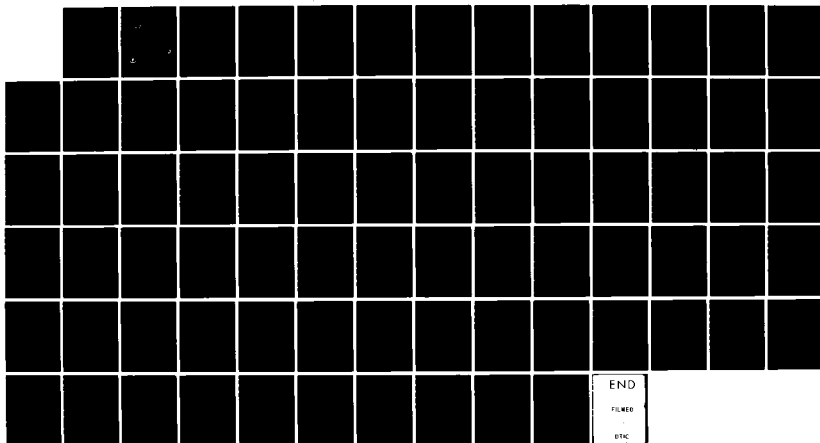


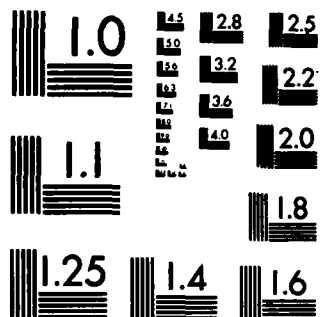
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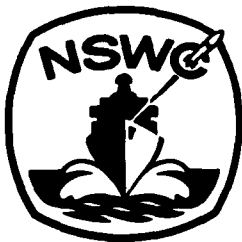
BY A. B. WARDLAW, JR., DAVID SHUMWAY,
FRANK BALTAKIS

RESEARCH AND TECHNOLOGY DEPARTMENT

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INTRODUCTION

This report describes a computational method for calculating supersonic inviscid flow within an inlet using an extension of the SWINT code which is described in References 1, 2 and 3. The SWINT code is designed to calculate 3-D external supersonic flow fields on a missile type configuration. It marches a known nosetip flow field down the length of the missile body. The computational domain is bounded on the inside by the body surface and on the outside by the bow shock which is tracked. It is restricted to flow fields which are supersonic everywhere and is specifically designed to treat thin lifting surfaces. The points interior to the computational domain are described using a weak conservation form of the Euler equations while a characteristic analysis is applied to determine the relations applicable at the body fin or shock. The MacCormack explicit method is used to advance the flow field.

The modifications to SWINT described in this report primarily consist of replacing the shock relations with solid wall conditions. The computational domain is now bounded along the lower and upper edges by the body and cowl respectively. The inlet computation is started using the flow field at the inlet face determined by the SWINT code. This flow field is re-grid at the inlet face to exclude portions of the flow field outside the cowl using the interface program COWLI which is also described in this report.

The extended SWINT code is only applicable to the supersonic portion of the inlet and fails when the axial Mach number becomes less than unity. Internal shocks are not tracked but instead captured by the numerical scheme. The modified SWINT code is most applicable to cylindrical inlets (not necessarily circular) since the left and right edges of the computational domain are treated using either a symmetry or antisymmetry condition

implemented in cylindrical coordinates. However, reflection boundary conditions may be used to simulate planar walls that are aligned with the body axis. This makes it possible, in principle, to treat certain non-cylindrical cases. Planar flows can also be approximated by using large body and cowl radii.

In the remainder of this report the extension of SWINT to handle inlets is outlined and several test cases are presented. The interface program, COWLI, is also described. This program calculates induced inlet drag, recovery pressure and mass capture as well as rezoning the inlet face flow field. Appendices A, B and C present a listing of COWLI, an update deck listing for converting the original SWINT to the extended version described in this report, and user instructions for applying SWINT. A sample inlet run is provided in Appendix D.

MODIFICATIONS TO THE SWINT CODE

COWL BOUNDARY CONDITIONS

The major modification of SWINT involves implementation of surface boundary conditions at the outer edge of the computational domain. This development parallels that for the body surface which is outlined in References 1-3 and given in detail in Reference 4. For completeness the results and analysis are summarized here. The physical and computational coordinates applicable to an inlet configuration are shown in Figures 1 and 2 respectively.

On the cowl surface ($X = 1$) the normal velocity component is zero which implies:

$$u - \tilde{c}_z w - (\tilde{c}_\phi / \tilde{c}) v = 0 \quad (1)$$

This condition is supplemented with certain characteristic compatibility relations associated with the Euler equations. It is found that there are three independent characteristic relations which are admissible on $X = 1$. These can be written as a system of quasi-linear first order partial differential equations on $X = 1$ for advancing $P = \ln(p)$, $V_4 = u(\tilde{c}_\phi / \tilde{c}) + v$ and s .

The resulting relations are

$$\frac{\partial P}{\partial Z} = \left[X_r \lambda - \frac{\partial p}{\partial X} - \frac{1}{\beta_1} \{ \rho w [\lambda - \frac{\partial A}{\partial X} - (a_7 w + a_4 v)] + \hat{p} \} \right] \frac{1}{p} \quad (2a)$$

$$\text{where} \quad \hat{p} = \frac{\rho v}{\tilde{c}} V_4 + w \lambda_{-1} + \xi \cdot \frac{\partial G}{\partial Y}$$

(2b)

$$+ p [\xi_2 (T_{g_5} Y_z + T_{g_6}) + \frac{1}{\tilde{c}} \xi_4 (T_{g_5} Y_\phi + \tilde{c}_\phi / \tilde{c})]$$

$$\lambda_- = \frac{a^2 (\beta_1 - \tilde{c}_z)}{w^2 - a^2}, \quad \beta_1 = -\sqrt{\frac{w^2}{a^2} v^2 - [1 + (\frac{\tilde{c}_\phi}{\tilde{c}})^2]}$$

$$a_7 = \frac{\partial \tilde{c}_z}{\partial Z} = \tilde{c}_{zz} - \tilde{c}_{z\phi} Y_z / Y_\phi$$

$$a_4 = \frac{\partial (\tilde{c}_\phi / \tilde{c})}{\partial Z} = \frac{1}{\tilde{c}} [\tilde{c}_{z\phi} - \frac{\tilde{c}_z \tilde{c}_\phi}{\tilde{c}} - (\tilde{c}_{\phi\phi} - \tilde{c}_\phi^2 / \tilde{c}) Y_z / Y_\phi]$$

$$\vec{\xi} = (\xi_1, \xi_2, \xi_3, \xi_4)$$

$$\xi_1 = w \lambda_- (2 - v^2 \kappa_1 / \rho), \quad \xi_2 = \tilde{c}_z - \lambda_- + w^2 \kappa_1 \lambda_- / \rho$$

$$\xi_3 = w u \kappa_1 \lambda_- / \rho - 1, \quad \xi_4 = w v \kappa_1 \lambda_- / \rho + \tilde{c}_\phi / \tilde{c}$$

$$\kappa_1 = (\frac{\partial \rho}{\partial h})_p = 1 / (\frac{\partial h}{\partial \rho})_p \quad (\kappa_1 = -\rho/h \text{ for a perfect gas})$$

$$T_{g_5} = g_{YY} / g_Y, \quad T_{g_6} = g_{ZY} / g_Y, \quad \hat{G} = GJ/r$$

$$v_\omega^2 = 1 + (\tilde{c}_\phi / \tilde{c})^2 + \tilde{c}_z^2$$

$$A = X_r u + \frac{X_\phi}{r} v + X_z w$$

$$\frac{\partial v_4}{\partial Z} = a_4 u + \hat{v} / \rho w \quad (3a)$$

where

$$\hat{v} = \hat{n} \cdot \frac{\partial \hat{G}}{\partial Y} - \rho v w \tilde{c}_z / \tilde{c} - p (T_{g_5} Y_\phi + \tilde{c}_\phi / \tilde{c}) / \tilde{c} \quad (3b)$$

$$\vec{n} = (n_1, n_2, n_3, n_4)$$

$$n_1 = v_4, \quad n_2 = 0, \quad n_3 = -\tilde{c}_\phi / \tilde{c}, \quad n_4 = -1$$

$$\frac{\partial s}{\partial z} = -\frac{B}{w} \frac{\partial s}{\partial Y}$$

$$\text{where } B = \frac{Y\phi v}{r} + Y_z w$$

Alternative expressions for $\hat{p}$ and v of (2b) and (3b) which often give improved results are:

$$\hat{p} = \frac{\rho v}{\tilde{c}} v_4 + [\tilde{c}_z Y_z + \frac{1}{\tilde{c}^2} \tilde{c}_\phi Y_\phi + (\frac{Bw}{a^2} - Y_z) \lambda_-] \frac{\partial p}{\partial Y} \quad (2c)$$

$$- \rho B (a_5 w + a_3 v)$$

$$+ \rho w \lambda_- \{ (T_{f6} - T_{g6}) w + \frac{v}{\tilde{c}} T_{f7} + \frac{w}{\tilde{c}} [Y_\phi \frac{\partial(v/w)}{\partial Y} + \tilde{c}_z] \}$$

where

$$a_5 = \frac{\partial \tilde{c}_z}{\partial Y} = \tilde{c}_{z\phi} / Y_\phi$$

$$a_3 = \frac{\partial (\tilde{c}_\phi / \tilde{c})}{\partial Y} = [\tilde{c}_{\phi\phi} / \tilde{c} - (\tilde{c}_\phi / \tilde{c})^2] Y_\phi$$

$$T_{f6} = T_{g6} + \frac{f_{ZX} + Y_z f_{YX}}{f_X} - \frac{(b_z - \tilde{c}_z)}{(\tilde{c} - b)}; \quad T_{f7} = \frac{Y_\phi f_{YX}}{f_X} + \frac{(\tilde{c}_\phi - b_\phi)}{(\tilde{c} - b)}$$

and

$$\hat{v} = \rho B (a_3 u - \frac{\partial v_4}{\partial Y}) - \frac{1}{\tilde{c}} Y_\phi \frac{\partial p}{\partial Y} - \frac{\rho v w}{\tilde{c}} \tilde{c}_z \quad (3c)$$

Many configurations of interest have sharp corners or edges such as those found on biconics and other segmented shapes. If the upstream cowl surface velocity normal to this edge is supersonic, either a shock wave or an expansion fan will be attached to it producing a discontinuity in the surface flow variables. To handle this situation, an oblique shock or Prandtl-Meyer expansion is applied at the edge as is described in References 1 to 4. In the interior these discontinuities are captured using the dissipative and conservation properties of the interior point scheme. Analogous procedures are applied on the body and fin surfaces.

COWL INTERFACE PROGRAM

The cowl interface program operates on the inlet face flow field generated by an external SWINT run. It is designed for cylindrical, but not necessarily circular, inlets and rezones the flow field to lie within the inlet. In addition, this program calculates recovery pressure throughout the inlet plane, average recovery pressure for the inlet plane and the flow entering the inlet, mass captured by the inlet and induced forces. A listing of this routine is provided in Appendix A and user instructions are outlined in Appendix C.

The average inlet plane recovery pressure ratio, average inlet recovery pressure ratio and the mass captured by the inlet are determined from Equations (4a), (4b) and (4c) respectively:

$$(p_t/p_{t\infty})_{\text{Inlet Plane}} = \frac{1}{Pt_{\infty} A_p} \int_0^{2\pi} \int_b^{\tilde{c}} p \left[1 + \frac{(\gamma-1)}{2} M^2 \right]^{\gamma/(\gamma-1)} r dr d\phi \quad (4a)$$

$$(p_t/p_{t\infty})_{\text{Inlet}} = \frac{1}{Pt_{\infty} A_I} \int_0^{2\pi} \int_b^{\tilde{c}} p \left[1 + \frac{(\gamma-1)}{2} M^2 \right]^{\gamma/(\gamma-1)} r dr d\phi \quad (4b)$$

$$\dot{m} = \int_0^{2\pi} \int_b^{\tilde{c}} \rho w r dr d\phi \quad (4c)$$

where:

$$A_I = \int_0^{2\pi} \int_b^{\tilde{c}} r dr d\phi, \quad A_P = \int_0^{2\pi} \int_b^c r dr d\phi$$

The induced forces are those produced by the action of pressure on the stream surface which intersects the cowl lip. They can be directly determined by storing the flow field upstream of the inlet face and tracking the stream surface intersecting the cowl lip back through the flow field until it intersects the bow shock. With the geometry of this stream surface known, the surface pressure along it can be integrated to produce induced drag and lift. For complicated bodies at incidence, the stream surface intersecting the cowl may exhibit a very complex shape and this type of procedure is both laborious and difficult to implement. An alternative approach is to balance forces and moments acting in the control volume illustrated in Figure 3. Here the induced forces are determined by performing integrations at the inlet face plane. The resulting equations for axial, normal and yaw force are:

$$F_a = \int_0^{2\pi} \int_c^{\tilde{c}} \left[\rho w (w_\infty - w) + \frac{\rho_w p_\infty}{\rho_\infty w_\infty} - p \right] r dr d\phi \quad (5a)$$

$$F_n = \int_0^{2\pi} \int_c^{\tilde{c}} \rho w [\tilde{u}_\infty - \tilde{u}] r dr d\phi \quad (5b)$$

$$F_y = \int_0^{2\pi} \int_{\tilde{c}}^c \rho w [\tilde{v}_\infty - \tilde{v}] r dr d\phi \quad (5c)$$

where $\tilde{u} = -\cos\phi u + \sin\phi v$

$\tilde{v} = \sin\phi u + \cos\phi v$

Figure 4 indicates the sign convention for these forces. Although this procedure is much simpler than the first approach described, the results must be carefully scrutinized. There may be cases where the values of the integrands in (5) are the small differences between two large numbers. Both approaches have been tested on sample axisymmetric cases and results agree within several percent. An additional check on the accuracy of this procedure can be accomplished by comparing the force coefficients calculated by SWINT with those of equation (5). Here the SWINT calculated force coefficients correspond to those acting on the portion of the body forward of the inlet plane, and equations (5) are integrated from the body to the shock. To adjust for the assumption used in SWINT that the based pressure is p_∞ , A^*/q_∞ must be added to the drag force coefficient calculated by SWINT. Here A^* is the center body cross-sectional area at the inlet plane. The drag force coefficients computed by these two different techniques generally agree to within 2%. Discrepancies between the SWINT calculated normal and yaw force and the results from (5b) and (5c) are greater, with errors of approximately 15% and 5% occurring on a cone at 5° incidence at Mach 2 and Mach 4 respectively. In order to provide a guide to the accuracy of the calculated induced forces, the interface program COWLI computes this comparison for each force component.

RESULTS

The extended SWINT code has been applied to a number of different configurations, three of which are illustrated in this section. In each case, measured surface pressures are compared to calculated values. The computations were carried out using 19 points between the body and the cowl. In the axisymmetric cases three circumferential planes were used, while in the other situations this number was increased to 13. The tested inlets were of the mixed compression, asymmetric type with a translating center-body. All cases feature boundary layer bleed and/or slots to reduce the thickness of the boundary layer.

The first inlet considered is described in Reference 5 and results, along with a sketch of the inlet, are shown in Figure 5. This example features a free-stream Mach number of 2.3, 0° incidence, boundary layer bleed and a center body scoop upstream of the throat. The geometry was approximated using a piece-wise continuous function generated from a tabular listing of the centerbody and cowl profiles which was provided in Reference 6. Derivatives were approximated using a central differencing of the surface locations evaluated with the local computation step size, $\pm \Delta z$. The scoop upstream of the throat was simulated using the inlet option of SWINT which excludes from the calculation that portion of the flow field entering the scoop.

Figure 6 illustrates a comparison between SWINT results and those measured in Reference 6. This inlet, which is depicted in Figure 6, features wall bleed, a free-stream Mach number of 2.5, and an incidence of 0° . The body and cowl geometries are described using the cubic splines provided in Reference 6.

The final case considered is illustrated in Figure 7 and features an inlet at Mach 3.3 and incidence of 3° . The experimental data used for comparison was generated in Reference 7 and reported in References 7 and 8. Results from the leeward and windward planes are compared with experiment. The geometry description was generated from a tabular listing of the body and cowl profiles. Central differencing was again used to generate needed body and cowl derivatives.

The results shown in Figures 6, 7 and 8 are in reasonable agreement with experiment. However, the predicted location at which shocks strike the centerbody or cowl is downstream of the measured one. This is to be expected since the effective distance between the centerbody and the cowl is decreased by the presence of the boundary layer.

In some of the calculated cases, it is possible to march through the diffuser to the end of the inlet without encountering subsonic flow. In cases where the throat Mach number is greater than unity, the exit conditions determine the location of the terminal shock and, hence, subsonic regions in the inlet. The marching method currently employed precludes application of the downstream boundary conditions, and the resulting solution represents exit conditions with sufficiently low pressure to permit supersonic flow throughout the inlet.

CONCLUDING REMARKS

The SWINT code has been extended to allow inviscid calculations to be performed on the supersonic portions of inlets. This procedure replaces the bow shock tracking procedure with solid surface boundary conditions. In addition, an interface program has been developed which rezones the external flow field upstream of the inlet face to include only that portion of the flow field entering the inlet. The interface program also calculates forces, mass captured by the inlet and average recovery pressure for the flow entering the inlet. The external flow field upstream of the inlet can be determined with either the original version of SWINT or the extended version described in this report. The extended SWINT code is best suited for calculating cylindrical inlets (not necessarily circular) and is restricted to geometries where the inlet lip lies in a plane perpendicular to the missile axis. Comparisons between calculation and experiment have been performed for several axisymmetric, external compression inlets with boundary layer bleed. Computed surface pressures are in reasonable agreement with experiment.

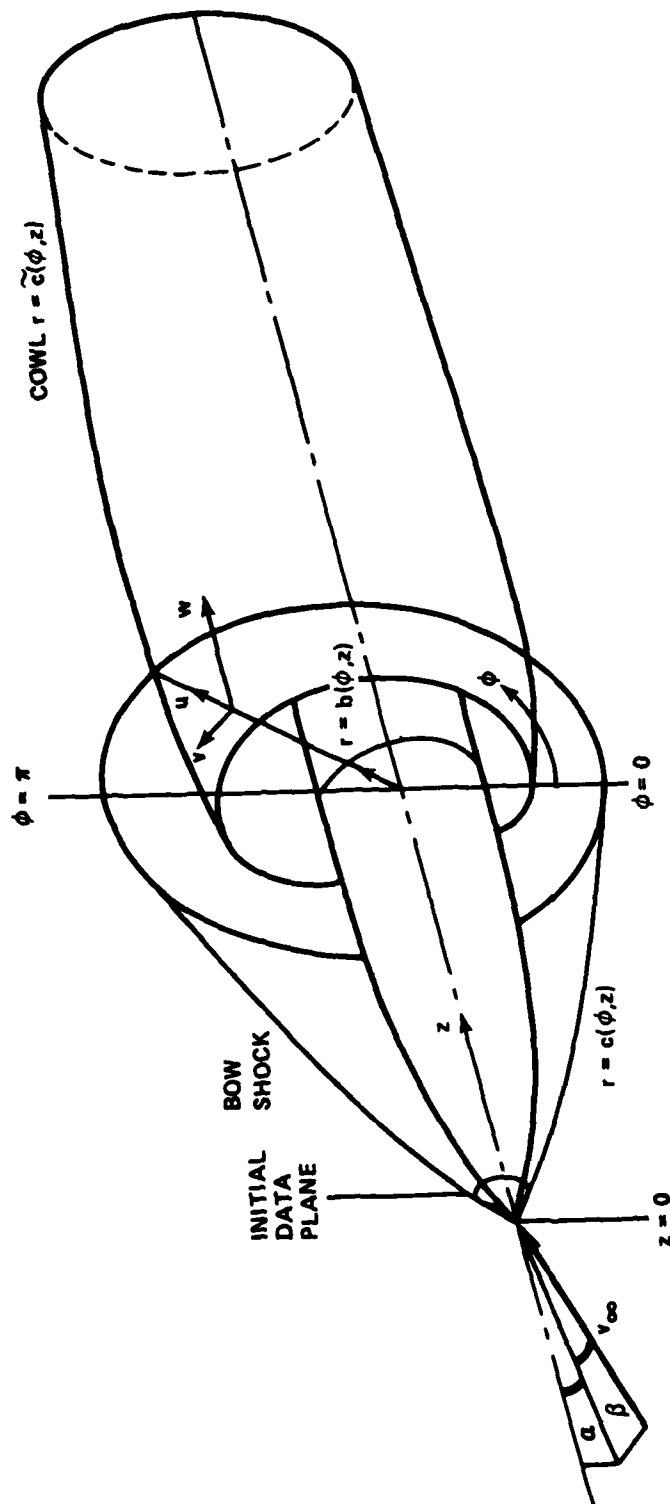


FIGURE 1. CYLINDRICAL COORDINATE SYSTEM USED FOR INVISCID FLOW CALCULATIONS

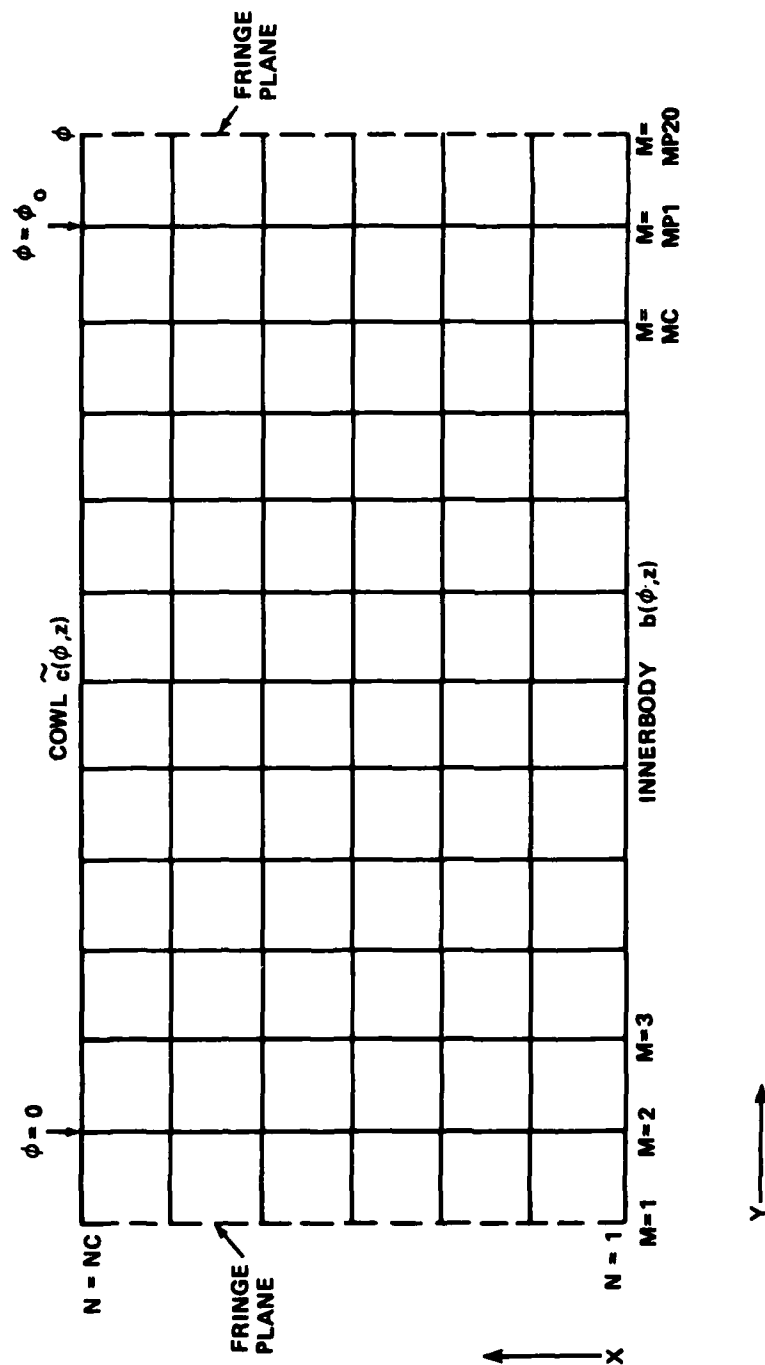


FIGURE 2. COMPUTATIONAL COORDINATES FOR AN INLET CONFIGURATION

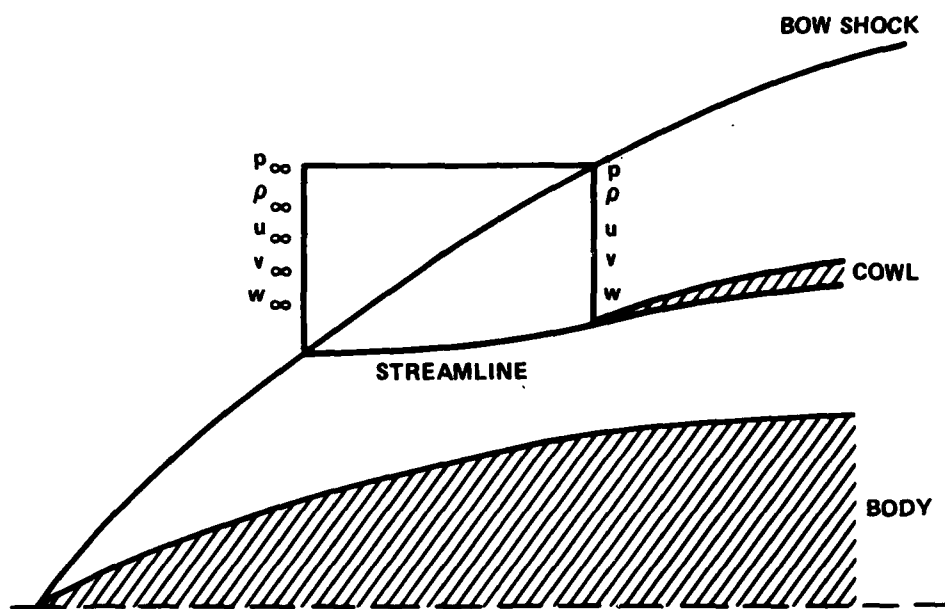


FIGURE 3. CONTROL VOLUME FOR CALCULATING INDUCED FORCES

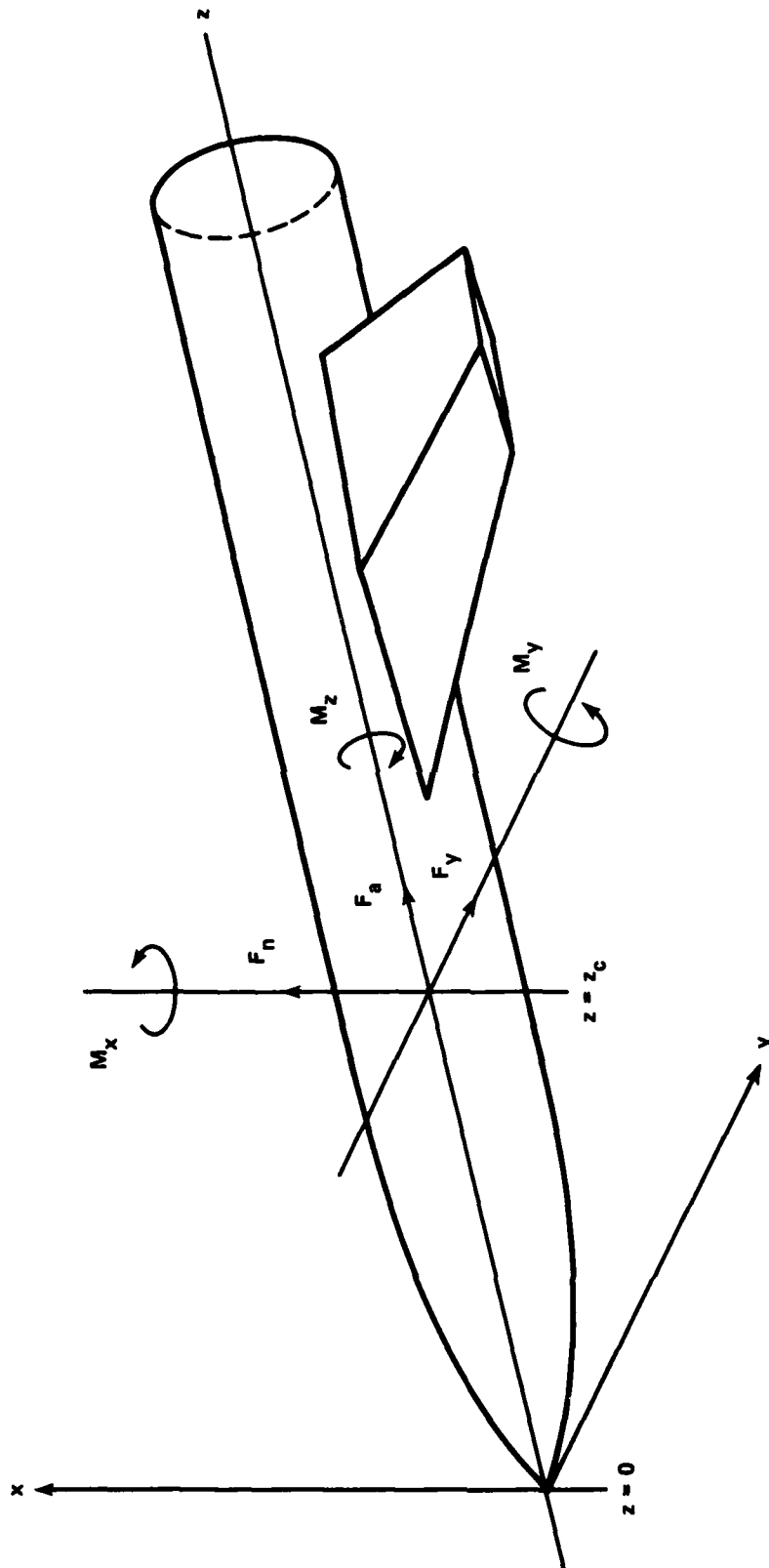


FIGURE 4. FORCE AND MOMENT SIGN CONVENTIONS

COWL STATIC PRESSURE
 SST INLET, MACH - 2.30, ANGLE - 0.0

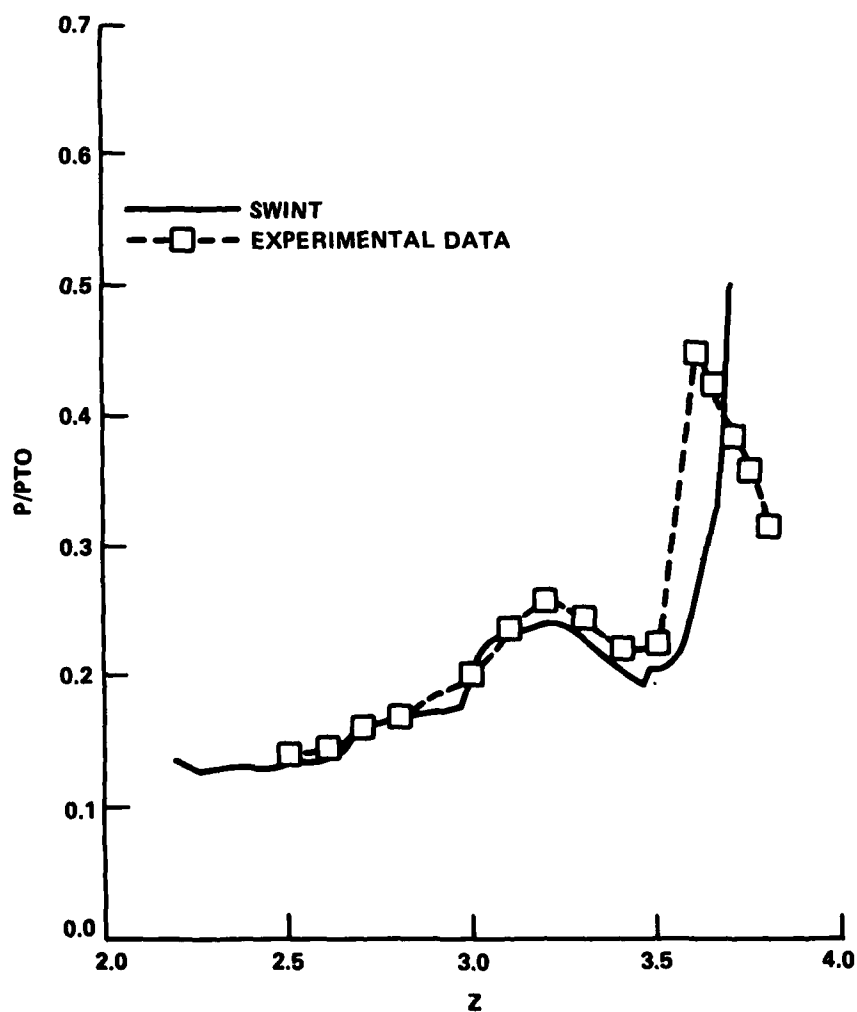
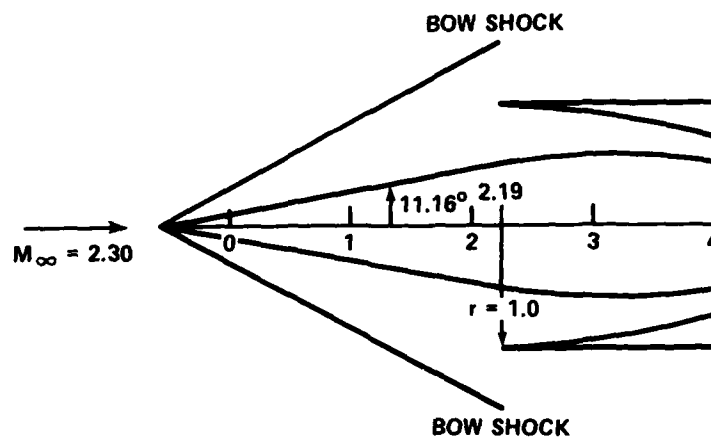


FIGURE 5. COMPARISON OF MEASURED AND CALCULATED SURFACE PRESSURES.
 EXPERIMENTAL DATA FROM REFERENCE 5

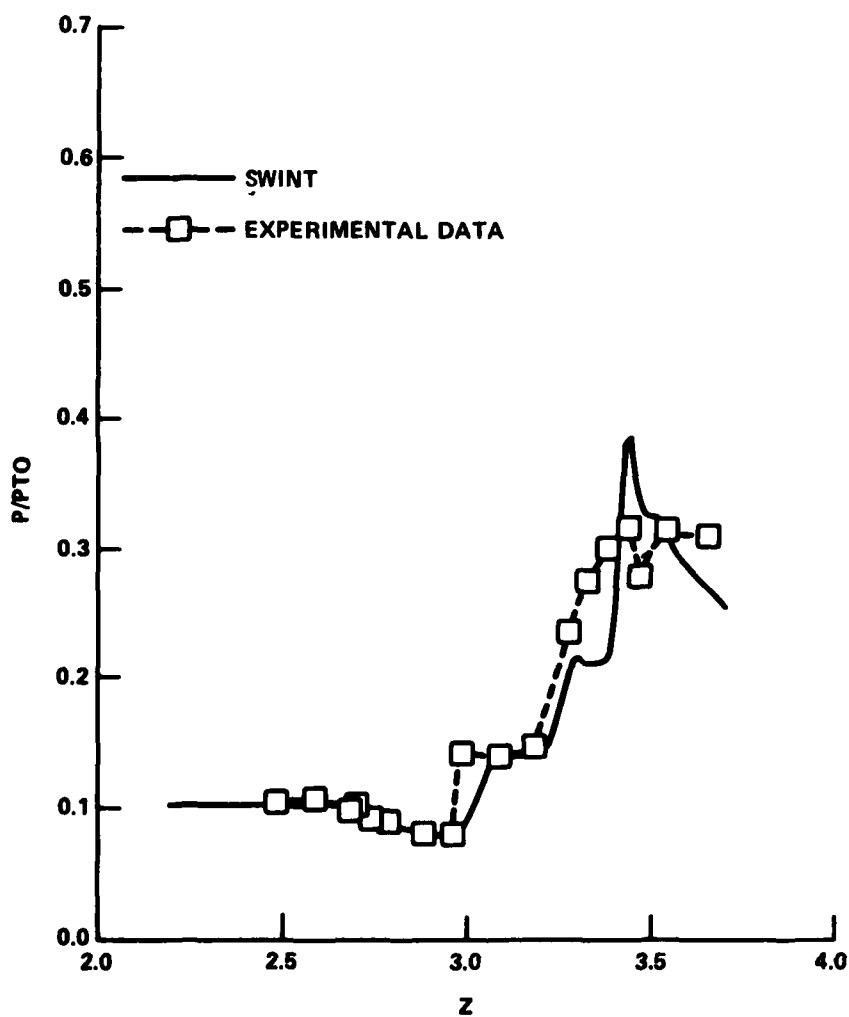
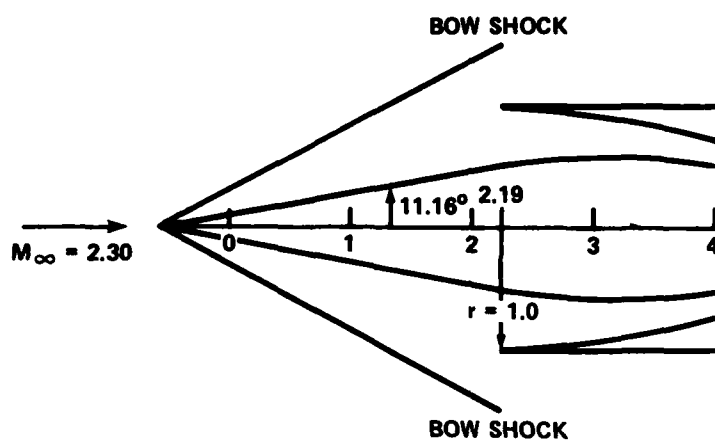
CENTERBODY STATIC PRESSURE
SST INLET, MACH - 2.30, ANGLE - 0.0

FIGURE 5. CONTINUED

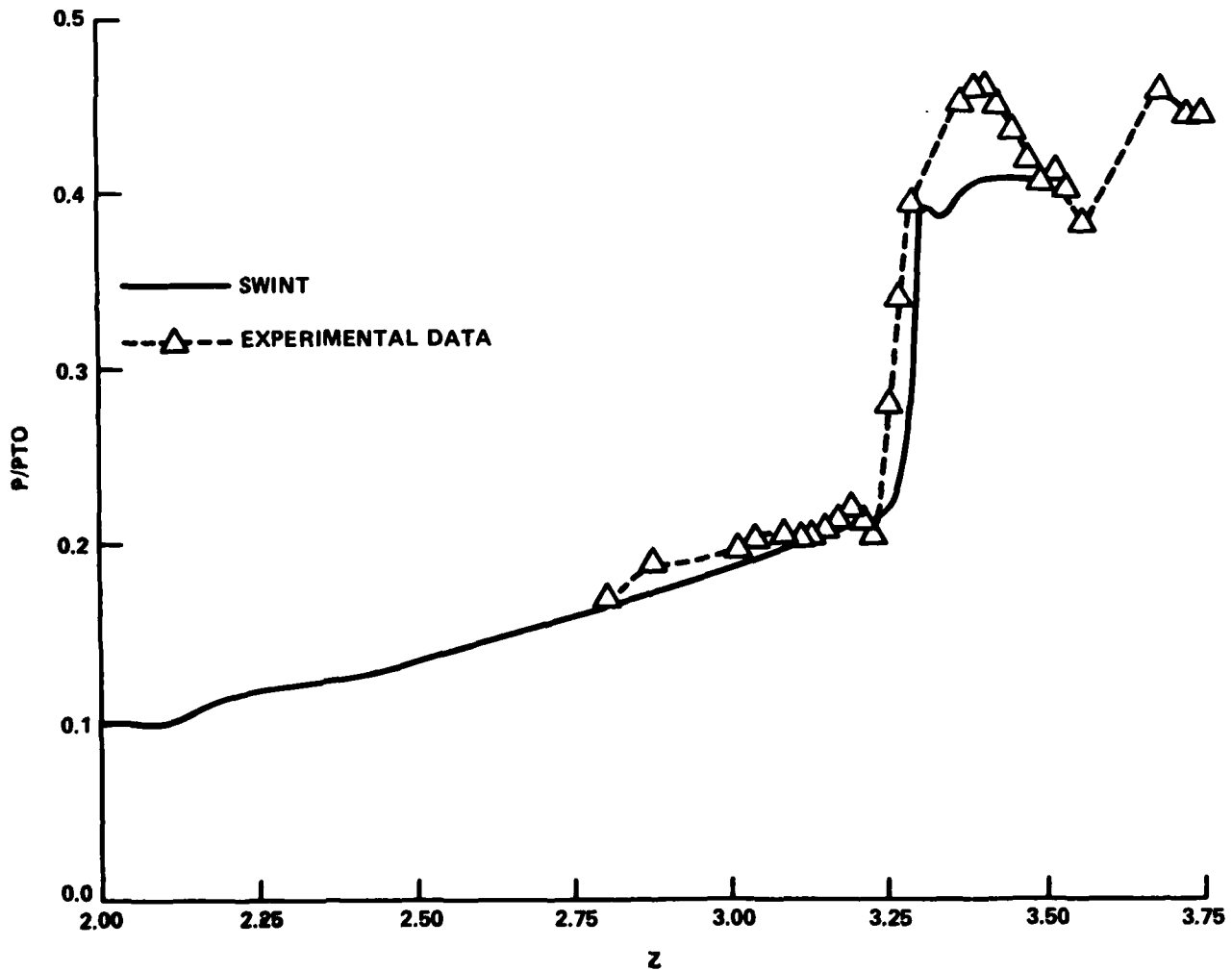
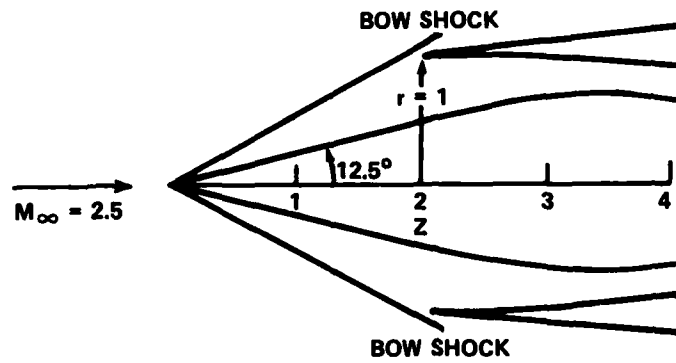
COWL STATIC PRESSURE
FUKUDA INLET, MACH - 2.5, ANGLE - 0.0

FIGURE 6. COMPARISON OF MEASURED AND CALCULATED SURFACE PRESSURES.
EXPERIMENTAL DATA FROM REFERENCE 6

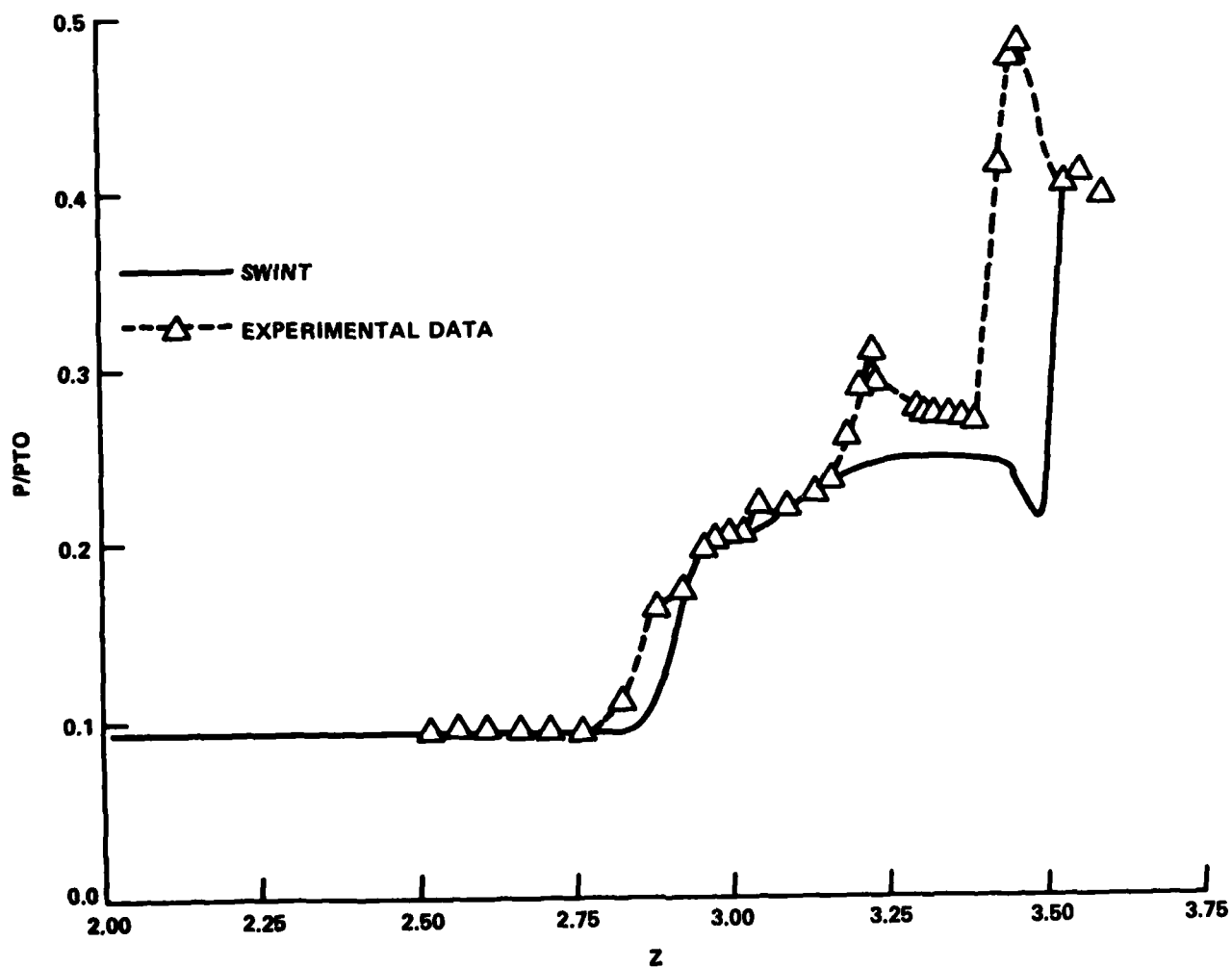
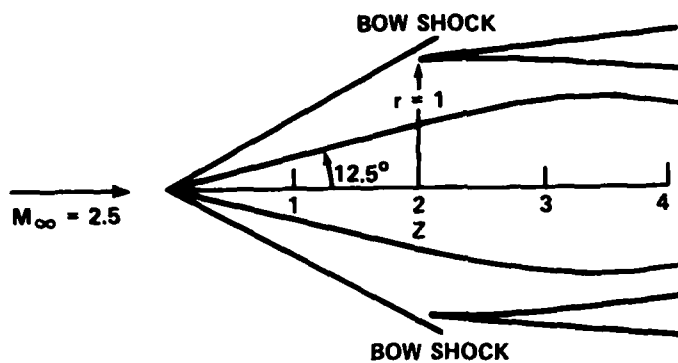
CENTERBODY STATIC PRESSURE
FUKUDA INLET, MACH - 2.5, ANGLE - 0.0

FIGURE 6. CONTINUED

COWL STATIC PRESSURE
PRESLEY INLET, MACH - 3.30, ANGLE - 3.0

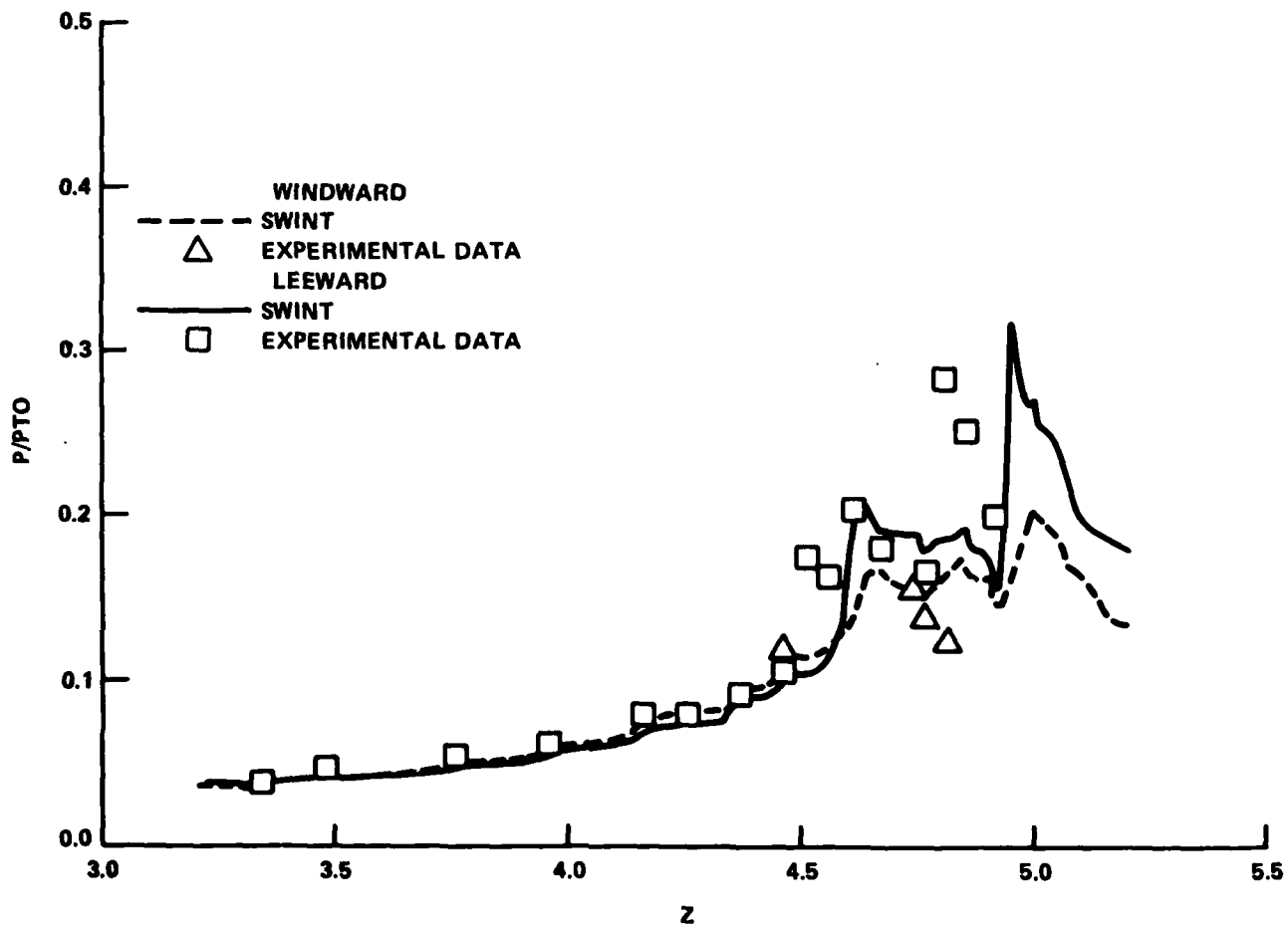
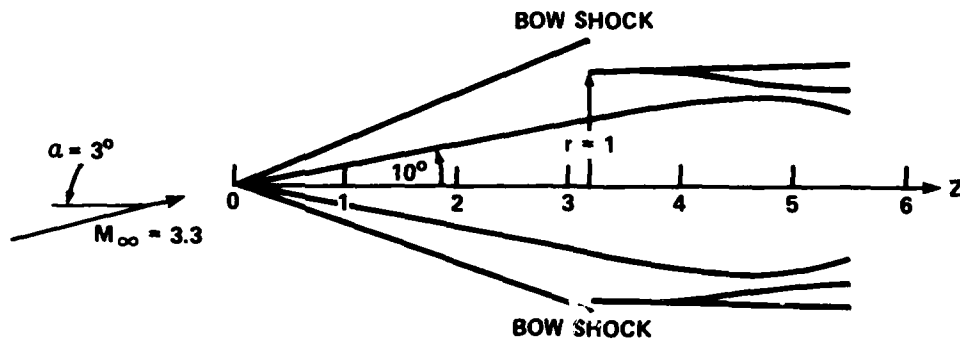


FIGURE 7. COMPARISON OF MEASURED AND CALCULATED SURFACE PRESSURES.
EXPERIMENTAL DATA FROM REFERENCES 7 AND 8

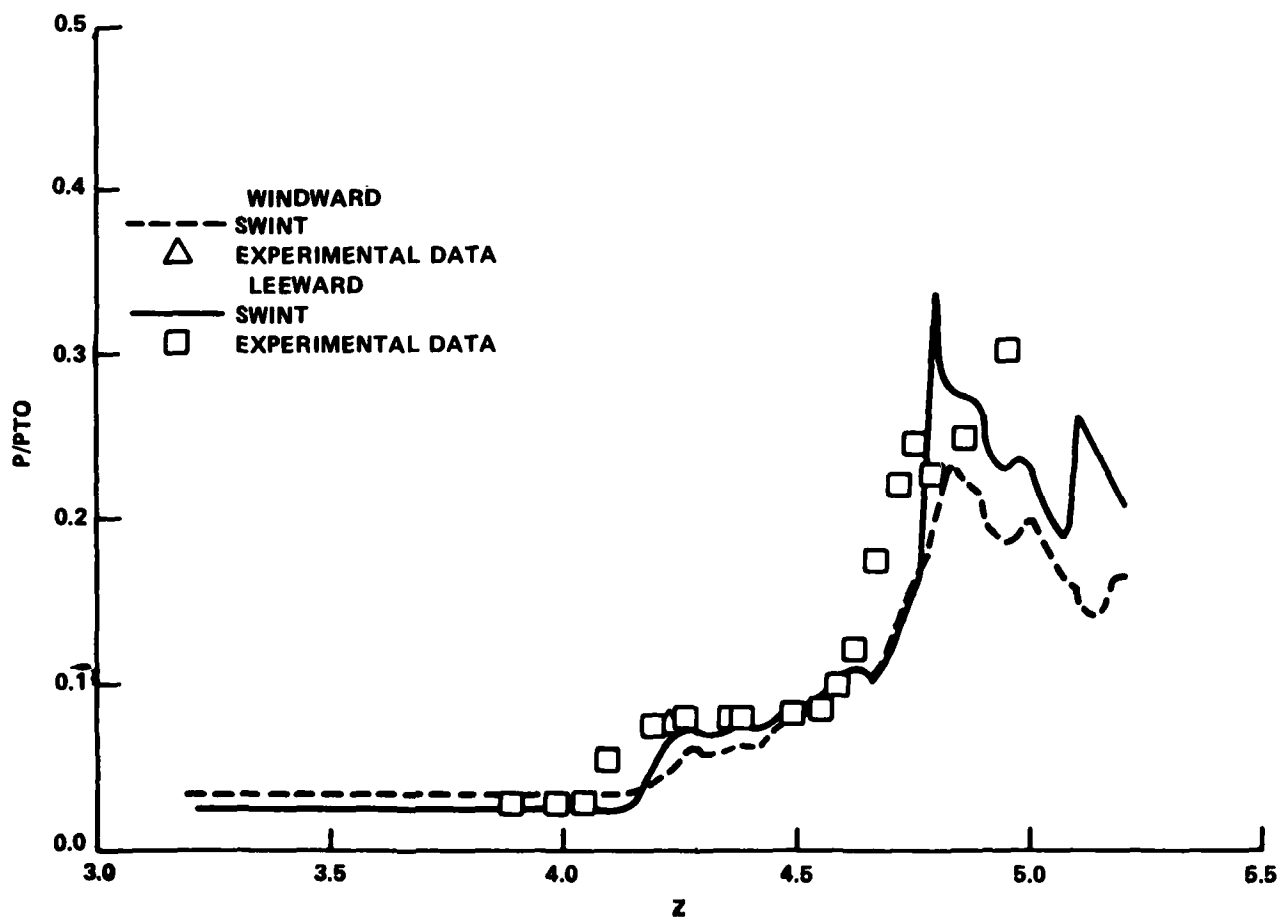
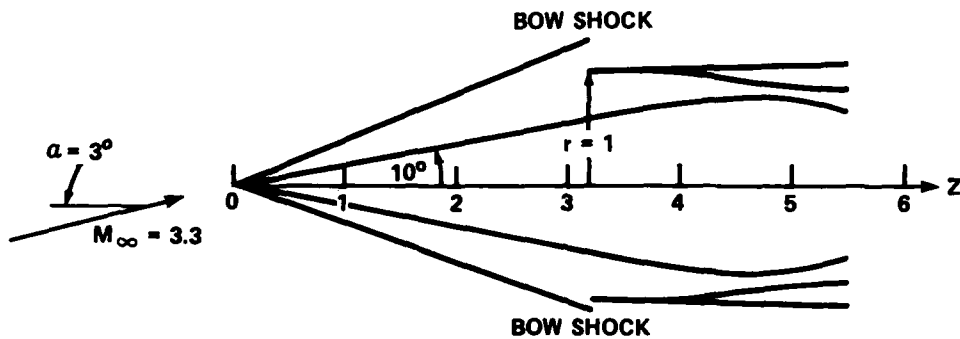
CENTERBODY STATIC PRESSURE
PRESLEY INLET, MACH - 3.30, ANGLE - 3.0

FIGURE 7. CONTINUED

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NOMENCLATURE

a	speed of sound
$b(\phi, z)$	Location of the body surface
$c(\phi, z)$	Location of bow shock
$\tilde{c}(\phi, z)$	Location of cowl surface
h	Enthalpy
H_0	Stagnation enthalpy
P	$\ln(p)$
p	pressure
p_t	recovery pressure
$\vec{q}$	Velocity vector
(r, ϕ, z)	Cylindrical coordinates (see Figure 1)
s	Entropy
(u, v, w)	Velocity components in cylindrical coordinates (see Figure 1)

(X,Y,Z)	Computational coordinates
Δz	Computational marching step
ρ	Density
∞	Free stream conditions

APPENDIX A. COWLI PROGRAM LISTING

1	PROGRAM COWLINT(INPUT=64,OUTPUT=64,TAPE5=INPUT,TAPE6=OUTPUT,	COWLINT	2
	1 TAPE3=512,TAPE11)	COWLINT	3
	C.....THIS PROGRAM REZONES THE SHOCK LAYER AT THE INLET PLANE	COWLINT	4
	C TO INCLUDE ONLY THE FLOW ENTERING THE INLET. IT CAN ALSO	COWLINT	5
5	C BE USED TO GENERATE A STARTING FLOW FOR EXTERNAL CALCULATIONS	COWLINT	6
	C DOWN STREAM OF THE INLET PLANE WHEN THE BOW SHOCK OR PORTIONS	COWLINT	7
	C OF THE BOW SHOCK ARE INSIDE THE INLET.	COWLINT	8
	C INPUT:	COWLINT	9
	C TAPE11 - SWINT RESTART TAPE AT INLET FACE	COWLINT	10
10	C BNEW,BZNEW,BPHNEW - NEW BODY SHAPE AT INLET FACE. NEED NOT	COWLINT	11
	C ALWAYS BE SPECIFIED.(SEE IBODY DESCRIPTIO	COWLINT	12
	C CNEW,CZNEW,CPHNEW - SHAPE OF OUTER BOUNDARY. NEED NOT ALWAYS	COWLINT	13
	C BE SPECIFIED(SEE ICOWL DESCRIPTION)	COWLINT	14
	C IBODY - 0 : FLOW AT INNER BOUNDARY IS NOT ALTERED.	COWLINT	15
15	C BNEW,BZNEW,BPHNEW NEED NOT BE SPECIFIED.	COWLINT	16
	C 1 : FLOW AT INNER BOUNDARY IS TURNED TANGENT TO	COWLINT	17
	C THE SURFACE. BNEW,BZNEW,BPHNEW MUST BE SPECIFIED.	COWLINT	18
	C 2 : INNER BODY FLOW QUANTITIES ARE PRESCRIBED ALONG	COWLINT	19
	C EACH M PLANE. BNEW,BZNEW,BPHNEW MUST BE SPECIFIED	COWLINT	20
20	C ICOWL MUST BE EQUAL 0 AND DDZ MUST BE PRESCRIBED.	COWLINT	21
	C ICOWL - 0 : FLOW AT OUTER BOUNDARY IS NOT ALTERED.	COWLINT	22
	C CNEW,CZNEW,CPHNEW MAY BE SPECIFIED, OTHERWISE	COWLINT	23
	C OLD VALUES ARE USED.	COWLINT	24
	C 1 : FLOW AT OUTER BOUNDARY TURNED TANGENT TO SURFACE	COWLINT	25
25	C CNEW,CZNEW AND CPHNEW MUST BE SPECIFIED.	COWLINT	26
	C 2 : OUTER BOUNDARY IS A MACH CONE. CNEW,CPHNEW MUST	COWLINT	27
	C BE SPECIFIED. CNEW MUST BE GREATER THEN C FOR ALL	COWLINT	28
	C PLANES.	COWLINT	29
	C AREA - REFERENCE AREA: DEFAULT IS BODY CROSSECTIONAL AREA	COWLINT	30
30	C AT THE INLET ENTRANCE PLANE.	COWLINT	31
	C RCLUST - R DIRECTION CLUSTERING: DEFAULT IS UNIFORM MESH.	COWLINT	32
	C DDZ - DISTANCE FROM COWL LIP TO STARTING PLANE. ONLY NEEDED	COWLINT	33
	C FOR IBODY=2.	COWLINT	34
	C IPRINT - 0 : DO NOT PRINT FLOW FIELD.	COWLINT	35
35	C 1 : PRINT FINAL FLOW FIELD. (DEFAULT)	COWLINT	36
	C 2 : PRINT ORIGINAL AND FINAL FLOW FIELD.	COWLINT	37
	C 3 : PRINT ORIGINAL,FINAL FLOW FIELD AND JUMP MESSAGE	COWLINT	38
	C OUTPUT:	COWLINT	39
	C TAPE3 - RESTART TAPE FOR SWINT	COWLINT	40
40	C COMMON NC,MC,K,IPRINT,PINF,DINF,PHIO,P1,RAD,Z,BZZ,GAMMA,MOT2,BMAX,	CONST	2
	C 1S1,S2,C1,C2,CONVR,PTINF,	CONST	3
	C 1 C(100),CZ(100),CPHI(100),R(25,100),D(25,100),P(25,100),U(25,100),	CONST	4
	C 1 V(25,100),W(25,100),PHI(100)	CONST	5
	C 2 ,BNEW(100),CNEW(100),DUMV(26),DUMP(26),DUMU(26),DUMW(26),DUMD(26)	CONST	6
45	C 3 ,BZNEW(100),BPHNEW(100),CZNEW(100),CPHNEW(100),ROLD(26)	CONST	7
	C 4 ,PTR(25,100),RCLUST(100),PHIL(102)	CONST	8
	C COMMON/RGASS/AX,MX,GX	RGASS	2
	C REAL MX,MY,MZ,MXZ,MYZ,MZZ	COWLINT	43
	C NAMELIST/INPUTS/BNEW,BZNEW,BPHNEW,CNEW,CZNEW,CPHNEW	COWLINT	44
50	C 1 ,IBODY,ICOWL,AREF,RCLUST,DDZ,IPRINT	COWLINT	45
	C.....INITIALIZE DATA	COWLINT	46
	C DO 5 M=1,25	COWLINT	47
	C BNEW(M)=0.	COWLINT	48
	C CNEW(M)=0.	COWLINT	49
55	C 5 CONTINUE	COWLINT	50
	C DDZ=0.	COWLINT	51
	C IPRINT = 1	COWLINT	52
	C PTRTOT = 0.0	COWLINT	53
	C PTRINL = 0.0	COWLINT	54
60	C AINL = 0.0	COWLINT	55
	C AREAT = 0.0	COWLINT	56
	C FADDA = 0.0	COWLINT	57
	C FADDN = 0.0	COWLINT	58
	C FADDY = 0.0	COWLINT	59
65	C FADDAT=0.	COWLINT	60
	C FADDNT=0.	COWLINT	61
	C FADDYT=0.	COWLINT	62
	C SUMINM=0.	COWLINT	63
	C ICOWL = 1	COWLINT	64
70	C IBODY=0	COWLINT	65
	C AREF = 0.0	COWLINT	66
	C	COWLINT	67
	C.....READ FLOW FIELD	COWLINT	68
	C	COWLINT	69
75	C READ(11)NC,MC,ATTACK,YAW,ACH,GAMMA,PINF,DINF,PHIO,K,Z,	COWLINT	70
	C 2 FN,FY,FA,MX,MY,MZ,FNZ,FYZ,FAZ,MXZ,MYZ,MZZ,	COWLINT	71
	C 3 (PHI(M),C(M),CZ(M),CPHI(M),M=1,MC)	COWLINT	72
	C 4 , ((R(N,M),U(N,M),V(N,M),W(N,M),P(N,M),D(N,M),	COWLINT	73

80	5 M = 1,MC),N=1,NC)	COWLINT	74
	IF (EOF(11))1000.25	COWLINT	75
	C	COWLINT	76
	25 CONTINUE	COWLINT	77
	DO 3 N=1,NC	COWLINT	78
	RCLUST(N)=(N-1.)/(NC-1.)	COWLINT	79
85	3 CONTINUE	COWLINT	80
	C	COWLINT	81
	C.....READ GEOMETRY DATA	COWLINT	82
	READ(5,INPUTS)	COWLINT	83
	WRITE(6,INPUTS)	COWLINT	84
90	PI = 4.0 * ATAN(1.0)	COWLINT	85
	CONVR=180./PI	COWLINT	86
	ATWO=0.	COWLINT	87
	MP2=MC+2	COWLINT	88
	MP1=MC+1	COWLINT	89
95	DO 10 M=2,MP1	COWLINT	90
	PHIL(M)=PHI(M-1)	COWLINT	91
	10 CONTINUE	COWLINT	92
	PHIL(1)=PHI(1)	COWLINT	93
	PHIL(MP2)=PHI(MC)	COWLINT	94
100	IF (ABS(PHIO-2*PI).GT.1.E-06)GO TO 11	COWLINT	95
	PHIL(1)=-PHI(2)	COWLINT	96
	PHIL(MP2)=2.*PI	COWLINT	97
	11 CONTINUE	COWLINT	98
	C.....COMPUTE REFERENCE AREA	COWLINT	99
105	DO 4 M = 1, MC	COWLINT	100
	IM1 = 0	COWLINT	101
	IMC = 2	COWLINT	102
	ATWO = ATWO + 0.25 * (PHIL(M+IMC)-PHIL(M-IM1)) * R(1,M)*R(1,M)	COWLINT	103
	4 CONTINUE	COWLINT	104
110	ATWO = ATWO * 2.0 * PI / PHIO	COWLINT	105
	2 CONTINUE	COWLINT	106
	IF (AREF.EQ.0.0)AREF=ATWO	COWLINT	107
	C.....CALCULATE CONSTANTS	COWLINT	108
115	GX=GAMMA	COWLINT	109
	NCM1=NC-1	COWLINT	110
	RAD=PI/180.	COWLINT	111
	ALPHA=ATTACK*RAD	COWLINT	112
	S4=SIN(ALPHA)	COWLINT	113
	VINF=SQRT(GAMMA*PINF/DINF)*ACH	COWLINT	114
120	YAWR = YAW * RAD	COWLINT	115
	WINF = VINF * COS(YAWR) * COS(ALPHA)	COWLINT	116
	V1INF = VINF * COS(YAWR) * S4	COWLINT	117
	V2INF = -VINF * SIN(YAWR)	COWLINT	118
	PTINF = PINF*(1.0 + (GAMMA-1.0) / 2.0 * ACH**2.0) ** (GAMMA/	COWLINT	119
125	1 (GAMMA-1.0))	COWLINT	120
	MO=GAMMA*PINF/((GAMMA-1.)*DINF)+VINF**2/2.	COWLINT	121
	CALL RGAS(PINF,DINF,SINF)	COWLINT	122
	C.....PRINT FREE STREAM CONDITIONS	COWLINT	123
	WRITE(6,5000)ACH,ATTACK,YAW,VINF,PINF,DINF,MO,SINF,PTINF	COWLINT	124
130	5000 FORMAT(1H1,5X,38H***** FREE STREAM CONDITIONS *****,/	COWLINT	125
	1,15X,15HACH NUMBER ,F15.7,/,	COWLINT	126
	2,15X,15HANGLE OF ATTACK,F15.7,/,	COWLINT	127
	3,15X,15HYAW ANGLE ,F15.7,/,	COWLINT	128
	4,15X,15HVINF ,F15.7,/,	COWLINT	129
135	5,15X,15HPINF ,F15.7,/,	COWLINT	130
	6,15X,15HDINF ,F15.7,/,	COWLINT	131
	7,15X,15HMO ,F15.7,/,	COWLINT	132
	8,15X,15HSINF ,F15.7,/,	COWLINT	133
	9,15X,15HPTINF ,F15.7,///)	COWLINT	134
140	C.....PROBLEM SET UP	COWLINT	135
	WRITE(6,5001)NC,MC,IBODY,DDZ,ICOWL	COWLINT	136
	WRITE(6,5003)(N,RCLUST(N),N=1,NC)	COWLINT	137
	5003 FORMAT(6X,27H***** CLUSTERING *****,/	COWLINT	138
	1 6X,1MN,7X,10MCLUSTERING,/,	COWLINT	139
145	2 (2X,15,F15.7))	COWLINT	140
	WRITE(6,5005)	COWLINT	141
	5005 FORMAT(///)	COWLINT	142
	5001 FORMAT(1M0,5X,30H***** PROBLEM SET UP *****,/	COWLINT	143
	1 ,15X,15HNC ,15,/,	COWLINT	144
150	2 ,15X,15HMC ,15,/,	COWLINT	145
	3 ,15X,15HIBODY ,15,/,	COWLINT	146
	4 ,15X,15HDDZ ,F10.5,/,	COWLINT	147
	5 ,15X,15HICOWL ,15,///)	COWLINT	148
	HOT2=2.*MO	COWLINT	149
155	E1 = PINF / DINF / WINF	COWLINT	150
	E3 = 0.5 * DINF * VINF*VINF * AREF	COWLINT	151
	C.....MAKE NEW GEOMETRY AXISYMETRIC IF ONLY ONE VALUE IS GIVEN	COWLINT	152
	DO 6 M=2,MC	COWLINT	153
	IF (CNEW(M).GT.0.)GO TO 7	COWLINT	154
160	CNEW(M)=CNEW(M-1)	COWLINT	155
	CZNEW(M)=CZNEW(M-1)	COWLINT	156

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      CPHNEW(M)=CPHNEW(M-1)
      CONTINUE
      IF(BNEW(M).GT.0.)GO TO 6
165      BNEW(M)=BNEW(M-1)
      BZNEW(M)=BZNEW(M-1)
      BPHNEW(M)=BPHNEW(M-1)
      CONTINUE
      6
      C.....USE TAPE READ GEOMETRY IF NO VALUE IS GIVEN
170      DO 8 M=1,MC
      IF(BNEW(M).LT.0.)BNEW(M)=R(1,M)
      IF(CNEW(M).GT.0.)GO TO 8
      CNEW(M)=C(M)
      CZNEW(M)=CZ(M)
175      CPHNEW(M)=CPHI(M)
      8 CONTINUE
      WRITE(6,5002)(M,BNEW(M),BZNEW(M),BPHNEW(M),CNEW(M),
      ) CZNEW(M),CPHNEW(M),M=1,MC)
      5002 FORMAT('00',5X,29H***** COWL GEOMETRY *****/,
180      1 5X,1HM,12X,1MB,13X,2MBZ,11X,4MBPHI,14X,1MC,13X,2MCZ,11X,4MCPHI/
      2 ('0',15,6F15.7))
      C.....PRINT ORIGINAL FLOW FIELD
      IF(IPRINT.GT.1)WRITE(6,5006)
185      5006 FORMAT(1H1,10X,19HORIGINAL FLOW FIELD)
      IF(IPRINT.GT.1)CALL OUTPUT(ACH,ATTACK,YAW)
      C
      C
      C.....PRE-COWL FLOW FIELD, SHOCK IS OUTER BOUNDARY
190      C
      DO 31 M = 1, MC
      IM0 = 1
      IMC = 2
      IFLAG = 0
195      C.....LOCAL VALUES ARE CALCULATED
      C.....SOME ARE AREA WEIGHTED AND SUMMED
      DO 30 M = 1, MC
      AX = SQRT(GX*P(N,M)/D(N,M))
      AMACH = SQRT(U(N,M)**2.0 + V(N,M)**2.0 + W(N,M)**2.0)/AX
200      PTR(N,M) = P(N,M) * (1.0 + (GAMMA-1.0)/2.0 *
      AMACH**2.0) ** (GAMMA/(GAMMA-1.0))
      IN1 = 1
      INC = 1
      IF (N.EQ. 1) IN1 = 0
      IF (N.EQ. MC) INC = 0
205      C.....WEIGHTING AREA FOR LOCAL POINT WITH ADJUSTMENTS
      C.....FOR FIELD EDGES
      AREA = 0.25 * (PHIL(M+IMC)-PHIL(M-IM1)) * ((0.5*(R(N,M)+
      R(N+INC,M)))**2.0 - (0.5*(R(N-1,M)+R(N,M)))**2.0)
210      AREAT = AREAT + AREA
      E2 = D(N,M) * W(N,M) * AREA
      V1 = -U(N,M) * COS(PHI(M)) + V(N,M) * SIN(PHI(M))
      V2 = U(N,M) * SIN(PHI(M)) + V(N,M) * COS(PHI(M))
      FADDA = FADDA + ((WINF-W(N,M)) * E1 - P(N,M)/D(N,M)
215      /W(N,M)) * E2
      FADDNT = FADDNT + (V1INF-V1) * E2
      FADDT = FADDT + (V2INF-V2) * E2
      PTRTOT = PTRTOT + PTR(N,M) * AREA
      IF(R(N,M).LE.CNEW(M))GO TO 29
220      C.....ELEMENT INTERSECTED BY COWL
      IF (N.EQ. 1) GO TO 29
      C.....CONDITION WHEN INSIDE SPILLAGE REGION
      C.....BUT NOT IN COWL VICINITY
      IF (IFLAG.EQ. 1) GO TO 28
225      C.....SPILLAGE MOMENTUM ADDITION (+ OR - DEPENDING ON WHICH
      C.....LOCAL POINT AREA THE COWL IS IN)
      AREAB = 0.25 * (PHIL(M+IMC)-PHIL(M-IM1)) * ((0.5*(R(N,M)+
      R(N+1,M)))**2.0 - CNEW(M)**2.0)
230      NB = N
      IF (0.5*(R(N,M)+R(N-1,M)) .GT. CNEW(M)) NB = N - 1
      E2 = D(NB,M) * W(NB,M) * AREAB
      V1 = -U(NB,M) * COS(PHI(M)) + V(NB,M) * SIN(PHI(M))
      V2 = U(NB,M) * SIN(PHI(M)) + V(NB,M) * COS(PHI(M))
      FADDA = FADDA + ((WINF-W(NB,M)) * E1 - P(NB,M)/D(NB,M)
235      /W(NB,M)) * E2
      FADDN = FADDN + (V1INF-V1) * E2
      FADDT = FADDT + (V2INF-V2) * E2
      SUMINM = SUMINM - D(NB,M) * W(NB,M) * AREAB
      PTRINL = PTRINL - PTR(NB,M) * AREAB
240      AINL = AINL - AREAB
      IFLAG = 1
      C.....WHOLE LOCAL AREA MOMENTUM IS SUMMED
      C.....OUTSIDE COWL
      28 CONTINUE

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245      E2 = D(N,M) * W(N,M) * AREA
          V1 = -U(N,M) * COS(PHI(M)) + V(N,M) * SIN(PHI(M))
          V2 = U(N,M) * SIN(PHI(M)) + V(N,M) * COS(PHI(M))
          FADDA = FADDA + ((WINF-W(N,M)) * E1 - P(N,M)/D(N,M)
1          /W(N,M)) * E2
250      FADDN = FADDN + (V1INF-V1) * E2
          FADDY = FADDY + (V2INF-V2) * E2
          GO TO 30
C.....INSIDE COWL
29      SUMINM = SUMINM + D(N,M) * W(N,M) * AREA
          PTRINL = PTRINL + PTR(N,M) * AREA
255      AINL = AINL + AREA
          30 CONTINUE
          IF(R(NC,M).GT.CNEW(M))GO TO 31
C.....SHOCK INSIDE COWL
260      AREA=.25*(PHIL(M+IMC)-PHIL(M-IM1))*(CNEW(M)**2-R(NC,M)**2)
          SUMINM=SUMINM+DINF*WINF*AREA
          PTRINL=PTRINL+PTINF*AREA
          AINL=AINL+AREA
          31 CONTINUE
265 C.....TOTAL FORCES
          FADDAT=FADDAT*2.*PI/PHIO
          FADDNT=FADDNT*2.*PI/PHIO
          IF(ABS(PHIO-2.*PI).GT.1.E-06)FADDYT=0.
          IF(ABS((PHIO-PI)*(PHIO-2.*PI)).GT.1.E-06)FADDNT=0.
270      FAA=FA*ATWO*PINF
          ERRA=(FADDAT-FAA)/FAA*100.
          ERRN=(FADDNT-FN)/SIGN(AMAX1(ABS(FN),1.E-08),FN)*100.
          ERRY=(FADDYT-FY)/SIGN(AMAX1(ABS(FY),1.E-08),FY)*100.
C.....INDUCED DRAG
275      FADDA=FADDA*2.*PI/(PHIO*E3)
          FADDN=FADDN*2.*PI/(PHIO*E3)
          FADDY=FADDY/E3
          IF(ABS(PHIO-2.*PI).GT.1.E-06)FADDY=0.
          IF(ABS((PHIO-PI)*(PHIO-2.*PI)).GT.1.E-06)FADDN=0.
280 C.....TOTAL PNESSURE RECOVERY DATA PRINTED
          PR = PTRTOT / AREAT
          PRINL = PTRINL / AINL
          AREAT=AREAT*2.*PI/PHIO
          AINL=AINL*2.*PI/PHIO
285      SUMINM=SUMINM*2.*PI/PHIO
          WRITE (6,2000)
2000      FORMAT(34HINLET PLANE FLOW FIELD PARAMETERS)
          PRINL=PRINL/PTINF
          PRR=PR/PTINF
290      WRITE(6,2010)PRR,PRINLR,AREAT,AINL,SUMINM,FADDA,ERRA,
          1 FADDN,ERRN,FADDY,ERRY,AREF
2010      FORMAT(1H0,10X,44HSHOCK LAYER AVERAGE PRESSURE RECOVERY RATIO ,
          1 F15.7/,
          1 10X,45H INLET AVERAGE PRESSURE RECOVERY RATIO ,F15.7/,
295      2 10X,45H SHOCK LAYER CROSSECTIONAL AREA ,F15.7/,
          3 10X,45H INLET ENTRANCE CROSSECTIONAL AREA ,F15.7/,
          4 10X,45H MASS CAPTURED BY THE INLET ,F15.7/,
          4 10X,45H ADDITIVE AXIAL FORCE COEFFICIENT ,F15.7,
          4 4X,29H TOTAL DRAG ERROR ,F10.4,4H 0/0,/,
300      5 10X,45H ADDITIVE NORMAL FORCE COEFFICIENT ,F15.7,
          5 4X,29H TOTAL NORMAL FORCE ERROR ,F10.4,4H 0/0,/,
          6 10X,45H ADDITIVE YAW FORCE COEFFICIENT ,F15.7,
          6 4X,29H TOTAL YAW FORCE ERROR ,F10.4,4H 0/0,/,
          7 10X,45H REFERENCE AREA ,F15.7/1H1)
305      DO 45 M=1,MC
C.....FREE STREAM FLOW FIELD VALUES ASSIGNED BEYOND SHOCK
          ROLD(NC+1)=2.*R(NC,M)-R(NCM1,M)
          S1=SIN(PHI(M))
          C1=COS(PHI(M))
310      DUMP(NC+1)=PINF
          DUMD(NC+1)=DINF
          DUMU(NC+1)=-VINFS4*C1
          DUMV(NC+1)=VINFS4*S1
          DUMW(NC+1)=SQRT(VINF*VINF-DUMU(NC+1)**2-DUMV(NC+1)**2)
315      DO 50 N=1,NC
C.....PRE-COWL FLOW FIELD STORED
          ROLD(N)=R(N,M)
          DUMP(N)=P(N,M)
          DUMD(N)=D(N,M)
          DUMU(N)=U(N,M)
          DUMV(N)=V(N,M)
          DUMW(N)=W(N,M)
320 C.....NEW COMPUTATIONAL GRID INSIDE COWL
          R(N,M) = BNEW(M) + (CNEW(M)-BNEW(M)) * RCLUST(N)
325      50 CONTINUE

```

	DO 60 N=1,NC	COWLINT 321
	DO 65 J=1,NC	COWLINT 322
	C.....DETERMINE IF R(N,M) IS INSIDE OLD SHOCK	COWLINT 323
	IF ((R(N,M)-ROLD(J))*R(N,M)-ROLD(J+1)).GT.0.1)GO TO 65	COWLINT 324
330	JJ=J	COWLINT 325
	GO TO 70	COWLINT 326
	65 CONTINUE	COWLINT 327
	C.....OUTSIDE OLD SHOCK, FREE STREAM (F) VALUES GIVEN TO R(N,M)	COWLINT 328
	P(N,M)=PINF	COWLINT 329
335	D(N,M)=DINF	COWLINT 330
	U(N,M)=-VINF*S4*C1	COWLINT 331
	V(N,M)=VINF*S4*S1	COWLINT 332
	W(N,M)=SQRT(VINF*VINF-U(N,M)**2-V(N,M)**2)	COWLINT 333
	GO TO 60	COWLINT 334
340	70 CONTINUE	COWLINT 335
	C.....INSIDE OLD SHOCK, INTERPOLATED (I) VALUES GIVEN TO R(N,M)	COWLINT 336
	JJ1=JJ+1	COWLINT 337
	FAC=(R(N,M)-ROLD(JJ1))/(ROLD(JJ1)-ROLD(JJ))	COWLINT 338
	U(N,M)=DUMU(JJ1)+DUMU(JJ1)-DUMU(JJ1)*FAC	COWLINT 339
345	V(N,M)=DUMV(JJ1)+DUMV(JJ1)-DUMV(JJ1)*FAC	COWLINT 340
	P(N,M)=DUMP(JJ1)+DUMP(JJ1)-DUMP(JJ1)*FAC	COWLINT 341
	D(N,M)=DUMD(JJ1)+DUMD(JJ1)-DUMD(JJ1)*FAC	COWLINT 342
	W(N,M)=SQRT(HOT2-P(N,M)*GAMMA*2./((GAMMA-1.)*D(N,M))	COWLINT 343
	-U(N,M)**2-V(N,M)**2)	COWLINT 344
350	1 CONTINUE	COWLINT 345
	IF (IBODY.EQ.0)GO TO 41	COWLINT 346
	C.....BODY JUMP (VALID ONLY FOR AN UNSWEPT LEADING EDGE)	COWLINT 347
	BZO=(U(1,M)-V(1,M)*BPHNEW(M)/BNEW(M))/W(1,M)	COWLINT 348
	DELHZ=BZO-BZNEW(M)	COWLINT 349
355	SIDE=ASIN(1./ACH)	COWLINT 350
	IF (ABS(DELHZ).LE.1.E-06)GO TO 43	COWLINT 351
	DELBP=0.	COWLINT 352
	SIDE = 1.	COWLINT 353
	CALL JUMPST(DELBP,DELHZ,M,1,BNEW(M),BZNEW(M),BPHNEW(M),SIDE)	COWLINT 354
360	U(1,M) = SIGN (U(1,M), BZNEW(M))	COWLINT 355
	IF (IBODY.EQ.1)GO TO 41	COWLINT 356
	C.....UNIFORM FLOW FROM BODY TO SHOCK	COWLINT 357
	43 CONTINUE	COWLINT 358
	CZNEW(M)=TAN(SIDE*ATAN(BZNEW(M)))	COWLINT 359
365	CNEW(M)=BNEW(M)*DDZ*(CZNEW(M)-BZNEW(M))	COWLINT 360
	CPHNEW(M)=BPHNEW(M)	COWLINT 361
	Z=Z+DDZ	COWLINT 362
	ICOWL=0	COWLINT 363
	DO 42 N=2,NC	COWLINT 364
370	R(N,M)=BNEW(M)+(CNEW(M)-BNEW(M))*RCLUST(N)	COWLINT 365
	U(N,M)=U(1,M)	COWLINT 366
	V(N,M)=V(1,M)	COWLINT 367
	W(N,M)=W(1,M)	COWLINT 368
	P(N,M)=P(1,M)	COWLINT 369
375	D(N,M)=D(1,M)	COWLINT 370
	42 CONTINUE	COWLINT 371
	41 CONTINUE	COWLINT 372
	IF (ICOWL.EQ.1)GO TO 44	COWLINT 373
	C.....COMPUTE CZ FOR MACH ZONE	COWLINT 374
380	IF (ICOWL.EQ.2)	COWLINT 375
	1 CZNEW(M)=(U(NC,M)-CPHNEW(M)*V(NC,M)/CNEW(M)	COWLINT 376
	2 *SQRT(GAMMA*P(NC,M)/D(NC,M)))/W(NC,M)	COWLINT 377
	GO TO 45	COWLINT 378
	44 CONTINUE	COWLINT 379
385	C.....COWL JUMP(VALID ONLY FOR UNSWEPT LEADING EDGE)	COWLINT 380
	BZO=(U(NC,M)-V(NC,M)*CPHNEW(M)/CNEW(M))/W(NC,M)	COWLINT 381
	DELHZ=BZO-CZNEW(M)	COWLINT 382
	IF (ABS(DELHZ).LE.1.E-6)GO TO 45	COWLINT 383
	DELBP=0.	COWLINT 384
390	SIDE=-1.	COWLINT 385
	CALL JUMPST(DELBP,DELHZ,M,NC,CNEW(M),CZNEW(M),CPHNEW(M),SIDE)	COWLINT 386
	U(NC,M) = SIGN (U(NC,M), CZNEW(M))	COWLINT 387
	45 CONTINUE	COWLINT 388
	WRITE(3)NC,MC,ATTACK,YAW,ACH,GAMMA,PINF,DINF,PHIO,K,Z	COWLINT 389
395	1 ,FN,FY,FA,MX,MY,MZ,FNZ,FYZ,FAZ,MXZ,MYZ,MZZ	COWLINT 390
	2 , (PHI(M),CNEW(M),CZNEW(M),CPHNEW(M),M=1,MC)	COWLINT 391
	3 , ((R(N,M),U(N,M),V(N,M),W(N,M),P(N,M),D(N,M),M=1,MC),N=1,NC)	COWLINT 392
	C.....PRINT FINAL FLOW FIELD DATA	COWLINT 393
	WRITE(6,5007)	COWLINT 394
400	5007 FORMAT(1H1,10X,16HFINAL FLOW FIELD)	COWLINT 395
	IF (IPRINT.GT.0)CALL OUTPUT(ACH,ATTACK,YAW)	COWLINT 396
	STOP" PROGRAM START"	COWLINT 397
	1000 CONTINUE	COWLINT 398
	STOP" TAPE READIN ERROR"	COWLINT 399
405	END	COWLINT 400

1	SUBROUTINE OUTPUT(ACH,ATTACK,YAW)	OUTPUT	2
	COMMON NC,MC,K,IPRINT,PINF,DINF,PHIO,PI,RAD,Z,BZZ,GAMMA,MOT2,BMAX,	COMST	2
	1S1,S2,C1,C2,CONVR,PTINF,	COMST	3
5	1 C(100),CZ(100),CPHI(100),R(25,100),D(25,100),P(25,100),U(25,100),	COMST	4
	1 V(25,100),W(25,100),PHI(100)	COMST	5
	2 ,BNEW(100),CNEW(100),DUMV(26),DUMP(26),DUMU(26),DUMW(26),DUMD(26)	COMST	6
	3 ,BZNEW(100),BPHNEW(100),CZNEW(100),CPHNEW(100),ROLD(26)	COMST	7
	4 ,PTR(25,100),RCLUST(100),PHIL(102)	COMST	8
10	COMMON/RGASS/AX,HX,GX	RGASS	2
	WRITE (6,3000) ACH,ATTACK,YAW	OUTPUT	5
	3000 FORMAT(* MACH NO IS*,1PE15.7,5X,*ANGLE OF ATTACK IS*,1PE15.7,5X,	OUTPUT	6
	1 * ANGLE OF SIDESLIP IS*,1PE15.7)	OUTPUT	7
	DO 100 M=1,MC	OUTPUT	8
	PHID=PHI(M)*CONVR	OUTPUT	9
15	WRITE (6,3010) M,PHID	OUTPUT	10
	3010 FORMAT(*0PLANE*14* ANGLE IS*F7.2* DEGREES*)	OUTPUT	11
	WRITE (6,3600) K,Z,BNEW(M),BZNEW(M),BPHNEW(M),CNEW(M),	OUTPUT	12
	1 CZNEW(M),CPHNEW(M)	OUTPUT	13
20	3600 FORMAT(* STATION*IS,4X*Z IS*1PE15.7,4X*B IS*1PE15.7,4X*BZ IS*	OUTPUT	14
	1 1PE15.7,4X*BPHI IS*1PE15.7/7X*C IS*1PE15.7,4X*CZ IS*1PE15.7,	OUTPUT	15
	1 4X,CPHI IS*1PE15.7)	OUTPUT	16
	WRITE (6,3700)	OUTPUT	17
	3700 FORMAT (/7X*R*12X*W*12X*U*12X*V*12X*P*10X*PT/PT0*8X*RM0*11X,	OUTPUT	18
	1 *S*12X,*M*)	OUTPUT	19
25	DO 90 N=1,NC	OUTPUT	20
	L=NC-N+1	OUTPUT	21
	IF (P(L,M).GT.0..AND.D(L,M).GT.0.) GO TO 80	OUTPUT	22
	AMACH=SX/XINDEF	OUTPUT	23
	GO TO 85	OUTPUT	24
30	80 CALL RGAS(P(L,M),D(L,M),SX)	OUTPUT	25
	AMACH=SQRT(U(L,M)**2+V(L,M)**2+W(L,M)**2)/AX	OUTPUT	26
	85 CONTINUE	OUTPUT	27
	PTRL=P(L,M)*(1+.5*(GAMMA-1.)*AMACH**2)**(GAMMA/(GAMMA-1.))/PTINF	OUTPUT	28
	WRITE (6,3400) R(L,M),W(L,M),U(L,M),V(L,M),P(L,M),PTRL,	OUTPUT	29
35	1 D(L,M),SX,AMACH	OUTPUT	30
	3400 FORMAT(1P9E13.4)	OUTPUT	31
	90 CONTINUE	OUTPUT	32
	100 CONTINUE	OUTPUT	33
	RETURN	OUTPUT	34
40	END	OUTPUT	35

1	SUBROUTINE RGAS(PX,RX,SX)	PGAS	2
	COMMON/RGASS/AX,HX,GX	RGASS	2
C	SHORTENED VERSION OF RGAS TO COMPUTE ONLY PERFECT GAS PROPERTIES	PGAS	4
C	PX=PRESSURE RX=DENSITY SX=ENTROPY	PGAS	5
5	C HX=ENTHALPY AX=SOUND SPEED	PGAS	6
	SX = ALOG(PX) - GX * ALOG(RX)	PGAS	7
	HX=PX/RX*(1+.1./(GX-1.))	PGAS	8
	AX=SQRT(GX*PX/RX)	PGAS	9
10	RETURN	PGAS	10
	END	PGAS	11

1	SUBROUTINE JUMPST(DBP,DBZ,MB,NN,RR,ETAP,SIP,POM)	JUMPST	2
	JUMPST COMPUTES JUMPS CORRESPONDING TO DISCONTINUITIES IN BZ	JUMPST	3
C	AND/OR BPHI FOR PERFECT GAS ONLY.	JUMPST	4
5	C	JUMPST	5
	COMMON NC,MC,K,IPRINT,PINF,DINF,PHIO,PI,RAD,Z,BZZ,GAMMA,MOT2,BMAX,	JUMPST	6
	1S1,S2,C1,C2,CONVR,PTINF,	COMST	2
	1 C(100),CZ(100),CPHI(100),R(25,100),D(25,100),P(25,100),U(25,100),	COMST	3
	1 V(25,100),W(25,100),PHI(100)	COMST	4
10	2 ,BNEW(100),CNEW(100),DUMV(26),DUMP(26),DUMU(26),DUMW(26),DUMD(26)	COMST	5
	3 ,BZNEW(100),BPHNEW(100),CZNEW(100),CPHNEW(100),ROLD(26)	COMST	6
	4 ,PTR(25,100),RCLUST(100),PHIL(102)	COMST	7
	COMMON/RGASS/AX,HX,GX	COMST	8
	DATA (INT=18)	RGASS	2
15	VW = V(NN,MB)	JUMPST	9
	PH = P(NN,MB)	JUMPST	10
	DW = D(NN,MB)	JUMPST	11
	WW = W(NN,MB)	JUMPST	12
	UW=U(NN,MB)	JUMPST	13
20	CALL RGAS(PW,DW,SW)	JUMPST	14
	ASQW=AX*AX	JUMPST	15
	PHID=PHI(MB)/RAD	JUMPST	16
	IF (IPRINT.EQ.3)WRITE (6,3100) NN, PHID, K, Z	JUMPST	17
	3100 FORMAT (1H0,*JUMP IS CALLED FOR AT RADIAL POINT*,14,5X,	JUMPST	18
25	1 *PHI IS*,F7.2,5X,*K IS*,14,5X,*Z IS*,1PE15.6)	JUMPST	19
	IF (IPRINT.EQ.3)WRITE (6,3110)	JUMPST	20
	3110 FORMAT (1H ,30X,*THE INPUT VARIABLES ARE AS FOLLOWS*)	JUMPST	21
	IF (IPRINT.EQ.3)WRITE (6,3120) PW,DW,UW,VW,WW,SW,ASQW	JUMPST	22
		JUMPST	23

5	THETAR=ACOS(XNMP/(XNP*XNM))	JUMPST	53
	CONST=HOT2-QT**2	JUMPST	54
60	QSQ=QSM**2	JUMPST	55
	THETAR=ACOS(ABS(XNMP/(XNP*XNM)))	JUMPST	56
	THETAD=THETAR/RAD	JUMPST	57
	AMACH=SQRT(QSQ/ASQW)	JUMPST	58
	IF (AMMSQ .GE. 1.0) GO TO 10	JUMPST	59
65	C *** SUBSONIC CORNER FLOW (NO JUMPS IN P,D,S,QSQ) ***	JUMPST	60
	QSP=QSM	JUMPST	61
	GO TO 110	JUMPST	62
	10 IF (QSM*POM .LT. 0.) GO TO 20	JUMPST	63
	C *** SUPERSONIC EXPANSION CORNER ***	JUMPST	64
70	IF (IPRINT.EQ.3) WRITE (6,3140)	JUMPST	65
	3140 FORMAT(1H ,20X,*,SUPERSONIC EXPANSION CORNER WHERE*)	JUMPST	66
	IF (IPRINT.EQ.3) WRITE (6,3150) THETAD,AMACH,QT,QSM	JUMPST	67
	3150 FORMAT(1H ,22H,THETA,AMACH,QT,QSM ,1P4E15.5)	JUMPST	68
	CALL RGAS(PW,DW,DUMMY)	JUMPST	69
75	ANG=ASIN(1./AMACH)	JUMPST	70
	VPOVR=SQRT(ASQW/(CONST-2.*HX-ASQW))	JUMPST	71
	DEL=THETAR/FLOAT(INT)	JUMPST	72
	DO 15 I=1,INT	JUMPST	73
	CC=0.	JUMPST	74
80	PW0=PW	JUMPST	75
	DW0=DW	JUMPST	76
	17 DPDAL=-DW*QSQ*VPOVR	JUMPST	77
	DDDAL=DPDAL/ASQW	JUMPST	78
	CD=CC+1.	JUMPST	79
85	PW=(PW0*PW*CC+DEL*DPDAL)/CD	JUMPST	80
	DW=(DW0*DW*CC+DEL*DDDAL)/CD	JUMPST	81
	CALL RGAS(PW,DW,DUMMY)	JUMPST	82
	QSQ=CONST-2.*HX	JUMPST	83
	ASQW=AX*AX	JUMPST	84
90	VPOVR=1./SQRT(QSQ/ASQW-1.0)	JUMPST	85
	CC=CD	JUMPST	86
	IF (CC .LT. 1.5) GO TO 17	JUMPST	87
	15 CONTINUE	JUMPST	88
	QSP=SQRT(QSQ)	JUMPST	89
95	GO TO 100	JUMPST	90
	C *** SUPERSONIC COMPRESSION CORNER ***	JUMPST	91
	20 COSTH2=(XNMP/(XNP*XNM))*2	JUMPST	92
	IF (IPRINT.EQ.3) WRITE (6,3160)	JUMPST	93
	3160 FORMAT(1H ,20X,*,SUPERSONIC COMPRESSION CORNER WHERE*)	JUMPST	94
100	IF (IPRINT.EQ.3) WRITE (6,3150) THETAD,AMACH,QT,QSM	JUMPST	95
	C *** (PERFECT GAS OBLIQUE SHOCK RELATIONS) ***	JUMPST	96
	SINTH2=1.-COSTH2	JUMPST	97
	AM4=AMMSQ**2	JUMPST	98
	AM2=AMMSQ	JUMPST	99
105	C1=-(AM2+2.)/AM2+GAMMA*SINTH2)	JUMPST	100
	C3=-COSTH2/AM4	JUMPST	101
	C2=(2.*AM2+1.)/AM4+(.25*(GAMMA+1.))*2*(GAMMA-1.)/AM2)*SINTH2	JUMPST	102
	DUMM=C1/3.	JUMPST	103
	A=-C2+DUMM*C1	JUMPST	104
110	S8=C3-(C2-2.*C1**2/9.)*DUMM	JUMPST	105
	DDUM=SQRT(A/3.)	JUMPST	106
	DDUM1=2.*DDUM	JUMPST	107
	TEST=-.5*S8/(DDUM**3)	JUMPST	108
	IF (TEST .GE. -1.0) GO TO 25	JUMPST	109
115	IF (IPRINT.EQ.3) WRITE (6,3165)	JUMPST	110
	3165 FORMAT(1H ,20X,*,NORMAL SHOCK MODE IS USED*)	JUMPST	111
	PW0=PW	JUMPST	112
	T=AM2	JUMPST	113
	GO TO 45	JUMPST	114
120	25 XX=ACOS(TEST)/3.	JUMPST	115
	X1=COS(XX)	JUMPST	116
	X2=COS(XX+2.*PI/3.)	JUMPST	117
	X3=COS(XX+4.*PI/3.)	JUMPST	118
	IF (X1 .LT. X2) GO TO 30	JUMPST	119
125	XDUM=X1	JUMPST	120
	X1=X2	JUMPST	121
	X2=XDUM	JUMPST	122
	30 IF (X1 .LE. X3) GO TO 35	JUMPST	123
	SX=X1	JUMPST	124
130	GO TO 40	JUMPST	125
	35 IF (X3 .LE. X2) X2=X3	JUMPST	126
	SX=X2	JUMPST	127
	40 SINTH2=DDUM1*SX-DUMM	JUMPST	128
	ANG=ASIN(SQRT(SINTH2))	JUMPST	129
135	T=AM2*SINTH2	JUMPST	130
	IF (IPRINT.EQ.3) WRITE (6 , 4007) SINTH2	JUMPST	131
	4007 FORMAT (10X, * SINTH2 = *, 1PE25.14)	JUMPST	132
	45 GA2=2.*GAMMA/(GAMMA-1.)	JUMPST	133
	GD=(GAMMA-1.)/2.	JUMPST	134
140	GE=GD+1.	JUMPST	135

	69=6E/6D	JUMPST	136
	PW=PW*((6A2*T-1.)/69)	JUMPST	137
	DW=DW*(T/(T/69+1./6E))	JUMPST	138
	QSP=QSM*SQRT(1.-(T-1.0)*(6AMMA*T+1.)/(T*AM2*6E**2))	JUMPST	139
145	CALL RGAS(PW,DW,SW)	JUMPST	140
	ASQW=AX*AX	JUMPST	141
	IF (TEST .6E. -1.0) GO TO 100	JUMPST	142
	CONST=ASQW/(6AMMA-1.0)+.5*QSP**2	JUMPST	143
	PW=PW*SINHT2	JUMPST	144
150	IF (PW .6T. PW0) GO TO 75	JUMPST	145
	PW=PW0	JUMPST	146
	75 CALL RGAS(PW,DW,SW)	JUMPST	147
	ASQW=AX*AX	JUMPST	148
	QSP=-SQRT(2.*(CONST-MX))	JUMPST	149
155	100 D(NN,MB)=DW	JUMPST	150
	P(NN,MB)=PW	JUMPST	151
	110 AA1=QT/XT	JUMPST	152
	AA2=QSP*POW/(DUM*XNP)	JUMPST	153
	V(NN,MB)=AA2*(XNP2*SIN-XNMP*SIP)-AA1*DBZ	JUMPST	154
160	U(NN,MB)=ABS(AA1*XT2+AA2*(XNMP-XNP2))	JUMPST	155
	W(NN,MB)=ARS(AA1*DBP+AA2*(XNP2*ETAM-XNMP*ETAP))	JUMPST	156
	IF(IPRINT.EQ.3)WRITE (6,3170)	JUMPST	157
3170	FORMAT(1H ,30X, 'THE OUTPUT VARIABLES ARE AS FOLLOWS')	JUMPST	158
	IF(IPRINT.EQ.3)WRITE (6,3120)PW,DW,U(NN,MB),V(NN,MB),W(NN,MB),SW,	JUMPST	159
165	1 ASQW	JUMPST	160
	POW=ANG	JUMPST	161
	RETURN	JUMPST	162
	END	JUMPST	163

APPENDIX B. LISTING OF SWINT CHANGES

The modifications extending SWINT to handle inlets are given in CDC update form in this section. The listing contains directive cards *DELETE, *INSERT and *BEFORE which describe where changes are to be inserted. The directive cards identify cards in SWINT using the right hand column designators provided in Appendix B of Reference 2. The directive cards are interpreted as follows:

1. *DELETE DECK.n,DECK2.m . The cards in SWINT located between and including DECK.n and DECK2.m are deleted. The cards in the update listing occurring between this *DELETE card and the next directive card are inserted in place of the deleted cards.

2. *INSERT DECK.m . The cards in the update listing lying between this *INSERT card and the next directive are inserted following the card in the SWINT deck with identifier DECK.m .

3. *BEFORE DECK.n . The cards in the update listing lying between this *BEFORE card and the next directive are inserted before the card in SWINT with the identifier DECK.n .

The listing provided in this section also contains *CALL NAME and *DECK cards. At the location in SWINT where *CALL NAME is added, the labeled common NAME should appear. *DECK cards can be disregarded.

The update listing contains the three new subroutines COWL,COWLP and WALL2. The functions of these subroutines are analogous to those of BODY,BODYP and WALL, but apply to the cowl surface rather than the inner body surface.

```

*IDENT COWLADD
*I CCONST.5
*COMMON COWL
  COMMON /COWL/
  1 C(25), CO(25), CPHI(25), CPHIO(25), CPHPHI(25), CPHPHO(25),
  2 CZ(25), CZO(25), CZPHI(25), CZPHIO(25), CZZ(25), CZZO(25),
  3 C2M(25), C3M(25), C4M(25), C5M(25), C7M(25), ICOWL,
  4 ICOWOPT, IJMPKTC(25), IJUMPC(25), IJUMP1C(25),
  5 PZCORC(25), SC(25),
  6 C3(3), C4(3), C5(3), C7(3),
  7 PCY(3), SCY(3), VOCY(3), V2C(3)
C
*DELETE CSWINT.4
  2 ASQ(20,25), DET(20,25),
*INSERT CDOPT.5
  4 , ISWMODC, ISWSMOC, MOD1C
*O SWINT.3
  1 TAPE3=512, TAPE9, TAPE16, TAPE17=512, TAPE20, TAPE22=512
  2 , TAPE23, TAPE24)
*INSERT SWINT.10
*CALL CCOWL
*INSERT SWINT.31
  IF (ICOWL.EQ. 1) CALL COWL (-1)
*INSERT SWINT.82
  IF (ICOWL.EQ. 1) CALL WALL2 (0, M, MP, MM, KN,
  5 CUP(1,NC,M), CUP(2,NC,M), CUP(3,NC,M))
*INSERT SWINT.92
  IF (ICOWL.EQ. 1) GO TO 10
*INSERT SWINT.108
  IF (ICOWL.EQ. 1) CALL COWL (0)
*INSERT SWINT.110
  IF (ICOWL.EQ. 1) GO TO 60
*INSERT SWINT.163
  IF (ICOWL.EQ. 0) GO TO 54
C.....ADVANCE COWL POINT.
  CALL WALL2 (1, M, MP, MM, KN, PZS, SZS, V2S)
  CU(1,NC,M) = 0.5 * (CU(1,NC,M) + CUP(1,NC,M) + DZ * PZS)
  CU(2,NC,M) = 0.5 * (CU(2,NC,M) + CUP(2,NC,M) + DZ * SZS)
  CU(3,NC,M) = 0.5 * (CU(3,NC,M) + CUP(3,NC,M) + DZ * V2S)
  54 CONTINUE
*INSERT SWINT.171
  IF (ICOWL.EQ. 1) GO TO 40
*DELETE SWINT.193
  CALL JUMP (M, 1)
*INSERT SWINT.198
  DO 48 M = 1, MP2
  IF (IJUMPC(M).EQ. 0) GO TO 48
  IF (M.EQ. MP20) GO TO 48
  CALL COWLP (M, 1)
C...COWL JUMP.
  CALL JUMP (M, NC)
  48 CONTINUE
*I CORNER.99
*DECK COWL
  SUBROUTINE COWL (JC)
C.....
C THIS ROUTINE COMPUTES THE COWL RADIUS AND DERIVATIVES AT ALL PHI
C PLANES FOR A GIVEN Z. COWLP IS THEN CALLED TO DETERMINE
C NECESSARY COWL SHAPE CONSTANTS AND TO CHECK FOR A JUMP. AT THE
C COMPLETION OF COWL, THE COWL RADIUS AND DERIVATIVES ARE STORED IN
C C(M),C7(M),ETC. OLD VALUES AT Z - DZ ARE STORED IN CO(M) CZO(M),
C ETC.FOR ANY PLANE ON WHICH A JUMP OCCURS,NEW AND OLD VALUES ARE
C STORED IN REVERSE ORDER.
C NOTE THAT Z IS ASSUMED TO BE INCREASING.
C SUBROUTINE MUST BE VALID ON FRINGE PLANES.
C.....
*CALL CBODY
*CALL CCONST
*CALL CCOWL
  DO 50 M=1,MP2 ← COWLADD.56
C
C.....TRANSFER NEW VALUES TO OLD
  CO(M)=C(M)
  CZO(M)=CZ(M)
  CPHIO(M)=CPHI(M)
  CPHPHO(M)=CPHPI(M)
  CZPHIO(M)=CZPHI(M)
  CZZO(M)=CZZ(M)
C
  C(M) = 0.0
  CZ(M) = 0.0
  CPHI(M) = 0.0

```

COMMON CCOWL
(new)

SUBROUTINE SWINT

SUBROUTINE COWL
(new)

```

CPHPI(M) = 0.0
CZPHI(M) = 0.0
CZZ(M) = 0.0

```

```

C *****INSERT DEFINITIONS OF C, CZ, CPHI, CPHPMI, CZPHI, AND CZZ BELOW.

```

COWLADD.73

SUBROUTINE COWL
(new)

```

C
C      CALL COWLP(M,JC)
50  CONTINUE
    RETURN
    END
*DECK COWLP
SUBROUTINE COWLP (M, JC)
C
C      COWLP COMPUTES COWL PARAMETERS AND CHECKS FOR COWL JUMP.
C      INPUT - M - M-PLANE NUMBER
C              JC = 0 CHECK FOR JUMP AND COMPUTE COWL PARAMETERS
C              JC = -1 COMPUTES COWL PARAMETERS ONLY
C              JC = 1 REVERSE NEW AND OLD COWL DESCRIPTION AND
C                   COMPUTES COWL PARAMETERS

```

```

C      *CALL CBODY
C      *CALL CCONST
C      *CALL CCOWL
C      *CALL CSTEPS
C      *CALL CXXYYZZ
C      INITIALIZE JUMP AND INLET KEY

```

```

C      IF (JC) 140, 10, 80
C      CHECK FOR A JUMP.
10  CONTINUE
    CZZC = CZZ(M) - YZM(M) * CZPHI(M) / YPHIM(M)
    CZZOC = CZZO(M) - YZM(M) * CZPHI(M) / YPHIM(M)
    TEST1 = AMAX1 (ABS(CZZC), ABS(CZZOC))
    TEST1 = ABS(CZ(M) - CZO(M)) - DZ * TEST1
    TEST2 = AMAX1 (ABS(CZPHI(M)), ABS(CZPHIO(M)))
    TEST2 = ABS(CPHI(M) - CPHIO(M)) - DZ * TEST2
    IF (TEST1.GT.1.E-6) GO TO 30
    IF (TEST2.GE.1.E-6) GO TO 30
    IJUMPC(M)=0
    GO TO 140

```

```

C.....JUMP OCCURS-CHECK FOR OVERRIDE

```

```

30  CONTINUE
    IJUMPC(M)=1
    IF (PHI(M).GE.PHI2J) GO TO 80
    IF (PHI(M).LE.PHI1J) GO TO 80

```

```

C.....NO JUMP
    ICFL = 1
    IJUMPC(M)=2
    IJUMPC(M)=0
    GO TO 140

```

```

80  CONTINUE
    XK=CZ(M)
    CZ(M)=CZO(M)
    CZO(M)=XK
    XK=CPHI(M)
    CPHI(M)=CPHIO(M)
    CPHIO(M)=XK
    XK=CZPHI(M)
    CZPHI(M)=CZPHIO(M)
    CZPHIO(M)=XK
    XK=CZZ(M)
    CZZ(M)=CZZO(M)
    CZZO(M)=XK
    XK=CPHPMI(M)
    CPHPMI(M)=CPHPMIO(M)
    CPHPMIO(M)=XK

```

```

C.....COMPUTE COWL SHAPE PARAMETERS

```

```

140 CONTINUE
    CM=C(M)
    CZM=CZ(M)
    PHIZ=-YZM(M)/YPHIM(M)
    CPOB = CPHI(M) / CM
    CPOB2 = CPOB ** 2
    DUM = 1.0 + CZM ** 2
    C22=DUM+CPOB2
    DUM1=(CPHPMI(M)/CM-CPOB2)
    DUM2=(CZZ(M)+CZPHI(M)*PHIZ)/DUM
    DUM3=CZPHI(M)/CM
    DUM4=DUM3-CZM*CPOB/CM
    CZM(M)=SQRT(C22)
    C3M(M)=DUM1/YPHIM(M)

```

SUBROUTINE COWLP
(new)

```

C4M(M)=DUM4*PHIZ*DUM1
C5M(M)=CZPHI(M)/YPHIM(M)
C7M(M)=DUM2*DUM
RETURN
END
*INSERT DECODE.16
*CALL CCOWL
*INSERT DECODE.115
  IF (ICOWL.EQ. 0) GO TO 2006
C
C...DECODE COWL POINT.
C
  U3 = CV(3,NC,M)
  SCM = CV(2,NC,M)
  SC(M) = SCM
  T1 = C2(M)
  T2 = CPHI(M) / C(M)
  T3 = 1.0 + T2 ** 2
  PM = EXP (CV(1,NC,M))
  IF (CV(1,NC,M) .GT. -600.0 .AND. CV(1,NC,M) .LT. 700.0) GO TO 2002
  WRITE (6 , 3457) M, PM
  CALL SAVE
2002 CONTINUE
  P(NC,M) = PM
  CALL RGAS (PM, DM, SCM, S)
  D(NC,M) = DM
  ASQ(NC,M) = AX * AX
  USQ = MOT2 - 2.0 * HX
  CDUMP = QSQ * T3 - U3 * U3
  IF (CDUMP .GE. 0.0) GO TO 2003
  CALL DHPSQRT (6HDECODE, 5, Z, K, M, NC, CDUMP)
2003 CONTINUE
  WM = SQRT (CDUMP) / C2(M)
  W(NC,M) = WM
  V(NC,M) = (U3 - T2 * T1 * WM) / T3
  U(NC,M) = T1 * WM + T2 * V(NC,M)
  GO TO 9
2006 CONTINUE
*INSERT DECODE.233
  IF (ICOWL.EQ. 1) GO TO 100
*INSERT DECODE.236
  100 CONTINUE
*INSERT DECODE.246
  3457 FORMAT (1H1, * IN SUBROUTINE DECODE THE LOG OF PRESSURE ON PLANE*,
    & 5 14, * ON THE COWL IS *, 1PE15.6, 5X, *--- STOP ---*)
*INSERT EVAL.15
*CALL CCOWL
*INSERT EVAL.29
  IF (ICOWL.EQ. 0) GO TO 15
  C3(KF) = C3M(M)
  C4(KF) = C4M(M)
  C5(KF) = C5M(M)
  C7(KF) = C7M(M)
  15 CONTINUE
*INSERT EVAL.101
  IF (M.LT. NC .OR. ICOWL.EQ. 0) GO TO 26
  PCY(KF) = PNM
  VOCY(KF) = VNM / WNM
  SCY(KF) = SC(M)
  V2C(KF) = VNM * CPHI(M) * UNM / C(M)
  26 CONTINUE
*INSERT FIELD.15
*CALL CCOWL
*CALL CDECODE
*INSERT FIELD.74
  GA=GA2*.5
  PTM = (1.0 + GD * ACH**2.0) ** (-GA)
  IF (ICOWL.EQ.0) GO TO 40
  PTRTOT = 0.0
  AREAT = 0.0
C.....PRESSURE RECOVERY CALCULATED
C.....PTR IS LOCAL TOTAL PRESSURE RATIO
C.....PRESSURE RECOVERY = SUM (PTR * LOCAL AFFECTED AREA) / TOTAL AREA
  DO 111 M = 2, MP1
    IM1 = 1
    IMC = 1
    IF ((1-IDYAW)*M.EQ. 2) IM1 = 0
    IF ((1-IDYAW)*M.EQ. MP1) IMC = 0
    DO 110 N = 1, NC
      AX = SQRT(GAMMA * P(N,M)/D(N,M))
      AMACH = SQRT(U(N,M)**2.0 + V(N,M)**2.0 + W(N,M)**2.0) / AX
      PTR = P(N,M) * PTM * (1.0 + GD * AMACH**2)**GA

```

SUBROUTINE COWLP
(new)

SUBROUTINE DECODE

SUBROUTINE EVAL

SUBROUTINE FIELD

```

      IN1 = 1
      INC = 1
      IF (N.EQ. 1) IN1 = 0
      IF (N.EQ. NC) INC = 0
      AREA = 0.25 * (PHI(M+INC)-PHI(M-IN1)) * ((0.5*(R(N,M)+
1      R(N+INC,M)))**2.0 - (0.5*(R(N-IN1,M)+R(N,M)))**2.0)
      AREAT = AREAT + AREA
      PTRTOT = PTRTOT + PTR * AREA
110  CONTINUE
111  CONTINUE
      PR = PTRTOT / AREAT
      WRITE (6,3005) PR
40  CONTINUE
*INSERT FIELD.84
      PTR=XINDEF
*1 FIELD.88
      PTR=P(L,M)*PTM*(1.+6D*AMACH**2)**6A
*DELETE FIELD.99
*DELETE FIELD.100
      WRITE(6,3400)L,R(L,M),W(L,M),U(L,M),V(L,M),P(L,M),PTR,
1      O(L,M),SX,AMACH,TH1,TZ1,ISX
*INSERT FIELD.114
      PTR=XINDEF
*INSERT FIELD.118
      PTR=P(L,MM)*PTM*(1.+6D*AMACH**2)**6A
*DELETE FIELD.120
*DELETE FIELD.121
      WRITE(6,3400)L,R(L,MM),W(L,MM),U(L,MM),V(L,MM),P(L,MM),
1      PTR,D(L,MM),SX,AMACH,THR(ICF,L),THZ(ICF,L),IS(ICF,L)
*INSERT FIELD.129
3005 FORMAT ('00',*PRESSURE RECOVERY   PTAVR/PTINF = *,F10.5)
*DELETE FIELD.131
3400 FORMAT ('*,I2,1X,3(1PE11.4,1X),1P8E11.4,1X,14)
*DELETE FIELD.136
*DELETE FIELD.137
3700 FORMAT ('0 N *,6X,1HR,11X,1HW,11X,1HU,11X,1HV,10X,1HP,7X,8HPT/PTINF,
1      6X,3HRMO,9X,1MS,10X,1HM,10X,2MTR,9X,2MTZ,5X,2HIS)
*INSERT FINAD.15
*CALL CCOWL
*INSERT FINAD.87
      IF (ICOWL.EQ. 1) CALL WALL2 (0, M2, MP, MM, KN,
1      S CUP(1,NC,M2), CUP(2,NC,M2), CUP(3,NC,M2))
*INSERT FINAD.117
      IF (ICOWL.EQ. 1) GO TO 35
*INSERT FINAD.199
      IF (ICOWL.EQ. 0) GO TO 61
      CALL WALL2 (1, M2, MP, MM, KN, PS, SS, VS)
      CU(1,NC,M2) = 0.5 * (CU(1,NC,M2) + CUP(1,NC,M2) + PS * DZ)
      CU(2,NC,M2) = 0.5 * (CU(2,NC,M2) + CUP(2,NC,M2) + SS * DZ)
      CU(3,NC,M2) = 0.5 * (CU(3,NC,M2) + CUP(3,NC,M2) + VS * DZ)
61  CONTINUE
*INSERT FINAD.231
      IF (ICOWL.EQ. 1) GO TO 70
*INSENT FRINGE.10
*CALL CCOWL
*BEFORE FRINGE.19
      IF (ICOWL.EQ. 0) GO TO 93
      CPHPHI(M1) = CPHPHI(M2)
      CZZ(M1) = CZZ(M2)
      CZPHI(M1) = CZPHI(M2)
      SC(M1) = SC(M2)
93  CONTINUE
*INSERT INIT.6
*CALL CCOWL
*INSERT INIT.83
      IF (ICOWL.EQ. 0) GO TO 42
      SC(M) = SFF
      CU(1,NC,M) = ALOG (P(NC,M))
      CU(2,NC,M) = SC(M)
      CU(3,NC,M) = V(NC,M) * U(NC,M) * CPHI(M) / C(M)
      GO TO 43
42  CONTINUE
*INSERT INIT.86
43  CONTINUE
*INSERT INIT.99
      IJUNPC(M) = 0
      IF (ICOWOPT.EQ. 1) GO TO 33
      IJUNPC(M) = 0
      IJMPKTC(M) = 0
      GO TO 34
33  CONTINUE
      IJUNPC(M) = 4
      IJMPKTC(M) = 1

```

SUBROUTINE FIELD

SUBROUTINE FINAD

SUBROUTINE FRINGE

SUBROUTINE INIT

```

34 CONTINUE
*INSERT INLET.14
*CALL CCOWL
*DELETE INLET.70
  WRITE (6, 1000)
1000 FORMAT (* INLET SUBROUTINE CALLED *)
  CALL JUMP (M, 1)
*INSERT INTEG.14
*CALL CCOWL
*INSERT INTEG.112
C
  IF (ICOWL .EQ. 0) GO TO 1600
C
C...INTEGRATE THE COWL PRESSURES.
C
  K1=1
  DO 1325 I=1,6
    SSF(I)=0.
    SUMJ(I,1)=0.
    SUMJ(I,2)=0.
1325 CONTINUE
C
  IF (IDYAW .EQ. 1) GO TO 1300
C *** SIMPSON'S RULE FOR SYMMETRY CASE (PHIO=180) ***
  DO 1200 M=2,MC
    CM = C(M)
    CPHIB = CPHI(M) / CM
    DUM = -2.0 * (P(NC,M) - PINF) * CM * PHIO * TG4M(M)
    SINP = SINPHI(M)
    COSP = COSPHI(M)
    SF(1)=DUM*(COSP*CPHIB*SINP)
    SF(3)=DUM*CZ(M)
    DUM1=SF(3)*CM
    SF(2)=DUM1*COSP
    IF (M.NE.3) GO TO 1125
    SF1(1) = SUMJ(1,1)
    SF1(2) = SUMJ(2,1)
    SF1(3) = SUMJ(3,1)
1125 DO 1150 I=1,3
1150 SUMJ(I,K1)=SUMJ(I,K1)+SF(I)
    K1=3-K1
1200 CONTINUE
    SF2(1)=2.0*(P(NC,MP1)-PINF)*C(MP1)*PHIO*TG4M(MP1)
    SF2(3)=-SF2(1)*CZ(MP1)
    SF2(2)=-SF2(3)*C(MP1)
    DO 1250 I=1,3
      F(I)=DYD3*(4.0*SUMJ(I,2)+2.0*SUMJ(I,1))-SSF(I)+F(I)
    IF (K1 .EQ. 1) GO TO 1225
C.....EVEN NUMBER OF POINTS-USE SIMPSONS RULE FROM M=2 TO MC.
C APPROXIMATE THE LAST INTERVAL USING TRAPEZOIDAL INTEGRATION.
    F(1)=F(1)+DYD3*(.5*SF(1)-SF1(1)+1.5*SF2(1))
    GO TO 1250
1225 F(1)=F(1)+DYD3*(SF2(1)-SF1(1))
C.....ODD NUMBER OF POINTS- APPLY SIMPSONS RULE DIRECTLY.
1250 CONTINUE
    GO TO 1600
C *** SIMPSON'S RULE FOR NON-SYMMETRIC CASE (PHIO=360) ***
1300 CONTINUE
  K1=1
  DO 1500 M=2,MP1
    CM = C(M)
    CPHIB = CPHI(M) / CM
    DUM=-(P(NC,M)-PINF)*CM*PHIO*TG4M(M)
    SINP = SINPHI(M)
    COSP = COSPHI(M)
    SF(1)=DUM*(COSP*CPHIB*SINP)
    SF(3) = DUM * CZ(M)
    DUM1 = SF(3) * CM
    SF(2) = DUM1 * COSP
    SF(4) = DUM1 * SINP
    SF(5)=DUM*(CPHIB*COSP-SINP)
    SF(6)=DUM*CM*CPHIB
    IF (M.NE.3) GO TO 1375
    DO 1350 I=1,6
      SF1(I) = SUMJ(I,1)
      SF2(I) = SF(I)
1350 CONTINUE
1375 DO 1400 I=1,6
1400 SUMJ(I,K1)=SUMJ(I,K1)+SF(I)
    K1=3-K1
1500 CONTINUE
    DO 1525 I=1,6
      F(I)=DYD3*(4.0*SUMJ(I,2)+2.0*SUMJ(I,1))-SSF(I)+F(I)

```

SUBROUTINE INIT

SUBROUTINE INLET

SUBROUTINE INTEG

```

C.....ODD NUMBER OF POINTS-APPLY SIMPSONS RULE DIRECTLY.
  IF (K1 .EQ. 1) GO TO 1525
C.....EVEN NUMBER OF POINTS-APPLY SIMPSON RULE FROM M=2 TO MPI AND
C  EXTEND TO M=3. USE TRAPEZOIDAL RULE TO SUBTRACT M=2 TO 3 INTERVAL.
  F(I)=F(I)*DYD3*(4.*SF1(I)-SF2(I)-2.*SF(I))
1525 CONTINUE
C
  1600 CONTINUE
*DELETE JUMP.2
  SUBROUTINE JUMP (MB, N)
*INSERT JUMP.16
*CALL CCOWL
*DELETE JUMP.24,JUMP.26
  SO = SW(MB)
  POM = 1.0
  ETAP = BZ(MB)
  SIP = BPHI(MB) / B(MB)
  IF (N .EQ. 1) GO TO 40
C...COWL SURFACE.
  DBP = CPHI(MB) / CO(MB) - CPHI(MB) / C(MB)
  DBZ = CZ(MB) - CZ(MB)
  SO = SC(MB)
  IF (N .EQ. 1) WRITE(JJJJJ,3130) B(MB),BZ(MB),BPHI(MB),DBP,DBZ,HOT2
  IF (N .GT. 1) WRITE(JJJJJ,3131) C(MB),CZ(MB),CPHI(MB),DBP,DBZ,HOT2
  POM = -1.0
  ETAP = CZ(MB)
  SIP = CPHI(MB) / C(MB)
  40 CONTINUE
  UM = U(N,MB)
  VM = V(N,MB)
  WM = W(N,MB)
  PM = P(N,MB)
  DM = D(N,MB)
  ASQW = ASQ(N,MB)
*DELETE JUMP.32
*DELETE JUMP.49
  IF (N .EQ. 1) IJUMP1(MB) = 2
  IF (N .GT. 1) IJUMP1(MB) = 2
*DELETE JUMP.55
  IF (N .EQ. 1) IJUMP1(MB) = 2
  IF (N .GT. 1) IJUMP1(MB) = 2
*DELETE JUMP.57
  10 CONTINUE
  IF (QSM*POM .LT. 0.0) GO TO 20
*DELETE JUMP.62
  ICFL = 1
  IF (N .GT. 1) GO TO 15
  IJUMP1(MB) = 3
  IJMPKT(MB) = 1
  GO TO 100
  15 CONTINUE
  IJUMP1(MB) = 3
  IJMPKT(MB) = 1
*DELETE JUMP.66,JUMP.68
  IF (N .GT. 1) GO TO 22
  IJUMP1(MB) = 4
  IJMPKT(MB) = 1
  GO TO 23
  22 CONTINUE
  IJUMP1(MB) = 4
  IJMPKT(MB) = 1
  23 CONTINUE
  CALL COMP (THETAR, AMACH, PM, DM, SO, QSM, QSP, QT, ASQW, XUK)
  100 CONTINUE
  D(N,MB) = DM
  P(N,MB) = PM
  ASQ(N,MB) = ASQW
*DELETE JUMP.70,JUMP.72
  IF (N .EQ. 1) SW(MB) = SO
  IF (N .GT. 1) SC(MB) = SO
  V(N,MB) = AA2 * (XNP2 * SIM - XNMP * SIP) - AA1 * DBZ
  U(N,MB) = AA1 * XT2 + AA2 * (XNMP - XNP2)
  W(N,MB) = AA1 * DBP + AA2 * (XNP2 * ETAP - XNMP * ETAP)
*DELETE JUMP.74,JUMP.77
  WRITE (JJJJJ,3120) PM,DM,U(N,MB),V(N,MB),W(N,MB),SO,ASQ(N,MB)
  CU(1,N,MB) = ALOG (P(N,MB))
  CU(2,N,MB) = SO
  CU(3,N,MB) = V(N,MB) * SIP * U(N,MB)
*INSERT JUMP.84
  3131 FORMAT (1H ,22HC,CZ,CPHI,DBP,DBZ,HOT2,1P6E15.5)

```

SUBROUTINE INTEG

SUBROUTINE JUMP

```

*INSERT OUT.8
*CALL COWL
*INSERT OUT.61
  WRITE (23) Z, MP2M1, (PB(M), M=1,MP2M1)
*INSERT OUT.71
  IF (ICOWL .EQ. 0) GO TO 850
C
C...THIS SECTION OUTPUTS PRESSURES AT THE COWL.
C
  REWIND 16
  NPTS = 0
  M1 = 1
  MCMX = MC
  MIP14 = M1 + 14
725 CONTINUE
  NPTS = NPTS + 1
730 CONTINUE
  MCS = MC
  READ (16) NC,MC,ATTA,YAW,ACH,GAMMA,PINF,DINF,PHIO,K,Z,
  1 (DUM, I=1,12), (PHI(M), DUM, DUM, DUM, M=1,MP2M1),
  2 ((DUM, DUM, DUM, DUM, PB(M), DUM, M=1,MP2M1), N=1,NC)
  IF (EOF (16)) 840, 750
750 CONTINUE
  M2 = MIN0 (MC, MIP14)
  IF (M2 .LT. M1) GO TO 730
  IF (MC .NE. MCS) NPTS = 1
  IF (MOD (NPTS-1, 53) .NE. 0) GO TO 775
  WRITE (6, 3000) ACH, ATTA, YAW, Z0
  IF (IPCID .EQ. 0) WRITE (6, 3520)
  IF (IPCID .NE. 0) WRITE (6, 3525)
  DO 760 M = M1, M2
    PHI(M) = PHI(M) / RAD
760 CONTINUE
  WRITE (6, 3030) (PHI(M), M=M1,M2)
  WRITE (6, 3040)
775 CONTINUE
  DO 762 M = M1, M2
    PB(M) = PB(M) / PINF
762 CONTINUE
  ZZ = Z + Z0
  IF (IPCID .EQ. 1) GO TO 800
  WRITE (6, 3050) ZZ, (PB(M), M=M1,M2)
  GO TO 825
800 CONTINUE
  DO 810 M = M1, M2
    PB(M) = (PB(M) - 1.0) / CONT1
810 CONTINUE
  WRITE (6, 3055) ZZ, (PB(M), M=M1,M2)
825 CONTINUE
  IF (M1 .GT. 1) GO TO 725
  MCMX = MAX0 (MC, MCMX)
  WRITE (24) Z, MP2M1, (PB(M), M=1,MP2M1)
  GO TO 725
840 CONTINUE
  M1 = M1 + 15
  IF (M1 .GT. MCMX) GO TO 850
  MIP14 = M1 + 14
  NPTS = 0
  REWIND 16
  GO TO 725
C*****
850 CONTINUE
*INSERT OUT.262
3520 FORMAT (1M0,35X,*C O W L   P R E S S U R E   R A T I O *)
3525 FORMAT (1M0,30X,*C O W L   P R E S S U R E   *,
  *   *C O E F F I C I E N T*)
*BEFORE PRINTST.19
*CALL COWL
*DELETE PRINTST.26
  1 ICOWL, NSFD, NS0D
*INSERT PRINTST.33
  IF (ICOWL.EQ.1) WRITE (6, 5023) ISWSMOC, ISWMODC, MODIC, ICOWOPT
*INSERT PRINTST.94
  8 9X,* ICOWL = *,I10,10X,*(OUTER BOUNDARY DEFINITION. 1=WALL,0=
  S  *SHOCK)*,/,
*INSERT PRINTST.157
C
5023 FORMAT (///, 5X, 4H****, * COWL OPTIONS*, 4H****, ///,
  1 9X,* ISWSMOC = *,I6,10X,*(ISWSMOC = 1 -ENTROPY EXTRAPOLATION, =
  S0-STANDARD)*,/,
  2 9X,* ISWMODC = *,I6,10X,*(FORM OF BOUNDARY CONDITIONS- 0 = 14A,
  S15A, 3 = 14C,15C)*,/,
  3 9X,* MODIC = *,I8,10X,*(ORDER OF ACCURACY-- 0=1ST ORDER, 1=2ND
  BORDER UNTIL COWL DISCONTINUITY ENCOUNTERED)*,/,

```

SUBROUTINE OUT

SUBROUTINE PRINTST

```

      4  9X,* ICOWOPT = *,16,10X,*(COWL NORMAL DERIVATIVE CONTROL- 0==
      3  *STANDARD,1=MODIFIED FOR 4 STEPS*)
*INSERT RADIUS.7
*CALL CCOWL
*DELETE RADIUS.20
      IF (ICOWL.EQ. 0) CC = CU(1,NC,M) - B(M)
      IF (ICOWL.EQ. 1) CC = C(M) - B(M)
*INSERT READIN.10
*CALL CCOWL
*INSERT READIN.34
      6  , ICOWL, ICOWOPT, ISWMODC, ISWSMOC, MODIC
*INSERT HEADIN.41
      ICOWL = 0
      ICOWOPT = 0
      ISWMODC = 3
      ISWSMOC = 0
      MODIC = 1
*INSERT READIN.157
      KFAC1 = 1
*INSERT REZONE.16
*CALL CCOWL
*INSERT REZONE.68
      IF (ICOWL.EQ. 1) CALL COWL (-1)
      IF (ICOWL.EQ. 1) GO TO 65
*INSERT REZONE.78
      65 CONTINUE
*INSERT SAVE.10
*CALL CCOWL
*INSERT SHOCK.14
*CALL CCOWL
*INSERT TRANF.17
*CALL CCOWL
*INSERT STEPS.20
C.....AT LAST STEP, MAKE SURE Z=ZEND.
      IF (Z+DZ.LE. ZEND) GO TO 204
      DZ = ZEND - Z
      Z = ZEND
      IF (DZ.LT. 1.E-4) DZ = 1.E-4
      GO TO 205
      204 CONTINUE
*I WALL.140
*DECK WALL2
      SUBROUTINE WALL2(L,M,JR,JL,JS6,PZ,SZ,V2Z)
C
C      WALL2 COMPUTES PREDICTED OR CORRECTED Z DERIVATIVES OF
C      P, V2, AND S(ENTROPY) USING CHARACTERISTIC COMP. RELS.
C      V2 IS VEL. COMP. TANGENT TO COWL V2=V*(CPH1/8)*U
C      V2C(J), SCY(J), VOCY(J), AND PCY(J) ARE COWL VALUES OF
C      V2, S, V/W AND P RESPECTIVELY. CONTROL INTEGERS IN ARGUMENT ARE
C      L, =0 FOR PREDICTOR AND 1 FOR CORRECTOR
C      M, Y PLANE
C      JR, STORAGE LOCATION OF RIGHT SIDE DIFFERENCE QUANTITIES
C      JL, STORAGE LOCATION OF LEFT SIDE DIFFERENCE QUANTITIES.
C      JS6, STORAGE LOCATION OF M PLANE FOR DIFFERENCED QUANTITIES.
C      JR AND JL ARE LINE IDENT. INDEXES FOR Y DIFFS.
C      JS6=1,2,3 LINE INDEX FOR TRANF AND COWL PARAMETERS
C      IF=1,2 LINE INDEX FOR TRANF PARAMETERS
C      THIS VERSION OF WALL2 CONTAINS SEVERAL OPTIONS FOR COWL B.C.
C      ISWSMOC NE 0 MEANS COWL ENTROPY EXTRAPOLATION
C      MODIC = 1 MEANS SECOND ORDER ACCURACY
C      ISWMODC = 0 MEANS MOD 0 FOR COWL B.C.
C      = 3 MEANS MOD 3 FOR COWL B.C.
C      THIS ROUTINE CONTAINS SPECIAL FEATURES AFTER A JUMP
C      IJUMPIC(M) = 0 MEANS NO JUMP ON LINE
C      IJUMPIC(M) NE 0 MEANS JUMP HAS BEEN CALLED (SEE JUMP)
C      IJUMPIC(M) = 2 MEANS NO SECOND ORDER ACCURACY
C      AND NO ENTROPY EXTRAP. IF A COMPRESSION JUMP
C      AND MOD 0 FOR COWL B.C.
C
*CALL CSWINT
*CALL CCUNST
*CALL CCOWL
*CALL CDECODE
*CALL CDOPT
*CALL CEVAL
*CALL CSHOCK
*CALL CSTEPS
*CALL CTRANF
*CALL CTRAN6
*CALL CWALL
*CALL CXXYZZ
C
      DIMENSION DC6Y(4),ICUNT(100)

```

SUBROUTINE PRINTST

SUBROUTINE RADIUS

SUBROUTINE READIN

SUBROUTINE REZONE

SUBROUTINE SAVE

SUBROUTINE SHOCK

SUBROUTINE TRANF

SUBROUTINE STEPS

SUBROUTINE WALL2
(new)

```

DATA ICONT/1000/
KMODIC = MODIC
KSWMOD = ISWMODC
CM = C(M)
CZM = CZ(M)
CPHOB = CPHI(M) / CM
YPHIJ = YPHI(JS6)
YZJ = YZ(JS6)
XRW = XR(NC,JS6)
UM = U(NC,M)
WM = W(NC,M)
PM = P(NC,M)
VM = V(NC,M)
DM = D(NC,M)
ASQM = ASQ(NC,M)
VOR = VM / CM
VOW = VM / WM
YPOR = YPHIJ / CM
BB = WM * YZJ * YPHIJ * VOR
PX = (PM - P(NA,M)) * DDX
DWM = DM * WM
ETA = WM ** 2 - ASQM
CDUMP = (ETA * (1.0 * CPHOB ** 2) + (WM * CZM) ** 2) / ASQM
IF (CDUMP .GE. 0.) GO TO 1001
CALL DMPSORT(SHALL2,1,Z,K,M,NC,CDUMP)
1001 BETA = -SQRT(CDUMP)
ALAM = ASQM * (BETA - CZM) / ETA
DUM4 = VM * CPHOB * UM
AAX = -UNOR(NA,JS6) * DDX
DSY = (SCY(JR) - SCY(JL)) * DDY
VZY = (VZC(JR) - VZC(JL)) * DDY
IF (IJUMPI(M) .EQ. 0) GO TO 20
IF (IJUMPI(M) .EQ. 2) GO TO 15
IF (L .EQ. 1) GO TO 10
IF (IJUMPI(M) .NE. 3) GO TO 210
IF (IJMPKTC(M) .GT. NJMPKT) GO TO 230
IFAC = NJMPKT
GO TO 215
210 CONTINUE
IF (IJMPKTC(M) .GT. NJMKTC) GO TO 230
IFAC = NJMKTC
IF (ICFL * KCFL .NE. 0) GO TO 215
IJMPKTC(M) = IJMPKTC(M) * KFAC
GO TO 10
215 CONTINUE
IJMPKTC(M) = IJMPKTC(M) + 1
GO TO 10
230 CONTINUE
IJUMPI(M) = 2
IJMPKTC(M) = 0
GO TO 15
10 FAC = FLOAT(IJMPKTC(M) - 1) / FLOAT(IFAC)
PX = FAC * PX
AAX = FAC * AAX
WRITE (LLLL,2002) Z, M, L, FAC
15 CONTINUE
MODIC = 0
ISWMODC = 0
ICONT(M) = ICONT(M) + 1
IF (ICONT(M) .EQ. 1) WRITE (LLLL,2000) Z, MODIC, ISWMODC, M
20 CONTINUE
IF (ISWMODC .EQ. 3) GO TO 25
DVOWY = (VOCY(JR) - VOCY(JL)) * DDY
PY = (PCY(JR) - PCY(JL)) * DDY
DUMM = (CZM / CM * YPOR * DVOWY) * WM
DUM = BB * WM / ASQM - YZJ
PZ23 = (ALAM * DUM * CZM * YZJ * YPOR * CPHOB) * PY
1 - DWM * (BB * (C5(JS6) * VOW * C3(JS6)))
2 - AL * M * (DUMM * (TF6(NC,JS6) - T66(JS6)) * WM * VOR * TF7(NC,JS6)))
VZ23 = (BB * (VZY - UM * C3(JS6)) * YPOR * PY / DM) / WM
GO TO 50
25 T65J = T65(JS6)
DO 40 I=1,4
DCGY(I) = (C6(I,NC,JR) * DETY(NC,JR) - C6(I,NC,JL) * DETY(NC,JL)) * DDY
40 CONTINUE
CE1 = DM * (UM / CM * T65J * BB * TF6(NC,JS6) * WM * TF7(NC,JS6) * VOR)
DUM1 = (T65J * YZJ + T66(JS6)) * PM
DUM2 = (T65J * YPHIJ * CPHOB) * PM / CM
QSQ = WM ** 2 * VM ** 2 * UM ** 2
DUM3 = UM * DCGY(3) - QSQ * DCGY(1) + WM * (DCGY(2) * DUM1) + VM * (DCGY(4) * DUM2)
C *** THE EQUATION FOR XK1 IS VALID FOR PERFECT GAS ONLY ***
XK1 = -DM / (ASQM * 68)

```

SUBROUTINE WALL2

```

PZ23=ALAM*WM*(CE1+2.*DCGY(1)+XK1*DUM3/DW)
1  *(CZM-ALAM)*(DCGY(2)+DUM1)-DCGY(3)+CPHOB*(DCGY(4)+DUM2)
VZ223=(CPHOB*DCGY(3)-DUM4*DCGY(1)+DCGY(4)+DUM2)/DW
50 PZ=ALAM*XRW*PX-(DWM*(ALAM*AAX-WM*C7(JS6)
1  -VM*C4(JS6)+DUM4*VOW/CM)+PZ23)/BETA
VZ2=UM*C4(JS6)-VOR*CZM-VZ223
IF (MODIC.NE. 1) GO TO 90
IF (L.EQ. 1) GO TO 80
PXX = (-2.0 * P(NA,M) + P(NC2,M) + PW) * DDX
AAXX = (-2.0 * UNOR(NA,JS6) + UNOR(NC2,JS6)) * DDX
PZCORC(M)=ALAM*(XRW*PXX-DWM*AAXX/BETA)
60 TO 90
80 PZ=PZ+PZCORC(M)
90 IF (M.GT. ISWSMOC) GO TO 100
CALL RGAS(P(NC2,M),D(NC2,M),SW3,4)
CALL RGAS(P(NA,M),D(NA,M),SW2,4)
SZ=2.*SW2-SW3
IF (SW2.LT.SW3) SZ=.5*(SW2+SW3)
CUP(2,NC,M)=SZ*FLOAT(L)
CU(2,NC,M)=SZ
SZ=0.
GO TO 125
100 SZ=-BB*DSY/WM
125 CONTINUE
PZ=PZ/PW
MODIC = KMODIC
ISWMODC = KSWMOD
IF (IJUMPC(M).EQ.0) GO TO 110
IF (L.EQ.1) GO TO 110
PZ=0.
WRITE (LLLL,2001) Z, M
110 CONTINUE
RETURN
C
2000 FORMAT (5X, * FROM WALL2-- AT Z = *, F15.7, * MODIC AND ISWMODC ARE PE
SRMANENTLY SET TO *, 2I4, * ON PLANE *, I4)
2001 FORMAT (5X, * FROM WALL2-- IN PREDICTOR STEP AT Z= *, F10.5,
1 * PZ IS SET TO 0.0 ON PLANE*, I5)
2002 FORMAT (5X, * FROM WALL2-- AT Z= *, F15.7, * AND ON PLANE*, I5,
1 * L= *, I5, * X DERIVATIVES ARE SCALED BY *, F10.5)
END

```

SUBROUTINE WALL2
(new)

APPENDIX C. USER INSTRUCTIONS FOR APPLICATION OF SWINT
TO AN INLET CONFIGURATION

The first step in calculating an inlet configuration is to determine the flow field at the inlet face. This is accomplished by running SWINT to the inlet face and saving TAPE17 which contains the final flow field information. The procedure for doing this with the extended version of SWINT is identical to that for the original version and is described in Reference 2. The output differs from that of the original SWINT in two respects: (1) a PTO/PTINF column has been added to the flow field output which is the ratio of the local stagnation pressure to the freestream stagnation pressure; (2) The program stops exactly at $z = ZEND$ rather than at the first step greater than $ZEND$.

Interface Program COWLI

The COWLI program rezones the flow field to lie between the inner body and the cowl. In addition, the inlet plane parameters described in Section 2.2 are calculated. This program is applicable even when the inlet or portions of it lie outside of the flow field generated by SWINT at the inlet face. At points outside of the SWINT generated flow field, freestream conditions are assumed to exist. It is also possible to use COWLI to generate a starting flow field for external calculations downstream of the inlet lip, even in cases where the bow shock lies completely within the inlet

To run the COWLI program the flow field at the inlet plane generated by SWINT must be attached as TAPE11 and relevant quantities in namelist INPUTS must be defined:

BNEW,BZNEW,BPHNEW - Inner wall boundary of the computational domain $b(\phi,z)$ and its derivatives $b_z(\phi,z)$ and $b_\phi(\phi,z)$. (See Figures 1,2)

CNEW,CZNEW,CPHNEW - Cowl or shock surface description $c(\phi,z)$ and its derivatives $c_z(\phi,z)$ and $c_\phi(\phi,z)$. (See Figures 1,2)

IBODY Controls conditions prescribed along inner boundary.

0 - inner body shape is not changed. BNEW,BZNEW,BPHNEW need not be specified.

1 - inner body shape is changed to BNEW,BZNEW,BPHNEW, which must be specified. Interpolated flow values at the wall are turned tangent to the surface using an oblique shock or Prantl-Meyer expansion.

2 - Same as IBODY = 1, except wall properties are also assigned between the body and shock. The outer boundary is assumed to be a shock with c_z calculated from the shock or Mach angle occurring at the wall, $c = b + (c_z - b_z)$, and $c_\phi = b_\phi$.

ICOWL Controls the conditions prescribed at the outer boundary and the type of surface (i.e., shock or cowl).

0 - outer surface geometry is not changed and CNEW,CZNEW,CPHNEW need not be specified.

1 - outer surface is a cowl with description
CNEW,CZNEW,CPHNEW. Interpolated flow values at the cowl
are turned parallel to the cowl surface.

2 - outer boundary is a Mach surface. The user specifies
CNEW,CPHNEW and CZNEW is computed.

DDZ Distance from the cowl lip at which calculation is
started. Specified only when IBODY = 2.

RCLUST Controls radial distribution of mesh points. Default is a
uniform distribution. For other cases enter $(r-b)/(c-b)$
for each radial plane starting at the body and moving
towards the outer boundary. The same radial distribution
is presumed on each constant ϕ plane.

AREA Reference area used in calculating induced load
coefficients. Default is the inner body cross-sectional
area at the inlet entrance plane.

IPRINT Controls the amount of printed output

0 - print only inlet plane flow field parameters.
(i.e., Eqs (4) and (5))

1 - (default) IPRINT = 0 output plus final rezoned
flow field.

2 - IPRINT = 1 output plus initial flow field from Tape 11.

3 - IPRINT = 2 output plus Jump subroutine messages.

To apply the interface program to an inlet geometry, options IBODY=0/ICOWL=1 or IBODY=1/ICOWL=1 are used depending on whether the innerbody slope or surface is discontinuous at the inlet face plane. Three additional modes of operation are IBODY=2/ICOWL=0, IBODY=1/ICOWL=2, and IBODY=1/ICOWL=0. These options are designed to facilitate restart of an external calculation downstream of the inlet lip. The first, IBODY=2/ICOWL=0 is applicable when the bow shock lies completely inside the cowl. Slightly downstream of the inlet lip, the flow values obtained by turning the free-stream tangent to the COWL outer surface provides an estimate of the local flow field. An alternative approach for handling this situation which is also applicable when the bow shock is only partially within the inlet is accomplished with IBODY=1/ICOWL=2. Here the outer edge of the computational domain is defined to be a Mach surface. As the SWINT calculation proceeds downstream from the lip, the shock or Prandtl-Meyer expansion generated at the body surface by IBODY=1 propagates into the flow field and merges with the outer Mach surface. The final option, IBODY=1/ICOWL=0 duplicates the function of the INLET subroutine of SWINT.

The output from COWLI consists of Tape3 which is the restart file for SWINT and printed data. The amount of flow field information printed is controlled by the parameter IPRINT and the output flow field quantities are designated using the same headings as found in SWINT. The items printed under the heading "inlet plane flow field parameters" are described in Section 2.2. The induced force coefficients are followed by a value labeled force error. This number is the percent discrepancy obtained by calculating the

forebody loads using direct pressure integration as opposed to Equations (5).

Applying SWINT to Inlets

The extended version of SWINT is applied to an inlet configuration in a manner similar to that described in Reference 2 for external configurations. Several additional variables must be prescribed along with a description of the geometry of the cowl.

The cowl geometry is described in a manner analogous to that used to describe the body. The quantities c , c_z , c_ϕ , c_{zz} , $c_{z\phi}$, and $c_{\phi\phi}$ must be specified using fortran statements inserted at the indicated locations in subroutine COWL of SWINT. As an example, consider a circular cowl starting at $z = 1$ with a radius of 2 and an outwards angle of 7° relative to the missile axis for $z > 1$. The necessary statements describing the cowl are:

$$c_z = .12278456$$

$$c = 2. + (z-1)*c_z$$

$$c_{zz} = c_{z\phi} = c_{\phi\phi} = c_\phi = 0$$

The final statement is not required since default derivative values are 0.

The additional variables which control the computation of the cowl surface are specified in namelist INPUT1:

ICOWL 0 if the outer boundary is a shock and 1 if the outer
 boundary is a wall.

ICOWOPT 0; cowl slope and surface is continuous at starting plane.
 1; A cowl slope or surface discontinuity occurs at the
 starting plane. This results in the cowl surface normal
 derivatives being modified for 4 steps.

MOD1C Controls order of accuracy of cowl boundary conditions.
 0 - first order, 1 - second order.

ISWSMOC Controls application of entropy extrapolation at cowl.
 Extrapolation is applied on planes $M < ISWSMOC$

ISWMODC Controls form of cowl boundary equations:
 0 - Form 2A and 3A (Analogous to 14A and 15A of Ref. 2 for
 centerbody)

 3 - Form 2C and 3C (Analogous to 14C and 15C of Ref. 2 for
 centerbody)

The variables MOD1C, ISWMODC and ISWSMOC are analogous to the body variables MOD1, ISWMOD and ISWSMO respectively. Recommended values for these parameters are discussed in Reference 2.

The output from a run for an inlet configuration differs from an external flow field calculation in the following respects:

1. At each plane where the flow field is printed, $PTAVR/PTINF$ is calculated which is the area weighted average of the recovery pressure divided by the free-stream recovery pressure.

2. At the completion of the calculation, the cowl pressures are printed.

3. The force and moment coefficients represent the integration of pressure over both the centerbody and cowl surfaces, but do not include induced loads.

APPENDIX D. SAMPLE RUN

This appendix illustrates the application of the extended SWINT code to the inlet configuration shown in Figure D-1. The initial flow field was calculated at $z = .1$ using the approximate conical starting program START which is described in Reference 2. The data cards used for this run are:

```

SINBUTS
  NC = 19,
  MC = 13,
  ADH = 3.3,
  ATTACK = 3.0,
  B(1) = 0.017633,
  Z = 0.1,
  ZS = 0.1,
SEND

```

This program generates TAPE3 which is the SWINT starting tape.

Using the extended version of SWINT with the errata update file, the flow field was marched from the starting plane at $z=.1$ to the start of the cowl which is located at $z = 3.216$. The errata update file is as follows:

```

*IDENT ERRATA
*DELETE EDGE.134,EDGE.135
  DUM = 0.0
  CALL JUMPF (I1, N, M, DUM)
  IF (MM .NE. M) CALL JUMPF (I2, N, MM, DUM)
*DELETE EDGE.70
  1 ABS (PHI(M) - PHI(MP)) * 0.35 / PINF)
*INSERT FRINGE.18
  B(M1) = B(M2)
  BZ(M1) = BZ(M2)
  BZZ(M1) = BZZ(M2)
  BZPHI(M1) = BZPHI(M2)
  BPHI(M1) = BPHI(M2)
  BPHPHI(M1) = BPHPHI(M2)
*DELETE REZONE.45,REZONE.46
*INSERT REZONE.40
  DX = 1.0 / FLOAT (NA)
  DDX = NA
*INSERT FIELD.31
  IF (IFIN .EQ. 0) GO TO 16
*INSERT FIELD.30
  16 CONTINUE
*DELETE INTEG.41,INTEG.43
  DTHETA = TH(I2,1) - TH(I,1)
  IF (M * (1 - IDYAW) .EQ. 2) DTHETA = 2.0 * TH(I,1)
  IF (M * (1 - IDYAW) .EQ. MP1) DTHETA = 2.0 * (PHI0 - TH(I,1))
*DELETE TRANGD.27,TRANGD.30
  5 CONTINUE
  DY = 1.0 / FLOAT (NSGD)
  SGDM2 = SGD(NSGD) - 1.0
  SGD(1) = SGD(NSGDP1) - 1.0
  SGDP2 = 1.0 + SGD(3)
  SGD(NSGDP2) = 1.0 + SGD(2)
*DELETE SHOCK.68
  DCUZ(I) = (FAC1 * DDX + FAC2 * DDY + CES(I)) / PINF
*DELETE FRINGE.35
  PYY = (P(N,M) - P(N,MP)) / (PHI(M) - PHI(MP)) / PINF
*INSERT FRINGE.26
  R(N,M1) = R(N,M2)

```

```

*DELETE OUT.208,OUT.211
  CY=XK0*FY
  CMX=XK1*(MX + ZC*FY)
  CMY=XK1*(MY - ZC*FN)
  CMZ=XK1*MZ
*DELETE OUT.214,OUT.215
  IF(CN.NE.0) XCPP=ZC/ZREF + CMY/CN + Z0/ZREF
  IF(CY.NE.0) XCPY=ZC/ZREF - CMX/CY + Z0/ZREF
*DELETE FEVAL.41
  SF(6)=RF*(COSPP*SF(5)+SINPP*SF(1))
*DELETE REZONE.80
*DELETE REZONE.82

```

The configuration geometry was described using the following update deck:

center-body:

```

*IDENT PRESSLY
*8 BODY.19
  REAL XMC(100),YMC(100),ZSAVE(3),BSAVE(3)
  DATA XMC/0.0, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.55, 4.6, 4.65,
1 4.7, 4.8, 4.9, 5.1, 5.3, 5.5, 5.6, 5.7, 5.8, 5.9, 6./
  DATA YMC/0., .70532, .7228, .7387, .7512, .759, .7625,
1 .763, .7625, .7611, .7585, .7504, .7391, .712, .6829, .6525,
2 .6362, .618, .5973, .5744, .5467/
  DATA KK /0/
  NPTS=20
  KK=KK+1
  ZDIFF=.001
  IF(KK.GT.2)ZDIFF=DZ
  ZSAVE(1)=Z-ZDIFF
  ZSAVE(2)=Z
  ZSAVE(3)=Z+ZDIFF
  DO 30 J=1,3
    DO 20 I=1,NPTS
      IF((XMC(I)-ZSAVE(J))*(XMC(I+1)-ZSAVE(J)).GT.0.)GO TO 20
      FAC=(ZSAVE(J)-XMC(I))/(XMC(I+1)-XMC(I))
      BSAVE(J)=YMC(I)+(YMC(I+1)-YMC(I))*FAC
    GO TO 30
  20 CONTINUE
  WRITE(6,2000)Z,ZDIFF,ZSAVE
2000 FORMAT(*1GEOMETRY OUT OF RANGE Z,ZDIFF,ZSAVE *,5E16.8)
  STOP"BAD GEOMETRY"
30 CONTINUE
  BBZ=(BSAVE(3)-BSAVE(1))/(2.*ZDIFF)
  BBZZ=(BSAVE(3)-2.*BSAVE(2)+BSAVE(1))/(ZDIFF*ZDIFF)
*1 BODY.35
  IF(Z.LE.4.)GO TO 18
  B(M)=BSAVE(2)
  BZ(M)=BBZ
  BZZ(M)=BBZZ
  GO TO 19
18 CONTINUE
  BZ(M)=.17633
  B(M)=Z*BZ(M)
19 CONTINUE

```

cow1:

```

*8 COWLADD.56
  REAL XMC(100),YMC(100),ZSAVE(3),CSAVE(3)
  DATA XMC/2.858, 3.1, 3.2, 3.4, 3.6, 3.8, 4.0, 4.1, 4.2, 4.25,
1 4.3, 4.4, 4.5, 4.55, 4.6, 4.65, 4.7, 4.8, 4.9, 5., 5.1, 5.6,
2 5.8, 5.9, 6.0/
  DATA YMC/1., 1.004188, 1.0054, 1.0051, .99996, .9882, .9681,
1 .954, .9364, .9261, .9154, .8949, .8768, .8695, .864,
2 .86, .8572, .8533, .8511, .8502, .85, .85, .8574,
3 .8646, .8735/
  DATA KK/0/
  NPTS =24
  KK=KK+1
  ZDIFF=.001
  IF(KK.GT.2)ZDIFF=DZ
  ZZ=Z-.356
  ZSAVE(1)=ZZ-ZDIFF
  ZSAVE(2)=ZZ
  ZSAVE(3)=ZZ+ZDIFF

```

```

DO 30 J=1,3
DO 20 I=1,NPTS
IF ((XHC(I)-ZSAVE(J))*(XHC(I+1)-ZSAVE(J)).GT.0.)GO TO 20
FAC=(ZSAVE(J)-XHC(I))/(XHC(I+1)-XHC(I))
CSAVE(J)=YHC(I)+(YHC(I+1)-YHC(I))*FAC
GO TO 30
20 CONTINUE
WRITE(6,2000)Z,ZDIFF,ZSAVE
2000 FORMAT(*16GEOMETRY OUT OF RANGE Z,ZDIFF,ZSAVE *,5E16.4)
STOP"BAD COWL GEOMETRY"
30 CONTINUE
CCZ=(CSAVE(3)-CSAVE(1))/(2.*ZDIFF)
CCZZ=(CSAVE(3)-2.*CSAVE(2)+CSAVE(1))/(ZDIFF*ZDIFF)
*1 COWLADD.73
C(M)=CSAVE(2)
CZ(M)=CCZ
CZZ(M)=CCZZ

```

The cards designated as COWLADD.73 and COWLADD.56 are so marked in Appendix B.

The namelist inputs used to make this run were:

```

$INBUT1
KA=2000,ZEND=3.216,
ISWMODC=0,MOD1C=0,ISWMOD=0,MOD1=0,
$END
$OUTRD
KOUT(1)=40,
$END

```

Sample output sheets from this run are shown in Table D-1. The restart file from this run is written to TAPE17.

To complete the calculation of the inlet configuration, program COWLI is used to rezone the flow field so that it lies within the inlet. To run COWLI, the restart tape generated by SWINT at $z = 3.216$ is accessed as TAPE11 and namelist quantities must be defined. The data cards used for this run are:

```

$INPUTS
ICOWL=1,CNEW=1,CZNEW=.0174,CPHNEW=0.,
IPRINT=0,
$END

```

The output from COWLI is shown in Table D-2. The rezoned restart file generated by COWLI is TAPE3.

The inlet section of the configuration is run using the restart file generated by COWLI which is accessed as TAPE3. The data cards used to complete this run are:

```

$INPUT1
ICOWL=1,ICOWOPT=1,
KA=2000,ZEND=5.2,
ISWMODC=0,MOD1C=0,ISWMOD=0,MOD1=0,
$END
$OUTRD
KOUT(1)=40,
$END

```

The output from this run is shown in Table D-3.

Table D-1. SWINT Forebody run (z = .1 to 3.216)

```

***** PROGRAM SWINT DATE 03/10/25. TIME 08.52.05. *****

****FREE STREAM CONDITIONS****
MACH NUMBER 3.3000E+00
ANGLE OF ATTACK 3.0000E+00
ANGLE OF YAW 0.
VINP 1.2347E+03
PINP 1.0000E+00
DINF 1.0000E-05
MINF 3.5000E+05
M0 1.1123E+06
SINF 0.

**** PROBLEM SET UP****
NC = 19 (NUMBER OF R-PLANES)
MC = 13 (NUMBER OF PHI-PLANES)
MA = 2000 (MAXIMUM NUMBER OF STEPS)
ZEND = 3.2160 (MAXIMUM Z VALUE)
FACTOR = .9000 (CFL SAFETY FACTOR)
PHIO = 180.0000 (MAXIMUM PHI)
IDYAW = 0 (0-SYMMETRIC, 1-ASYMMETRIC)
IZONE = 0 (IF IZONE .GT. 0 THEN REZONE)
ICOWL = 0 (OUTER BOUNDARY DEFINITION, 1=WALL, 0=SHOCK)
NSFD = 0 (IF NSFD .GT. 0 USER READS IN A MESH CLUSTERED IN R - DIRECTION)
NS6D = 0 (IF NS6D .GT. 0 USER READS IN A MESH CLUSTERED IN PHI - DIRECTION)
JM1 = 1 (=0 DIFFERENCE USING M-M-1, =1 USE M+1,M - FOR PREDICTOR)
JM2 = 0 (=0 DIFFERENCE USING M-M-1, =1 USE M+1,M - FOR CORRECTOR)
JN1 = 1 (=0 DIFFERENCE USING N-M-1, =1 USE N+1,N - FOR PREDICTOR)
JN2 = 0 (=0 DIFFERENCE USING N-M-1, =1 USE N+1,N - FOR CORRECTOR)
ISWDIF = 0 (=1 ALLOWS DIFFERENCING OPTION TO BE SWITCHED IN SUCCESSIVE STEPS, =0 NO SWITCHING)
ZCFL1 = 6.4320 (LOWER BOUNDARY OF INTERVAL IN WHICH CFL FACTOR IS REDUCED)
ZCFL2 = 6.4320 (UPPER BOUNDARY OF INTERVAL IN WHICH CFL FACTOR IS REDUCED)
KFAC = 3 (IN INTERVAL ZCFL1 TO ZCFL2, CFL FACTOR REDUCED BY KFAC)

**** OUTPUT CONTROL****
KOUT = 40 20 20 20 (PRINT FREQUENCY)
ZPRINT = 10000.00 10000.00 10000.00 10000.00 (TRANSITION PT IN Z FOR KOUT)
ZTARGET = 0.00 0.00 0.00 0.00 (TARGET OUTPUT STATIONS)
NMAX = 19 (OUTPUT RESTRICTED FOR N .LE. NMAX)
MMIN, MMAX = 2 14 (OUTPUT RESTRICTED FOR MMIN .LE. M .LE. MMAX)
ZTAPE = 10000.0000 (PLOT TAPE WRITTEN AT EACH OUTPUT Z .GT. ZTAPE)
DZPRINT = 10000.0000 (Z INTERVAL FOR FIELD OUTPUT)
JUUU = 9 (=6 PRINT DEBUG WHITE MESSAGES, =9 NO PRINTING)
LLLL = 9 (=6 PRINT DEBUG WHITE MESSAGES, =9 NO PRINTING)
IPCID = 0 (=0 PINF/P PRINTED IN OUT, =1 CP PRINTED)
INTRE = 0 (NUMBER OF CONSTANT RADIAL LINES FOR FIN SURFACE PRESSURE INTERPOLATION)
RINT = -R -R -R -R -R -R -R -R (INTERPOLATION RADII)

**** WALL OPTIONS****
ISWSHO = 0 (ISWSHO = 1 -ENTROPY EXTRAPOLATION, =0 -STANDARD)
ISWROD = 0 (FORM OF BOUNDARY CONDITIONS- 0 = 1A, 15A, 3 = 14C, 15C)

```

Table D-1 (Continued)

(ORDER OF ACCURACY -- 0=1ST ORDER, 1=2ND ORDER UNTIL BODY DISCONTINUITY ENCOUNTERED)
 (0 = ON SEPARATION, 1 = SEPARATION AND INTERIOR POINT SMOOTHING)
 (LOWER BOUNDARY OF INTERVAL IN WHICH A BODY JUMP IS IGNORED)
 (UPPER BOUNDARY OF INTERVAL IN WHICH A BODY JUMP IS IGNORED)
 (NUMBER OF STEPS AFTER AN EXPANSION DISCONTINUITY TO REDUCE CFL FACTOR)
 (MAX NUMBER OF STEPS AFTER AN EXPANSION DISCONTINUITY FOR WHICH X-DERIVATIVES AT WALL SET =0)
 (MAX NUMBER OF STEPS AFTER A COMPRESSION DISCONTINUITY FOR WHICH X-DERIVATIVES AT WALL SET =0)

MOD1 = 0
 ISEP = 0
 ZALOW = 0.00
 ZH1 = 0.00
 KCPL = 0
 NUMPKT = 0
 NUMKTS = 4

**** FIN OPTIONS****

IFIN = 0 (NUMBER OF FINS)
 NFIN = 0 (NUMBER OF FIN SURFACES)

**** SMOOTHING OPTIONS****

ZSMON = 0.00 (IF Z .GT. ZSMON, SMOOTHING IS TURNED ON)
 ZSHOFF = 10000.00 (IF Z .GT. ZSHOFF, SMOOTHING IS TURNED OFF)

** INTERIOR POINTS**

IFD = 0 (0 = NO SMOOTHING, 1 = SMOOTH)
 TMCH = 0.0000 (SMOOTHING COEFFICIENT IN X DIRECTION)
 TMCY = 0.0000 (SMOOTHING COEFFICIENT IN Y DIRECTION)

** SURFACE POINTS**

NSMTH = 0 (NUMBER OF SMOOTHING REGIONS)
 M9 = 0 (0 = 0 (OUTER M-LIMIT FOR SMOOTHING)
 M8 = 0 (LOWER M-LIMIT FOR SMOOTHING)
 M9 = 0 (UPPER M-LIMIT FOR SMOOTHING)
 X9 = 0.00 0.00 0.00 0.00 (.GT. 0 SMOOTHING CONSTANT, .LT. 0 ABS MULTIPLIED BY DENSITY SWITCH)

MACH NO IS 3.3000000E+00 ANGLE OF ATTACK IS 3.0000000E+00 ANGLE OF SIDESLIP IS 0.

PLANE 2 ANGLE IS 0.00 DEGREES

STATION 0 Z IS 1.0000000E-01 C IS 3.5063389E-02 C2 IS 3.5063389E-01 CPMI IS 0.
 B IS 1.763300E-02 BZ IS 1.763300E-01 BPHI IS 0. BZ2 IS 0. B2PMI IS 0. BPHMI IS 0.

N	M	W	U	V	P	PT/PTINF	RHO	S	M	TR	YZ	IS
19	3.5063E-02	1.1861E+03	6.9425E+01	0.	1.6662E+00	9.8660E-01	1.4345E-05	1.6123E+01	2.9463E+00	-R	-R	-R
18	3.4095E-02	1.1833E+03	7.7469E+01	0.	1.7053E+00	9.8660E-01	1.4584E-05	1.6123E+01	2.9309E+00	-R	-R	-R
17	3.3127E-02	1.1808E+03	8.4789E+01	0.	1.7392E+00	9.8660E-01	1.4791E-05	1.6123E+01	2.9179E+00	-R	-R	-R
16	3.2158E-02	1.1786E+03	9.1680E+01	0.	1.7695E+00	9.8660E-01	1.4975E-05	1.6123E+01	2.9064E+00	-R	-R	-R
15	3.1190E-02	1.1765E+03	9.8311E+01	0.	1.7971E+00	9.8660E-01	1.5141E-05	1.6123E+01	2.8962E+00	-R	-R	-R
14	3.0222E-02	1.1745E+03	1.0480E+02	0.	1.8225E+00	9.8660E-01	1.5294E-05	1.6123E+01	2.8869E+00	-R	-R	-R
13	2.9253E-02	1.1726E+03	1.1121E+02	0.	1.8461E+00	9.8660E-01	1.5435E-05	1.6123E+01	2.8784E+00	-R	-R	-R
12	2.8285E-02	1.1708E+03	1.1763E+02	0.	1.8681E+00	9.8660E-01	1.5566E-05	1.6123E+01	2.8707E+00	-R	-R	-R
11	2.7317E-02	1.1690E+03	1.2411E+02	0.	1.8885E+00	9.8660E-01	1.5688E-05	1.6123E+01	2.8635E+00	-R	-R	-R
10	2.6348E-02	1.1672E+03	1.3068E+02	0.	1.9076E+00	9.8660E-01	1.5800E-05	1.6123E+01	2.8569E+00	-R	-R	-R
9	2.5380E-02	1.1655E+03	1.3741E+02	0.	1.9252E+00	9.8660E-01	1.5905E-05	1.6123E+01	2.8508E+00	-R	-R	-R
8	2.4411E-02	1.1638E+03	1.4433E+02	0.	1.9414E+00	9.8660E-01	1.6000E-05	1.6123E+01	2.8453E+00	-R	-R	-R
7	2.3443E-02	1.1621E+03	1.5150E+02	0.	1.9562E+00	9.8660E-01	1.6087E-05	1.6123E+01	2.8403E+00	-R	-R	-R
6	2.2475E-02	1.1604E+03	1.5896E+02	0.	1.9694E+00	9.8660E-01	1.6165E-05	1.6123E+01	2.8359E+00	-R	-R	-R
5	2.1506E-02	1.1587E+03	1.6678E+02	0.	1.9809E+00	9.8660E-01	1.6232E-05	1.6123E+01	2.8321E+00	-R	-R	-R
4	2.0538E-02	1.1570E+03	1.7501E+02	0.	1.9905E+00	9.8660E-01	1.6288E-05	1.6123E+01	2.8289E+00	-R	-R	-R
3	1.9570E-02	1.1552E+03	1.8374E+02	0.	1.9978E+00	9.8660E-01	1.6331E-05	1.6123E+01	2.8265E+00	-R	-R	-R
2	1.8601E-02	1.1534E+03	1.9306E+02	0.	2.0026E+00	9.8660E-01	1.6359E-05	1.6123E+01	2.8249E+00	-R	-R	-R
1	1.7633E-02	1.1516E+03	2.0306E+02	0.	2.0044E+00	9.8660E-01	1.6369E-05	1.6123E+01	2.8243E+00	-R	-R	-R

Table D-1. (Continued)

PLANE 3 ANGLE IS 15.00 DEGREES									
STATION	0	Z IS	1.0000000E-01	C IS	3.5112223E-02	CZ IS	3.5112223E-01	CPHI IS	0.
B IS	1.763300E-02	BZ IS	1.763300E-01	BPPI IS	0.	BZZ IS	0.	BZPHI IS	0.
N	R	W	U	V	P	PT/PTIME	RMO	S	M
19	3.5112E-02	1.1867E-03	6.9570E+01	1.6725E+01	1.6533E+00	9.8717E-01	1.4271E-05	1.6123E+01	2.9516E+00
18	3.4141E-02	1.1835E-03	7.7621E+01	1.6725E+01	1.6928E+00	9.8717E-01	1.4511E-05	1.6123E+01	2.9361E+00
17	3.3170E-02	1.1815E-03	8.4930E+01	1.6725E+01	1.7260E+00	9.8717E-01	1.4717E-05	1.6123E+01	2.9230E+00
16	3.2199E-02	1.1752E-03	9.1819E+01	1.6725E+01	1.7568E+00	9.8717E-01	1.4901E-05	1.6123E+01	2.9116E+00
15	3.1229E-02	1.1773E-03	9.8438E+01	1.6725E+01	1.7843E+00	9.8717E-01	1.5067E-05	1.6123E+01	2.9013E+00
14	3.0257E-02	1.1752E-03	1.0491E+02	1.6725E+01	1.8096E+00	9.8717E-01	1.5219E-05	1.6123E+01	2.8928E+00
13	2.9288E-02	1.1733E-03	1.1122E+02	1.6725E+01	1.8331E+00	9.8717E-01	1.5360E-05	1.6123E+01	2.8833E+00
12	2.8313E-02	1.1714E-03	1.1772E+02	1.6725E+01	1.8549E+00	9.8717E-01	1.5490E-05	1.6123E+01	2.8757E+00
11	2.7344E-02	1.1696E-03	1.2419E+02	1.6725E+01	1.8753E+00	9.8717E-01	1.5611E-05	1.6123E+01	2.8685E+00
10	2.6373E-02	1.1675E-03	1.3075E+02	1.6725E+01	1.8943E+00	9.8717E-01	1.5724E-05	1.6123E+01	2.8619E+00
9	2.5402E-02	1.1652E-03	1.3747E+02	1.6725E+01	1.9118E+00	9.8717E-01	1.5828E-05	1.6123E+01	2.8558E+00
8	2.4430E-02	1.1624E-03	1.4438E+02	1.6725E+01	1.9280E+00	9.8717E-01	1.5924E-05	1.6123E+01	2.8502E+00
7	2.3459E-02	1.1627E-03	1.5155E+02	1.6725E+01	1.9427E+00	9.8717E-01	1.6010E-05	1.6123E+01	2.8452E+00
6	2.2488E-02	1.1610E-03	1.5901E+02	1.6725E+01	1.9559E+00	9.8717E-01	1.6088E-05	1.6123E+01	2.8408E+00
5	2.1517E-02	1.1593E-03	1.6682E+02	1.6725E+01	1.9673E+00	9.8717E-01	1.6155E-05	1.6123E+01	2.8370E+00
4	2.0546E-02	1.1576E-03	1.7507E+02	1.6725E+01	1.9763E+00	9.8717E-01	1.6211E-05	1.6123E+01	2.8338E+00
3	1.9575E-02	1.1559E-03	1.8381E+02	1.6725E+01	1.9840E+00	9.8717E-01	1.6254E-05	1.6123E+01	2.8313E+00
2	1.8605E-02	1.1541E-03	1.9314E+02	1.6725E+01	1.9900E+00	9.8717E-01	1.6282E-05	1.6123E+01	2.8298E+00
1	1.7633E-02	1.1523E-03	2.0318E+02	1.6725E+01	1.9908E+00	9.8717E-01	1.6292E-05	1.6123E+01	2.8292E+00

PLANE 13 ANGLE IS 185.00 DEGREES									
STATION	0	Z IS	1.0000000E-01	C IS	3.9479962E-02	CZ IS	3.9479962E-01	CPHI IS	0.
B IS	1.763300E-02	BZ IS	1.763300E-01	BPPI IS	0.	BZZ IS	0.	BZPHI IS	0.
N	R	W	U	V	P	PT/PTIME	RMO	S	M
19	3.9480E-02	1.2208E-03	9.2483E+01	1.6725E+01	1.1318E+00	9.9981E-01	1.0924E-05	1.6118E+01	3.2151E+00
18	3.8266E-02	1.2179E-03	1.0096E+02	1.6725E+01	1.1629E+00	9.9981E-01	1.1137E-05	1.6118E+01	3.2197E+00
17	3.7033E-02	1.2157E-03	1.0968E+02	1.6725E+01	1.1895E+00	9.9981E-01	1.1292E-05	1.6118E+01	3.1835E+00
16	3.5819E-02	1.2139E-03	1.1170E+02	1.6725E+01	1.2044E+00	9.9981E-01	1.1420E-05	1.6118E+01	3.1728E+00
15	3.4623E-02	1.2123E-03	1.1641E+02	1.6725E+01	1.2212E+00	9.9981E-01	1.1534E-05	1.6118E+01	3.1634E+00
14	3.3411E-02	1.2107E-03	1.2097E+02	1.6725E+01	1.2366E+00	9.9981E-01	1.1637E-05	1.6118E+01	3.1550E+00
13	3.2188E-02	1.2093E-03	1.2551E+02	1.6725E+01	1.2509E+00	9.9981E-01	1.1733E-05	1.6118E+01	3.1472E+00
12	3.0987E-02	1.2078E-03	1.3011E+02	1.6725E+01	1.2645E+00	9.9981E-01	1.1824E-05	1.6118E+01	3.1399E+00
11	2.9770E-02	1.2064E-03	1.3484E+02	1.6725E+01	1.2774E+00	9.9981E-01	1.1910E-05	1.6118E+01	3.1330E+00
10	2.8556E-02	1.2050E-03	1.3977E+02	1.6725E+01	1.2898E+00	9.9981E-01	1.1993E-05	1.6118E+01	3.1265E+00
9	2.7343E-02	1.2035E-03	1.4497E+02	1.6725E+01	1.3017E+00	9.9981E-01	1.2072E-05	1.6118E+01	3.1203E+00
8	2.6129E-02	1.2021E-03	1.5050E+02	1.6725E+01	1.3132E+00	9.9981E-01	1.2148E-05	1.6118E+01	3.1144E+00
7	2.4915E-02	1.2008E-03	1.5647E+02	1.6725E+01	1.3241E+00	9.9981E-01	1.2219E-05	1.6118E+01	3.1088E+00
6	2.3702E-02	1.1995E-03	1.6297E+02	1.6725E+01	1.3343E+00	9.9981E-01	1.2287E-05	1.6118E+01	3.1036E+00
5	2.2488E-02	1.1974E-03	1.7013E+02	1.6725E+01	1.3438E+00	9.9981E-01	1.2350E-05	1.6118E+01	3.0988E+00
4	2.1274E-02	1.1956E-03	1.7812E+02	1.6725E+01	1.3523E+00	9.9981E-01	1.2405E-05	1.6118E+01	3.0946E+00
3	2.0060E-02	1.1938E-03	1.8717E+02	1.6725E+01	1.3594E+00	9.9981E-01	1.2452E-05	1.6118E+01	3.0911E+00
2	1.8847E-02	1.1917E-03	1.9757E+02	1.6725E+01	1.3645E+00	9.9981E-01	1.2485E-05	1.6118E+01	3.0886E+00
1	1.7633E-02	1.1895E-03	2.0975E+02	1.6725E+01	1.3685E+00	9.9981E-01	1.2498E-05	1.6118E+01	3.0875E+00

PLANE 14 ANGLE IS 180.00 DEGREES									
STATION	0	Z IS	1.0000000E-01	C IS	3.9596531E-02	CZ IS	3.9596531E-01	CPHI IS	0.
B IS	1.763300E-02	BZ IS	1.763300E-01	BPPI IS	0.	BZZ IS	0.	BZPHI IS	0.
N	R	W	U	V	P	PT/PTIME	RMO	S	M
19	3.9597E-02	1.2213E-03	9.4394E+01	-2.2167E-13	1.1261E+00	9.9983E-01	1.0885E-05	1.6118E+01	3.2185E+00
18	3.8376E-02	1.2184E-03	1.0182E+02	-2.2167E-13	1.1549E+00	9.9983E-01	1.1097E-05	1.6118E+01	3.2002E+00

Table D-1. (Continued)

17	3.7150E-02	1.2102E+03	1.0746E+02	-2.2167E-13	1.1792E+00	9.9983E-01	1.1249E-05	1.6118E+01	3.1872E+00	-R	----									
16	3.5976E-02	1.2144E+03	1.1242E+02	-2.2167E-13	1.1978E+00	9.9983E-01	1.1376E-05	1.6118E+01	3.1766E+00	-R	----									
15	3.4716E-02	1.2188E+03	1.1705E+02	-2.2167E-13	1.2143E+00	9.9983E-01	1.1487E-05	1.6118E+01	3.1673E+00	-R	----									
14	3.3497E-02	1.2131E+03	1.2161E+02	-2.2167E-13	1.2343E+00	9.9983E-01	1.1569E-05	1.6118E+01	3.1589E+00	-R	----									
13	3.2273E-02	1.2088E+03	1.2603E+02	-2.2167E-13	1.2635E+00	9.9983E-01	1.1684E-05	1.6118E+01	3.1512E+00	-R	----									
12	3.1055E-02	1.2044E+03	1.3057E+02	-2.2167E-13	1.2569E+00	9.9983E-01	1.1774E-05	1.6118E+01	3.1439E+00	-R	----									
11	2.9833E-02	1.2070E+03	1.3524E+02	-2.2167E-13	1.2697E+00	9.9983E-01	1.1859E-05	1.6118E+01	3.1371E+00	-R	----									
10	2.8615E-02	1.2056E+03	1.4012E+02	-2.2167E-13	1.2819E+00	9.9983E-01	1.1940E-05	1.6118E+01	3.1306E+00	-R	----									
9	2.7398E-02	1.2056E+03	1.4526E+02	-2.2167E-13	1.2937E+00	9.9983E-01	1.2019E-05	1.6118E+01	3.1245E+00	-R	----									
8	2.6174E-02	1.2027E+03	1.5074E+02	-2.2167E-13	1.3050E+00	9.9983E-01	1.2093E-05	1.6118E+01	3.1186E+00	-R	----									
7	2.4954E-02	1.2012E+03	1.5666E+02	-2.2167E-13	1.3158E+00	9.9983E-01	1.2165E-05	1.6118E+01	3.1130E+00	-R	----									
6	2.3734E-02	1.1997E+03	1.6311E+02	-2.2167E-13	1.3259E+00	9.9983E-01	1.2232E-05	1.6118E+01	3.1078E+00	-R	----									
5	2.2514E-02	1.1980E+03	1.7023E+02	-2.2167E-13	1.3374E+00	9.9983E-01	1.2294E-05	1.6118E+01	3.1031E+00	-R	----									
4	2.1294E-02	1.1963E+03	1.7820E+02	-2.2167E-13	1.3438E+00	9.9983E-01	1.2350E-05	1.6118E+01	3.0988E+00	-R	----									
3	2.0073E-02	1.1943E+03	1.8723E+02	-2.2167E-13	1.3509E+00	9.9983E-01	1.2396E-05	1.6118E+01	3.0953E+00	-R	----									
2	1.8853E-02	1.1924E+03	1.9746E+02	-2.2167E-13	1.3560E+00	9.9983E-01	1.2429E-05	1.6118E+01	3.0928E+00	-R	----									
1	1.7633E-02	1.1902E+03	2.0987E+02	-2.2167E-13	1.3580E+00	9.9983E-01	1.2443E-05	1.6118E+01	3.0917E+00	-R	----									
STEP#	1	02#	1.343524E-03	CFL=	3.7215559E+01	N,M,J=	19	2	3	Z=	1.0134352E-01	OPTIONS=	0	0	0	JS=	1	1	0	0
STEP#	2	02#	1.3616197E-03	CFL=	3.6720973E+01	N,M,J=	19	2	3	Z=	1.0270514E-01	OPTIONS=	0	0	0	JS=	1	1	0	0
STEP#	3	02#	1.3799518E-03	CFL=	3.6233150E+01	N,M,J=	19	2	3	Z=	1.0408510E-01	OPTIONS=	0	0	0	JS=	1	1	0	0
STEP#	4	02#	1.3985237E-03	CFL=	3.5751986E+01	N,M,J=	19	2	3	Z=	1.0548362E-01	OPTIONS=	0	0	0	JS=	1	1	0	0
STEP#	5	02#	1.4173382E-03	CFL=	3.5277396E+01	N,M,J=	19	2	3	Z=	1.0690096E-01	OPTIONS=	0	0	0	JS=	1	1	0	0
MACH NO IS 3.3000000E+00 ANGLE OF ATTACK IS 3.0000000E+00 ANGLE OF SIDESLIP IS 0.																				
PLANE 2 ANGLE IS 0.00 DEGREES																				
STATION 272 Z IS 3.2160000E+00 C IS 1.0894893E+00 C2 IS 3.3849630E-01 CPHI IS 0.																				
B IS 5.670773E-01 BZ IS 1.763300E-01 BPHI IS 0. BZZ IS 0. BPHI IS 0. BPHI IS 0.																				
N	R	M	U	V	P	PT/PTINF	RHO	S	M	IS	TZ	TR	IS							
19	1.0895E+00	1.1930E+03	5.3714E+01	0.	1.5704E+00	9.9071E-01	1.3767E-05	1.6122E+01	2.9884E+00	-R	----									
18	1.0605E+00	1.1903E+03	6.1638E+01	0.	1.6079E+00	9.9068E-01	1.4001E-05	1.6122E+01	2.9127E+00	-R	----									
17	1.0314E+00	1.1880E+03	6.8477E+01	0.	1.6407E+00	9.9064E-01	1.4204E-05	1.6122E+01	2.9592E+00	-R	----									
16	1.0024E+00	1.1858E+03	7.5749E+01	0.	1.6704E+00	9.9063E-01	1.4388E-05	1.6122E+01	2.9473E+00	-R	----									
15	9.7340E-01	1.1838E+03	8.2432E+01	0.	1.6990E+00	9.9059E-01	1.4557E-05	1.6122E+01	2.9364E+00	-R	----									
14	9.4437E-01	1.1818E+03	8.9044E+01	0.	1.7238E+00	9.9056E-01	1.4714E-05	1.6122E+01	2.9264E+00	-R	----									
13	9.1535E-01	1.1799E+03	9.5672E+01	0.	1.7482E+00	9.9051E-01	1.4863E-05	1.6122E+01	2.9171E+00	-R	----									
12	8.8633E-01	1.1780E+03	1.0239E+02	0.	1.7714E+00	9.9047E-01	1.5003E-05	1.6122E+01	2.9083E+00	-R	----									
11	8.5731E-01	1.1761E+03	1.0926E+02	0.	1.7934E+00	9.9042E-01	1.5136E-05	1.6122E+01	2.9001E+00	-R	----									
10	8.2828E-01	1.1742E+03	1.1636E+02	0.	1.8144E+00	9.9036E-01	1.5262E-05	1.6122E+01	2.8924E+00	-R	----									
9	7.9926E-01	1.1724E+03	1.2373E+02	0.	1.8344E+00	9.9029E-01	1.5381E-05	1.6122E+01	2.8851E+00	-R	----									
8	7.7024E-01	1.1705E+03	1.3145E+02	0.	1.8532E+00	9.9021E-01	1.5494E-05	1.6122E+01	2.8783E+00	-R	----									
7	7.4121E-01	1.1686E+03	1.3959E+02	0.	1.8704E+00	9.9011E-01	1.5598E-05	1.6122E+01	2.8720E+00	-R	----									
6	7.1219E-01	1.1666E+03	1.4825E+02	0.	1.8870E+00	9.9002E-01	1.5694E-05	1.6122E+01	2.8663E+00	-R	----									
5	6.8317E-01	1.1646E+03	1.5752E+02	0.	1.9015E+00	9.8991E-01	1.5799E-05	1.6122E+01	2.8611E+00	-R	----									
4	6.5415E-01	1.1625E+03	1.6749E+02	0.	1.9142E+00	9.8979E-01	1.5884E-05	1.6122E+01	2.8567E+00	-R	----									
3	6.2512E-01	1.1603E+03	1.7847E+02	0.	1.9234E+00	9.8972E-01	1.5966E-05	1.6122E+01	2.8531E+00	-R	----									
2	5.9610E-01	1.1580E+03	1.9000E+02	0.	1.9329E+00	9.8964E-01	1.5964E-05	1.6122E+01	2.8502E+00	-R	----									
1	5.6708E-01	1.1555E+03	2.0374E+02	0.	1.9385E+00	9.8960E-01	1.5936E-05	1.6123E+01	2.8490E+00	-R	----									

Table D-1. (Continued)

PLANE 3 ANGLE IS 15.00 DEGREES									
STATION 272 Z IS 3.2160000E+00 C IS 1.0923011E+00 CZ IS 3.3936430E-01 CPNI IS 2.0766518E-02									
B IS 5.670773E-01 BZ IS 1.763300E-01 BPHI IS 0. BZP IS 0. BZPHI IS 0. BPMPHI IS 0.									
M	R	W	U	V	P	PT/PTINF	RMO	S	M
19	1.0923E+00	1.1933E+03	5.4592E+01	1.4501E+01	1.5631E+00	9.9099E-01	1.3722E-05	1.6122E+01	2.9917E+00
18	1.0831E+00	1.1907E+03	6.2493E+01	1.4545E+01	1.6003E+00	9.9097E-01	1.3955E-05	1.6122E+01	2.9760E+00
17	1.0339E+00	1.1803E+03	6.9700E+01	1.4618E+01	1.6329E+00	9.9094E-01	1.4157E-05	1.6122E+01	2.9626E+00
16	1.0048E+00	1.1862E+03	7.6539E+01	1.4717E+01	1.6624E+00	9.9091E-01	1.4339E-05	1.6122E+01	2.9507E+00
15	9.7550E-01	1.1841E+03	8.3185E+01	1.4840E+01	1.6897E+00	9.9087E-01	1.4507E-05	1.6122E+01	2.9398E+00
14	9.4641E-01	1.1822E+03	8.9759E+01	1.4988E+01	1.7152E+00	9.9083E-01	1.4663E-05	1.6122E+01	2.9299E+00
13	9.1723E-01	1.1802E+03	9.6349E+01	1.5162E+01	1.7393E+00	9.9079E-01	1.4810E-05	1.6122E+01	2.9206E+00
12	8.8805E-01	1.1784E+03	1.0303E+02	1.5363E+01	1.7622E+00	9.9074E-01	1.4949E-05	1.6122E+01	2.9119E+00
11	8.5887E-01	1.1765E+03	1.0986E+02	1.5593E+01	1.7840E+00	9.9069E-01	1.5080E-05	1.6122E+01	2.9037E+00
10	8.2969E-01	1.1747E+03	1.1691E+02	1.5857E+01	1.8048E+00	9.9062E-01	1.5205E-05	1.6122E+01	2.8961E+00
9	8.0051E-01	1.1728E+03	1.2424E+02	1.6156E+01	1.8244E+00	9.9055E-01	1.5323E-05	1.6122E+01	2.8889E+00
8	7.7133E-01	1.1709E+03	1.3191E+02	1.6497E+01	1.8430E+00	9.9046E-01	1.5434E-05	1.6122E+01	2.8821E+00
7	7.4215E-01	1.1690E+03	1.4001E+02	1.6884E+01	1.8603E+00	9.9036E-01	1.5537E-05	1.6122E+01	2.8759E+00
6	7.1297E-01	1.1670E+03	1.4861E+02	1.7322E+01	1.8762E+00	9.9026E-01	1.5631E-05	1.6122E+01	2.8702E+00
5	6.8379E-01	1.1650E+03	1.5783E+02	1.7824E+01	1.8904E+00	9.9003E-01	1.5714E-05	1.6122E+01	2.8651E+00
4	6.5461E-01	1.1630E+03	1.6775E+02	1.8388E+01	1.9027E+00	9.9000E-01	1.5787E-05	1.6122E+01	2.8608E+00
3	6.2544E-01	1.1608E+03	1.7867E+02	1.9041E+01	1.9116E+00	9.8930E-01	1.5837E-05	1.6122E+01	2.8573E+00
2	5.9626E-01	1.1585E+03	1.9013E+02	1.9747E+01	1.9208E+00	9.8972E-01	1.5893E-05	1.6122E+01	2.8544E+00
1	5.6708E-01	1.1560E+03	2.0383E+02	2.0394E+01	1.9180E+00	9.8664E-01	1.5862E-05	1.6123E+01	2.8533E+00

STATION 272 Z IS 3.2160000E+00 C IS 1.2963169E+00 CZ IS 4.0393232E-01 CPNI IS 3.2606111E-02									
B IS 5.670773E-01 BZ IS 1.763300E-01 BPHI IS 0. BZP IS 0. BZPHI IS 0. BPMPHI IS 0.									
M	R	W	U	V	P	PT/PTINF	RMO	S	M
19	1.2963E+00	1.2150E+03	1.0713E+02	1.5601E+01	1.1950E+00	9.9942E-01	1.1355E-05	1.6118E+01	3.1779E+00
18	1.2558E+00	1.2119E+03	1.1478E+02	1.5323E+01	1.2275E+00	9.9938E-01	1.1575E-05	1.6118E+01	3.1596E+00
17	1.2153E+00	1.2096E+03	1.2094E+02	1.5709E+01	1.2527E+00	9.9935E-01	1.1744E-05	1.6118E+01	3.1459E+00
16	1.1748E+00	1.2076E+03	1.2616E+02	1.5433E+01	1.2728E+00	9.9931E-01	1.1878E-05	1.6118E+01	3.1351E+00
15	1.1343E+00	1.2058E+03	1.3107E+02	1.5681E+01	1.2908E+00	9.9927E-01	1.1997E-05	1.6118E+01	3.1256E+00
14	1.0938E+00	1.2042E+03	1.3571E+02	1.6165E+01	1.3066E+00	9.9921E-01	1.2102E-05	1.6118E+01	3.1173E+00
13	1.0532E+00	1.2027E+03	1.4029E+02	1.6376E+01	1.3214E+00	9.9916E-01	1.2200E-05	1.6118E+01	3.1097E+00
12	1.0127E+00	1.2012E+03	1.4481E+02	1.6624E+01	1.3349E+00	9.9910E-01	1.2288E-05	1.6118E+01	3.1028E+00
11	9.7221E-01	1.1998E+03	1.4938E+02	1.6905E+01	1.3475E+00	9.9903E-01	1.2371E-05	1.6118E+01	3.0964E+00
10	9.3170E-01	1.1984E+03	1.5402E+02	1.7229E+01	1.3592E+00	9.9895E-01	1.2447E-05	1.6119E+01	3.0906E+00
9	8.9118E-01	1.1970E+03	1.5881E+02	1.7596E+01	1.3701E+00	9.9886E-01	1.2518E-05	1.6119E+01	3.0851E+00
8	8.5067E-01	1.1957E+03	1.6376E+02	1.8015E+01	1.3802E+00	9.9874E-01	1.2584E-05	1.6119E+01	3.0801E+00
7	8.1016E-01	1.1943E+03	1.6895E+02	1.8489E+01	1.3895E+00	9.9860E-01	1.2643E-05	1.6119E+01	3.0755E+00
6	7.6964E-01	1.1930E+03	1.7441E+02	1.9025E+01	1.3978E+00	9.9841E-01	1.2697E-05	1.6119E+01	3.0714E+00
5	7.2913E-01	1.1916E+03	1.8023E+02	1.9629E+01	1.4051E+00	9.9819E-01	1.2743E-05	1.6119E+01	3.0678E+00
4	6.8862E-01	1.1902E+03	1.8643E+02	2.0278E+01	1.4113E+00	9.9774E-01	1.2782E-05	1.6119E+01	3.0645E+00
3	6.4810E-01	1.1888E+03	1.9324E+02	2.0991E+01	1.4157E+00	9.9740E-01	1.2809E-05	1.6119E+01	3.0622E+00
2	6.0759E-01	1.1872E+03	2.0043E+02	2.1250E+01	1.4198E+00	9.9601E-01	1.2830E-05	1.6120E+01	3.0593E+00
1	5.6708E-01	1.1859E+03	2.0911E+02	2.2880E+01	1.4201E+00	9.9266E-01	1.2844E-05	1.6118E+01	3.0613E+00

PLANE 14 ANGLE IS 180.00 DEGREES									
STATION 272 Z IS 3.2160000E+00 C IS 1.3007765E+00 CZ IS 4.0542136E-01 CPNI IS 0.									
B IS 5.670773E-01 BZ IS 1.763300E-01 BPHI IS 0. BZP IS 0. BZPHI IS 0. BPMPHI IS 0.									
M	R	W	U	V	P	PT/PTINF	RMO	S	M
19	1.3008E+00	1.2154E+03	1.0813E+02	6.9666E-13	1.1894E+00	9.9947E-01	1.1317E-05	1.6118E+01	3.1811E+00
18	1.2606E+00	1.2123E+03	1.1501E+02	0.	1.2221E+00	9.9942E-01	1.1538E-05	1.6118E+01	3.1627E+00
17	1.2193E+00	1.2100E+03	1.2195E+02	0.	1.2472E+00	9.9939E-01	1.1707E-05	1.6118E+01	3.1489E+00
16	1.1785E+00	1.2080E+03	1.2715E+02	0.	1.2672E+00	9.9934E-01	1.1841E-05	1.6118E+01	3.1381E+00
15	1.1377E+00	1.2062E+03	1.3203E+02	0.	1.2851E+00	9.9930E-01	1.1960E-05	1.6118E+01	3.1286E+00
14	1.0970E+00	1.2046E+03	1.3663E+02	0.	1.3009E+00	9.9925E-01	1.2084E-05	1.6118E+01	3.1203E+00

3	1.0562E+00	1.2031E+03	1.4117E+02	0.	1.3155E+00	9.9919E-01	1.2161E-05	1.6118E+01	3.1127E+00	-R	0000
2	1.0154E+00	1.2016E+03	1.4565E+02	0.	1.3289E+00	9.9913E-01	1.2249E-05	1.6118E+01	3.1059E+00	-R	0000
1	9.7469E-01	1.2002E+03	1.5018E+02	0.	1.3415E+00	9.9905E-01	1.2332E-05	1.6118E+01	3.0995E+00	-R	0000
8	9.3932E-01	1.1988E+03	1.5478E+02	0.	1.3532E+00	9.9897E-01	1.2408E-05	1.6119E+01	3.0934E+00	-R	0000
9	8.9327E-01	1.1975E+03	1.5951E+02	0.	1.3661E+00	9.9887E-01	1.2479E-05	1.6119E+01	3.0881E+00	-R	0000
8	8.5240E-01	1.1961E+03	1.6441E+02	0.	1.3782E+00	9.9874E-01	1.2544E-05	1.6119E+01	3.0831E+00	-R	0000
7	8.1164E-01	1.1948E+03	1.6953E+02	0.	1.3894E+00	9.9860E-01	1.2604E-05	1.6119E+01	3.0785E+00	-R	0000
6	7.7080E-01	1.1934E+03	1.7492E+02	0.	1.3918E+00	9.9841E-01	1.2658E-05	1.6119E+01	3.0743E+00	-R	0000
5	7.3125E-01	1.1921E+03	1.8066E+02	0.	1.3992E+00	9.9815E-01	1.2705E-05	1.6119E+01	3.0705E+00	-R	0000
4	6.9393E-01	1.1907E+03	1.8678E+02	0.	1.4056E+00	9.9775E-01	1.2745E-05	1.6119E+01	3.0672E+00	-R	0000
3	6.6060E-01	1.1893E+03	1.9349E+02	0.	1.4102E+00	9.9736E-01	1.2774E-05	1.6119E+01	3.0647E+00	-R	0000
2	6.3078E-01	1.1877E+03	2.0061E+02	0.	1.4146E+00	9.9692E-01	1.2798E-05	1.6120E+01	3.0621E+00	-R	0000
1	5.6708E-01	1.1865E+03	2.0921E+02	0.	1.4153E+00	9.9933E-01	1.2815E-05	1.6118E+01	3.0640E+00	-R	0000

MACH NO =	ANGLE OF ATTACK =		P R E S S U R E		A N G L E O F S I D E S L I P =		Z 0 =						
	0.0	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	135.0	150.0	165.0	180.0
2.004	1.991	1.951	1.891	1.814	1.729	1.643	1.562	1.491	1.434	1.392	1.367	1.358	1.358
2.010	1.977	1.939	1.880	1.806	1.724	1.640	1.561	1.492	1.436	1.396	1.371	1.362	1.362
2.013	1.964	1.927	1.870	1.799	1.719	1.638	1.561	1.494	1.439	1.399	1.375	1.367	1.367
2.014	1.965	1.928	1.862	1.792	1.714	1.635	1.561	1.495	1.442	1.404	1.380	1.372	1.372
2.015	1.964	1.928	1.862	1.792	1.714	1.635	1.561	1.497	1.445	1.408	1.385	1.377	1.377
2.017	1.944	1.933	1.899	1.847	1.780	1.707	1.632	1.561	1.499	1.448	1.389	1.382	1.382
2.018	1.924	1.891	1.860	1.775	1.703	1.630	1.561	1.500	1.451	1.415	1.393	1.386	1.386
2.020	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.017	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.055	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.094	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.133	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.172	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.212	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415
2.256	1.930	1.918	1.882	1.828	1.760	1.688	1.616	1.552	1.500	1.461	1.435	1.420	1.415

AERODYNAMIC DATA

F R E E S T R E A M C O N D I T I O N S									
MACH NO. = 3.300000E+00		ANGLE OF ATTACK = 3.000000E+00		ANGLE OF SIDESLIP = 0.					
VINP = 1.234747E+03		TOTAL ANGLE OF ATTACK = 3.000000E+00		AERO ROLL ANGLE = 0.					
PINP = 1.000000E+00		DINF = 1.000000E-05		SINF = 0.					
PERFECT GAS		GAMMA = 1.400000E+00							
R E F E R E N C E Q U A N T I T I E S									
REFERENCE LENGTH IS 3.216000E+00		REFERENCE AREA IS 1.010263E+00		Z0 IS 0.					
ICPP	CML	CMX	CNN	CY	CA	CN	Z-Z0	ICPY	
6.62296E-01	0.	5.8840E-02	0.	0.	7.81570E-02	0.87881E-02	3.094		-R
6.70607E-01	0.	6.10525E-02	0.	0.	6.91304E-02	9.10407E-02	3.133		-R
6.79025E-01	0.	6.33869E-02	0.	0.	8.21690E-02	9.33503E-02	3.172		-R
6.87544E-01	0.	6.58105E-02	0.	0.	8.42588E-02	9.57183E-02	3.212		-R
6.88389E-01	0.	6.60544E-02	0.	0.	8.44609E-02	9.59550E-02	3.216		-R

Table D-2. COWLI output

```

***** FREE STREAM CONDITIONS *****
MACH NUMBER      3.3000000
ANGLE OF ATTACK  3.0000000
YAW ANGLE        0.0000000
VINP             1234.7469376
PINP             1.0000000
DINF             .0000100
MO              1112300.0000000
SINF            16.1180957
PTINF           57.2187841

```

```

***** PROBLEM SET UP *****
NC          19
MC          13
IBODY       0
DOZ         0.00000
ICOWL       1

```

```

***** CLUSTERING *****
M CLUSTERING
1 0.000000
2 .0555556
3 .1111111
4 .1666667
5 .2222222
6 .2777778
7 .3333333
8 .3888889
9 .4444444
10 .5000000
11 .5555556
12 .6111111
13 .6666667
14 .7222222
15 .7777778
16 .8333333
17 .8888889
18 .9444444
19 1.0000000

```

Table D-2. (Continued)

***** CONFL GEOMETRY *****						
M	b	RZ	BPFI	C	CZ	CPHI
1	.5670773	-R	-R	1.0000000	.0174000	0.0000000
2	.5670773	-R	-R	1.0000000	.0174000	0.0000000
3	.5670773	-R	-R	1.0000000	.0174000	0.0000000
4	.5670773	-R	-R	1.0000000	.0174000	0.0000000
5	.5670773	-R	-R	1.0000000	.0174000	0.0000000
6	.5670773	-R	-R	1.0000000	.0174000	0.0000000
7	.5670773	-R	-R	1.0000000	.0174000	0.0000000
8	.5670773	-R	-R	1.0000000	.0174000	0.0000000
9	.5670773	-R	-R	1.0000000	.0174000	0.0000000
10	.5670773	-R	-R	1.0000000	.0174000	0.0000000
11	.5670773	-R	-R	1.0000000	.0174000	0.0000000
12	.5670773	-R	-R	1.0000000	.0174000	0.0000000
13	.5670773	-R	-R	1.0000000	.0174000	0.0000000
INLET PLANE FLOW FIELD PARAMETERS						
SHOCK LAYER AVERAGE PNESSURE RECOVERY RATIO						
INLET AVERAGE PRESSURE RECOVERY RATIO				.9959060		
SHOCK LAYER CROSSSECTIONAL AREA				3.4453534		
INLET ENTRANCE CROSSSECTIONAL AREA				2.1313298		
MASS CAPTURED BY THE INLET				.0349651		
ADDDITIVE AXIAL FORCE COEFFICIENT				.0570209		
ADDDITIVE NORMAL FORCE COEFFICIENT				-.0170264		
ADDDITIVE YAW FORCE COEFFICIENT				0.0000000		
REFERENCE AREA				1.0102628		
TOTAL DRAG ERROR				-.2080 0/0		
TOTAL NORMAL FORCE ERROR				4.8896 0/0		
TOTAL YAW FORCE ERROR				0.0000 0/0		

Table D-3. SWINT Inlet output. (z=3.216 to 5.2)

```

***** PROGRAM SWINT DATE 03/10/25. TIME 09.19.39. *****

*****FREE STREAM CONDITIONS*****
MACH NUMBER 3.3000E+00
ANGLE OF ATTACK 3.0000E+00
ANGLE OF YAW 0.
VINP 1.2347E+03
PINF 1.0000E+00
DINF 1.0000E-05
MINF 3.5000E+05
MO 1.1123E+06
SINF 0.

**** PROBLEM SET UP****
NC = 19 (NUMBER OF R-PLANES)
MC = 13 (NUMBER OF PHI-PLANES)
KA = 2000 (MAXIMUM NUMBER OF STEPS)
ZEND = 5.2000 (MAXIMUM Z VALUE)
FACTOR = .9000 (CFL SAFETY FACTOR)
PHIO = 100.0000 (MAXIMUM PHI)
IDYAN = 0 (0-SYMMETRIC, 1-ASYMMETRIC)
IZONE = 0 (IF IZONE .GT. 0 THEN REZONE)
ICOWL = 1 (OUTER BOUNDARY DEFINITION, 1=WALL,0=SHOCK)
ISFO = 0 (IF NSFO .GT. 0 USER READS IN A MESH CLUSTERED IN PHI - DIRECTION)
NSGO = 0 (IF NSGO .GT. 0 USER READS IN A MESH CLUSTERED IN R - DIRECTION)
JN1 = 1 (=0 DIFFERENCE USING M,N-1, =1 USE M+1,M - FOR PREDICTOR)
JN2 = 0 (=0 DIFFERENCE USING M,N-1, =1 USE M+1,M - FOR CORRECTOR)
JN1 = 1 (=0 DIFFERENCE USING M,N-1, =1 USE M+1,M - FOR PREDICTOR)
JN2 = 0 (=0 DIFFERENCE USING M,N-1, =1 USE M+1,M - FOR CORRECTOR)
ISWOF = 0 (=1 ALLOWS DIFFERENCING OPTION TO BE SWITCHED IN SUCCESSIVE STEPS, =0 NO SWITCHING)
ZCFL1 = 10.4000 (LOWER BOUNDARY OF INTERVAL IN WHICH CFL FACTOR IS REDUCED)
ZCFL2 = 10.4000 (UPPER BOUNDARY OF INTERVAL IN WHICH CFL FACTOR IS REDUCED)
KFAC = 3 (IN INTERVAL ZCFL1 TO ZCFL2, CFL FACTOR REDUCED BY KFAC)

**** OUTPUT CONTROL****
KOUT = 40 20 20 20 20 (PRINT FREQUENCY)
ZPRINT = 10000.00 10000.00 10000.00 10000.00 (TRANSITION PT IN Z FOR KOUT)
ZTARGET = 0.00 0.00 0.00 0.00 0.00 (TARGET OUTPUT STATIONS)
NMAX = 19 (OUTPUT RESTRICTED FOR N .LE. NMAX)
NMIN, NMAX = 2 14 (OUTPUT RESTRICTED FOR M .LE. M .LE. NMAX)
ZTAPE = 10000.0000 (PLOT TAPE WRITTEN AT EACH OUTPUT Z .GT. ZTAPE)
DZPRINT = 10000.0000 (Z INTERVAL FOR FIELD OUTPUT)
JJJJJ = 9 (=6 PRINT DEBUG WRITE MESSAGES, =9 NO PRINTING)
LLLLL = 9 (=6 PRINT DEBUG WRITE MESSAGES, =9 NO PRINTING)
IPCIO = 0 (=0 PINF/P PRINTED IN OUT, =1 CP PRINTED)
INTRE = 0 (NUMBER OF CONSTANT RADIAL LINES FOR FIN SURFACE PRESSURE INTERPOLATION)
RINT = -R -R -R -R -R -R -R (INTERPOLATION RADII)

**** WALL OPTIONS****
ISWSMO = 0 (ISWSMO = 1 -ENTROPY EXTRAPOLATION, =0 -STANDARD)
ISWMOU = 0 (FORM OF BOUNDARY CONDITIONS- 0 = 14A,15A, 3 = 14C,15C)

```

Table D-3. (Continued)

```

ORDER OF ACCURACY -- 0=1ST ORDER, 1=2ND ORDER UNTIL BODY DISCONTINUITY ENCOUNTERED)
ON SEPARATION, 1 = SEPARATION AND INTERIOR POINT SMOOTHING)
FLOWER BOUNDARY OF INTERVAL IN WHICH A BODY JUMP IS IGNORED)
UPPER BOUNDARY OF INTERVAL IN WHICH A BODY JUMP IS IGNORED)
NUMBER OF STEPS AFTER AN EXPANSION DISCONTINUITY TO REDUCE CFL FACTOR)
NUMBER OF STEPS AFTER AN EXPANSION DISCONTINUITY FOR WHICH X-DERIVATIVES AT WALL SET =0)
MAX NUMBER OF STEPS AFTER A COMPRESSION DISCONTINUITY FOR WHICH X-DERIVATIVES AT WALL SET =0)

```

*** COAL OPTIONS ***

```

      IZISWOC = 1 -ENTROPY EXTRAPOLATION, =0-STANDARD)
      IFORM OF BOUNDARY CONDITIONS- 0 = 1A,15A, 3 = 14C,15C)
      ORDER OF ACCURACY-- 0=1ST ORDER, 1=2ND ORDER UNTIL COWL DISCONTINUITY ENCOUNTERED)
      ICOL NORMAL DERIVATIVE CONTROL- 0=STANDARD,1=MODIFIED FOR 4 STEPS)

```

1990 FIN OPTIONS...

(NUMBER OF FINS)
(NUMBER OF FIN SURFACES)

*** SMOOTHING OPTIONS ***

(IF Z .6T. ZSMON, SMOOTHING IS TURNED ON)
(IF Z .6T. ZSMOFF, SMOOTHING IS TURNED OFF)

♦♦ INTERIOR POINTS♦♦

(0 = NO SMOOTHING, 1 = SMOOTH)
(SMOOTHING COEFFICIENT IN X DIRECTION)
(SMOOTHING COEFFICIENT IN Y DIRECTION)

*** SURFACE POINTS**

NSMTH =	0		(NUMBER OF SMOOTHING REGIONS)
M9 =	0	0	0 (OUTER M-LIMIT FOR SMOOTHING)
M8 =	0	0	0 (LOWER M-LIMIT FOR SMOOTHING)
M7 =	0	0	0 (UPPER M-LIMIT FOR SMOOTHING)
X9 =	0.00	0.00	0.00 (-61.0 SMOOTHING CONSTANT .-LI. 0 ABS MULTIPLIED BY DENSITY SWITCH)

MACH NO IS 3.300000E+00 ANGLE OF ATTACK IS 3.000000E+00 ANGLE OF SIDESLIP IS 0.

PTAVR/PTINF =	.99495
---------------	--------

PLANE 2 ANGLE IS 0.00 DEGREES

STATION 0 2 IS 3.216000E+00 C IS 1.000034E+00 CZ IS 1.730578E-02 CPW1 IS 0.
B IS 5.670773E-01 BZ IS 1.763308E-01 BPW1 IS 0. BZP1 IS 0. BPWPI IS 0.

N	R	M	U	V	P	PT/PTNF	RHO	S	M	TR	IS	TZ
19	1.000E+00	1.167E+03	2.0312E+01	0.	2.0461E+00	9.8979E-01	1.6627E-05	1.6122E+01	2.8129E+00	-R	-R	----
18	9.7598E-01	1.1839E+03	8.1045E-01	0.	1.6956E+00	9.9059E-01	1.4542E-05	1.6122E+01	2.9373E+00	-R	-R	----
17	9.5193E-01	1.1823E+03	8.7833E-01	0.	1.7171E+00	9.9055E-01	1.4674E-05	1.6122E+01	2.9299E+00	-R	-R	----
16	9.2788E-01	1.1807E+03	9.2819E-01	0.	1.7377E+00	9.9052E-01	1.4799E-05	1.6122E+01	2.9219E+00	-R	-R	----

Table D-3. (Continued)

15	9.0382E-01	1.1791E+03	9.8348E+01	0.	1.7574E+00	9.9045E-01	1.4918E-05	1.6122E+01	2.9136E+00	-R
14	9.7977E-01	1.1776E+03	1.0393E+02	0.	1.7704E+00	9.9045E-01	1.5033E-05	1.6122E+01	2.9004E+00	-R
13	8.5572E-01	1.1760E+03	1.0966E+02	0.	1.7966E+00	9.9045E-01	1.5143E-05	1.6122E+01	2.8997E+00	-R
12	8.3166E-01	1.1745E+03	1.1554E+02	0.	1.8120E+00	9.9036E-01	1.5247E-05	1.6122E+01	2.8933E+00	-R
11	8.0781E-01	1.1729E+03	1.2161E+02	0.	1.8287E+00	9.9030E-01	1.5347E-05	1.6122E+01	2.8872E+00	-R
10	7.8356E-01	1.1714E+03	1.2791E+02	0.	1.8445E+00	9.9024E-01	1.5442E-05	1.6122E+01	2.8814E+00	-R
9	7.5950E-01	1.1698E+03	1.3447E+02	0.	1.8597E+00	9.9017E-01	1.5532E-05	1.6122E+01	2.8760E+00	-R
8	7.3545E-01	1.1682E+03	1.4132E+02	0.	1.8740E+00	9.9005E-01	1.5617E-05	1.6122E+01	2.8709E+00	-R
7	7.1140E-01	1.1665E+03	1.4851E+02	0.	1.8874E+00	9.9001E-01	1.5697E-05	1.6122E+01	2.8661E+00	-R
6	6.8734E-01	1.1649E+03	1.5619E+02	0.	1.8994E+00	9.8983E-01	1.5767E-05	1.6122E+01	2.8618E+00	-R
5	6.6329E-01	1.1632E+03	1.6435E+02	0.	1.9102E+00	9.8979E-01	1.5830E-05	1.6122E+01	2.8581E+00	-R
4	6.3924E-01	1.1614E+03	1.7313E+02	0.	1.9189E+00	9.8944E-01	1.5881E-05	1.6122E+01	2.8549E+00	-R
3	6.1510E-01	1.1595E+03	1.8242E+02	0.	1.9267E+00	9.8930E-01	1.5926E-05	1.6122E+01	2.8521E+00	-R
2	5.9113E-01	1.1576E+03	1.9235E+02	0.	1.9325E+00	9.8912E-01	1.5959E-05	1.6122E+01	2.8500E+00	-R
1	5.6708E-01	1.1555E+03	2.0374E+02	0.	1.9355E+00	9.88660E-01	1.5936E-05	1.6123E+01	2.8490E+00	-R

PLANE 3 ANGLE IS 15.00 DEGREES

STATION 0	Z IS 3.216000E+00	C IS 1.000034E+00	CZ IS 1.730578E-02	CPI IS 0.
8 IS 5.670773E-01	HZ IS 1.763300E-01	BPI IS 0.	BZ IS 0.	BPI IS 0.
				BPMPI IS 0.

N	R	M	U	V	P	PIPIINF	RHO	S	M	IR	TZ
19	1.0000E+00	1.1672E+03	2.0308E+01	1.4737E+01	2.0486E+00	9.9008E-01	1.6642E-05	1.6122E+01	2.8123E+00	-R	----
18	9.7598E-01	1.1842E+03	8.3102E+01	1.4839E+01	1.6893E+00	9.9087E-01	1.4505E-05	1.6122E+01	2.9400E+00	-R	----
17	9.5193E-01	1.1825E+03	8.8522E+01	1.4961E+01	1.7104E+00	9.9083E-01	1.634E-05	1.6122E+01	2.9317E+00	-R	----
16	9.2788E-01	1.1809E+03	9.3951E+01	1.5059E+01	1.7306E+00	9.9079E-01	1.4757E-05	1.6122E+01	2.9239E+00	-R	----
15	9.0382E-01	1.1794E+03	9.9424E+01	1.5254E+01	1.7499E+00	9.9075E-01	1.4874E-05	1.6122E+01	2.9166E+00	-R	----
14	8.7977E-01	1.1778E+03	1.0497E+02	1.5482E+01	1.7644E+00	9.9071E-01	1.4986E-05	1.6122E+01	2.9096E+00	-R	----
13	8.5572E-01	1.1763E+03	1.1063E+02	1.5622E+01	1.7843E+00	9.9067E-01	1.5094E-05	1.6122E+01	2.9026E+00	-R	----
12	8.3166E-01	1.1748E+03	1.1644E+02	1.5849E+01	1.8034E+00	9.9062E-01	1.5197E-05	1.6122E+01	2.8966E+00	-R	----
11	8.0761E-01	1.1732E+03	1.2244E+02	1.6084E+01	1.8197E+00	9.9056E-01	1.5294E-05	1.6122E+01	2.8906E+00	-R	----
10	7.8356E-01	1.1717E+03	1.2870E+02	1.6354E+01	1.8352E+00	9.9049E-01	1.5387E-05	1.6122E+01	2.8849E+00	-R	----
9	7.5950E-01	1.1701E+03	1.3528E+02	1.6654E+01	1.8500E+00	9.9041E-01	1.5475E-05	1.6122E+01	2.8796E+00	-R	----
8	7.3545E-01	1.1686E+03	1.1919E+02	1.6985E+01	1.8639E+00	9.9033E-01	1.5558E-05	1.6122E+01	2.8746E+00	-R	----
7	7.1140E-01	1.1669E+03	1.4911E+02	1.7350E+01	1.8770E+00	9.9024E-01	1.5635E-05	1.6122E+01	2.8700E+00	-R	----
6	6.8734E-01	1.1653E+03	1.5671E+02	1.7763E+01	1.8887E+00	9.9006E-01	1.5704E-05	1.6122E+01	2.8657E+00	-R	----
5	6.6329E-01	1.1636E+03	1.6480E+02	1.8220E+01	1.8991E+00	9.9000E-01	1.5766E-05	1.6122E+01	2.8621E+00	-R	----
4	6.3924E-01	1.1618E+03	1.7305E+02	1.8732E+01	1.9074E+00	9.9003E-01	1.5813E-05	1.6122E+01	2.8589E+00	-R	----
3	6.1518E-01	1.1600E+03	1.8257E+02	1.9289E+01	1.9149E+00	9.8945E-01	1.5857E-05	1.6122E+01	2.8563E+00	-R	----
2	5.9113E-01	1.1580E+03	1.9254E+02	1.9634E+01	1.9203E+00	9.8918E-01	1.5888E-05	1.6122E+01	2.8542E+00	-R	----
1	5.6700E-01	1.1560E+03	2.0383E+02	2.0046E+01	1.9190E+00	9.8864E-01	1.5862E-05	1.6123E+01	2.8523E+00	-R	----

PLANE 13 ANGLE IS 165.00 DEGREES

STATION 0 2 IS 3.216000E+00 C IS 1.0000346E+00 CZ IS 1.7305705E+02
B 15 5.670773E-01 BZ IS 1.763300E-01 BPHI IS 0. BPHI IS 0.
RZ IS 0. BPHI IS 0.

N	R	W	U	V	P	PT/PTNF	RHO	S	M	TR	TZ
19	1.0000E+00	1.1640E+03	2.025E+02	1.6712E+01	2.1094E+00	9.8959E-01	1.6992E-05	1.6122E+01	2.7929E+00	-R	-R
18	9.7598E-01	1.1999E+03	1.4896E+02	1.6879E+01	1.3463E+00	9.8904E-01	1.2363E-05	1.6118E+01	3.0970E+00	-R	-R
17	9.5193E-01	1.1901E+03	1.5171E+02	1.7067E+01	1.3536E+00	9.8989E-01	1.2409E-05	1.6119E+01	3.0935E+00	-R	-R
16	9.1983E-01	1.1903E+03	1.5438E+02	1.7265E+01	1.3602E+00	9.9049E-01	1.2454E-05	1.6119E+01	3.0901E+00	-R	-R
15	9.0382E-01	1.1975E+03	1.5742E+02	1.7482E+01	1.3667E+00	9.9088E-01	1.2496E-05	1.6119E+01	3.0868E+00	-R	-R
14	8.7977E-01	1.1967E+03	1.6021E+02	1.7714E+01	1.3730E+00	9.9082E-01	1.2537E-05	1.6119E+01	3.0837E+00	-R	-R
13	8.5572E-01	1.1959E+03	1.6315E+02	1.7963E+01	1.3790E+00	9.9075E-01	1.2576E-05	1.6119E+01	3.0807E+00	-R	-R
12	8.3168E-01	1.1951E+03	1.6620E+02	1.8233E+01	1.3846E+00	9.9067E-01	1.2612E-05	1.6119E+01	3.0780E+00	-R	-R
11	8.0761E-01	1.1942E+03	1.6929E+02	1.8523E+01	1.3900E+00	9.9059E-01	1.2647E-05	1.6119E+01	3.0753E+00	-R	-R
10	7.8356E-01	1.1934E+03	1.7254E+02	1.8842E+01	1.3949E+00	9.9047E-01	1.2674E-05	1.6119E+01	3.0728E+00	-R	-R
9	7.5950E-01	1.1926E+03	1.7587E+02	1.9177E+01	1.3996E+00	9.9035E-01	1.2708E-05	1.6119E+01	3.0705E+00	-R	-R
8	7.3542E-01	1.1918E+03	1.7932E+02	1.9593E+01	1.4039E+00	9.9022E-01	1.2736E-05	1.6119E+01	3.0683E+00	-R	-R
7	7.1140E-01	1.1910E+03	1.8294E+02	1.9993E+01	1.4078E+00	9.9796E-01	1.2760E-05	1.6119E+01	3.0663E+00	-R	-R

[illegible]

PLANE 3 ANGLE IS 15.00 DEGREES											
STATION 151		Z IS 5.200000E+00		C IS 0.5233200E-01		CZ IS -2.2000000E-02		CPHI IS 0.		BPM PHI IS 0.	
0 IS 6.974500E-01		0Z IS -1.455000E-01		0 PHI IS 0.		0ZZ IS 0.					
112	7.9210E-01	9.6846E+02	-6.6366E+01	0.	8.2138E+00	9.8728E-01	4.4839E-05	1.6123E+01	1.9169E+00	-R	0000
110	7.8356E-01	9.6920E+02	-7.5673E+01	0.	9.1511E+00	9.8717E-01	4.4593E-05	1.6123E+01	1.9217E+00	-R	0000
111	7.7489E-01	9.6916E+02	-8.4833E+01	0.	8.1202E+00	9.8716E-01	4.4472E-05	1.6123E+01	1.9242E+00	-R	0000
9	7.6429E-01	9.6829E+02	-9.4321E+01	0.	8.1197E+00	9.8715E-01	4.4470E-05	1.6123E+01	1.9242E+00	-R	0000
8	7.5688E-01	9.6829E+02	-1.0358E+02	0.	8.1358E+00	9.8696E-01	4.4530E-05	1.6123E+01	1.9228E+00	-R	0000
7	7.4908E-01	9.6663E+02	-1.0972E+02	0.	8.2081E+00	9.8700E-01	4.4806E-05	1.6123E+01	1.9173E+00	-R	0000
6	7.4047E-01	9.5802E+02	-1.0749E+02	0.	8.4633E+00	9.8619E-01	4.5793E-05	1.6124E+01	1.8968E+00	-R	0000
5	7.3187E-01	9.4857E+02	-9.6460E+01	0.	8.6625E+00	9.8503E-01	4.7691E-05	1.6124E+01	1.8569E+00	-R	0000
4	7.2326E-01	9.3982E+02	-9.0080E+01	0.	9.3900E+00	9.8481E-01	4.9302E-05	1.6124E+01	1.8284E+00	-R	0000
3	7.1466E-01	9.3704E+02	-9.4187E+01	0.	9.4657E+00	9.8318E-01	4.9562E-05	1.6125E+01	1.8221E+00	-R	0000
2	7.0605E-01	9.3635E+02	-1.1578E+02	0.	9.3546E+00	9.7795E-01	4.9071E-05	1.6127E+01	1.8263E+00	-R	0000
1	6.9745E-01	9.3696E+02	-1.3633E+02	0.	9.2816E+00	9.8660E-01	4.8920E-05	1.6123E+01	1.8371E+00	-R	0000
19	8.5233E-01	9.8430E+02	-2.1655E+01	1.5778E+01	7.6398E+00	9.8946E-01	4.2611E-05	1.6122E+01	1.9654E+00	-R	0000
18	8.4373E-01	9.8220E+02	-1.8713E+01	1.5280E+01	7.6531E+00	9.8000E-01	4.2542E-05	1.6126E+01	1.9577E+00	-R	0000
17	8.3512E-01	9.7996E+02	-1.9068E+01	1.5448E+01	7.7916E+00	9.8573E-01	4.3181E-05	1.6124E+01	1.9499E+00	-R	0000
16	8.2652E-01	9.7420E+02	-2.6066E+01	1.5583E+01	8.0333E+00	9.8649E-01	4.4123E-05	1.6124E+01	1.9307E+00	-R	0000
15	8.1791E-01	9.6920E+02	-3.6250E+01	1.5811E+01	8.2411E+00	9.8720E-01	4.4944E-05	1.6123E+01	1.9147E+00	-R	0000
14	8.0931E-01	9.6713E+02	-4.6608E+01	1.5806E+01	8.3106E+00	9.8756E-01	4.5251E-05	1.6123E+01	1.9099E+00	-R	0000
13	8.0070E-01	9.6713E+02	-5.6768E+01	1.6045E+01	8.2940E+00	9.8752E-01	4.5154E-05	1.6123E+01	1.9107E+00	-R	0000
12	7.9210E-01	9.6799E+02	-6.6621E+01	1.6219E+01	8.2282E+00	9.8752E-01	4.4896E-05	1.6123E+01	1.9156E+00	-R	0000
11	7.8356E-01	9.6799E+02	-7.5930E+01	1.6403E+01	8.1683E+00	9.8724E-01	4.4653E-05	1.6123E+01	1.9206E+00	-R	0000
10	7.7489E-01	9.6804E+02	-8.5093E+01	1.6579E+01	8.1360E+00	9.8722E-01	4.4535E-05	1.6123E+01	1.9239E+00	-R	0000
9	7.6629E-01	9.6775E+02	-9.4583E+01	1.6755E+01	8.1362E+00	9.8721E-01	4.4535E-05	1.6123E+01	1.9239E+00	-R	0000
8	7.5768E-01	9.6634E+02	-1.0377E+02	1.6942E+01	8.1545E+00	9.8701E-01	4.4604E-05	1.6123E+01	1.9214E+00	-R	0000
7	7.4908E-01										

PLANE 13 ANGLE IS 165.00 DEGREES

STATION	151	2 IS	5.200000E+00	C IS	8.5233200E-01	CZ IS	-2.2000000E-02	CPHI IS	0.	BPMPHI	IS	0.
B IS	6.974500E-01	BZ IS	-1.455000E-01	BPHI IS	0.	HZZ IS	0.	82PHI IS	0.			
19	8.5233E-01	9.2668E+02	-2.0387E+01	1.9394E+01	1.0249E+01	9.0966E-01	5.2557E-05	1.6122E+01	1.7743E+00	-R		
18	8.4373E-01	9.2033E+02	-2.6172E+01	1.3517E+01	1.0207E+01	9.5676E-01	5.1900E-05	1.6136E+01	1.7548E+00	-R		
17	8.3512E-01	9.2488E+02	-3.2015E+01	1.3654E+01	1.0111E+01	9.6904E-01	5.1736E-05	1.6131E+01	1.7695E+00	-R		
16	8.2652E-01	9.2540E+02	-3.9274E+01	1.3892E+01	1.0111E+01	9.7277E-01	5.1795E-05	1.6129E+01	1.7719E+00	-R		
15	8.1791E-01	9.2148E+02	-4.4688E+01	1.3959E+01	1.0304E+01	9.7424E-01	5.2520E-05	1.6129E+01	1.7605E+00	-R		
14	8.0931E-01	9.1169E+02	-3.8124E+01	1.3824E+01	1.0793E+01	9.7381E-01	5.4282E-05	1.6129E+01	1.7297E+00	-R		
13	8.0078E-01	8.9614E+02	-1.9668E+01	1.3285E+01	1.1586E+01	9.7215E-01	5.7076E-05	1.6129E+01	1.6816E+00	-R		
12	7.9210E-01	8.8781E+02	-1.1752E+01	1.2605E+01	1.2029E+01	9.7260E-01	5.8634E-05	1.6129E+01	1.6569E+00	-R		
11	7.8350E-01	8.8965E+02	-2.0367E+01	1.2507E+01	1.1921E+01	9.7221E-01	5.8250E-05	1.6129E+01	1.6627E+00	-R		
10	7.7489E-01	8.9475E+02	-3.4853E+01	1.2825E+01	1.1639E+01	9.7259E-01	5.7269E-05	1.6129E+01	1.6789E+00	-R		
9	7.6639E-01	8.9780E+02	-4.8305E+01	1.3087E+01	1.1536E+01	9.7271E-01	5.6616E-05	1.6129E+01	1.6896E+00	-R		
8	7.5788E-01	8.9714E+02	-5.8410E+01	1.3117E+01	1.1566E+01	9.7292E-01	5.6629E-05	1.6129E+01	1.6896E+00	-R		
7	7.4908E-01	8.9392E+02	-6.6745E+01	1.2962E+01	1.1596E+01	9.7314E-01	5.7126E-05	1.6129E+01	1.6817E+00	-R		
6	7.4047E-01	8.8969E+02	-7.6003E+01	1.2727E+01	1.1752E+01	9.7125E-01	5.7641E-05	1.6130E+01	1.6715E+00	-R		

Table D-3. (Continued)

PLANE 1A ANGLE IS 100.00 DEGREES									
STATION 151 Z IS 5.200000E-00 C IS 8.5233200E-01 CZ IS -2.200000E-02 CPPI IS 0. BPHPI IS 0.									
B IS 6.974500E-01 BZ IS -1.455000E-01 BPPI IS 0. BZPI IS 0.									
M	R	W	U	V	P	PT/PTINF	RHO	S	M
19	8.5233E-01	9.2509E-02	-2.0370E-01	0.	1.0294E-01	9.8935E-01	5.2717E-05	1.6122E-01	1.7713E+00
18	8.4373E-01	9.1933E-02	-2.6440E-01	0.	1.0256E-01	9.5635E-01	5.2069E-05	1.6136E-01	1.7514E+00
17	8.3512E-01	9.2358E-02	-3.2358E-01	0.	1.0172E-01	9.6844E-01	5.1951E-05	1.6131E-01	1.7651E+00
16	8.2652E-01	9.2744E-02	-3.8401E-01	0.	1.0204E-01	9.7221E-01	5.2127E-05	1.6129E-01	1.7655E+00
15	8.1791E-01	9.1769E-02	-4.4557E-01	0.	1.0494E-01	9.7370E-01	5.3203E-05	1.6129E-01	1.7481E+00
14	8.0931E-01	9.0432E-02	-3.0066E-01	0.	1.1168E-01	9.7268E-01	5.5604E-05	1.6129E-01	1.7064E+00
13	8.0070E-01	8.8919E-02	-1.2250E-01	0.	1.1952E-01	9.7176E-01	5.8349E-05	1.6130E-01	1.6606E+00
12	7.9210E-01	8.8563E-02	-1.0693E-01	0.	1.2142E-01	9.7212E-01	5.9018E-05	1.6129E-01	1.6503E+00
11	7.8350E-01	8.8974E-02	-2.2215E-01	0.	1.1908E-01	9.7137E-01	5.8190E-05	1.6130E-01	1.6628E+00
10	7.7489E-01	8.9485E-02	-3.6489E-01	0.	1.1626E-01	9.7179E-01	5.7210E-05	1.6130E-01	1.6791E+00
9	7.6629E-01	8.9705E-02	-4.0473E-01	0.	1.1687E-01	9.7202E-01	5.6724E-05	1.6129E-01	1.6872E+00
8	7.5768E-01	8.9582E-02	-5.7433E-01	0.	1.1525E-01	9.7221E-01	5.6862E-05	1.6129E-01	1.6851E+00
7	7.4908E-01	8.9254E-02	-6.5632E-01	0.	1.1666E-01	9.7237E-01	5.7359E-05	1.6129E-01	1.6772E+00
6	7.4047E-01	8.8856E-02	-7.5303E-01	0.	1.1805E-01	9.7023E-01	5.7810E-05	1.6130E-01	1.6678E+00
5	7.3187E-01	8.8540E-02	-8.6804E-01	0.	1.1888E-01	9.6816E-01	5.8066E-05	1.6131E-01	1.6617E+00
4	7.2326E-01	8.8292E-02	-9.6804E-01	0.	1.1912E-01	9.6503E-01	5.8095E-05	1.6132E-01	1.6582E+00
3	7.1466E-01	8.8071E-02	-1.0985E-02	0.	1.1890E-01	9.5952E-01	5.7924E-05	1.6135E-01	1.6556E+00
2	7.0605E-01	8.8302E-02	-1.1887E-02	0.	1.1839E-01	9.5040E-01	5.7591E-05	1.6138E-01	1.6521E+00
1	6.9745E-01	8.8897E-02	-1.2935E-02	0.	1.1817E-01	9.9983E-01	5.8353E-05	1.6118E-01	1.6871E+00

MACH NO = 3.300 ANGLE OF ATTACK = 3.000 ANGLE OF SIDESLIP = 0.000 Z0 = 0.000

Z=20 0.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0 120.0 135.0 150.0 165.0 180.0

5.112	8.507	8.513	8.541	8.620	8.620	9.325	10.628	13.068	14.250	14.001	13.970	14.241	14.365
5.119	8.565	8.581	8.638	8.793	9.167	10.056	11.647	13.605	13.737	13.494	13.729	14.096	14.225
5.126	8.807	8.843	8.962	9.260	9.913	11.174	12.765	13.381	13.157	13.130	13.595	13.984	14.105
5.133	9.316	9.383	9.593	10.068	10.933	12.112	12.894	12.873	12.664	12.918	13.502	13.858	13.962
5.141	10.057	10.153	10.432	10.975	11.732	12.379	12.528	12.333	12.299	12.794	13.361	13.678	13.766
5.148	10.763	10.858	11.113	11.522	11.928	12.106	12.006	11.855	12.050	12.682	13.194	13.437	13.510
5.156	11.102	11.166	11.324	11.524	11.647	11.615	11.482	11.470	11.873	12.524	12.943	13.146	13.208
5.164	11.010	11.040	11.111	11.173	11.168	11.087	11.019	11.175	11.713	12.504	12.651	12.830	12.887
5.172	10.658	10.669	10.692	10.694	10.655	10.600	10.637	10.944	11.533	12.044	12.351	12.522	12.578
5.181	10.214	10.215	10.219	10.206	10.178	10.183	10.746	11.325	11.775	12.070	12.244	12.244	12.300
5.189	9.766	9.765	9.766	9.760	9.746	9.841	10.084	10.560	11.105	11.524	11.826	12.006	12.064
5.198	9.357	9.357	9.363	9.376	9.422	9.562	9.878	10.379	10.893	11.308	11.618	11.800	11.858
5.200	9.282	9.282	9.289	9.305	9.359	9.511	9.840	10.345	10.853	11.267	11.579	11.760	11.817

Table D-3. (Continued)

MACH NO = 3.300										ANGLE OF ATTACK = 3.000										ANGLE OF SIDESLIP = 0.000										Z0 = 0.000																																																																																																													
Z0										C O M L P R E S S U R E R A T I O										120.0										135.0										150.0										165.0										180.0																																																																															
0.0										15.0										30.0										45.0										60.0										75.0										90.0										105.0										120.0										135.0										150.0										165.0										180.0																			
5.112										9.025										9.048										9.117										9.235										9.404										9.620										9.866										10.121										10.375										10.629										10.860										11.025										11.086									
5.119										8.883										8.905										8.971										9.085										9.246										9.452										9.646										9.935										10.196										10.471										10.726										10.911										10.979									
5.126										8.735										8.757										8.821										8.930										9.085										9.282										9.508										9.759										10.039										10.341										10.626										10.834										10.911									
5.133										8.591										8.612										8.675										8.781										8.931										9.121										9.347										9.609										9.914										10.251										10.571										10.803										10.889									
5.141										8.455										8.475										8.536										8.640										8.787										8.977										9.208										9.469										9.826										10.203										10.558										10.813										10.907									
5.148										8.329										8.349										8.410										8.513										8.659										8.852										9.101										9.444										9.807										10.184										10.563										10.856										10.955									
5.156										7.942										7.962										8.020										8.121										8.265										8.459										8.713										9.040										9.444										9.818										10.207										10.560										10.656									
5.164										7.739										7.758										7.818										7.920										8.069										8.274										8.547										8.907										9.347										9.818										10.256										10.492										10.583									
5.172										7.659										7.678										7.739										7.844										7.999										8.217										8.514										8.905										9.372										9.851										10.244										10.488										10.569									
5.181										7.609										7.629										7.692										7.801										7.965										8.199										8.520										8.936										9.417										9.885										10.245										10.457										10.526									
5.189										7.593										7.614										7.679										7.793										7.967										8.216										8.588										9.063										9.537										10.010										10.368										10.444																			
5.198										7.610										7.631										7.698										7.817										7.999										8.261										8.612										9.042										9.488										9.870										10.132										10.277										10.323									
5.200										7.619										7.640										7.707										7.826										8.009										8.272										8.623										9.048										9.485										9.855										10.108										10.249										10.294									

A E R O D Y N A M I C D A T A

F R E E S T R E A M C O N D I T I O N S

MACH NO. = 3.300000E+00

VINF = 1.234747E+03

PINF = 1.000000E+00

PERFECT GAS (GAMMA = 1.400000E+00)

R E F E R E N C E Q U A N T I T I E S

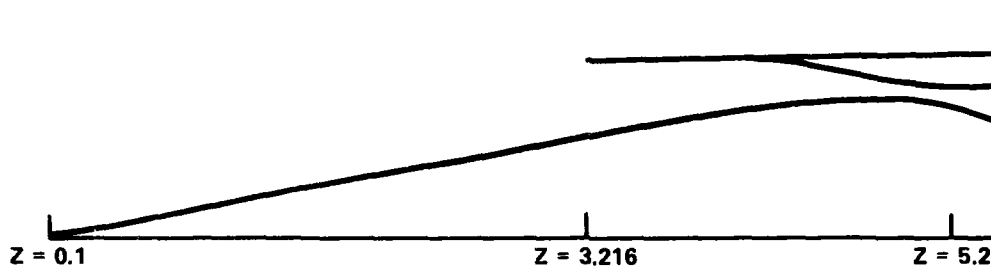
REFERENCE LENGTH IS 5.200000E+00

REFERENCE AREA IS 1.520185E+00

Z0 IS 0.

F O R C E A N D M O M E N T C O E F F I C I E N T S

Z0	CN	CA	CY	CMX	CMY	CML	XCPP	XCPY	ACPY
5.112	8.50732E-02	4.01516E-01	0.	0.	0.	0.	5.01882E-01	-R	
5.119	8.22954E-02	3.98622E-01	0.	0.	0.	0.	4.86555E-01	-R	
5.126	7.98954E-02	3.95512E-01	0.	0.	0.	0.	4.72469E-01	-R	
5.133	7.82419E-02	3.92265E-01	0.	0.	0.	0.	4.62338E-01	-R	
5.141	7.75220E-02	3.88970E-01	0.	0.	0.	0.	4.57981E-01	-R	
5.148	7.72555E-02	3.85354E-01	0.	0.	0.	0.	4.59688E-01	-R	
5.156	7.65817E-02	3.81632E-01	0.	0.	0.	0.	4.65672E-01	-R	
5.164	7.97605E-02	3.77637E-01	0.	0.	0.	0.	4.73644E-01	-R	
5.172	8.10345E-02	3.73553E-01	0.	0.	0.	0.	4.82043E-01	-R	
5.181	8.22458E-02	3.69536E-01	0.	0.	0.	0.	4.89866E-01	-R	
5.189	8.32960E-02	3.65598E-01	0.	0.	0.	0.	4.96570E-01	-R	
5.198	8.41044E-02	3.61740E-01	0.	0.	0.	0.	5.01768E-01	-R	
5.200	8.42307E-02	3.60997E-01	0.	0.	0.	0.	5.02579E-01	-R	



$M_{\infty} = 3.5$ INLET CONTOUR DEFINITION

Z/r_a	r/r_a	$Z/r_a - .356$	r/r_a
Centerbody		Annulus	
0.0	0.0	2.86	1.0
4.0	0.70532	3.1	1.004188
4.1	0.7228	3.2	1.0054
4.2	0.7387	3.4	1.0051
4.3	0.7512	3.6	0.99996
4.4	0.759	3.8	0.9882
4.5	0.7625	4.0	0.9681
4.55	0.763	4.1	0.954
4.6	0.7625	4.2	0.9364
4.65	0.7611	4.25	0.9261
4.7	0.7585	4.3	0.9154
4.8	0.7504	4.4	0.8949
4.9	0.7391	4.5	0.8768
5.1	0.7120	4.55	0.8695
5.3	0.6829	4.6	0.864
5.5	0.6525	4.65	0.86
5.6	0.6362	4.7	0.8572
5.7	0.618	4.8	0.8533
5.8	0.5973	4.9	0.8511
5.9	0.5744	5.0	0.8502
6.0	0.5467	5.1	0.85
		5.6	0.85
		5.8	0.8574
		5.9	0.8646
		6.0	0.8735

Figure D-1. Inlet Configuration Geometry

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