374.5	1344.2
1	D	4.4181	.8913	.0000	1.941	2634.5	2563.12	1.9486E-03	766.5	2624.0	-234.5	.0	18309.5	1344.2

INCIDENT WAVE SHOCK POINTS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.153651E+00	-3.681369E-01	9.297716E-01	2.492736E-06

INCIDENT WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.4181	.8913	.0000	2.153	2787.3	1849.21	1.5448E-03	697.5	2738.0	-522.2	.0	18374.5	1344.2
1	D	4.4181	.8913	.0000	1.941	2634.5	2563.12	1.9486E-03	766.5	2624.0	-234.5	.0	18309.5	1344.2

REFLECTED WAVE UPSTREAM AND DOWNSTREAM BODY STREAMLINE POINTS

I	J	X (FT)	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	U	4.4181	.8913	.0000	1.941	2634.5	2563.12	1.9486E-03	766.5	2624.0	-234.5	.0	18309.5	1344.2
1	D	4.4181	.8913	.0000	1.741	2468.4	3478.24	2.4214E-03	837.0	2424.7	-462.4	.0	18256.5	1344.2

REFLECTED WAVE SHOCK POINTS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.142816E+00	-6.582802E-01	-7.527730E-01	-2.025662E-06

Figure 13. Continued.

SOLUTION PLANE NO. 55 X= 4.42525(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.7602	-.0000	1.746	2472.3	3430.69	2.3946E-03	834.8	2470.0	108.2	-.0	18146.8	1343.6	1	3
1	2	.7656	-.0000	1.739	2466.4	3460.77	2.4090E-03	837.1	2465.4	69.9	-.0	18123.3	1343.5	1	3
1	3	.7712	-.0000	1.736	2463.9	3472.91	2.4145E-03	838.1	2463.6	34.6	-.0	18109.2	1343.5	1	3
1	4	.7770	-.0000	1.738	2465.2	3464.16	2.4097E-03	837.7	2465.2	1.3	-.0	18103.0	1343.6	1	4
1	5	.7831	-.0000	1.741	2467.9	3448.79	2.4018E-03	836.7	2467.8	-27.5	-.0	18102.1	1343.7	1	3
1	6	.7894	-.0000	1.737	2465.1	3466.43	2.4104E-03	838.0	2464.8	-41.7	-.0	18103.8	1343.9	1	3
1	7	.7958	-.0000	1.736	2464.5	3472.25	2.4131E-03	838.4	2463.9	-52.8	-.0	18106.6	1344.0	1	3
1	8	.8026	-.0000	1.754	2479.9	3364.14	2.3692E-03	832.3	2478.5	-81.9	-.0	18118.7	1344.2	1	3
1	9	.8095	.0000	1.771	2495.2	3297.88	2.3261E-03	826.1	2492.9	-107.0	-.0	18130.6	1344.4	1	2
1	10	.8167	.0000	1.768	2492.7	3315.48	2.3350E-03	827.4	2490.6	-102.6	-.0	18141.3	1344.6	1	2
1	11	.8240	.0000	1.765	2489.9	3334.75	2.3448E-03	828.7	2488.1	-95.3	-.0	18153.2	1344.8	1	3
1	12	.8315	.0000	1.788	2509.9	3222.56	2.2886E-03	820.5	2507.0	-119.7	-.0	18169.3	1344.9	1	3
1	13	.8394	.0000	1.816	2533.7	3090.78	2.2220E-03	810.5	2529.3	-148.3	-.0	18188.0	1344.9	1	2
1	14	.8474	.0000	1.822	2538.9	3064.63	2.2089E-03	808.4	2534.7	-147.2	-.0	18204.5	1345.0	1	2
1	15	.8555	.0000	1.820	2537.4	3076.77	2.2154E-03	809.2	2535.9	-133.7	-.0	18220.9	1345.2	1	3
1	16	.8638	.0000	1.838	2552.8	2993.99	2.1732E-03	802.8	2548.7	-145.1	-.0	18238.8	1345.3	1	3
1	17	.8724	.0000	1.878	2585.1	2819.88	2.0634E-03	788.7	2578.7	-181.4	.0	18262.3	1345.0	1	3
1	18	.8814	.0000	1.915	2614.3	2666.14	2.0030E-03	775.6	2605.8	-211.4	.0	18287.2	1344.6	1	3
1	U	.8851	.0000	1.925	2621.6	2628.83	1.9833E-03	772.3	2612.7	-215.9	.0	18295.9	1344.5	1	3
1	D	.8851	.0000	1.723	2452.6	3570.75	2.4662E-03	843.7	2412.0	-445.4	.0	18242.5	1344.5	1	1
1	19	.8900	.0000	1.729	2458.5	3537.81	2.4509E-03	841.1	2415.8	-455.9	.0	18256.5	1344.2	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.143292E+00	-6.582802E-01	-7.527730E-01	-2.021496E-06

MASS FLOW RATE FOR ENTIRE PLANE= 3.83503E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 1, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 7.251737E-03(FT)

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Figure 13. Continued.

SOLUTION PLANE NO. 245 X= 5.32102(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.6797	-.0000	2.091	2743.8	1969.38	1.6179E-03	716.5	2713.5	-406.6	.0	17944.6	1343.2	1	3
1	2	.6876	-.0000	2.089	2742.2	1995.38	1.6214E-03	717.1	2715.6	-381.0	.0	17939.8	1343.0	1	3
1	3	.6960	-.0000	2.087	2740.3	2002.72	1.6257E-03	717.8	2717.3	-354.5	.0	17936.7	1342.9	1	3
1	4	.7046	-.0000	2.084	2738.5	2010.40	1.6302E-03	718.6	2718.8	-327.7	.0	17935.3	1342.8	1	3
1	5	.7134	-.0000	2.082	2736.7	2018.24	1.6348E-03	719.3	2720.2	-300.2	-.0	17935.7	1342.8	1	3
1	6	.7226	-.0000	2.079	2735.0	2026.06	1.6395E-03	720.1	2721.4	-272.1	-.0	17937.6	1342.8	1	3
1	7	.7319	-.0000	2.077	2733.4	2033.56	1.6439E-03	720.8	2722.5	-243.6	-.0	17941.1	1342.7	1	3
1	8	.7414	-.0000	2.075	2732.0	2040.20	1.6479E-03	721.4	2723.6	-214.4	-.0	17946.3	1342.7	1	3
1	U	.7421	-.0000	2.075	2731.9	2040.53	1.6481E-03	721.4	2723.7	-212.3	-.0	17946.7	1342.7	1	2
1	D	.7421	-.0000	2.032	2700.9	2182.79	1.7294E-03	735.5	2687.9	-265.0	-.0	17946.2	1342.7	1	4
1	9	.7508	-.0000	2.022	2694.0	2216.11	1.7483E-03	738.6	2683.1	-242.7	-.0	17953.6	1342.7	1	3
1	10	.7603	-.0000	2.018	2690.7	2233.23	1.7582E-03	740.1	2681.8	-217.9	-.0	17962.6	1342.8	1	3
1	11	.7699	-.0000	2.014	2687.6	2249.26	1.7675E-03	741.5	2680.5	-196.0	-.0	17973.8	1342.8	1	3
1	12	.7796	-.0000	2.012	2686.8	2254.									

Figure 13. Continued.

6. SAMPLE CASE NO. 5

Sample Case No. 5 is concerned with the computation of the internal flow field in the Mach 3.5 inlet discussed in Sample Case No. 4, for the off-design conditions of a free-stream Mach number of 2.5, a centerbody foward translation of 0.855 ft, and an angle of incidence of 3.0 degrees. This sample case also illustrates the use of the program restart option.

The data deck listings for this sample case are presented in Figures 14 and 15. Figure 14 presents the data deck used for the initial execution, and Figure 15 presents the data deck used for the restart execution. The first card in each data deck is the title card. For the initial execution data deck, namelist LIST1 is identical to namelist LIST1 in Sample Case No. 4, except for the specified values of KSYM, IPRSTP, and KSTART. Since the vehicle is at a nonzero angle of attack, only one plane of flow symmetry exists; hence KSYM = 1. The desired number of solution planes to be computed in the initial execution is 25; hence IPRSTP = 25. Thus, the execution will be terminated after plane No. 25 has been printed. Since this is the initial execution and a program restart is to ensue, KSTART = 1 is specified in namelist LIST1. This causes the binary restart file to be written on TAPE 4 (it is assumed that this file will be stored and then retrieved when the restart execution is performed).

The free-stream Mach number for this sample case is 2.5; hence MFS = 2.5 is specified in namelist LIST2. The angle of attack is 3.0 degrees; hence PITCH = 3.0. With the prescribed centerbody translation of 0.855 ft, the axial location of the cowl lip, and thereby of the initial-value plane, is x = 3.715 ft. Note that the origin of the coordinate system remains at the forebody tip, hence a forward centerbody translation corresponds to a rearward cowl translation. Consequently, XI = 3.715 is specified in namelist LIST2. For this execution, the results of Jones (3) are used for the initial data since the forebody is conical. Hence, the initial-value plane flow property field is externally specified. Consequently, KIVS = 0 is specified in namelist LIST2. The bow shock wave is conical, consequently KCØN is retained at its default value of 1. The initial-value plane will be entered by a formatted read of the input file; hence ITAPE is left at its default value of 5.

All input parameters in namelist LIST3 are retained at their default values, except for ISTØP. As in Sample Case No. 2, 21 circumferential stations are specified in the computed sector (half-plane); hence ISTØP = 21.

All parameters in namelist LIST4, which specifies the thermodynamic model, retain their default values.

All parameters in namelist LIST5 are identical to those in Sample Case No. 4, except for DXTRAN, which specifies the centerbody (cowl) translation. In this case, the centerbody has been translated forward by 0.855 ft, or, alternatively, the cowl has been translated backward by 0.855 ft. Hence, DXTRAN = 0.855 is specified in namelist LIST5.

All convergence tolerances and iteration limits are retained at their default values. Hence no parameters are input in namelist LIST6.

```
SAMPLE CASE NO. 5
 $LIST1 KCALL(1)=0, XEND(2)=6.9, KSYM=1, KPRINT=2, IPRSTP=25, KSTART=1 $
 $LIST2 MFS=2.5, PITCH=3.0, XI=3.715, KIVS=0 $
 $LIST3 ISTOP=21 $
 $LIST4 $
 $LIST5 NCENT=11, NCOWL=14, KDCENT(1)=11*1, KDCOWL(1)=14*1,
 XCENT(1)= 0.0, 2.798794, 4.0, 4.2, 4.4, 4.55, 4.7, 4.9, 5.5, 6.28, 6.9,
 KCENT(1)=11*0.0,
 ACENT(1)= 0.0, .493511, .70532, .7387, .759, .763, .7585, .7391,
 .6525, .4, 0.0,
 BCENT(1)= .17633, .17633, .17633, .144, .052, 0.0, -.0646, -.1295, -.153,
 0.0, 0.0,
 CCENT(1)= 0.0, 0.0, .02020035, -.1774997, -.1600005, -.1693327,
 -.1615001, -.03499995, .1651873, 0.0, 0.0,
 DCENT(1)= 0.0, 0.0, -.3367512, -.1750011, -.05925696, -.2044475,
 -2.499656E-03, .01712957, -.4923802, 0.0, 0.0,
 XCOWL(1)= 2.86, 3.1, 3.4, 4.0, 4.2, 4.3, 4.5, 4.6, 4.7, 5.1, 5.6, 6.1, 6.5,
 6.9,
 KCOWL(1)=14*0.0,
 ACOWL(1)=1.0, 1.004188, 1.0051, .9681, .9364, .9154, .8768, .864, .8572, .85,
 .85, .8839, .9227, 0.0,
 BCOWL(1)= .01745001, .01745, -.011, -.124, -.1942, -.213, -.163, -.093, -.0485,
 0.0, 0.0, .107, .0729, 0.0,
 CCOWL(1)= 0.0, -.04926635, -.06500001, -.1664999, -.2859976, .05000008,
 .3500018, .3049997, .1075002, 0.0, .1928, .01025012, -.01512487, 0.0,
 DCOWL(1)= 0.0, 4.110418E-03, -.03240740, -.0300005, 1.279984,
 .2499998, -1.251464E-05, -.5499974, -.07812535, 0.0, -.1144, -.08812521,
 8.74978E-03, 0.0,
 DXTRAN=0.855 $
 $LIST6 $
 $LIST7 $
 6.5505473333193E-01-1.5137063432436E-08 2.3108741049088E+03 4.0746945743999E+02
-9.5925328260476E-06 3.1020272481190E+02 4.3206146580673E-04
 7.8561540748198E-01-8.7743895330697E-07 2.3181055968066E+03 3.7203606616003E+02
-4.1687875708468E-04 3.0933111360508E+02 4.3134845529953E-04
 9.1217608163243E-01-1.0213924058373E-06 2.3247090952549E+03 3.4303255206582E+02
-3.8446265760914E-04 3.0719748716877E+02 4.2922112488989E-04
 1.0407367557829E+00-1.1653458583677E-06 2.3311025783340E+03 3.1866591519535E+02
-3.5721134419579E-04 3.0427839240714E+02 4.2630366736915E-04
 1.1692974299334E+00-1.3092993108980E-06 2.3373811367411E+03 2.9754472795215E+02
-3.3358209596933E-04 3.0061871527400E+02 4.2283563526007E-04
 1.2978581040838E+00-1.4532527634284E-06 2.3436245103793E+03 2.7871765124381E+02
-3.1251496135275E-04 2.9695298008855E+02 4.1894770396752E-04
 1.4264187782343E+00-1.5972062159588E-06 2.3499849147152E+03 2.6134263226085E+02
-2.9306965026112E-04 2.9269256882197E+02 4.1464748842468E-04
```

```
-1.4118999667307E+00 0.                   2.3259929161670E+03-8.4508243644906E+01
 0.                  3.2981520378008E+02 4.5140391356456E-04
-1.5065056209055E+00 0.                   2.3364504884367E+03-5.7897086987378E+01
 0.                  3.1977683586671E+02 4.4154704165349E-04
-1.6011112750804E+00 0.                   2.3498464328799E+03-2.5922170048988E+01
 0.                  3.0670442486558E+02 4.2857719172761E-04
```

Figure 14. Data deck for Sample Case No. 5, initial execution.

```
SAMPLE CASE NO. 5 - CONTINUED
 $LIST1 KCALL(1)=0, XEND(2)=6.9, KSYM=1, KPRINT=2, IPRSTP=50, KSTART=2 $
 $LIST2 MFS=2.5, PITCH=3.0, XI=3.715, KIVS=0 $
 $LIST3 ISTOP=21 $
 $LIST4 $
 $LIST5 NCENT=11, NCOWL=14, KDCENT(1)=11*1, KDCOWL(1)=14*1,
  XCENT(1)= 0.0, 2.798794, 4.0, 4.2, 4.4, 4.55, 4.7, 4.9, 5.5, 6.28, 6.9,
  RCENT(1)=11*0.0,
  ACENT(1)= 0.0, .493511, .70532, .7387, .759, .765, .7585, .7391,
  .6525, .4, 0.0,
  BCENT(1)= .17633, .17633, .17633, .144, .052, 0.0, -.0646, -.1295, -.153,
  0.0, 0.0,
  CCENT(1)= 0.0, 0.0, .02020035, -.1774997, -.1600005, -.1693327,
  -.1615001, -.03499995, .1651873, 0.0, 0.0,
  DCENT(1)= 0.0, 0.0, -.3367512, -.1750011, -.05925696, -.2044475,
  -2.499656E-03, .01712957, -.4923802, 0.0, 0.0,
  XCOWL(1)= 2.86, 3.1, 3.4, 4.0, 4.2, 4.3, 4.5, 4.6, 4.7, 5.1, 5.6, 6.1, 6.5,
  6.9,
  RCOWL(1)=14*0.0,
  ACOWL(1)=1.0, 1.004188, 1.0051, .9681, .9364, .9154, .8768, .864, .8572, .85,
  .85, .8839, .9227, 0.0,
  BCOWL(1)= .01745001, .01745, -.011, -.124, -.1942, -.215, -.165, -.093, -.0485,
  0.0, 0.0, .107, .0729, 0.0,
  CCOWL(1)= 0.0, -.04926635, -.06500001, -.1664999, -.2859976, .05000008,
  .3500018, .3049997, .1075002, 0.0, .1928, .01025012, -.01512487, 0.0,
  DCOWL(1)= 0.0, 4.110418E-03, -.03240740, -.0300005, 1.279984,
  .2499998, -1.251464E-05, -.5499974, -.07812535, 0.0, -.1144, -.08812521,
  8.74978E-03, 0.0,
  UXTRAN=0.855 $
  $LIST6 $
  $LIST7 $
```

Figure 15. Data deck for Sample Case No. 5, restart execution.

No debug output is to be printed. Hence, all parameters in namelist LIST7 are left equal to their default values.

The data deck for the initial-value plane flow property field follows namelist LIST7. The complete listing of the data deck for the initial-value plane is not shown to conserve space. Since the bow shock wave is conical (the forebody is conical), the BETA angles are internally generated and are not specified by the user (KCØN = 1).

Figure 16 presents selected portions of the output for the initial execution of Sample Case No. 5. This execution required 755 seconds of central processor time on the CDC-6500 computer. At the end of this execution, the restart file written on TAPE 4 was stored.

Figure 15 presents the data deck for the restart execution. This data deck is identical to the initial execution data deck, except that the initial-value plane flow property field is not entered, and the specified values for IPRSTP and KSTART in namelist LIST1 are different. The initial-value plane for this execution is solution plane No. 25 from the initial execution, which is read from the binary restart file written on TAPE 4 (TAPE 4 is linked to the dummy file RESTRT in the PRØGRAM card). The new value for the plane number at which the program execution is to be terminated is 50; hence IPRSTP = 50 is specified in namelist LIST1. Since this is a program restart, KSTART = 2 is specified in namelist LIST1. All other namelists are identical to those used in the initial execution of Sample Case No. 5.

Figure 17 presents selected portions of the output for the restart execution of Sample Case No. 5. The solution terminated just after solution plane No. 46. This execution required 590 seconds of central processor time on the CDC-6500 computer.

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-191 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 5

SPECIFIED COMPUTATION OPTIONS

1.) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

FLOW SYMMETRY

ONE PLANE OF SYMMETRY - COMPUTED SECTOR IS THE HALF-PLANE BOUNDED BY THE Y-AXIS AND CONTAINING THE +Z-AXIS

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000 GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS

VISCOUS AND THERMAL DIFFUSION TERMS ARE NOT INCLUDED IN THE COMPUTATION - INVISCID AND ADIABATIC FLOW IS ASSUMED

ORIENTATION AND FREE STREAM DATA

ORIENTATION - PITCH= 3.00000(DEGREES) YAW= 0.00000(DEGREES)

FREE STREAM DATA - MACH NO.= 2.50000 PRESSURE= 2.422000E+02(LBF/FT**2) DENSITY= 3.622000E-04(SLUG/FT**3)

TEMPERATURE= 3.896437E+02(DEG R) SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 2.415579E+03(FT/SEC) Y-VELOCITY= 1.265951E+02(FT/SEC) Z-VELOCITY= 0. (FT/SEC)

Figure 16. Selected output for Sample Case No. 5, initial execution.

INITIAL VALUE SURFACE

A USER SUPPLIED INITIAL VALUE SURFACE IS READ FROM TAPE NO. 5 AND IS SPECIFIED AS BEING LOCATED AT X= 3.715000E+00(FT)

INDEX PARAMETERS

ISTOP=21 IMAX=40 JMAXI=11

JINLET=11

INTEGRATION TERMINATION POINTS

INTERNAL FLOW FIELD INTEGRATION TERMINATES AT X= 6.900000E+00(FT)

CENTERBODY GEOMETRY

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	1	0.	0.	0.	1.763300E-01	0.	0.
2	1	2.798794E+00	0.	4.935110E-01	1.763300E-01	0.	0.
3	1	4.000000E+00	0.	7.053200E-01	1.763300E-01	2.020035E-02	-3.367512E-01
4	1	4.200000E+00	0.	7.387000E-01	1.440000E-01	-1.774997E-01	-1.750011E-01
5	1	4.400000E+00	0.	7.590000E-01	5.200000E-02	-1.600005E-01	-5.925696E-02
6	1	4.550000E+00	0.	7.630000E-01	0.	-1.693327E-01	-2.044475E-01
7	1	4.700000E+00	0.	7.585000E-01	-6.460000E-02	-1.615001E-01	-2.499656E-03
8	1	4.900000E+00	0.	7.391000E-01	-1.295000E-01	-3.499995E-02	1.712957E-02
9	1	5.500000E+00	0.	6.525000E-01	-1.530000E-01	1.651873E-01	-4.923802E-01
10	1	6.280000E+00	0.	4.000000E-01	0.	0.	0.
11	1	6.900000E+00	0.	0.	0.	0.	0.

COWL GEOMETRY

TRANSLATION FROM DESIGN POSITION= 8.550000E-01(FT)

I	KDCOWL	XCOWL (FT)	RCOWL (FT)	ACOWL (FT)	BCOWL	CCOWL (FT**-1)	DCOWL (FT**-2)
1	1	2.860000E+00	0.	1.000000E+00	1.745001E-02	0.	0.
2	1	3.100000E+00	0.	1.004188E+00	1.745000E-02	-4.926635E-02	4.110418E-03
3	1	3.400000E+00	0.	1.005100E+00	-1.100000E-02	-6.500001E-02	-3.240740E-02
4	1	4.000000E+00	0.	9.681000E-01	-1.240000E-01	-1.664999E-01	-3.000050E-02
5	1	4.200000E+00	0.	9.364000E-01	-1.942000E-01	-2.859976E-01	1.279984E+00
6	1	4.300000E+00	0.	9.154000E-01	-2.130000E-01	5.000008E-02	2.499998E-01
7	1	4.500000E+00	0.	8.768000E-01	-1.630000E-01	3.500018E-01	-1.251464E-05
8	1	4.600000E+00	0.	8.640000E-01	-9.300000E-02	3.049997E-01	-5.499974E-01
9	1	4.700000E+00	0.	6.572000E-01	-4.850000E-02	1.075002E-01	-7.812535E-02
10	1	5.100000E+00	0.	8.500000E-01	0.	0.	0.
11	1	5.600000E+00	0.	8.500000E-01	0.	1.928000E-01	-1.144000E-01
12	1	6.100000E+00	0.	8.839000E-01	1.070000E-01	1.025012E-02	-8.812521E-02
13	1	6.500000E+00	0.	9.227000E-01	7.290000E-02	-1.512487E-02	8.749780E-03
14	1	6.900000E+00	0.	0.	0.	0.	0.

Figure 16. Continued.

```
CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

     CONVERGENCE TOLERANCES AND OTHER PARAMETERS

          CRIT( 1)= 1.000000E-01
          CRIT( 2)= 1.000000E-07
          CRIT( 3)= 1.000000E-04
          CRIT( 4)= 1.000000E-05
          CRIT( 5)= 1.000000E-04
          CRIT( 6)= 1.000000E-04
          CRIT( 7)= 5.000000E-01
          CRIT( 8)= 1.000000E+00
          CRIT( 9)= 1.000000E-04
          CRIT(10)= 8.000000E-01
          CPIT(11)= 1.000000E-06
          CRIT(12)= 2.000000E-01
          CRIT(13)= 1.000000E-05
          CRIT(14)= 4.000000E-01
          CRIT(15)= 1.000000E-04
          CRIT(16)= 1.000000E-06

     ITERATION LIMITS

          ITEND(1)=10
          ITEND(2)=10
          ITEND(3)=10
          ITEND(4)=20
          ITEND(5)=10
          ITEND(6)=10

     INPUT SAFETY FACTOR= 9.750000E-01
```

Figure 16. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

INITIAL DATA PLANE X= 3.71500(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RHO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.6551	-.0000	2.341	2346.5	310.20	4.3206E-04	418.4	2310.9	407.5	-.0	4132.6	876.7
2	1	.6470	.1025	2.340	2346.3	310.42	4.3227E-04	418.4	2310.4	407.5	32.8	4132.8	876.7
3	1	.6230	.2024	2.339	2345.6	311.10	4.3296E-04	418.7	2309.2	406.4	66.9	4132.7	876.7
4	1	.5837	.2974	2.336	2344.5	312.27	4.3411E-04	419.1	2307.1	403.8	104.0	4132.8	876.7
5	1	.5300	.3850	2.333	2342.8	313.97	4.3580E-04	419.8	2304.3	397.6	144.0	4132.6	876.7
6	1	.4632	.4632	2.328	2340.6	316.28	4.3809E-04	420.7	2300.9	386.0	188.0	4132.7	876.7
7	1	.3850	.5300	2.322	2337.7	319.20	4.4098E-04	421.8	2296.8	367.0	233.9	4132.6	876.7
8	1	.2974	.5837	2.315	2334.2	322.82	4.4455E-04	423.1	2292.3	338.6	281.2	4132.6	876.7
9	1	.2024	.6230	2.307	2330.1	327.08	4.4872E-04	424.7	2287.5	300.3	326.5	4132.6	876.7
10	1	.1025	.6470	2.297	2325.4	332.00	4.5354E-04	426.5	2282.5	250.4	367.7	4132.4	876.7
11	1	.0000	.6551	2.287	2320.3	337.43	4.5882E-04	428.5	2277.3	190.7	401.6	4132.6	876.7
12	1	-.1025	.6470	2.276	2314.8	343.30	4.6451E-04	430.6	2272.3	121.4	424.7	4132.3	876.7
13	1	-.2024	.6230	2.264	2309.2	349.39	4.7038E-04	432.8	2267.3	45.8	435.3	4132.6	876.7
14	1	-.2974	.5837	2.253	2303.5	355.54	4.7628E-04	435.0	2262.7	-33.9	430.2	4132.2	876.7
15	1	-.3850	.5300	2.243	2298.2	361.50	4.8197E-04	437.1	2258.5	-113.6	409.7	4132.6	876.7
16	1	-.4632	.4632	2.233	2293.1	367.04	4.8724E-04	439.0	2254.8	-189.7	372.1	4132.2	876.7
17	1	-.5300	.3850	2.224	2288.8	371.96	4.9189E-04	440.6	2251.6	-258.5	319.6	4132.6	876.7
18	1	-.5837	.2974	2.218	2285.1	376.00	4.9570E-04	442.0	2249.0	-315.9	252.8	4132.2	876.7
19	1	-.6230	.2024	2.212	2282.5	379.05	4.9857E-04	443.0	2247.2	-359.7	175.3	4132.6	876.7
20	1	-.6470	.1025	2.209	2280.8	380.91	5.0031E-04	443.6	2246.1	-386.4	89.6	4132.2	876.7
21	1	-.6551	0.0000	2.208	2280.3	381.56	5.0093E-04	443.8	2245.7	-396.0	0.0	4132.6	876.7
1	2	.7836	-.0000	2.343	2347.8	309.33	4.3135E-04	417.9	2318.1	372.0	-.0	4137.8	876.7
2	2	.7737	.1225	2.343	2347.5	309.60	4.3161E-04	418.0	2317.7	371.5	31.6	4137.9	876.7
3	2	.7443	.2418	2.341	2346.7	310.42	4.3243E-04	418.3	2316.6	368.9	64.0	4137.8	876.7
4	2	.6961	.3547	2.338	2345.3	311.80	4.3380E-04	418.8	2314.8	364.2	98.2	4137.8	876.7
5	2	.6307	.4582	2.334	2343.4	313.77	4.3575E-04	419.6	2312.4	355.7	134.0	4137.5	876.7
6	2	.5498	.5498	2.329	2340.9	316.33	4.3828E-04	420.6	2309.3	342.6	172.2	4137.5	876.7
7	2	.4557	.6272	2.322	2337.8	319.51	4.4142E-04	421.8	2305.7	323.2	210.9	4137.1	876.7
8	2	.3508	.6885	2.315	2334.1	323.30	4.4514E-04	423.2	2301.6	296.4	250.2	4136.9	876.7
9	2	.2379	.7323	2.306	2329.9	327.67	4.4942E-04	424.8	2297.3	261.6	286.8	4136.5	876.7
10	2	.1200	.7579	2.297	2325.2	332.59	4.5422E-04	426.7	2292.7	217.6	320.2	4136.1	876.7
11	2	.0000	.7646	2.286	2320.1	337.92	4.5939E-04	428.6	2288.0	166.3	346.5	4135.6	876.7
12	2	-.1192	.7527	2.276	2314.7	343.60	4.6488E-04	430.7	2283.4	107.0	364.5	4135.1	876.7
13	2	-.2347	.7225	2.265	2309.4	349.40	4.7046E-04	432.8	2278.9	43.4	371.5	4134.7	876.7
14	2	-.3439	.6749	2.254	2304.0	355.22	4.7603E-04	434.8	2274.6	-24.0	366.0	4134.1	876.7
15	2	-.4440	.6111	2.244	2298.9	360.80	4.8134E-04	436.8	2270.7	-90.5	347.6	4133.9	876.7
16	2	-.5329	.5329	2.235	2294.2	365.97	4.8625E-04	438.6	2267.2	-154.5	315.0	4133.3	876.7
17	2	-.6086	.4422	2.227	2290.1	370.52	4.9055E-04	440.1	2264.2	-211.8	270.4	4133.2	876.7
18	2	-.6693	.3410	2.221	2286.7	374.27	4.9408E-04	441.4	2261.8	-260.0	213.5	4132.6	876.7
19	2	-.7136	.2319	2.216	2284.3	377.07	4.9671E-04	442.3	2260.1	-296.5	148.1	4132.7	876.7
20	2	-.7406	.1173	2.213	2282.7	378.78	4.9832E-04	442.9	2259.1	-318.9	75.6	4132.3	876.7
21	2	-.7497	0.0000	2.212	2282.2	379.39	4.9888E-04	443.1	2258.7	-326.9	0.0	4132.6	876.7
1	3	.9122	-.0000	2.348	2349.9	307.20	4.2922E-04	417.0	2324.7	343.0	-.0	4137.8	876.7
2	3	.9004	.1426	2.347	2349.6	307.48	4.2951E-04	417.2	2324.4	342.2	29.8	4137.9	876.7
3	3	.8655	.2812	2.345	2348.7	308.35	4.3037E-04	417.5	2323.4	338.9	60.1	4137.8	876.7
4	3	.8086	.4120	2.342	2347.3	309.79	4.3180E-04	418.0	2321.7	333.3	91.5	4137.8	876.7
5	3	.7315	.5315	2.338	2345.3	311.82	4.3382E-04	418.8	2319.5	323.9	123.8	4137.6	876.7
6	3	.6365	.6365	2.333	2342.7	314.44	4.3641E-04	419.8	2316.7	310.4	157.5	4137.6	876.7
7	3	.5263	.7244	2.326	2339.6	317.65	4.3958E-04	421.1	2313.5	291.5	191.0	4137.3	876.7
8	3	.4042	.7933	2.318	2335.9	321.43	4.4331E-04	422.5	2309.8	266.4	224.5	4137.1	876.7
9	3	.2735	.8416	2.310	2331.7	325.72	4.4752E-04	424.1	2305.8	234.6	255.3	4136.7	876.7
10	3	.1376	.8687	2.301	2327.2	330.51	4.5219E-04	425.9	2301.6	195.5	282.9	4136.4	876.7
11	3	.0000	.8742	2.291	2322.3	335.64	4.5719E-04	427.8	2297.3	150.3	304.4	4136.0	876.7
12	3	-.1360	.8584	2.280	2317.1	341.06	4.6243E-04	429.8	2293.0	98.7	316.6	4135.5	876.7
13	3	-.2671	.8219	2.270	2312.0	346.56	4.6773E-04	431.7	2288.8	43.7	323.5	4135.1	876.7

Figure 16. Continued.

INITIAL DATA PLANE X= 3.71500(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
14	3	-.3903	.7661	2.260	2306.9	352.04	4.7299E-04	433.7	2284.9	-14.4	317.8	4134.5	876.7
15	3	-.5030	.6923	2.250	2302.1	357.26	4.7798E-04	435.5	2281.2	-71.5	301.1	4134.1	876.7
16	3	-.6027	.6027	2.242	2297.7	362.09	4.8257E-04	437.2	2278.0	-126.4	272.5	4133.5	876.7
17	3	-.6872	.4993	2.234	2293.9	366.32	4.8658E-04	438.7	2275.2	-175.4	233.6	4133.3	876.7
18	3	-.7549	.3846	2.228	2290.7	369.60	4.8986E-04	439.9	2273.0	-216.7	184.3	4132.8	876.7
19	3	-.8042	.2613	2.224	2288.4	372.40	4.9231E-04	440.8	2271.4	-247.9	127.8	4132.8	876.7
20	3	-.8342	.1321	2.221	2287.0	373.99	4.9381E-04	441.3	2270.4	-267.1	65.2	4132.4	876.7
21	3	-.8443	0.0000	2.220	2286.5	374.54	4.9433E-04	441.5	2270.0	-273.9	0.0	4132.6	876.7
1	4	1.0407	-.0000	2.354	2352.8	304.28	4.2630E-04	415.9	2331.1	318.7	-.0	4137.8	876.7
2	4	1.0271	.1627	2.353	2352.5	304.57	4.2659E-04	416.0	2330.8	317.7	27.8	4137.9	876.7
3	4	.9868	.3206	2.351	2351.6	305.43	4.2745E-04	416.4	2329.9	314.2	55.9	4137.8	876.7
4	4	.9210	.4693	2.348	2350.2	306.87	4.2889E-04	416.9	2328.4	308.1	84.7	4137.8	876.7
5	4	.8323	.6047	2.344	2348.2	308.68	4.3069E-04	417.7	2326.3	298.7	114.0	4137.6	876.7
6	4	.7231	.7231	2.339	2345.7	311.47	4.3346E-04	418.7	2323.8	285.4	143.9	4137.6	876.7
7	4	.5969	.8216	2.332	2342.5	314.61	4.3658E-04	419.9	2320.8	267.3	173.5	4137.3	876.7
8	4	.4576	.8981	2.325	2339.0	318.29	4.4021E-04	421.3	2317.4	243.9	202.6	4137.2	876.7
9	4	.3090	.9510	2.316	2334.9	322.44	4.4430E-04	422.9	2313.7	214.9	229.0	4136.8	876.7
10	4	.1552	.9796	2.307	2330.5	327.03	4.4880E-04	424.6	2309.8	179.6	252.4	4136.5	876.7
11	4	.0000	.9858	2.298	2325.8	331.93	4.5358E-04	426.4	2305.8	139.4	270.4	4136.1	876.7
12	4	-.1527	.9641	2.288	2320.9	337.07	4.5857E-04	428.3	2301.8	93.8	282.0	4135.7	876.7
13	4	-.2994	.9214	2.278	2316.0	342.27	4.6359E-04	430.2	2297.9	45.4	285.5	4135.2	876.7
14	4	-.4368	.8573	2.268	2311.2	347.42	4.6855E-04	432.1	2294.2	-5.3	279.7	4134.7	876.7
15	4	-.5620	.7735	2.259	2306.6	352.31	4.7324E-04	433.8	2290.8	-55.2	264.6	4134.3	876.7
16	4	-.6725	.6725	2.251	2302.5	356.62	4.7755E-04	435.4	2287.7	-102.9	239.1	4133.7	876.7
17	4	-.7659	.5564	2.244	2296.9	360.77	4.8130E-04	436.8	2285.1	-145.7	204.7	4133.4	876.7
18	4	-.8405	.4282	2.238	2295.9	364.00	4.8437E-04	437.9	2283.0	-181.5	161.4	4132.9	876.7
19	4	-.8948	.2907	2.234	2293.8	366.42	4.8665E-04	438.7	2281.5	-208.6	111.8	4132.8	876.7
20	4	-.9276	.1469	2.231	2292.4	367.89	4.8804E-04	439.2	2280.6	-225.3	57.0	4132.5	876.7
21	4	-.9389	0.0000	2.231	2292.0	368.41	4.8853E-04	439.4	2280.3	-231.2	0.0	4132.6	876.7
1	5	1.1693	-.0000	2.361	2356.2	300.62	4.2284E-04	414.5	2337.4	297.5	-.0	4137.8	876.7
2	5	1.1538	.1627	2.360	2356.0	301.10	4.2312E-04	414.7	2337.1	296.5	25.7	4137.8	876.7
3	5	1.1081	.3600	2.359	2355.1	301.94	4.2396E-04	415.0	2336.3	293.0	51.6	4137.8	876.7
4	5	1.0335	.5266	2.356	2353.7	303.35	4.2537E-04	415.5	2334.8	287.0	78.0	4137.8	876.7
5	5	.9330	.6779	2.351	2351.7	305.31	4.2733E-04	416.3	2333.0	277.7	104.5	4137.6	876.7
6	5	.8098	.8098	2.346	2349.3	307.82	4.2983E-04	417.3	2330.6	264.9	131.4	4137.6	876.7
7	5	.6675	.9188	2.340	2346.2	310.85	4.3265E-04	416.5	2327.8	248.0	157.7	4137.4	876.7
8	5	.5110	1.0029	2.333	2342.8	314.39	4.3636E-04	419.8	2324.6	226.2	183.2	4137.2	876.7
9	5	.3445	1.0603	2.325	2336.9	318.37	4.4028E-04	421.3	2321.2	199.7	206.4	4136.9	876.7
10	5	.1727	1.0905	2.316	2334.6	322.74	4.4459E-04	423.0	2317.5	167.8	226.5	4136.6	876.7
11	5	.0000	1.0963	2.307	2330.1	327.39	4.4914E-04	424.7	2313.8	131.7	241.9	4136.2	876.7
12	5	-.1694	1.0698	2.297	2325.5	332.25	4.5388E-04	426.5	2310.0	91.1	251.4	4135.8	876.7
13	5	-.3317	1.0208	2.288	2320.8	337.14	4.5863E-04	428.3	2306.4	48.2	253.9	4135.3	876.7
14	5	-.4833	.9465	2.279	2316.2	341.98	4.6331E-04	430.1	2302.9	3.3	248.3	4134.8	876.7
15	5	-.6210	.8547	2.270	2311.9	346.57	4.6772E-04	431.8	2299.7	-40.7	234.5	4134.4	876.7
16	5	-.7422	.7422	2.262	2308.0	350.79	4.7176E-04	433.3	2296.8	-82.7	211.6	4133.8	876.7
17	5	-.8445	.6136	2.255	2304.6	354.47	4.7528E-04	434.6	2294.3	-120.2	181.0	4133.5	876.7
18	5	-.9261	.4719	2.250	2301.8	357.48	4.7815E-04	435.6	2292.4	-151.7	142.6	4133.0	876.7
19	5	-.9854	.3202	2.246	2299.8	359.73	4.8029E-04	436.4	2290.9	-175.6	98.7	4132.8	876.7
20	5	-1.0214	.1618	2.243	2298.5	361.10	4.8159E-04	436.9	2290.1	-190.2	50.4	4132.5	876.7
21	5	-1.0335	0.0000	2.243	2298.1	361.58	4.8205E-04	437.1	2289.8	-195.4	0.0	4132.6	876.7
1	6	1.2979	-.0000	2.369	2360.1	296.95	4.1895E-04	413.0	2343.6	278.7	-.0	4137.8	876.7
2	6	1.2805	.2028	2.369	2359.9	297.23	4.1922E-04	413.1	2343.4	277.7	23.6	4137.8	876.7
3	6	1.2294	.3994	2.367	2359.0	298.04	4.2004E-04	413.5	2342.6	274.3	47.3	4137.8	876.7
4	6	1.1460	.5839	2.364	2357.7	299.40	4.2141E-04	414.0	2341.3	268.4	71.3	4137.8	876.7
5	6	1.0338	.7511	2.360	2355.8	301.28	4.2329E-04	414.7	2339.5	259.6	95.4	4137.7	876.7

Figure 16. Continued.

INITIAL DATA PLANE X= 3.71500(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
6	6	.8964	.8964	2.355	2453.4	303.68	4.2570E-04	415.7	2337.2	247.6	119.6	4137.6	876.7
7	6	.7382	1.0160	2.349	2350.5	306.59	4.2860E-04	416.8	2334.6	231.8	143.1	4137.4	876.7
8	6	.5644	1.1077	2.342	2347.1	309.97	4.3197E-04	418.1	2331.6	211.8	165.7	4137.2	876.7
9	6	.3800	1.1696	2.334	2343.4	313.75	4.3572E-04	419.6	2328.4	187.6	186.1	4137.0	876.7
10	6	.1903	1.2014	2.325	2339.3	317.90	4.3981E-04	421.2	2325.0	158.8	203.7	4136.7	876.7
11	6	.0000	1.2029	2.317	2335.0	322.30	4.4414E-04	422.8	2321.5	126.2	216.9	4136.3	876.7
12	6	-.1862	1.1754	2.308	2330.6	326.88	4.4863E-04	424.6	2317.9	89.9	225.0	4135.9	876.7
13	6	-.3640	1.1203	2.299	2326.2	331.48	4.5312E-04	426.3	2314.5	51.6	226.8	4135.4	876.7
14	6	-.5297	1.0397	2.290	2321.8	336.02	4.5752E-04	427.9	2311.2	11.7	221.4	4134.9	876.7
15	6	-.6800	.9359	2.282	2317.8	340.31	4.6165E-04	429.5	2308.2	-27.3	208.8	4134.4	876.7
16	6	-.8120	.8120	2.274	2314.0	344.25	4.6547E-04	430.9	2305.5	-64.5	188.2	4133.9	876.7
17	6	-.9232	.6707	2.268	2310.8	347.69	4.6877E-04	432.2	2303.2	-97.8	160.9	4133.5	876.7
18	6	-1.0117	.5155	2.263	2308.2	350.50	4.7146E-04	433.2	2301.3	-125.6	126.7	4133.1	876.7
19	6	-1.0760	.3496	2.259	2306.3	352.60	4.7347E-04	433.9	2299.9	-146.7	87.7	4132.9	876.7
20	6	-1.1150	.1766	2.256	2305.1	353.87	4.7468E-04	434.4	2299.1	-159.6	44.7	4132.6	876.7
21	6	-1.1281	0.0000	2.256	2304.7	354.32	4.7511E-04	434.6	2298.8	-164.2	0.0	4132.6	876.7
1	7	1.4264	-.0000	2.379	2364.5	292.69	4.1465E-04	411.3	2350.0	261.3	-.0	4137.9	876.7
2	7	1.4072	.2229	2.378	2364.2	292.96	4.1491E-04	411.4	2349.7	260.4	21.5	4137.9	876.7
3	7	1.3506	.4388	2.376	2363.4	293.73	4.1570E-04	411.7	2349.0	257.1	43.0	4137.9	876.7
4	7	1.2584	.6412	2.373	2362.1	295.03	4.1701E-04	412.3	2347.8	251.7	64.7	4137.8	876.7
5	7	1.1346	.8243	2.370	2360.3	296.82	4.1881E-04	413.0	2346.1	243.5	86.4	4137.7	876.7
6	7	.9831	.9831	2.365	2358.0	299.11	4.2111E-04	413.9	2344.0	232.3	108.1	4137.7	876.7
7	7	.8088	1.1132	2.359	2355.2	301.88	4.2389E-04	415.0	2341.5	217.8	129.2	4137.5	876.7
8	7	.6178	1.2125	2.352	2352.0	305.08	4.2709E-04	416.2	2338.7	199.6	149.3	4137.3	876.7
9	7	.4155	1.2789	2.344	2348.4	308.66	4.3066E-04	417.6	2335.7	177.6	167.3	4137.1	876.7
10	7	.2078	1.3123	2.336	2344.5	312.58	4.3454E-04	419.1	2332.4	151.6	182.8	4136.8	876.7
11	7	.0000	1.3125	2.328	2340.4	316.72	4.3864E-04	420.7	2329.1	122.4	194.3	4136.4	876.7
12	7	-.2029	1.2811	2.319	2336.2	321.03	4.4288E-04	422.4	2325.8	89.8	201.2	4136.0	876.7
13	7	-.3963	1.2197	2.310	2332.0	325.35	4.4712E-04	424.0	2322.5	55.6	202.6	4135.5	876.7
14	7	-.5762	1.1309	2.302	2327.9	329.60	4.5127E-04	425.6	2319.4	20.1	197.6	4135.0	876.7
15	7	-.7390	1.0171	2.294	2324.1	333.62	4.5517E-04	427.1	2316.6	-14.6	186.1	4134.5	876.7
16	7	-.8817	.8817	2.287	2320.6	337.30	4.5874E-04	428.4	2314.0	-47.7	167.7	4134.0	876.7
17	7	-1.0018	.7279	2.281	2317.5	340.50	4.6183E-04	429.6	2311.8	-77.2	143.2	4133.6	876.7
18	7	-1.0973	.5591	2.276	2315.0	343.12	4.6435E-04	430.6	2310.0	-101.9	112.8	4133.1	876.7
19	7	-1.1666	.3790	2.272	2313.2	345.07	4.6623E-04	431.3	2308.8	-120.6	78.0	4132.9	876.7
20	7	-1.2086	.1914	2.270	2312.1	346.26	4.6737E-04	431.7	2308.0	-132.1	39.8	4132.6	876.7
21	7	-1.2227	0.0000	2.269	2311.7	346.67	4.6777E-04	431.9	2307.7	-136.1	0.0	4132.7	876.7
1	8	1.5550	-.0000	2.389	2369.2	288.10	4.0999E-04	409.5	2356.5	245.1	-.0	4137.9	876.7
2	8	1.5339	.2429	2.388	2368.9	288.35	4.1024E-04	409.6	2356.2	244.2	19.3	4137.9	876.7
3	8	1.4719	.4783	2.386	2368.2	289.08	4.1098E-04	409.9	2355.5	241.2	38.7	4137.9	876.7
4	8	1.3709	.6985	2.384	2366.9	290.31	4.1223E-04	410.4	2354.4	236.2	58.3	4137.8	876.7
5	8	1.2353	.8975	2.380	2365.2	291.99	4.1394E-04	411.0	2352.8	228.6	77.7	4137.8	876.7
6	8	1.0697	1.0697	2.375	2363.0	294.14	4.1611E-04	411.9	2350.9	218.4	97.1	4137.7	876.7
7	8	.8794	1.2104	2.370	2360.3	296.75	4.1874E-04	412.9	2348.5	205.3	115.8	4137.5	876.7
8	8	.6712	1.3173	2.363	2357.3	299.76	4.2176E-04	414.1	2345.9	188.8	133.6	4137.3	876.7
9	8	.4511	1.3882	2.356	2353.9	303.13	4.2514E-04	415.5	2343.0	169.0	149.5	4137.1	876.7
10	8	.2254	1.4231	2.348	2350.2	306.80	4.2880E-04	416.9	2340.0	145.7	163.1	4136.8	876.7
11	8	.0000	1.4220	2.340	2346.3	310.69	4.3266E-04	418.4	2336.9	119.5	173.2	4136.4	876.7
12	8	-.2197	1.3868	2.332	2342.3	314.72	4.3665E-04	420.0	2333.7	90.5	179.2	4136.0	876.7
13	8	-.4286	1.3192	2.324	2338.4	318.76	4.4063E-04	421.5	2330.6	60.1	180.3	4135.6	876.7
14	8	-.6227	1.2221	2.316	2334.5	322.72	4.4452E-04	423.0	2327.7	28.5	175.7	4135.0	876.7
15	8	-.7980	1.0983	2.308	2330.9	326.47	4.4819E-04	424.4	2325.0	-2.3	165.4	4134.6	876.7
16	8	-.9515	.9515	2.301	2327.6	329.89	4.5152E-04	425.7	2322.6	-31.7	148.9	4134.0	876.7
17	8	-1.0805	.7850	2.296	2324.7	332.87	4.5442E-04	426.8	2320.5	-57.8	127.1	4133.6	876.7
18	8	-1.1829	.6027	2.291	2322.4	335.31	4.5678E-04	427.7	2318.5	-79.7	100.1	4133.2	876.7

Figure 16. Continued.

INITIAL DATA PLANE X= 3.71500(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
19	8	-1.2572	.4085	2.287	2320.6	337.12	4.5853E-04	428.4	2317.6	-96.3	69.2	4132.9	876.7
20	8	-1.3022	.2063	2.285	2319.6	338.22	4.5959E-04	428.8	2316.9	-106.4	35.3	4132.7	876.7
21	8	-1.3173	0.0000	2.285	2319.2	338.61	4.5997E-04	429.0	2316.6	-110.0	0.0	4132.7	876.7
1	9	1.6835	-.0000	2.401	2374.8	282.70	4.0449E-04	407.3	2363.8	228.4	-.0	4137.9	876.7
2	9	1.6606	.2630	2.400	2374.5	282.93	4.0473E-04	407.3	2363.5	227.6	17.0	4137.9	876.7
3	9	1.5932	.5177	2.399	2373.8	283.62	4.0543E-04	407.6	2362.9	224.9	34.0	4137.9	876.7
4	9	1.4833	.7558	2.396	2372.6	284.78	4.0660E-04	408.1	2361.8	220.5	51.1	4137.8	876.7
5	9	1.3361	.9707	2.392	2371.0	286.36	4.0821E-04	408.8	2360.3	213.8	68.2	4137.8	876.7
6	9	1.1564	1.1564	2.388	2368.9	288.37	4.1025E-04	409.6	2358.5	204.8	85.2	4137.7	876.7
7	9	.9500	1.3076	2.383	2366.4	290.82	4.1274E-04	410.6	2356.3	193.2	101.7	4137.5	876.7
8	9	.7246	1.4221	2.376	2363.5	293.64	4.1559E-04	411.7	2353.8	178.7	117.3	4137.4	876.7
9	9	.4866	1.4975	2.369	2360.2	296.79	4.1877E-04	413.0	2351.1	161.3	131.4	4137.1	876.7
10	9	.2430	1.5340	2.362	2356.8	300.22	4.2221E-04	414.3	2348.2	140.8	143.3	4136.8	876.7
11	9	.0000	1.5316	2.354	2353.1	303.66	4.2585E-04	415.8	2345.2	117.7	152.2	4136.5	876.7
12	9	-.2364	1.4925	2.346	2349.3	307.61	4.2958E-04	417.3	2342.2	92.2	157.5	4136.0	876.7
13	9	-.4609	1.4186	2.339	2345.6	311.39	4.3333E-04	418.7	2339.3	65.3	158.4	4135.6	876.7
14	9	-.6692	1.3133	2.331	2341.9	315.07	4.3697E-04	420.1	2336.5	37.6	154.4	4135.1	876.7
15	9	-.8570	1.1795	2.324	2338.5	318.56	4.4040E-04	421.5	2333.9	10.4	145.4	4134.6	876.7
16	9	-1.0212	1.0212	2.317	2335.4	321.73	4.4352E-04	422.7	2331.7	-15.4	130.9	4134.1	876.7
17	9	-1.1591	.8421	2.312	2332.7	324.50	4.4623E-04	423.7	2329.7	-38.5	111.8	4133.6	876.7
18	9	-1.2685	.6463	2.307	2330.5	326.76	4.4843E-04	424.6	2328.1	-57.8	88.0	4133.2	876.7
19	9	-1.3478	.4379	2.304	2328.9	328.44	4.5007E-04	425.2	2326.9	-72.4	60.9	4132.9	876.7
20	9	-1.3958	.2211	2.302	2327.9	329.46	4.5106E-04	425.6	2326.2	-81.3	31.0	4132.7	876.7
21	9	-1.4119	0.0000	2.301	2327.5	329.82	4.5140E-04	425.7	2326.0	-84.5	0.0	4132.7	876.7
1	10	1.8121	-.0000	2.416	2381.7	276.07	3.9769E-04	404.5	2372.4	209.9	-.0	4137.9	876.7
2	10	1.7873	.2831	2.415	2381.5	276.29	3.9791E-04	404.6	2372.2	209.3	14.2	4137.9	876.7
3	10	1.7145	.5571	2.414	2380.8	276.92	3.9857E-04	404.9	2371.6	207.1	28.5	4137.9	876.7
4	10	1.5958	.8131	2.411	2379.7	278.00	3.9967E-04	405.3	2370.6	203.5	42.9	4137.8	876.7
5	10	1.4369	1.0439	2.408	2378.1	279.46	4.0117E-04	405.9	2369.2	198.0	57.3	4137.8	876.7
6	10	1.2430	1.2430	2.404	2376.2	281.32	4.0306E-04	406.7	2367.5	190.6	71.7	4137.7	876.7
7	10	1.0207	1.4048	2.399	2373.8	283.61	4.0541E-04	407.6	2365.3	180.9	85.8	4137.5	876.7
8	10	.7780	1.5269	2.393	2371.1	286.22	4.0806E-04	408.7	2363.0	168.7	99.3	4137.4	876.7
9	10	.5221	1.6069	2.386	2368.0	289.17	4.1105E-04	409.9	2360.4	153.9	111.5	4137.1	876.7
10	10	.2605	1.6449	2.379	2364.7	292.35	4.1427E-04	411.2	2357.7	136.5	121.9	4136.8	876.7
11	10	.0000	1.6412	2.372	2361.3	295.74	4.1769E-04	412.6	2354.8	116.7	129.8	4136.5	876.7
12	10	-.2531	1.5982	2.364	2357.7	299.22	4.2118E-04	414.0	2352.0	94.9	134.6	4136.1	876.7
13	10	-.4933	1.5181	2.357	2354.2	302.73	4.2469E-04	415.4	2349.2	71.8	135.6	4135.6	876.7
14	10	-.7156	1.4045	2.349	2350.7	306.13	4.2808E-04	416.7	2346.5	47.9	132.4	4135.1	876.7
15	10	-.9160	1.2607	2.343	2347.5	309.37	4.3150E-04	418.0	2344.0	24.3	124.8	4134.6	876.7
16	10	-1.0910	1.0910	2.336	2344.6	312.31	4.3420E-04	419.1	2341.9	2.0	112.6	4134.1	876.7
17	10	-1.2377	.8993	2.331	2342.0	314.87	4.3673E-04	420.1	2340.0	-18.0	96.2	4133.6	876.7
18	10	-1.3541	.6900	2.327	2340.0	316.95	4.3877E-04	420.9	2336.5	-34.7	75.8	4133.2	876.7
19	10	-1.4384	.4674	2.324	2338.4	318.51	4.4030E-04	421.5	2337.4	-47.4	52.4	4132.9	876.7
20	10	-1.4894	.2359	2.322	2337.5	319.45	4.4122E-04	421.9	2336.7	-55.1	26.8	4132.7	876.7
21	10	-1.5065	0.0000	2.321	2337.2	319.78	4.4155E-04	422.0	2336.5	-57.9	0.0	4132.7	876.7
1	D	1.9407	-.0000	2.442	2393.3	265.25	3.8649E-04	399.9	2386.3	182.6	-.0	4137.9	876.7
2	D	1.9140	.3031	2.441	2393.1	265.46	3.8671E-04	400.0	2386.1	182.3	9.8	4137.9	876.7
3	D	1.8357	.5965	2.440	2392.4	266.07	3.8734E-04	400.3	2385.4	181.2	19.8	4137.9	876.7
4	D	1.7083	.8704	2.437	2391.3	267.12	3.8844E-04	400.7	2384.3	179.2	30.2	4137.8	876.7
5	D	1.5376	1.1172	2.434	2389.7	268.52	3.8988E-04	401.3	2382.9	175.9	40.8	4137.8	876.7
6	D	1.3297	1.3297	2.429	2387.8	270.29	3.9172E-04	402.1	2381.1	171.1	51.7	4137.7	876.7
7	D	1.0913	1.5020	2.424	2385.5	272.52	3.9401E-04	403.0	2378.9	164.7	63.0	4137.5	876.7
8	D	.8314	1.6317	2.418	2382.8	275.02	3.9659E-04	404.1	2376.5	156.1	73.9	4137.4	876.7
9	D	.5576	1.7162	2.412	2379.8	277.85	3.9949E-04	405.3	2373.9	145.4	84.2	4137.1	876.7
10	D	.2781	1.7558	2.405	2376.6	280.38	4.0259E-04	406.5	2371.1	132.2	93.3	4136.8	876.7

Figure 16. Continued.

INITIAL DATA PLANE X= 3.71500(FT) FOREBODY FLOW FIELD

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
11	D	.0000	1.7507	2.397	2373.2	284.11	4.0589E-04	407.9	2368.2	117.0	100.6	4136.5	876.7
12	D	-.2699	1.7039	2.390	2369.6	287.41	4.0924E-04	409.2	2365.3	99.7	105.3	4136.1	876.7
13	D	-.5256	1.6176	2.382	2366.3	290.73	4.1260E-04	410.6	2362.5	81.1	107.2	4135.6	876.7
14	D	-.7621	1.4957	2.375	2363.0	293.94	4.1583E-04	411.9	2359.8	61.8	105.4	4135.1	876.7
15	D	-.9750	1.3419	2.369	2359.9	296.99	4.1889E-04	413.1	2357.4	42.4	100.0	4134.6	876.7
16	D	-1.1607	1.1607	2.363	2357.1	299.73	4.2164E-04	414.2	2355.2	24.1	90.6	4134.1	876.7
17	D	-1.3164	.9564	2.356	2354.6	302.13	4.2404E-04	415.2	2353.5	7.4	77.8	4133.7	876.7
18	D	-1.4397	.7336	2.353	2352.6	304.07	4.2596E-04	416.0	2351.8	-6.5	61.5	4133.2	876.7
19	D	-1.5290	.4968	2.350	2351.2	305.52	4.2740E-04	416.5	2350.7	-17.1	42.6	4132.9	876.7
20	D	-1.5830	.2507	2.348	2350.3	306.40	4.2827E-04	416.9	2350.1	-23.6	21.8	4132.7	876.7
21	D	-1.6011	0.0000	2.348	2350.0	306.70	4.2858E-04	417.0	2349.8	-25.9	0.0	4132.7	876.7

MASS FLOW RATE FOR ENTIRE PLANE= 8.52347E+00(SLUG/SEC)

Figure 16. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 3.71500(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.6551	0.0000	2.341	2346.5	310.21	4.3207E-04	418.4	2310.9	407.6	-.0	4132.7	876.7
2	1	.6470	.1025	2.340	2346.3	310.43	4.3229E-04	418.4	2310.4	407.4	32.9	4132.7	876.7
3	1	.6230	.2024	2.339	2345.6	311.11	4.3297E-04	418.7	2309.2	406.4	67.2	4132.8	876.7
4	1	.5837	.2974	2.336	2344.5	312.29	4.3413E-04	419.2	2307.1	403.6	104.1	4132.7	876.7
5	1	.5300	.3850	2.333	2342.8	314.00	4.3583E-04	419.8	2304.3	397.3	144.4	4132.6	876.7
6	1	.4632	.4632	2.328	2340.5	316.30	4.3811E-04	420.7	2300.9	385.6	188.0	4132.5	876.7
7	1	.3850	.5300	2.322	2337.6	319.25	4.4102E-04	421.8	2296.8	366.5	234.1	4132.4	876.7
8	1	.2974	.5837	2.315	2334.2	322.85	4.4457E-04	423.2	2292.4	338.2	281.1	4132.4	876.7
9	1	.2024	.6230	2.306	2330.0	327.13	4.4877E-04	424.8	2287.5	299.6	326.4	4132.2	876.7
10	1	.1025	.6470	2.297	2325.4	332.03	4.5356E-04	426.6	2282.5	250.0	367.3	4132.2	876.7
11	1	.0000	.6551	2.287	2320.2	337.47	4.5886E-04	428.5	2277.4	190.1	401.0	4132.1	876.7
12	1	-.1025	.6470	2.276	2314.7	343.33	4.6453E-04	430.7	2272.3	121.2	424.3	4132.1	876.7
13	1	-.2024	.6230	2.264	2309.1	349.42	4.7041E-04	432.8	2267.4	45.5	434.4	4131.9	876.7
14	1	-.2974	.5837	2.253	2303.4	355.56	4.7630E-04	435.0	2262.8	-34.0	429.7	4132.0	876.7
15	1	-.3850	.5300	2.243	2298.0	361.51	4.8198E-04	437.1	2258.5	-113.5	408.8	4131.9	876.7
16	1	-.4632	.4632	2.233	2293.1	367.06	4.8725E-04	439.0	2254.8	-189.5	371.6	4131.9	876.7
17	1	-.5300	.3850	2.224	2288.7	371.95	4.9188E-04	440.6	2251.6	-258.0	318.9	4131.8	876.7
18	1	-.5837	.2974	2.217	2285.1	376.01	4.9571E-04	442.0	2249.1	-315.5	252.5	4131.9	876.7
19	1	-.6230	.2024	2.212	2282.4	379.03	4.9855E-04	443.0	2247.2	-358.9	174.9	4131.8	876.7
20	1	-.6470	.1025	2.209	2280.8	380.91	5.0031E-04	443.6	2246.1	-385.9	89.5	4131.9	876.7
21	1	-.6551	.0000	2.208	2280.2	381.54	5.0091E-04	443.8	2245.7	-395.1	.0	4131.8	876.6
1	2	.6982	0.0000	2.341	2346.9	310.00	4.3192E-04	418.2	2313.4	395.3	-.0	4135.0	876.7
2	2	.6896	.1092	2.341	2346.7	310.24	4.3216E-04	418.3	2313.0	394.8	32.3	4134.9	876.7
3	2	.6640	.2158	2.339	2346.0	310.97	4.3289E-04	418.6	2311.8	393.4	65.9	4135.0	876.7
4	2	.6221	.3170	2.337	2344.7	312.21	4.3413E-04	419.1	2309.9	389.9	101.7	4134.9	876.7
5	2	.5648	.4104	2.333	2343.0	314.02	4.3591E-04	419.8	2307.2	382.9	140.5	4134.9	876.7
6	2	.4937	.4937	2.328	2340.6	316.42	4.3829E-04	420.7	2303.9	370.6	181.9	4134.8	876.7
7	2	.4104	.5648	2.322	2337.7	319.46	4.4129E-04	421.8	2300.1	351.2	225.5	4134.8	876.7
8	2	.3170	.6221	2.315	2334.1	323.14	4.4492E-04	423.2	2295.8	323.3	269.4	4134.7	876.7
9	2	.2158	.6640	2.306	2329.9	327.48	4.4917E-04	424.8	2291.3	285.7	311.6	4134.6	876.7
10	2	.1092	.6896	2.297	2325.2	332.39	4.5397E-04	426.6	2286.5	238.3	349.3	4134.5	876.7
11	2	.0000	.6982	2.286	2320.1	337.83	4.5925E-04	428.6	2281.6	181.1	379.9	4134.3	876.7
12	2	-.1092	.6896	2.275	2314.7	343.62	4.6486E-04	430.7	2276.8	116.1	400.7	4134.2	876.7
13	2	-.2158	.6640	2.264	2309.1	349.63	4.7065E-04	432.9	2272.1	44.8	409.1	4134.0	876.7
14	2	-.3170	.6221	2.253	2303.6	355.64	4.7641E-04	435.0	2267.8	-29.5	403.8	4133.9	876.7
15	2	-.4104	.5648	2.243	2298.3	361.46	4.8195E-04	437.0	2263.7	-103.9	383.3	4133.7	876.7
16	2	-.4937	.4937	2.233	2293.5	366.65	4.8707E-04	438.9	2260.2	-174.5	347.9	4133.6	876.7
17	2	-.5648	.4104	2.225	2289.2	371.60	4.9156E-04	440.5	2257.2	-238.1	298.1	4133.4	876.7
18	2	-.6221	.3170	2.219	2285.7	375.53	4.9527E-04	441.8	2254.8	-291.4	235.8	4133.4	876.7
19	2	-.6640	.2158	2.214	2283.1	378.45	4.9801E-04	442.8	2253.0	-331.5	163.2	4133.2	876.7
20	2	-.6896	.1092	2.210	2281.6	380.27	4.9971E-04	443.4	2252.0	-356.7	83.5	4133.3	876.7
21	2	-.6982	.0000	2.209	2281.0	380.87	5.0028E-04	443.6	2251.6	-365.0	.0	4133.1	876.7
1	3	.7413	0.0000	2.342	2347.2	309.81	4.3179E-04	418.1	2315.8	382.7	-.0	4136.7	876.7
2	3	.7322	.1160	2.341	2347.0	310.06	4.3205E-04	418.2	2315.4	382.2	32.2	4136.8	876.7
3	3	.7050	.2291	2.340	2346.2	310.65	4.3283E-04	418.5	2314.3	379.8	65.3	4136.6	876.7
4	3	.6605	.3365	2.337	2344.9	312.18	4.3415E-04	419.0	2312.5	375.3	100.4	4136.6	876.7
5	3	.5997	.4357	2.333	2343.0	314.08	4.3604E-04	419.7	2310.0	366.9	137.4	4136.4	876.7
6	3	.5242	.5242	2.328	2340.5	316.59	4.3852E-04	420.7	2306.9	353.5	176.9	4136.3	876.7
7	3	.4357	.5997	2.322	2337.4	319.72	4.4160E-04	421.9	2303.3	333.5	217.1	4136.0	876.7
8	3	.3365	.6605	2.314	2333.8	323.49	4.4531E-04	423.3	2299.3	305.6	257.7	4135.8	876.7
9	3	.2291	.7050	2.306	2329.6	327.84	4.4957E-04	424.9	2295.0	269.2	295.7	4135.4	876.7
10	3	.1160	.7322	2.296	2324.9	332.77	4.5438E-04	426.7	2290.5	223.5	329.7	4135.1	876.7
11	3	.0000	.7413	2.286	2319.8	338.12	4.5957E-04	428.7	2285.9	170.1	356.5	4134.8	876.7
12	3	-.1160	.7322	2.275	2314.4	343.82	4.6509E-04	430.8	2281.4	108.9	374.2	4134.3	876.7
13	3	-.2291	.7050	2.264	2309.0	349.66	4.7071E-04	432.9	2277.0	43.2	380.8	4134.1	876.7

Figure 16. Continued.

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REDISTRIBUTED PLANE AT COWL ENTRANCE X= 3.71500(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
14	3	-.3365	.6605	2.254	2303.6	355.51	4.7630E-04	434.9	2272.9	-25.6	374.3	4133.6	876.7
15	3	-.4357	.5997	2.244	2298.5	361.11	4.8163E-04	436.9	2269.1	-93.5	354.6	4133.4	876.7
16	3	-.5242	.5242	2.234	2293.8	366.29	4.8655E-04	438.7	2265.8	-158.3	320.8	4132.9	876.7
17	3	-.5997	.4357	2.226	2289.8	370.84	4.9085E-04	440.2	2262.9	-216.3	274.7	4132.9	876.7
18	3	-.6605	.3365	2.220	2286.4	374.58	4.9438E-04	441.5	2260.7	-264.7	216.7	4132.4	876.7
19	3	-.7050	.2291	2.215	2284.0	377.39	4.9701E-04	442.4	2259.0	-301.4	150.1	4132.5	876.7
20	3	-.7322	.1160	2.212	2282.4	379.09	4.9861E-04	443.0	2258.0	-323.8	76.6	4132.1	876.7
21	3	-.7413	.0000	2.211	2281.9	379.69	4.9917E-04	443.2	2257.7	-331.8	.0	4132.4	876.7
1	4	.7844	0.0000	2.343	2347.8	309.35	4.3137E-04	417.9	2318.2	371.7	-.0	4137.9	876.7
2	4	.7748	.1227	2.343	2347.5	309.61	4.3163E-04	418.0	2317.8	371.0	31.6	4138.0	876.7
3	4	.7460	.2424	2.341	2346.7	310.43	4.3244E-04	418.3	2316.7	368.2	64.0	4137.8	876.7
4	4	.6969	.3561	2.338	2345.4	311.79	4.3380E-04	418.8	2315.0	363.1	98.1	4137.9	876.7
5	4	.6346	.4611	2.334	2343.4	313.74	4.3573E-04	419.6	2312.7	354.1	133.7	4137.7	876.7
6	4	.5547	.5547	2.329	2340.9	316.30	4.3826E-04	420.5	2309.7	340.3	171.3	4137.7	876.7
7	4	.4611	.6346	2.322	2337.8	319.46	4.4137E-04	421.7	2306.3	320.3	209.3	4137.4	876.7
8	4	.3561	.6989	2.315	2334.2	323.24	4.4509E-04	423.2	2302.5	292.7	247.3	4137.2	876.7
9	4	.2424	.7460	2.306	2330.0	327.57	4.4933E-04	424.8	2298.4	257.5	282.5	4136.9	876.7
10	4	.1227	.7748	2.297	2325.4	332.44	4.5409E-04	426.6	2294.1	213.7	313.8	4136.6	876.7
11	4	.0000	.7844	2.287	2320.4	337.70	4.5919E-04	428.5	2289.8	162.8	338.2	4136.2	876.7
12	4	-.1227	.7748	2.276	2315.1	343.29	4.6459E-04	430.6	2285.5	104.9	353.9	4135.8	876.7
13	4	-.2424	.7460	2.266	2309.8	348.98	4.7006E-04	432.6	2281.3	43.2	359.2	4135.5	876.7
14	4	-.3561	.6989	2.255	2304.6	354.65	4.7549E-04	434.6	2277.4	-21.4	352.3	4134.9	876.7
15	4	-.4611	.6346	2.246	2299.7	360.06	4.8064E-04	436.5	2273.8	-84.9	333.2	4134.7	876.7
16	4	-.5547	.5547	2.237	2295.1	365.05	4.8538E-04	438.2	2270.7	-145.3	300.9	4134.1	876.7
17	4	-.6346	.4611	2.229	2291.2	369.43	4.8952E-04	439.7	2268.0	-199.3	257.5	4134.1	876.7
18	4	-.6989	.3561	2.223	2288.0	373.02	4.9291E-04	441.0	2265.8	-244.2	202.8	4133.5	876.7
19	4	-.7460	.2424	2.218	2285.6	375.71	4.9543E-04	441.9	2264.3	-278.4	140.4	4133.6	876.8
20	4	-.7748	.1227	2.215	2284.1	377.34	4.9697E-04	442.4	2263.3	-299.1	71.6	4133.2	876.7
21	4	-.7844	.0000	2.214	2283.7	377.92	4.9751E-04	442.6	2263.0	-306.6	.0	4133.5	876.8
1	5	.8275	0.0000	2.344	2348.4	308.74	4.3078E-04	417.6	2320.4	361.4	-.0	4138.5	876.7
2	5	.8173	.1295	2.344	2348.2	309.01	4.3105E-04	417.7	2320.1	360.6	31.0	4138.6	876.7
3	5	.7870	.2557	2.342	2347.3	309.84	4.3187E-04	418.0	2319.1	357.5	62.6	4138.5	876.7
4	5	.7373	.3757	2.339	2346.0	311.23	4.3325E-04	418.6	2317.4	352.0	95.7	4138.6	876.7
5	5	.6695	.4864	2.335	2344.0	313.20	4.3520E-04	419.3	2315.2	342.6	130.0	4138.4	876.7
6	5	.5852	.5852	2.330	2341.5	315.76	4.3774E-04	420.3	2312.4	328.5	166.0	4138.4	876.7
7	5	.4864	.6695	2.324	2338.4	318.92	4.4085E-04	421.5	2309.2	308.6	201.8	4138.1	876.7
8	5	.3757	.7373	2.316	2334.8	322.67	4.4454E-04	423.0	2305.6	281.5	237.6	4137.9	876.7
9	5	.2557	.7870	2.307	2330.5	326.94	4.4871E-04	424.6	2301.7	246.1	269.9	4136.1	876.7
10	5	.1295	.8173	2.298	2325.9	331.71	4.5337E-04	426.3	2297.6	204.1	298.6	4135.8	876.7
11	5	.0000	.8275	2.288	2321.0	336.84	4.5835E-04	428.2	2293.5	155.7	320.5	4135.3	876.7
12	5	-.1295	.8173	2.278	2315.9	342.26	4.6360E-04	430.2	2289.4	101.0	334.4	4134.9	876.7
13	5	-.2557	.7870	2.268	2310.8	347.76	4.6889E-04	432.2	2285.5	43.1	338.3	4134.5	876.7
14	5	-.3757	.7373	2.258	2305.7	353.22	4.7412E-04	434.1	2281.8	-17.4	331.0	4134.0	876.7
15	5	-.4864	.6695	2.248	2301.0	358.42	4.7908E-04	435.9	2278.4	-76.5	312.4	4133.7	876.7
16	5	-.5852	.5852	2.240	2296.6	363.21	4.8363E-04	437.6	2275.4	-132.7	281.7	4133.1	876.7
17	5	-.6695	.4864	2.232	2292.9	367.39	4.8759E-04	439.1	2272.9	-182.7	240.6	4133.0	876.7
18	5	-.7373	.3757	2.226	2289.8	370.82	4.9083E-04	440.2	2270.8	-224.4	189.4	4132.5	876.7
19	5	-.7870	.2557	2.222	2287.5	373.38	4.9324E-04	441.1	2269.4	-255.9	131.0	4132.5	876.7
20	5	-.8173	.1295	2.219	2286.1	374.94	4.9470E-04	441.6	2268.5	-275.1	66.8	4132.2	876.7
21	5	-.8275	.0000	2.218	2285.6	375.48	4.9521E-04	441.8	2268.2	-282.0	.0	4132.3	876.7
1	6	.8706	0.0000	2.346	2349.1	308.01	4.3003E-04	417.4	2322.6	351.6	-.0	4137.7	876.7
2	6	.8599	.1362	2.345	2348.8	308.28	4.3030E-04	417.5	2322.3	350.7	30.5	4137.8	876.7
3	6	.8280	.2690	2.344	2348.0	309.11	4.3113E-04	417.8	2321.3	347.3	61.5	4137.7	876.7
4	6	.7758	.3953	2.341	2346.6	310.51	4.3252E-04	418.3	2319.8	341.3	93.6	4137.7	876.7
5	6	.7044	.5118	2.337	2344.6	312.48	4.3447E-04	419.1	2317.6	331.4	126.6	4137.5	876.7

Figure 16. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 3.71500(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
6	6	.6156	.6156	2.331	2342.1	315.03	4.3700E-04	420.1	2315.0	317.1	160.9	4137.4	876.7
7	6	.5118	.7044	2.325	2339.1	318.16	4.4009E-04	421.3	2311.9	297.0	194.9	4137.1	876.7
8	6	.3953	.7758	2.318	2335.5	321.86	4.4373E-04	422.7	2308.5	270.4	228.4	4136.9	876.7
9	6	.2690	.8280	2.309	2331.4	326.07	4.4786E-04	424.2	2304.8	237.2	256.8	4136.6	876.7
10	6	.1362	.8599	2.300	2326.9	330.74	4.5243E-04	426.0	2300.9	196.8	285.4	4136.3	876.7
11	6	.0000	.8706	2.290	2322.2	335.75	4.5729E-04	427.8	2297.0	150.6	305.5	4135.9	876.7
12	6	-.1362	.8599	2.280	2317.2	341.02	4.6240E-04	429.7	2293.2	98.5	317.9	4135.5	876.7
13	6	-.2690	.8280	2.270	2312.2	346.34	4.6752E-04	431.7	2289.4	43.7	320.9	4135.2	876.7
14	6	-.3953	.7758	2.261	2307.3	351.62	4.7259E-04	433.5	2285.9	-13.4	313.4	4134.7	876.7
15	6	-.5118	.7044	2.252	2302.7	356.62	4.7737E-04	435.3	2282.7	-69.0	295.4	4134.4	876.7
16	6	-.6156	.6156	2.243	2298.5	361.22	4.8174E-04	436.9	2279.8	-121.9	265.9	4133.9	876.7
17	6	-.7044	.5118	2.236	2294.9	365.24	4.8555E-04	438.3	2277.4	-168.7	227.0	4133.7	876.7
18	6	-.7758	.3953	2.231	2291.9	368.52	4.8865E-04	439.4	2275.5	-207.7	178.4	4133.2	876.7
19	6	-.8280	.2690	2.226	2289.8	370.97	4.9096E-04	440.3	2274.1	-237.2	123.4	4133.2	876.7
20	6	-.8599	.1362	2.224	2288.4	372.46	4.9236E-04	440.8	2273.2	-255.2	62.9	4132.8	876.7
21	6	-.8706	.0000	2.223	2288.0	372.98	4.9285E-04	441.0	2273.0	-261.6	.0	4133.0	876.7
1	7	.9138	0.0000	2.348	2349.9	307.18	4.2920E-04	417.0	2324.8	342.6	-.0	4137.8	876.7
2	7	.9025	.1429	2.347	2349.6	307.45	4.2948E-04	417.1	2324.5	341.6	29.8	4137.9	876.7
3	7	.8690	.2824	2.345	2348.8	308.28	4.3030E-04	417.5	2323.6	338.0	60.0	4137.8	876.7
4	7	.8142	.4148	2.342	2347.4	309.67	4.3169E-04	418.0	2322.1	331.8	91.2	4137.8	876.7
5	7	.7593	.5371	2.338	2345.5	311.63	4.3363E-04	418.8	2320.1	321.7	123.0	4137.6	876.7
6	7	.6461	.6461	2.333	2343.0	314.16	4.3614E-04	419.7	2317.5	307.3	155.9	4137.6	876.7
7	7	.5371	.7393	2.327	2340.0	317.25	4.3919E-04	420.9	2314.6	287.4	188.1	4137.4	876.7
8	7	.4148	.8142	2.320	2336.5	320.89	4.4278E-04	422.3	2311.3	261.4	219.9	4137.3	876.7
9	7	.2824	.8690	2.311	2332.5	325.01	4.4682E-04	423.8	2307.9	229.3	248.3	4137.0	876.7
10	7	.1429	.9025	2.302	2328.1	329.57	4.5128E-04	425.5	2304.2	190.3	273.2	4136.7	876.7
11	7	.0000	.9138	2.293	2323.5	334.44	4.5602E-04	427.3	2300.5	146.2	291.6	4136.4	876.7
12	7	-.1429	.9025	2.283	2318.6	339.54	4.6097E-04	429.2	2296.7	96.5	302.9	4136.0	876.7
13	7	-.2824	.8690	2.274	2313.8	344.68	4.6592E-04	431.1	2293.2	44.6	305.1	4135.7	876.7
14	7	-.4148	.8142	2.264	2309.0	349.71	4.7076E-04	432.9	2289.9	-9.6	295.9	4134.2	876.7
15	7	-.5371	.7393	2.255	2304.6	354.50	4.7534E-04	434.6	2286.9	-61.7	278.3	4133.8	876.7
16	7	-.6461	.6461	2.247	2300.5	358.89	4.7952E-04	436.1	2284.2	-111.1	250.3	4133.3	876.7
17	7	-.7393	.5371	2.241	2297.1	362.72	4.8316E-04	437.4	2281.9	-154.8	213.3	4133.1	876.7
18	7	-.8142	.4148	2.235	2294.2	365.84	4.8611E-04	438.5	2280.1	-191.2	167.6	4132.6	876.7
19	7	-.8690	.2824	2.231	2292.1	368.17	4.8831E-04	439.3	2278.8	-218.6	115.7	4132.6	876.7
20	7	-.9025	.1429	2.229	2290.8	369.59	4.8965E-04	439.8	2278.0	-235.4	59.0	4132.2	876.7
21	7	-.9138	.0000	2.228	2290.4	370.08	4.9011E-04	440.0	2277.7	-241.3	.0	4132.4	876.7
1	8	.9569	0.0000	2.350	2350.8	306.26	4.2829E-04	416.7	2327.0	334.1	-.0	4137.9	876.7
2	8	.9451	.1497	2.349	2350.6	306.53	4.2856E-04	416.8	2326.7	333.1	29.1	4138.0	876.7
3	8	.9101	.2957	2.347	2349.7	307.36	4.2938E-04	417.1	2325.8	329.3	58.5	4137.9	876.7
4	8	.8526	.4344	2.344	2348.4	308.73	4.3075E-04	417.6	2324.4	323.0	88.8	4137.9	876.7
5	8	.7741	.5624	2.340	2346.5	310.67	4.3268E-04	418.4	2322.5	312.7	119.5	4137.8	876.7
6	8	.6766	.6766	2.335	2344.0	313.16	4.3515E-04	419.3	2320.0	298.4	151.0	4137.8	876.7
7	8	.5624	.7741	2.329	2340.9	316.23	4.3818E-04	420.5	2317.3	277.9	181.8	4137.1	876.7
8	8	.4344	.8526	2.322	2337.5	319.79	4.4169E-04	421.9	2314.1	252.4	211.5	4136.9	876.7
9	8	.2957	.9101	2.314	2333.6	323.80	4.4563E-04	423.4	2310.8	221.2	238.2	4136.6	876.7
10	8	.1497	.9451	2.305	2329.3	328.23	4.4997E-04	425.0	2307.3	183.7	261.1	4136.3	876.7
11	8	.0000	.9569	2.296	2324.8	332.94	4.5456E-04	426.8	2303.8	141.4	277.9	4135.9	876.7
12	8	-.1497	.9451	2.286	2320.1	337.86	4.5934E-04	428.6	2300.3	94.3	287.8	4135.5	876.7
13	8	-.2957	.9101	2.277	2315.5	342.80	4.6411E-04	430.4	2296.9	45.1	289.3	4135.1	876.7
14	8	-.4344	.8526	2.268	2310.9	347.68	4.6880E-04	432.1	2293.7	-5.8	281.4	4134.6	876.7
15	8	-.5624	.7741	2.259	2306.7	352.28	4.7321E-04	433.8	2290.8	-55.1	264.3	4134.3	876.7
16	8	-.6766	.6766	2.252	2302.8	356.49	4.7723E-04	435.3	2288.3	-101.7	237.3	4133.8	876.7
17	8	-.7741	.5624	2.245	2299.5	360.15	4.8071E-04	436.6	2286.1	-142.9	202.1	4133.6	876.7
18	8	-.8526	.4344	2.240	2296.7	363.13	4.8354E-04	437.6	2284.4	-177.2	158.6	4133.1	876.7

Figure 16. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 3.71500(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
19	8	-.9101	.2957	2.236	2294.7	365.36	4.8564E-04	438.4	2283.1	-203.0	109.5	4133.0	876.7
20	8	-.9451	.1497	2.234	2293.5	366.71	4.8692E-04	438.8	2282.4	-218.7	55.8	4132.7	876.7
21	8	-.9569	.0000	2.233	2293.1	367.18	4.8736E-04	439.0	2282.1	-224.3	.0	4132.8	876.7
1	U	1.0000	0.0000	2.352	2351.8	305.29	4.2731E-04	416.3	2329.1	325.8	-.0	4137.7	876.7
2	U	.9877	.1564	2.351	2351.5	305.56	4.2758E-04	416.4	2328.8	324.7	28.5	4137.8	876.7
3	U	.9511	.3090	2.349	2350.7	306.37	4.2840E-04	416.7	2328.0	320.8	57.2	4137.7	876.7
4	U	.8910	.4540	2.346	2349.3	307.73	4.2975E-04	417.3	2326.6	314.2	86.6	4137.7	876.7
5	U	.8090	.5878	2.342	2347.4	309.64	4.3165E-04	418.0	2324.8	303.9	116.2	4137.5	876.7
6	U	.7071	.7071	2.337	2345.0	312.09	4.3408E-04	418.9	2322.5	289.4	146.4	4137.5	876.7
7	U	.5878	.8090	2.331	2342.1	315.06	4.3702E-04	420.1	2319.8	270.0	175.6	4137.3	876.7
8	U	.4540	.8910	2.324	2338.7	318.54	4.4046E-04	421.4	2316.9	245.1	203.9	4137.1	876.7
9	U	.3090	.9511	2.316	2334.9	322.44	4.4430E-04	422.9	2313.7	214.8	229.0	4136.8	876.7
10	U	.1564	.9877	2.308	2330.8	326.75	4.4852E-04	424.5	2310.4	178.7	250.5	4136.6	876.7
11	U	.0000	1.0000	2.299	2326.4	331.30	4.5297E-04	426.2	2307.0	138.2	266.0	4136.3	876.7
12	U	-.1564	.9877	2.290	2321.9	336.06	4.5759E-04	427.9	2303.7	93.1	274.9	4135.9	876.7
13	U	-.3090	.9511	2.281	2317.4	340.82	4.6219E-04	429.7	2300.5	46.3	275.9	4135.5	876.7
14	U	-.4540	.8910	2.272	2313.0	345.50	4.6670E-04	431.4	2297.4	-2.1	267.9	4135.0	876.7
15	U	-.5878	.8090	2.264	2308.9	349.91	4.7093E-04	432.9	2294.7	-48.8	251.4	4134.7	876.7
16	U	-.7071	.7071	2.256	2305.2	353.94	4.7478E-04	434.4	2292.2	-92.9	225.4	4134.1	876.7
17	U	-.8090	.5878	2.250	2301.9	357.34	4.7803E-04	435.6	2290.3	-130.9	190.6	4133.2	876.7
18	U	-.8910	.4540	2.245	2299.3	360.18	4.8073E-04	436.6	2288.7	-163.0	149.6	4132.7	876.7
19	U	-.9511	.3090	2.241	2297.4	362.29	4.8273E-04	437.3	2287.5	-187.1	103.2	4132.6	876.7
20	U	-.9877	.1564	2.239	2296.2	363.57	4.8394E-04	437.8	2286.8	-201.8	52.5	4132.3	876.7
21	U	-1.0000	.0000	2.238	2295.9	364.01	4.8436E-04	437.9	2286.5	-207.0	.0	4132.4	876.7
1	D	1.0000	0.0000	2.077	2208.4	465.73	5.7652E-04	470.7	2208.1	38.5	-.0	4106.2	876.7
2	D	.9877	.1564	2.077	2208.5	465.69	5.7649E-04	470.7	2208.0	41.6	-16.4	4106.4	876.7
3	D	.9511	.3090	2.077	2208.8	465.36	5.7623E-04	470.6	2208.0	50.5	-30.7	4107.1	876.7
4	D	.8910	.4540	2.078	2209.1	465.02	5.7597E-04	470.4	2207.8	64.1	-40.9	4108.2	876.7
5	D	.8090	.5878	2.079	2209.7	464.45	5.7552E-04	470.2	2207.8	80.9	-45.8	4109.6	876.7
6	D	.7071	.7071	2.080	2210.2	464.04	5.7523E-04	470.1	2207.5	98.8	-44.3	4111.3	876.7
7	D	.5878	.8090	2.081	2210.8	463.49	5.7481E-04	469.8	2207.4	115.8	-36.5	4113.1	876.7
8	D	.4540	.8910	2.081	2211.1	463.29	5.7471E-04	469.7	2207.2	129.6	-22.8	4115.1	876.7
9	D	.3090	.9511	2.082	2211.5	462.99	5.7452E-04	469.6	2207.2	138.9	-4.6	4117.0	876.7
10	D	.1564	.9877	2.082	2211.6	463.14	5.7473E-04	469.6	2207.0	141.6	16.6	4118.8	876.7
11	D	.0000	1.0000	2.082	2211.6	463.23	5.7487E-04	469.5	2207.0	138.2	38.5	4120.4	876.7
12	D	-.1564	.9877	2.082	2211.4	463.70	5.7534E-04	469.6	2206.9	127.3	59.2	4121.8	876.7
13	D	-.3090	.9511	2.081	2211.2	464.13	5.7577E-04	469.7	2207.1	111.0	76.6	4123.1	876.7
14	D	-.4540	.8910	2.081	2210.8	464.76	5.7636E-04	469.9	2207.2	89.2	88.7	4124.0	876.7
15	D	-.5878	.8090	2.080	2210.4	465.39	5.7695E-04	470.0	2207.4	65.0	94.8	4124.9	876.7
16	D	-.7071	.7071	2.079	2210.0	465.96	5.7747E-04	470.2	2207.6	39.0	93.5	4125.3	876.7
17	D	-.8090	.5878	2.080	2210.2	465.56	5.7715E-04	470.0	2208.5	14.2	85.2	4125.4	876.7
18	D	-.8910	.4540	2.079	2210.0	465.91	5.7747E-04	470.1	2208.8	-7.4	70.3	4125.6	876.7
19	D	-.9511	.3090	2.079	2209.7	466.34	5.7786E-04	470.2	2208.9	-24.2	50.3	4125.8	876.7
20	D	-.9877	.1564	2.079	2209.6	466.42	5.7793E-04	470.3	2209.1	-34.9	26.1	4125.8	876.7
21	D	-1.0000	.0000	2.078	2209.4	466.62	5.7811E-04	470.3	2209.1	-38.5	.0	4126.0	876.7
1	9	1.0000	0.0000	2.077	2208.4	465.73	5.7652E-04	470.7	2208.1	38.5	-.0	4106.2	876.7
2	9	.9877	.1564	2.077	2208.5	465.69	5.7649E-04	470.7	2208.0	41.6	-16.4	4106.4	876.7
3	9	.9511	.3090	2.077	2208.8	465.36	5.7623E-04	470.6	2208.0	50.5	-30.7	4107.1	876.7
4	9	.8910	.4540	2.078	2209.1	465.02	5.7597E-04	470.4	2207.8	64.1	-40.9	4108.2	876.7
5	9	.8090	.5878	2.079	2209.7	464.45	5.7552E-04	470.2	2207.8	80.9	-45.8	4109.6	876.7
6	9	.7071	.7071	2.080	2210.2	464.04	5.7523E-04	470.1	2207.5	98.8	-44.3	4111.3	876.7
7	9	.5878	.8090	2.081	2210.8	463.49	5.7481E-04	469.8	2207.4	115.8	-36.5	4113.1	876.7
8	9	.4540	.8910	2.081	2211.1	463.29	5.7471E-04	469.7	2207.2	129.6	-22.8	4115.1	876.7
9	9	.3090	.9511	2.082	2211.5	462.99	5.7452E-04	469.6	2207.2	138.9	-4.6	4117.0	876.7
10	9	.1564	.9877	2.082	2211.6	463.14	5.7473E-04	469.6	2207.0	141.6	16.6	4118.8	876.7

Figure 16. Continued.

REDISTRIBUTED PLANE AT COWL ENTRANCE X= 3.71500(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
11	9	.0000	1.0000	2.082	2211.6	463.23	5.7487E-04	469.5	2207.0	138.2	38.5	4120.4	876.7
12	9	-.1564	.9877	2.082	2211.4	463.70	5.7534E-04	469.6	2206.9	127.3	59.2	4121.8	876.7
13	9	-.3090	.9511	2.081	2211.2	464.13	5.7577E-04	469.7	2207.1	111.0	76.6	4123.1	876.7
14	9	-.4540	.8910	2.081	2210.8	464.76	5.7636E-04	469.9	2207.2	89.2	88.7	4124.0	876.7
15	9	-.5878	.8090	2.080	2210.4	465.39	5.7695E-04	470.0	2207.4	65.0	94.8	4124.9	876.7
16	9	-.7071	.7071	2.079	2210.0	465.96	5.7747E-04	470.2	2207.6	39.0	93.5	4125.3	876.7
17	9	-.8090	.5878	2.080	2210.2	465.56	5.7715E-04	470.0	2208.5	14.2	85.2	4125.4	876.7
18	9	-.8910	.4540	2.079	2210.0	465.91	5.7747E-04	470.1	2208.8	-7.4	70.3	4125.6	876.7
19	9	-.9511	.3090	2.079	2209.7	466.34	5.7786E-04	470.2	2208.9	-24.2	50.3	4125.8	876.7
20	9	-.9877	.1564	2.079	2209.6	466.42	5.7793E-04	470.3	2209.1	-34.9	26.1	4125.8	876.7
21	9	-1.0000	.0000	2.078	2209.4	466.62	5.7811E-04	470.3	2209.1	-38.5	.0	4126.0	876.7

SHOCK WAVE POINT PARAMETERS -

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.204358E+00	-3.882322E-01	-9.215616E-01	-9.344063E-16
2	1.203829E+00	-3.883928E-01	-9.101488E-01	-1.441534E-01
3	1.202001E+00	-3.888944E-01	-8.761916E-01	-2.846919E-01
4	1.199209E+00	-3.897054E-01	-8.205632E-01	-4.180970E-01
5	1.195219E+00	-3.908387E-01	-7.446671E-01	-5.410323E-01
6	1.190522E+00	-3.922443E-01	-6.504400E-01	-6.504400E-01
7	1.184826E+00	-3.939285E-01	-5.402576E-01	-7.436008E-01
8	1.178773E+00	-3.958213E-01	-4.169120E-01	-8.182358E-01
9	1.172012E+00	-3.979164E-01	-2.834989E-01	-8.725199E-01
10	1.165246E+00	-4.001314E-01	-1.433656E-01	-9.051747E-01
11	1.158147E+00	-4.024399E-01	-1.274309E-14	-9.154464E-01
12	1.1513[illegible]E+00	-4.047624E-01	1.430471E-01	-9.031638E-01
13	1.144607E+00	-4.070488E-01	2.822581E-01	-8.687011E-01
14	1.138358E+00	-4.092391E-01	4.142333E-01	-8.129786E-01
15	1.132645E+00	-4.112620E-01	5.357764E-01	-7.374329E-01
16	1.127513E+00	-4.130680E-01	6.439559E-01	-6.439559E-01
17	1.122310E+00	-4.147026E-01	7.361707E-01	-5.348593E-01
18	1.118752E+00	-4.159669E-01	8.102633E-01	-4.128498E-01
19	1.116329E+00	-4.168775E-01	8.644749E-01	-2.808849E-01
20	1.114668E+00	-4.174505E-01	8.975121E-01	-1.421519E-01
21	1.114279E+00	-4.176285E-01	9.086179E-01	-7.952887E-15

MASS FLOW RATE FOR ENTIRE PLANE= 1.88292E+00(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I=21, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 7.310351E-02(FT)

Figure 16. Continued.

SOLUTION PLANE NO. 1   X= 3.78810(FT)   INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.6600	-.0000	2.341	2346.9	309.85	4.3171E-04	418.2	2311.2	407.5	-.0	4132.8	876.7	1	2
2	1	.6599	.1035	2.341	2346.7	310.04	4.3190E-04	418.3	2310.8	407.3	32.6	4132.8	876.7	1	2
3	1	.6359	.2045	2.340	2346.1	310.68	4.3253E-04	418.5	2309.7	406.4	66.7	4132.8	876.7	1	2
4	1	.5965	.3007	2.337	2345.0	311.74	4.3359E-04	418.9	2307.7	403.6	103.3	4132.7	876.7	1	2
5	1	.5426	.3896	2.334	2343.4	313.33	4.3517E-04	419.6	2305.0	397.5	143.2	4132.6	876.7	1	2
6	1	.4755	.4692	2.330	2341.3	315.47	4.3729E-04	420.4	2301.7	386.1	186.5	4132.5	876.7	1	2
7	1	.3967	.5374	2.324	2338.6	318.24	4.4003E-04	421.4	2297.9	367.4	232.4	4132.4	876.7	1	2
8	1	.3062	.5926	2.317	2335.3	321.68	4.4342E-04	422.7	2293.5	339.7	279.2	4132.3	876.7	1	2
9	1	.2120	.6334	2.309	2331.3	325.77	4.4744E-04	424.2	2288.8	301.6	324.6	4132.2	876.7	1	2
10	1	.1105	.6587	2.300	2326.8	330.52	4.5209E-04	426.0	2283.9	252.8	365.9	4132.1	876.7	1	2
11	1	.0061	.6679	2.290	2321.7	335.81	4.5724E-04	427.9	2278.8	193.3	400.1	4132.0	876.7	1	2
12	1	-.0965	.6606	2.279	2316.3	341.56	4.6282E-04	430.0	2273.8	124.7	424.0	4131.9	876.7	1	2
13	1	-.2009	.6370	2.268	2310.6	347.55	4.6861E-04	432.2	2268.9	48.9	434.9	4131.8	876.7	1	3
14	1	-.2984	.5976	2.257	2305.2	353.66	4.7447E-04	434.3	2264.3	-30.7	430.9	4131.7	876.6	1	3
15	1	-.3887	.5432	2.246	2299.8	359.56	4.8012E-04	436.4	2260.1	-110.9	410.6	4131.7	876.6	1	3
16	1	-.4693	.4753	2.236	2294.8	365.12	4.8541E-04	438.3	2256.3	-187.6	373.9	4131.7	876.6	1	2
17	1	-.5383	.3954	2.228	2290.4	370.01	4.9004E-04	440.0	2253.1	-257.0	321.2	4131.6	876.6	1	2
18	1	-.5939	.3056	2.221	2286.7	374.11	4.9392E-04	441.4	2250.5	-315.3	254.6	4131.6	876.6	1	2
19	1	-.6347	.2081	2.216	2284.1	377.13	4.9676E-04	442.4	2248.7	-359.4	176.5	4131.6	876.6	1	2
20	1	-.6596	.1054	2.212	2282.4	379.05	4.9857E-04	443.0	2247.5	-386.9	90.3	4131.6	876.6	1	2
21	1	-.6680	.0000	2.211	2281.8	379.65	4.9914E-04	443.2	2247.2	-396.2	.0	4131.6	876.6	1	2
1	2	.7107	-.0000	2.341	2346.6	310.14	4.3206E-04	418.3	2313.2	395.3	-.0	4134.9	876.7	1	2
2	2	.7021	.1102	2.341	2346.5	310.36	4.3231E-04	418.4	2312.8	394.9	32.0	4135.0	876.7	1	2
3	2	.6765	.2178	2.339	2345.8	311.09	4.3301E-04	418.6	2311.7	393.4	65.2	4135.0	876.7	1	2
4	2	.6344	.3202	2.337	2344.6	312.32	4.3423E-04	419.1	2309.8	390.0	100.6	4135.0	876.7	1	2
5	2	.5770	.4148	2.333	2342.9	314.07	4.3597E-04	419.8	2307.2	383.1	138.9	4134.9	876.7	1	2
6	2	.5055	.4994	2.328	2340.6	316.43	4.3830E-04	420.7	2304.0	371.1	180.0	4134.9	876.7	1	2
7	2	.4216	.5720	2.322	2337.7	319.40	4.4123E-04	421.8	2300.2	352.2	223.1	4134.8	876.7	1	2
8	2	.3273	.6306	2.315	2334.2	323.03	4.4481E-04	423.2	2296.0	324.9	266.8	4134.7	876.7	1	2
9	2	.2249	.6739	2.307	2330.1	327.29	4.4898E-04	424.8	2291.5	288.0	308.7	4134.6	876.7	1	2
10	2	.1169	.7007	2.297	2325.5	332.15	4.5373E-04	426.6	2286.8	241.1	346.7	4134.5	876.7	1	2
11	2	.0059	.7103	2.287	2320.4	337.51	4.5895E-04	428.5	2282.0	184.8	377.6	4134.3	876.7	1	2
12	2	-.1054	.7024	2.276	2315.0	343.27	4.6452E-04	430.6	2277.2	120.0	398.9	4134.2	876.7	1	2
13	2	-.2142	.6772	2.265	2309.5	349.24	4.7027E-04	432.7	2272.6	49.2	408.0	4134.1	876.7	1	2
14	2	-.3179	.6351	2.254	2304.0	355.23	4.7601E-04	434.8	2268.3	-25.3	403.2	4133.9	876.7	1	2
15	2	-.4137	.5772	2.244	2298.7	361.05	4.8156E-04	436.9	2264.3	-99.7	383.5	4133.8	876.7	1	2
16	2	-.4993	.5049	2.234	2293.8	366.43	4.8667E-04	438.7	2260.8	-170.5	348.4	4133.6	876.7	1	2
17	2	-.5725	.4201	2.226	2289.6	371.22	4.9120E-04	440.4	2257.8	-234.9	299.0	4133.5	876.7	1	2
18	2	-.6315	.3246	2.219	2286.1	375.14	4.9490E-04	441.7	2255.4	-288.7	236.6	4133.4	876.7	1	2
19	2	-.6747	.2211	2.214	2283.5	378.11	4.9769E-04	442.7	2253.6	-329.4	164.0	4133.4	876.7	1	2
20	2	-.7011	.1119	2.211	2281.9	379.90	4.9937E-04	443.3	2252.6	-354.6	83.9	4133.3	876.7	1	2
21	2	-.7100	.0000	2.210	2281.3	380.54	4.9997E-04	443.5	2252.2	-363.3	.0	4133.3	876.7	1	2
1	3	.7534	-.0000	2.342	2347.1	309.89	4.3187E-04	418.1	2315.6	383.6	-.0	4136.7	876.7	1	2
2	3	.7443	.1170	2.341	2346.9	310.15	4.3213E-04	418.2	2315.2	383.0	31.9	4136.7	876.7	1	2
3	3	.7170	.2311	2.340	2346.1	310.91	4.3289E-04	418.5	2314.1	380.8	64.8	4136.6	876.7	1	2
4	3	.6724	.3397	2.337	2344.8	312.22	4.3419E-04	419.0	2312.3	376.4	99.6	4136.6	876.7	1	2
5	3	.6114	.4401	2.333	2343.0	314.07	4.3603E-04	419.7	2309.8	368.3	136.6	4136.4	876.7	1	2
6	3	.5354	.5298	2.328	2340.6	316.54	4.3847E-04	420.7	2306.7	355.3	175.9	4136.3	876.7	1	2
7	3	.4463	.6066	2.322	2337.6	319.61	4.4150E-04	421.8	2303.2	335.7	216.3	4136.1	876.7	1	2
8	3	.3463	.6687	2.314	2333.9	323.34	4.4516E-04	423.2	2299.2	306.3	257.0	4135.9	876.7	1	2
9	3	.2377	.7144	2.306	2329.8	327.65	4.4938E-04	424.8	2294.9	272.2	295.5	4135.5	876.7	1	2
10	3	.1232	.7427	2.296	2325.1	332.55	4.5416E-04	426.7	2290.3	227.1	330.8	4135.2	876.7	1	2
11	3	.0055	.7527	2.286	2320.0	337.88	4.5935E-04	428.6	2285.7	173.5	357.6	4134.9	876.7	1	2
12	3	-.1124	.7442	2.275	2314.7	343.59	4.6486E-04	430.7	2281.1	113.4	376.2	4134.5	876.7	1	2
13	3	-.2276	.7173	2.265	2309.2	349.46	4.7051E-04	432.8	2276.7	46.1	383.4	4134.2	876.7	1	2

Figure 16. Continued.

SOLUTION PLANE NO. 1 X= 3.78810(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
14	3	-.3373	.6726	2.254	2303.8	355.33	4.7613E-04	434.9	2272.5	-23.3	377.7	4133.8	876.7	1	2
15	3	-.4387	.6112	2.244	2298.7	360.99	4.8153E-04	436.8	2268.7	-92.4	358.4	4133.5	876.7	1	2
16	3	-.5293	.5346	2.234	2293.9	366.22	4.8649E-04	438.6	2265.3	-158.1	324.9	4133.2	876.7	1	2
17	3	-.6067	.4447	2.226	2289.8	370.66	4.9087E-04	440.2	2262.4	-217.3	278.4	4133.0	876.7	1	2
18	3	-.6691	.3436	2.220	2286.4	374.64	4.9443E-04	441.5	2260.1	-266.8	220.0	4132.7	876.7	1	2
19	3	-.7148	.2340	2.215	2283.9	377.51	4.9712E-04	442.5	2258.4	-304.3	152.4	4132.6	876.7	1	2
20	3	-.7427	.1185	2.212	2282.3	379.23	4.9874E-04	443.1	2257.4	-327.4	77.9	4132.4	876.7	1	2
21	3	-.7521	-.0000	2.211	2281.8	379.85	4.9932E-04	443.3	2257.0	-335.5	-.0	4132.5	876.7	1	2
1	4	.7962	-.0000	2.343	2347.7	309.36	4.3138E-04	417.9	2318.0	372.6	-.0	4137.9	876.7	1	2
2	4	.7865	.1237	2.343	2347.5	309.62	4.3163E-04	418.0	2317.6	372.0	31.4	4138.0	876.7	1	2
3	4	.7577	.2444	2.341	2346.7	310.40	4.3242E-04	418.3	2316.6	369.3	63.6	4137.9	876.7	1	2
4	4	.7104	.3592	2.338	2345.4	311.73	4.3374E-04	418.8	2314.9	364.3	97.5	4137.9	876.7	1	2
5	4	.6458	.4653	2.334	2343.5	313.63	4.3561E-04	419.5	2312.6	355.6	133.0	4137.7	876.7	1	2
6	4	.5655	.5601	2.329	2341.1	316.11	4.3807E-04	420.5	2309.7	342.1	170.6	4137.7	876.7	1	2
7	4	.4713	.6412	2.323	2338.1	319.19	4.4111E-04	421.6	2306.4	322.4	208.6	4137.4	876.7	1	2
8	4	.3655	.7068	2.316	2334.5	322.94	4.4479E-04	423.1	2302.5	295.4	246.8	4137.4	876.7	1	2
9	4	.2506	.7550	2.307	2330.3	327.28	4.4905E-04	424.7	2298.4	260.2	282.2	4136.8	876.7	1	2
10	4	.1296	.7848	2.297	2325.6	332.19	4.5383E-04	426.5	2294.1	216.7	313.9	4136.6	876.7	1	2
11	4	.0052	.7952	2.287	2320.6	337.42	4.5891E-04	428.4	2289.8	165.9	338.8	4136.2	876.7	1	2
12	4	-.1193	.7861	2.277	2315.4	342.99	4.6430E-04	430.5	2285.4	108.0	355.2	4135.8	876.7	1	2
13	4	-.2410	.7576	2.266	2310.1	348.66	4.6976E-04	432.5	2281.3	45.9	361.0	4135.5	876.7	1	2
14	4	-.3568	.7103	2.256	2304.9	354.35	4.7520E-04	434.5	2277.3	-19.1	354.7	4135.0	876.7	1	2
15	4	-.4638	.6454	2.246	2299.9	359.78	4.8038E-04	436.4	2273.7	-83.4	336.0	4134.8	876.7	1	2
16	4	-.5593	.5644	2.237	2295.3	364.81	4.8516E-04	438.2	2270.5	-144.6	303.9	4134.2	876.7	1	2
17	4	-.6410	.4694	2.229	2291.4	369.22	4.8932E-04	439.7	2267.8	-199.4	260.2	4134.1	876.7	1	2
18	4	-.7066	.3627	2.223	2288.1	372.85	4.9275E-04	440.9	2265.7	-245.2	205.2	4133.6	876.7	1	2
19	4	-.7550	.2470	2.218	2285.8	375.56	4.9529E-04	441.8	2264.1	-279.9	142.1	4133.7	876.8	1	2
20	4	-.7845	.1250	2.216	2284.2	377.23	4.9685E-04	442.4	2263.1	-301.2	72.5	4133.3	876.7	1	2
21	4	-.7944	.0000	2.215	2283.6	377.80	4.9739E-04	442.6	2262.8	-308.7	.0	4133.5	876.8	1	2
1	5	.8389	-.0000	2.344	2348.4	308.80	4.3084E-04	417.6	2320.2	362.5	-.0	4138.5	876.7	1	2
2	5	.8287	.1304	2.344	2348.1	309.06	4.3110E-04	417.7	2319.9	361.8	30.9	4138.6	876.7	1	2
3	5	.7983	.2577	2.342	2347.3	309.88	4.3191E-04	418.1	2318.9	358.7	62.3	4138.5	876.7	1	2
4	5	.7485	.3787	2.339	2346.0	311.25	4.3327E-04	418.6	2317.2	353.3	95.3	4138.5	876.7	1	2
5	5	.6803	.4905	2.335	2344.0	313.19	4.3519E-04	419.3	2315.0	344.1	129.5	4138.3	876.7	1	2
6	5	.5956	.5904	2.330	2341.6	315.73	4.3770E-04	420.3	2312.2	330.4	165.4	4138.3	876.7	1	2
7	5	.4962	.6759	2.324	2338.5	318.85	4.4078E-04	421.5	2309.0	310.7	201.4	4138.1	876.7	1	2
8	5	.3847	.7449	2.316	2334.9	322.52	4.4439E-04	422.9	2305.4	283.6	237.5	4137.6	876.7	1	2
9	5	.2636	.7956	2.308	2330.7	326.75	4.4853E-04	424.5	2301.5	249.3	270.5	4136.5	876.7	1	2
10	5	.1360	.8269	2.299	2326.1	331.52	4.5318E-04	426.3	2297.4	207.2	299.8	4135.9	876.7	1	2
11	5	.0050	.8378	2.289	2321.3	336.64	4.5816E-04	428.1	2293.3	158.7	322.4	4135.5	876.7	1	2
12	5	-.1262	.8281	2.278	2316.1	342.07	4.6341E-04	430.1	2289.1	103.7	337.0	4135.0	876.7	1	2
13	5	-.2543	.7979	2.268	2311.0	347.58	4.6872E-04	432.1	2285.2	45.2	341.6	4134.6	876.7	1	2
14	5	-.3762	.7480	2.258	2305.9	353.09	4.7399E-04	434.1	2281.4	-16.0	334.8	4134.1	876.7	1	2
15	5	-.4889	.6796	2.249	2301.1	358.32	4.7899E-04	435.9	2278.0	-76.1	316.4	4133.8	876.7	1	2
16	5	-.5894	.5943	2.240	2296.7	363.17	4.8359E-04	437.6	2274.9	-133.4	285.7	4133.3	876.7	1	2
17	5	-.6754	.4942	2.232	2292.9	367.40	4.8760E-04	439.1	2272.4	-184.4	244.4	4133.2	876.7	1	2
18	5	-.7446	.3818	2.226	2289.7	370.88	4.9088E-04	440.2	2270.3	-227.1	192.5	4132.6	876.7	1	2
19	5	-.7953	.2600	2.222	2287.5	373.48	4.9333E-04	441.1	2268.8	-259.4	133.2	4132.7	876.7	1	2
20	5	-.8263	.1316	2.219	2286.0	375.06	4.9482E-04	441.7	2267.9	-279.1	68.0	4132.3	876.7	1	2
21	5	-.8367	-.0000	2.218	2285.5	375.61	4.9534E-04	441.9	2267.6	-286.1	-.0	4132.5	876.7	1	2
1	6	.8817	-.0000	2.346	2349.0	308.08	4.3011E-04	417.4	2322.3	353.0	-.0	4137.7	876.7	1	2
2	6	.8710	.1372	2.345	2348.7	308.35	4.3037E-04	417.5	2322.0	352.1	30.4	4137.8	876.7	1	2
3	6	.8390	.2710	2.343	2347.9	309.18	4.3119E-04	417.8	2321.0	348.8	61.3	4137.7	876.7	1	2
4	6	.7865	.3982	2.341	2346.6	310.55	4.3256E-04	418.3	2319.5	343.0	93.4	4137.7	876.7	1	2
5	6	.7149	.5157	2.337	2344.6	312.50	4.3449E-04	419.1	2317.4	333.3	126.4	4137.5	876.7	1	2

Figure 16. Continued.

SOLUTION PLANE NO. 1 X= 3.78810(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
6	6	.6257	.6207	2.331	2342.1	315.03	4.3700E-04	420.1	2314.7	319.2	160.8	4137.5	876.7	1	2
7	6	.5212	.7105	2.325	2339.1	318.13	4.4006E-04	421.2	2311.6	299.5	195.0	4137.2	876.7	1	2
8	6	.4039	.7830	2.318	2335.6	321.74	4.4361E-04	422.6	2308.3	273.2	228.8	4137.2	876.7	1	2
9	6	.2766	.8363	2.310	2331.6	325.66	4.4765E-04	424.2	2304.6	239.8	259.5	4136.5	876.7	1	2
10	6	.1425	.8690	2.301	2327.2	330.48	4.5217E-04	425.9	2300.8	199.6	286.7	4136.4	876.7	1	2
11	6	.0048	.8804	2.291	2322.4	335.46	4.5701E-04	427.7	2296.9	153.2	307.3	4136.0	876.7	1	2
12	6	-.1330	.8701	2.281	2317.5	340.71	4.6209E-04	429.6	2293.0	100.9	320.4	4135.6	876.7	1	2
13	6	-.2676	.8383	2.271	2312.4	346.12	4.6731E-04	431.6	2289.2	45.6	324.0	4135.3	876.7	1	2
14	6	-.3957	.7858	2.261	2307.4	351.55	4.7252E-04	433.5	2285.5	-12.1	316.5	4134.7	876.7	1	2
15	6	-.5140	.7139	2.251	2302.7	356.72	4.7746E-04	435.3	2282.2	-68.5	298.6	4134.4	876.7	1	2
16	6	-.6196	.6242	2.243	2298.4	361.37	4.8188E-04	437.0	2279.3	-122.2	269.3	4133.9	876.7	1	2
17	6	-.7098	.5191	2.236	2294.7	365.43	4.8573E-04	438.4	2276.9	-169.9	230.0	4133.7	876.7	1	2
18	6	-.7825	.4010	2.230	2291.7	368.76	4.8887E-04	439.5	2274.9	-209.8	181.1	4133.3	876.7	1	2
19	6	-.8357	.2730	2.226	2289.5	371.24	4.9122E-04	440.4	2273.5	-239.9	125.2	4133.3	876.7	1	2
20	6	-.8682	.1382	2.223	2288.1	372.75	4.9264E-04	440.9	2272.6	-258.3	63.8	4132.9	876.7	1	2
21	6	-.8791	.0000	2.222	2287.7	373.28	4.9314E-04	441.1	2272.3	-264.8	.0	4133.1	876.7	1	2
1	7	.9246	-.0000	2.347	2349.8	307.26	4.2928E-04	417.1	2324.5	344.1	-.0	4137.8	876.7	1	2
2	7	.9133	.1439	2.347	2349.6	307.53	4.2955E-04	417.2	2324.2	343.1	29.7	4137.9	876.7	1	2
3	7	.8797	.2843	2.345	2348.7	308.34	4.3036E-04	417.5	2323.3	339.6	59.9	4137.8	876.7	1	2
4	7	.8246	.4177	2.342	2347.4	309.71	4.3173E-04	418.0	2321.8	333.5	91.1	4137.8	876.7	1	2
5	7	.7494	.5410	2.338	2345.5	311.64	4.3364E-04	418.8	2319.8	323.6	123.0	4137.7	876.7	1	2
6	7	.6559	.6510	2.333	2343.0	314.16	4.3614E-04	419.7	2317.3	309.5	155.9	4137.7	876.7	1	2
7	7	.5462	.7452	2.327	2339.9	317.29	4.3923E-04	420.9	2314.3	289.7	188.3	4137.4	876.7	1	2
8	7	.4232	.8211	2.319	2336.4	320.96	4.4285E-04	422.3	2311.0	263.9	220.3	4137.3	876.7	1	2
9	7	.2897	.8769	2.311	2332.4	325.07	4.4688E-04	423.9	2307.4	231.8	249.2	4137.0	876.7	1	2
10	7	.1490	.9112	2.302	2328.0	329.64	4.5134E-04	425.6	2303.7	192.9	274.5	4136.7	876.7	1	2
11	7	.0047	.9231	2.293	2323.4	334.52	4.5610E-04	427.4	2300.0	148.6	293.5	4136.4	876.7	1	2
12	7	-.1398	.9122	2.283	2318.5	339.65	4.6107E-04	429.2	2296.2	98.7	305.3	4136.0	876.7	1	2
13	7	-.2809	.8788	2.273	2313.7	344.77	4.6601E-04	431.1	2292.7	46.1	308.0	4135.5	876.7	1	2
14	7	-.4151	.8237	2.264	2308.9	349.64	4.7088E-04	432.9	2289.3	-8.8	300.2	4134.5	876.7	1	2
15	7	-.5391	.7482	2.255	2304.4	354.68	4.7551E-04	434.6	2286.2	-62.1	282.7	4134.0	876.7	1	2
16	7	-.6497	.6542	2.247	2300.3	359.14	4.7976E-04	436.2	2283.4	-112.5	254.5	4133.4	876.7	1	2
17	7	-.7443	.5440	2.240	2296.8	363.03	4.8346E-04	437.6	2281.1	-157.3	217.1	4133.2	876.7	1	2
18	7	-.8204	.4203	2.234	2293.9	366.21	4.8647E-04	438.7	2279.2	-194.6	170.7	4132.7	876.7	1	2
19	7	-.8761	.2861	2.230	2291.8	368.59	4.8871E-04	439.5	2277.9	-222.7	118.0	4132.7	876.7	1	2
20	7	-.9101	.1449	2.228	2290.5	370.03	4.9007E-04	440.0	2277.1	-239.9	60.1	4132.3	876.7	1	2
21	7	-.9216	-.0000	2.227	2290.0	370.54	4.9055E-04	440.1	2276.8	-246.1	-.0	4132.5	876.7	1	2
1	8	.9674	-.0000	2.349	2350.6	306.44	4.2847E-04	416.7	2326.6	335.6	-.0	4137.9	876.7	1	2
2	8	.9556	.1506	2.349	2350.4	306.71	4.2873E-04	416.9	2326.3	334.6	29.1	4138.0	876.7	1	2
3	8	.9204	.2975	2.347	2349.6	307.53	4.2955E-04	417.2	2325.4	331.0	58.5	4137.9	876.7	1	2
4	8	.8628	.4372	2.344	2348.2	308.90	4.3092E-04	417.7	2324.0	324.7	88.7	4137.9	876.7	1	2
5	8	.7840	.5662	2.340	2346.3	310.83	4.3284E-04	418.5	2322.0	314.6	119.5	4137.8	876.7	1	2
6	8	.6861	.6814	2.335	2343.9	313.28	4.3527E-04	419.4	2319.6	300.4	151.2	4137.7	876.7	1	2
7	8	.5713	.7799	2.329	2340.9	316.31	4.3826E-04	420.6	2316.8	280.5	182.3	4137.2	876.7	1	2
8	8	.4424	.8593	2.322	2337.4	319.86	4.4176E-04	421.9	2313.7	255.1	212.6	4137.0	876.7	1	2
9	8	.3027	.9176	2.314	2333.5	323.87	4.4571E-04	423.4	2310.3	223.9	239.7	4136.6	876.7	1	2
10	8	.1556	.9534	2.305	2329.2	328.32	4.5006E-04	425.1	2306.8	186.3	263.2	4136.4	876.7	1	2
11	8	.0045	.9657	2.296	2324.7	333.05	4.5467E-04	426.8	2303.2	143.8	280.7	4136.0	876.7	1	2
12	8	-.1467	.9543	2.286	2320.0	338.02	4.5949E-04	428.7	2299.6	96.2	291.2	4135.6	876.7	1	2
13	8	-.2942	.9193	2.277	2315.4	342.92	4.6423E-04	430.4	2296.3	46.4	293.1	4135.4	876.7	1	2
14	8	-.4346	.8616	2.268	2310.9	347.74	4.6886E-04	432.2	2293.2	-5.4	285.1	4134.6	876.7	1	2
15	8	-.5642	.7826	2.259	2306.6	352.34	4.7327E-04	433.8	2290.3	-55.5	268.2	4134.4	876.7	1	2
16	8	-.6799	.6843	2.251	2302.6	356.71	4.7744E-04	435.4	2287.6	-103.0	241.2	4133.9	876.7	1	2
17	8	-.7787	.5690	2.245	2299.1	360.56	4.8110E-04	436.7	2285.3	-144.8	205.3	4133.5	876.7	1	2
18	8	-.8583	.4395	2.239	2296.2	363.72	4.8410E-04	437.8	2283.5	-179.9	161.3	4133.1	876.7	1	2

Figure 16. Continued.

SOLUTION PLANE NO. 1 X= 3.78810(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
19	8	-.9166	.2992	2.235	2294.2	365.99	4.8624E-04	438.6	2282.2	-206.3	111.4	4133.0	876.7	1	2
20	8	-.9522	.1515	2.232	2292.9	367.36	4.8754E-04	439.1	2281.4	-222.4	56.8	4132.7	876.7	1	2
21	8	-.9641	.0000	2.232	2292.5	367.84	4.8799E-04	439.2	2281.1	-228.1	.0	4132.8	876.7	1	2
1	U	.9692	-.0000	2.349	2350.7	306.41	4.2843E-04	416.7	2326.6	335.3	-.0	4137.9	876.7	1	2
2	U	.9574	.1508	2.349	2350.4	306.68	4.2870E-04	416.6	2326.4	334.3	29.0	4136.0	876.7	1	3
3	U	.9222	.2980	2.347	2349.6	307.50	4.2952E-04	417.2	2325.5	330.6	58.4	4137.9	876.7	1	3
4	U	.8645	.4379	2.344	2348.3	308.86	4.3088E-04	417.7	2324.1	324.3	88.6	4137.9	876.7	1	3
5	U	.7857	.5671	2.340	2346.3	310.79	4.3280E-04	418.4	2322.1	314.3	119.3	4137.8	876.7	1	3
6	U	.6876	.6825	2.335	2343.9	313.24	4.3522E-04	419.4	2319.7	300.0	151.0	4137.7	876.7	1	3
7	U	.5727	.7813	2.329	2340.9	316.25	4.3820E-04	420.5	2317.0	280.2	182.0	4137.2	876.7	1	3
8	U	.4436	.8609	2.322	2337.5	319.79	4.4170E-04	421.9	2313.8	254.8	212.2	4137.0	876.7	1	3
9	U	.3037	.9194	2.314	2333.6	323.80	4.4563E-04	423.4	2310.5	223.7	239.2	4136.7	876.7	1	3
10	U	.1563	.9554	2.305	2329.3	328.24	4.4998E-04	425.0	2306.9	186.2	262.7	4136.4	876.7	1	3
11	U	.0049	.9679	2.296	2324.8	332.96	4.5458E-04	426.8	2303.4	143.8	280.0	4136.0	876.7	1	3
12	U	-.1466	.9565	2.286	2320.1	337.92	4.5939E-04	428.6	2299.8	96.2	290.5	4135.6	876.7	1	3
13	U	-.2946	.9215	2.277	2315.5	342.63	4.6414E-04	430.4	2296.5	46.5	292.5	4135.4	876.7	1	3
14	U	-.4353	.8637	2.268	2311.0	347.63	4.6876E-04	432.1	2293.4	-5.1	284.5	4134.6	876.7	1	3
15	U	-.5653	.7846	2.260	2306.7	352.23	4.7317E-04	433.8	2290.5	-55.1	267.6	4134.4	876.7	1	3
16	U	-.6813	.6860	2.252	2302.7	356.60	4.7733E-04	435.3	2287.8	-102.5	240.7	4133.9	876.7	1	3
17	U	-.7804	.5704	2.245	2299.2	360.47	4.8101E-04	436.7	2285.5	-144.2	204.8	4133.6	876.7	1	3
18	U	-.8602	.4407	2.239	2296.3	363.63	4.8401E-04	437.8	2283.6	-179.1	160.9	4133.1	876.7	1	3
19	U	-.9187	.3000	2.235	2294.3	365.89	4.8615E-04	438.6	2282.3	-205.5	111.2	4133.0	876.7	1	3
20	U	-.9544	.1519	2.233	2293.0	367.26	4.8744E-04	439.0	2281.6	-221.6	56.6	4132.7	876.7	1	3
21	U	-.9664	-.0000	2.232	2292.6	367.74	4.8790E-04	439.2	2281.3	-227.3	.0	4132.8	876.7	1	3
1	D	.9692	-.0000	2.065	2202.0	473.60	5.8334E-04	473.1	2201.7	38.6	-.0	4103.4	876.7	1	1
2	D	.9574	.1508	2.065	2202.0	473.63	5.8337E-04	473.1	2201.6	41.8	-17.1	4103.6	876.7	1	1
3	D	.9222	.2980	2.066	2202.2	473.41	5.8321E-04	473.0	2201.4	50.9	-32.1	4104.3	876.7	1	1
4	D	.8645	.4379	2.066	2202.4	473.32	5.8317E-04	472.9	2201.0	65.0	-42.9	4105.4	876.7	1	1
5	D	.7857	.5671	2.067	2202.8	473.04	5.8298E-04	472.8	2200.7	82.5	-48.3	4106.7	876.7	1	1
6	D	.6876	.6825	2.067	2202.9	473.06	5.8306E-04	472.8	2200.1	101.0	-46.9	4108.3	876.7	1	1
7	D	.5727	.7813	2.068	2203.2	472.82	5.8293E-04	472.6	2199.7	118.6	-39.0	4109.9	876.7	1	1
8	D	.4436	.8609	2.067	2203.1	473.19	5.8333E-04	472.7	2198.9	132.9	-25.0	4111.8	876.7	1	1
9	D	.3037	.9194	2.067	2203.0	473.52	5.8369E-04	472.7	2196.3	142.9	-6.5	4113.6	876.7	1	1
10	D	.1563	.9554	2.066	2202.5	474.40	5.8454E-04	472.9	2197.6	146.1	15.3	4115.4	876.7	1	1
11	D	.0049	.9679	2.065	2202.0	475.24	5.8555E-04	473.1	2197.0	142.9	38.0	4117.1	876.7	1	1
12	D	-.1466	.9565	2.064	2201.1	476.54	5.8655E-04	473.4	2196.3	132.0	59.4	4118.6	876.7	1	1
13	D	-.2946	.9215	2.062	2200.3	477.74	5.8766E-04	473.7	2195.9	115.6	77.5	4120.0	876.7	1	1
14	D	-.4353	.8637	2.061	2199.5	478.78	5.8861E-04	474.0	2195.7	93.1	90.1	4120.8	876.7	1	1
15	D	-.5653	.7846	2.059	2198.6	480.17	5.8987E-04	474.3	2195.4	68.4	96.7	4121.9	876.7	1	1
16	D	-.6813	.6860	2.058	2197.6	481.53	5.9109E-04	474.7	2195.1	41.7	95.8	4122.5	876.7	1	1
17	D	-.7804	.5704	2.056	2196.8	482.63	5.9208E-04	475.0	2195.0	16.3	87.7	4123.1	876.7	1	1
18	D	-.8602	.4407	2.055	2196.1	483.59	5.9293E-04	475.2	2194.9	-6.4	72.6	4123.4	876.7	1	1
19	D	-.9187	.3000	2.054	2195.5	484.47	5.9370E-04	475.5	2194.7	-23.8	51.9	4123.7	876.7	1	1
20	D	-.9544	.1519	2.054	2195.2	484.77	5.9398E-04	475.6	2194.8	-35.0	27.0	4123.7	876.7	1	1
21	D	-.9664	-.0000	2.053	2195.0	485.09	5.9426E-04	475.7	2194.7	-38.8	.0	4123.9	876.7	1	1
1	9	1.0013	-.0000	2.069	2203.9	471.55	5.8166E-04	472.4	2203.5	38.5	-.0	4106.2	876.7	1	2
2	9	.9891	.1559	2.069	2204.0	471.44	5.8157E-04	472.4	2203.5	41.5	-16.2	4106.4	876.7	1	2
3	9	.9527	.3080	2.069	2204.2	471.21	5.8139E-04	472.3	2203.4	50.2	-30.4	4107.1	876.7	1	2
4	9	.8931	.4526	2.070	2204.6	470.81	5.8109E-04	472.1	2203.3	63.7	-40.6	4108.2	876.7	1	2
5	9	.8117	.5863	2.071	2205.1	470.39	5.8077E-04	471.9	2203.1	80.3	-45.5	4109.6	876.7	1	2
6	9	.7104	.7056	2.072	2205.6	469.86	5.8037E-04	471.7	2203.0	98.1	-44.2	4111.3	876.7	1	2
7	9	.5916	.8078	2.073	2206.1	469.47	5.8010E-04	471.6	2202.8	114.9	-36.5	4113.1	876.7	1	2
8	9	.4563	.8902	2.073	2206.5	469.17	5.7991E-04	471.4	2202.6	128.9	-23.1	4115.1	876.7	1	2
9	9	.3136	.9509	2.074	2206.7	469.15	5.7997E-04	471.4	2202.4	136.0	-5.1	4117.0	876.7	1	3
10	9	.1611	.9882	2.074	2206.8	469.25	5.8013E-04	471.3	2202.2	141.2	15.9	4118.8	876.7	1	2

Figure 16. Continued.

SOLUTION PLANE NO. 1 X= 3.78810(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
11	9	.0046	1.0013	2.073	2206.6	469.65	5.8054E-04	471.4	2202.0	137.5	37.8	4120.4	876.7	1	2
12	9	-.1522	.9896	2.073	2206.4	470.15	5.8104E-04	471.5	2201.9	127.3	58.5	4121.9	876.7	1	2
13	9	-.3053	.9536	2.072	2206.0	470.71	5.8159E-04	471.6	2201.9	110.7	75.8	4123.1	876.7	1	2
14	9	-.4510	.8939	2.072	2205.7	471.24	5.8209E-04	471.7	2202.1	89.5	88.2	4124.1	876.7	1	2
15	9	-.5856	.8121	2.071	2205.1	472.06	5.8284E-04	471.9	2202.2	64.9	94.2	4124.8	876.7	1	2
16	9	-.7056	.7102	2.070	2204.7	472.70	5.8343E-04	472.1	2202.4	39.2	93.1	4125.3	876.7	1	2
17	9	-.8085	.5906	2.069	2204.3	473.15	5.8385E-04	472.2	2202.6	14.3	84.8	4125.4	876.7	1	2
18	9	-.8912	.4563	2.069	2203.9	473.64	5.8430E-04	472.3	2202.8	-7.3	70.1	4125.6	876.7	1	3
19	9	-.9519	.3107	2.068	2203.6	474.15	5.8475E-04	472.5	2202.9	-24.1	50.1	4125.8	876.7	1	2
20	9	-.9888	.1573	2.068	2203.4	474.41	5.8498E-04	472.6	2202.9	-34.8	26.1	4125.9	876.7	1	2
21	9	-1.0013	.0000	2.068	2203.3	474.46	5.8503E-04	472.6	2203.0	-38.4	.0	4125.9	876.7	1	2

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.211483E+00	-3.882322E-01	-9.215616E-01	5.308319E-09
2	1.211041E+00	-3.863910E-01	-9.102387E-01	-1.435891E-01
3	1.209322E+00	-3.888876E-01	-8.765416E-01	-2.836215E-01
4	1.206815E+00	-3.896906E-01	-8.213163E-01	-4.166362E-01
5	1.203101E+00	-3.908136E-01	-7.459158E-01	-5.393277E-01
6	1.198889E+00	-3.922077E-01	-6.522265E-01	-6.486708E-01
7	1.193459E+00	-3.938801E-01	-5.425682E-01	-7.419422E-01
8	1.187916E+00	-3.957621E-01	-4.196714E-01	-8.168527E-01
9	1.181663E+00	-3.978482E-01	-2.866006E-01	-8.715371E-01
10	1.175444E+00	-4.000575E-01	-1.466487E-01	-9.046815E-01
11	1.168877E+00	-4.023635E-01	-3.317613E-06	-9.154740E-01
12	1.162599E+00	-4.046879E-01	1.396749E-01	-9.036939E-01
13	1.156426E+00	-4.069794E-01	2.793583E-01	-8.696705E-01
14	1.150373E+00	-4.091787E-01	4.117482E-01	-8.142704E-01
15	1.145126E+00	-4.112121E-01	5.337546E-01	-7.389253E-01
16	1.140306E+00	-4.130494E-01	6.424516E-01	-6.454813E-01
17	1.136000E+00	-4.146758E-01	7.351405E-01	-5.362952E-01
18	1.132596E+00	-4.159514E-01	8.096501E-01	-4.140666E-01
19	1.130392E+00	-4.168703E-01	8.641912E-01	-2.817671E-01
20	1.128827E+00	-4.174486E-01	8.974400E-01	-1.426114E-01
21	1.128503E+00	-4.176285E-01	9.086179E-01	6.823451E-11

MASS FLOW RATE FOR ENTIRE PLANE= 1.88362E+00(SLUG/SEC)

COURANT NUMBER= .97500

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 5, J=11 SAFETY FACTOR= 9.750000E-01 DELTA-X= 5.894270E-02(FT)

Figure 16. Continued.

SOLUTION PLANE NO. 25 X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.7511	.0000	1.866	2079.5	632.67	7.1336E-04	516.8	2070.3	-195.7	.0	4024.3	876.8	1	3
2	1	.7440	.1033	1.868	2080.7	631.09	7.1211E-04	516.4	2071.3	-190.5	-51.8	4025.2	876.8	1	3
3	1	.7226	.2053	1.873	2084.2	626.33	7.0836E-04	515.2	2074.4	-175.7	-99.2	4027.3	876.8	1	3
4	1	.6868	.3041	1.881	2089.1	619.44	7.0291E-04	513.5	2078.8	-152.3	-141.6	4029.8	876.8	1	3
5	1	.6374	.3975	1.889	2094.6	611.80	6.9686E-04	511.6	2083.4	-119.7	-180.3	4032.5	876.8	1	3
6	1	.5748	.4835	1.900	2101.7	602.08	6.8917E-04	509.1	2089.4	-79.2	-212.8	4037.0	876.8	1	3
7	1	.4991	.5613	1.914	2110.3	590.60	6.8008E-04	506.0	2097.0	-35.2	-234.0	4043.1	876.7	1	3
8	1	.4111	.6286	1.926	2117.7	580.86	6.7232E-04	503.4	2103.5	10.1	-244.3	4049.0	876.7	1	3
9	1	.3130	.6828	1.935	2123.5	573.46	6.6646E-04	501.4	2108.4	57.6	-245.7	4054.7	876.7	1	3
10	1	.2060	.7223	1.945	2129.9	565.25	6.5993E-04	499.1	2114.2	102.2	-237.0	4060.9	876.7	1	3
11	1	.0914	.7456	1.958	2137.9	554.87	6.5153E-04	496.3	2122.0	139.8	-219.3	4066.7	876.7	1	3
12	1	-.0276	.7506	1.970	2145.2	545.29	6.4370E-04	493.6	2129.3	172.7	-195.1	4071.4	876.7	1	3
13	1	-.1476	.7365	1.979	2150.5	538.57	6.3825E-04	491.7	2134.7	200.4	-165.7	4076.0	876.7	1	3
14	1	-.2662	.7024	1.984	2154.0	534.34	6.3489E-04	490.4	2138.8	217.7	-133.8	4080.8	876.7	1	3
15	1	-.3794	.6483	1.990	2157.6	530.08	6.3146E-04	489.1	2143.4	224.1	-103.6	4085.0	876.6	1	3
16	1	-.4834	.5749	1.997	2161.4	525.31	6.2756E-04	487.8	2148.3	225.4	-75.9	4088.6	876.6	1	3
17	1	-.5744	.4840	2.000	2163.6	522.72	6.2548E-04	487.0	2151.4	223.1	-50.9	4091.5	876.6	1	3
18	1	-.6493	.3776	2.002	2164.5	521.82	6.2480E-04	486.7	2153.3	217.2	-31.6	4093.8	876.6	1	3
19	1	-.7051	.2589	2.004	2165.8	520.24	6.2352E-04	486.2	2155.5	210.5	-18.0	4095.5	876.6	1	3
20	1	-.7395	.1317	2.005	2166.6	519.24	6.2271E-04	485.9	2156.8	205.8	-7.7	4096.5	876.6	1	3
21	1	-.7511	.0000	2.005	2166.7	519.18	6.2267E-04	485.9	2157.1	203.9	.0	4096.8	876.6	1	3
1	2	.7800	.0000	1.851	2069.7	651.65	7.2952E-04	520.5	2058.8	-212.4	.0	4047.7	877.1	1	3
2	2	.7726	.1078	1.851	2069.9	651.54	7.2946E-04	520.5	2058.7	-208.3	-55.8	4048.6	877.1	1	3
3	2	.7497	.2142	1.857	2073.6	646.35	7.2537E-04	519.2	2062.0	-192.0	-105.3	4050.1	877.1	1	3
4	2	.7118	.3175	1.864	2078.6	639.10	7.1963E-04	517.5	2066.7	-165.8	-148.0	4051.9	877.1	1	3
5	2	.6609	.4154	1.869	2082.0	634.42	7.1597E-04	516.3	2069.2	-131.9	-189.1	4054.6	877.2	1	3
6	2	.5957	.5047	1.879	2088.2	625.92	7.0929E-04	514.2	2074.2	-88.3	-224.6	4058.4	877.2	1	3
7	2	.5148	.5845	1.894	2098.1	611.78	6.9808E-04	510.7	2083.4	-41.8	-244.9	4062.7	877.1	1	3
8	2	.4229	.6550	1.904	2104.6	603.20	6.9128E-04	508.5	2089.1	4.7	-254.8	4067.7	877.2	1	4
9	2	.3208	.7116	1.910	2108.5	598.37	6.8750E-04	507.2	2091.9	54.5	-258.4	4072.6	877.2	1	3
10	2	.2092	.7511	1.921	2115.3	589.16	6.8016E-04	504.7	2098.0	101.3	-250.3	4077.3	877.2	1	3
11	2	.0896	.7746	1.934	2123.8	577.59	6.7078E-04	501.7	2106.7	139.7	-229.9	4081.6	877.2	1	3
12	2	-.0339	.7797	1.944	2130.1	569.33	6.6401E-04	499.6	2113.1	174.2	-204.9	4085.1	877.3	1	3
13	2	-.1579	.7641	1.952	2135.3	562.59	6.5853E-04	497.8	2118.2	204.7	-175.0	4088.5	877.3	1	3
14	2	-.2803	.7275	1.958	2138.8	558.08	6.5492E-04	496.5	2122.2	223.9	-143.1	4091.9	877.3	1	3
15	2	-.3974	.6706	1.964	2142.1	553.88	6.5155E-04	495.4	2126.6	230.9	-113.4	4095.0	877.3	1	3
16	2	-.5047	.5945	1.969	2145.8	549.13	6.4764E-04	494.1	2131.4	233.6	-84.7	4097.7	877.4	1	3
17	2	-.5983	.5001	1.973	2147.9	546.58	6.4556E-04	493.3	2134.3	234.3	-58.5	4099.8	877.4	1	3
18	2	-.6752	.3899	1.974	2148.6	545.81	6.4499E-04	493.1	2135.9	230.2	-38.3	4101.4	877.4	1	3
19	2	-.7325	.2673	1.977	2150.3	543.63	6.4320E-04	492.5	2138.5	223.9	-22.7	4102.5	877.4	1	3
20	2	-.7678	.1359	1.978	2151.0	542.66	6.4240E-04	492.2	2139.7	220.1	-9.9	4103.2	877.4	1	3
21	2	-.7797	-.0000	1.978	2150.9	542.86	6.4258E-04	492.3	2139.7	219.0	.0	4103.4	877.4	1	3
1	3	.8095	.0000	1.823	2051.1	683.18	7.5541E-04	527.0	2041.0	-203.2	.0	4065.2	877.2	1	3
2	3	.8013	.1128	1.821	2049.8	685.33	7.5712E-04	527.4	2039.1	-202.0	-55.9	4065.7	877.2	1	3
3	3	.7772	.2241	1.826	2053.3	680.19	7.5312E-04	526.3	2042.1	-186.5	-103.8	4067.0	877.2	1	3
4	3	.7376	.3321	1.835	2059.5	670.93	7.4588E-04	524.1	2048.3	-158.4	-143.7	4068.7	877.2	1	3
5	3	.6834	.4339	1.839	2062.4	666.92	7.4271E-04	523.2	2050.3	-125.6	-184.9	4070.7	877.3	1	3
6	3	.6148	.5269	1.847	2067.7	659.46	7.3690E-04	521.5	2054.1	-82.8	-221.3	4074.0	877.3	1	3
7	3	.5304	.6102	1.864	2078.4	643.66	7.2455E-04	517.6	2064.2	-37.4	-239.5	4077.9	877.2	1	3
8	3	.4342	.6827	1.873	2084.6	635.03	7.1774E-04	515.6	2069.8	7.9	-248.0	4081.9	877.3	1	4
9	3	.3273	.7401	1.878	2088.2	630.50	7.1418E-04	514.4	2072.1	57.2	-252.7	4085.7	877.4	1	3
10	3	.2108	.7799	1.890	2096.0	619.35	7.0537E-04	511.6	2079.1	102.7	-245.3	4089.5	877.4	1	3
11	3	.0863	.8034	1.906	2105.8	605.52	6.9422E-04	508.2	2089.3	139.1	-223.0	4092.7	877.4	1	3
12	3	-.0418	.8079	1.914	2111.6	597.80	6.8789E-04	506.4	2095.2	172.6	-197.9	4095.4	877.5	1	3
13	3	-.1699	.7909	1.922	2116.8	590.73	6.8215E-04	504.6	2100.3	202.9	-168.5	4098.2	877.6	1	3

Figure 16. Continued.

ORIGINAL PAGE IS OF POOR QUALITY

SOLUTION PLANE NO. 25 X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
14	3	-.2960	.7516	1.929	2120.7	585.37	6.7789E-04	503.2	2104.6	221.5	-138.7	4100.9	877.5	1	3
15	3	-.4164	.6917	1.934	2123.8	581.32	6.7465E-04	502.1	2108.6	227.9	-110.9	4103.2	877.5	1	3
16	3	-.5266	.6126	1.939	2127.0	577.16	6.7121E-04	501.0	2112.8	230.6	-83.1	4105.2	877.6	1	3
17	3	-.6222	.5148	1.942	2129.3	574.11	6.6873E-04	500.3	2115.6	232.1	-57.7	4106.8	877.7	1	3
18	3	-.7006	.4010	1.944	2130.3	572.78	6.6770E-04	499.9	2117.7	228.7	-38.3	4107.9	877.6	1	3
19	3	-.7593	.2748	1.947	2132.2	570.33	6.6567E-04	499.2	2120.4	222.4	-23.0	4106.7	877.7	1	3
20	3	-.7952	.1397	1.948	2132.6	569.48	6.6497E-04	499.0	2121.5	219.0	-9.9	4109.2	877.7	1	3
21	3	-.8073	-.0000	1.948	2132.7	569.68	6.6516E-04	499.1	2121.5	218.2	.0	4109.3	877.7	1	3
1	4	.8392	.0000	1.800	2035.5	709.62	7.7683E-04	532.3	2028.6	-166.8	.0	4076.9	877.2	1	3
2	4	.8302	.1179	1.796	2033.0	713.52	7.7992E-04	533.1	2025.3	-169.6	-51.4	4077.3	877.1	1	3
3	4	.8050	.2340	1.800	2035.5	709.81	7.7707E-04	532.3	2027.3	-157.1	-94.3	4078.4	877.2	1	3
4	4	.7642	.3467	1.810	2042.2	699.43	7.6905E-04	529.9	2034.1	-128.4	-128.7	4080.0	877.1	1	3
5	4	.7062	.4520	1.813	2044.9	695.87	7.6620E-04	529.2	2035.5	-100.8	-168.6	4081.8	877.3	1	3
6	4	.6340	.5467	1.819	2049.0	690.03	7.6173E-04	527.8	2037.9	-63.4	-203.4	4084.6	877.3	1	3
7	4	.5464	.6358	1.834	2058.9	674.90	7.5009E-04	524.3	2047.2	-21.9	-217.7	4088.1	877.2	1	3
8	4	.4459	.7100	1.844	2065.5	665.54	7.4271E-04	522.1	2053.0	19.9	-225.8	4091.5	877.3	1	3
9	4	.3342	.7682	1.850	2069.6	659.93	7.3830E-04	520.8	2055.6	65.4	-231.1	4094.6	877.4	1	3
10	4	.2130	.8093	1.862	2077.1	648.94	7.2973E-04	518.2	2062.1	106.0	-225.1	4097.8	877.3	1	3
11	4	.0840	.8329	1.877	2087.0	634.44	7.1815E-04	514.8	2072.4	138.5	-204.0	4100.4	877.4	1	3
12	4	-.0486	.8361	1.884	2092.0	627.65	7.1262E-04	513.2	2077.2	169.7	-181.6	4102.6	877.5	1	3
13	4	-.1811	.8177	1.892	2097.0	620.69	7.0700E-04	511.6	2082.0	197.7	-154.5	4105.1	877.6	1	3
14	4	-.3112	.7762	1.898	2101.3	614.60	7.0220E-04	510.0	2086.5	214.3	-127.5	4107.4	877.6	1	3
15	4	-.4350	.7137	1.903	2104.1	610.86	6.9924E-04	509.0	2090.1	219.5	-101.8	4109.3	877.6	1	3
16	4	-.5483	.6317	1.906	2106.7	607.41	6.9639E-04	508.2	2093.7	221.2	-75.3	4110.8	877.7	1	3
17	4	-.6464	.5304	1.910	2109.2	603.91	6.9356E-04	507.4	2096.9	221.8	-51.8	4112.0	877.7	1	3
18	4	-.7266	.4128	1.913	2110.6	601.94	6.9202E-04	506.9	2099.1	218.1	-34.3	4112.8	877.7	1	3
19	4	-.7868	.2827	1.915	2112.3	599.65	6.9013E-04	506.3	2101.6	211.7	-20.4	4113.4	877.7	1	3
20	4	-.8235	.1437	1.916	2112.8	598.97	6.8957E-04	506.1	2102.5	208.5	-8.6	4113.8	877.7	1	3
21	4	-.8358	-.0000	1.916	2112.8	599.02	6.8963E-04	506.1	2102.6	207.6	.0	4113.9	877.7	1	3
1	5	.8679	.0000	1.788	2027.0	724.37	7.8883E-04	535.1	2022.2	-138.6	.0	4084.6	877.1	1	3
2	5	.8580	.1228	1.783	2024.0	729.06	7.9251E-04	536.0	2018.3	-144.5	-47.6	4084.7	877.1	1	3
3	5	.8315	.2435	1.785	2024.8	727.92	7.9166E-04	535.8	2018.4	-135.3	-86.7	4085.5	877.1	1	3
4	5	.7892	.3607	1.794	2031.4	717.64	7.8381E-04	533.5	2025.2	-105.8	-117.5	4087.3	877.0	1	3
5	5	.7284	.4700	1.794	2031.7	717.93	7.8396E-04	533.6	2023.9	-82.6	-157.2	4089.3	877.2	1	3
6	5	.6525	.5702	1.796	2032.6	716.97	7.8331E-04	533.3	2022.9	-52.3	-191.4	4091.7	877.3	1	3
7	5	.5616	.6607	1.810	2042.2	701.92	7.7189E-04	529.9	2032.1	-12.9	-201.6	4094.7	877.0	1	3
8	5	.4570	.7368	1.820	2048.9	692.20	7.6426E-04	527.8	2038.0	27.9	-209.3	4097.9	877.2	1	3
9	5	.3405	.7963	1.826	2053.2	686.08	7.5947E-04	526.4	2040.7	70.3	-215.2	4100.6	877.3	1	3
10	5	.2144	.8383	1.837	2060.4	675.15	7.5105E-04	523.8	2046.8	106.7	-210.4	4103.3	877.2	1	3
11	5	.0811	.8621	1.654	2071.7	658.18	7.3759E-04	520.0	2058.6	137.2	-186.4	4105.6	877.2	1	3
12	5	-.0558	.8643	1.862	2077.6	649.94	7.3094E-04	518.1	2064.2	166.6	-166.0	4107.5	877.4	1	3
13	5	-.1929	.8443	1.871	2083.5	641.49	7.2418E-04	516.2	2069.9	191.5	-140.7	4109.8	877.5	1	3
14	5	-.3270	.8010	1.878	2088.4	634.38	7.1858E-04	514.4	2074.9	206.0	-116.5	4111.8	877.5	1	3
15	5	-.4542	.7359	1.883	2091.2	630.41	7.1542E-04	513.5	2078.5	210.8	-92.7	4113.4	877.5	1	3
16	5	-.5702	.6505	1.887	2093.8	626.96	7.1259E-04	512.7	2081.9	211.6	-67.8	4114.5	877.6	1	3
17	5	-.6708	.5459	1.891	2096.4	623.15	7.0953E-04	511.8	2085.2	211.4	-46.3	4115.5	877.6	1	3
18	5	-.7530	.4247	1.893	2098.1	620.75	7.0764E-04	511.2	2087.6	207.5	-30.4	4116.2	877.6	1	3
19	5	-.8144	.2906	1.896	2099.8	618.43	7.0572E-04	510.6	2090.0	201.6	-18.2	4116.7	877.6	1	3
20	5	-.8519	.1476	1.896	2100.3	617.75	7.0517E-04	510.5	2090.8	198.7	-7.6	4116.9	877.7	1	3
21	5	-.8646	-.0000	1.897	2100.3	617.61	7.0507E-04	510.4	2091.0	197.6	.0	4117.0	877.6	1	3
1	6	.8959	.0000	1.775	2018.3	739.19	8.0065E-04	538.0	2015.5	-110.3	.0	4090.0	877.1	1	2
2	6	.8866	.1268	1.774	2017.6	740.21	8.0150E-04	538.1	2013.9	-114.0	-41.9	4089.8	877.0	1	2
3	6	.8585	.2531	1.773	2016.6	741.97	8.0288E-04	538.5	2012.1	-109.4	-78.0	4090.6	877.0	1	3
4	6	.8149	.3725	1.783	2023.5	731.03	7.9456E-04	536.1	2019.3	-80.3	-103.6	4092.4	877.0	1	2
5	6	.7511	.4881	1.783	2023.7	731.50	7.9487E-04	536.2	2017.9	-59.6	-141.6	4094.7	877.1	1	3

Figure 16. Continued.

SOLUTION PLANE NO. 25 X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
6	U	.6740	.5890	1.780	2021.8	735.06	7.9773E-04	536.9	2013.9	-38.7	-174.3	4096.9	877.2	1	2
7	6	.5769	.6854	1.794	2031.5	719.53	7.8598E-04	533.4	2023.6	-1.8	-179.3	4099.4	877.0	1	4
8	6	.4683	.7636	1.804	2038.5	709.25	7.7795E-04	531.2	2029.7	37.4	-165.9	4102.5	877.1	1	3
9	6	.3472	.8244	1.811	2042.9	702.90	7.7304E-04	529.8	2032.4	75.4	-192.5	4104.9	877.2	1	3
10	6	.2163	.8671	1.819	2048.3	694.51	7.6667E-04	527.8	2036.6	105.6	-190.6	4107.0	877.1	1	3
11	6	.0786	.8911	1.840	2062.8	672.23	7.4906E-04	522.9	2051.9	133.9	-165.0	4109.1	877.1	1	3
12	U	-.0576	.8924	1.849	2068.5	663.95	7.4246E-04	521.1	2057.1	160.8	-146.7	4110.0	877.3	1	2
13	U	-.1987	.8698	1.659	2075.5	653.65	7.3440E-04	518.8	2063.4	183.2	-127.2	4112.7	877.4	1	2
14	U	-.3375	.8267	1.868	2081.0	645.58	7.2789E-04	516.8	2069.1	195.6	-105.7	4114.6	877.3	1	2
15	U	-.4684	.7589	1.873	2084.6	640.43	7.2377E-04	515.6	2073.2	200.8	-83.8	4116.0	877.3	1	2
16	U	-.5873	.6700	1.877	2087.1	636.97	7.2094E-04	514.8	2076.4	201.9	-61.1	4116.8	877.4	1	2
17	U	-.6900	.5614	1.881	2089.9	632.97	7.1772E-04	513.9	2079.7	201.7	-41.9	4117.5	877.5	1	2
18	U	-.7745	.4368	1.884	2091.7	630.27	7.1559E-04	513.2	2082.2	197.7	-27.2	4118.1	877.4	1	2
19	U	-.8369	.2986	1.886	2093.2	628.15	7.1383E-04	512.8	2084.3	193.1	-16.6	4118.5	877.5	1	2
20	U	-.8751	.1517	1.887	2094.0	627.02	7.1291E-04	512.5	2085.4	190.4	-6.9	4118.7	877.5	1	2
21	U	-.8881	-.0000	1.886	2094.5	626.27	7.1232E-04	512.3	2086.0	188.7	.0	4118.7	877.5	1	2
1	D	.8959	.0000	1.658	1933.6	881.57	9.0785E-04	565.8	1921.0	-220.4	.0	4087.7	877.1	1	4
2	D	.8866	.1268	1.645	1923.2	899.60	9.2110E-04	569.1	1908.1	-233.6	-59.2	4086.7	877.0	1	3
3	U	.8594	.2517	1.773	2016.5	742.16	8.0303E-04	538.5	2012.1	-109.1	-77.4	4090.6	877.0	1	2
4	D	.8149	.3725	1.661	1935.3	878.86	9.0611E-04	565.2	1920.6	-184.7	-151.1	4089.8	877.0	1	4
5	U	.7529	.4857	1.783	2023.7	731.43	7.9482E-04	536.2	2018.0	-59.9	-140.7	4094.6	877.1	1	2
6	D	.6740	.5890	1.665	1938.5	874.74	9.0315E-04	564.4	1919.3	-119.4	-244.9	4094.7	877.2	1	3
7	U	.5803	.6826	1.794	2031.2	719.97	7.8631E-04	533.5	2023.3	-3.0	-179.1	4099.4	877.0	1	2
8	U	.4730	.7627	1.804	2038.0	710.02	7.7857E-04	531.4	2029.4	36.7	-183.9	4102.6	877.1	1	2
9	U	.3525	.8242	1.810	2042.4	703.69	7.7368E-04	530.0	2032.1	74.5	-190.5	4105.0	877.2	1	2
10	U	.2223	.8690	1.817	2046.9	696.66	7.6839E-04	528.3	2035.5	104.1	-188.5	4107.3	877.1	1	2
11	U	.0839	.8916	1.840	2062.3	673.10	7.4978E-04	523.1	2051.4	132.6	-164.9	4109.1	877.1	1	2
12	D	-.0576	.8924	1.709	1971.3	820.75	8.6362E-04	553.8	1944.4	170.5	-276.5	4106.8	877.3	1	4
13	D	-.1987	.8698	1.726	1984.0	799.98	8.4801E-04	549.7	1957.0	211.7	-247.7	4109.3	877.4	1	3
14	D	-.3375	.8267	1.760	2008.1	760.50	8.1815E-04	541.6	1984.4	233.9	-199.3	4112.8	877.3	1	3
15	D	-.4684	.7589	1.756	2004.8	766.03	8.2240E-04	542.8	1980.1	259.3	-177.2	4113.6	877.3	1	3
16	D	-.5873	.6700	1.783	2023.8	735.67	7.9901E-04	536.5	2002.8	261.2	-127.7	4115.6	877.4	1	4
17	D	-.6900	.5614	1.770	2015.3	749.49	8.0968E-04	539.4	1992.5	282.8	-107.1	4115.5	877.5	1	3
18	D	-.7745	.4368	1.783	2023.9	735.65	7.9906E-04	536.5	2002.9	280.9	-73.8	4116.6	877.4	1	3
19	D	-.8369	.2986	1.784	2025.2	733.75	7.9753E-04	536.1	2004.7	283.5	-48.5	4116.9	877.5	1	3
20	D	-.8751	.1517	1.785	2025.4	733.43	7.9728E-04	536.0	2005.0	285.7	-23.3	4117.1	877.5	1	3
21	D	-.8861	-.0000	1.788	2027.8	729.55	7.9430E-04	535.2	2008.0	282.9	.0	4117.2	877.5	1	3
1	6	.8970	.0000	1.660	1934.5	880.13	9.0680E-04	565.6	1921.9	-220.5	.0	4087.9	877.1	1	1
2	6	.8866	.1277	1.645	1923.1	899.88	9.2130E-04	569.1	1907.9	-233.3	-59.6	4086.7	877.0	1	1
3	D	.8594	.2517	1.647	1924.7	897.19	9.1968E-04	568.6	1908.7	-221.7	-110.2	4087.8	877.0	1	3
4	6	.8147	.3749	1.661	1935.8	878.01	9.0549E-04	565.0	1921.1	-184.3	-151.5	4089.9	877.0	1	1
5	D	.7529	.4657	1.667	1940.2	871.17	9.0041E-04	563.8	1924.0	-150.9	-199.9	4092.4	877.1	1	4
6	6	.6715	.5918	1.665	1936.5	874.67	9.0310E-04	564.3	1919.4	-117.9	-245.1	4094.7	877.2	1	1
7	D	.5803	.6826	1.677	1947.5	859.52	8.9224E-04	561.3	1928.2	-74.7	-262.0	4097.0	877.0	1	3
8	D	.4730	.7627	1.711	1972.9	816.71	8.6058E-04	553.1	1956.0	-9.6	-258.1	4101.5	877.1	1	4
9	D	.3525	.8242	1.696	1962.0	835.83	8.7474E-04	556.8	1940.4	32.9	-288.4	4102.9	877.2	1	3
10	D	.2223	.8690	1.720	1979.2	806.88	8.5331E-04	551.0	1958.0	81.9	-276.7	4106.0	877.1	1	4
11	D	.0839	.8916	1.733	1968.7	791.28	8.4150E-04	547.9	1967.1	124.0	-264.9	4107.3	877.1	1	4
12	6	-.0626	.8928	1.711	1972.7	818.52	8.6188E-04	553.4	1945.9	170.7	-274.8	4106.5	877.3	1	1
13	6	-.2042	.8711	1.732	1967.8	793.62	8.4316E-04	548.5	1960.7	211.4	-249.4	4109.3	877.4	1	1
14	6	-.3424	.8259	1.759	2006.9	762.43	8.1963E-04	542.0	1983.5	233.7	-197.1	4112.8	877.3	1	1
15	6	-.4729	.7582	1.760	2007.7	761.44	8.1886E-04	541.8	1982.6	260.9	-178.3	4113.6	877.4	1	1
16	6	-.5917	.6695	1.782	2023.1	736.72	7.9984E-04	536.7	2002.3	260.5	-126.9	4115.7	877.4	1	1
17	6	-.6948	.5614	1.770	2015.2	749.58	8.0979E-04	539.4	1992.3	283.6	-106.8	4115.7	877.4	1	1
18	6	-.7792	.4366	1.781	2022.8	737.43	8.0048E-04	536.8	2002.1	279.0	-73.0	4116.8	877.4	1	1

Figure 16. Continued.

SOLUTION PLANE NO. 25 X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
19	6	-.8417	.2986	1.782	2023.6	736.32	7.9957E-04	536.6	2003.3	281.9	-48.0	4117.2	877.5	1	1
20	6	-.8800	.1517	1.782	2023.8	736.02	7.9934E-04	536.5	2003.7	283.8	-23.0	4117.4	877.5	1	1
21	6	-.8931	-.0000	1.786	2026.0	732.44	7.9659E-04	535.8	2006.4	281.0	.0	4117.5	877.5	1	1
1	7	.9230	.0000	1.685	1953.9	647.47	8.8282E-04	559.4	1941.2	-222.5	.5	4092.5	877.2	1	5
2	7	.9124	.1322	1.608	1895.0	951.46	9.5892E-04	578.2	1884.3	-188.5	-68.4	4091.2	877.1	1	3
3	7	.8834	.2623	1.563	1859.8	1016.49	1.0054E-03	589.1	1852.5	-145.0	-78.7	4092.3	877.1	1	5
4	7	.8373	.3881	1.677	1947.6	858.39	8.9123E-04	561.2	1933.4	-188.3	-139.9	4094.2	877.0	1	4
5	7	.7714	.5051	1.684	1952.6	850.57	8.8544E-04	559.7	1936.2	-156.2	-198.7	4096.7	877.1	1	4
6	7	.6888	.6121	1.637	1917.3	913.29	9.3171E-04	571.2	1902.5	-87.6	-220.4	4099.3	877.2	1	3
7	7	.5900	.7083	1.726	1983.7	798.26	8.4648E-04	549.5	1962.3	-115.1	-266.8	4101.0	877.1	1	4
8	7	.4781	.7889	1.730	1986.4	794.54	8.4383E-04	548.7	1970.2	-8.9	-253.2	4104.4	877.1	1	4
9	7	.3524	.8504	1.746	1997.5	776.47	8.3005E-04	545.1	1972.3	9.0	-316.5	4105.9	877.2	1	5
10	7	.2174	.8946	1.711	1972.6	818.64	8.6240E-04	553.1	1956.3	90.1	-236.4	4109.2	877.0	1	3
11	7	.0753	.9174	1.740	1993.5	783.39	8.3540E-04	546.4	1969.3	115.6	-287.4	4106.9	877.2	1	4
12	7	-.0699	.9181	1.739	1994.2	783.01	8.3389E-04	547.1	1972.2	145.7	-257.2	4101.7	878.2	1	5
13	7	-.2152	.8947	1.772	2016.3	746.66	8.0734E-04	538.9	1986.7	201.7	-278.7	4110.4	877.3	1	5
14	7	-.3572	.8487	1.732	1988.2	793.81	8.4371E-04	548.2	1969.1	216.6	-169.2	4114.5	877.3	1	3
15	7	-.4904	.7780	1.603	2037.4	713.59	7.8204E-04	531.7	2007.2	280.8	-208.2	4116.4	877.2	1	4
16	7	-.6124	.6871	1.775	2018.8	743.93	8.0561E-04	538.1	1999.5	248.9	-123.9	4117.5	877.3	1	3
17	7	-.7174	.5756	1.769	2013.8	751.83	6.1181E-04	539.6	1989.9	289.5	-108.6	4117.5	877.2	1	3
18	7	-.8038	.4475	1.771	2015.6	749.12	8.0978E-04	539.0	1996.7	266.5	-70.0	4118.6	877.2	1	3
19	7	-.8675	.3060	1.769	2014.5	751.12	8.1130E-04	539.5	1995.4	272.5	-46.4	4119.0	877.3	1	3
20	7	-.9065	.1554	1.770	2014.9	750.34	8.1071E-04	539.3	1996.2	273.5	-22.2	4119.0	877.3	1	3
21	7	-.9199	-.0000	1.772	2016.2	748.19	8.0907E-04	538.9	1998.0	270.4	.0	4119.0	877.2	1	3
1	6	.9496	.0000	1.643	1922.2	904.25	9.2458E-04	569.9	1911.0	-207.4	.2	4095.6	877.5	1	3
2	8	.9390	.1371	1.612	1898.2	947.26	9.5596E-04	577.4	1867.3	-194.8	-56.3	4096.3	877.3	1	3
3	8	.9088	.2722	1.617	1902.4	939.99	9.5093E-04	576.0	1891.8	-180.3	-86.0	4098.1	877.2	1	2
4	8	.8600	.4023	1.641	1920.8	906.62	9.2681E-04	570.0	1908.2	-178.3	-128.2	4098.1	877.1	1	3
5	8	.7918	.5230	1.649	1926.8	896.58	9.1956E-04	568.1	1911.9	-143.2	-192.0	4100.4	877.2	1	3
6	8	.7054	.6336	1.647	1925.3	900.53	9.2255E-04	568.8	1909.9	-106.2	-217.7	4104.4	877.3	1	3
7	8	.6024	.7324	1.672	1944.4	867.03	8.9793E-04	562.6	1927.1	-99.0	-239.3	4105.3	877.4	1	3
8	8	.4863	.8150	1.710	1971.8	819.87	8.6285E-04	553.7	1953.1	-42.6	-267.0	4105.7	877.3	1	4
9	8	.3565	.8774	1.707	1970.2	823.32	8.6550E-04	554.3	1948.2	18.2	-293.1	4108.7	877.4	1	3
10	8	.2172	.9227	1.716	1976.6	812.80	8.5807E-04	552.0	1959.9	68.3	-246.6	4112.5	877.2	1	3
11	8	.0707	.9449	1.711	1972.4	619.44	8.6306E-04	553.2	1953.7	99.7	-251.5	4111.0	877.1	1	3
12	8	-.0785	.9465	1.702	1967.2	828.27	8.6793E-04	556.1	1948.7	147.8	-225.0	4100.2	878.2	1	4
13	8	-.2278	.9196	1.710	1972.4	821.02	8.6413E-04	553.6	1950.9	192.8	-217.5	4115.3	877.5	1	3
14	8	-.3735	.8712	1.743	1995.6	782.49	8.3547E-04	545.7	1978.1	200.1	-171.0	4120.3	877.2	1	3
15	8	-.5101	.7985	1.732	1987.4	795.34	8.4553E-04	548.2	1968.6	224.1	-156.5	4118.4	877.0	1	3
16	8	-.6349	.7049	1.752	2002.5	771.17	8.2677E-04	543.5	1986.2	229.0	-111.7	4120.4	877.3	1	3
17	8	-.7414	.5897	1.743	1995.7	781.89	8.3513E-04	545.6	1977.9	249.8	-90.9	4119.8	877.1	1	3
18	8	-.8297	.4582	1.757	2005.7	765.64	8.2273E-04	542.3	1990.0	241.6	-64.0	4121.1	877.1	1	3
19	8	-.8944	.3132	1.755	2004.1	768.23	8.2478E-04	542.7	1988.3	247.2	-42.2	4121.3	877.1	1	3
20	8	-.9343	.1590	1.756	2005.0	766.55	8.2350E-04	542.4	1989.6	247.6	-19.5	4121.1	877.0	1	3
21	8	-.9476	-.0000	1.758	2006.1	764.87	8.2221E-04	542.1	1991.0	245.6	.0	4121.5	877.1	1	3
1	9	.9754	.0000	1.628	1910.4	926.64	9.4165E-04	573.3	1899.2	-206.9	-.0	4104.6	877.1	1	3
2	9	.9649	.1427	1.614	1899.9	945.43	9.5540E-04	576.6	1888.7	-200.9	-48.0	4103.9	877.1	1	3
3	9	.9336	.2825	1.611	1897.4	950.35	9.5887E-04	577.5	1885.9	-186.4	-93.5	4104.4	877.2	1	3
4	9	.8818	.4168	1.640	1920.1	909.73	9.2960E-04	570.2	1908.2	-166.7	-133.8	4106.2	877.1	1	3
5	9	.8106	.5425	1.648	1925.8	900.16	9.2263E-04	568.5	1913.3	-135.9	-171.8	4108.3	877.2	1	3
6	9	.7209	.6570	1.657	1932.6	888.55	9.1430E-04	566.3	1919.6	-100.4	-200.4	4110.5	877.2	1	3
7	9	.6142	.7577	1.686	1954.1	850.54	8.8680E-04	558.9	1940.7	-65.0	-219.5	4113.1	876.7	1	4
8	9	.4926	.8418	1.722	1980.1	807.56	8.5471E-04	550.5	1966.0	-24.3	-234.0	4118.5	876.9	1	4
9	9	.3585	.9071	1.723	1981.1	806.19	8.5355E-04	550.4	1966.5	21.7	-239.0	4119.1	877.1	1	4
10	9	.2146	.9515	1.714	1974.9	818.01	8.6255E-04	552.6	1959.7	68.1	-234.3	4123.2	877.3	1	3

Figure 16. Continued.

SOLUTION PLANE NO. 25 X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
11	9	.0641	.9733	1.703	1966.4	831.30	8.7332E-04	554.7	1951.1	108.7	-220.2	4124.6	876.5	1	3
12	9	-.0897	.9712	1.707	1968.6	826.15	6.6949E-04	553.6	1953.2	142.2	-200.6	4120.3	876.2	1	3
13	9	-.2431	.9446	1.713	1972.9	819.80	8.6480E-04	552.4	1957.9	164.2	-178.0	4123.7	876.4	1	3
14	9	-.3914	.8934	1.721	1979.9	810.32	8.5712E-04	550.9	1965.2	186.0	-152.3	4128.4	877.2	1	3
15	9	-.5308	.8183	1.725	1962.3	805.14	8.5331E-04	549.8	1968.1	201.5	-124.9	4125.5	876.9	1	3
16	9	-.6572	.7208	1.730	1986.1	799.05	8.4860E-04	548.7	1972.4	211.4	-98.1	4126.1	877.0	1	3
17	9	-.7666	.6031	1.734	1989.1	793.63	8.4456E-04	547.6	1975.9	216.9	-72.6	4125.3	876.9	1	3
18	9	-.6557	.4681	1.738	1991.8	789.41	8.4124E-04	546.8	1979.3	216.1	-54.3	4125.7	877.1	1	3
19	9	-.9214	.3198	1.739	1992.7	787.73	8.3995E-04	546.5	1980.6	216.7	-33.9	4124.8	877.0	1	3
20	9	-.9618	.1623	1.740	1993.6	786.14	8.3874E-04	546.2	1961.7	216.3	-16.3	4124.5	877.0	1	3
21	9	-.9754	-.0000	1.741	1993.9	785.65	8.3837E-04	546.1	1982.2	216.0	.0	4124.7	877.0	1	3

SHOCK WAVE POINT PARAMETERS .

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.079394E+00	-6.505069E-01	-7.595003E-01	-3.004805E-07
2	1.088382E+00	-6.568879E-01	-7.444629E-01	-1.078969E-01
3	1.085842E+00	-6.609981E-01	-7.204390E-01	-2.098790E-01
4	1.083205E+00	-6.523310E-01	-6.899798E-01	-3.136751E-01
5	1.078781E+00	-6.543377E-01	-6.339516E-01	-4.122470E-01
6	1.078366E+00	-6.617651E-01	-5.640631E-01	-4.938621E-01
7	1.079879E+00	-6.555420E-01	-4.943533E-01	-5.708586E-01
8	1.062448E+00	-6.431039E-01	-4.053693E-01	-6.496869E-01
9	1.077476E+00	-6.528562E-01	-2.957983E-01	-6.973393E-01
10	1.065655E+00	-6.406426E-01	-1.861228E-01	-7.379845E-01
11	1.072610E+00	-6.432844E-01	-6.540973E-02	-7.628281E-01
12	1.096551E+00	-6.545994E-01	5.593975E-02	-7.539034E-01
13	1.091589E+00	-6.516330E-01	1.748769E-01	-7.381006E-01
14	1.073583E+00	-6.418508E-01	2.902500E-01	-7.097763E-01
15	1.080789E+00	-6.456424E-01	4.053062E-01	-6.472038E-01
16	1.064338E+00	-6.368649E-01	5.126465E-01	-5.758443E-01
17	1.076005E+00	-6.425044E-01	5.974106E-01	-4.798840E-01
18	1.069260E+00	-6.388817E-01	6.711966E-01	-3.759325E-01
19	1.069622E+00	-6.368580E-01	7.254483E-01	-2.560961E-01
20	1.070263E+00	-6.391608E-01	7.579709E-01	-1.302062E-01
21	1.068341E+00	-6.378690E-01	7.701449E-01	2.010428E-06

MASS FLOW RATE FOR ENTIRE PLANE= 1.88884E+00(SLUG/SEC)

COURANT NUMBER= .97500

Figure 16. Continued.

THE ANALYSIS OF STEADY THREE-DIMENSIONAL FLOW IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS

ABSTRACT

THE FLOW FIELD IN A SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLET IS COMPUTED USING THE METHOD OF CHARACTERISTICS FOR STEADY THREE-DIMENSIONAL FLOW. THE BOW SHOCK WAVE AND REFLECTED INTERNAL SHOCK WAVE SYSTEMS ARE COMPUTED USING A DISCRETE SHOCK-FITTING PROCEDURE. THE PROGRAM HAS THE CAPABILITY TO INCLUDE THE INFLUENCE OF MOLECULAR TRANSPORT ON THE SOLUTION BY TREATING THESE EFFECTS AS CORRECTION TERMS IN THE CHARACTERISTICS SCHEME.

THIS PROGRAM WAS DEVELOPED AT THE PURDUE UNIVERSITY THERMAL SCIENCES AND PROPULSION CENTER BY J. VADYAK UNDER N.A.S.A. GRANT NO. NGR-15-005-191 FOR THE N.A.S.A. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. THE PRINCIPAL INVESTIGATOR WAS J.D. HOFFMAN AND THE N.A.S.A. TECHNICAL DIRECTOR WAS A. BISHOP.

JOB TITLE

SAMPLE CASE NO. 5 - CONTINUED

SPECIFIED COMPUTATION OPTIONS

1.) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

FLOW SYMMETRY

ONE PLANE OF SYMMETRY - COMPUTED SECTOR IS THE HALF-PLANE BOUNDED BY THE Y-AXIS AND CONTAINING THE +Z-AXIS

THERMODYNAMIC MODEL

A THERMALLY AND CALORICALLY PERFECT GAS IS SPECIFIED WITH

SPECIFIC HEAT RATIO=1.40000 GAS CONSTANT= 1.716161E+03(FT-LBF/SLUG-DEG R)

VISCOSITY AND THERMAL CONDUCTIVITY TRANSPORT TERMS

VISCOUS AND THERMAL DIFFUSION TERMS ARE NOT INCLUDED IN THE COMPUTATION - INVISCID AND ADIABATIC FLOW IS ASSUMED

ORIENTATION AND FREE STREAM DATA

ORIENTATION - PITCH= 3.00000(DEGREES) YAW= 0.00000(DEGREES)

FREE STREAM DATA - MACH NO.= 2.50000 PRESSURE= 2.422000E+02(LBF/FT**2) DENSITY= 3.622000E-04(SLUG/FT**

TEMPERATURE= 3.896437E+02(DEG R) SONIC SPEED= 9.675577E+02(FT/SEC)

X-VELOCITY= 2.415579E+03(FT/SEC) Y-VELOCITY= 1.265951E+02(FT/SEC) Z-VELOCITY= 0. (FT/SEC)

Figure 17. Selected output for Sample Case No. 5, restart execution.

INITIAL VALUE SURFACE

A PROGRAM RESTART IS SPECIFIED - LAST SOLUTION PLANE IS READ FROM TAPE NO. 4 AND IS LOCATED AT X= 4.792513E+00(FT)

INDEX PARAMETERS

ISTOP=21 IMAX=40 JMAXI=11

JINLET=11

INTEGRATION TERMINATION POINTS

INTERNAL FLOW FIELD INTEGRATION TERMINATES AT X= 6.900000E+00(FT)

CENTERBODY GEOMETRY

I	KDCENT	XCENT (FT)	RCENT (FT)	ACENT (FT)	BCENT	CCENT (FT**-1)	DCENT (FT**-2)
1	1	0.	0.	0.	1.763300E-01	0.	0.
2	1	2.798794E+00	0.	4.935110E-01	1.763300E-01	0.	0.
3	1	4.000000E+00	0.	7.056200E-01	1.763300E-01	2.020035E-02	-3.367512E-01
4	1	4.200000E+00	0.	7.387000E-01	1.440000E-01	-1.774997E-01	-1.750011E-01
5	1	4.400000E+00	0.	7.590000E-01	5.200000E-02	-1.600005E-01	-5.925696E-02
6	1	4.550000E+00	0.	7.630000E-01	0.	-1.693327E-01	-2.044475E-01
7	1	4.700000E+00	0.	7.585000E-01	-6.460000E-02	-1.615001E-01	-2.499656E-03
8	1	4.900000E+00	0.	7.391000E-01	-1.295000E-01	-3.499995E-02	1.712957E-02
9	1	5.500000E+00	0.	6.525000E-01	-1.530000E-01	1.651873E-01	-4.923802E-01
10	1	6.280000E+00	0.	4.000000E-01	0.	0.	0.
11	1	6.900000E+00	0.	0.	0.	0.	0.

COWL GEOMETRY

TRANSLATION FROM DESIGN POSITION= 6.550000E-01(FT)

I	KDCOWL	XCOWL (FT)	RCOWL (FT)	ACOWL (FT)	BCOWL	CCOWL (FT**-1)	DCOWL (FT**-2)
1	1	2.860000E+00	0.	1.000000E+00	1.745001E-02	0.	0.
2	1	3.100000E+00	0.	1.004188E+00	1.745000E-02	-4.926635E-02	4.110418E-03
3	1	3.400000E+00	0.	1.005100E+00	-1.100000E-02	-6.500001E-02	-3.240740E-02
4	1	4.000000E+00	0.	9.681000E-01	-1.240000E-01	-1.664999E-01	-3.000050E-02
5	1	4.200000E+00	0.	9.364000E-01	-1.942000E-01	-2.859976E-01	1.279984E+00
6	1	4.300000E+00	0.	9.154000E-01	-2.130000E-01	5.000008E-02	2.499998E-01
7	1	4.500000E+00	0.	8.768000E-01	-1.630000E-01	3.500018E-01	-1.251464E-05
8	1	4.600000E+00	0.	8.640000E-01	-9.300000E-02	3.049997E-01	-5.499974E-01
9	1	4.700000E+00	0.	8.572000E-01	-4.050000E-02	1.075002E-01	-7.812535E-02
10	1	5.100000E+00	0.	8.500000E-01	0.	0.	0.
11	1	5.600000E+00	0.	8.500000E-01	0.	1.928000E-01	-1.144000E-01
12	1	6.100000E+00	0.	8.839000E-01	1.070000E-01	1.025012E-02	-8.812521E-02
13	1	6.500000E+00	0.	9.227000E-01	7.290000E-02	-1.512487E-02	8.749780E-03
14	1	6.900000E+00	0.	0.	0.	0.	0.

Figure 17. Continued.

ORIGINAL PAGE IS
OF POOR QUALITY

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CONVERGENCE TOLERANCES, ITERATION LIMITS, AND OTHER PARAMETERS

     CONVERGENCE TOLERANCES AND OTHER PARAMETERS

          CRIT( 1)= 1.000000E-01
          CRIT( 2)= 1.000000E-07
          CRIT( 3)= 1.000000E-04
          CRIT( 4)= 1.000000E-05
          CRIT( 5)= 1.000000E-04
          CRIT( 6)= 1.000000E-04
          CRIT( 7)= 5.000000E-01
          CRIT( 8)= 1.000000E+00
          CRIT( 9)= 1.000000E-04
          CRIT(10)= 8.000000E-01
          CRIT(11)= 1.000000E-06
          CRIT(12)= 2.000000E-01
          CRIT(13)= 1.000000E-05
          CRIT(14)= 4.000000E-01
          CRIT(15)= 1.000000E-04
          CRIT(16)= 1.000000E-06

     ITERATION LIMITS

          ITEND(1)=10
          ITEND(2)=10
          ITEND(3)=10
          ITEND(4)=20
          ITEND(5)=10
          ITEND(6)=10

     INPUT SAFETY FACTOR= 9.750000E-01
```

Figure 17. Continued.

RESTART PLANE X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
1	1	.7511	.0000	1.866	2079.5	632.67	7.1336E-04	516.8	2070.3	-195.7	.0	4024.3	876.8
2	1	.7440	.1033	1.868	2060.7	631.09	7.1211E-04	516.4	2071.3	-190.5	-51.8	4025.2	876.8
3	1	.7226	.2053	1.873	2084.2	626.33	7.0836E-04	515.2	2074.4	-175.7	-99.2	4027.3	876.8
4	1	.6868	.3041	1.881	2089.1	619.44	7.0291E-04	513.5	2078.8	-152.3	-141.6	4029.8	876.8
5	1	.6374	.3975	1.889	2094.6	611.80	6.9686E-04	511.6	2083.4	-119.7	-180.3	4032.5	876.8
6	1	.5748	.4835	1.900	2101.7	602.08	6.8917E-04	509.1	2089.4	-79.2	-212.8	4037.0	876.8
7	1	.4991	.5613	1.914	2110.3	590.60	6.8006E-04	506.0	2097.0	-35.2	-234.0	4043.1	876.7
8	1	.4111	.6286	1.926	2117.7	580.86	6.7252E-04	503.4	2103.5	10.1	-244.3	4049.0	876.7
9	1	.3130	.6828	1.935	2123.5	573.46	6.6646E-04	501.4	2108.4	57.6	-245.7	4054.7	876.7
10	1	.2060	.7223	1.945	2129.9	565.25	6.5995E-04	499.1	2114.2	102.2	-237.0	4060.9	876.7
11	1	.0914	.7456	1.958	2137.9	554.87	6.5153E-04	496.3	2122.0	139.8	-219.3	4066.7	876.7
12	1	-.0276	.7506	1.970	2145.2	545.29	6.4370E-04	493.6	2129.3	172.7	-195.1	4071.4	876.7
13	1	-.1476	.7365	1.979	2150.5	538.57	6.3825E-04	491.7	2134.7	200.4	-165.7	4076.0	876.7
14	1	-.2662	.7024	1.984	2154.0	534.34	6.3489E-04	490.4	2138.8	217.7	-133.8	4080.8	876.7
15	1	-.3794	.6483	1.990	2157.6	530.08	6.3146E-04	489.1	2143.4	224.1	-103.6	4085.0	876.6
16	1	-.4834	.5749	1.997	2161.4	525.31	6.2756E-04	487.8	2148.3	225.4	-75.9	4088.6	876.6
17	1	-.5744	.4840	2.000	2163.6	522.72	6.2548E-04	487.0	2151.4	223.1	-50.9	4091.5	876.6
18	1	-.6493	.3776	2.002	2164.5	521.82	6.2480E-04	486.7	2153.3	217.2	-31.6	4093.8	876.6
19	1	-.7051	.2589	2.004	2165.8	520.24	6.2352E-04	486.2	2155.5	210.5	-18.0	4095.5	876.6
20	1	-.7395	.1317	2.005	2166.6	519.24	6.2271E-04	465.9	2156.8	205.8	-7.7	4096.5	876.6
21	1	-.7511	.0000	2.005	2166.7	519.18	6.2267E-04	485.9	2157.1	203.9	.0	4096.8	876.6
1	2	.7800	.0000	1.851	2069.7	651.65	7.2952E-04	520.5	2058.8	-212.4	.0	4047.7	877.1
2	2	.7726	.1078	1.851	2069.9	651.54	7.2946E-04	520.5	2058.7	-208.3	-55.8	4048.6	877.1
3	2	.7497	.2142	1.857	2073.6	646.35	7.2537E-04	519.2	2062.0	-192.0	-105.3	4050.1	877.1
4	2	.7118	.3175	1.864	2078.6	639.10	7.1963E-04	517.5	2066.7	-165.8	-148.0	4051.9	877.1
5	2	.6609	.4154	1.869	2082.0	634.42	7.1597E-04	516.3	2069.2	-131.9	-189.1	4054.6	877.2
6	2	.5957	.5047	1.879	2088.2	625.92	7.0929E-04	514.2	2074.2	-88.3	-224.6	4058.4	877.2
7	2	.5146	.5845	1.894	2098.1	611.78	6.9808E-04	510.7	2083.4	-41.8	-244.9	4062.7	877.1
8	2	.4229	.6550	1.904	2104.6	603.20	6.9128E-04	508.5	2089.1	4.7	-254.8	4067.7	877.2
9	2	.3208	.7116	1.910	2108.5	598.37	6.8750E-04	507.2	2091.9	54.5	-258.4	4072.6	877.2
10	2	.2092	.7511	1.921	2115.3	589.16	6.8016E-04	504.7	2098.0	101.3	-250.3	4077.3	877.2
11	2	.0896	.7746	1.934	2123.8	577.59	6.7078E-04	501.7	2106.7	139.7	-229.9	4081.6	877.2
12	2	-.0339	.7797	1.944	2130.1	569.63	6.6401E-04	499.6	2113.1	174.2	-204.9	4085.1	877.3
13	2	-.1579	.7641	1.952	2135.3	562.59	6.5853E-04	497.8	2118.2	204.7	-175.0	4088.5	877.3
14	2	-.2803	.7275	1.958	2138.8	558.08	6.5492E-04	496.5	2122.2	223.9	-143.1	4091.9	877.3
15	2	-.3974	.6706	1.964	2142.1	553.88	6.5155E-04	495.4	2126.6	230.9	-113.4	4095.0	877.3
16	2	-.5047	.5945	1.969	2145.8	549.13	6.4764E-04	494.1	2131.4	233.6	-84.7	4097.7	877.4
17	2	-.5963	.5001	1.973	2147.9	546.58	6.4556E-04	493.3	2134.3	234.3	-58.5	4099.8	877.4
18	2	-.6752	.3899	1.974	2148.6	545.81	6.4499E-04	493.1	2135.9	230.2	-38.3	4101.4	877.4
19	2	-.7325	.2673	1.977	2150.3	543.63	6.4320E-04	492.5	2138.5	223.9	-22.7	4102.5	877.4
20	2	-.7678	.1359	1.978	2151.0	542.66	6.4240E-04	492.2	2139.7	220.1	-9.9	4103.2	877.4
21	2	-.7797	-.0000	1.978	2150.9	542.86	6.4258E-04	492.3	2139.7	219.0	.0	4103.4	877.4
1	3	.8095	.0000	1.823	2051.1	683.18	7.5541E-04	527.0	2041.0	-203.2	.0	4065.2	877.2
2	3	.8013	.1128	1.821	2049.8	685.33	7.5712E-04	527.4	2039.1	-202.0	-55.9	4065.7	877.2
3	3	.7772	.2241	1.826	2053.3	680.19	7.5312E-04	526.3	2042.1	-186.5	-103.8	4067.0	877.2
4	3	.7376	.3321	1.835	2059.5	670.93	7.4588E-04	524.1	2048.3	-158.4	-143.7	4068.7	877.2
5	3	.6834	.4339	1.839	2062.4	666.92	7.4271E-04	523.2	2050.3	-125.6	-184.9	4070.7	877.3
6	3	.6148	.5269	1.847	2067.7	659.46	7.3690E-04	521.5	2054.1	-82.8	-221.3	4074.0	877.3
7	3	.5304	.6102	1.864	2078.4	643.66	7.2455E-04	517.6	2064.2	-37.4	-239.5	4077.9	877.2
8	3	.4342	.6827	1.873	2084.6	635.03	7.1774E-04	515.6	2069.8	7.9	-248.0	4081.9	877.3
9	3	.3273	.7401	1.878	2088.2	630.50	7.1418E-04	514.4	2072.1	57.2	-252.7	4085.7	877.4
10	3	.2108	.7799	1.890	2096.0	619.35	7.0537E-04	511.6	2079.1	102.7	-245.3	4089.5	877.4
11	3	.0863	.8034	1.906	2105.8	605.52	6.9422E-04	508.2	2089.3	139.1	-223.0	4092.7	877.4
12	3	-.0418	.8079	1.914	2111.6	597.80	6.8789E-04	506.4	2095.2	172.6	-197.9	4095.4	877.5
13	3	-.1699	.7909	1.922	2116.8	590.73	6.8215E-04	504.6	2100.3	202.9	-168.5	4098.2	877.6

Figure 17. Continued.

RESTART PLANE X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
14	3	-.2960	.7516	1.929	2120.7	585.37	6.7789E-04	503.2	2104.6	221.5	-138.7	4100.9	877.5
15	3	-.4164	.6917	1.934	2123.6	581.62	6.7465E-04	502.1	2108.6	227.9	-110.9	4103.2	877.5
16	3	-.5266	.6126	1.939	2127.0	577.16	6.7121E-04	501.0	2112.8	230.6	-83.1	4105.2	877.6
17	3	-.6222	.5148	1.942	2129.3	574.11	6.6873E-04	500.3	2115.8	232.1	-57.7	4106.8	877.7
18	3	-.7006	.4010	1.944	2130.3	572.78	6.6770E-04	499.9	2117.7	226.7	-38.3	4107.9	877.6
19	3	-.7593	.2748	1.947	2132.2	570.33	6.6567E-04	499.2	2120.4	222.4	-23.0	4108.7	877.7
20	3	-.7952	.1397	1.948	2132.6	569.48	6.6497E-04	499.0	2121.5	219.0	-9.9	4109.2	877.7
21	3	-.8073	-.0000	1.948	2132.7	569.06	6.6516E-04	499.1	2121.5	218.2	.0	4109.3	877.7
1	4	.8392	.0000	1.800	2035.5	709.62	7.7683E-04	532.3	2028.6	-166.8	.0	4076.9	877.2
2	4	.8302	.1179	1.796	2033.0	713.52	7.7992E-04	533.1	2025.3	-169.6	-51.4	4077.3	877.1
3	4	.8050	.2340	1.800	2035.5	709.81	7.7707E-04	532.3	2027.3	-157.1	-94.3	4076.4	877.2
4	4	.7642	.3467	1.810	2042.2	699.43	7.6905E-04	529.9	2034.1	-128.4	-128.7	4080.0	877.1
5	4	.7062	.4520	1.813	2044.9	695.87	7.6620E-04	529.2	2035.5	-100.8	-168.6	4081.8	877.3
6	4	.6340	.5487	1.819	2049.0	690.03	7.6173E-04	527.8	2037.9	-63.4	-203.4	4084.6	877.3
7	4	.5464	.6356	1.834	2058.9	674.90	7.5009E-04	524.3	2047.2	-21.9	-217.7	4088.1	877.2
8	4	.4459	.7100	1.844	2065.5	665.54	7.4271E-04	522.1	2053.0	19.9	-225.6	4091.5	877.3
9	4	.3342	.7682	1.850	2069.6	659.93	7.3830E-04	520.8	2055.6	65.4	-231.1	4094.6	877.4
10	4	.2130	.8093	1.862	2077.1	646.94	7.2973E-04	518.2	2062.1	106.0	-225.1	4097.8	877.3
11	4	.0840	.8329	1.877	2087.0	634.44	7.1815E-04	514.8	2072.4	138.5	-204.0	4100.4	877.4
12	4	-.0486	.8361	1.884	2092.0	627.65	7.1262E-04	513.2	2077.2	169.7	-181.6	4102.6	877.5
13	4	-.1811	.8177	1.892	2097.0	620.69	7.0700E-04	511.6	2082.0	197.7	-154.5	4105.1	877.6
14	4	-.3112	.7762	1.898	2101.3	614.60	7.0220E-04	510.0	2086.5	214.3	-127.5	4107.4	877.6
15	4	-.4350	.7137	1.903	2104.1	610.86	6.9924E-04	509.0	2090.1	219.5	-101.8	4109.3	877.6
16	4	-.5463	.6317	1.906	2106.7	607.41	6.9639E-04	508.2	2093.7	221.2	-75.3	4110.8	877.7
17	4	-.6464	.5304	1.910	2109.2	603.91	6.9356E-04	507.4	2096.9	221.8	-51.8	4112.0	877.7
18	4	-.7266	.4128	1.913	2110.6	601.94	6.9202E-04	506.9	2099.1	218.1	-34.3	4112.8	877.7
19	4	-.7868	.2827	1.915	2112.3	599.65	6.9013E-04	506.3	2101.6	211.7	-20.4	4113.4	877.7
20	4	-.8235	.1437	1.916	2112.8	598.97	6.8957E-04	506.1	2102.5	208.5	-8.6	4113.8	877.7
21	4	-.8358	-.0000	1.916	2112.8	599.02	6.8963E-04	506.1	2102.6	207.6	.0	4113.9	877.7
1	5	.8679	.0000	1.788	2027.0	724.37	7.8883E-04	535.1	2022.2	-138.6	.0	4084.6	877.1
2	5	.8580	.1228	1.783	2024.0	729.06	7.9251E-04	536.0	2018.3	-144.5	-47.6	4084.7	877.1
3	5	.8315	.2435	1.785	2024.8	727.92	7.9166E-04	535.8	2018.4	-135.3	-86.7	4085.5	877.1
4	5	.7892	.3607	1.794	2031.4	717.64	7.8391E-04	533.5	2025.2	-105.8	-117.5	4087.3	877.0
5	5	.7284	.4700	1.794	2031.7	717.93	7.8396E-04	533.6	2023.9	-82.6	-157.2	4089.3	877.2
6	5	.6525	.5702	1.796	2032.6	716.97	7.8331E-04	533.3	2022.9	-52.3	-191.4	4091.7	877.3
7	5	.5616	.6607	1.810	2042.2	701.92	7.7189E-04	529.9	2032.1	-12.9	-201.6	4094.7	877.0
8	5	.4570	.7368	1.820	2048.9	692.20	7.6426E-04	527.8	2038.0	27.9	-209.3	4097.9	877.2
9	5	.3405	.7963	1.826	2053.2	686.06	7.5947E-04	526.4	2040.7	70.3	-215.2	4100.6	877.3
10	5	.2144	.8383	1.837	2060.4	675.15	7.5105E-04	523.8	2046.6	106.7	-210.4	4103.3	877.2
11	5	.0811	.8621	1.854	2071.7	658.18	7.3759E-04	520.0	2058.6	137.2	-188.4	4105.6	877.2
12	5	-.0556	.8643	1.862	2077.6	649.94	7.3094E-04	518.1	2064.2	166.6	-166.0	4107.5	877.4
13	5	-.1929	.8443	1.871	2083.5	641.49	7.2418E-04	516.2	2069.9	191.5	-140.7	4109.8	877.5
14	5	-.3270	.8010	1.876	2086.4	634.36	7.1858E-04	514.4	2074.9	206.0	-116.5	4111.8	877.5
15	5	-.4542	.7359	1.883	2091.2	630.41	7.1542E-04	513.5	2078.5	210.8	-92.7	4113.4	877.5
16	5	-.5702	.6505	1.887	2093.8	626.96	7.1259E-04	512.7	2081.9	211.6	-67.8	4114.5	877.6
17	5	-.6708	.5459	1.891	2096.4	623.15	7.0953E-04	511.6	2085.2	211.4	-46.3	4115.5	877.6
18	5	-.7530	.4247	1.893	2098.1	620.75	7.0764E-04	511.2	2087.6	207.5	-30.4	4116.2	877.6
19	5	-.8144	.2906	1.896	2099.8	618.43	7.0572E-04	510.6	2090.0	201.6	-18.2	4116.7	877.6
20	5	-.8519	.1476	1.896	2100.3	617.75	7.0517E-04	510.5	2090.8	198.7	-7.6	4116.9	877.7
21	5	-.8646	-.0000	1.897	2100.3	617.61	7.0507E-04	510.4	2091.0	197.6	.0	4117.0	877.6
1	6	.8959	.0000	1.775	2016.3	739.19	8.0065E-04	538.0	2015.3	-110.3	.0	4090.0	877.1
2	6	.8866	.1268	1.774	2017.6	740.21	8.0150E-04	538.1	2013.9	-114.0	-41.9	4089.8	877.0
3	6	.8585	.2531	1.773	2016.6	741.97	8.0288E-04	538.5	2012.1	-109.4	-78.0	4090.6	877.0
4	6	.8149	.3725	1.783	2023.5	731.03	7.9456E-04	536.1	2019.3	-80.3	-103.6	4092.4	877.0
5	6	.7511	.4861	1.783	2023.7	731.50	7.9487E-04	536.2	2017.9	-59.6	-141.6	4094.7	877.1

Figure 17. Continued.

RESTART PLANE X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	C (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
6	U	.6740	.5890	1.780	2021.8	735.06	7.9773E-04	536.9	2013.9	-38.7	-174.3	4096.9	877.2
7	6	.5769	.6854	1.794	2031.5	719.53	7.8598E-04	533.4	2023.6	-1.8	-179.3	4099.4	877.0
8	6	.4683	.7636	1.804	2038.5	709.25	7.7795E-04	531.2	2029.7	37.4	-185.9	4102.5	877.1
9	6	.3472	.8244	1.811	2042.9	702.90	7.7304E-04	529.8	2032.4	75.4	-192.5	4104.9	877.2
10	6	.2163	.8671	1.819	2046.3	694.51	7.6667E-04	527.8	2036.6	105.6	-190.6	4107.0	877.1
11	6	.0786	.8911	1.840	2062.8	672.23	7.4908E-04	522.9	2051.9	133.9	-165.0	4109.1	877.1
12	U	-.0576	.8924	1.849	2066.5	663.95	7.4246E-04	521.1	2057.1	160.8	-146.7	4110.8	877.3
13	U	-.1987	.8698	1.859	2075.5	653.65	7.3440E-04	518.8	2063.4	183.2	-127.2	4112.7	877.4
14	U	-.3375	.8267	1.868	2081.0	645.58	7.2789E-04	516.8	2069.1	195.6	-105.7	4114.6	877.3
15	U	-.4684	.7589	1.873	2084.6	640.43	7.2377E-04	515.6	2073.2	200.6	-83.8	4116.0	877.3
16	U	-.5873	.6700	1.877	2087.1	636.97	7.2094E-04	514.8	2076.4	201.9	-61.1	4116.8	877.4
17	U	-.6900	.5614	1.881	2089.5	632.97	7.1772E-04	513.9	2079.7	201.7	-41.9	4117.5	877.5
18	U	-.7745	.4368	1.884	2091.7	630.27	7.1559E-04	513.2	2082.2	197.7	-27.2	4118.1	877.4
19	U	-.8369	.2986	1.886	2093.2	628.15	7.1386E-04	512.8	2084.3	193.1	-16.6	4118.5	877.5
20	U	-.8751	.1517	1.887	2094.0	627.02	7.1291E-04	512.5	2085.4	190.4	-6.9	4118.7	877.5
21	U	-.8881	-.0000	1.888	2094.5	626.27	7.1232E-04	512.3	2086.0	188.7	.0	4118.7	877.5
1	D	.8959	.0000	1.658	1933.6	881.57	9.0785E-04	565.8	1921.0	-220.4	.0	4087.7	877.1
2	D	.8866	.1268	1.645	1923.2	899.60	9.2110E-04	569.1	1908.1	-233.6	-59.2	4086.7	877.0
3	U	.8594	.2517	1.773	2016.5	742.16	8.0303E-04	538.5	2012.1	-109.1	-77.4	4090.6	877.0
4	D	.8149	.3725	1.661	1935.3	876.86	9.0611E-04	565.2	1920.6	-184.7	-151.1	4089.8	877.0
5	U	.7529	.4857	1.783	2023.7	731.43	7.9482E-04	536.2	2018.0	-59.9	-140.7	4094.6	877.1
6	D	.6740	.5890	1.665	1938.5	874.74	9.0315E-04	564.4	1919.3	-119.4	-244.9	4094.7	877.2
7	U	.5803	.6826	1.794	2031.2	719.97	7.8631E-04	533.5	2023.3	-3.0	-179.1	4099.4	877.0
8	U	.4730	.7627	1.804	2038.0	710.02	7.7857E-04	531.4	2029.4	36.7	-183.9	4102.6	877.1
9	U	.3525	.8242	1.810	2042.4	703.69	7.7366E-04	530.0	2032.1	74.5	-190.5	4105.0	877.2
10	U	.2223	.8690	1.817	2046.9	696.66	7.6839E-04	528.3	2035.5	104.1	-188.5	4107.3	877.1
11	U	.0839	.8916	1.840	2062.3	673.10	7.4978E-04	523.1	2051.4	132.6	-164.9	4109.1	877.1
12	D	-.0576	.8924	1.709	1971.3	820.75	8.6362E-04	553.8	1944.4	170.5	-276.5	4106.8	877.3
13	U	-.1987	.8698	1.726	1984.0	799.98	8.4801E-04	549.7	1957.0	211.7	-247.7	4109.3	877.4
14	D	-.3375	.8267	1.760	2006.1	760.50	8.1815E-04	541.6	1984.4	233.9	-199.3	4112.8	877.3
15	D	-.4664	.7589	1.756	2004.8	766.03	8.2240E-04	542.8	1980.1	259.3	-177.2	4113.6	877.3
16	U	-.5873	.6700	1.783	2023.8	735.67	7.9901E-04	536.5	2002.8	261.2	-127.7	4115.6	877.4
17	D	-.6900	.5614	1.770	2015.3	749.49	8.0968E-04	539.4	1992.5	282.8	-107.1	4115.5	877.5
18	D	-.7745	.4368	1.783	2023.9	735.65	7.9906E-04	536.5	2002.9	280.9	-73.8	4116.6	877.4
19	D	-.8369	.2986	1.784	2025.2	733.75	7.9753E-04	536.1	2004.7	283.5	-48.5	4116.9	877.5
20	D	-.8751	.1517	1.785	2025.4	733.43	7.9728E-04	536.0	2005.0	285.7	-23.3	4117.1	877.5
21	D	-.8881	-.0000	1.788	2027.8	729.56	7.9430E-04	535.2	2008.0	282.9	.0	4117.2	877.5
1	6	.8970	.0000	1.660	1934.5	880.13	9.0680E-04	565.6	1921.9	-220.5	.0	4087.9	877.1
2	6	.8866	.1277	1.645	1923.1	899.68	9.2130E-04	569.1	1907.9	-233.3	-59.6	4086.7	877.0
3	D	.8594	.2517	1.647	1924.7	897.19	9.1938E-04	568.6	1908.7	-221.7	-110.2	4087.8	877.0
4	6	.8147	.3749	1.661	1935.6	876.01	9.0549E-04	565.0	1921.1	-184.3	-151.5	4089.9	877.0
5	D	.7529	.4657	1.667	1940.2	871.17	9.0041E-04	563.8	1924.0	-150.9	-199.9	4092.4	877.1
6	6	.6715	.5918	1.665	1938.5	874.67	9.0310E-04	564.3	1919.4	-117.9	-245.1	4094.7	877.2
7	D	.5603	.6826	1.677	1947.3	859.52	8.9224E-04	561.3	1928.2	-74.7	-262.0	4097.0	877.0
8	D	.4730	.7627	1.711	1972.9	816.71	8.6038E-04	553.1	1956.0	-9.6	-258.1	4101.5	877.1
9	D	.3525	.8242	1.696	1962.0	835.63	8.7474E-04	556.8	1940.4	32.9	-286.4	4102.9	877.2
10	D	.2223	.8690	1.720	1979.2	806.68	8.5331E-04	551.0	1958.0	81.9	-276.7	4106.0	877.1
11	D	.0839	.8916	1.733	1988.7	791.28	8.4150E-04	547.9	1967.1	124.0	-264.9	4107.3	877.1
12	6	-.0626	.8928	1.711	1972.7	818.52	8.6188E-04	553.4	1945.9	170.7	-274.8	4106.5	877.3
13	6	-.2042	.8711	1.732	1987.8	793.62	8.4316E-04	548.5	1960.7	211.4	-249.4	4109.3	877.4
14	6	-.3424	.8259	1.759	2006.9	762.43	8.1963E-04	542.0	1983.5	233.7	-197.1	4112.8	877.3
15	6	-.4729	.7582	1.760	2007.7	761.44	8.1886E-04	541.8	1982.6	260.9	-176.3	4113.6	877.4
16	6	-.5917	.6695	1.782	2023.1	736.72	7.9984E-04	536.7	2002.3	260.5	-126.9	4115.7	877.4
17	6	-.6946	.5614	1.770	2015.2	749.56	8.0979E-04	539.4	1992.3	283.6	-106.8	4115.7	877.4
18	6	-.7792	.4366	1.781	2022.8	737.43	8.0048E-04	536.8	2002.1	279.0	-73.0	4116.8	877.4

Figure 17. Continued.

RESTART PLANE X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
19	6	-.8417	.2986	1.782	2023.6	736.32	7.9957E-04	536.6	2003.3	281.9	-48.0	4117.2	877.5
20	6	-.8800	.1517	1.782	2023.8	736.02	7.9934E-04	536.5	2003.7	283.8	-23.0	4117.4	877.5
21	6	-.8931	-.0000	1.786	2026.0	732.44	7.9659E-04	535.8	2006.4	281.0	.0	4117.5	877.5
1	7	.9230	.0000	1.685	1953.9	847.47	8.8282E-04	559.4	1941.2	-222.5	.5	4092.5	877.2
2	7	.9124	.1322	1.608	1895.0	951.46	9.5892E-04	578.2	1884.3	-188.5	-68.4	4091.2	877.1
3	7	.8834	.2623	1.563	1859.8	1016.49	1.0054E-03	589.1	1852.5	-145.0	-78.7	4092.3	877.1
4	7	.8373	.3881	1.677	1947.6	858.39	8.9123E-04	561.2	1933.4	-188.3	-139.9	4094.2	877.0
5	7	.7714	.5051	1.684	1952.6	850.57	8.8544E-04	559.7	1936.2	-156.2	-198.7	4096.7	877.1
6	7	.6888	.6121	1.637	1917.3	913.29	9.3171E-04	571.2	1902.5	-87.6	-220.4	4099.3	877.2
7	7	.5900	.7083	1.726	1983.7	798.26	8.4648E-04	549.5	1962.3	-115.1	-266.8	4101.0	877.1
8	7	.4781	.7889	1.730	1986.4	794.54	8.4383E-04	548.7	1970.2	-8.9	-253.2	4104.4	877.1
9	7	.3524	.8504	1.746	1997.5	776.47	8.3005E-04	545.1	1972.3	9.0	-316.5	4105.9	877.2
10	7	.2174	.8946	1.711	1972.6	818.64	8.6240E-04	553.1	1956.3	90.1	-236.4	4109.2	877.0
11	7	.0753	.9174	1.740	1993.5	783.39	8.3540E-04	546.4	1969.3	115.6	-287.4	4106.9	877.2
12	7	-.0699	.9181	1.739	1994.2	783.01	8.3389E-04	547.1	1972.2	145.7	-257.2	4101.7	878.2
13	7	-.2152	.8947	1.772	2016.3	746.66	8.0734E-04	538.9	1986.7	201.7	-276.7	4110.4	877.3
14	7	-.3572	.8487	1.732	1988.2	793.81	8.4371E-04	548.2	1969.1	216.6	-169.2	4114.5	877.3
15	7	-.4904	.7780	1.803	2037.4	713.59	7.8204E-04	531.7	2007.2	280.8	-208.2	4116.4	877.2
16	7	-.6124	.6671	1.775	2018.8	743.93	8.0561E-04	538.1	1999.5	248.9	-123.9	4117.5	877.3
17	7	-.7174	.5756	1.769	2013.8	751.83	8.1181E-04	539.6	1989.9	289.5	-108.6	4117.5	877.2
18	7	-.8038	.4475	1.771	2015.6	749.12	8.0978E-04	539.0	1996.7	266.5	-70.0	4118.6	877.2
19	7	-.8675	.3060	1.769	2014.5	751.12	8.1150E-04	539.5	1995.4	272.5	-46.4	4119.0	877.3
20	7	-.9065	.1554	1.770	2014.9	750.34	8.1071E-04	539.3	1996.2	273.5	-22.2	4119.0	877.3
21	7	-.9199	-.0000	1.772	2016.2	748.19	8.0907E-04	538.9	1998.0	270.4	.0	4119.0	877.2
1	8	.9496	.0000	1.643	1922.2	904.25	9.2458E-04	569.9	1911.0	-207.4	.2	4095.6	877.5
2	8	.9390	.1371	1.612	1896.2	947.26	9.5596E-04	577.4	1887.3	-194.8	-56.3	4096.3	877.3
3	8	.9068	.2722	1.617	1902.4	939.99	9.5093E-04	576.0	1891.6	-180.3	-86.0	4098.1	877.2
4	8	.8600	.4023	1.641	1920.8	906.62	9.2681E-04	570.0	1908.2	-178.3	-128.2	4098.1	877.1
5	8	.7918	.5230	1.649	1926.8	896.58	9.1956E-04	568.1	1911.9	-143.2	-192.0	4100.4	877.2
6	8	.7054	.6336	1.647	1925.3	900.53	9.2255E-04	568.8	1909.9	-106.2	-217.7	4104.4	877.3
7	8	.6024	.7324	1.672	1944.4	867.03	8.9793E-04	562.6	1927.1	-99.0	-239.3	4105.3	877.4
8	8	.4863	.8150	1.710	1971.8	819.87	8.6285E-04	553.7	1953.1	-42.6	-267.0	4105.7	877.3
9	8	.3565	.8774	1.707	1970.2	823.32	8.6550E-04	554.3	1948.2	18.2	-293.1	4108.7	877.4
10	8	.2172	.9227	1.716	1976.6	812.80	8.5807E-04	552.0	1959.9	68.3	-246.6	4112.5	877.2
11	8	.0707	.9449	1.711	1972.4	819.44	8.6306E-04	553.2	1953.7	99.7	-251.5	4111.0	877.1
12	8	-.0785	.9465	1.702	1967.2	828.27	8.6793E-04	556.1	1948.7	147.8	-225.0	4100.2	878.2
13	8	-.2278	.9196	1.710	1972.4	821.02	8.6413E-04	553.6	1950.9	192.8	-217.5	4115.3	877.5
14	8	-.3735	.8712	1.743	1995.6	782.49	8.3547E-04	545.7	1978.1	200.1	-171.0	4120.3	877.2
15	8	-.5101	.7985	1.732	1987.4	795.34	8.4533E-04	548.2	1968.6	224.1	-156.5	4118.4	877.0
16	8	-.6349	.7049	1.752	2002.5	771.17	8.2677E-04	543.5	1986.2	229.0	-111.7	4120.4	877.3
17	8	-.7414	.5897	1.743	1995.7	781.89	8.3513E-04	545.6	1977.9	249.8	-90.9	4119.8	877.1
18	8	-.8297	.4582	1.757	2005.7	765.64	8.2273E-04	542.3	1990.0	241.6	-64.0	4121.1	877.1
19	8	-.8944	.3132	1.755	2004.1	768.23	8.2478E-04	542.7	1988.3	247.2	-42.2	4121.3	877.1
20	8	-.9343	.1590	1.756	2005.0	766.55	8.2350E-04	542.4	1989.6	247.6	-19.5	4121.1	877.0
21	8	-.9478	-.0000	1.758	2006.1	764.87	8.2221E-04	542.1	1991.0	245.6	.0	4121.5	877.1
1	9	.9754	-.0000	1.628	1910.4	926.64	9.4185E-04	573.3	1899.2	-206.9	-.0	4104.6	877.1
2	9	.9649	.1427	1.614	1899.9	945.43	9.5540E-04	576.6	1888.7	-200.9	-48.0	4103.9	877.1
3	9	.9336	.2825	1.611	1897.4	950.35	9.5887E-04	577.5	1885.9	-186.4	-93.5	4104.4	877.2
4	9	.8818	.4168	1.640	1920.1	909.73	9.2960E-04	570.2	1908.2	-166.7	-133.8	4106.2	877.1
5	9	.8106	.5425	1.648	1925.8	900.16	9.2263E-04	568.5	1913.3	-135.9	-171.8	4108.3	877.2
6	9	.7209	.6570	1.657	1932.6	888.55	9.1430E-04	566.3	1919.6	-100.4	-200.4	4110.5	877.2
7	9	.6142	.7577	1.686	1954.1	850.54	8.8680E-04	558.9	1940.7	-65.0	-219.5	4113.1	876.7
8	9	.4926	.8418	1.722	1980.1	807.56	8.5471E-04	550.5	1966.0	-24.3	-234.0	4118.5	876.9
9	9	.3585	.9071	1.723	1981.1	806.19	8.5355E-04	550.4	1966.5	21.7	-239.0	4119.1	877.1
10	9	.2146	.9515	1.714	1974.9	818.01	8.6255E-04	552.6	1959.7	68.1	-234.3	4123.2	877.3

Figure 17. Continued.

RESTART PLANE X= 4.79251(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)
11	9	.0641	.9733	1.703	1966.4	831.30	8.7332E-04	554.7	1951.1	108.7	-220.2	4124.6	876.5
12	9	-.0897	.9712	1.707	1966.6	826.15	8.6949E-04	553.6	1953.2	142.2	-200.6	4120.3	876.2
13	9	-.2431	.9446	1.713	1972.9	819.60	8.6480E-04	552.4	1957.9	164.2	-176.0	4123.7	876.4
14	9	-.3914	.8934	1.721	1979.9	810.32	8.5712E-04	550.9	1965.2	196.0	-152.3	4128.4	877.2
15	9	-.5308	.8183	1.725	1982.3	805.14	8.5331E-04	549.8	1968.1	201.5	-124.9	4125.5	876.9
16	9	-.6572	.7208	1.730	1986.1	799.05	8.4860E-04	548.7	1972.4	211.4	-98.1	4126.1	877.0
17	9	-.7666	.6031	1.734	1989.1	793.63	8.4456E-04	547.6	1975.9	216.9	-72.6	4125.3	876.9
18	9	-.8557	.4681	1.736	1991.8	789.41	8.4124E-04	546.8	1979.3	216.1	-54.3	4125.7	877.1
19	9	-.9214	.3198	1.739	1992.7	787.73	8.3995E-04	546.5	1980.6	216.7	-33.9	4124.6	877.0
20	9	-.9618	.1623	1.740	1993.6	786.14	8.3874E-04	546.2	1981.7	216.3	-16.3	4124.5	877.0
21	9	-.9754	-.0000	1.741	1993.9	785.65	8.3837E-04	546.1	1982.2	216.0	.0	4124.7	877.0

MASS FLOW RATE FOR ENTIRE PLANE= 1.00864E+00(SLUG/SEC)

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 3, J= 9 SAFETY FACTOR= 9.750000E-01 DELTA-X= 2.855232E-02(FT)

Figure 17. Continued.

SOLUTION PLANE NO. 46 X= 5.25172(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	C (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
1	1	.6900	-.0000	1.340	1666.1	1371.46	1.2388E-03	645.1	1650.2	-243.8	.0	4013.6	876.7	1	3
2	1	.6840	.0906	1.342	1670.0	1368.09	1.2367E-03	644.6	1652.0	-240.6	-42.3	4014.7	876.7	1	3
3	1	.6656	.1810	1.345	1673.0	1362.77	1.2334E-03	643.8	1655.0	-231.1	-82.0	4017.4	876.8	1	3
4	1	.6355	.2687	1.348	1675.8	1358.36	1.2308E-03	643.1	1657.6	-216.0	-118.0	4021.0	876.9	1	3
5	1	.5936	.3518	1.355	1682.3	1346.40	1.2234E-03	641.3	1663.9	-194.7	-153.7	4025.1	876.9	1	3
6	1	.5405	.4288	1.369	1694.6	1322.32	1.2082E-03	637.7	1675.7	-162.6	-193.2	4029.4	876.8	1	3
7	1	.4762	.4993	1.381	1705.5	1301.65	1.1954E-03	634.5	1685.5	-117.5	-232.1	4034.3	876.6	1	3
8	1	.4008	.5616	1.389	1712.1	1290.08	1.1884E-03	632.5	1691.0	-66.4	-259.6	4041.5	876.6	1	3
9	1	.3156	.6136	1.405	1726.2	1263.59	1.1714E-03	628.6	1704.2	-16.8	-274.5	4047.9	876.6	1	3
10	1	.2214	.6535	1.436	1754.0	1209.65	1.1358E-03	620.6	1730.7	37.1	-282.6	4053.1	876.7	1	3
11	1	.1195	.6795	1.471	1783.8	1152.14	1.0974E-03	611.8	1759.0	95.4	-280.7	4057.9	876.6	1	3
12	1	.0113	.6899	1.498	1806.4	1109.74	1.0687E-03	605.1	1781.0	143.6	-265.6	4062.9	876.7	1	3
13	1	-.1016	.6824	1.522	1826.1	1073.41	1.0438E-03	599.2	1801.4	174.1	-243.2	4067.7	876.8	1	3
14	1	-.2147	.6557	1.548	1847.1	1034.87	1.0172E-03	592.6	1823.2	201.0	-217.7	4072.4	876.8	1	3
15	1	-.3233	.6095	1.568	1863.4	1005.12	9.9673E-04	587.6	1839.8	229.9	-185.8	4076.7	876.6	1	3
16	1	-.4236	.5446	1.591	1881.3	973.10	9.7463E-04	582.0	1857.8	256.2	-148.5	4081.3	876.6	1	3
17	1	-.5127	.4618	1.603	1890.7	956.80	9.6294E-04	579.0	1867.8	272.4	-110.0	4085.4	876.6	1	3
18	1	-.5874	.3620	1.612	1897.9	944.75	9.5445E-04	576.8	1875.9	277.4	-78.2	4088.8	876.6	1	3
19	1	-.6436	.2487	1.612	1897.7	945.45	9.5504E-04	576.8	1876.6	277.0	-52.4	4090.4	876.6	1	3
20	1	-.6782	.1267	1.621	1904.5	933.43	9.4640E-04	574.7	1883.9	278.0	-27.9	4091.5	876.6	1	3
21	1	-.6900	-.0000	1.623	1906.5	929.76	9.4377E-04	574.0	1886.0	278.7	-.0	4091.6	876.6	1	3
1	2	.7136	-.0000	1.354	1681.4	1351.03	1.2269E-03	641.6	1662.7	-249.8	.0	4032.5	877.0	1	3
2	2	.7071	.0937	1.356	1683.0	1347.91	1.2249E-03	641.2	1664.2	-246.7	-45.8	4033.4	877.0	1	3
3	2	.6876	.1879	1.357	1683.8	1347.20	1.2246E-03	641.0	1664.8	-236.0	-88.0	4035.4	877.0	1	3
4	2	.6562	.2791	1.357	1684.4	1347.15	1.2248E-03	640.9	1665.2	-220.2	-125.8	4038.8	877.1	1	3
5	2	.6129	.3656	1.366	1691.9	1333.30	1.2161E-03	638.8	1672.2	-199.9	-162.7	4043.6	877.1	1	3
6	2	.5577	.4456	1.378	1703.3	1311.43	1.2023E-03	635.6	1682.8	-167.0	-203.0	4048.2	877.1	1	3
7	2	.4895	.5180	1.392	1715.1	1288.49	1.1877E-03	632.1	1693.8	-117.2	-243.0	4052.6	877.0	1	3
8	2	.4102	.5827	1.397	1719.8	1280.67	1.1832E-03	630.8	1696.4	-66.0	-273.9	4058.6	877.0	1	3
9	2	.3213	.6365	1.415	1735.4	1251.00	1.1638E-03	626.4	1711.2	-21.7	-288.0	4064.1	877.1	1	3
10	2	.2228	.6767	1.448	1764.2	1194.23	1.1261E-03	618.0	1738.9	33.4	-296.0	4067.5	877.0	1	3
11	2	.1169	.7030	1.483	1793.5	1137.11	1.0877E-03	609.2	1766.1	97.5	-296.8	4070.1	876.9	1	3
12	2	.0056	.7124	1.508	1814.9	1096.47	1.0599E-03	602.8	1785.8	149.8	-287.2	4072.8	877.0	1	3
13	2	-.1105	.7040	1.532	1834.7	1059.71	1.0345E-03	596.9	1805.7	180.5	-270.5	4076.0	877.1	1	3
14	2	-.2265	.6757	1.560	1857.0	1018.71	1.0061E-03	590.0	1828.7	210.9	-244.6	4080.1	877.1	1	3
15	2	-.3378	.6269	1.575	1869.0	997.18	9.9121E-04	586.2	1840.3	246.7	-213.7	4084.0	877.0	1	3
16	2	-.4412	.5604	1.600	1888.5	962.33	9.6667E-04	580.1	1860.5	276.6	-169.4	4088.4	877.0	1	3
17	2	-.5316	.4744	1.607	1894.3	952.40	9.5973E-04	578.2	1866.5	297.6	-127.4	4091.3	877.0	1	3
18	2	-.6081	.3716	1.619	1903.8	936.05	9.4806E-04	575.3	1877.5	301.8	-90.4	4093.9	877.0	1	3
19	2	-.6648	.2549	1.614	1899.8	943.35	9.5340E-04	576.6	1874.0	305.6	-62.6	4094.8	877.0	1	3
20	2	-.7007	.1300	1.626	1908.8	927.47	9.4195E-04	573.7	1883.9	305.2	-33.4	4095.8	877.0	1	3
21	2	-.7116	-.0000	1.626	1909.2	926.60	9.4133E-04	573.6	1884.4	306.7	-.0	4095.6	877.0	1	3
1	3	.7398	.0000	1.369	1695.1	1329.28	1.2141E-03	638.0	1676.1	-253.3	.0	4051.1	877.2	1	2
2	3	.7321	.0979	1.370	1695.7	1328.27	1.2134E-03	637.9	1676.3	-251.1	-48.7	4051.5	877.2	1	2
3	3	.7110	.1964	1.369	1695.1	1329.75	1.2144E-03	638.0	1675.7	-238.9	-92.3	4052.5	877.2	1	2
4	3	.6786	.2913	1.371	1696.7	1327.64	1.2133E-03	637.6	1676.9	-221.5	-132.4	4055.6	877.2	1	3
5	3	.6319	.3807	1.381	1705.9	1310.09	1.2021E-03	635.0	1685.2	-202.5	-171.8	4059.9	877.3	1	3
6	3	.5739	.4641	1.393	1716.8	1289.37	1.1889E-03	631.9	1694.9	-170.1	-214.0	4064.4	877.3	1	3
7	3	.5025	.5397	1.410	1731.5	1260.56	1.1702E-03	627.7	1708.3	-120.2	-255.8	4068.5	877.3	1	3
8	3	.4191	.6059	1.416	1738.5	1248.07	1.1623E-03	625.7	1712.2	-75.6	-291.5	4073.4	877.3	1	3
9	3	.3261	.6604	1.438	1755.7	1215.08	1.1405E-03	620.8	1728.2	-31.3	-307.7	4077.8	877.4	1	3
10	3	.2232	.7011	1.469	1782.6	1162.17	1.1051E-03	612.8	1754.1	25.9	-316.7	4080.5	877.3	1	3
11	3	.1129	.7275	1.500	1808.5	1111.76	1.0708E-03	605.0	1777.8	95.6	-317.8	4081.5	877.2	1	3
12	3	-.0023	.7358	1.521	1826.2	1077.83	1.0474E-03	599.6	1792.9	153.4	-311.7	4082.1	877.2	1	3
13	3	-.1214	.7257	1.543	1843.5	1045.62	1.0250E-03	594.4	1809.6	186.2	-299.1	4084.3	877.3	1	3

Figure 17. Continued.

SOLUTION PLANE NO. 46 X= 5.25172(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
14	3	-.2402	.6960	1.571	1866.4	1003.98	9.9589E-04	587.4	1833.3	221.7	-270.6	4088.6	877.4	1	3
15	3	-.3541	.6442	1.561	1874.6	989.84	9.8614E-04	584.9	1840.4	263.6	-240.1	4092.9	877.4	1	3
16	3	-.4601	.5754	1.609	1896.0	951.38	9.5888E-04	578.1	1863.6	294.4	-187.7	4096.5	877.4	1	3
17	3	-.5516	.4859	1.612	1898.2	947.85	9.5646E-04	577.4	1865.6	319.5	-143.1	4098.2	877.4	1	3
18	3	-.6296	.3806	1.627	1910.4	926.05	9.4079E-04	573.6	1880.4	321.7	-101.6	4099.7	877.4	1	3
19	3	-.6866	.2608	1.620	1904.4	937.14	9.4888E-04	575.5	1874.3	329.7	-71.3	4100.4	877.4	1	3
20	3	-.7239	.1332	1.633	1914.7	916.84	9.3561E-04	572.2	1886.1	327.5	-37.2	4101.2	877.4	1	3
21	3	-.7344	-.0000	1.631	1913.1	921.64	9.3767E-04	572.7	1884.4	329.9	-.1	4100.9	877.4	1	3
1	4	.7649	.0001	1.370	1696.3	1331.88	1.2168E-03	637.6	1679.1	-240.3	.1	4065.4	877.3	1	2
2	4	.7565	.1025	1.371	1697.1	1330.11	1.2157E-03	637.6	1679.2	-241.1	-47.5	4065.5	877.3	1	2
3	4	.7332	.2051	1.373	1696.5	1327.23	1.2138E-03	637.1	1660.2	-231.1	-91.0	4065.3	877.3	1	2
4	4	.7013	.3044	1.382	1706.5	1311.65	1.2040E-03	634.9	1687.6	-215.1	-134.3	4068.9	877.3	1	3
5	4	.6511	.3962	1.399	1722.3	1280.91	1.1839E-03	630.4	1701.0	-202.1	-178.9	4072.7	877.3	1	3
6	4	.5903	.4834	1.417	1737.7	1250.98	1.1644E-03	626.0	1714.1	-174.8	-225.6	4077.0	877.4	1	3
7	4	.5161	.5626	1.439	1757.3	1212.53	1.1390E-03	620.3	1731.5	-129.4	-270.6	4080.5	877.4	1	3
8	4	.4285	.6300	1.454	1769.7	1189.18	1.1236E-03	616.7	1739.9	-89.0	-310.6	4084.6	877.4	1	3
9	4	.3314	.6850	1.475	1787.6	1154.88	1.1005E-03	611.5	1756.6	-42.8	-328.6	4088.3	877.5	1	3
10	4	.2240	.7268	1.502	1810.2	1111.83	1.0712E-03	604.8	1778.5	17.7	-336.6	4091.5	877.5	1	3
11	4	.1093	.7534	1.525	1829.0	1075.28	1.0461E-03	599.0	1796.5	91.4	-331.1	4091.4	877.4	1	3
12	4	-.0098	.7602	1.538	1840.1	1053.82	1.0311E-03	595.5	1805.0	153.3	-322.7	4090.1	877.4	1	2
13	4	-.1320	.7475	1.554	1852.9	1029.99	1.0144E-03	591.7	1817.3	187.9	-308.8	4091.2	877.4	1	2
14	4	-.2540	.7174	1.582	1875.2	989.84	9.8615E-04	584.9	1840.9	226.0	-276.5	4096.1	877.6	1	2
15	4	-.3706	.6629	1.586	1878.8	984.65	9.8270E-04	583.9	1842.0	272.0	-250.7	4101.0	877.7	1	2
16	4	-.4796	.5916	1.612	1898.6	946.99	9.5731E-04	577.6	1863.5	304.2	-198.7	4103.8	877.7	1	3
17	4	-.5723	.4984	1.613	1899.8	946.70	9.5578E-04	577.2	1864.4	331.4	-153.4	4104.3	877.6	1	2
18	4	-.6530	.3906	1.636	1917.1	915.71	9.3337E-04	571.7	1885.1	331.5	-108.9	4105.1	877.6	1	2
19	4	-.7096	.2674	1.629	1912.1	924.94	9.4015E-04	573.3	1879.3	344.4	-76.7	4106.0	877.6	1	2
20	4	-.7483	.1366	1.644	1923.3	905.22	9.2576E-04	569.8	1892.1	342.9	-39.2	4106.9	877.7	1	2
21	4	-.7586	-.0000	1.640	1920.3	910.43	9.2959E-04	570.7	1888.7	347.1	-.1	4106.6	877.6	1	2
1	5	.7906	.0001	1.381	1705.6	1316.32	1.2074E-03	635.3	1691.3	-220.1	.3	4076.1	877.4	1	3
2	5	.7812	.1068	1.380	1705.0	1317.48	1.2082E-03	635.4	1689.4	-225.3	-44.5	4076.0	877.4	1	3
3	5	.7567	.2139	1.382	1707.1	1312.89	1.2052E-03	634.8	1690.6	-219.8	-88.2	4075.5	877.3	1	3
4	5	.7237	.3173	1.398	1720.6	1286.35	1.1880E-03	630.9	1702.6	-208.2	-135.9	4079.2	877.4	1	3
5	5	.6707	.4124	1.422	1742.5	1243.07	1.1597E-03	624.6	1720.7	-202.3	-185.6	4082.8	877.3	1	3
6	5	.6065	.5031	1.443	1760.5	1208.00	1.1364E-03	619.4	1736.0	-177.9	-232.8	4086.7	877.4	1	3
7	5	.5288	.5855	1.466	1779.7	1170.50	1.1113E-03	613.7	1753.3	-134.3	-274.2	4089.2	877.4	1	3
8	5	.4376	.6550	1.482	1793.3	1144.67	1.0940E-03	609.7	1763.2	-96.0	-313.0	4092.3	877.4	1	3
9	5	.3365	.7105	1.502	1810.3	1112.66	1.0721E-03	604.7	1778.9	-46.9	-332.1	4095.5	877.5	1	3
10	5	.2243	.7530	1.524	1828.5	1078.99	1.0490E-03	599.4	1797.3	16.0	-336.1	4099.9	877.7	1	3
11	5	.1051	.7794	1.541	1842.7	1051.60	1.0300E-03	594.9	1811.8	88.1	-324.5	4099.7	877.6	1	3
12	5	-.0181	.7855	1.550	1849.5	1037.82	1.0202E-03	592.7	1816.8	150.1	-312.3	4096.9	877.5	1	3
13	5	-.1435	.7705	1.563	1859.8	1018.55	1.0067E-03	589.5	1826.3	185.4	-297.9	4096.9	877.5	1	2
14	5	-.2688	.7398	1.591	1882.3	978.51	9.7846E-04	582.7	1850.3	224.0	-263.0	4102.7	877.6	1	2
15	5	-.3877	.6818	1.594	1884.7	975.32	9.7642E-04	582.0	1849.3	270.6	-243.1	4107.3	877.7	1	2
16	5	-.4996	.6076	1.618	1903.4	941.94	9.5249E-04	576.2	1868.9	301.9	-197.1	4109.7	877.8	1	2
17	5	-.5941	.5114	1.616	1902.2	943.47	9.5375E-04	576.4	1867.5	327.6	-153.7	4108.8	877.6	1	2
18	5	-.6769	.4007	1.641	1921.0	909.97	9.2941E-04	570.5	1889.8	327.1	-109.3	4109.7	877.7	1	2
19	5	-.7345	.2743	1.637	1917.7	915.86	9.3383E-04	571.5	1885.1	343.9	-76.4	4110.6	877.6	1	2
20	5	-.7733	.1400	1.652	1929.5	895.48	9.1883E-04	567.9	1897.8	346.5	-38.4	4111.8	877.8	1	2
21	5	-.7842	-.0000	1.648	1926.5	900.53	9.2260E-04	566.8	1894.2	351.5	-.1	4111.3	877.7	1	2
1	6	.8169	.0001	1.407	1729.1	1270.60	1.1779E-03	628.6	1714.6	-223.7	.7	4083.8	877.4	1	3
2	6	.8067	.1108	1.407	1728.9	1270.94	1.1782E-03	628.6	1713.0	-229.8	-44.3	4083.8	877.4	1	3
3	6	.7819	.2233	1.410	1732.1	1264.58	1.1739E-03	627.7	1715.3	-222.8	-90.0	4083.8	877.4	1	3
4	6	.7463	.3309	1.424	1743.8	1242.04	1.1593E-03	624.3	1725.3	-210.3	-141.2	4087.8	877.4	1	3
5	6	.6909	.4296	1.447	1763.4	1203.39	1.1337E-03	618.5	1741.4	-202.3	-191.1	4091.1	877.4	1	3

Figure 17. Continued.

ORIGINAL PAGE IS OF POOR QUALITY

SOLUTION PLANE NO: 46 X= 5.25172(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
6	6	.6233	.5241	1.462	1776.5	1178.55	1.1171E-03	614.8	1752.6	-174.5	-232.2	4094.5	877.5	1	2
7	6	.5411	.6088	1.475	1787.8	1156.65	1.1024E-03	611.4	1762.9	-131.2	-266.8	4096.2	877.5	1	2
8	6	.4470	.6807	1.494	1803.5	1126.55	1.0821E-03	606.7	1774.8	-96.5	-305.6	4098.9	877.4	1	2
9	6	.3419	.7365	1.517	1822.4	1090.81	1.0575E-03	601.0	1791.0	-48.4	-333.2	4101.5	877.5	1	2
10	6	.2251	.7796	1.543	1843.8	1051.40	1.0304E-03	594.6	1812.1	13.2	-340.4	4106.7	877.6	1	3
11	6	.1014	.8056	1.560	1858.0	1024.39	1.0114E-03	590.2	1827.3	81.2	-326.4	4106.2	877.5	1	2
12	6	-.0265	.8121	1.568	1864.0	1011.87	1.0025E-03	588.2	1832.4	142.3	-310.7	4102.7	877.4	1	2
13	6	-.1552	.7947	1.577	1870.9	998.75	9.9317E-04	586.0	1839.1	182.4	-291.2	4102.1	877.4	1	2
14	6	-.2839	.7627	1.598	1887.6	970.03	9.7296E-04	580.9	1857.6	221.0	-251.7	4109.0	877.5	1	2
15	6	-.4051	.7013	1.606	1894.3	956.62	9.6490E-04	576.9	1861.5	263.9	-231.3	4112.1	877.6	1	2
16	6	-.5200	.6245	1.629	1912.3	926.77	9.4185E-04	573.4	1880.2	292.5	-190.2	4114.3	877.8	1	3
17	6	-.6161	.5250	1.627	1910.3	929.47	9.4398E-04	573.7	1878.4	314.8	-146.7	4112.5	877.5	1	3
18	6	-.7009	.4110	1.644	1925.0	907.20	9.2769E-04	569.8	1894.1	315.2	-105.0	4113.9	877.7	1	2
19	6	-.7596	.2814	1.643	1922.4	908.24	9.2857E-04	569.9	1891.9	333.5	-72.6	4114.4	877.6	1	2
20	6	-.7966	.1434	1.655	1931.9	892.14	9.1663E-04	567.1	1901.8	337.6	-35.8	4115.7	877.8	1	2
21	6	-.8103	-.0000	1.653	1930.4	894.36	9.1856E-04	567.5	1899.7	342.9	-.1	4114.9	877.6	1	2
1	7	.8425	.0001	1.424	1744.3	1241.91	1.1594E-03	624.2	1728.8	-232.2	1.1	4090.7	877.5	1	2
2	7	.8329	.1149	1.425	1745.2	1240.30	1.1586E-03	623.9	1728.6	-235.9	-43.8	4091.1	877.5	1	2
3	7	.8077	.2330	1.436	1754.7	1221.27	1.1455E-03	621.2	1737.3	-229.0	-91.7	4091.4	877.5	1	2
4	7	.7682	.3448	1.447	1763.7	1204.40	1.1346E-03	618.6	1745.0	-212.0	-144.3	4095.3	877.5	1	2
5	7	.7110	.4472	1.466	1779.8	1172.95	1.1136E-03	613.7	1758.2	-198.8	-192.3	4098.1	877.4	1	2
6	7	.6403	.5451	1.474	1787.2	1159.48	1.1046E-03	611.6	1764.9	-166.6	-227.1	4101.4	877.5	1	2
7	7	.5528	.6322	1.485	1796.2	1142.07	1.0930E-03	608.9	1772.9	-125.9	-259.3	4103.3	877.4	1	2
8	7	.4562	.7072	1.514	1820.2	1095.95	1.0618E-03	601.5	1793.6	-92.9	-295.5	4106.7	877.2	1	3
9	7	.3464	.7625	1.543	1843.4	1051.65	1.0312E-03	594.3	1813.2	-47.5	-329.1	4108.5	877.2	1	3
10	7	.2256	.8082	1.570	1865.7	1011.48	1.0031E-03	587.6	1835.8	14.0	-332.5	4114.5	877.3	1	3
11	7	.0970	.8520	1.584	1876.6	990.89	9.8653E-04	584.1	1847.0	76.4	-323.2	4114.2	877.2	1	3
12	7	-.0352	.8378	1.594	1884.4	975.46	9.7743E-04	581.5	1854.6	136.2	-305.0	4110.9	877.1	1	3
13	7	-.1675	.8181	1.599	1888.0	968.48	9.7251E-04	580.4	1857.7	180.4	-284.6	4109.2	877.1	1	3
14	7	-.2997	.7848	1.607	1894.9	958.04	9.6510E-04	578.4	1867.4	215.6	-239.0	4116.8	877.3	1	3
15	7	-.4229	.7199	1.623	1906.9	936.64	9.4954E-04	574.8	1878.0	253.0	-213.5	4117.5	877.5	1	3
16	7	-.5409	.6413	1.643	1923.0	906.58	9.2900E-04	569.9	1894.6	278.9	-175.8	4119.6	877.7	1	3
17	7	-.6387	.5384	1.641	1920.6	911.77	9.3141E-04	570.4	1892.8	296.8	-134.7	4116.8	877.5	1	3
18	7	-.7251	.4210	1.648	1926.6	901.62	9.2403E-04	568.7	1899.9	304.1	-99.9	4118.4	877.7	1	2
19	7	-.7849	.2882	1.653	1929.9	895.76	9.1970E-04	567.5	1902.1	319.3	-67.8	4118.1	877.6	1	3
20	7	-.8243	.1467	1.661	1936.6	884.53	9.1128E-04	565.6	1909.0	324.0	-33.3	4119.0	877.8	1	3
21	7	-.8365	-.0000	1.658	1933.9	888.69	9.1448E-04	566.3	1906.3	325.2	-.1	4118.0	877.6	1	3
1	8	.8688	.0001	1.435	1753.3	1226.65	1.1497E-03	621.7	1738.2	-229.2	1.1	4099.2	877.6	1	3
2	8	.8602	.1199	1.441	1759.1	1215.24	1.1421E-03	620.0	1743.3	-231.5	-43.2	4100.1	877.6	1	3
3	8	.8338	.2434	1.452	1768.2	1197.37	1.1300E-03	617.4	1752.0	-221.5	-89.1	4101.0	877.7	1	3
4	8	.7906	.3598	1.468	1781.8	1171.43	1.1128E-03	613.4	1765.1	-203.5	-135.1	4104.8	877.7	1	3
5	8	.7314	.4664	1.483	1794.6	1146.46	1.0962E-03	609.4	1775.7	-184.2	-182.3	4106.8	877.5	1	3
6	8	.6566	.5673	1.490	1800.5	1135.89	1.0893E-03	607.6	1780.3	-156.3	-218.7	4110.6	877.5	1	3
7	8	.5643	.6571	1.504	1811.5	1114.53	1.0749E-03	604.1	1790.4	-117.5	-249.4	4112.5	877.2	1	3
8	8	.4639	.7339	1.531	1833.6	1072.68	1.0469E-03	597.0	1809.7	-80.1	-284.4	4119.3	876.9	1	1
9	8	.3497	.7901	1.571	1866.0	1011.63	1.0042E-03	587.0	1837.5	-39.2	-322.6	4121.2	876.9	1	3
10	8	.2244	.8354	1.565	1861.1	1022.50	1.0124E-03	588.5	1837.5	26.1	-294.5	4128.0	876.8	1	3
11	8	.0914	.8598	1.572	1866.7	1011.86	1.0052E-03	586.6	1843.5	81.6	-281.9	4129.1	876.6	1	1
12	8	-.0454	.8667	1.588	1879.0	988.04	9.8855E-04	582.5	1857.0	125.6	-258.0	4127.6	876.4	1	1
13	8	-.1816	.8436	1.602	1889.6	967.72	9.7323E-04	579.4	1866.1	166.2	-246.6	4122.8	876.6	1	3
14	8	-.3156	.8020	1.603	1891.0	966.36	9.7206E-04	579.3	1868.8	199.5	-209.3	4125.3	877.0	1	3
15	8	-.4419	.7362	1.622	1906.0	939.38	9.5218E-04	574.9	1881.7	236.1	-190.8	4124.4	877.3	1	3
16	8	-.5571	.6500	1.640	1920.1	914.76	9.3390E-04	570.8	1894.3	267.3	-165.4	4124.3	877.6	1	3
17	8	-.6594	.5486	1.640	1920.4	913.39	9.3284E-04	570.5	1896.1	278.5	-123.6	4121.9	877.6	1	3
18	8	-.7427	.4260	1.648	1926.2	903.46	9.2543E-04	568.9	1902.5	287.6	-90.8	4122.2	877.7	1	3

Figure 17. Continued.

SOLUTION PLANE NO. 46 X= 5.25172(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
19	D	-.8039	.2919	1.659	1934.5	888.80	9.1467E-04	566.2	1909.9	301.0	-61.8	4122.0	877.7	1	3
20	D	-.8411	.1481	1.658	1934.2	889.26	9.1493E-04	566.3	1910.0	303.6	-29.9	4121.5	877.8	1	3
21	D	-.8550	-.0000	1.661	1936.7	884.76	9.1164E-04	565.5	1912.7	303.9	-.1	4121.3	877.7	1	3
1	D	.8942	.0000	1.447	1764.0	1208.97	1.1385E-03	618.6	1748.8	-231.3	.0	4110.9	877.8	1	3
2	D	.8853	.1264	1.450	1767.1	1202.80	1.1345E-03	617.9	1751.6	-228.4	-42.0	4111.2	877.8	1	3
3	D	.8564	.2522	1.465	1779.3	1178.85	1.1182E-03	614.3	1764.1	-215.8	-87.1	4112.3	877.9	1	3
4	D	.8073	.3713	1.465	1780.0	1177.91	1.1177E-03	614.1	1762.9	-205.2	-134.9	4113.6	877.8	1	3
5	D	.7428	.4817	1.487	1797.8	1142.56	1.0940E-03	608.5	1779.2	-185.8	-179.1	4115.3	877.6	1	3
6	D	.6627	.5825	1.499	1807.7	1123.18	1.0813E-03	605.3	1788.1	-154.6	-215.8	4117.2	877.3	1	3
7	D	.5660	.6692	1.514	1815.9	1099.46	1.0653E-03	601.4	1798.3	-119.2	-253.2	4119.2	877.1	1	3
8	D	.4579	.7400	1.534	1836.0	1066.49	1.0441E-03	596.3	1812.3	-75.8	-284.2	4120.7	876.9	1	3
9	D	.3415	.7976	1.555	1852.6	1037.62	1.0229E-03	591.1	1828.0	-25.4	-300.0	4124.9	876.8	1	3
10	D	.2244	.8354	1.672	1943.4	872.90	9.0434E-04	562.4	1900.2	-3.6	-407.8	4129.7	876.8	1	2
11	D	.0825	.8626	1.572	1866.5	1012.52	1.0057E-03	586.5	1843.9	84.7	-276.7	4130.3	876.6	1	3
12	D	-.0553	.8666	1.568	1879.0	988.10	9.8847E-04	582.5	1857.4	127.6	-254.2	4128.2	876.4	1	3
13	D	-.1931	.8455	1.593	1883.2	960.36	9.8273E-04	581.3	1861.8	164.0	-230.2	4126.9	876.5	1	3
14	U	-.3156	.8020	1.724	1962.0	806.11	8.5413E-04	549.9	1937.5	252.7	-332.7	4127.8	877.0	1	2
15	U	-.4419	.7362	1.733	1988.9	794.88	8.4521E-04	548.0	1943.4	302.1	-295.9	4126.3	877.3	1	2
16	U	-.5571	.6500	1.740	1994.0	786.84	8.3872E-04	546.7	1949.0	340.5	-248.3	4125.8	877.6	1	2
17	U	-.6594	.5486	1.750	2000.8	775.00	8.2965E-04	544.3	1955.5	372.3	-201.9	4123.7	877.6	1	2
18	U	-.7427	.4260	1.755	2004.6	769.07	8.2497E-04	543.2	1960.2	392.0	-149.6	4124.0	877.7	1	2
19	U	-.8039	.2919	1.760	2008.5	762.52	8.1992E-04	541.9	1964.0	408.6	-100.0	4123.5	877.7	1	2
20	U	-.8411	.1481	1.762	2010.1	759.68	8.1784E-04	541.4	1965.3	419.0	-50.1	4123.1	877.8	1	2
21	U	-.8550	-.0000	1.766	2012.5	755.94	8.1481E-04	540.6	1967.9	421.1	-.1	4122.9	877.7	1	2
1	U	.8942	.0000	1.570	1865.9	1011.81	1.0027E-03	588.0	1830.7	-360.7	.0	4113.3	877.8	1	2
2	U	.8853	.1264	1.574	1869.3	1005.57	9.9827E-04	587.0	1833.8	-357.3	-61.1	4113.6	877.8	1	2
3	U	.8564	.2522	1.585	1878.0	989.71	9.8701E-04	584.3	1843.2	-337.1	-125.8	4114.5	877.9	1	2
4	U	.8073	.3713	1.581	1874.9	995.55	9.9130E-04	585.2	1838.5	-315.3	-189.4	4115.6	877.8	1	2
5	U	.7428	.4817	1.592	1883.5	979.50	9.8020E-04	582.3	1846.8	-279.0	-242.8	4116.8	877.6	1	2
6	U	.6627	.5825	1.604	1892.3	963.27	9.6901E-04	579.2	1854.4	-236.7	-293.2	4118.7	877.3	1	2
7	U	.5660	.6692	1.614	1899.9	949.19	9.5926E-04	576.6	1860.2	-185.3	-339.1	4120.5	877.1	1	2
8	U	.4579	.7400	1.630	1911.7	927.72	9.4401E-04	572.6	1870.2	-127.7	-375.0	4121.9	876.9	1	2
9	U	.3415	.7976	1.652	1926.4	898.69	9.2317E-04	567.2	1885.5	-65.3	-398.9	4126.1	876.8	1	2
10	8	.2248	.8372	1.673	1944.2	871.76	9.0366E-04	562.1	1901.1	-3.6	-406.9	4131.2	876.8	1	2
11	U	.0825	.8626	1.688	1955.3	852.20	8.8943E-04	558.3	1911.9	71.0	-403.2	4132.5	876.6	1	2
12	U	-.0553	.8666	1.708	1969.5	826.68	8.7052E-04	553.5	1926.7	135.6	-385.5	4130.6	876.4	1	2
13	U	-.1931	.8455	1.718	1977.2	813.89	8.6057E-04	551.1	1933.3	198.1	-363.5	4129.6	876.5	1	2
14	8	-.3175	.8068	1.728	1984.5	802.32	8.5155E-04	549.0	1940.7	250.3	-330.5	4130.8	876.8	1	2
15	8	-.4441	.7399	1.736	1990.9	791.70	8.4295E-04	547.3	1946.0	299.9	-294.9	4128.1	877.2	1	2
16	8	-.5645	.6586	1.749	2000.5	776.52	8.3106E-04	544.5	1956.7	335.3	-246.3	4128.6	877.6	1	2
17	8	-.6638	.5522	1.753	2003.2	771.27	8.2687E-04	543.5	1958.7	369.1	-200.9	4125.2	877.6	1	2
18	8	-.7515	.4310	1.763	2010.6	759.65	8.1782E-04	541.2	1967.8	385.3	-147.9	4126.0	877.8	1	2
19	8	-.8127	.2951	1.764	2011.0	758.62	8.1704E-04	541.0	1967.1	405.8	-99.9	4124.9	877.7	1	3
20	8	-.8525	.1501	1.771	2016.5	749.96	8.1024E-04	539.4	1973.8	409.8	-49.0	4125.3	877.9	1	3
21	8	-.8650	-.0000	1.770	2015.1	751.60	8.1160E-04	539.6	1971.4	417.4	-.1	4123.9	877.7	1	3
1	9	.8955	.0000	1.572	1867.4	1009.01	1.0008E-03	587.5	1832.5	-359.7	.0	4113.8	877.8	1	2
2	9	.8865	.1266	1.577	1871.6	1001.36	9.9551E-04	586.2	1836.5	-355.5	-60.7	4114.1	877.8	1	2
3	9	.8590	.2530	1.584	1876.9	992.00	9.8870E-04	584.6	1841.6	-339.6	-126.6	4115.8	877.9	1	2
4	9	.8136	.3742	1.588	1880.6	985.75	9.8446E-04	583.5	1845.0	-312.3	-187.7	4118.4	877.9	1	2
5	9	.7513	.4873	1.598	1888.0	972.53	9.7546E-04	580.9	1851.9	-276.4	-241.9	4121.7	877.7	1	2
6	9	.6726	.5912	1.611	1897.7	954.43	9.6316E-04	577.4	1861.0	-230.3	-291.4	4124.5	877.2	1	2
7	9	.5783	.6837	1.626	1906.5	935.55	9.5044E-04	573.6	1871.3	-178.4	-330.3	4131.8	876.8	1	2
8	9	.4712	.7615	1.645	1922.6	911.33	9.3376E-04	568.7	1884.6	-121.1	-360.2	4140.2	876.4	1	2
9	9	.3525	.8232	1.666	1939.8	881.72	9.1296E-04	562.6	1901.2	-61.5	-379.7	4148.8	876.0	1	2
10	9	.2229	.8673	1.690	1955.6	854.53	8.9363E-04	557.2	1916.6	1.5	-388.8	4156.0	875.6	1	3

Figure 17. Continued.

SOLUTION PLANE NO. 46 X= 5.25172(FT) INTERNAL FLOW FIELD WITH SHOCK WAVE SYSTEM

I	J	Y (FT)	Z (FT)	M	Q (FT/SEC)	P (LBF/FT2)	RO (SLUG/FT3)	T (DEG R)	U (FT/SEC)	V (FT/SEC)	W (FT/SEC)	PT (LBF/FT2)	TT (DEG R)	ITG	ITL
11	9	.0852	.8914	1.709	1968.9	831.68	8.7703E-04	552.6	1929.4	66.1	-386.8	4159.9	875.3	1	3
12	9	-.0570	.8937	1.725	1980.7	810.70	8.6116E-04	548.5	1940.9	128.9	-373.6	4157.8	875.1	1	2
13	9	-.1994	.8730	1.738	1990.2	794.19	8.4796E-04	545.7	1950.3	185.5	-350.4	4152.2	875.5	1	2
14	9	-.3375	.8294	1.748	1997.6	781.83	8.3753E-04	543.9	1958.0	236.1	-318.9	4147.1	876.2	1	2
15	9	-.4685	.7632	1.757	2005.6	769.45	8.2713E-04	542.1	1966.0	280.9	-280.4	4143.4	876.9	1	2
16	9	-.5883	.6751	1.765	2012.1	759.51	8.1858E-04	540.6	1972.7	317.5	-237.0	4139.6	877.7	1	2
17	9	-.6929	.5673	1.773	2017.4	750.53	8.1126E-04	539.1	1978.3	346.4	-189.9	4136.1	877.9	1	2
18	9	-.7793	.4412	1.778	2021.4	744.11	8.0600E-04	537.9	1982.7	366.8	-142.1	4134.4	878.1	1	2
19	9	-.8430	.3022	1.783	2024.5	738.56	8.0165E-04	536.8	1986.2	380.5	-94.0	4132.3	878.0	1	2
20	9	-.8822	.1535	1.786	2026.8	734.95	7.9871E-04	536.2	1988.7	388.1	-46.8	4131.7	878.1	1	2
21	9	-.8955	-.0000	1.787	2027.5	733.29	7.9747E-04	535.8	1989.5	390.6	-.1	4130.3	878.0	1	3

SHOCK WAVE POINT PARAMETERS

I	INCIDENT NORMAL MACH NO.	X-COMP. OF UNIT NORMAL	Y-COMP. OF UNIT NORMAL	Z-COMP. OF UNIT NORMAL
1	1.080290E+00	-5.349186E-01	8.449036E-01	1.368894E-05
2	1.080794E+00	-5.326611E-01	8.371562E-01	1.242643E-01
3	1.076797E+00	-5.278683E-01	8.091571E-01	2.581080E-01
4	1.075641E+00	-5.238915E-01	7.632836E-01	3.780685E-01
5	1.066968E+00	-5.140000E-01	7.060951E-01	4.841542E-01
6	1.066781E+00	-5.063131E-01	6.278352E-01	5.911599E-01
7	1.065690E+00	-4.960883E-01	5.292389E-01	6.883332E-01
8	1.063042E+00	-4.848433E-01	4.344809E-01	7.590430E-01
9	1.064190E+00	-4.748658E-01	3.297458E-01	8.159475E-01
10	1.070936E+00	-4.716462E-01	2.229585E-01	8.531650E-01
11	1.077516E+00	-4.713197E-01	9.484315E-02	8.768481E-01
12	1.080332E+00	-4.661404E-01	-5.406553E-02	8.830572E-01
13	1.084123E+00	-4.610865E-01	-2.196835E-01	8.597316E-01
14	1.081846E+00	-4.554775E-01	-3.527875E-01	8.173623E-01
15	1.075087E+00	-4.452859E-01	-4.760581E-01	7.583464E-01
16	1.067404E+00	-4.383702E-01	-5.871179E-01	6.805322E-01
17	1.073806E+00	-4.369731E-01	-6.909445E-01	5.758908E-01
18	1.072277E+00	-4.342098E-01	-7.851216E-01	4.416400E-01
19	1.068624E+00	-4.282918E-01	-8.516063E-01	3.022132E-01
20	1.070485E+00	-4.273605E-01	-8.905279E-01	1.559035E-01
21	1.070547E+00	-4.264057E-01	-9.045320E-01	-1.548356E-05

MASS FLOW RATE FOR ENTIRE PLANE= 1.88653E+00(SLUG/SEC)

COURANT NUMBER= .75590

X-STEP REGULATION PARAMETERS

LIMITING POINT - I= 3, J= 1 SAFETY FACTOR= 9.750000E-01 DELTA-X= 1.637538E-02(FT)

Figure 17. Continued.

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15. Supplementary Notes

16. Abstract

A computer program has been developed for calculating the flow field in supersonic mixed-compression aircraft inlets at angle of attack. The calculation procedure is based on the method of characteristics for steady three-dimensional flow. The bow shock wave and the internal shock wave system are computed using a discrete shock wave fitting procedure. The general structure of the computer program is discussed, and a brief description of each subroutine is given. All program input parameters are defined, and a brief discussion on interpretation of the output is provided. A number of sample cases, complete with data deck listings, are presented.

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