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A THEORETICAL INVESTIGATION OF GROUND EFFECTS
ON USB CONFIGURATIONS

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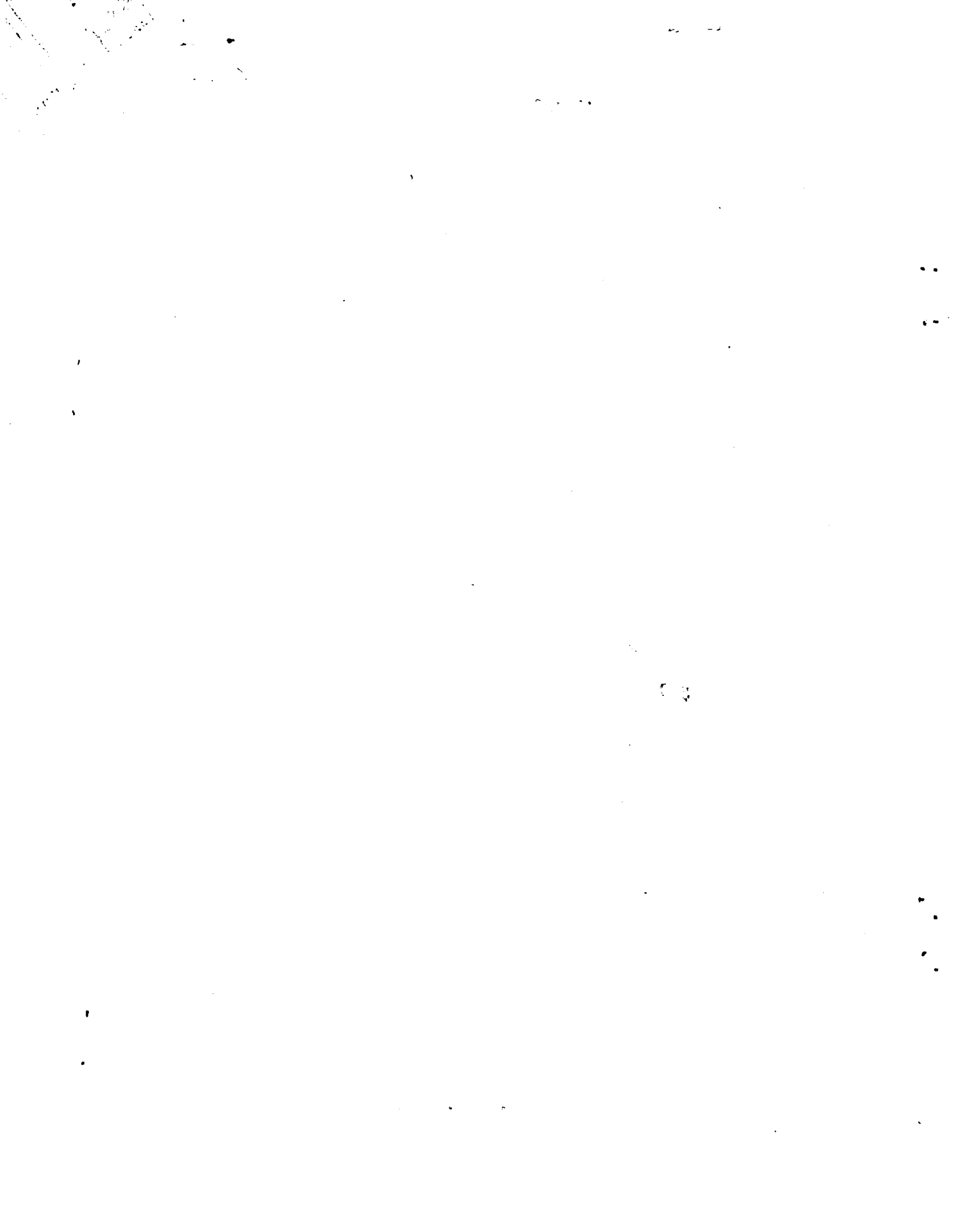
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A THEORETICAL INVESTIGATION OF GROUND
EFFECTS ON USB CONFIGURATIONS

by

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SUMMARY

A theoretical wing-jet interaction theory is presented for predicting the ground effects for upper-surface-blowing configurations. The formulation predicts the variation of circulation forces and jet reaction forces in ground proximity as a function of ground height. The predicted results agree well with available experimental data. It is shown that the wing-alone theory is not capable of predicting the ground effect for USB configurations.

1. List of Symbols

A	aspect ratio
b	span
c	chord length
\bar{c}	mean aerodynamic chord
C_D	drag coefficient
c_l	sectional lift coefficient
C_L	lift coefficient
ΔC_p	lifting pressure coefficient
C_T	propulsive thrust coefficient
C_μ	jet momentum coefficient
D_e	equivalent jet diameter
h	ground height of wing aerodynamic center
h_1	ground height of mean surface on which the vortex is distributed.
h'	ground height of USB flap hinge
$\hat{i}, \hat{j}, \hat{k}$	unit vector in the x, y, and z directions
l_c	characteristic jet length which is assumed to rotate rigidly in ground proximity
M	Mach number
n, s	coordinates normal and along the jet surface, respectively
\hat{n}	unit normal vector
s_c	length of the approximately straight portion of the jet
T	$= \rho_\infty / \rho_j$
u, v, w	induced velocity components in the x, y, and z directions, respectively.
V	velocity
x, y, z	rectangular coordinate system with positive x-axis pointing downstream, positive y-axis pointing to the right and positive z-axis point upward.
z_c	camber ordinate

α	angle of attack
δ_f	flap angle
δ_j	jet deflection angle out of ground effect
δ'_j	jet deflected angle in ground effect
γ	vortex density or flight path angle
λ	taper ratio
Λ	sweep angle
μ	$= V_\infty / V_j$
μ'	$= \mu \cos \alpha$
$\bar{\phi}$	nondimensional velocity potential
ψ	nondimensional additional velocity potential due to jet interaction
ρ	density
θ	pitch attitude angle

Subscripts

G	ground effect
i	image
j	jet flow
o	external flow
w	wing
wj	wing flow with jet Mach number
wo	wing flow with freestream Mach number
Γ	circulation
∞	freestream or free air

2. Introduction

Recent investigations of ground effect on aerodynamic characteristics have been stimulated by the interest in powered-lift STOL airplanes. Gratzner and Mahal (Ref. 1) have concluded from analyzing experimental data and theoretical study that the powered-lift ground effects will generally be adverse, i.e. with substantial lift loss. Early wind-tunnel data on augmentor wing and externally-blown-flap (EBF) configurations have also indicated adverse ground effect. However, the opposite has been found from flight tests of Augmentor Wing Aircraft C-8A and EBF aircraft YC-15. This disagreement of wind-tunnel and flight data has prompted Campbell, Hassell and Thomas (Ref. 2) to examine carefully the wind-tunnel data. They found that most of the disagreement could be traced to the wind-tunnel models which were not representative of the aircraft in wing sweep, taper ratio, flap angle, etc. and to the different operating lift coefficients. When a correct YC-14 model with upper-surface blowing (USB) was tested, generally favorable ground effect has been obtained, except at high angles of attack (Ref. 3).

In an effort to study theoretically the ground effect of the jet flap and EBF configurations, Gratzner and Mahal (Ref. 1) employed the conventional vortex-lattice method with flat wake to simulate the wing circulation lift. They indicated that if the jet reaction lift is less than 30% of the total lift, the wing-alone method of ground effect analysis without directly representing the jet is valid. Stevens and Wingrove (Ref. 4) used a simple horseshoe vortex to predict the ground effects of augmentor wing C-8A and EBF aircraft YC-15 and found that the predicted increase in lift in ground proximity is generally less than that obtained from flight tests. An accurate 3-D thin jet flap theory was presented in Ref. 5. Some ground-effect calculations using that theory was given in Ref. 6. The predicted lift is in general higher than the experimental values. No theoretical methods for USB configurations in ground effect are available, however.

The main purpose of the present investigation is to extend the USB jet-wing interaction theory reported in Ref. 7 to treat the ground effect problem and to present some calculated results.

3. Theoretical Formulation

For the present analysis, the basis assumptions made in Ref. 7 are still valid. That is, 1) the unperturbed jet flow and freestream are uniform, and the perturbed flow field in each region is governed by the Prandtl-Glauert equation with Mach number M_o or M_j , for the freestream and the jet flow, respectively; 2) the jet is of constant shape and at a small deflection angle; and 3) the effects of fuselage, nacelle, and wing thickness are not included. The boundary conditions require that the jet surface be a stream surface and the static pressure be continuous across it, in addition to the usual wing surface tangency condition. To account for the difference in M_o and M_j , the linearized problem is regarded as the sum of the wing-alone flow field and the additional flow field due to jet interaction. The aforementioned boundary conditions — jet stream surface condition, jet surface static pressure continuity and the wing tangency condition, in the linearized form in free air, are given by, respectively (see Ref. 7),

$$\frac{\partial \psi_o}{\partial n} - \frac{\partial \psi_j}{\partial n} = - \frac{\vec{V} \cdot \hat{n} (1 - \mu')}{\vec{V}_o \cdot \hat{e}} + \frac{\partial \bar{\phi}_{wj}}{\partial n} - \frac{\partial \bar{\phi}_{wo}}{\partial n} \quad (1)$$

$$\frac{\partial \psi_j}{\partial s} - T(\mu')^2 \frac{\partial \psi_o}{\partial s} = - \frac{\partial \bar{\phi}_{wj}}{\partial s} + T(\mu')^2 \frac{\partial \bar{\phi}_{wo}}{\partial s} \quad (2)$$

$$\frac{\partial \psi_o}{\partial z} = 0 \quad (3)$$

where the subscripts (o,j) denote the outer flow and the jet flow, respectively, ψ is the additional nondimensional velocity potential due to jet interaction and ϕ the wing-alone velocity potential. \vec{V}_o is the freestream velocity vector and (\hat{n}, \hat{e}) the unit vectors normal and along the jet surface, respectively. With

shallow jet approximation, $\hat{n} = \hat{k}$ and $\hat{e} = \hat{i}$.

In addition,

$$\mu' = \mu \cos \alpha \quad (4)$$

$$\mu = V_\infty / V_j \quad (5)$$

In Eqs. (1) and (2), $\bar{\phi}_{wo}$ and $\bar{\phi}_{wj}$ are the wing-alone velocity potentials satisfying the wing surface tangency conditions:

$$\frac{\partial \bar{\phi}_{wo}}{\partial z}(M_o) = \frac{\partial z_c}{\partial x} - \tan \alpha \quad (6)$$

$$\frac{\partial \bar{\phi}_{wj}}{\partial z}(M_j) = \frac{\partial z_c}{\partial x} - \tan \alpha \quad (7)$$

The above problem has been solved with the vortex distribution on wing and jet surfaces through the quasi-vortex-lattice method (QVLM) (Ref. 8). The jet flap effect within the present thick-jet formulation and the Coanda jet reaction forces have also been included (Ref. 7). The total aerodynamic characteristics are obtained through integrating the calculated pressure distribution.

In ground proximity, the additional boundary condition of no flow-through at the ground plane can be satisfied by using image vortex distribution with opposite circulation as illustrated in Fig. 1. In Fig. (1a), the

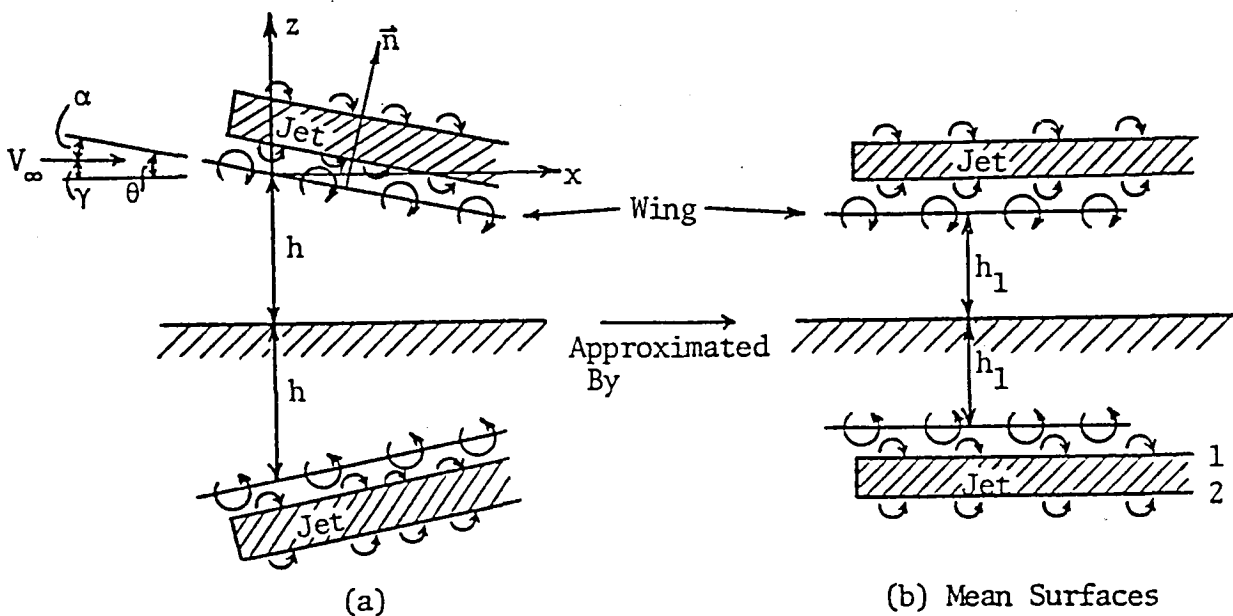


Figure 1. Geometry and Vortex Distribution in Ground Proximity 6

ground height h is assumed to be measured from the wing aerodynamic center or some reference point. Fig. (1b) shows that in the present linearized theory, the location of the wing mean surface is taken to be at h_1 , where h_1 is the ground height of 3/4 chord point of the mean aerodynamic chord for clean configuration as indicated in Ref. 9, and is taken to be the ground height of the trailing edge of the mean aerodynamic chord for configurations with flap deflection. latter choice is to account approximately for the larger wake deflection associated with flap deflection. The induced velocities on the wing and jet surfaces due to the physical wing and jet vortices are calculated in the usual manner as shown in Ref. (7). The effects of the image vortices are twofold. Firstly, they will induce upwash on the physical wing and jet surfaces. Let \vec{v}_t be the velocity vector induced by image horseshoe vortices at a given point on the wing:

$$\vec{v}_t = \hat{i} u_x + \hat{j} v_x + \hat{k} w_x \quad (8)$$

As shown in Fig.(1a), the unit normal vector on the wing surface is given by

$$\hat{n} = \hat{i} \sin \theta + \hat{k} \cos \theta \quad (9)$$

It follows that the upwash induced by the image vortex is

$$\vec{v}_t \cdot \hat{n} = w_x \cos \theta + u_x \sin \theta \approx w_x + u_x \theta \quad (10)$$

Although $u_x \theta$ is a second-order term, its retention improves the accuracy (Ref. 9). As can be seen from Fig. 1, this backwash term $u_x \theta$ is to produce downwash on the wing if θ is positive, thus reducing the loading. This is consistent with the 2-D solution given by Woods (Ref. 10):

$$C_L = 2\pi \sin \alpha \left[1 - \left(\frac{c}{2h} \right) \sin \alpha + \dots \right] \quad (11)$$

where the second-order term in α is to reduce the lift coefficient. In Eq. (11), α inside the brackets is the same as θ in the present formulation. Flight test results also indicate the same trend (Ref. 4). Eq. (10) is to be incorporated

into the left-hand side of Eqs. (1) and (3) and also the wing-alone problem Eqs. (6) and (7). Similarly, the image-induced x-perturbation velocity will be included in Eq. (2). Note that only $\frac{\partial \psi_0}{\partial \eta}$, $\frac{\partial \psi_0}{\partial s}$ and $\frac{\partial \psi_0}{\partial z}$ are affected by the image vortices. Secondly, the image wing and jet vortices will induce backwash on the wing to reduce the freestream velocity. Thus, once the vortex strengths have been calculated by satisfying the boundary conditions with ground effect, the lifting pressure will be given by

$$\Delta C_p = 2 \gamma_w' \cos \alpha (1 + u_i) \quad (12)$$

where u_i is the backwash induced by the image vortices and is usually negative. The wing vortex density γ_w is the sum of wing-alone vortex density and the additional vortex density due to jet interaction. The term involving u_i in Eq. (12) is again a second-order term.

The special features described above for the ground effect are concerned only with wing circulation loading. Examination of some available USB force data (Ref. 11) indicates that the lift component of the jet reaction will be decreased as the aircraft approaches the ground. This implies that the USB jet deflection angle will be reduced if the ground height is small. This possibility has also been suggested by May and Bean (Ref. 3). The fundamental idea behind this concept is that as the nearly rectangular jet impinges on the ground, the increase in the upstream static pressure would force the jet to deform further in the downstream direction. Since the jet deflection angle is not constrained in the USB case, it would be decreased to accommodate the stronger jet-cross flow interaction in ground proximity. Since the exact theory for this phenomenon is certainly complicated and is not available at the present time, the following empirical theory will be used for the present purpose.

Because of the similarity between the present case and a round jet in the cross flow, Margason's formula for the round jet trajectory (Ref. 12) will be used as a first step:

$$\frac{x}{D} = - \frac{\mu^2 T}{4 \sin^2 \delta_j} \left(\frac{z}{D} \right)^3 - \left(\frac{z}{D} \right) \cot \delta_j \quad (13)$$

Differentiating Eq. (13) with respect to z gives

$$\frac{d(x/D)}{d(z/D)} = - \frac{3\mu^2 T}{4 \sin^2 \delta_j} \left(\frac{z}{D}\right)^2 - \cot \delta_j \quad (14)$$

where $T = S_\infty / S_j$. At this point, it is assumed that the jet possesses a characteristic length. When it touches the ground, the reduction of the jet deflection angle becomes possible. This characteristic length will be calculated as follows. First, the two terms on the right hand side of Eq. (14) are equated and solved for z which will be denoted by z'_c . Note that the first term represents the effect of cross flow interaction. Thus,

$$\left| \frac{z'_c}{D} \right| = \sqrt{\frac{2}{3}} \sqrt{\frac{\sin 2\delta_j}{\mu^2 T}} \quad (15)$$

When this expression is used to check against the experimental data on a round jet, see for example, Fig. 12 of Ref. 13, it indicates approximately the straight portion of a deformed jet. However, Eq. (15) shows that at $\delta_j = 90^\circ$, the straight portion of the jet will vanish. This is not so according to the experimental data. Therefore, Eq. (15) is to be adjusted for correct representation at $\delta_j = 90^\circ$. In addition, two more assumptions are made. First, the characteristics of the USB jet for the present purpose, i.e., μ and T , will be evaluated at the USB flap hinge, and will be denoted by $\bar{\mu}$ and \bar{T} . They will be obtained by the method shown in Ref. 14 for a turbulent round jet. The diameter D in Eq. (15) is taken to be the equivalent round jet diameter D_e at the USB flap hinge. Second, Unlike a round jet in a uniform cross flow, the USB jet is subject to the interference of wing flow field and the uniform freestream. It is assumed that the jet angle to be used in Eq. (15) is the average of δ_j and $\delta_j + \alpha$, to be denoted by $\bar{\delta}_j$:

$$\bar{\delta}_j = \delta_j + \alpha/2 \quad (16)$$

Accounting for the above assumptions, Eq. (15) becomes

$$\left| \frac{z'_c}{D} \right| = \sqrt{\frac{2}{3}} \sqrt{\frac{0.135 + \sin 2\bar{\delta}_j}{\bar{\mu}^2 \bar{T}}} \quad (17)$$

where the constant 0.135 is obtained by correlating with the experimental data shown on Fig. 12 of Ref. 13 with $\bar{\delta}_j = 90^\circ$. The length of the approximately straight portion of the jet is therefore given by

$$s_c = \frac{z'_c}{\sin \bar{\delta}_j} \quad (18)$$

When a length of jet equal to s_c is assumed rigid and, if it touches the ground, would be forced to rotate in the downstream direction to reduce the jet angle, it is found that the results are quite reasonable except when $\bar{\mu}$ is small, i.e. when the freestream velocity is low compared with the jet velocity. This can be seen from Eqs. (17) and (18). For small $\bar{\mu}$, z'_c and s_c would be large. For a given ground height, the resulting jet angle would be small. Therefore, the characteristic length mentioned above will be defined as

$$l_c = s_c (C_1 \bar{\mu}^2) , \quad C_1 \bar{\mu}^2 < 1 \quad (19a)$$

$$= s_c , \quad C_1 \bar{\mu}^2 \geq 1 \quad (19b)$$

where C_1 is a constant to be determined after correlation with experiment. (C_1 is finally chosen to be 19.2). The jet deflection angle δ'_j in ground proximity is then given by

$$\delta'_j + \theta = \sin^{-1} \frac{h'}{l_c} \quad (20)$$

where h' is the ground height of the USB flap hinge. Of course, if l_c does not reach the ground, the jet angle is assumed to be unchanged. The corresponding geometry for Eq. (20) is illustrated in Fig. 2.

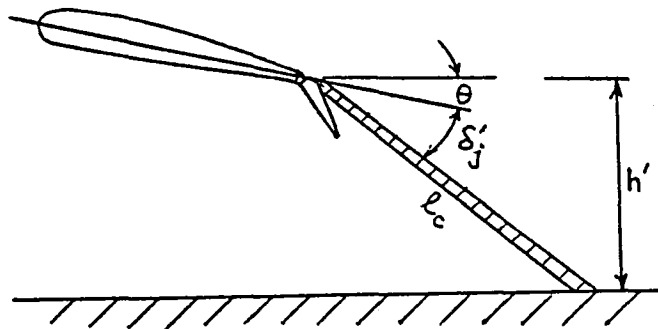


Figure 2. Geometry for Determining the Jet Deflection Angle in Ground Proximity

4. Numerical Results and Discussions

As indicated above, the present formulation is based on the quasi-vortex-lattice method. To check its accuracy, some predicted results for lift curve and moment curve slopes for rectangular wings are compared with Saunders' (Ref. 15) in Fig. 3. Saunders' method is based on the kernel function technique. It is seen that the agreement between the present method and Saunders' is quite good. The theoretical results also agree quite well with experimental data given in Ref. 16. Since the operation of aircraft in ground proximity usually involves the deflected flaps, their influence on the magnitude of the ground effect must be assessed. Gratzner and Mahal (Ref. 1) have presented some results showing the influence of various configuration parameters on the aerodynamic characteristics in ground effect. Fig. 4 shows the comparison of the present results with Gratzner and Mahal's for a tapered wing of aspect ratio 8.0 and sweep angle 30° . Note that the conventional vortex-lattice method was used in Ref. 1. It is seen that the agreement between the two methods is good.

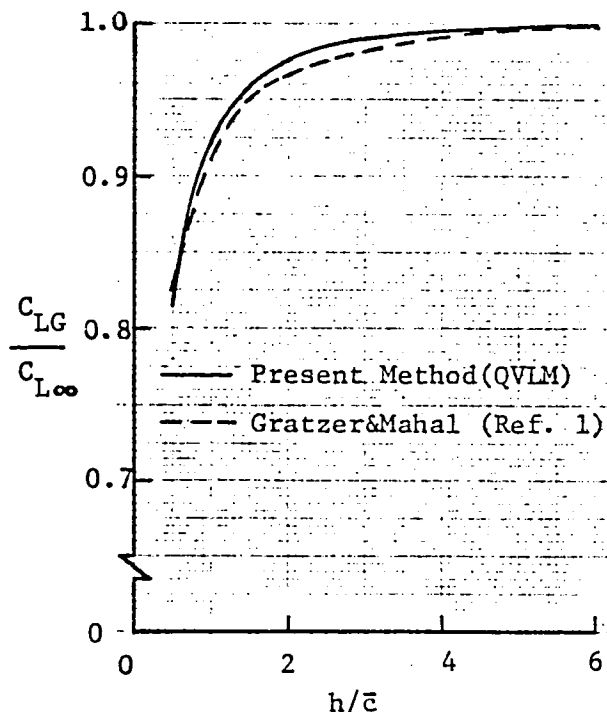


Figure 4. Comparison of Predicted Lift Coefficients in Ground Effect by Different Methods. $C_{L\infty}=3.0$, $\Lambda=30^\circ$, $\lambda=0.4$, $A=8.0$, $\delta_f=50^\circ$ (Full Span) and Flap-Chord Ratio of 0.35.

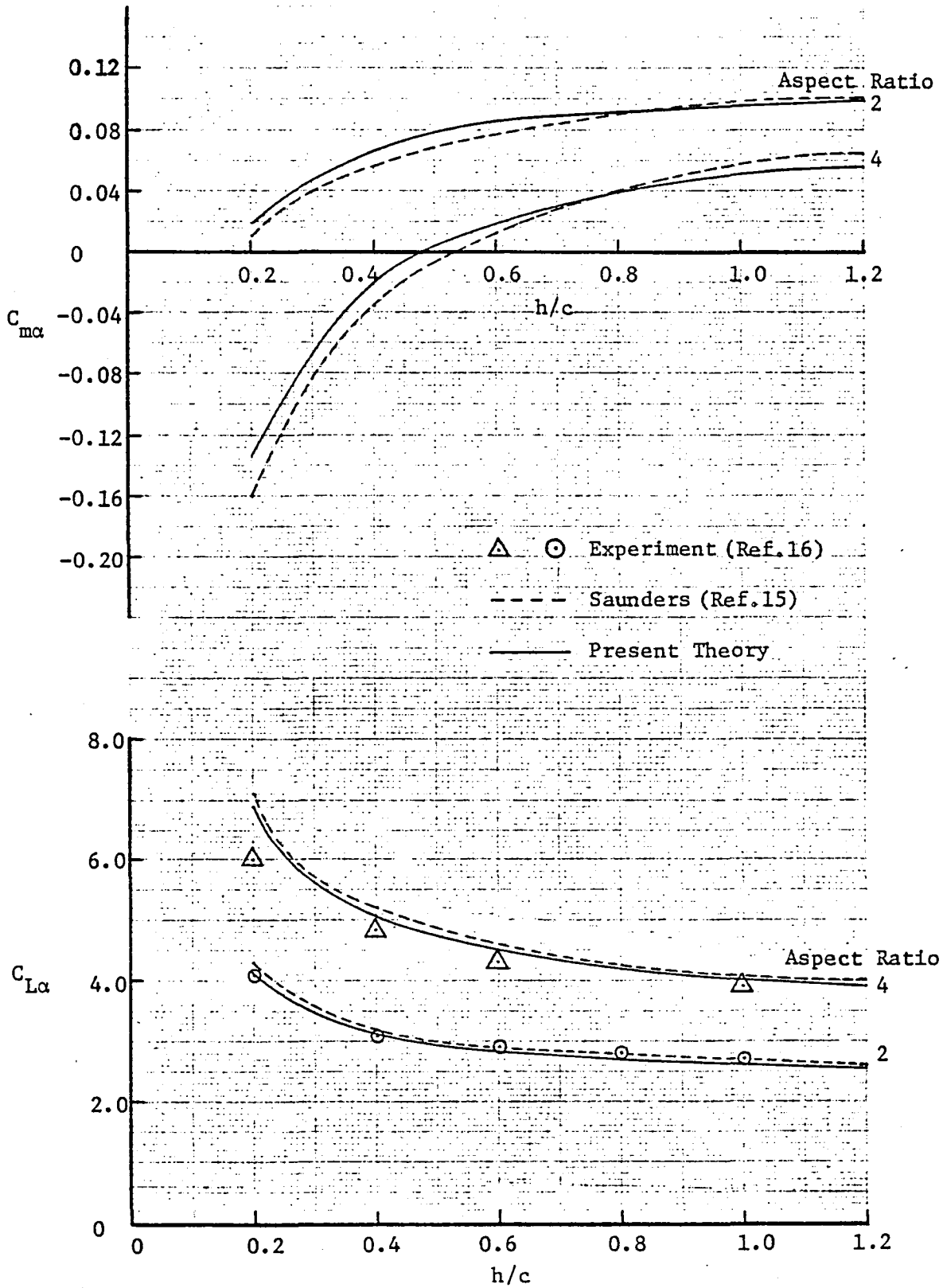


Figure 3. Comparison of Predicted Lift Curve Slope and Moment Curve Slope about Quarter Chord in Per Radian for Clean Rectangular Wings in Ground Effect.

The present thick-jet program is also applicable to the thin jet flap theory with appropriate changes as indicated in Ref. 7. Some predicted results for a full-span thin jet flap on a rectangular wing of aspect ratio 8.3 are compared with those given in Ref. 6 and experiment (Ref. 17) in Fig. 5. The agreement between theories is excellent. However, the experimental data show large adverse ground effect not predicted by the theory. Although some flow mechanisms responsible for the discrepancy have been discussed in Ref. 6, one important possible reason is that the experimental data are not reliable because a fixed ground plane was used in the test set-up. According to Turner's criterion discussed and applied in Ref. 2, a moving ground board would have to be used under the high lift conditions investigated.

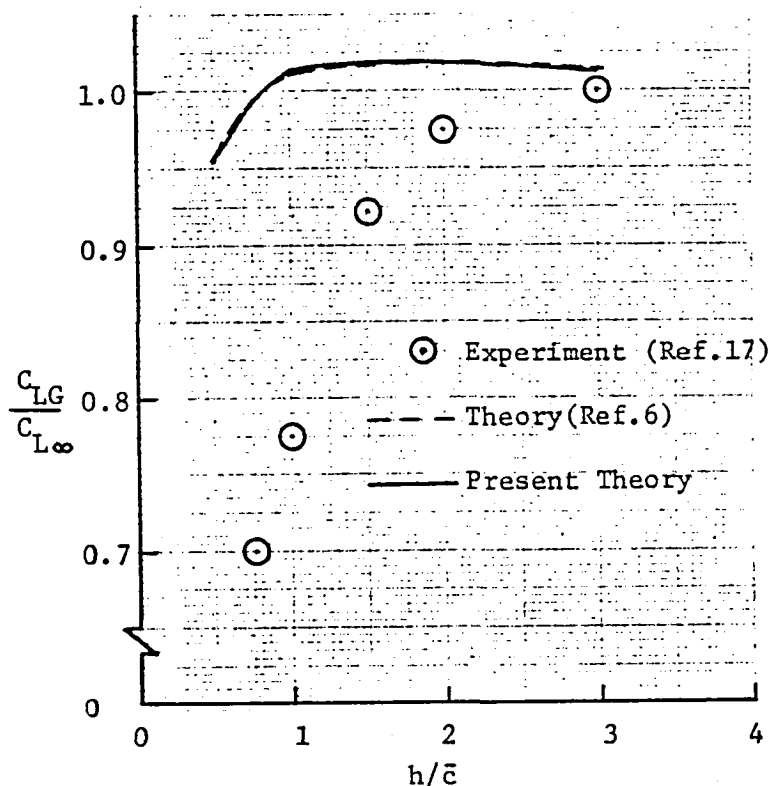


Figure 5. Comparison of Predicted Ground Effect for a Rectangular Wing of $A = 8.3$ with Full-Span Thin Jet Flap. $C_{\mu} = 3.0$, $\alpha = 0^{\circ}$, $\delta_j = 55^{\circ}$.

Published data for USB configurations in ground effect are scarce.

Some YC-14 data are given in Ref. 3. These data are for a complete configuration including the fuselage and horizontal tail which are not modelled in the present program. Since the actual jet deflection angle δ_j in free air is not available, and since the correct free-air C_L is important in predicting the ground effect, δ_j is taken to be a value so that at $\alpha=2^\circ$, the lift coefficient in free air will match as closely as possible the experimental value. This is based on the assumption that at $\alpha = 2^\circ$, the tail contribution to the total lift is small. Using the data at $\alpha = 2^\circ$ with $C_T = 2.0$ in landing configuration for correlation to find the constant C_1 in Eq. (19.a), it is found that $C_1 = 19.2$ will provide the best over-all results. The predicted lift curves are compared with experimental data in Fig. 6 for the YC-14 landing configuration (thrust recovery efficient $\eta = 0.9$) and Fig. 7 for the takeoff configuration ($\eta = 1.0$). It should be noted that the theoretical C_L is obtained by adding the predicted incremental C_L due to ground effect to the experimental free-air values. It is seen from Fig. 6 that the predicted ground effect for the landing configuration agrees well with experiment. For the takeoff configuration in which the USB flaps are retracted, the ground effect at $C_T = 1.0$ is underpredicted by the theory.

Another set of available USB ground effect data is given in Ref.11. The predicted results are compared with the experimental data in landing configurations in Fig. 8. The free-air deflection angle is taken to be 42° . Also shown in Fig. 8 is the dashed curve predicted by the QVLM without the jet. In the latter case, the angle of attack is taken to be such that the free-air C_L can be correctly obtained and the jet reaction lift is assumed to be unchanged from the free-air value. It is seen that the present USB theory predicts the ground effect quite well. According to the theory, the jet deflection angle starts to be reduced at about $h/b = 0.3$ and the decrease in lift is mainly due to this reduction in jet deflection angle, which, of course will slightly affect the circulation lift also. The wing-alone method, which has been used in Refs. 1

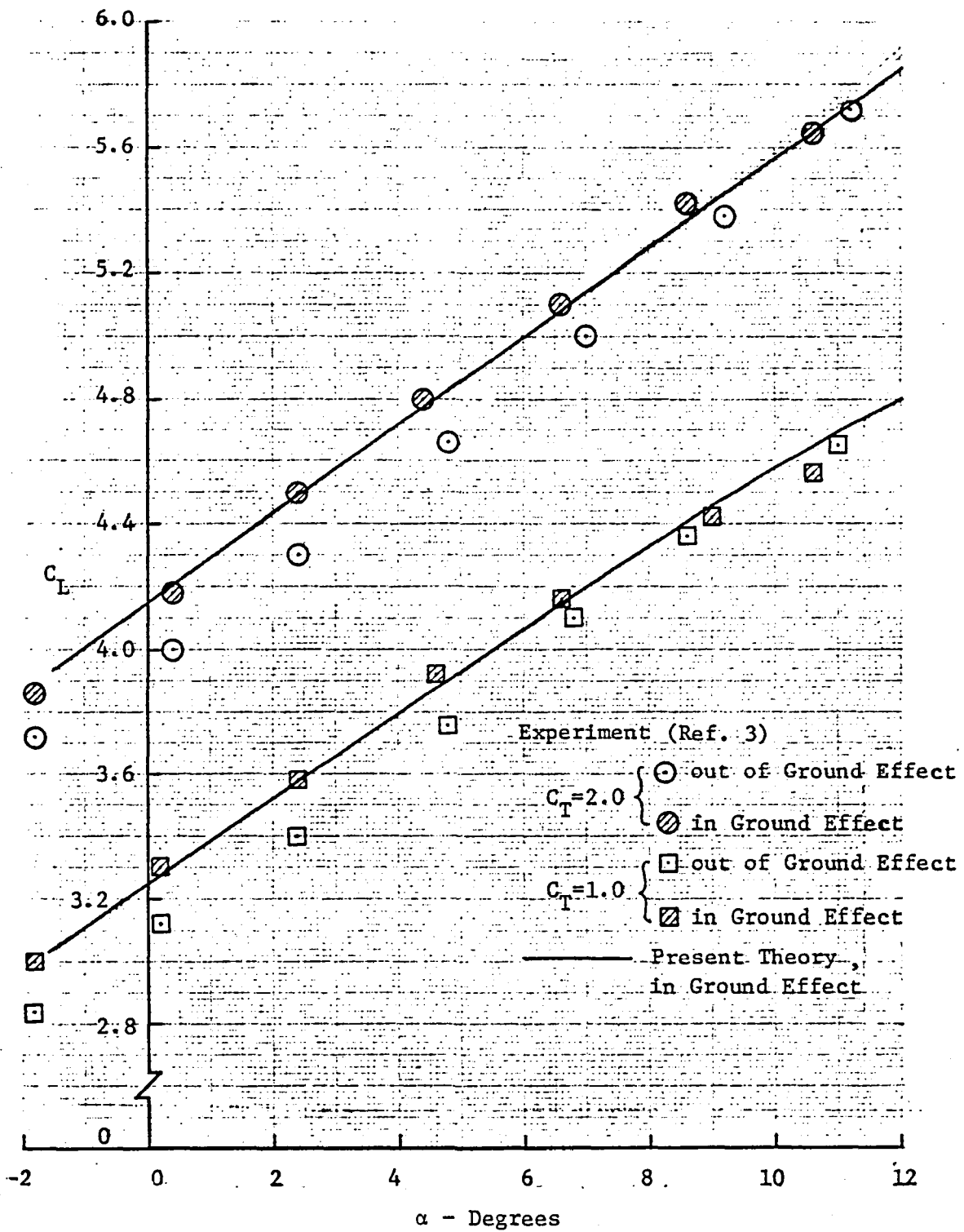


Figure 6. Comparison of Predicted Lift Curves with Experiment for YC-14 Landing Configuration in Ground Effect with $h/b=0.187$.

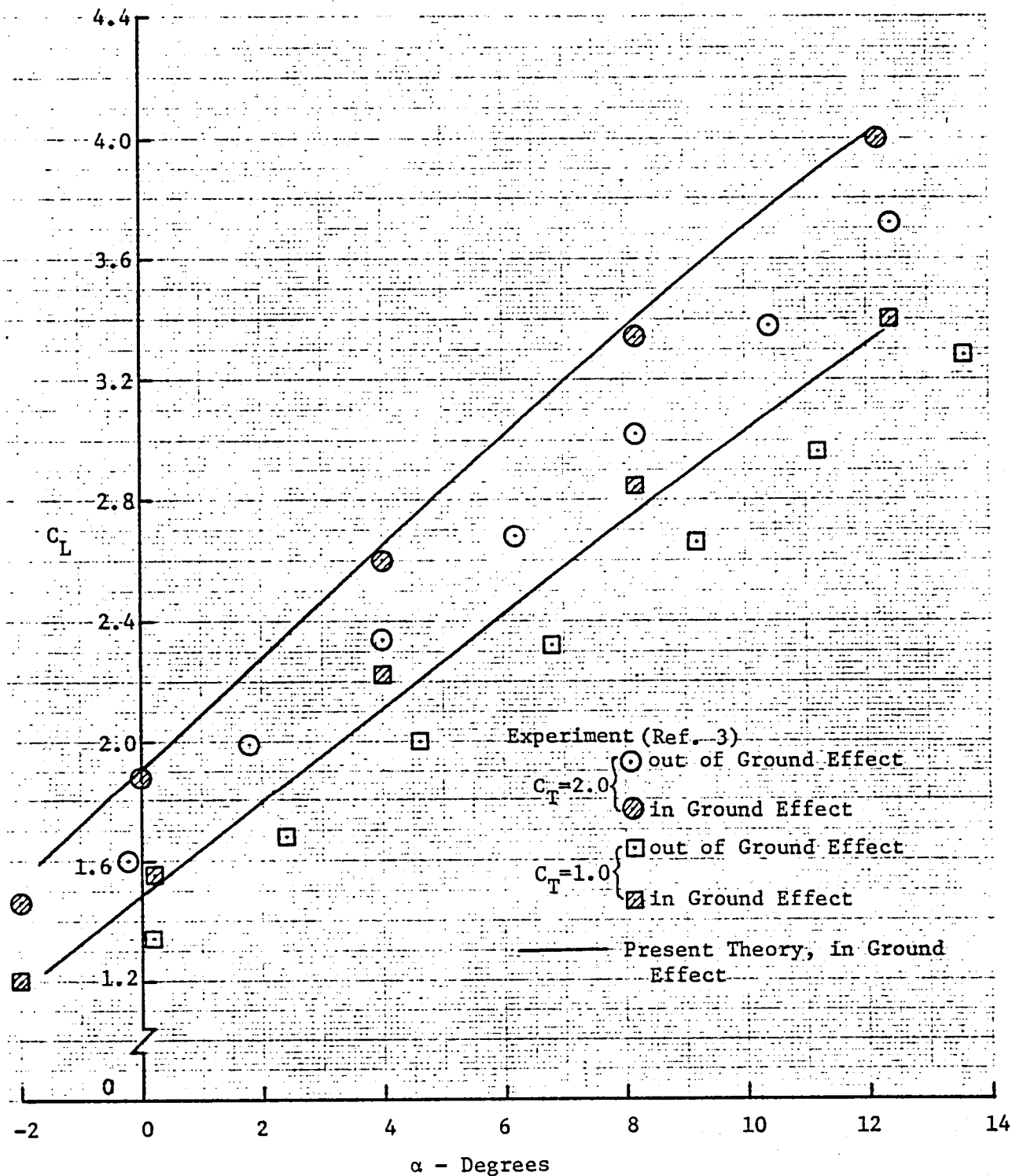


Figure 7. Comparison of Predicted Lift Curves with Experiment for YC-14 Takeoff Configuration in Ground Effect with $h/b=0.187$.

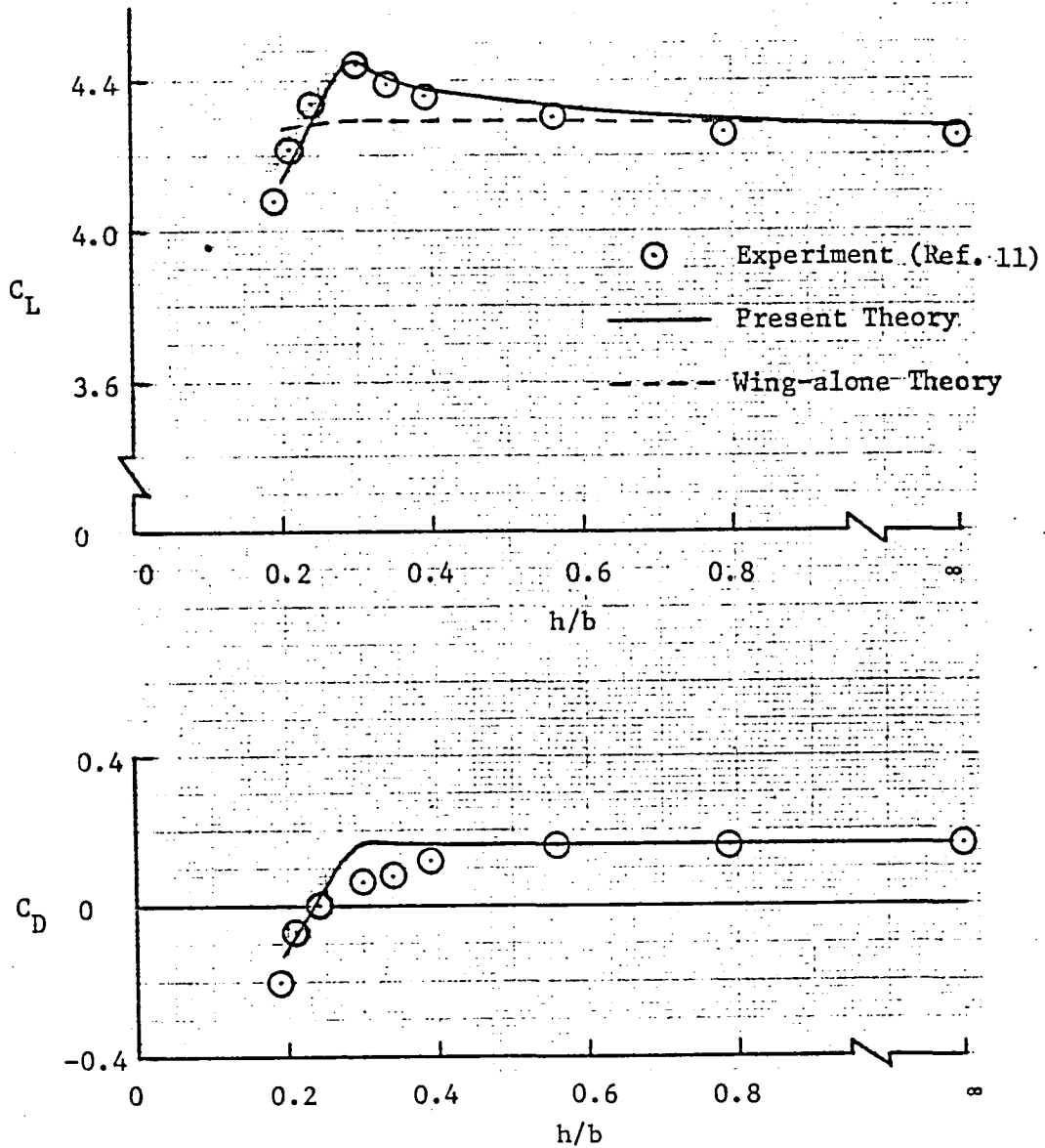


Figure 8. Comparison of Predicted Ground Effect on Longitudinal Aerodynamics of a USB Landing Configuration. $\alpha=5^\circ$, $C_T=1.8$.

and 4 to predict the ground effect of the external-blown flap and augmentor-wing configurations, is seen to be incapable of predicting the ground effect of USB configurations. As shown in Fig. 9, the wing-alone theory does not predict the large increase in circulation lift predicted by the USB theory when the ground is approached. In addition to the difference in circulation distribution, one important mechanism is that the USB theory predicts less backwash on the wing due to the image vortex system. This is illustrated in Fig. 1b. As usual, the image wing vortices will induce backwash on the physical wing. However, the image jet vortices will either induce backwash (from surface 2) or increase the longitudinal velocity (from surface 1). In general, the effect of jet surface 1 is dominant because it is closer to the physical wing and the vortex strength is much larger. Therefore, the net backwash due to the image vortex system for the same free-air C_L is reduced.

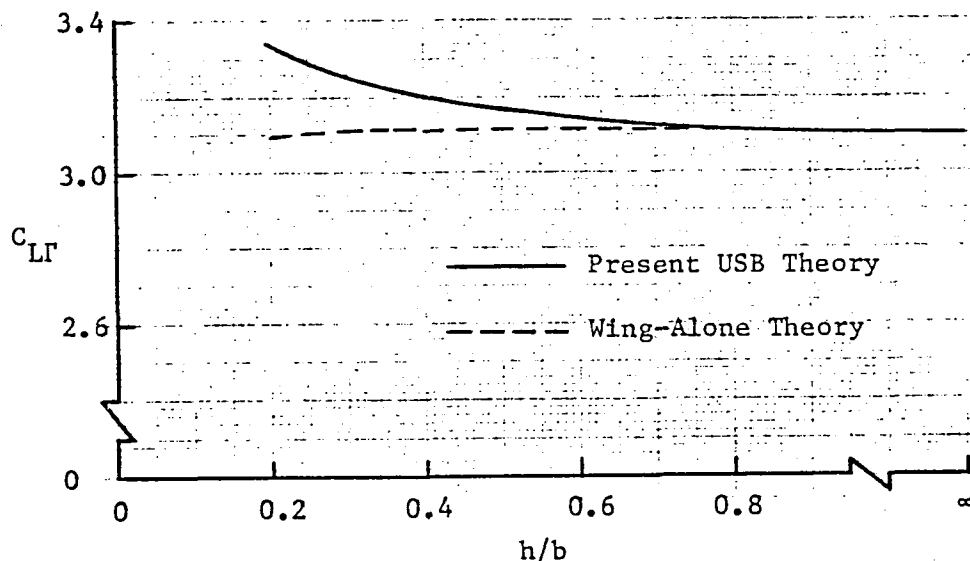


Figure 9. Comparison of Circulation Lift In Ground Effect Predicted by USB Jet Theory and Wing-Alone Theory for the Configuration of Figure 8.

The conclusion from the results presented above is that for a given USB configuration with a given thrust coefficient, the important parameters affecting the lift in ground effect are the pitch attitude angle and the jet deflection angle in free air. Large angles of both may decrease the lift in ground proximity. For given angles of both, there is a ground height at which the lift is maximum.

In Reference 4, typical results for the Augmentor Wing Research Aircraft C-8A exhibiting dynamic ground effect have been presented. It is shown that the ground effect is slightly more positive in descending flight than in ascending flight and there is an abrupt lift loss during the change of flight path. From the viewpoint of the present theoretical formulation, the phenomenon may be explained as follows. In descending flight, the pitch attitude angle for this aircraft is negative (Ref. 18) so that the backwash produced by the image vortices contributes to the upwash and hence, higher lift, as shown in Eq. (10). The opposite is true in ascending flight, in which the pitch attitude angle can be more than 20° . Of course, the flap angle is also changed in the transition. If the time history of the pitch attitude angle and the flap angle is known, it may be possible to predict this dynamic ground effect based on the quasi-steady approximation.

5. Conclusions

The ground effects on a USB configuration may involve changes in both the circulation forces and the jet reaction forces. In this report, a theoretical formulation to predict these effects has been presented. The predicted results agree well with available experimental data. The theory indicates that a positive pitch attitude angle will contribute to a reduction in lift. It is also shown that the wing-alone method is not capable of predicting the ground effect of a USB configuration.

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- (17) Vogler, R. D. and Turner, T. R., "Wind-Tunnel Investigation at Low Speeds to Determine Flow-Field Characteristics and Ground Influence on a Model with Jet-Augmented Flaps," NACA TN 4116, 1957.
- (18) Quigley, H. C. and Innis, R. C., "A Flight Investigation of the STOL Characteristics of an Augmented Jet Flap STOL Research Aircraft," NASA TM X-62,334, 1974.
- (19) Lan, C. E.; Fillman, G. L.; and Fox, C. H., Jr., "Computer Program for Calculating Aerodynamic Characteristics of Upper-Surface-Blowing and Over-Wing-Blowing Configurations," NASA TMX-73987, February 1977.

- (20) Lan, C. E., "Theoretical Aerodynamics of Over-Wing-Blowing Configurations," NASA CR-144969, 1976.

Appendix Instructions on the Usage of the Computer Program and Program Listing.

The present computer program is a modified version of Ref. 19 by incorporating the ground effect calculation and the thin jet flap theory. Therefore, the program capabilities and limitations described in Ref. 19 are still applicable. The input instructions are described in the following.

The program is written in Fortran language and runs on CDC Cyber 175 computer. It is available from COSMIC of the University of Georgia, Athens, Georgia.

INPUT DATA FORMAT

Group 1. Format 13A6 1 card

Any title identifying the cases to be run.

Group 2. Format 4(6X,I4) 1 card

ICASE Numer of cases to be run.

NG = 0 if all cases have the same geometry other than
the angle of attack.

= 1 if new configurations or different freestream-
jet velocity ratios are to be treated.

ISYM = 0 for a centered jet

= 1, otherwise.

NGRD = 0 without ground effect.

= 1 in ground effect

Group 3. Format 8F10.5 1 card

AM1 Mach number of the freestream

AM2 Mach number of the jet flow

VMU Freestream velocity divided by jet velocity.

TEMP Jet static absolute temperature divided by freestream
static absolute temperature. Assumed to be the same as
ratio of freestream density and jet density.

ALP Angle of attack in degrees.

XEL X-coordinate of the wing L.E. at the jet centerline.

XET X-coordinate of the wing T.E. at the jet centerline.

Note: If the thrust coefficient is given, VMU may be computed as

$$\frac{V_j}{V_\infty} = \frac{1}{2} \left\{ 1 + \left[1 + \frac{2C_T (S_w/2)^{1/2}}{A_j (\rho_j/\rho_\infty)} \right] \right\}$$

$$VMU = V_{\infty}/V_j$$

where

C_T = thrust coefficient

S_W = wing area used to define C_T .

A_j = jet cross-sectional area

When the thrust coefficient is computed with the static thrust, the following formula for V_j/V_{∞} is preferred:

$$\frac{V_j}{V_{\infty}} = \left[\frac{C_T (S_W/2)}{2A_j (\rho_j/\rho_{\infty})} \right]^{1/2}$$

If the nozzle pressure ratio, $p_{t,j}/p_{\infty}$, is given, the following isentropic relations may be used.

$$M_j^2 = \frac{2}{\gamma-1} \left[\left(\frac{p_{t,j}}{p_{\infty}} \right)^{\frac{\gamma-1}{\gamma}} - 1 \right]$$

$$\frac{T_j}{T_{\infty}} = \frac{1 + \frac{\gamma-1}{2} M_{\infty}^2}{1 + \frac{\gamma-1}{2} M_j^2}$$

$$\frac{V_{\infty}}{V_j} = VMU = \frac{M_{\infty}}{M_j} \left(\frac{T_j}{T_{\infty}} \right)^{1/2}$$

Group 4. Format 4F10.5 1 card

HEIGHT Ground height of wing aerodynamic center.

ATT Pitch attitude angle in degrees

XAC x-coordinate of wing aerodynamic center or the reference point about which the ground height is measured.

XHG x-coordinate of USB flap hinge. If the USB flap is not deflected, the trailing edge of the USB flap may be used.

Note: The above four variables may be set to 0. if NGRD = 0.

Group 5. Format 2(6X, I4) 5F10.5 1 card

NFP Number of flap sections, including the jet span.

A maximum of five flap sections may be input.

NJP Numerical order of the jet span among the NFP sections.

DF(I) Flap deflection angles in degrees for the flap sections.

I=1, NFP

Group 6. Format 8F10.5 1 card

HALFSW One half of the reference wing area.

CREF Reference chord

TWIST Difference in angles of attack at the tip and the root
in deg. Negative for washout.

TWISTR Incidence angle of the root chord in degrees.

XJ X, Y, and Z-coordinates of the midpoint of the jet cross-

YJ section at the exit.

ZJ

RJ Jet radius.

Note: The last four variables are needed only for over-wing-blowing applications. They may be any non-zero numbers for USB applications, unless the rectangular jet is not on the wing surface and the entrainment is to be accounted for, or the ground effect is to be calculated. For the latter cases, these variables are used to define the equivalent circular jet.

Group 7. Format 7F10.5 1 card

TEANGL Trailing-edge half angle of the airfoil at the jet center-
line in deg. For USB applications, it may be arbitrary.

PTIAL = 0. for clean or full-span flap configuration

= 1. for partial-span flap deflection.

USB = 1. for USB applications.

= 2. for thin jet flap theory

= 0. for OWB applications

CAMLER L.E. camber slope at the root leading edge.
CAMLET L.E. camber slope at the tip leading edge.
CAMTER T.E. camber slope at the root trailing edge.
CAMTET T.E. camber slope at the tip trailing edge.

Note: For USB applications, TEANGL may be any value. If the camber ordinates are to be read in, the leading edge and trailing edge camber slopes may be arbitrary numbers.

Note: The following card must be omitted for OWB applications.

Group 8. Format 4F10.5 1 card

CMU Jet thrust coefficient

DFJ Jet deflection angle in degrees at the trailing edge relative to the chord line. At small flap angles, it may be taken as the sum of flap angle and the airfoil trailing edge half angle. At large flap angles, experimental values should be used.

TNJ = 0. if the entrainment is not to be accounted for. Usually this is the case if the jet is on the wing surface.
= 1. if the entrainment due to an equivalent round jet is to be accounted for when a rectangular jet is not on the wing surface.

DTEST = 1. if the USB jet deflection angle is to be modified by the program in ground effect.
= 0., otherwise.

Group 9. Format 8(6X, I4) 1 card

NC Number of spanwise sections. A natural way of dividing a planform into sections is to follow lines of discontinuity, such as edges of partial-span flap, jet boundaries, wing edge discontinuities, etc. NC is limited to 8.

M1(1) Number of vortex strips in each spanwise section, plus
 one.
 Minimum value for each is 3. Maximum for each M1(I) is 31.
 I=1,NC The total number of spanwise strips is limited to 30.

Group 10. 5(6X, I4) 1 card

NJW(I) The numerical order of the flap and jet spans among
 I=1,NFP the spanwise sections.

Group 11. 5(6X, I4) 1 card

NW(1) Number of chordwise vortex elements in each chordwise section.

NW(2) The planform is divided into chordwise sections according
 NW(3) to such lines of discontinuity as jet exit, flap hinge, etc.
 If there is only one section, SET NW(2) = NW(3) = 0. For 2
 sections, SET NW(3) = 0.

ICAM = 1 if the camber ordinates of the airfoils are to be read in.
 = 0, otherwise. In this case, the camber functions ($\frac{dz_c}{dx}$)
 in close-form expressions are to be inserted manually into
 subprograms ZCR(x) and ZCT(X), the root chord and tip chord
 camber functions, respectively.

IM Number of camber ordinates to be read in. (Limited to eleven).
 Arbitrary if ICAM = 0.

Note: Group 12 must be deleted if ICAM = 0.

Group 12. Format 8F10.5 4 or 8 cards.

XT(1,J), J=1,IM Non-dimensional x-coordinates to define root camber.
 ZC(1,J), J=1,IM Non-dimensional camber ordinates of the root chord.
 XT(2,J), J=1,IM Non-dimensional x-coordinates to define tip camber.
 ZC(2,J), J=1,IM Non-dimensional camber ordinates of the tip chord.

Group 13. Format 6F10.5 1 card for each wing section.

XXL(1) x-coordinate of the leading edge of the inboard boundary chord
 of a given spanwise section.

XXT(1) x-coordinate of the trailing edge of the inboard boundary
 chord of the same spanwise section.
 YL(1) y-coordinate of the inboard boundary chord.
 XXL(2) x-coordinate of the leading edge of the outboard boundary
 chord of the same spanwise section.
 XXT(2) x-coordinate of the trailing edge of the outboard boundary
 chord.
 YL(2) y-coordinate of the outboard boundary chord.

Group 14. Format 6(6X, I4), 1 card

NNJ Number of jet sections.

Note: The jet region above or on the wing must be divided into streamwise sections by following the divided planform pattern. It is important to start the jet sections always from the wing leading edge even if the jet exit is downstream of the leading edge. The only exception is when the jet exit is at the trailing edge. In this case, NNJ=1 and the jet section starts from the trailing edge. NNJ is limited to 4.

NSJ = Number of jet circumferential strips minus one for a non-centered jet (always use odd numbers).

= Number of jet circumferential strips on the half jet plus one for a centered jet (always use even numbers).

NCJ(I), Number of streamwise vortex elements in each section. There
 I=1, NNJ should be NNJ numbers. For those jet sections above the wing, these numbers should agree with the corresponding numbers of wing vortices. See NW(1), NW(2), NW(3) in Group.11.

Note: Group 15 must be deleted for USB applications

Group 15. Format 6F10.5 NNJ cards

XXL(1)

XXT(1)

YL(1)

XXL(2) Coordinates of bounding chords of the jet section

XXT(2) projected on the x-y plane. For definition, see Group 13.

YL(2)

Note: Group 16 is to be deleted for OWB applications.

Group 16. Format 4F10.5 (4xNNJ) cards.

XXL(I) Coordinates of the bounding lines defining the

XXT(I) rectangular jet sections in USB applications.

YL(I) They are the x-coordinates of the leading and

ZL(I) trailing edges, the y-coordinate and the z-

I=1,...,4 coordinate of the bounding line. The 4 stream-

wise edges of each section are defined in the clockwise

order (facing upstream), starting from the inboard lower

bounding line. There are 4 cards for each jet section.

The jet section behind the trailing edge, (trailing jet

section), should be at least one local chord in length for

thick jet applications and two local chord in length for

thin jet flap theory.

Note: If ICASE > 1 and NG = 1, Groups 3-16 are to be repeated.

Group 17. Format F10.5 (ICASE-1) cards

ALP angles of attack in degrees. These cards are to be included
only if additional angles of attack for the same configuration
and VMU (NG=0 ,NGRD=0) are to be run.

Note: The read statements for the input data in group 3 thru group 16 can be found in subroutine "GEOMTY" of the program listing along with a short definition of the parameters to be read in. The read statements for groups 1, 2, and 17 along with the corresponding parameter definitions can be found near the beginning of the program listing in the main routine.

Pre-Run Check List

Before the program is run, the following checklist should be completed:

- (1) The array, GAMMA, defined in the subroutine "SOLUTN", should be dimensioned to have at least $(N+1)^2/4$ elements, where N is the total number of unknowns (= LTOTAL).
- (2) For N = 260, the minimum memory needed is 40K (decimal). For any other N, the required memory can be computed accordingly, based on the change in GAMMA array.
- (3) The root and tip camber slope functions should be defined manually in the subprograms ZCR(X), ZCT(X) respectively; otherwise the root and tip camber ordinates should be read in. The camber slope function, dz_c/dx , is defined with respect to a unit chord length.
- (4) Two temporary files or tapes must be provided, one being designated as (01) and the other (02).
- (5) Check input data.

OUTPUT DATA FORMAT

First the title of the job and the input data will be printed in the same format as it was input. If the job is an over-wing blowing configuration, the computed jet entrainment will be printed after the fourth line of input data as follows:

XJET Downstream distance of a given cross-section from the jet exit divided by the jet radius at the exit (r_0).

R_{JET} the radius of the jet cross section divided by the original jet radius (r_0).

$\frac{DM}{DX}$ Values printed are actually the nondimensionalized entrainment function $E(\bar{x})$ (see equation 33 or reference 20).

If the job is with ground effect and the jet deflection angle is modified by the program, the equivalent velocity ratio, the equivalent jet radius and the estimated jet deflection angle will be printed at this point. The first two quantities are used to estimate the third one.

HALF SW the reference half-wing area

CREF the reference chord

LAST the number of wing vortices plus the number of outer jet vortices.

JPANEL the number of outer (or inner) jet vortices

LTOTAL LTOTAL is the total number of vortices used which is also the total number of unknowns to be solved.

LTOTAL = LAST + JPANEL

If the job is an OWB configuration a note will be printed at this time indicating the shape of the equivalent jet cross-section used for the interaction computations along with 3 parameters defined below.

1. x-coordinate where the equivalent jet properties are evaluated.

2. Equivalent Jet Radius: the radius of the jet at the x location listed above.
3. $\frac{V_o}{V_j}$ the velocity ratio of the equivalent jet.

Vortex Element Endpoint Coordinates

(X₁, Y₁, Z₁) coordinates for the inboard endpoint of a bound vortex element

(X₂, Y₂, Z₂) coordinates for the corresponding outboard endpoint. Wing elements are listed first and then jet elements. The number of elements listed should equal (LAST).

Control Point Coordinates

2 columns of control point coordinates, one point for each vortex element. Number of points listed should equal (LAST).

Sectional Pressure and Force Data

XV	Percent chord location
YV	Percent span location
CP	the total ΔC_p at the given (XV, YV) point due to both wing and jet induced circulation
CPW	The ΔC_p that would occur at that same point for the wing alone case
Y/SP	the y-coordinate of the chord in question divided by the half-span
CL	The sectional lift coefficient due to circulation (jet on), nondimensionalized with $q_\infty c$.
CM	The sectional pitching moment coefficient about the Y-axis, nondimensionalized with $q_\infty c^2$.
CT	The sectional leading edge thrust coefficient, nondimensionalized with $q_\infty c$.
CDI	The sectional induced drag coefficient, nondimensionalized with $q_\infty c$.

CLW The sectional lift coefficient for the wing along case

CMW The sectional pitching moment about the Y-axis for the wing alone case

CDW The sectional induced drag coefficient for the wing alone case.

Total Force and Moment Data

The Lift Coefficient The total circulation lift coefficient due to wing, wing-jet interaction and entrainment (if any).

Total Induced Drag Coefficient Total induced drag coeff. for the jet on case

Induced drag = parameter $\frac{C_{D_I}}{C_L^2}$ or $\frac{1}{\pi eAR}$

Total Pitching = Moment Coefficient Pitching moment coefficient due to all circulation forces, about the Y-axis. Nondimensionalized with CREF.

Note: In the case of OWB jobs, these coefficients reflect the total jet-on forces and moments, but for USB jobs the coanda force and moment coefficients must be added to these; see below.

USB Jobs

Coanda Lift - The lift coefficient due to the lift component of the jet reaction force

Coanda Drag - Drag coefficient due to the drag component of the jet reaction.

Coanda Pitching Moment Coeff. - Pitching moment coefficient due to the pitching moment caused by the jet reaction force (about Y-axis).

OWB Jobs

In the case of O.W.B. jobs the next three coefficients listed have the same definition as the first three except that the effects of wing-jet interaction have been omitted from the computation.

The last four coefficients printed are due to aerodynamic forces and moments generated solely by the wing without any jet effects.

SAMPLE INPUT No. 1

* YC-14 IN GROUND EFFECT WITH LANDING FLAPS *

0.	0.	0.18274	1.	12.	0.1849	1.933485
2.4123	12.	0.73861	1.35063			
8.8107	2	1 56.	47.	0.85328	1.35	0.32114 0.32114
0.	1.472	0.	0.			
1.8	1.	1.	1.			
	33.	0.	1.			
	4	2	4	7	5	
	2	3				
	2	2	2			
0.	0.8	0.	0.123285	0.853285	0.9	
0.123285	0.853285	0.9	0.246569	0.853285	1.8	
0.246569	0.853285	1.8	0.598613	1.058759	5.1	
0.598613	1.058759	5.1	0.88354	1.14281	6.45	
0.8	1.3493	0.	0.853285	1.3502	0.9	
0.853285	1.3502	0.9	0.853285	1.351065	1.8	
0.853285	1.351065	1.8	1.058759	1.354241	5.1	
1.058759	1.354241	5.1	1.14281	1.35554	6.45	
1.3493	2.024	0.	1.3502	1.963657	0.9	
1.3502	1.963657	0.9	1.351065	1.903313	1.8	
1.351065	1.903313	1.8	1.354241	1.682055	5.1	
1.354241	1.682055	5.1	1.35554	1.59154	6.45	
	4	7	2	2	2	4
0.123285	0.853285	0.9	0.			
0.123285	0.853285	0.9	0.36			
0.246569	0.853285	1.8	0.36			
0.246569	0.853285	1.8	0.			
0.853285	1.3502	0.9	0.			
0.853285	1.3502	0.9	0.36			
0.853285	1.351065	1.8	0.36			
0.853285	1.351065	1.8	0.			
1.3502	1.963657	0.9	0.			
1.3502	1.963657	0.9	0.36			
1.351065	1.903313	1.8	0.36			
1.351065	1.903313	1.8	0.			
1.96365	4.76135	0.9	0.			
1.96365	4.76135	0.9	0.36			
1.90331	4.70101	1.8	0.36			
1.90331	4.70101	1.8	0.			

SAMPLE OUTPUT No. 1

 * YC-14 IN GROUND EFFECT WITH LANDING FLAPS *

 1 1 1 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

CASE NUMBER = 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

INPUT DATA

0.00000	0.00000	.18274	1.00000	12.00000	.18493	1.93349	
2.41230	12.00000	.73861	1.35063				
2	1	56.00000	47.00000				
8.81070	1.47200	0.00000	0.00000	.85328	1.35000	.32114	.32114
0.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	
1.80000	33.00000	0.00000	1.00000				

THE EQUIVALENT VELOCITY RATIO, V_0/V_J , AT FLAP HINGE = .19694

THE EQUIVALENT JET RADIUS AT FLAP HINGE IN MULTIPLES OF EXIT RADIUS = 1.15813

THE ACTUAL JET DEFLECTION ANGLE IS ESTIMATED TO BE = 24.407 DEGREES

	4	2	4	7	5	
2	2	3				
2	2	2	0	0		
0.00000	.80000	0.00000	.12329	.85329	.90000	
.12329	.85329	.90000	.24657	.85329	1.80000	
.24657	.85329	1.80000	.69861	1.05876	5.10000	
.69861	1.05876	5.10000	.88354	1.14281	6.45000	
.80000	1.34930	0.00000	.85329	1.35020	.90000	
.85329	1.35020	.90000	.85329	1.35107	1.80000	
.85329	1.35107	1.80000	1.05876	1.35424	5.10000	
1.05876	1.35424	5.10000	1.14281	1.35554	6.45000	
1.34930	2.02400	0.00000	1.35020	1.96366	.90000	
1.35020	1.96366	.90000	1.35107	1.90331	1.80000	
1.35107	1.90331	1.80000	1.35424	1.68206	5.10000	
1.35424	1.68206	5.10000	1.35554	1.59154	6.45000	

	4	7	2	2	2	4
.12329	.85329	.90000	0.00000			
.12329	.85329	.90000	.36000			
.24657	.85329	1.80000	.36000			
.24657	.85329	1.80000	0.00000			
.85329	1.35020	.90000	0.00000			
.85329	1.35020	.90000	.36000			
.85329	1.35107	1.80000	.36000			
.85329	1.35107	1.80000	0.00000			
1.35020	1.96366	.90000	0.00000			
1.35020	1.96366	.90000	.36000			
1.35107	1.90331	1.80000	.36000			
1.35107	1.90331	1.80000	0.00000			
1.96365	4.76135	.90000	0.00000			
1.96365	4.76135	.90000	.36000			
1.90331	4.70101	1.80000	.36000			
1.90331	4.70101	1.80000	0.00000			

HALF SW= .88107E+01

CREF= .14720E+01

LAST,JPANEL,LTOTAL=
164 80

244

VORTEX ELEMENT ENDPOINT COORDINATES=

X1	X2	Y1	Y2	Z1	Z2
.11716	.23019	0.00000	.90000	0.00000	0.00000
.68284	.74638	0.00000	.90000	0.00000	0.00000
.23019	.26267	.90000	1.17779	0.00000	0.00000
.74638	.75195	.90000	1.17779	0.00000	0.00000
.26267	.30294	1.17779	1.52221	0.00000	0.00000
.75195	.75886	1.17779	1.52221	0.00000	0.00000
.30294	.33542	1.52221	1.80000	0.00000	0.00000
.75886	.76443	1.52221	1.80000	0.00000	0.00000
.33542	.38079	1.80000	2.15998	0.00000	0.00000
.76443	.79079	1.80000	2.15998	0.00000	0.00000
.38079	.45315	2.15998	2.73409	0.00000	0.00000
.79079	.83282	2.15998	2.73409	0.00000	0.00000
.45315	.54339	2.73409	3.45000	0.00000	0.00000
.83282	.88523	2.73409	3.45000	0.00000	0.00000

.54339	.63362	3.45000	4.16591	0.00000	0.00000
.88523	.93763	3.45000	4.16591	0.00000	0.00000
.63362	.70598	4.16591	4.74002	0.00000	0.00000
.93763	.97966	4.16591	4.74002	0.00000	0.00000
.70598	.75136	4.74002	5.10000	0.00000	0.00000
.97966	1.00602	4.74002	5.10000	0.00000	0.00000
.75136	.78643	5.10000	5.37824	0.00000	0.00000
1.00602	1.02639	5.10000	5.37824	0.00000	0.00000
.78643	.83643	5.37824	5.77500	0.00000	0.00000
1.02639	1.05543	5.37824	5.77500	0.00000	0.00000
.83643	.88644	5.77500	6.17176	0.00000	0.00000
1.05543	1.08447	5.77500	6.17176	0.00000	0.00000
.88644	.91735	6.17176	6.41696	0.00000	0.00000
1.08447	1.10242	6.17176	6.41696	0.00000	0.00000
.88044	.92606	0.00000	.90000	0.00000	0.00000
1.26886	1.27743	0.00000	.90000	0.00000	0.00000
.92606	.92610	.90000	1.17779	0.00000	0.00000
1.27743	1.27766	.90000	1.17779	0.00000	0.00000
.92610	.92614	1.17779	1.52221	0.00000	0.00000
1.27766	1.27794	1.17779	1.52221	0.00000	0.00000
.92614	.92618	1.52221	1.80000	0.00000	0.00000
1.27794	1.27817	1.52221	1.80000	0.00000	0.00000
.92618	.94537	1.80000	2.15998	0.00000	0.00000
1.27817	1.28174	1.80000	2.15998	0.00000	0.00000
.94537	.97596	2.15998	2.73409	0.00000	0.00000
1.28174	1.28745	2.15998	2.73409	0.00000	0.00000
.97596	1.01411	2.73409	3.45000	0.00000	0.00000
1.28745	1.29457	2.73409	3.45000	0.00000	0.00000
1.01411	1.05226	3.45000	4.16591	0.00000	0.00000
1.29457	1.30168	3.45000	4.16591	0.00000	0.00000
1.05226	1.08285	4.16591	4.74002	0.00000	0.00000
1.30168	1.30739	4.16591	4.74002	0.00000	0.00000
1.08285	1.10203	4.74002	5.10000	0.00000	0.00000
1.30739	1.31097	4.74002	5.10000	0.00000	0.00000
1.10203	1.11686	5.10000	5.37824	0.00000	0.00000
1.31097	1.31373	5.10000	5.37824	0.00000	0.00000
1.11686	1.13800	5.37824	5.77500	0.00000	0.00000
1.31373	1.31768	5.37824	5.77500	0.00000	0.00000
1.13800	1.15914	5.77500	6.17176	0.00000	0.00000
1.31768	1.32162	5.77500	6.17176	0.00000	0.00000

1.15914	1.17220	6.17176	6.41696	0.00000	0.00000
1.32162	1.32406	6.17176	6.41696	0.00000	0.00000
1.44811	1.44004	0.00000	.90000	0.00000	0.00000
1.92519	1.87382	0.00000	.90000	0.00000	0.00000
1.44004	1.43754	.90000	1.17779	0.00000	0.00000
1.87382	1.85796	.90000	1.17779	0.00000	0.00000
1.43754	1.43444	1.17779	1.52221	0.00000	0.00000
1.85796	1.83830	1.17779	1.52221	0.00000	0.00000
1.43444	1.43194	1.52221	1.80000	0.00000	0.00000
1.83830	1.82244	1.52221	1.80000	0.00000	0.00000
1.43194	1.42870	1.80000	2.15998	0.00000	0.00000
1.82244	1.80189	1.80000	2.15998	0.00000	0.00000
1.42870	1.42354	2.15998	2.73409	0.00000	0.00000
1.80189	1.76911	2.15998	2.73409	0.00000	0.00000
1.42354	1.41709	2.73409	3.45000	0.00000	0.00000
1.76911	1.72824	2.73409	3.45000	0.00000	0.00000
1.41709	1.41065	3.45000	4.16591	0.00000	0.00000
1.72824	1.68737	3.45000	4.16591	0.00000	0.00000
1.41065	1.40549	4.16591	4.74002	0.00000	0.00000
1.68737	1.65460	4.16591	4.74002	0.00000	0.00000
1.40549	1.40225	4.74002	5.10000	0.00000	0.00000
1.65460	1.63405	4.74002	5.10000	0.00000	0.00000
1.40225	1.39974	5.10000	5.37824	0.00000	0.00000
1.63405	1.61816	5.10000	5.37824	0.00000	0.00000
1.39974	1.39617	5.37824	5.77500	0.00000	0.00000
1.61816	1.59551	5.37824	5.77500	0.00000	0.00000
1.39617	1.39260	5.77500	6.17176	0.00000	0.00000
1.59551	1.57286	5.77500	6.17176	0.00000	0.00000
1.39260	1.39040	6.17176	6.41696	0.00000	0.00000
1.57286	1.55886	6.17176	6.41696	0.00000	0.00000
.23019	.23019	.90000	.90000	0.00000	.36000
.74638	.74638	.90000	.90000	0.00000	.36000
.23019	.26267	.90000	1.17779	.36000	.36000
.74638	.75195	.90000	1.17779	.36000	.36000
.26267	.30294	1.17779	1.52221	.36000	.36000
.75195	.75886	1.17779	1.52221	.36000	.36000
.30294	.33542	1.52221	1.80000	.36000	.36000
.75886	.76443	1.52221	1.80000	.36000	.36000
.33542	.33542	1.80000	1.80000	.36000	0.00000
.76443	.76443	1.80000	1.80000	.36000	0.00000

.23019	.26267	.90000	1.17779	0.00000	0.00000
.74638	.75195	.90000	1.17779	0.00000	0.00000
.26267	.30294	1.17779	1.52221	0.00000	0.00000
.75195	.75886	1.17779	1.52221	0.00000	0.00000
.30294	.33542	1.52221	1.80000	0.00000	0.00000
.75886	.76443	1.52221	1.80000	0.00000	0.00000
.92606	.92606	.90000	.90000	0.00000	.36000
1.27743	1.27743	.90000	.90000	0.00000	.36000
.92606	.92610	.90000	1.17779	.36000	.36000
1.27743	1.27766	.90000	1.17779	.36000	.36000
.92610	.92614	1.17779	1.52221	.36000	.36000
1.27766	1.27794	1.17779	1.52221	.36000	.36000
.92614	.92618	1.52221	1.80000	.36000	.36000
1.27794	1.27817	1.52221	1.80000	.36000	.36000
.92618	.92618	1.80000	1.80000	.36000	0.00000
1.27817	1.27817	1.80000	1.80000	.36000	0.00000
.92606	.92610	.90000	1.17779	0.00000	0.00000
1.27743	1.27766	.90000	1.17779	0.00000	0.00000
.92610	.92614	1.17779	1.52221	0.00000	0.00000
1.27766	1.27794	1.17779	1.52221	0.00000	0.00000
.92614	.92618	1.52221	1.80000	0.00000	0.00000
1.27794	1.27817	1.52221	1.80000	0.00000	0.00000
1.44004	1.44004	.90000	.90000	0.00000	.36000
1.87382	1.87382	.90000	.90000	0.00000	.36000
1.44004	1.43754	.90000	1.17779	.36000	.36000
1.87382	1.85796	.90000	1.17779	.36000	.36000
1.43754	1.43444	1.17779	1.52221	.36000	.36000
1.85796	1.83830	1.17779	1.52221	.36000	.36000
1.43444	1.43194	1.52221	1.80000	.36000	.36000
1.83830	1.82244	1.52221	1.80000	.36000	.36000
1.43194	1.43194	1.80000	1.80000	.36000	0.00000
1.82244	1.82244	1.80000	1.80000	.36000	0.00000
1.44004	1.43754	.90000	1.17779	0.00000	0.00000
1.87382	1.85796	.90000	1.17779	0.00000	0.00000
1.43754	1.43444	1.17779	1.52221	0.00000	0.00000
1.85796	1.83830	1.17779	1.52221	0.00000	0.00000
1.43444	1.43194	1.52221	1.80000	0.00000	0.00000
1.83830	1.82244	1.52221	1.80000	0.00000	0.00000
2.07013	2.07013	.90000	.90000	0.00000	.36000
2.82718	2.82718	.90000	.90000	0.00000	.36000
3.89782	3.89782	.90000	.90000	0.00000	.36000
4.65487	4.65487	.90000	.90000	0.00000	.36000

2.07013	2.05151	.90000	1.17779	.36000	.36000
2.82718	2.80856	.90000	1.17779	.36000	.36000
3.89782	3.87919	.90000	1.17779	.36000	.36000
4.65487	4.63624	.90000	1.17779	.36000	.36000
2.05151	2.02842	1.17779	1.52221	.36000	.36000
2.80856	2.78547	1.17779	1.52221	.36000	.36000
3.87919	3.85610	1.17779	1.52221	.36000	.36000
4.63624	4.61315	1.17779	1.52221	.36000	.36000
2.02842	2.00979	1.52221	1.80000	.36000	.36000
2.78547	2.76684	1.52221	1.80000	.36000	.36000
3.85610	3.83748	1.52221	1.80000	.36000	.36000
4.61315	4.59453	1.52221	1.80000	.36000	.36000
2.00979	2.00979	1.80000	1.80000	.36000	0.00000
2.76684	2.76684	1.80000	1.80000	.36000	0.00000
3.83748	3.83748	1.80000	1.80000	.36000	0.00000
4.59453	4.59453	1.80000	1.80000	.36000	0.00000
2.07013	2.05151	.90000	1.17779	0.00000	0.00000
2.82718	2.80856	.90000	1.17779	0.00000	0.00000
3.89782	3.87919	.90000	1.17779	0.00000	0.00000
4.65487	4.63624	.90000	1.17779	0.00000	0.00000
2.05151	2.02842	1.17779	1.52221	0.00000	0.00000
2.80856	2.78547	1.17779	1.52221	0.00000	0.00000
3.87919	3.85610	1.17779	1.52221	0.00000	0.00000
4.63624	4.61315	1.17779	1.52221	0.00000	0.00000
2.02842	2.00979	1.52221	1.80000	0.00000	0.00000
2.78547	2.76684	1.52221	1.80000	0.00000	0.00000
3.85610	3.83748	1.52221	1.80000	0.00000	0.00000
4.61315	4.59453	1.52221	1.80000	0.00000	0.00000

CONTROL POINT COORDINATES-

XCP	YCP	ZCP	XCP	YCP	ZCP
.44414	.45000	0.00000	.82664	.45000	0.00000
.49731	1.03180	0.00000	.85329	1.03180	0.00000
.51911	1.35000	0.00000	.85329	1.35000	0.00000
.54090	1.66820	0.00000	.85329	1.66820	0.00000
.56621	1.96340	0.00000	.86346	1.96340	0.00000
.61182	2.42124	0.00000	.89197	2.42124	0.00000
.67773	3.08284	0.00000	.93316	3.08284	0.00000
.75088	3.81716	0.00000	.97888	3.81716	0.00000
.81680	4.47876	0.00000	1.02008	4.47876	0.00000
.86241	4.93660	0.00000	1.04858	4.93660	0.00000

.89153	5.22891	0.00000	1.06679	5.22891	0.00000
.92515	5.56641	0.00000	1.08780	5.56641	0.00000
.96671	5.98359	0.00000	1.11377	5.98359	0.00000
1.00033	6.32109	0.00000	1.13478	6.32109	0.00000
1.08820	.45000	0.00000	1.34975	.45000	0.00000
1.10181	1.03180	0.00000	1.35033	1.03180	0.00000
1.10196	1.35000	0.00000	1.35063	1.35000	0.00000
1.10211	1.66820	0.00000	1.35094	1.66820	0.00000
1.10734	1.96340	0.00000	1.35122	1.96340	0.00000
1.12181	2.42124	0.00000	1.35166	2.42124	0.00000
1.14273	3.08284	0.00000	1.35230	3.08284	0.00000
1.16594	3.81716	0.00000	1.35301	3.81716	0.00000
1.18686	4.47876	0.00000	1.35364	4.47876	0.00000
1.20133	4.93660	0.00000	1.35408	4.93660	0.00000
1.21058	5.22891	0.00000	1.35437	5.22891	0.00000
1.22124	5.56641	0.00000	1.35469	5.56641	0.00000
1.23443	5.98359	0.00000	1.35509	5.98359	0.00000
1.24510	6.32109	0.00000	1.35542	6.32109	0.00000
1.67179	.45000	0.00000	1.99383	.45000	0.00000
1.65257	1.03180	0.00000	1.95482	1.03180	0.00000
1.64206	1.35000	0.00000	1.93349	1.35000	0.00000
1.63154	1.66820	0.00000	1.91215	1.66820	0.00000
1.62179	1.96340	0.00000	1.89236	1.96340	0.00000
1.60666	2.42124	0.00000	1.86166	2.42124	0.00000
1.58480	3.08284	0.00000	1.81730	3.08284	0.00000
1.56024	3.81716	0.00000	1.76807	3.81716	0.00000
1.53868	4.47876	0.00000	1.72371	4.47876	0.00000
1.52355	4.93660	0.00000	1.69301	4.93660	0.00000
1.51389	5.22891	0.00000	1.67341	5.22891	0.00000
1.50274	5.56641	0.00000	1.65078	5.56641	0.00000
1.48895	5.98359	0.00000	1.62281	5.98359	0.00000
1.47780	6.32109	0.00000	1.60018	6.32109	0.00000
.48828	.90000	.18000	.85329	.90000	.18000
.49731	1.03180	.36000	.85328	1.03180	.36000
.51911	1.35000	.36000	.85328	1.35000	.36000
.54090	1.66820	.36000	.85329	1.66820	.36000
.54993	1.80000	.18000	.85329	1.80000	.18000
.49731	1.03180	0.00000	.85328	1.03180	0.00000
.51911	1.35000	0.00000	.85328	1.35000	0.00000
.54090	1.66820	0.00000	.85329	1.66820	0.00000
1.10174	.90000	.18000	1.35020	.90000	.18000

1.10181	1.03180	.36000	1.35033	1.03180	.36000
1.10196	1.35000	.36000	1.35063	1.35000	.36000
1.10211	1.66820	.36000	1.35094	1.66820	.36000
1.10217	1.80000	.18000	1.35107	1.80000	.18000
1.10181	1.03180	0.00000	1.35033	1.03180	0.00000
1.10196	1.35000	0.00000	1.35063	1.35000	0.00000
1.10211	1.66820	0.00000	1.35094	1.66820	0.00000
1.65693	.90000	.18000	1.96366	.90000	.18000
1.65257	1.03180	.36000	1.95482	1.03180	.36000
1.64206	1.35000	.36000	1.93349	1.35000	.36000
1.63154	1.66820	.36000	1.91215	1.66820	.36000
1.62719	1.80000	.18000	1.90331	1.80000	.18000
1.65257	1.03180	0.00000	1.95482	1.03180	0.00000
1.64206	1.35000	0.00000	1.93349	1.35000	0.00000
1.63154	1.66820	0.00000	1.91215	1.66820	0.00000
2.37336	.90000	.18000	3.36250	.90000	.18000
4.35164	.90000	.18000	4.76135	.90000	.18000
2.36453	1.03180	.36000	3.35366	1.03180	.36000
4.34280	1.03180	.36000	4.75251	1.03180	.36000
2.34319	1.35000	.36000	3.33233	1.35000	.36000
4.32147	1.35000	.36000	4.73118	1.35000	.36000
2.32186	1.66820	.36000	3.31100	1.66820	.36000
4.30013	1.66820	.36000	4.70985	1.66820	.36000
2.31302	1.80000	.18000	3.30216	1.80000	.18000
4.29130	1.80000	.18000	4.70101	1.80000	.18000
2.36453	1.03180	0.00000	3.35366	1.03180	0.00000
4.34280	1.03180	0.00000	4.75251	1.03180	0.00000
2.34319	1.35000	0.00000	3.33233	1.35000	0.00000
4.32147	1.35000	0.00000	4.73118	1.35000	0.00000
2.32186	1.66820	0.00000	3.31100	1.66820	0.00000
4.30013	1.66820	0.00000	4.70985	1.66820	0.00000

XX

ALPHA = 12.000 DEGREES

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VORTEX	XV	YV	CP	CPW
1	.05798	.06977	4.93840	4.49174
2	.33794	.06977	2.03630	1.80658
3	.43557	.06977	1.61966	1.41632

4	.62701	.06977	1.35171	1.14022
5	.71547	.06977	1.26255	1.04710
6	.95118	.06977	.55648	.43763
7	.05749	.15997	5.17628	4.91924
8	.33509	.15997	1.94055	2.13170
9	.43272	.15997	12.94878	1.83168
10	.62653	.15997	23.47637	2.76872
11	.71548	.15997	25.58114	2.64594
12	.95118	.15997	4.88929	.65845
13	.05598	.20930	5.49179	5.27058
14	.32626	.20930	2.03749	2.37103
15	.42389	.20930	12.61774	2.13158
16	.62501	.20930	30.66566	3.27826
17	.71548	.20930	29.91524	3.15942
18	.95118	.20930	5.66084	.80458
19	.05434	.25864	5.82602	5.61273
20	.31674	.25864	2.24051	2.52948
21	.41437	.25864	18.48643	2.31290
22	.62338	.25864	24.75371	3.43344
23	.71548	.25864	29.31779	3.28769
24	.95118	.25864	5.09970	.87123
25	.05363	.30440	6.27956	5.86603
26	.31258	.30440	2.82792	2.63523
27	.41021	.30440	2.66803	2.40955
28	.62267	.30440	3.83146	3.33918
29	.71548	.30440	3.65268	3.17765
30	.95118	.30440	1.12738	.89520
31	.05363	.37539	6.60530	6.14539
32	.31258	.37539	2.98516	2.75541
33	.41021	.37539	2.71678	2.50328
34	.62267	.37539	3.61212	3.39208
35	.71548	.37539	3.43112	3.21847
36	.95118	.37539	1.02036	.91740
37	.05363	.47796	6.83083	6.42785
38	.31258	.47796	3.03305	2.86224
39	.41021	.47796	2.73191	2.58819
40	.62267	.47796	3.57361	3.45521
41	.71548	.47796	3.37998	3.27261
42	.95118	.47796	.98585	.93773
43	.05363	.59181	6.85893	6.55062
44	.31258	.59181	3.01201	2.89290

45	.41021	.59181	2.70518	2.60905
46	.62267	.59181	3.54252	3.47165
47	.71548	.59181	3.34801	3.28590
48	.95118	.59181	.96614	.93903
49	.05363	.69438	6.61919	6.38674
50	.31258	.69438	2.86516	2.78002
51	.41021	.69438	2.57079	2.50375
52	.62267	.69438	3.42590	3.38113
53	.71548	.69438	3.24046	3.20224
54	.95118	.69438	.91511	.89795
55	.05363	.76536	6.18823	5.99843
56	.31258	.76536	2.56704	2.49930
57	.41021	.76536	2.26844	2.21579
58	.62267	.76536	3.08043	3.04784
59	.71548	.76536	2.90735	2.88006
60	.95118	.76536	.77877	.76599
61	.05363	.81068	5.75794	5.59202
62	.31258	.81068	2.20923	2.15046
63	.41021	.81068	1.82115	1.77537
64	.62267	.81068	1.47834	1.44702
65	.71548	.81068	1.32197	1.29526
66	.95118	.81068	.53080	.51966
67	.05363	.86301	5.09837	4.96020
68	.31258	.86301	1.79425	1.74582
69	.41021	.86301	1.40774	1.37001
70	.62267	.86301	.99004	.96398
71	.71548	.86301	.84997	.82771
72	.95118	.86301	.34788	.33869
73	.05363	.92769	4.14762	4.04358
74	.31258	.92769	1.33189	1.29704
75	.41021	.92769	1.01141	.98457
76	.62266	.92769	.67029	.65201
77	.71548	.92769	.56505	.54947
78	.95118	.92769	.22698	.22053
79	.05363	.98001	2.70343	2.64027
80	.31257	.98001	.68885	.67130
81	.41020	.98001	.50200	.48883
82	.62266	.98001	.32683	.31781
83	.71548	.98001	.27672	.26894
84	.95118	.98001	.11796	.11449

Y/SP	CL	CM	CT	CDI	CLW	CMW	CDW
.06977	2.39685	-1.01035	.62707	-.13161	2.11436	-.86374	-.11557
.15997	9.20284	-6.80517	.71562	6.00533	2.55332	-1.17296	.39475
.20930	10.87951	-8.29251	.77570	7.10137	2.84719	-1.39361	.49090
.25864	11.13111	-8.22672	.84321	6.90405	3.01614	-1.51926	.48851
.30440	3.51999	-1.88996	.92170	.46753	3.19384	-1.68191	.37693
.37539	3.57576	-1.93452	1.01240	.34117	3.31949	-1.79805	.33260
.47796	3.63258	-2.04619	1.08172	.27053	3.44493	-1.95117	.28729
.59181	3.62100	-2.15128	1.08835	.25414	3.48934	-2.08213	.26722
.69438	3.47233	-2.16881	1.01294	.27768	3.37889	-2.11685	.28321
.76536	3.15166	-2.02546	.89206	.26812	3.07813	-1.98265	.26936
.81068	2.62123	-1.67358	.78047	-.24075	2.55362	-1.63128	-.23805
.86301	2.10887	-1.34571	.62259	-.18825	2.05327	-1.30961	-.18840
.92769	1.59608	-1.04439	.42388	-.09410	1.55581	-1.01719	-.09636
.98001	.92471	-.61568	.20746	-.01555	.90252	-.60033	-.01795

THE LIFT COEFFICIENT = 4.09698

TOTAL INDUCED DRAG COEFFICIENT = 1.24738

THE INDUCED DRAG PARAMETER = .07431

TOTAL PITCHING MOMENT COEFFICIENT = -2.62551

THE COANDA LIFT COEFFICIENT, CLR = 1.06833

THE COANDA DRAG COEFFICIENT, CDR = -1.11975

THE COANDA MOMENT COEFFICIENT, CMR = -.30907

THE LIFT COEFFICIENT FOR THE WING ALONE = 2.66469

THE INDUCED DRAG COEFFICIENT FOR THE WING ALONE = .18863

THE PITCHING MOMENT COEFFICIENT FOR THE WING ALONE = -1.45559

THE INDUCED DRAG PARAMETER FOR THE WING ALONE = .02657

SAMPLE INPUT No. 2

* OVER-WING-BLOWING CONFIGURATION OF TN D-7367 *

0.4	1	1.003	1	0.43026	1	0.85914	1	0.	0.01386	3.08396
1.7664		10.		0.558617		3.08396				
	1		1	0.				-1.299	2.032	0.508
12.99971		3.22804		0.		0.		0.	0.	0.254
1.5		0.		0.		0.				
	3		5		5		5			
	2									
	4									
-2.40778		2.12077	0.		0	-0.28884	0	2.96356	0	1.778
-0.28884		2.96356	1.778		0	0.316567	0	3.20436	0	2.286
0.316567		3.20436	2.286		0	2.855	0	4.214	0	4.416
	3		9		3		4		2	
-1.299		-0.28884	1.778		3	-1.299	4	0.316567	2	2.286
-0.28884		2.96356	1.778		3	0.316567	4	3.20436	2	2.286
2.96356		6.21596	1.778		3	3.20436	4	6.45676	2	2.286

SAMPLE OUTPUT No. 2

 * OVER-WING-BLOWING CONFIGURATION OF TN D-7367 *

 1 1 1 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

CASE NUMBER = 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

INPUT DATA

.40000	1.00300	.43026	.85914	5.00000	.01386	3.08396	
1.76640	10.00000	.55862	3.08396				
1	1	0.00000					
12.99971	3.22804	0.00000	0.00000	-1.29900	2.03200	.50800	.25400
1.50000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	

THE COMPUTED JET ENTRAINMENT ARE AS FOLLOWS

XJET	RJET	DM/DX
10.76626	2.37532	.03114
12.01626	2.37532	.03114
14.51626	2.37905	.03104
17.01626	2.41896	.03000
19.51626	2.50324	.02793
22.01626	2.61298	.02547
24.51626	2.73386	.02302
27.01626	2.85818	.02077
29.51626	2.98203	.01876
32.01626	3.10350	.01700
34.51626	3.22167	.01545
37.01626	3.33617	.01410
39.51626	3.44692	.01292
42.01626	3.55396	.01188
44.51626	3.65744	.01096
47.01626	3.75751	.01015
49.51626	3.85436	.00943
52.01626	3.94818	.00878

54.51626	4.03912	.00820			
57.01626	4.12742	.00767			
59.51626	4.21317	.00720			
62.01626	4.29654	.00677			
64.51626	4.37767	.00638			
67.01626	4.45669	.00603			
69.51626	4.53372	.00570			
72.01626	4.60880	.00541			
74.51626	4.68222	.00513			
77.01626	4.75355	.00488			
79.51626	4.82394	.00465			
82.01626	4.89216	.00443			
84.51626	4.95926	.00423			
. 3	5	5	5		
2					
4	0	0	0	0	
-2.40778	2.12077	0.00000	-.28884	2.96356	1.77800
-.28884	2.96356	1.77800	.31657	3.20436	2.28600
.31657	3.20436	2.28600	2.85500	4.21400	4.41600
3	9	3	4	2	
-1.29900	-.28884	1.77800	-1.29900	.31657	2.28600
-.28884	2.96356	1.77800	.31657	3.20436	2.28600
2.96356	6.21596	1.77800	3.20436	6.45676	2.28600
HALF SW= .13000E+02			CREF= .32280E+01		

LAST,JPANEL,LTOTAL= 138 90 228

XX

A RECTANGULAR JET WITH LATERAL EXTENT EQUAL TO THE EQUIVALENT JET DIAMETER IS USED FOR INTERACTION COMPUTATION

NOTE. CHECK WHETHER THE WING IS IMMERSSED IN THE JET

XX

THE EQUIVALENT JET PROPERTIES ARE EVALUATED AT 1.54891
 THE EQUIVALENT JET RADIUS IS .49329

THE VELOCITY RATIO OF THE EQUIVALENT JET, V_0/V_J , IS .66254

VORTEX ELEMENT ENDPOINT COORDINATES =

X1	X2	Y1	Y2	Z1	Z2
-2.23542	-1.86613	0.00000	.31714	0.00000	0.00000
-1.01001	-.70231	0.00000	.31714	0.00000	0.00000
.72300	.94358	0.00000	.31714	0.00000	0.00000
1.94841	2.10740	0.00000	.31714	0.00000	0.00000
-1.86613	-1.33956	.31714	.76935	0.00000	0.00000
-.70231	-.26357	.31714	.76935	0.00000	0.00000
.94358	1.25812	.31714	.76935	0.00000	0.00000
2.10740	2.33411	.31714	.76935	0.00000	0.00000
-1.33956	-.81298	.76935	1.22157	0.00000	0.00000
-.26357	.17518	.76935	1.22157	0.00000	0.00000
1.25812	1.57265	.76935	1.22157	0.00000	0.00000
2.33411	2.56082	.76935	1.22157	0.00000	0.00000
-.81298	-.44370	1.22157	1.53871	0.00000	0.00000
.17518	.48287	1.22157	1.53871	0.00000	0.00000
1.57265	1.79324	1.22157	1.53871	0.00000	0.00000
2.56082	2.71981	1.22157	1.53871	0.00000	0.00000
-.44370	-.20692	1.53871	1.74205	0.00000	0.00000
.48287	.68016	1.53871	1.74205	0.00000	0.00000
1.79324	1.93467	1.53871	1.74205	0.00000	0.00000
2.71981	2.82175	1.53871	1.74205	0.00000	0.00000
-.20692	.13071	1.74205	2.03200	0.00000	0.00000
.68016	.96147	1.74205	2.03200	0.00000	0.00000
1.93467	2.13635	1.74205	2.03200	0.00000	0.00000
2.82175	2.96711	1.74205	2.03200	0.00000	0.00000
.13071	.46834	2.03200	2.32195	0.00000	0.00000
.96147	1.24279	2.03200	2.32195	0.00000	0.00000
2.13635	2.33802	2.03200	2.32195	0.00000	0.00000
2.96711	3.11247	2.03200	2.32195	0.00000	0.00000
.46834	.70512	2.32195	2.52529	0.00000	0.00000
1.24279	1.44008	2.32195	2.52529	0.00000	0.00000
2.33802	2.47946	2.32195	2.52529	0.00000	0.00000
3.11247	3.21442	2.32195	2.52529	0.00000	0.00000
.70512	1.15889	2.52529	2.91498	0.00000	0.00000
1.44008	1.81816	2.52529	2.91498	0.00000	0.00000
2.47946	2.75051	2.52529	2.91498	0.00000	0.00000
3.21442	3.40978	2.52529	2.91498	0.00000	0.00000

1.15889	1.80592	2.91498	3.47065	0.00000	0.00000
1.81816	2.35727	2.91498	3.47065	0.00000	0.00000
2.75051	3.13700	2.91498	3.47065	0.00000	0.00000
3.40978	3.68835	2.91498	3.47065	0.00000	0.00000
1.80592	2.45296	3.47065	4.02631	0.00000	0.00000
2.35727	2.89638	3.47065	4.02631	0.00000	0.00000
3.13700	3.52349	3.47065	4.02631	0.00000	0.00000
3.68835	3.96692	3.47065	4.02631	0.00000	0.00000
2.45296	2.85285	4.02631	4.36973	0.00000	0.00000
2.89638	3.22958	4.02631	4.36973	0.00000	0.00000
3.52349	3.76235	4.02631	4.36973	0.00000	0.00000
3.96692	4.13908	4.02631	4.36973	0.00000	0.00000
-1.25044	-1.25044	1.53871	1.53871	0.00000	.77487
-.93651	-.93651	1.53871	1.53871	0.00000	.77487
-.62258	-.62258	1.53871	1.53871	0.00000	.77487
-1.25044	-1.23420	1.53871	1.74205	.77487	.77487
-.93651	-.81534	1.53871	1.74205	.77487	.77487
-.62258	-.39648	1.53871	1.74205	.77487	.77487
-1.23420	-1.21105	1.74205	2.03200	.77487	.77487
-.81534	-.64257	1.74205	2.03200	.77487	.77487
-.39648	-.07408	1.74205	2.03200	.77487	.77487
-1.21105	-1.18791	2.03200	2.32195	.77487	.77487
-.64257	-.46979	2.03200	2.32195	.77487	.77487
-.07408	.24832	2.03200	2.32195	.77487	.77487
-1.18791	-1.17167	2.32195	2.52529	.77487	.77487
-.46979	-.34863	2.32195	2.52529	.77487	.77487
.24832	.47442	2.32195	2.52529	.77487	.77487
-1.17167	-1.17167	2.52529	2.52529	.77487	0.00000
-.34863	-.34863	2.52529	2.52529	.77487	0.00000
.47442	.47442	2.52529	2.52529	.77487	0.00000
-1.25044	-1.23420	1.53871	1.74205	0.00000	0.00000
-.93651	-.81534	1.53871	1.74205	0.00000	0.00000
-.62258	-.39648	1.53871	1.74205	0.00000	0.00000
-1.23420	-1.21105	1.74205	2.03200	0.00000	0.00000
-.81534	-.64257	1.74205	2.03200	0.00000	0.00000
-.39648	-.07408	1.74205	2.03200	0.00000	0.00000
-1.21105	-1.18791	2.03200	2.32195	0.00000	0.00000
-.64257	-.46979	2.03200	2.32195	0.00000	0.00000
-.07408	.24832	2.03200	2.32195	0.00000	0.00000
-1.18791	-1.17167	2.32195	2.52529	0.00000	0.00000
-.46979	-.34863	2.32195	2.52529	0.00000	0.00000
.24832	.47442	2.32195	2.52529	0.00000	0.00000

-.44369	-.44369	1.53871	1.53871	0.00000	.77487
.48287	.48287	1.53871	1.53871	0.00000	.77487
1.79324	1.79324	1.53871	1.53871	0.00000	.77487
2.71981	2.71981	1.53871	1.53871	0.00000	.77487
-.44369	-.20692	1.53871	1.74205	.77487	.77487
.48287	.68016	1.53871	1.74205	.77487	.77487
1.79324	1.93467	1.53871	1.74205	.77487	.77487
2.71981	2.82175	1.53871	1.74205	.77487	.77487
-.20692	.13071	1.74205	2.03200	.77487	.77487
.68016	.96147	1.74205	2.03200	.77487	.77487
1.93467	2.13635	1.74205	2.03200	.77487	.77487
2.82175	2.96711	1.74205	2.03200	.77487	.77487
.13071	.46834	2.03200	2.32195	.77487	.77487
.96147	1.24279	2.03200	2.32195	.77487	.77487
2.13635	2.33802	2.03200	2.32195	.77487	.77487
2.96711	3.11247	2.03200	2.32195	.77487	.77487
.46834	.70512	2.32195	2.52529	.77487	.77487
1.24279	1.44008	2.32195	2.52529	.77487	.77487
2.33802	2.47946	2.32195	2.52529	.77487	.77487
3.11247	3.21442	2.32195	2.52529	.77487	.77487
.70512	.70512	2.52529	2.52529	.77487	0.00000
1.44008	1.44008	2.52529	2.52529	.77487	0.00000
2.47946	2.47946	2.52529	2.52529	.77487	0.00000
3.21442	3.21442	2.52529	2.52529	.77487	0.00000
-.44369	-.20692	1.53871	1.74205	0.00000	0.00000
.48287	.68016	1.53871	1.74205	0.00000	0.00000
1.79324	1.93467	1.53871	1.74205	0.00000	0.00000
2.71981	2.82175	1.53871	1.74205	0.00000	0.00000
-.20692	.13071	1.74205	2.03200	0.00000	0.00000
.68016	.96147	1.74205	2.03200	0.00000	0.00000
1.93467	2.13635	1.74205	2.03200	0.00000	0.00000
2.82175	2.96711	1.74205	2.03200	0.00000	0.00000
.13071	.46834	2.03200	2.32195	0.00000	0.00000
.96147	1.24279	2.03200	2.32195	0.00000	0.00000
2.13635	2.33802	2.03200	2.32195	0.00000	0.00000
2.96711	3.11247	2.03200	2.32195	0.00000	0.00000
.46834	.70512	2.32195	2.52529	0.00000	0.00000
1.24279	1.44008	2.32195	2.52529	0.00000	0.00000
2.33802	2.47946	2.32195	2.52529	0.00000	0.00000
3.11247	3.21442	2.32195	2.52529	0.00000	0.00000
3.32643	3.32643	1.53871	1.53871	0.00000	.77487
5.62623	5.62623	1.53871	1.53871	0.00000	.77487
3.32643	3.42282	1.53871	1.74205	.77487	.77487

5.62623	5.72262	1.53871	1.74205	.77487	.77487
3.42282	3.56026	1.74205	2.03200	.77487	.77487
5.72262	5.86006	1.74205	2.03200	.77487	.77487
3.56026	3.69770	2.03200	2.32195	.77487	.77487
5.86006	5.99750	2.03200	2.32195	.77487	.77487
3.69770	3.79409	2.32195	2.52529	.77487	.77487
5.99750	6.09389	2.32195	2.52529	.77487	.77487
3.79409	3.79409	2.52529	2.52529	.77487	0.00000
6.09389	6.09389	2.52529	2.52529	.77487	0.00000
3.32643	3.42282	1.53871	1.74205	0.00000	0.00000
5.62623	5.72262	1.53871	1.74205	0.00000	0.00000
3.42282	3.56026	1.74205	2.03200	0.00000	0.00000
5.72262	5.86006	1.74205	2.03200	0.00000	0.00000
3.56026	3.69770	2.03200	2.32195	0.00000	0.00000
5.86006	5.99750	2.03200	2.32195	0.00000	0.00000
3.69770	3.79409	2.32195	2.52529	0.00000	0.00000
5.99750	6.09389	2.32195	2.52529	0.00000	0.00000

CONTROL POINT COORDINATES-

XCP	YCP	ZCP	XCP	YCP	ZCP
-1.58493	.14693	0.00000	-.02113	.14693	0.00000
1.54267	.14693	0.00000	2.19042	.14693	0.00000
-1.16692	.53161	0.00000	.29926	.53161	0.00000
1.76545	.53161	0.00000	2.37276	.53161	0.00000
-.65024	1.00710	0.00000	.69529	1.00710	0.00000
2.04081	1.00710	0.00000	2.59814	1.00710	0.00000
-.23223	1.39177	0.00000	1.01568	1.39177	0.00000
2.26358	1.39177	0.00000	2.78048	1.39177	0.00000
.02981	1.63292	0.00000	1.21652	1.63292	0.00000
2.40324	1.63292	0.00000	2.89479	1.63292	0.00000
.29782	1.87956	0.00000	1.42195	1.87956	0.00000
2.54608	1.87956	0.00000	3.01170	1.87956	0.00000
.62911	2.18444	0.00000	1.67587	2.18444	0.00000
2.72263	2.18444	0.00000	3.15622	2.18444	0.00000
.89713	2.43108	0.00000	1.88130	2.43108	0.00000
2.86547	2.43108	0.00000	3.27313	2.43108	0.00000
1.19569	2.70584	0.00000	2.11014	2.70584	0.00000
3.02459	2.70584	0.00000	3.40337	2.70584	0.00000
1.70932	3.17852	0.00000	2.50382	3.17852	0.00000
3.29833	3.17852	0.00000	3.62742	3.17852	0.00000
2.34420	3.76278	0.00000	2.99044	3.76278	0.00000

3.63668	3.76278	0.00000	3.90437	3.76278	0.00000
2.85783	4.23545	0.00000	3.38413	4.23545	0.00000
3.91042	4.23545	0.00000	4.12842	4.23545	0.00000
-1.11775	1.53871	.38743	-.75526	1.53871	.38743
-.57402	1.53871	.38743	-1.08969	1.63292	.77487
-.67106	1.63292	.77487	-.46174	1.63292	.77487
-1.01620	1.87956	.77487	-.45060	1.87956	.77487
-.16780	1.87956	.77487	-.92537	2.18444	.77487
-.17810	2.18444	.77487	.19553	2.18444	.77487
-.85188	2.43108	.77487	.04235	2.43108	.77487
.48947	2.43108	.77487	-.82381	2.52529	.38743
.12656	2.52529	.38743	.60175	2.52529	.38743
-1.08969	1.63292	0.00000	-.67106	1.63292	0.00000
-.46174	1.63292	0.00000	-1.01620	1.87956	0.00000
-.45060	1.87956	0.00000	-.16780	1.87956	0.00000
-.92537	2.18444	0.00000	-.17810	2.18444	0.00000
.19553	2.18444	0.00000	-.85188	2.43108	0.00000
.04235	2.43108	0.00000	.48947	2.43108	0.00000
-.07256	1.53871	.38743	1.13806	1.53871	.38743
2.34868	1.53871	.38743	2.85013	1.53871	.38743
.02981	1.63292	.77487	1.21652	1.63292	.77487
2.40324	1.63292	.77487	2.89479	1.63292	.77487
.29783	1.87956	.77487	1.42195	1.87956	.77487
2.54608	1.87956	.77487	3.01170	1.87956	.77487
.62911	2.18444	.77487	1.67587	2.18444	.77487
2.72263	2.18444	.77487	3.15622	2.18444	.77487
.89713	2.43108	.77487	1.88130	2.43108	.77487
2.86547	2.43108	.77487	3.27313	2.43108	.77487
.99950	2.52529	.38743	1.95977	2.52529	.38743
2.92003	2.52529	.38743	3.31779	2.52529	.38743
.02981	1.63292	0.00000	1.21652	1.63292	0.00000
2.40324	1.63292	0.00000	2.89479	1.63292	0.00000
.29783	1.87956	0.00000	1.42195	1.87956	0.00000
2.54608	1.87956	0.00000	3.01170	1.87956	0.00000
.62911	2.18444	0.00000	1.67587	2.18444	0.00000
2.72263	2.18444	0.00000	3.15622	2.18444	0.00000
.89713	2.43108	0.00000	1.88130	2.43108	0.00000
2.86547	2.43108	0.00000	3.27313	2.43108	0.00000
4.47633	1.53871	.38743	6.10253	1.53871	.38743
4.52099	1.63292	.77487	6.14719	1.63292	.77487
4.63790	1.87956	.77487	6.26410	1.87956	.77487
4.78242	2.18444	.77487	6.40862	2.18444	.77487
4.89933	2.43108	.77487	6.52553	2.43108	.77487

4.94399	2.52529	.38743	6.57019	2.52529	.38743
4.52099	1.63292	0.00000	6.14719	1.63292	0.00000
4.63790	1.87956	0.00000	6.26410	1.87956	0.00000
4.78242	2.18444	0.00000	6.40862	2.18444	0.00000
4.89933	2.43108	0.00000	6.52553	2.43108	0.00000

XX

ALPHA = 5.000 DEGREES

XX

VORTEX	XV	YV	CP	CPW
1	.03806	.03327	.55466	.53297
2	.30866	.03327	.31487	.29304
3	.69134	.03327	.19362	.18808
4	.96194	.03327	.06992	.06924
5	.03806	.12038	.67586	.64303
6	.30866	.12038	.32142	.29846
7	.69134	.12038	.19132	.18791
8	.96194	.12038	.06478	.06467
9	.03806	.22806	.84434	.77634
10	.30866	.22806	.33053	.30929
11	.69134	.22806	.18079	.18348
12	.96194	.22806	.05858	.05967
13	.03806	.31517	1.01515	.86627
14	.30866	.31517	.32355	.32193
15	.69134	.31517	.17149	.18088
16	.96194	.31517	.05647	.05725
17	.03806	.36977	1.26691	.91789
18	.30866	.36977	.47674	.33014
19	.69134	.36977	.28746	.17957
20	.96194	.36977	.11785	.05610
21	.03806	.42563	1.30991	.96930
22	.30866	.42563	.45969	.33742
23	.69134	.42563	.27107	.17708
24	.96194	.42563	.12635	.05449
25	.03806	.49466	1.29880	1.02713
26	.30866	.49466	.46247	.34541
27	.69134	.49466	.26593	.17378
28	.96194	.49466	.12824	.05252
29	.03806	.55052	1.23668	1.06873
30	.30866	.55052	.50937	.35017

31	.69134	.55052	.26907	.16995
32	.96194	.55052	.11744	.05058
33	.03806	.61274	1.17011	1.11778
34	.30866	.61274	.37977	.35774
35	.69134	.61274	.18117	.16708
36	.96194	.61274	.05614	.04829
37	.03806	.71977	1.24057	1.18776
38	.30866	.71977	.38389	.36642
39	.69134	.71977	.16546	.15570
40	.96194	.71977	.04504	.04199
41	.03806	.85208	1.27622	1.23170
42	.30866	.85208	.35295	.33957
43	.69134	.85208	.11828	.11288
44	.96194	.85208	.02907	.02761
45	.03806	.95912	1.12402	1.09053
46	.30866	.95912	.16695	.16119
47	.69134	.95912	.04529	.04331
48	.96194	.95912	.01122	.01068

Y/SP	CL	CM	CT	CDI	CLW	CMW	CDW
.03327	.27768	.05924	.00447	.01981	.26442	.05562	.01888
.12038	.29704	.03839	.00970	.01626	.28252	.03509	.01567
.22806	.32132	.00735	.01538	.01267	.30444	.00337	.01304
.31517	.34142	-.02278	.02369	.00609	.32149	-.02884	.01086
.36977	.48434	-.08598	.00955	.03279	.33174	-.05158	.00943
.42563	.48014	-.11759	.01149	.03047	.34114	-.07619	.00782
.49466	.47798	-.16088	.01240	.02937	.35148	-.10863	.00582
.55052	.48486	-.20104	.00904	.03334	.35792	-.13575	.00405
.61274	.38917	-.17980	.03277	.00116	.36683	-.16828	.00244
.71977	.39414	-.23522	.03589	-.00155	.37572	-.22386	-.00063
.85208	.36908	-.28078	.03846	-.00632	.35521	-.27011	-.00531
.95912	.24950	-.21922	.03251	-.01081	.24147	-.21212	-.00991

THE LIFT COEFFICIENT = .35321

TOTAL INDUCED DRAG COEFFICIENT = .01248

THE INDUCED DRAG PARAMETER = .10004

TOTAL PITCHING MOMENT COEFFICIENT = -.08710

THE LIFT COEFFICIENT WITH JET ENTRAINMENT ALONE = .31601
THE INDUCED DRAG COEFFICIENT WITH JET ENTRAINMENT ALONE = .00741
THE PITCHING MOMENT COEFFICIENT WITH JET ENTRAINMENT ALONE = -.07680
THE LIFT COEFFICIENT FOR THE WING ALONE = .31057
THE INDUCED DRAG COEFFICIENT FOR THE WING ALONE = .00756
THE PITCHING MOMENT COEFFICIENT FOR THE WING ALONE = -.07524
THE INDUCED DRAG PARAMETER FOR THE WING ALONE = .07840

ERROR SUMMARY

ERROR	TIMES
0115	0328

PROGRAM LISTING

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OVERRIDE (USRTIME,0.0) GEF 10
PROGRAM USRTIME(INPUT,OUTPUT,TAPF5=INPUT,TAPF6=OUTPUT,TAPE1,TAPE2) GEF 20
C AERODYNAMICS OF WING-JET INTERACTION GEF 30
C BY C. EDWARD LAN OF THE UNIVERSITY OF KANSAS GEF 40
C GEF 50
C THIS PROGRAM IS APPLICABLE TO BOTH UPPER-SURFACE-BLOWING AND OVER- GEF 60
C WING BLOWING CONFIGURATIONS WITH AND WITHOUT GROUND EFFECT. GEF 70
C GEF 80
C NOTE. ROOT AND TIP CAMBER FUNCTIONS MAY BE DEFINED AS FUNCTION GEF 90
C SUBPROGRAMS ZCP(X) AND ZCT(Y), RESPECTIVELY. GEF 100
C THE ARRAY DIMENSIONS OF THIS PROGRAM RESTRICT THE NUMBER OF WING GEF 110
C VORTICES TO BE 100 MAXIMUM AND THE TOTAL WING AND JET VORTICES TO, RESPECTIVELY, GEF 120
C 200 MAXIMUM. ALSO, CHECK THE ARRAY SIZE OF GAMMA IN SUBROUTINE GEF 130
C "SOLUTION" BEFORE USING THE PROGRAM. GEF 140
C GEF 150
C DIMENSION TITLE(13) GEF 160
C COMMON /CODE/ KCODE GEF 170
C COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41), GEF 180
C IYLL(41) GEF 190
C COMMON /GCOM/ HA(FSW),YCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XT GEF 200
C IF(50),PSI(20),CH(95),XV(200),YV(100),SN(R,R),XM(200,2),YN(200,2),Z GEF 210
C 2N(200,2),WIDTH(R),YCON(25),SWEEP(50),HALFR,CJ(21,8),EX(95,2),TX(95 GEF 220
C 3,2),SC(160,5),ST(160,5),LC(3) GEF 230
C COMMON /AFRO/ AM1,AM2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100) GEF 240
C COMMON /CONST/ ACS,NCW,M(8),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),J GEF 250
C IPANEL,MJU(5),NW(3),NNJ,MJP GEF 260
C COMMON /PARAM/ ALPT,ALPC,ALPS,COE,SDF,TH,TDF,NGRD,HEIGHT,ATT GEF 270
C COMMON /JET/ PK1,XC,YJT(31),A(31),B(31) GEF 280
C COMMON /ADD/ CP(100),CH(30),REFAK(R),SWP(R,15),CAL(30),ISYM,VMU,V GEF 290
C I,TEMP,FCR,CAMLEP,CAMLET,CAMTER,CAMTET,XJ,YJ,ZJ,RJ,ALP,CREF,TWIST GEF 300
C COMMON /COST/ LTOTAL,LPAN1,MJU(5),LPANEL,IFNTN,LPAN2,EXIT,PTIAL,TW GEF 310
C LIST,RE(5),NEP GEF 320
C COMMON /CAMR/ ICAM,IV,XT(2,11),ZC(2,11),AAM(2,10),RPM(2,10),CCM(2, GEF 330
C 110),COM(2,10) GEF 340
C DIMENSION ISPEC(6) GEF 350
C DATA ISPEC/3*(-0),(0),2*(-0)/ GEF 360
C SYSTEMC SUPPRESSES THE PRINTING OF NON-FATAL ERROR MESSAGES IN THE GEF 370
C EVALUATION OF EXP(A), WHEN (A) IS LESS THAN (-675,R4) ON CYBER-175 GEF 380
C . THIS CALL MAY NOT BE NEEDED FOR OTHER COMPUTER SYSTEMS. GEF 390
C CALL SYSTEMC(115,ISPEC) GEF 400
C PI=3.14159265 GEF 410
C READ(5,70) (TITLE(I),I=1,13) GEF 420
C WRITE(6,80) GEF 430
C WRITE(6,70) (TITLE(I),I=1,13) GEF 440
C WRITE(6,80) GEF 450
C NCON=1 GEF 460
C GEF 470
C ***NUMBER OF CASES TO BE RUN, GEOMETRY CODE (=1 IF GEOMETRY VARIES. GEF 480
C IN THIS CASE, ALPHA MAY ALSO BE DIFFERENT, =0 FOR THE SAME GEOME- GEF 490

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C      TRY OUT DIFFERENT ALPHAS) , AND SYMMETRY CODE (=0 FOR A CENTERED GEF 500
C      JET, AND=1 OTHERWISE) *** GEF 510
C      NGRD=1 IF THE WING IS IN GROUND EFFECT, =0 OTHERWISE GEF 520
C GEF 530
      READ (5,60) ICASE,NG,ISYM,NGRD GEF 540
      WRITE (6,60) ICASE,NG,ISYM,NGRD GEF 550
10    CONTINUE GEF 560
      WRITE (6,90) GEF 570
      WRITE (6,100) NCON GEF 580
      WRITE (6,90) GEF 590
      CALL OVERLAY (AHUSRIGF,1,0) GEF 600
      CALL OVERLAY (AHUSRIGF,2,0) GEF 610
      CALL OVERLAY (AHUSRIGF,3,0) GEF 620
20    CONTINUE GEF 630
      CALL OVERLAY (AHUSRIGF,4,0) GEF 640
      CALL OVERLAY (AHUSRIGF,5,0) GEF 650
      NCON=NCON+1 GEF 660
      IF (NCON.GT.ICASE) GO TO 40 GEF 670
      IF (NG.EQ.1) GO TO 10 GEF 680
C GEF 690
C      ***ADDITIONAL ANGLES OF ATTACK IN DEGS. TO BE COMPUTED, TO BE READ IN GEF 700
C      BEHIND THE GEOMETRY DATA DEFINED IN SUBROUTINE "GEOMTY" *** GEF 710
C GEF 720
      READ (5,50) ALP GEF 730
      ALP=ALP*PI/180. GEF 740
      ALPS=SIN(ALP) GEF 750
      ALPC=COS(ALP) GEF 760
      ALPT=ALPS/ALPC GEF 770
      DO 30 I=1,NCS GEF 780
      XLL(I)=ALP+(TVYCTP+TWIST*YLE(I)/HALFR)*PI/180. GEF 790
      T=XLL(I) GEF 800
30    YTT(I)=SIN(T)/COS(T) GEF 810
      WRITE (6,90) GEF 820
      WRITE (6,100) NCON GEF 830
      WRITE (6,90) GEF 840
      GO TO 20 GEF 850
40    CONTINUE GEF 860
      STOP GEF 870
C GEF 880
50    FORMAT (5F10.5) GEF 890
60    FORMAT (7(6X,T4)) GEF 900
70    FORMAT (13A6) GEF 910
80    FORMAT (40H***** GEF 920
90    FORMAT (1H0,20Y,25HXXXXXXXXXXXXXXXXXXXXXXXXXXXX) GEF 930
100   FORMAT (1H0,25Y,13HCASE NUMBER =,I2) GEF 940
      END GEF 950
      FUNCTION ZCP (X) GEF 960
      COMMON /CAMR/ TCAM,IM,XT(2,11),ZC(2,11),AAM(2,10),BBM(2,10),CCM(2,7CP GEF 970
      110),DDM(2,10) ZCP 30 GEF 980

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      IF (ICAM.EQ.1) GO TO 10
C
C *** CAMBER FUNCTION FOR THE ROOT SECTION ***
C
      ZCP=0.
      GO TO 20
10  ZCP=ZCAM(1,X)
20  RETURN
      END
      FUNCTION ZCT (X)
      COMMON /CAMR/ ICAM,IM,XT(2,11),ZC(2,11),AAM(2,10),PRM(2,10),CCM(2,
110),DDM(2,10)
      IF (ICAM.EQ.1) GO TO 10
C
C *** CAMBER FUNCTION FOR THE TIP SECTION ***
C
      ZCT=ZCP(X)
      GO TO 20
10  ZCT=ZCAM(2,X)
20  RETURN
      END
      FUNCTION ZCAM (I,X)
      COMMON /CAMR/ ICAM,IM,XT(2,11),ZC(2,11),AAM(2,10),PRM(2,10),CCM(2,
110),DDM(2,10)
      K=1
10  IF (X.GE.XT(I,K).AND.X.LT.XT(I,K+1)) GO TO 20
      K=K+1
      IF (K.GE.IM) GO TO 30
      GO TO 10
20  SM=X-XT(I,K)
      ZCAM=3.*AAM(I,K)*SM**2+2.*PRM(I,K)*SM+CCM(I,K)
      GO TO 50
30  IF (X.LT.XT(I,1)) GO TO 40
      K=IM-1
      GO TO 20
40  K=1
      GO TO 20
50  RETURN
      END
      SUBROUTINE VMSECN (NC1,K,AA,A,CA)
C
C TO SOLVE THE SIMULTANEOUS EQUATIONS BY BURCELL'S VECTOR METHOD
      DIMENSION AA(1), CA(1), A(1)
      NC=K*NC1
      SUM1=0.
      K1=K-1
      JJ=1
      DO 10 J=1,K1
      SUM1=SUM1+AA(J)*A(JJ)
10  JJ=JJ+NC1+1
      VSN 40
      ZCP 50
      ZCP 60
      ZCP 70
      ZCP 80
      ZCP 90
      ZCP 100
      ZCP 110
      ZCP 120
      ZCT 10
      ZCT 20
      ZCT 30
      ZCT 40
      ZCT 50
      ZCT 60
      ZCT 70
      ZCT 80
      ZCT 90
      ZCT 100
      ZCT 110
      ZCT 120
      ZCM 10
      ZCM 20
      ZCM 30
      ZCM 40
      ZCM 50
      ZCM 60
      ZCM 70
      ZCM 80
      ZCM 90
      ZCM 100
      ZCM 110
      ZCM 120
      ZCM 130
      ZCM 140
      ZCM 150
      ZCM 160
      ZCM 170
      ZCM 180
      VSN 10
      VSN 20
      VSN 30
      VSN 40
      VSN 50
      VSN 60
      VSN 70
      VSN 80
      VSN 90
      VSN 100

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	SUM1=SUM1+AA(K)	VSN 110
	DO 30 I=1,NC1	VSN 120
	SUM2=0.	VSN 130
	JJ=I+1	VSN 140
	DO 20 J=1,K1	VSN 150
	SUM2=SUM2+AA(J)*A(JJ)	VSN 160
20	JJ=JJ+NC1+1	VSN 170
	KK=K+1	VSN 180
	SUM2=SUM2+AA(KK)	VSN 190
30	CA(I)=-SUM2/SUM1	VSN 200
	M=1	VSN 210
	L=0	VSN 220
	KNC=(K-1)*NC1	VSN 230
	DO 60 I=1,KNC	VSN 240
	IF (I.GT.KNC) GO TO 50	VSN 250
	MM=(M-1)*NC1+1	VSN 260
	IF (I.EQ.MM) GO TO 70	VSN 270
40	KK=KK+1	VSN 280
	IL=I+L	VSN 290
	A(I)=CA(KK)*BASE+A(IL)	VSN 300
	GO TO 60	VSN 310
50	II=I-KNC	VSN 320
	A(I)=CA(II)	VSN 330
60	CONTINUE	VSN 340
	GO TO 80	VSN 350
70	II=MM+M-1	VSN 360
	BASE=A(II)	VSN 370
	KK=0	VSN 380
	L=L+1	VSN 390
	M=M+1	VSN 400
	GO TO 40	VSN 410
80	CONTINUE	VSN 420
	RETURN	VSN 430
	END	VSN 440
	SUBROUTINE INTER (F,MM,LJ,I7,IJ,R,IP)	INT 10
C	TO MAKE REFINED INTEGRATION FOR INDUCED TANGENTIAL VELOCITIES	INT 20
	COMMON /REFM/ HALFR, YCP(200), YCP(200), ZCP(200), XLE(50), YLE(50), XTINT	INT 30
	IF(50), PST(20), CH(95), XV(200), YV(100), SN(8,8), YN(200,2), YN(200,2), ZINT	INT 40
	2N(200,2), WIDTH(8), YCON(25), SWEEP(50), HALFR, SJ(21,8), FX(95,2), TX(95	INT 50
	3,2), SC(160,5), ST(160,5), LC(3)	INT 60
	DT=.1418926E	INT 70
	J=LJ+1	INT 80
	JJ=MM+16	INT 90
	IF (MM.GT.6) JJ=MM*9	INT 100
	FJ=JJ	INT 110
	C1=TX(I7,1)-FX(I7,1)	INT 120
	C2=TX(I7,2)-FX(I7,2)	INT 130
	SUM=0.	INT 140
	DO 10 K=1, JJ	INT 150

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YY1=FX(I7,1)+C1*SC(K,TP)          INT 160
XX2=FX(I7,2)+C2*SC(K,TP)          INT 170
X1=XX1-XCP(IJ)                     INT 180
X2=XX2-XCP(IJ)                     INT 190
Y1=YN(J,1)-YCP(IJ)                 INT 200
Y2=YN(J,2)-YCP(IJ)                 INT 210
Z1=ZN(J,1)-ZCP(IJ)                 INT 220
Z2=ZN(J,2)-ZCP(IJ)                 INT 230
X12=XX2-XX1                        INT 240
Y12=YN(J,2)-YN(J,1)                INT 250
Z12=ZN(J,2)-ZN(J,1)                INT 260
Y7I=Y1*Z12-Z1*Y12                 INT 270
XYK=X1*Y12-Y1*X12                 INT 280
X7J=X1*Z12-Z1*X12                 INT 290
ALF=XYK*XYK+X7J*X7J+P*Y7I*Y7I     INT 300
R1=SQRT(X1*X1+P*Y1*Y1+P*Z1*Z1)     INT 310
R2=SQRT(X2*X2+P*Y2*Y2+P*Z2*Z2)     INT 320
IH1=(X2*Y12+P*Y2*Y12+P*Z2*Z12)/R2-(X1*Y12+P*Y1*Y12+P*Z1*Z12)/R1  INT 330
10  SUM=SUM+IH1*Y7I/ALF*SI(K,TP)     INT 340
F=SUM*CH(I7)/(P.*FJ)               INT 350
DEFINITION                           INT 360
END                                    INT 370
SUBROUTINE WING (AW,LPAN1,J,PP,LPAN2,NGRD,HEIGHT,ATT) WNG 10
C  TO COMPUTE THE JET-OFF INFLUENCE COEFFICIENT MATRIX WNG 20
DIMENSION AW(1)                       WNG 30
DIMENSION W(4), W1(2)                 WNG 40
COMMON /GEOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLF(50),YLE(50),XTWNG 50
IF(50),PSI(20),CH(95),YV(200),YV(100),SN(R,R),YN(200,2),YN(200,2),7WNG 60
ZN(200,2),WIDTH(R),YCON(25),SWEEP(50),HALFR,SJ(21,R),EX(95,2),TX(95WNG 70
3,2),SC(160,5),ST(160,5),IC(3)      WNG 80
COMMON /AERO/ AM1,AM2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100) WNG 90
COMMON /CONST/ NCS,NCH,N1(2),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JWNG 100
IPANFL,MJJ(5),NA(3),NAJ,NAJF        WNG 110
IP=1                                  WNG 120
LG=1                                  WNG 130
IF (NGRD.EQ.1) LG=2                  WNG 140
W1(1)=0.                              WNG 150
W1(2)=0.                              WNG 160
I7=1                                  WNG 170
IFF=1                                  WNG 180
ISN=1                                  WNG 190
NL=AW(1)                              WNG 200
NN=AW(1)                              WNG 210
DO 90 J=1,LPANFL                      WNG 220
NI=J-IFF+1                            WNG 230
FN=NL                                  WNG 240
IF (J.GT.LPAN1.AND.J.LE.LPAN2) ISN=2 WNG 250
IF (J.GT.LPAN2.AND.J.LE.LPANFL) ISN=3 WNG 260
IF (J.GE.LPAN1.AND.J.LT.LPANFL) GO TO 10 WNG 270

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	GO TO 20	WNG 280
10	NL=NL(2)	WNG 290
	IF (J.GF.LPANEL.AND.J.LT.LPANEL) NL=NL(3)	WNG 300
20	CONTINUE	WNG 310
	X1=XN(J,1)-YCP(T)	WNG 320
	X2=XN(J,2)-YCP(T)	WNG 330
	Y12=XN(J,2)-YN(J,1)	WNG 340
	Y12=YN(J,2)-YN(J,1)	WNG 350
	Z12=ZN(J,2)-ZN(J,1)	WNG 360
	DO 80 II=1,2	WNG 370
	IF (II.EQ.1) GO TO 30	WNG 380
	N=1	WNG 390
	GO TO 40	WNG 400
30	N=2	WNG 410
40	CONTINUE	WNG 420
	YC=(-1.)**N*YCP(T)	WNG 430
	Y1=YN(J,1)-YC	WNG 440
	Y2=YN(J,2)-YC	WNG 450
	XYK=Y1*Y12-Y1*Y12	WNG 460
	DO 80 KK=1,IG	WNG 470
	IF (KK.EQ.1) GO TO 50	WNG 480
	GF=-1.	WNG 490
	ZC=-2.*(ZCP(I)+HEIGHT)+ZCP(T)	WNG 500
	FCON=1.	WNG 510
	GO TO 50	WNG 520
50	GF=1.	WNG 530
	ZC=ZCP(I)	WNG 540
	FCON=0.	WNG 550
60	Z1=ZN(J,1)-ZC	WNG 560
	Z2=ZN(J,2)-ZC	WNG 570
	X7J=X1*Z12-Z1*X12	WNG 580
	HCON=-Z1*Y12*ATT*FCON	WNG 590
	Y7I=Y1*Z12-Z1*Y12	WNG 600
	ALF1=XYK*XYK+X7J*X7J+PP*Y7I*Y7I	WNG 610
	P1P1=SQRT(X1*Y1+PP*Y1*Y1+PP*Z1*Z1)	WNG 620
	P2P1=SQRT(X2*Y2+PP*Y2*Y2+PP*Z2*Z2)	WNG 630
	H1P1=(Y2*X12+PP*Y2*Y12+PP*Z2*Z12)/P2P1-(X1*X12+PP*Y1*Y12+PP*Z1*Z12)/P1P1	WNG 640
	G1P1=(1.-X1/P1P1)/(Y1*Y1+Z1*Z1)	WNG 650
	G2P1=(1.-X2/P2P1)/(Y2*Y2+Z2*Z2)	WNG 660
	F1=H1P1*(HCON+XYK)*GF/ALF1	WNG 680
	F2=(-Y2*G2P1+Y1*G1P1)*GF	WNG 690
	IF (KK.EQ.2) GO TO 70	WNG 700
	W(IT)=(F1+F2)*CH(IT)*SN(MI,ISN)/(P.*FN)	WNG 710
	GO TO 80	WNG 720
70	W1(IT)=(F1+F2)*CH(IT)*SN(MI,ISN)/(P.*FN)	WNG 730
80	CONTINUE	WNG 740
	AW(J)=W(1)+W(2)+W1(1)+W1(2)	WNG 750
	IF (J.LT.NN.OR.J.EQ.LPANEL) GO TO 90	WNG 760

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I7=I7+1 WNG 770
IEE=NN+1 WNG 780
NN=NN+NL WNG 790
90 CONTINUE WNG 800
RFT(IPM) WNG 810
END WNG 820
OVERLAY (HSPICE,1.0) GEO 10
PROGRAM GEOMTY GEO 20
C TO SET UP THE GEOMETRY OF THE VORTEX ELEMENTS AND CONTROL POINTS GEO 30
DIMENSION XXL(5),YL(5),XYT(5),ZL(5),CPCWL(31),CPSWL(31) GEO 40
COMMON /CODE/ YCODE GEO 50
COMMON /SCHEME/ C(2),Y(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41),GEO 60
IXLL(41) GEO 70
COMMON /GECM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLF(50),YLE(50),XTGEO 80
IF(50),PST(20),CH(95),XV(200),YV(100),SN(8,2),XN(200,2),YN(200,2),7GEO 90
2N(200,2),WIDTH(8),YCON(25),SWEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95GEO 100
3,2),SC(160,5),ST(160,5),LC(2) GEO 110
COMMON /AFPO/ AM1,AM2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100) GEO 120
COMMON /CONST/ NCS,NCW,M1(2),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JGEO 130
IPANFL,MJJ(5),MW(3),MNJ,MJP GEO 140
COMMON /PARAM/ ALPRT,ALPC,ALPS,CDF,SDF,TH,TDF,NGRD,HEIGHT,ATT GEO 150
COMMON /ADD/ CP(100),CM(20),BPAK(8),SWP(8,15),GAL(30),ISYM,VMU,VHIGEO 160
I,TEMP,FCR,CAMLEP,CAMLET,CAMTER,CAMTET,XJ,YJ,ZJ,PJ,ALP,CREF,TWISTR GEO 170
COMMON /CONST/ LTOTAL,LPAN1,MJW(5),LPANFL,TFNTM,LPAN2,EXIT,PTIAL,TWGEO 180
LIST,DF(5),NEP GEO 190
COMMON /CAMR/ ICAM,IM,XT(2,11),ZC(2,11),AAM(2,10),BRM(2,10),CCM(2,GEO 200
110),DDM(2,10) GEO 210
WRITE (6,540) GEO 220
PI=3.14159265 GEO 230
NCS=0 GEO 240
KL=0 GEO 250
IPANFL=1 GEO 260
PT=0. GEO 270
DO 10 I=1,5 GEO 280
10 DF(I)=0. GEO 290
C GEO 300
C ***MACH NUMBERS OF FREESTREAM AND JET FLOW, FREESTREAM/JET VELOCITY GEO 310
C RATIO,JET/FREESTREAM TEMPERATURE RATIO,ANGLE OF ATTACK IN DEGREE, GEO 320
C WING L.F. AND T.F. X-COORDINATES AT THE JET AXIS LOCATION*** GEO 330
C GEO 340
C READ (6,490) AM1,AM2,VMU,TEMP,ALP,XEL,XFT GEO 350
C WRITE (6,490) AM1,AM2,VMU,TEMP,ALP,XEL,XFT GEO 360
C GEO 370
C HEIGHT= HEIGHT OF WING A. C. FROM GROUND IF NGRD=1, GEO 380
C =0, OTHERWISE GEO 390
C ATT=PITCH ATTITUDE OF WING IN DEGREES, =0, IF NGRD=0 GEO 400
C YAC=X-COORDINATE OF WING A. C. OR THE REFERENCE POINT ABOUT WHICH GEO 410
C THE GROUND HEIGHT IS MEASURED. GEO 420
C XHC=X-COORDINATE OF USE FLAP HINGE. GEO 430

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C
C      READ (F.490) HEIGHT,ATT,YAC,YHC
C      WRITE (A.490) HEIGHT,ATT,YAC,YHC
C      ATG=ATT*PI/180.
C      ATT=SIN(ATG)
C ***NUMBER OF FLAP SECTIONS (INCLUDING THE JET SPAN), THE NUMERICAL
C ORDER OF JET SPAN AND THE CORRESPONDING FLAP DEFLECTION ANGLES IN
C DEGREES ***
C      READ (F.530) NFP,NJP,(DF(I),I=1,NFP)
C      WRITE (A.530) NFP,NJP,(DF(I),I=1,NFP)
C ***REFERENCE HALF WING AREA, REFERENCE CHORD, TWIST IN DEG.,
C INCIDENCE OF ROOT CHORD IN DEG., X-, Y- AND Z-COORDINATES OF JET
C CENTER AT EXIT, AND JET RADIUS, 7J IS REFERRED TO THE WING PLANE.
C * NOTE, FOR USR APPLICATIONS, YJ,7J AND RJ MAY BE ANY NON-ZERO VALUES
C UNLESS THE RECTANGULAR JET IS NOT ON THE SURFACE AND THE ENTRAIN-
C MENT EFFECT IS TO BE ACCOUNTED FOR.
C      READ (F.490) HALFSA,CREF,TWIST,TWISTR,YJ,YJ,7J,RJ
C      WRITE (A.490) HALFSA,CREF,TWIST,TWISTR,YJ,YJ,7J,RJ
C ***TRAILING-EDGE ANGLE IN DEG., PARTIAL-SPAN FLAP INDICATOR (=0, FOR
C NO OR FULL-SPAN FLAP, AND =1, OTHERWISE), CONFIGURATION INDICATOR
C (=1, FOR USR, =2, FOR THIN JET FLAP, AND =0, FOR OWP), L.E. CAMBER
C AT THE ROOT AND TIP, AND T.F. CAMBER AT THE ROOT AND TIP ***
C * NOTE, FOR USR APPLICATIONS, TEANGL MAY BE ANY VALUE *
C * IF CAMBER ORDINATES ARE TO BE READ IN, THE L.F. AND T.F. CAMBER
C SLOPES TO BE READ IN BELOW MAY BE ARBITRARY NUMBERS *
C      READ (F.490) TEANGL,PTIAL,USR,CAMLEP,CAMLET,CAMTER,CAMTET
C      WRITE (A.490) TEANGL,PTIAL,USR,CAMLEP,CAMLET,CAMTER,CAMTET
C      IUSP=USR
C      DEJ=0.
C      CMU=0.
C      DTST=0.
C * THE FOLLOWING DATA ARE NOT NEEDED FOR OWP APPLICATIONS *
C IF (IUSR.EQ.0) GO TO 20
C *** THRUST COEFFICIENT, JET DEFLECTION ANGLE IN DEG, AND ENTRAINMENT
C CODE IF THE RECTANGULAR JET IS NOT ON THE WING SURFACE (=1, IF THE
C ENTRAINMENT DUE TO AN EQUIVALENT ROUND JET IS TO BE INCLUDED, =0,
C OTHERWISE)
C DTST=0, IF THE JET DEFLECTION ANGLE IS NOT TO BE CHANGED,
C =1, OTHERWISE
C      READ (F.490) CMU,DEJ,TNJ,DTST

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WRITE (A,400) CMI,DFJ,TN,I,DTFST
20 CONTINUE
DFJ=DFJ*PI/180.
CDF=DFJ
ITFST=DTFST
DO 30 I=1,5
30 DF(I)=DF(I)*PI/180.
TNF=DF(A,JP)
ALP=ALP*PI/180.
ALPS=SIN(ALP)
ALPC=COS(ALP)
ALPT=ALPS/ALPC
CMIIT=CMI
DF=TFANGL*PI/180.+TNF
IF (IHSR,NE,0) CDF=DFJ
FYIT=0.
IF (YJ,GT,XFL) FYIT=1.
HT=HEIGHT
HEIGHT=HEIGHT-0.75*CDF*ATT
YTFJ=YFT
XFL=(XFL-YJ)/PJ
YFT=(YFT-YJ)/PJ
Z=ZJ/PJ
TH=0.
M1(4)=0
ITN=TNJ
YCON(23)=TNJ
IF (NGRD,FO,0,DFJ,LT,0,01) GO TO 50
IF (IHSR,FO,0) GO TO 50
IF (ITFST,FO,0) GO TO 50
XPR=(XHG-XJ)/PJ
IHS=1
KCD=1
TEMT=TEMP
CALL FNTON (VMH,AM2,TEMT,YH,CV,PR,YFI,XPR,Z,KCD,XJC,IHS)
DFCU=PD*PJ
DUT=DFJ+(ALP+TWISTC*PI/180.)*C.F
ZCRIT=0.814497*SCRIT((0.135+SIN(DUT*2.))/(CV*CV+TEMT))*RECU*2.
H1=HT-(XHG-YAC)*ATT
SCRIT=ZCRIT/SIN(DUT)
CK=19.2*CV*CV
IF (.X,GE,1.) GO TO 40
SCRIT=SCRIT*CK
40 CONTINUE
IF (SCRIT,LT,H1) GO TO 50
XCRIT=SCRIT(SCRIT*SCRIT-H1*H1)
ANK=ATAN(H1/XCRIT)
IF (ANK,GT,(DFJ+ATC)) GO TO 50
DFJ=ANK-ATC
GEO 930
GEO 940
GEO 950
GEO 960
GEO 970
GEO 980
GEO 990
GEO1000
GEO1010
GEO1020
GEO1030
GEO1040
GEO1050
GEO1060
GEO1070
GEO1080
GEO1090
GEO1100
GEO1110
GEO1120
GEO1130
GEO1140
GEO1150
GEO1160
GEO1170
GEO1180
GEO1190
GEO1200
GEO1210
GEO1220
GEO1230
GEO1240
GEO1250
GEO1260
GEO1270
GEO1280
GEO1290
GEO1300
GEO1310
GEO1320
GEO1330
GEO1340
GEO1350
GEO1360
GEO1370
GEO1380
GEO1390
GEO1400
GEO1410

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IF (DFJ.LT.0.) DFJ=0.
CDF=DFJ
ANK=DFJ
ANK=ANK*180./PI
WRITE (6,720) CV
WRITE (6,730) CF
WRITE (6,740) ANK
50 CONTINUE
IF (IUSR.NE.0.AND.ITN.EQ.0) GO TO 60
CALL ENTPN (VMU,AMP,TEMP,VM,CI,PT,XFL,XET,7,KCODE,XJC,IUSR)
YFOU=X**PJ+YJ
PFOU=PT*PJ
PT=PFOU
IF (IUSR.NE.0) GO TO 60
IF (XFL.LT.0..AND.7J.GE.(2.*PJ)) KCODE=0
IF (7J.GE.(3.*PJ)) KCODE=0
F1=-29.5428*CI*(CI+33.737)*CI-2.9148
IF (CI.GT.0.6339) F1=0.6+0.4*(CI-0.6339)/0.3661
IF (F1.LT.0..AND.7J.GE.(1.9*PJ)) KCODE=0
IF (KCODE.EQ.0) GO TO 60
70=PI*PT/2.
T4=70
60 CONTINUE
IF (IUSR.NE.0) KCODE=1
IF (IUSR.EQ.0.AND.KCODE.EQ.1) GO TO 70
GO TO 80
70 AX=XFL*PJ
DJX=2.*PJ
IF (F1.LT.0.) F1=0.
IF (7J.LT.(2.*PJ).AND.7J.GE.(1.5*PJ)) F1=F1+(1.-F1)*(2.*PJ-7J)/(0.
15*PJ)
IF (7J.LT.(1.5*PJ)) F1=1.
IF (F1.GT.1.) F1=1.
FACT=F1
CDF=CDF*FACT
80 CONTINUE
DO 90 I=1,8
90 M1(I)=0
C
C *** TOTAL NUMBER OF SPANWISE SECTIONS, AND THE NUMBER OF VORTEX
C STRIPS IN EACH SECTION PLUS 1 ***
C * THE NUMBER OF VORTEX STRIPS IN THE JET REGION SHOULD BE CONSISTENT
C WITH THAT OF JET VORTEX STRIPS *
C
C READ (5,500) NC,(M1(I),I=1,NC)
C WRITE (6,500) NC,(M1(I),I=1,NC)
C
C ***THE NUMERICAL ORDER OF FLAP AND JET SPANS AMONG THE SPANWISE
C SECTIONS ***

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GEO1420
GEO1430
GEO1440
GEO1450
GEO1460
GEO1470
GEO1480
GEO1490
GEO1500
GEO1510
GEO1520
GEO1530
GEO1540
GEO1550
GEO1560
GEO1570
GEO1580
GEO1590
GEO1600
GEO1610
GEO1620
GEO1630
GEO1640
GEO1650
GEO1660
GEO1670
GEO1680
GEO1690
GEO1700
GEO1710
GEO1720
GEO1730
GEO1740
GEO1750
GEO1760
GEO1770
GEO1780
GEO1790
GEO1800
GEO1810
GEO1820
GEO1830
GEO1840
GEO1850
GEO1860
GEO1870
GEO1880
GEO1890
GEO1900

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C      READ (5.500) (NJW(I),I=1,NFC)
C      WRITE (6.500) (NJW(I),I=1,NFC)
C
C *** NUMBER OF CHORDWISE VORTEX ELEMENTS IN CHORDWISE SECTIONS, AND
C CAMBER CODE (=1 IF CAMBER ORDINATES ARE TO BE READ IN, =0 IF
C CAMBER FUNCTIONS ARE DEFINED BY CLOSED-FORM EXPRESSIONS MANUALLY
C IN SUBPROGRAMS ZCP(X) AND ZCT(X)), AND THE NUMBER OF CAMBER ORDI-
C NATES TO BE READ IN (ARBITRARY IF ICAM=0) ***
C * NOTE, THE MAXIMUM NUMBER OF CAMBER ORDINATES ALLOWED IS 11 *
C
C      READ (5.500) (NCW(I),I=1,2),ICAM,IM
C      WRITE (6.500) (NCW(I),I=1,2),ICAM,IM
C      NCW=NCW(1)
C      L=1
C      IF (ICAM.NE.1) GO TO 110
C
C *** IF ICAM=1, READ IN THE Y-COORDINATES AND THE CAMBER ORDINATES,
C FIRST FOR THE ROOT SECTION AND THEN FOR THE TIP SECTION ***
C
C      DO 100 I=1,2
C      READ (5.490) (YT(I,J),J=1,IN)
C      READ (5.490) (ZC(I,J),J=1,IN)
C      CALL SPLINE (IM,YT,ZC,MM,FFM,CCM,DDM,1,2)
C      CONTINUE
C      CONTINUE
C      LL=1
C      FN=NCW
C      DO 130 I=1,NCW
C      FT=1
C      CPCWL(I)=0.5*(1.-COS((2.*PI-1.)*PI/(2.*FN)))
C      SN(I,L)=2.*SQRT(CPCWL(I)*(1.-CPCWL(I)))
C      CPCWL(I)=CPCWL(I)*100.
C      DO 250 KK=1,NC
C
C *** COORDINATES OF BREAK CHORDS BOUNDING SPANWISE SECTIONS ***
C
C      READ (5.490) (YYL(I),YYT(I),YL(I),I=1,2)
C      WRITE (6.490) (YYL(I),YYT(I),YL(I),I=1,2)
C      IF (IUSE.NE.0) GO TO 210
C      IF (ISYM.EC.0.AND.KK.EC.1) GO TO 140
C      IF (KK.EC.(NJW(NJP)+1)) GO TO 150
C      IF (ISYM.NE.0.AND.KK.EC.(NJW(NJP)-1)) GO TO 160
C      IF (ISYM.NE.0.AND.KK.EC.NJW(NJP)) GO TO 140
C      GO TO 210
C      140  YXL(2)=XXL(1)+(YYL(2)-YYL(1))*(YL(2)-YL(1)+PI-FJ)/(YL(2)-YL(1))
C          XXT(2)=XXT(1)+(YYT(2)-YYT(1))*(YL(2)-YL(1)+PI-FJ)/(YL(2)-YL(1))
C          IF (ISYM.EC.0) GO TO 170
C      150  YXL(1)=YXL2

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	XYT(1)=YT2	GE02400
	GO TO 170	GE02410
160	XXL(2)=XXL(1)+(XXI(2)-XXI(1))*(YL(2)-YL(1)-PT+FJ)/(YL(2)-YL(1))	GE02420
	XYT(2)=XYT(1)+(XYT(2)-XYT(1))*(YL(2)-YL(1)-PT+FJ)/(YL(2)-YL(1))	GE02430
170	XL2=XXL(2)	GE02440
	XT2=XYT(2)	GE02450
	IF (ISYM.EQ.0.AND.KK.EQ.1) GO TO 180	GE02460
	IF (ISYM.NE.0.AND.KK.EQ.(NJW(NJW)-1)) GO TO 180	GE02470
	YL(1)=YL2	GE02480
180	IF (ISYM.EQ.0) GO TO 190	GE02490
	IF (KK.EQ.(NJW(NJW)+1)) GO TO 210	GE02500
	IF (KK.EQ.NJW(NJW)) YL(2)=YL(2)+PT-RJ	GE02510
	IF (KK.EQ.(NJW(NJW)-1)) YL(2)=YL(2)-PT+RJ	GE02520
	GO TO 200	GE02530
190	IF (KK.EQ.1) YL(2)=YL(2)+PT-RJ	GE02540
200	YL2=YL(2)	GE02550
210	CONTINUE	GE02560
	FM=M/(KK)	GE02570
	NSW=M/(KK)	GE02580
	DO 220 J=1,NSW	GE02590
	FJ=J	GE02600
	CPSWL(J)=0.5*(1.-COS((2.*FJ-1.)*PI/(2.*FM)))*100.	GE02610
	VCON(J)=0.5*(1.-COS(FJ*PI/FM))	GE02620
	SJ(J,KK)=SIN(FJ*PT/FM)	GE02630
220	CONTINUE	GE02640
	IF (KK.EQ.NC) GO TO 230	GE02650
	CPSWL(1)=0.	GE02660
	CPSWL(NSW)=100.	GE02670
	GO TO 240	GE02680
230	CPSWL(1)=0.	GE02690
240	IF (KK.EQ.NJW(1)) NJW1(L,1)=IPANFL	GE02700
	IF (KK.EQ.NJW(NJW)) LC(L)=KL+1	GE02710
	LP=(L-1)*NC+KK	GE02720
	CALL PANFL (XXI,YL,XYT,CPSWL,CPSWL,NSW,IPANFL,LPANFL,KL,LP,SWP)	GE02730
	IPANFL=LPANFL+1	GE02740
	NCS=NCS+NSW-1	GE02750
	WIDTH(KK)=YL(2)-YL(1)	GE02760
	RODFAK(KK)=YL(1)	GE02770
	IF (KK.EQ.NJW(1)) NJW2(L,1)=LPANFL	GE02780
	IF (KK.NE.NC) GO TO 250	GE02790
	HALFP=YL(2)	GE02800
250	IF (KK.EQ.NJW(LL)) LI=LI+1	GE02810
	IF (L.EQ.3) GO TO 300	GE02820
	IF (L.EQ.1) LPAN1=LPANFL	GE02830
	IF (L.EQ.2) LPAN2=LPANFL	GE02840
	IF (NW(2).EQ.0) GO TO 260	GE02850
	L=L+1	GE02860
	NCW=NW(L)	GE02870
	IF (L.EQ.3.AND.NW(3).EQ.0) GO TO 280	GE02880

	GO TO 120	GE02890
260	DO 270 I=2,3	GE02900
	DO 270 J=1,NFP	GE02910
	MJW1(I,J)=0	GE02920
270	MJW2(I,J)=0	GE02930
	LPAN2=LPANFL	GE02940
	NCS=NCS*3	GE02950
	GO TO 300	GE02960
290	DO 290 I=1,NFP	GE02970
	MJW1(3,I)=0	GE02980
290	MJW2(3,I)=0	GE02990
	L=L-1	GE03000
	NCS=NCS+NCS/2	GE03010
300	CONTINUE	GE03020
	NCS=NCS/3	GE03030
	NCW=NCW(1)+NCW(2)+NCW(3)	GE03040
	VUJ=VMUJ	GE03050
	IF (IUSP.NF.0) CU=VMUJ	GE03060
	VMU=CU	GE03070
	RTJ=PJ	GE03080
	ZJT=ZJ	GE03090
	IF (PT.GT.ARS(7J).AND.KCONF.EQ.0) ZJT=RT*7J/ARS(ZJ)	GE03100
	IF (IUSP.NF.0) GO TO 310	GE03110
	AM2=AM1/(VMU*SQRT(TEMP))	GE03120
	IF (AM2.GT.0.9) WRITE (6,590) AM2	GE03130
	IF (AM2.GT.0.9) AM2=0.9	GE03140
310	CONTINUE	GE03150
	LAST=LPANFL	GE03160
C		GE03170
C	*** TOTAL NUMBER OF STREAMWISE JET SECTIONS, NUMBER OF JET CIRCUM-	GE03180
C	FERENTIAL STRIPS MINUS ONE FOR A NON-CENTERED JET (USE ODD NUMBERS	GE03190
C) AND PLUS ONE FOR A CENTERED JET (USE EVEN NUMBERS), AND NUMBERS	GE03200
C	OF JET VORTEX ELEMENTS ON EACH JET SECTION ***	GE03210
C		GE03220
	READ (5,500) NNJ,NSJ,(NCJ(I),I=1,NNJ)	GE03230
	WRITE (6,500) NNJ,NSJ,(NCJ(I),I=1,NNJ)	GE03240
	IF (KCONF.EQ.0) CALL CIRCJ (ISYM,NSJ,Y)	GE03250
	IF (ISYM.EQ.0) NSJJ=NSJ/2	GE03260
	IF (ISYM.NF.0) NSJJ=(NSJ+1)/2	GE03270
	NSYM=1-ISYM	GE03280
	NSJ1=NSJJ-1	GE03290
	FNJ=NSJJ	GE03300
	CPSWL(1)=0.	GE03310
	CPSWL(NSJJ)=1.	GE03320
	YCON(1)=0.5*(1.-COS(PI/FNJ))	GE03330
	DO 320 I=2,NSJ1	GE03340
	FI=I	GE03350
	CPSWL(I)=0.5*(1.-COS((2.*FI-1.)*PI/(2.*FNJ)))	GE03360
320	YCON(I)=0.5*(1.-COS(FI*PI/FNJ))	GE03370

	IFNTN=NC	GE03380
	JC=NCS*L	GE03390
	NJ1=NNJ-1	GE03400
	DO 420 JJ=1,NNJ	GE03410
	IF (IUSR.NF.0) GO TO 370	GE03420
C		GE03430
C	*** COORDINATES OF BOUNDING LINES OF JET SECTIONS PROJECTED ON X-Y	GE03440
C	PLANE ***	GE03450
C		GE03460
	READ (5,490) (XXL(I),XYT(I),YL(I),I=1,2)	GE03470
	WRITE (6,490) (XXL(I),XYT(I),YL(I),I=1,2)	GE03480
	IF (ISYM.F0.0) GO TO 330	GE03490
	XL1=XXL(1)-(XXL(2)-XXL(1))*(PT-PTJ)/(YL(2)-YL(1))	GE03500
	XT1=XYT(1)-(XYT(2)-XYT(1))*(PT-PTJ)/(YL(2)-YL(1))	GE03510
330	XL2=XXL(1)+(XXL(2)-XXL(1))*(PT+PTJ)/(YL(2)-YL(1))	GE03520
	XT2=XYT(1)+(XYT(2)-XYT(1))*(PT+PTJ)/(YL(2)-YL(1))	GE03530
	IF (ISYM.F0.0) GO TO 340	GE03540
	XXL(1)=XL1	GE03550
	XYT(1)=XT1	GE03560
340	XXL(2)=XL2	GE03570
	XYT(2)=XT2	GE03580
	IF (ISYM.F0.0) GO TO 350	GE03590
	YL(1)=YL(1)-PT+PTJ	GE03600
350	YL(2)=YL(2)+PT-PTJ	GE03610
	IF (KCONF.F0.0) GO TO 360	GE03620
	XXL(4)=XXL(2)	GE03630
	XYT(4)=XYT(2)	GE03640
	YL(4)=YL(2)	GE03650
	XXL(2)=XXL(1)	GE03660
	XYT(2)=XYT(1)	GE03670
	YL(2)=YL(1)	GE03680
	XXL(3)=XXL(4)	GE03690
	XYT(3)=XYT(4)	GE03700
	YL(3)=YL(4)	GE03710
	ZL(1)=0.	GE03720
	ZL(2)=7P	GE03730
	ZL(3)=7Q	GE03740
	ZL(4)=0.	GE03750
360	CONTINUE	GE03760
	GO TO 390	GE03770
C		GE03780
C	*** COORDINATES OF BREAK POINTS DEFINING RECTANGULAR JET SECTIONS FOR	GE03790
C	USE CONFIGURATIONS ***	GE03800
C		GE03810
370	DO 390 I=1,4	GE03820
	READ (5,490) XXI(I),XYT(I),YL(I),ZL(I)	GE03830
380	WRITE (6,490) XXI(I),XYT(I),YL(I),ZL(I)	GE03840
390	CONTINUE	GE03850
	II=JJ	GE03860

	JJ1=JJ+1	GE03970
	FNCJ=NCJ(JJ)	GE03980
	NJ=NCJ(JJ)	GE03990
	NMJ=NJ*16	GE03900
	IF (N.I.FT.6) NMJ=NMJ*8	GE03910
	FMJ=NMJ	GE03920
	DO 400 J=1,NMJ	GE03930
	FJ=J	GE03940
	SC(J,JJ)=0.5*(1.-COS((2.*FJ-1.)*PI/(2.*FMJ)))	GE03950
400	ST(J,JJ)=SIN((2.*FJ-1.)*PI/(2.*FMJ))	GE03960
	DO 410 J=1,NJ	GE03970
	FJ=J	GE03980
	CPCWL(J)=0.5*(1.-COS((2.*FJ-1.)*PI/(2.*FNCJ)))	GE03990
410	SN(J,JJ)=2.*SCPT(CPCWL(J))*(1.-CPCWL(J))	GE04000
	IF (KCODE.FO.0) CALL USHAP (XYL,XYT,YL,YU,ZUT,FT,CPCWL,IPANEL,NJ,GE04010	
	IJC,ISYM)	GE04020
	IF (KCODE.FO.1) CALL RESHAP (XYL,XYT,YL,ZL,CPCWL,CPSWL,IPANEL,NJ,GE04030	
	IC,IT,NSYM)	GE04040
	MJJ(JJ)=LAST	GE04050
420	IPANEL=LAST+1	GE04060
	SDF=XYT(1)-XYL(1)	GE04070
	IF (IUSP.NE.0) TH=ZL(3)-ZL(4)	GE04080
	IF (KCODE.FO.1) YCON(25)=ZL(4)	GE04090
	YCON(24)=IUSP	GE04100
	INTP=NIJ*(NJ)	GE04110
	IF (IUSP.FO.2) CMU=CMU*HALESW/WIDTH(INTP)	GE04120
	C(1)=CMU	GE04130
	IF (KCODE.FO.0) YCON(25)=1.	GE04140
	IF (KCODE.FO.1) CALL RECTJ (ISYM,NSJ,Y)	GE04150
	WRITE (6,510) HALESW,CDFE	GE04160
	JPANEL=LAST+JPANEL	GE04170
	LTOTAL=LAST+JPANEL	GE04180
	WRITE (6,550)	GE04190
	WRITE (6,500) LAST,JPANEL,LTOTAL	GE04200
	IF (IUSP.NE.0) GO TO 430	GE04210
	WRITE (6,670)	GE04220
	IF (KCODE.FO.0) WRITE (6,650)	GE04230
	IF (KCODE.FO.1) WRITE (6,700)	GE04240
	IF (KCODE.FO.1) WRITE (6,710)	GE04250
	WRITE (6,670)	GE04260
	WRITE (6,650) XFCNT	GE04270
	WRITE (6,660) BECNT	GE04280
	WRITE (6,680) VMI	GE04290
430	CONTINUE	GE04300
	IF (ICAM.NE.1) GO TO 440	GE04310
	WRITE (6,590)	GE04320
	WRITE (6,610) (YT(1,I),I=1,IM)	GE04330
	WRITE (6,620) (ZC(1,I),I=1,IM)	GE04340
	WRITE (6,600)	GE04350

	WRITE (6,610) (YT(2,I),I=1,IM)	GE04360
	WRITE (6,620) (ZC(2,I),I=1,IM)	GE04370
	CANLFP=7CP(0.)	GE04380
	CANTFP=7CP(1.)	GE04390
	CANLFT=7CT(0.)	GE04400
	CANTFT=7CT(1.)	GE04410
440	CONTINUE	GE04420
	WRITE (6,640)	GE04430
	WRITE (6,630)	GE04440
	WRITE (6,620) (X(I,1),XN(I,2),Y(I,1),YN(I,2),ZN(I,1),ZN(I,2),I=1	GE04450
	1, LAST)	GE04460
	WRITE (6,670)	GE04470
	WRITE (6,640)	GE04480
	WRITE (6,620) (YCF(I),YCF(I),7CP(I),I=1, LAST)	GE04490
	IF (KCOFF.F0,1) GO TO 460	GE04500
	IF (ISYM.F0,0) GO TO 450	GE04510
	FN2=(NSJ-1)/2+1	GE04520
	NJH=(NSJ-1)/2+2	GE04530
	ANG=PI/(2.*FN2)	GE04540
	FAC=(SIN(3.*ANG)-SIN(ANG)/COS(ANG))/(1.-COS(3.*ANG))	GE04550
	PHT=PI/2.-ATAN(FAC)	GE04560
	NJH1=NJH-1	GE04570
	NJH2=NJH+1	GE04580
	Y(2,2)=SIN(PHT)	GE04590
	Y(4,2)=-COS(PHT)	GE04600
	Y(2,NJH1)=Y(2,2)	GE04610
	Y(4,NJH1)=-Y(4,2)	GE04620
	Y(2,NJH2)=-Y(2,2)	GE04630
	Y(4,NJH2)=Y(4,2)	GE04640
	Y(2,NSJ1)=-Y(2,2)	GE04650
	Y(4,NSJ1)=-Y(4,2)	GE04660
	GO TO 460	GE04670
450	FN2=NSJ/2	GE04680
	NJH=NSJ/2	GE04690
	ANG1=1.-0.5*(1.-COS(PI/(2.*FN2)))	GE04700
	ANG2=1.-0.5*(1.-COS(3.*PI/(2.*FN2)))	GE04710
	ANG1=ATAN(SQRT(1.-ANG1*ANG1)/ANG1)	GE04720
	ANG2=ATAN(SQRT(1.-ANG2*ANG2)/ANG2)	GE04730
	FAC=(SIN(ANG2)-SIN(ANG1)/COS(ANG1))/(1.-COS(ANG2))	GE04740
	PHT=PI/2.-ATAN(FAC)	GE04750
	NJH1=NJH-1	GE04760
	NJH2=NSJ1	GE04770
	Y(2,NJH1)=SIN(PHT)	GE04780
	Y(4,NJH1)=COS(PHT)	GE04790
	Y(2,NJH2)=-Y(2,NJH1)	GE04800
	Y(4,NJH2)=Y(4,NJH1)	GE04810
460	CONTINUE	GE04820
	FNJ=NCJ(MNJ)	GE04830
	NPJ=NCJ(MNJ)	GE04840

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DO 470 J=1,NPU
FJ=J
470 P5T(J)=SIN(FJ*PI/PMU)
PETA]=COSPT(1.-AM18AM1)
PETA2=COSPT(1.-AM28AM2)
P]=PETA]+PETA]
P2=PETA2+PETA2
DO 480 KK=1,NCS
YLL(KK)=A1.9+(TMTSTF+T-IST)Y[F(KK)/HAL,EG]*PI/180.
T=XI L(KK)
480 YTT(KK)=SIN(T)/COS(T)
YCON(22)=CMUIT
C[,20]=XAC
PETHON
C
480 FORMAT (9(F10.5))
500 FORMAT (9(4X,I4))
510 FORMAT (10X,9H-HALF SX=.F10.5,10X,9H-REFE=.F10.5)
520 FORMAT (6(F10.5))
530 FORMAT (2(4X,I4),7F10.5)
540 FORMAT (11H0,10H-INPUT DATA)
550 FORMAT (11H0,19H-LEFT PANEL,LTOTAL=)
560 FORMAT (11H0,24H-CORTEX ELEMENT ENDPOINT COORDINATES=)
570 FORMAT (11H0,24H-CONTROL POINT COORDINATES=)
580 FORMAT (11H0,42H-LAPLAC, THE EQUIVALENT JET MACH NUMBER IS,F10.5,4)
1HIT HAS BEEN SET TO 0.0 IN THE COMPUTATION)
590 FORMAT (/45H*** CAMBER ORDINATES FOR THE ROOT SECTION ***)
600 FORMAT (/43H*** CAMBER ORDINATES FOR THE TIP SECTION ***)
610 FORMAT (/7X,7HY/C,11F10.5)
620 FORMAT (/7X,7H7/C,11F10.5)
630 FORMAT (/4X,2HY1,2X,2HY2,2X,2HY1,2X,2HY2,2X,2HY1,2X,2HY2,2X,2HY1,2X,2HY2)
640 FORMAT (/4X,2HYCP,7X,2HYCP,7X,3H7CP,7X,3HYCP,7X,3HYCP,7X,3H7CP)
650 FORMAT (11H0,46H-THE EQUIVALENT JET PROPERTIES ARE EVALUATED AT,F10.5,15)
660 FORMAT (11H0,22H-THE EQUIVALENT JET RADIUS IS,F10.5)
670 FORMAT (/20X,50HYXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX)
1)
680 FORMAT (11H0,42H-THE VELOCITY RATIO OF THE EQUIVALENT JET,VO/VJ,IS,F6F05220)
110.5)
690 FORMAT (/20X,39H-THE EQUIVALENT CYCLOLAP JET IS USED FOR/20X,23H-INTERACTION)
1)
700 FORMAT (/20X,42H-THE CYCLOLAP JET WITH LATERAL EXTENT EQUAL/20X,42)
1)
710 FORMAT (/20X,51H-NOTE, CHECK WHETHER THE WING IS IMMERSSED IN THE JET)
1)
720 FORMAT (/2X,63H-THE EQUIVALENT VELOCITY RATIO, VO/VJ, AT FLAP HINGE)
1=.F10.5)
730 FORMAT (/2X,60H-THE EQUIVALENT JET RADIUS AT FLAP HINGE IN MULTIPLE)

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IS OF EXIT RADII = .F10.5)
740  FORMAT (/2X,52HTHE ACTUAL JET DEFLECTION ANGLE IS ESTIMATED TO BE
1=,F7.3,2X,7HFFGRFFS)
END
SUBROUTINE ENTEN (H,AMJ,T,XM,CMU,PT,YF1,YFT,7,KCODE,XJC,IUSR)
C   TO COMPUTE THE JET ENTRAINMENT FUNCTION
DIMENSION CSJ(70), SSJ(70)
DIMENSION RH1(31), RH2(31), FU1(31), FU2(31), FU3(31), RR2(31)
COMMON /JET/ PK1,YC,X(31),A(31),P(31)
IF (IUSR,EO,0) WRITE (6,260)
IF (IUSR,EO,0) WRITE (6,270)
PI=3.14159265
IK=1
PFJ=T
PK1=0.0125+0.0118H
KCODE=0
XMITD=0.5*(YF1+YFT)
XM=XMITD
X0=0.
R0=1.
F=2.*PK1*SQRT((1.-H)*PFJ)
XC=0.35/F
XJC=XC
PI=1.-H
HA=(1.+2.*PI/(1.-H))/(1.+H/(1.-H))
Y(1)=XC
DXY=(2.*YFT-YF1)/30.
IDY=0XY
DXY=IDY
IF (DXY,GT,3.) GO TO 10
IF (DXY,GE,1. AND DXY,LE,3.) DXY=2.5
IF (DXY,LT,1.) DXY=1.5
10  CONTINUE
Y(2)=Y(1)+DXY/2.
DO 20 I=2,30
20  Y(I+1)=Y(I)+DXY
DO 30 I=1,70
FI=I
CSJ(I)=COS((2.*FI-1.)*PI/140.)
SSJ(I)=SIN((2.*FI-1.)*PI/140.)
DO 160 I=1,31
IF (H,LE,0.01) GO TO 80
IF (I,EO,1. AND ABS(T-1.)*I,EO,0.01) GO TO 100
IF (I,EO,1) S=(2.*PK1*SQRT(PFJ*(1.-H))*XC/0.72-0.35)*SQRT((1.-H)/H)
1*ALOG(HA)
IF (I,EO,2) S=DXY*(Y(2)-YC)
IF (I,GT,2) S=SH+DSY*DXY
M=1
IF (I,EO,1) M=2

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40 CONTINUE ENT 460
SIIM=0. ENT 470
DO 50 J=1,70 ENT 480
CR=0.5*SI*(1.-CS1(J)) ENT 490
AP1=(1.-II)*(1.-EXP(-1./(2.*CF))) ENT 500
AG=ALOG((1.+2.*II/AP1)/(1.+II/AP1)) ENT 510
50 SIIM=SIIM+(1./SQRT(AP1*AG)-SQRT(2.*SP/(1.-II)+0.69314718)))*SSJ(J) ENT 520
DFC=SIIM*PI/70.*0.5*CS*SQRT(II)+SQRT(2.*II/(1.-II))*S**1.5/1.0397208 ENT 530
X1=DFC+0.35 ENT 540
IF (4.*F.1) GO TO 70 ENT 550
YT=X1/(2.*PK1*SQRT((1.-II)*FFJ)) ENT 560
P1=(1.-II)*(1.-EXP(-1./(2.*S))) ENT 570
A1=ALOG((1.+2.*II/P1)/(1.+II/P1)) ENT 580
DSY=2.*PK1*SQRT(FFJ*(1.-II)*S1*G1/II) ENT 590
SH=S ENT 600
IF (ABS(X(I)-YT).LE.0.01) GO TO 60 ENT 610
DX=X(I)-YT ENT 620
S=S+DX*DSY ENT 630
SH=S ENT 640
GO TO 40 ENT 650
60 P1=(1.-II)*(1.-EXP(-1./(2.*SK))) ENT 660
70 IF (ABS(T-1.).LE.0.01) GO TO 100 ENT 670
YH=X1*0.72/(2.*PK1*SQRT((1.-II)*CFJ)) ENT 680
IF (ABS(X(I)-YH).LE.0.01) GO TO 90 ENT 690
AK2=(1.-II)*(1.-EXP(-1./(2.*S))) ENT 700
AG2=ALOG((1.+2.*II/AK2)/(1.+II/AK2)) ENT 710
DSY1=2.*PK1/0.72*SQRT(CFJ*(1.-II)*AK2*AG2/II) ENT 720
DX=X(I)-YH ENT 730
S=S+DX*DSY1 ENT 740
M=M+1 ENT 750
GO TO 40 ENT 760
90 IF (T.*F.1) SH=2.*PK1*SQRT(CFJ)*Y(I)-0.35 ENT 770
IF (T.*F.1) P1=(1.-II)*(1.-EXP(-1./(2.*SH))) ENT 780
DSY=2.*PK1*SQRT(CFJ) ENT 790
IF (ABS(T-1.).LE.0.01) GO TO 100 ENT 800
S=2.*PK1/0.72*SQRT(CFJ)*Y(I)-0.35 ENT 810
90 IF (T.*F.1.AND.11.GT.0.01) DSX=2.*PK1*SQRT(CFJ*ALOG(II)/II)*(1.-II) ENT 820
HOP=1.-EXP(-1./(2.*S)) ENT 830
HOP=-2.*HOP**2/0.72 ENT 840
D10=-2.*S1*P1/(1.-II) ENT 850
D2=(T-1.+0.2*(1.-11)*AMJ*AMJ*T)*HOP-0.2*P1*AMJ*AMJ*T*(P1+2.*11) ENT 860
D20=(T-1.+0.2*(1.-11)*AMJ*AMJ*T)*HOP-0.2*D10*AMJ*AMJ*T*(P1+2.*11)- ENT 870
10.2*D1*AMJ*AMJ*T*D10 ENT 880
F1P=-D20*0.8907*(0.08901-0.04005*P2+0.01792*P2**2-0.00646*P2**3)/(ENT 890
11.+1.05001*P2) ENT 900
F2P=-D20*0.79375*(0.0527-0.02886*P2+0.01478*P2**2-0.00589*P2**3)/(ENT 910
11.+1.08869*P2) ENT 920
F3P=-D20*(0.12057-0.04657*P2+0.01820*P2**2-0.00599*P2**3)/(1.+1.02ENT 930
1272*P2) ENT 940

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100 GO TO 110 ENT 950
    P2=0. ENT 960
    P2P=0. ENT 970
    F1P=0. ENT 980
    F2P=0. ENT 990
    F3P=0. ENT 1000
    IF (I.FO.1.AND.U.GT.0.01) DSX=2.*P1*SQRT(PEJ*ALOG(UA)/U)*(1.-U) ENT 1010
110 P1P=-2.*P1*P1/(1.-U) ENT 1020
    F1=0.0007*(0.12057+0.01617*P2-0.00407*P2**2+0.00192*P2**3)/(1.+0.8 ENT 1030
    I1P17*P2) ENT 1040
    F2=0.79335*(0.06676+0.00453*P2-0.00204*P2**2+0.00075*P2**3)/(1.+0.8 ENT 1050
    I1P5714*P2) ENT 1060
    F3=(0.21420+0.04061*P2-0.01249*P2**2+0.00351*P2**3)/(1.+0.78948*P2 ENT 1070
    I1) ENT 1080
    F11=U*P1*F1+P1*P1*F2 ENT 1090
    DMC1=(P1P*F1+P1*F1P-U*P2*F3-U*P2*F3P)/(F11 ENT 1100
    DMC2=(F1*F1-U*P2*F3)*(U*P1*F1+U*P1*F1P+2.*P1*P1*F2+P1*P1*F2P)/(F11 ENT 1110
    I11*FU) ENT 1120
    DMX=2.*(1.-U)*(DMC1-DMC2)*DSX/SQRT(PEJ) ENT 1130
    P1P2=0.5*(1.-U)/FU ENT 1140
    P1J=SQRT(P1P2) ENT 1150
    IF (IUSP.NF.1) WRITE (6.250) X(T),P1J,DMX ENT 1160
    IF (7.LT.0) GO TO 140 ENT 1170
    IF (IK.GT.1) GO TO 140 ENT 1180
    IF (X(I).GE.XFL) GO TO 120 ENT 1190
    GO TO 140 ENT 1200
120 IF (P1J.LT.7) GO TO 140 ENT 1210
    XMJ=X0+(7-P1J)*(Y(T)-X0)/(P1J-P0) ENT 1220
    IF (YFL.LT.0) GO TO 130 ENT 1230
    IF (XMJ.LT.XFT) KCODE=1 ENT 1240
    IK=IK+1 ENT 1250
    GO TO 140 ENT 1260
130 YM=0.5*XFT ENT 1270
    IF (IUSP.NF.0) YM=XFT ENT 1280
    IF (XMJ.LE.XM) KCODE=1 ENT 1290
    IK=IK+1 ENT 1300
140 CONTINUE ENT 1310
    P0=P1J ENT 1320
    X0=X(T) ENT 1330
    P11(I)=P1 ENT 1340
    P12(I)=P2 ENT 1350
    F11(I)=F1 ENT 1360
    F12(I)=F2 ENT 1370
    F13(I)=F3 ENT 1380
    P12(I)=P12 ENT 1390
    IF (I.FO.1) GO TO 150 ENT 1400
    R(I)=(DMX-DMXC)/(X(I+1)-X(I)) ENT 1410
    A(I)=DMX0-R(I)*X(I) ENT 1420
    GO TO 140 ENT 1430

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150	A(T)=0.145*DMY/0.32	ENT1440
	R(T)=(DMY-A(T))/YC	ENT1450
160	DMXC=DMY	ENT1460
	K=1	ENT1470
170	IF (K.GT.30) GO TO 240	ENT1480
	IF (YM.GE.0..AND.YM.LT.XC) GO TO 180	ENT1490
	IF (YM.GE.X(K)..AND.YM.LT.Y(K+1)) GO TO 180	ENT1500
	K=K+1	ENT1510
	GO TO 170	ENT1520
180	F11=DD2(K)+(DU1(K)*U*FU1(K)+DU1(K)**2*FU2(K))/(U*U)	ENT1530
	F12=DD2(K+1)+(DU1(K+1)*U*FU1(K+1)+DU1(K+1)**2*FU2(K+1))/(U*U)	ENT1540
	F21=DD2(K)+(DU1(K)*FU1(K)-U*FU2(K)*FU3(K))/U	ENT1550
	F22=DD2(K+1)+(DU1(K+1)*FU1(K+1)-U*FU2(K+1)*FU3(K+1))/U	ENT1560
	IF (ABS(T-1.) .LE. 0.001) GO TO 190	ENT1570
	F31=DD2(K)+(C.*DU1(K)/70.-DU1(K)*FU1(K)+U*DU2(K)*FU3(K))/U	ENT1580
	F32=DD2(K+1)+(C.*DU1(K+1)/70.-DU1(K+1)*FU1(K+1)+U*DU2(K+1)*FU3(K+1))/U	ENT1590
	Y11=F11/(F21+F31)	ENT1600
	Y12=F12/(F22+F32)	ENT1610
	GO TO 200	ENT1620
190	F31=0.	ENT1630
	F32=0.	ENT1640
200	CONTINUE	ENT1650
	X1=Y(K)	ENT1660
	Y2=Y(K+1)	ENT1670
	Y21=F11/(F21+F31)+F31*(F11/(F21+F31)-1.)/F21	ENT1680
	Y22=F12/(F22+F32)+F32*(F12/(F22+F32)-1.)/F22	ENT1690
	Y31=2.*F21*(F21+F31)/(F11-F21-F31)	ENT1700
	X31=SQRT(Y31)	ENT1710
	X32=2.*F22*(F22+F32)/(F12-F22-F32)	ENT1720
	Y32=SQRT(X32)	ENT1730
	IF (YM.GE.0..AND.YM.LT.XC) GO TO 210	ENT1740
	GO TO 220	ENT1750
210	X1=0.	ENT1760
	Y2=YC	ENT1770
	Y22=Y21	ENT1780
	Y32=Y21	ENT1790
	Y21=1./U	ENT1800
	Y31=1.	ENT1810
	IF (ABS(T-1.) .LE. 0.001) GO TO 220	ENT1820
	Y12=Y11	ENT1830
	X11=1./(T*U)	ENT1840
220	CMU=X21+(XM-X1)*(Y22-Y21)/(Y2-Y1)	ENT1850
	QT=Y21+(XM-X1)*(Y32-X31)/(Y2-Y1)	ENT1860
	CMU=1./CMU	ENT1870
	IF (ABS(T-1.) .LE. 0.001) GO TO 230	ENT1880
	DU=X11+(XM-X1)*(X12-X11)/(Y2-X1)	ENT1890
	T=1./(CMU*DU)	ENT1900
230	CONTINUE	ENT1910
		ENT1920

240	CONTINUE	ENT1930
	RETURN	ENT1940
C		ENT1950
250	FORMAT (RF10,E)	ENT1960
260	FORMAT (/SY,4R4THE COMPUTED JET ENTRAINMENT ARE AS FOLLOWS)	ENT1970
270	FORMAT (/SY,4HXJET,FX,4HRJET,FX,5RDM/RX)	ENT1980
	END	ENT1990
	SUBROUTINE RCJ (ISYM,NSJ,Y)	RCJ 10
C	TO DEFINE THE UNIT NORMAL VECTORS TO THE SURFACE OF RECTANGULAR	RCJ 20
C	JETS	RCJ 30
	DIMENSION Y (10,41)	RCJ 40
	IF (ISYM,FC,0) GO TO 10	RCJ 50
	NSJ=NSJ+1	RCJ 60
	NJH=(NSJ-1)/2+2	RCJ 70
	GO TO 20	RCJ 80
10	NSJ=NSJ-1	RCJ 90
	NJH=NSJ/2	RCJ 100
20	DO 50 I=1,NSJ	RCJ 110
	IF (I,FC,1) AND (ISYM,FE,0) GO TO 30	RCJ 120
	IF (I,FC,NJH) GO TO 40	RCJ 130
	Y(2,I)=1.	RCJ 140
	Y(4,I)=0.	RCJ 150
	GO TO 50	RCJ 160
30	Y(2,I)=0.	RCJ 170
	Y(4,I)=-1.	RCJ 180
	GO TO 50	RCJ 190
40	Y(2,I)=0.	RCJ 200
	Y(4,I)=1.	RCJ 210
50	CONTINUE	RCJ 220
	RETURN	RCJ 230
	END	RCJ 240
	SUBROUTINE CRJ (ISYM,NSJ,Y)	CRJ 10
C	TO DEFINE THE UNIT NORMAL VECTORS TO THE SURFACE OF CIRCULAR JETS	CRJ 20
	DIMENSION Y (10,41)	CRJ 30
	DT=3.14159245	CRJ 40
	IF (ISYM,FC,0) GO TO 10	CRJ 50
	NSJ=NSJ+1	CRJ 60
	NN=(NSJ-1)/2+1	CRJ 70
	END=NN	CRJ 80
	NJH=NN+1	CRJ 90
	Y(1,1)=-SIN(DT/(2.*ENN))	CRJ 100
	Y(2,1)=-COS(DT/(2.*ENN))	CRJ 110
	GO TO 20	CRJ 120
10	Y(1,1)=1.	CRJ 130
	Y(2,1)=0.	CRJ 140
	NSJ=NSJ-1	CRJ 150
	ENN=NSJ/2	CRJ 160
	NJH=NSJ/2	CRJ 170
20	CONTINUE	CRJ 180

	DO 50 I=1,NJH	CRJ 190
	K=I	CRJ 200
	KI=I	CRJ 210
	IF (I.GT.NJH.AND.ISYM.NF.0) K=I-NJH+1	CRJ 220
	IF (I.GT.NJH.AND.ISYM.FO.0) K=I-NJH	CRJ 230
	FI=K	CRJ 240
	IF (ISYM.NF.0) ANG2=(FI-1.)*PI/FM2	CRJ 250
	IF (ISYM.FO.0) ANG2=FI*PI/FM2	CRJ 260
	YD=0.5*(1.-COS(ANG2))	CRJ 270
	IF (ISYM.FO.0) ANG2=PI-ATAN(SQRT(1.-YD*YD)/YD)	CRJ 280
	II=I+1	CRJ 290
	KK=I	CRJ 300
	KII=II	CRJ 310
	IF (I.GT.NJH) KK=II-NJH	CRJ 320
	FII=KK	CRJ 330
	IF (I.LE.NJH.AND.ISYM.FO.0) FII=KK+1	CRJ 340
	ANG1=(2.*FII-1.)*PI/(2.*FM2)	CRJ 350
	YD=0.5*(1.-COS(ANG1))	CRJ 360
	IF (ANG1.GT.PI) YD=-YD	CRJ 370
	IF (ISYM.FO.0) ANG1=PI-ATAN(SQRT(1.-YD*YD)/YD)	CRJ 380
	IF (I.GT.NJH) GO TO 30	CRJ 390
	GO TO 40	CRJ 400
30	ANG1=-ANG1	CRJ 410
	ANG2=-ANG2	CRJ 420
40	CONTINUE	CRJ 430
	Y(1,KII)=SIN(ANG1)	CRJ 440
	Y(2,KII)=-COS(ANG1)	CRJ 450
	Y(3,KI)=SIN(ANG2)	CRJ 460
	Y(4,KI)=-COS(ANG2)	CRJ 470
50	CONTINUE	CRJ 480
	RETURN	CRJ 490
	END	CRJ 500.
	SUBROUTINE SPLINE (N,X,Y,A,P,C,D,LM,NT)	SPL 10
	DIMENSION S(40), H(12), CA(11), X(2,11), Y(2,11)	SPL 20
	DIMENSION A(2,10), P(2,10), C(2,10), D(2,10)	SPL 30
	L=LM	SPL 40
	DO 90 NN=1,NT	SPL 50
	T=1	SPL 60
	NT=N+1	SPL 70
	N1=N-1	SPL 80
	H(NT)=0.	SPL 90
	H(1)=X(L,3)-X(1,2)	SPL 100
	H(2)=-X(L,3)+X(1,1)	SPL 110
	H(3)=X(L,2)-X(L,1)	SPL 120
	DO 10 K=4,N	SPL 130
10	H(K)=0.	SPL 140
	DO 20 K=1,N	SPL 150
20	S(K)=-H(K+1)/H(1)	SPL 160
	NJ=N-1	SPL 170

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DO 70 I=2,N                                SPL 180
IF (I.EQ.N) GO TO 30                        SPL 190
H(NI)=-6.*((Y(L,I+1)-Y(L,I))/(X(L,I+1)-X(L,I))-(Y(L,I)-Y(L,I-1))/(SPL 200
IX(L,I)-X(L,I-1)))                          SPL 210
GO TO 40                                    SPL 220
30 H(NI)=0.                                  SPL 230
40 DO 60 J=1,N                               SPL 240
H(J)=0.                                      SPL 250
IF (I.EQ.N) GO TO 50                        SPL 260
IF (J.LT.(I-1).OR.J.GT.(I+1)) GO TO 60    SPL 270
H(I-1)=Y(L,I)-Y(L,I-1)                     SPL 280
H(I)=2.*(Y(L,I+1)-Y(L,I-1))                SPL 290
H(I+1)=Y(L,I+1)-Y(L,I)                     SPL 300
GO TO 60                                    SPL 310
50 H(N-2)=Y(L,N)-Y(L,N-1)                   SPL 320
H(N-1)=-Y(L,N)+Y(L,N-2)                    SPL 330
H(N)=Y(L,N-1)-X(L,N-2)                      SPL 340
60 CONTINUE                                  SPL 350
II=I                                         SPL 360
CALL VMSEGN (NJ,II,F,S,CA)                  SPL 370
NJ=NJ-1                                     SPL 380
70 CONTINUE                                  SPL 390
DO 80 I=1,N1                                SPL 400
A(L,I)=(S(I+1)-S(I))/(6.*(X(L,I+1)-X(L,I))) SPL 410
R(L,I)=S(I)/2.                              SPL 420
C(L,I)=(Y(I,I+1)-Y(L,I))/(X(L,I+1)-X(L,I))-(X(L,I+1)-X(L,I))*(2.*SSPL 430
I(I)+S(I+1))/6.                             SPL 440
90 D(L,I)=Y(L,I)                             SPL 450
90 L=L+1                                     SPL 460
OPTI=0                                       SPL 470
END                                           SPL 480
SUBROUTINE RESHAP (XXL,XXT,YL,ZL,CPCWL,CPSWL,IPANEL,NJ,JC,JJ,NSYM) RSP 10
TO DEFINE THE LOCATIONS OF VORTEX AND CONTROL POINTS ON RECT. JETS RSP 20
DIMENSION XXL(1), YL(1), XXT(1), ZL(1), CPCWL(1), CPSWL(1) RSP 30
COMMON /SCHEME/ C(2),Y(10,41),Y(10,41),SLOPF(15),XL(2,15),XTT(41),RSP 40
IXLI(41) RSP 50
COMMON /GEOM/ HALFSP,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTRSP 60
IF(EQ),PST(20),CH(95),YV(200),YV(100),SN(8,8),XM(200,2),YN(200,2),7PSP 70
2N(200,2),WIDTH(8),YCON(25),SHEEP(50),HALFR,SJ(21,8),FX(95,2),TX(95RSP 80
2,2),SC(160,5),ST(160,5),LC(7) RSP 90
COMMON /CONST/ NCS,NCH,M1(F),MSJ,MCJ(F),LAST,MJW1(3,5),MJW2(3,5),JRSP 100
IPANEL,MJ(5),M1(7),M2(7) RSP 110
OT=7.14159265 RSP 120
IF (NSYM.EQ.0) MSJJ=(NSJ+1)/2 RSP 130
IF (NSYM.NE.0) MSJJ=NSJ/2 RSP 140
MSJ1=MSJJ-1 RSP 150
DO 10 J=1,NJ RSP 160
FJ=J RSP 170
FNJ=NJ RSP 180

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10	RSJ(J)=0.5*(1.-COS(PI*RI/RIJ))	RSP 190
	DO 170 IS=1,4	RSP 200
	IF (MSYN.EQ.1.AND.IS.EQ.1) GO TO 170	RSP 210
	IF (IS.EQ.4) GO TO 20	RSP 220
	K1=IS	RSP 230
	K2=IS+1	RSP 240
	GO TO 30	RSP 250
20	K1=1	RSP 260
	K2=4	RSP 270
30	CONTINUE	RSP 280
	SPAN=YL(K2)-YL(K1)	RSP 290
	XDTF=XXL(K2)-XXL(K1)	RSP 300
	DO 40 I=1,2	RSP 310
	II=I+K1-1	RSP 320
	IF (IS.EQ.4.AND.I.EQ.2) II=4	RSP 330
	C(I)=XYT(II)-XXL(II)	RSP 340
	DO 40 J=1,NJ	RSP 350
40	XL(I,J)=XXL(II)+CPSWL(J)*C(I)	RSP 360
	IF (ABS(SPAN).LE.0.001) GO TO 70	RSP 370
	DO 50 J=1,NJ	RSP 380
50	SLOPF(J)=(XL(2,J)-XL(1,J))/SPAN	RSP 390
	DO 60 K=1,MSJJ	RSP 400
	YK=CPSWL(K)*SPAN	RSP 410
	DO 60 J=1,NJ	RSP 420
	Y(J,K)=YK+YL(K1)	RSP 430
	X(J,K)=XL(1,J)+SLOPF(J)*(Y(J,K)-YL(K1))	RSP 440
60	CONTINUE	RSP 450
	NS=MSJJ	RSP 460
70	IF (ABS(SPAN).LE.0.001) NS=1	RSP 470
	DO 160 K=1,NS	RSP 480
	YC=YCON(K)	RSP 490
	IF (ABS(SPAN).LE.0.001) YC=0.5	RSP 500
	KK=JC+K	RSP 510
	CH(KK)=C(1)-(C(1)-C(2))*YC	RSP 520
	IF (ABS(SPAN).LE.0.001) GO TO 80	RSP 530
	YC1=CPSWL(K)	RSP 540
	YC2=CPSWL(K+1)	RSP 550
	GO TO 80	RSP 560
80	YC1=0.	RSP 570
	YC2=1.	RSP 580
90	CONTINUE	RSP 590
	FX(KK,1)=XXL(K1)+XDTF*YC1	RSP 600
	FX(KK,2)=XXL(K1)+XDTF*YC2	RSP 610
	TX(KK,1)=XXT(K1)+(XXT(K2)-XXT(K1))*YC1	RSP 620
	TX(KK,2)=XXT(K1)+(XXT(K2)-XXT(K1))*YC2	RSP 630
	DO 160 J=1,NJ	RSP 640
	MPANFL=(K-1)*NJ+J-1+IPANFL	RSP 650
	MPAN1=MPANFL-1	RSP 660
	DO 130 I=1,2	RSP 670

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KT1=K+T-1                                RSP 680
IF (ABS(SPAN).LE.0.001) GO TO 100         RSP 690
X1=X(J,KT1)                               RSP 700
Y1=Y(J,KT1)                               RSP 710
IF (J.NE.1) GO TO 110                    RSP 720
Z7=ZL(K1)+(ZL(K2)-ZL(K1))*(Y1-YL(K1))/SPAN RSP 730
YY=X0IF*(Y1-YL(K1))/SPAN+XXL(K1)         RSP 740
GO TO 120                                  RSP 750
100  I7N=K1                                 RSP 760
     IF (I.EQ.2) I7N=K2                   RSP 770
     Y1=YL(I,J)                            RSP 780
     Y1=YL(K1)                              RSP 790
     IF (J.NE.1) GO TO 110                RSP 800
     Z7=ZL(I7N)                            RSP 810
     YY=XXL(I7N)                            RSP 820
     GO TO 120                              RSP 830
110  Z7=ZN(NPANEL,I)                       RSP 840
     YY=YN(NPANEL,I)                       RSP 850
120  YN(NPANEL,I)=Y1                       RSP 860
     YN(NPANEL,I)=Y1                       RSP 870
     ZN(NPANEL,I)=Z7                       RSP 880
130  CONTINUE                              RSP 890
     XC=X0IF*YC+XXL(K1)                   RSP 900
     YCP(NPANEL)=X0+CH(KK)*PSI(J)         RSP 910
     YCP(NPANEL)=YC+SPAN+YL(K1)          RSP 920
     IF (ABS(SPAN).LE.0.001) GO TO 140    RSP 930
     ZC=ZN(NPANEL,1)+(ZN(NPANEL,1)-ZN(NPANEL,2))*(YCP(NPANEL)-YN(NPANEL,1))/
     (YN(NPANEL,1)-YN(NPANEL,2))          RSP 940
     YC=YN(NPANEL,1)+SI(CPF(J))*(YCP(NPANEL)-YN(NPANEL,1)) RSP 950
     GO TO 150                              RSP 960
140  ZC=0.5*(ZN(NPANEL,1)+ZN(NPANEL,2))   RSP 970
     YC=0.5*(YN(NPANEL,1)+YN(NPANEL,2))   RSP 980
150  ZCP(NPANEL)=ZC                        RSP 990
     XV(NPANEL)=YC                         RSP1000
160  CONTINUE                              RSP1010
     IPANEL=NPANEL+1                       RSP1020
     LAST=NPANEL                           RSP1030
     JC=KK                                  RSP1040
170  CONTINUE                              RSP1050
     RETURN                                 RSP1060
     END                                    RSP1070
SUBROUTINE PANEL (XXL,YL,YXT,CPCWL,CPSWL,NSW,IPANEL,LPANEL,KK,LP,SPANL 10
140)                                       PNL 20
C TO DEFINE THE LOCATIONS OF VORTEX AND CONTROL POINTS ON THE WING PNL 30
DIMENSION XXL(1),YL(1),YXT(1),CPCWL(1),CPSWL(1) PNL 40
DIMENSION SWP(9,15) PNL 50
COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPF(15),XL(2,15),YTT(41),PNL 60
1XLL(41) PNL 70
COMMON /GEOM/ HALFSP,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTPNL 80

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1F(50),PST(20),CH(65),XV(200),YV(100),SN(9,9),XN(200,2),YN(200,2),7PNL 90
2N(200,2),WIDTH(8),YCON(25),SUFFR(50),PAIFR,SJ(21,8),FX(95,2),TX(95PNL 100
3,2),SC(160,5),ST(160,5),LC(7) PNL 110
COMMON /CONST/ NCS,NCW,M1(2),NCJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JPNL 120
1PANFL,MJJ(5),MW(2),MJJ,MJJ PNL 130
DT=3.14159265 PNL 140
NSW1=NSW-1 PNL 150
DO 10 I=1,2 PNL 160
C(I)=XYT(I)-XXL(I) PNL 170
DO 10 J=1,NCW PNL 180
10 YL(I,J)=XXL(I)+CPSWL(J)*C(I)/100. PNL 190
SPAN=YL(2)-YL(1) PNL 200
DO 20 J=1,NCW PNL 210
PST(J)=0.9*(1.-COS(FLCAT(J)*PI/FLCAT(NCW))) PNL 220
SLOPF(J)=(XL(2,J)-XL(1,J))/SPAN PNL 230
20 SWP(J,LD)=ATAN(SLOPF(J)) PNL 240
DO 30 K=1,NSW PNL 250
YK=CPSWL(K)*SPAN/100. PNL 260
DO 30 J=1,NCW PNL 270
Y(J,K)=YK+YL(1) PNL 280
X(J,K)=XL(1,J)+SLOPF(J)*(Y(J,K)-YL(1)) PNL 290
30 CONTINUE PNL 300
YLL(1)=XXL(1) PNL 310
XTT(1)=XYT(1) PNL 320
DO 40 I=2,NSW PNL 330
XLL(I)=YLL(I-1)+(XXL(2)-XXL(1))*(Y(1,I)-Y(1,I-1))/SPAN PNL 340
40 XTT(I)=XTT(I-1)+(XYT(2)-XYT(1))*(Y(1,I)-Y(1,I-1))/SPAN PNL 350
DO 60 K=1,NSW1 PNL 360
KK=NCW+K PNL 370
YLF(KK)=YCON(K)*SPAN+YL(1) PNL 380
XLF(KK)=XLL(K)+(YLL(K+1)-YLL(K))*(YLF(KK)-Y(1,K))/(Y(1,K+1)-Y(1,K)) PNL 390
1) XTF(KK)=XTT(K)+(XTT(K+1)-XTT(K))*(YLF(KK)-Y(1,K))/(Y(1,K+1)-Y(1,K)) PNL 400
1) CH(KK)=XTF(KK)-YLF(KK) PNL 410
FX(KK,1)=XXL(1)+(XXL(2)-XXL(1))*CPSWL(K)/100. PNL 420
FX(KK,2)=XXL(1)+(XXL(2)-XXL(1))*CPSWL(K+1)/100. PNL 430
TX(KK,1)=XYT(1)+(XYT(2)-XYT(1))*CPSWL(K)/100. PNL 440
TX(KK,2)=XYT(1)+(XYT(2)-XYT(1))*CPSWL(K+1)/100. PNL 450
TANG=(XXL(2)-XXL(1))/SPAN PNL 460
SUFFR(KK)=ATAN(TANG) PNL 470
DO 60 J=1,NCW PNL 480
NPANFL=(K-1)*NCW+J-1+1PANFL PNL 490
DO 50 I=1,2 PNL 500
KII=K+I-1 PNL 510
XN(NPANFL,I)=X(J,KII) PNL 520
YN(NPANFL,I)=Y(J,KII) PNL 530
7N(NPANFL,I)=0. PNL 540
50 CONTINUE PNL 550

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YCP(NPANEL)=YLF(KK)+PSI(I,J)*CF(KK) PNL 580
YCP(NPANEL)=YLF(KK) PNL 590
ZCP(NPANEL)=0. PNL 600
YV(NPANEL)=XLF(KK)+CPCWL(J)*CF(KK)/100. PNL 610
YV(NPANEL)=YLF(KK) PNL 620
60 CONTINUE PNL 630
LPANEL=NPANEL PNL 640
PFTJON PNL 650
FND PNL 660
SHPROTIME JSHAPF (XXL,XYT,YL,YJ,7J,PJ,CPCWL,IPANEL,NJ,JC,ISYM) JSP 10
C TO DEFINE THE LOCATIONS OF VORTEX AND CONTROL POINTS ON CIRCUJLAP JSP 20
C JETS JSP 30
DIMENSION CPCWL(1),XXL(1),XYT(1),YL(1) JSP 40
COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPF(15),XL(2,15),XTT(41),JSP 50
1YLL(41) JSP 60
COMMON /GEOM/ HALF5,YCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTJSP 70
IE(50),PSI(20),CF(95),YV(200),YV(100),SM(R,R),YN(200,2),YN(200,2),7JSP 80
2N(200,2),WIDTH(R),YCON(25),SUFFP(50),HALFR,SJ(21,8),EX(95,2),TX(95JSP 90
3,2),SC(160,5),SI(160,5),LC(3) JSP 100
COMMON /CONST/ NCS,NCW,M1(R),MSJ,MCJ(5),LAST,MJW1(3,5),MJW2(3,5),JJSP 110
IPANEL,MJJ(5),NM(2),PNJ,MJP JSP 120
PT=3.14159265 JSP 130
N1=MSJ+1 JSP 140
IF (ISYM.EQ.0) N1=MSJ-1 JSP 150
N2=N1+1 JSP 160
IF (ISYM.EQ.0) N2=MSJ JSP 170
N12=N1/2+2 JSP 180
IF (ISYM.EQ.0) N12=MCJ/2+1 JSP 190
DO 10 I=1,2 JSP 200
C(I)=XYT(I)-XXL(I) JSP 210
DO 10 J=1,NJ JSP 220
10 XL(I,J)=XXL(I)+CPCWL(J)*C(I) JSP 230
DO 20 J=1,NJ JSP 240
FJ=J JSP 250
FNCJ=MJ JSP 260
PSI(J)=0.5*(1.-COS(FJ*PT/FNCJ)) JSP 270
20 SLOPF(J)=(XL(2,J)-XL(1,J))/(2.*FJ) JSP 280
DO 30 K=1,N2 JSP 290
YV=Y(2,K) JSP 300
IF (ISYM.NE.0.AND.K.EQ.1) YV=-1. JSP 310
IF (ISYM.NE.0.AND.K.EQ.2) YV=-1. JSP 320
IF (K.EQ.(N12-1).OR.K.EQ.N12) YV=1. JSP 330
IF (K.EQ.N2) YV=1. JSP 340
XTT(K)=YJ+PJ*YV JSP 350
DO 30 J=1,NJ JSP 360
30 X(J,K)=XL(1,J)+SLOPF(J)*(XTT(K)-YL(I)) JSP 370
DO 120 K=1,N1 JSP 380
KK=JC+K JSP 390
L=K JSP 400

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	IF (K,FC,N12) I=1	JSP 410
	FX(KK,1)=XXL(1)+(XXL(2)-XXL(1))*(XTT(L)-YL(1))/(2.*PJ)	JSP 420
	FX(KK,2)=XXL(1)+(XXL(2)-XXL(1))*(XTT(K+1)-YL(1))/(2.*PJ)	JSP 430
	TX(KK,1)=XXT(1)+(XYT(2)-XYT(1))*(XTT(L)-YL(1))/(2.*PJ)	JSP 440
	TX(KK,2)=XXT(1)+(XYT(2)-XYT(1))*(XTT(K+1)-YL(1))/(2.*PJ)	JSP 450
	CH(KK)=C(1)-(C(1)-C(2))*0.5*(1.+Y(4.K))	JSP 460
	DO 120 J=1,NJ	JSP 470
	NPANFL=(K-1)*NJ+J-1+IPANFL	JSP 480
	DO 90 I=1,2	JSP 490
	KI1=K+I-1	JSP 500
	SIGN=1.	JSP 510
	IF (K,FC,N12.AND.I,FC,1) KI1=1	JSP 520
	IF (ISYM,FC,0) GO TO 40	JSP 530
	IF (KI1,FC,1.OR.KI1,FC,2) GO TO 60	JSP 540
	GO TO 50	JSP 550
40	IF (K,FC,N12.AND.KI1,FC,1) SIGN=-1.	JSP 560
50	CONTINUE	JSP 570
	IF (KI1,FC,(N12-1).OR.KI1,FC,N12) GO TO 70	JSP 580
	IF (KI1,FC,N2) GO TO 70	JSP 590
	YY=Y(2,KI1)	JSP 600
	ZZ=Y(1,KI1)*SIGN	JSP 610
	GO TO 80	JSP 620
60	YY=-1.	JSP 630
	ZZ=-Y(1,KI1)/Y(2,KI1)	JSP 640
	GO TO 80	JSP 650
70	YY=1.	JSP 660
	ZZ=Y(1,KI1)/Y(2,KI1)	JSP 670
80	CONTINUE	JSP 680
	XN(NPANFL,I)=X(J,KI1)	JSP 690
	YN(NPANFL,I)=YJ+PJ*YY	JSP 700
90	ZN(NPANFL,I)=ZJ+PJ*ZZ	JSP 710
	YK=0.5*(1.+Y(4.K))	JSP 720
	IF (ISYM,FC,0) YK=2.*YK-1.	JSP 730
	XCP(NPANFL)=XXI(1)+(XXL(2)-XXI(1))*YK+OSI(J)*CH(KK)	JSP 740
	IF (ABS(YN(NPANFL,2)-YN(NPANFL,1)).LE.0.0001) GO TO 100	JSP 750
	YCP(NPANFL)=YL(1)+YK*(YL(2)-YL(1))	JSP 760
	ZCP(NPANFL)=ZN(NPANFL,1)+(ZN(NPANFL,2)-ZN(NPANFL,1))*(YCP(NPANFL)-	JSP 770
	YN(NPANFL,1))/(YN(NPANFL,2)-YN(NPANFL,1))	JSP 780
	GO TO 110	JSP 790
100	ZCP(NPANFL)=ZJ	JSP 800
	YCP(NPANFL)=YN(NPANFL,1)	JSP 810
110	CONTINUE	JSP 820
	YV(NPANFL)=XXL(1)+(XXL(2)-XXL(1))*YK+CPCL(J)*CH(KK)	JSP 830
120	CONTINUE	JSP 840
	JC=JC+N1	JSP 850
	LAST=NPANFL	JSP 860
	RETURN	JSP 870
	END	JSP 880-
	OVERLAY (HSRIGF,2,0)	JOE 10

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PROGRAM JETOFF                                JOF 20
C TO SET UP THE JETOFF INFLUENCE COEFFICIENT MATRIX AND COMPUTE THE JOF 30
C CAMBER TERMS                                JOF 40
DIMENSION AW(101)                             JOF 50
COMMON /GEOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),YTJOF 60
IF(50),PSI(20),CH(95),XV(200),YV(100),SN(R,R),XN(200,2),YN(200,2),ZJOF 70
2N(200,2),WIDTH(R),YCCN(25),SWEEP(50),HALFR,SJ(21,8),FX(95,2),TX(95)JOF 80
3,2),SC(160,5),ST(160,5),LC(2)              JOF 90
COMMON /AERO/ AM1,AM2,R1,P2,CL(30),CT(30),CD(30),GAM(2,100)   JOF 100
COMMON /CONST/ NCS,NCW,K1(R),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JJOF 110
1PANEL,MJJ(5),MW(3),MNJ,NJP                    JOF 120
COMMON /ADD/ CP(100),CM(30),REFAK(R),SWP(R,15),GAL(30),ISYM,VMU,VIIJOF 130
1,TEMP,FOP,CAMLER,CAMLET,CAMTER,CAMTET,XJ,YJ,ZJ,RJ,ALP,CREF,TWISTP JOF 140
COMMON /PARAM/ ALPT,ALPC,ALDS,CDF,SDF,TH,TDF,NGPD,HEIGHT,ATT    JOF 150
COMMON /COST/ LTO&L(LPAN1,MJW(5),LPANEL,IFENTN,LPAN2,EXIT,PTIAL,TWJOF 160
1IST,DF(5),NFP                                JOF 170
PEWIND 01                                      JOF 180
J1=LPANEL+1                                    JOF 190
ATH=-ATT                                       JOF 200
R=R1                                           JOF 210
IC=1                                           JOF 220
MG=MW(1)                                       JOF 230
NR=MW(1)                                       JOF 240
NC=IFENTN                                     JOF 250
IC=1                                           JOF 260
10 CONTINUE                                    JOF 270
LL=1                                           JOF 280
IF (MW(2),EQ,0) GO TO 30                       JOF 290
II=1+NCS                                       JOF 300
IF (MW(3),NE,0) GO TO 20                      JOF 310
CHCRD=CH(1)+CH(II)                             JOF 320
GO TO 40                                       JOF 330
20 III=II+NCS                                  JOF 340
CHCRD=CH(1)+CH(II)+CH(III)                   JOF 350
GO TO 40                                       JOF 360
30 CHCRD=CH(1)                                 JOF 370
40 CONTINUE                                    JOF 380
CALL WING (AW,LPANEL,I,R,LPAN1,LPAN2,NGPD,HEIGHT,ATH) JOF 390
XC=(YCP(1)-YLE(IC))/CHCRD                     JOF 400
CAM=ZCP(XC)-(ZCP(XC)-ZCT(XC))*YCP(1)/HALFR   JOF 410
AW(J1)=-CAM                                    JOF 420
WRITE (01) (AW(K),K=1,J1)                     JOF 430
IJ=2                                           JOF 440
NJ=LPANEL-I                                    JOF 450
CONTINUE                                       JOF 460
50 CALL WING (AW,LPANEL,IJ,R,LPAN1,LPAN2,NGPD,HEIGHT,ATH) JOF 470
IF (MW(2),EQ,0) GO TO 70                      JOF 480
II=IG+NCS                                       JOF 490
IF (MW(3),NE,0) GO TO 60                      JOF 500

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	CHORD=CH(IG)+CH(II)	JOF 510
	CHFL=CH(IG)	JOF 520
	GO TO 80	JOF 530
60	III=II+NCS	JOF 540
	CHORD=CH(IG)+CH(II)+CH(III)	JOF 550
	CHFL=CH(IG)+CH(II)	JOF 560
	GO TO 80	JOF 570
70	CHORD=CH(IG)	JOF 580
	CHFL=CH(IG)	JOF 590
80	CONTINUE	JOF 600
	FCR=CHFL/CHORD	JOF 610
	XC=(XCP(IJ)-YLF(IG))/CHORD	JOF 620
	COM=ARS(XC-FCR)	JOF 630
	FCR1=FCR-0.01	JOF 640
	FCR2=FCR+0.01	JOF 650
	C7=0.	JOF 660
	IF (ARS(1.-XC),LF,0.01) GO TO 90	JOF 670
	ZC1=ZCP(XC)	JOF 680
	ZC2=ZCT(XC)	JOF 690
	C7=ZC1-(ZC1-ZC2)*YCP(IJ)/HALFR	JOF 700
90	CONTINUE	JOF 710
	IF (ARS(1.-XC),IF,0.01) C7=CANTER-(CANTER-CANTET)*YCP(IJ)/HALFR	JOF 720
	IF (XC.LT.FCR1) CAM=C7	JOF 730
	IF (COM.LT.0.001) CAM=C7-0.5*DF(LL)	JOF 740
	IF (XC.GT.FCR2.AND.ARS(1.-XC).GT.0.01) CAM=-DF(LL)+C7	JOF 750
	IF (ARS(1.-XC),IF,0.01) CAM=-DF(LL)+C7	JOF 760
	IF (PTIAL.LE.0.01.AND.XC.GT.FCR1) GO TO 140	JOF 770
	IF (PTIAL.GT.0.01) GO TO 110	JOF 780
100	IF (IJ.NE.MG) GO TO 140	JOF 790
	IF (ARS(XC-1.),IF,0.01) GO TO 120	JOF 800
	JK=1	JOF 810
	IF (NW(3).NE.0.AND.IJ.GT.1) JK=2	JOF 820
	NOM=IJ*(NCS-IG)*NW(JK)+(IG-1)*NW(JK+1)+1	JOF 830
	XC1=(XCP(NOM)-XLF(IG))/CHORD	JOF 840
	CAM1=ZCP(XC1)-(ZCP(XC1)-ZCT(XC1))*YCP(IJ)/HALFR	JOF 850
	CAM=(CAM+CAM1)/2.	JOF 860
	C7=CAM	JOF 870
	GO TO 140	JOF 880
110	IF (IJ.GE.MJW1(1,LL).AND.IJ.LE.MJW2(1,LL)) GO TO 130	JOF 890
	IF (IJ.GE.MJW1(2,LL).AND.IJ.LE.MJW2(2,LL)) GO TO 140	JOF 900
	IF (IJ.GE.MJW1(3,LL).AND.IJ.LE.MJW2(3,LL)) GO TO 140	JOF 910
	CAM=C7	JOF 920
	GO TO 100	JOF 930
120	CAM=CANTER-(CANTER-CANTET)*YCP(IJ)/HALFR	JOF 940
	GO TO 140	JOF 950
130	IF (XC.GT.FCR1) GO TO 140	JOF 960
	GO TO 100	JOF 970
140	CONTINUE	JOF 980
	AW(J1)=-CAM	JOF 990

	WRITE (01) (AW(K),K=1,J1)	JOF1000
	IF (IJ.GE.LPAN1.AND.IJ.LT.LPAN2) NG=NW(2)	JOF1010
	IF (IJ.GE.LPAN2.AND.IJ.LT.LPANFL) NG=NW(3)	JOF1020
	IF (IJ.EQ.MJW2(1,LL).OR.IJ.EQ.MJW2(2,LL)) LL=LL+1	JOF1030
	IF (IJ.EQ.MJW2(3,LL)) LL=LL+1	JOF1040
	IF (LL.GT.NFP) LL=1	JOF1050
	IF (IJ.LT.MG) GO TO 150	JOF1060
	IG=IG+1	JOF1070
	MG=MG+NG	JOF1080
150	IF (IJ.EQ.LPAN1.OR.IJ.EQ.LPAN2) IG=1	JOF1090
	IF (IJ.EQ.LPAN1.OR.IJ.EQ.LPAN2) LL=1	JOF1100
	IJ=IJ+1	JOF1110
	NJ=NJ-1	JOF1120
	IF (IJ.LE.LPANFL) GO TO 50	JOF1130
	IC=IC+1	JOF1140
	R=R2	JOF1150
	IG=1	JOF1160
	NG=NW(1)	JOF1170
	MG=NW(1)	JOF1180
	IF (ABS(R1-R2).LE.C.001) GO TO 160	JOF1190
	IF (IC.LE.2) GO TO 10	JOF1200
160	CONTINUE	JOF1210
	RETURN	JOF1220
C		JOF1230
	END	JOF1240
	OVERLAY (USRIGF,3,0)	JON 10
	PROGRAM JFTON	JON 20
C	TO SET UP THE JFTON INFLUENCE COEFFICIENT MATRICES	JON 30
	DIMENSION A4(300)	JON 40
	COMMON /CODE/ KCODE	JON 50
	COMMON /GEOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTJON 60	
	IF(50),PSI(20),CH(95),XV(200),YV(100),SN(R,8),XN(200,2),YN(200,2),ZJON 70	
	ZN(200,2),WIDTH(8),YCON(25),SWEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95JON 80	
	3,2),SC(160,5),ST(160,5),LC(3)	JON 90
	COMMON /AFRC/ AN1,AN2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100)	JON 100
	COMMON /CONST/ NCS,NCW,M1(R),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JJON 110	
	IPANEL,MJJ(5),NW(3),NNJ,NJP	JON 120
	COMMON /PARAM/ ALPT,ALPC,ALPS,CDF,SDF,TH,TDF,NGRC,HEIGHT,ATT	JON 130
	COMMON /ADD/ CP(100),CM(30),RPAK(R),SWP(R,15),GAL(30),ISYM,VMU,VIJON 140	
	1,TEMP,FCR,CAMLER,CAMLET,CAMTER,CAMTET,XJ,YJ,ZJ,PJ,ALP,CREF,TWISTP JON 150	
	COMMON /COST/ LTOTAL,LPAN1,NJW(5),LPANEL,IENTN,LPAN2,FXIT,PTIAL,TWJON 160	
	LIST,DF(5),NFP	JON 170
	REWIND 02	JON 180
	LP1=LTOTAL+1	JON 190
	MJ=LPANEL+NCJ(1)	JON 200
	MCCN=LAST+NCJ(1)	JON 210
	IPHI=1	JON 220
	ATG=ATT	JON 230
	ATT=-ATG	JON 240

	J1=LAST+1	JON 250
	IINN=1	JON 260
	LN=1	JON 270
	LN1=1	JON 280
	JNN=1	JON 290
	VVIC=VMU*ALPC	JON 300
	MK=1	JON 310
	T=LAST+1	JON 320
	I1=I-JPANEL	JON 330
	CALL MATRIX (AW,I TOTAL,LPANEL,VVIC,T,MCON,MJ,IPHI,INN,LN,LN1,TEMP,	JON 340
	LPAN1,ISYM,KCOFF,EXIT,LPAN2)	JON 350
	WRITE (01) (AW(K),K=1,LTOTAL)	JON 360
	KI=2	JON 370
	NI=LTOTAL-1	JON 380
	LI=LAST+2	JON 390
	VMP=VMIC	JON 400
10	KJ=LI	JON 410
	IF (LI.GT.LAST) KJ=LI-JPANEL	JON 420
	CALL MATRIX (AW,LTOTAL,LPANEL,VMP,LI,MCON,MJ,IPHI,INN,LN,LN1,TEMP,	JON 430
	LPAN1,ISYM,KCOFF,EXIT,LPAN2)	JON 440
	WRITE (01) (AW(K),K=1,LTOTAL)	JON 450
	IF (KJ.LT.MJ.OP,KJ.EQ.LAST) GO TO 20	JON 460
	IPHI=IPHI+1	JON 470
	MJ=MJ+NCJ(INN)	JON 480
20	CONTINUE	JON 490
	MJI=MJJ(INN)-1	JON 500
	IF (KJ.EQ.MJI) GO TO 30	JON 510
	GO TO 40	JON 520
30	JNN=IINN	JON 530
	IINN=IINN+1	JON 540
40	IF (KJ.EQ.MJJ(JNN)) IPHI=1	JON 550
	IF (LI.GT.LPANEL) GO TO 60	JON 560
	IF (LI.EQ.MJW2(1,LL).OP,LI.EQ.MJW2(2,LL)) LL=LL+1	JON 570
	IF (LI.EQ.MJW2(3,LL)) LL=LL+1	JON 580
	IF (LL.GT.NFP) LL=1	JON 590
	IF (LI.GF.LPAN1.AND.LI.LT.LPAN2) NG=NW(2)	JON 600
	IF (LI.GF.LPAN2.AND.LI.LT.LPANEL) NG=NW(3)	JON 610
	IF (LI.LT.NG) GO TO 50	JON 620
	NG=MG+NG	JON 630
50	IF (LI.EQ.LPAN1.OP,LI.EQ.LPAN2) LL=1	JON 640
60	CONTINUE	JON 650
	IF (LI.EQ.LTOTAL) GO TO 70	JON 660
	GO TO 80	JON 670
70	CONTINUE	JON 680
	IPHI=1	JON 690
	MJ=LPANEL+NCJ(I)	JON 700
	JNN=1	JON 710
	IINN=1	JON 720
80	CONTINUE	JON 730

	KI=KI+1	JON 740
	NI=NI-1	JON 750
	IF (LI.FO.LTOTAL) GO TO 90	JON 760
	IF (LI.FO.LAST) GO TO 100	JON 770
	LI=LI+1	JON 780
	GO TO 110	JON 790
90	LI=L PANFL+1	JON 800
	GO TO 110	JON 810
100	LI=1	JON 820
110	CONTINUE	JON 830
	JP=LI-LAST+L PANFL	JON 840
	JP1=JP-1	JON 850
	IF (JP.FO.MJJ(LN1)) LN1=LN1+1	JON 860
	IF (JP1.FO.MJJ(LN)) LN=LN+1	JON 870
	IF (KI.FO.LTOTAL) GO TO 10	JON 880
	ATT=ATR	JON 890
	RETURN	JON 900
	END	JON 910
	SUBROUTINE MATRIX (AW,LTOTAL,L PANFL,VMU,I,MCON,MJ,IPHI,INN,LN,LN1, MAT 10	
	TEMP,L PAN1,ISYM,KCOEF,EXIT,L PAN2) MAT 20	
C	TO COMPUTE THE JETON INFLUENCE COEFFICIENT MATRICES MAT 30	
	DIMENSION AW(1) MAT 40	
	DIMENSION W(4), W1(2) MAT 50	
	DIMENSION SV(300) MAT 60	
	COMMON /GFOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTMAT 70	
	IF(50),PSI(20),CH(95),XV(200),YV(100),SN(8,8),YN(200,2),YM(200,2),ZMAT 80	
	ZN(200,2),WIDTH(8),YCON(25),SVFEP(50),HALFR,SJ(21,8),EX(95,2),TX(95MAT 90	
	3,2),SC(160,5),ST(160,5),LC(3) MAT 100	
	COMMON /CONST/ NCS,NCW,Y1(8),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JMAT 110	
	IPANFL,MJJ(5),NW(3),NNJ,NJP MAT 120	
	COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41), MAT 130	
	YLL(41) MAT 140	
	COMMON /AERO/ AM1,AM2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100) MAT 150	
	COMMON /PARAM/ ALPT,ALPC,ALPS,CPF,SDF,TH,TDF,NGED,HEIGHT,ATT MAT 160	
	EQUIVALENCE (X(1,1),SV(1)) MAT 170	
	PI=3.14159265 MAT 180	
	ZJET=YCON(25) MAT 190	
	IUSP=YCON(24) MAT 200	
	IF (IUSP.FO.2) VMU=0.2 MAT 210	
	CMU=C(1) MAT 220	
	LG=1 MAT 230	
	IF (NGPD.FO.1) LG=2 MAT 240	
	W1(1)=0. MAT 250	
	W1(2)=0. MAT 260	
	DEFJ=CPF MAT 270	
	VUT=VMU MAT 280	
	TFM=TFMP MAT 290	
	NN2=NNJ-1 MAT 300	
	N1=NNJ-1 MAT 310	

	N2=NNJ-2	MAT 320
	N3=NNJ-3	MAT 330
	NJH=(NSJ+1)/2+1	MAT 340
	IF (ISYM.EQ.0) NJH=NSJ/2	MAT 350
	IF (ISYM.EQ.0) NP=NSJ-1	MAT 360
	IF (ISYM.NE.0) NP=NSJ+1	MAT 370
	NJT=NNJ-1	MAT 380
	I7=1	MAT 390
	IFF=1	MAT 400
	MV=NW(1)	MAT 410
	NN=NW(1)	MAT 420
	IND=1	MAT 430
	ISN=1	MAT 440
	L1=LPAFL+1	MAT 450
	LASTI=LAST-1	MAT 460
	IF (I.GT.LAST) GO TO 10	MAT 470
	IJ=I	MAT 480
	GO TO 20	MAT 490
10	IJ=I-JPAFL	MAT 500
20	CONTINUE	MAT 510
	DO 260 J=1, LAST	MAT 520
	MI=J-IFF+1	MAT 530
	FN=NN	MAT 540
	IF (J.GT.LPAN1.AND.J.LE.LPAN2) ISN=2	MAT 550
	IF (J.GT.LPAN2.AND.J.LE.LPAFL) ISN=3	MAT 560
	IF (J.GE.LPAN1.AND.J.LT.LPAFL) GO TO 30	MAT 570
	GO TO 40	MAT 580
30	NN=NW(2)	MAT 590
	IF (J.GE.LPAN2.AND.J.LT.LPAFL) NN=NW(3)	MAT 600
40	CONTINUE	MAT 610
	IF (J.GE.LPAFL.AND.J.LT.MJJ(IND)) NN=NCJ(IND)	MAT 620
	CHORD=CH(I7)	MAT 630
	IF (J.EQ.L1) GO TO 50	MAT 640
	GO TO 60	MAT 650
50	ISN=ISN+1	MAT 660
	L1=MJJ(IND)+1	MAT 670
60	NL=MJJ(IND)-1	MAT 680
	IF (NL.EQ.LASTI) GO TO 70	MAT 690
	IF (J.EQ.NL) IND=IND+1	MAT 700
70	CONTINUE	MAT 710
	X1=XN(J,1)-YCP(IJ)	MAT 720
	X2=XN(J,2)-XCP(IJ)	MAT 730
	X12=XN(J,2)-XN(J,1)	MAT 740
	Y12=YN(J,2)-YN(J,1)	MAT 750
	Z12=ZN(J,2)-ZN(J,1)	MAT 760
	DO 260 II=1,2	MAT 770
	IF (II.EQ.1) GO TO 80	MAT 780
	N=1	MAT 790
	GO TO 90	MAT 800

80	N=2	MAT 810
90	CONTINUE	MAT 820
	YC=(-1.)*N*YCP(IJ)	MAT 830
	Y1=YN(J,1)-YC	MAT 840
	Y2=YN(J,2)-YC	MAT 850
	XYK=X1*Y12-Y1*Y12	MAT 860
	DO 250 KK=1,LC	MAT 870
	IF (KK.EQ.1) GO TO 100	MAT 880
	GF=-1.	MAT 890
	ZC=-2.*(ZCP(IJ)+HEIGHT)+ZCP(IJ)	MAT 900
	FCON=1.	MAT 910
	GO TO 110	MAT 920
100	GF=1.	MAT 930
	ZC=ZCP(IJ)	MAT 940
	FCON=0.	MAT 950
110	CONTINUE	MAT 960
	Z1=ZN(J,1)-ZC	MAT 970
	Z2=ZN(J,2)-ZC	MAT 980
	X7J=X1*Z12-Z1*Y12	MAT 990
	UCOM=-Z1*Y12*ATT*FCON	MAT1000
	Y7J=Y1*Z12-Z1*Y12	MAT1010
	ALP1=XYK*XYK+X7J*X7J+P1*Y7I*Y7I	MAT1020
	R1R1=SQRT(X1*X1+P1*Y1*Y1+P1*Z1*Z1)	MAT1030
	R2R1=SQRT(X2*X2+P1*Y2*Y2+P1*Z2*Z2)	MAT1040
	UUR1=(X2*X12+P1*Y2*Y12+P1*Z2*Z12)/R2R1-(X1*X12+P1*Y1*Y12+P1*Z1*Z12	MAT1050
	1)/R1R1	MAT1060
	G1R1=(1.-X1/R1R1)/(Y1*Y1+Z1*Z1)	MAT1070
	G2R1=(1.-X2/R2R1)/(Y2*Y2+Z2*Z2)	MAT1080
	IF (I.GT.LPANFL) GO TO 130	MAT1090
	F1=UUR1*(UCOM+XYK)*GF/ALP1	MAT1100
	F2=(-Y2*G2R1+Y1*G1R1)*GF	MAT1110
	IF (J.GT.LPANFL) GO TO 120	MAT1120
	GO TO 220	MAT1130
120	F3=0.	MAT1140
	F4=0.	MAT1150
	F1=2.*F1	MAT1160
	F2=2.*F2	MAT1170
	GO TO 220	MAT1180
130	CONTINUE	MAT1190
	IF (J.LE.LPANFL) GO TO 150	MAT1200
	IF (ABS(R1-R2).LE.0.001) GO TO 140	MAT1210
	ALP2=XYK*XYK+X7J*X7J+P2*Y7I*Y7I	MAT1220
	R1R2=SQRT(X1*X1+P2*Y1*Y1+P2*Z1*Z1)	MAT1230
	R2R2=SQRT(X2*X2+P2*Y2*Y2+P2*Z2*Z2)	MAT1240
	UUR2=(X2*X12+P2*Y2*Y12+P2*Z2*Z12)/R2R2-(X1*X12+P2*Y1*Y12+P2*Z1*Z12	MAT1250
	1)/R1R2	MAT1260
	G1R2=(1.-X1/R1R2)/(Y1*Y1+Z1*Z1)	MAT1270
	G2R2=(1.-X2/R2R2)/(Y2*Y2+Z2*Z2)	MAT1280
	GO TO 150	MAT1290

140	ALR2=ALR1	MAT1300
	UIR2=UIR1	MAT1310
	G2R2=G2R1	MAT1320
	G1R2=G1R1	MAT1330
150	CONTINUE	MAT1340
	IF (I.GT.LAST) GO TO 180	MAT1350
	F13=UIR1*X7J/ALP1	MAT1360
	F12=UIR1*(UCOM*XYK)/ALR1	MAT1370
	G13=72*G2R1-71*G1R1	MAT1380
	G12=-Y2*G2R1+Y1*G1R1	MAT1390
	IF (J.LE.LPANEL) GO TO 160	MAT1400
	F23=UIR2*X7J/ALR2	MAT1410
	F22=UIR2*XYK/ALR2	MAT1420
	G23=72*G2R2-71*G1R2	MAT1430
	G22=-Y2*G2R2+Y1*G1R2	MAT1440
	GO TO 170	MAT1450
160	F22=0.	MAT1460
	G22=0.	MAT1470
	F23=0.	MAT1480
	G23=0.	MAT1490
170	F1=-F13*Y(4.IPHI)*(-1.)**N+F12*Y(3.IPHI)*GF	MAT1500
	F2=G13*Y(4.IPHI)*(-1.)**N+G12*Y(3.IPHI)*GE	MAT1510
	F3=-F23*Y(4.IPHI)*(-1.)**N+F22*Y(3.IPHI)	MAT1520
	F4=G23*Y(4.IPHI)*(-1.)**N+G22*Y(3.IPHI)	MAT1530
	IF (J.LE.LPANEL) GO TO 210	MAT1540
	F1=F1*2.	MAT1550
	F2=2.*F2	MAT1560
	F3=2.*F3	MAT1570
	F4=2.*F4	MAT1580
	GO TO 210	MAT1590
180	F1=UIR1*YZI/ALP1	MAT1600
	IF (EXIT.LE.0.001) GO TO 190	MAT1610
	IF (NMJ.EQ.1) GO TO 190	MAT1620
	IF (IJ.GT.LPANEL.AND.IJ.LE.MJJ(1)) VMU=1.	MAT1630
	IF (IJ.GT.LPANEL.AND.IJ.LE.MJJ(1)) TEMP=1.	MAT1640
190	CONTINUE	MAT1650
	F2=0.	MAT1660
	IF (J.LE.LPANEL) GO TO 200	MAT1670
	F3=UIR2*YZI/ALR2	MAT1680
	F4=0.	MAT1690
	F1=-F1*VMU*VMU*2.*TEMP	MAT1700
	F3=-F3*2.	MAT1710
	GO TO 210	MAT1720
200	F1=-F1*VMU*VMU*TEMP	MAT1730
210	CONTINUE	MAT1740
220	IF (KK.EQ.2) GO TO 230	MAT1750
	W(II)=(F1+F2)*CHORD*SN(MI.ISN)/(P.*FN)	MAT1760
	IF (J.LE.LPANEL) GO TO 240	MAT1770
	IF (II.EQ.2) GO TO 240	MAT1780

	K2=I1+2	MAT1790
	W(K2)=(F3+F4)*CHORD*SN(MI,ISN)/(R.*FN)	MAT1800
	GO TO 240	MAT1810
230	W1(I1)=(F1+F2)*CHORD*SN(MI,ISN)/(R.*FN)	MAT1820
240	CONTINUE	MAT1830
250	CONTINUE	MAT1840
260	CONTINUE	MAT1850
	IF (J.LT.MM) GO TO 270	MAT1860
	I7=I7+1	MAT1870
	IFF=MM+1	MAT1880
	MM=MM+AN	MAT1890
270	CONTINUE	MAT1900
	IF (J.LE.LPANFL) JA=J+2*JPANFL	MAT1910
	IF (J.GT.LPANFL) JA=J-(JPANFL+JPANFL)	MAT1920
	AW(JA)=W(1)+W(2)+W1(1)+W1(2)	MAT1930
	SV(JA)=W(1)	MAT1940
	IF (J.LE.LPANFL) GO TO 280	MAT1950
	J1=J-LPANFL	MAT1960
	AW(J1)=W(3)	MAT1970
	VMI=V(I)	MAT1980
	TEMP=TEM	MAT1990
280	CONTINUE	MAT2000
	IF (IUSR.NE.2) GO TO 310	MAT2010
	IF (I.GT.LPANFL.AND.I.LE.LAST) GO TO 290	MAT2020
	GO TO 310	MAT2030
290	DO 300 K=1,JPANFL	MAT2040
300	AW(K)=0.	MAT2050
310	CONTINUE	MAT2060
	IF (KCODE.EQ.0) GO TO 430	MAT2070
	IF (IUSR.NE.0.AND.7JET.GT.0.G1) GO TO 410	MAT2080
	IF (DFJ.LE.0.0001) GO TO 410	MAT2090
	IF (NNJ.EQ.1.AND.I.LE.LPANFL) GO TO 410	MAT2100
	IF (NNJ.EQ.1.AND.I.GT.LPANFL) GO TO 320	MAT2110
	IF (I.LE.MJJ(N1).OR.I.GT.LAST) GO TO 410	MAT2120
320	CONTINUE	MAT2130
	IF (I.GT.LAST) GO TO 410	MAT2140
	IF (IPHI.EQ.NJH) GO TO 410	MAT2150
	IF (ISYM.NE.0.AND.IPHT.EQ.1) GO TO 410	MAT2160
	IF (IPHI.LT.NJH) IL=IPHI-ISYM	MAT2170
	IF (IPHI.GT.NJH) IL=IPHI-NJH	MAT2180
	REWIND 02	MAT2190
	IF (NNJ.EQ.1) MJN1=LPANFL	MAT2200
	IF (NNJ.NE.1) MJN1=MJJ(N1)	MAT2210
	MF=IJ-MJN1-(IPHT-1)*NCJ(NNJ)	MAT2220
	FNMJ=NCJ(NNJ)	MAT2230
	DISTJ=SDF	MAT2240
	DLX=DISTJ*0.5*PI/FNMJ	MAT2250
	S7X=-(1.-VMI)	MAT2260
	IF (IUSR.EQ.2) S7X=-1.	MAT2270

	TO=(IL-1)*NCJ(MNJ)	MAT2280
	CALL SKIP (IC.JPANEL)	MAT2290
	DO 360 JJ=1,MF	MAT2300
	READ (02) (SV(K),K=1,JPANEL)	MAT2310
	IF (JJ.EQ.MF) GO TO 330	MAT2320
	IF (IUSR.EQ.2) DXTH=DLX*PSI(JJ)*2./CMU	MAT2330
	IF (IUSR.NE.2) DXTH=DLX*PSI(JJ)/TH	MAT2340
	GO TO 340	MAT2350
330	IF (IUSR.EQ.2) DXTH=DLX*PSI(JJ)*2.*0.5/CMU	MAT2360
	IF (IUSR.NE.2) DXTH=DLX*PSI(JJ)*0.5/TH	MAT2370
340	CONTINUE	MAT2380
	PRDD=SZX*DXTH	MAT2390
	DO 350 K1=1,JPANEL	MAT2400
	KK=K1+JPANEL	MAT2410
350	AW(KK)=AW(KK)+PRDD*SV(K1)	MAT2420
360	CONTINUE	MAT2430
	TO=NCJ(MNJ)-MF+((NP-1-ISYM)/2-1)*NCJ(MNJ)	MAT2440
	CALL SKIP (IC.JPANEL)	MAT2450
	DO 400 JJ=1,MF	MAT2460
	READ (02) (SV(K),K=1,JPANEL)	MAT2470
	IF (JJ.EQ.MF) GO TO 370	MAT2480
	IF (IUSR.EQ.2) DXTH=DLX*PSI(JJ)*2./CMU	MAT2490
	IF (IUSR.NE.2) DXTH=DLX*PSI(JJ)/TH	MAT2500
	GO TO 380	MAT2510
370	IF (IUSR.EQ.2) DXTH=DLX*PSI(JJ)*2.*0.5/CMU	MAT2520
	IF (IUSR.NE.2) DXTH=DLX*PSI(JJ)*0.5/TH	MAT2530
380	PRDD=SZX*DXTH	MAT2540
	DO 390 K1=1,JPANEL	MAT2550
	KK=K1+JPANEL	MAT2560
390	AW(KK)=AW(KK)-PRDD*SV(K1)	MAT2570
400	CONTINUE	MAT2580
410	CONTINUE	MAT2590
	IF (EXIT.LE.0.001) GO TO 420	MAT2600
	IF (MNJ.EQ.1) GO TO 420	MAT2610
	IF (IJ.GT.LPANEL.AND.IJ.LE.MJJ(1)) VMU=1.	MAT2620
	IF (IJ.GT.LPANEL.AND.IJ.LE.MJJ(1)) TFM=1.	MAT2630
420	CONTINUE	MAT2640
430	IF (I.LE.LAST) GO TO 790	MAT2650
	IF (IPHI.EQ.NJH) GO TO 640	MAT2660
	IF (ISYM.NE.0.AND.IPHI.EQ.1) GO TO 640	MAT2670
	IF (MNJ.EQ.1) GO TO 500	MAT2680
	IF (IJ.GT.MJJ(M1)) GO TO 500	MAT2690
	IF (IPHI.GT.NJH.AND.ZJET.LE.0.01) GO TO 500	MAT2700
	IF (IPHI.GT.NJH) L1=NJH	MAT2710
	IF (ISYM.EQ.0.AND.IPHI.GT.NJH) L1=MJH+1	MAT2720
	IF (IPHI.LE.NJH) L1=1	MAT2730
	NZ=1	MAT2740
	IF (NW(2).NE.0.AND.NW(3).EQ.0) N7=2	MAT2750
	IF (NW(3).NE.0) N7=3	MAT2760

	IF (NNJ.LE.3.AND.NW(2).NE.0) IP=N2	MAT2770
	IF (NNJ.LE.3.AND.NW(2).EQ.0) IP=N1	MAT2780
	IF (NNJ.GE.4.AND.NW(3).NE.0) IP=N3	MAT2790
	IF (NNJ.EQ.4.AND.NW(3).EQ.0) IP=N2	MAT2800
	DO 490 NP=1,N7	MAT2810
	K1=MJW1(NP,NJP)+(IPHI-L1-ISYM)*NW(NP)-1	MAT2820
	K2=LC(NP)+IPHI-L1-ISYM	MAT2830
	KNW=NW(NP)	MAT2840
	K1=K1-KNW	MAT2850
	K2=K2-1	MAT2860
	MP=3	MAT2870
	IF (K1.GE.0) GO TO 440	MAT2880
	K1=K1+KNW	MAT2890
	K2=K2+1	MAT2900
	MP=2	MAT2910
440	DO 480 NQ=1,MP	MAT2920
	SUM=0.	MAT2930
	DO 450 KK=1,KNW	MAT2940
	KL=K1+KK	MAT2950
	JA=KL+2*JPANFL	MAT2960
450	SUM=SUM+SV(JA)	MAT2970
	CALL INTEG (RES,KNW,K1,K2,IJ,P1,IP)	MAT2980
	DO 470 KK=1,KNW	MAT2990
	KL=K1+KK	MAT3000
	JA=KL+2*JPANFL	MAT3010
	AA=1.	MAT3020
	DO 460 L=1,KNW	MAT3030
	LL=K1+L	MAT3040
	IF (L.EQ.KK) GO TO 460	MAT3050
	AA=AA*(XCP(IJ)-XV(LL))/(XV(KL)-XV(LL))	MAT3060
460	CONTINUE	MAT3070
	AW(JA)=AW(JA)-SUM*AA-RES*AA*VM11*VM11*TEMP	MAT3080
470	CONTINUE	MAT3090
	K1=K1+KNW	MAT3100
	K2=K2+1	MAT3110
480	CONTINUE	MAT3120
	IP=IP+1	MAT3130
490	CONTINUE	MAT3140
500	CONTINUE	MAT3150
	IF (KCODE.EQ.0) GO TO 640	MAT3160
	IF (NW(2).EQ.0) NSTRIP=NCS	MAT3170
	IF (NW(2).NE.0.AND.NW(3).EQ.0) NSTRIP=NCS*2	MAT3180
	IF (NW(3).NE.0) NSTRIP=NCS*3	MAT3190
	IF (IPHI.LT.NJH) IP=NJH+1	MAT3200
	IF (IPHI.GT.NJH) IP=ISYM+1	MAT3210
	IF (NNJ.EQ.1) GO TO 550	MAT3220
	IF (IJ.GT.MJJ(N1)) GO TO 550	MAT3230
	IF (NNJ.EQ.2) GO TO 560	MAT3240
	IF (IJ.GT.MJJ(N2)) GO TO 560	MAT3250

	IF (NNJ.EQ.3) GO TO 540	MAT3260
	IF (IJ.GT.MJJ(N3)) GO TO 530	MAT3270
	IF (NNJ.EQ.4) GO TO 520	MAT3280
	IF (NNJ.EQ.5.AND.IJ.GT.MJJ(NNJ-4)) GO TO 510	MAT3290
	L1=NNJ-4	MAT3300
	I7=NSTRIP	MAT3310
	GO TO 570	MAT3320
510	L1=N3	MAT3330
	I7=NSTRIP+NP	MAT3340
	GO TO 570	MAT3350
520	L1=N3	MAT3360
	I7=NSTRIP	MAT3370
	GO TO 570	MAT3380
530	L1=N2	MAT3390
	I7=NSTRIP+(NNJ-3)*NP	MAT3400
	GO TO 570	MAT3410
540	CONTINUE	MAT3420
	L1=N2	MAT3430
	I7=NSTRIP	MAT3440
	GO TO 570	MAT3450
550	L1=NNJ	MAT3460
	I7=NSTRIP+(NNJ-1)*NP	MAT3470
	GO TO 570	MAT3480
560	L1=N1	MAT3490
	I7=NSTRIP+(NNJ-2)*NP	MAT3500
570	CONTINUE	MAT3510
	I7=I7+IP	MAT3520
	NT=NJT	MAT3530
	IF (ISYM.NF.0) NT=NJT-1	MAT3540
	KNW=NCJ(L1)	MAT3550
	DO 630 KP=1,NT	MAT3560
	SIUM1=0.	MAT3570
	SIUM2=0.	MAT3580
	K1=MJJ(L1)-NP*NCJ(L1)+(KP-1)*NCJ(L1)+(IP-1)*NCJ(L1)	MAT3590
	DO 580 KK=1,KNW	MAT3600
	KL=K1+KK	MAT3610
	KJ=KL+JPANFL	MAT3620
	TA=KL-[JPANFL+JPANFL	MAT3630
	IP=KJ-LAST	MAT3640
	SIUM]=SIUM1+SV(TA)	MAT3650
580	SIUM2=SIUM2+AW(IP)	MAT3660
	CALL INTEG (PFC,KNW,K1,I7,IJ,P1,L1)	MAT3670
	IF (ABS(P1-P2).LE.0.001) GO TO 590	MAT3680
	CALL INTEG (PFF,KNW,K1,I7,IJ,P2,L1)	MAT3690
	GO TO 600	MAT3700
590	REF=RES	MAT3710
600	DO 620 KK=1,KNW	MAT3720
	KL=K1+KK	MAT3730
	KJ=KL+JPANFL	MAT3740

	IA=KL-LPANFL+JPANFL	MAT3750
	IR=KJ-LAST	MAT3760
	AA=1.	MAT3770
	DO 610 L=1,KNW	MAT3780
	LL=K1+L	MAT3790
	IF (L.EQ.KK) GO TO 610	MAT3800
	AA=AA*(XCP(IJ)-YV(LL))/(YV(KL)-XV(LL))	MAT3810
610	CONTINUE	MAT3820
	AW(IA)=AW(IA)-SUM1*AA-RES*AA*VM1*VM1*TEMP*2.	MAT3830
	AW(IR)=AW(IR)-SUM2*AA-REF*AA*2.	MAT3840
620	CONTINUE	MAT3850
	I7=I7+1	MAT3860
630	CONTINUE	MAT3870
640	CONTINUE	MAT3880
	SK=1.	MAT3890
	IF (IPHI.GT.*JH) SK=-1.	MAT3900
	JT=T-LAST+LPANFL	MAT3910
	K=MCON-LAST-NCJ(LN)+LPANFL	MAT3920
	JNJ=NCJ(LN)	MAT3930
	DO 660 KK=1,JNJ	MAT3940
	KL=K+KK	MAT3950
	KJ=KL+JPANFL	MAT3960
	IA=KL-LPANFL+JPANFL	MAT3970
	IR=KJ-LAST	MAT3980
	AA=1.	MAT3990
	DO 650 L=1,JNJ	MAT4000
	LL=K+L	MAT4010
	IF (L.EQ.KK) GO TO 650	MAT4020
	AA=AA*(XCP(JI)-YV(LL))/(YV(KL)-XV(LL))	MAT4030
650	CONTINUE	MAT4040
	AW(IR)=AW(IR)+AA*SK	MAT4050
660	AW(IA)=AW(IA)-AA*VM1*VM1*TEMP*SK	MAT4060
	IF (I.EQ.MCON.AND.I.LT.LTOTAL) MCON=MCON+NCJ(LN1)	MAT4070
	IF (KCODE.EQ.0) GO TO 750	MAT4080
	IF (IUSR.NF.0.AND.7JET.GT.0.01) GO TO 750	MAT4090
	IF (NNJ.EQ.1) GO TO 750	MAT4100
	IF (IJ.GT.MJJ(N1)) GO TO 750	MAT4110
	IF (IPHI.LE.NJH) GO TO 750	MAT4120
	L1=NJH	MAT4130
	IF (ISYM.EQ.0) L1=NJH+1	MAT4140
	IF (NW(2).EQ.0) GO TO 680	MAT4150
	IF (NW(3).EQ.0) GO TO 670	MAT-160
	IF (IJ.GT.MJJ(N2)) GO TO 710	MAT4170
	IF (IJ.GT.MJJ(N3)) GO TO 700	MAT4180
	IF (NNJ.EQ.4) GO TO 690	MAT4190
	IF (NNJ.EQ.5.AND.IJ.GT.MJJ(NJ-4)) GO TO 690	MAT4200
	GO TO 750	MAT4210
670	IF (IJ.GT.MJJ(N2)) GO TO 700	MAT4220
	IF (NNJ.EQ.3) GO TO 690	MAT4230

	IF (NNJ.EQ.4.AND.IJ.GT.MJJ(N3)) GO TO 690	MAT4240
	GO TO 750	MAT4250
680	IF (NNJ.EQ.2) GO TO 690	MAT4260
	IF (NNJ.EQ.3.AND.IJ.GT.MJJ(N2)) GO TO 690	MAT4270
	GO TO 750	MAT4280
690	K1=MJW1(1.NJP)*(IPHI-L1-ISYM)*NW(1)-1	MAT4290
	KNW=NW(1)	MAT4300
	GO TO 720	MAT4310
700	K1=MJW1(2.NJP)*(IPHI-L1-ISYM)*NW(2)-1	MAT4320
	KNW=NW(2)	MAT4330
	GO TO 720	MAT4340
710	K1=MJW1(3.NJP)*(IPHI-L1-ISYM)*NW(3)-1	MAT4350
	KNW=NW(3)	MAT4360
720	DO 740 KK=1,KNW	MAT4370
	KL=K1+KK	MAT4380
	JA=KL+2*JPANEL	MAT4390
	AA=1.	MAT4400
	DO 730 L=1,KNW	MAT4410
	LL=K1+L	MAT4420
	IF (L.EQ.KK) GO TO 730	MAT4430
	AA=AA*(XCP(IJ)-YV(LL))/(YV(KL)-YV(LL))	MAT4440
730	CONTINUE	MAT4450
740	AW(JA)=AW(JA)-AA*VMU*VMU*TEMP*0.5	MAT4460
750	CONTINUE	MAT4470
	IF (KCODE.EQ.0) GO TO 790	MAT4480
	IF (ZJET.GT.0.01) GO TO 790	MAT4490
	IF (DFJ.LE.0.0001) GO TO 790	MAT4500
	IF (NNJ.EQ.1) GO TO 760	MAT4510
	IF (IJ.LE.MJJ(N1)) GO TO 790	MAT4520
760	CONTINUE	MAT4530
	IF (IPHI.EQ.NJH) GO TO 790	MAT4540
	IF (ISYM.NE.0.AND.IPHI.EQ.1) GO TO 790	MAT4550
	DO 780 J=1,JPANEL	MAT4560
	JJ=J+JPANEL	MAT4570
	IF (IISP.EQ.2) GO TO 770	MAT4580
	SV(J)=-AW(JJ)	MAT4590
	GO TO 780	MAT4600
770	SV(J)=-AW(JJ)/(TEMP*VMU*VMU)	MAT4610
	AW(JJ)=0.	MAT4620
780	CONTINUE	MAT4630
	WRITE (02) (SV(J),J=1,JPANEL)	MAT4640
790	CONTINUE	MAT4650
	VMU=VIJT	MAT4660
	TEMP=TFM	MAT4670
	RETURN	MAT4680
C		MAT4690
	END	MAT4700
	SUBROUTINE SKIP (I,JPANEL)	SKP 10
	DIMENSION DUMMY(200)	SKP 20

	IF (I.EQ.0) GO TO 20	SKP	30
	DO 10 J=1,I	SKP	40
	READ (02) (DUMMY(K),K=1,JPANFL)	SKP	50
10	CONTINUE	SKP	60
20	RETURN	SKP	70
	END	SKP	80.
	OVERLAY (HISRTCF,4.0)	SOL	10
	PROGRAM SOLJTA	SOL	20
C	TO SOLVE THE JET ON AND JET OFF EQUATIONS	SOL	30
C		SOL	40
C	*** GAMMA MUST BE DIMENSIONED TO HAVE AT LEAST (N+1)**2/4 ELEMENTS,	SOL	50
C	WHERE N IS THE SIZE OF THE MATRIX ***	SOL	60
	DIMENSION GAMMA(15010)	SOL	70
C		SOL	80
	DIMENSION AW(301), CA(300)	SOL	90
	DIMENSION GAMVP(300), PHIN(250)	SOL	100
	COMMON /CODE/ KCODE	SOL	110
	COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41),	SOL	120
	IXLL(41)	SOL	130
	COMMON /GFOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTSOL	SOL	140
	IF(50),PSI(20),CH(95),XV(200),YV(100),SN(8,8),XN(200,2),YN(200,2),ZSOL	SOL	150
	ZN(200,2),WIDTH(8),YCON(25),SWEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95	SOL	160
	3,2),SC(160,5),SI(160,5),LC(3)	SOL	170
	COMMON /PAPAN/ ALPT,ALPC,ALPS,CDF,SDF,TH,TDF,NGPD,HEIGHT,ATT	SOL	180
	COMMON /AERO/ AM1,AM2,P1,P2,CL(30),CT(30),CD(30),GAM(2,100)	SOL	190
	COMMON /ADD/ CP(100),CM(30),PBFAK(8),SWP(8,15),GAL(30),ISYM,VMU,VUSOL	SOL	200
	1,TEMP,FCP,CAMLEP,CAMLET,CAMTER,CAMTET,XJ,YJ,ZJ,PJ,ALP,CREF,TWISTP	SOL	210
	COMMON /CONST/ NCS,NCW,M1(8),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JSOL	SOL	220
	IPANFL,MJJ(5),NW(3),NNJ,NJP	SOL	230
	COMMON /COST/ LTOTAL,LPAN1,MJW(5),LPANFL,IFENTN,LPAN2,EXIT,PTIAL,TWSOL	SOL	240
	1IST,DF(5),NEP	SOL	250
	EQUIVALENCE (X(1,1),PHIN(1))	SOL	260
	DEFIND 01	SOL	270
	DEFIND 02	SOL	280
	IHSR=YCON(24)	SOL	290
	NC=IFENTN	SOL	300
	ZZ=YCON(25)	SOL	310
	ITT=YCON(23)	SOL	320
	IC=1	SOL	330
	J1=LPANFL+1	SOL	340
	LP1=LTOTAL+1	SOL	350
	RR=R1	SOL	360
	DFJ=CDF	SOL	370
	NA=3	SOL	380
	IF (NW(2).EQ.0) NA=1	SOL	390
	IF (NW(2).NE.0.AND.NW(3).EQ.0) NA=2	SOL	400
10	CONTINUE	SOL	410
	IG=1	SOL	420
	MG=NW(1)	SOL	430

	NG=NW(1)	SOL 440
	READ (01) (AW(I),I=1,J1)	SOL 450
	XR=YCP(I)	SOL 460
	YR=YCP(I)	SOL 470
	PHRV=0.	SOL 480
	IF (IHSP.NE.0.AND.ITN.EQ.0) GO TO 20	SOL 490
	CALL INDVFL (XR,YR,XJ,YJ,ZJ,PJ,PP,PHRV,PHX,TEMP,VU,PHY,ISYM,NGPD,HSOL	SOL 500
	IFIGHT)	SOL 510
20	CONTINUE	SOL 520
	AW(J1)=AW(J1)+XTT(IG)+PHRV/(ALPC*VU)	SOL 530
	DO 30 I=1,LPANFL	SOL 540
30	GAMMA(I)=-AW(I+1)/AW(I)	SOL 550
	NJ=LPANFL-1	SOL 560
	DO 40 IJ=2,LPANFL	SOL 570
	READ (01) (AW(K),K=1,J1)	SOL 580
	XR=YCP(IJ)	SOL 590
	YR=YCP(IJ)	SOL 600
	IF (IHSP.NE.0.AND.ITN.EQ.0) GO TO 40	SOL 610
	CALL INDVFL (XR,YR,XJ,YJ,ZJ,RJ,PP,PHRV,PHX,TEMP,VU,PHY,ISYM,NGPD,HSOL	SOL 620
	IFIGHT)	SOL 630
40	CONTINUE	SOL 640
	AW(J1)=AW(J1)+XTT(IG)+PHRV/(ALPC*VU)	SOL 650
	IK=IJ	SOL 660
	CALL VMSEFN (NJ,IK,AW,GAMMA,CA)	SOL 670
	NJ=NJ-1	SOL 680
	IF (IJ.GE.LPAN1.AND.IJ.LT.LPAN2) NG=NW(2)	SOL 690
	IF (IJ.GE.LPAN2.AND.IJ.LT.LPANFL) NG=NW(3)	SOL 700
	IF (IJ.LT.MG) GO TO 50	SOL 710
	IG=IG+1	SOL 720
	MG=MG+NG	SOL 730
50	IF (IJ.EQ.LPAN1.OR.IJ.EQ.LPAN2) IC=1	SOL 740
60	CONTINUE	SOL 750
	DO 70 I=1,LPANFL	SOL 760
70	GAM(IG,I)=GAMMA(I)	SOL 770
	IF (ABS(R1-R2).LE.0.001) GO TO 80	SOL 780
	IC=IC+1	SOL 790
	RR=RR	SOL 800
	IF (IC.GT.2) GO TO 80	SOL 810
	GO TO 10	SOL 820
80	CONTINUE	SOL 830
	VMUC=VMU*ALPC	SOL 840
	IPHI=1	SOL 850
	MJ=LPANFL+NCJ(1)	SOL 860
	INM=1	SOL 870
	JNM=1	SOL 880
	I=LAST+1	SOL 890
	READ (01) (AW(K),K=1,LTOTAL)	SOL 900
	CALL STREAM (ALPHA,VMUC,I,IPHI,LPANFL,TEMP,LPAN1,LPAN2,ISYM,KCODE,SOL	SOL 910
	IFX(IT,MJ,PHIN)	SOL 920

	AW(LP1)=ALPHA	SOL 930
	DO 90 I=1,LTOTAL	SOL 940
90	GAMMA(I)=-AW(I+1)/AW(I)	SOL 950
	KI=2	SOL 960
	NI=LTOTAL-1	SOL 970
	LI=LAST+2	SOL 980
	IH=NW(MA)+MJWI(MA,MJP)-1	SOL 990
100	KJ=LI	SOL1000
	IF (LI.GT.LAST) KJ=LI-JPANFL	SOL1010
	OFAD (01) (AW(K),K=1,LTOTAL)	SOL1020
	CALL STPFAM (ALPHA,VMUIC,LI,IPHI,LPANEL,TEMP,LPAN1,LPAN2,ISYM,KCODE	SOL1030
	1,EXIT,MJ,PHIN)	SOL1040
	IF (KCODE.EQ.0) GO TO 120	SOL1050
	IF (77.GE.0.01) GO TO 120	SOL1060
C	ADDITIONAL EXTERNAL FLOW DEFLECTION IS ALLOWED IF THE JET ANGLE IS	SOL1070
C	GREATER THAN THE FLAP ANGLE BECAUSE OF THE EFFECT OF FINITE TRAI-	SOL1080
C	LING-EDGE ANGLES. FOR THIN AIRFOILS, THIS CAN BE ELIMINATED BY	SOL1090
C	INSERTING THE STATEMENT, IF (KCODE.EQ.1) GO TO 63	SOL1100
	IF (LI.GE.MJWI(MA,MJP).AND.LI.LE.MJW2(MA,MJP)) GO TO 110	SOL1110
	GO TO 120	SOL1120
110	IF (LI.NE.IH) GO TO 120	SOL1130
	IF ((DFJ-TDF).LT.0.) GO TO 120	SOL1140
	C7T=CAMTER-(CAMTER-CAMTET)*YCP(LI)/HALFR	SOL1150
	APA=0.5*(DFJ-TDF+C7T)	SOL1160
	IF (VMU.GT.0.95) APA=APA*(1.-VMU)/0.15	SOL1170
	IF (APA.LT.0.) APA=0.	SOL1180
	ALPHA=ALPHA+APA	SOL1190
	IH=IH+NW(MA)	SOL1200
120	CONTINUE	SOL1210
	AW(LP1)=ALPHA	SOL1220
	CALL VMSEQN (NI,KI,AW,GAMMA,CA)	SOL1230
	IF (KJ.LT.MJ.OP,KJ.EQ.LAST) GO TO 130	SOL1240
	IPHI=IPHI+1	SOL1250
	MJ=MJ+MCJ(INN)	SOL1260
130	CONTINUE	SOL1270
	MJI=MJJ(INN)-1	SOL1280
	IF (KJ.EQ.MJI) GO TO 140	SOL1290
	GO TO 150	SOL1300
140	JNA=INN	SOL1310
	INN=INN+1	SOL1320
150	IF (KJ.EQ.MJJ(JNA)) IPHI=1	SOL1330
	IF (LI.EQ.LTOTAL) GO TO 160	SOL1340
	GO TO 170	SOL1350
160	CONTINUE	SOL1360
	IPHI=1	SOL1370
	MJ=LPANEL+MCJ(1)	SOL1380
	JNN=1	SOL1390
	INN=1	SOL1400
170	CONTINUE	SOL1410

	KI=KI+1	SOL1420
	NJ=NJ-1	SOL1430
	IF (LI.EQ.LTOTAL) GO TO 180	SOL1440
	IF (LI.EQ.LAST) GO TO 190	SOL1450
	LI=LI+1	SOL1460
	GO TO 200	SOL1470
180	LI=LPAFEL+1	SOL1480
	GO TO 200	SOL1490
190	LI=1	SOL1500
200	CONTINUE	SOL1510
	IF (KI.LE.LTOTAL) GO TO 100	SOL1520
	IA=2*JPANEL	SOL1530
	JPAF1=JPANEL+1	SOL1540
	IA1=IA+1	SOL1550
	DO 210 I=1,LTOTAL	SOL1560
210	GAMMA(I)=GAMMA(I)	SOL1570
	DO 220 I=IA1,LTOTAL	SOL1580
	J=I-IA	SOL1590
220	GAMMA(I)=(GAMMA(I)+GAM(1,J))*AIDC	SOL1600
	WRITE (02) (GAMMA(I),I=1,LTOTAL)	SOL1610
	IF (IUSR.NE.0.AND.ITN.EQ.0) GO TO 270	SOL1620
	IG=1	SOL1630
	MG=MW(1)	SOL1640
	NG=NW(1)	SOL1650
	REWIND 01	SOL1660
	READ (01) (AW(I),I=1,J1)	SOL1670
	AW(J1)=AW(J1)+XTT(IG)	SOL1680
	DO 230 I=1,LPAFEL	SOL1690
230	GAMMA(I)=-AW(I+1)/AW(1)	SOL1700
	NJ=LPAFEL-1	SOL1710
	DO 250 IJ=2,LPAFEL	SOL1720
	READ (01) (AW(K),K=1,J1)	SOL1730
	AW(J1)=AW(J1)+XTT(IG)	SOL1740
	IK=IJ	SOL1750
	CALL VMSEGM (NJ,IK,AW,GAMMA,CA)	SOL1760
	NJ=NJ-1	SOL1770
	IF (IJ.GE.LPAF1.AND.IJ.LT.LPAF2) NG=NW(2)	SOL1780
	IF (IJ.GE.LPAF2.AND.IJ.LT.LPAFEL) NG=NW(3)	SOL1790
	IF (IJ.LT.MG) GO TO 240	SOL1800
	IG=IG+1	SOL1810
	MG=MG+NG	SOL1820
240	IF (IJ.EQ.LPAF1.OR.IJ.EQ.LPAF2) IG=1	SOL1830
250	CONTINUE	SOL1840
	DO 260 I=1,LPAFEL	SOL1850
260	GAM(2,I)=GAMMA(I)	SOL1860
	GO TO 290	SOL1870
270	DO 280 I=1,LPAFEL	SOL1880
280	GAM(2,I)=GAM(1,I)	SOL1890
290	CONTINUE	SOL1900

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CAM=CAMLEP                                SOL1910
CAMT=CAMLET                                SOL1920
CALL TRPHST (LTOTAL,LPANEL,CAMVR,CAM,LPAN1,MJ,XJ,YJ,ZJ,PJ,TFMP,GAL SOL1930
1,ISYM,LPAN2,CAMT)                        SOL1940
DO 300 I=1,LPANEL                          SOL1950
  IP=I+TA                                    SOL1960
  IC=1                                        SOL1970
300  GAMVR(I)=CAMVR(IP)+GAM(IC,I)           SOL1980
DO 310 I=1,LPANEL                          SOL1990
310  CP(I)=GAMVR(I)*2.*ALPC                SOL2000
      C(I)=YCON(22)                         SOL2010
      RETURN                                 SOL2020
C                                            SOL2030
      END                                    SOL2040
SUPROTIME STREAM (ALPHA,VMH,J,TPHT,LPANEL,TEMP,LPAN1,LPAN2,ISYM,KSTP 10
1CODE,EXIT,MJ,PHIN)                        STR 20
C TO COMPUTE THE RIGHT HAND SIDE OF THE SIMULTANEOUS EQUATIONS      STR 30
  DIMENSION PHIN(1)                         STR 40
  COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41),STR 50
  1XLL(41)                                   STR 60
  COMMON /GEOM/ HALF5W,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTSTR 70
  1F(50),PSI(20),CH(95),XV(200),YV(100),SM(R,R),XN(200,2),YN(200,2),ZSTR 80
  2N(200,2),WIDTH(R),YCON(25),SHEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95STR 90
  3,2),SC(160,5),ST(160,5),LC(3)           STR 100
  COMMON /AERO/ AM1,AM2,P1,P2,CL(30),CT(30),CP(30),GAM(2,100)     STR 110
  COMMON /CONST/ ACS,NCW,M1(R),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JSTR 120
  1PANEL,MJJ(5),MW(3),MNJ,MNJ
  COMMON /PARAM/ ALPT,ALPC,ALPS,CPF,SDF,TH,TRF,NGPD,HEIGHT,ATT     STR 130
  PI=3.14159265                             STR 140
  IHSP=YCON(24)                              STR 150
  ZJET=YCON(25)                              STR 160
  CMH=C(1)                                   STR 170
  IF (IHSP.EQ.2) VMH=0.                      STR 180
  N1=MNJ-1                                   STR 190
  N2=MNJ-2                                   STR 200
  N3=MNJ-3                                   STR 210
  IF (MNJ.EQ.1) N1=1                          STR 220
  MJH=(NSJ+11)/2+1                           STR 230
  IF (ISYM.EQ.0) MJH=NSJ/2                   STR 240
  NP=MJH-1                                   STR 250
  IF (ISYM.EQ.0) NP=MJH                       STR 260
  ALPHA=0.                                    STR 270
  IF (I.GT,LPANEL) GO TO 10                  STR 280
  GO TO 230                                   STR 290
10  IF (I.GT,LAST) GO TO 110                  STR 300
  IF (EXIT.LE,0.001) GO TO 20                STR 310
  IF (MNJ.EQ.1) GO TO 20                      STR 320
  IF (I.LE,MJJ(1).AND,I.NE,MJ) GO TO 230     STR 330
20  CONTINUE                                  STR 340

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	ALPHA=ALOT*Y(3,TPHT)*(1.-VMU)	STR 360
	IF (KCODE.EQ.0) ALPHA=0.	STR 370
	IF (TH.LE.0.001) GO TO 30	STR 380
	IF (TPHI.EQ.NUH) GO TO 30	STR 390
	IF (ISYM.NE.0.AND.TPHI.EQ.1) GO TO 30	STR 400
	IF (MNU.EQ.1.AND.I.GT.LPANEL) ALPHA=ALPHA+CDE*(1.-VMU)	STR 410
30	IF (MNU.NE.1.AND.I.GT.MJU(M1)) ALPHA=ALPHA+CDE*(1.-VMU)	STR 420
	CONTINUE	STR 430
	IF (IUSR.EQ.2) GO TO 40	STR 440
	IF (ABS(P1-P2).LE.0.001) GO TO 50	STR 450
40	CONTINUE	STR 460
	CALL MCRSPD (I,ALPH,LPANEL,TPHI,LPANI,LPAN2,NGFD,HEIGHT,ATT)	STR 470
	ALPHA=ALPHA*ALPH	STR 480
50	IF (KCODE.EQ.0) GO TO 230	STR 490
	IF (EXIT.LE.0.001) GO TO 60	STR 500
	IF (MNU.EQ.1) GO TO 60	STR 510
	IF (I.LE.MJU(1).AND.I.EQ.MJ) ALPHA=ALPHA/2.	STR 520
60	IF (TPHI.EQ.NUH) GO TO 230	STR 530
	IF (ISYM.NE.0.AND.TPHI.EQ.1) GO TO 230	STR 540
	IF (IUSR.NE.0.AND.7JFT.GT.0.01) GO TO 230	STR 550
	IF (CDE.LT.0.0001) GO TO 230	STR 560
	IF (MNU.EQ.1) GO TO 70	STR 570
	IF (I.LE.MJU(M1)) GO TO 230	STR 580
70	IF (TPHI.LT.NUH) TL=TPHI+ISYM	STR 590
	IF (TPHI.GT.NUH) TL=TPHI-NUH+ISYM	STR 600
	IF (MNU.EQ.1) MJN1=LPANEL	STR 610
	IF (MNU.NE.1) MJN1=MJU(M1)	STR 620
	MF=I-MJN1-(TPHT-1)*NCJ(MNU)	STR 630
	FNNJ=NCJ(MNU)	STR 640
	RISTJ=SCF	STR 650
	DLX=RISTJ*0.5*BT/FNNJ	STR 660
	S7X=(1.-VMU)	STR 670
	TC=(TL-1)*NCJ(MNU)	STR 680
	IF (MNU.EQ.1) TC=LPANEL+TC+1	STR 690
	IF (MNU.NE.1) TC=MJU(M1)+TC+1	STR 700
	DO 100 JJ=1,MF	STR 710
	IF (JJ.EQ.MF) GO TO 80	STR 720
	IF (IUSR.EQ.2) DXTM=DLX*BST(JJ)*2./CMU	STR 730
	IF (IUSR.NE.2) DXTM=DLX*BST(JJ)*TFMP*VMU*VMU/TH	STR 740
	GO TO 90	STR 750
80	IF (IUSR.EQ.2) DXTM=DLX*BST(JJ)*2.*0.5/CMU	STR 760
	IF (IUSR.NE.2) DXTM=DLX*BST(JJ)*TFMP*VMU*VMU/180.5/TH	STR 770
90	JK1=TP+JJ	STR 780
	JK2=JK1-1	STR 790
	PROR=S7X*DXTM	STR 800
	JK3=JK2+NP*NCJ(MNU)	STR 810
	ALPHA=ALPHA+PROR*(PHIN(JK2)-PHIN(JK3))	STR 820
100	CONTINUE	STR 830
	GO TO 230	STR 840

110	CONTINUE	STR 850
	IJ=I-JPANEL	STR 860
	IF (KCCDF.EQ.0) GO TO 210	STR 870
	IF (EXIT.LF.0.01) GO TO 120	STR 880
	IF (NNJ.EQ.1) GO TO 120	STR 890
	IF (IJ.GT.LPANEL.AND.IJ.LE.MJU(1)) GO TO 230	STR 900
120	CONTINUE	STR 910
	IF (IUSR.NE.0.AND.7JET.GT.0.01) GO TO 210	STR 920
	IF (NNJ.EQ.1) GO TO 210	STR 930
	IF (IJ.GT.MJU(N1)) GO TO 210	STR 940
	IF (IPHI.LE.NJH) GO TO 210	STR 950
	L1=NJH	STR 960
	IF (ISYM.EQ.0) L1=NJH+1	STR 970
	IF (NW(2).EQ.0) GO TO 140	STR 980
	IF (NW(3).EQ.0) GO TO 130	STR 990
	IF (IJ.GT.MJU(N2)) GO TO 170	STR1000
	IF (IJ.GT.MJU(N3)) GO TO 160	STR1010
	IF (NNJ.EQ.4) GO TO 150	STR1020
	IF (NNJ.EQ.5.AND.IJ.GT.MJU(NNJ-4)) GO TO 150	STR1030
	GO TO 210	STR1040
130	IF (IJ.GT.MJU(N2)) GO TO 160	STR1050
	IF (NNJ.EQ.3) GO TO 150	STR1060
	IF (NNJ.EQ.4.AND.IJ.GT.MJU(N3)) GO TO 150	STR1070
	GO TO 210	STR1080
140	IF (NNJ.EQ.2) GO TO 150	STR1090
	IF (NNJ.EQ.3.AND.IJ.GT.MJU(N2)) GO TO 150	STR1100
	GO TO 210	STR1110
150	K1=MJW(1,NJP)+(IPHI-L1-ISYM)*NW(1)-1	STR1120
	K2=LC(1)+IPHI-L1-ISYM	STR1130
	KNW=NW(1)	STR1140
	GO TO 190	STR1150
160	K1=MJW(2,NJP)+(IPHI-L1-ISYM)*NW(2)-1	STR1160
	K2=LC(2)+IPHI-L1-ISYM	STR1170
	KNW=NW(2)	STR1180
	GO TO 190	STR1190
170	K1=MJW(3,NJP)+(IPHI-L1-ISYM)*NW(3)-1	STR1200
	K2=LC(3)+IPHI-L1-ISYM	STR1210
	KNW=NW(3)	STR1220
180	CONTINUE	STR1230
	ALPHA1=0.	STR1240
	ALPHA2=0.	STR1250
	DO 200 KK=1,KNW	STR1260
	KL=K1+KK	STR1270
	AA=1.	STR1280
	DO 190 L=1,KNW	STR1290
	LL=K1+L	STR1300
	IF (L.EQ.KK) GO TO 190	STR1310
	AA=AA*(XCP(IJ)-XV(LL))/(XV(KL)-XV(LL))	STR1320
190	CONTINUE	STR1330

	ALPHA1=ALPHA1+AA*CAM(1,KL)	STR1340
	IF (ABS(R1-R2).LE.0.001) GO TO 200	STR1350
	ALPHA2=ALPHA2+AA*CAM(2,KL)	STR1360
200	CONTINUE	STR1370
	IF (ABS(R1-R2).LE.0.001) ALPHA2=ALPHA1	STR1380
	ALPHA=(ALPHA2-TEMP*VMI)*VMI*ALPHA1)*0.5	STR1390
	GO TO 230	STR1400
210	CONTINUE	STR1410
	CALL SFFFD (VMI,T,ALPHA,LPANFL,TEMP,LPAN1,LPAN2,PHIS,IPHI,ISYM,NGR	STR1420
	10,HEIGHT)	STR1430
	IF (THSP,EO.2) ALPHA=0.	STR1440
	IF (KCODE,EO.0) GO TO 230	STR1450
	IF (CDF,LT.0.0001) GO TO 230	STR1460
	IF (NMJ,EO.1) GO TO 220	STR1470
	IF (TJ,LE,MJJ(N1)) GO TO 230	STR1480
220	PHIN(TJ)=PHIS	STR1490
230	CONTINUE	STR1500
	RETURN	STR1510
C	END	STR1520
		STR1530
	SUBROUTINE THRUST (LTOTAL,LPANFL,GAMMA,CAM,LPAN1,VMI,XJ,YJ,ZJ,PJ,TTHR	THR 10
	1,GAL,ISYM,LPAN2,CAMLET)	THR 20
C	TO EVALUATE THE LEADING EDGE THRUST	THR 30
	DIMENSION GAMMA(1), GAL(1)	THR 40
	COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41),	THR 50
	IXLL(41)	THR 60
	COMMON /GEOM/ HALFSW,YCP(200),YCP(200),ZCP(200),XLF(50),YLE(50),XTTHR	THR 70
	IF(50),PSI(20),CH(95),XV(200),YV(100),SM(2,P),XM(200,2),YN(200,2),ZTHR	THR 80
	2N(200,2),WIDTH(P),YCON(25),SWEEP(50),HALFR,SJ(21,8),FX(95,2),TX(95THR	THR 90
	3,2),SC(160,5),SI(160,5),LC(3)	THR 100
	COMMON /AFRO/ AN1,AN2,P1,P2,CL(30),CT(30),CD(30),CAM(2,100)	THR 110
	COMMON /CONST/ NCS,NCW,N1(P),TSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JTHR	THR 120
	IPANFL,MJJ(5),NM(3),NMJ,MJP	THR 130
	COMMON /PAPAN/ ALPT,ALPC,ALPS,CDF,SDF,TH,TOF,NGRD,HEIGHT,ATT	THR 140
	PI=3.14159265	THR 150
	LG=1	THR 160
	IF (NGRD,EO.1) LG=2	THR 170
	CAMLEO=CAM	THR 180
	CN=NM(1)	THR 190
	THSP=YCON(24)	THR 200
	ITN=YCON(23)	THR 210
	DO 240 I=1,NCS	THR 220
	FCOS=COS(SWEEP(I))	THR 230
	FTAN=TAN(SWEEP(I))	THR 240
	NK=T*NM(I)	THR 250
	IF (NM(2),EO.0) GO TO 20	THR 260
	IT=I+NCS	THR 270
	IF (NM(3),EO.0) GO TO 10	THR 280
	CHL=CH(I)+CH(IT)	THR 290

	GO TO 20	THR 300
10	III=II+NCS	THR 310
	CHI=CH(I)+CH(II)+CH(III)	THR 320
	GO TO 30	THR 330
20	CHI=CH(I)	THR 340
30	CONTINUE	THR 350
	SRT=SQRT(CH(I)/CHI)	THR 360
	RR=PI	THR 370
	IC=1	THR 380
	TZ=1	THR 390
	MM=0	THR 400
	ISN=1	THR 410
	NN=NN(1)	THR 420
	KD=1+(T-1)*NW(1)	THR 430
	NL=NW(1)	THR 440
	PC=0.	THR 450
	A=0.	THR 460
	DO 110 NN=1,LPANFL	THR 470
	J=NN-MM	THR 480
	FN=NL	THR 490
	IF (NN.GE.LPAN1.AND.NN.LT.LPANFL) GO TO 40	THR 500
	GO TO 50	THR 510
40	NL=NW(2)	THR 520
	IF (NN.GE.LPAN2.AND.NN.LT.LPANFL) NL=NW(3)	THR 530
	IF (NN.GT.LPAN1.AND.NN.LE.LPAN2) ISN=2	THR 540
	IF (NN.GT.LPAN2.AND.NN.LE.LPANFL) ISN=3	THR 550
50	CONTINUE	THR 560
	X1=XN(NN,1)-YLF(T)	THR 570
	X2=XN(NN,2)-XLF(T)	THR 580
	X12=XN(NN,2)-XN(NN,1)	THR 590
	Y12=YN(NN,2)-YN(NN,1)	THR 600
	Z12=0.	THR 610
	DO 100 K=1,2	THR 620
	IF (K.EQ.1) GO TO 60	THR 630
	N1=1	THR 640
	GO TO 70	THR 650
60	N1=2	THR 660
70	CONTINUE	THR 670
	YC=YLF(T)*(-1)**N1	THR 680
	Y1=YN(NN,1)-YC	THR 690
	Y2=YN(NN,2)-YC	THR 700
	YYK=Y1*Y12-Y1*Y12	THR 710
	DO 100 KK=1,LC	THR 720
	IF (KK.EQ.1) GO TO 80	THR 730
	GF=-1.	THR 740
	ZC=-2.*(ZCP(KK)+HEIGHT)+ZCP(KD)	THR 750
	FCCN=1.	THR 760
	GO TO 90	THR 770
80	GF=1.	THR 780

	ZC=7C0 (X0)	THR 790
	FCON=0.	THR 800
90	Z1=7N(MM.1)-ZC	THR 810
	Z2=7N(MM.2)-ZC	THR 820
	X7J=X1*Z1Z-71*X1Z	THR 830
	UCCN=-71*Y1Z*(-ATT)*FCON	THR 840
	Y7I=Y1*Z1Z-71*Y1Z	THR 850
	ALP1=XVK*XYK+X7J*X7J+PF*Y7I*Y7I	THR 860
	P1=SQRT(X1*X1+PP*Y1*Y1+FF*Z1*Z1)	THR 870
	P2=SQRT(X2*X2+PP*Y2*Y2+FF*Z2*Z2)	THR 880
	U(JP)=(Y2*X1Z+PP*Y2*Y1Z+PP*Z2*Z1Z)/P2-(X1*X1Z+PP*Y1*Y1Z+PP*Z1*Z1Z)/P1	THR 890
	101	THR 900
	G1=(1.-Y1/P1)/(Y1*Y1+Z1*Z1)	THR 910
	G2=(1.-Y2/P2)/(Y2*Y2+Z2*Z2)	THR 920
	F1=(HHR)*(UCCN+XVK)*GF/ALP1	THR 930
	F2=(-Y2*G2+Y1*G1)*GF	THR 940
	RC=PC*(F1+F2)*SN(J,JSN)*GAM(Z,MM)*CH(T7)/FN	THR 950
100	A=A*(F1+F2)*SN(J,JSN)*GAM(TC,MM)*CH(T7)/FN	THR 960
	IF (MM.LT.NM.OR.MM.EQ.LPANEL) GO TO 110	THR 970
	I7=I7+1	THR 980
	MM=MM	THR 990
	NN=MM*NL	THR1000
110	CONTINUE	THR1010
	CAMLF=CAMLER-(CAMLER-CAMLET)*YLF(I)/HALFR	THR1020
	A=A/P.+XTT(I)-CAMLF	THR1030
	XR=YLF(I)	THR1040
	YP=YLF(I)	THR1050
	PHRV=0.	THR1060
	IF (THSR.NE.0.AND.ITN.EQ.0) GO TO 120	THR1070
	CALL INDEVL (XP.YP.XJ.YJ.7J.PJ.P1.PHRV.PHY.T.VNU.PHY.ISYM.NGRD.HEI	THR1080
	108T)	THR1090
120	CONTINUE	THR1100
	A=A+PHRV/(ALPC*UM(I))	THR1110
	A=A*SPT	THR1120
	THPT1=A/(CN*SQRT(FTAN*FTAN+FF))	THR1130
	XTE(I)=(PI/Z.)*SQRT(1.-AM)*AM)*FCOS*FCOS)*THPT1*THPT1/FCOS	THR1140
	PC=PC/P.+XTT(I)-CAMLF	THR1150
	RC=PC*SPT	THR1160
	THP=RC/(CN*SQRT(FTAN*FTAN+FF))	THR1170
	X(F,I)=(PI/Z.)*SQRT(1.-AM)*AM)*FCOS*FCOS)*THP*THP/FCOS	THR1180
	NN=NW(I)	THR1190
	IND=1	THR1200
	ISN=1	THR1210
	L1=L.PANEL+1	THR1220
	SK=1.	THR1230
	I7=1	THR1240
	MM=0	THR1250
	II=NW(I)	THR1260
	A=0.	THR1270

	FACTOR=1.	THR1290
	AM=AM1	THR1290
	BR=BI	THR1300
	CONV=AI,PC	THR1310
	DO 230 NN=1, LAST	THR1320
	IF (NN.GT.LPANFL) NA=NN-LPANFL+JPANFL	THR1330
	IF (NN.LF.LPANFL) NA=NN+2*JPANFL	THR1340
	FN=II	THR1350
	IF (NN.GT.LPAN1.AND.NN.LF.LPAN2) ISN=2	THR1360
	IF (NN.GT.LPAN2.AND.NN.LF.LPAN1) ISN=3	THR1370
	IF (NN.GF.LPAN1.AND.NN.LT.LPAN1) GO TO 130	THR1380
	GO TO 140	THR1390
130	IT=NM(2)	THR1400
	IF (NN.GF.LPAN2.AND.NN.LT.LPAN1) IT=NM(3)	THR1410
140	CONTINUE	THR1420
	IF (NN.GF.LPAN1.AND.NN.LT.MJJ(IND)) IT=NCJ(IND)	THR1430
	J=NN-MM	THR1440
	CHORD=CH(I7)	THR1450
	IF (NN.EQ.L1) GO TO 150	THR1460
	GO TO 160	THR1470
150	ISN=ISN+1	THR1480
	LI=MJJ(IND)+1	THR1490
160	NL=MJJ(IND)-1	THR1500
	IF (NN.EQ.NL) IND=IND+1	THR1510
	IF (NN.GT.LPANFL) FACTOR=0.5	THR1520
	X1=XN(NN.1)-XLF(I)	THR1530
	X2=XN(NN.2)-XLF(I)	THR1540
	X12=XN(NN.2)-XN(NN.1)	THR1550
	Y12=YN(NN.2)-YN(NN.1)	THR1560
	Z12=ZN(NN.2)-ZN(NN.1)	THR1570
	DO 210 K=1,2	THR1580
	IF (K.EQ.1) GO TO 170	THR1590
	NI=1	THR1600
	GO TO 180	THR1610
170	NI=2	THR1620
180	CONTINUE	THR1630
	YC=YLF(I)*(-1)**NI	THR1640
	Y1=YN(NN.1)-YC	THR1650
	Y2=YN(NN.2)-YC	THR1660
	XVK=Y1*Y12-Y2*X12	THR1670
	DO 210 KK=1,LC	THR1680
	IF (KK.EQ.1) GO TO 190	THR1690
	GF=-1.	THR1700
	ZC=-2.*(ZCP(KP)+HEIGHT)+ZCP(KP)	THR1710
	FCCN=1.	THR1720
	GO TO 200	THR1730
190	GF=1.	THR1740
	ZC=ZCP(KP)	THR1750
	FCCN=0.	THR1760

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200  71=7N(NM.1)-7C                                THR1770
      72=7N(NM.2)-7C                                THR1780
      X7J=X1*712-71*Y12                            THR1790
      UCCM=-71*Y12*(-ATT)*SCOM                      THR1800
      Y7I=Y1*712-71*Y12                            THR1810
      ALPRIM=XYK*XYK+Y7J*X7J+PR*Y7I*Y7I          THR1820
      OXY71=SQRT(X1*X1+PR*Y1*Y1+PR*71*71)         THR1830
      OXY72=SQRT(X2*X2+PR*Y2*Y2+PR*72*72)         THR1840
      UUI=(X2*Y12+PR*Y2*Y12+PR*72*712)/RYV72-(X1*Y12+PR*Y1*Y12+PR*71*712) THR1850
      I/OXY71                                         THR1860
      GN1=(1.-X1/OXY71)/(Y1*Y1+71*71)             THR1870
      GN2=(1.-X2/OXY72)/(Y2*Y2+72*72)             THR1880
      F1=(UUI*(UCCM+XYK)*GF/ALPRIM                 THR1890
      F2=(GN1*Y1-GN2*Y2)*GF                        THR1900
210  A=A+(F1+F2)*SN(J.TSN)*CHORD*GAMMA(MA)/(R.*FN*FACTOR) THR1910
      IF (NM.LT.NM) GO TO 220                       THR1920
      I7=I7+1                                         THR1930
      NM=NM                                           THR1940
      NM=NM+II                                         THR1950
220  CONTINUE                                         THR1960
230  CONTINUE                                         THR1970
      A=ASST                                         THR1980
      THRT2=A/(CN*SQRT(FTAN*FTAN+PR))              THR1990
      THRT=(THRT1+THRT2)*CONV                       THR2000
      GAL(I)=2.*THRT/(SRT*CONV)                    THR2010
      CT(I)=(PI/2.)*SQRT(1.-AM*AN*FCOS*FCOS)+THRT*THRT/FCOS THR2020
240  CONTINUE                                         THR2030
      RETURN                                          THR2040
      END                                             THR2050
SUBROUTINE MORSPD (I,ALPH,LPANFL,IPHI,LPAN1,LPAN2,NGRD,HEIGHT,ATT)NRD 10
C TO COMPUTE THE INDUCED NORMAL VELOCITIES DUE TO WING ALONE NRD 20
C VORTICES NRD 30
COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPE(15),XL(2,15),XTT(41),NRD 40
IXLL(41) NRD 50
COMMON /GCOM/ HALES4,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTNRD 60
IF(50),PSI(20),CH(95),XV(200),YV(100),SN(8,8),XN(200,2),YN(200,2),7NRD 70
2N(200,2),WIDTH(8),YCON(25),SWEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95NRD 80
3,2),SC(160,5),ST(160,5),LC(3) NRD 90
COMMON /AERO/ AM1,AM2,S1,P2,CL(30),CT(30),CD(30),GAM(2,100) NRD 100
COMMON /CONST/ MCS,NC4,M1(8),MSJ,NCJ(5),LAST,MJU1(3,5),MJU2(3,5),JNRD 110
LPANFL,MJU(5),MW(3),NMJ,NJP NRD 120
NJP=(MSJ-1)/2 NRD 130
LG=1 NRD 140
TUSE=YCON(24) NRD 150
IF (NGRD.EQ.1) LG=2 NRD 160
I7=1 NRD 170
NM=0 NRD 180
NM=NM(1) NRD 190
ISN=1 NRD 200

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	NL=NM(1)	NRD 210
	A1=0.	NRD 220
	A2=0.	NRD 230
	DO 80 J=1,LPANEL	NRD 240
	JJ=J-MM	NRD 250
	FN=NL	NRD 260
	IF (J.GT.LPAN1.AND.J.LE.LPAN2) ISN=2	NRD 270
	IF (J.GT.LPAN2.AND.J.LE.LPANEL) ISN=3	NRD 280
	IF (J.GE.LPAN1.AND.J.LT.LPANEL) GO TO 10	NRD 290
	GO TO 20	NRD 300
10	NL=NM(2)	NRD 310
	IF (J.GE.LPAN2.AND.J.LT.LPANEL) NL=NM(3)	NRD 320
20	CONTINUE	NRD 330
	X1=YM(J.1)-XCP(I)	NRD 340
	X2=XN(J.2)-XCP(I)	NRD 350
	X12=XN(J.2)-XN(J.1)	NRD 360
	Y12=YM(J.2)-YM(J.1)	NRD 370
	Z12=0.	NRD 380
	DO 70 K=1,2	NRD 390
	IF (K.EQ.1) GO TO 30	NRD 400
	M=1	NRD 410
	GO TO 40	NRD 420
30	M=2	NRD 430
40	CONTINUE	NRD 440
	YC=(-1.)**M*YCP(I)	NRD 450
	Y1=YM(J.1)-YC	NRD 460
	Y2=YM(J.2)-YC	NRD 470
	XYK=X1*Y12-Y1*Y12	NRD 480
	DO 70 KK=1,LC	NRD 490
	IF (KK.EQ.1) GO TO 50	NRD 500
	CF=-1.	NRD 510
	ZC=-2.*(ZCP(I)+HEIGHT)+ZCP(I)	NRD 520
	FCCN=1.	NRD 530
	GO TO 60	NRD 540
50	CF=1.	NRD 550
	ZC=ZCP(I)	NRD 560
	FCCN=0.	NRD 570
60	Z1=ZM(J.1)-ZC	NRD 580
	Z2=ZM(J.2)-ZC	NRD 590
	X7J=X1*Z12-Z1*Y12	NRD 600
	UCCM=-Z1*Y12*(-ATT)*FCCN	NRD 610
	Y7I=Y1*Z12-Z1*Y12	NRD 620
	ALR1=XYK*XYK+X7J*X7J+R1*Y7I*Y7I	NRD 630
	R1R1=SQRT(Y1*X1+R1*Y1*Y1+R1*Z1*Z1)	NRD 640
	R2R1=SQRT(X2*X2+R1*Y2*Y2+R1*Z2*Z2)	NRD 650
	UUR1=(X2*Y12+R1*Y2*Y12+R1*Z2*Z12)/R2R1-(X1*Y12+R1*Y1*Y12+R1*Z1*Z12)/R1R1	NRD 660
	G1=(1.-X1/R1R1)/(Y1*Y1+Z1*Z1)	NRD 670
	G2=(1.-X2/R2R1)/(Y2*Y2+Z2*Z2)	NRD 680
		NRD 690

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ALP2=XYK*XYK+Y7J*X7J+P2*V7I*Y7I      NRD 700
P1P2=SQRT(X1*X1+P2*Y1*Y1+P2*71*71)     NRD 710
P2P2=SQRT(X2*X2+P2*Y2*Y2+P2*72*72)     NRD 720
IIIP2=(X2*Y12+P2*Y2*Y12+P2*72*712)/P2P2-(Y1*Y12+P2*Y1*Y12+P2*71*712NRD 730
1)/P1P2
G3=(1.-X1/P1P2)/(Y1*Y1+71*71)          NRD 750
G4=(1.-X2/P2P2)/(Y2*Y2+72*72)          NRD 760
F13=IIIP1*X7J/ALP1                      NRD 770
F12=IIIP1*XYK/ALP1                      NRD 780
G13=72*G2-71*G1                         NRD 790
G12=-Y2*G2+Y1*G1                        NRD 800
F23=IIIP2*X7J/ALP2                      NRD 810
F22=IIIP2*XYK/ALP2                      NRD 820
G23=72*G4-71*G3                         NRD 830
G22=-Y2*G4+Y1*G3                       NRD 840
F1=-F13*Y(4,IPHI)*(-1.)*SN+F12*Y(3,IPHI)*GF NRD 850
F2=G13*Y(4,IPHI)*(-1.)*SN+G12*Y(3,IPHI)*GF NRD 860
F3=-F23*Y(4,IPHI)*(-1.)*SN+F22*Y(3,IPHI)*GF NRD 870
F4=G23*Y(4,IPHI)*(-1.)*SN+G22*Y(3,IPHI)*GF NRD 880
A1=A1+(F1+F2)*CH(I7)*SN(JJ,ISN)*GAM(1,J)/FM NRD 890
A2=A2+(F3+F4)*CH(I7)*SN(JJ,ISN)*GAM(2,J)/FM NRD 900
IF (J.LT.NM) GO TO 90                    NRD 910
I7=I7+1                                  NRD 920
MM=NM                                     NRD 930
NM=NM+M                                    NRD 940
90 CONTINUE                               NRD 950
IF (IISC,FQ,2) ALPH=A1/P.                 NRD 960
IF (IISC,NE,2) ALPH=(A1-A2)/P.           NRD 970
RETURN                                     NRD 980
END                                         NRD 990
SUBROUTINE SPEED (VMU,I,ALPHA,LPANEL,TEMP,LPAN1,LPAN2,PHIS,IPHI,ISSPD 10
IYM,NGDD,HEIGHT)                          SPD 20
C TO COMPUTE THE INDUCED TANGENTIAL VELOCITIES DUE TO WING ALONE SPD 30
C VORTICES                                  SPD 40
DIMENSION SU(100)                          SPD 50
COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPF(15),XL(2,15),XTT(41),SPD 60
1YLL(41)                                    SPD 70
COMMON /GEOM/ HALFSP,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTSPD 80
1F(50),PST(20),CH(95),YV(200),YV(100),SN(R,R),XN(200,2),YN(200,2),ZSPD 90
2N(200,2),WIDTH(F),YCON(25),SWEEP(50),HALFR,SJ(21,R),EX(95,2),TX(95SPD 100
3,2),SC(160,5),ST(160,5),IC(3)           SPD 110
COMMON /AERO/ AM1,AM2,P1,P2,C,(30),CT(30),CD(30),GAM(2,100) SPD 120
COMMON /CONST/ MCS,MCM,M1(P),MSJ,MCJ(5),LAST,MJW1(3,5),MJW2(3,5),JSPD 130
1DANEL,MJJ(5),NM(3),NNJ,NJP              SPD 140
N1=NNJ-1                                    SPD 150
N2=NNJ-2                                    SPD 160
N3=NNJ-3                                    SPD 170
7JET=YCON(25)                              SPD 180
IT=I-JPANEL                                SPD 190

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	PR=PI	SPD 200
	IC=1	SPD 210
	LG=1	SPD 220
	IF (NGRC.FO.1) LG=2	SPD 230
10	CONTINUE	SPD 240
	I7=1	SPD 250
	MM=0	SPD 260
	ISN=1	SPD 270
	NL=NI(1)	SPD 280
	NJM=NI(1)	SPD 290
	R=0.	SPD 300
	DO 00 J=1,LPANEL	SPD 310
	JJ=J-MV	SPD 320
	FN=NL	SPD 330
	IF (J.GT.LPAN1.AND.J.LE.LPAN2) ISN=2	SPD 340
	IF (J.GT.LPAN2.AND.J.LE.LPANL) ISN=3	SPD 350
	IF (J.GE.LPAN1.AND.J.LT.LPANL) GO TO 20	SPD 360
	GO TO 30	SPD 370
20	NI=NI(2)	SPD 380
	IF (J.GE.LPAN2.AND.J.LT.LPANL) NI=NI(3)	SPD 390
30	CONTINUE	SPD 400
	X1=XN(J.1)-XCP(II)	SPD 410
	X2=XN(J.2)-XCP(II)	SPD 420
	X12=XN(J.2)-XN(J.1)	SPD 430
	Y12=YN(J.2)-YN(J.1)	SPD 440
	Z12=0.	SPD 450
	DO 00 K=1,2	SPD 460
	IF (K.FO.1) GO TO 40	SPD 470
	N=1	SPD 480
	GO TO 50	SPD 490
40	N=2	SPD 500
50	CONTINUE	SPD 510
	YC=(-1.)**N*YCP(II)	SPD 520
	Y1=YN(J.1)-YC	SPD 530
	Y2=YN(J.2)-YC	SPD 540
	XYK=X1*Y12-Y1*X12	SPD 550
	DO 00 KK=1,LC	SPD 560
	IF (KK.FO.1) GO TO 60	SPD 570
	GF=-1.	SPD 580
	ZC=-2.*(ZCP(II)+HEIGHT)+ZCP(II)	SPD 590
	FCON=1.	SPD 600
	GO TO 70	SPD 610
60	GF=1.	SPD 620
	ZC=ZCP(II)	SPD 630
	FCON=0.	SPD 640
70	Z1=ZN(J.1)-ZC	SPD 650
	Z2=ZN(J.2)-ZC	SPD 660
	Y7J=-Z1*X12	SPD 670
	Y7I=-Z1*Y12	SPD 680


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ALP1=XVK*XYK+X7J*Y7J+PP*Y7I*Y7I      SPD 690
D1R1=SQRT(X1*X1+PP*Y1*Y1+PP*71*71)      SPD 700
D2R1=SQRT(Y2*Y2+PP*Y2*Y2+PP*72*72)      SPD 710
IH1R1=(Y2*X12+PP*Y2*Y12+PP*72*712)/D2R1-(X1*X12+PP*Y1*Y12+PP*71*712) SPD 720
1)/D1R1      SPD 730
F1=(IH1R1*Y7I/ALP1      SPD 740
SUM=F1*CH(I7)*SN(JJ,ISN)*GAM(IC,J)/FN      SPD 750
IF (K.FO.1.AND.KK.FO.1) SU(J)=F1*CH(I7)*SN(JJ,ISN)/FN      SPD 760
90  R=R+SUM      SPD 770
IF (J.LT.NM) GO TO 90      SPD 780
I7=I7+1      SPD 790
NM=NM      SPD 800
NW=NM+NL      SPD 810
90  CONTINUE      SPD 820
NJH=(NSJ+1)/2+1      SPD 830
IF (ISYM.FO.0) NJH=NSJ/2      SPD 840
IF (IPHI.FO.NJH) GO TO 160      SPD 850
IF (ISYM.NE.0.AND.IPHI.FO.1) GO TO 160      SPD 860
IF (MNJ.FO.1) GO TO 160      SPD 870
IF (II.GT.NJJ(M1)) GO TO 160      SPD 880
IF (IPHI.GT.NJH.AND.ZJET.(F.0.01) GO TO 160      SPD 890
IF (IPHI.GT.NJH) I1=NJH      SPD 900
IF (ISYM.FO.0.AND.IPHI.GT.NJH) I1=NJH+1      SPD 910
IF (IPHI.LE.NJH) I1=1      SPD 920
N7=1      SPD 930
IF (NW(2).NE.0.AND.NW(3).FO.0) N7=2      SPD 940
IF (NW(3).NE.0) N7=3      SPD 950
IF (MNJ.LE.3.AND.NW(2).NE.0) IP=N2      SPD 960
IF (MNJ.LE.3.AND.NW(2).FO.0) IP=N1      SPD 970
IF (MNJ.GE.4.AND.NW(3).NE.0) IP=N3      SPD 980
IF (MNJ.FO.4.AND.NW(3).FO.0) IP=N2      SPD 990
DO 150 MP=1,N7      SPD1000
K1=MJW1(MP,NJP)+(IPHI-I1-ISYM)*NW(MP)-1      SPD1010
K2=I1C(MP)+IPHI-I1-ISYM      SPD1020
KNW=NW(MP)      SPD1030
K1=K1-KNW      SPD1040
K2=K2-1      SPD1050
ND=3      SPD1060
IF (K1.GE.0) GO TO 100      SPD1070
K1=K1+KNW      SPD1080
K2=K2+1      SPD1090
ND=2      SPD1100
100  DO 140 NP=1,NE      SPD1110
SUM=0.      SPD1120
DO 110 KK=1,KNW      SPD1130
KL=K1+KK      SPD1140
110  SUM=SUM+SU(KL)      SPD1150
CALL INTEG (PFC,KNW,K1,K2,II,PP,IP)      SPD1160
CORN=0.      SPD1170

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	DO 130 KK=1,KMW	SPD1180
	KL=K1+KK	SPD1190
	AA=1.	SPD1200
	DO 120 L=1,KNL	SPD1210
	LL=K1+L	SPD1220
	IF (L,FC,KK) GO TO 120	SPD1230
	AA=AA*(XCP(TI)-XV(LL))/(XV(KL)-XV(LL))	SPD1240
120	CONTINUE	SPD1250
130	COPN=COPN+AA*GAV(TC,KL)	SPD1260
	R=R-COPN*SUM+COPN*RES*R.	SPD1270
	K1=K1+KMW	SPD1280
	K2=K2+1	SPD1290
140	CONTINUE	SPD1300
	IP=IP+1	SPD1310
150	CONTINUE	SPD1320
160	CONTINUE	SPD1330
	IF (IC,FO,2) GO TO 170	SPD1340
	ALPHA1=R/R.	SPD1350
	IC=IC+1	SPD1360
	RR=R2	SPD1370
	IF (ABS(R1-R2),LE,0.001) GO TO 180	SPD1380
	GO TO 10	SPD1390
170	ALPHA2=R/R.	SPD1400
	GO TO 150	SPD1410
180	ALPHA2=ALPHA1	SPD1420
190	ALPHA=ALPHA2-TEMP*VMII*VMII*ALPHA1	SPD1430
	PHIS=ALPHA2	SPD1440
	DETLPH	SPD1450
C		SPD1460
	END	SPD1470
	SUBROUTINE INDMEL (XC,Y,XJ,YJ,ZJ,RJ,R2,PHOV,PHX,T,U,PHY,ISYM,NGCD,IND	IND 10
	HEIGHT)	IND 20
C	TO COMPUTE THE INDUCED VELOCITIES DUE TO JET ENTRAINMENT	IND 30
	DIMENSION V7(2), VX(2), VY(2)	IND 40
	COMMON /JET/ PK1,XC,X(31),A(31),R(31)	IND 50
	PFJ=T	IND 60
	LG=1	IND 70
	IF (NGCD,FO,1) LG=2	IND 80
	V7(2)=0.	IND 90
	VX(2)=0.	IND 100
	VY(2)=0.	IND 110
	SPJ=SQRT(PFJ)	IND 120
	XR=(XC-XJ)/RJ	IND 130
	NCOT=ISYM+1	IND 140
	DO 40 K=1,NCOT	IND 150
	VX(K)=0.	IND 160
	VY(K)=0.	IND 170
	V7(K)=0.	IND 180
	IF (K,FO,1) FC=1.	IND 190

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IF (K.FC.2) FC=-1.                                IND 200
DO 40 KY=1,LC                                       IND 210
IF (KK.FC.1) ZC=ZJ                                 IND 220
IF (KK.FC.2) ZC=-(ZJ+2.*HEIGHT)                   IND 230
RR=SQRT(ZC*ZC+(Y*FC-YJ)**2)/PJ                     IND 240
F1=SQRT((XR-XC)**2+R2*DR*DR)                       IND 250
F2=SQRT(XR**2+F2*DR*DR)                             IND 260
G10=(XR-XC)/F1-YR/F2                                IND 270
G20=1./F1-1./F2                                     IND 280
SUMP=- (A(1)+R(1)*YR)*G10/DR-R2*DR*R(1)*G20       IND 290
SUMX=(A(1)+R(1)*YR)*G20-R(1)*G10+R(1)*ALOG((XR-XC+F1)/(XR+F2)) IND 300
IF (H.LE.0.01) GO TO 20                             IND 310
J=2                                                  IND 320
10  SIJM=SIJVR                                       IND 330
    SIJM2=SIJMX                                       IND 340
    F1=SQRT((XR-Y(J))**2+R2*DR*DR)                 IND 350
    F2=SQRT((XR-Y(J-1))**2+R2*DR*DR)               IND 360
    G1=(XR-Y(J))/F1-(XR-Y(J-1))/F2                 IND 370
    G2=1./F1-1./F2                                  IND 380
    SUMP=SUMP-(A(J)+R(J)*YR)*G1/DR-R2*DR*R(J)*G2   IND 390
    SIJMV=SIJMX+(A(J)+R(J)*YR)*G2-R(J)*G1+R(J)*ALOG((XR-Y(J)+F1)/(XR-Y(J) IND 400
1-1)+F2))
    IF (J.GE.31) GO TO 30                             IND 420
    J=J+1                                             IND 430
    GO TO 10                                           IND 440
20  SUMP=SUMP+0.32*(1.+(XR-XC)/F1)/FR              IND 450
    SIJMX=SIJMX+0.32/F1                               IND 460
30  PHRV=SPJ*0.25*SUMP*ZC/(PR*PJ)                  IND 470
    PHV=-SPJ*0.25*SUMP*(Y-YJ*FC)/(PR*PJ)           IND 480
    PHX=-SPJ*0.25*SIJMX                              IND 490
    VX(K)=PHX/2.+VX(K)                                IND 500
    VY(K)=PHV/2.+VY(K)                                IND 510
40  V7(K)=PHRV/2.+V7(K)                              IND 520
    PHRV=V7(1)+V7(2)                                  IND 530
    PHX=VX(1)+VX(2)                                  IND 540
    PHV=VY(1)+VY(2)                                  IND 550
    PFTIIPN                                           IND 560
C                                                     IND 570
    FMP                                               IND 580
    OVERLAY (HSCRIF,5,0)                               LOD 10
    PROGRAM LOAD                                       LOD 20
C    TO EVALUATE THE AERODYNAMIC CHARACTERISTICS     LOD 30
    DIMENSION CA(30),CPSWL(30),AM(30),GAMJ(200),GAMW1(100),GAMW2(LOD 40
1100)
    COMMON /GEOM/ HALFSW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTLOD 60
1E(50),PSI(20),CH(95),XV(200),YV(100),SN(A,8),XN(200,2),YN(200,2),ZLOD 70
2N(200,2),WIDTH(A),YCON(25),SWEFP(50),HALFR,SJ(21,8),EX(95,2),TX(95LOD 80
3,2),SC(160,5),SJ(160,5),LC(3)
    COMMON /AERO/ AM1,AM2,R1,R2,CL(30),CT(30),CD(30),GAM(2,100)     LOD 100

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COMMON /CONST/ NCS,NCW,M1(8),NSJ,NCJ(5),LAST,MJW1(3,5),MJW2(3,5),JL00 110
IPANEL,MJJ(5),NW(3),NMJ,NJP LOD 120
COMMON /PARAM/ ALPT,ALPC,ALPS,CDF,SDF,TH,TOF,NGRD,HEIGHT,ATT LOD 130
COMMON /SCHEME/ C(2),X(10,41),Y(10,41),SLOPF(15),XL(2,15),XTT(41),LOD 140
IXLL(41) LOD 150
COMMON /ADD/ CP(100),CM(30),PPFAK(8),SWP(8,15),GAL(30),ISYM,VMU,VU(LOD 160
1,TEMP,FCP,CAM,FR,CAMLET,CAMTER,CAMTET,XJ,YJ,7J,PJ,ALP,CREF,TWISTP LOD 170
COMMON /COST/ LTOTAL,LPAN1,NJW(5),LPANEL,IFNTN,LPAN2,EXIT,PTIAL,TWLOD 180
IIST,DF(5),NFP LOD 190
PI=3.14159265 LOD 200
PEWIND 02 LOD 210
PFAD (02) (GAMJ(J),J=1,LTOTAL) LOD 220
DO 10 I=1,LPANEL LOD 230
GAMW1(I)=GAM(I,I)*ALPC LOD 240
GAMW2(I)=GAM(2,I)*ALPC LOD 250
ALPH=ALP*180./PI LOD 260
WRITE (6,360) LOD 270
WRITE (6,350) ALPH LOD 280
WRITE (6,360) LOD 290
7JFT=YCON(25) LOD 300
IJSR=YCON(24) LOD 310
ITN=YCON(23) LOD 320
XAC=CL(30) LOD 330
NC=IFNTN LOD 340
DFJ=CDF LOD 350
CMU=C(1) LOD 360
CLT=0. LOD 370
CMT=0. LOD 380
CNT=0. LOD 390
CLW=0. LOD 400
CMWT=0. LOD 410
COW=0. LOD 420
CLWW=0. LOD 430
CMWWT=0. LOD 440
COWW=0. LOD 450
KC=1 LOD 460
NCOL=M1(1) LOD 470
KLL=0 LOD 480
MM=0 LOD 490
IJJ=1 LOD 500
IF (NW(2),NE,0) IJJ=2 LOD 510
IF (NW(3),NE,0) IJJ=3 LOD 520
NW2=NW(1)+NW(2) LOD 530
NW3=NW(2)+NW(3) LOD 540
NCW1=NCW+1 LOD 550
NL=1 LOD 560
DO 170 IT=1,NCS LOD 570
IF (NW(2),EO,0) GO TO 30 LOD 580
II=I+NCS LOD 590

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	IF (NW(3),NF,0) GO TO 20	LOD 600
	CHORD=CH(I)+CH(II)	LOD 610
	GO TO 40	LOD 620
20	III=II+NCS	LOD 630
	CHORD=CH(I)+CH(II)+CH(III)	LOD 640
	GO TO 40	LOD 650
30	CHORD=CH(I)	LOD 660
40	CONTINUE	LOD 670
	CM=0.	LOD 680
	CL(I)=0.	LOD 690
	CD(I)=0.	LOD 700
	CA(I)=0.	LOD 710
	CMW=0.	LOD 720
	CPSWL(I)=0.	LOD 730
	CMWW=0.	LOD 740
	X(4,I)=0.	LOD 750
	X(6,I)=0.	LOD 760
	Y(7,I)=0.	LOD 770
	DO 150 J=1,NCW	LOD 780
	NN=J+MM	LOD 790
	IF (NW(2),FO,0) GO TO 60	LOD 800
	IF (J,LF,NW(1)) GO TO 60	LOD 810
	IF (J,GT,NW(2)) GO TO 50	LOD 820
	LL=L PANI +NW(2)*(I-1)+J-NW(1)	LOD 830
	IL=II	LOD 840
	JLL=J-NW(1)	LOD 850
	L=2	LOD 860
	FN=NW(2)	LOD 870
	GO TO 70	LOD 880
50	LL=L PAN2 +NW(3)*(I-1)+J-NW2	LOD 890
	IL=III	LOD 900
	JLL=J-NW2	LOD 910
	L=3	LOD 920
	FN=NW(3)	LOD 930
	GO TO 70	LOD 940
60	LL=NN	LOD 950
	IL=I	LOD 960
	JLL=J	LOD 970
	L=1	LOD 980
	FN=NW(1)	LOD 990
70	CONTINUE	LOD1000
	XC=(YV(LL)-XLF(I))/CHORD	LOD1010
	X(1,J)=7CP(XC)	LOD1020
	X(2,J)=7CT(XC)	LOD1030
	UJ=0.	LOD1040
	U1=0.	LOD1050
	U2=0.	LOD1060
	IF (NGRD,FO,0) GO TO 90	LOD1070
	D7=0.	LOD1080

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7CW=-2.*(7N(LL.1)+HFICHT)+7F(LL.1)-D7                                LOD1090
CALL BACKWH (XV(LL).YV(LL).7CW.LAST.LPANEL.P1.LPAN1.LPAN2.NW.GAMJ.LOD1100
IUJ.LAST.NCJ.MJJ)                                                    LOD1110
CALL BACKWH (XV(LL)*YV(LL).7CW.LAST.LPANEL.P1.LPAN1.LPAN2.NW.GAMW2LOD1120
I.UJ.O.NCJ.MJJ)                                                       LOD1130
IF (IUSP.NF.O.AND.ITN.FO.O) GO TO 80                                  LOD1140
CALL BACKWH (XV(LL).YV(LL).7CW.LAST.LPANEL.P1.LPAN1.LPAN2.NW.GAMW1LOD1150
I.UJ.O.NCJ.MJJ)                                                       LOD1160
GO TO 80                                                                LOD1170
80  I1=I2                                                                LOD1180
90  CONTINUE                                                            LOD1190
GRS=CP(LL)*(1.+IUJ)*SN(JLL.L)*CH(IL)/(2.*FN)                        LOD1200
WRS=GAM(1.LL)*SN(JLL.L)*CH(IL)*ALPC*(1.+U1)/FN                      LOD1210
WAS=GAM(2.LL)*SN(JLL.L)*CH(IL)*ALPC*(1.+U2)/FN                      LOD1220
CP(LL)=CP(LL)*(1.+IUJ)                                               LOD1230
GAM(2.LL)=GAM(2.LL)*(1.+U2)                                           LOD1240
IF (DF(NL).LE.O.OO1) GO TO 100                                        LOD1250
IF (PTIAL.LE.O.1) GO TO 110                                           LOD1260
IF (NW(3).FO.O) GO TO 130                                             LOD1270
IF (LL.GF.MJW1(3.NL).AND.I1.LE.MJW2(3.NL)) GO TO 120                LOD1280
100 CAM=X(1.J)-(X(1.J)-X(2.J))*YV(LL)/HALF                             LOD1290
    FPHA=XLL(I)-ATAN(CAM)                                              LOD1300
    CS=COS(FPHA)                                                       LOD1310
    SS=SIN(FPHA)                                                       LOD1320
    GO TO 140                                                           LOD1330
110 IF (NW(2).NF.O.AND.I1.LE.LPAN1) GO TO 100                         LOD1340
    IF (NW(3).NF.O.AND.I1.LE.LPAN2) GO TO 100                         LOD1350
120 FP=XLL(I)+DF(NL)                                                  LOD1360
    CAM=X(1.J)-(X(1.J)-X(2.J))*YV(LL)/HALF                             LOD1370
    FP=FP-ATAN(CAM)                                                    LOD1380
    CS=COS(FP)                                                         LOD1390
    SS=SIN(FP)                                                         LOD1400
    GO TO 140                                                           LOD1410
130 IF (LL.GF.MJW1(2.NL).AND.I1.LE.MJW2(2.NL)) GO TO 120            LOD1420
    GO TO 100                                                           LOD1430
140 CONTINUE                                                            LOD1440
    CL(I)=CL(I)+GRS*CS                                                 LOD1450
    CM=CML-GRS*YV(I1)*CS                                              LOD1460
    CD(I)=CD(I)+GRS*SS                                                 LOD1470
    CA(I)=CA(I)+WRS*CS                                                 LOD1480
    CMW=CMW-WRS*YV(LL)*CS                                             LOD1490
    CPSWL(I)=CPSWL(I)+GRS*SS                                          LOD1500
    X(4.I)=X(4.I)+WAS*CS                                              LOD1510
    CMWW=CMWW-WAS*YV(LL)*CS                                          LOD1520
    X(6.I)=X(6.I)+WAS*SS                                              LOD1530
150 CONTINUE                                                            LOD1540
    CAMLE=CAMLEP-(CAMLEP-CAMLET)*YLF(I)/HALF                          LOD1550
    FPHA=XLL(I)-ATAN(CAMLE)                                           LOD1560
    Y(1.NCW1)=COS(FPHA)                                               LOD1570

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	X(2,NCW1)=STA(FSHA)	L0D1580
	CL(I)=CL(I)*PI/CHORD+CT(I)*X(2,NCW1)	L0D1590
	CM(I)=CML*PI/(CFFF*CHORD)	L0D1600
	CD(I)=CD(I)*PI/CHORD-CT(I)*X(1,NCW1)	L0D1610
	CA(I)=CA(I)*PI/CHORD+XTE(I)*X(2,NCW1)	L0D1620
	AW(I)=CWW*PI/(CFFF*CHORD)	L0D1630
	CPSWL(I)=CPSWL(I)*PI/CHORD-YTE(I)*X(1,NCW1)	L0D1640
	X(4,I)=X(4,I)*PI/CHORD+X(5,I)*X(2,NCW1)	L0D1650
	X(7,I)=CWW*PI/(CFFF*CHORD)	L0D1660
	X(6,I)=X(6,I)*PI/CHORD-X(5,I)*X(1,NCW1)	L0D1670
	IF(I,LT,NCOL) GO TO 160	L0D1680
	KLL=NCOL-1	L0D1690
	KC=KC+1	L0D1700
	NCOL=NCOL+Y1(KC)-1	L0D1710
160	KL=I-KLL	L0D1720
	FX=M1(KC)	L0D1730
	AA=CHORD*FX(KL,KC)*WIDTH(KC)/FX	L0D1740
	CLT=CLT+CL(I)*AA	L0D1750
	CMT=CMT+CM(I)*AA	L0D1760
	COT=COT+CD(I)*AA	L0D1770
	CLW=CLW+CA(I)*AA	L0D1780
	CMWT=CMWT+AW(I)*AA	L0D1790
	CDW=CDW+CPSWL(I)*AA	L0D1800
	CLWW=CLWW+X(4,I)*AA	L0D1810
	CMWWT=CMWWT+X(7,I)*AA	L0D1820
	CDWW=CDWW+X(6,I)*AA	L0D1830
	MM=(NCW-NCW3)*I	L0D1840
	IF(LL,FC,MJW2(TII,NL)) NL=NL+1	L0D1850
170	CONTINUE	L0D1860
	CLT=CLT*PI/(2.*HALFSW)	L0D1870
	CMT=CMT*PI/(2.*HALFSW)	L0D1880
	COT=COT*PI/(2.*HALFSW)	L0D1890
	COL2=COT/(CLT*CLT)	L0D1900
	CLW=CLW*PI/(2.*HALFSW)	L0D1910
	CMWT=CMWT*PI/(2.*HALFSW)	L0D1920
	CDW=CDW*PI/(2.*HALFSW)	L0D1930
	CLWW=CLWW*PI/(2.*HALFSW)	L0D1940
	CMWWT=CMWWT*PI/(2.*HALFSW)	L0D1950
	CDWW=CDWW*PI/(2.*HALFSW)	L0D1960
	IF(COLW,LE,0,AA1) GO TO 180	L0D1970
	COL2=CDWW/(CLWW*CLWW)	L0D1980
	GO TO 190	L0D1990
180	COL2=0.	L0D2000
190	CONTINUE	L0D2010
	WRITE(6,370)	L0D2020
	K1=0	L0D2030
	JJ1=0	L0D2040
	DO 270 I=1,NC5	L0D2050
	IF(NW(2),FC,0) GO TO 210	L0D2060

	II=I+NCS	L002070
	IF (NW(3),NF,0) GO TO 200	L002080
	CHORD=CH(I)+CH(II)	L002090
	GO TO 220	L002100
200	III=II+NCS	L002110
	CHORD=CH(I)+CH(II)+CH(III)	L002120
	GO TO 220	L002130
210	CHORD=CH(I)	L002140
220	CONTINUE	L002150
	DO 260 J=1,NCW	L002160
	JJ=JJ1+J	L002170
	KK=K1+J	L002180
	IF (NW(2),FO,0) GO TO 240	L002190
	IF (J,LF,NW(1)) GO TO 240	L002200
	IF (J,GT,NW(2)) GO TO 230	L002210
	LL=(PAN1+NW(2))*(I-1)+J-NW(1)	L002220
	GO TO 250	L002230
230	LL=(PAN2+NW(3))*(I-1)+J-NW2	L002240
	GO TO 250	L002250
240	LL=JJ	L002260
250	CONTINUE	L002270
	XT=(XV(LL)-XLF(I))/CHORD	L002280
	FTA=YV(LL)/HALFP	L002290
	CPW=2.*GAM(2,LL)*ALPC	L002300
260	WRITE (6,390) KK, XI, FTA, CP(LL), CPW	L002310
	JJ1=(NCW-NW3)*I	L002320
	K1=K1+NCW	L002330
270	CONTINUE	L002340
	WRITE (6,390)	L002350
	DO 290 I=1,NCS	L002360
	YF=YLF(I)/HALFP	L002370
290	WRITE (6,400) YF, CL(I), CH(I), CT(I), CP(I), X(4,I), X(7,I), X(6,I)	L002380
	WRITE (6,410) CLT	L002390
	WRITE (6,420) CDT	L002400
	WRITE (6,430) CDC(2)	L002410
	WRITE (6,440) CMT	L002420
	IF (IUSR,FO,0) GO TO 330	L002430
	IF (7JFT,GT,0,01) GO TO 330	L002440
	SDFJ=SIN(DFJ)	L002450
	CDFJ=COS(DFJ)	L002460
	CLD=CMII*SIN(DFJ+ALP)	L002470
	CRD=CMII*(VMI-COS(DFJ+ALP))	L002480
	CF=COS(TDF)	L002490
	SF=SIN(TDF)	L002500
	IF (NMJ,FO,1) CRD=-CMII*COS(DFJ+ALP)	L002510
	IJ=(NSJ+1)/2-1	L002520
	IF (TSYM,FO,0) IJ=NSJ/2-1	L002530
	IF (NW(3),NF,0) GO TO 290	L002540
	IF (NW(2),FO,0) GO TO 300	L002550


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I7=ACS*(MJI(2,NJP)-LPAI)-1)/NW(2)+1                                LOD2560
KJ=MJI(2,NJP)                                                            LOD2570
NN=NW(2)                                                                    LOD2580
GO TO 310                                                                    LOD2590
200 I7=ACS*2+(MJI(3,NJP)-LPAI2-1)/NW(3)+1                                LOD2600
KJ=MJI(3,NJP)                                                            LOD2610
NN=NW(3)                                                                    LOD2620
GO TO 310                                                                    LOD2630
300 I7=LC(I)                                                                LOD2640
KJ=MJI(1,NJP)                                                            LOD2650
NN=NW(1)                                                                    LOD2660
310 CONTINUE                                                                LOD2670
CM=0.                                                                        LOD2680
DO 320 I=1,IJ                                                            LOD2690
YDIF=YN(KJ,2)-YN(KJ,1)                                                    LOD2700
CM]=CM]+YDIF/WIDTH(NJW(NJP))*((YLE(I7)+CH(I7)*CF)*SDFJ-CH(I7)*SF*CLOD2710
1DFJ)                                                                    LOD2720
KJ=KJ+1                                                                    LOD2730
320 I7=I7+1                                                                LOD2740
CMP=-CM]*CM]/CDEF                                                         LOD2750
IF (NNJ.NF,1) WRITE (6,450) CLP                                           LOD2760
IF (NNJ.EC,1) WRITE (6,460) CLP                                           LOD2770
IF (NNJ.NF,1) WRITE (6,470) CPP                                           LOD2780
IF (NNJ.EC,1) WRITE (6,480) CPP                                           LOD2790
IF (DFJ.LE,0.00) GO TO 330                                                LOD2800
IF (NNJ.NF,1) WRITE (6,490) CMP                                           LOD2810
IF (NNJ.EC,1) WRITE (6,500) CMP                                           LOD2820
330 CONTINUE                                                                LOD2830
IF (IUSR.NF,0) GO TO 340                                                  LOD2840
WRITE (6,510) CLW                                                         LOD2850
WRITE (6,520) CDW                                                         LOD2860
WRITE (6,530) CMWT                                                        LOD2870
340 CONTINUE                                                                LOD2880
WRITE (6,540) CLWW                                                        LOD2890
WRITE (6,550) CDWW                                                        LOD2900
WRITE (6,560) CMWWT                                                       LOD2910
WRITE (6,570) CDWWT                                                       LOD2920
RETURN                                                                    LOD2930
C                                                                            LOD2940
350 FORMAT (1H0,26X,7H2ALPHA =,F10,2,3X,7HDEFOFFS)                       LOD2950
360 FORMAT (1H0,20X,40HXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX)     LOD2960
370 FORMAT (1H0,3X,6HVORTEX,14X,2HYV,17X,2HYV,19X,2HCP,19X,3HCPW)       LOD2970
380 FORMAT (6X,I3.4(10X,F10.5))                                           LOD2980
390 FORMAT (1H0,9X,4HY/SP,11X,2HCL,13X,2HCM,12X,2HCT,13X,3HCDI,12X,3HCLOD2990
1LW,12X,3HCMW,12X,3HCDW)                                                  LOD3000
400 FORMAT (8(FY,F10.5))                                                  LOD3010
410 FORMAT (1H0,22HTHE LIFT COEFFICIENT =,F10.5)                         LOD3020
420 FORMAT (1H0,32HTOTAL INDUCED DRAG COEFFICIENT =,F10.5)              LOD3030
430 FORMAT (1H0,28HTHE INDUCED DRAG PARAMETER =,F10.5)                   LOD3040

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440 FORMAT (1H0.35HTOTAL PITCHING MOMENT COEFFICIENT =,F10.5) LOD3050
450 FORMAT (1H0.34HTHE COANDA LIFT COEFFICIENT, CLR =,F10.5) LOD3060
460 FORMAT (1H0.47HTHE LIFT COEFFICIENT DUE TO JET REACTION, CLJ =,F10LOD3070
1.5) LOD3080
470 FORMAT (1H0.34HTHE COANDA DRAG COEFFICIENT, CDR =,F10.5) LOD3090
480 FORMAT (1H0.47HTHE DRAG COEFFICIENT DUE TO JET REACTION, CDJ =,F10LOD3100
1.5) LOD3110
490 FORMAT (1H0.36HTHE COANDA MOMENT COEFFICIENT, CMR =,F10.5) LOD3120
500 FORMAT (1H0.59HTHE PITCHING MOMENT COEFFICIENT DUE TO JET REACTIONLOD3130
1. CMJ =,F10.5) LOD3140
510 FORMAT (1H0.2X.48HTHE LIFT COEFFICIENT WITH JET ENTRAINMENT ALONE LOD3150
1=.F10.5) LOD3160
520 FORMAT (1H0.2X.57HTHE INDUCED DRAG COEFFICIENT WITH JET ENTRAINMENLOD3170
IT ALONE =,F10.5) LOD3180
530 FORMAT (1H0.2X.40HTHE PITCHING MOMENT COEFFICIENT WITH JET ENTRAINLOD3190
MENT ALONE =,F10.5) LOD3200
540 FORMAT (1H0.40HTHE LIFT COEFFICIENT FOR THE WING ALONE=,F10.5) LOD3210
550 FORMAT (1H0.48HTHE INDUCED DRAG COEFFICIENT FOR THE WING ALONE=,F1LOD3220
10.5) LOD3230
560 FORMAT (1H0.51HTHE PITCHING MOMENT COEFFICIENT FOR THE WING ALONE=LOD3240
1.F10.5) LOD3250
570 FORMAT (1H0.46HTHE INDUCED DRAG PARAMETER FOR THE WING ALONE=,F10.LOD3260
15) LOD3270
END LOD3280
SUBROUTINE BACKWASH (X,Y,Z,LAST,L PANEL,R1,L PAN1,L PAN2,NW,GAMMA,VX,JLRCH 10
1.MCJ,MJJ) RCH 20
C RCH 30
C TO EVALUATE THE BACKWASH ON THE WING DUE TO IMAGE VORTEX SYSTEMS RCH 40
C DIMENSION NW(1), GAMMA(1), U(2), MCJ(1), MJJ(1) RCH 50
COMMON /GFORM/ HALF SW,XCP(200),YCP(200),ZCP(200),XLE(50),YLE(50),XTRCH 60
1E(50),PSI(20),CW(95),XV(200),YV(100),SN(R,R),XN(200,2),YN(200,2),7RCH 70
2N(200,2),WIDTH(8),YCON(25),SWEEP(50),HALFR,SJ(21,8),EX(95,2),TX(95RCH 80
3,2),SC(160,5),ST(160,5),LC(3) RCH 90
PI=3.14159265 RCH 100
TCOM=L PANEL RCH 110
IF (JL,EC,LAST) TCOM=LAST RCH 120
IA=2*(LAST-L PANEL) RCH 130
IP=LAST-L PANEL RCH 140
I7=1 RCH 150
I7F=1 RCH 160
ISA=1 RCH 170
MM=NW(1) RCH 180
NN=NW(1) RCH 190
IND=1 RCH 200
L1=L PANEL+1 RCH 210
[AST]=LAST-1 RCH 220
VX=0. RCH 230
DO 90 J=1,TCOM RCH 240
MT=J-I7F+1 RCH 250

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	FN=NM	RCH 260
	IF (J.GT.LPANFL) GO TO 20	RCH 270
	IF (J.GT.LPAN1.AND.J.LE.LPAN2) ISN=2	RCH 280
	IF (J.GT.LPAN2.AND.J.LE.LPANFL) ISN=3	RCH 290
	IF (J.GE.LPAN1.AND.J.LT.LPANFL) GO TO 10	RCH 300
	GO TO 20	RCH 310
10	NN=NW(2)	RCH 320
	IF (J.GE.LPAN2.AND.J.LT.LPANFL) NN=NW(3)	RCH 330
20	CONTINUE	RCH 340
	IF (J.GE.LPANFL.AND.J.LT.MJJ(IND)) NN=NCJ(IND)	RCH 350
	IF (JL.EQ.0) GO TO 50	RCH 360
	IF (J.EQ.L1) GO TO 30	RCH 370
	GO TO 40	RCH 380
30	ISN=ISN+1	RCH 390
	L1=MJJ(IND)+1	RCH 400
40	NL=MJJ(IND)-1	RCH 410
	IF (NL.EQ.LAST1) GO TO 50	RCH 420
	IF (J.EQ.NL) IND=IND+1	RCH 430
50	CONTINUE	RCH 440
	JJ=J	RCH 450
	IF (J.LE.LPANFL.AND.JL.EQ.LAST) JJ=J+1A	RCH 460
	IF (J.GT.LPANFL.AND.JL.EQ.LAST) JJ=J+1B-LPANFL	RCH 470
	CHORD=CH(I7)	RCH 480
	X1=YN(J,1)-X	RCH 490
	X2=YN(J,2)-X	RCH 500
	X12=YN(J,2)-YN(J,1)	RCH 510
	Y12=YN(J,2)-YN(J,1)	RCH 520
	Z12=ZN(J,2)-ZN(J,1)	RCH 530
	Z1=ZN(J,1)-Z	RCH 540
	Z2=ZN(J,2)-Z	RCH 550
	X7J=X1*Z12-Z1*Y12	RCH 560
	DO 70 II=1,2	RCH 570
	FCP=1.	RCH 580
	IF (II.EQ.2) FCP=-1.	RCH 590
	YC=Y*FCP	RCH 600
	Y1=YN(J,1)-YC	RCH 610
	Y2=YN(J,2)-YC	RCH 620
	YVK=X1*Y12-Y1*Y12	RCH 630
	Y7I=Y1*Z12-Z1*Y12	RCH 640
	ALR1=XVK*XVK+X7J*X7J+P1*Y7I*Y7I	RCH 650
	R1P1=SQRT(X1*X1+R1*Y1*Y1+R1*Z1*Z1)	RCH 660
	R2P1=SQRT(X2*X2+R1*Y2*Y2+R1*Z2*Z2)	RCH 670
	UHF1=(X2*X12+R1*Y2*Y12+R1*Z2*Z12)/R2P1-(X1*X12+R1*Y1*Y12+R1*Z1*Z12)	RCH 680
	I1/P1P1	RCH 690
	F3=UHF1*Y7I/ALR1	RCH 700
	IF (J.LE.LPANFL) GO TO 60	RCH 710
	F3=2.*F3	RCH 720
60	CONTINUE	RCH 730
	U(I1)=F3*CHORD*SN(MI,ISN)*GAMMA(JJ)/(R.*FN)	RCH 740

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70 CONTINUE
   VX=U(1)+U(2)+VX
   IF (J.LT.MM) GO TO 80
   I7=I7+1
   IFF=MM+1
   MM=MM+NN
80 CONTINUE
   RETURN
   END
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BCH 750
BCH 760
BCH 770
BCH 780
BCH 790
BCH 800
BCH 810
BCH 820
BCH 830-
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16. Abstract A theoretical wing-jet interaction theory is presented for predicting the ground effects for upper-surface-blowing configurations. The formulation predicts the variation of circulation forces and jet reaction forces in ground proximity as a function of ground height. The predicted results agree well with available experimental data. It is shown that the wing-alone theory is not capable of predicting the ground effect for USB configurations.					
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