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A Generalized Vortex Lattice
Method for Subsonic and
Supersonic Flow Applications

Luis R. Miranda, Robert D. Elliott,
and William M. Baker

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Luis R. Miranda, Robert D. Elliott,
and William M. Baker

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A GENERALIZED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS

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SUMMARY

A vortex lattice method applicable to both subsonic and supersonic flow is described. It is shown that if the discrete vortex lattice is considered as an approximation to the surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vorticity-induced velocity field. The proper incorporation of this term to the velocity field generated by the discrete vortex lines renders the present vortex lattice method valid for supersonic flow. Special techniques for simulating nonzero thickness lifting surfaces and fusiform bodies with vortex lattice elements are included. Thickness effects of wing-like components are simulated by a double (biplanar) vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentrical cylindrical surfaces. The analysis of sideslip effects by the subject method is described. Numerical considerations peculiar to the application of these techniques are also discussed. A summary comparison of the results obtained by the method of this report with other theoretical and experimental results is presented. This method has been implemented in a digital computer code identified as VORLAX. A users manual for the VORLAX program is contained in Appendix A. A complete Fortran compilation and executed case are contained in Appendix B. Appendices C and D describe input conversion programs useful for transforming input between the VORLAX and NASA Wave Drag programs.

INTRODUCTION

The several versions or variations of the vortex lattice method that are presently available have proven to be very practical and versatile theoretical tools for the aerodynamic analysis and design of planar and nonplanar configurations. The success of the method is due in great part to the relative simplicity of the numerical techniques involved, and to the high accuracy, within the limitations of the basic theory, of the results obtained. But most of the work on vortex lattice methods appears to have concentrated on subsonic flow application. The applicability of the basic techniques of vortex lattice theory to supersonic flow has been largely ignored. The method presented herein allows the direct extension of vortex lattice techniques to supersonic Mach numbers. The equations allowing this extended application are derived in the next section starting from the first order vector equations governing inviscid compressible flow. They are then applied to the particular case of a skewed-horseshoe vortex with special attention given to the supersonic horseshoe.

In the following theoretical discussion, the basic arguments involved in the simulation of thickness and volume effects by vortex lattice elements are presented. This particular modeling of the above effects represents an alternative, with somewhat reduced computational requirements, to the method of quadrilateral vortex rings (refs. 1 and 2). The simulation of thickness and volume effects makes possible the computation of the surface pressure distribution on wing-body configurations. The fact that this can be done without having to resort to additional types of singularities, such as sources, results in a simpler digital computer code.

THEORETICAL DISCUSSION

The Basic Equations

Ward has shown, (ref. 3), that the small-perturbation, linearized flow of an inviscid compressible fluid is governed by the three first order vector equations:

$$\nabla \times \bar{v} = \bar{\omega}, \quad \nabla \cdot \bar{w} = Q, \quad \bar{w} = \Psi \cdot \bar{v} \quad (1)$$

on the assumption that the vorticity $\bar{\omega}$ and the source intensity Q are known functions of the point whose position vector is \bar{R} . The vector \bar{v} is the perturbation velocity with orthogonal Cartesian components u , v , and w , and Ψ is a constant symmetrical tensor that for orthogonal Cartesian coordinates with the x -axis aligned with the freestream direction has the form

$$\Psi = \begin{bmatrix} 1 - M_\infty^2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (2)$$

where M_∞ is the freestream Mach number. If $\beta^2 = 1 - M_\infty^2$, then the vector \bar{w} has the components $\bar{w} = \beta^2 u \bar{i} + v \bar{j} + w \bar{k}$. This vector was first introduced by Robinson (ref. 4), who called it the "reduced current velocity". If \bar{u} denotes the total velocity vector, i.e., $\bar{u} = (u_\infty + u) \bar{i} + v \bar{j} + w \bar{k}$, and ρ the fluid density, then it can be shown that for irrotational and homentropic flow

$$\rho \bar{u} = \rho_\infty \bar{u}_\infty + \rho_\infty \bar{w} + \text{higher order terms} \quad (3)$$

where the subscript ∞ indicates the value of the quantity at upstream infinity, e.g., $\bar{u}_\infty = u_\infty \bar{i}$. Therefore, to a linear approximation, the vector \bar{w} is directly related to the perturbation mass flux as follows:

$$\bar{w} = (\rho \bar{u} - \rho_\infty \bar{u}_\infty) / \rho_\infty \quad (4)$$

The second equation of (1), i.e., the continuity condition, shows that for source-free flows ($Q = 0$), w is a conserved quantity.

Ward has integrated the three first order vector equations directly without having to resort to an auxiliary potential function. He obtained two different solutions for $\bar{v}(\bar{R})$, depending on whether β^2 is positive (subsonic flow), or negative (supersonic flow). These two solutions can be combined formally into a single expression if the following convention is used:

$$\begin{aligned} K &= 2 \quad \text{for } \beta^2 > 0 \\ K &= 1 \quad \text{for } \beta^2 < 0 \\ R_\beta &= \text{Real part of } \left\{ (x-x_1)^2 + \beta^2 \left[(y-y_1)^2 + (z-z_1)^2 \right] \right\}^{1/2} \end{aligned}$$

\oint = Finite part of integral as defined by Hadamard (refs. 5 and 6).

The resulting solution for the perturbation velocity \bar{v} at the point whose position vector is $\bar{R}_1 = x_1 \bar{i} + y_1 \bar{j} + z_1 \bar{k}$, is given by

$$\begin{aligned} \bar{v}(\bar{R}_1) = & -\frac{1}{2\pi K} \oint_S \bar{n} \cdot \bar{w}(\bar{R}) \nabla_{\bar{R}} \frac{1}{R_\beta} dS \\ & + \frac{\beta^2}{2\pi K} \oint_S \{ \bar{n} \times \bar{v}(\bar{R}) \} \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} dS \\ & + \frac{1}{2\pi K} \int_V Q(\bar{R}) \nabla_{\bar{R}} \frac{1}{R_\beta} dV + \frac{\beta^2}{2\pi K} \int_V \frac{\bar{R} - \bar{R}_1}{R_\beta^3} \times \bar{w}(\bar{R}) dV \quad (5) \end{aligned}$$

This formula determines the value of \bar{v} within the region V bounded by the surface S . The vector \bar{n} is the unit outward (from the region V) normal to the surface S . Furthermore, it is understood that for supersonic flow only those parts of V and S lying within the domain of dependence (Mach forecone) of the point \bar{R}_1 are to be included in the integration.

For source-free ($Q \equiv 0$), irrotational ($\bar{w} \equiv 0$) flow, equation (5) reduces to

$$\bar{v}(\bar{R}_1) = -\frac{1}{2\pi K} \oint_S \bar{n} \cdot \bar{w}(\bar{R}) \nabla_{\bar{R}} \frac{1}{R_\beta} dS + \frac{\beta^2}{2\pi K} \oint_S \{ \bar{n} \times \bar{w}(\bar{R}) \} \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} dS \quad (6)$$

This is a relation between \bar{v} inside S and the values of $\bar{n} \cdot \bar{w}$ and $\bar{n} \times \bar{w}$ on S , but these two quantities cannot be specified independently on S .

To determine the source-free, irrotational flow about an arbitrary body B by means of equation (6), assume that the surface S coincides with the wetted surface of the body, with any trailing wake that it may have, and with a sphere of infinite radius enclosing the body and the whole flow field about it, namely, $S = S_B + S_W + S_\infty$.

This surface S divides the space into two regions, V_e external to the body, and V_i internal to it. Applying equation (6) to both V_e and V_i , since the integrals over S_∞ converge to zero, the following expression is obtained:

$$\bar{v}(\bar{R}_1) = \frac{1}{2\pi K} \int_{S_B + S_W} \bar{N} \cdot \Delta \bar{w}(\bar{R}) \nabla \frac{1}{R_\beta} dS - \frac{\beta^2}{2\pi K} \int_{S_B + S_W} \{\bar{N} \times \Delta \bar{v}(\bar{R})\} \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} dS \quad (7)$$

where $\bar{N} = \bar{n}_i = -\bar{n}_e$ is the unit normal to the body, or wake as the case may be, positive from the interior to the exterior of the body, $\Delta \bar{w} = \bar{w}_e - \bar{w}_i$, and $\Delta \bar{v} = \bar{v}_e - \bar{v}_i$. Here the subscripts designate the values of the quantities on the corresponding face of S. The first surface integral can be considered as representing the contribution of a source distribution of surface density $\bar{N} \cdot \Delta \bar{w}$, while the second surface integral gives the contribution of a vorticity distribution of surface density $\bar{N} \times \Delta \bar{v}$.

If the boundary condition of zero mass flux through the surface $S_B + S_W$ is applied to both external and internal flows

$$\begin{aligned} \bar{N} \cdot \rho \bar{u}_e &= \bar{N} \cdot (\rho_\infty \bar{u}_\infty + \rho_\infty \bar{w}_e) = 0 \\ \bar{N} \cdot \rho \bar{u}_i &= \bar{N} \cdot (\rho_\infty \bar{u}_\infty + \rho_\infty \bar{w}_i) = 0 \end{aligned} \quad (8)$$

then the condition $\bar{N} \cdot \Delta \bar{w} = 0$ exists over $S_B + S_W$, and the flow field is uniquely determined by

$$\bar{v}(\bar{R}_1) = - \frac{\beta^2}{2\pi K} \int_{S_B + S_W} \bar{v}(\bar{R}) \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} dS \quad (9)$$

where $\bar{v}(\bar{R}) = \bar{N} \times \Delta \bar{v}$ is the surface vorticity density.

Extension to Supersonic Flow

In order to extend the application of the vortex lattice method to supersonic flow, it is essential to consider the fundamental element of the method, the vortex filament, as a numerical approximation scheme to the integral expression (9) instead of a real physical entity. The velocity field generated by a vortex filament can be obtained by a straightforward limiting process, the result being

$$\bar{v}(\bar{R}_1) = \frac{-\beta^2}{2\pi K} \int_C \bar{\Gamma} \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} d\ell \quad (10)$$

$$\text{where } \bar{\Gamma} = \lim_{\substack{\bar{\gamma} \rightarrow \infty \\ \delta \rightarrow 0}} \bar{\gamma} \cdot \delta$$

δ is a dimension normal to γ , and $d\ell$ is the distance element along γ . In the classical vortex lattice method, applicable only to subsonic flow, the vorticity distribution over the body and the wake, i.e., over the surface $S_B + S_W$, is replaced by a suitable arrangement of vortex filaments whose velocity fields are everywhere determined by equation (10). This procedure is no longer appropriate for supersonic flow. For this latter case, it is necessary to go back to equation (9) and to derive an approximation to it. This is done in the following.

If the surface $S_B + S_W$, which defines the body and its wake, is considered as being composed of a large number of discrete flat area elements τ over which the surface vorticity density $\bar{\gamma}$ can be assumed approximately constant, then equation (9) can be approximated by the following equation:

$$\bar{v}(\bar{R}_1) = - \frac{\beta^2}{2\pi K} \sum_{J=1}^N \oint_{\tau_J} \bar{\gamma}_J \times \frac{\bar{R} - \bar{R}_1}{R^3 \beta} dS \quad (11)$$

where N is the total number of discrete area elements τ . When the point whose position vector is \bar{R}_1 is not part of τ_J , the integral over this discrete area can be approximated by the mean value theorem as follows:

$$\oint_{\tau_J} \bar{\gamma}_J \times \frac{\bar{R} - \bar{R}_1}{R^3 \beta} dS = \bar{\gamma}_J \delta_J \times \oint_{C_J} \frac{\bar{R} - \bar{R}_1}{R^3 \beta} d\ell \quad (12)$$

where C_J is a line in τ_J parallel to the average direction of $\bar{\gamma}$ in τ_J , δ_J is a distance normal to C_J , and $d\ell$ is the arc length element along C_J . This means that the velocity field induced by a discrete vorticity patch τ_J can be approximated for points outside of τ_J by some mean discrete vortex line whose strength per unit length is $\bar{\gamma}_J \delta_J$. But if the point \bar{R}_1 is part of the discrete area τ , the integral in equation (11) has an inherent singularity of the Cauchy type due to the fact that $\bar{R} = \bar{R}_1$ at some point within τ . In order to evaluate the integral expression for this case, consider a point close to \bar{R}_1 but located just above τ by a distance ϵ . As indicated in figure 1, the area of integration in τ is divided into two regions, $A_{\tau-\epsilon}$ and A_ϵ . Obviously, the integral over $A_{\tau-\epsilon}$ has no Cauchy-type singularity, Hadamard's finite part concept being sufficient to perform the indicated integration. Thus,

$$\begin{aligned} \int_{\tau} \bar{\gamma} \times \frac{\bar{R}-\bar{R}_1}{R^3} dS &= \lim_{\epsilon \rightarrow 0} \int_{A_\epsilon} + \lim_{\epsilon \rightarrow 0} \int_{A_{\tau-\epsilon}} \\ &= \lim_{\epsilon \rightarrow 0} I(\epsilon) + \bar{\gamma} \delta \times \int_C \frac{\bar{R}-\bar{R}_1}{R^3} dl \end{aligned} \quad (13)$$

The last integral in equation (13) represents the conventional discrete vortex line contribution whose evaluation presents no difficulty. In order to determine the integration denoted by $I(\epsilon)$ assume that, for simplicity, the coordinate system is centered at the point \bar{R}_1 , and that the x-y plane is determined by the discrete area τ . Then, if γ denotes the modulus of $\bar{\gamma}$,

$$I(\epsilon) = \gamma \int_{A_\epsilon} \frac{y \sin \Lambda - x \cos \Lambda}{\{x^2 - B^2(y^2 + \epsilon^2)\}^{3/2}} dx dy \quad (14)$$

where Λ is the angle between the y-axis and the direction of the vorticity in τ , and $B^2 = -\beta^2 > 0$ (supersonic flow). The components of the vector cross product $\bar{\gamma} \times (\bar{R}-\bar{R}_1) = \bar{\gamma} \times \bar{R}$ which are not normal to the plane of τ have been left out of equation (14) because, when the limit operation $\epsilon \rightarrow 0$ is carried out, they will vanish. The area A_ϵ is bounded by a line parallel to the vorticity direction going through $x = -(1+B)\epsilon$ and by the intersection of the Mach forecone from the point $(0, 0, \epsilon)$ with the τ -plane, consequently, if the integration with respect to x is performed first,

$$I(\epsilon) = \gamma \cos \Lambda \int_{\lambda_1}^{\lambda_2} \left\{ \int_{ty - (1+B)\epsilon}^{-B\sqrt{y^2 + \epsilon^2}} \frac{ty - x}{\{x^2 - B^2(y^2 + \epsilon^2)\}^{3/2}} dx \right\} dy \quad (15)$$

where $t = \tan \Lambda$, and λ_1, λ_2 are the values of y corresponding to the intersection of the line $x = ty - (1+B)\epsilon$ with the hyperbola $x = -B\sqrt{y^2 + \epsilon^2}$. Let $\phi = \epsilon^2(1+2B) - 2(1+B)\epsilon ty - (B^2 - t^2)y^2$, then the finite part of the x-integration yields

$$I(\epsilon) = \gamma \cos \Lambda \int_{\lambda_1}^{\lambda_2} \left\{ \frac{ty (ty - (1+B)\epsilon)}{B^2 (y^2 + \epsilon^2) \sqrt{\phi}} - \frac{1}{\sqrt{\phi}} \right\} dy$$

$$= \frac{\gamma \cos \Lambda}{B^2} \int_{\lambda_1}^{\lambda_2} \left\{ \frac{B^2 \epsilon - (1+B) \epsilon t y - (B^2 - t^2) y^2}{y^2 + \epsilon^2} \right\} \frac{dy}{\sqrt{\phi}} \quad (16)$$

Since ϵ is a very small quantity, the variation of y in the interval (λ_1, λ_2) is going to be equally small, and, therefore, the quantity within brackets in the last integrand of equation (16) can be replaced by a mean value and taken outside of the integral sign. The same is not true of the term $1/\sqrt{\phi}$ since it will vary from ∞ for $y = \lambda_1$, go through finite values in the integration interval, and then again increase to ∞ for $y = \lambda_2$. With this in mind, and if \tilde{y} denotes a mean value of y , $I(\epsilon)$ can be written as

$$I(\epsilon) = \frac{\gamma \cos \Lambda}{B^2} \frac{B^2 \epsilon - (1+B) \epsilon t \tilde{y} - (B^2 - t^2) \tilde{y}^2}{\tilde{y}^2 + \epsilon^2} \int_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{\phi}} \quad (17)$$

But λ_1, λ_2 are the roots of $ty - \epsilon = -B\sqrt{y^2 + \epsilon^2}$, i.e., they are the roots of the polynomial denoted by ϕ . Thus

$$\sqrt{\phi} = \sqrt{\epsilon^2(1+2B) - 2(1+B)\epsilon t y - (B^2 - t^2) y^2} = \sqrt{B^2 - t^2} \cdot \sqrt{(\lambda_1 - y)(y - \lambda_2)} \quad (18)$$

Introducing this expression for $\sqrt{\phi}$ into (17), and taking the limit $\epsilon \rightarrow 0$, the following value for $I(\epsilon)$ is obtained:

$$I(0) = \lim_{\epsilon \rightarrow 0} I(\epsilon) = - \frac{\gamma \cos \Lambda}{B^2} \sqrt{B^2 - t^2} \int_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{(\lambda_1 - y)(y - \lambda_2)}} \quad (19)$$

The integral appearing in equation (19) can be easily evaluated by complex variable methods; its value is found to be

$$\int_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{(\lambda_1 - y)(y - \lambda_2)}} = \pi \quad (20)$$

The contribution of the inherent singularity to the velocity field, within τ , induced by the vorticity patch τ , and denoted herein by w^* , is therefore given by

$$w^* = -\frac{\beta^2}{2\pi} \lim_{\epsilon \rightarrow 0} I(\epsilon) = -\frac{\gamma \cos \Lambda}{2} \sqrt{B^2 - t^2} \quad (21)$$

This contribution is perpendicular to the plane of τ , and it has only physical meaning when $B^2 > t^2$, i.e., when the vortex lines are swept in front of the Mach lines. It is expression (21), taken in conjunction with equations (11) and (12), that makes the vortex lattice method applicable to supersonic flow.

The Skewed-Horseshoe Vortex

Velocity fields due to complex vortex curves can be generated by the linear superposition of fields induced by simple vortex geometries. For instance, the velocity field due to a horseshoe line vortex can be obtained by the addition of the corresponding fields induced by three rectilinear segments: a transverse skewed segment, and two trailing legs, figure 2. Therefore, the determination of the velocity field due to a line vortex segment of constant, but arbitrary, sweep is the fundamental building block in the formulation of aerodynamic influence coefficients of complex three-dimensional vortex lattices. Choosing a coordinate system such that the vortex line lies in the plane $z = 0$, the conventional discrete vortex contribution to the velocity at a point whose coordinates are (x_0, y_0, z_0) is given, in Cartesian components, by the following expressions

$$\begin{aligned} u &= + \frac{\Gamma z_0}{2\pi K} \beta^2 \int_C \frac{dy}{\left\{ (x-x_0)^2 + \beta^2 \left((y-y_0)^2 + z_0^2 \right) \right\}^{3/2}} \\ v &= - \frac{\Gamma z_0}{2\pi K} \beta^2 \int_C \frac{dx}{\left\{ (x-x_0)^2 + \beta^2 \left((y-y_0)^2 + z_0^2 \right) \right\}^{3/2}} \\ w &= + \frac{\Gamma}{2\pi K} \beta^2 \int_C \frac{(x-x_0) dy - (y-y_0) dx}{\left\{ (x-x_0)^2 + \beta^2 \left((y-y_0)^2 + z_0^2 \right) \right\}^{3/2}} \end{aligned} \quad (22)$$

where Γ represents the circulation per unit length of discrete vortex line length, and the integrations are to be carried out along that part of C which satisfies the conditions

$$(x - x_0)^2 + \beta^2 ((y - y_0)^2 + z_0^2) > 0$$

and

$$x - x_0 < 0 \quad \text{if} \quad M_\infty > 1.$$

For the transverse leg of the horseshoe vortex, the coordinate x appearing in equations (22) can be expressed as a function of y , i.e., $x = ty$, and the indicated integrations carried out between the limits $y = -s$ and $y = +s$, figure 2. By defining the following auxiliary variables

$$\begin{aligned} x_1 &= x_0 + ts & x_2 &= x_0 - ts \\ y_1 &= y_0 + s & y_2 &= y_0 - s \\ x^* &= x_0 - ty_0 \end{aligned}$$

The resulting formulas giving the velocity components induced by the skewed transverse rectilinear vortex filament can be written as follows:

$$\begin{aligned} u &= + \frac{\Gamma z}{2\pi K} \cdot \frac{1}{x^{*2} + (t^2 + \beta^2) z_0^2} \cdot \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_0^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_0^2)}} \right] \\ v &= - \frac{\Gamma z}{2\pi K} \cdot \frac{t}{x^{*2} + (t^2 + \beta^2) z_0^2} \cdot \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_0^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_0^2)}} \right] \\ w &= - \frac{\Gamma}{2\pi K} \cdot \frac{x^*}{x^{*2} + (t^2 + \beta^2) z_0^2} \cdot \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_0^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_0^2)}} \right] \end{aligned} \quad (23)$$

In the above expressions, the coordinates (x_0, y_0, z_0) of the receiving field point are measured with respect to the midpoint of the rectilinear vortex segment, the x - y plane of the coordinate system coinciding with the plane defined by the x -axis and the vortex itself.

The case of a rectilinear vortex segment parallel to the x-axis ($t = \infty$) is of special importance since the trailing legs of a horseshoe vortex are generally assumed to be parallel to the x-axis. Since $dy = 0$, equations (22) become

$$u = 0$$

$$v = -\frac{\Gamma z_0}{2\pi K} \beta^2 \int_c \frac{dx}{\left\{ (x-x_0)^2 + \beta^2 \left((y-y_0)^2 + z_0^2 \right) \right\}^{3/2}} \quad (24)$$

$$w = -\frac{\Gamma (y-y_0)}{2\pi K} \beta^2 \int_c \frac{dx}{\left\{ (x-x_0)^2 + \beta^2 \left((y-y_0)^2 + z_0^2 \right) \right\}^{3/2}}$$

If the vortex segment extends from $x = x_i$ to $x = x_f$, the above integration yields

$$u = 0$$

$$v = -\frac{\Gamma z_0}{2\pi K} \left[\frac{x_0 - x_i}{\sqrt{(x_0 - x_i)^2 + \beta^2 \left((y_0 - y)^2 + z_0^2 \right)}} - \frac{x_0 - x_f}{\sqrt{(x_0 - x_f)^2 + \beta^2 \left((y_0 - y)^2 + z_0^2 \right)}} \right] \frac{1}{(y_0 - y)^2 + z_0^2} \quad (25)$$

$$w = +\frac{\Gamma}{2\pi K} \left[\frac{x_0 - x_i}{\sqrt{(x_0 - x_i)^2 + \beta^2 \left((y_0 - y)^2 + z_0^2 \right)}} - \frac{x_0 - x_f}{\sqrt{(x_0 - x_f)^2 + \beta^2 \left((y_0 - y)^2 + z_0^2 \right)}} \right] \frac{y_0 - y}{(y_0 - y)^2 + z_0^2}$$

For a conventional horseshoe vortex whose trailing legs stretch to downstream infinity, equations (25) would give the contribution of the port leg with the following substitutions

$$x_i = \infty \quad \text{if} \quad M_\infty < 1$$

$$x_i = x_0 - \sqrt{-\beta^2 \left((y_0 + s)^2 + z_0^2 \right)} \quad \text{if} \quad M_\infty > 1$$

$$x_f = -ts$$

$$y = -s$$

Likewise, the contribution from the starboard trailing leg can be computed by introducing the following values into equations (25)

$$x_i = +ts$$

$$x_f = \infty \quad \text{if} \quad M_\infty < 1$$

$$x_f = x_o - \sqrt{-\beta^2 ((y_o - s)^2 + z_o^2)} \quad \text{if} \quad M_\infty > 1$$

$$y = +s$$

Combining these results with equations (23), the formulas defining the flow field induced by a discrete vortex consisting of a skewed segment and two trailing legs parallel to the x-axis (the skewed-horseshoe vortex) are obtained. Keeping in mind Hadamard's finite part concept, and after introducing the following notation

$$F_1 = \frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} \quad ;$$

$$F_2 = \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} \quad ;$$

(26)

$$G_1 = \frac{x_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1: C = 1; M_\infty > 1: C = 0)$$

$$G_2 = \frac{x_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1: C = 1; M_\infty > 1: C = 0)$$

then, the horseshoe vortex induced field formulas can be expressed as follows:

$$\begin{aligned}
u(x_o, y_o, z_o) &= + \frac{\Gamma}{2\pi K} \frac{z_o}{x^{*2} + (t^2 + \beta^2) z_o^2} (F_1 - F_2) \\
v(x_o, y_o, z_o) &= + \frac{\Gamma}{2\pi K} z_o \left\{ - \frac{(F_1 - F_2) t}{x^{*2} + (t^2 + \beta^2) z_o^2} + \frac{G_1}{y_1^2 + z_o^2} - \frac{G_2}{y_2^2 + z_o^2} \right\} \\
w(x_o, y_o, z_o) &= - \frac{\Gamma}{2\pi K} \left\{ \frac{x^* (F_1 - F_2)}{x^{*2} + (t^2 + \beta^2) z_o^2} + \frac{y_1}{y_1^2 + z_o^2} G_1 - \frac{y_2}{y_2^2 + z_o^2} G_2 \right\}
\end{aligned} \tag{27}$$

The finite part concept determines the value of the constant C appearing in the definition of G_1 and G_2 .

A notable simplification of equations (27) occurs for supersonic flow when the receiving point (x_o, y_o, z_o) is in the plane of the horseshoe, namely, $z_o = 0$. First, the values of the axialwash and sidewash, u and v , vanish identically; secondly, the upwash expression becomes

$$w(x_o, y_o, 0) = - \frac{\Gamma}{2\pi K} \left\{ \frac{F_1 - F_2}{x^*} + \frac{G_1}{y_1} - \frac{G_2}{y_2} \right\} \tag{28}$$

Equation (28) is applicable to both subsonic and supersonic flow in its present format. But for the supersonic flow case, the fact that the constant C of the G functions becomes null due to the finite part concept allows further simplification of the upwash equation. Introducing the corresponding values of the F and G functions, the expanded version of equation (28) is

$$\begin{aligned}
w(x_o, y_o, 0) &= - \frac{\Gamma}{2\pi K} \left\{ \frac{1}{x^*} \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 y_1^2}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 y_2^2}} \right] \right. \\
&\quad \left. + \frac{x_1/y_1}{\sqrt{x_1^2 + \beta^2 y_1^2}} - \frac{x_2/y_2}{\sqrt{x_2^2 + \beta^2 y_2^2}} \right\}
\end{aligned} \tag{29}$$

Since $x^* = x_0 - ty_0 = x_1 - ty_1 = x_2 - ty_2$, the rearrangement of equation (28) in factors of $\left[(x_1 - ty_1) \sqrt{x_1^2 + \beta^2 y_1^2} \right]^{-1}$ and $\left[(x_2 - ty_2) \sqrt{x_2^2 + \beta^2 y_2^2} \right]^{-1}$ finally reduces the upwash formula to

$$w(x_0, y_0, 0) = -\frac{\Gamma}{2\pi K} \cdot \frac{1}{x^*} \left\{ \frac{\sqrt{x_1^2 + \beta^2 y_1^2}}{y_1} - \frac{\sqrt{x_2^2 + \beta^2 y_2^2}}{y_2} \right\} \quad (30)$$

When the field point $(x_0, y_0, 0)$ is within the distributed vorticity patch which is approximated by the discrete horseshoe vortex, e.g., the control point associated with the horseshoe, the upwash given by equation (30) has to be complemented by the distribution due to the generalized principal part of the upwash integral, as given by equation (21). If δx is the distance, measured in the x-direction, occupied by the distributed vorticity γ which has been lumped into the discrete transverse vortex leg of circulation Γ , the relationship between the γ of equation (21) and the Γ of equations (27) and (30) is

$$\Gamma = \gamma \cos \Lambda \delta x \quad (31)$$

Modeling of Lifting Surfaces with Thickness

The method of quadrilateral vortex rings placed on the actual body surface (ref. 1) provides a way of computing the surface pressure distribution of arbitrary bodies using discrete vortex lines only. Numerical difficulties may occur when the above method is applied to the analysis of airfoils with sharp trailing edges due to the close proximity of two vortex surfaces of nearly parallel direction. An alternative approach, requiring somewhat less computer storage and easier to handle numerically, consists in using a double, or biplanar, sheet of swept horseshoe vortices to model a lifting surface with thickness, as shown schematically in figure 3. This constitutes an approximation to the true location of the singularities, similar in nature to the classical lifting surface theory approximation of a cambered sheet.

All the swept horseshoe vortices, and their boundary condition control points, corresponding to a given surface, upper or lower, are located in a same plane. The upper and lower surface lattice planes are separated by a gap which represents the chordwise average of the airfoil thickness distribution. The results are not too sensitive to the magnitude of this gap; any value between one half to the full maximum chordwise thickness of the airfoil has been found to be adequate, the preferred value being two thirds of the maximum thickness. Furthermore, the gap can vary in the direction normal to the x-axis to allow for spanwise thickness taper. On the other hand, the chordwise distribution, or spacing, of the transverse elements of the horseshoe vortices have a significant influence on the accuracy of the computed

surface pressure distribution. For greater accuracy, for a given chordwise number of horseshoe vortices, the transverse legs have to be longitudinally spaced according to the cosine distribution law

$$x_J^v - x_0 = \frac{c}{2} \left[1 - \cos \left(\pi \frac{2J-1}{2N} \right) \right] \quad (32)$$

where $x_J^v - x_0$ represents the distance from the leading edge to the midpoint of the swept leg of the J th horseshoe vortex, c is the length of the local chord running through the midpoints of a given chordwise strip, and N is the number of horseshoe vortices per strip. The chordwise control point location corresponding to this distribution of vortex elements is given by

$$x_J^c - x_0 = \frac{c}{2} \left[1 - \cos \left(\pi \frac{J}{N} \right) \right] \quad (33)$$

The control points are located along the centerline, or midpoint line, of the chordwise strip (fig. 4). Lan has shown (ref. 7) that the chordwise 'cosine' collocation of the lattice elements, defined by equations (32) and (33), greatly improve the accuracy of the computation of the effects due to lift. His results are directly extendable to the computation of surface pressure distributions of wings with thickness by the biplanar lattice scheme presented herein.

The small perturbation boundary condition

$$\bar{v} \cdot \bar{n}' = -\bar{u}_\infty \cdot \bar{n} \quad (34)$$

is applied at the control points. In equation (34), $\bar{n} = l\bar{i} + m\bar{j} + n\bar{k}$, and $\bar{n}' = m'\bar{j} + n'\bar{k}$, where l , m , and n are the direction cosines of the normal to the actual airfoil surface. Equation (34) implies that $|lu| \ll |mv + nw|$. The use of the small perturbation boundary condition is consistent with the present biplanar approach to the simulation of thick wings.

Modeling of Fusiform Bodies

The modeling of fusiform bodies with horseshoe vortices requires a special concentric vortex lattice if the simulation of the volume displacement effects, and the computation of the surface pressure distribution, are to be carried out. To define this lattice, it is necessary to consider first an auxiliary body, identical in cross-sectional shape and longitudinal area distribution to the actual body, with a straight baricentric line, i.e., without camber. The cross-sectional shape of this auxiliary body is then approximated by a polygon whose sides determine the transverse legs of the horseshoe vortices. The vertices of the polygon and the axis of the auxiliary body (which by definition is rectilinear (zero camber) and internal to all possible cross sections of the body) define a set of radial planes in which

the bound trailing legs of the horseshoe vortices lie parallel to the axis (fig. 5). As the body cross section changes shape along its length, the corresponding polygon is allowed to change accordingly, but with the constraint that the polygonal vertices must always lie in the same set of radial planes. The axial spacing of the cross-sectional planes that determine the transverse vortex elements, or polygonal rings, follows the cosine law of equation (32). The boundary condition control points are located on the auxiliary body surface, and in the bisector radial planes, with their longitudinal spacing given by equation (33).

The boundary condition to be satisfied at these control points is the zero mass flux equation.

$$\bar{w} \cdot \bar{n} = -\bar{u}_\infty \cdot \bar{n} \quad (35)$$

where all the components of the scalar product $\bar{w} \cdot \bar{n} = \beta^2 l u + m v + n w$ are to be retained. Thus, equation (35) is a higher order condition than equation (34). The use of this higher order boundary condition, within the framework of a linearized theory, is not mathematically consistent. Therefore, it can only be justified by its results rather than by a strict mathematical derivation. In the present treatment of fusiform bodies, it has been found that the use of higher order, or exact boundary conditions is a requisite for the accurate determination of the surface pressure distribution.

The fact that the vector \bar{w} , instead of \bar{v} , appears in the left hand member of equation (35) requires some elaboration. First, it should be pointed out that for small perturbations $\bar{w} \cdot \bar{n} \cong \bar{v} \cdot \bar{n}'$. Furthermore, for incompressible flow ($\beta = 1$), the vector \bar{w} is identical to the perturbation velocity \bar{v} . Consequently, the boundary condition equation (34) is consistent with the continuity equation, $\nabla \cdot \bar{w} = 0$, to a first order for compressible flow, and to any higher order for incompressible flow. But when a higher order boundary condition is applied in compressible flow to a linearized solution, it should be remembered that this solution satisfies the conservation of \bar{w} , not of \bar{v} , i.e., $\nabla \cdot \bar{w} = 0$. Thus, the higher order boundary condition should involve the reduced current velocity, or perturbation mass flux, vector \bar{w} , as in equation (35), rather than the perturbation velocity vector \bar{v} .

The body camber, which was eliminated in the definition of the auxiliary body, is taken into account in the computation of the direction cosines l, m , and n , which are implicit in equation (35). Therefore, the effect of camber is represented in the boundary condition but ignored in the spatial placement of the horseshoe elements. This scheme will give a fair approximation to cambered fusiform bodies provided that the amount of body camber is not too large.

Computation of Sideslip Effects

The aerodynamics of an isolated wing in sideslip can be analyzed by two different approaches depending on the coordinate system chosen. In one approach, the coordinate system consists of wind axes, the longitudinal axis being aligned with the free-stream velocity vector, figure 6. This formulation of the problem is known as the skewed-wing approach, and a first order solution obtained within this framework will give the dominant effects of sideslip, even for the case of zero dihedral. The other approach, also shown schematically in figure 6 and known as the skewed free-stream approach, is based on a body-axis formulation of the problem and the corresponding first order solution, though it may be adequate for large dihedral, will fail to produce the significant effects of sideslip for low or zero dihedral. To compute the sideslip effects correctly within the framework of a skewed free-stream formulation, it is necessary to solve partial differential equations containing second order terms of the perturbation velocities. This implies a much more involved computational procedure than that required for the solution of the first order perturbation equations (1). On the other hand, the application of the skewed-wing approach to anything more complex than an isolated wing in sideslip, such as might be the case with a configuration with wing, fuselage, and nacelles, becomes geometrically very complicated.

The approach adopted herein is a combination of the two approaches mentioned above, formulated with the objective of obtaining reasonably accurate sideslip effects using only a first order perturbation solution but without all of the geometrical complications inherent in the skewed-wing approach. Basically it is assumed that the vortex lattice representing the configuration and its vortex wake consists of both bound and free elements or legs; the vortex filaments that model rigid surfaces are considered bound, and those that constitute the wake are the so-called free elements, figure 7. The bound portion of the lattice, containing both transverse and trailing, or chordwise, segments, is invariant in a body axis system, the chordwise legs being parallel to the x-axis. The free legs of the lattice are not actually force free, rather they are assumed to extend to downstream infinity parallel to a predetermined direction which is proportional to the angles of attack and sideslip. If the proportionality factors are unity, then the free portion of the lattice would be invariant in wind axes.

After the circulation strengths of the above lattice geometry are solved for under the appropriate boundary conditions, the pressure coefficient distribution is computed in accordance with the higher order expression

$$c_p = - \frac{2}{q_\infty} (U_\infty u + V_\infty v) \quad (36)$$

where U_∞ and V_∞ are the components along the x and y body axes of the free-stream velocity vector of modulus q_∞ ; the corresponding perturbation velocity components are denoted by u and v, as usual. The use of equation (36) instead of the linear approximation

$$C_p = - \frac{2}{q_\infty} U_\infty u \quad (37)$$

is required for the correct computation, within the present framework, of the rolling moment due to sideslip of a planar wing. This is due to the fact that the bound trailing legs, being defined in body axes, are not lined up with the free-stream flow and therefore, according to the theorem of Kutta, they contribute to the normal force. This contribution is represented by the second order term in equation (36), namely, $V_\infty v$. Even though this contribution is of second order, it must be included in the computation of the differential rolling moment due to sideslip, since this quantity itself is of the second order for a planar, or nearly planar, wing.

THE GENERALIZED VORTEX LATTICE METHOD

Description of Computational Method

The four items discussed in the preceding section, i.e., the inclusion of the vorticity-induced residual term w^* for supersonic flow, the biplanar scheme for representing thickness effects, the use of a vortex grid of concentric polygonal cylinders for the simulation of fusiform bodies, and the special lattice geometry consisting of both bound and free elements for the analysis of sideslip effects, have been implemented in a computational procedure herein known as the generalized vortex lattice (GVL) method. This method, outlined in what follows, has been codified in a Fortran IV computer program (VORLAX).

The basic element of the method is the swept horseshoe vortex whose trailing legs has both bound and free segments. The latter segments may trail to downstream infinity in any arbitrary, but predetermined, direction whereas the bound trailing legs are laid out on the proper cylindrical control surfaces in a direction which is parallel to the x body axis. Figure 8 illustrates schematically the representation of a wing-body configuration within the context of the present method. In this illustration, the streamwise arrangement of the lattice follows the cosine distribution law, equation (32), but both chordwise and spanwise distributions of vortex lines can be independently specified to be either of the cosine or of the equal spacing. To each horseshoe vortex there corresponds a control point which is placed midway between the bound trailing legs of the horseshoe; the longitudinal location of the control point is determined by equation (33) if the cosine chordwise distribution has been chosen, otherwise it is located halfway between the transverse legs, as required by quarter-chord/three-quarter-chord rule.

The direction of floatation of the wake vortex filaments is defined by the two angles α_v and β_v shown in figure 8, the former being proportional to the angle of attack, and the latter being proportional to the sideslip angle. The proportionality constants are part of the program input, the recommended values being 0 for the sideslip constant, and 0 or 0.5 for the angle of attack constant.

The velocity field induced by the elementary horseshoe vortex is given by equations (27) when above constants are both zero, and by somewhat more complicated expressions which take into account the kinks in the trailing legs when either one or both of the wake floatation parameters are nonzero. Though not presented here, these expressions can be easily derived through the application of equations (23).

When the influence induced by a horseshoe vortex upon its own control point is being evaluated, the contribution from the generalized principal part, as given by equation (21), is included in the normalwash if the free-stream is supersonic. Furthermore, for the supersonic case, the simplified downwash formula, equation (30), is used whenever the receiving point is in the same plane of the inducing horseshoe.

The horseshoe vortex velocity field is used to generate the coefficients of a system of linear equations relating the unknown vortex strengths to the appropriate boundary condition at the control points. This linear system is solved by either a Gauss-Seidel iterative procedure, known as controlled successive over-relaxation (ref. 8), or by a vector orthogonalization technique, i.e., Purcell's vector method (ref. 9). If the inverse process is desired, i.e., synthesis or design instead of analysis, the linear system of equations is used to compute the slope distribution (surface warp) required to achieve a specified surface loading; this involves a straightforward matrix multiplication process. Mixed cases, i.e., design and analysis, are easily handled by proper grouping of the boundary condition equations.

The pressure coefficients are computed in terms of the perturbation velocity components, the computation being carried out according to either one of three possible ways, as follows:

1. If the surface under consideration is assumed wetted by the flow on both sides (zero thickness panel) and the configuration sideslip angle is zero, then a net loading coefficient is computed based on the local value of the spanwise vorticity, namely,
$$\Delta C_p = 2\gamma \cos\Lambda;$$
2. When the configuration sideslip angle is not zero, the net loading coefficient of a zero-thickness surface is calculated through the use of the higher order expression (36); and
3. When surface pressure coefficients are computed, i.e., the panel under consideration is assumed wetted by the flow on one side only, the isentropic flow relationship giving the pressure coefficient in terms of free-stream Mach number and local-to-free-stream velocity ratio is resorted to.

The force and moment coefficients are calculated by numerical integration of the pressure coefficient distribution with due account being given to the edge forces. If cosine chordwise lattice spacing is specified by the VORLAX program user, the computation of the leading edge suction of zero thickness

panels is carried out according to Lan's procedure (ref. 7), whose application to supersonic flow is made possible by the generalized vortex-induced velocity field formulas presented in this report. If equal chordwise lattice spacing is specified, the contribution of the leading edge suction singularity to the forces and moments is calculated by the technique indicated by Hancock in reference 10; this approach is not nearly as accurate as Lan's, the magnitude of the leading edge suction being significantly underestimated.

The VORLAX computer program has the capability of analyzing symmetrical and asymmetrical cases as well as configurations in steady state angular rotation about any or all of three axes, parallel to the coordinate axes, going through the input moment reference center. Steady state angular rotation cases are treated by the subterfuge of assuming a nonuniform onset flow, this onset flow being defined by the values of the angular rates and distance of the field point to the rotation center.

Ground proximity effects are analyzed by the method of images, i.e., the configuration is mirrored about the ground plane; the flow around the airplane and its image then contains a stream surface which coincides with the ground plane due to the symmetry of the arrangement. In this modeling of a configuration in ground proximity, it is assumed that the trailing vorticity wake floats to downstream infinity parallel to the plane of the ground.

Numerical Considerations

At supersonic Mach numbers, the velocity induced by a discrete horseshoe vortex becomes very large in the very close proximity of the envelope of Mach cones generated by the transverse leg of the horseshoe. At the characteristic envelope surface itself, the induced velocity correctly vanishes, due to the finite part concept. This singular behavior of the velocity field occurs only for field points off the plane of the horseshoe. For the planar case, the velocity field is well behaved in the vicinity of the characteristic surface. A simple procedure to treat this numerical singularity consists of defining the characteristic surfaces by the equation

$$(x-x_1)^2 = C B^2 \left\{ (y-y_1)^2 + (z-z_1)^2 \right\} \quad (38)$$

where C is a numerical constant whose value is greater than, but close to, 1. It has been found that this procedure yields satisfactory results, and that these results are quite insensitive to reasonable variations of the parameter C.

Another numerical problem, peculiar to the supersonic horseshoe vortex, exists in the planar case (field point in the plane of the horseshoe) when the field point is close to a transverse vortex leg swept exactly parallel to the Mach lines (sonic vortex), while the vortex lines immediately in front of and

behind this sonic vortex are subsonic and supersonic, respectively. This problem can be handled by replacing the boundary condition equation for such sonic vortex with the averaging equation

$$-\gamma_I^*_{-1} + 2 \gamma_I^* - \gamma_I^*_{+1} = 0 \quad (39)$$

where γ_I^* is the circulation strength of the critical horseshoe vortex, and $\gamma_I^*_{-1}$ and $\gamma_I^*_{+1}$ are the respective circulation values for the fore-and-aft adjacent subsonic and supersonic vortices.

The axialwash induced velocity component (u) is needed for the computation of the surface pressure distribution, and for the formulation of the boundary condition for fusiform bodies. When the field point is not too close to the generating vorticity element, the axialwash is adequately described by the conventional discrete horseshoe vortex representation. But if this point is in the close vicinity of the generating element, as may occur in the biplanar and in the concentric cylindrical lattices of the present method, the error in the computation of the axialwash due to the discretization of the vorticity becomes unacceptable. This problem is solved by resorting to a vortex-splitting technique, similar to the one presented in reference 11. Briefly, this technique consists of computing the axialwash induced by the transverse leg of a horseshoe as the summation of several transverse legs longitudinally redistributed, according to an interdigitation scheme, over the region that contains the vorticity represented by the single discrete vortex. This is done only if the point at which the axialwash value is required lies within a given near field region surrounding the original discrete vortex.

COMPARISON WITH OTHER THEORIES AND EXPERIMENTAL RESULTS

Conical flow theory provides a body of exact results, within the context of linearized supersonic flow, for some simple three-dimensional configurations. These exact results can be used as bench mark cases to evaluate the accuracy of numerical techniques. This has been done rather extensively for the GVL method, and very good agreement between it and conical flow theory has been observed in the computed aerodynamic load distribution and all force and moment coefficients. Only some typical comparisons are presented in this report, figures 9 through 12.

Finally, the capability of computing surface pressure distributions by the method of this paper is illustrated in figures 13 and 14.

CONCLUDING REMARKS

The present vortex lattice method, in the form of a computer program, has the capability to calculate the aerodynamic load distribution at subsonic and supersonic Mach numbers for arbitrary nonplanar configurations. It has been found to be a very useful preliminary design tool, particularly when aircraft configurations whose mission requirements involve both subsonic and supersonic flight are considered. It is also capable of the inverse process, namely, the computation of the surface warp required to achieve a given load distribution. Correlation with experimental data and with results from other theories shows a good agreement not only in the overall force and moment coefficients due to lift, but also in the distribution of the load coefficients.

The schemes shown for the simulation of thickness and volume effects, which allow the computation of surface pressure distribution by using only vortex lattice singularities, appear adequate for most practical purposes, though experience in this respect is somewhat limited.

The treatment of sideslip cases by the present method does not require higher order solutions, as is necessary for the skewed free-stream approach, and it is not as geometrically complicated as the skewed-wing formulation. Yet the analysis of complex configurations in sideslip still requires care and caution due to the numerical anomalies that may result from the interaction among aircraft components, such as a horizontal tail or a body, and the "free" trailing legs of the horseshoe vortices.

Additional capabilities that can be added to the present computer code, and that would enhance the value of the method as a preliminary design tool include the following:

- Incorporation of an optimization algorithm based either on Lagrange multipliers or on a gradient method, to design the surface warp for minimum drag under specified constraints.
- Application of the technique of reference 11, or of some other adequate technique, for the simulation of jet exhaust effects, with particular attention to its extension to supersonic flow.
- Introduction of a design procedure for the calculation of the geometry required to achieve a given surface pressure distribution, i.e., synthesis of both camber and thickness. The biplanar vortex lattice simulation of a thick lifting surface is well suited for the development of such a design procedure when combined with an iterative scheme.

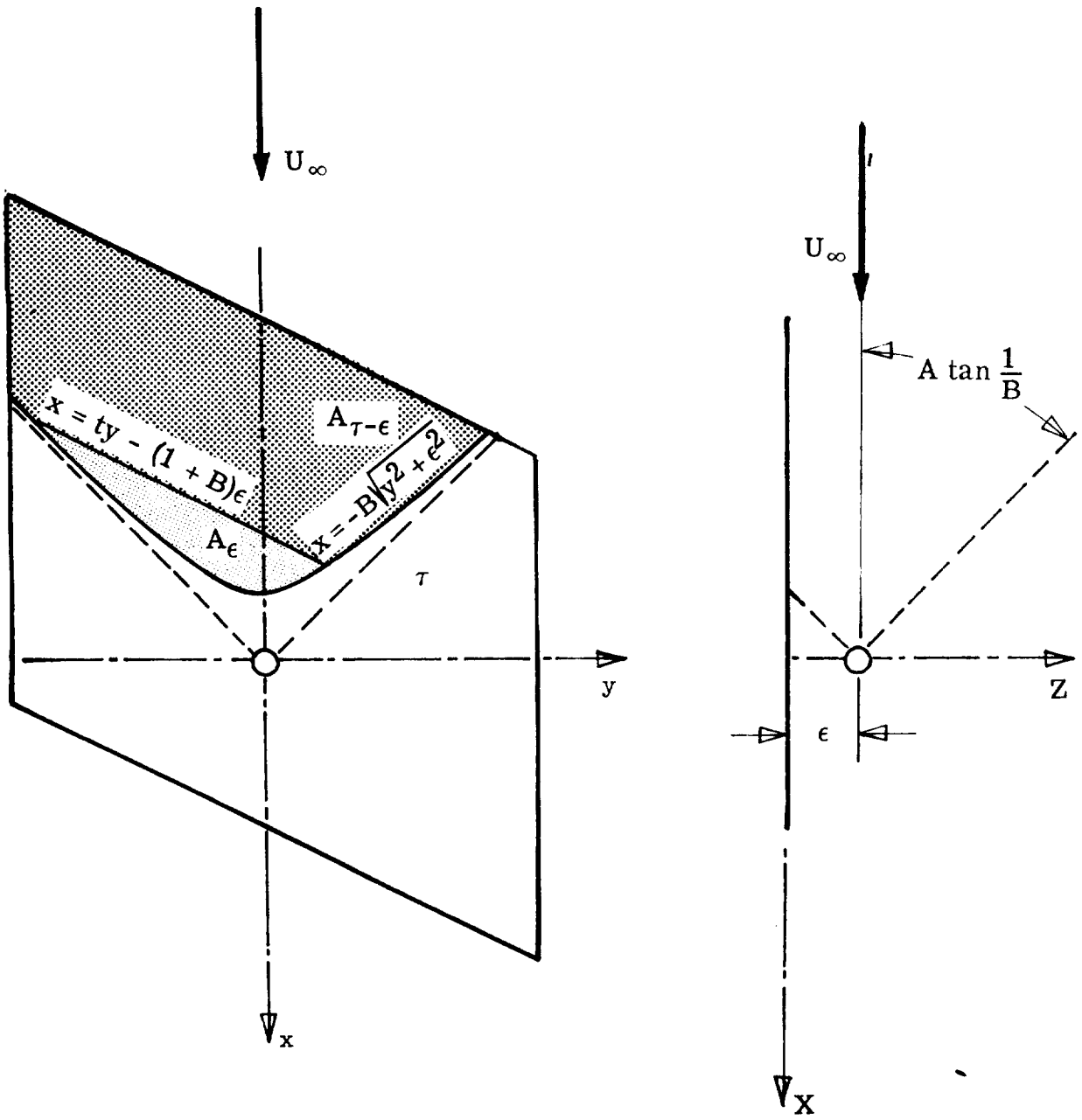


Figure 1.- Definition of integration regions for the computation of principal part.

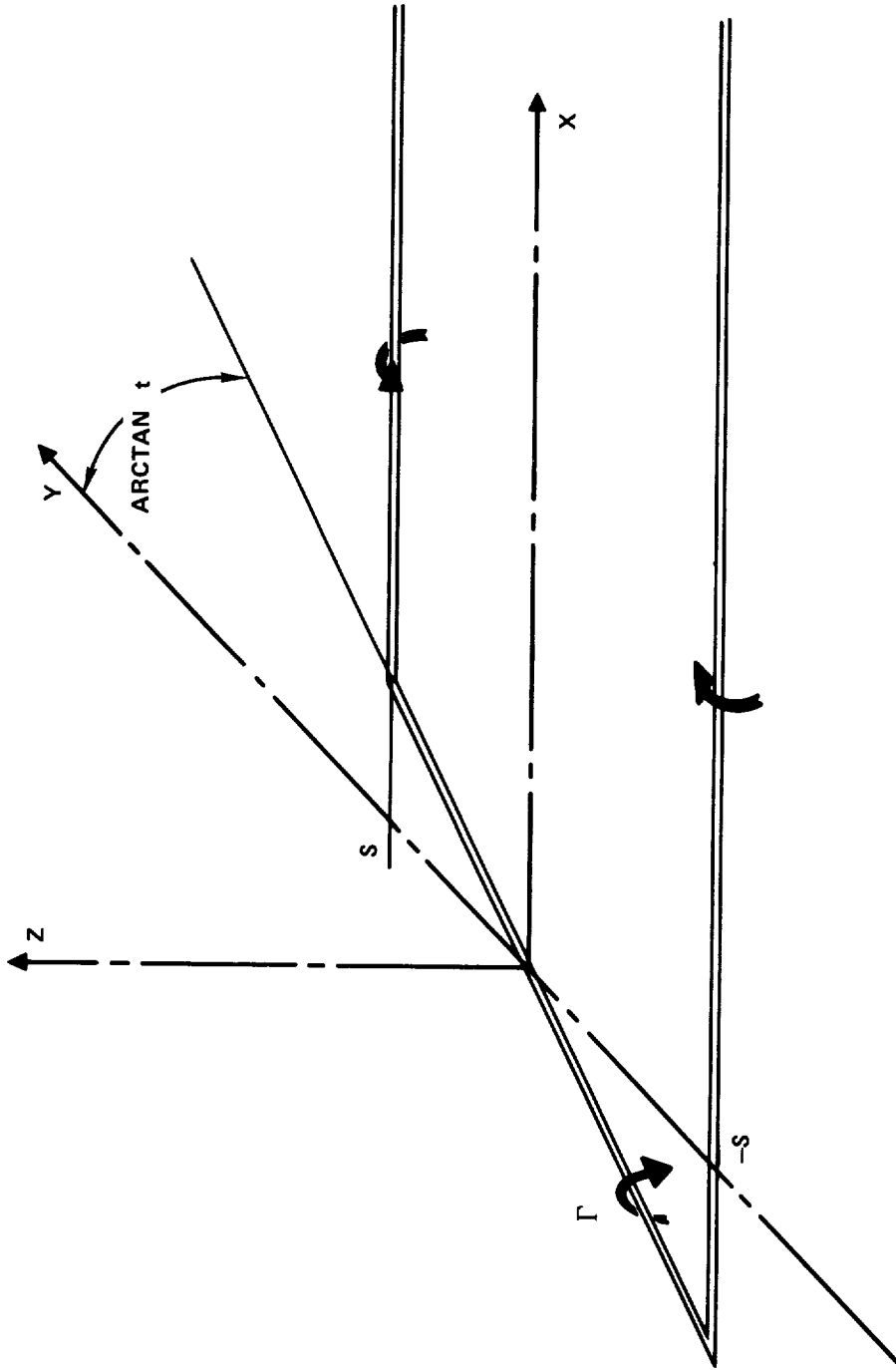
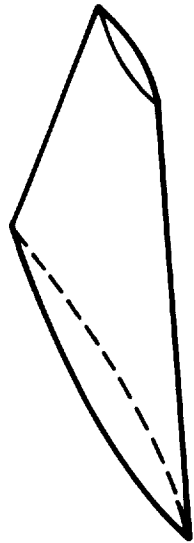


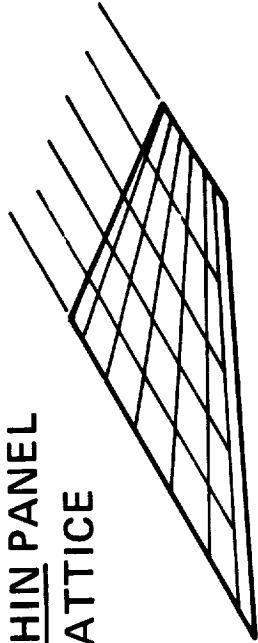
Figure 2.- Sweptback horseshoe vortex



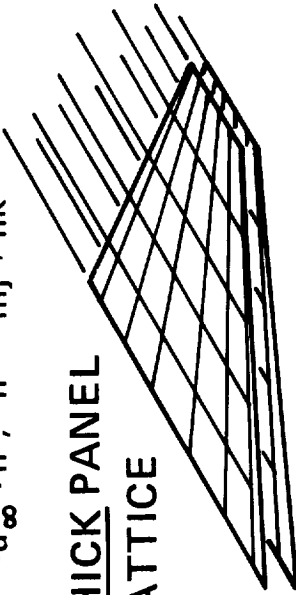
ACTUAL WING PANEL

BOUNDARY CONDITION: $\bar{w} \cdot \bar{n}' = \bar{v} \cdot \bar{n}' = -\bar{u}_\infty \cdot \bar{n}'$; $\bar{n}' = m\bar{j} + n\bar{k}$

THIN PANEL
LATTICE



THICK PANEL
LATTICE



CHORDWISE DISTRIBUTION OF VORTEX LINES:

$$\frac{X_j^v \cdot X_0}{C} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{2j-1}{2N} \right) \right\}$$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS:

$$\frac{X_j^c \cdot X_0}{C} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{j}{N} \right) \right\}$$

Figure 3.- Modeling of thick wing with horseshoe vortices.

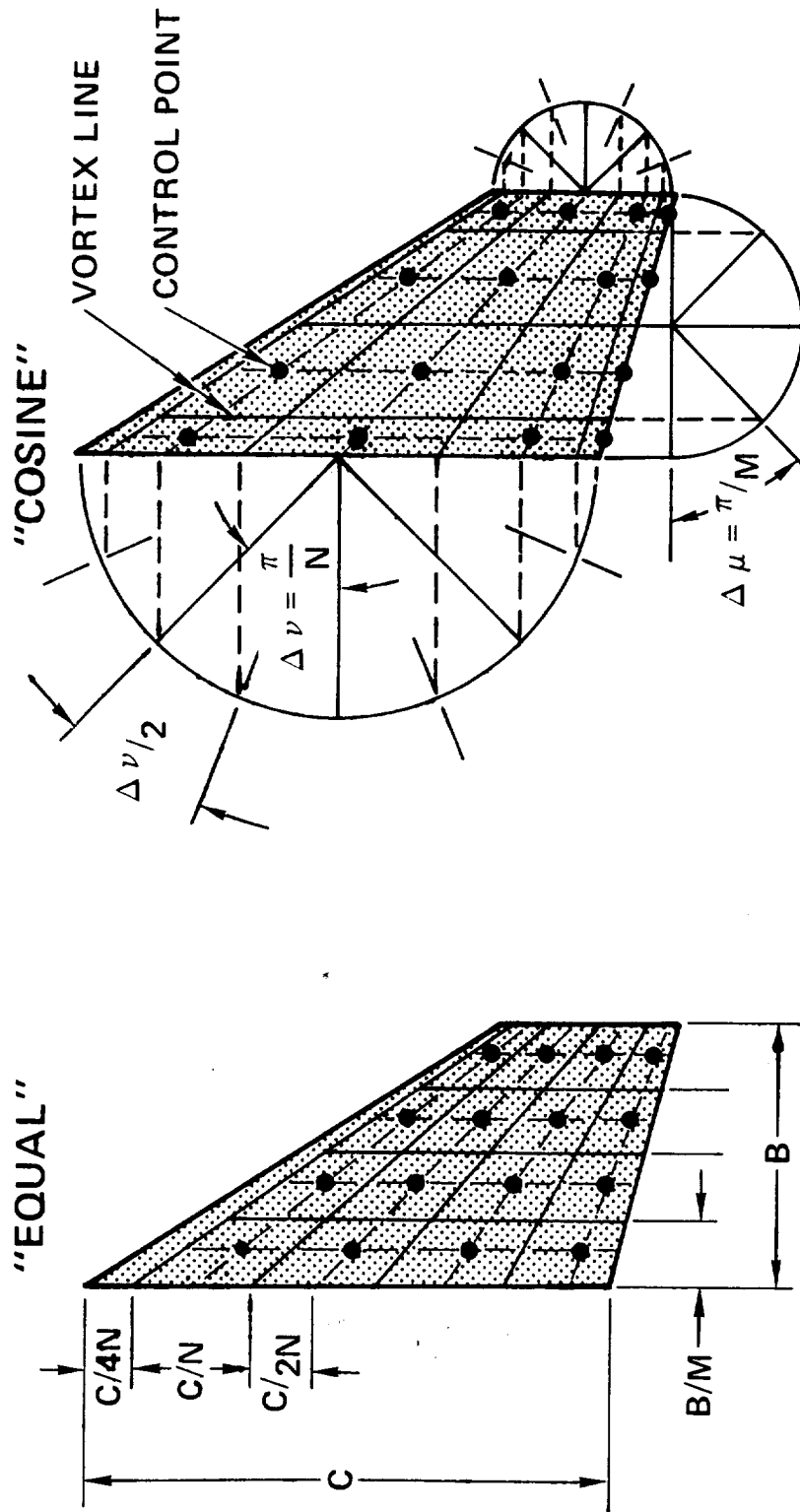
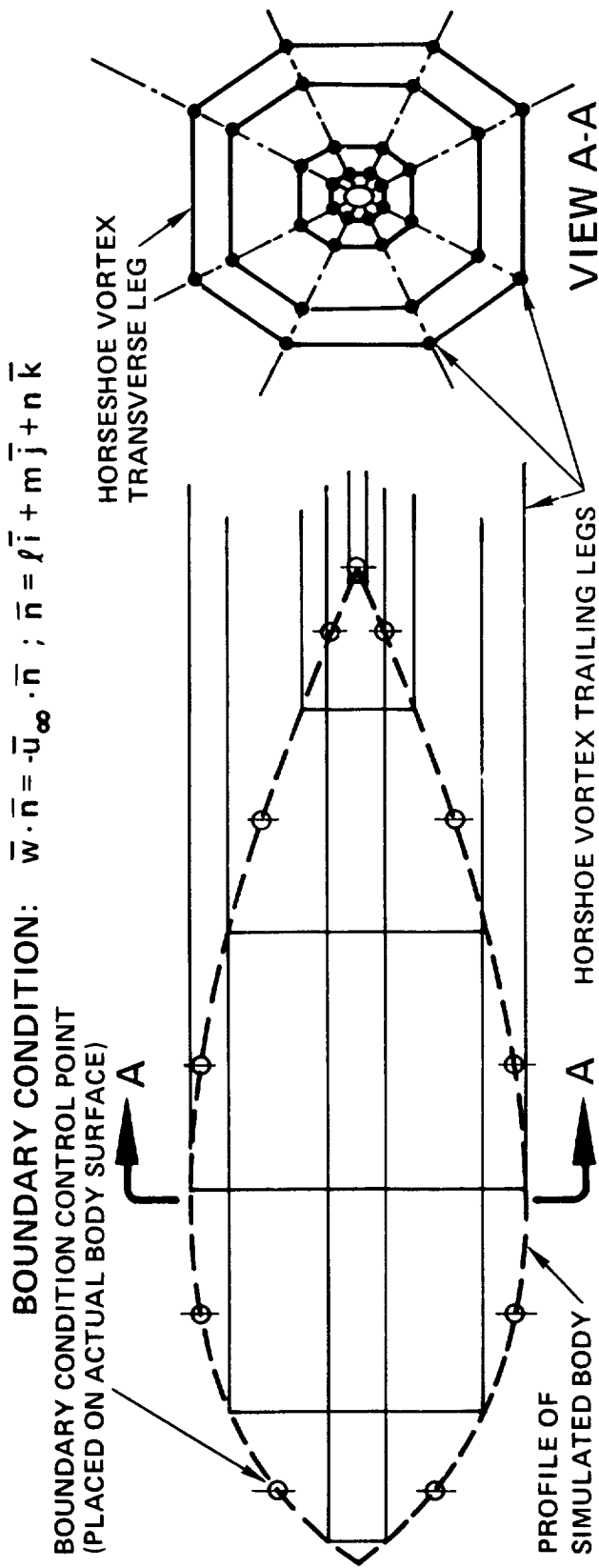


Figure 4.- Vortex lattice collocation.



AXIAL DISTRIBUTION OF VORTEX LINES:

$$\frac{X_j^y \cdot X_0}{L} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{2j-1}{2N} \right) \right\}$$

AXIAL DISTRIBUTION OF B.C. CONTROL POINTS:

$$\frac{X_j^c \cdot X_0}{L} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{j}{N} \right) \right\}$$

Figure 5.- Modeling of fusiform body with horseshoe vortices.

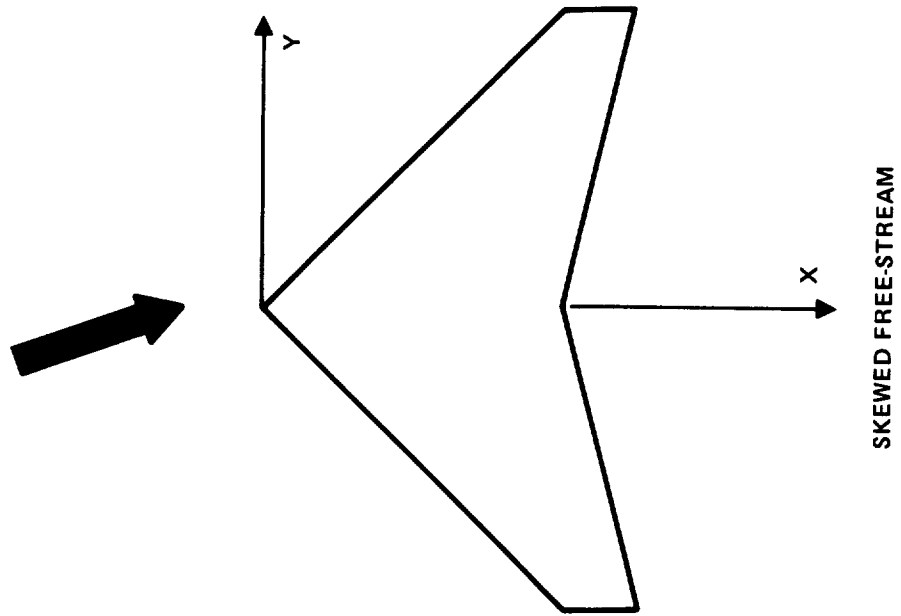
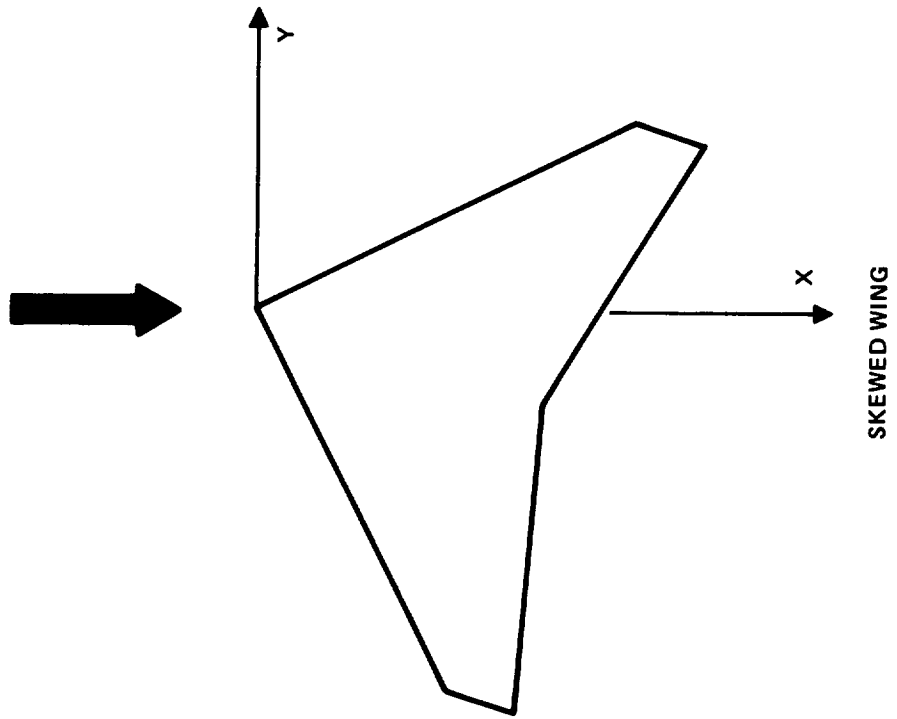


Figure 6.- Conventional approaches for analysis of wing in sideslip.

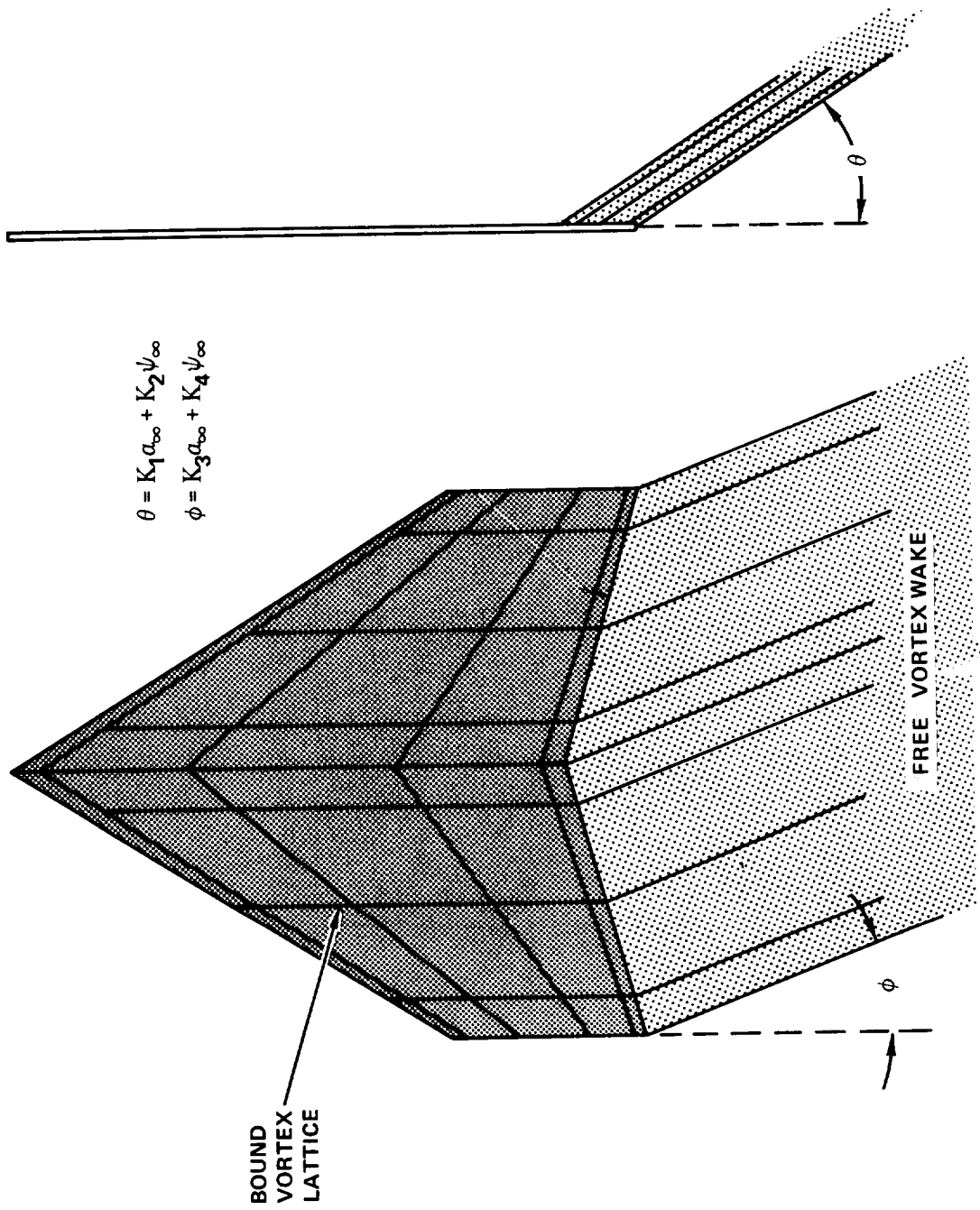


Figure 7.- Lattice geometry for analysis of wing in sideslip.

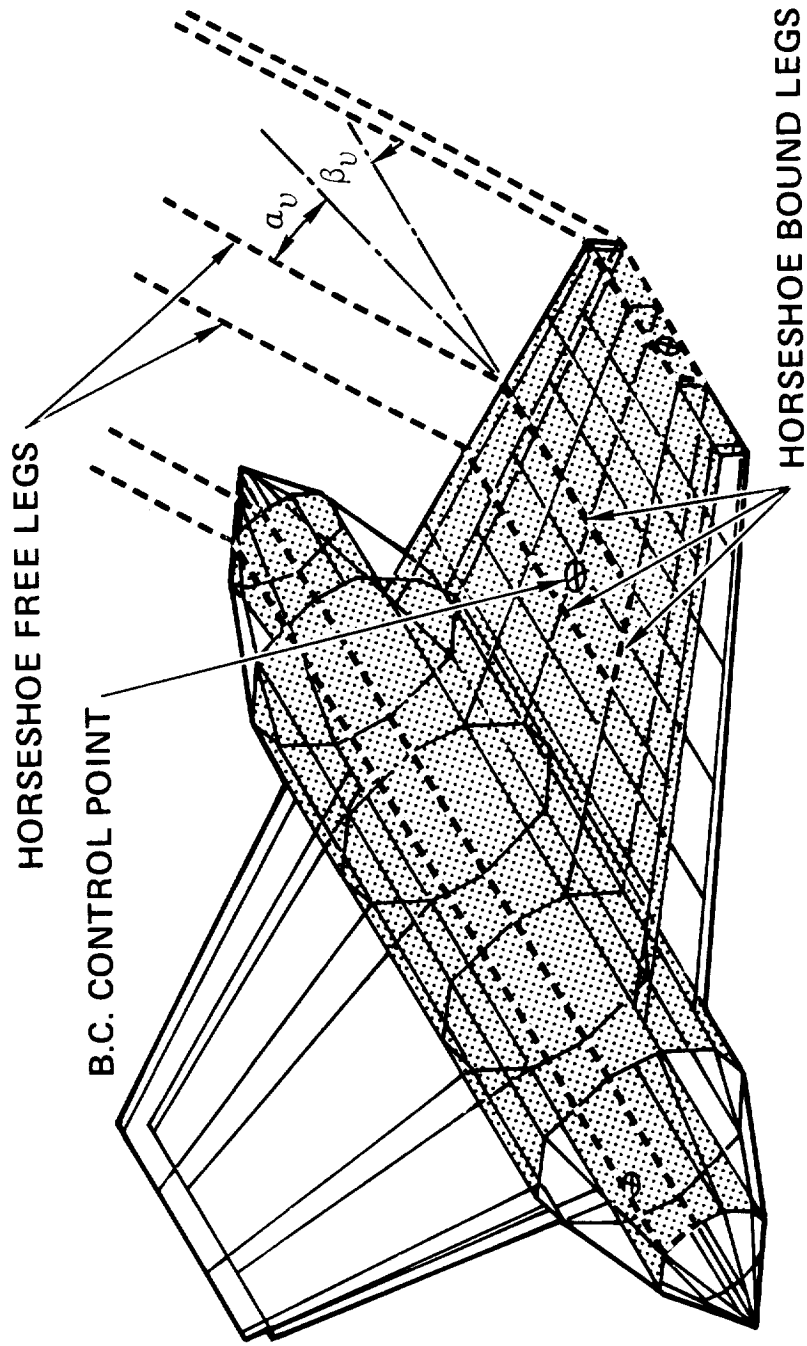
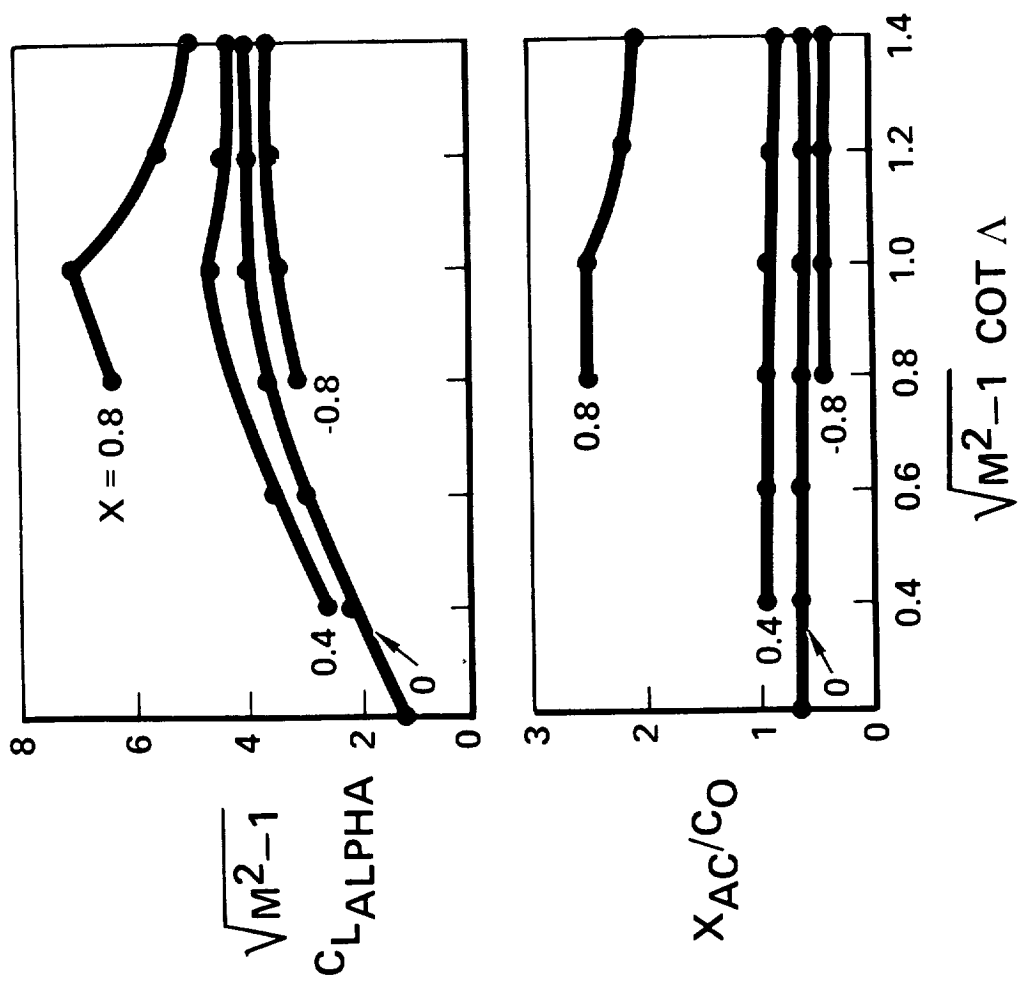


Figure 8.- Generalized vortex lattice model of wing-body configuration.



— CONICAL FLOW THEORY

● GVL (16 x 16 GRID)

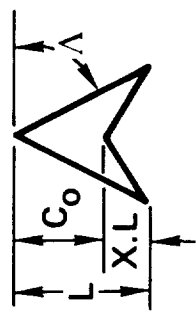


Figure 9.- Theoretical comparison of arrow wing lift slope and aerodynamic center location.

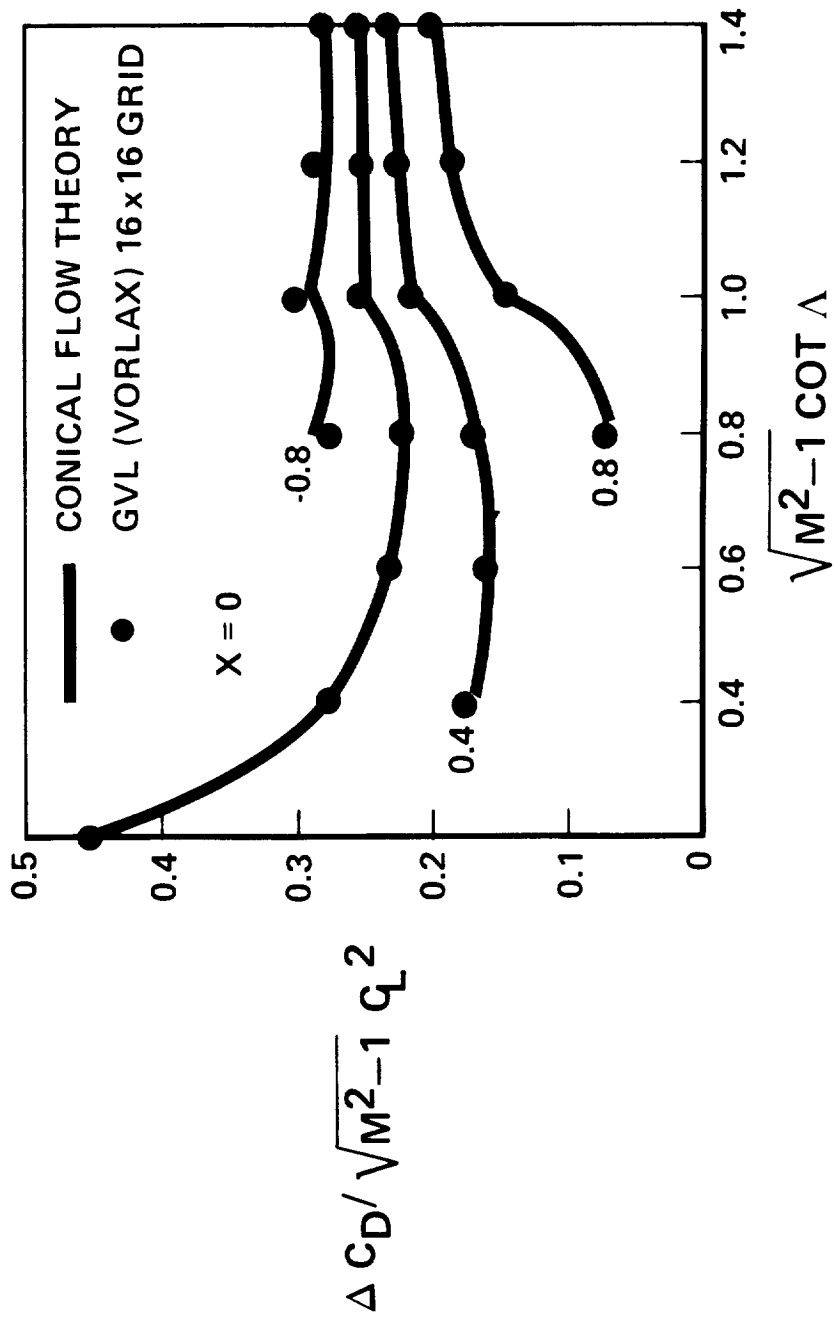


Figure 10.- Theoretical comparison of arrow wing drag-due-to-lift factor.

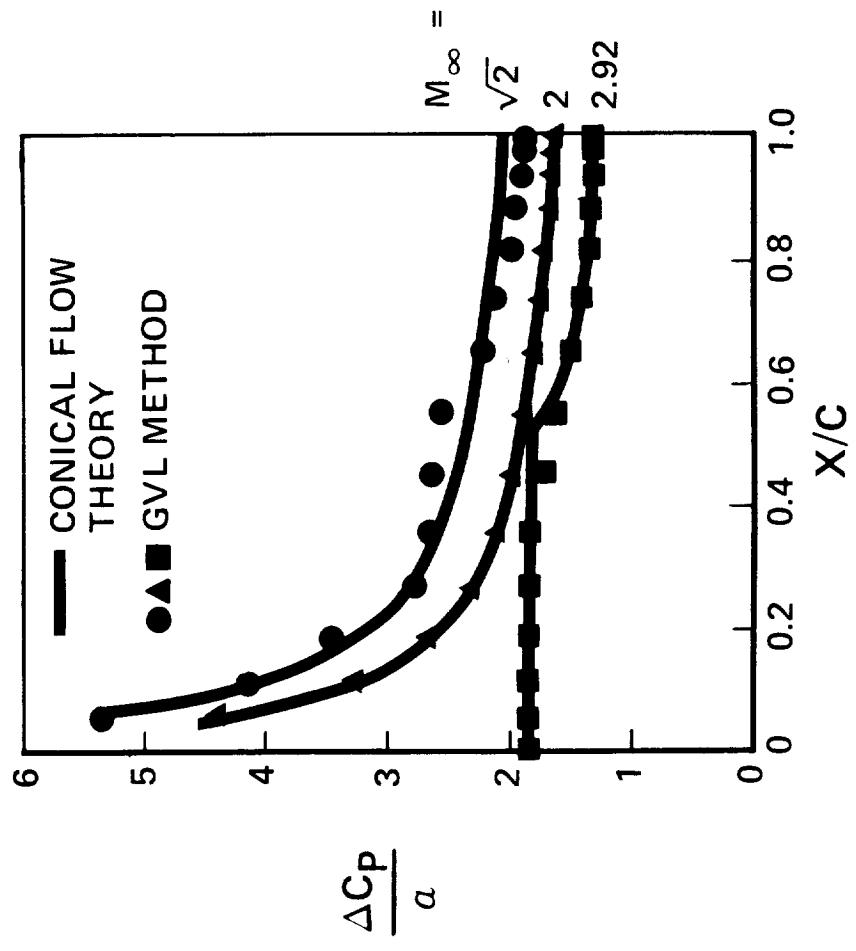
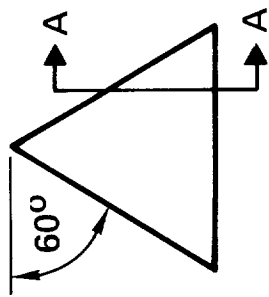


Figure 11.- Theoretical comparison of chordwise loading for delta wing.

SWEEP=59° ; ASPECT RATIO = 1.92 MACH NUMBER=√2

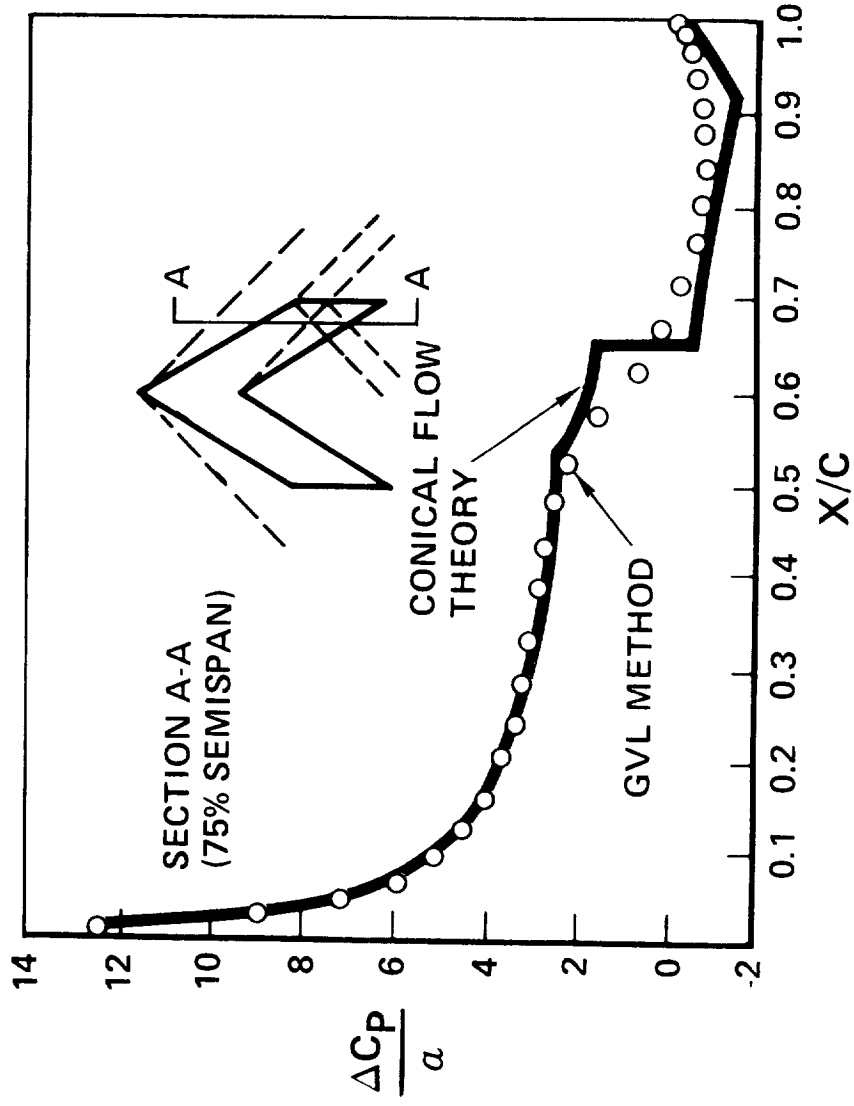
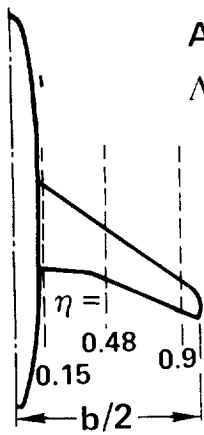


Figure 12.- Theoretical comparison of chordwise loading for sweptback rectangular wing.



AR = 6.95
 $\Delta_{C/4} = 35^\circ$

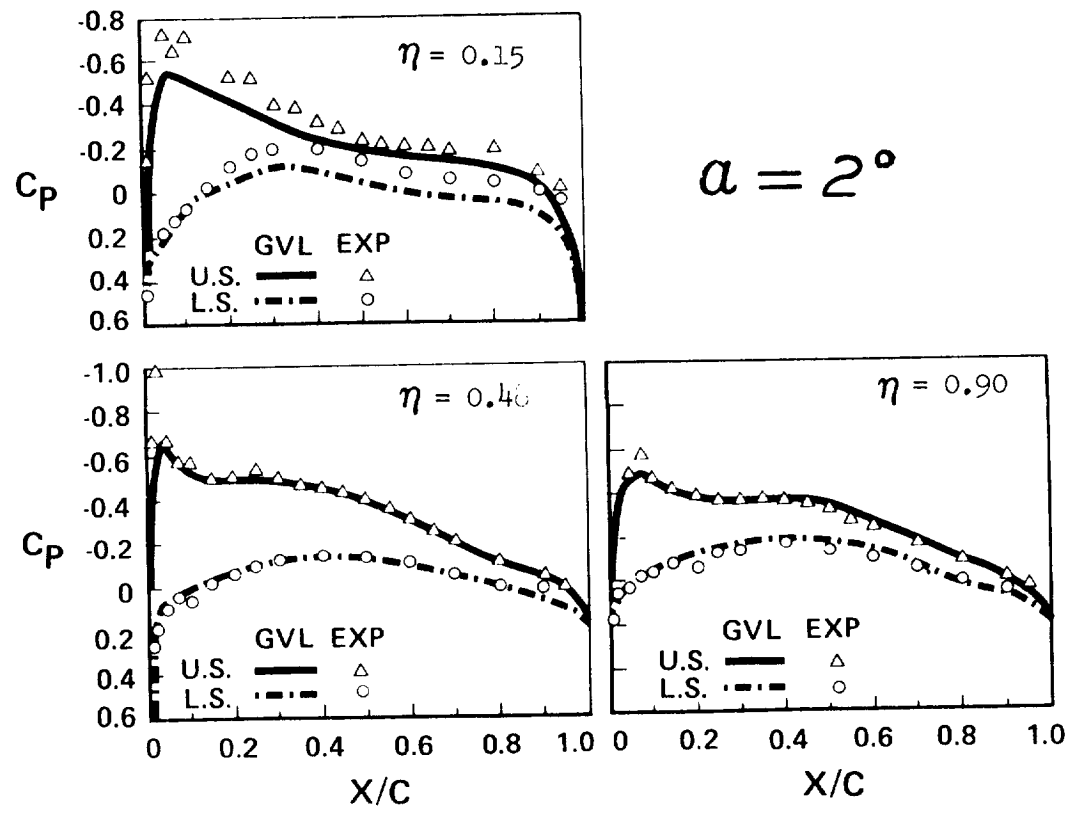
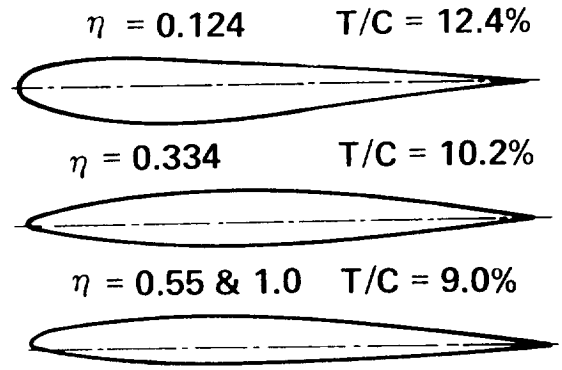


Figure 13.- Comparison with experimental pressure distribution on wing-body model at Mach = 0.5.

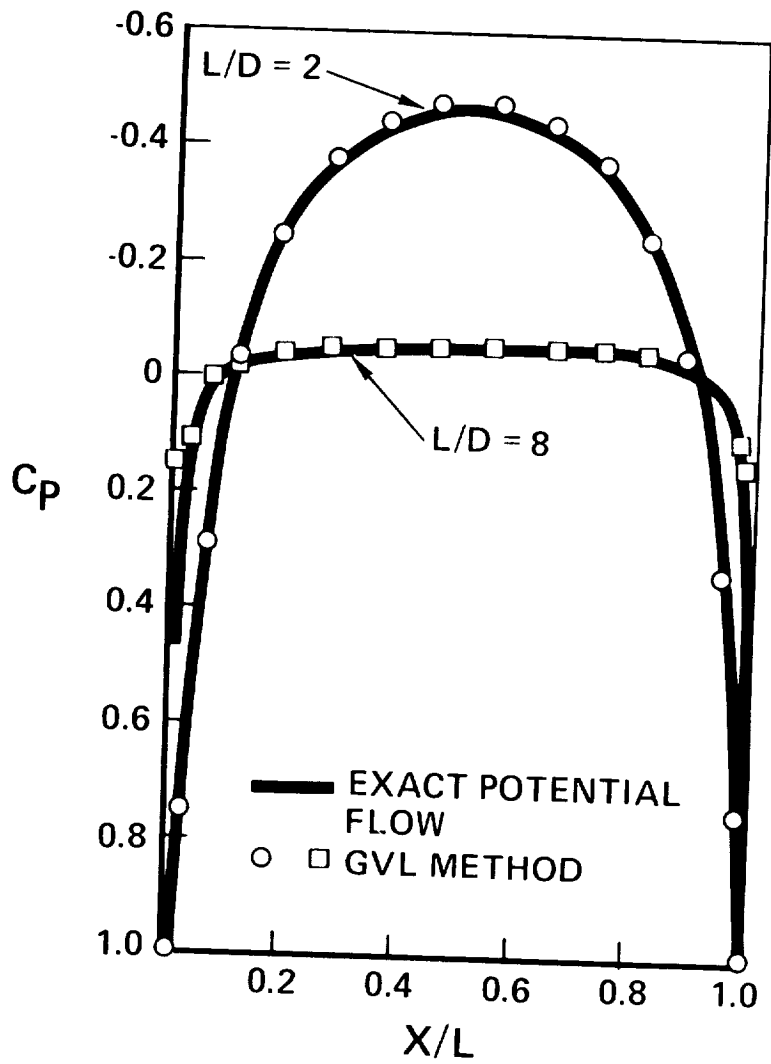


Figure 14.- Theoretical comparison of pressure distribution on ellipsoids at zero angle of attack in incompressible flow.

APPENDIX A
USER'S MANUAL
FOR
A GENERALIZED VORTEX LATTICE METHOD
FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS



THE VORLAX COMPUTER PROGRAM

A computer program has been developed for the aerodynamic analysis and design of arbitrary aircraft configurations in subsonic and supersonic flow. This computer program, herein identified as VORLAX, has been codified in FORTRAN IV for use on the CDC 6600, the IBM 360, and the IBM 370 digital computer systems. A complete compilation and executed case in CDC FORTRAN IV is contained in Appendix B. Two auxiliary interface programs, treated in Appendices C and D, provide for input data transformation from NASA Wave Drag format (Reference 12) to VORLAX format (Appendix C) and for transformation from VORLAX to NASA Wave Drag format (Appendix D).

The VORLAX program is based on a generalized vortex lattice (GVL) method which extends the applicability of vortex lattice techniques to a broader range of problems than has heretofore been considered. In this program, the configuration is represented by a three-dimensional, generally nonplanar, vortex lattice; the basic element of the lattice is the skewed horseshoe vortex whose induced velocity formulas have been generalized for subsonic and supersonic flow. Thickness effects can be simulated by a double (biplanar or sandwich) lattice arrangement. Fusiform bodies can be modelled by a concentric cylindrical lattice of polygonal cross sections. The computational capabilities of the program include the following:

- Surface pressure or net load coefficient distribution.
- Aerodynamic force and moment coefficients.
- Surface warp (camber and twist) design in order to achieve input pressure distribution.
- Longitudinal/lateral stability derivatives.
- Ground and wall (wind tunnel interference) effects.
- Flow field survey.
- Symmetrical/asymmetrical configurations and/or flight conditions.

The limitations of the VORLAX program are characteristic of methods based on inviscid linearized potential flow theory, as follows:

- Attached flow.
- Small perturbation flow.
- Flow entirely subsonic or supersonic (no mixed transonic flow).
- Straight Mach lines.
- Rigid vortex wake.

PRACTICAL INPUT INSTRUCTIONS

In defining a configuration for the program input, a master frame of reference X- Y- Z- is assumed. The X-Z plane is the centerline plane, the Z axis directed upward, and the X-axis pointing in the downstream direction; the Y axis points to starboard. The origin of the system can be any convenient point in the X-Z plane. In general, the configuration can be made up of symmetrical and asymmetrical components, and in defining the symmetrical components only the starboard elements need be specified.

The configuration to be input is divided into a set of major panels; up to 20 of these panels can be input, symmetrical components being counted only once. For instance, a wing with straight leading and trailing edges, and with linear lofting between the root and tip, constitutes a major panel. Complex planforms, and nonlinear changes in twist and airfoil sections are described by defining more than one panel for a given wing. The computer program will then subdivide each major panel into a number of smaller elementary panels spaced chordwise and spanwise, i.e., a finer mesh lattice is generated internally. The chordwise and spanwise spacing is specified by the user, two options being available: (1) the semicircle or cosine distribution so well known in airfoil and wing theory, and (2) the equally spaced distribution.

Up to 2000 elementary panels can be used in the definition of a given configuration. Any consistent system of length and area dimensions can be used in the specification of the configuration length, but it is recommended that the system of units used be such that the largest length dimension does not require more than three digits to the left of the decimal point. Otherwise, significant digits may be lost in the output printout.

Wing thickness effects can be taken into account within the context of control surface theory. By control surface theory one means that the exact linearized theory is used to evaluate induced velocities along a given mean surface, known as the control surface, and these values enter into the computation of the boundary conditions which are satisfied at this control surface rather than at the actual boundary surface. The control surface equivalent of a typical two-dimensional airfoil is illustrated in figure A-1. The assumption inherent in control surface theory is that the induced velocities vary very little in the vicinity of the surface. Experience has shown that for the majority of practical configurations the loss in accuracy is negligible, and is more than compensated for by the increase in computational efficiency. Any wing-like component with thickness is then represented by a double set of panels, one for the upper surface and one for the lower surface as shown schematically in figure A-2.

All the swept horseshoe vortices, and their boundary condition control points, corresponding to a given surface, upper or lower, are located in a same plane. The upper and lower surface lattice planes are separated by a gap which represents the chordwise average of the airfoil thickness

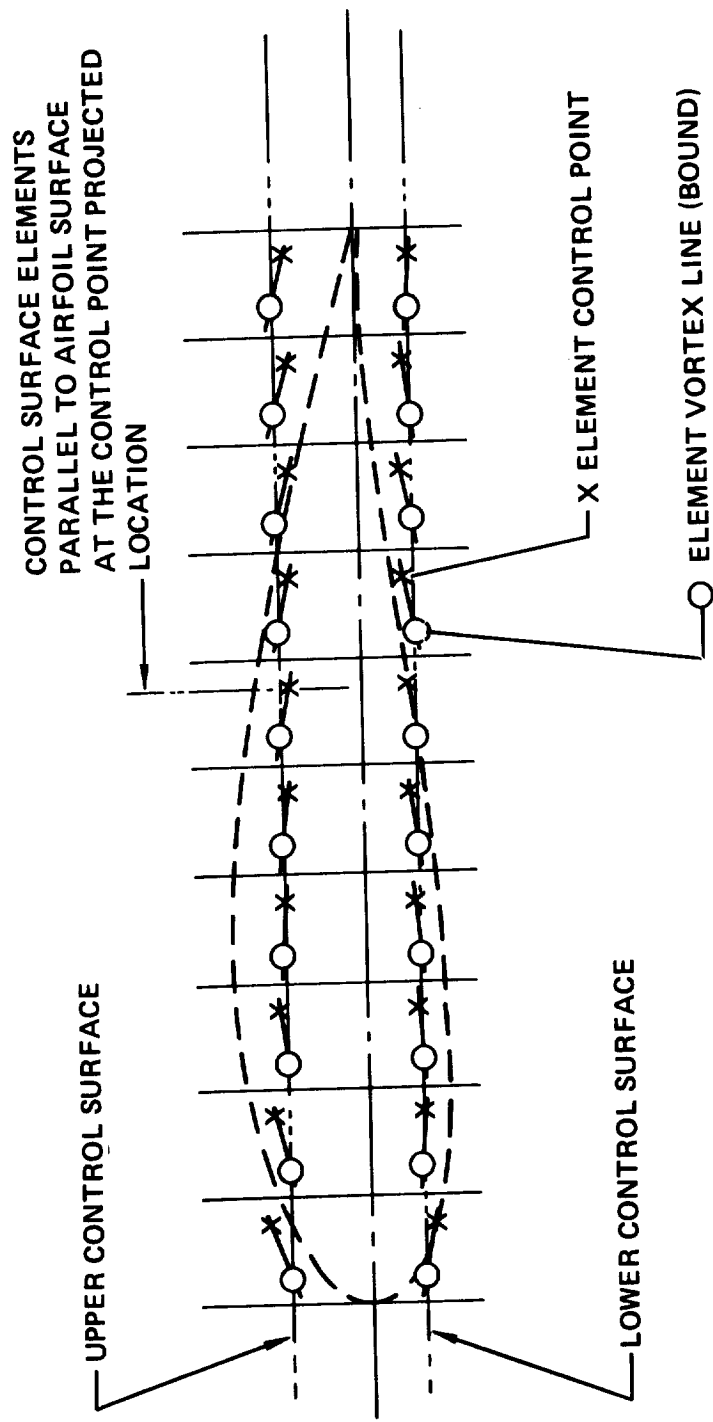
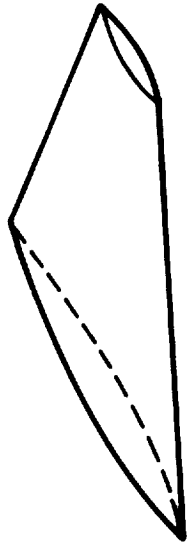


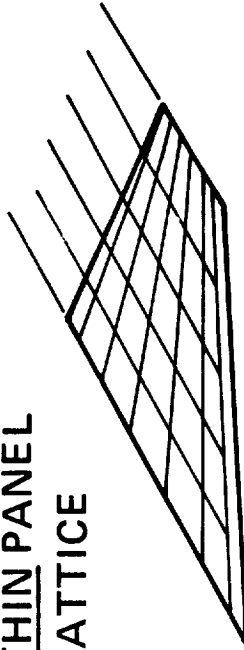
Figure A-1. - Control surface nomenclature



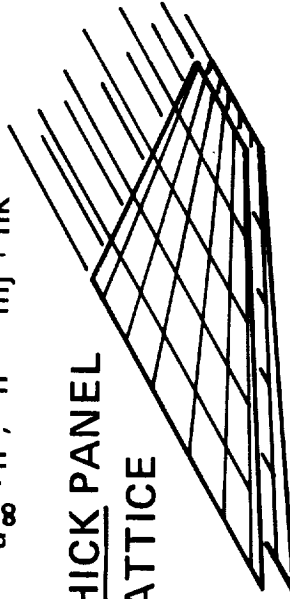
ACTUAL WING PANEL

BOUNDARY CONDITION: $\bar{w} \cdot \bar{n}' = \bar{v} \cdot \bar{n}' = -\bar{u}_\infty \cdot \bar{n}'$; $\bar{n}' = m\bar{j} + n\bar{k}$

THIN PANEL LATTICE



THICK PANEL LATTICE



CHORDWISE DISTRIBUTION OF VORTEX LINES:

$$\frac{X_j^v \cdot X_0^v}{C} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{2j-1}{2N} \right) \right\}$$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS:

$$\frac{X_j^c \cdot X_0^c}{C} = \frac{1}{2} \left\{ 1 - \cos \left(\pi \frac{j}{N} \right) \right\}$$

Figure A-2. - Modeling of thick wing with horseshoe vortices

distribution. The results are not too sensitive to the magnitude of this gap; any value between one half to the full maximum chordwise thickness of the airfoil has been found to be adequate, the preferred value being two thirds of the maximum thickness. Furthermore, the gap can vary in the direction normal to the x-axis to allow for spanwise thickness taper. On the other hand, the chordwise distribution, or spacing, of the transverse elements of the horseshoe vortices have a significant influence on the accuracy of the computed surface pressure distribution. For greater accuracy, for a given chordwise number of horseshoe vortices, the transverse legs have to be longitudinally spaced according to the cosine distribution law

$$x_j^v - x_o = \frac{c}{2} \left[1 - \cos \left(\pi \frac{2j-1}{2N} \right) \right]$$

where $x_j^v - x_o$ represents the distance from the leading edge to the midpoint of the swept leg of the J th horseshoe vortex, c is the length of the local chord running through the midpoints of a given chordwise strip, and N is the number of horseshoe vortices per strip. The chordwise control point location corresponding to this distribution of vortex elements is given by

$$x_J^c - x_o = \frac{c}{2} \left[1 - \cos \left(\pi \frac{J}{N} \right) \right]$$

The control points are located along the centerline, or midpoint line, of the chordwise strip (figure A-3).

The modeling of fusiform bodies with horseshoe vortices requires a special concentric vortex lattice if the simulation of the volume displacement effects, and the computation of the surface pressure distribution, are to be carried out. To define this lattice, it is necessary to consider first an auxiliary body, identical in cross-sectional shape and longitudinal area distribution to the actual body, with a straight baricentric line, i.e., without camber. The cross-sectional shape of this auxiliary body is then approximated by a polygon whose sides determine the transverse legs of the horseshoe vortices. The vertices of the polygon and the axis of the auxiliary body, which by definition is rectilinear (zero camber) and internal to all possible cross sections of the body, define a set of radial planes in which the bound trailing legs of the horseshoe vortices lie parallel to the axis (figure A-4). As the body cross section changes shape along its length, the corresponding polygon is allowed to change accordingly, but with the constraint that the polygonal vertices must always lie in the same set of radial planes. As in the case of the biplanar representation of thickness effects, cosine axial spacing should be used for the analysis of fusiform bodies. The effect of body camber is taken into account by independently specifying the camber of the baricentric axis of the body.

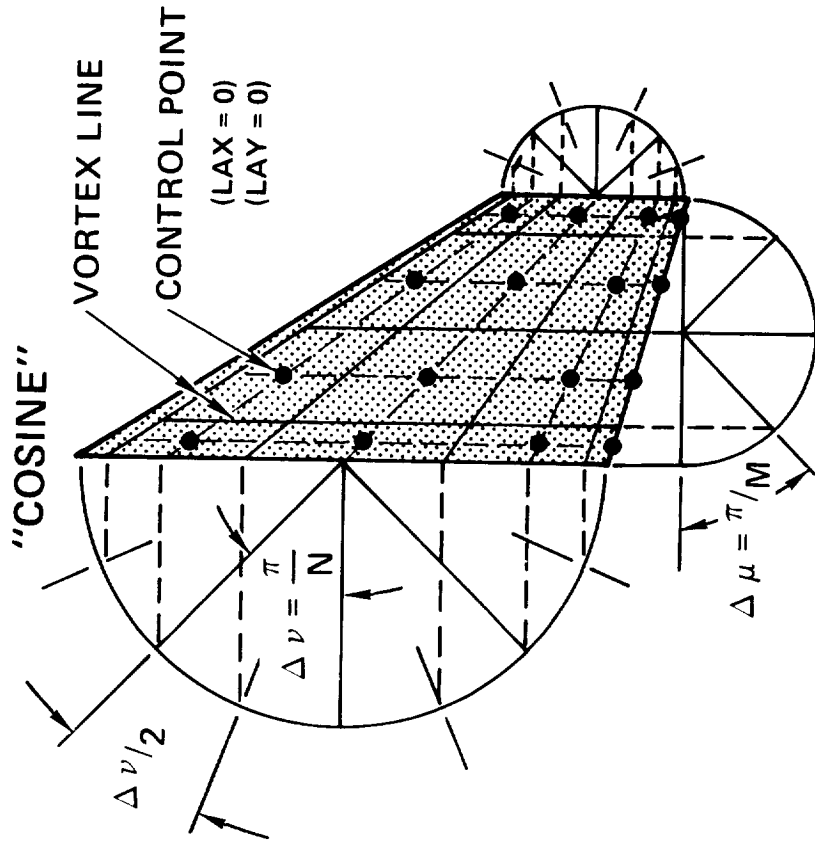
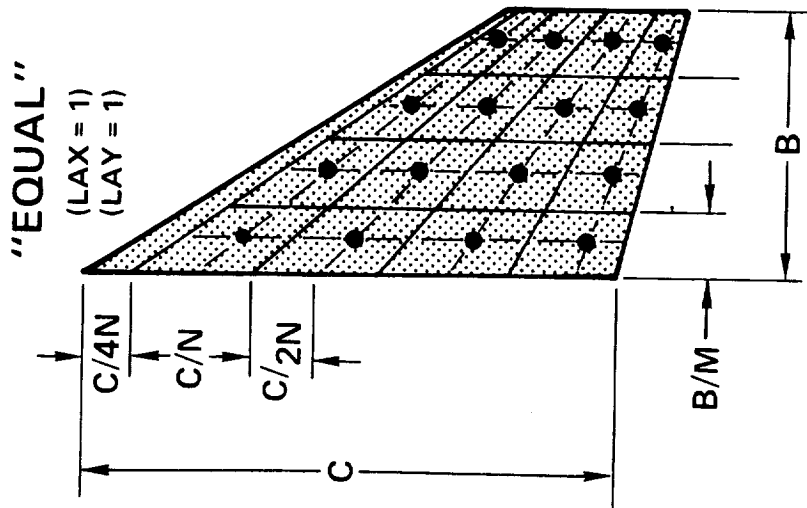


Figure A-3. - Vortex lattice collocation

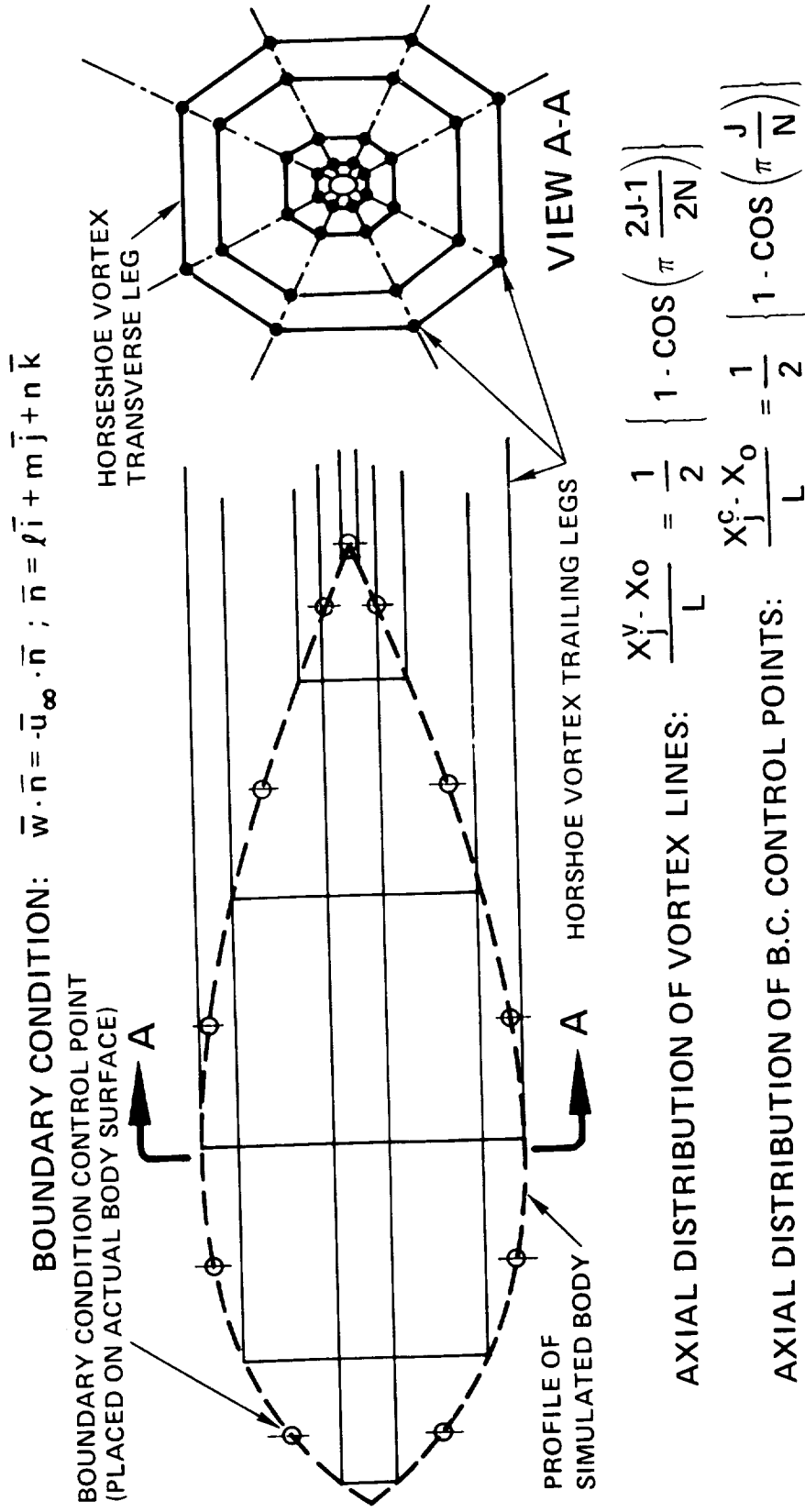


Figure A-4. - Modeling of fusiform body with horseshoe vortices

INPUT CARD IMAGE DESCRIPTION

The cards that constitute the input data deck are described in the following paragraphs. All format specifications are given in FORTRAN IV.

While some 19 cards are described, this does not mean that input for a case consists of 19 cards. Rather, these should be thought of as card types. Furthermore, not all card types will be included in a given case, those to be included or deleted being a function of some of the input values as shown in figure A-5.

CARD (1):	TITLE	In columns 1 through 80 write any alphanumeric identification heading.
CARD (2):	ISØLV	Method to be used for solving the system of linear equations relating the boundary conditions to the vorticity strength, in integer format, in column 2. ISØLV = 0: Gauss-Seidel relaxation with accelerated convergence (under- or over-relaxation); ISØLV = 1: Purcell's vector orthogonalization method.
	LAX	Chordwise, or streamwise, spacing of vortices, integer quantity punched in column 12, LAX = 0: vortices are collocated at the percent chord (X/C) values determined by the cosine law $X/C = 0.5 (1 - \cos((2K-1)\pi/2N))$, where K varies between 1 and N, N being the number of chordwise vortices; LAX = 1: vortices are collocated according to the equally-spaced quarter-chord law $X/C = (4K-3)/(4N)$. The cosine law is recommended for greater accuracy for a given number of vortices.
	LAY	Spanwise, or lateral, spacing of vortices, integer quantity punched in column 22. LAY = 0: vortices are spaced at intervals (elementary vortex span) given by the cosine distribution law $\Delta b = b_p(\cos((J-1)\pi/M) - \cos(J\pi/M))/2$, where Δb is the vortex element span, b_p is the panel span, and J varies between 1 and M, M being the spanwise number of vortices in a given panel; LAY = 1: vortices are equally spaced along the panel span, i.e., $\Delta b = b_p/M$. The cosine spacing is recommended for enhanced accuracy, but

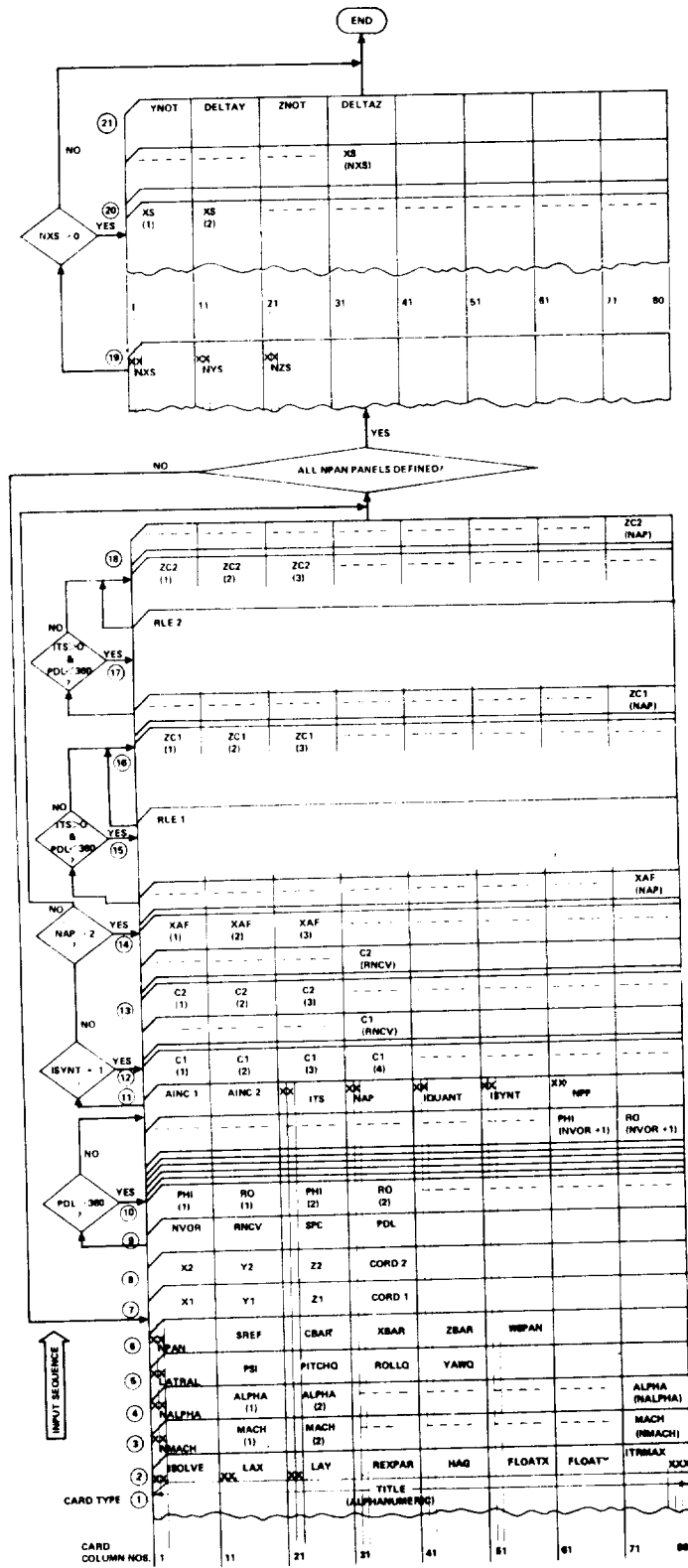


Figure A-5. - VORLAX case data deck setup

for most cases the difference in the results between cosine spanwise spacing and even spanwise spacing is negligible.

REXP

Over-relaxation parameter, in F10.0 format starting in column 31. This parameter is intended to accelerate the Gauss-Seidel relaxation process, and/or make it convergent when it might otherwise diverge. Blank, or zero, input, implies that the program will compute internally the optimum over-relaxation value. If a positive quantity between 0.01 and 0.99 is input, this becomes the value of the over-relaxation parameter that the program will use, the optimum value being overridden. If ISØLV = 1, this parameter is not used, and therefore, not a required input quantity.

HAG

Height above ground of the moment reference center, in F10.0 format starting in column 41. If it is punched equal to zero, or left blank, the height above the ground is infinity, i.e., no ground effect. If a quantity different than zero is input, then the ground effect will be computed by the method of images, the height being given by the input value, in consistent units.

FLØATX

Longitudinal vortex wake flotation factor, in F10.0 format, starting in column 51. If zero, or blank, then the trailing vortex legs being shed from the corresponding trailing edges, extend to infinity parallel to the X-Y plane. If a value different from zero is input, then the trailing vortex legs shed from the trailing edges form an angle $\alpha_v = \text{FLØATX} \cdot \text{ALPHA}$ with the X-Y plane, where ALPHA is the freestream angle of attack. (See figure A-6)

FLØATY

Lateral vortex wake flotation factor, in F10.0 format, starting in column 61. If zero or blank, then the trailing vortex legs being shed from the corresponding trailing edges extend to infinity parallel to the X-Z plane. If a value different from zero is input, then the vortex legs shed from the trailing edges form an angle

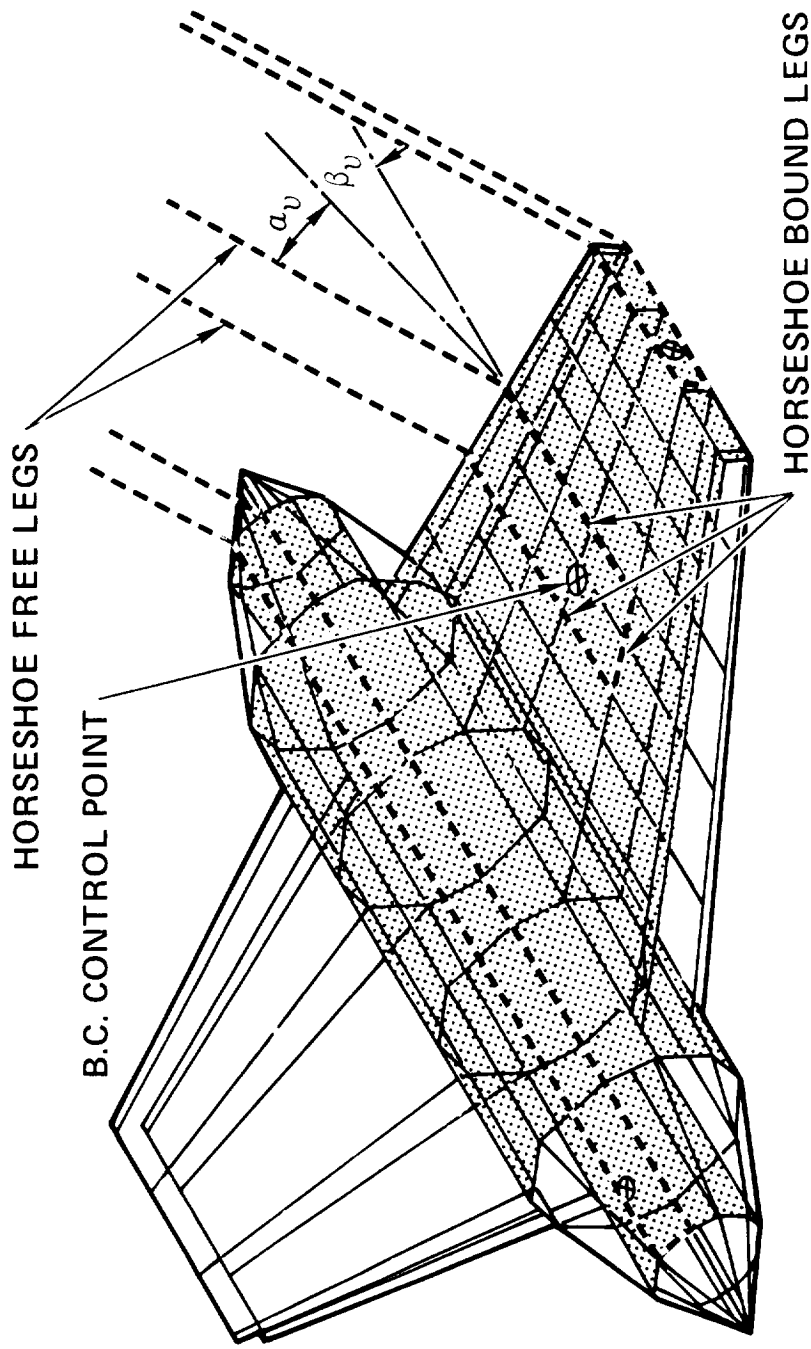


Figure A-6. Generalized vortex lattice model of wing body configuration

$\beta_y = \text{FL}\phi\text{ATY} \cdot \text{BETA}$ with the X-Z plan, where BETA is the freestream angle of slideslip (see figure A-6).

	ITRMAX	Maximum number of iterations allowed for the Gauss-Seidel relaxation method, in I3 format right-adjusted to column 80. If no value is input, the code will make ITRMAX = 99 by default. If IS ϕ LV = 1, i.e., the vector orthogonalization solution is resorted to, then ITRMAX is not a required input.
CARD (3):	NMACH	Number of Mach numbers to be analyzed, in I2 format; i.e., integer value of NMACH in column 2. NMACH \leq 7.
	MACH	Mach numbers in F10.0 format starting in column 11.
CARD (4):	NALPHA	Number of angles of attack in I2 format; i.e., integer value of NALPHA in column 2. NALPHA \leq 7.
	ALPHA	Angles of attack in degrees in F10.0 format, starting in column 11.
CARD(5):	LATRAL	Asymmetric flight or configuration flag. 0 in column 2 = symmetric flight and symmetric configuration about the X-Z plane. 1 in column 2 = asymmetric flight and/or asymmetric configuration.
	PSI	Sideslip angle in degrees in F10.0 format starting in column 11. + = wind coming from left side of nose. Input 0. or blank when LATRAL is 0. Used to obtain static stability derivatives such as $C_{n\beta}$, $C_{y\beta}$, etc.
	PITCHQ	Pitch rate in degrees/second in F10.0 format starting in column 21. + = nose up pitch. Used to obtain dynamic stability derivatives such as C_{m_q} , C_{L_q} , etc. LATRAL may be 0 when PITCHQ is nonzero.
	R ϕ LLQ	Roll rate in degrees/second in F10.0 format starting in column 31. + = left roll. Input 0. or blank when LATRAL is 0. Used to obtain dynamic stability derivatives such as C_{l_p} , C_{n_p} , etc.

YAWQ	Yaw rate in degrees/second in F10.0 format starting in column 41. + = left yaw or air-stream component washing from left to right across nose of airplane. Input 0. or blank when LATRAl is 0. Used to obtain dynamic stability derivatives such as C_{n_r} , C_{y_r} , etc.
VINF	Reference free stream velocity in F10.0 format starting in column 51. If no value is input, VINF is automatically set equal to 1.0 by the program. This parameter is only used when any of the angular rates is different from zero. It enters in the computation of the equivalent flow angle. For instance, if VINF = WSPAN/2 (wing semi-span) and ROLLQ = 5.73, then pb/2V = 0.1, and the rolling moment coefficient printed out by the program will be exactly one-tenth the value of the stability derivative C_{l_p} . Likewise, if VINF = CBAR/2 (half the mean aerodynamic chord) and PITCHQ = 5.73, then the difference between the output pitching moment coefficient and the pitching moment coefficient for the case PITCHQ = 0. will be equal to one-tenth of the C_{m_q} derivative.
CARD (6):	
NPAN	Number of major panels that will define the configuration, in I2 format; i.e., integer value of NPAN in columns 1-2 right adjusted to 2. NPAN \leq 20.
SREF	Reference area for force and moment coefficients, in F10.0 format starting in column 11.
CBAR	Pitching moment coefficient reference length, in F10.0 format starting in column 21. Usually mean aerodynamic chord length.
XBAR	Abcissa of moment reference point, in F10.0 format starting in column 31. X-coordinate in master frame of reference.
ZBAR	Ordinate of moment reference point, in F10.0 format starting in column 41. Z-coordinate in master frame of reference.

	WSPAN	Total wing span in units consistent with SREF and CBAR, in F10.0 format starting in column 51. If left blank, a value of 2.0 will be assumed by the program.
CARD (7):	X1	X or longitudinal coordinate of the leading edge of one side of a major panel. Usually taken as the most inboard side in the case of wings. Input in F10.0 format starting in column 1.
	Y1	Y or lateral coordinate of leading edge of first side of a major panel. Input in F10.0 format starting in column 11.
	Z1	Z or vertical coordinate of leading edge of first side of a major panel. Input in F10.0 format starting in column 21.
	CØRD1	Chord length of first side of major panel measured from X1, Y1, Z1 above in the positive direction of, and parallel to, the X axis.
CARD (8):	X2	X or longitudinal coordinate of the leading edge of the second side of the major panel described on card (7). Usually taken as the most outboard side in the case of wings. In the case of a closed curved panel, e.g., a cylindrical segment representative of a nacelle, X2 would be identical to X1. Input in F10.0 format starting in column 1.
	Y2	Y or lateral coordinate of leading edge of second side of the major panel described on Card (7). Input in F10.0 format starting in column 11.
	Z2	Z or vertical coordinate of leading edge of second side of the major panel described on Card (7). Input in F10.0 format starting in column 21.
	CØRD2	Chord length of second side of major panel measured from X2, Y2, Z2 above in the positive direction of, and parallel to, the X axis.

Note: Columns 41-80 of cards (7) and (8) are not read. Thus, any information useful for identification purposes may be written there.

Note that the side edges 1 and 2 of a major panel, which have just been described by the input in cards (7) and (8), define the direction of the positive normal for that panel. This is determined by the feet-to-head direction for an observer standing on the panel looking upstream (down the negative X-axis) and with panel edge 1 to his left, and panel edge 2 to his right. In this analogy it is assumed that gravity is not a factor in that an observer could be standing on the bottom of a wing, for example, equally as easily as he might stand on top. In the case of curved panels, such as a nacelle component, the direction of the positive normal loses its meaning for the panel as a whole, but it is still applicable to each one of the longitudinal, or chordwise, strips that make up the major panel.

CARD (9)	NVØR	Number of spanwise elements or vortices that will be used to represent the panel, in F10.0 format starting in column 1. NVØR ≤100.0.
	RNCV	Number of chordwise vortices that will be used to represent the panel, in F10.0 format starting in column 11. RNCV ≤50. The program, using NVØR and RNCV, will subdivide the panel under consideration into a grid of NVØR x RNCV swept horseshoe vortices collocated in accordance with the values of the LAX and LAY parameters. Note that chordwise and lateral distributions are independent, e.g., a cosine chordwise spacing (LAX=0) is compatible with equal spanwise distribution (LAY = 1), and vice versa. The corresponding control points at which the boundary conditions are satisfied are collocated according to the law $(X/C)_{\text{control}} = 0.5 (1 - \cos (K\pi/N))$, K varying between 1 and N, where N is the number of chordwise vortices, if LAX = 0. If LAX = 1, then the control points are placed at $(X/C)_{\text{control}} = (4K-1)/(4N)$, namely, according to the equally spaced three-quarter chord distribution. The spanwise location of the control points is always at the centerline of the elementary swept horseshoe vortices.

To determine the surface slope at each element control point, the program uses straight line element lofting between the two longitudinal, or butt line, edges of the major panel.

In addition to the above limitations to the values of NVØR and RNCV, if more than one major panel is used in the description of the configuration, the following should be observed:

NPAN

If LATRAL=0, $\sum_1^{NPAN} NVØR \times RNCV \leq 2000$

NPAN

If LATRAL=1, $\sum_1^{NPAN} NVØR \times RNCV \times IQUANT \leq 2000$

IQUANT being defined further down.

SPC Leading edge suction multiplier, in F10.0 format starting in column 21. 0. = no suction. 1. = 100 percent leading edge suction. Nonzero values are recommended for all panels whose leading edges are wetted by the airstream. The program has the capability of computing the effects of free leading edge vorticity (leading edge vortex flows) by a localized application of the Polhamus analogy. This computation is triggered by inputting the SPC parameter as a negative quantity. When this is done, the sectional leading edge suction vector will be rotated normal to the camber surface at the leading edge, instead of the corresponding attached-flow tangential orientation, and the forces and moments will be computed using the rotated suction vector.

PDL Planar/curved panel flag, in F10.0 format starting in column 31. 0. = planar major panel is to be described (including warped planar.) PDL = 999. (or >360.) = a curved major panel is to be described.

CARD (10): PHI Polar coordinate angle of radius vector when defining the subpaneling of a curved major panel. Omit this card when PDL = 0. PHI is the angle measured from the horizontal in a plane parallel to the Y-Z plane. PHI = 0 coincides with a line parallel to and in the positive direction of the Y-axis. Positive values of PHI are measured counterclockwise when viewed from the rear of the aircraft.

PHI is input in F10.0 format starting in column 1. This and the subsequent input R0 constitute a polar coordinate pair. The number of pairs to be input = NVØR + 1. Four pairs per card may be input in F10.0 format starting in column 1. As many cards as necessary are used. While the location of the origin from which the polar angle, PHI, is arbitrary the first PHI, RØ polar coordinate pair must coincide with the Y1, Z1 rectangular coordinates input on Card (7). Likewise, the last input polar pair must coincide with the Y2, Z2 of Card (8).

RØ Radius vector from arbitrary origin when defining the subpaneling of a curved major panel. Input in F10.0 format. Each RØ is part of a PHI, RØ polar coordinate pair.

CARD (11): AINC1 Tangent of the angle subtended by major panel root chordline, or first edge (described in Card (7)), and the positive X-axis, in F10.0 format starting in column 1. Sign convention is determined by observing the edge 1 chordline and the X-axis from edge 2. The edge 1 chord is then rotated counterclockwise until it is parallel to the X-axis. If the angle rotated through is less than 90 degrees then the angle, and consequently its tangent, are considered positive. If it is greater than 90 degrees, then AINC1 is negative.

AINC2 Tangent of the angle subtended by major panel tip chordline, or second edge (described in Card (8)), in F10.0 format starting in column 11. Sign convention is determined by observing edge 2 and the X-axis, looking in the direction from edge 2 toward edge 1. The edge 2 chord is then rotated counterclockwise until it is parallel to the X-axis. If the angle rotated through is less than 90 degrees, then the sign is positive; otherwise it is negative.

ITS Surface flag input as a two place integer in columns 21 and 22, right-adjusted to column 22. ITS = 0 or blank indicates that the panel is considered as a lifting surface of zero thickness, i.e., both its upper and

lower surface are wetted by the external flow. ITS = 01 means that only the panel upper surface is wetted by the real external flow. ITS = -1 indicates that only the panel lower surface is wetted by the real external flow. A double panel setup can then be used to represent a wing-like component with non-zero thickness, as previously illustrated in Figure 2. Notice that the X1, Y1, Z1, X2, Y2, and Z2 values to be input correspond to the control surface plane, and not to the actual chordal plane. The results are not critically sensitive to the separation between the upper surface panel (ITS = 01) and the lower surface panel (ITS = -1), a separation of two thirds the thickness ratio of the air-foil being a good average value to use.

NAP Number of percent chords or stations along the chord (CORD1 and CORD2) at which the camber, or surface, ordinates are to be input. Input as a two-place integer in columns 31 and 32, right-adjusted to column 32. Maximum value of NAP is 50. A NAP = 0, 1, or 2 will be interpreted as a flat wing and no subsequent camber cards will be expected. If ISYNT, on this same card, is to be input as 1, i.e., a design case, then NAP should be 0 or blank.

IQUANT Symmetry flag with respect to X-Z plane input as an integer in column 42. IQUANT = 0 or 2 indicates there is a mirror image of the panel on the opposite side of the X-Z plane. IQUANT = 1 indicates the panel is unique to the side for which it is being input.

ISYNT Design/analysis flag input as an integer in column 52. ISYNT = 0 or blank indicates that the panel has been defined geometrically and only analysis is to take place. ISYNT = 1 indicates that the panel camber is to be designed by the program to support a specified pressure distribution. If NAP on this same card was input >2, then ISYNT should be zero or blank.

NPP

Nonplanar parameter, input as an integer in column 62. NPP = 0 indicates that all the vortex filaments representing a given surface lie in the cylindrical surface whose directrix is the leading edge of the panel, and whose generatrices are all parallel to the X-axis. NPP = 1 denotes that the transverse vortex filaments are located on the actual body surface, but the bound trailing legs are parallel to the x-axis. This parameter affects the definition of ZC_1 and ZC_2 on cards 16 and 18.

CARD (12): C1

Pressure coefficients along the first, or root, edge of major panel defined on Card (7). If ISYNT = 0, then this card is omitted. Units are dimensionless, $\Delta p/q$. Format is 8F10.0 starting in column 1 with as many cards as necessary to input RNCV values of C1.

The desired values of the aerodynamic loading are defined at the chordwise location of the vortex lines. Thus, if LAX = 0, the corresponding X/C points follow the cosine distribution $(1 - \cos((2K-1)\pi/2N))/2$; if LAX = 1, then the definition points are located by the law $(4K-3)/4N$. In the above expressions K ranges between 1 and N, N being equal to RNCV, the chordwise number of vortices.

CARD (13): C2

Pressure coefficients along the second, or tip edge of major panel defined on card (8). If ISYNT = 0, then this card is omitted. Format is 8 F10.0 starting in column 1 with as many cards as required to input RNCV values of C1. Linear interpolation between corresponding values of C1 and C2 is used to obtain ΔC_p at intermediate spanwise values for the subpanels.

CARD (14): XAF

Chord percent values at which camber, or surface ordinates will be supplied for the major panel, in 8F10.0 format starting in column 1 using as many cards as necessary to define NAP values of XAF. If NAP is 0, 1, or 2, then a flat uncambered surface is implied and this card is omitted. These chord percents

need not be equally spaced, but the same set applies to both the root and tip chords, or edges of the panel. Second order Lagrange or sliding parabola interpolation is used to interpolate between input XAF points to obtain the surface slope value at the control point of each subpanel.

For a panel representing the surface of a non-zero thickness airfoil or body, $ITS \neq 0$, the Lagrange interpolation is modified to a fractional power (1/2) Lagrange method in the neighborhood of the leading edge. This allows the precise definition of the surface slopes at the control points for a blunt leading edge.

CARD (15): RLE1

Leading edge radius, in percent chord, of airfoil section at the first, or root, edge of panel, in F10.0 format between columns 1 and 10. This card exists only if $ITS \neq 0$, $PDL < 360.0$ and $NAP > 2$, i.e., an airfoil with non-zero thickness is being simulated. Otherwise, it must be omitted.

CARD (16): ZC1

Camber ordinates or surface ordinates of root chord of the major panel described on Card (7) in units of percent chord, in 8F10.0 format, using as many cards as necessary to input NAP values, each corresponding to an XAF of the Card (14) series. Omit this card if NAP is 0, 1, or 2. If a lifting surface, such as a wing, is being simulated by a zero thickness panel then the ordinates of the wing camber line should be input here. If the wing thickness is being simulated by the sandwich or biplanar, method, i.e., a separate panel for upper and lower surfaces, then the surface ordinates for upper or lower should be input here. If a curved panel is being simulated (i.e., $PDL > 360.$) and $NPP = 0$ then ordinates of the panel streamwise edge should be input. These might represent the mean line of a shaped cowl for a flow through nacelle, for example. In this simulation all shed vortices will lie in the same cylindrical surface determined by the leading edge of the curved panel and the X direction. If $NPP = 1$

and PDL > 360.0, the ZC1 array represents the camber of the body axis.

CARD (17): RLE2 Leading edge radius, in percent chord, of airfoil section at the second, or tip, edge of panel, in F10.0 format between columns 1 and 10. This card exists only if ITS \neq 0, PDL < 360.0 and NAP > 2, otherwise it must be omitted.

CARD (18): ZC2 Camber ordinates, or surface ordinates of the second, or tip chord of the major panel, or area ratios of the major panel in 8F10.0 format, using as many cards as necessary to input NAP values, each corresponding to an XAF of the Card (14) series. Omit this card if NAP is 0, 1, or 2. Linear spanwise interpolation is used to obtain intermediate values.

If a curved panel is being simulated (PDL > 360.) and NPP = 1 then area ratios in percent are expected here. These should represent the ratio of the cross sectional area of the closed polygonal surface being simulated at the XAF station under consideration divided by the area of the reference polygon times 100. Note that ZC2 is entered in percent where a value of 100 represents a section exactly the size of the reference polygon. Values greater or less than 100 are permitted down to and including 0. The reference polygon is that input via the PHI-RO pairs on Card 10. In this simulation it is presumed that all stations along the panel have the same shape as the reference polygon, and the transverse vortices are located on the actual body surface of the curved panel.

This concludes the input for the first major panel of the configuration. If there is more than one panel, then start over with Card (7) and work down to this point. Panels may be input in any sequence.

After the last panel is described, continue with Card (19).

CARD (19): NXS Number of X-stations that will define the spatial flow field survey grid. NXS = 00 means no survey desired. Maximum value of NXS is 20. Input as a two-digit integer in columns 1 and 2, right-adjusted to column 2.

	NYS	Number of Y-stations that will define the butt line values of the survey grid. NYS = 00 for no survey. NYS and NZS (following) may be any positive integer subject to $NXS \times NYS \times NZS \leq 2000$.
		Input as a two digit integer in columns 11 and 12.
	NZS	Number of Z-stations that will define the water line values of the survey grid. NZS = 00 for no survey. Input as a two digit integer in columns 21 and 22.
CARD (20):	XS	X station values for the spatial flow field grid. <u>Omit this card if NXS=0.</u> Input in 8F10.0 format starting in column 1, using as many cards as necessary to define NXS values.
CARD (21):	YNØT	Beginning of grid in the butt line direction. Input in F10.0 format starting in column 1. <u>Omit this card if NXS = 0.</u>
	DELTAY	Y-spacing of the grid. There will be NYS butt line planes equally spaced a distance DELTAY apart. Input in F10.0 format starting in column 11.
	ZNØT	Beginning of grid in the water line direction. Input in F10.0 format starting in column 21.
	DELTAZ	Z-spacing of the grid. There will be NZS water line planes equally spaced a distance DELTAZ apart. Input in F10.0 format starting in column 31.

This ends the input description for a single case.

Consecutive data sets or cases can be submitted at the same time. The program will always identify the presence of a new set by the corresponding title card (Card (1)).

PROGRAM OUTPUT

The program output is processed by a standard 132 characters-per-line printer. The output from each configuration is preceded by a printout of the input data cards. This printout is not an exact image of the input deck; rather, it is the version of the deck as the code sees it, namely, the default value of an input parameter is printed if there is a corresponding blank in the input card. Also, data within a format field are lined up for clarity in identification, even though in the input deck such data may be arbitrarily located within its field. The input deck data is followed by a list of the major geometric parameters used by the program and generated from the input data deck. Next, the component and total force and moment coefficients are printed out for a given flow condition (Mach number, angle of attack, angle of sideslip, and rotational velocities). These are followed by a tabulation of the location of all the vortex elements, the pressure coefficients, the circulation strengths, and other ancillary information. If a flow field survey about the configuration has been requested, then the flow parameters (velocity components, flow angles, Mach number, and pressure ratios) at a series of field grid points will be listed. If other flow conditions have been analyzed, the same type of output will follow for each one of them, starting with the listing of the component and total force and moment coefficients. If other configurations have been input, then the output will continue with the listing of the corresponding input data deck, and so on. Rather than describing the output format in detail, a glossary of the output terms, arranged in sequential order of appearance, and a sample computer output, Table A-1, are presented.

I	Numbering index for major panel identification. For cases where LATERAL = 1, the I-number preceded by a double asterisk in the PANEL GEOMETRY list denotes that the panel is the mirror image (about the X-Z axis) of the panel with the same I-number but without asterisks.
XAPEX	=XI (see input terminology).
YAPEX	=Y1 (see input terminology).
ZAPEX	=Z1 (see input terminology).
PDC	=PDC (see input terminology).
LESWP	Sweep of the panel leading edge, in degrees. Positive for sweepback, negative for sweep forward.
CSTART	=CØRD1 (see input terminology).
TAPER	Panel taper ratio, CØRD2/CØRD1.

PSPAN Panel span.

NVØR =NVØR (see input terminology).

RNCV =RNCV (see input terminology).

SPC =SPC (see input terminology).

SURF Panel surface area.

CN Panel normal force coefficient, referenced to its own surface area.

CL Panel lift coefficient, wind axes, referenced to its own surface area.

CY Panel lateral force coefficient, wind axes, referenced to its own surface area.

CD Panel drag coefficient, wind axes, referenced to its own surface area.

CT Panel leading edge thrust coefficient, referenced to its own surface area.

CS Panel leading edge suction coefficient referenced to its own surface area.

CM Panel pitching moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes.

CRM Panel rolling moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes.

CYM Panel yawing moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes.

SREF =SREF (see input terminology).

WSPAN =WSPAN (see input terminology).

CBAR =CBAR (see input terminology).

CLTØT Total (summation over all panels) lift coefficient referenced to SREF.

CDTØT Total pressure drag coefficient, referenced to SREF.

CYTØT Total lateral force coefficient, wind axes, referenced to SREF.

CMTØT Total pitching moment coefficient about moment reference center, wind axes, referenced to SREF and CBAR.

CRTØT Total rolling moment coefficient about moment reference center, wind axes, referenced to SREF and WSPAN.

CNTØT Total yawing moment coefficient about moment reference center, wind axes, referenced to SREF and WSPAN.

E Oswald's efficiency factor.

S Perimetral, or spanwise, index of vortex element.

C Chordwise, or streamwise, index of vortex element, 1 denotes leading edge element, and C value equal to RNCV corresponds to the last, or trailing edge element.

X/C Percent chord location of bound vortex line.

X, Y, Z Coordinates of horseshoe vortex element centroid (center point of bound vortex line).

CHØRD Local chord length.

SLØPE Surface slope at boundary control point.

ITS Flag which indicates type of panel surface (see input terminology). A zero value means that the panel is considered as a zero thickness lifting surface. A positive unit value (1) denotes that the panel is the upper surface of an airfoil-like element. A negative unit value (-1) corresponds to the lower surface. In the case of body-like components, 1 denotes the external, or wetted, surface. For a flow-through nacelle arrangement, 1 stands for the external surface, and -1 for the internal surface.

DCP Local loading coefficient ($\Delta C_p = C_{pl} - C_{pu}$) if panel ITS = 0. If ITS \neq 0, then DCP is the local pressure coefficient (C_p).

CNC Sectional normal force coefficient times local chord.

CN Sectional normal force coefficient.

DL Local dihedral, in degrees.

CMT Sectional pitching moment coefficient about local quarter chord.

GAMMA Vortex element circulation strength, divided by freestream velocity.

ZC/C If the design option is being invoked, the resulting surface warp is printed out instead of GAMMA. This surface warp is expressed in fraction of the local chord, and it includes both camber and twist.

CTC Sectional thrust coefficient times local chord.

CDC Sectional pressure drag coefficient times local chord.

ITRMAX Maximum allowable number of relaxation cycles if Gauss-Seidel solution is used (see input terminology).

EPS Tolerance, or minimum, iteration change for relaxation process.

ITER Actual number of relaxation cycles.

BIG Actual iteration change for relaxation process. Relaxation will stop when $BIG \leq EPS$, or when $ITER = ITRMAX$.

If a flow field survey about the configuration has been requested ($NXS > 0$ in the input deck, see input description), then the following parameters will also be output as part of this survey:

X, Y, Z Coordinates of the survey grid points (not to be confused with the X, Y, Z coordinates of the vortex centroids previously described), referenced to the configuration master coordinate frame. The X, Y, Z coordinates are determined by the XS, YNOT, DELTAY, ZNOT, DELTAZ input values (see input terminology).

U Dimensionless velocity (freestream velocity at infinity assumed to be unity) along the X-direction (body axes).

V Dimensionless velocity along the Y-direction (body axes).

W Dimensionless velocity along the Z-direction (body axes).

EPSSLØN Upwash angle in degrees. this angle is measured with respect to the X-axis in a plane parallel to the X-Z plane.

SIGMA Sidewash angle in degrees. This angle is measured with respect to the X-axis in a plane parallel to the X-Y plane.

CP Local field pressure coefficient ($CP = (P_{static} - P_{inf})/q_{inf}$).

MLOC Local Mach number.

P/PTØT Local static-to-total pressure ratio for isentropic flow.

P/PINF Local to-freestream static pressure ratio for isentropic flow.

TABLE A-1. SAMPLE OUTPUT

INPUT DECK *****

SONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (1/10 SCALE).
 1 0 1 0.10 0.0 0.0 0.0 11

2 0.500 2.550
 1 5.000
 0 0.0 0.0 0.0 0.0 1.000
 11 9676.80 107.2280 191.0400 -5.4500 129.0000

***** 1 *****
 0.0 0.0 4.5762 352.3999 FUSELAGE (FUSIFORM PANEL)
 0.0 0.0 -9.7868 352.3999 FUSELAGE (FUSIFORM PANEL)
 3.0000 48.0000 0.0 999.0000 NVOR,RNCV,SPC,PDL
 90.00 7.1815 35.00 7.1815 -23.74 7.1815 -90.00 7.1815
 0.0 0.0 1 29 2 0 1
 0.0 3.4052 6.8104 10.2157 13.6209 17.0261 20.4313 23.8365
 27.2418 30.6470 34.0522 37.4574 40.8627 44.2679 47.6731 54.4825
 60.1989 63.5641 66.9693 70.3746 75.6044 77.1850 80.5902 83.9955
 87.4007 90.8059 94.2111 97.6163 100.0000
 -1.0783 -0.8726 -0.6739 -0.5250 -0.4597 -0.4512 -0.4881 -0.5931
 -0.7616 -0.9293 -1.0423 -1.1501 -1.2789 -1.4015 -1.5233 -1.7477
 -1.9552 -2.0687 -2.1283 -2.1737 -2.1793 -2.1737 -2.1254 -2.0233
 -1.8927 -1.7281 -1.5125 -1.2571 -1.0499
 0.0 16.0000 30.2500 45.0000 59.2900 72.2500 85.0000 100.0000
 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000
 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 85.0000 72.2500
 59.2900 45.0000 30.2500 16.0000 0.0

***** 2 *****
 94.4100 6.5740 -5.4960 144.8940 WING PANEL NO. 1
 146.2500 22.3940 -5.4470 92.5970 WING PANEL NO. 1
 4.0000 10.0000 1.0000 0.0 NVOR,RNCV,SPC,PDL
 0.0 0.0 0 13 2 0 0
 0.0 1.0000 5.0000 10.0000 20.0000 30.0000 40.0000 50.0000
 60.0000 70.0000 80.0000 90.0000 100.0000
 0.0 -0.0129 -0.1367 -0.4893 -1.2589 -1.9373 -2.4770 -2.8862
 -3.1954 -3.4439 -3.6668 -3.9008 -4.1644 -0.7430 -0.6825 -1.1609
 0.0 0.0529 0.2700 0.3078 0.1145
 -1.6545 -2.1469 -2.6232 -3.0692 -3.4807 -3.4807

***** 3 *****
 146.2500 22.3940 -5.4470 92.5970 WING PANEL NO. 2
 176.8800 31.7410 -6.9000 65.0010 WING PANEL NO. 2
 3.0000 10.0000 1.0000 0.0 NVOR,RNCV,SPC,PDL
 0.0 0.0 0 13 2 0 0
 0.0 1.0000 5.0000 10.0000 20.0000 30.0000 40.0000 50.0000
 60.0000 70.0000 80.0000 90.0000 100.0000
 0.0 0.0529 0.2700 0.3078 0.1145 -0.7430 -0.6825 -1.1609
 -1.6545 -2.1469 -2.6232 -3.0692 -3.4807
 0.0 0.0138 0.1708 0.3492 0.4138 0.3277 0.1538 -0.0785
 -0.3554 -0.6585 -0.9846 -1.3231 -1.6677

***** 4 *****
 176.8800 31.7410 -6.9000 65.0010 WING PANEL NO. 3
 190.5400 36.8040 -7.7160 62.9870 WING PANEL NO. 3
 2.0000 10.0000 1.0000 0.0 NVOR,RNCV,SPC,PDL
 0.0 0.0 0 13 2 0 0
 0.0 1.0000 5.0000 10.0000 20.0000 30.0000 40.0000 50.0000
 60.0000 70.0000 80.0000 90.0000 100.0000
 0.0 0.0138 0.1708 0.3492 0.4138 0.3277 0.1538 -0.0785
 -0.3554 -0.6585 -0.9846 -1.3231 -1.6677
 0.0 0.0151 0.0774 0.2623 0.3095 0.2567 0.1378 -0.0226
 -0.2227 -0.4511 -0.7002 -0.9606 -1.2367

TABLE A-1. - Continued

***** 5 *****									
190.5400	36.8040	-7.7160	52.9870					WING PANEL NO. 4	
222.5800	48.6830	-9.9740	31.1720					WING PANEL NO. 4	
4.0000	10.0000	1.0000	0.0					NVDR,RNCV,SPC,PDL	
0.0	0.0	0	13	2	0	0			
0.0	1.0000	5.0000	10.0000		20.0000	30.0000	40.0000	50.0000	
60.0000	70.0000	80.0000	90.0000	100.0000					
0.0	0.0151	0.0774	0.2623	0.3095	0.2567	0.1378	-0.0226		
-0.2227	-0.4511	-0.7002	-0.9606	-1.2362					
0.0	-0.0257	-0.1123	-0.1155	0.0513	0.1283	0.1925	0.2310		
0.2631	0.2919	0.3112	0.3272	0.3368					
***** 6 *****									
222.5800	48.6830	-8.9740	31.1720					WING PANEL NO. 5	
248.0000	64.5000	-10.0000	14.4500					WING PANEL NO. 5	
5.0000	10.0000	0.0	0.0					NVDR,RNCV,SPC,PDL	
0.0	0.0	0	13	2	0	0			
0.0	1.0000	5.0000	10.0000		20.0000	30.0000	40.0000	50.0000	
60.0000	70.0000	80.0000	90.0000	100.0000					
0.0	-0.0257	-0.1123	-0.1155	0.0513	0.1283	0.1893	0.2310		
0.2631	0.2951	0.3112	0.3272	0.3368					
0.0	-0.0411	-0.1800	-0.3137	-0.4371	-0.4731	-0.4628	-0.3651		
-0.2057	-0.0051	0.2674	0.5811	0.9103					
***** 7 *****									
209.4000	22.3940	-3.4000	39.3000					UPPER NACELLE PYLON	
209.4000	22.3940	-5.4470	39.3000					UPPER NACELLE PYLON	
1.0000	10.0000	0.0	0.0						
0.0	0.0	0	0	2	0	0			
***** R *****									
209.4000	22.3940	3.3840	39.3000					UPPER NACELLE	
209.4000	22.3940	3.3840	39.3000					UPPER NACELLE	
6.0000	10.0000	0.0	999.0000					NVDR,RNCV,SPC,PDL	
90.00	3.3920	30.00	3.3920		-30.00	3.3920	-90.00	3.3920	
-150.00	3.3920	-210.00	3.3920		-270.00	3.3920			
0.0	0.0	1	3	2	0	1			
0.0	12.1522	100.0000							
0.0	0.0	0.0							
100.0000	100.0000	100.0000							
***** 9 *****									
209.1000	22.3940	-5.4470	39.4000					LOWER NACELLE PYLON	
209.1000	22.3940	-7.2000	39.4000					LOWER NACELLE PYLON	
1.0000	10.0000	0.0	0.0						
0.0	0.0	0	0	2	0	0			
***** 1C *****									
209.1000	22.3940	-7.2000	39.4000					LOWER NACELLE	
209.1000	22.3940	-7.2000	39.4000					LOWER NACELLE	
6.0000	10.0000	0.0	999.0000					NVDR,RNCV,SPC,PDL	
90.00	3.2000	30.00	3.2000		-30.00	3.2000	-90.00	3.2000	
-150.00	3.2000	-210.00	3.2000		-270.00	3.2000			
0.0	0.0	1	3	2	0	1			
0.0	11.9148	100.0000							
0.0	0.0	0.0							
100.0000	100.0000	100.0000							
***** 11 *****									
248.0000	64.5000	-10.0000	14.45000					FIN PANEL NO. 1	
259.5398	64.5000	-2.8000	14.1100					FIN PANEL NO. 1	
4.0000	10.0000	0.0	0.0					NVDR,RNCV,SPC,PDL	
0.0	0.0	0	0	2	0	0			
0	0	0							

***** END OF INPUT DECK *****

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-32/-4 WING) WITH OAI NACELLES. (1/10 SCALE).

PANEL GEOMETRY											
I	XAPEX(I)	YAPEX(I)	ZAPEX(I)	PD.(I)	LESHR(I)	CSTART(I)	TAPER(I)	PSPAN(I)	NVDR(I)	RMCV(I)	SPC(I)
1	0.0	0.0	4.5762	999.0000	0.0	157.9594	1.0000	21.5267	3.	48.	0.0
2	94.4100	5.5740	-5.4960	0.1775	73.0293	144.9940	0.6391	15.8201	4.	10.	1.00
3	140.2500	22.7940	-5.4470	-8.1360	72.8381	97.5970	0.7020	9.4593	3.	10.	1.00
4	176.8900	31.7410	-6.5000	-5.1556	69.4225	65.0010	0.8152	5.1283	7.	10.	1.00
5	190.5400	36.8040	-7.2160	-6.3452	64.5331	52.9870	0.5983	11.9454	4.	10.	0.0
6	222.5900	43.6970	-9.8740	-3.7114	58.0350	31.1720	0.6240	15.8502	5.	10.	0.0
7	209.4000	22.3440	-3.4000	-50.0000	0.0	34.3000	1.0000	2.0470	1.	10.	0.0
8	209.4000	22.3440	3.3340	499.0000	0.0	39.7000	1.0000	20.2520	6.	10.	0.0
9	209.1000	22.3940	-5.4470	-50.0000	0.0	39.4000	1.0000	1.7530	1.	10.	0.0
10	209.1000	22.3940	-7.2000	999.0000	0.0	39.4000	1.0000	14.2000	6.	10.	0.0
11	248.0000	64.5000	-10.0000	90.0000	58.0382	19.4500	0.7254	7.2000	4.	10.	0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL 1

0.0	0.0	0.0609	0.0604	0.0598	0.0639	0.0781	0.0515	0.0443	0.0269
0.0614	0.0517	-0.0009	-0.0157	-0.0313	-0.0495	-0.0542	-0.0319	-0.0325	-0.0340
0.0168	0.0052	-0.0009	-0.0354	-0.0342	-0.0371	-0.0348	-0.0283	-0.0165	-0.0120
-0.0372	-0.0354	-0.0001	0.0214	0.0316	0.0374	0.0417	0.0502	0.0601	0.0661
-0.0022	0.0017	0.0061	0.0843	0.0879	0.0901	0.0914	0.0918	0.0901	0.0900
0.0706	0.0762	0.0909	0.1570	0.1117	0.1175	0.1175	0.0974	0.0901	0.0900
33.9357	16.8514	11.1351	8.1629	2.2044	-0.0001	-0.0001	0.0001	0.0001	0.0000
2.4080	2.4013	2.0000	2.1629	-0.0001	0.0	0.0	-2.7042	-3.1901	-3.6802
-0.0000	0.0002	-0.0000	-0.0001	-0.0001	-2.2866	-2.2866	-2.9884	-3.1901	-3.6802
-0.0004	-0.0004	-2.3432	-2.2380	-2.1524	-2.2866	-2.2866	-2.9884	-3.1901	-3.6802
-3.0517	-4.6004	-6.2496	-4.0663	-13.0301	-20.5287	-42.3057	-100.0000	-3.1901	-3.6802

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL 2

0.0	0.0	-0.0725	-0.0739	-0.0354	-0.0227	-0.0229	-0.0210	-0.0271	-0.0278
-0.0261	-0.0725	-0.0739	-0.0540	-0.0354	-0.0492	-0.0453	-0.0427	-0.0403	-0.0394
0.0600	0.0007	-0.0377	-0.0439	-0.0436	-0.0492	-0.0453	-0.0427	-0.0403	-0.0394

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL 3

0.0	0.0	-0.0332	-0.0439	-0.0480	-0.0492	-0.0453	-0.0427	-0.0403	-0.0394
0.0600	0.0007	-0.0377	-0.0439	-0.0436	-0.0492	-0.0453	-0.0427	-0.0403	-0.0394
0.0397	0.0277	-0.0048	-0.0271	-0.0255	-0.0304	-0.0332	-0.0342	-0.0346	-0.0348

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL 4

0.0	0.0	-0.0049	-0.0171	-0.0255	-0.0304	-0.0332	-0.0342	-0.0346	-0.0348
0.0377	0.0277	-0.0048	-0.0271	-0.0255	-0.0304	-0.0332	-0.0342	-0.0346	-0.0348
0.0129	0.0282	-0.0024	-0.0117	-0.0180	-0.0229	-0.0254	-0.0269	-0.0274	-0.0293

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CLL=07-07-04 WING) WITH 600 MACCELLES. (1/10 SCALE).

MACH = 0.600
 ALPHA = 5.000 DEG.
 PSI = 0.0 DEG.
 PITCH RATE = 0.0 DEG/SEC
 ROLL RATE = 0.0 DEG/SEC
 YAW RATE = 0.0 DEG/SEC

ANALYSIS (DIRECT) CASE (INVPAS = 0)

MOMENT AND POTENTIAL CENTER : XBAR = 0.19104E 03 ZBAR = -0.14500E 01 ***** VINP = 0.10000E 01

CONFIGURATION IS OUT OF BOUND EFFECT

VORTEX MAKE FLOUTATION PARAMETERS : ELDTX = 0.0 ELDTY = 0.0

1	SURE/SREF	CN(I)	CL(I)	CY(I)	CP(I)	CT(I)	CS(I)	CM(I)	CRM(I)	CYM(I)
1	0.7834E 00	0.00279	0.00462	0.00254	0.00128	0.0	0.0	0.4681E-02	-0.8690E-04	-0.2451E-03
2	0.1941E 00	0.16756	0.02104	-0.00010	0.00270	0.00036	0.00328	0.8474E-02	0.3571E-02	-0.2870E-03
3	0.7704E-01	0.21512	0.01434	0.00235	0.00067	0.00094	0.00291	0.7174E-03	0.3438E-02	-0.2254E-03
4	0.3120E-01	0.06976	0.00133	0.00133	0.00014	0.00054	0.00153	-0.9000E-03	0.2221E-02	0.6381E-04
5	0.5194E-01	0.12202	0.01670	0.00176	-0.00004	0.00154	0.00441	-0.4465E-02	0.5578E-02	0.3906E-03
6	0.4146E-01	0.37010	0.01924	0.00099	0.00148	0.0	0.0	-0.7380E-02	0.6671E-02	-0.2670E-03
7	0.8313E-02	-0.04364	-0.00000	-0.00038	-0.00000	0.0	0.0	0.9647E-10	-0.1704E-05	-0.5411E-04
8	0.8245E-01	0.03816	-0.00014	-0.00043	-0.00001	0.0	0.0	0.1909E-04	-0.8790E-05	-0.3366E-04
9	0.7138E-02	0.01964	0.00000	0.00014	0.00000	0.0	0.0	-0.3530E-10	0.2869E-05	0.2190E-04
10	0.7917E-01	-0.04563	-0.00000	0.00012	-0.00000	0.0	0.0	-0.6546E-04	0.3690E-05	-0.2815E-05
11	0.1249E-01	0.23383	0.00000	-0.00242	0.00000	0.0	0.0	-0.2350E-08	-0.1631E-03	-0.1461E-02

SREF	WSPAN	CHAK	CLTOT	CDTOT	CYTOT	CRMTOT	CYMTOT
0.64768E 04	0.12400E 03	0.10223E 03	0.19438	0.01254	0.0	0.22025E-02	0.0

CD/CL*2 = 0.3285 E = 0.5635

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (ELLIPTIC-37-24 WING) WITH 200 MACULLES. (1/10 SCALE).

S	C	X/C	Y	Y	Y	Z	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	GMT	D/S	GAMMA	CTC	CDC
1	1	0.003	0.044	0.137	-2.400	352.400	0.6676	1	-4.000	5.431	0.014	-27.50	-0.3022	0.1391E 03	0.0	0.64334			
1	2	0.0024	0.848	0.371	-1.509	352.400	0.3369	1	0.360					0.1741E 02					
1	3	0.0007	2.353	0.932	-1.533	352.400	0.2547	1	0.469					0.7369E 01					
1	4	0.0131	4.603	0.741	-1.132	352.400	0.2317	1	0.190					0.4561E 01					
1	5	0.0215	7.587	0.645	-0.790	352.400	0.1800	1	0.076					0.3392E 01					
1	6	0.0320	11.283	1.143	-0.408	352.400	0.1455	1	0.052					0.2787E 01					
1	7	0.0446	15.716	1.227	-0.057	352.400	0.1300	1	0.032					0.2442E 01					
1	8	0.0590	20.965	1.517	0.298	352.400	0.1161	1	0.022					0.2213E 01					
1	9	0.0754	26.570	1.701	0.662	352.400	0.1075	1	0.019					0.2049E 01					
1	10	0.0926	32.976	1.891	1.077	352.400	0.0824	1	0.009					0.1934E 01					
1	11	0.1135	39.895	2.078	1.376	352.400	0.0656	1	0.002					0.1847E 01					
1	12	0.1361	47.567	2.250	1.724	352.400	0.0493	1	-0.009					0.1782E 01					
1	13	0.1592	55.751	2.420	2.043	352.400	0.0355	1	-0.006					0.1732E 01					
1	14	0.1828	64.420	2.576	2.343	352.400	0.0251	1	-0.011					0.1690E 01					
1	15	0.2084	73.547	2.756	2.659	352.400	0.0121	1	-0.022					0.1654E 01					
1	16	0.2360	83.154	2.933	3.029	352.400	0.0039	1	-0.044					0.1639E 01					
1	17	0.2643	93.180	2.941	3.045	352.400	-0.0481	1	-0.028					0.1611E 01					
1	18	0.2936	103.481	2.941	3.045	352.400	-0.0300	1	-0.027					0.1614E 01					
1	19	0.3239	114.133	2.941	3.045	352.400	-0.0280	1	-0.044					0.1637E 01					
1	20	0.3549	125.051	2.941	3.045	352.400	-0.0302	1	-0.059					0.1656E 01					
1	21	0.3865	136.189	2.941	3.045	352.400	-0.0330	1	-0.057					0.1659E 01					
1	22	0.4186	147.497	2.947	3.045	352.400	-0.0319	1	-0.044					0.1652E 01					
1	23	0.4510	158.924	2.941	3.045	352.400	-0.0314	1	-0.037					0.1641E 01					
1	24	0.4836	170.434	2.941	3.045	352.400	-0.0287	1	-0.035					0.1631E 01					
1	25	0.5164	181.965	2.941	3.045	352.400	-0.0304	1	-0.042					0.1625E 01					
1	26	0.5490	193.470	2.941	3.045	352.400	-0.0329	1	-0.045					0.1612E 01					
1	27	0.5814	204.902	2.941	3.045	352.400	-0.0309	1	-0.044					0.1612E 01					
1	28	0.6135	216.210	2.941	3.045	352.400	-0.0251	1	-0.036					0.1587E 01					
1	29	0.6451	227.348	2.942	3.045	352.400	-0.0146	1	-0.025					0.1564E 01					
1	30	0.6761	238.266	2.941	3.045	352.400	-0.0107	1	-0.020					0.1548E 01					
1	31	0.7064	248.918	2.941	3.045	352.400	0.0020	1	-0.009					0.1526E 01					
1	32	0.7357	259.259	2.941	3.045	352.400	0.0015	1	-0.011					0.1526E 01					
1	33	0.7640	269.245	2.950	3.063	352.400	-0.0043	1	-0.077					0.1513E 01					
1	34	0.7912	278.852	2.808	2.760	352.400	-0.0211	1	0.007					0.1507E 01					
1	35	0.8172	287.979	2.644	2.474	352.400	-0.0108	1	0.016					0.1460E 01					
1	36	0.8418	296.648	2.489	2.176	352.400	-0.0084	1	0.018					0.1448E 01					
1	37	0.8649	304.801	2.332	1.875	352.400	-0.0119	1	0.018					0.1448E 01					
1	38	0.8865	312.404	2.163	1.551	352.400	-0.0089	1	0.025					0.1440E 01					
1	39	0.9064	319.423	1.988	1.214	352.400	-0.0079	1	0.028					0.1439E 01					
1	40	0.9246	325.829	1.807	0.865	352.400	-0.0074	1	0.033					0.1440E 01					
1	41	0.9410	331.594	1.630	0.525	352.400	0.0075	1	0.036					0.1438E 01					
1	42	0.9554	336.694	1.496	0.269	352.400	-0.0156	1	0.021					0.1453E 01					
1	43	0.9680	341.106	1.327	-0.056	352.400	-0.0457	1	0.021					0.1451E 01					
1	44	0.9785	344.813	1.126	-0.442	352.400	-0.0887	1	0.039					0.1442E 01					
1	45	0.9869	347.797	0.901	-0.875	352.400	-0.1576	1	0.090					0.1417E 01					
1	46	0.9933	350.046	0.656	-1.345	352.400	-0.2912	1	0.226					0.1341E 01					
1	47	0.9976	351.551	0.399	-1.840	352.400	-0.6851	1	0.594					0.0983E 00					
1	48	0.9997	352.305	0.133	-2.351	352.400	-1.7262	1	0.715					-0.1169E 00					

PANEL NO. 1

ENSELAGE (ENKIFORM PANEL)

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CLL1607-32/-24.41MG) WITH W/1 MACFLLES. (1/10 CALF).

MACH = 0.500 ALPHA = 5.000 DG PSI = 0.0 DG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S CDC

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	FCP	CMT	DL	CNT	GAMMA	CTC	D/S	CDC
2	1	0.0003	0.094	0.227	-2.563	352.400	0.0087	1	-4.000	7.01E	0.020	-0.0044	0.1369E 03	0.0	0.1631E	0.1631E
2	2	0.0024	0.849	0.679	-2.538	352.400	0.2053	1	0.944				0.1724E 01		0.1724E 01	
2	3	0.0067	2.353	1.177	-2.494	352.400	0.7637	1	0.427				0.4531E 01		0.4531E 01	
2	4	0.0131	4.605	1.569	-2.461	352.400	0.1514	1	0.149				0.3369E 01		0.3369E 01	
2	5	0.0215	7.837	2.001	-2.408	352.400	0.0495	1	0.039				0.2770E 01		0.2770E 01	
2	6	0.0320	11.293	2.421	-2.367	352.400	0.0P28	1	0.023				0.2427E 01		0.2427E 01	
2	7	0.0446	15.706	2.809	-2.328	352.400	0.0743	1	0.014				0.2199E 01		0.2199E 01	
2	8	0.0590	20.805	3.201	-2.290	352.400	0.0743	1	0.014				0.2039E 01		0.2039E 01	
2	9	0.0754	26.570	3.602	-2.250	352.400	0.0674	1	0.012				0.1917E 01		0.1917E 01	
2	10	0.0936	32.976	4.004	-2.210	352.400	0.0603	1	0.008				0.1832E 01		0.1832E 01	
2	11	0.1135	39.994	4.400	-2.171	352.400	0.0515	1	0.005				0.1768E 01		0.1768E 01	
2	12	0.1351	47.598	4.777	-2.134	352.400	0.0432	1	0.003				0.1719E 01		0.1719E 01	
2	13	0.1582	55.751	5.124	-2.100	352.400	0.0356	1	0.002				0.1674E 01		0.1674E 01	
2	14	0.1828	64.620	5.454	-2.067	352.400	0.0369	1	0.003				0.1637E 01		0.1637E 01	
2	15	0.2088	73.567	5.836	-2.036	352.400	0.0361	1	0.003				0.1624E 01		0.1624E 01	
2	16	0.2360	83.154	6.211	-1.995	352.400	0.0049	1	0.002				0.1608E 01		0.1608E 01	
2	17	0.2643	93.140	6.228	-1.991	352.400	0.0053	1	0.004				0.1638E 01		0.1638E 01	
2	18	0.2936	103.481	6.228	-1.991	352.400	0.0032	1	0.004				0.1658E 01		0.1658E 01	
2	19	0.3239	114.133	6.229	-1.991	352.400	0.0033	1	0.004				0.1677E 01		0.1677E 01	
2	20	0.3549	125.051	6.228	-1.991	352.400	0.0037	1	0.009				0.1678E 01		0.1678E 01	
2	21	0.3865	136.189	6.228	-1.991	352.400	0.0035	1	0.049				0.1655E 01		0.1655E 01	
2	22	0.4186	147.497	6.228	-1.991	352.400	0.0035	1	0.013				0.1631E 01		0.1631E 01	
2	23	0.4510	158.924	6.228	-1.991	352.400	0.0032	1	0.016				0.1625E 01		0.1625E 01	
2	24	0.4836	170.434	6.228	-1.991	352.400	0.0034	1	0.033				0.1624E 01		0.1624E 01	
2	25	0.5164	181.965	6.228	-1.991	352.400	0.0036	1	0.083				0.1607E 01		0.1607E 01	
2	26	0.5490	193.470	6.228	-1.991	352.400	0.0034	1	0.028				0.1636E 01		0.1636E 01	
2	27	0.5814	204.902	6.224	-1.991	352.400	0.0078	1	0.028				0.1582E 01		0.1582E 01	
2	28	0.6135	216.210	6.224	-1.991	352.400	0.0016	1	0.074				0.1567E 01		0.1567E 01	
2	29	0.6451	227.348	6.228	-1.991	352.400	0.0012	1	0.022				0.1559E 01		0.1559E 01	
2	30	0.6761	238.266	6.228	-1.991	352.400	0.0002	1	0.004				0.1525E 01		0.1525E 01	
2	31	0.7064	248.618	6.228	-1.991	352.400	0.0002	1	0.004				0.1513E 01		0.1513E 01	
2	32	0.7357	259.254	6.228	-1.991	352.400	0.0002	1	0.028				0.1512E 01		0.1512E 01	
2	33	0.7640	269.245	5.947	-2.019	352.400	0.0373	1	0.001				0.1472E 01		0.1472E 01	
2	34	0.7912	278.832	5.590	-2.053	352.400	0.0351	1	0.005				0.1463E 01		0.1463E 01	
2	35	0.8172	287.979	5.270	-2.086	352.400	0.0371	1	0.006				0.1461E 01		0.1461E 01	
2	36	0.8418	296.648	4.939	-2.119	352.400	0.0439	1	0.005				0.1460E 01		0.1460E 01	
2	37	0.8649	304.801	4.581	-2.154	352.400	0.0481	1	0.004				0.1457E 01		0.1457E 01	
2	38	0.8865	312.404	4.210	-2.190	352.400	0.0543	1	0.010				0.1457E 01		0.1457E 01	
2	39	0.9064	319.423	3.826	-2.228	352.400	0.0589	1	0.014				0.1457E 01		0.1457E 01	
2	40	0.9246	325.829	3.451	-2.265	352.400	0.0673	1	0.019				0.1455E 01		0.1455E 01	
2	41	0.9410	331.594	3.168	-2.293	352.400	0.0742	1	0.002				0.1474E 01		0.1474E 01	
2	42	0.9554	336.694	2.810	-2.328	352.400	0.1075	1	0.008				0.1480E 01		0.1480E 01	
2	43	0.9680	341.106	2.385	-2.370	352.400	0.1527	1	0.001				0.1485E 01		0.1485E 01	
2	44	0.9785	344.813	2.385	-2.417	352.400	0.2228	1	0.021				0.1492E 01		0.1492E 01	
2	45	0.9869	347.797	1.907	-2.468	352.400	0.3557	1	0.063				0.1503E 01		0.1503E 01	
2	46	0.9933	350.046	1.389	-2.522	352.400	0.7438	1	0.066				0.1480E 01		0.1480E 01	
2	47	0.9978	351.551	0.844	-2.522	352.400	0.7438	1	0.643				0.1550E 01		0.1550E 01	
2	48	0.9997	352.505	0.281	-2.578	352.400	1.7670	1								
3	1	0.0003	0.094	0.120	-2.789	352.400	0.5277	1	-4.000	-0.668	-0.025	-146.87	0.0037	0.1343E 03	0.0	0.8924E

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (LL1607-127-DW WING) WITH CWI WAFELLES. (P/D SCALE)

MACH = 0.500 ALPHA = 5.000 DEG PSI = 0.0 DEG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/Z	X	Y	Z	CMGRD	SLOPE	ITS	QCP	ENC	CN	DL	CMT	GAMMA	CTC	CDC
4	2	0.0545	104.430	9.551	-1.440	135.357	-0.062	0	0.704					0.1023E 00		
4	3	0.1464	121.112	9.551	-1.440	135.357	-0.0617	0	0.249					0.1248E 00		
4	4	0.2730	138.563	9.551	-1.440	135.357	-0.0617	0	0.200					0.1005E 00		
4	5	0.4218	159.744	9.551	-1.440	135.357	-0.0775	0	-0.619					-0.9461E-02		
4	6	0.5790	180.540	9.551	-1.440	135.357	-0.0279	0	0.644					0.2429E-01		
4	7	0.7270	201.474	9.551	-1.440	135.357	-0.0257	0	0.214					0.1079E 00		
4	8	0.8536	219.098	9.551	-1.440	135.357	-0.0272	0	-0.011					-0.5766E-02		
4	9	0.9455	231.707	9.551	-1.440	135.357	-0.0284	0	0.048					0.4395E-01		
4	10	0.9938	239.345	9.551	-1.440	135.357	-0.0290	0	0.467					0.2342E 00		
5	1	0.0062	114.621	12.506	-5.478	125.293	-0.062	0	0.754	19.154	0.154	0.18	-0.0152	0.3797E 00	0.54511	1.72378
5	2	0.0545	120.077	12.506	-5.478	125.293	-0.0471	0	0.279					0.1496E 00		
5	3	0.1464	132.147	12.506	-5.478	125.293	-0.0583	0	0.779					0.1202E 00		
5	4	0.2730	148.652	12.506	-5.478	125.293	-0.0504	0	0.140					0.7039E-01		
5	5	0.4218	163.632	12.506	-5.478	125.293	-0.0407	0	0.177					0.3975E-01		
5	6	0.5782	184.240	12.506	-5.478	125.293	-0.0334	0	0.104					0.5196E-01		
5	7	0.7270	204.724	12.506	-5.478	125.293	-0.0317	0	0.118					0.7469E-01		
5	8	0.8536	220.785	12.506	-5.478	125.293	-0.0317	0	0.065					0.3266E-01		
5	9	0.9455	232.105	12.506	-5.478	125.293	-0.0320	0	0.047					0.3332E-01		
5	10	0.9938	238.361	12.506	-5.478	125.293	-0.0322	0	0.042					0.4661E-01		
6	1	0.0062	127.500	16.461	-5.465	112.208	-0.0277	0	0.587	19.519	0.174	0.18	-0.0177	0.4450E 00	0.69383	1.47152
6	2	0.0545	132.925	16.461	-5.465	112.208	-0.0270	0	0.378					0.1899E 00		
6	3	0.1464	143.243	16.461	-5.465	112.208	-0.0478	0	0.245					0.1728E 00		
6	4	0.2730	157.443	16.461	-5.465	112.208	-0.0478	0	0.152					0.7694E-01		
6	5	0.4218	174.137	16.461	-5.465	112.208	-0.0438	0	0.121					0.6054E-01		
6	6	0.5782	191.690	16.461	-5.465	112.208	-0.0400	0	0.125					0.6261E-01		
6	7	0.7270	208.384	16.461	-5.465	112.208	-0.0374	0	0.171					0.9066E-01		
6	8	0.8536	222.581	16.461	-5.465	112.208	-0.0361	0	0.079					0.3951E-01		
6	9	0.9455	232.902	16.461	-5.465	112.208	-0.0353	0	0.061					0.3047E-01		
6	10	0.9938	238.337	16.461	-5.465	112.208	-0.0351	0	0.031					0.1543E-01		
7	1	0.0062	140.380	20.416	-5.423	99.134	0.0443	0	0.676	19.834	0.200	0.18	-0.0221	0.4900E 00	0.75394	1.33710
7	2	0.0545	145.172	20.416	-5.423	99.134	-0.0048	0	0.477					0.2045E 00		
7	3	0.1464	154.287	20.416	-5.423	99.134	-0.0374	0	0.284					0.1325E 00		
7	4	0.2730	166.834	20.416	-5.423	99.134	-0.0451	0	0.194					0.9339E-01		
7	5	0.4218	181.502	20.416	-5.423	99.134	-0.0470	0	0.155					0.7796E-01		
7	6	0.5782	197.090	20.416	-5.423	99.134	-0.0461	0	0.142					0.7113E-01		
7	7	0.7270	211.839	20.416	-5.423	99.134	-0.0434	0	0.240					0.1203E 00		
7	8	0.8536	224.386	20.416	-5.423	99.134	-0.0400	0	0.091					0.4047E-01		
7	9	0.9455	233.501	20.416	-5.423	99.134	-0.0386	0	0.055					0.2753E-01		
7	10	0.9938	238.292	20.416	-5.423	99.134	-0.0380	0	0.016					0.8018E-02		
8	1	0.0062	151.897	23.952	-5.689	87.998	0.0566	0	1.065	17.259	0.196	-0.0131	-0.0131	0.5346E 00	0.79470	0.85042
8	2	0.0545	156.151	23.952	-5.689	87.998	0.0048	0	0.422					0.2168E 00		
8	3	0.1464	164.247	23.952	-5.689	87.998	-0.0274	0	0.260					0.1451E 00		
8	4	0.2730	175.379	23.952	-5.689	87.998	-0.0393	0	0.217					0.1090E 00		
8	5	0.4218	188.471	23.952	-5.689	87.998	-0.0447	0	0.182					0.9120E-01		
8	6	0.5782	202.237	23.952	-5.689	87.998	-0.0460	0	0.140					0.7012E-01		

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-177-24 WING) WITH NO MACCELLS. (1/10 SCALE).

MACH = 0.500 ALPHA = 5.000 DEG PSI = 0.0 OC PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	FN	FL	CMT	D/S	GANNA	CTC	CDC
6	7	0.0062	215.324	23.952	-6.609	67.998	-0.0441	0	0.067					0.4618E-01			
8	9	0.9536	226.464	23.952	-6.609	67.998	-0.0413	0	0.064					0.4730E-01			
8	9	0.9555	234.557	22.952	-5.609	67.998	-0.0393	0	0.054					0.2956E-01			
6	10	0.9938	238.911	23.952	-6.609	67.998	-0.0356	0	0.074					0.1302E-01			
9	1	0.0062	162.050	27.067	-6.173	78.799	0.0494	0	1.166	14.960	0.214	-8.844	-0.0152	0.5951E-00	0.87132	0.69443	
9	3	0.0545	165.856	27.067	-6.173	78.799	0.0140	0	0.454					0.2278E-00			
9	4	0.1464	173.155	27.067	-6.173	78.799	-0.0184	0	0.317					0.1500E-00			
9	5	0.2730	193.077	27.067	-6.173	78.799	-0.0364	0	0.264					0.1234E-00			
9	6	0.4218	194.501	27.067	-6.173	78.799	-0.0370	0	0.159					0.3967E-01			
9	7	0.5782	207.174	27.067	-6.173	78.799	-0.0395	0	0.140					0.7039E-01			
9	8	0.7270	219.851	27.067	-6.173	78.799	-0.0397	0	0.121					0.6072E-01			
9	9	0.8536	229.924	27.067	-6.173	78.799	-0.0384	0	0.107					0.5259E-01			
9	10	0.9455	236.076	27.067	-6.173	78.799	-0.0374	0	0.064					0.3216E-01			
10	1	0.0062	172.202	30.183	-6.658	69.600	-0.0371	0	0.022					0.1109E-01			
10	2	0.0545	175.568	30.183	-6.658	69.600	0.0431	0	1.196	16.545	0.279	-8.84	-0.0166	0.6515E-00	0.56421	0.69674	
10	3	0.1464	181.968	30.183	-6.658	69.600	-0.0092	0	0.490					0.2475E-00			
10	4	0.2730	190.774	30.183	-6.658	69.600	-0.0214	0	0.250					0.1800E-00			
10	5	0.4218	201.131	30.183	-6.658	69.600	-0.0247	0	0.270					0.1356E-00			
10	6	0.5782	212.015	30.183	-6.658	69.600	-0.0247	0	0.209					0.1049E-00			
10	7	0.7270	222.374	30.183	-6.658	69.600	-0.0335	0	0.159					0.7998E-01			
10	8	0.8536	231.182	30.183	-6.658	69.600	-0.0353	0	0.140					0.7015E-01			
10	9	0.9455	237.582	30.183	-6.658	69.600	-0.0350	0	0.111					0.5567E-01			
10	10	0.9938	240.947	30.183	-6.658	69.600	-0.0355	0	0.069					0.3469E-01			
11	1	0.0062	180.677	33.007	-7.104	61.997	0.0330	0	1.517	16.050	0.259	-9.16	-0.0171	0.7612E-00	0.98488	0.39914	
11	2	0.0545	183.674	33.007	-7.104	61.997	0.0271	0	0.542					0.2724E-00			
11	3	0.1464	189.374	33.007	-7.104	61.997	-0.0042	0	0.387					0.1918E-00			
11	4	0.2730	197.221	33.007	-7.104	61.997	-0.0158	0	0.281					0.1408E-00			
11	5	0.4218	206.444	33.007	-7.104	61.997	-0.0224	0	0.210					0.1098E-00			
11	6	0.5782	216.143	33.007	-7.104	61.997	-0.0255	0	0.179					0.8987E-01			
11	7	0.7270	225.367	33.007	-7.104	61.997	-0.0312	0	0.153					0.7673E-01			
11	8	0.8536	233.212	33.007	-7.104	61.997	-0.0324	0	0.118					0.5902E-01			
11	9	0.9455	238.914	33.007	-7.104	61.997	-0.0329	0	0.074					0.3690E-01			
11	10	0.9938	241.911	33.007	-7.104	61.997	-0.0332	0	0.025					0.1252E-01			
12	1	0.0062	187.476	35.538	-7.512	55.990	0.0196	0	1.654	15.430	0.276	-9.16	-0.0184	0.8300E-00	1.64207	0.31782	
12	2	0.0545	190.176	35.538	-7.512	55.990	0.0240	0	0.573					0.2878E-00			
12	3	0.1464	195.325	35.538	-7.512	55.990	-0.0030	0	0.401					0.2013E-00			
12	4	0.2730	202.411	35.538	-7.512	55.990	-0.0131	0	0.292					0.1468E-00			
12	5	0.4218	210.741	35.538	-7.512	55.990	-0.0144	0	0.232					0.1166E-00			
12	6	0.5782	219.500	35.538	-7.512	55.990	-0.0248	0	0.144					0.861E-01			
12	7	0.7270	227.830	35.538	-7.512	55.990	-0.0272	0	0.164					0.8228E-01			
12	8	0.8536	234.916	35.538	-7.512	55.990	-0.0287	0	0.124					0.6212E-01			
12	9	0.9455	240.064	35.538	-7.512	55.990	-0.0296	0	0.078					0.3914E-01			
12	10	0.9938	242.771	35.538	-7.512	55.990	-0.0299	0	0.027					0.1367E-01			
13	1	0.0062	194.854	38.289	-7.873	50.260	0.0083	0	1.809	14.727	0.293	-6.05	-0.0196	0.9077E-00	1.12199	0.19800	

WING PANEL NO. 3

PANEL NO. 4

WING PANEL NO. 4

PANEL NO. 5

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CLL107-32/-24 WING) WITH OVI MANEUVER. (1/10 SCALE).

MACH = 0.500 ALPHA = 5.000 DEG PSI = 0.0 DEG PITCH RATE = 0.0 F/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	CCP	CNC	CM	FL	CMT	GAMMA	CTC	DDC
13	2	0.0545	197.24	33.285	-7.873	50.260	0.0262	0	0.612	12.075	0.312	-6.65	-0.0175	0.0020E-01	1.10E-11	0.05440
13	3	0.1464	201.90	33.284	-7.873	50.260	-0.0010	0	0.420	0.2207E-00	0.0000	0.0000	0.0000	0.3071E-00		
13	4	0.2730	208.26	33.284	-7.873	50.260	-0.0004	0	0.308	0.1552E-00	0.0000	0.0000	0.0000	0.2107E-00		
13	5	0.4218	215.74	33.284	-7.873	50.260	-0.0153	0	0.240	0.1372E-00	0.0000	0.0000	0.0000	0.1546E-00		
13	6	0.5782	223.66	33.284	-7.873	50.260	-0.0197	0	0.219	0.1106E-00	0.0000	0.0000	0.0000	0.1253E-00		
13	7	0.7270	231.04	33.284	-7.873	50.260	-0.0222	0	0.172	0.3653E-01	0.0000	0.0000	0.0000	0.3071E-00		
13	8	0.8536	237.44	33.284	-7.873	50.260	-0.0234	0	0.174	0.6328E-01	0.0000	0.0000	0.0000	0.6328E-01		
13	9	0.9455	242.06	33.284	-7.873	50.260	-0.0244	0	0.076	0.3820E-01	0.0000	0.0000	0.0000	0.3820E-01		
13	10	0.9938	244.46	33.284	-7.873	50.260	-0.0247	0	0.024	0.1247E-01	0.0000	0.0000	0.0000	0.1247E-01		
14	1	0.0062	202.83	41.254	-8.188	44.806	-0.0010	0	1.472	0.0020E-00	1.10E-11	-6.65	-0.0175	0.0020E-00	1.10E-11	0.05440
14	2	0.0545	204.97	41.254	-8.188	44.806	0.0191	0	0.668	0.3111E-00	0.0000	0.0000	0.0000	0.3111E-00		
14	3	0.1464	209.11	41.250	-8.188	44.806	0.0116	0	0.440	0.2207E-00	0.0000	0.0000	0.0000	0.2207E-00		
14	4	0.2730	214.78	41.250	-8.188	44.806	-0.0049	0	0.329	0.1552E-00	0.0000	0.0000	0.0000	0.1552E-00		
14	5	0.4218	221.45	41.254	-8.188	44.806	-0.0094	0	0.273	0.1372E-00	0.0000	0.0000	0.0000	0.1372E-00		
14	6	0.5782	229.46	41.254	-8.188	44.806	-0.0135	0	0.227	0.1141E-00	0.0000	0.0000	0.0000	0.1141E-00		
14	7	0.7270	235.12	41.254	-8.188	44.806	-0.0157	0	0.176	0.3773E-01	0.0000	0.0000	0.0000	0.3773E-01		
14	8	0.8536	240.74	41.254	-8.188	44.806	-0.0162	0	0.111	0.6097E-01	0.0000	0.0000	0.0000	0.6097E-01		
14	9	0.9455	244.46	41.254	-8.188	44.806	-0.0172	0	0.075	0.3633E-01	0.0000	0.0000	0.0000	0.3633E-01		
14	10	0.9938	247.08	41.254	-8.188	44.806	-0.0175	0	0.023	0.1157E-01	0.0000	0.0000	0.0000	0.1157E-01		
15	1	0.0062	210.80	44.228	-8.502	34.353	-0.0103	0	2.172	12.167	0.274	-6.05	-0.0152	0.1390E-01	1.2748E-01	0.09027
15	2	0.0545	212.76	44.228	-8.502	34.353	0.0131	0	0.716	0.3410E-00	0.0000	0.0000	0.0000	0.3410E-00		
15	3	0.1464	216.35	44.228	-8.502	34.353	0.0043	0	0.472	0.2369E-00	0.0000	0.0000	0.0000	0.2369E-00		
15	4	0.2730	221.30	44.228	-8.502	34.353	-0.0003	0	0.367	0.1839E-00	0.0000	0.0000	0.0000	0.1839E-00		
15	5	0.4218	227.10	44.228	-8.502	34.353	-0.0040	0	0.302	0.1419E-00	0.0000	0.0000	0.0000	0.1419E-00		
15	6	0.5782	233.31	44.228	-8.502	34.353	-0.0068	0	0.224	0.1177E-00	0.0000	0.0000	0.0000	0.1177E-00		
15	7	0.7270	239.17	44.228	-8.502	34.353	-0.0084	0	0.171	0.8587E-01	0.0000	0.0000	0.0000	0.8587E-01		
15	8	0.8536	244.19	44.228	-8.502	34.353	-0.0093	0	0.114	0.5756E-01	0.0000	0.0000	0.0000	0.5756E-01		
15	9	0.9455	247.77	44.228	-8.502	34.353	-0.0100	0	0.066	0.3290E-01	0.0000	0.0000	0.0000	0.3290E-01		
15	10	0.9938	249.67	44.228	-8.502	34.353	-0.0102	0	0.022	0.1083E-01	0.0000	0.0000	0.0000	0.1083E-01		
16	1	0.0062	218.78	47.198	-8.817	30.899	-0.0196	0	2.440	12.133	0.264	-6.05	-0.0093	0.1229E-01	1.3928E-01	0.27624
16	2	0.0545	220.42	47.198	-8.817	30.899	0.0071	0	0.820	0.4115E-00	0.0000	0.0000	0.0000	0.4115E-00		
16	3	0.1464	223.53	47.198	-8.817	30.899	0.0064	0	0.595	0.2788E-00	0.0000	0.0000	0.0000	0.2788E-00		
16	4	0.2730	228.24	47.198	-8.817	30.899	0.0008	0	0.417	0.2095E-00	0.0000	0.0000	0.0000	0.2095E-00		
16	5	0.4218	233.87	47.198	-8.817	30.899	0.0008	0	0.312	0.1506E-00	0.0000	0.0000	0.0000	0.1506E-00		
16	6	0.5782	238.17	47.198	-8.817	30.899	0.0004	0	0.227	0.1139E-00	0.0000	0.0000	0.0000	0.1139E-00		
16	7	0.7270	243.21	47.198	-8.817	30.899	-0.0016	0	0.161	0.8059E-01	0.0000	0.0000	0.0000	0.8059E-01		
16	8	0.8536	247.50	47.198	-8.817	30.899	-0.0023	0	0.106	0.5210E-01	0.0000	0.0000	0.0000	0.5210E-01		
16	9	0.9455	250.62	47.198	-8.817	30.899	-0.0028	0	0.060	0.3032E-01	0.0000	0.0000	0.0000	0.3032E-01		
16	10	0.9938	252.26	47.198	-8.817	30.899	-0.0030	0	0.020	0.9965E-02	0.0000	0.0000	0.0000	0.9965E-02		
PANEL NO. 6																
17	1	0.0062	225.30	50.265	-9.077	30.000	-0.0254	0	3.125	11.321	0.378	-3.71	0.0005	0.1568E-01	0.0	1.05437
17	2	0.0545	226.75	50.265	-9.077	30.000	0.0014	0	0.974	0.4887E-00	0.0000	0.0000	0.0000	0.4887E-00		
17	3	0.1464	229.51	50.265	-9.077	30.000	0.0070	0	0.572	0.2871E-00	0.0000	0.0000	0.0000	0.2871E-00		
17	4	0.2730	233.31	50.265	-9.077	30.000	0.0056	0	0.401	0.2012E-00	0.0000	0.0000	0.0000	0.2012E-00		
17	5	0.4218	237.77	50.265	-9.077	30.000	0.0046	0	0.290	0.1455E-00	0.0000	0.0000	0.0000	0.1455E-00		
17	6	0.5782	242.46	50.265	-9.077	30.000	0.0049	0	0.206	0.1036E-00	0.0000	0.0000	0.0000	0.1036E-00		

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL11607-32/-24 WING) WITH DU/NACELLES. (1/10 SCALE).

MACH = 0.500 ALPHA = 5.000 DG PSI = 0.0 DG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 U/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	D/S	GAMMA	CTC	CDC
17	7	0.7770	246.932	50.265	-9.077	30.000	0.0044	0	0.144	10.341	0.376	-3.71	0.0043	0.1604E 01	0.0	0.98182	
17	8	0.8536	250.728	50.265	-9.077	30.000	0.0043	0	0.084					0.5052E 00			
17	9	0.9455	253.487	50.265	-9.077	30.000	0.0340	0	0.571					0.2914E 00			
17	10	0.9938	254.937	50.265	-9.077	30.000	0.0039	0	0.397					0.1991E 00			
18	1	0.0062	230.376	53.428	-9.282	27.655	-0.0277	0	3.196					0.1389E 00			
18	2	0.0545	231.713	53.428	-9.282	27.655	-0.0040	0	1.006					0.9641E-01			
18	3	0.1464	234.256	53.428	-9.282	27.655	0.0042	0	0.571					0.6558E-01			
18	4	0.2730	237.756	53.428	-9.282	27.655	0.0045	0	0.397					0.4277E-01			
18	5	0.4218	241.870	53.428	-9.282	27.655	0.0064	0	0.192					0.8019E-02			
18	6	0.5782	246.197	53.428	-9.282	27.655	0.0083	0	0.131								
18	7	0.7270	250.311	53.428	-9.282	27.655	0.0094	0	0.085								
18	8	0.8536	253.811	53.428	-9.282	27.655	0.0106	0	0.069								
18	9	0.9455	256.354	53.428	-9.282	27.655	0.0106	0	0.046								
18	10	0.9938	257.691	53.428	-9.282	27.655	0.0106	0	0.016								
19	1	0.0062	235.646	56.591	-9.487	25.311	-0.0300	0	3.266	9.370	0.370	-3.71	0.0074	0.1639E 01	0.0	0.90573	
19	2	0.0545	236.689	56.591	-9.487	25.311	-0.0044	0	1.031					0.5174E 00			
19	3	0.1464	238.997	56.591	-9.487	25.311	0.0014	0	0.563					0.2924E 00			
19	4	0.2730	242.200	56.591	-9.487	25.311	0.0034	0	0.388					0.1946E 00			
19	5	0.4218	245.966	56.591	-9.487	25.311	0.0083	0	0.260					0.1304E 00			
19	6	0.5782	249.925	56.591	-9.487	25.311	0.0118	0	0.178					0.9949E-01			
19	7	0.7270	253.691	56.591	-9.487	25.311	0.0153	0	0.121					0.6071E-01			
19	8	0.8536	256.894	56.591	-9.487	25.311	0.0167	0	0.080					0.4027E-01			
19	9	0.9455	259.221	56.591	-9.487	25.311	0.0171	0	0.066					0.2799E-01			
19	10	0.9938	260.445	56.591	-9.487	25.311	0.0172	0	0.015					0.7435E-02			
20	1	0.0062	240.515	59.755	-9.692	22.967	-0.0323	0	3.317	8.385	0.365	-3.71	0.0094	0.1665E 01	0.0	0.82633	
20	2	0.0545	241.625	59.755	-9.692	22.967	-0.0147	0	1.045					0.5246E 00			
20	3	0.1464	243.737	59.755	-9.692	22.967	0.0014	0	0.575					0.2889E 00			
20	4	0.2730	246.644	59.755	-9.692	22.967	0.0023	0	0.371					0.1860E 00			
20	5	0.4218	250.061	59.755	-9.692	22.967	0.0101	0	0.247					0.1237E 00			
20	6	0.5782	253.653	59.755	-9.692	22.967	0.0152	0	0.177					0.8891E-01			
20	7	0.7270	257.070	59.755	-9.692	22.967	0.0208	0	0.117					0.5868E-01			
20	8	0.8536	259.977	59.755	-9.692	22.967	0.0229	0	0.073					0.3669E-01			
20	9	0.9455	262.089	59.755	-9.692	22.967	0.0236	0	0.040					0.1985E-01			
20	10	0.9938	263.199	59.755	-9.692	22.967	0.0238	0	0.012					0.6227E-02			
21	1	0.0062	245.585	62.918	-9.897	20.622	-0.0346	0	3.284	7.382	0.358	-3.71	0.0120	0.1648E 01	0.0	0.74211	
21	2	0.0545	246.582	62.918	-9.897	20.622	-0.0201	0	1.022					0.5151E 00			
21	3	0.1464	248.478	62.918	-9.897	20.622	-0.0042	0	0.545					0.2737E 00			
21	4	0.2730	251.088	62.918	-9.897	20.622	0.0017	0	0.395					0.1983E 00			
21	5	0.4218	254.156	62.918	-9.897	20.622	0.0119	0	0.269					0.1300E 00			
21	6	0.5782	257.382	62.918	-9.897	20.622	0.0167	0	0.170					0.8528E-01			
21	7	0.7270	260.650	62.918	-9.897	20.622	0.0263	0	0.093					0.4657E-01			
21	8	0.8536	263.060	62.918	-9.897	20.622	0.0291	0	0.052					0.2618E-01			
21	9	0.9455	264.956	62.918	-9.897	20.622	0.0301	0	0.026					0.1323E-01			
21	10	0.9938	265.953	62.918	-9.897	20.622	0.0304	0	0.008					0.4019E-02			
22	1	0.0062	209.642	22.394	-4.423	39.300	0.0	0	-0.692	-1.794	-0.046	-90.00	-0.0114	-0.3473E 00	0.0	-0.00000	

PANEL NO. 7 UPPER NACELLE PYLON

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (ELLIPTIC-22/24 WING) WITH (AU) NACELLE. (1/10 SCALE).

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	PCP	CNC	EN	DL	GMT	GAMMA	CIC	D/S	YAW RATE =	D/S	CDC	
22	2	0.0545	211.542	22.394	-4.423	39.300	0.0	0	-0.406											
22	3	0.1464	215.155	22.394	-4.423	39.300	0.0	0	-0.000											
22	4	0.2730	220.129	22.394	-4.423	39.300	0.0	0	0.000											
22	5	0.4218	225.976	22.394	-4.423	39.300	0.0	0	0.000											
22	6	0.5782	232.124	22.394	-4.423	39.300	0.0	0	0.000											
22	7	0.7270	237.971	22.394	-4.423	39.300	0.0	0	0.000											
22	8	0.8536	242.945	22.394	-4.423	39.300	0.0	0	0.000											
22	9	0.9455	246.558	22.394	-4.423	39.300	0.0	0	0.000											
22	10	0.9938	248.458	22.394	-4.423	39.300	0.0	0	0.000											
PANIL NO. 8																				
23	1	0.0062	209.642	23.863	2.536	39.300	0.0000	1	-0.011	1.443	0.037	-30.00	-0.0066	-0.2716E-01	0.0					0.10885
23	2	0.0545	211.542	23.863	2.536	39.300	0.0000	1	-0.047					0.1241E-01						
23	3	0.1464	215.155	23.863	2.536	39.300	0.0000	1	-0.063					0.2170E-01						
23	4	0.2730	220.129	23.863	2.536	39.300	0.0000	1	-0.062					0.2082E-01						
23	5	0.4218	225.976	23.863	2.536	39.300	0.0000	1	-0.045					0.2182E-01						
23	6	0.5782	232.124	23.863	2.536	39.300	0.0000	1	-0.037					0.1615E-01						
23	7	0.7270	237.971	23.863	2.536	39.300	0.0000	1	-0.025					0.1045E-01						
23	8	0.8536	242.945	23.863	2.536	39.300	0.0000	1	-0.014					0.6180E-02						
23	9	0.9455	246.558	23.863	2.536	39.300	0.0000	1	-0.014					0.3631E-02						
23	10	0.9938	248.458	23.863	2.536	39.300	0.0000	1	-0.014					0.1247E-02						
24	1	0.0062	209.642	25.332	-0.008	39.300	0.0000	1	0.195	1.204	0.031	-90.00	-0.0083	-0.2419E 00	0.0					0.00000
24	2	0.0545	211.542	25.332	-0.008	39.300	0.0000	1	-0.011					0.1973E-01						
24	3	0.1464	215.155	25.332	-0.008	39.300	0.0000	1	-0.047					0.1982E-01						
24	4	0.2730	220.129	25.332	-0.008	39.300	0.0000	1	-0.063					0.2307E-01						
24	5	0.4218	225.976	25.332	-0.008	39.300	0.0000	1	-0.062					0.2539E-01						
24	6	0.5782	232.124	25.332	-0.008	39.300	0.0000	1	-0.042					0.1842E-01						
24	7	0.7270	237.971	25.332	-0.008	39.300	0.0000	1	-0.030					0.1060E-01						
24	8	0.8536	242.945	25.332	-0.008	39.300	0.0000	1	-0.019					0.4654E-02						
24	9	0.9455	246.558	25.332	-0.008	39.300	0.0000	1	-0.014					0.2038E-02						
24	10	0.9938	248.458	25.332	-0.008	39.300	0.0000	1	-0.012					0.6064E-03						
25	1	0.0062	209.642	23.863	-2.552	39.300	0.0000	1	0.143	0.943	0.024	-150.00	-0.0064	-0.1463E 00	0.0					-0.07120
25	2	0.0545	211.542	23.863	-2.552	39.300	0.0000	1	0.023					0.2605E-01						
25	3	0.1464	215.155	23.863	-2.552	39.300	0.0000	1	-0.044					0.2647E-01						
25	4	0.2730	220.129	23.863	-2.552	39.300	0.0000	1	-0.042					0.1400E-01						
25	5	0.4218	225.976	23.863	-2.552	39.300	0.0000	1	-0.053					0.2819E-01						
25	6	0.5782	232.124	23.863	-2.552	39.300	0.0000	1	-0.035					0.1428E-01						
25	7	0.7270	237.971	23.863	-2.552	39.300	0.0000	1	-0.021					0.6713E-02						
25	8	0.8536	242.945	23.863	-2.552	39.300	0.0000	1	-0.008					-0.6931E-03						
25	9	0.9455	246.558	23.863	-2.552	39.300	0.0000	1	-0.006					-0.1739E-02						
25	10	0.9938	248.458	23.863	-2.552	39.300	0.0000	1	-0.006					-0.8534E-03						
26	1	0.0062	209.642	20.925	-2.552	39.300	0.0000	1	-0.407	2.244	0.057	150.00	0.0027	0.2994E 00	0.0					-0.16968
26	2	0.0545	211.542	20.925	-2.552	39.300	0.0000	1	-0.235					0.1539E 00						
26	3	0.1464	215.155	20.925	-2.552	39.300	0.0000	1	-0.096					0.4018E-01						
26	4	0.2730	220.129	20.925	-2.552	39.300	0.0000	1	-0.042					0.8998E-02						
26	5	0.4218	225.976	20.925	-2.552	39.300	0.0000	1	-0.048					0.2575E-01						
26	6	0.5782	232.124	20.925	-2.552	39.300	0.0000	1	-0.028					0.1094E-01						

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL14-07-32/-24 WING) WITH 0/1 MACFLUFFS. (1/10 SCALE)

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CM	DL	CMT	D/S	GAMMA	C/T	D/S
30	10	0.9938	248.257	23.780	-8.000	39.400	0.0000	1	-0.001	-1.718	-0.044	-40.00	0.0068	0.1073E-02	0.1174E 00	0.0	-0.00000
31	1	0.0062	209.343	25.165	-10.400	39.400	-0.0000	1	-0.076					-0.2153E-01			
31	2	0.0545	211.247	25.165	-10.400	39.400	-0.0000	1	0.056					-0.4249E-01			
31	3	0.1464	214.870	25.165	-10.400	39.400	-0.0000	1	0.071					-0.4063E-01			
31	4	0.2730	219.856	25.165	-10.400	39.400	0.0000	1	0.060					-0.3916E-01			
31	5	0.4218	225.718	25.165	-10.400	39.400	0.0000	1	0.061					-0.2656E-01			
31	6	0.5782	231.882	25.165	-10.400	39.400	0.0000	1	0.047					-0.1477E-01			
31	7	0.7270	237.744	25.165	-10.400	39.400	0.0000	1	0.016					-0.5989E-02			
31	8	0.8536	242.730	25.165	-10.400	39.400	0.0000	1	0.009					-0.2345E-02			
31	9	0.9455	246.353	25.165	-10.400	39.400	0.0000	1	0.007					-0.6535E-03			
31	10	0.9938	248.257	25.165	-10.400	39.400	0.0000	1	0.007								
32	1	0.0062	209.343	23.780	-12.800	39.400	-0.0000	1	0.017	-1.784	-0.045	-150.00	0.0071	0.2733E-01	0.0		0.13467
32	2	0.0545	211.247	23.780	-12.800	39.400	-0.0000	1	0.041					-0.2999E-01			
32	3	0.1464	214.870	23.780	-12.800	39.400	-0.0000	1	0.046					-0.3997E-01			
32	4	0.2730	219.856	23.780	-12.800	39.400	-0.0000	1	0.067					-0.3691E-01			
32	5	0.4218	225.718	23.780	-12.800	39.400	0.0000	1	0.067					-0.3671E-01			
32	6	0.5782	231.882	23.780	-12.800	39.400	0.0000	1	0.045					-0.2561E-01			
32	7	0.7270	237.744	23.780	-12.800	39.400	0.0000	1	0.033					-0.1596E-01			
32	8	0.8536	242.730	23.780	-12.800	39.400	0.0000	1	0.021					-0.0811E-02			
32	9	0.9455	246.353	23.780	-12.800	39.400	0.0000	1	0.016					-0.4653E-02			
32	10	0.9938	248.257	23.780	-12.800	39.400	0.0000	1	0.017					-0.1959E-02			
33	1	0.0062	209.343	21.008	-12.800	39.400	-0.0000	1	0.179	-1.823	-0.046	150.00	0.0044	-0.1554E 00	0.0		0.13762
33	2	0.0545	211.247	21.008	-12.800	39.400	-0.0000	1	0.067					-0.5676E-01			
33	3	0.1464	214.870	21.008	-12.800	39.400	-0.0000	1	0.064					-0.3925E-01			
33	4	0.2730	219.856	21.008	-12.800	39.400	-0.0000	1	0.054					-0.3202E-01			
33	5	0.4218	225.718	21.008	-12.800	39.400	0.0000	1	0.049					-0.3200E-01			
33	6	0.5782	231.882	21.008	-12.800	39.400	0.0000	1	0.036					-0.2773E-01			
33	7	0.7270	237.744	21.008	-12.800	39.400	0.0000	1	0.029					-0.1399E-01			
33	8	0.8536	242.730	21.008	-12.800	39.400	0.0000	1	0.021					-0.9025E-02			
33	9	0.9455	246.353	21.008	-12.800	39.400	0.0000	1	0.016					-0.5145E-02			
33	10	0.9938	248.257	21.008	-12.800	39.400	0.0000	1	0.011					-0.1722E-02			
34	1	0.0062	209.343	19.623	-10.400	39.400	-0.0000	1	0.278	-1.823	-0.047	90.00	0.0022	-0.2695E 00	0.0		0.00000
34	2	0.0545	211.247	19.623	-10.400	39.400	-0.0000	1	0.109					-0.8659E-01			
34	3	0.1464	214.870	19.623	-10.400	39.400	-0.0000	1	0.064					-0.3920E-01			
34	4	0.2730	219.856	19.623	-10.400	39.400	0.0000	1	0.064					-0.2832E-01			
34	5	0.4218	225.718	19.623	-10.400	39.400	0.0000	1	0.044					-0.3063E-01			
34	6	0.5782	231.882	19.623	-10.400	39.400	0.0000	1	0.038					-0.2107E-01			
34	7	0.7270	237.744	19.623	-10.400	39.400	0.0000	1	0.023					-0.1047E-01			
34	8	0.8536	242.730	19.623	-10.400	39.400	0.0000	1	0.014					-0.5772E-02			
34	9	0.9455	246.353	19.623	-10.400	39.400	0.0000	1	0.009					-0.2266E-02			
34	10	0.9938	248.257	19.623	-10.400	39.400	0.0000	1	0.006					-0.3666E-03			
35	1	0.0062	209.343	21.008	-8.000	39.400	-0.0000	1	0.267	-2.043	-0.052	30.00	-0.0010	-0.2372E 00	0.0		-0.15421
35	2	0.0545	211.247	21.008	-8.000	39.400	-0.0000	1	0.188					-0.1518E 00			
35	3	0.1464	214.870	21.008	-8.000	39.400	-0.0000	1	0.087					-0.5357E-01			
35	4	0.2730	219.856	21.008	-8.000	39.400	0.0000	1	0.043					-0.1639E-01			
35	5	0.4218	225.718	21.008	-8.000	39.400	0.0000	1	0.054					-0.3914E-01			

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL11A07-37/-24 WING) WITH O/U MANIFOLDS, (1/10 SCALE).

MACH = 0.500 ALPHA = 5.000 DEG PSI = 0.0 CC PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITC	ICP	CNC	CM	NL	CHT	D/S	GAMMA	CTC	D/S	CDC	
35	6	0.5782	231.882	21.008	-8.000	39.400	0.0000	1	0.033						-0.1904E-01				
35	7	0.7270	237.744	21.008	-8.000	39.400	0.0000	1	0.033						-0.4627E-02				
35	8	0.8536	242.730	21.008	-8.000	39.400	0.0000	1	0.009						-0.1426E-03				
35	9	0.9455	246.352	21.009	-9.000	39.400	0.0000	1	0.001						0.1356E-02				
35	10	0.9938	248.257	21.009	-9.000	39.400	0.0000	1	0.001						0.9059E-03				
PANEL NO. 11 0																			
36	1	0.0062	249.558	64.500	-9.100	18.782	0.0	0	0.454	5.477	0.267	90.00	0.0112	0.1232E-01	0.0			0.00000	
36	2	0.0545	250.466	64.500	-9.100	18.782	0.0	0	0.874					0.4189E-00					
36	3	0.1464	252.193	64.500	-9.100	18.782	0.0	0	0.874					0.2576E-00					
36	4	0.2730	254.570	64.500	-9.100	18.782	0.0	0	0.739					0.1694E-00					
36	5	0.4218	257.365	64.500	-9.100	18.782	0.0	0	0.214					0.1072E-00					
36	6	0.5782	260.303	64.500	-9.100	18.782	0.0	0	0.124					0.0327E-01					
36	7	0.7270	263.097	64.500	-9.100	18.782	0.0	0	0.060					0.3486E-01					
36	8	0.8536	265.474	64.500	-9.100	18.782	0.0	0	0.024					0.1764E-01					
36	9	0.9455	267.201	64.500	-9.100	18.782	0.0	0	0.014					0.7774E-02					
36	10	0.9938	268.104	64.500	-9.100	18.782	0.0	0	0.005					0.2299E-02					
PANEL NO. 12 0																			
37	1	0.0062	252.435	64.500	-7.300	17.447	0.0	0	0.752	4.467	0.264	90.00	0.0154	0.1196E-01	0.0			0.00000	
37	2	0.0545	253.278	64.500	-7.300	17.447	0.0	0	0.704					0.3987E-00					
37	3	0.1464	254.862	64.500	-7.300	17.447	0.0	0	0.455					0.2294E-00					
37	4	0.2730	257.091	64.500	-7.300	17.447	0.0	0	0.284					0.1424E-00					
37	5	0.4218	259.686	64.500	-7.300	17.447	0.0	0	0.169					0.9425E-01					
37	6	0.5782	262.416	64.500	-7.300	17.447	0.0	0	0.061					0.4554E-01					
37	7	0.7270	265.011	64.500	-7.300	17.447	0.0	0	0.027					0.2323E-01					
37	8	0.8536	267.220	64.500	-7.300	17.447	0.0	0	0.023					0.1146E-01					
37	9	0.9455	268.824	64.500	-7.300	17.447	0.0	0	0.011					0.5352E-02					
37	10	0.9938	269.667	64.500	-7.300	17.447	0.0	0	0.003					0.1610E-02					
PANEL NO. 13 0																			
38	1	0.0062	255.311	64.500	-5.500	16.112	0.0	0	0.275	3.477	0.216	90.00	0.0191	0.1142E-01	0.0			0.00000	
38	2	0.0545	256.040	64.500	-5.500	16.112	0.0	0	0.742					0.3724E-00					
38	3	0.1464	257.572	64.500	-5.500	16.112	0.0	0	0.401					0.2015E-00					
38	4	0.2730	259.611	64.500	-5.500	16.112	0.0	0	0.222					0.1114E-00					
38	5	0.4218	262.006	64.500	-5.500	16.112	0.0	0	0.111					0.5578E-01					
38	6	0.5782	264.529	64.500	-5.500	16.112	0.0	0	0.054					0.2707E-01					
38	7	0.7270	266.926	64.500	-5.500	16.112	0.0	0	0.027					0.1340E-01					
38	8	0.8536	268.965	64.500	-5.500	16.112	0.0	0	0.014					0.6685E-02					
38	9	0.9455	270.447	64.500	-5.500	16.112	0.0	0	0.004					0.3165E-02					
38	10	0.9938	271.226	64.500	-5.500	16.112	0.0	0	0.002					0.9604E-03					
PANEL NO. 14 0																			
39	1	0.0062	256.188	64.500	-3.700	14.778	0.0	0	0.046	2.283	0.155	90.00	0.0200	0.1027E-01	0.0			0.00000	
39	2	0.0545	258.902	64.500	-3.700	14.778	0.0	0	0.630					0.3161E-00					
39	3	0.1464	260.261	64.500	-3.700	14.778	0.0	0	0.277					0.1367E-00					
39	4	0.2730	262.131	64.500	-3.700	14.778	0.0	0	0.111					0.5551E-01					
39	5	0.4218	264.330	64.500	-3.700	14.778	0.0	0	0.048					0.2417E-01					
39	6	0.5782	266.641	64.500	-3.700	14.778	0.0	0	0.023					0.1163E-01					
39	7	0.7270	268.840	64.500	-3.700	14.778	0.0	0	0.012					0.5903E-02					
39	8	0.8536	270.710	64.500	-3.700	14.778	0.0	0	0.006					0.3018E-02					
39	9	0.9455	272.049	64.500	-3.700	14.778	0.0	0	0.003					0.1456E-02					
39	10	0.9938	272.703	64.500	-3.700	14.778	0.0	0	0.001					0.4450E-03					

END OF CASE

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL11A07-32/-74 WING) WITH CAU VAGELLES, (1/10 SCALE).

MACH = 2.550
 ALPHA = 5.000 DEG.
 PSI = 0.0 DEG.
 PITCH RATE = 0.0 DEG / SEC
 ROLL RATE = 0.0 DEG / SEC
 YAW RATE = 0.0 DEG / SEC

ANALYSIS (DIRECT) CASE (INVERS = 0)

MOMENT AND ROTATION CENTER : XPRK = (-.19104E 03 ZPRK = (-1.5450E 01 ***** VINT = 0.17000E 01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS : FLOATX = 0.0 FLOATY = 0.0

I	SURF/SREF	CY(I)	CL(I)	CLT(I)	CY(I)	CL(I)	CLT(I)	CS(I)	CM(I)	CK(I)	CY(I)	CM(I)	CK(I)
1	0.7839E 00	-0.00124	0.00664	0.00080	0.00080	0.00145	0.0	0.0	0.2739E-02	0.1020E-02	0.1185E-01	0.3245E-02	0.3245E-02
2	0.1941E 00	0.14962	0.02885	-0.07609	-0.07609	0.00704	0.00036	0.00172	0.6345E-02	0.3245E-02	-0.3192E-03	0.3245E-02	-0.3192E-03
3	0.7703E-01	0.70611	0.01543	0.00744	0.00744	0.00137	0.00026	0.00030	-0.5579E-04	0.3245E-02	-0.2688E-03	0.3245E-02	-0.2688E-03
4	0.3126E-01	0.25130	0.00773	0.00125	0.00125	0.00060	0.00004	0.00027	-0.0404E-03	0.3245E-02	0.4779E-04	0.3245E-02	0.4779E-04
5	0.5194E-01	0.30532	0.01574	0.00107	0.00107	0.00111	0.00003	0.00000	-0.4589E-02	0.3245E-02	0.2622E-04	0.3245E-02	0.2622E-04
6	0.4146E-01	0.36326	0.01468	0.00097	0.00097	0.00174	0.0	0.0	0.7905E-02	0.3245E-02	-0.1306E-03	0.3245E-02	-0.1306E-03
7	0.8313E-02	-0.01778	-0.00000	-0.00014	-0.00014	-0.00000	0.0	0.0	0.3722E-10	-0.5662E-04	-0.2329E-04	-0.5662E-04	-0.2329E-04
8	0.8245E-01	-0.00575	0.00000	-0.00007	-0.00007	0.00000	0.0	0.0	-0.5924E-04	0.3245E-02	-0.1810E-04	0.3245E-02	-0.1810E-04
9	0.7134E-02	-0.00304	-0.00000	-0.00002	-0.00002	0.00000	0.0	0.0	0.1567E-10	-0.1000E-05	-0.9749E-05	-0.1000E-05	-0.9749E-05
10	0.7817E-01	-0.00922	0.00000	0.00014	0.00014	0.00000	0.0	0.0	0.1419E-04	0.2749E-04	0.6441E-04	0.2749E-04	0.6441E-04
11	0.1249E-01	0.14356	0.00000	-0.00174	-0.00174	0.00000	0.0	0.0	-0.1596E-08	-0.1107E-03	-0.9918E-03	-0.1107E-03	-0.9918E-03
SREF	WSPAN	CRACK	CLTOT	CLTOT	CLTOT	CLTOT	CLTOT	CYTOT	CMTOT	CRMTOT	CYTOT	CMTOT	CRMTOT
0.9676E 04	0.12960E 03	0.10213E 03	0.115002	0.115002	0.115002	0.01859	0.0	-0.92462E-02	0.0	0.0	0.0	0.0	0.0

CD/CL**2 = 0.5736 E = 0.2227

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-2/-4 WING) WITH OAI NOZZLES. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.000 DEG PSI = 0.0 DG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	I/S	DCP	CNC	CN	CL	CMT	D/S	GAMMA	CTC	CDC
FUSELAGE (FUSIFORM PANEL)																	
1	1	0.0003	0.094	0.107	-2.400	352.400	0.6674	1	1.825	2.4C1	0.007	-27.5C	-0.0098	-0.4169F	0C	C.40	0.75721
1	2	0.0024	0.848	0.321	-1.985	352.400	0.7589	1	0.714					-0.2249E	0C		
1	3	0.0067	2.353	0.532	-1.583	352.400	0.2547	1	0.292					-0.1379E	0C		
1	4	0.0131	4.603	0.741	-1.182	352.400	0.2017	1	0.229					-0.1463E	0C		
1	5	0.0215	7.587	0.945	-0.790	352.400	0.1650	1	0.185					-0.1138E	0C		
1	6	0.0320	11.293	1.143	-0.409	352.400	0.1455	1	0.137					-0.9129E	-01		
1	7	0.0446	15.766	1.377	0.298	352.400	0.1300	1	0.142					-0.8299E	-01		
1	8	0.0590	20.805	1.512	0.298	352.400	0.1161	1	0.131					-0.8117E	-01		
1	9	0.0754	26.570	1.701	0.682	352.400	0.1035	1	0.114					-0.6701E	-01		
1	10	0.0936	32.974	1.891	1.027	352.400	0.0824	1	0.095					-0.4865E	-01		
1	11	0.1135	39.944	2.078	1.386	352.400	0.0656	1	0.077					-0.4291E	-01		
1	12	0.1351	47.590	2.256	1.729	352.400	0.0480	1	0.064					-0.3378E	-01		
1	13	0.1582	55.751	2.420	2.043	352.400	0.0388	1	0.049					-0.1294E	-01		
1	14	0.1828	64.420	2.576	2.343	352.400	0.0251	1	0.031					-0.4579E	-02		
1	15	0.2088	73.567	2.756	2.689	352.400	0.0121	1	0.027					-0.1698E	-02		
1	16	0.2360	83.154	2.933	3.029	352.400	-0.0434	1	-0.015					0.2974E	-01		
1	17	0.2645	93.140	2.941	3.045	352.400	-0.0481	1	-0.010					0.2176E	-01		
1	18	0.2936	103.481	2.941	3.045	352.400	-0.0300	1	0.014					0.2203E	-02		
1	19	0.3239	114.133	2.941	3.045	352.400	-0.0288	1	0.017					0.4363F	-03		
1	20	0.3549	125.051	2.941	3.045	352.400	-0.0302	1	-0.006					0.1092E	-01		
1	21	0.3865	136.189	2.941	3.045	352.400	-0.0330	1	-0.036					0.1942E	-01		
1	22	0.4186	147.647	2.942	3.045	352.400	-0.0319	1	-0.032					0.1865E	-01		
1	23	0.4510	158.924	2.941	3.045	352.400	-0.0314	1	-0.041					0.2961E	-01		
1	24	0.4836	170.434	2.941	3.045	352.400	-0.0287	1	-0.034					0.1919E	-01		
1	25	0.5164	181.965	2.941	3.045	352.400	-0.0304	1	-0.040					0.3047E	-01		
1	26	0.5490	193.470	2.941	3.045	352.400	-0.0329	1	-0.042					0.3887E	-01		
1	27	0.5814	204.902	2.941	3.045	352.400	-0.0309	1	-0.032					0.2719E	-01		
1	28	0.6135	216.210	2.941	3.045	352.400	-0.0251	1	-0.038					0.3714E	-01		
1	29	0.6451	227.348	2.942	3.045	352.400	-0.0146	1	-0.018					0.1977E	-01		
1	30	0.6761	238.266	2.941	3.045	352.400	-0.0107	1	-0.003					0.2929E	-02		
1	31	0.7064	248.918	2.941	3.045	352.400	-0.0020	1	-0.015					0.1857E	-01		
1	32	0.7357	259.254	2.941	3.045	352.400	0.0015	1	0.010					0.1604E	-01		
1	33	0.7640	269.245	2.950	3.043	352.400	-0.0343	1	-0.043					0.4749E	-01		
1	34	0.7912	278.832	2.809	2.790	352.400	-0.0211	1	-0.005					0.1003E	-01		
1	35	0.8172	287.979	2.644	2.474	352.400	-0.0108	1	-0.021					0.3563E	-01		
1	36	0.8418	296.648	2.489	2.176	352.400	-0.0084	1	-0.013					0.3149E	-01		
1	37	0.8649	304.801	2.333	1.875	352.400	-0.0119	1	-0.025					0.3492E	-01		
1	38	0.8865	312.404	2.163	1.551	352.400	-0.0056	1	-0.013					0.1252E	-01		
1	39	0.9064	319.423	1.988	1.214	352.400	-0.0079	1	-0.036					0.3112E	-01		
1	40	0.9246	325.824	1.807	0.865	352.400	-0.0075	1	-0.057					0.4492E	-01		
1	41	0.9410	331.594	1.630	0.525	352.400	0.0075	1	0.086					0.3928E	-01		
1	42	0.9554	336.694	1.496	0.269	352.400	-0.0156	1	-0.086					0.7224E	-01		
1	43	0.9680	341.106	1.327	-0.056	352.400	-0.0457	1	-0.117					0.1046E	0C		
1	44	0.9785	344.813	1.126	-0.442	352.400	-0.0887	1	-0.154					0.1695E	0C		
1	45	0.9869	347.797	0.901	-0.875	352.400	-0.1576	1	-0.154					0.2872E	0C		
1	46	0.9933	350.046	0.656	-1.345	352.400	-0.2912	1	-0.154					0.2464E	0C		
1	47	0.9976	351.551	0.399	-1.840	352.400	-0.6851	1	-0.062					0.1325E	0C		
1	48	0.9997	352.305	0.133	-2.351	352.400	-1.7262	1	1.486					0.5511E	-01		

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (LL1A07-52/-24 WING) WITH O/U NACELLES. (1/10 SCALE).

S	C	X/C	Y	Y	Z	CHORD	SLOPE	ITS	DPC	CNC	CN	DL	CMT	D/S	GAMMA	CTC	CDC
2	1	0.0003	0.094	0.227	-2.483	352.400	0.6087	1	1.378	4.557	0.013	-84.37	-0.0117	0.0	-0.4354E-00	0.0	0.57313
2	2	0.0024	0.848	0.679	-2.538	352.400	0.3043	1	0.868						-0.2410E-00		
2	3	0.0067	2.353	1.127	-2.494	352.400	0.2032	1	0.280						-0.1494E-00		
2	4	0.0131	4.603	1.569	-2.451	352.400	0.1514	1	0.163						-0.1430E-00		
2	5	0.0215	7.587	2.001	-2.408	352.400	0.1147	1	0.142						-0.1173E-00		
2	6	0.0320	11.293	2.421	-2.367	352.400	0.0935	1	0.169						-0.1377E-00		
2	7	0.0444	15.704	2.804	-2.329	352.400	0.0828	1	0.122						-0.1043E-00		
2	8	0.0590	20.805	3.201	-2.290	352.400	0.0743	1	0.113						-0.9588E-01		
2	9	0.0754	26.576	3.607	-2.250	352.400	0.0674	1	0.114						-0.9397E-01		
2	10	0.0936	32.976	4.004	-2.210	352.400	0.0615	1	0.109						-0.7695E-01		
2	11	0.1135	39.995	4.400	-2.171	352.400	0.0515	1	0.291						-0.6320E-01		
2	12	0.1351	47.598	4.777	-2.134	352.400	0.0437	1	0.044						-0.2787E-01		
2	13	0.1582	55.751	5.124	-2.100	352.400	0.0366	1	0.061						-0.3600E-01		
2	14	0.1828	64.420	5.454	-2.067	352.400	0.0319	1	0.058						-0.3289E-01		
2	15	0.2088	73.567	5.836	-2.030	352.400	0.0281	1	0.054						-0.3123E-01		
2	16	0.2360	83.154	6.211	-1.993	352.400	0.0264	1	0.017						0.3471E-02		
2	17	0.2643	93.140	6.528	-1.991	352.400	0.0253	1	0.012						0.5023E-02		
2	18	0.2936	103.481	6.828	-1.991	352.400	0.0253	1	0.013						0.2628E-01		
2	19	0.3239	114.133	7.229	-1.991	352.400	0.0253	1	0.039						0.4093E-01		
2	20	0.3549	125.051	7.629	-1.991	352.400	0.0253	1	0.046						0.3924E-01		
2	21	0.3865	136.184	8.029	-1.991	352.400	0.0253	1	0.026						0.9064E-02		
2	22	0.4186	147.497	8.429	-1.991	352.400	0.0253	1	0.053						0.4101E-01		
2	23	0.4510	158.924	8.829	-1.991	352.400	0.0253	1	0.071						0.9133E-02		
2	24	0.4836	170.424	9.229	-1.991	352.400	0.0253	1	0.042						0.3027E-01		
2	25	0.5164	181.965	9.629	-1.991	352.400	0.0253	1	0.067						0.3971E-01		
2	26	0.5490	193.476	10.029	-1.991	352.400	0.0253	1	0.046						0.9032E-02		
2	27	0.5814	204.902	10.429	-1.991	352.400	0.0253	1	0.099						-0.5549E-02		
2	28	0.6135	216.210	10.829	-1.991	352.400	0.0253	1	0.014						0.1957E-01		
2	29	0.6451	227.346	11.229	-1.991	352.400	0.0253	1	0.020						0.4460E-01		
2	30	0.6761	238.266	11.629	-1.991	352.400	0.0253	1	0.043						0.4509E-01		
2	31	0.7064	248.918	12.029	-1.991	352.400	0.0253	1	0.000						-0.5548E-02		
2	32	0.7357	259.254	12.429	-1.991	352.400	0.0253	1	0.003						0.2630E-01		
2	33	0.7640	269.245	12.829	-1.991	352.400	0.0253	1	0.020						0.4740E-01		
2	34	0.7912	278.832	13.229	-2.019	352.400	0.0253	1	0.075						0.4501E-01		
2	35	0.8172	287.974	13.629	-2.053	352.400	0.0351	1	0.031						0.509E-01		
2	36	0.8418	296.648	14.029	-2.086	352.400	0.0371	1	0.044						0.6368E-01		
2	37	0.8649	304.901	14.429	-2.118	352.400	0.0424	1	0.060						0.5305E-01		
2	38	0.8865	312.404	14.829	-2.154	352.400	0.0481	1	0.060						0.5969E-01		
2	39	0.9064	319.423	15.229	-2.190	352.400	0.0543	1	0.063						0.6145E-01		
2	40	0.9246	325.829	15.629	-2.228	352.400	0.0599	1	0.070						0.6611E-01		
2	41	0.9410	331.494	16.029	-2.265	352.400	0.0473	1	0.075						0.7758E-01		
2	42	0.9554	336.694	16.429	-2.303	352.400	0.0742	1	0.086						0.1273E-00		
2	43	0.9680	341.106	16.829	-2.338	352.400	0.1071	1	0.120						0.1810E-00		
2	44	0.9785	344.813	17.229	-2.370	352.400	0.1527	1	0.146						0.3029E-00		
2	45	0.9869	347.747	17.629	-2.407	352.400	0.2228	1	0.154						0.2270E-00		
2	46	0.9933	350.044	18.029	-2.448	352.400	0.3557	1	0.144						0.1219E-00		
2	47	0.9976	351.551	18.429	-2.422	352.400	0.7438	1	0.035						0.2270E-00		
2	48	0.9997	352.305	18.829	-2.578	352.400	1.7670	1	1.681						0.7176E-01		
3	1	0.0003	0.094	0.120	-2.789	352.400	0.5777	1	1.282						-0.0041	0.0	1.25124

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1107-37/-24 WING) WITH (MAIN) ACCELLES. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.000 DEG PSI = 0.0 LC PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	PCP	CMC	CN	CL	CAT	D/S	GAMMA	CIC	CDC
3	2	0.0024	0.846	0.358	-3.154	352.400	0.2364	1	0.603						-0.2559E-00		
3	3	0.0067	2.353	0.595	-3.517	352.400	0.1138	1	0.375						-0.1891E-00		
3	4	0.0131	4.603	0.828	-3.874	352.400	0.0282	1	0.197						-0.1689E-00		
3	5	0.0215	7.457	1.056	-4.237	352.400	0.0092	1	0.127						-0.1617E-00		
3	6	0.0320	11.293	1.278	-4.593	352.400	0.0030	1	0.118						-0.1143E-00		
3	7	0.0446	15.706	1.483	-4.937	352.400	0.0234	1	0.128						-0.1122E-00		
3	8	0.0590	20.805	1.680	-5.193	352.400	0.0234	1	0.114						-0.9825E-01		
3	9	0.0754	26.576	1.901	-5.453	352.400	0.0234	1	0.117						-0.9740E-01		
3	10	0.0936	32.976	2.117	-5.683	352.400	0.0234	1	0.117						-0.9754E-01		
3	11	0.1138	39.995	2.327	-6.183	352.400	0.0736	1	0.193						-0.5916E-01		
3	12	0.1351	47.598	2.521	-6.468	352.400	0.0367	1	0.156						-0.5294E-01		
3	13	0.1582	55.751	2.704	-6.745	352.400	0.0236	1	0.070						-0.6044E-01		
3	14	0.1928	64.420	2.878	-7.016	352.400	0.0501	1	0.079						-0.6141E-01		
3	15	0.2088	73.567	3.030	-7.305	352.400	0.0639	1	0.577						-0.33384E-01		
3	16	0.2360	83.154	3.278	-7.627	352.400	0.0418	1	0.541						-0.1518E-01		
3	17	0.2643	93.140	3.287	-7.641	352.400	0.0454	1	0.677						-0.49614E-02		
3	18	0.2936	103.481	3.287	-7.641	352.400	0.0282	1	0.601						-0.7916E-02		
3	19	0.3239	114.133	3.287	-7.642	352.400	0.0272	1	0.622						-0.1719E-01		
3	20	0.3549	125.051	3.287	-7.642	352.400	0.0254	1	0.632						-0.1235E-01		
3	21	0.3865	136.189	3.287	-7.641	352.400	0.0312	1	0.624						-0.3961E-01		
3	22	0.4186	147.497	3.287	-7.642	352.400	0.0301	1	0.652						-0.3770E-01		
3	23	0.4510	158.924	3.287	-7.641	352.400	0.0286	1	0.649						-0.2433E-01		
3	24	0.4836	170.434	3.287	-7.641	352.400	0.0271	1	0.630						-0.4193E-01		
3	25	0.5164	181.965	3.287	-7.641	352.400	0.0287	1	0.632						-0.1122E-01		
3	26	0.5490	193.470	3.287	-7.641	352.400	0.0311	1	0.667						-0.6829E-02		
3	27	0.5814	204.902	3.287	-7.641	352.400	0.0292	1	0.667						0.3594E-02		
3	28	0.6135	216.210	3.287	-7.641	352.400	0.0287	1	0.637						-0.2146E-01		
3	29	0.6451	227.348	3.287	-7.642	352.400	0.0138	1	0.611						0.3513E-01		
3	30	0.6761	238.266	3.287	-7.641	352.400	0.0101	1	0.636						0.7341E-01		
3	31	0.7064	248.918	3.287	-7.641	352.400	0.0018	1	0.664						0.7428E-01		
3	32	0.7357	259.259	3.287	-7.641	352.400	-0.0018	1	0.664						0.8661E-01		
3	33	0.7640	269.745	3.297	-7.657	352.400	-0.0018	1	0.630						0.9045E-01		
3	34	0.7912	278.832	3.138	-7.414	352.400	-0.0046	1	-0.024						0.9759E-01		
3	35	0.8172	287.979	2.955	-7.132	352.400	-0.0032	1	-0.034						0.9949E-01		
3	36	0.8418	296.646	2.781	-6.867	352.400	-0.0032	1	-0.047						0.9557E-01		
3	37	0.8649	304.901	2.607	-6.599	352.400	-0.0075	1	-0.050						0.1052E-00		
3	38	0.8865	312.404	2.418	-6.310	352.400	-0.0036	1	-0.061						0.1485E-00		
3	39	0.9064	319.473	2.227	-6.010	352.400	-0.1087	1	-0.066						0.2208E-00		
3	40	0.9246	325.829	2.019	-5.699	352.400	-0.1161	1	-0.072						0.1878E-00		
3	41	0.9410	331.594	1.821	-5.345	352.400	-0.1112	1	-0.071						0.2161E-00		
3	42	0.9554	336.494	1.672	-5.167	352.400	-0.1423	1	-0.076						0.1090E-00		
3	43	0.9680	341.106	1.483	-4.877	352.400	-0.1787	1	-0.082						0.2966E-01		
3	44	0.9785	344.813	1.259	-4.434	352.400	-0.2758	1	-0.104								
3	45	0.9869	347.797	1.007	-4.148	352.400	-0.2960	1	-0.132								
3	46	0.9933	350.046	0.733	-3.728	352.400	-0.4258	1	-0.107								
3	47	0.9976	351.551	0.445	-3.288	352.400	-0.7496	1	-0.103								
3	48	0.9997	352.305	0.149	-2.832	352.400	-1.7835	1	1.022								

PANEL NO. 2 WING PANEL NO. 1

4	1	0.0062	101.747	8.551	-5.490	138.357	-0.0153	0	0.505	17.596	0.127	0.18	-0.0212	0.2537E-00	0.19952	1.98746
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TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (GL1907-37/-24 WING) WITH DU MAGELLES. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.000 DEG PSI = C.C. PG PITCH RATE = C.C. D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITC	FCP	CNC	CN	DL	CMT	GAMMA	CTC	D/S	CDC
4	2	0.0545	108.450	8.551	-5.490	138.357	-0.0632	0	0.231	17.076	0.142	0.18	-0.0220	0.2734E-00	0.20355	1.92527	
4	3	0.1464	121.152	9.551	-5.490	138.357	-0.0697	0	0.175					0.5284E-01			
4	4	0.2730	134.667	9.551	-5.490	138.357	-0.0832	0	0.115					0.5756E-01			
4	5	0.4218	159.246	9.551	-5.490	138.357	-0.0974	0	0.104					0.5253E-01			
4	6	0.5782	180.890	9.551	-5.490	138.357	-0.0776	0	0.044					0.4751E-01			
4	7	0.7270	201.474	9.551	-5.490	138.357	-0.0287	0	0.152					0.7405E-01			
4	8	0.8536	218.925	8.551	-5.490	138.357	-0.0272	0	0.260					0.2995E-01			
4	9	0.9455	231.707	8.551	-5.490	138.357	-0.0298	0	0.126					0.6325E-01			
4	10	0.9938	238.346	9.551	-5.490	138.357	-0.0293	0	0.277					0.1342E-01			
5	1	0.0062	114.621	12.506	-5.478	125.283	0.0062	0	0.555					0.2734E-00	0.20355	1.92527	
5	2	0.0545	120.677	12.506	-5.478	125.283	-0.0451	0	0.277					0.1390E-00			
5	3	0.1464	132.197	12.506	-5.478	125.283	-0.0543	0	0.150					0.7974E-01			
5	4	0.2730	148.652	12.506	-5.478	125.283	-0.0504	0	0.176					0.6817E-01			
5	5	0.4218	166.692	12.506	-5.478	125.283	-0.0407	0	0.112					0.5661E-01			
5	6	0.5782	186.290	12.506	-5.478	125.283	-0.0334	0	0.090					0.4504E-01			
5	7	0.7270	204.924	12.506	-5.478	125.283	-0.0316	0	0.149					0.7431E-01			
5	8	0.8536	220.785	12.506	-5.478	125.283	-0.0317	0	0.107					0.5349E-01			
5	9	0.9455	232.305	12.506	-5.478	125.283	-0.0320	0	0.067					0.3373E-01			
5	10	0.9938	238.361	12.506	-5.478	125.283	-0.0322	0	0.143					0.7160E-01			
6	1	0.0062	127.500	16.461	-5.465	112.208	0.0777	0	0.651					0.3268E-00	0.23781	1.85533	
6	2	0.0545	132.424	16.461	-5.465	112.208	-0.0270	0	0.248					0.1345E-00			
6	3	0.1464	143.247	16.461	-5.465	112.208	-0.0476	0	0.169					0.1024E-00			
6	4	0.2730	157.442	16.461	-5.465	112.208	-0.0476	0	0.104					0.8458E-01			
6	5	0.4218	174.137	16.461	-5.465	112.208	-0.0438	0	0.174					0.6682E-01			
6	6	0.5782	191.640	16.461	-5.465	112.208	-0.0400	0	0.065					0.4905E-01			
6	7	0.7270	208.394	16.461	-5.465	112.208	-0.0374	0	0.125					0.6784E-01			
6	8	0.8536	225.484	16.461	-5.465	112.208	-0.0261	0	0.121					0.6069E-01			
6	9	0.9455	232.403	16.461	-5.465	112.208	-0.0347	0	0.177					0.9009E-01			
6	10	0.9938	238.327	16.461	-5.465	112.208	-0.0351	0	0.041					0.4545E-01			
7	1	0.0062	140.360	20.416	-5.453	99.134	0.0442	0	0.682					0.3324E-00	0.23325	1.66739	
7	2	0.0545	145.172	20.416	-5.453	99.134	-0.0680	0	0.297					0.1489E-00			
7	3	0.1464	154.287	20.416	-5.453	99.134	-0.0374	0	0.232					0.1165E-00			
7	4	0.2730	166.434	20.416	-5.453	99.134	-0.0451	0	0.192					0.9620E-01			
7	5	0.4218	181.582	20.416	-5.453	99.134	-0.0470	0	0.151					0.7694E-01			
7	6	0.5782	197.040	20.416	-5.453	99.134	-0.0461	0	0.111					0.5667E-01			
7	7	0.7270	211.836	20.416	-5.453	99.134	-0.0434	0	0.134					0.6723E-01			
7	8	0.8536	224.386	20.416	-5.453	99.134	-0.0404	0	0.157					0.7865E-01			
7	9	0.9455	233.450	20.416	-5.453	99.134	-0.0286	0	0.094					0.4229E-01			
7	10	0.9938	238.293	20.416	-5.453	99.134	-0.0380	0	0.117					0.5898E-01			
PANEL NO. 3																	
8	1	0.0062	151.897	23.952	-5.669	87.998	0.0564	0	0.700	16.500	0.100	-0.0244	-0.0244	0.3513E-00	0.23383	1.47703	
8	2	0.0545	156.151	23.952	-5.669	87.998	-0.0045	0	0.290					0.1408E-00			
8	3	0.1464	164.247	23.952	-5.669	87.998	-0.0276	0	0.270					0.1332E-00			
8	4	0.2730	175.374	23.952	-5.669	87.998	-0.0393	0	0.276					0.9099E-01			
8	5	0.4218	188.471	23.952	-5.669	87.998	-0.0447	0	0.181					0.5817E-01			
8	6	0.5782	202.237	23.952	-5.669	87.998	-0.0460	0	0.134								

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-3/-74 WING) WITH DU MAGELLES. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.000 DG PSI = 0.0 DG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
8	7	0.7270	215.324	23.482	-5.659	87.999	-0.0441	0	C.173	15.737	0.707	-6.84	-0.0278	0.4364E 00	0.29429	1.33561
8	8	0.8536	226.466	23.952	-5.686	87.999	-0.0413	0	C.085					0.4268E-01		
8	9	0.9455	234.557	24.422	-5.694	87.999	-0.0393	0	C.170					0.5514E-01		
8	10	0.9938	238.811	24.952	-5.694	87.999	-0.0386	0	C.112					0.5624E-01		
9	1	0.0062	162.050	27.067	-6.173	78.799	0.0459	0	C.846					0.4364E 00	0.29429	1.33561
9	2	0.0345	165.854	27.067	-6.173	78.799	0.0140	0	C.226					0.1136E 00		
9	3	0.1464	173.105	27.067	-6.173	78.799	-0.0185	0	C.304					0.1531E 00		
9	4	0.2730	183.077	27.067	-6.173	78.799	-0.0304	0	C.266					0.1284E 00		
9	5	0.4218	194.901	27.067	-6.173	78.799	-0.0370	0	C.266					0.1076E 00		
9	6	0.5782	207.128	27.067	-6.173	78.799	-0.0394	0	C.157					0.7879E-01		
9	7	0.7270	218.851	27.067	-6.173	78.799	-0.0357	0	C.146					0.7338E-01		
9	8	0.8536	228.524	27.067	-6.173	78.799	-0.0334	0	C.173					0.6165E-01		
9	9	0.9455	236.076	27.067	-6.173	78.799	-0.0374	0	C.091					0.4894E-01		
9	10	0.9938	239.875	27.067	-6.173	78.799	-0.0371	0	C.148					0.7405E-01		
10	1	0.0062	172.203	30.183	-6.658	69.600	0.0431	0	C.750	15.979	0.229	-6.84	-0.0284	0.3766E 00	0.29429	1.33561
10	2	0.0345	175.568	30.183	-6.658	69.600	0.0231	0	C.360					0.1849E 00		
10	3	0.1464	181.966	30.183	-6.658	69.600	-0.0063	0	C.783					0.1671E 00		
10	4	0.2730	190.776	30.183	-6.658	69.600	-0.0216	0	C.279					0.1399E 00		
10	5	0.4218	201.131	30.183	-6.658	69.600	-0.0293	0	C.224					0.1127E 00		
10	6	0.5782	212.014	30.183	-6.658	69.600	-0.0235	0	C.170					0.9542E-01		
10	7	0.7270	222.374	30.183	-6.658	69.600	-0.0352	0	C.157					0.7871E-01		
10	8	0.8536	231.182	30.183	-6.658	69.600	-0.0356	0	C.131					0.6565E-01		
10	9	0.9455	237.582	30.183	-6.658	69.600	-0.0356	0	C.104					0.5629E-01		
10	10	0.9938	240.947	30.183	-6.658	69.600	-0.0355	0	C.061					0.4454E-01		
PANEL NO. 4																
11	1	0.0062	180.677	33.007	-7.104	61.997	0.0330	0	C.966	15.236	0.246	-9.16	-0.0217	0.4847E 00	0.11176	1.20229
11	2	0.0345	183.674	33.007	-7.104	61.997	0.0278	0	C.644					0.3483E 00		
11	3	0.1464	189.374	33.007	-7.104	61.997	-0.0042	0	C.422					0.2119E 00		
11	4	0.2730	197.221	33.007	-7.104	61.997	-0.0158	0	C.150					0.7545E-01		
11	5	0.4218	206.444	33.007	-7.104	61.997	-0.0236	0	C.177					0.9904E-01		
11	6	0.5782	216.143	33.007	-7.104	61.997	-0.0285	0	C.205					0.1029E 00		
11	7	0.7270	225.367	33.007	-7.104	61.997	-0.0312	0	C.133					0.6665E-01		
11	8	0.8536	233.213	33.007	-7.104	61.997	-0.0324	0	C.123					0.6191E-01		
11	9	0.9455	238.914	33.007	-7.104	61.997	-0.0324	0	C.133					0.6664E-01		
11	10	0.9938	241.911	33.007	-7.104	61.997	-0.0327	0	C.145					0.7291E-01		
12	1	0.0062	187.470	35.538	-7.512	55.990	0.0196	0	C.610	14.415	0.257	-9.16	-0.0200	0.5068E 00	0.18205	1.07213
12	2	0.0345	190.176	35.538	-7.512	55.990	0.0280	0	C.734					0.3682E 00		
12	3	0.1464	195.325	35.538	-7.512	55.990	-0.0030	0	C.458					0.2297E 00		
12	4	0.2730	202.411	35.538	-7.512	55.990	-0.0131	0	C.182					0.9116E-01		
12	5	0.4218	210.741	35.538	-7.512	55.990	-0.0199	0	C.212					0.1063E 00		
12	6	0.5782	219.500	35.538	-7.512	55.990	-0.0246	0	C.163					0.8159E-01		
12	7	0.7270	227.830	35.538	-7.512	55.990	-0.0273	0	C.172					0.6132E-01		
12	8	0.8536	234.916	35.538	-7.512	55.990	-0.0287	0	C.143					0.7167E-01		
12	9	0.9455	240.064	35.538	-7.512	55.990	-0.0286	0	C.135					0.6767E-01		
12	10	0.9938	242.771	35.538	-7.512	55.990	-0.0299	0	C.144					0.7237E-01		
PANEL NO. 5																
13	1	0.0062	194.654	39.289	-7.873	50.260	0.0083	0	C.106	13.737	0.273	-6.05	-0.0248	0.5101E 00	0.18381	1.03845

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-32/-4 WING) WITH OAU MACELLES. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.000 DG PSI = 0.4 C DG PITCH RATE = 0.4 C D/S ROLL RATE = 0.4 C D/S YAW RATE = 0.4 C D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	D/S	GAMMA	C TC	CDC
22	2	0.0545	211.542	22.394	-4.423	39.300	0.0	0	-0.009					-0.4203E-02			
22	3	0.1464	215.155	22.394	-4.423	39.300	0.0	0	-0.065					-0.3244E-01			
22	4	0.2730	220.129	22.394	-4.423	39.300	0.0	0	-0.015					-0.7725E-02			
22	5	0.4218	225.976	22.394	-4.423	39.300	0.0	0	-0.081					-0.4064E-01			
22	6	0.5782	232.124	22.394	-4.423	39.300	0.0	0	-0.099					-0.1475E-01			
22	7	0.7270	237.971	22.394	-4.423	39.300	0.0	0	0.045					0.2244E-01			
22	8	0.8536	242.945	22.394	-4.423	39.300	0.0	0	-0.070					-0.3530E-01			
22	9	0.9455	246.558	22.394	-4.423	39.300	0.0	0	0.113					0.5690E-01			
22	10	0.9938	248.458	22.394	-4.423	39.300	0.0	0	0.131					0.6570E-01			
PANEL NO. P UPPER MACELLE																	
23	1	0.0062	209.642	23.863	2.536	39.300	0.0000	1	-0.016	-0.074	-0.002	-30.400	0.0039	0.1740E-01	0.0		-0.00592
23	2	0.0545	211.542	23.863	2.536	39.300	0.0000	1	-0.019					0.1726E-01			
23	3	0.1464	215.155	23.863	2.536	39.300	0.0000	1	-0.021					0.2211E-01			
23	4	0.2730	220.129	23.863	2.536	39.300	0.0000	1	-0.033					0.1669E-01			
23	5	0.4218	225.976	23.863	2.536	39.300	0.0000	1	0.009					-0.2595E-02			
23	6	0.5782	232.124	23.863	2.536	39.300	-0.0000	1	0.026					-0.1357E-01			
23	7	0.7270	237.971	23.863	2.536	39.300	-0.0000	1	-0.004					0.7854E-02			
23	8	0.8536	242.945	23.863	2.536	39.300	-0.0000	1	0.004					-0.7634E-02			
23	9	0.9455	246.558	23.863	2.536	39.300	-0.0000	1	0.032					-0.2540E-01			
23	10	0.9938	248.458	23.863	2.536	39.300	-0.0000	1	0.015					-0.1794E-01			
24	1	0.0062	209.642	25.332	-0.008	39.300	0.0000	1	0.005	-0.203	-0.005	-90.400	0.0075	-0.8541E-02	0.0		-0.00000
24	2	0.0545	211.542	25.332	-0.008	39.300	0.0000	1	-0.000					-0.5280E-02			
24	3	0.1464	215.155	25.332	-0.008	39.300	0.0000	1	0.003					-0.1287E-01			
24	4	0.2730	220.129	25.332	-0.008	39.300	0.0000	1	-0.002					-0.6970E-02			
24	5	0.4218	225.976	25.332	-0.008	39.300	0.0000	1	-0.002					-0.2859E-02			
24	6	0.5782	232.124	25.332	-0.008	39.300	-0.0000	1	0.009					-0.1012E-01			
24	7	0.7270	237.971	25.332	-0.008	39.300	-0.0000	1	0.016					-0.1541E-01			
24	8	0.8536	242.945	25.332	-0.008	39.300	-0.0000	1	0.006					-0.7801E-02			
24	9	0.9455	246.558	25.332	-0.008	39.300	-0.0000	1	0.004					0.2437E-02			
24	10	0.9938	248.458	25.332	-0.008	39.300	-0.0000	1	0.032					-0.7874E-02			
25	1	0.0062	209.642	23.863	-2.552	39.300	0.0000	1	0.005	-0.563	-0.017	-150.400	0.0013	-0.2108E-01	0.0		0.04979
25	2	0.0545	211.542	23.863	-2.552	39.300	0.0000	1	0.032					-0.2545E-01			
25	3	0.1464	215.155	23.863	-2.552	39.300	0.0000	1	0.044					-0.3925E-01			
25	4	0.2730	220.129	23.863	-2.552	39.300	0.0000	1	0.024					-0.2449E-01			
25	5	0.4218	225.976	23.863	-2.552	39.300	0.0000	1	0.008					-0.8913E-02			
25	6	0.5782	232.124	23.863	-2.552	39.300	-0.0000	1	0.014					-0.1422E-01			
25	7	0.7270	237.971	23.863	-2.552	39.300	-0.0000	1	0.021					-0.1753E-01			
25	8	0.8536	242.945	23.863	-2.552	39.300	-0.0000	1	-0.017					0.2360E-01			
25	9	0.9455	246.558	23.863	-2.552	39.300	-0.0000	1	0.015					-0.1021E-01			
25	10	0.9938	248.458	23.863	-2.552	39.300	-0.0000	1	0.024					-0.2005E-01			
26	1	0.0062	209.642	20.925	-2.552	39.300	0.0000	1	0.017	-0.276	-0.007	150.400	-0.0002	-0.2424E-01	0.0		0.02083
26	2	0.0545	211.542	20.925	-2.552	39.300	0.0000	1	0.026					-0.2529E-01			
26	3	0.1464	215.155	20.925	-2.552	39.300	0.0000	1	0.024					-0.1615E-01			
26	4	0.2730	220.129	20.925	-2.552	39.300	0.0000	1	0.011					-0.7927E-02			
26	5	0.4218	225.976	20.925	-2.552	39.300	0.0000	1	0.004					0.5244E-03			
26	6	0.5782	232.124	20.925	-2.552	39.300	-0.0000	1	-0.007					0.1434E-01			

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (COLL67-22/24 WING) WITH DU MACELLE. (1/10 SCALE).

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DEP	CNC	CN	DL	SMT	D/S	GAMMA	CTC	CDC
MACH = 2.550 ALPHA = 5.000 DG PSI = 0.0 CG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S																	
26	7	0.7270	237.971	20.925	-2.552	39.300	-0.0000	1	-0.014	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
26	8	0.8536	242.945	20.925	-2.552	39.300	-0.0000	1	0.005	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
26	9	0.9455	246.558	20.925	-2.552	39.300	-0.0000	1	0.010	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
26	10	0.9938	248.458	20.925	-2.552	39.300	-0.0000	1	0.015	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	1	0.0062	209.642	19.456	-0.008	39.300	0.0000	1	0.000	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	2	0.0545	211.542	19.456	-0.008	39.300	0.0000	1	0.005	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	3	0.1464	215.155	19.456	-0.008	39.300	0.0000	1	0.010	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	4	0.2730	220.129	19.456	-0.008	39.300	0.0000	1	0.020	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	5	0.4218	225.976	19.456	-0.008	39.300	0.0000	1	0.040	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	6	0.5782	232.124	19.456	-0.008	39.300	-0.0000	1	0.080	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	7	0.7270	237.971	19.456	-0.008	39.300	-0.0000	1	0.160	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	8	0.8536	242.945	19.456	-0.008	39.300	-0.0000	1	0.320	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	9	0.9455	246.558	19.456	-0.008	39.300	-0.0000	1	0.640	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
27	10	0.9938	248.458	19.456	-0.008	39.300	-0.0000	1	1.280	-0.328	-0.008	00.00	0.0039	0.0039	0.9857E-07	0.0	0.00000
28	1	0.0062	209.642	20.925	2.536	39.300	0.0000	1	0.000	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	2	0.0545	211.542	20.925	2.536	39.300	0.0000	1	0.005	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	3	0.1464	215.155	20.925	2.536	39.300	0.0000	1	0.010	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	4	0.2730	220.129	20.925	2.536	39.300	0.0000	1	0.020	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	5	0.4218	225.976	20.925	2.536	39.300	0.0000	1	0.040	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	6	0.5782	232.124	20.925	2.536	39.300	-0.0000	1	0.080	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	7	0.7270	237.971	20.925	2.536	39.300	-0.0000	1	0.160	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	8	0.8536	242.945	20.925	2.536	39.300	-0.0000	1	0.320	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	9	0.9455	246.558	20.925	2.536	39.300	-0.0000	1	0.640	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
28	10	0.9938	248.458	20.925	2.536	39.300	-0.0000	1	1.280	0.187	0.008	30.00	0.0035	0.0035	0.2593E-01	0.0	0.01410
LOWER MACELLE PYLON																	
29	1	0.0062	209.642	22.394	-6.323	39.400	0.0	0	-0.000	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	2	0.0545	211.247	22.394	-6.323	39.400	0.0	0	-0.005	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	3	0.1464	214.870	22.394	-6.323	39.400	0.0	0	-0.010	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	4	0.2730	219.856	22.394	-6.323	39.400	0.0	0	-0.020	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	5	0.4218	225.716	22.394	-6.323	39.400	0.0	0	-0.040	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	6	0.5782	231.862	22.394	-6.323	39.400	0.0	0	-0.080	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	7	0.7270	237.744	22.394	-6.323	39.400	0.0	0	-0.160	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	8	0.8536	242.730	22.394	-6.323	39.400	0.0	0	-0.320	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	9	0.9455	246.553	22.394	-6.323	39.400	0.0	0	-0.640	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
29	10	0.9938	248.257	22.394	-6.323	39.400	0.0	0	-1.280	-0.120	-0.003	-60.00	0.0023	0.0023	-0.1423E-01	0.0	-0.00000
LOWER MACELLE																	
30	1	0.0062	209.343	23.780	-8.000	39.400	-0.0000	1	-0.011	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	2	0.0545	211.247	23.780	-8.000	39.400	-0.0000	1	-0.055	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	3	0.1464	214.870	23.780	-8.000	39.400	-0.0000	1	-0.110	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	4	0.2730	219.856	23.780	-8.000	39.400	-0.0000	1	-0.220	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	5	0.4218	225.718	23.780	-8.000	39.400	-0.0000	1	-0.440	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	6	0.5782	231.882	23.780	-8.000	39.400	-0.0000	1	-0.880	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	7	0.7270	237.744	23.780	-8.000	39.400	-0.0000	1	-1.760	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	8	0.8536	242.730	23.780	-8.000	39.400	-0.0000	1	-3.520	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	9	0.9455	246.353	23.780	-8.000	39.400	-0.0000	1	-7.040	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425
30	9	0.9455	246.353	23.780	-8.000	39.400	-0.0000	1	-7.040	-0.120	-0.005	-30.00	0.0018	0.0018	0.1210E-01	0.0	-0.01425

TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (GL1007-327-24 WING) WITH OVI NACELLEFS. (1/10 SCALE).

MACH = 2.540 ALPHA = 5.000 DEG PSI = 0.0 DEG PITCH RATE = 0.0 C/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	PCP	CNIC	CN	TL	CMT	GAMMA	CTC	CD
30	10	0.9938	248.257	23.740	-10.400	39.400	0.0000	1	-0.011	-0.214	-0.008	-90.00	-0.0010	0.1158E-01	0.0	-0.00000
31	1	0.0062	209.343	25.165	-10.400	39.400	-0.0000	1	0.012							
31	2	0.0545	211.247	25.165	-10.400	39.400	-0.0000	1	0.025							
31	3	0.1464	214.870	25.165	-10.400	39.400	-0.0000	1	0.047							
31	4	0.2730	219.856	25.165	-10.400	39.400	-0.0000	1	0.114							
31	5	0.4218	225.718	25.165	-10.400	39.400	-0.0000	1	-0.004							
31	6	0.5782	231.882	25.165	-10.400	39.400	-0.0000	1	0.000							
31	7	0.7270	237.744	25.165	-10.400	39.400	-0.0000	1	0.004							
31	8	0.8536	242.730	25.165	-10.400	39.400	-0.0000	1	0.005							
31	9	0.9455	246.353	25.165	-10.400	39.400	-0.0000	1	-0.007							
31	10	0.9938	248.257	25.165	-10.400	39.400	-0.0000	1	-0.014							
32	1	0.0062	209.343	23.740	-12.800	39.400	-0.0000	1	0.026	-0.223	-0.006	-150.00	-0.0034	-0.1077E-01	0.0	0.07442
32	2	0.0545	211.247	23.740	-12.800	39.400	-0.0000	1	0.049							
32	3	0.1464	214.870	23.740	-12.800	39.400	-0.0000	1	0.080							
32	4	0.2730	219.856	23.740	-12.800	39.400	-0.0000	1	0.085							
32	5	0.4218	225.718	23.740	-12.800	39.400	-0.0000	1	0.024							
32	6	0.5782	231.882	23.740	-12.800	39.400	-0.0000	1	0.000							
32	7	0.7270	237.744	23.740	-12.800	39.400	-0.0000	1	-0.015							
32	8	0.8536	242.730	23.740	-12.800	39.400	-0.0000	1	-0.017							
32	9	0.9455	246.353	23.740	-12.800	39.400	-0.0000	1	-0.004							
32	10	0.9938	248.257	23.740	-12.800	39.400	-0.0000	1	-0.012							
33	1	0.0062	209.343	21.008	-12.800	39.400	-0.0000	1	0.033	-0.475	-0.012	150.00	0.0001	-0.1593E-01	0.0	0.03456
33	2	0.0545	211.247	21.008	-12.800	39.400	-0.0000	1	0.054							
33	3	0.1464	214.870	21.008	-12.800	39.400	-0.0000	1	0.075							
33	4	0.2730	219.856	21.008	-12.800	39.400	-0.0000	1	-0.002							
33	5	0.4218	225.718	21.008	-12.800	39.400	-0.0000	1	0.000							
33	6	0.5782	231.882	21.008	-12.800	39.400	-0.0000	1	0.000							
33	7	0.7270	237.744	21.008	-12.800	39.400	-0.0000	1	0.007							
33	8	0.8536	242.730	21.008	-12.800	39.400	-0.0000	1	-0.006							
33	9	0.9455	246.353	21.008	-12.800	39.400	-0.0000	1	0.004							
33	10	0.9938	248.257	21.008	-12.800	39.400	-0.0000	1	0.004							
34	1	0.0062	209.343	19.623	-10.400	39.400	-0.0000	1	-0.002	-0.475	-0.016	90.00	0.0003	0.1907E-04	0.0	0.00000
34	2	0.0545	211.247	19.623	-10.400	39.400	-0.0000	1	0.018							
34	3	0.1464	214.870	19.623	-10.400	39.400	-0.0000	1	0.037							
34	4	0.2730	219.856	19.623	-10.400	39.400	-0.0000	1	0.004							
34	5	0.4218	225.718	19.623	-10.400	39.400	-0.0000	1	0.000							
34	6	0.5782	231.882	19.623	-10.400	39.400	-0.0000	1	0.000							
34	7	0.7270	237.744	19.623	-10.400	39.400	-0.0000	1	0.000							
34	8	0.8536	242.730	19.623	-10.400	39.400	-0.0000	1	0.019							
34	9	0.9455	246.353	19.623	-10.400	39.400	-0.0000	1	0.011							
34	10	0.9938	248.257	19.623	-10.400	39.400	-0.0000	1	0.015							
35	1	0.0062	209.343	21.008	-8.000	39.400	-0.0000	1	0.010	-0.723	-0.007	30.00	0.0004	0.2861E-01	0.0	-0.01984
35	2	0.0545	211.247	21.008	-8.000	39.400	-0.0000	1	-0.010							
35	3	0.1464	214.870	21.008	-8.000	39.400	-0.0000	1	-0.017							
35	4	0.2730	219.856	21.008	-8.000	39.400	-0.0000	1	0.000							
35	5	0.4218	225.718	21.008	-8.000	39.400	-0.0000	1	0.000							

TABLE A-1. - Concluded

SUPERSONIC CRUISE VEHICLE (ELLIPTIC-75/74.4MM) WITH 700 NEWELL'S. (1/10 SCALE).

MACH = 2.550 ALPHA = 5.0000 PSI = 0.0000 PITCH RATE = 0.0000 ROLL RATE = 0.0000 DYS YAW RATE = 0.0000 DYS
 S C X/C X Y Z (CM) SLOPE ITS DCP SMC SN PL SMT GAMMA CTC CDC

S	C	X/C	X	Y	Z	(CM)	SLOPE	ITS	DCP	SMC	SN	PL	SMT	GAMMA	CTC	CDC
35	0	0.5782	231.047	21.000	-0.0000	20.400	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	-0.1155E-01	0.0000	0.0000
35	7	0.7270	237.744	21.000	-0.0000	20.400	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	-0.1440E-01	0.0000	0.0000
35	8	0.8536	242.733	21.000	-0.0000	20.400	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	-0.2530E-02	0.0000	0.0000
35	9	0.9455	246.347	21.000	-0.0000	20.400	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	-0.3691E-02	0.0000	0.0000
35	10	0.9938	248.267	21.000	-0.0000	20.400	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	-0.9462E-02	0.0000	0.0000
PANEL NO. 11																
36	1	0.0062	249.656	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	2	0.0545	250.466	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	3	0.1464	252.243	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	4	0.2730	256.572	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	5	0.4218	257.265	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	6	0.5782	260.353	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	7	0.7270	263.097	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	8	0.8536	265.474	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	9	0.9455	267.201	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	10	0.9938	268.100	64.500	-0.0000	17.750	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	1	0.0062	262.433	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	2	0.0545	263.278	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	3	0.1464	264.843	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	4	0.2730	267.041	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	5	0.4218	269.590	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	6	0.5782	262.418	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	7	0.7270	265.011	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	8	0.8536	267.200	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	9	0.9455	268.624	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	10	0.9938	269.067	64.500	-0.0000	17.447	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	1	0.0062	265.311	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	2	0.0545	266.080	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	3	0.1464	267.571	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	4	0.2730	269.611	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	5	0.4218	262.000	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	6	0.5782	264.650	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	7	0.7270	266.624	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	8	0.8536	268.941	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	9	0.9455	270.447	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	10	0.9938	271.226	64.500	-0.0000	16.112	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	1	0.0062	268.167	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	2	0.0545	269.482	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	3	0.1464	260.761	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	4	0.2730	262.121	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	5	0.4218	264.330	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	6	0.5782	266.641	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	7	0.7270	268.940	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	8	0.8536	270.710	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	9	0.9455	272.069	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	10	0.9938	272.752	64.500	-0.0000	14.778	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

END OF CASE

RECOMMENDATIONS FOR THE EFFICIENT USE OF THE VORLAX PROGRAM

The definitions of the input and output data presented above should suffice for the running of any arbitrary configuration through the VORLAX program. But in order to achieve an efficient and accurate use of the capabilities provided by the generalized nonplanar vortex lattice method, the following recommendations should be adhered to:

- When running a new configuration for the first time, run only one flow condition point, i.e., NMACH=1 and NALPHA=1, to check out the input deck. This should be repeated for both subsonic and supersonic Mach numbers if the analysis of the given configuration will extend through both flow regimes.
- Use this relaxation solution (ISOLV=0) whenever possible. This is due to the fact that the relaxation procedure computational time varies somewhat proportionately to the second power of the total number of vortices making up the configuration, whereas the vector solution time varies as the third power. In addition, the vector solution involves an order of magnitude increase in the data transfer operations between the computer storage and core regions.
- When major panels are in tandem, and lying approximately in the same plane, the spanwise distribution of vortex elements should be identical to prevent the trailing vortex legs shed by the fore panel from running through the control points of the aft panel, in which case, pressure distributions may show spurious oscillations with possible consequent effects on aerodynamic coefficients.
- In specifying the vortex lattice density of a given configuration as a whole, or of a particular major panel, by the quantities NVOR and RNCV, three different degrees may be considered: sparse, medium, and dense. To illustrate the case, the starboard panel of an aspect ratio 3 straight-tapered wing is sparsely latticed if NVOR=10 and RNCV=5, say; if NVOR=16 and RNCV=10, then the panel may be said to have a medium density grid. A finely latticed, or dense, grid would be obtained for the values NVOR=30 and RNCV=20. In the above examples, the grid density was considered to be uniform in both the chordwise and spanwise directions. It is obvious that mixed-type lattices like dense-spanwise-sparse-chordwise are also possible. The type of lattice, when correctly specified, is a powerful tool for the program user. It allows him to achieve the lowest computational cost for a given type of required data, as follows:
 - (1) Stability and control type data (accuracy is essential only in the force and moment coefficients, good definition of the aerodynamic load distribution is not required, drag coefficient accuracy not too critical): sparse lattice.

- (2) Load distribution and drag type data (good definition of the aerodynamic load distribution, both spanwise and chordwise, is required, accurate drag coefficient values are needed): medium density lattice.
 - (3) Surface pressure distribution type data (good definition of the surface pressure distribution -- control surface theory -- is essential, such as for wing design): lattice with maximum chordwise density and with medium spanwise density.
- In addition to the lattice, or vortex grid, density, the type of vortex distribution (cosine and equal spacing) is highly significant in determining the accuracy of the results. It has been found that chordwise cosine spacing (LAX=0) is superior in accuracy to the chordwise equal spacing (LAX=1). In terms of spanwise spacing, no significant differences have been observed between cosine (LAY=0) and equal spacing (LAY=1), the cosine spacing appearing to be slightly more accurate. For the same number of vortices, there is no difference in the computational cost between cosine and equal spacing lattices.
 - When the fusiform body representation is being used (PDL=360 and NPP=1), the number of sides of the polygon defining the body cross section should be kept as low as possible, e.g., the cross section of a body of revolution can be adequately represented by a hexagon. Also, when a very slender body with pointed nose is being considered, the nose (and afterbody if it is also pointed) should be arbitrarily blunted in the input definition in order to minimize the numerical difficulties caused by the crowding of the vortical singularities in the body nose region.

Figure A-7 illustrates a typical vortex lattice model of an advanced twin-engine tactical fighter. This particular lattice model, with even chordwise and spanwise spacing (LAX=1, LAY=1), is considered sparse, and quite adequate for stability and control work, both longitudinal and lateral. In this model, both the fuselage and nacelles are represented, or simulated, by flat plate elements, i.e., NPP=0. Obviously, this body simulation does not allow the computation of surface pressures, but it is adequate, and the most computationally efficient, for stability and control work as well as for load distribution and drag data.

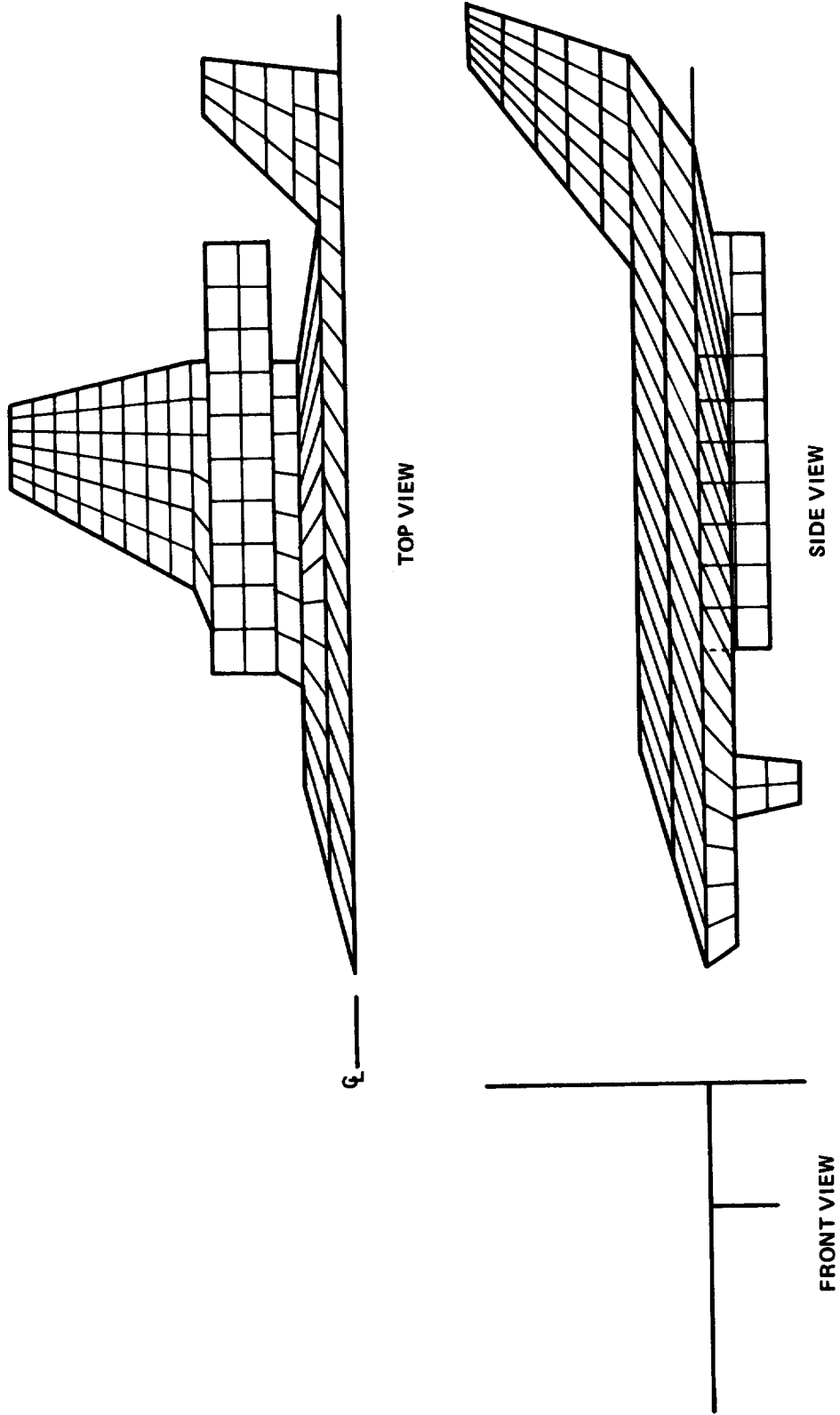


Figure A-7. - Vortex lattice panel representation for twin engine fighter



APPENDIX B

COMPLETE PROGRAM COMPILATION AND EXECUTION
FOR
A GENERALIZED VORTEX LATTICE METHOD
FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS

HARDWARE AND SYSTEMS

The VORLAX program has been run on several different IBM computer systems at Lockheed. All classified work conducted by the Advanced Development Projects Division, "Skunk Works", has been run on a 360/65 and no information can be presented about operation on this system. All non-"Skunk Works" areas such as commercial and military engineering perform aerodynamic and loads analysis using VORLAX on the IBM 360/91. Furthermore, a 370/168 has been used to assure that VORLAX can be efficiently run on this system if scientific applications are removed from the 360/91 system.

The program has been used for a wide range of aircraft configurations and a good idea of the best operational procedures has been established. The program has been run at sizes ranging from 65K words (260K bytes) to 85K words (340K bytes). An initial attempt was made to use a central memory region of 65K. This proved extremely inefficient because the number of accesses for I/O to peripheral storage soared with the imposed limitation of small buffers for each logical unit used. The program became I/O bound and larger buffers were called for. By going to large buffers, approximately 3000 words are accessed with a single read or write. With the smaller buffers, the number of words per access might be 600 - a factor of five smaller. When large cases are run on VORLAX, 5 to 10 million words may have to be accessed; it is readily apparent that the number of reads and writes can become overwhelming if the buffering is not adequate.

Almost all cases run on VORLAX use less than 20 minutes of central processor time on the 360/91. Lockheed has demonstrated that a 25 minute case will run in about 15 minutes on a Control Data Cyber 175. It is, however, incumbent on the user to ensure that the system control language is properly adjusted to optimize operation of the program and the computer on which it is running.

Since small central core size is usually an objective, it is worth noting that due consideration has been given to various methods of reducing VORLAX central memory requirements. All the obvious methods of core reduction have been found to have disadvantages. In particular, by studying the tree structure of the program, it was determined that overlay would not significantly reduce size and it would introduce inefficiencies. Consequently, in order to reduce core size requirements, the actual array sizes in the program have been minimized to allow reasonable configuration complexity without unnecessary waste. But more importantly, mathematical techniques were used in the problem solution that reduce the need to have large matrices in central memory. One, two, or three elements are brought into central memory, processed, and shipped back to peripheral storage to minimize memory requirements. This results in enormous savings in central memory.

Since the Spring of 1975, the source coding has almost doubled in size

with a comparable increase in program flexibility and capability and yet central memory requirements have only increased about 20 percent. This was made possible only through continued attention to the optimization of the operation of the program on Lockheed's computer complex. It is of on-going concern to continue to study possible means of improving program operational efficiency, and to this end several novel ideas are being actively examined for their possible future incorporation to the computer code.

PROGRAM
UNIFIED VORTEX LATTICE METHOD
FOR SUBSONIC AND SUPERSONIC FLOW
(VORLAX)

COMPLETE COMPILE
AND EXECUTION
IN CDC FORTRAN



C...B2	COMPRESSIBILITY FACTOR ($M^{**2} - 1.$)	VORLAX
C...CD, CL, CM, CN	PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL FORCE COEFFICIENTS.	VORLAX
C...	PANEL X- AND Y-FORCE COEFFICIENTS.	VORLAX
C...CX, CY	DIHEDRAL OF CHORDWISE ROW OF HORSESHOE VORTICES.	VORLAX
C...DL		VORLAX
C...	PANEL NORMAL AND Y-FORCE PER UNIT Q.	VORLAX
C...FN, FY	ANGLE OF ATTACK AND MACH NUMBER INDICES.	VORLAX
C...IH, IQ	TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES.	VORLAX
C...NT	PANEL ROLLING MOMENT PER UNIT Q.	VORLAX
C...RM	SPANWISE LOCATION INDEX.	VORLAX
C...SX	ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES.	VORLAX
C...XS	PANEL YAWING MOMENT PER UNIT Q.	VORLAX
C...YM	Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS.	VORLAX
C...YY	NORMAL CAMBER COORDINATE IN FRACTION OF CHORD.	VORLAX
C...ZC	Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.	VORLAX
C...ZZ	MAXIMUM CHANGE PER RELAXATION CYCLE.	VORLAX
C...BIG	CHORDWISE CD AND CN TIMES LOCAL CHORD.	VORLAX
C...CDC, CNC	PANEL ROLLING AND YAWING MOMENT COEFFICIENTS.	VORLAX
C...CRM, CYM	PRESSURE COEFFICIENTS (EITHER LOAD OR SURFACE).	VORLAX
C...DCP	ACCEPTABLE FINAL RELAXATION CYCLE CHANGE.	VORLAX
C...	HEIGHT ABOVE GROUND OF MOMENT REFERENCE CENTER.	VORLAX
C...EPS	PANEL AND STRIP FLOW EXPOSURE FLAGS.	VORLAX
C...HAG	LATTICE CHORDWISE AND SPANWISE DISTRIBUTION FLAGS.	VORLAX
C...	PANEL CHORDWISE NONPLANARITY FLAG.	VORLAX
C...NPP	NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGONAL TO THE COORDINATE AXES).	VORLAX
C...NXS, NYS, NZS	PANEL SPANWISE NONPLANARITY FLAG. ALSO PANEL DIHEDRAL IF PANEL IS FLAT IN THE SPANWISE DIRECTION.	VORLAX
C...PDL	YAW ANGLE (POSITIVE WHEN FLOW COMES FROM PORTSIDE).	VORLAX
C...	CROSS-SECTION RADIUS VECTOR.	VORLAX
C...PSI	APPROXIMATE VALUE OF EIGENVALUE RADIUS OF NORMAL WASH MATRIX.	VORLAX
C...	SLOPE AT LEADING EDGE.	VORLAX
C...RCS	PANEL LEADING EDGE SUCTION FACTOR.	VORLAX
C...RLM	TANGENT OF LEADING EDGE SWEEP.	VORLAX
C...	TANGENT OF TRAILING EDGE SWEEP.	VORLAX
C...SLE	TANGENT OF SKEWED VORTEX LINE.	VORLAX
C...SPC	SEMISPAN OF CHORDWISE VORTEX ROW.	VORLAX
C...TNL	ACTUAL HORSESHOE VORTEX SEMISPAN.	VORLAX
C...TNT	CHORDWISE PERCENT COORDINATES AT WHICH CAMBER IS INPUT.	VORLAX
C...VSP	TRAILING EDGE ABSCISSA OF VORTEX ROW.	VORLAX
C...VSS	ANGLE OF ATTACK (IN RADIANS).	VORLAX
C...VST	COMPONENT OF FREE-STREAM AND ONSET FLOWS NORMAL TO THE SURFACE AT THE CONTROL POINTS. ALSO AUXILIARY ARRAY.	VORLAX
C...XAF	PRANDTL-GLAUERT FACTOR.	VORLAX
C...	REFERENCE CHORD.	VORLAX
C...XTE	CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD TIMES LOCAL CHORD.	VORLAX
C...ALFA	PANEL LEADING EDGE THRUST PER UNIT Q.	VORLAX
C...ALOC		
C...		
C...		
C...BETA		
C...CBAR		
C...CMTC		
C...		
C...CSUC		

C...DRAG	PANEL INDUCED DRAG PER UNIT Q.	VORLAX
C...HEAD	PANEL DESCRIPTION INFORMATION.	VORLAX
C...IDES	DESIGN (SYNTHESIS) FLAG.	VORLAX
C...IPAN	HORSESHOE STRIP PANEL INDEX.	VORLAX
C...ITER	ACTUAL NUMBER OF RELAXATION CYCLES.	VORLAX
C...LIFT	PANEL LIFT PER UNIT Q.	VORLAX
C...MACH	FREE-STREAM MACH NUMBER.	VORLAX
C...NPAN	NUMBER OF PANELS DEFINED IN THE DATA INPUT.	VORLAX
C...NVOR	NUMBER OF PANEL CHORDWISE STRIPS OF VORTICES.	VORLAX
C...RNCV	CHORDWISE NUMBER OF HORSESHOE VORTICES FOR A GIVEN PANEL.	VORLAX
C...		VORLAX
C...SLE1, SLE2	SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE EDGES.	VORLAX
C...		VORLAX
C...SMAX	NT.	VORLAX
C...SREF	CONFIGURATION REFERENCE AREA.	VORLAX
C...SURF	PANEL SURFACE AREA (PLANFORM AREA).	VORLAX
C...VINP	REFERENCE FREE STREAM VFLOCITY.	VORLAX
C...XBAR	ABSCISSA OF MOMENT REFERENCE CENTER.	VORLAX
C...XSUC	PANEL LEADING EDGE THRUST PER UNIT Q.	VORLAX
C...YAWQ	YAW RATE (DEGS/SEC).	VORLAX
C...YNOT	BUTTLINE ORIGIN OF FLOW FIELD SURVEY GRID.	VORLAX
C...ZBAH	ORDINATE OF MOMENT REFERENCE CENTER.	VORLAX
C...ZETA	INCIDENCE OF STREAMWISE VORTEX ROW (STRIP) CHORDLINE.	VORLAX
C...		VORLAX
C...ZLE1, ZLE2	LEADING EDGE OFFSET OF CAMBERLINE AT THE PANEL SIDE EDGES.	VORLAX
C...		VORLAX
C...ZNOT	WATERLINE ORIGIN OF FLOW FIELD SURVEY GRID.	VORLAX
C...AINC1, AINC2	CHORDLINE INCIDENCE AT SIDE EDGES OF PANEL.	VORLAX
C...ALPHA	ANGLE OF ATTACK (DEGS).	VORLAX
C...CDTOT	TOTAL INDUCED DRAG COEFFICIENT.	VORLAX
C...CHORD	CHORD LENGTH MEASURED ALONG CENTRLINE OF STREAMWISE ROW OF HORSESHOE VORTICES.	VORLAX
C...		VORLAX
C...CLTOT	TOTAL LIFT COEFFICIENT.	VORLAX
C...CMTGT	TOTAL PITCHING MOMENT COEFFICIENT.	VORLAX
C...CNT01	TOTAL YAWING MOMENT COEFFICIENT.	VORLAX
C...CRTOT	TOTAL ROLLING MOMENT COEFFICIENT.	VORLAX
C...CYTOT	TOTAL SIDE FORCE COEFFICIENT.	VORLAX
C...DNDX1, DNDX2	SURFACE SLOPES AT THE CONTROL POINTS MEASURED ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN VOKED, THEY ARE THE LOAD COEFFICIENTS AT THE LOAD POINTS ALONG THE PANEL SIDE EDGES.	VORLAX
C...		VORLAX
C...		VORLAX
C...GAMMA	HORSESHOE VORTEX CIRCULATION . ALSO USED AS TEMPORARY DATA STORAGE.	VORLAX
C...		VORLAX
C...ISOLV	FLAG DETERMINING SYSTEM OF SOLUTION FOR THE BOUNDARY CONDITION EQUATIONS.	VORLAX
C...		VORLAX
C...LESWP	PANEL LEADING EDGE SWEEP (DEGS).	VORLAX
C...NMACH	NUMBER OF MACH NUMBERS PER CASE.	VORLAX
C...ONSET	ONSET FLOW VELOCITIES GENERATED BY THE ROTATION OF THE CONFIGURATION ABOUT THE MOMENT REFERENCE CENTER.	VORLAX
C...		VORLAX
C...PSPAN	PANEL SPAN.	VORLAX
C...RFLAG	COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY CONDITION EQUATIONS.	VORLAX
C...		VORLAX
C...RNMAX	NUMBER OF VORTICES FOR A GIVEN CHORDWISE ROW.	VORLAX
C...ROLLQ	ROLL RATE (DEGS/SEC).	VORLAX
C...SLOPE	SURFACE SLOPE AT THE LATTICE CONTROL POINTS.	VORLAX
C...SYNTH	PANEL SYNTHESIS (DESIGN) FLAG.	VORLAX

C...TAPER	PANEL TAPER RATIO.	VORLAX
C...TITLE	CASE TITLE.	VORLAX
C...WSPAN	CONFIGURATION REFERENCE WING SPAN.	VORLAX
C...XAPEX, YAPEX, ZAPEX	COORDINATES OF PANEL FIRST SIDE EDGE LEADING	VORLAX
C...	EDGE (PANEL APEX).	VORLAX
C...CSTART	CHORD LENGTH OF PANEL FIRST SIDE EDGE.	VORLAX
C...DELTAY, DELTAZ	BUTLINE AND WATERLINE SPACING OF FLOW FIELD	VORLAX
C...	SURVEY GRID.	VORLAX
C...FLOATX, FLOATY	VORTEX WAKE FLOATATION PARAMETERS.	VORLAX
C...INTRAC	PANEL LATERAL NONPLANARITY PARAMETER.	VORLAX
C...INVERS	DESIGN (SYNTHESIS) FLAG.	VORLAX
C...IQUANT	PANEL SYMMETRY FLAG.	VORLAX
C...ITRMAX	MAXIMUM ALLOWABLE NUMBER OF RELAXATION CYCLES.	VORLAX
C...LATRAL	CONFIGURATION OR FLIGHT CONDITION SYMMETRY	VORLAX
C...	FLAG.	VORLAX
C...MOMENT	PANEL PITCHING MOMENT PER UNIT Q.	VORLAX
C...NALPHA	NUMBER OF ANGLES OF ATTACK PER CASE.	VORLAX
C...NPNAS	TOTAL NUMBER OF PANELS THAT HAVE TO BE TAKEN	VORLAX
C...	INTO ACCOUNT IN THE ACTUAL COMPUTATION	VORLAX
C...	PROCESS.	VORLAX
C...PHIMED	ANGULAR COORDINATE OF CROSS-SECTION RADIUS	VORLAX
C...	VECTOR.	VORLAX
C...PITCHW	PITCH RATE (DEGS/SEC).	VORLAX
C...		VORLAX
C.....	{PER UNIT Q} MEANS {PER UNIT FREE-STREAM	VORLAX
C.....	DYNAMIC PRESSURE[.	VORLAX
C...		VORLAX
C		VORLAX
C		VORLAX

CONTROL*VRLX,AERO		VORLAX	307
C...		VORLAX	308
SUBROUTINE AERO (EW, ITOTAL)		VORLAX	309
C...		VORLAX	310
C...PURPOSE	TO COMPUTE FORCE AND MOMENT DATA BY INTEGRATION OF	VORLAX	311
C...	PRESSURE DISTRIBUTION DATA AND BY TAKING INTO ACCOUNT	VORLAX	312
C...	EDGE SUCTION FORCES.	VORLAX	313
C...		VORLAX	314
C...INPUT	CALLING SEQUENCES	VORLAX	315
C...	EW = NORMALWASH AT LEADING EDGE INFLUENCE COEFFICIENT	VORLAX	316
C...	MATRIX (RETRIEVED ROW BY ROW FROM UNIT 9).	VORLAX	317
C...	COMMON<	VORLAX	318
C...	X, Y, Z, H2, DL, SX, YY, ZL, DCP, JTS, LAX, PSI,	VORLAX	319
C...	SPC, VSS, VST, XTE, ALFA, MACH, NPAN, NVOR, SREF,	VORLAX	320
C...	VINF, KHAR, YAWQ, ZBAR, ZETA, CHORD, GAMMA, LESWP,	VORLAX	321
C...	PSPAN, RNMAX, ROLLQ, SLOPE, TAPER, CSTART, IQUANT,	VORLAX	322
C...	LATRAL, NPANAS, PITCHQ,	VORLAX	323
C...		VORLAX	324
C...OUTPUT	CALLING SEQUENCES	VORLAX	325
C...	NONE.	VORLAX	326
C...	COMMON<	VORLAX	327
C...	CD, CL, CM, CN, CX, CY, FJ, FY, RM, YM, CDC, CNC,	VORLAX	328
C...	CRM, CYM, CMT, CSUC, DRAG, LIFT, SURF, XSUC,	VORLAX	329
C...	CDTOT, CLTOT, CMTOT, CNTOT, CRTOT, CYTOT, MOMENT,	VORLAX	330
C...		VORLAX	331
C...SUBROUTINES		VORLAX	332
C...CALLED	NONE.	VORLAX	333
C...		VORLAX	334
C...DISCUSSION	SUBROUTINE AERO COMPUTES THE AERODYNAMIC FORCE AND	VORLAX	335
C...	MOMENT COEFFICIENTS BY INTEGRATING THE PRESSURE	VORLAX	336
C...	DISTRIBUTION AND COMPUTING THE LEADING EDGE SUCTION	VORLAX	337
C...	FORCES IN ACCORDANCE WITH LAN'S PROCEDURE. THERE ARE	VORLAX	338
C...	THREE CLASSES OF COEFFICIENTS, AS FOLLOWS: (1) TOTAL	VORLAX	339
C...	CONFIGURATION COEFFICIENTS, (2) PANEL COEFFICIENTS,	VORLAX	340
C...	AND (3) STRIPWISE, OR CHORDWISE, COEFFICIENTS. ALL	VORLAX	341
C...	TOTAL COEFFICIENTS ARE REFERENCED TO WIND AXES. CLASS	VORLAX	342
C...	(?) AND (3) COEFFICIENTS ARE REFERENCED EITHER TO BODY	VORLAX	343
C...	OR TO WIND AXES AS REQUIRED BY THE CORRESPONDING COEFF.	VORLAX	344
C...	DEFINITION. AERO SUBROUTINE IS CALLED BY MAIN FOR EVERY	VORLAX	345
C...	ANGLE OF ATTACK AND MACH NUMBER COMBINATION.	VORLAX	346
C		VORLAX	347
C		VORLAX	348

CONTROL*VRLX.BOUNDY	9/17/76	VORLAX	747
C... SUBROUTINE BOUNDY (ITOTAL)		VORLAX	748
C... PURPOSE		VORLAX	749
C... TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO		VORLAX	750
C... THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON		VORLAX	751
C... TROL POINTS.		VORLAX	752
C... CALLING SEQUENCE <		VORLAX	753
C... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	754
C... COMMON <		VORLAX	755
C... ALFA, PSI, VINFL, PITCHQ, ROLLQ, YAWQ, LAX, RNMAX.		VORLAX	756
C... SX, CX, X, YY, ZZ, DL, CHORD, XBAR, ZBAR, SLOPE.		VORLAX	757
C... RFLAG.		VORLAX	758
C... COMMON <		VORLAX	759
C... ALOC, ONSET.		VORLAX	760
C... SUBROUTINES		VORLAX	761
C... CALLED NONE.		VORLAX	762
C... DISCUSSION		VORLAX	763
C... THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY		VORLAX	764
C... AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED		VORLAX	765
C... BY PROJECTING THE FREE-STREAM VELOCITY VECTOR		VORLAX	766
C... ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT		VORLAX	767
C... A RIGID BODY ROTATION ABOUT THE POINT (XBAR, 0,		VORLAX	768
C... ZBAR). THE ONSET FLOW NORMAL COMPONENT IS ALOC.		VORLAX	769
C... ONSET DENOTES THE RIGID BODY ROTATION INDUCED		VORLAX	770
C... VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY		VORLAX	771
C... ALOC AND ONSET, ARE DIMENSIONLESS. I.E., THEY ARE		VORLAX	772
C... REFERENCED TO THE FREE-STREAM VELOCITY.		VORLAX	773
C...		VORLAX	774
C...		VORLAX	775
C...		VORLAX	776
C...		VORLAX	777
C...		VORLAX	778
C...		VORLAX	779

CONTROL*VRLX.GAUSS		9/13/76	VORLAX	856
C...			VORLAX	857
SUBROUTINE GAUSS (ITOTAL, REXPAR, FW, XRT)			VORLAX	858
C...			VORLAX	859
C...PURPOSE	TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE		VORLAX	860
C...	METHOD OF CONTROLLED SUCCESSIVE OVER-RELAXATION.		VORLAX	861
C...			VORLAX	862
C...INPUT	CALLING SEQUENCES		VORLAX	863
C...	ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	864
C...	REXPAR = RELAXATION PARAMETER.		VORLAX	865
C...	EW = ROW OF NORMALWASH MATRIX.		VORLAX	866
C...	COMMON		VORLAX	867
C...	CX, SX, LAX, ALOC, IDES, CHORD, PNMAX, INVERS,		VORLAX	868
C...	ITRMAX.		VORLAX	869
C...			VORLAX	870
C...OUTPUT	CALLING SEQUENCES		VORLAX	871
C...	XRT = AUXILIARY VECTOR USED IN C.S.O.R. SOLUTION.		VORLAX	872
C...	COMMON		VORLAX	873
C...	BIG, DCP, EPS, MLM, SLE, ITER, GAMMA, SLOPE.		VORLAX	874
C...	GAMMA IS THE SOLUTION VECTOR OF BOUNDARY CONDITION		VORLAX	875
C...	EQUATIONS, I. E., HORSESHOE VORTEX CIRCULATION		VORLAX	876
C...	STRENGTHS.		VORLAX	877
C...	NOTES IF INVERS = 1 (DESIGN PROCESS) THEN GAMMA IS		VORLAX	878
C...	PART INPUT AND PART OUTPUT.		VORLAX	879
C...			VORLAX	880
C...SUBROUTINES			VORLAX	881
C...CALLED	NONE.		VORLAX	882
C...			VORLAX	883
C...DISCUSSION	THIS SUBROUTINE SOLVES FOR THE CIRCULATION STRENGTH		VORLAX	884
C...	OF THE HORSESHOE VORTICES THAT SATISFY THE B.C. OF		VORLAX	885
C...	NO MASS-FLUX ALONG THE NORMAL TO THE SURFACE AT THE		VORLAX	886
C...	CONTROL POINTS. THIS SOLUTION IS PERFORMED ITERA-		VORLAX	887
C...	TIVELY ROW BY ROW BY USING THE C.S.O.R. METHOD. IF		VORLAX	888
C...	A GIVEN ROW IS PART OF A PANEL TO BE DESIGNED, I.E.,		VORLAX	889
C...	IDES = 1, THEN INSTEAD OF SOLVING FOR GAMMA(= XPR),		VORLAX	890
C...	THE COMPUTATION OF THE SLOPE DISTRIBUTION ALONG		VORLAX	891
C...	THAT ROW IS PERFORMED BY MATRIX MULTIPLICATION,		VORLAX	892
C...	SLOPE = EW * GAMMA.		VORLAX	893
C...			VORLAX	894
C...			VORLAX	895

CONTROL*VRLX.GEOM		9/16/76	VORLAX	1077
C...			VORLAX	1078
SUBROUTINE GEOM (ITOTAL)			VORLAX	1079
C...			VORLAX	1080
C...PURPOSE	TO COMPUTE THE VORTEX LATTICE GEOMETRY AND SURFACE		VORLAX	1081
C...	SLOPES AT THE CONTROL POINTS. ALSO TO COMPUTE THE		VORLAX	1082
C...	LOAD DISTRIBUTION AT THE CORRESPONDING LOAD POINTS		VORLAX	1083
C...	IF DESIGN PROCESS IS INVOKED (IDFS = 1).		VORLAX	1084
C...			VORLAX	1085
C...INPUT	CALLING SEQUENCES		VORLAX	1086
C...	NONE.		VORLAX	1087
C...	COMMONS		VORLAX	1088
C...	DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR,		VORLAX	1089
C...	RNCV, SLE1, SLE2, ZLE1, ZLF2, AINC1, AINC2, DNDX1,		VORLAX	1090
C...	DNDX2, GAMMA, LESWP, PSPAN, SYNTH, TAPER, XAPEX,		VORLAX	1091
C...	YAPEX, ZAPEX, CSTART, INTRAC, IQUANT, LATRAL,		VORLAX	1092
C...	PHIMED.		VORLAX	1093
C...			VORLAX	1094
C...OUTPUT	CALLING SEQUENCES		VORLAX	1095
C...	ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	1096
C...	COMMONS		VORLAX	1097
C...	X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,		VORLAX	1098
C...	INL, INT, VSP, VSS, VST, XTE, ALNC, IPAN, SMAX,		VORLAX	1099
C...	ZETA, CHORD, RNMAX, SLOPE, NPANAS,		VORLAX	1100
C...	NOTES DL AND VSS MAY BE EITHER INPUT OR OUTPUT		VORLAX	1101
C...	DEPENDING ON CONFIGURATION CONDITIONS.		VORLAX	1102
C...			VORLAX	1103
C...SUBROUTINES			VORLAX	1104
C...CALLED	NONE.		VORLAX	1105
C...			VORLAX	1106
C...DISCUSSION	THE VORTEX LATTICE GEOMETRY IS LAID OUT PANEL BY		VORLAX	1107
C...	PANEL BASED ON THE GEOMETRIC AND VORTEX DISTRIBU		VORLAX	1108
C...	TION CHARACTERISTICS SPECIFIED FOR THE GIVEN PANEL		VORLAX	1109
C...	IN THE INPUT DATA (INPUT SUBROUTINE). EACH PANEL		VORLAX	1110
C...	IS SUBDIVIDED INTO A NUMBER OF X-AXIALWISE STRIPS		VORLAX	1111
C...	(NVOR), EACH STRIP CONTAINING A GIVEN NUMBER (RNMAX =		VORLAX	1112
C...	RNCV) OF HORSESHOE VORTICES WHOSE BOUND TRAILING LFES		VORLAX	1113
C...	COINCIDE WITH THE X-AXIALWISE EDGES OF THE STRIP IF		VORLAX	1114
C...	THE PARAMETER NPP = 0. WHEN NPP = 1 THERE IS NO		VORLAX	1115
C...	LONGER A CONTINUOUS STRIP OF VORTICES SINCE THEY ARE		VORLAX	1116
C...	NOT LOCATED IN THE SAME PLANE. IN THIS CASE (NPP =		VORLAX	1117
C...	1) THE STRIP BECOMES AN ARRAY OR ROW OF VORTICES		VORLAX	1118
C...	LOCATED IN TANDEM BUT WHOSE SPANS ARE NOT NECES		VORLAX	1119
C...	SARILY EQUAL. EACH STRIP OR VORTEX ROW IS IDENTI		VORLAX	1120
C...	FIED BY AN INDEX (SX). EACH HORSESHOE VORTEX IN A		VORLAX	1121
C...	GIVEN STRIP OR ROW IS IDENTIFIED BY A SECOND INDEX		VORLAX	1122
C...	(CX), THE VALUE CX = 1 DENOTING THE LEADING EDGE		VORLAX	1123
C...	ELEMENT, AND CX = RNMAX = RNCV DENOTING THE LAST,		VORLAX	1124
C...	OR TRAILING EDGE, HORSESHOE OF THE ROW. THEREFORE		VORLAX	1125
C...	EACH AND EVERY HORSESHOE VORTEX IS UNIQUELY IDEN		VORLAX	1126
C...	TIFIED BY EITHER AN OVERALL INDEX (WHICH RUNS FROM		VORLAX	1127
C...	1 TO ITOTAL) OR BY THE PAIR OF VALUES (CX, SX).		VORLAX	1128
C...	THE SPATIAL LAY-OUT OF THE VORTEX LATTICE CORRES		VORLAX	1129
C...	PONDING TO A GIVEN PANEL DEPENDS ON THE VALUES OF		VORLAX	1130
C...	TWO PARAMETERS: PDL AND NPP. IF PDL .LE. 360.0 THEN		VORLAX	1131
C...	THE TRANSVERSE VORTEX SEGMENTS OF THE SAME VALUE OF		VORLAX	1132
C...	CX FORM A CONTINUOUS STRAIGHT LINE. BUT IF PDL .GT.		VORLAX	1133

CONTROL*VRLX.MAP		9/14/76	VORLAX	1971
C...			VORLAX	1972
C... SUBROUTINE MAP (EW, EWX, EWY, ITOTAL)			VORLAX	1973
C...			VORLAX	1974
C...PURPOSE	TO COMPUTE THE FLOW FIELD ABOUT THE CONFIGURATION.		VORLAX	1975
C...			VORLAX	1976
C...INPUT	CALLING SEQUENCES		VORLAX	1977
C...	EW = UPWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED		VORLAX	1978
C...	ROW BY ROW FROM UNIT 3).		VORLAX	1979
C...	EWX = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED		VORLAX	1980
C...	ROW BY ROW FROM UNIT 4).		VORLAX	1981
C...	EWY = SIDEWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED		VORLAX	1982
C...	ROW BY ROW FROM UNIT 7).		VORLAX	1983
C...	ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	1984
C...	COMMONS		VORLAX	1985
C...	IH, IQ, NT, XS, NXS, NYS, NZS, PSI, ALFA, MACH, YNOT,		VORLAX	1986
C...	ZNOT, ALPHA, GAMMA, RNMAX, DELTAY, DELTAZ.		VORLAX	1987
C...			VORLAX	1988
C...OUTPUT	CALLING SEQUENCES		VORLAX	1989
C...	NONE.		VORLAX	1990
C...	COMMONS		VORLAX	1991
C...	NONE.		VORLAX	1992
C...	DIRECT PRINTS		VORLAX	1993
C...	XS, YK1, ZK1 = FIELD GRID POINT COORDINATES (BODY AXIS		VORLAX	1994
C...	SYSTEM).		VORLAX	1995
C...	VX, VF, WF = TOTAL DIMENSIONLESS (REFERENCED TO VELO-		VORLAX	1996
C...	CITY AT UPSTREAM INFINITY) VELOCITY COMPO-		VORLAX	1997
C...	NENTS ALONG THE X-Y-Z AXES RESPECTIVELY		VORLAX	1998
C...	(BODY AXIS SYSTEM).		VORLAX	1999
C...	EPSILON = UPWASH FLOW ANGLE IN DEGREES.		VORLAX	2000
C...	SIGMA = SIDEWASH FLOW ANGLE IN DEGREES.		VORLAX	2001
C...	CP = LOCAL PRESSURE COEFFICIENT.		VORLAX	2002
C...	RM = LOCAL MACH NUMBER.		VORLAX	2003
C...	PPTOT = (LOCAL STATIC PRESSURE)/(TOTAL PRESSURE).		VORLAX	2004
C...	PIF = (LOCAL STATIC PRESSURE)/(FREE STREAM STATIC PRES-		VORLAX	2005
C...	SURE).		VORLAX	2006
C...			VORLAX	2007
C...SUBROUTINES			VORLAX	2008
C...CALLED	NONE.		VORLAX	2009
C...			VORLAX	2010
C...DISCUSSION	FLOW FIELD QUANTITIES ARE COMPUTED AT THE NODAL POINTS		VORLAX	2011
C...	OF A 3-D GRID DEFINED AROUND THE CONFIGURATION BY A SET		VORLAX	2012
C...	OF ORTHOGONAL PLANES (X = CONST., Y = CONST., AND		VORLAX	2013
C...	Z = CONST. PLANES). THE VELOCITIES ARE CALCULATED BY		VORLAX	2014
C...	THE USE OF INFLUENCE COEFFICIENT MATRICES BASED ON THE		VORLAX	2015
C...	VORTEX LATTICE REPRESENTATION OF THE CONFIGURATION.		VORLAX	2016
C...	THESE MATRICES ARE COMPUTED IN SUBROUTINE SURVEY AND		VORLAX	2017
C...	STORED IN UNITS 3, 4, AND 7 (ONE MATRIX AND ONE UNIT		VORLAX	2018
C...	PER VELOCITY COMPONENT). THE PRESSURE RATIOS AND RELATED		VORLAX	2019
C...	FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF ISFN		VORLAX	2020
C...	TROPIC FLOW RELATIONSHIPS.		VORLAX	2021
C			VORLAX	2022
C			VORLAX	2023

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CONTROL*VRLX.MATRIX
C...
C... SUBROUTINE MATRX (EW, EU, ITOTAL)
C....
C...PURPOSE TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI
C...CESS (1) THE NORMALWASH AT THE CONTROL POINTS
C... (EW / UNIT 1)+ (2) THE AXIALWASH AT THE CONTROL POINTS
C... (EU / UNIT 2)+ AND (3) THE NORMALWASH AT THE LEAD. EDGE
C... (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED
C... VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE
C... LATTICE.
C...
C...INPUT CALLING SEQUENCES
C...ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C...COMMON<
C... X, H2, CX, DL, NT, SX, YY, ZZ, MAG, LAX, NPP, PSI, INT.
C... VSP, VST, XTE, ALFA, IPAN, XHAK, ZBAR, CHORD, RFLAG,
C... MNMAX, SLOPE, FLOATX, FLOATY, INVERS, LATKAL.
C...
C...OUTPUT CALLING SEQUENCES
C...EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY
C...ROW IN UNIT 1).
C...EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY
C...ROW IN UNIT 9).
C...EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2).
C...COMMON<
C...NONE.
C...
C...SUBROUTINES
C...CALLED WASH, UXVEL.
C...
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES
C...ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY
C...INDUCED AT THE (K1,J1) CONTROL POINT BY THE (K,J)
C...HORSESHOE VORTEX OF UNIT STRENGTH. IF K = K1 AND
C...J = J1 (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF
C...THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF
C...THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL
C...POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE
C...INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION
C...IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.
C...
C...
C...

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9/16/76 VORLAX 2147
VORLAX 2148
VORLAX 2149
VORLAX 2150
VORLAX 2151
VORLAX 2152
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VORLAX 2185
VORLAX 2186
VORLAX 2187
VORLAX 2188
VORLAX 2189

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CONTROL*VRLX.INPUT		9/16/76	VORLAX	1416
C...			VORLAX	1417
SUBROUTINE INPUT			VORLAX	1418
C...			VORLAX	1419
C...PURPOSE	TO READ IN INPUT DATA AND PREPARE SUCH DATA FOR		VORLAX	1420
C...	USE IN THE GENERATION OF VORTEX LATTICE GEOMETRY		VORLAX	1421
C...	TO BE DONE IN SUBROUTINE GEOM.		VORLAX	1422
C...			VORLAX	1423
C...INPUT	CALLING SEQUENCES		VORLAX	1424
C...	NONE.		VORLAX	1425
C...	COMMONS		VORLAX	1426
C...	LAX.		VORLAX	1427
C...			VORLAX	1428
C...OUTPUT	CALLING SEQUENCES		VORLAX	1429
C...	NONE.		VORLAX	1430
C...	COMMONS		VORLAX	1431
C...	DL, XS, ITS, NPP, NXS, NYS, NZS, PDL, PSI, RCS,		VORLAX	1432
C...	SPC, VSS, CBAR, HEAD, MACH, NPAN, NVOR, RNCV, SLF1,		VORLAX	1433
C...	SLE2, SREF, VINP, XHAR, YAWQ, YNOT, ZHAR, ZLE1,		VORLAX	1434
C...	ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2,		VORLAX	1435
C...	GAMMA, IESWP, NMACH, PSPAN, ROLLO, SYNTH, TAPER,		VORLAX	1436
C...	WSPAN, XAPEX, YAPEX, ZAPEX, CSIAPT, DELTAY, DELTAZ,		VORLAX	1437
C...	INTRAC, INVERS, IQUANT, LTRAL, NALPHA, PHIMEN,		VORLAX	1438
C...	PITCHQ.		VORLAX	1439
C...			VORLAX	1440
C...SUBROUTINES			VORLAX	1441
C...CALLED	NONE.		VORLAX	1442
C...			VORLAX	1443
C...DISCUSSION	A MASTER FRAME OF REFERENCE IS ASSUMED IN DEFINING		VORLAX	1444
C...	A CONFIGURATION. THIS FRAME OF REFERENCE IS AN		VORLAX	1445
C...	ORTHOGONAL CARTESIAN COORDINATE SYSTEM, THE X-Z		VORLAX	1446
C...	BEING THE CENTERLINE PLANE WITH THE X-AXIS POINTING		VORLAX	1447
C...	DOWNSTREAM, AND THE Z-AXIS DIRECTED UPWARD, THE		VORLAX	1448
C...	Y-AXIS POINTS TO STARBOARD. THE ORIGIN OF THE SYS		VORLAX	1449
C...	TEM CAN BE ANY CONVENIENT POINT IN THE X-Z PLANE.		VORLAX	1450
C...	THE CONFIGURATION CAN BE MADE UP OF SYMMETRICAL		VORLAX	1451
C...	(ABOUT THE X-Z PLANE) AND/OR ASYMMETRICAL COMPO-		VORLAX	1452
C...	NENTS, AND IN DEFINING THE SYMMETRICAL COMPONENTS		VORLAX	1453
C...	ONLY THE STARBOARD ELEMENTS ARE SPECIFIED. THE		VORLAX	1454
C...	CONFIGURATION TO BE INPUT IS DIVIDED INTO A SET		VORLAX	1455
C...	OF MAJOR PANELS, UP TO 20 OF THESE PANELS CAN BE		VORLAX	1456
C...	INPUT, SYMMETRICAL COMPONENTS (LEFT + RIGHT) BEING		VORLAX	1457
C...	COUNTED ONLY ONCE. FOR INSTANCE, A WING OF ZERO		VORLAX	1458
C...	THICKNESS AND WITH STRAIGHT LEADING AND TRAILING		VORLAX	1459
C...	EDGES, AND WITH LINEAR LOFTING BETWEEN ROOT AND		VORLAX	1460
C...	TIP, CONSTITUTES A MAJOR PANEL. COMPLEX PLANFORMS,		VORLAX	1461
C...	AND NON-LINEAR CHANGES IN TWIST AND AIRFOIL SECTIONS		VORLAX	1462
C...	ARE DESCRIBED BY DEFINING MORE THAN ONE PANEL FOR A		VORLAX	1463
C...	GIVEN WING. SUBROUTINE INPUT PREPARES THE DATA SPE		VORLAX	1464
C...	CIFIED FOR EACH MAJOR PANEL SO THAT THEY CAN LATER		VORLAX	1465
C...	BE USED IN SUBROUTINE GEO4 TO GENERATE THE PROPER		VORLAX	1466
C...	VORTEX LATTICE FOR EACH PANEL.		VORLAX	1467
C...	AN AIRFOIL WITH THICKNESS CAN BE REPRESENTED BY A		VORLAX	1468
C...	DOUBLE VORTEX SHEET, I. E., BY DEFINING TWO MAJOR PA		VORLAX	1469
C...	NELS ARRANGED IN A #BIPLANE#, OR #SANDWICH# FASHION,		VORLAX	1470
C...	ONE PANEL REPRESENTING THE UPPER SURFACE OF THE AIR		VORLAX	1471
C...	FOIL, AND THE OTHER PANEL REPRESENTING THE LOWER		VORLAX	1472

C...	SURFACE OF THE SAME AIRFOIL.	VORLAX	1473
C...	FUSIFORM BODIES ARE MODELLED BY DEFINING AN AUXILIARY	VORLAX	1474
C...	BODY IDENTICAL IN CROSS-SECTIONAL SHAPE AND LONGITUDI	VORLAX	1475
C...	NAL AREA DISTRIBUTION TO THE ACTUAL BODY BUT WITHOUT	VORLAX	1476
C...	CAMBER. THE AUXILIARY BODY CROSS-SECTION IS APPROXI	VORLAX	1477
C...	MATED BY A POLYGON WHOSE SIDES DETERMINE THE TRANS	VORLAX	1478
C...	VERSE LEGS OF THE HORSESHOE VORTICES. THE VERTICES	VORLAX	1479
C...	OF THE POLYGON AND THE AUXILIARY BODY AXIS DEFINE	VORLAX	1480
C...	A SET OF RADIAL PLANES IN WHICH THE BOUND TRAILING	VORLAX	1481
C...	LEGS OF THE HORSESHOE VORTICES LIE PARALLEL TO THE	VORLAX	1482
C...	AXIS. AS THE CROSS-SECTION CHANGES SHAPE ALONG THE	VORLAX	1483
C...	AXIS, THE POLYGON CHANGES ACCORDINGLY BUT WITH THE	VORLAX	1484
C...	CONSTRAINT THAT THE POLYGONAL VERTICES MUST ALWAYS	VORLAX	1485
C...	LIE IN THE SAME SET OF RADIAL PLANES. THE BODY CAMBER	VORLAX	1486
C...	IS SPECIFIED INDEPENDENTLY.	VORLAX	1487
C...		VORLAX	1488
C...		VORLAX	1489
C...		VORLAX	1490

CONTROL=VRLX.PRESS	9/15/76	VORLAX	2524
C...		VORLAX	2525
SUBROUTINE PRESS (ITOTAL, EU)		VORLAX	2526
C		VORLAX	2527
C		VORLAX	2528
C...PURPOSE	TO COMPUTE PRESSURE LOAD COEFFICIENTS (CLOWER	VORLAX	2529
C...	CPUPPER), OR SURFACE PRESSURE COEFFICIENTS, FROM THE	VORLAX	2530
C...	VALUES OF THE INDUCED VELOCITIES AND CIRCULATION	VORLAX	2531
C...	STRENGTHS.	VORLAX	2532
C...		VORLAX	2533
C...INPUT	CALLING SEQUENCES	VORLAX	2534
C...	ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.	VORLAX	2535
C...	EU = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED	VORLAX	2536
C...	ROW BY ROW FROM UNIT 2).	VORLAX	2537
C...	COMMON<	VORLAX	2538
C...	B2, CX, DL, SX, JTS, PSI, TNL, INT, ALFA, YAWQ, CHORD,	VORLAX	2539
C...	GAMMA, ONSET, RNMAX, SLOPE, WSPAN.	VORLAX	2540
C...		VORLAX	2541
C...OUTPUT	CALLING SEQUENCES	VORLAX	2542
C...	NONE.	VORLAX	2543
C...	COMMON<	VORLAX	2544
C...	DCP.	VORLAX	2545
C...		VORLAX	2546
C...SUBROUTINES		VORLAX	2547
C...CALLED	NONE.	VORLAX	2548
C...		VORLAX	2549
C...DISCUSSION	THIS SUBROUTINE COMPUTES THE PRESSURE COEFFICIENT ARRAY	VORLAX	2550
C...	DCP. EACH ELEMENT OF DCP CORRESPONDS TO A GIVEN	VORLAX	2551
C...	HORSESHOE VORTEX OF THE LATTICE, AND IT IS ASSUMED TO	VORLAX	2552
C...	ACT AT THE HORSESHOE CENTROID, I.E., THE MI=	VORLAX	2553
C...	THE TRANSVERSE, OR SKEWED, LEG. AN ELEMENT OF THE DCP	VORLAX	2554
C...	ARRAY IS EITHER A LOAD COEFFICIENT (IF THE SURFACE	VORLAX	2555
C...	IS ASSUMED WETTED ON BOTH FACES, I.E., JTS = ITS = 1),	VORLAX	2556
C...	OR A SURFACE PRESSURE COEFFICIENT (IF THE SURFACE IS	VORLAX	2557
C...	ASSUMED WETTED ON ONE SIDE ONLY, I.E., JTS = ITS = 0).	VORLAX	2558
C...	IN THE COMPUTATION OF LOAD COEFFICIENTS, THE CIRCULA	VORLAX	2559
C...	TION STRENGTHS, THE FREE STREAM VELOCITY COMPONENTS,	VORLAX	2560
C...	AND THE ONSET FLOW DUE TO ANY ANGULAR ROTATION OF THE	VORLAX	2561
C...	CONFIGURATION ARE TAKEN INTO ACCOUNT. THE EFFECT OF	VORLAX	2562
C...	THE INDUCED AXIALWASH IS IGNORED (SECOND ORDER ERROR).	VORLAX	2563
C...	IN THE COMPUTATION OF SURFACE PRESSURE COEFFICIENTS,	VORLAX	2564
C...	THE AXIALWASH IS ALSO TAKEN INTO ACCOUNT. IF NPP = 1,	VORLAX	2565
C...	THE *AXIALWASH* IS NO LONGER A TRUE AXIALWASH (X-AXIS	VORLAX	2566
C...	VELOCITY COMPONENT), RATHER IT REPRESENTS THE VELOCITY	VORLAX	2567
C...	COMPONENT TANGENTIAL TO THE SURFACE BUT WITH THE SIDE	VORLAX	2568
C...	WASH LEFT OUT. SURFACE PRESSURE COEFFICIENTS ARE LIMI	VORLAX	2569
C...	TED BY THE ISENTROPIC VALUES CORRESPONDING TO STAGNA	VORLAX	2570
C...	TION AND 70 PERCENT OF VACUUM FOR THE GIVEN FREE-STREAM	VORLAX	2571
C...	MACH NUMBER.	VORLAX	2572
C...		VORLAX	2573
C...		VORLAX	2574

CONTROL*VRLX.PRINT	9/17/76	VORLAX	2768
C... SUBROUTINE PRINT (ITOTAL, EW, EWX, EWY)		VORLAX	2769
C... PURPOSE TO PRINT PROGRAM DATA.		VORLAX	2770
C... INPUT CALLING SEQUENCES		VORLAX	2771
C... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	2772
C... EW, EWX, EWY = STORAGE ARRAYS SET ASIDE FOR CALLING		VORLAX	2773
C... SUBROUTINE MAP.		VORLAX	2774
C... COMMONS		VORLAX	2775
C... CD, CL, CM, CM, CX, CY, DL, IH, IO, YY, ZC, ZZ,		VORLAX	2776
C... BIG, CDC, CNC, CRM, CYM, DCP, EPS, HAG, JTS, LAX,		VORLAX	2777
C... NXS, PDL, PSI, RLM, SPC, XBAR, CMTC, CSUC, HEAD,		VORLAX	2778
C... IPAN, ITER, LIFT, MACH, NPAN, NVOR, RNCV, SREF,		VORLAX	2779
C... SURF, VINP, XBAR, XSUC, YAWO, ZBAR, AINC1, AINC2,		VORLAX	2780
C... ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CRTOT, CYTOT,		VORLAX	2781
C... DNDX1, DNDX2, GAMMA, ISOLV, LESWP, PSPAN, RNMAX,		VORLAX	2782
C... ROLLQ, SLOPE, SYNTH, TAPER, TITLF, WSPAN, XAPEX,		VORLAX	2783
C... YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVEKS,		VORLAX	2784
C... IQUANT, IIRMAX, LATRAL, MOMENT, PITCHQ.		VORLAX	2785
C... OUTPUT CALLING SEQUENCES		VORLAX	2786
C... NONE.		VORLAX	2787
C... COMMONS		VORLAX	2788
C... NONE.		VORLAX	2789
C... SUBROUTINES		VORLAX	2790
C... CALLED ZNORM, MAP.		VORLAX	2791
C... DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED		VORLAX	2792
C... IN THREE GROUPS, AS FOLLOWS		VORLAX	2793
C... (1) INPUT DATA+ THESE ARE DATA WHICH ARE TAKEN FROM		VORLAX	2794
C... THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT		VORLAX	2795
C... SUITABLE FOR USE BY THE PROGRAM.		VORLAX	2796
C... (2) PANEL AND TOTAL CONFIGURATION FORCE AND MUMENT		VORLAX	2797
C... COEFFICIENT DATA.		VORLAX	2798
C... (3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS		VORLAX	2799
C... OR TO INDIVIDUAL HORSESHOE VORTICES.		VORLAX	2800
C... THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.		VORLAX	2801
C... IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES		VORLAX	2802
C... PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.		VORLAX	2803
C...		VORLAX	2804
C...		VORLAX	2805
C...		VORLAX	2806
C...		VORLAX	2807
C...		VORLAX	2808
C...		VORLAX	2809
C...		VORLAX	2810

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CONTROL*VRLX.SURVEY          9/17/76  VORLAX  3055
C...                          VORLAX  3056
SUBROUTINE SURVEY (EW, EWX, EWY, ITOTAL)
C...                          VORLAX  3057
C...                          VORLAX  3058
C...                          VORLAX  3059
C...PURPOSE  TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT
C...          MATRICES (1) THE UPWASH AT THE FLOW FIELD SURVEY
C...          POINTS (EW / UNIT 3)+ (2) THE AXIALWASH AT THE FLOW
C...          FIELD SURVEY POINTS (EWX / UNIT 4)+ AND (3) THE
C...          SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EWY / UNIT 7).
C...          THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELDS
C...          DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW
C...          FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED
C...          3-D GRID.
C...          VORLAX  3067
C...          VORLAX  3068
C...          VORLAX  3069
C...INPUT    CALLING SEQUENCES
C...          ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C...          COMMON<
C...          X, BZ, CX, DL, NT, SX, XS, YY, Z7, HAG, LAX, NXS,
C...          NYS, NZS, PSI, TMT, VSP, VST, XTF, ALFA, YNOT, XBAR,
C...          ZBAR, ZNOT, CHORD, RNMAX, DELTAY, DELTAZ, FLOATX,
C...          FLOATY, LATRAL.
C...          VORLAX  3076
C...          VORLAX  3077
C...OUTPUT   CALLING SEQUENCES
C...          EW = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)
C...          EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4)
C...          EWY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7)
C...          COMMON<
C...          NONE.
C...          VORLAX  3082
C...          VORLAX  3083
C...          VORLAX  3084
C...SUBROUTINES
C...CALLED   WASH, UXVEL.
C...          VORLAX  3085
C...          VORLAX  3086
C...          VORLAX  3087
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE
C...            GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW
C...            FIELD SURVEY POINT BY THE (K+ J) HORSESHOE VORTEX OF
C...            UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT I=
C...            WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING
C...            HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS
C...            COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW
C...            FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-D GRID
C...            DEFINED BY A SET OF THREE ORTHOGONAL PLANES. THESE
C...            PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT,
C...            DELTAY, ZNOT, AND DELTAZ.
C...            VORLAX  3097
C...            VORLAX  3098
C...            VORLAX  3099
C...            VORLAX  3100

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CONTROL*VRLX.UXVEL		9/14/76	VORLAX	3355
C...'			VORLAX	3356
	SUBROUTINE UXVEL (X, Y, Z, S, T, B2, TOLZ, U)		VORLAX	3357
C...'			VORLAX	3358
C...PURPOSE	TO COMPUTE THE AXIALWASH INDUCED BY A SKEWED		VORLAX	3359
C...'	RECTILINEAR VORTEX SEGMENT OF UNIT CIRCULATION.		VORLAX	3360
C...'			VORLAX	3361
C...INPUT	CALLING SEQUENCES		VORLAX	3362
C...'	X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF		VORLAX	3363
C...'	RECEIVING POINT MEASURED IN A REFERENCE FRAME		VORLAX	3364
C...'	CENTERED AT THE MIDPOINT OF VORTEX SEGMENT.		VORLAX	3365
C...'	THE X-AXIS IS PARALLEL TO THE X-AXIS OF THE		VORLAX	3366
C...'	MASTER (CONFIGURATION) COORDINATE SYSTEM. THE		VORLAX	3367
C...'	Y-AXIS IS NORMAL TO THE X-AXIS BUT LIES IN		VORLAX	3368
C...'	THE PLANE DETERMINED BY THE X-AXIS AND THE		VORLAX	3369
C...'	VORTEX SEGMENT, AND THE Z-AXIS IS NORMAL TO		VORLAX	3370
C...'	SUCH PLANE.		VORLAX	3371
C...'	S = SEMISPAN OF VORTEX SEGMENT.		VORLAX	3372
C...'	T = TANGENT OF SWEEP ANGLE OF VORTEX SEGMENT.		VORLAX	3373
C...'	B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).		VORLAX	3374
C...'	TOLZ = NUMERICAL TOLERANCE CONSTANT.		VORLAX	3375
C...'	COMMONS		VORLAX	3376
C...'	NONE.		VORLAX	3377
C...'			VORLAX	3378
C...OUTPUT	CALLING SEQUENCES		VORLAX	3379
C...'	U = X-AXIS VELOCITY COMPONENT (AXIALWASH) INDUCED BY		VORLAX	3380
C...'	SKEWED VORTEX SEGMENT OF UNIT INTENSITY.		VORLAX	3381
C...'	COMMONS		VORLAX	3382
C...'	NONE.		VORLAX	3383
C...'			VORLAX	3384
C...SUBROUTINES			VORLAX	3385
C...CALLED	NONE.		VORLAX	3386
C...'			VORLAX	3387
C...DISCUSSION	THIS SUBROUTINE IS CALLED WHEN THE AXIALWASH IS		VORLAX	3388
C...'	COMPUTED IN ACCORDANCE WITH VORTEX SPLITTING SCHEME.		VORLAX	3389
C...'	ONLY THE AXIALWASH IS COMPUTED, AND ONLY THE TRANS		VORLAX	3390
C...'	VERSE SEGMENT OF THE HORSESHOE IS TAKEN INTO ACCOUNT.		VORLAX	3391
C...'	THE SAME COMMENTS PRESENTED IN SUBROUTINE WASH		VORLAX	3392
C...'	REGARDING THE NUMERICAL SINGULARITY IN THE VICINITY		VORLAX	3393
C...'	OF THE CHARACTERISTIC SURFACES (MACH CONES) ARE		VORLAX	3394
C...'	ALSO APPLICABLE HERE. SUBROUTINE UXVEL IS A DIRECT		VORLAX	3395
C...'	COPY OF PARTS OF SUBROUTINE WASH.		VORLAX	3396
C...'			VORLAX	3397
C...'			VORLAX	3398

CONTROL*VRLX.VECTOR		9/14/76	VORLAX	3484
C...			VORLAX	3485
	SUBROUTINE VECTOR (ITOTAL, NX1, AV, EW, VORI, VORK, VORL)		VORLAX	3486
C			VORLAX	3487
C			VORLAX	3488
C...PURPOSE	TO SOLVE THE LINEAR SYSTEM OF BOUNDARY CONDITION		VORLAX	3489
C...	EQUATIONS BY PURCELL'S VECTOR ORTHOGONALIZATION		VORLAX	3490
C...	METHOD.		VORLAX	3491
C...			VORLAX	3492
C...INPUT	CALLING SEQUENCES		VORLAX	3493
C...	ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.		VORLAX	3494
C...	NX1 = ITOTAL + 1		VORLAX	3495
C...	EW = ROW OF NORMALWASH INFLUENCE COEFFICIENT MATRIX.		VORLAX	3496
C...	COMMONS		VORLAX	3497
C...	ALOC.		VORLAX	3498
C...			VORLAX	3499
C...OUTPUT	CALLING SEQUENCES		VORLAX	3500
C...	VORI = AUXILIARY COMPUTATIONAL ROW VECTOR.		VORLAX	3501
C...	VORK = EXTENDED SOLUTION ROW VECTOR.		VORLAX	3502
C...	VORL = AUXILIARY COMPUTATIONAL ROW VECTOR.		VORLAX	3503
C...	COMMONS		VORLAX	3504
C...	GAMMA.		VORLAX	3505
C...			VORLAX	3506
C...SUBROUTINES			VORLAX	3507
C...CALLED	NONE.		VORLAX	3508
C...			VORLAX	3509
C...DISCUSSION	THE BOUNDARY CONDITION EQUATIONS ARE SOLVED DIRECTLY		VORLAX	3510
C...	BY A VECTOR ORTHOGONALIZATION PROCEDURE (PURCELL'S		VORLAX	3511
C...	VECTOR METHOD). SETS OF LINEARLY INDEPENDENT VECTORS		VORLAX	3512
C...	ARE CONSTRUCTED WHICH ARE SUCCESSIVELY ORTHOGONAL TO		VORLAX	3513
C...	EACH ROW. WHEN ALL ROWS HAVE BEEN CONSIDERED THERE IS		VORLAX	3514
C...	ONE VECTOR WHICH IS NORMAL (ORTHOGONAL) TO ALL ROWS		VORLAX	3515
C...	AND CONTAINS THE SOLUTION VECTOR. NO MATRIX INVERSION		VORLAX	3516
C...	IS INVOLVED AND ONLY ONE ROW OF THE COEFFICIENT MATRIX		VORLAX	3517
C...	IS REQUIRED AT A TIME. AND ONCE OPERATED ON CAN BE		VORLAX	3518
C...	OVERWRITTEN. IN ADDITION, TWO AUXILIARY ROW VECTORS		VORLAX	3519
C...	ARE NEEDED FOR TEMPORARY STORAGE OF INTERMEDIATE VECTOR		VORLAX	3520
C...	VECTOR DATA.		VORLAX	3521
C...			VORLAX	3522
C...			VORLAX	3523

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CONTROL*VRLX.WASH                                9/14/76  VORLAX  3611
C... SUBROUTINE WASH (X, Y, Z, S, T, HZ, U, V, W, AA, AM, TE, CT, MM)  VORLAX  3612
C... PURPOSE TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A  VORLAX  3613
C... GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT STRENGTH.  VORLAX  3614
C... STRENGTH. VORLAX  3615
C... VORLAX  3616
C... VORLAX  3617
C... VORLAX  3618
C... INPUT CALLING SEQUENCES VORLAX  3619
C... X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF VORLAX  3620
C... RECEIVING (FIELD OR CONTROL) POINT MEASURED VORLAX  3621
C... IN A REFERENCE FRAME CENTERED AT THE MIDPOINT VORLAX  3622
C... OF THE TRANSVERSE VORTEX SEGMENT (HORSESHOE VORLAX  3623
C... VORTEX CENTROID); THE X-AXIS IS PARALLEL TO VORLAX  3624
C... THE X-AXIS OF THE MASTER (CONFIGURATION) VORLAX  3625
C... COORDINATE SYSTEM; THE Y-AXIS IS NORMAL TO VORLAX  3626
C... THE X-AXIS BUT LIES IN THE PLANE DETERMINED VORLAX  3627
C... BY THE X-AXIS ITSELF AND THE TRANSVERSE LEG VORLAX  3628
C... OF THE HORSESHOE; AND THE Z-AXIS IS NORMAL VORLAX  3629
C... TO SUCH PLANE. VORLAX  3630
C... S = HORSESHOE VORTEX SEMISPAN. VORLAX  3631
C... T = TANGENT OF SWEEP ANGLE OF TRANSVERSE LEG, POSITIVE VORLAX  3632
C... FOR SWEEPBACK. VORLAX  3633
C... HZ = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0). VORLAX  3634
C... AA, AM = DIRECTION ANGLES (ANGLES OF FLOATATION) OF VORLAX  3635
C... FREE (WAKE) TRAILING LEGS. VORLAX  3636
C... TE = TANGENT OF TRAILING EDGE SWEEP ANGLE. VORLAX  3637
C... CT = AVERAGE LENGTH OF BOUND TRAILING LEGS OF HORSESHOE VORLAX  3638
C... (DISTANCE BETWEEN VORTEX CENTROID AND TRAILING VORLAX  3639
C... EDGE MEASURED) ALONG X-AXIS). VORLAX  3640
C... MM = FLOATING WAKE COMPUTATION FLAG. VORLAX  3641
C... COMMONS VORLAX  3642
C... NONE. VORLAX  3643
C... VORLAX  3644
C... OUTPUT CALLING SEQUENCES VORLAX  3645
C... U, V, W = ORTHOGONAL VELOCITY COMPONENTS INDUCED BY VORLAX  3646
C... GENERALIZED HORSESHOE VORTEX OF UNIT VORLAX  3647
C... CIRCULATION INTENSITY. VORLAX  3648
C... VORLAX  3649
C... SUBROUTINES VORLAX  3650
C... CALLED NONE. VORLAX  3651
C... VORLAX  3652
C... DISCUSSION THE (GENERALIZED) HORSESHOE VORTEX ELEMENT CONSISTS OF VORLAX  3653
C... FIVE LEGS OR SEGMENTS, OF WHICH THREE ARE (BOUND) AND VORLAX  3654
C... TWO ARE (FREE) OR (FLOATING). THE BOUND LEGS ARE THE VORLAX  3655
C... SKEWED, OR SWEEP, TRANSVERSE SEGMENT AND THE TWO VORLAX  3656
C... TRAILING, OR CHORDWISE, FILAMENTS EXTENDING FROM THE VORLAX  3657
C... ENDS OF THE TRANSVERSE LEG TO THE TRAILING EDGE. THE VORLAX  3658
C... FLOATING TRAILING LEGS ARE THE SEMI-INFINITE LINES VORLAX  3659
C... WHICH START AT THE TRAILING EDGE AND CONTINUE TO VORLAX  3660
C... DOWNSTREAM INFINITY ACCORDING TO A PRESCRIBED DIRECTION VORLAX  3661
C... DETERMINED BY THE FLOATATION ANGLES AA AND AM. THESE VORLAX  3662
C... FLOATING TRAILING LEGS CONSTITUTE THE CONTINUATION VORLAX  3663
C... IN THE WAKE OF THE BOUND TRAILING SEGMENTS. VORLAX  3664
C... AT SUPERSONIC MACH NUMBERS THE VELOCITY INDUCED BY A VORLAX  3665
C... DISCRETE HORSESHOE VORTEX BECOMES VERY LARGE IN THE VORLAX  3666
C... VICINITY OF THE MACH WAKES GENERATED BY THE SKEWED VORLAX  3667

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C...	LEG OF THE HORSESHOE. AT THE CHARACTERISTIC ENVELOPE	VORLAX	3668
C...	ITSELF. THE INDUCED VELOCITY VANISHES DUE TO THE FINITE	VORLAX	3669
C...	PART CONCEPT. THIS SINGULAR BEHAVIOR OCCURS ONLY FOR	VORLAX	3670
C...	FIELD POINTS OFF THE PLANE OF THE HORSESHOE. TO AVOID	VORLAX	3671
C...	THIS NUMERICAL SINGULARITY THE CHARACTERISTIC SURFACES	VORLAX	3672
C...	(MACH CONES) ARE TAKEN TO BE GIVEN BY	VORLAX	3673
C...	$(X - X1) **2 = B2 * ((Y - Y1) **2 + (Z - Z1) **2) / \text{CUTOFF}$	VORLAX	3674
C...	WHERE CUTOFF IS A NUMERICAL CONSTANT WHOSE VALUE IS	VORLAX	3675
C...	LESS THAN, BUT CLOSE TO, 1.0 .	VORLAX	3676
C...		VORLAX	3677
C...		VORLAX	3678
C...		VORLAX	3679

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CONTROL*VRLX.ZNORM                                9/14/76  VORLAX  3894
C... SUBROUTINE ZNORM (I, IS, RTOP)                VORLAX  3895
C... SUBROUTINE ZNORM (I, IS, RTOP)                VORLAX  3896
C... SUBROUTINE ZNORM (I, IS, RTOP)                VORLAX  3897
C...PURPOSE TO INTEGRATE THE CHORDWISE SLOPE DISTRIBUTION IN ORDER VORLAX  3898
C... TO OBTAIN THE SURFACE CAMBER (OR WARP) ORDINATES. VORLAX  3899
C... CALLING SEQUENCES VORLAX  3900
C... I = ELEMENT INDEX (TOTAL COUNT). VORLAX  3901
C... IS = STRIP INDEX (SPANWISE COUNT). VORLAX  3902
C... RNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP VORLAX  3904
C... (CHORDWISE ROW). VORLAX  3905
C... COMMONS VORLAX  3906
C... LAX, SLF, SLOPE. VORLAX  3907
C... CALLING SEQUENCES VORLAX  3908
C... NONE. VORLAX  3909
C... COMMONS VORLAX  3910
C... ZC. VORLAX  3911
C... SUBROUTINES VORLAX  3912
C... CALLED NONE. VORLAX  3913
C... DISCUSSION THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES VORLAX  3914
C... BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS VORLAX  3915
C... TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY VORLAX  3916
C... CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS VORLAX  3917
C... IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS VORLAX  3918
C... TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED VORLAX  3919
C... TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS VORLAX  3920
C... DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS VORLAX  3921
C... EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD VORLAX  3922
C... LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL VORLAX  3923
C... SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST. VORLAX  3924
C... SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE VORLAX  3925
C... STRIP OR ROW OF HORSESHOE VORTICES. VORLAX  3926
C... VORLAX  3927
C... VORLAX  3928
C... VORLAX  3929
C... VORLAX  3930
C... VORLAX  3931
C... VORLAX  3932

```

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1 CONTROL*VRLX.AAMAINCD          9/16/77  VORLAX
C*****                          *****
C                                  *****
C L      000      CCCC      K K H H EEEFE EEEEE DDDDD
C L      0 0 0  C      K K H H E      E      D  D
C L      0 0 0  C      K K H H E      E      D  D
C L      0 0 0  C      KK HHHH EEEFE EEEEE D  D
C L      0 0 0  C      K K H H E      E      D  D
C L      0 0 0  C      K K H H E      E      D  D
C LLLLL 000      CCCC      K K H H EEEFE EEEEE DDDDD
C
C
C P P P P R R R R R 000 P P P P P R R R R R I I I I I F E E E E I T T T A A A R R R R H Y Y
C P P R R 0 0 P P R R I F E T A A R R Y Y
C P P P P R R R R R 0 0 P P P P R R R R I F E E E E T A A A A R R R R Y
C P R R 0 0 P P R R I F E T A A R R Y
C P R R 0 0 P P R R I F E T A A R R Y
C P R R 000 P R R I I I I F E E E E T A A R R Y
C*****
C THIS DATA CONTAINS INFORMATION AND/OR DESIGNS WHICH ARE THE PROPERTY OF
C LOCKHEED AIRCRAFT CORPORATION.

```

RECIPIENT, BY ACCEPTING THE SAME, AGREES THAT THE DATA WILL NOT BE REPRODUCED, TRANSFERRED TO OTHER DOCUMENTS, DISCLOSED OUTSIDE OF THE RECIPIENT ORGANIZATION, OR USED FOR MANUFACTURING OR PROCUREMENT WITHOUT THE EXPRESS WRITTEN PERMISSION OF LOCKHEED AIRCRAFT CORPORATION. THIS LIMITATION MAY BE REMOVED OCTOBER 1977.

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30 C*****
C GENERALIZED VORTEX LATTICE PROGRAM (SIHSON,IC/SUPERSONIC NONPI ANAH)
C LUIS R. MIRANDA (DEPT. 75-41) /BLDG. 636 / (213) 847-6812/
C WILLIAM M. BAKER (DEPT. 80-34) /BLDG. 67 / (213) 847-3537/
C ***** LOCKHEED-CALIFORNIA COMPANY, BURBANK, CALIFORNIA *****
C COMPUTER SERVICES JOB NUMBER 4565
C*****
C
C-----
C V V 000 HRRR L A A X X
C V V 0 0 R R L A A X X
C V V 0 0 R R R R L A A A A X
C V V 0 0 R R L A A X X
C V 000 R R L L L L L A A X X
C-----
C
C PROGRAM VORLAX (INPUT,OUTPUT,TAPES=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2,
*TAPE3,TAPE4,TAPE7,TAPE9,TAPE11,TAPE12)
C...
C...DEFINITION OF VARIABLES STORED IN COMMON BLOCKS.
C...
C...X, Y, Z COORDINATES OF HORSESHOE VORTEX CENTROIDS
C... (MIDPOINTS OF TRANSVERSE LEGS).

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60	C...B2 C...CD, CL, CM, CN C...CX, CY C...DL	COMPRESSIBILITY FACTOR (M **2 - 1.) PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL FORCE COEFFICIENTS. PANEL X- AND Y-FORCE COEFFICIENTS. DIBEDRAL OF CHORDWISE ROW OF HORSESHOE VORTICES.	VORLAX VORLAX VORLAX VORLAX	59 60 61 62 63 64
65	C...FN, FY C...IH, IU C...NT C...RM C...SX C...XS C...YM C...YY C...ZC C...ZZ	PANEL NORMAL AND Y-FORCE PER UNIT U. ANGLE OF ATTACK AND MACH NUMBER INDICES. TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES. PANEL ROLLING MOMENT PER UNIT U. SPANWISE LOCATION INDEX. ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES. PANEL YAWING MOMENT PER UNIT U. Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS. NORMAL CAMBER COORDINATE IN FRACTION OF CHORD. Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.	VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX	65 66 67 68 69 70 71 72 73 74
70	C...BIG C...CDC, CNC C...CRM, CYM C...DCP	MAXIMUM CHANGE PER RELAXATION CYCLE. CHORDWISE CD AND CN TIMES LOCAL CHORD. PANEL ROLLING AND YAWING MOMENT COEFFICIENTS. PRESSURE COEFFICIENTS (FIFTER LOAD OR SURFACE).	VORLAX VORLAX VORLAX VORLAX	75 76 77 78
80	C...EPS C...HAG C...ITS, JTS C...LAX,LAY	ACCEPTABLE FINAL RELAXATION CYCLE CHANGE. HEIGHT ABOVE GROUND OF MOMENT REFERENCE CENTER. PANEL AND STRIP FLOW EXPOSURE FLAGS. LATTICE CHORDWISE AND SPANWISE DISTRIBUTION FLAGS.	VORLAX VORLAX VORLAX VORLAX	79 80 81 82
85	C...MPP C...NKS, NYS, NZS C...PDL	PANEL CHORDWISE NONPLANARITY FLAG. NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGONAL TO THE COORDINATE AXES). PANEL SPANWISE NONPLANARITY FLAG. ALSO PANEL PANEL DIBEDRAL IF PANEL IS FLAT IN THE SPANWISE DIRECTION.	VORLAX VORLAX VORLAX	83 84 85
90	C...PSI C...RCS C...RLM	YAW ANGLE (POSITIVE WHEN FLOW COMES FROM PORTSIDE). CROSS-SECTION RADIUS VECTOR. APPROXIMATE VALUE OF EIGENVALUE RADIUS OF NORMAL WASH MATRIX.	VORLAX VORLAX VORLAX	86 87 88
95	C...SLE C...SPC C...TNL C...TNT C...VSP C...VSS C...VST C...XAF	SLOPE AT LEADING EDGE. PANEL LEADING EDGE SUCTION FACTOR. TANGENT OF LEADING EDGE SWEEP. TANGENT OF TRAILING EDGE SWEEP. TANGENT OF SKEWED VORTEX LINE. SEMISPAN OF CHORDWISE VORTEX ROW. ACTUAL HORSESHOE VORTEX SEMISPAN. CHORDWISE PERCENT COORDINATES AT WHICH CAMBER IS INPUT.	VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX	89 90 91 92 93 94 95 96 97
100	C...XTE C...ALFA C...ALOC C...HFTA C...GRAR C...CHTC C...CSUC	TRAILING EDGE ARCISSA OF VORTEX ROW. ANGLE OF ATTACK (IN RADTANS). COMPONENT OF FREE-STREAM AND) ONSET FLOWS NORMAL TO THE SURFACE AT THE CONTROL POINTS. ALSO AUXILIARY ARRAY. PRANDTL-GLAUFERT FACTOR. REFERENCE CHORD. CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD TIMES LOCAL CHORD. PANEL LEADING EDGE THRUST PER UNIT U.	VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX VORLAX	98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115

115	C...DRAG	PANEL INDUCED DRAG PER UNIT Q.	VORLAX	116
	C...HEAD	PANEL DESCRIPTION INFORMATION.	VORLAX	117
	C...IDES	DESIGN (SYNTHESIS) FLAG.	VORLAX	118
	C...IPAN	HORSESHOE STRIP PANEL INDEX.	VORLAX	119
	C...ITER	ACTUAL NUMBER OF RELAXATION CYCLES.	VORLAX	120
120	C...LIFT	PANEL LIFT PER UNIT Q.	VORLAX	121
	C...MACH	FREE-STREAM MACH NUMBER.	VORLAX	122
	C...MPAN	NUMBER OF PANELS DEFINED IN THE DATA INPUT.	VORLAX	123
	C...NVOR	NUMBER OF PANEL CHORDWISE STRIPS OF VORTICES.	VORLAX	124
	C...RNCV	CHORDWISE NUMBER OF HORSESHOE VORTICES FOR A GIVEN PANEL.	VORLAX	125
125	C...SLE1, SLE2	SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE EDGES.	VORLAX	126
	C...SMAX	NT.	VORLAX	127
	C...SREF	CONFIGURATION REFERENCE AREA.	VORLAX	128
130	C...SURF	PANEL SURFACE AREA (PLANFORM AREA).	VORLAX	129
	C...VINP	REFERENCE FREE STREAM VELOCITY.	VORLAX	130
	C...XRAR	ABSCISSA OF MOMENT REFERENCE CENTER.	VORLAX	131
	C...XSUC	PANEL LEADING EDGE THRUST PER UNIT Q.	VORLAX	132
	C...YAWU	YAW RATE (DEGS/SEC).	VORLAX	133
135	C...YNOT	HULLLINE ORIGIN OF FLOW FIELD SURVEY GRID.	VORLAX	134
	C...ZBAC	ORDINATE OF MOMENT REFERENCE CENTER.	VORLAX	135
	C...ZETA	INCIDENCE OF STREAMWISE VORTEX ROW (STRTP) CHORDLINE.	VORLAX	136
140	C...ZLE1, ZLE2	LEADING EDGE OFFSET OF CAMBERLINE AT THE PANEL SIDE EDGES.	VORLAX	137
	C...ZNOT	WATERLINE ORIGIN OF FLOW FIELD SURVEY GRID.	VORLAX	138
	C...AINC1, AINC2	CHORDLINE INCIDENCE AT SIDE EDGES OF PANEL.	VORLAX	139
	C...ALPHA	ANGLE OF ATTACK (DEGS).	VORLAX	140
145	C...CDTOT	TOTAL INDUCED DRAG COEFFICIENT.	VORLAX	141
	C...CHORD	CHORD LENGTH MEASURED ALONG CENTRLINE OF STREAMWISE ROW OF HORSESHOE VORTICES.	VORLAX	142
	C...CLTOT	TOTAL LIFT COEFFICIENT.	VORLAX	143
	C...CMTOT	TOTAL PITCHING MOMENT COEFFICIENT.	VORLAX	144
	C...CNTOT	TOTAL YAWING MOMENT COEFFICIENT.	VORLAX	145
150	C...CRTOT	TOTAL ROLLING MOMENT COEFFICIENT.	VORLAX	146
	C...CYTOT	TOTAL SIDE FORCE COEFFICIENT.	VORLAX	147
	C...DNDX1, DNDX2	SURFACE SLOPES AT THE CONTROL POINTS MEASURED ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN VOKED, THEY ARE THE LOAN COEFFICIENTS AT THE LOAD POINTS ALONG THE PANEL SIDE EDGES.	VORLAX	148
155	C...GAMMA	HORSESHOE VORTEX CIRCULATION . ALSO USED AS TEMPORARY DATA STORAGE.	VORLAX	149
	C...ISOLV.	FLAG DETERMINING SYSTEM OF SOLUTION FOR THE BOUNDARY CONDITION EQUATIONS.	VORLAX	150
	C...LESWP	PANEL LEADING EDGE SWEEP (DEGS).	VORLAX	151
160	C...NMACH	NUMBER OF MACH NUMBERS PER CASE.	VORLAX	152
	C...ONSET	ONSET FLOW VELOCITIES GENERATED BY THE ROTATION OF THE CONFIGURATION ABOUT THE MOMENT REFERENCE CENTER.	VORLAX	153
165	C...PPSPAN	PANEL SPAN.	VORLAX	154
	C...REFLAG	COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY CONDITION EQUATIONS.	VORLAX	155
	C...RNMAX	NUMBER OF VORTICES FOR A GIVEN CHORDWISE ROW.	VORLAX	156
	C...ROLLQ	ROLL RATE (DEGS/SEC).	VORLAX	157
170	C...SLOPE	SURFACE SLOPE AT THE LATTICE CONTROL POINTS.	VORLAX	158
	C...SYNH	PANEL SYNTHESIS (DESIGN) FLAG.	VORLAX	159
			VORLAX	160
			VORLAX	161
			VORLAX	162
			VORLAX	163
			VORLAX	164
			VORLAX	165
			VORLAX	166
			VORLAX	167
			VORLAX	168
			VORLAX	169
			VORLAX	170
			VORLAX	171
			VORLAX	172


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230 COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CINTOT
    COMMON /SET13 /BIG, ITER, ITRMAX, EPS, WSPAN, RLM
    COMMON /SET14 /NPNAN, NT, SHAX, NPNANAS
    COMMON /SET15 /B2, BETA, CHAR, XBAR, ZBAR
    COMMON /SET16 /GAMMA ( 2000 ), ONSET (2000)
    COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)
    COMMON /SET18 /NKS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)
    COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)
    COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),
    * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)
    C....
    C....
    C....
    C....
240
245 PI = 3.14159
    DTR = .01745329
    C
    C
250 READ (5, 20) TITLE
    WRITE (6, 50) TITLE
    IF (EOF(5).NE.0) GO TO 110
    FORMAT (20A*)
    READ (5, 30) ISOLV, LAX, LAY, REXPAX, MAG, FLOATX, FLOATY,
    * ITRMAX
    IF (ITRMAX.EQ. 0) ITRMAX = 99
    IF (REXPAX.LT. 0.01) REXPAX = 0.10
    WRITE (6, 40) ISOLV, LAX, LAY, REXPAX, MAG, FLOATX, FLOATY,
    * ITRMAX
    FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)
    30
    40
    50
    255 FORMAT (1H, 3 (I2, 8X), 4F10.2, 7X, I3)
    FORMAT (1H), 32H***** INPUT DECK *****//1H, 20A*)
    C
    C....
    C....
    C....
260
265 CALL INPUT
    CALL GEOM (ITOTAL)
    C
    60
270 DO 100 IQ = 1, NMACH
    B2 = MACH (IQ) **2 - 1.0
    RETA = SORT (ABS (B2))
    ALFA = 0.0
    ICALL = 0
    IF (FLOATX.NE. 0.0 .OR. MAG.NE. 0.0) ICALL = 1
    IM = ICALL * NKS
    IF (ICALL.EQ. 0) CALL MATRIX (EM, FU, ITOTAL)
    IF (IM.EQ. NKS .AND. IM.GT. 0) CALL SURVEY(EM, EMX, EMY, ITOTAL)
    C
275 DO 90 IH = 1, NALPHA
    ALFA = ALPHA (IH) *DTR
    IF (ICALL.EQ. 1) CALL MATRIX (EM, FU, ITOTAL)
    IF (IM.GT.NKS .AND. NKS.GT. 0) CALL SURVEY(EM, EMX, EMY, ITOTAL)
    NX1 = ITOTAL + 1
    CALL ROUNDY (ITOTAL)
    IF (ISOLV.EQ. 0) CALL GAUSS (ITOTAL, REXPAX, EM, EMX)
    IF (ISOLV.EQ. 1) CALL VECTOR (ITOTAL, NX1, AV, EM, EU, E-X, EMY)
    CALL PRESS (ITOTAL, EU)
    C
280
285

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VORLAX 230
VORLAX 231
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VORLAX 285
VORLAX 286

PROGRAM VORLAX 74/74 OPT=1

```

          CALL AERO (EM, ITOTAL)
          CALL PRINT (ITOTAL, EM, EMX, EMY)
C
          IPASS = 1 - INVERS
          INVERS = 0
          IF (IPASS .EQ. 1) GO TO 90
          DO 70 IRR = 1, ITOTAL
          IDES (IRR) = 0
          GO TO 60
70
C
          80 FORMAT (I11, 20A4)
          90 CONTINUE
C
          100 CONTINUE
C
          GO TO 10
          110 WRITE (6, 80)
          STOP
C
          305 END
          VORLAX 297
          VORLAX 298
          VORLAX 299
          VORLAX 300
          VORLAX 301
          VORLAX 302
          VORLAX 303
          VORLAX 304
          VORLAX 305
          VORLAX 306

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CARD NR. SEVERITY DETAILS DIAGNOSIS OF PROBLEM

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267 I CONTROL VARIABLE IN COMMON OR EQUIVALENCED. OPTIMIZATION MAY BE INHIBITED.
277 I CONTROL VARIABLE IN COMMON OR EQUIVALENCED. OPTIMIZATION MAY BE INHIBITED.

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SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
24531 VORLAX

VARIABLES	SN	TYPE	RELOCATION	ARRAY	SET4	SET6	SET13	SET15	SET19	SET10	SET12	SET17	SET12	SET17	SET12	SET17	SET12	SET17
1440	AINC1	REAL	AINC2	ARRAY	SET4	SET6												
20	ALFA	REAL	ALOC	ARRAY	SET11	SET6												
10	BETA	REAL	AV	ARRAY	SET11	SET6												
1	BETA	REAL	HIG	ARRAY	SET15	SET6												
0	R2	REAL	CHAM	ARRAY	SET15	SET6												
240	CD	REAL	CDC	ARRAY	SET8	SET6												
1	CDTOT	REAL	CHORD	ARRAY	SET12	SET6												
170	CL	REAL	CLTOT	ARRAY	SET8	SET6												
310	CM	REAL	CNTC	ARRAY	SET8	SET6												
2	CDTOT	REAL	CM	ARRAY	SET12	SET6												
144	CNC	REAL	CNTUT	ARRAY	SET9	SET6												
670	CRM	REAL	CKTOT	ARRAY	SET8	SET6												
430	CSTART	REAL	CSUC	ARRAY	SET3	SET6												
0	CA	INTEGER	CY	ARRAY	SET8	SET6												
1010	CYM	REAL	C2	ARRAY	SET8	SET6												
25033	C1	REAL	C2	*UNDEF	*UNDEF	*UNDEF												
0	DCP	REAL	DELTAZ	ARRAY	SET2	SET6												
6	DELTAZ	REAL	DESCRP	ARRAY	SET1A	SET6												

VARIABLES	SN	TYPE	RELOCATION	74/74	OPT=1	FTN 4.5*410A	10/04/76	10.15.13	PAGE	7
144 DL	REAL	ARRAY	SET10	0	0	REAL	SET4	SET4		
620 DNDX2	REAL	ARRAY	SET4	50	50	REAL	ARRAY	ARRAY		
25023 DTR	REAL	ARRAY	SET4	3	3	REAL	ARRAY	ARRAY		
41355 EU	REAL	ARRAY	SET4	25573	25573	REAL	ARRAY	ARRAY		
31513 EWX	REAL	ARRAY	SET4	35434	35434	REAL	ARRAY	ARRAY		
12 FLOATX	REAL	ARRAY	SET4	13	13	REAL	ARRAY	ARRAY		
360 FN	REAL	ARRAY	SET8	500	500	REAL	ARRAY	ARRAY		
0 GAMMA	REAL	ARRAY	SFT16	11	11	REAL	ARRAY	ARRAY		
24 HEAD	REAL	ARRAY	SFT16	25026	25026	REAL	ARRAY	ARRAY		
13560 IDES	INTEGER	ARRAY	SET3	3	3	INTEGER	ARRAY	ARRAY		
25027 IM	INTEGER	ARRAY	SET3	404	404	INTEGER	ARRAY	ARRAY		
14 INVERHS	INTEGER	ARRAY	SET3	1130	1130	INTEGER	ARRAY	ARRAY		
25031 IPASS	INTEGER	ARRAY	SET3	2	2	INTEGER	ARRAY	ARRAY		
360 IOUANT	INTEGER	ARRAY	SET5	25032	25032	INTEGER	ARRAY	ARRAY		
15 ISOLV	INTEGER	ARRAY	SET5	1	1	INTEGER	ARRAY	ARRAY		
25025 ITOTAL	INTEGER	ARRAY	SET5	2	2	INTEGER	ARRAY	ARRAY		
170 ITS	INTEGER	ARRAY	SET5	214	214	INTEGER	ARRAY	ARRAY		
4 LATRALL	INTEGER	ARRAY	SET5	0	0	INTEGER	ARRAY	ARRAY		
1 LAY	INTEGER	ARRAY	SET5	240	240	INTEGER	ARRAY	ARRAY		
0 LIFT	REAL	ARRAY	SET5	0	0	REAL	ARRAY	ARRAY		
120 MOMENT	REAL	ARRAY	SET5	23	23	REAL	ARRAY	ARRAY		
22 NMACH	INTEGER	ARRAY	SET11	0	0	INTEGER	ARRAY	ARRAY		
3 NPANAS	INTEGER	ARRAY	SET11	360	360	INTEGER	ARRAY	ARRAY		
1 NT	INTEGER	ARRAY	SET14	420	420	INTEGER	ARRAY	ARRAY		
0 NXS	INTEGER	ARRAY	SET14	25030	25030	INTEGER	ARRAY	ARRAY		
1 NYS	INTEGER	ARRAY	SET18	2	2	INTEGER	ARRAY	ARRAY		
3720 ONSET	REAL	ARRAY	SET18	170	170	REAL	ARRAY	ARRAY		
25262 PHI	REAL	ARRAY	SET16	50	50	REAL	ARRAY	ARRAY		
25022 PI	REAL	ARRAY	SET16	6	6	REAL	ARRAY	ARRAY		
5 PSI	REAL	ARRAY	SET16	550	550	REAL	ARRAY	ARRAY		
214 RCS	REAL	ARRAY	SET20	25024	25024	REAL	ARRAY	ARRAY		
7640 RFLAG	REAL	ARRAY	SET3	5	5	REAL	ARRAY	ARRAY		
620 RH	REAL	ARRAY	SET8	0	0	REAL	ARRAY	ARRAY		
24 RNMAX	REAL	ARRAY	SET7	25177	25177	REAL	ARRAY	ARRAY		
7 ROLLQ	REAL	ARRAY	SET7	50	50	REAL	ARRAY	ARRAY		
0 SLE1	REAL	ARRAY	SET19	24	24	REAL	ARRAY	ARRAY		
3720 SLOPE	REAL	ARRAY	SET2	2	2	REAL	ARRAY	ARRAY		
310 SPC	REAL	ARRAY	SET2	3	3	REAL	ARRAY	ARRAY		
1130 SURF	REAL	ARRAY	SET17	3720	3720	REAL	ARRAY	ARRAY		
310 SYNTH	REAL	ARRAY	SFT5	500	500	REAL	ARRAY	ARRAY		
0 TITILE	INTEGER	ARRAY	SFT5	454	454	INTEGER	ARRAY	ARRAY		
620 TNT	REAL	ARRAY	SET10	21	21	REAL	ARRAY	ARRAY		
7640 VSP	REAL	ARRAY	SET2	310	310	REAL	ARRAY	ARRAY		
10270 VST	REAL	ARRAY	SET20	4	4	REAL	ARRAY	ARRAY		
0 X	REAL	ARRAY	SET1	25345	25345	REAL	ARRAY	ARRAY		
0 XAPEX	REAL	ARRAY	SET5	3	3	REAL	ARRAY	ARRAY		
7 XS	REAL	ARRAY	SET18	1060	1060	REAL	ARRAY	ARRAY		
764 XTE	REAL	ARRAY	SET10	3720	3720	REAL	ARRAY	ARRAY		
50 YAPEX	REAL	ARRAY	SET5	10	10	REAL	ARRAY	ARRAY		
740 YM	REAL	ARRAY	SET8	3	3	REAL	ARRAY	ARRAY		
430 YY	REAL	ARRAY	SET20	4064	4064	REAL	ARRAY	ARRAY		
120 ZAPEX	REAL	ARRAY	SET5	25427	25427	REAL	ARRAY	ARRAY		
4230 ZC	REAL	ARRAY	SET1	214	214	REAL	ARRAY	ARRAY		
25511 ZC2	REAL	ARRAY	SET1	24	24	REAL	ARRAY	ARRAY		
0 ZLE1	REAL	ARRAY	SET20	4350	4350	REAL	ARRAY	ARRAY		
5 ZNOT	REAL	ARRAY	SET18	7	7	REAL	ARRAY	ARRAY		

PROGRAM VORLAX 74/74 OPT=1

FILE NAMES MODE
 0 INPUT 2041 OUTPUT 20410 TAPE11
 22451 TAPE12 6143 TAPE2 12245 TAPE4
 0 TAPES 2041 TAPE6 FMT 16347 TAPE9

EXTERNALS TYPE ARGS
 AERO REAL 2
 EOF REAL 1
 GEOM REAL 1
 MATRIX REAL 3
 PRINT REAL 4
 SURVEY REAL 4

INLINE FUNCTIONS TYPE ARGS
 ABS REAL 1
 INTRIN REAL 1

STATEMENT LABELS
 24535 10 FMT 24737 20 FMT 24770 30 FMT
 24774 40 FMT 25000 50 FMT 24560 60 FMT
 0 70 FMT 25006 80 FMT 24652 90 FMT
 0 100 FMT 24660 110 FMT

LOOPS LABEL INDEX FROM-TO LENGTH PROPERTIES EXITS NOT INNER
 24561 100 * IO 267 299 768 FXT REFS NOT INNER
 24605 90 * IH 277 297 508 FXT REFS NOT INNER
 24646 70 IRR 292 293 2H INSTACK

COMMON BLOCKS LENGTH
 / 14
 SET1 2250
 SET2 6000
 SET3 8000
 SET4 840
 SET5 440
 SET6 2220
 SET7 240
 SET8 640
 SET9 200
 SET10 700
 SET11 20
 SET12 7
 SET13 6
 SET14 4
 SET15 5
 SET16 4000
 SET17 240
 SET18 27
 SET19 240
 SET20 6280

STATISTICS
 PROGRAM LENGTH 245168 10574
 BUFFER LENGTH 245138 10571
 CM LABELED COMMON LENGTH 771478 12359
 CM BLANK COMMON LENGTH 168 14

```

1 CONTROL*VRLX,AERO
C... SUBROUTINE AERO (EW, ITOTAL)
C...
5 C...PURPOSE TO COMPUTE FORCE AND MOMENT DATA BY INTEGRATION OF
C... PRESSURE DISTRIBUTION DATA AND BY TAKING INTO ACCOUNT
C... EDGE SUCTION FORCES.
C...
10 C...INPUT CALLING SEQUENCES
C... EW = NORMALWASH AT LEADING EDGE INFLUENCE COEFFICIENT
C... MATRIX (RETRIEVED ROW BY ROW FROM UNIT 9).
C... COMMONS
C... X, Y, Z, H2, DL, SX, YY, ZZ, DCP, JTS, LAX, PSI,
C... SPC, VSS, VSI, XTE, ALFA, MACF, NPAR, NVOR, SREF,
C... VINF, XBAR, YAWQ, ZBAR, ZETA, CHORD, GAMMA, LESWP,
C... PSPAN, RNMAX, ROLLU, SLOPE, TAPPR, CSTART, IQUANT,
C... LAIRAL, NPNAS, PITCHQ.
C...
20 C...OUTPUT CALLING SEQUENCES
C... NONE.
C... COMMON<
C... CRM, CYM, CMTIC, CSUC, DRAG, LIFT, SURF, XSUC,
C... CDTOT, CLTOT, CMTOT, CNTOT, CRTOT, CYTOT, MOMENT.
C...
25 C...SUBROUTINES NONE.
C...CALLED
C...
30 C...DISCUSSION SUBROUTINE AERO COMPUTES THE AERODYNAMIC FORCE AND
C... MOMENT COEFFICIENTS BY INTEGRATING THE PRESSURE AND
C... DISTRIBUTION AND COMPUTING THE LEADING EDGE SUCTION
C... FORCES IN ACCORDANCE WITH LANP'S PROCEDURE. THERE ARE
C... THREE CLASSES OF COEFFICIENTS AS FOLLOWS (1) TOTAL
C... CONFIGURATION COEFFICIENTS, (2) PANEL COEFFICIENTS,
C... AND (3) STRIPWISE OR CHORDWISE COEFFICIENTS. ALL
C... TOTAL COEFFICIENTS ARE REFERENCED TO WIND AXES. CLASS
C... (2) AND (3) COEFFICIENTS ARE REFERENCED EITHER TO BODY
C... OR TO WIND AXES AS REQUIRED BY THE CORRESPONDING COEFF.
C... DEFINITION. AERO SUBROUTINE IS CALLED BY MAIN FOR EVERY
C... ANGLE OF ATTACK AND MACH NUMBER COMBINATION.
C...
40 C...
C...
45 DIMENSION EW (ITOTAL)
C... COMMON LAX, LAY, I0, IH, LAIRAL, PSI, PITCHQ, ROLLU, YAWQ, HAG,
C... * FLOATX, FLOATY, INVERS
C... COMMON /SET1 /X (2000), Y (1000), Z (1000), ZC (50)
C... COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
C... COMMON /SET3 /CX (2000), SX (2000), HFLAG (2000), IDES (2000)
C... COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPFX (40), PDL (40),
C... * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPPR (40),
C... * PSPAN (40), NVOR (40)
C... COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)
C... COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),
C... * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),
C... * RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SURF (40)
C... COMMON /SET9 /CDC (100), CNC (100)

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COMMON /SET10 /CHORD (100), DL (100), V-S (100), TNL (100),
* TNT (100), ATE (100), IPAN (100)
COMMON /SET11 /MACH (8), ALPHA (H), ALFA, VINFL, NMACH, NALPHA
COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT
COMMON /SET13 /RIG, ITER, ITMAX, EPS, *SPAN, RLM
COMMON /SET14 /NPAN, NI, SMAX, NPNAS
COMMON /SET15 /R2, BETA, CHAR, XBAR, ZBAR
COMMON /SET16 /GAMMA ( 2000 ), ONSSET (2000)
COMMON /SET17 /CSUC (100), CMC (100), SPC (40)
COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)
COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMFD (100), RCS (100),
* NPP (20), INTRAC (20), YY (2000), ZZ (2000), VSR (2000)

C
REAL MACH, NVOR, LIFT, MOMENT, LFSWP
INTEGER CX, SX
PI = 3.14159
DTR = 0.01745329

C
PSIRAD = PSI *DTR
FLAX = LAX

C
C...UNIT 9 CONTAINS THE LEADING EDGE NORMAL WASH INFLUENCE COEFFICIENT
C...MATRIX AS COMPUTED IN SUBROUTINE MATRIX. MATRIX STORED BY ROWS.
C
REWIND 9

C
C...ALFA = ANGLE OF ATTACK IN RADIAN.
C...PSIRAD = ANGLE OF YAW IN RADIAN.
C
SINALF = SIN (ALFA)
COSALF = COS (ALFA)
SINPSI = SIN (PSIRAD)
COSPSI = COS (PSIRAD)
COSIN = COSALF *SINPSI *2.0
COSINP = COSALF *SINPSI
COSCOS = COSALF *COSPSI
PITCH = DTR *PITCHQ /VINFL
ROLL = DTR *HOLLO /VINFL
YAW = DTR *YAWQ /VINFL

C
C...LIFT = PANEL LIFT PER UNIT Q
C...DRAG = PANEL DRAG PER UNIT Q
C...XSUC = PANEL LEADING EDGE THRUST PER UNIT Q
C...MOMENT = PANEL PITCHING MOMENT ABOUT REF. CFNTEM PER UNIT Q
C...FN = PANEL NORMAL FORCE PER UNIT Q
C...FY = PANEL SIDE FORCE PER UNIT Q
C...FM = PANEL ROLLING MOMENT PER UNIT Q
C...YM = PANEL YAWING MOMENT PER UNIT Q
C...ALL ABOVE PANEL FORCES ARE REFERENCED TO *IND AXES EXCEPT FOR FN
C...WHICH IS IN BODY AXES.
C
C...INITIALIZE PANEL FORCE ARRAYS
C
DU 10 IX = 1, NPNAS
LIFT (IX) = 0.
DRAG (IX) = 0.
XSUC (IX) = 0.

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115      MOMENT (IX) = 0.
        FN (IX) = 0.
        FY (IX) = 0.
        RM (IX) = 0.
        YM (IX) = 0.
120      10 CONTINUE
        C
        C
        C...HORSESHOE VORTEX STREAMWISE STRIPS ARE IDENTIFIED BY
        C...A SPANWISE OR LATERAL INDEX, IR, EACH HORSESHOE VORTEX IS
        C...IDENTIFIED BY AN ELEMENT INDEX, IRT. EACH MAJOR PANEL IS
        C...WHEN I = IX THEN INPUT HALF OF CONFIGURATION IS BEING DEALT WITH.
        C...WHEN I = IX THEN MIRRORED (ABOUT X-7 PLANE) COMPONENTS ARE BEING
        C...CONSIDERED. I AND IX ARE DIFFERENT ONLY FOR ASYMMETRICAL
        C...CONFIGURATIONS AND/OR FLIGHT CONDITIONS. ICYCLE IS AN AUXILIARY
        C...INDEX ICYCLE = 1 FOR IX = I; ICYCLE = 2 FOR IX = 6T. I.
        C....
        C....
        C...INITIALIZE INDICES<
        C....
        IRT = 0
        IR = 0
        I = 1
        IX = 0
        ICYCLF = 1
140      20  IX = IX + 1
        C....
        C...COMPUTE PANEL REFERENCE AREA, TANGENT OF LEADING EDGE SWEEP (TLE),
        C...TANGENT OF TRAILING EDGE SWEEP (TTE), AND THE PRINCIPAL PART
        C...PARAMETER (STB).
        C....
        SURF (IX) = CSTART (I) * (1. + TAPER (I)) / 2. * PSPAN (I)
        TEPAR = 2. * SURF (IX) / PSPAN (I) **2
        TEPAR = TEPAR * (1. - TAPER (I)) / (1. + TAPER (I))
        NV = NVOR (I)
        TLE = TAN (DTR * LESWP (I))
        TTE = TLE - TEPAR
        IF (ICYCLE .EQ. 2) TLE = - TLE
        IF (ICYCLE .EQ. 2) TTE = - TTE
        T2 = TLE **2
        STB = 0.0
        IF (82 .LT. I2) STB = SMT (I2 - 82)
        C
        C...THERE ARE NV STREAMWISE STRIPS OF HORSESHOE VORTICES FOR THE
        C...PANEL (IX) UNDER CONSIDERATION. THE DO-LOOP ENDED BY LABEL 110
        C...COMPUTES THE FORCE AND MOMENT CONTRIBUTION OF EACH STRIP AND
        C...THEN PERFORMS THE CORRESPONDING SUMMATIONS TO OBTAIN THE
        C...INTEGRATED PANEL FORCES AND MOMENTS (PER UNIT U).
        C....
        DO 110 J = 1, NV
            IR = IR + 1
        C....
        C...DL IS THE DIRMEDRAL ANGLE (WITH RESPECT TO THE X-Y PLANE) OF
        C...THE IR STREAMWISE STRIP OF HORSESHOE VORTICES.
        C....
        SID = SIN (DTR * DL (IR))

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175 C... COD = COS (DIR *DL (IR))
C... STRIPWISE PARAMETERS OR COEFFICIENTS<
C...CNC = NORMAL (TO LOCAL CHORDLINE) FORCE COEFF. TIMES LOCAL
C... CHORD LENGTH<
C...CDC = DRAG COEFF. (WIND AXES) TIMES LOCAL CHORD LENGTH<
C...CSUC = LEADING EDGE THRUST COEFF. MEASURED IN A PLANE
C... PARALLEL TO THE X-X AXIS AND ALONG THE TANGENT
C... TO THE CAMBER LINE IN SAME PLANE<
C...CMTIC = PITCHING MOMENT (BODY AXES) ABOUT LOCAL QUARTEK CHORD
C... TIMES LOCAL CHORD LENGTH<
C... INITIALIZE COEFFICIENTS<
C...
C...
180 CNC (IR) = 0.
CDC (IR) = 0.0
CSUC (IR) = 0.
CMTIC (IR) = 0.0
C
MAX = RNMAX (IR)
PION = (PI *(1.0 - FLAX) + 2.0 *FLAX) /RMAX (IR)
ADC = 0.5 *PION
IF (JTS (IR) .GT. 0) ADC = - 0.5 *PION
C...XLE = LOCATION OF FIRST VORTEX MIDPOINT IN FRACTION OF CHORD.
C... XLE=.5 *(1.0 - COS (.5 *PION)) *(1.0 - FLAX) + 0.125 *PION *FLAX
C...
C...
200 C...BMLE = PITCHING MOMENT ABOUT FIRST VORTEX MIDPOINT IN BODY AXFS.
C...CAXL = AXIAL (X-AXIS) FORCE COEFFICIENT.
C...SICPLE = COUPLE (ABOUT STRIP CENTERLINE) DUE TO SIDESLIP.
C...
C...
205 BMLE = 0.
CAXL = 0.0
SICPLE = 0.0
C
RJTS = JTS (IR)
GAF = 0.5 + 0.5 *RJTS **2
C
C...THE DO-LOOP ENDED BY LABEL 60 PERFORMS PRESSURE COEFF.
C... INTEGRATIONS ALONG THE STRIP TO OBTAIN CNC (PRESENTLY TREATED
C...AS CN). CAXL, BMLF, AND SICPLE.
C...
215 DO 60 K = 1, MAX
IRT = IRT + 1
RK = K
C...
C...FORMED IS LENGTH OF STRIP CENTERLINE HEIGHTEN LOAD POINT
C...AND TRAILING EDGE< THIS PARAMETER IS USED IN THE COMPUTATION
C...OF THE STRIP ROLLING COUPLE CONTRIBUTION DUE TO SIDESLIP.
C...
220 CURMED = XTE (IH) - X (IRT)
C...
C...SINIF REFERENCES THE LOAD CONTRIBUTION OF INT-VORTEX TO THE
C...STRIP NOMINAL AREA, I.E., AREA OF STRIP ASSUMING CONSTANT

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230 C....(CHORDWISE) HORSESHOE SPAN.
C....
      SINP = (FLAX + (1.0 - FLAX) * SIN (IRK - .5) * PIUN)) * ADC
      *DCP (IRT) *VST (IRT) /VSS (IR)
      CNC (IR) = CNC (IR) + SINP
      SICPLE = SICPLE + SINP *CURNED
235 C....COMPUTE SLOPE (TX) WITH RESPECT TO X-AXIS AT LOAD POINTS HY INTER
C....POLATING BETWEEN CONTROL POINTS AND) TAKING INTO ACCOUNT THE LOCAL
C....INCIDENCE.
C....
      XX = .5 *(1. - COS (IRK - .5) *PIUN))
      XX = XX *(1.0 - FLAX) + (RK - .75) *PIUN /2.0 *FLAX
      IF (K .GT.1) GO TO 30
      KX = K
      IRTX = IRT
      GO TO 40
      KX = K - 1
      IRTX = IRT - 1
      RKX = KX
240 X1 = .5 *(1. - COS (RKX *PIUN))
      X1 = X1 *(1.0 - FLAX) + (RKX - .25) *PIUN /2.0 *FLAX
      X2 = .5 *(1. - COS (RKX + 1.) *PIUN))
      X2 = X2 *(1.0 - FLAX) + (RKX + .75) *PIUN /2.0 *FLAX
      F1 = SLOPE (IRTX)
      F2 = SLOPE (IRTX + 1)
      TANX = (X1 - X2) / (X1 - X2) *F1 + (X2 - X1) / (X2 - X1) *F2
      TX = TANX - ZETA (IR)
      CAXL = CAXL - SI-F *TX / (1.0 + TX **2)
      BMLE = BMLE + (XLE - XX) *SINF
      CONTINUE
245 C
      SICPLE = - SICPLE *COSIN *COD *GAF
C
C....
C....IRTL = VALUE OF IPT INDEX FOR FIRST (ALONG CHORD) HORSESHOF
C....VORTEX. I.E., LEADING EDGE ELEMENT.
250 C....
      IRTL = IRT - MAX + 1
C....
C....
C....COMPUTE LEADING EDGE THRUST COEFF. (CSUC) BY CALCULATING
C....THE TOTAL INDUCED FLOW AT THE LEADING EDGE. THIS COMPUTATION
C....ONLY PERFORMED FOR COSINE CHORDWISE SPACING (LAX = 0).
C....
      CLE = 0.0
      IF (LAX .EQ. 1) GO TO 90
      READ (9) EM
      DO 70 II = 1, IRTOTAL
      CLE = CLE + EM (II) *GAMMA (II)
      70 CONTINUE
255 C
C....XGIRO, YGIRO, ZGIRO ARE THE COORDINATES OF THE STRIP LEADING EDGE
C....MIDPOINT WITH RESPECT TO THE POINT OF AIRCRAFT ROTATION (IF ANY).

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C....
      XGIRO = X (IRTLF) - CHORD (IR) *XLF - XHAP
      YGIRO = YY (IRTLF)
      ZGIRO = ZZ (IRTLF) - ZBAK
290 C... VX, VY, VZ ARE THE FLOW ONSET VELOCITY COMPONENTS AT THE LEADING
C... EDGE (STRIP MIDPOINT). VX, VY, VZ AND THE ROTATION RATES ANF
C... REFERENCED TO THE FREE STREAM VELOCITY.
C....
      VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO
      VY = COSINP - YAW *XGIRO + ROLL *ZGIRO
      VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO
300 C... CCNTL AND SCNTL ARE DIRECTION COSINE PARAMETERS OF TANGENT TO
C... CAMBERLINE AT LEADING EDGE.
C....
      CCNTL = 1. /SQRT (1.0 + SLE (IR) **2)
      SCNTL = SLE (IR) *CCNTL
305 C... EFFINC = COMPONENT OF ONSET FLOW ALONG NORMAL TO CAMBERLINE AT
C... LEADING EDGE.
C....
      EFFINC = VX *SCNTL + VY *CCNTL *SIN - VZ *CCNTL *COS
      CLE = CLE - EFFINC
      IF (STR .GT. 0.0) CLE = CLE /RMAX (IR) /STR
310 80 XA = XLE
90 CLE = CLE + 0.5 *DCP (IRTLF) *SORT (XX) *FLAX
      CSUC (IR) = 0.5 *PI *ABS (SPC (I)) *CLE **2 *STH
315 C... END OF L.O.E. THRUST COEFF. (CSUC) COMPUTATION FOR STRIP IR.
C....
C... ORIENT L.O.E. THRUST VECTOR ACCORDING TO SIGN OF SPC PARAMETERS
C... IF SPC % 0 THEN L.O.F. THRUST VECTOR IS TANGENTIAL TO CAMBER
C... SURFACE OTHERWISE IT IS NORMAL TO IT. IF THE FIRST ELEMENT
C... CARRIES A POSITIVE LOAD THEN THE THRUST VECTOR IS NORMAL TO THE
C... CAMBER SURFACE ALONG THE POSITIVE NORMAL DIRECTION OTHERWISE
C... IT IS ALONG THE NEGATIVE NORMAL (THE PARAMETER FKEY DETER-
C... MINES THIS DIRECTION ≤ FKEY = 0, POSITIVE NORMAL +
C... FKEY = -1, NEGATIVE NORMAL).
C... TFX AND TFZ ARE THE COMPONENTS OF LEADING EDGE FORCE VECTOR ALONG
C... ALONG THE X AND Z BODY AXES.
C....
      FKEY = 1 - JFS (IR) *(1 + JFS (IR))
      XCOS = 1.0 /SORT (1.0 + (SLE (IR) - ZETA (IR)) **2)
      XSIN = (SLE (IR) - ZETA (IR)) *XCOS
      TFX = XCOS
      IF (SPC (I) .LT. 0) TFX = XSIN *SIGN (1.0, DCP (IRTLF)) *FKEY
      CAAL = CAAL - TFX *CSUC (IR)
      TFZ = -XSIN
      IF (SPC (I) .LT. 0) TFZ = SIGN (XCOS, DCP (IRTLF)) *FKEY
      CNC (IR) = CNC (IR) + CSUC (IR) *SORT (1.0 + T2) *TFZ
335 C... FCO5 AND FSIN ARE THE COSINE AND SINE OF THE ANGLE BETWEEN
C... THE CHORDLINE OF THE IR-STRIP AND THE X-AXIS
C....
      100 FCO5 = 1. /SQRT (1. + ZETA (IR) *ZETA (IR))

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345 C....
      FSN = FCOS *ZETA (IR)
      C...BFX, RFY, AND RFZ ARE THE COMPONENTS ALONG THE BODY AXES
      C...OF THE STRIP FORCE CONTRIBUTION.
      C....
      BFX = - CNC (IR) *FSIN + CAXL *FCOS
      RFY = - (CNC (IR) *FCOS + CAXL *FSIN) *SIN
      RFZ = (CNC (IR) *FCOS + CAXL *FSIN) *COS
350 C....CONVERT CNC FROM CN INTO CNC (COEFF. *CHORD).
      C....
      CNC (IR) = CNC (IR) *CHORD (IR)
      RMLE = RMLE *CHORD (IR)
355 C....
      C...BMX, BMY, AND BMZ ARE THE COMPONENTS ALONG THE BODY AXES
      C...OF THE STRIP MOMENT (ABOUT MOM. REF. POINT) CONTRIBUTION.
      C....
      BMX = RFZ *Y (IR) - RFY *Z (IR) - ZRMR
      BMY = BMX + SICPIE
      BMZ = RMLE *COD + RFX * Z (IR) - ZRMR - HFZ * (X (IR) * (IR) - XHAR)
360 C....
      CDC (IR) = RFZ *SINALE + (RFX *COPSI + HFY *SINPSI) *COSALF
      CMC (IR) = RMLE + CNC (IR) * (0.25 - XLE)
      C
365 C
      ES = 2.0 *VSS (IR)
      STRIP = ES *CHORD (IR)
      LIFT (IX) = (BFZ *COSALF - (BFX *COPSI + RFY *SINPSI) *SINALF)
      *STRIP + LIFT (IX)
      DRAG (IX) = CDC (IR) *ES + DRAG (IX)
      FY (IX) = (BFX *COPSI - BFX *SINPSI) *SIRTP + FY (IX)
370 C
      FN (IX) = FN (IX) + CNC (IR) *ES
      C
375 C
      MOMENT (IX) = MOMENT (IX) + STRIP *(BMY *COPSI - BMX *SINPSI)
      RM (IX) = RM (IX) + STRIP *(BMX *COSALF *COPSI + BMY *COSALF
      *SINPSI + BMZ *SINALF)
      YH (IX) = YH (IX) + STRIP *(BMZ *COSALF - (BMX *COPSI + BMY
      *SINPSI) *SINALF)
      XSUC (IX) = XSUC (IX) + CSUC (IR) *STRIP /SURF (IX)
380 C
      C 110 CONTINUE
      C
385 C
      IF (ICYCLE .EQ. ?) GO TO 130
      I = I + 1
390 120 IF (I - NPLAN) 20, 20, 120
      IF (LATERAL .EQ. 0) GO TO 140
      ICYCLE = 2
      I = 0
      I = I + 1
395 130 IF (I .GT. NPLAN) GO TO 140
      IF (IQUNANT (I) .EQ. 1) GO TO 130
      GO TO 20
      C
      C....INITIALIZE TOTAL FORCE AND MOMENT COEFFICIENTS.
      C

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 VORLAX 704
 VORLAX 705

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400          140  CLTOT = 0.
              CDTOT = 0.0
              CMTOT = 0.0
              CYTOT = 0.0
              CRTOT = 0.0
              CNTOT = 0.0

405          C....THE PARAMETERS AX AND AY INTRODUCE THE PROPER REFERENCE AREA
              C....AND DETERMINE WHETHER A PANEL CONTRIBUTION HAS TO BE DUPLICA
              C....TED (SYMMETRICAL CASE) OR NOT.
              C....
              AX = 1.0 /SREF
              IF (LATRAL.EQ. 0) AX = 2.0 *AX
              AY = 1.0 /SREF
              IF (LATRAL.EQ. 0) AY = 0.0

415          C....THE DO-LOOP ENDED BY LABEL 150 COMPUTES PANEL AND TOTAL
              C....FORCE AND MOMENT COEFFICIENTS. MOMENT COEFFICIENTS ARE NOT
              C....DIMENSIONLESS YET THEY STILL CARRY A LENGTH DIMENSION.
              C....
              DO 150 IX = 1, NPNAS
                CL (IX) = LIFT (IX) /SURF (IX)
                CD (IX) = DRAG (IX) /SURF (IX)
                CM (IX) = MOMENT (IX) /SURF (IX)
                CN (IX) = FN (IX) /SURF (IX)
                CY (IX) = FY (IX) /SURF (IX)
                CRM (IX) = RM (IX) /SURF (IX)
                CYM (IX) = YM (IX) /SURF (IX)
                CLTOT = CLTOT + LIFT (IX) *AX
                CDTOT = CDTOT + DRAG (IX) *AX
                CMTOT = CMTOT + MOMENT (IX) *AX
                CYTOT = CYTOT + FY (IX) *AY
                CRTOT = CRTOT + RM (IX) *AY
                CNTOT = CNTOT + YM (IX) *AY
              150 CONTINUE
              C
435          C REWIND 9
              C
              C RETURN
440          END

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VORLAX 706
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 VORLAX 746

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 AERO

VARIABLES	SN	TYPE	RELOCATION	20	ALFA	REAL
732 ADC		REAL		1012	AX	REAL
10 ALPHA		REAL	ARRAY SET11	1	HETA	REAL
1002 BFX		REAL		1003	RFY	REAL
1004 BFZ		REAL		0	RIG	REAL
						SET11
						SET15
						SET13

VARIABLES SN TYPE RELOCATION

VARIABLES	SN	TYPE	RELOCATION
734	BMLE	REAL	
1006	RMV	REAL	
0	B2	REAL	SET15
2	CHAR	REAL	SET15
240	CD	REAL	ARRAY SET8
1	CDTOT	REAL	ARRAY SET12
170	CL	REAL	ARRAY SET8
0	CLTOT	REAL	ARRAY SET12
144	CMTC	REAL	ARRAY SET8
430	CN	REAL	ARRAY SET8
6	CNTOT	REAL	ARRAY SET12
703	COPSI	REAL	
701	COSALF	REAL	
704	COSIN	REAL	
670	CPM	REAL	
430	CSTART	REAL	ARRAY SET8
0	CX	INTEGER	ARRAY SET8
1010	CYM	REAL	
0	DCP	REAL	
50	DRAG	REAL	
772	EFFINC	REAL	
1010	FS	REAL	
1000	FCOS	REAL	
677	FLAX	REAL	
13	FLOATY	REAL	
1001	FSIN	REAL	
753	F1	REAL	
740	GAF	REAL	
11	HAG	REAL	
716	ICYCLE	INTEGER	
3	IH	INTEGER	
404	INTRAC	INTEGER	ARRAY SET20
1130	IPAN	INTEGER	ARRAY SET10
360	IQUANT	INTEGER	ARRAY SET5
713	IRT	INTEGER	
747	IRTX	INTEGER	
0	ITOTAL	INTEGER	
170	ITS	INTEGER	F.P. SET7
725	J	INTEGER	
741	K	INTEGER	
4	LATRAL	INTEGER	
1	LAY	INTEGER	
0	LIFT	REAL	
730	MAX	INTEGER	ARRAY SET8
23	NALPHA	INTEGER	
0	NPAN	INTEGER	SET11
360	NPP	INTEGER	SET14
720	NV	INTEGER	SET20
3720	ONSET	REAL	
50	PHIMED	REAL	ARRAY SET16
731	PION	REAL	ARRAY SET20
6	PITCHQ	REAL	
676	PSIRAD	REAL	
214	RCS	REAL	ARRAY SET20
730	RJTS	REAL	
757	RKX	REAL	
620	RM	REAL	ARRAY SET8
1005	RMX	REAL	
1007	RMZ	REAL	
735	CAXL	REAL	
770	CNTL	REAL	
0	CJC	REAL	ARRAY SET9
0	CHORD	REAL	ARRAY SET10
740	CLE	REAL	
310	CM	REAL	ARRAY SET8
2	CMTOT	REAL	ARRAY SET12
144	CNC	REAL	ARRAY SET9
727	COD	REAL	
743	CORMEDJ	REAL	
706	COSCOS	REAL	
715	COSINP	REAL	
5	CKTOT	REAL	
0	CSUC	REAL	ARRAY SET12
550	CY	REAL	ARRAY SET17
4	CYTOT	REAL	ARRAY SET8
144	DL	REAL	ARRAY SET12
675	DTR	REAL	ARRAY SET10
3	FPS	REAL	ARRAY SET13
0	EW	REAL	F.P. SET3
773	FKEY	REAL	
12	FLOATX	REAL	
360	FN	REAL	
500	FY	REAL	ARRAY SET8
754	F2	REAL	ARRAY SET8
0	GAMMA	REAL	ARRAY SET16
715	I	INTEGER	
13560	IDFS	INTEGER	ARRAY SET3
761	II	INTEGER	
14	INVERS	INTEGER	
2	IQ	INTEGER	
714	IR	INTEGER	
757	IRLE	INTEGER	
1	ITER	INTEGER	SET13
2	ITRMAX	INTEGER	SET13
712	IX	INTEGER	
214	JTS	INTEGER	ARRAY SET7
746	KX	INTEGER	
0	LAX	INTEGER	
240	LESMP	REAL	
0	MACH	REAL	ARRAY SET5
120	MOMENT	REAL	ARRAY SET11
22	NMACH	REAL	ARRAY SET8
3	NPANAS	INTEGER	ARRAY SET11
1	NT	INTEGER	SET14
620	NVOR	REAL	SET14
170	PDL	REAL	ARRAY SET5
674	PI	REAL	ARRAY SET5
707	PITCH	REAL	
5	PSI	REAL	
550	PSPAN	REAL	
7640	RFLAG	REAL	
742	RK	REAL	
5	RLM	REAL	
0	RNCV	REAL	ARRAY SET17

VARIABLES	SN	TYPE	RELOCATION	710	ROLL	REAL
24	RNMAX	REAL	SET7 / /	771	SCNTL	REAL
7	ROLLQ	REAL		776	SID	REAL
736	SICPLE	REAL		744	SINF	REAL
700	SINALF	REAL		50	SLE	REAL
702	SINPSI	REAL		24	SLE2	REAL
0	SLE1	REAL	SET19	2	SMAX	REAL
3720	SLOPE	REAL	SET2	3	SREF	REAL
310	SPC	REAL	SET17	1011	STRIP	REAL
724	STB	REAL		3720	SX	INIFGFR
1130	SURF	REAL	SET8	755	TANX	REAL
310	SYNTH	REAL	SET5	717	TEPAR	REAL
500	TAPER	REAL	SET5	777	TFZ	REAL
776	TFX	REAL		454	TNL	REAL
721	TLE	REAL	SET10	722	TIE	REAL
620	TNT	REAL		723	T2	REAL
756	TX	REAL		7640	VSP	REAL
21	VINF	REAL	SET11	10270	VST	REAL
310	VSS	REAL	SET10	766	VY	REAL
765	VX	REAL		4	WSPAN	REAL
767	VZ	REAL		0	XAPEX	REAL
0	X	REAL	SET1	774	XCOS	REAL
3	XBAR	REAL	SET15	733	XLE	REAL
762	XGIRO	REAL		1060	XSUC	REAL
775	XGIN	REAL		745	XX	REAL
764	XTE	REAL	SET10	752	X2	REAL
751	X1	REAL		50	YAPEX	REAL
3720	Y	REAL	SET1	10	YAW3	REAL
711	YAW	REAL		740	YM	REAL
763	YGIRO	REAL		4064	Z	REAL
430	YY	REAL	SET20	4	ZBAR	REAL
120	ZAPEX	REAL	SET5	214	ZETA	REAL
4230	ZC	REAL	SET1	0	ZLE1	REAL
764	ZGIRO	REAL		4350	ZZ	REAL
24	ZLE2	REAL	SET20			

FILE NAMES MODE UNFMT
TAPE9

EXTERNALS	TYPE	ARGS	LIBRARY	LIBRARY	LIBRARY
COS	REAL	1	LIBRARY	LIBRARY	LIBRARY
SORT	REAL	1	LIBRARY	LIBRARY	LIBRARY

INLINE FUNCTIONS	TYPE	ARGS	INTRIN	INTRIN	INTRIN
ABS	REAL	1	INTRIN	INTRIN	INTRIN

STATEMENT LABELS	62	20	221	30
0	10	0	0	60
225	40	0	364	90
0	70	0	0	120
572	100	577	0	150
572	130			

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
50	10	IX	111 120	6H	INSTACK
116	110	* J	165 384	445H	EXT REFS NOT INNER
157	60	* K	217 259	115H	FAT REFS
314	70	II	280 282	4H	INSTACK

INACTIVE

PROPERTY'S
OPT

OPT=1

74/74

SUBROUTINE AERO

LOOPS	LABEL	INDEX	LENGTH	FROM-TO	LENGTH
615	150	IX	334	420 434	334
COMMON BLOCKS					
	/	LENGTH			
	SET1	13			
	SET2	2250			
	SET3	6000			
	SET4	8000			
	SET5	440			
	SET7	240			
	SET8	640			
	SET9	200			
	SET10	700			
	SET11	20			
	SET12	7			
	SET13	6			
	SET14	4			
	SET15	5			
	SET16	4000			
	SET17	240			
	SET19	240			
	SET20	6280			

STATISTICS

PROGRAM LENGTH	10228	530
CM LABELED COMMON LENGTH	711308	29272
CM BLANK COMMON LENGTH	158	13


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1 CONTROL*VRLX.BOUNDY
C.... SUBROUTINE BOUNDY (ITOTAL)
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5 C.... PURPOSE
C.... TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO
C.... THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON-
C.... TROL POINTS.
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10 C.... INPUT
C.... CALLING SEQUENCE <
C.... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C.... COMMON <
C.... ALFA, PSI, VINFL, PITCHQ, ROLLG, YAWU, LAX, MNMAX,
C.... SX, CX, X, YY, ZZ, DL, CHORD, KHAR, ZBAR, SLOPE,
C.... KFLAG.
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15 C.... OUTPUT
C.... COMMON <
C.... ALUC, ONSET.
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20 C.... SUBROUTINES
C.... CALLED NONE.
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25 C.... DISCUSSION
C.... THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY
C.... AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED
C.... BY PROJECTING THE PREF-STREAM VELOCITY VECTOR
C.... ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT
C.... A RIGID BODY ROTATION ABOUT THE POINT (KHAR, 0,
C.... ZBAR). THE ONSET FLOW NORMAL COMPONENT IS ALUC,
C.... ONSET DEFINES THE RIGID BODY ROTATION INDUCED
C.... VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY
C.... ALUC AND ONSET, ARE DIMENSIONLESS, I.E., THEY ARE
C.... REFERENCED TO THE PREF-STREAM VELOCITY.
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30 C.... COMMON LAX, LAY, IQ, IH, LATHAL, PSI, PITCHQ, WOLLO, YAWU, HAG,
C.... FLOATX, FLOATY, INVERS
C.... COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)
C.... COMMON /SET2 /DCP (2000), SLOPF (2000), VSP (2000)
C.... COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
C.... COMMON /SET6 /TITLE (20), HEAD (200), ALUC (2000)
C.... COMMON /SET7 /RNCV (20), MNMAX (100), IIS (20), JIS (100)
C.... COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
C.... INT (100), XTE (100), IPAN (100)
C.... COMMON /SET11 /MACH (R), ALPHA (R), ALFA, VINFL, NMACH, NAIPHA
C.... COMMON /SET13 /RIG, ITER, ITRMAX, FPS, *SPAN, KLM
C.... COMMON /SET15 /RP, BETA, CHAR, XRAJ, ZH4J
C.... COMMON /SET16 /GAMMA (2000) * OUSSET (2000)
C.... COMMON /SET20 /ZIE1 (20), ZLE2 (20), PHIMED (100), RCS (100)
C.... * NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST (2000)
C.... INTEGER CX, SX
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35 C.... PI = 3.14159
C.... DTR = 0.01745329
C.... PITCH = DTR * PITCHQ / VINFL
C.... ROLL = DTR * WOLLO / VINFL
C.... YAW = DTR * YAWU / VINFL
C.... PSINAD = DTR * PSI
C.... SINLAF = SIN (ALFA)
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60      COSIN = COS (ALFA) *SIN (PSIRAD)
        COSCOS = COS (ALFA) *COS (PSIRAD)
        FLAX = LAX
        C
        DO 10 IR = 1, ITOTAL
        C.... LOCATE VORTEX LATTICE CONTROL POINT WITH RESPECT TO THE
        C.... ROTATION CENTER (XRAR, 0, ZBAR). THE RELATIVE COORDINATES
        C.... ARE XGIRO, YGIRO, AND ZGIRO.
        C....
        PION = PI /RMAX (SX (IR))
        RCX = CX (IR)
        RSX = SX (IR)
        DELTAX = 0.5 * (COS (RCX - .5) *PION) - COS (RCX *PION)
        DELTAX = DELTAX * (1. - FLAX) + 0.5/RMAX (SX (IR)) *FLAX
        XGIRO = X (IR) + CHORD (SX (IR)) *DELTAX - XRAR
        YGIRO = Y (IR)
        ZGIRO = Z (IR) - ZBAR
        C
        C.... COMPUTE ONSET FLOW (FREE-STREAM + RIGID BODY ROTATION)
        C.... VELOCITY COMPONENTS ALONG BODY AXES, VX, VY, AND VZ.
        C....
        VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO
        VY = COSIN - YAW *XGIRO + ROLL *ZGIRO
        VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO
        C
        C.... COMPUTE DIRECTION COSINES.
        C
        SCNTL = SLOPE (IR) /SQRT (1. + SLOPF (IR) **2)
        CCNTL = SQRT (1.0 - SCNTL **2)
        COD = COS (DTR *DL (SX (IR)))
        SID = SIN (DTR *DL (SX (IR)))
        C
        C.... COMPUTE ONSET FLOW COMPONENT ALONG THE OUTWARD NORMAL TO
        C.... THE SURFACE AT THE CONTROL POINT, ALOC.
        C....
        ALOC (IR) = VX *SCNTL + VY *CCNTL *SID - VZ *CCNTL *COD
        C....
        C.... THE VALUE OF RFLAG (0. OR 1.) DETERMINES WHETHER THE HORSE
        C.... SHOE VORTEX IS SONIC (RFLAG = 0.) OR NOT (RFLAG = 1.). FOR
        C.... A SONIC VORTEX THE BOUNDARY CONDITION EQUATION IS REPLACED
        C.... BY AN AVERAGING PROCESS AND THEREFORE THE VALUE OF ALOC HAS
        C.... TO BE ZEROED OUT.
        C....
        ALOC (IR) = ALOC (IR) *RFLAG (IR)
        C....
        C.... COMPUTE VELOCITY COMPONENT ALONG X-AXIS INDUCED BY THE RIGID
        C.... BODY ROTATION, ONSET.
        C....
        ONSET (IR) = - PITCH *ZGIRO + YAW *YGIRO
        10 CONTINUE
        C
        C
        RETURN
        END

```

VORLAX 804
 VORLAX 805
 VORLAX 806
 VORLAX 807
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 VORLAX 857
 VORLAX 858

SUBROUTINE BOUNDY

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 BOUNDY

VARIABLES	SN	TYPE	RELOCATION	ARGS	TYPE
20 ALPHA	1	REAL	SET11		REAL
10 ALPHA	2	REAL	SET11		REAL
0 BIG	3	REAL	SET13		REAL
2 CBAR	4	REAL	SET15		REAL
0 CHORD	5	REAL	SET10		REAL
161 COSCOS	6	REAL	SET3		REAL
0 CX	7	INTEGER			REAL
167 DELTAX	8	REAL			REAL
152 DTR	9	REAL			REAL
162 FLAX	10	REAL			REAL
13 FLOATY	11	REAL			REAL
11 HAG	12	REAL			REAL
13560 IDES	13	INTEGER	SET3		REAL
404 INTRAC	14	INTEGER	SET20		REAL
1130 IPAN	15	INTEGER	SET10		REAL
163 IR	16	INTEGER			REAL
0 ITOTAL	17	INTEGER	F.P.		REAL
170 ITS	18	INTEGER	SET7		REAL
4 LATRAL	19	INTEGER			REAL
1 LAY	20	INTEGER			REAL
23 NALPHA	21	INTEGER	SET11		REAL
360 NPP	22	INTEGER	SET20		REAL
50 PHIMED	23	INTEGER	SET20		REAL
164 PION	24	REAL			REAL
6 PITCHQ	25	REAL			REAL
156 PSIRAD	26	REAL			REAL
165 RCX	27	REAL			REAL
5 RLM	28	REAL	SET13		REAL
24 RNMAX	29	REAL	SET7		REAL
7 POLLO	30	REAL			REAL
174 SCNTL	31	REAL			REAL
157 SINLAF	32	REAL			REAL
1720 SK	33	INTEGER	SET3		REAL
1720 SK	34	INTEGER	SET10		REAL
1720 SK	35	INTEGER	SET11		REAL
1720 SK	36	INTEGER	SET10		REAL
1720 SK	37	INTEGER			REAL
1720 SK	38	INTEGER			REAL
1720 SK	39	INTEGER			REAL
1720 SK	40	INTEGER			REAL
1720 SK	41	INTEGER			REAL
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1720 SK	200	INTEGER			REAL

74/74 OPT=1

SUBROUTINE ROUNDY

STATEMENT LABELS
0 10

LOOPS	LABEL	* I ²	INDEX	FROM-TU	LFNGTH	PROPERTIES
44	10			42 108	1008	FXT REFS

COMMON	RLOCKS	LENGTH
/	/	13
SET1		2250
SET2		6000
SET3		8000
SET6		2220
SET7		240
SET10		700
SET11		20
SET13		6
SET15		5
SET16		4000
SET20		6280

STATISTICS

PROGRAM LENGTH	2048	132
CM LABELED COMMON LENGTH	720318	29721
CM BLANK COMMON LENGTH	158	13

```

1 CONTROL*VRLX.GAUSS
C.... SURROUTINE GAUSS (ITOTAL, *EXPAR, FM, XRT)
C....
5 C.... PURPOSE TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE
C.... METHOD OF CONTROLLED SUCCESSIVE OVER-RELAXATION.
C....
C.... CALLING SEQUENCES
C.... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C.... REPAR = RELAXATION PARAMETER.
C.... EM = ROW OF NORMAL WASH MATRIX.
C.... COMMON <
C.... CX, SX, LAX, ALOC, IDES, CHORD, RMAX, INVERS,
C.... ITHMAX.
C....
15 C.... CALLING SEQUENCES
C.... XRT = AUXILIARY VECTOR USED IN C.S.O.M. SOLUTION.
C.... COMMON <
C.... RIG, DCP, EPS, MLM, SLE, ITER, GAMMA, SLOPE.
C.... GAMMA IS THE SOLUTION VECTOR OF BOUNDARY CONDITION
C.... EQUATIONS. I, E, HORSESHOE VORTICES CIRCULATION
C.... STRENGTHS.
C.... NOTES: IF INVERS = 1 (DESIGN PROCESS) THEN GAMMA IS
C.... PART INPUT AND PART OUTPUT.
C....
25 C.... SURROUTINES
C.... CALLED NONE.
C....
C.... DISCUSSION THIS SURROUTINE SOLVES FOR THE CIRCULATION STRENGTH
C.... OF THE HORSESHOE VORTICES THAT SATISFY THE B.C. OF
C.... NO MASS-FLUX ALONG THE NORMAL TO THE SURFACE AT THE
C.... CONTROL POINTS. THIS SOLUTION IS PERFORMED ITERA-
C.... TIVELY ROW BY ROW BY USING THE C.S.O.M. METHOD. IF
C.... A GIVEN ROW IS PART OF A PANEL TO BE DESIGNED, I.E.,
C.... IDES = 1, THEN INSTEAD OF SOLVING FOR GAMMA (= XPD),
C.... THE COMPUTATION OF THE SLOPE DISTRIBUTION ALONG
C.... THAT ROW IS PERFORMED BY MATRIX MULTIPLICATION.
C.... SLOPE = E.M * GAMMA.
C....
40 COMMON LAX, LAY, IO, IM, LATERAL, PSI, PITCHO, ROLLO, YAWO, HAG,
* FLOATX, FLOATY, INVERS
COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
COMMON /SET3 /CX (2000), SX (2000), KFLAG (2000), IDES (2000)
COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)
COMMON /SET7 /RNCV (20), RMAX (100), IIS (20), JIS (100)
COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
* TNT (100), XIE (100), IPAN (100)
COMMON /SET13 /RIG, ITER, ITHMAX, FPS, *SPAN, RLM
COMMON /SET16 /GAMMA (2000), *ONSET (2000)
COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)
INTEGER CX, SX
C
55 C DIMENSION EW (ITOTAL), XRT (ITOTAL)
C
C REMIND 1
C

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60 C....INITIALIZE ARRAYS.
C.... DO 20 IRR = 1, ITOTAL
VORLAX 914
VORLAX 917
VORLAX 914
VORLAX 919
VORLAX 920
VORLAX 921
VORLAX 922
VORLAX 923
VORLAX 924
VORLAX 925
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VORLAX 968
VORLAX 969
VORLAX 970
VORLAX 971
VORLAX 972

65 C.... IF THE IR-HORSESHOF VORTEX IS PART OF A DESIGN PANEL THEN
C.... ITS CIRCULATION STRENGTH IS DIRECTLY COMPUTED FROM THE INPUT
C.... LOAD DISTRIBUTION AND NO SOLUTION BY RELAXATION IS REQUIRED
C.... FOR THE IR-ELEMENT.
C....
C.... IF (IDES (IRR) .EQ. 0) GO TO 20
C.... IF (LAX .EQ. 1) GO TO 10
C.... GAMMA (IRR) = 0.5 *DCP (IRR)
C.... GO TO 20
C.... GAMMA (IRR) = .5*DCP (IRR) *CHORD (SX (IRR)) /RNMAX (SX (IRR))
C.... CONTINUE
C.... ***** GAUSS-SEIDEL OVER-RELAXATION *****
C....
C.... RX1 = 1.0 + REXPAR
C.... RX2 = 1.0 - REXPAR
C.... RIGO = 1.0
C.... ITER = 1
C.... BEGIN THE ITERATION SCHEME.
C....
C.... DO 30 IRR = 1, ITOTAL
C.... DO 90 IRR = 1, ITOTAL
C.... FROM HERE THROUGH LABEL 70 THE SUM OF THE PRODUCTS OF INFLU-
C.... ENCE COEFF. TIMES CIRCULATION STRENGTH FOR A ROW IS COMPUTED
C.... EXCLUDING THE DIAGONAL TERM.
C....
C.... SUM = 0.0
C.... UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE
C.... COEFF. MATRIX.
C....
C.... READ (1) EW
C.... IF (IDES (IRR) .EQ. 1) GO TO 90
C.... IF (IRR .EQ. 1) GO TO 60
C.... LAST = IRR - 1
C.... DO 50 IRR = 1, LAST
C.... SUM = SUM + EW (IRR) *GAMMA (IRR)
C.... IF (IRR .EQ. ITOTAL) GO TO 80
C.... INITL = IRR + 1
C....
70
75
80
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100
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115 DO 70 IR = INITL, ITOTAL
      SUM = SUM + EW (IR) * GAMMA (IR)
      C....
      C....DETERMINE NEW VALUE OF A VARIABLE.
120 80 TEMP = (ALOC (IRR) - SUM) / EW (IRR)
      C....
      C....APPLY OVER-RELAXATION USING A RELAXATION PARAMETER BASED ON
      C....VARIABLE VALUES FROM PREVIOUS CYCLE.
      C....
      TEMP1 = TEMP * GAMMA (IRR)
      RAX = RAX + TEMP1
      XRT (IRR) = XRT (IRR) + TEMP1
      TEMP2 = RAX * TEMP1
      GAMMA (IRR) = GAMMA (IRR) + TEMP2
130 C....PUT LARGEST RELAXATION RESIDUAL IN BIG.
      C....
      VARMOD = ABS (TEMP2)
      IF (VARMOD .GT. BIG) BIG = VARMOD
135 C....COUNT DETERMINES THE NUMBER OF VARIABLES THAT ARE BEING
      C....SOLVED FOR.
      C....
      COUNT = COUNT + 1.0
140 C....
      C....EPSUM IS TO BE USED IN CONJUNCTION WITH COUNT TO DETERMINE A
      C....ROOT MEAN SQUARE VALUE OF ALL VARIABLES.
      C....
      EPSUM = EPSUM + GAMMA (IRR) * GAMMA (IRR)
145 90 CONTINUE
      REWIND 1
      C....
      C....RLM GIVES APPROXIMATE VALUE OF CONVERGENCE RATE OR MAGNIFI
      C....CATION FACTOR (MODULUS OF LARGEST EIGEN-VALUE).
      C....
      RLM = BIG / BIGO
155 C....
      C....ESTABLISH TOLERANCE LEVEL (EPS) AS A SMALL PERCENTAGE OF ROOT
      C....MEAN SQUARE VALUE OF ALL VARIABLES.
      C....
      EPS = SQRT (EPSUM / (COUNT + 1.0)) / 200.0
160 C....
      C....IF LARGEST RESIDUAL IS LESS THEN EPS, PROCESS HAS CONVERGED.
      C....
      IF (BIG .LT. EPS .OK. COUNT .LT. 0.5) GO TO 100
      C....
      C....IF ITERATION COUNTER EXCEEDS MAXIMUM ALLOWABLE, END RELAXATION.
      C....
      IF (ITER .GE. ITRMAX) GO TO 100
      ITER = ITER + 1
      BIGO = BIG
      GO TO 30
170 C ***** END OF GAUSS-SEIDEL OVER-RELAXATION *****
      C
      C

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VORLAX 973
 VORLAX 974
 VORLAX 975
 VORLAX 976
 VORLAX 977
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 VORLAX 1023
 VORLAX 1024
 VORLAX 1025
 VORLAX 1026
 VORLAX 1027
 VORLAX 1028
 VORLAX 1029

10/04/76 10.15.13

FTN 4.5+410A

SUBROUTINE GAUSS 74/74 OPT=1

```

175 C...FROM HERE TO END OF SUBROUTINE THE DESIGN PROCESS IS PERFORMED.
C...IF NO DESIGN IS INVOLVED (INVERS = 0) THEN THIS SEGMENT IS BY-
C...PASSED.
C
180 100 IF (INVERS .EQ. 0) GO TO 150
C...UNIT 9 CONTAINS THE LEADING EDGE NORMALWASH INFLUENCE COEFF.
C...MATRIX.
C... REWIND 9
      DO 140 IRR = 1, IITOTAL
C... UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE
C...COEFF. MATRIX.
C... READ (1) EW
C... THE LEADING EDGE NORMALWASH INFLUENCE COEFF. MATRIX IS ONLY
C...DEFINED FOR LEADING EDGE ELEMENTS (CX = 1). THEREFORE ITS
C...READING IN IS BYPASSED IF THE ELEMENT IS NOT AT THE L. E..
C... IF (CX (IRR) .GT. 1) GO TO 110
      READ (9) XRT
195 110 IF (IDES (IRR) .EQ. 0) GO TO 140
C...
C... COMPUTE SURFACE SLOPE AT VORTEX CONTROL POINT LOCATION, SLOPE.
C...
      THETA = 0.
      DO 120 IR = 1, IITOTAL
        THETA = THETA + FW (IR) * GAMMA (IR)
120 CONTINUE
        SLOPE (IRR) = THETA
C... COMPUTE SURFACE SLOPE AT LEADING EDGE OF VORTEX STRIP
C... CENTERLINE, SLE.
C...
        IF (CX (IRR) .GT. 1) GO TO 140
        THETA = 0.0
        DO 130 IR = 1, IITOTAL
          THETA = THETA + XRT (IR) * GAMMA (IR)
130 CONTINUE
        SLE (SX (IRR)) = THETA
140 CONTINUE
        REWIND 1
        REWIND 9
150 RETURN
      END

```

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 GAUSS

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VORLAX 1030
VORLAX 1031
VORLAX 1032
VORLAX 1033
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VORLAX 1070
VORLAX 1071
VORLAX 1072
VORLAX 1073
VORLAX 1074
VORLAX 1075
VORLAX 1076

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VARIABLES	SN	TYPE	RELOCATION	41G	REAL	SET	ARRAY	SET	REAL	ARRAY	SET
334	ALOC	REAL	SET6	0	REAL		ARRAY		REAL		SET13
275	R1G0	REAL		0	REAL				REAL	ARRAY	SET10
276	COUNT	REAL		0	INTEGER				INTEGER	ARRAY	SET10
0	DCP	REAL	SET2	144	REAL		ARRAY		REAL		/
3	EPS	REAL	SET13	277	REAL		ARRAY		REAL		/
0	EW	REAL	F.P.	12	REAL		ARRAY		REAL	ARRAY	SET16
13	FLOATY	REAL	/	0	REAL		ARRAY		REAL	ARRAY	SET16
11	HAG	REAL	/	24	REAL		ARRAY		REAL		/
13560	IDES	INTEGER	SET3	3	INTEGER		ARRAY		INTEGER		/
303	INITL	INTEGER		14	INTEGER		ARRAY		INTEGER		/
1130	IPAN	INTEGER	SET10	2	INTEGER		ARRAY		INTEGER		/
272	IR	INTEGER		300	INTEGER		ARRAY		INTEGER		/
1	ITER	INTEGER	SET13	0	INTEGER		ARRAY		INTEGER		F.P.
2	ITRMAX	INTEGER	SET13	170	INTEGER		ARRAY		INTEGER	ARRAY	SET7
214	JTS	INTEGER	SET7	302	INTEGER		ARRAY		INTEGER		/
4	LATRAL	INTEGER	/	0	INTEGER		ARRAY		INTEGER		/
1	LAY	INTEGER	/	3720	REAL		ARRAY		REAL		SET16
6	PITCHQ	REAL	/	5	REAL		ARRAY		REAL		/
306	RAX	REAL		0	REAL		ARRAY		REAL		F.P.
7640	RFLAG	REAL	SET3	5	REAL		ARRAY		REAL		SET13
0	RNCV	REAL	SET7	24	REAL		ARRAY		REAL	ARRAY	SET7
7	ROLLQ	REAL	/	273	REAL		ARRAY		REAL		/
274	RX2	REAL		50	REAL		ARRAY		REAL	ARRAY	SET19
0	SLE1	REAL	SET19	24	REAL		ARRAY		REAL	ARRAY	SET19
3720	SLOPE	REAL	SET2	311	REAL		ARRAY		REAL		SET16
3720	SX	INTEGER	SET3	304	INTEGER		ARRAY		REAL	ARRAY	SET2
305	TEMP1	REAL		307	REAL		ARRAY		REAL	ARRAY	SET13
311	THETA	REAL		0	REAL		ARRAY		REAL	ARRAY	SET10
454	TNL	REAL	SET10	620	REAL		ARRAY		REAL	ARRAY	SET10
310	VARMOD	REAL		7640	REAL		ARRAY		REAL	ARRAY	SET2
310	VSS	REAL	SET10	4	REAL		ARRAY		REAL	ARRAY	SET13
0	XRT	REAL	F.P.	764	REAL		ARRAY		REAL	ARRAY	SET10
10	YANG	REAL	/	214	REAL		ARRAY		REAL	ARRAY	SET19

FILE NAMES MODE TAPE9 UNFMT

EXTERNALS SORT TYPE ARGS I LIBRARY

INLINE FUNCTIONS TYPE ARGS I INTRIN

STATEMENT LABELS

33	10		37	20					46	30
0	40	INACTIVE	0	50					76	60
0	70		110	80					137	90
162	100		203	110					0	120
0	130		233	140					241	150

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
26	20	IR	60 78	128	OPT
52	90	* IRR	96 146	708	EXT REFS NOT INNER
67	50	IR	111 112	48	INSTACK
103	70	IR	115 116	48	INSTACK
166	140	* IRR	182 214	508	EXT REFS NOT INNER
211	120	IR	200 202	48	INSTACK

SUBROUTINE GAUSS		74/74	OPT=1	PROPERTIES	
LOOPS	LABEL	FROM-TO	LENGTH	LENGTH	INSTACK
224	130	210 212	4H		

COMMON BLOCKS	INDEX	LENGTH
/ /	IR	13
SET2	6000	
SET3	8000	
SET6	2220	
SET7	240	
SET10	700	
SET13	6	
SET16	4000	
SET19	240	

STATISTICS

PROGRAM LENGTH	3428	226
CM LABELED COMMON LENGTH	516368	21406
CM BLANK COMMON LENGTH	158	13

1 CONTROL*VRLX.GEOM
 C... SUBROUTINE GEOM (ITOTAL) 9/16/76
 C...
 5 C... PURPOSE TO COMPUTE THE VORTEX LATTICE GEOMETRY AND SURFACE
 C... SLOPES AT THE CONTROL POINTS. ALSO TO COMPUTE THE
 C... LOAD DISTRIBUTION AT THE CORRESPONDING LOAD POINTS
 C... IF DESIGN PROCESS IS INVOKED (IDFS = 1).
 C...
 10 C... INPUT CALLING SEQUENCES
 C... NONE.
 C... COMMONS
 C... DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR,
 C... RNCV, SLE1, SLE2, ZLE1, ZLE2, AINC1, AINC2, DNDX1,
 C... DNDX2, GAMMA, LESWP, PSPAN, SYNTH, TAPER, XAPEX,
 C... YAPEX, ZAPEX, CSTART, INTRAC, IQUANT, LATRAL,
 C... PHIMED.
 C...
 15 C... OUTPUT CALLING SEQUENCES
 C... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
 C... COMMONS
 C... X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,
 C... TNL, TNT, VSP, VSS, VST, XIE, ALOC, IPAN, SMAK,
 C... ZETA, CHORD, RNMAX, SLOPE, NPNAS.
 C... NOTES DL AND VSS MAY BE EITHER INPUT OR OUTPUT
 C... DEPENDING ON CONFIGURATION CONDITIONS.
 C...
 20 C... SUBROUTINES
 C... CALLED NONE.
 C...
 25 C... DISCUSSION THE VORTEX LATTICE GEOMETRY IS LAID OUT PANEL BY
 C... PANEL BASED ON THE GEOMETRIC AND VORTEX DISTRIBU
 C... TION CHARACTERISTICS SPECIFIED FOR THE GIVEN PANEL
 C... IN THE INPUT DATA (INPUT SUBROUTINE). EACH PANEL
 C... IS SUBDIVIDED INTO A NUMBER OF X-AXIALWISE STRIPS
 C... (NVOR), EACH STRIP CONTAINING A GIVEN NUMBER (RNMAX =
 C... RNCV) OF HORSESHOE VORTICES WHOSE BOUND TRAILING LFGS
 C... COINCIDE WITH THE X-AXIALWISE EDGES OF THE STRIP IF
 C... THE PARAMETER NPP = 0. WHEN NPP = 1 THERE IS NO
 C... LONGER A CONTINUOUS STRIP OF VORTICES SINCE THEY ARE
 C... NOT LOCATED IN THE SAME PLANE IN THIS CASE (NPP =
 C... 1) THE STRIP BECOMES AN ARRAY OR ROW OF VORTICES
 C... LOCATED IN TANDEM BUT WHOSE SPANS ARE NOT NECESSA
 C... RILY EQUAL. EACH STRIP OR VORTEX ROW IS IDENTIFI
 C... FIED BY AN INDEX (SX). EACH HORSESHOE VORTEX IN A
 C... GIVEN STRIP OR ROW IS IDENTIFIED BY A SECOND INDEX
 C... (CX), THE VALUE CX = 1 DENOTING THE LEADING EDGE
 C... ELEMENT, AND CX = RNMAX = RNCV DENOTING THE LAST,
 C... OR TRAILING EDGE, HORSESHOE OF THE ROW. THEREFORE
 C... EACH AND EVERY HORSESHOE VORTEX IS UNIQUELY IDENT
 C... IFIED BY EITHER AN OVERALL INDEX (WHICH RUNS FROM
 C... 1 TO ITOTAL) OR BY THE PAIR OF VALUES (CX, SX).
 C... THE SPATIAL LAY-OUT OF THE VORTEX LATTICE CORRES
 C... PONDING TO A GIVEN PANEL DEPENDS ON THE VALUES OF
 C... TWO PARAMETERS: PDL AND NPP. IF PDL .LE. 360.0 THEN
 C... THE TRANSVERSE VORTEX SEGMENTS OF THE SAME VALUE OF
 C... CX FORM A CONTINUOUS STRAIGHT LINE BUT IF PDL .GT.
 C... 360.0

VORLAX 1077
 VORLAX 1078
 VORLAX 1079
 VORLAX 1080
 VORLAX 1081
 VORLAX 1082
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 VORLAX 1112
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 VORLAX 1118
 VORLAX 1119
 VORLAX 1120
 VORLAX 1121
 VORLAX 1122
 VORLAX 1123
 VORLAX 1124
 VORLAX 1125
 VORLAX 1126
 VORLAX 1127
 VORLAX 1128
 VORLAX 1129
 VORLAX 1130
 VORLAX 1131
 VORLAX 1132
 VORLAX 1133

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C....
C....
60 C.... 360.0 THEN THE TRANSVERSE VORTEX SEGMENTS OF SAME CX,
C....   THOUGH STILL CONTINUOUS, FORM A POLYGONAL LINE
C....   WHEN PROJECTED ON A PLANE NORMAL TO THE X-AXIS. IF
C....   NPP = 0 THEN ALL THE TRANSVERSE VORTEX SEGMENTS
C....   OF A GIVEN ROW (SAME SX) LIE IN THE SAME PLANE.
C....   BUT IF NPP = 1 THEN THE TRANSVERSE SEGMENTS OF A
C....   ROW ARE LAID ON THE ACTUAL HULL SURFACE. THE ROUND
C....   TRAILING LEGS OR SEGMENTS ARE ALWAYS PARALLEL TO
C....   THE X-AXIS (UP TO THE TRAILING EDGE OF THE GIVEN
C....   STRIP OR ROW).
C....
C....
70 COMMON LAX, LAY, IO, IH, LATRAL, PSI, PITCHU, ROLLQ, YAWQ, HAG,
* FLOATX, FLUATY, INVERS
COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)
COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINCL (20), AINCL2 (20)
COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),
* LESWP (40), SYNTH (40), IOUANT (40), CSTART (40), TAPER (40),
* PSPAN (40), NV04 (40)
COMMON /SET6 /TITLE (20), HEAD (200), ALJC (2000)
COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)
COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
* INT (100), XTE (100), IPAN (100)
COMMON /SET14 /NPAN, NT, SMAX, NPANAS
COMMON /SET16 /GAMMA ( 2000 ), ONSET (2000)
COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)
COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),
* NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST (2000)
INTEGER TITLE, CX, SX
REAL NVOR, LESWP
PI = 3.14159
DTP = 0.01745329
C
C LATTICE GEOMETRY
C
C...INITIALIZE INDICES.
C....
IR = 0
IMR = 0
SMAX = 0.
NPANAS = 0
KED = 0
KEG = 0
SIGN = 1.0
I = 1
ICYCLE = 1
JUMP = 0
C
C...IN DEFINING THE VORTEX LATTICE GEOMETRY, THE COMPUTATION IS
C...PERFORMED ONE PANFL AT A TIME (STATEMENTS INCLUDED) BETWEEN
C...LABELS 10 AND 80). IF THE CONFIGURATION IS SYMMETRICAL THE
C...COMPUTATION EXTENDS OVER ONE HALF OF IT ONLY (MIRROR SYM
C...METRY IS ASSUMED). OTHERWISE THE COMPUTATIONAL CYCLE IS RE
C...PEATED FOR THE OTHER HALF OF THE CONFIGURATION.
C....
110

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VORLAX 1134
VORLAX 1135
VORLAX 1136
VORLAX 1137
VORLAX 1138
VORLAX 1139
VORLAX 1140
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VORLAX 1149
VORLAX 1150
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VORLAX 1159
VORLAX 1160
VORLAX 1161
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VORLAX 1180
VORLAX 1181
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VORLAX 1190

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247 C

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175      XLE = KNOT + DTJ *TAD *SIGN
          ETA = ETA + DTJ /PSPAN (I)
C....
C....COMPUTE TANGENT OF LOCAL INCIDENCE (ANGLE BETWEEN CHORDLINE
C....AND STRIP REFERENCE LINE) BY ASSUMING STRAIGHT ELEMENT LINE
C....LOFTING (THE TANGENT IS CALLED DINC).
C....
          DINC = AINC1 (I) *(1. - ETA) + AINC2 (I) *TAPER (I) *ETA
          DINC = DINC / (1.0 - ETA + TAPER (I) *ETA)
C....
C....THE PARAMETER INTRAC DETERMINES WHETHER THE PANEL UNDER CON
C....SIDERATION IS PART OF A QUASI-CYLINDRICAL BODY OR PART OF A
C....OR PART OF A FUSIFORM BODY (INTRAC = 1). FOR A FUSIFORM BODY
C....A INC1 IS THE TANGENT OF THE INCIDENCE OF THE BODY AXIS WITH
C....RESPECT TO THE X-Y PLANE, AND AINC2 IS THE TANGENT OF THE
C....INCIDENCE OF THE BODY AXIS WITH RESPECT TO THE X-Z PLANE.
C....
          IF (INTRAC (I) .EQ. 1) DINC = AINC1 (I) *C00 + AINC2 (I) *SID
C....
C....COMPUTE CHORD LENGTH (CHORD) ALONG STRIP CENTERLINE BY
C....ASSUMING STRAIGHT PANEL LEADING AND TRAILING EDGES AND
C....NEGLECTING THE EFFECT OF TWIST.
C....
          CHORD (IR) = CSTART (I) *(1.0 + ETA *(TAPER (I) - 1.0))
C....
C....COMPUTE LEADING EDGE SLOPE (SLE).
C....
          SLE (IR) = SLE1 (I) *(1. - ETA) + SLE2 (I) *ETA + DINC
          IF (INTRAC (I) .EQ. 0) GO TO 40
          FRC = RCS (IR) /CHORD (IR)
          CODIF = COS (DTR *(90.0 - PHIMED (IR) + DL (IR)))
          JTS (IR) = ITS (I)
          ZETA (IR) = UINC
C....
C....COMPUTE TANGENT OF LEADING EDGE SWEEP (TNL), TANGENT OF
C....TRAILING EDGE SWEEP (TNT), AND X-ORDINATE OF TRAILING EDGE
C....OF STRIP CENTERLINE (XTE).
C....
          TNL (IR) = TAD
          TNT (IR) = TAD - SIGN *CSTART (I) *(1. - TAPER (I)) /PSPAN (I)
          XTE (IR) = XLE + CHORD (IR)
          MAX = RNMAX (IR)
          PION = PI /RNMAX (IR)
C
C
C....THE DO-LOOP ENDED BY LABEL 70 COMPUTES FOR A GIVEN STRIP OR
C....VORTEX ROW THE VALUES OF TRANSVERSE SEGMENT MIDPOINT X-ORDI
C....NATES (X), THE TANGENT OF THE SWEEP OF THOSE SEGMENTS (VSP),
C....THE SLOPE OF THE SURFACE AT THE CONTROL POINTS (SLOPE) AS
C....DETERMINED BY STRAIGHT ELEMENT LINE LOFTING, OR IF A DESIGN
C....PROCESS IS INVOKED (SYNTH = 1), THE VALUE OF THE LOAD COEFF.
C....(DCP) AT VORTEX MIDPOINT IS DETERMINED BY LINEAR INTERPOLATION.
C....ALSO EACH HORSESHOE VORTEX IS GIVEN A VALUE OF IDES WHICH OF
C....TERMINES WHETHER ITS LOAD COEFFICIENT IS A KNOWN (INPUT)
C....QUANTITY (IDES = 1) OR IT IS TO BE SOLVED FOR (IDES = 0).
C....IN ADDITION, THE HORSESHOE VORTICES ARE TAGGED WITH THE PROPER
C....CX - SX VALUES. ALOC IS AN AUXILIARY ARRAY WHICH CONTAINS THE

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VORLAX 1244
 VORLAX 1249
 VORLAX 1250
 VORLAX 1251
 VORLAX 1252
 VORLAX 1253
 VORLAX 1254
 VORLAX 1255
 VORLAX 1256
 VORLAX 1257
 VORLAX 1258
 VORLAX 1259
 VORLAX 1260
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 VORLAX 1297
 VORLAX 1298
 VORLAX 1299
 VORLAX 1300
 VORLAX 1301
 VORLAX 1302
 VORLAX 1303
 VORLAX 1304

```

230 C...THE DISPLACEMENTS OF THE VORTEX MIDPOINTS (LOAD POINTS) WITH
C...RESPECT TO THE STRIP REFERENCE LINE, IN PERCENT OF LOCAL
C...CHORD LENGTH.
C....
      DO 70 K = 1, MAX
      KEDK = KEDOR + K
      KEGK = KEGOR + K
      IF (J.GT.1) GO TO 50
      KED = KED + 1
      KEG = KEG + 1
      IRR = IRR + 1
      CX (IRR) = K
      SX (IRR) = IR
      RK = K
      DTJ = .5 * (1.0 - COS ((RK - .5) *PI))
      IF (LAX.EQ.1) DTJ = (RK - 0.75) /RNMAX (IR)
      X (IRR) = XLE + DTJ *CHORD (IR)
      VSP (IRR) = TAD -DTJ *CSTART(I) *(1.-TAPER(I))/ABS(PSPAN(I)) *SIGN
      ALOC (IRR) = 0.0
      IF (SYNTH (I).GT. 0.5) GO TO 60
      IDES (IRR) = 0
      SLOPE (IRR) = DNDX1 (KEDK) *(1. - FTA) + DNDX2 (KEDK) *ETA + UINC
      KEGK2 = KEGK + MAX
      ALOC (IRR) = GAMMA (KEGK) *(1. - ETA) + GAMMA (KEGK2) *ETA
      ALOC (IRR) = ALOC (IRR) + DINC *DTJ *100.
      IF (INTRAC (I).EQ. 0) GO TO 70
      SLOPE (IRR) = DNDX1 (KEDK) *COS + FKC *DNDX2 (KEDK) *CODIF + DINC
      ALOC (IRR) = GAMMA (KEGK2)
      GO TO 70
      DCP (IRR) = DNDX1 (KEDK) + (DNDX2 (KEDK) - DNDX1 (KEDK)) *ETA
      IDES (IRR) = 1
      SLOPE (IRR) = 0.0
      CONTINUE
      C
      C
      80 CONTINUE
      C
      C
      C
      C
      C
      C
      KEG = KEG + MAX
      IF (ICYCLE.EQ. 2) GO TO 100
      I = I + 1
      IF (I - NPAN) 10, 10, 90
      IF (LATERAL.EQ. 0) GO TO 110
      90
      C...
      C...
      C...IF CONFIGURATION OR FLIGHT CONDITION IS ASYMMETRICAL (LATERAL
      C...= 1) THEN DETERMINING PANEL HAS TO BE DUPLICATED FOR OPPOSITEIF
      C...HALF OF CONFIGURATION.
      C...
      C...
      ICYCLE = 2
      JUMP = IR
      I = 0
      SIGN = - 1.0
      240
      245
      250
      255
      260
      265
      270
      275
      280
      285
  
```

VORLAX 1305
 VORLAX 1306
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 VORLAX 1350
 VORLAX 1351
 VORLAX 1352
 VORLAX 1353
 VORLAX 1354
 VORLAX 1355
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 VORLAX 1357
 VORLAX 1358
 VORLAX 1359
 VORLAX 1360
 VORLAX 1361

```

      KED = 0
      KEG = 0
      I = I + 1
100  IF (I .GT. NPAN) GO TO 110
      NV = NVOR (I)
      NCORD = RNCV (I)
      IF (IQUANT(I) .EQ. 1) KED = KFD + NCORD
      IF (IQUANT(I) .EQ. 1) KEG = KEG + 2 *NCORD
      JUMP = JUMP + NV * (IQUANT (I) - 2)
      IF (IQUANT (I) .EQ. 1) GO TO 100
      GO TO 10
110  ITOTAL = IRK
      NT = SMAX
      C
      C
      C   IRR = 0
      C
      C...THE DO-LOOP ENDED BY LABEL 140 COMPUTES THE LATERAL COORDI
      C...NATES OF VORTEX MINPOINTS (YY AND ZZ) AND THE SEMISPAN OF
      C...EACH HORSESHOE. IF NPP = 0 THE VORTEX MINPOINT LATERAL CO
      C...ORDINATES COINCIDE WITH THOSE OF STRIP CENTERLINE.
      C....
      DO 190 IR = 1, NT
      MAX = RMAX (IR)
      DNORM = CHORD (IR) *0.010
      INX = IPAN (IR)
      ISEND = 1 + INTRAC (INX)
      GO TO (120, 130), ISEND
120  CDL = COS (DTR *DL (IR))
      SDL = SIN (DTR *DL (IR))
      GO TO 140
130  CDL = SIN (DTR *PHIMED (IR))
      SDL = - COS (DTR *PHIMED (IR))
140  DU 180 L = 1, MAX
      IRR = IRR + 1
      YY (IRR) = Y (IR)
      ZZ (IRR) = Z (IR)
      VST (IRR) = VSS (IR)
      IF (NPP (INX) .EQ. 0) GO TO 180
      GO TO (150, 160), ISEND
150  DELTA = ALOC (IRR) *DNORM
      GO TO 170
160  DELTA = RCS (IR) * (0.1 *SQRT (ALOC (IRR)) - 1.0)
170  YY (IRR) = Y (IR) - DELTA *SDL
      ZZ (IRR) = Z (IR) + DELTA *CDL
      VOREX = 1.0
      IF (INTRAC (INX) .EQ. 1) VOREX = (RCS (IP) + DELTA) /RCS (IR)
180  CONTINUE
190  CONTINUE
      C
      C   RETURN
      END

```

VORLAX 1362
 VORLAX 1363
 VORLAX 1364
 VORLAX 1365
 VORLAX 1366
 VORLAX 1367
 VORLAX 1368
 VORLAX 1369
 VORLAX 1370
 VORLAX 1371
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 VORLAX 1396
 VORLAX 1397
 VORLAX 1398
 VORLAX 1399
 VORLAX 1400
 VORLAX 1401
 VORLAX 1402
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 VORLAX 1410
 VORLAX 1411
 VORLAX 1412
 VORLAX 1413
 VORLAX 1414
 VORLAX 1415

CARD NR. SEVERITY DETAILS DIAGNOSIS OF PROBLEM

313 I AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.
 325 I AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
 3 GEOM

VARIABLES	SN	TYPE	RELOCATION	1464	AINC2	REAL	ARRAY	SET4
1440 AINC1		REAL	SET4	601	COL	REAL	ARRAY	SET4
334 ALOC		REAL	SET6	560	COL	REAL	ARRAY	SET6
0 CHORD		REAL	SET10	430	CSTAR1	REAL	ARRAY	SET10
565 CODIF		REAL	SET3	0	JCP	REAL	ARRAY	SET3
545 DELTA		REAL	SET10	563	DINC	REAL	ARRAY	SET10
144 DL		REAL	SET4	0	DNDX1	REAL	ARRAY	SET4
620 DNDX2		REAL	SET4	576	DNDX2	REAL	ARRAY	SET4
561 DTJ		REAL		534	DTR	REAL	ARRAY	
546 ETA		REAL	/ /	12	FLOATA	REAL	ARRAY	/ /
13 FLOATY		REAL	/ /	564	FRC	REAL	ARRAY	/ /
0 GAMMA		REAL	SET14	11	HAG	REAL	ARRAY	SET14
24 HEAD		REAL	SET16	542	T	REAL	ARRAY	SET16
543 ICYCLE		INTEGER		13560	IDES	INTEGER	ARRAY	SET3
3 IH		INTEGER	/ /	404	INTRAC	INTEGER	ARRAY	SET20
14 INVERS		INTEGER	/ /	577	INX	INTEGER	ARRAY	SET20
1130 IPAN		INTEGER	SET10	2	IQ	INTEGER	ARRAY	SET10
360 IQUANT		INTEGER	SET15	535	IQ	INTEGER	ARRAY	SET15
536 IRR		INTEGER	F.P.	600	ISENC	INTEGER	ARRAY	F.P.
0 ITOTAL		INTEGER		170	TTS	INTEGER	ARRAY	SET7
556 J		INTEGER		214	TTS	INTEGER	ARRAY	SET7
544 JUMP		INTEGER		570	K	INTEGER	ARRAY	SET7
537 KED		INTEGER		571	KEDK	INTEGER	ARRAY	SET7
554 KEDOR		INTEGER		540	KEG	INTEGER	ARRAY	SET7
572 KEGK		INTEGER		574	KEGK2	INTEGER	ARRAY	SET7
555 KEGOR		INTEGER		603	L	INTEGER	ARRAY	SET7
4 LATRAL		INTEGER	/ /	0	LAX	INTEGER	ARRAY	/ /
1 LAY		INTEGER	/ /	240	LESWF	REAL	ARRAY	SET5
566 MAX		INTEGER	/ /	575	VCORL	REAL	ARRAY	SET5
0 NPA		INTEGER	SET14	3	MPANAS	INTEGER	ARRAY	SET14
360 NPP		INTEGER	SET20	1	JT	INTEGER	ARRAY	SET14
550 NV		INTEGER	SET20	170	JOL	REAL	ARRAY	SET14
3720 ONSET		REAL	SET16	620	NVOH	REAL	ARRAY	SET14
50 PHIMED		REAL	SET20	533	J	REAL	ARRAY	SET14
567 PIJON		REAL	SET20	6	PITCHY	REAL	ARRAY	SET14
5 PSI		REAL	/ /	550	PSPAN	REAL	ARRAY	/ /
214 RCS		REAL	SET20	7640	PFLAG	REAL	ARRAY	SET5
573 RK		REAL	SET17	0	PNCV	REAL	ARRAY	SET3
24 RNMAX		REAL	SET7	547	PULLG	REAL	ARRAY	SET7
602 SDL		REAL		50	SLE	REAL	ARRAY	/ /
541 SIGN		REAL	SET19	24	SLE2	REAL	ARRAY	SET19
0 SLE1		REAL	SET2	2	SMAX	REAL	ARRAY	SET19
3720 SLOPE		REAL	SET2			REAL	ARRAY	SET19

VARIABLES SN TYPE RELOCATION
 3720 SX INTEGER ARRAY SET3
 547 TAD REAL
 0 TITLE INTEGER
 620 TNT REAL SFT6
 7640 VSP REAL SFT10
 10270 VST REAL SFT2
 0 XAPEX REAL SET20
 551 XNOT REAL SET5
 3720 Y REAL SET1
 10 YAWQ REAL / /
 430 YY REAL SET20
 120 ZAPEX REAL SFT5
 214 ZETA REAL SFT19
 24 ZLE2 REAL SET19
 4350 ZZ REAL SET20

EXTERNALS TYPE ARGS
 COS REAL 1 LIBRARY
 SORT REAL 1 LIBRARY

INLINE FUNCTIONS TYPE ARGS
 ABS REAL 1 INTNIN

STATEMENT LABELS

17	10	0	20	INACTIVE	142	30
211	40	241	50		322	60
331	70	0	80		0	90
353	100	377	110		421	120
430	130	437	140		457	150
462	160	470	170		510	180
0	190					

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
44	80	* J	132 264	2728	
232	70	* K	233 261	1028	EXT REFS NOT INNER
404	190	* IR	308 335	1118	EXT REFS NOT INNER
440	180	* L	319 334	536	EXT REFS NOT INNER

COMMON BLOCKS	LENGTH
/ /	13
SET1	2250
SET2	6000
SET3	8000
SET4	840
SET5	440
SET6	2220
SET7	240
SET10	700
SET14	4
SET16	4000
SET19	240
SET20	6280

STATISTICS

PROGRAM LENGTH	6058	389
CM LABELED COMMON LENGTH	747568	11214
CM BLANK COMMON LENGTH	158	13

INACTIVE

1 CONTROL*VRLX.INPUT 1416
C.... SUBROUTINE INPUT 1417
C.... 1418
C.... 1419
5 C.... PURPOSE TO READ IN INPUT DATA AND PREPARE SUCH DATA FOR 1420
C.... USE IN THE GENERATION OF VORTEX LATTICE GEOMETRY 1421
C.... TO BE DONE IN SUBROUTINE GEOM. 1422
C.... 1423
10 C.... CALLING SEQUENCES 1424
C.... NONE. 1425
C.... COMMONS 1426
C.... LAX. 1427
C.... 1428
15 C.... CALLING SEQUENCES 1429
C.... NONE. 1430
C.... COMMONS 1431
C.... DL, XS, ITS, NPP, NXS, NYS, NZS, PDL, PSI, RCS, 1432
C.... SPC, VSS, CBAR, HEAD, MACH, MPAN, NVOR, RNCV, SLE1, 1433
C.... SLE2, SREF, VINP, XBAR, YAWQ, YNOT, ZBAR, ZLE1, 1434
C.... ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2, 1435
C.... GAMMA, LESMP, NMACH, PSPAN, ROLLO, SYNTH, TAPER, 1436
C.... WSPAN, XAPEX, YAPEX, ZAPEX, CSTART, DELTAY, DELTAZ, 1437
C.... INTRAC, INVERS, IQUANT, LATRAL, NALPHA, PHINED, 1438
C.... PITCHQ. 1439
C.... 1440
25 C.... SUBROUTINES 1441
C.... CALLED NONE. 1442
C.... 1443
C.... 1444
30 C.... DISCUSSION A MASTER FRAME OF REFERENCE IS ASSUMED IN DEFINING 1445
C.... A CONFIGURATION. THIS FRAME OF REFERENCE IS AN 1446
C.... ORTHOGONAL CARTESIAN COORDINATE SYSTEM. THE X-Z 1447
C.... BEING THE CENTERLINE PLANE WITH THE X-AXIS POINTING 1448
C.... DOWNSTREAM, AND THE Z-AXIS DIRECTED UPWARD. THE 1449
C.... Y-AXIS POINTS TO STARBOARD. THE ORIGIN OF THE SYS 1450
C.... TEM CAN BE ANY CONVEIENT POINT IN THE X-Z PLANE. 1451
C.... THE CONFIGURATION CAN BE MADE UP OF SYMMETRICAL 1452
C.... (ABOUT THE X-Z PLANE) AND/OR ASYMMETRICAL COMPO- 1453
C.... NENTS, AND IN DEFINING THE SYMMETRICAL COMPONENTS 1454
C.... ONLY THE STARBOARD ELEMENTS ARE SPECIFIED. THE 1455
C.... CONFIGURATION TO BE INPUT IS DIVIDED INTO A SET 1456
C.... OF MAJOR PANELS UP TO 20 OF THESE PANELS CAN BE 1457
C.... INPUT, SYMMETRICAL COMPONENTS (LFTT + RIGHT) BEING 1458
C.... COUNTED ONLY ONCE. FOR INSTANCE, A WING OF ZERO 1459
C.... THICKNESS AND WITH STRAIGHT LEADING AND TRAILING 1460
C.... EDGES, AND WITH LINEAR LOFTING BETWEEN ROOT AND 1461
C.... TIP, CONSTITUTES A MAJOR PANEL. COMPLEX PLANFORMS, 1462
C.... AND NON-LINEAR CHANGES IN TWIST AND AIRFOIL SECTIONS 1463
C.... ARE DESCRIBED BY DEFINING MORE THAN ONE PANEL FOR A 1464
C.... GIVEN WING. SUBROUTINE INPUT PREPARES THE DATA SPE 1465
C.... CIFIED FOR EACH MAJOR PANEL SO THAT THEY CAN LATFR 1466
C.... BE USED IN SUBROUTINE GEOM4 TO GENERATE THE PROPER 1467
C.... VORTEX LATTICE FOR EACH PANEL. 1468
C.... AN AIRFOIL WITH THICKNESS CAN BE REPRESENTED BY A 1469
C.... DOUBLE VORTEX SHEET, I. E., BY OFFINING TWO MAJOR PA 1470
C.... NELS ARRANGED IN A #BIPLANE, OR #SANDWICH#, FASHION. 1471
C.... ONE PANEL REPRESENTING THE UPPER SURFACE OF THE AIR 1472
C.... FOIL, AND THE OTHER PANEL REPRESENTING THE LOWER


```

115 C
    READ (5, 10) NMACH, (MACH (I), I = 1, NMACH)
    WRITE (6, 20) NMACH, (MACH (I), I = 1, NMACH)
    FORMAT (I2, 8X, 7F10.0)
    FORMAT (1H0, 12, 8X, 7F10.3)
120 C...
    C...
    C...
125 C...
    READ (5, 10) NALPHA, (ALPHA (I), I = 1, NALPHA)
    WRITE (6, 20) NALPHA, (ALPHA (I), I = 1, NALPHA)
130 C...
    C...
    C...
    READ (5, 10) LATRAL, PSI, PITCHQ, ROLLG, YAWQ, VINQ
    IF (PSI .NE. 0.) LATRAL = 1
    IF (ROLLG .NE. 0.) LATRAL = 1
    IF (YAWQ .NE. 0.) LATRAL = 1
    IF (VINQ .LE. 0.001) VINQ = 1.0
    WRITE (6, 20) LATRAL, PSI, PITCHQ, ROLLG, YAWQ, VINQ
135 C...
    C...
    READ (5, 30) NSPAN, SREF, CHAN, XBAR, ZBAR, WSPAN
    FORMAT (I2, 8X, 5F10.0)
    FORMAT (1H0, 12, 8X, F10.2, 4F10.4)
    IF (WSPAN .LE. 0.0001) WSPAN = 2.0
    WRITE (6, 40) NSPAN, SREF, CRAR, XRAR, ZBAR, WSPAN
    FORMAT (8F10.0)
140 C...
    C...
    C...
    INVERS = 0
    KEG = 0
    KEGR = 0
145 C...
    C...
150 C...
    C... THE DO-LOOP ENDED BY LABEL 365 READS IN THE COMPLETE DEFINITION
    C... OF EACH MAJOR PANEL MAKING UP THE CONFIGURATION, THERE BEING
    C... NSPAN SUCH PANELS.
155 C...
    C...
    DO 390 I = 1, NSPAN
    WRITE (6, 70) I
    FORMAT (1H0, 10H*****. I3, 114 *****)
    FORMAT (1H, 8F10.4)
160 C...
    C... DEFINE STREAMWISE EDGES (2) OF PANEL BY SPECIFYING COORDINATES
    C... OF LEADING EDGES (X1, Y1, Z1, X2, Y2, Z2) AND CHORD LENGTHS
    C... (COND1, COND2). CHORD LENGTHS ARE MEASURED PARALLEL TO X-AXIS.
    C... DESCRP IS ANY PANEL IDENTIFICATION LABEL.
165 C...
    READ (5, 100) X1, Y1, Z1, COND1, DESCRP
170 C...
    C... SAVE PANEL DESCRIPTION INFORMATION FOR IDENTIFICATION IN
    C... PRINTOUT OF DATA IN SUBROUTINE PRINT.
    C...
    ISTART = (I - 1) * 10
    
```

VORLAX 1530
VORLAX 1531
VORLAX 1532
VORLAX 1533
VORLAX 1534
VORLAX 1535
VORLAX 1536
VORLAX 1537
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VORLAX 1581
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VORLAX 1583
VORLAX 1584
VORLAX 1585
VORLAX 1586


```

230      IF (I.EQ.1) GO TO 130
        ITOP = I - 1
        DO 120 J = 1, ITOP
          INV = NVOR (J)
          IBOT = IBOT + INV
        CONTINUE
        120      C....
        C....
        C....READ IN POLAR COORDINATES OF CONTROL SURFACE CYLINDER CROSS
        C....SECTION, OR AUXILIARY BODY MASTER CROSS-SECTION. ONLY
        C....APPLICABLE IF INTRAC = 1.
        C....
        C....
        130      ITOP = IBOT + NV - 1
              JJTOP = NVOR (I) + 1
              READ (5, 50) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)
              WRITE (6, 60) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)
              PSPAN (I) = 0.0
        C....
        C....
        C....COMPUTE CROSS-SECTIONAL PARAMETERS OF CONTROL SURFACE CYLINDER
        C....OR AUXILIARY BODY.
        C....
        C....
        DO 140 IR = IBOT, ITOP
          JJ = IR - IBOT + 1
          DELTAZ = RO (JJ + 1) * SIN (DTR*PHI (JJ + 1)) - RO (JJ) *
            * SIN (DTR * PHI (JJ))
          DELTAY = RO (JJ + 1) * COS (DTR*PHI (JJ + 1)) - RO (JJ) *
            * COS (DTR * PHI (JJ))
          DL (IR) = 1. /DTR *ATAN2 (DELTAZ, DELTAY)
          DMZ = RO (JJ) * SIN (DTR*PHI (JJ)) + 0.5 * DELTAZ
          DMY = RO (JJ) * COS (DTR * PHI (JJ)) + 0.5 * DELTAY
          PHIMED (IR) = ATAN2 (DMZ, DMY) /DTR
          RCS (IR) = SQRT (DMY **2 + DMZ **2)
          VSS (IR) = 0.5 *SORT (DELTAZ **2 + DELTAY **2)
          PSPAN (I) = PSPAN (I) + 2.0 *VSS (IR)
        CONTINUE
        140      C....
        C....
        C....      LESWP (I) = 1. /DTR *ATAN2 (DELTAZ, PSPAN (I))
        C....
        C....CONTINUE READING IN DATA APPLICABLE TO ROIH INTRAC = 0 AND
        C....INTRAC = 1.
        C....
        150      READ(5,160) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)
        C....
        C....MAKE APPROPRIATE INPUT PARAMETERS COMPATIBLE WITH PANEL CHARAC
        C....TERISTICS TO PREVENT EXECUTION ERRORS.
        C....
        C....
        IF (INTRAC (I) .EQ. 1 .AND. NAP .LT. 3) NPP (I) = 0
        IF (IQUANT (I) .EQ. 0) IQUANT (I) = 2
        IF (IQUANT (I) .EQ. 1) LATRAL = 1
        C....
        C....      WRITE(6,170) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)
        C....

```

VORLAX 1644
VORLAX 1645
VORLAX 1646
VORLAX 1647
VORLAX 1648
VORLAX 1649
VORLAX 1650
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C...
160 FORMAT (2F10.0, 5 (I2, 8X))
170 FORMAT (1H, 2F10.4, 5 (I2, 8X))
C...
290 SYNTH (I) = ISYNT
MAX = RNCV (I)
ZLE1 (I) = 0.0
ZLE2 (I) = 0.0

C...
295 C...CLEAR OUT APPROPRIATE SECTION OF ARRAY GAMMA WHICH IS TO BE
C...USED AS TEMPORARY INPUT DATA STORAGE FOR LATER MANIPULATION
C...IN SUBROUTINE GEOM.
C...
DO 180 LI = 1, MAX
KEG = KEG + 1
KEG2 = KEG + MAX
GAMMA (KEG) = 0.0
GAMMA (KEG2) = 0.0
CONTINUE
180
C...
300 C...
C...
305 C...IF PANEL SURFACE WARP WILL NOT BE DESIGNED (ANALYSIS CASE)
C...THEN BYPASS READING IN OF LOAD COEFFICIENTS.
C...
310 C...
IF (ISYNT .EQ. 0) GO TO 190
READ (5, 50) (C1 (K), K = 1, MAX)
WRITE (6, 80) (C1 (K), K = 1, MAX)
READ (5, 50) (C2 (K), K = 1, MAX)
WRITE (6, 80) (C2 (K), K = 1, MAX)
C...
315 C...INVERS INDICATES WHETHER THERE IS ONE (OR MORE) PANEL IN THE
C...CONFIGURATION WHICH IS TO BE DESIGNED IN TERMS OF SURFACE WARP.
C...INVERS = 1 S CAMBER DESIGN REQUIRED FOR ONE OR MORE PANELS.
C...INVERS = 0 S NO PANEL IS TO BE DESIGNED.
C...
INVERS = 1
SLE1 (I) = 0.
SLE2 (I) = 0.
GO TO 300
325 C...
C...
330 C...IF PANEL IS A FLAT PLATE THEN SKIP READING OF PANEL CAMBER
C...DEFINITION DATA. IF NAP .LT. 3 PANEL IS ASSUMED TO BE FLAT .
C...
190 IF (NAP .LT. 3) GO TO 280
C...
335 C...IF PANEL IS EITHER UPPER SURFACE OR LOWER SURFACE OF AN AIRFOIL
C...(ILE .EQ. 1 .OR. ILE .EQ. - 1) THEN THE CORRESPONDING LEADING
C...EDGE RADII (RLE1, RLE2) HAVE TO BE READ IN.
C...
ILE = ITS (I) * (1 - INTRAC (I))
READ (5, 50) (XAF (JJ), JJ = 1, NAP)
WRITE (6, 80) (XAF (JJ), JJ = 1, NAP)
RLE1 = 0.0
RLE2 = 0.0
340
VORLAX 1701
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345 IF (ILE .NE. 0) HEAD (5, 50) RLE1
   IF (ILE .NE. 0) WRITE (6, 80) RLE1
   READ (5, 50) (ZC1 (JJ), JJ = 1, NAP)
   WRITE (6, 80) (ZC1 (JJ), JJ = 1, NAP)
   IF (ILE .NE. 0) HEAD (5, 50) RLE2
   IF (ILE .NE. 0) WRITE (6, 80) RLE2
   READ (5, 50) (ZC2 (JJ), JJ = 1, NAP)
   WRITE (6, 80) (ZC2 (JJ), JJ = 1, NAP)
   ZLE1 (1) = ZC1 (1)
   ZLE2 (1) = ZC2 (1)

C
C
C
C...THE DO-LOOP ENDED BY LABEL 270 COMPUTES THE SLOPE OF THE
C...SURFACE AT THE CORRESPONDING CONTROL POINTS ALONG THE
C...STREAMWISE EDGES OF THE PANEL. THESE SLOPES ARE STORED IN
C...ARRAYS DNDX1 (EDGE 1) AND DNDX2 (EDGE 2). THE SLOPE COMPUTATION
C...IS DONE BY USING 3-POINT LAGRANGE POLYNOMIALS. IF ILE .NE. 0
C...THEN SQUARE ROOT TYPE LAGRANGE POLYNOMIAL IS USED FOR THE
C...COMPUTATION OF SLOPE NEAR THE LEADING EDGE.
C...
      DO 270 JJX = 1, MAXIM
      JX = JJX - 1
      IF (LAX .EQ. 1) GO TO 200
      XX = (1. - COS (PI *FLOAT (JX) /RNCV (I))) *50.0
      GO TO 210
200  XX = (FLOAT (JX) - 0.25) /RNCV (I) *100.0
      IF (XX .LT. 0.) XX = 0.
210  IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC)) GO TO 220
      IF (JC .EQ. (NAP - 1)) GO TO 220
      JC = JC + 1
      GO TO 210
220  XX1 = XAF (JC - 1)
      XX2 = XAF (JC)
      XX3 = XAF (JC + 1)
      D1 = (XX1 - XX2) * (XX1 - XX3)
      D2 = (XX2 - XX3) * (XX2 - XX1)
      D3 = (XX3 - XX1) * (XX3 - XX2)
      P1 = (XX2 + XX3) /D1
      P2 = (XX3 + XX1) /D2
      P3 = (XX1 + XX2) /D3
      V11 = ZC1 (JC - 1)
      V12 = ZC1 (JC)
      V13 = ZC1 (JC + 1)
      V01 = ZC2 (JC - 1)
      V02 = ZC2 (JC)
      V03 = ZC2 (JC + 1)
      IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 240
      IF (XX .LE. 0.0) GO TO 230

C
      SIGN1 = 1.0
      SIGN2 = 1.0
      IF (V12 .LT. V11) SIGN1 = -1.0
      IF (V02 .LT. V01) SIGN2 = -1.0
      B1A0 = SIGN1 *SIGN2 (2.0 *RLE1)

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400      R2A0 = SIGN2 *SORT (2.0 *RLE2)
        RIC2 = VI2 - B1A0 *SORT (XX2) - V11
        R2C2 = V02 - B2A0 *SORT (XX2) - V01
        R1C3 = VI3 - B1A0 *SORT (XX3) - V11
        R2C3 = V03 - B2A0 *SORT (XX3) - V01
405      B2A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) / (XX3 - XX2)
        B1A2 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) / (XX2 - XX3)
        R1A2 = (B1C2 /XX2 - B1C3 /XX3) / (XX2 - XX3)
        R2A2 = (B2C2 /XX2 - B2C3 /XX3) / (XX2 - XX3)
        CIVAL = 0.5 *B1A0 /SORT (XX) + R1A1 + 2. *R1A2 *XX
        C2VAL = 0.5 *B2A0 /SORT (XX) + B2A1 + 2. *B2A2 *XX
C
230      GO TO 250
        CIVAL = 0.0
        C2VAL = 0.0
415      GO TO 250
        CIVAL = 2.0*(V11/D1+V12/D2+V13/D3)*XX-P1*V11-P2*V12-P3*V13
        C2A = V01 /D1 + V02 /D2 + V03 /D3
        C2B = P1 *V01 + P2 *V02 + P3 *V03
        C2VAL = 2.0 *C2A *XX - C2B
420      IF (INTRAC (I) .EQ. 0) GO TO 250
        C2C = V01 *XX2 *XX3 /D1 + V02 *XX3 *XX1 /D2 + V03 *XX1 *XX2 /D3
        FTEMP = C2A *XX **2 - C2B *XX + C2C
425      IF (FTEMP .GT. 0.0) C2VAL = 5.0 *C2VAL /SORT (FTEMP)
        IF (FTEMP .LE. 0.0) C2VAL = -100.
        SLE1 (I) = CIVAL
        SLE2 (I) = C2VAL
        GO TO 270
430      C1 (JX) = CIVAL
        C2 (JX) = C2VAL
270      CONTINUE
        GO TO 300
C....
C....
C....*FOR FLAT PLATE PANFL MAKE SLOPES EQUAL TO ZFRO.
C....
280      DO 290 K = 1, MAX
        C1 (K) = 0.0
        C2 (K) = 0.0
440      CONTINUE
        SLE1 (I) = 0.
        SLE2 (I) = 0.
C....
445      C....
        C....*STONE SLOPES ON LOAD COEFFICIENTS (AS CASE MAY BE) IN ARRAYS
        C....*DNDX1 AND DNDX2.
        C....
300      DO 310 K = 1, MAX
        KED = KED + 1
        DNDX1 (KED) = C1 (K)
        DNDX2 (KED) = C2 (K)
450      CONTINUE
310      CONTINUE
        C....
        C....
455      C....
        C....

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SUBROUTINE INPUT 74/74 OPT=1

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C...IF VORTEX LATTICE IS TO BE LAID OUT ON BODY SURFACE KATHER
C...THAN ON SOME CYLINDRICAL CONTROL SURFACE (NON = 1), THEN THE
C...PROFILE OF THIS SURFACE AT THE PANEL EDGES IS COMPUTED IN THE
C...DO-LOOP ENDED BY LABEL 370, THE RESULTS ARE STORED IN THE ARRAY
C...GAMMA FOR USE IN SUBROUTINE GEOM. FOR FUSIFORM BODIES. BODY
C...SURFACE IMPLIES AUXILIARY BODY SURFACE.
C....
      NON = 1
      IF (NPP (1) .EQ. 0) NON = 0
      IF (NAP .LT. 3) NON = 0
      IF (ISYNT .EQ. 1) NON = 0
      IF (NON .EQ. 0) GO TO 380
      JC = 2
      DO 370 JX = 1, MAX
      KEGR = KEGR + 1
      RJX = JX
      IF (LAX .EQ. 1) GO TO 320
      XX = (1.0 - COS ((RJX - 0.5) *PI /RNCV (1))) *50.0
      GO TO 330
320  XX = (RJX - 0.75) /RNCV (1) *100.0
330  IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC)) GO TO 340
      JC = JC + 1
      GO TO 330
340  XX1 = XAF (JC - 1)
      XX2 = XAF (JC)
      XX3 = XAF (JC + 1)
      D1 = (XX1 - XX2) * (XX1 - XX3)
      D2 = (XX2 - XX3) * (XX2 - XX1)
      D3 = (XX3 - XX1) * (XX3 - XX2)
      P1 = (XX2 + XX3) /D1
      P2 = (XX3 + XX1) /D2
      P3 = (XX1 + XX2) /D3
      F1 = ZC1 (JC - 1)
      F2 = ZC1 (JC)
      F3 = ZC2 (JC - 1)
      FF2 = ZC2 (JC)
      FF3 = ZC2 (JC + 1)
      C1A = F1 /D1 + F2 /D2 + F3 /D3
      C1B = F1 *P1 + F2 *P2 + F3 *P3
      C1C = F1 *XX2 *XX3 /D1 + F2 *XX3 *XX1 /D2 + F3 *XX1 *XX2 /D3
      C2A = FF1 /D1 + FF2 /D2 + FF3 /D3
      C2B = FF1 *P1 + FF2 *P2 + FF3 *P3
      C2C = FF1 *XX2 *XX3 /D1 + FF2 *XX3 *XX1 /D2 + FF3 *XX1 *XX2 /D3
      IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 350
      B1A0 = SQRT (2.0 *HLE1)
      B2A0 = SQRT (2.0 *RLE2)
      B1C2 = F2 - B1A0 *SQRT (XX2) - F1
      B2C2 = F2 - B2A0 *SQRT (XX2) - FF1
      B1C3 = F3 - B1A0 *SQRT (XX3) - F1
      B2C3 = F3 - B2A0 *SQRT (XX3) - FF1
      B1A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) / (XX3 - XX2)
      B2A1 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) / (XX3 - XX2)
  
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VARIABLES	SN	TYPE	RELOCATION	74/74	OPT=1	FTN 4.5+410A	10/04/76	10.15.13	PAGE	11
2150 B1A1		REAL								
2144 B1C2		REAL								
0 B2		REAL	SET15							
2151 B2A1		REAL								
2145 B2C2		REAL								
2 C8AR		REAL								
0 CDC		REAL	SET15							
0 CHORD		REAL	SFT9	ARRAY						SET8
0 CLTOT		REAL	SFT10	ARRAY						SET12
144 CMTC		REAL	SET12							SET9
430 CN		REAL	SET17	ARRAY						SET12
6 CNTOT		REAL	SET8	ARRAY						SET9
2067 CORD2		REAL	SET12							SET9
5 CORTOT		REAL	SET17	ARRAY						SET5
0 CSUC		REAL	SET8	ARRAY						SET3
550 CY		REAL	SET12	ARRAY						SET8
4 CYTOT		REAL	SET12	ARRAY						SET8
2172 C1A		REAL								
2174 C1C		REAL								
2260 C2		REAL		ARRAY						
2157 C2B		REAL								
2155 C2VAL		REAL								
2070 DELTAX		REAL								
6 DELTAZ		REAL								
144 DL		REAL								
2101 DMZ		REAL	SFT18	ARRAY						SFT2
620 DNDX2		REAL	SET10	ARRAY						SET1A
2050 DTR		REAL								
2125 D2		REAL	SET4	ARRAY						SET4
3 EPS		REAL								SFT8
2170 FF2		REAL	SET13							
12 FLOATX		REAL	/ /							/ /
360 FN		REAL	/ /	ARRAY						/ /
500 FY		REAL	SET8	ARRAY						
2165 F2		REAL	SET16	ARRAY						
0 GAMMA		REAL	SET16	ARRAY						
24 HEAD		REAL	SET16	ARRAY						
2072 IBOT		INTEGER	/ /							SET3
3 IH		INTEGER	/ /							
2111 ILE		INTEGER	SET120	ARRAY						SET10
404 INTRAC		INTEGER	/ /							SET5
14 INVERS		INTEGER	/ /							/ /
2 IQ		INTEGER	/ /							/ /
2100 IR		INTEGER	SET13							SET7
2061 ISTART		INTEGER	SET13							SET7
1 IITER		INTEGER	SET13							
2 ITRMAX		INTEGER	SET13							
2074 J		INTEGER	/ /							
2077 JJ		INTEGER	/ /							
2116 JJK		INTEGER	/ /							
2117 JK		INTEGER	/ /							
2052 KED		INTEGER	/ /							
2054 KEGR		INTEGER	/ /							
2107 KEG2		INTEGER	/ /							
0 LAX		INTEGER	/ /							
240 LESWP		REAL	SET5	ARRAY						SET8
2106 LI		INTEGER	SET5	ARRAY						SET11

VARIABLES	SN	TYPE	RELOCATION	2115	MAXIM	INTEGR	ARRAY	SET#	ARRAY	SET#	ARRAY	SET#
2105	MAX	INTEGER		23	NALPHA	INTEGER						SET11
120	MOMENT	REAL	SET8	22	NMACH	INTEGER						SET11
2103	NAP	INTEGER		0	NPAN	INTEGER						SET14
2162	NON	INTEGER		360	NPP	INTEGER					ARRAY	SET20
3	NPNAS	INTEGER	SET14	2071	NV	INTEGER						
1	NT	INTEGER	SET14	0	NXS	INTEGER						SET18
620	NVOR	REAL	SET15	2	NZS	INTEGER						SET18
1	NYS	INTEGER	SET18	170	PDL	REAL					ARRAY	SET5
3720	ONSET	REAL	SET16	50	PHIMEU	REAL					ARRAY	SET20
2425	PHI	REAL		6	PITCHU	REAL					ARRAY	SET5
2047	PI	REAL	/ /	550	PSPAN	REAL					ARRAY	SET20
5	PSI	REAL		2130	P2	REAL						
2127	P1	REAL		214	P3	REAL						
2131	P3	REAL		2163	RJX	REAL						
7640	RFLAG	REAL	SET3	2113	RLE2	REAL						
2112	RL1	REAL		620	RM	REAL						SET8
5	RLM	REAL	SET13	7	RNMAX	REAL					ARRAY	SET7
0	RNCV	REAL	SET7	2141	ROLLG	REAL						SET7
2342	RO	REAL		0	SIGN2	REAL						SET19
2140	SIGN1	REAL		3720	SLOPE	REAL						SET2
50	SLE	REAL	SET19	310	SPC	REAL						SET17
24	SLE2	REAL	SET14	1130	SURF	REAL						SET8
2	SMAX	REAL	SET12	310	SYNTH	REAL						SET5
3	SREF	REAL	SET3	0	TITLE	INTEGER						SET6
3720	SX	INTEGER	SET5	620	TNT	REAL						SET10
500	TAPER	REAL	SET10	2132	V11	REAL						
454	TNL	REAL	SET11	2134	V13	REAL						
21	VINF	REAL		2136	V02	REAL						
2133	V12	REAL		7640	VSP	REAL						SET2
2135	V01	REAL		10270	VST	REAL						SET20
2137	V03	REAL	SET10	0	X	REAL						SET1
310	VSS	REAL	SET13	7	XS	REAL						SET1
4	WSPAN	REAL		764	XTE	REAL						SET5
2510	XAF	REAL	SET15	2123	XX3	REAL						SET18
3	XBAR	REAL	SET8	2064	X2	REAL						SET10
1060	XSUC	REAL		50	YAPEX	REAL						
2120	XX	REAL		740	YM	REAL						
2122	XX2	REAL		430	YY	REAL						
2055	X1	REAL		2065	Y2	REAL						
3720	Y	REAL	SET1	120	ZAPEX	REAL						
10	YAWQ	REAL	/ /	4230	ZC	REAL						
3	YNOT	REAL	SET18	2654	ZC2	REAL						
2056	Y1	REAL		0	ZLE1	REAL						
4064	Z	REAL		5	ZNOT	REAL						
4	ZBAR	REAL	SET1	2057	Z1	REAL						
2572	ZC1	REAL	SET15									
214	ZETA	REAL	SET15									
24	ZLE2	REAL	SET19									
4350	ZZ	REAL	SET20									
2066	ZZ	REAL	SET20									

FILE NAMES	TAPES	MODE	TAPE6	FMT
		FMT		

EXTERNALS	ATAN2	SIN	TYPE	ARCS
			REAL	2 LIBRARY
			REAL	1 LIBRARY
			REAL	CUS
			REAL	SURT
			REAL	1 LIBRARY
			REAL	1 LIBRARY

INLINE FUNCTIONS TYPE REAL ARGVS
 FLOAT 1 INTRIN

STATEMENT LABELS	1367	20	FMT	1443	30	FMT
1364 10 FMT	1367	20	FMT	1443	30	FMT
1446 40 FMT	1463	50	FMT	1465	60	FMT
1474 70 FMT	1501	80	FMT	0	90	
1567 100 FMT	1572	110	FMT	0	120	
212 130 FMT	0	140		345	150	
1641 160 FMT	1644	170	FMT	0	180	
456 190	556	200		564	210	
573 220	724	230		726	240	
1000 250	1006	260		1011	270	
1014 280	0	290		1025	300	
0 310	1066	320		1072	330	
1101 340	1264	350		1274	360	
0 370	1303	380		0	390	
1763 400 FMT	1765	410	FMT	2023	420	FMT

LOOPS LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES	EXT REFS	NOT INNER
66 390	* I	156 534	1222H			
101 90	IL	172 175	48	INSTACK		
205 120	J	231 234	48	INSTACK		
223	* JJ	244 244	108		EXT REFS	
237	* JJ	245 245	108		EXT REFS	
253 140	* IR	253 266	658		EXT REFS	
420 180	L1	299 304	48	INSTACK		
544 270	* JJX	366 431	250H		EXT REFS	
1017 290	K	438 441	38	INSTACK		
1031 310	K	450 454	48	INSTACK		
1053 370	* JX	473 524	230H		EXT REFS	

COMMON BLOCKS	LENGTH
/ /	14
SET1	2220
SET2	6000
SET3	8000
SET4	840
SET5	440
SET6	2220
SET7	240
SET8	640
SET9	200
SET10	700
SET11	20
SET12	7
SET13	6
SET14	4
SET15	5
SET16	4000
SET17	240
SET18	27
SET19	240
SET20	6280

STATISTICS	PROGRAM LENGTH	2750B	1512
CM LABELED COMMON LENGTH	771118	32329	

SUBROUTINE INPUT
STATISTICS
CM BLANK COMMON LENGTH

74/74 OPT=1
168 14

FTN 4.5*410A 10/04/76 10.15.13 PAGE 14


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1 CONTROL*VRLX.MAP
C.... SUBROUTINE MAP (EW, EWX, EMY, ITOTAL)
C....
C....PURPOSE TO COMPUTE THE FLOW FIELD ABOUT THE CONFIGURATION.
C....
C....INPUT
C.... CALLING SEQUENCES
C.... EW = UPWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED
C.... ROW BY ROW FROM UNIT 3).
C.... EMX = AXIAL WASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED
C.... ROW BY ROW FROM UNIT 4).
C.... EMY = SIDEWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED
C.... ROW BY ROW FROM UNIT 7).
C.... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C.... COMMONS
C.... IH, IO, NI, XS, NX5, NYS, NZ5, PSI, ALFA, MACH, YNOT,
C.... ZNOT, ALPHA, GAMMA, RMAX, DELTAY, DELTAZ.
C....
C....OUTPUT
C.... CALLING SEQUENCES
C.... NONE.
C.... COMMONS
C.... NONE.
C.... DIRECT PRINTS
C.... XS, YK1, ZK1 = FIELD GRID POINT COORDINATES (BODY AXIS
C.... SYSTEM).
C.... VX, VF, WF = TOTAL DIMENSIONLESS (REFERENCED TO VELO-
C.... CITY AT UPST-STREAM INFINITY) VELOCITY COMPO-
C.... NENTS ALONG THE X-Y-Z AXES RESPECTIVELY
C.... (BODY AXIS SYSTEM).
C.... EPSILON = UPWASH FLOW ANGLE IN DEGREES.
C.... SIGMA = SIDEWASH FLOW ANGLE IN DEGREES.
C.... CP = LOCAL PRESSURE COEFFICIENT.
C.... RM = LOCAL MACH NUMBER.
C.... PPIUT = (LOCAL STATIC PRESSURE)/(TOTAL PRESSURE).
C.... PPIF = (LOCAL STATIC PRESSURE)/(FREE STREAM STATIC PRES-
C.... SURE).
C....
C.... SUBROUTINES
C.... CALLED NONE.
C....
C....DISCUSSION FLOW FIELD QUANTITIES ARE COMPUTED AT THE NODAL POINTS
C.... OF A 3-D GRID DEFINED AROUND THE CONFIGURATION BY A SET
C.... OF ORTHOGONAL PLANES ( X = CONST., Y = CONST., AND
C.... Z = CONST. PLANES). THE VELOCITIES ARE CALCULATED BY
C.... THE USE OF INFLUENCE COEFFICIENT MATRICES HASFD BY THE
C.... VORTEX LATTICE REPRESENTATION OF THE CONFIGURATION.
C.... THESE MATRICES ARE COMPUTED IN SUBROUTINE SURVEY AND
C.... STORED IN UNITS 3, 4, AND 7 (CME MATRIX AND ONE UNIT
C.... PER VELOCITY COMPONENT). THE PRESSURE RATIOS AND RELATED
C.... FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF 15FN
C.... TROPIC FLOW RELATIONSHIPS.
C....
C....
C.... DIMENSION EW (ITOTAL), EMX (ITOTAL), EMY (ITOTAL)
C.... COMMON LAX, LAY, IO, IH, LATRAL, PSI, FITCHQ, ROLLO, YAWQ, HAQ,
C.... * FLOATX

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VORLAX 1971
VORLAX 1972
VORLAX 1973
VORLAX 1974
VORLAX 1975
VORLAX 1976
VORLAX 1977
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VORLAX 2018
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VORLAX 2020
VORLAX 2021
VORLAX 2022
VORLAX 2023
VORLAX 2024
VORLAX 2025
VORLAX 2026
VORLAX 2027

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COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)
COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)
COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINP, NMACH, NALPHA
COMMON /SET14 /NPAN, NT, SMAX, NPNAS
COMMON /SET16 /GAMMA ( 2000 ), ONSET (2000)
COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)
INTEGER TITLE
REAL MACH
C
PI = 3.14159
DIR = 0.01745329
C
C
REWIND 3
REWIND 4
REWIND 7
COSA = COS (ALFA)
SINA = SIN (ALFA)
COPSI = COS (DIR * PSI)
SIPSI = SIN (DIR * PSI)
C
C...LINE IS AN OUTPUT LINE COUNTER USED TO DETERMINE WHEN TO SWITCH
C...TO A NEW PRINTOUT PAGE.
C
LINE = 1
DO 80 I = 1, NXS
DO 70 JI = 1, NZS
RJ1 = J1
C
C...COMPUTE COORDINATES IN CROSS-FLOW PLANE, ZK1 AND YK1.
C
ZK1 = ZNOT * DELTAZ * (RJ1 - 1.)
DO 70 K1 = 1, NYS
RK1 = K1
YK1 = YNOT * DELTAY * (RK1 - 1.)
C
C...READ IN INDUCED VELOCITY COMPONENT INFLUENCE COEFFICIENTS.
C
READ (3) EW
READ (4) EWX
READ (7) EWY
C
C...COMPUTE INDUCED VELOCITY COMPONENTS.
C
IR = 0
UF = 0.
VF = 0.
WF = 0.
DO 10 K = 1, NT
MAX = RNMAX (K)
DO 10 J = 1, MAX
IR = TR + 1
UF = UF + GAMMA (IR) *EWX (IR)
VF = VF + GAMMA (IR) *EWY (IR)
WF = WF + GAMMA (IR) *EW (IR)
10 CONTINUE
VX = COSA *COPSI + UF

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VORLAX 2028
VORLAX 2029
VORLAX 2030
VORLAX 2031
VORLAX 2032
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VORLAX 2083
VORLAX 2084

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115      VF = COSA *SIPSI + VF
      WF = SINA + WF
C
C...IF AN INCOMPRESSIBLE CASE IS BEING CONSIDERED (MACH = 0.) THEN
C...THE FLOW IS MADE SLIGHTLY COMPRESSIBLE (MACH = 0.01) TO ALLOW THE
C...USE OF COMPRESSIBLE ISENTROPIC FLOW FORMULAS.
C
      XM = 0.01
      IF (MACH (IQ) .GT. XM) XM = MACH (IQ)
      XM2 = XM **2
      A2 = (1. + .2 *XM2) / (1.2 *XM2)
      VR2 = VX **2 + VF **2 + WF **2
      VRATIO = VR2 /A2
      VCAL = VRATIO
      IF (VRATIO .GT. 5.5) VRATIO = 5.5
C
C...THE VELOCITIES INDUCED BY THE VORTEX LATTICE MAY BE TOO HIGH DUE
C...TO THE NUMERICAL SINGULARITIES INHERENT TO A LATTICE GEOMETRY. CAL
C...IS A CORRECTION APPLIED TO PREVENT LESS-THAN-VACUUM PRESSURES
C...DUE TO SUCH SINGULARITIES.
C
      CAL = 1.0
      IF (VCAL .GT. 0.0) CAL = SQRT (VRATIO /VCAL)
      VX = VX *CAL
      VF = VF *CAL
      WF = WF *CAL
      VR2 = VR2 *CAL *CAL
      EPSILON = 1. /DIR *ATAN2 (WF, VX)
      SIGMA = 1. /DIR *ATAN2 (VF, VX)
      RM2 = 2. *VRATIO / (2.4 - .4 *VRATIO)
      PPTOT = (1.0 - .4 *VRATIO /2.4) **3.5
      PIPT = (1.0 - 0.4 / (2.4 *A2)) **3.5
      PIF = PPTOT /PIPT
      IF (XM .LE. 0.1) CP = 1. - VR2
      RM = SQRT (RM2)
      IF (LINE .EQ. 1) WRITE (6, 20) TITLE
20      FORMAT (I11, 20A4)
      IF (LINE .EQ. 1) WRITE (6, 30) MACH (IQ), ALPHA (IH)
30      FORMAT (I10, 6HMACH =, F7.3, 6X, 7HALPHA =, F7.3, 5H DEG.)
      IF (LINE .EQ. 1) LINE = 3
      IF (LINE .EQ. 3) WRITE (6, 40)
40      FORMAT (I10, 40H      X      Y      Z      U
      * 40H      V      W      EPSILON      SIGMA ,
      * 40H      CP      MLOC      P/PTOT      P/PINF)
      IF (LINE .EQ. 3) WRITE (6, 50)
50      FORMAT (I10 )
      IF (LINE .EQ. 3) LINE = 7
      WRITE (6, 60) XS (1), YK1, ZK1, VX, VF, WF, EPSILON, SIGMA, CP,
      * RM, PPTOT, PIF
60      FORMAT (I11, 6F10.4, F8.2, F10.2, F12.4, 3F10.4)
      LINE = LINE + 1
      IF (LINE .GT. 45) LINE = 1
70      CONTINUE
      WRITE (6, 50)
      IF (LINE .NE. 1) LINE = LINE + 2
80      CONTINUE
      VORLAX 2085
      VORLAX 2086
      VORLAX 2087
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      VORLAX 2140
      VORLAX 2141

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VORLAX 2142
 VORLAX 2143
 VORLAX 2144
 VORLAX 2145
 VORLAX 2146

REWIND 3
 REWIND 4
 REWIND 7
 RETURN
 END

175

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
 3 MAP

VARIABLES	SN	TYPE	RELOCATION	ARRAY	SET6
20 ALFA	REAL	SET11			
10 ALPHA	REAL	SFT11			
506 CAL	REAL	ARRAY			
454 COSA	REAL				
4 DELTAY	REAL	SET18			SET18
453 DTR	REAL				
0 EW	REAL	F.P.			F.P.
0 EY	REAL	F.P.			/ /
0 GAMMA	REAL	SET16			/ /
24 HEAD	REAL	SET6			/ /
3 IH	INTEGER	/ /			/ /
470 IR	INTEGER				F.P.
170 ITS	INTEGER	SET7			
214 JTS	INTEGER	SET7			
474 K	INTEGER	/ /			/ /
4 LATRAL	INTEGER	/ /			/ /
1 LAY	INTEGER	/ /			/ /
0 MACH	REAL	SET11			SET11
23 NALPHA	INTEGER	SET11			SET14
0 NPAN	INTEGER	SET14			SET18
1 NT	INTEGER	SET18			SET18
1 NYS	INTEGER	SFT16			
3720 ONSET	REAL	ARRAY			
514 PIF	REAL	/ /			
6 PIICHO	REAL	/ /			
5 PSI	REAL				
466 RK1	REAL	SET7			SET7
511 RM2	REAL				
24 RNMAX	REAL	ARRAY			
510 SIGMA	REAL				
457 SIPS1	REAL	ARRAY			SET14
0 TITLE	INTEGER	SET6			
505 VCAL	REAL	SFT11			
21 VINP	REAL				
503 VR2	REAL				
473 WF	REAL				
501 XM2	REAL				
10 YAW0	REAL	/ /			SET18
3 YNOT	REAL	SET18			
5 ZNOT	REAL	SFT18			
334 ALOC	REAL				
502 A2	REAL				
456 CUPSI	REAL				
515 CP	REAL				
6 DELTAZ	REAL				
517 EPSLON	REAL				
0 FWX	REAL	ARRAY			ARRAY
12 FLOATX	REAL	F.P.			/ /
11 HAG	REAL	F.P.			/ /
461 T	INTEGER	SET6			/ /
2 TO	INTEGER	/ /			/ /
0 TTOTAL	INTEGER				
476 J	INTEGER	SET7			
462 J1	INTEGER	SET7			
465 K1	INTEGER				
0 LAX	INTEGER	/ /			/ /
440 LINE	INTEGER	/ /			/ /
475 MAX	INTEGER	SET11			SET11
22 NMACH	INTEGER	SET11			SET14
3 NPANA3	INTEGER	SET14			SET18
0 NXS	INTEGER	SET18			SET18
2 NZS	INTEGER				
452 PI	REAL				
513 P1PT	REAL	/ /			
512 PPTOT	REAL	/ /			
463 RJ1	REAL				
516 RM	REAL				
0 RNCV	REAL	ARRAY			ARRAY
7 RULLC	REAL				
455 SINA	REAL	SET7			
2 SMAX	REAL				
471 UF	REAL	SET6			SET14
472 VF	REAL				
504 VRATIO	REAL				
477 VX	REAL				
500 XM	REAL				
7 XS	REAL	/ /			SET18
467 YK1	REAL	SET18			
464 ZK1	REAL	SFT18			

FILE NAMES	MODE	TAPE3	UNFMT	TYPE	REAL	REAL	ARGS	TAPE4	UNFMT	TAPE6	FMT	TAPE7	UNFMT
EXTERNALS	ATAN2			REAL			2 LIBRARY			MEAL			
	SIN			REAL			1 LIBRARY			MEAL			
STATEMENT LABELS													
	0 10							336 20					
	356 40			FMT				400 50					
	0 70							0 80					

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
40	80	* I	83 171	2458	
41	70	* J1	84 168	2348	EXT REFS NOT INNER
47	70	* K1	90 168	2248	EXT REFS NOT INNER
77	10	* K	106 113	238	EXT REFS NOT INNER
107	10	J	108 113	78	NOT INNER

COMMON BLOCKS	/	LENGTH
SET6		2220
SET7		240
SET11		20
SET14		4
SET16		4000
SET18		27

STATISTICS	PROGRAM LENGTH	5348	348
CM LABELED COMMON LENGTH	145578	6511	
CM BLANK COMMON LENGTH	138	11	

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1 CONTROL*VRLX.MATRIX
C.... SUBROUTINE MATRIX (EW, EU, ITOTAL)
C.....
5 C....PURPOSE
C.... TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI
C.... CESS (1) THE NORMALWASH AT THE CONTROL POINTS
C.... (EW / UNIT 1) AND (2) THE AXIALWASH AT THE CONTROL POINTS
C.... (EU / UNIT 2) AND (3) THE NORMALWASH AT THE LEAD. EDGE
C.... (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED
C.... VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE
C.... LATTICE.
C....
C.... CALLING SEQUENCES
C.... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C.... COMMONS
C.... X, B2, CX, DL, NT, SX, YY, ZZ, HAG, LAX, NPP, PSI, TNT,
C.... VSP, VST, XTE, ALFA, IPAN, XBAR, ZBAR, CHORD, RFLAG,
C.... RNMAY, SLOPE, FLOATX, FLOATY, INVERS, LATRAX.
C....
20 C....OUTPUT
C.... CALLING SEQUENCES
C.... EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY
C.... ROW IN UNIT 1).
C.... EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY
C.... ROW IN UNIT 9).
C.... EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2).
C.... COMMONS
C.... NONE.
C....
30 C....SUBROUTINES
C....CALLED WASH, UXVEL.
C....
C....DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES
C.... ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY
C.... INDUCED AT THE (KI,JI) CONTROL POINT BY THE (K,J)
C.... HORSESHOE VORTEX OF UNIT STRENGTH. IF K = KI AND
C.... J = JI (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF
C.... THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF
C.... THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL
C.... POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE
C.... INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION
C.... IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.
C....
45 DIMENSION EW (ITOTAL), EU (ITOTAL)
COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, KOLLQ, YAWU, HAG,
* FLOATX, FLOATY, INVERS, ISOLV
COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)
COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
COMMON /SET7 /RNV (20), RNMAY (100), IT5 (20), JTS (100)
* TNT (100), XTE (100), DL (100), VSS (100), TNL (100),
COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINP, NMACH, NALPHA
COMMON /SET14 /NPAN, NT, SMAX, NPANAS
COMMON /SET15 /B2, BETA, CHAR, XBAR, ZBAR
COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHMFD (100), RCS (100),
* NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST (2000)
C....

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VORLAX 2147
VORLAX 2148
VORLAX 2149
VORLAX 2150
VORLAX 2151
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VORLAX 2202
VORLAX 2203

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60      C      INTEGER CX, SX, FLAG
        C      PI = 3.14159
        C      DTR = 0.01745329

65      C      REWIND 1
        C      REWIND 2
        C      REWIND 9
        C      FLAX = LAX
        C      FAL = FLOATX *ALFA
        C      FBL = FLOATY *PSI * DTR
        C      MM = 0
        C      IF (FAL .NE. 0.0 .OR. FBL .NE. 0.0) MM = 1
        C      SIZE = SIN (2.0 *ALFA)
        C      COZA = COS (2.0 *ALFA)
        C      HIM = MAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)
75      C      XIMO = 2.0 *HIM *SIN (ALFA)
        C      ZIMO = - 2.0 *HIM *COS (ALFA)
        C      TANZA = SIZE /COZA

80      C      C...THERE ARE TWO MAJOR DOUBLE DO-LOOPS THAT GENERATE THE COEFFICIENTS
        C      C...OF THE AERODYNAMIC INFLUENCE MATRICES S (1) THOSE ENDED BY LABEL
        C      C...230 AND (2) THOSE ENDED BY LABEL 210. THE FIRST (OUTER) 230-LOOP
        C      C...DETERMINES THE VORTEX STRIP, AND THE SECOND (INNER) 230-LOOP
        C      C...LOCATES THE POINT WITHIN THAT STRIP AT WHICH THE INDUCED
        C      C...VELOCITIES WILL BE COMPUTED. THE FIRST (OUTER) 210-LOOP
85      C      C...ESTABLISHES THE STRIP, AND THE SECOND (INNER) 210-LOOP DETERMINES
        C      C...THE HORSESHOE VORTEX WITHIN THAT STRIP WHOSE INFLUENCE IS TO BE
        C      C...COMPUTED. THE 210-LOOPS ARE NESTED WITHIN THE 130-LOOPS.

90      C      IRR = 1

95      C      DO 230 K1 = 1, NT
        C      KEY = IPAN(K1)
        C      MAX = RNMAX (K1)
        C      COX = 1.0 - FLAX + FLAX *CHORD (K1) /RNMAX (K1)
        C      PION = PI /RNMAX (K1)
        C      MAXIM = MAX + 1

100     C      DO 230 J1 = 1, MAXIM

105     C      C...J1 = 1 CORRESPONDS TO THE VERY LEADING EDGE. IT IS NOT A CONTROL
        C      C...POINT IN THE CONVENTIONAL SENSE, BUT THE NORMALWASH INFLUENCE
        C      C...COEFFICIENT IS NEEDED FOR THE COMPUTATION OF THE LEADING EDGE
        C      C...SUCTION IN ACCORDANCE WITH LAN#S PROCEDURE.

110     C      J1 = J1 - 1
        C      RJ1 = J1

        C      C...LOCATE SENSING, OR RECEIVING, POINT ON CORRESPONDING CONTROL
        C      C...SURFACE. EITHER ON ACTUAL BODY SURFACE (NPP = 1) OR ON CYLINDRICAL
        C      C...SURFACE IN THE PROXIMITY OF BODY (NPP = 0).
    
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VORLAX 2204
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 VORLAX 2259
 VORLAX 2260

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115 C
      DELTAX = .5 * (COS (RJI - .5) * PION) - COS (RJI * PION)
      IF (JI .EQ. 0) JI = 1
      IF (LAX .EQ. 1) DELTAX = .5 / RNMAX (K1)
      XCNTL = X (IRR) + DELTAX * CHORD (K1)
120 C
      IRRB = IRR
      IF (CX (IRR) .LT. MAX) IRRB = IRR + 1
      IRR = IRRB - 1
      RATIO = (XCNTL - X (IRRB)) / (X (IRRB) - X (IRRA))
      YCNTL = YY (IRRA) * (1.0 - RATIO) + YY (IRRB) * RATIO
      ZCNTL = ZZ (IRRA) * (1.0 - RATIO) + ZZ (IRRB) * RATIO
125 C
C...IF NPP = 1 THEN THE SURFACE NORMAL DIRECTION COSINES ARE COMPUTED
C...EXACTLY+ OTHERWISE THE USUAL TRIGONOMETRIC APPROXIMATIONS ARE
C...APPLIED. E.G., SIN F = TANGENT = ARGUMENT.
130 C
      COSINE = 1.0
      SINE = 0.0
      IF (NPP (KEY) .EQ. 0) GO TO 10
      SINE = SLOPE (IRR) / SQRT (1.0 + SLOPE (IRR) **2)
      COSINE = SQRT (1.0 - SINE **2)
135 C
10 CONTINUE
140 C
      IF (JJI .EQ. 1) GO TO 30
C...DETERMINE IF TRANSVERSE VORTEX LEG OF HORSESHOE ASSOCIATED TO THE
C...CONTROL POINT UNDER CONSIDERATION IS SONIC / SWEEP PARALLEL TO MACH
C...LINE) ↓ IF SO THEN MFLAG = 0.0, OTHERWISE MFLAG = 1.0.
145 C
      FLAG = 0
      ESP1 = VSP (IRR)
      T2 = ESP1 * ESP1
      IF (R2 .LE. 0.0) GO TO 20
      IF (J1 .EQ. 1) GO TO 20
      IF (J1 .EQ. MAX) GO TO 20
      ESPF = VSP (IRR - 1)
      T2F = ESPF * ESPF
      ESPA = VSP (IRR + 1)
      T2A = ESPA * ESPA
      TRANS = (R2 - T2F) * (R2 - T2A)
      IF (TRANS .LT. 0.0) FLAG = 1
      RFLAG (IRR) = 1 - FLAG
150 C
155 C
C...COMPUTE THE GENERALIZED PRINCIPAL PART OF THE VORTEX-INDUCED
C...VELOCITY INTEGRAL, W WAVE.
160 C
      W WAVE = 0.0
      IF (R2 .GT. T2) W WAVE = - 0.5 * SQRT (R2 - T2) / COX
      IR = 0
165 C
C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE ALONG A
C...GIVEN STRIP, STRIP BY STRIP, I.E., THE OUTER 210-LOOP REFERS TO
C...A CHORDWISE STRIP OF HORSESHOE VORTICES, AND THE INNER 210-LOOP
C...RELATES TO A PARTICULAR HORSESHOE ON THE STRIP.
170 C

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VORLAX 2261
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 VORLAX 2317


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C      DU 210 K = 1, NT
C
C...COMPUTE PARAMETERS COMMON TO A GIVEN CHORDWISE STRIP OF HOSES/HOE
C...VORTICES.
      PION2 = PI *.5 /RNMAX (K)
      PION3 = 0.5 *PION2
      PION4 = PION2 /8.0
      DELX = CHORD (K) /RNMAX (K)
      WEIGHT = 1.0
      WT1 = 0.25 *DELX
      CDL = COS (DTR *DL (K))
      SDL = SIN (DTR *DL (K))
      COS1 = COS (DTR *(DL (K1) - DL (K)))
      SIN1 = SIN (DTR *(DL (K1) - DL (K)))
      COS2 = COS (DTR *(DL (K1) + DL (K)))
      SIN2 = SIN (DTR *(DL (K1) + DL (K)))
      COSIM = COS (2.0 *DTR *DL (K))
      SINIM = SIN (2.0 *DTR *DL (K))
      MAX2 = RNMAX (K)
C
      AA = FAL *CDL - FBL *SDL
      AM = FBL *CDL + FAL *SDL
C
C      DO 210 J = 1, MAX2
      IR = IR + 1
      XLOAD = X (IR)
      YP = YCNTL - XLOAD
      YS = YCNTL + Y (IR)
      ZS = ZCNTL - ZZ (IR)
      Z1 = ZS *CDL + ZS *SDL
      Y2 = YP *CDL - ZS *SDL
      Z2 = ZS *CDL + YP *SDL
      RYZ1 = Y1 *Y1 + Z1 *Z1
      RYZ2 = Y2 *Y2 + Z2 *Z2
      X150 = X1 *X1
      RS1 = X150 - B2 *RYZ1
      RS2 = X150 - B2 *RYZ2
      IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)
      IF (RS2 .GT. 0.0) RS2 = SQRT (RS2)
      IF (LAX .EQ. 1) GO TO 50
      RJ = 2 *J - 1
      RJ1 = 4 *J - 3
      DELX = 1.0
      WEIGHT = PION2 *SIN (RJ *PION2) *CHORD (K)
      WT1 = PION3 *SIN (RJ1 *PION3) *CHORD (K)
      XU1 = XLOAD - WT1
      CT = XTE (K) - XLOAD
      TESP = TNT (K)
      ESP = VSP (IR)
      VOSS = VST (IR)
      TOLZ = WEIGHT *DELX *1.0E-1
C
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230 C...IF CONTROL, OR RECEIVING, POINT IS WITHIN A GIVEN NEAR FIELD
C...RADIUS (RNF) OF SENDING ELEMENT, THEN COMPUTE AXIALWASH (UI) BY
C...INTERDIGITATED VORTEX SPLITTING.
C
      UVEL = 0.0
      IDIT = 0
      RNF = 4.0 *WEIGHT *DELX
      IF (SX (IR) .EQ. SX (IRR)) GO TO 90
      IF (RS) .LE. 0.0) GO TO 90
      IF (RS) .GT. RNF) GO TO 90
      RJM = J - 1
      CUSH = .COS (2.0 *PIUN2 *RJM)
      DO 80 L = 1, 8
      IF (LAX .EQ. 0) GO TO 60
      RVL = 4 *L - 3
      XDIF = RVL *DELX /32.0
      WFR = 0.1250
      GO TO 70
      60 RVL = 16 *(J - 1) + 2 *L - 1
      XDIF = 0.5 *(CUSH - COS (PION4 *RVL)) *CHORD (K)
      WFR = PION4 *SIN (PION4 *RVL)
      XINT = XCNTL - XII - XDIF
      CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, B2, TOLZ, UDV)
      UVEL = UVEL + UDV *WFR
      80 CONTINUE
      DCW = 1.0
      IF (LAX .EQ. 0) DCW = CHORD (K) /4EIGHT
      UVEL = UVEL * DCW
      IDIT = 1
C
235 C...SUBROUTINE WASH COMPUTES THE VELOCITIES INDUCED BY A GENERALIZED
C...HORSESHOE VORTEX OF UNIT INTENSITY.
C
      90 CALL WASH (X1,Y1,Z1,VOSS,ESP,B2,U1,V1,W1,AA,AM,TESP,CT,MM)
      IF (IDIT .EQ. 1) U1 = UVEL
C
240 C...IF CONFIGURATION IS IN GROUND EFFECT (HAG % 0.) THEN COMPUTE THE
C...VELOCITIES INDUCED BY THE HORSESHOE IMAGE MIRRORRED ABOUT THE
C...GROUND PLANE.
C
      IF (HAG .EQ. 0.0) GO TO 100
      XIM = XIMO + X (IR) *CO2A + ZZ (IR) *S1ZA
      ZIM = ZIMO + X (IR) *S1ZA - ZZ (IR) *CO2A
      XII = XCNTL - XIM
      ZSI = ZCNTL - ZIM - XII *TAN2A
      YII = YS *CDL - ZSI *SDL
      ZII = ZSI *CDL + YS *SDL
      CALL WASH (XII,YII,ZII,VOSS,ESP,B2,U1I,V1I,W1I,AA,AM,TESP,CT,MM)
      U1 = U1 - U1I
      V1 = V1 - V1I
      W1 = W1 + W1I *SINIM - W1I *COSIM
      100 IF (LAXL .EQ. 1) GO TO 160
C
245 C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN
C...COMPUTE INFLUENCE OF HORSESHOE VORTEX IMAGE MIRRORRED ABOUT
C...CENTER PLANE, I.E.. X-Z PLANE.
C

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VORLAX 2375
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VORLAX 2430
VORLAX 2431

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290      UVEL = 0.0
        IDIT = 0
        IF (RS2 .LE. 0.0) GO TO 140
        IF (RS2 .GT. RNF) GO TO 140
        RJM = J - 1
        COSM = COS (2.0 *PION2 *RJM)
        DU 130 L = 1.8
        IF (LAX .EQ. 0) GO TO 110
        RVL = 4 *L - 3
        XDIF = RVL *DELX /32.0
        WFR = 0.1250
        GO TO 120
110      RVL = 16 *(J - 1) + 2 *L - 1
        XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)
        WFR = PION4 *SIN (PION4 *RVL)
120      XINT = XCNTL - XU1 - XDIF
        CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)
        UVEL = UVEL + UDV *WFR
130      CONTINUE
        DCW = 1.0
        IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT
        UVEL = UVEL *DCW
        IDIT = 1
C
310      CALL WASH (X1,Y2,Z2,VOSS, - ESP*B2,U2,V2,W2,AA,AM, -TESP,CT,MM)
        IF (IDIT .EQ. 1) U2 = UVEL
C
        IF (HAG .EQ. 0.0) GO TO 150
C
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND
C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF
C...DOUBLE-MIRRORED HORSESHOE IMAGE (ONCE ABOUT CENTER PLANE, AND
C...ANOTHER ABOUT GROUND PLANE).
        Y2I = YP *CDL + ZSI *SDL
        Z2I = ZSI *CDL - YP *SDL
        CALL WASH(X1I,Y2I,Z2I,VOSS,- ESP*RP,U2I,V2I,W2I,AA,AM,-TESP,CT,MM)
        U2 = U2 - U2I
        W2 = W2 - W2I *COSIM + W2I *SINIM
C
150      EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT
        EU (IR) = (U1 + U2) *WEIGHT
        GO TO 170
C
160      EW (IR) = (W1 *COS1 - V1 *SIN1) *WFIGHT
        EU (IR) = U1 *WEIGHT
170      IF (JJ1 .EQ. 1) GO TO 210
C
180      ENORM = EW (IR) *COSINE + H2 *FU(IQ) *SINF
        ETAN = EW (IR) *SINE + EU (IR) *COSINE
        EW (IR) = ENORM
        EU (IR) = ETAN
C
340      IF (IR .NE. IRR) GO TO 190
        EW (IR) = EW (IRR) + WNAVE
190      CONTINUE
        VORLAX 2432
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        VORLAX 2486
        VORLAX 2487
        VORLAX 2488
    
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SUBROUTINE MATRIX

VARIABLES	SN	TYPE	RELOCATION	OPT=1	74/74	FTN 4.5+4J0A	10/04/76	10.15.13	PAGE
144 DL	REAL	ARRAY	SET10						
1201 ENORM	REAL								
1204 ESPA	REAL								
1200 ESP1	REAL								
0 EU	REAL	ARRAY	F.P.						
1144 FAL	REAL								
1140 FLAG	INTEGER								
12 FLOATX	REAL								
11 MAG	REAL								
13560 IDES	INTEGER	ARRAY	SET3						
3 IM	INTEGER								
14 INVERS	INTEGER								
2 IQ	INTEGER								
1155 IRR	INTEGER								
1171 IRRB	INTEGER								
0 ITOTAL	INTEGER								
1233 J	INTEGER								
214 JTS	INTEGER								
1211 K	INTEGER	ARRAY	SET7						
1156 K1	INTEGER								
4 LAY	INTEGER								
1 LAY	INTEGER								
1160 MAX	INTEGER								
1230 MAX2	INTEGER								
23 NALPHA	INTEGER								
0 NPAN	INTEGER								
360 NPP	INTEGER	ARRAY	SET20						
50 PHIMED	REAL	ARRAY	SET20						
1162 PION	REAL								
1213 PION3	REAL								
6 PITCHQ	REAL								
1173 RATIO	REAL								
214 RCS	REAL								
1252 RJ	REAL	ARRAY	SET20						
1166 RJ1	REAL								
1263 RNF	REAL								
7 ROLLO	REAL								
1251 RS2	REAL								
1245 RY21	REAL								
1221 SOL	REAL								
1227 SINJM	REAL								
1225 SIN2	REAL								
3720 SLOPE	REAL								
3720 SX	REAL	ARRAY	SET2						
1255 TESP	REAL	ARRAY	SET3						
620 TNT	REAL								
1206 TRANS	REAL								
1205 T2A	REAL								
1273 UDV	REAL								
1275 U1	REAL								
1311 U2	REAL								
21 VINP	REAL								
7640 VSP	REAL								
10270 VST	REAL	ARRAY	SET2						
1307 V11	REAL	ARRAY	SET20						
1317 V21	REAL								
1271 WFR	REAL								
1142 DTR	REAL								
1256 ESP	REAL								
1202 ESPF	REAL								
1322 ETAN	REAL								
0 EW	REAL	ARRAY	F.P.						
1145 FHL	REAL								
1143 FLAX	REAL								
13 FLOATY	REAL								
1151 HIM	REAL								
1262 IOIT	INTEGER								
404 INTRAC	INTEGER	ARRAY	SET20						
1130 IPAN	INTEGER	ARRAY	SET10						
1210 IR	INTEGER								
1172 IRRA	INTEGER								
15 ISOLV	INTEGER								
170 ITS	INTEGER	ARRAY	SET7						
1164 JJ1	INTEGER								
1165 JJ	INTEGER								
1157 KEY	INTEGER								
1266 L	INTEGER								
0 LAX	INTEGER								
0 MACH	INTEGER	ARRAY	SET11						
1163 MAXIM	INTEGER								
1146 MM	INTEGER								
22 NMACH	INTEGER								
3 NPANAS	INTEGER								
1 NT	INTEGER								
1141 PI	REAL								
1212 PION2	REAL								
1214 PION4	REAL								
5 PSI	REAL								
1323 RCC	REAL								
7640 RFLAG	REAL	ARRAY	SET3						
1264 RJM	REAL	ARRAY	SET7						
0 RNCV	REAL	ARRAY	SET7						
24 RNMAX	REAL								
1250 RS1	REAL								
1247 RVL	REAL								
1246 RYZ2	REAL								
1177 SINE	REAL								
1223 SIN1	REAL								
1147 SI2A	REAL								
2 SMAK	REAL								
1154 TAN2A	REAL	ARRAY	SET14						
454 TNL	REAL								
1250 TOLZ	REAL	ARRAY	SET10						
1201 T2	REAL								
1203 T2F	REAL								
1241 VEL	REAL								
1306 V11	REAL								
1316 V21	REAL								
1257 VOSS	REAL								
310 VSS	REAL								
1276 V1	REAL	ARRAY	SET11						
1312 V2	REAL	ARRAY	SET2						
1216 WEIGHT	REAL	ARRAY	SET20						
1217 WT1	REAL								

SUBROUTINE MATRIX

COMMON BLOCKS	LENGTH
SET7	240
SET10	700
SET11	20
SET14	4
SET15	5
SET20	6280

STATISTICS

PROGRAM LENGTH	13458	741
CM LABELED COMMON LENGTH	557138	23499
CM BLANK COMMON LENGTH	168	14

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1 CONTROL*VRLX.PRESS          9/15/76 2524
C... SUBROUTINE PRESS (ITOTAL, EU) 2525
C 2526
C 2527
5 C...PURPOSE TO COMPUTE PRESSURE LOAD COEFFICIENTS (CPLUWER 2528
C... CPUPPER), OR SURFACE PRESSURE COEFFICIENTS, FROM THE 2529
C... VALUES OF THE INDUCED VELOCITIES AND CIRCULATION 2530
C... STRENGTHS. 2531
C... 2532
10 C...INPUT 2533
C...ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES. 2534
C...EU = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED 2535
C... ROW BY ROW FROM UNIT 2). 2536
C...COMMON< 2537
C...B2, CX, DL, SX, JTS, PSI, TNL, INT, ALFA, YAWQ, CHORD, 2538
C...GAMMA, UNSET, RNMAX, SLOPE, WSPAN. 2539
C... 2540
20 C...OUTPUT 2541
C...NONE. 2542
C...COMMON: 2543
C...DCP. 2544
C... 2545
25 C...SUBROUTINES 2546
C...CALLED NONE. 2547
C... 2548
C... 2549
C...DISCUSSION THIS SUBROUTINE COMPUTES THE PRESSURE COEFFICIENT ARRAY 2550
C... DCP. EACH ELEMENT OF DCP CORRESPONDS TO A GIVEN 2551
C... HORSESHOE VORTEX OF THE LATTICE, AND IT IS ASSUMED TO 2552
C... ACT AT THE HORSESHOE CENTROID, I.E., THE M1= 2553
C... THE TRANSVERSE, OR SKEWED, LEG. AN ELEMENT OF THE DCP 2554
C... ARRAY IS EITHER A LOAD COEFFICIENT (IF THE SURFACE 2555
C... IS ASSUMED WETTED ON BOTH FACES, I.E., JTS = ITS = 1), 2556
C... OR A SURFACE PRESSURE COEFFICIENT (IF THE SURFACE IS 2557
C... ASSUMED WETTED ON ONE SIDE ONLY, I.E., JTS = ITS = 0). 2558
C... IN THE COMPUTATION OF LOAD COEFFICIENTS, THE CIRCULA 2559
C... TION STRENGTHS, THE FREE STREAM VELOCITY COMPONENTS, 2560
C... AND THE ONSET FLOW DUE TO ANY ANGULAR ROTATION OF THE 2561
C... CONFIGURATION ARE TAKEN INTO ACCOUNT, THE EFFECT OF 2562
C... THE INDUCED AXIALWASH IS IGNORED (SECOND ORDER ERROR). 2563
C... IN THE COMPUTATION OF SURFACE PRESSURE COEFFICIENTS, 2564
C... THE AXIALWASH IS ALSO TAKEN INTO ACCOUNT. IF NPP = 1, 2565
C... THE #AXIALWASH# IS NO LONGER A TRUE AXIALWASH (X-AXIS 2566
C... VELOCITY COMPONENT), RATHER IT REPRESENTS THE VELOCITY 2567
C... COMPONENT TANGENTIAL TO THE SURFACE BUT WITH THE SIDE 2568
C... WASH LEFT OUT. SURFACE PRESSURE COEFFICIENTS ARE LIMITI 2569
C... TED BY THE ISENTROPIC VALUES CORRESPONDING TO STAGNA 2570
C... TION AND 70 PERCENT OF VACUUM FOR THE GIVEN FREE-STREA 2571
C... MACH NUMBER. 2572
C... 2573
C... 2574
C... 2575
55 COMMON LAX, LAY, I0, IH, LATHAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,
* FLOATX, FLOATY, INVERS
COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)
C... 2576
C... 2577
C... 2578
C... 2579
C... 2580

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COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
* TNT (100), XTE (100), IPAI (100)
COMMON /SET11 /MACH (8), ALPHA (H), ALFA (H), VINFL, NMACH, NALPHA
COMMON /SET13 /RIG, ITER, ITHMAX, EPS, WSPAN, KLM
COMMON /SET15 /B2, BETA, CHAR, XBRAP, ZBAR
COMMON /SET16 /GAMMA ( 2000 ), ONSET (2000)
INTEGER CX, SX

65 C DIMENSION EU (ITOTAL)
C REWIND 2
70 C PI = 3.14159
C DTR = 0.017*5329
75 C...COMPUTE ISENTROPIC FLOW PARAMETERS AND CUIOFF VALUES FOR
C...SURFACE PRESSURE COEFFICIENTS (CPSTAG AND CPVAC).
C CPSTAG = 1.0
  XM1 = 1.0
  XM2 = 0.0
  XM3 = 1.0
  XM4 = 1.0
  XM5 = 0.0
  CPVAC = - 1*2.86
  IF (B2 .LT. -.98) GO TO 10
85 C CPSTAG = ((1.2 + .2 *R2) **3.5 - 1.) / (.7*(1.+B2))
  CPVAC = - 1.0 / (1.0 + B2)
  XM1 = 1.4286 / (1.0 + R2)
  XM2 = 1.0
  XM3 = 0.2 * (1.0 + R2)
  XM4 = 3.5
  XM5 = 1.0
90 C 10 CONTINUE
C
95 C...COMPUTE FREE-STREAM AND ONSET FLOW PARAMETERS.
C
  YAW = DTR *YAWQ *2.0 /WSPAN
  COSALF = 1.0 /SQRT (1. + ALFA **2)
  SINPSI = SIN (DTR *PSI)
  COSPSI = COS (DTR *PSI)
  FORAXL = COSALF *COSPSI
  FORLAT = COSALF *SINPSI *2.0
  FLAX = LAX
105 C DO 90 IR = 1, ITOTAL
  KC = CX (IR)
  KS = SX (IR)
  RC = KC
  RS = RC
  PION = PI /RNMAX (KS)
  MAX = RNMAX (KS)
  DCPSID = 0.0
  IF (PSI .EQ. 0.0) GO TO 40
  
```

VORLAX 2581
VORLAX 2582
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VORLAX 2632
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VORLAX 2634
VORLAX 2635
VORLAX 2636
VORLAX 2637

```

115 C
C...COMPUTE EFFECT OF SIDESLIP.
C
XIA = 0.5*(1. - COS((RC - 1.)*PION))*FLAX
XIA = XIA + (RC - 1.0)/RNMAX*(KS)*FLAX
XIB = 0.5*(1. - COS(PION))*FLAX
XIB = XIB + RC/RNMAX*(KS)*FLAX
TANA = TANL(KS)*(1. - XIA) + TNL(KS)*XIA
TANB = TANL(KS)*(1. - XIB) + TNL(KS)*XIB
KTOP = KC - 1
GANT = 0.0
IF (KTOP.EQ. 0) GO TO 30
DO 20 KK = 1, KTOP
KIR = IR - KC + KK
RKK = KK
GFX = .5*PION*SIN((RKK - .5)*PION)*(1. - FLAX)
GFX = GFX + FLAX/CHORD*(KS)
GANT = GANT + GFX*GAMMA*(KIR)
CONTINUE
20
30 GLAT = GANT*(TANA - TANB)
GFX = .5*PION*SIN((RC - .5)*PION)*(1. - FLAX)
GLAT = GLAT + GFX*GAMMA*(IR)*TANH
DCPSID = FORLAT*COS(DTR*DL*(KS))*GLAT/(XIB - XIA)
FACTOR = FORAXL + ONSET*(IR)
C
140 C...COMPUTE LOAD COEFFICIENT.
C
GNET = GAMMA*(IR)*FACTOR
IF (LAX.EQ. 1) GNET = GNET*RNMAX*(SX*(IR))/CHORD*(SX*(IR))
DCP*(IR) = 2.0*GNET + DCPSID
C
145 C
READ(2) EU
IF (JTS*(SX*(IR)).EQ. 0) GO TO 90
C
150 C...COMPUTATION OF SURFACE PRESSURE COEFFICIENT.
C
C...COMPUTE TOTAL INDUCED AXIALWASH AT CONTROL POINT RELATED TO
C...HORSESHOE VORTEX UNDER CONSIDERATION (UB).
C
UB = 0.0
DO 50 IRR = 1, ITOTAL
UBF = EU*(IRR)
UB = UB + UBF*GAMMA*(IRR)
50 CONTINUE
C
F2 = UB
C
165 C FS2 = SLOPE*(IR)
C
IF (KC.EQ. 1) GO TO 80
C
170 C...COMPUTE AXIALWASH AT VORTEX CENTROID (LOAD POINT) BY INTERPOLATING
C...(EXTRAPOLATING FOR THE FIRST CHORDWISE ELEMENT) BETWEEN CONTROL
C...POINTS.

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VORLAX 2638
VORLAX 2639
VORLAX 2640
VORLAX 2641
VORLAX 2642
VORLAX 2643
VORLAX 2644
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VORLAX 2646
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VORLAX 2680
VORLAX 2681
VORLAX 2682
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VORLAX 2684
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VORLAX 2687
VORLAX 2688
VORLAX 2689
VORLAX 2690
VORLAX 2691
VORLAX 2692
VORLAX 2693
VORLAX 2694

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C
175 IF (LAX .EQ. 1) GO TO 60
   XX = .5*(1.0 - COS (IRC - 0.5)*PI0N))
   X1 = .5*(1.0 - COS (IRC - 1.0)*PI0N))
   X2 = .5*(1.0 - COS (RC*PI0N))
   GO TO 70
60   XX = (RC - 0.75)/RNMAX (KS)
   X1 = (RC - 1.25)/RNMAX (KS)
   X2 = (RC + 0.75)/RNMAX (KS)
70   UB = (XX - X2)/(X1 - X2)*F1 + (XX - X1)/(X2 - X1)*F2
C...COMPUTE AXIALWASH DUE TO THE DISTRIBUTED VORTICITY WHICH HAS BEEN
C...CONCENTRATED IN TRANSVERSE LEG OF THE HORSESHOE UNDER CONSIDERA
C...TION (UG). THIS COMPONENT HAS NOT BEEN INCLUDED IN UR.
C
C   UG = 0.25*FLOAT (JTS (KS)) *DCP (IR)
C
C...ADD UG TO FREE-STREAM X-VELOCITY COMPONENT, ACCOUNT FOR SURFACE
C...INCLINATION IN ORDER TO OBTAIN TRUE TANGENTIAL COMPONENT, AND ADD
C...TO UB TO COMPUTE TOTAL TANGENTIAL VELOCITY (VELOX). THIS IS ONLY
C...AN APPROXIMATION BECAUSE SIDEWASH CONTRIBUTION IS NOT INCLUDED.
C
   FTAN = (XX - X2)/(X1 - X2)*FS1 + (XX - X1)/(X2 - X1)*FS2
   FSQ = 1.0/SQRT (1.0 + FTAN**2)
   VELOX = UB + (UG + COSALF)*FSQ
C
C...COMPUTE SURFACE PRESSURE COEFFICIENT USING ISENTROPIC FLOW
C...FLOW FORMULAS, AND APPLY ESTABLISHED PHYSICAL LIMITS (CPSTAG AND
C...CPVAC) TO IT.
C
   RADVEX = XM2 + XM3*(1.0 - VELOX*VELOX)
   DCP (IR) = CPVAC
   IF (RADVEX .GT. 0.0) DCP (IR) = XM1*(RADVEX**XM4 - XMS)
   IF (B2 .LT. -.98) DCP (IR) = RADVEX
C
   IF (KC .GT. 2) GO TO 80
C
C...CARRY OUT COMPUTATIONS RELATED TO FIRST CHORDWISE ELEMENT.
C...EXTRAPOLATE USING FIRST AND SECOND CHORDWISE CONTROL POINTS.
C
   XX = .5*(1.0 - COS (0.5*PI0N))
   IF (LAX .EQ. 1) XX = 0.25/RNMAX (KS)
   UB = (XX - X2)/(X1 - X2)*F1 + (XX - X1)/(X2 - X1)*F2
   FTAN = (XX - X2)/(X1 - X2)*FS1 + (XX - X1)/(X2 - X1)*FS2
   UG = 0.25*FLOAT (JTS (KS)) *DCP (IR - KC + 1)
   FSQ = 1.0/SQRT (1.0 + FTAN**2)
   VELOX = UB + (UG + COSALF)*FSQ
   RADVEX = XM2 + XM3*(1.0 - VELOX*VELOX)
   DCP (IR - KC + 1) = CPVAC
   IF (RADVEX .GT. 0.0) DCP (IR - KC + 1) = XM1*(RADVEX**XM4 - XMS)
   IF (B2 .LT. -.98) DCP (IR - KC + 1) = RADVEX
C
   IF (DCP (IR - KC + 1) .GT. CPSTAG) DCP (IR - KC + 1) = CPSTAG
   IF (DCP (IR - KC + 1) .LT. CPVAC) DCP (IR - KC + 1) = CPVAC
C
C...END OF COMPUTATIONS PARTICULAR TO FIRST CHORDWISE ELEMENT ONLY.

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VORLAX 2695

VORLAX 2696

VORLAX 2697

VORLAX 2698

VORLAX 2699

VORLAX 2700

VORLAX 2701

VORLAX 2702

VORLAX 2703

VORLAX 2704

VORLAX 2705

VORLAX 2706

VORLAX 2707

VORLAX 2708

VORLAX 2709

VORLAX 2710

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VORLAX 2740

VORLAX 2741

VORLAX 2742

VORLAX 2743

VORLAX 2744

VORLAX 2745

VORLAX 2746

VORLAX 2747

VORLAX 2748

VORLAX 2749

VORLAX 2750

VORLAX 2751

SUBROUTINE PRESS 74/74 OPT=1

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230      C      80      F1 = F2
          FS1 = FS2
          IF (KC.EQ. 1) GO TO 90
          IF (DCP (IR) .GT. CPSTAG) DCP (IR) = CPSTAG
          IF (DCP (IR) .LT. CPVAC) DCP (IR) = CPVAC

235      C
          C
          C***END OF SURFACE PRESSURE COEFFICIENT COMPUTATION
          C
          C      90      CONTINUE
          C
          REWIND 2
          RETURN
          END
    
```

VORLAX 2752
 VORLAX 2753
 VORLAX 2754
 VORLAX 2755
 VORLAX 2756
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 VORLAX 2758
 VORLAX 2759
 VORLAX 2760
 VORLAX 2761
 VORLAX 2762
 VORLAX 2763
 VORLAX 2764
 VORLAX 2765
 VORLAX 2766
 VORLAX 2767

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
 3 PRESS

VARIABLES	SN	TYPE	RELOCATION
20	ALFA	REAL	SET11
1	BETA	REAL	SET15
0	R2	REAL	SET15
0	CHORD	REAL	SET10
507	COSALF	REAL	ARRAY
505	CPVAC	REAL	ARRAY
0	DCP	REAL	ARRAY
144	DL	REAL	SET2
3	EPS	REAL	SET10
540	FACTOR	REAL	SET13
12	FLOATX	REAL	/ /
512	FORAXL	REAL	/ /
556	FS0	REAL	/ /
546	FS2	REAL	/ /
552	F1	REAL	ARRAY
0	GAMMA	REAL	SET16
536	GFX	REAL	ARRAY
541	GNET	REAL	ARRAY
13560	IDES	INTEGER	SET3
14	INVERS	INTEGER	/ /
2	I0	INTEGER	/ /
543	IRR	INTEGER	ARRAY
0	ITOTAL	INTEGER	ARRAY
170	IIS	INTEGER	F.P.
516	KC	INTEGER	SET7
533	KK	INTEGER	ARRAY
531	KTOP	INTEGER	ARRAY
0	LAX	INTEGER	/ /
0	MACH	INTEGER	ARRAY
23	NALPHA	INTEGER	SET11
10	ALPHA	REAL	SET11
0	RIG	REAL	SET13
2	CHAR	REAL	SET15
511	CO PSI	REAL	SET15
477	CPSTAG	REAL	SET15
0	CX	INTEGER	SET3
524	DCPSIU	REAL	SET3
476	DIR	REAL	F.P.
0	FU	REAL	/ /
514	FLAX	REAL	/ /
13	FLOATY	REAL	/ /
513	FORLAT	REAL	/ /
555	FS1	REAL	/ /
554	FTAN	REAL	/ /
545	F2	REAL	/ /
532	GANT	REAL	/ /
537	GLAT	REAL	/ /
11	HAG	REAL	/ /
3	IH	INTEGER	/ /
1130	IPAN	INTEGER	ARRAY
515	IR	INTEGER	SET10
1	ITER	INTEGER	SET13
2	ITRMAX	INTEGER	SET13
214	JIS	INTEGER	SET7
534	KIR	INTEGER	ARRAY
517	K5	INTEGER	ARRAY
4	LATRAL	INTEGER	/ /
1	LAY	INTEGER	/ /
523	MAX	INTEGER	/ /
22	NMACH	INTEGER	SET11

SUBROUTINE PRESS

VARIABLES	SN	TYPE	MODE	RELOCATION	FILE NAMES
3720 ONSET		REAL	UNFMT		
522 PION		REAL		ARRAY SET16	
5	PSI	REAL		/ /	
520 RC		REAL			475 PI
535 RKK		REAL		ARRAY SET7	560 PITCH
0	RNCV	REAL		/ /	7640 RADVEX
7	ROLLQ	REAL			5
		REAL			24 RLM
510 SIMPSI		REAL		ARRAY SET7	521 RNMAX
3720 SX		INTEGER		/ /	3720 SLOPE
530 TANB		REAL		ARRAY SET3	527 TANA
620 TNT		REAL		ARRAY SET10	454 TNL
544 UBF		REAL			542 UB
557 VELOX		REAL		ARRAY SET2	553 UG
7640 VSP		REAL		ARRAY SET2	21 VINP
4	WSPAN	REAL		ARRAY SET13	310 VSS
525 XIA		REAL			3 XBAN
500 XM1		REAL			526 XIB
502 XM3		REAL			501 XM2
504 XM5		REAL			503 XM4
547 XX		REAL			764 XTE
551 X2		REAL			550 X1
10 YAWO		REAL		/ /	506 YAW
		REAL			4 ZBAR

EXTERNALS

TAPE2	TYPE	ARGS	LIBRARY	REAL	LIBRARY
COS	REAL	1	LIBRARY		
SORT	REAL	1	LIBRARY		

INLINE FUNCTIONS

TYPE	REAL	INTRIN
FLOAT	1	

STATEMENT LABELS

47	10	0	20
203	40	0	50
274	70	426	80

LOOPS

LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES	EXT REFS	NOT INNER
71	90	106 240	3538			
135	20	127 133	218			
232	50	158 161	58	INSTACK		

COMMON BLOCKS

/ /	LENGTH
SET2	6000
SET3	8000
SET7	240
SET10	700
SET11	20
SET13	6
SET15	5
SET16	4000

STATISTICS

PROGRAM LENGTH	5708	376
COMMON LENGTH	450338	18971

SUBROUTINE PRESS

74/74 OPT=1

STATISTICS

CM BLANK COMMON LENGTH

158 13

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CONTROL*VRLX.PRINT
C.... SUBROUTINE PRINT (ITOTAL, EW, EMX, EMY)
C....
C.... PURPOSE TO PRINT PROGRAM DATA.
C....
C.... INPUT
CALLING SEQUENCES
ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
EM, EMX, EMY = STORAGE ARRAYS SET ASIDE FOR CALLING
SUBROUTINE MAP.
COMMONS
CD, CL, CM, CX, CY, DL, IH, IJ, IY, ZC, ZZ,
BIG, CDC, CNC, CRM, CYM, DCP, EPS, HAG, JTS, LAX,
NAX, PDL, PSI, RLM, SPC, CBAR, CHTC, CSUC, HEAD,
IPAN, ITER, LIFT, MACH, NPAN, NVOR, NVCV, SREF,
SURF, VINF, XBAR, XSUC, YAWO, ZBAR, AINC1, AINC2,
ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CRTOT, CYTOT,
DNDX1, DNDX2, GAMMA, ISOLV, LESMP, PSPAN, RNMAX,
ROLLQ, SLOPE, SYNTH, TAPER, TITL, WSPAN, XAPEX,
YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVERS,
IQUANT, ITHMAX, LATRAL, MOMENT, PITCHQ.
C....
C.... OUTPUT
CALLING SEQUENCES
NONE.
COMMONS
NONE.
C....
C.... SUBROUTINES
C.... CALLED
ZNORM, MAP.
C....
C.... DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED
IN THREE GROUPS, AS FOLLOWS
(1) INPUT DATA THESE ARE DATA WHICH ARE TAKEN FROM
THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT
SUITABLE FOR USE BY THE PROGRAM.
(2) PANEL AND TOTAL CONFIGURATION FORCE AND MOMENT
COEFFICIENT DATA.
(3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS
OR TO INDIVIDUAL HORSESHOE VORTICES.
THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.
IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES
PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.
C....
C....
DIMENSION EM (2000), EMX (2001), EMY (2001), EU (2001)
REAL MACH, NVOR, LIFT, MOMENT, LESMP
INTEGER TITLE, CX, SX
COMMON LAX, LAY, IO, IH, LATRAL, PSI, PITCHQ, KOLLO, YAWO, HAG,
*FLOATX, FLOATY, INVERS, ISOLV
COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)
COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)
COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),
*LESMP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),
*PSPAN (40), NVOR (40)
COMMON /SET6 /TITLE (20), HEAD (200), ALUC (2000)

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VORLAX 2768
VORLAX 2769
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VORLAX 2824

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60 COMMON /SET7 /RNCV (20), RMAX (100), ITS (20), JTS (100)
COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),
* CD (40), CM (40), FN (40), CN (40), CY (40), CY (40),
* RM (40), CRM (40), YM (40), CYM (40), XSIJC (40), SURF (40)
COMMON /SET9 /CDC (100), CNC (100)
COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
* TNT (100), XTE (100), IPAN (100)
65 COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINP, NMACH, NAI, PA
COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT
COMMON /SET13 /BIG, ITER, ITRMAX, EPS, *SPAN, MLM
COMMON /SET14 /NPAN, NI, SMAX, *NPANAS
COMMON /SET15 /R2, BETA, CHAR, XBAR, ZBAR, ZBAR
70 COMMON /SET16 /GAMMA (2000), ONSET (2000)
COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)
COMMON /SET18 /NYS, NYS, NZS, YNOT, DELIAY, ZNOT, DELIAZ, XS (20)
COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)
COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),
* NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST (2000)
75 C
PI = 3.14159
DTR = 0.01745329
C
80 IF (IO.EQ.1.AND.IH.EQ.1) GO TO 10
WRITE (6, 350) TITLE
GO TO 110
C
85 C...PRINTOUT FIRST DATA GROUP, I.E., INPUT DATA REARRANGED IN A FORMAT
C...SUITABLE FOR USE BY THE PROGRAM.
C
10 WRITE (6, 20) TITLE
20 FORMAT (1H, 20A4////1H, 14HPANEL GEOMETRY)
WRITE (6, 30)
30 FORMAT (1H0, 44H I, XAPEX(I), YAPEX(I), ZAPEX(I), PDL(T),
* 56HLESWP(I), CSTART(I), TAPER(I), PSPAN(I), NVOR(I), RNCV(I),
* 9H SPC(I)/)
00 50 I = 1, NPAN
95 WRITE (6, 40) I, XAPEX(I), YAPEX(I), ZAPEX(I), PDL(I), LESWP(I),
* CSTART(I), TAPER(I), PSPAN(I), NVOR(I), RNCV(I), SPC(I)
40 FORMAT (1H, I2, 8F10.4, 2F8.0, F10.2)
50 CONTINUE
KED1 = 1
100 DO 100 I = 1, NPAN
IF (.SYNTH (I) .LT. 0.5) WRITE (6, 60) I
60 FORMAT (1H0, 43HINCIDENCE AND CAMBER SLOPE INPUT FOR PANEL ,I4)
IF (.SYNTH (I) .GT. 0.5) WRITE (6, 70) I
70 FORMAT (1H0, 38HPRESSURE DISTRIBUTION INPUT FOR PANEL , I4)
MAX = RNCV (I)
KED2 = KED1 + MAX - 1
105 WRITE (6, 80) AINC1 (I), AINC2 (I)
80 FORMAT (1H0, 2F10.4)
WRITE (6, 90) (DNDX1 (J), J = KED1, KED2)
90 FORMAT (1H, 10F10.4)
WRITE (6, 90) (DNDX2 (J), J = KED1, KED2)
KED1 = KED1 + MAX
100 CONTINUE
C

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VORLAX 2825
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VORLAX 2874
VORLAX 2875
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VORLAX 2880
VORLAX 2881


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115 C...PRINTOUT PANEL AND TOTAL CONFIGURATION DATA (SECOND DATA GROUP).
C
110 WRITE (6, 350) TITLE
120 * SPSI = , F7.3, 5M DEG./1H , 12HPITCH RATE = , F7.2
* 10M DEG /SEC /1H , 11HROLL RATE = , F7.2, 10M DEG /SEC /1H ,
* 10HYAW RATE = , F7.2, 9M DEG /SEC ///
IF (INVERS = .EQ. 0) WRITE (6, 130)
IF (INVERS = .EQ. 1) WRITE (6, 140)
130 FORMAT (1H , 37H ANALYSIS (DIRECT) CASE (INVERS = 0)////)
140 FORMAT (1H , 37H DESIGN (INVERSE) CASE (INVERS = 1)////)
150 WRITE (6, 150) XBAR, ZBAR, VINP
160 * 5X, 7HZRAR = , E12.5, 15H ***** VINP = , E12.5
IF (MAG = .EQ. 0.) WRITE (6, 160)
170 FORMAT (1H0, 37H CONFIGURATION IS OUT OF GROUND EFFECT)
180 * 5X, 7HZRAR = , E12.5, 15H ***** VINP = , E12.5
190 FORMAT (1H0, 45H VORTEX MAKE FLOATION PARAMETERS S FLUATX = ,
* F5.2, 5X, 8H FLOATY = , F5.2)
200 * 24H REFERENCED TO SREF*WSPAN/
210 * 7X, 5HCY(I), 7X, 5HCD(I), 7X, 5HCT(I), 7X, 5HCL(I),
* 5HCM(I), 7X, 6HCM(I), 7X, 6HCM(I) /)
220 * 5X, 7HZRAR = , E12.5, 15H ***** VINP = , E12.5
230 * 5X, 7HZRAR = , E12.5, 15H ***** VINP = , E12.5
I = 1
IX = 0
ICYCLE = 1
IX = IX + 1
CS = XSUC (IX) *SQRT (1.0 + (TAN (DTR *LESWP (I))) **2)
F1 = SURF (IX) /SREF
F2 = CN (IX)
F3 = CL (IX) *F1
F4 = CY (IX) *F1
F5 = CD (IX) *F1
F6 = XSUC (IX) *F1
F7 = CS *F1
F8 = CM (IX) *F1 /CHAR
F9 = CRM (IX) *F1 /WSPAN
F10 = CYM (IX) *F1 /WSPAN
IF (ICYCLE = 1) 250, 250, 260
250 GO TO 270
260 WHITE (6, 230) I, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10
270 IF (ICYCLE = .EQ. 2) GO TO 290
I = I + 1
IF (I = NSPAN) 240, 240, 280

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VORLAX 2882
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VORLAX 2895
VORLAX 2896
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VORLAX 2899
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VORLAX 2937
VORLAX 2938

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280 IF (LATERAL .EQ. 0) GO TO 300
    ICYCLE = 2
    I = 0
290 I = I + 1
    IF (I .GT. NSPAN) GO TO 300
    IF (IQUANT (I) .EQ. 1) GO TO 290
    GO TO 240
300 WRITE (6, 310)
310 FORMAT (IHO, 6X, 4H$REF, 9X, 5H$SPAN, 10X, 4H$BAR, 13X, 5H$CLTOT, 9X,
    * 5H$CDTOT, 9X, 5H$CYTOT, 5X, 5H$CMTOT, 9X, 6H$CRTTOT, 8X, 6H$CYMTOT /)
320 FORMAT (1H, 3E14.5, 3F14.5, 3E14.5 //)
    CMTOT = CMTOT / C$BAR
    CRTTOT = CRTTOT / C$SPAN
    CMTOT = CMTOT / W$SPAN
    WRITE (6, 320) $REF, W$SPAN, C$BAR, CLTOT, CDTOT, CYTOT, CMTOT,
    * CRTTOT, CNTOT
    IF (CLTOT .EQ. 0.) GO TO 340
    CDCL = CDTOT / (CLTOT ** 2)
    E = ($REF * CLTOT ** 2) / (W$SPAN ** 2 * PI * CDTOT)
    WRITE (6, 330) CDCL, E
330 FORMAT (1H0, 10H$CD/CL**2 =, F7.4, 4X, 3H$E =, F7.4)
C
C
C...PRINTOUT DATA PERTAINING TO THE CHORDWISE LATTICE STRIPS AND
C...TO THE INDIVIDUAL HORSESHOE VORTICES (AERODYNAMIC LOAD DISTRIBUTION
C...DATA, THIRD DATA GROUP).
C...
C...INDEX LINE IS AN OUTPUT LINE COUNTER TO DETERMINE PAGE SWITCH
C...CONTROL.
C...
340 LINE = 1
    DO 460 I = 1, ITOTAL
    IF (LINE .EQ. 1) WRITE (6, 350) TITLE
    FORMAT (1H1, 20A4)
    IF (LINE .EQ. 1) WRITE (6, 360) MACH (IU), ALPHA (IM), PSI,
    * PITCHQ, ROLLQ, YAWQ
360 FORMAT (1H0, 6H$MACH =, F7.3, 4X, 7H$ALPHA =, F7.3, 3H $DG, 4X,
    * 5H$PSI =, F7.3, 3H $DG, 4X, 12H$PITCH RATE =, F6.2, 4H $D/S, 4X,
    * 11H$ROLL RATE =, F6.2, 4H $D/S, 4X, 10H$YAW RATE =, F6.2, 4H $D/S)
    IF (LINE .EQ. 1) LINE = 3
    IF (LINE .EQ. 3 .AND. INVERS .EQ. 0) WRITE (6, 420)
    IF (LINE .EQ. 3 .AND. INVERS .EQ. 1) WRITE (6, 430),
    IF (LINE .EQ. 3) LINE = 7
    IS = SX (I)
    IC = CX (I)
    ILEX = INVERS * IC
C
C...IF DESIGN PROCESS HAS BEEN INVOKED (INVERS = 1) THEN CALL
C...SUBROUTINE ZNORM TO GENERATE THE CAMERLINE THAT CORRESPONDS TO
C...THE COMPUTED SLOPE DISTRIBUTION.
C
    IF (ILEX .EQ. 1) CALL ZNORM (I, IS, RNMAX (IS))
    RIV = IC
    R1 = .5 * (1. - COS ((RIV - .5) * PI / RNMAX (IS)))
    IF (LAX .EQ. 1) R1 = (RIV - 0.75) / RNMAX (IS)
    R2 = X (I)
    R3 = Y (I)

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VORLAX 2939
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 VORLAX 2989
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 VORLAX 2991
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 VORLAX 2993
 VORLAX 2994
 VORLAX 2995

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230      R4 = ZZ (I)
        R5 = CHORD (IS)
        R6 = SLOPE (I)
        R7 = DCP (I)
        R8 = CNC (IS)
        R9 = R8 /HS
        R10 = DL (IS)
        R11 = CMFC (IS) /RS
        R12 = GAMMA (I)
        IF (INVERS.EQ.1) R12 = ZC (IC)
        R13 = CSUC (IS) *RS
        R14 = CDC (IS)
        IF (IC.NE.1) GO TO 400
C
        IF (IS.EQ.1) GO TO 370
        IF (IPAN (IS).EQ. IPAN (IS - 1)) GO TO 390
        IM1 = (IPAN (IS) - 1) *10 + 1
        IM2 = IM1 + 9
        WRITE (6, 380) IPAN (IS), (HEAD (JJ), JJ = IM1, IM2)
        LINE = LINE + 2
        FORMAT (I10, 30X, 9HPANEL NO., 2X, I2, 5X, 10A4)
C
390      WRITE (6, 440) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS), R7,
        *R8, R9, R10, R11, R12, R13, R14
        GO TO 410
400      WRITE (6, 450) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS), R7, R12
410      LINE = LINE + 1
        IF (LINE.GT. 57) LINE = 1
420      FORMAT (I10, 2X, I15, 2X, 1HC, 2X, 3HX/C, 6X, I1X, 6X, I1Y,
        * 8X, I1Z, 5X, 5HCORDB, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,
        * 3HCNC, 5X, 2HCN, 6X, 2HDUL, 6X, 3HCMT, 8X, 5HGAMMA, 6X, 3HCCTC,
        * 6X, 3HCDC/I10)
430      FORMAT (I10, 2X, I15, 2X, 1HC, 2X, 3HX/C, 6X, I1X, 6X, I1Y,
        * 8X, I1Z, 5X, 5HCORDB, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,
        * 3HCNC, 5X, 2HCN, 6X, 2HDUL, 6X, 3HCMT, 8X, 4HZC/C, 6X, 3HCCTC,
        * 6X, 3HCDC/I10)
440      FORMAT (I10, 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, 13, 1X, F8.3,
        * F10.3, F7.3, F8.2, F10.4, E12.4, 2F9.5)
450      FORMAT (I1, 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, 13, 1X, F8.3,
        * 35X, E12.4)
460      CONTINUE
        IF (ISOLV.EQ.1) GO TO 480
C
C...PRINTOUT RELAXATION SOLUTION PARAMETERS.
C
475      WRITE (6, 470) ITRMAX, EPS, ITER, RIG, RLM
        FORMAT (I10, 8HITRMAX =, I3/I10, 5HEPS =, F10.5/I10, 6HITER =,
        * I3/I10, 5HBIG =, F10.5/I10, 20HCONVERGENCE FACTOR =, F10.5)
C
C...IF FLOW FIELD SURVEY HAS BEEN REQUESTED (NKS % 0) THEN CALL
C...SUBROUTINE MAP TO COMPUTE AND PRINT THE FLOW QUANTITIES AT
C...THE NODAL POINTS OF THE SURVEY GRID.
C
480      IF (NKS.GT. 0) CALL MAP (EM, EMX, EMY, ITOTAL)
490      WRITE (6, 500)
500      FORMAT (I10, 11MENU OF CASE)

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VORLAX 2996
 VORLAX 2997
 VORLAX 2998
 VORLAX 2999
 VORLAX 3000
 VORLAX 3001
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 VORLAX 3050
 VORLAX 3051
 VORLAX 3052

RETURN
END

VORLAX 3053
VORLAX 3054

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 PRINT

VARIABLES	SN	TYPE	RELOCATION
1440 AINCL	1464	REAL	AINC2
20 ALFA	374	REAL	ALOC
10 ALPHA	1	REAL	HETA
0 BIG	0	REAL	H2
2 CBAR	240	REAL	CD
0 CDC	1433	REAL	CDCL
1 CDTOT	0	REAL	CHORD
170 CL	0	REAL	CLTOT
310 CM	144	REAL	CUTC
2 CMTOT	430	REAL	CN
144 CNC	6	REAL	CNTOT
670 CRH	5	REAL	CRTOT
1420 CS	430	REAL	CSTAKI
0 CSUC	0	REAL	CX
550 CY	1010	REAL	CYM
4 CYTOT	0	REAL	DCP
4 DELTAY	6	REAL	DELTAZ
144 DL	0	REAL	DNDX1
620 DNDX2	50	REAL	DRAG
1410 DTR	1434	REAL	E
3 EPS	1463	REAL	FU
0 EW	0	REAL	FWX
0 EWF	12	REAL	FLOATX
13 FLOATY	360	REAL	FN
500 FY	1421	REAL	F1
1432 F10	1422	REAL	F2
1423 F3	1424	REAL	F4
1425 F5	1426	REAL	F6
1427 F7	1430	REAL	F8
1431 F9	0	REAL	GAMMA
11 HAG	24	REAL	HEAD
1411 I	1437	INTEGER	IC
1417 ICYCLE	13560	INTEGER	IDES
3 IH	1440	INTEGER	ILEX
1460 IM1	1461	INTEGER	IM2
404 INTRAC	14	INTEGER	INVERS
1130 IPAN	2	INTEGER	I0
360 IQUANT	1436	INTEGER	IS
15 ISOLV	1	INTEGER	ITEM
0 ITOTAL	2	INTEGER	ITRMAX
170 ITS	1416	INTEGER	IX
1415 J	1462	INTEGER	JJ
214 JTS	1412	INTEGER	KED1
1414 KED2	4	INTEGER	LATRAL
		ARRAY	SET4
		ARRAY	SET6
		ARRAY	SET11
		ARRAY	SET15
		ARRAY	SETH
		ARRAY	SET10
		ARRAY	SET12
		ARRAY	SET17
		ARRAY	SEIR
		ARRAY	SET12
		ARRAY	SET12
		ARRAY	SET5
		ARRAY	SET3
		ARRAY	SET8
		ARRAY	SET12
		ARRAY	SET18
		ARRAY	SET4
		ARRAY	SET13
		ARRAY	F.P.
		ARRAY	F.P.
		ARRAY	/ /
		ARRAY	SET8
		ARRAY	/ /
		ARRAY	/ /
		ARRAY	SET20
		ARRAY	SET10
		ARRAY	SET5
		ARRAY	/ /
		ARRAY	F.P.
		ARRAY	SET7
		ARRAY	SET7
		ARRAY	SET16
		ARRAY	SET6
		ARRAY	SET3
		ARRAY	/ /
		ARRAY	/ /
		ARRAY	SET13
		ARRAY	SET13
		ARRAY	/ /

VARIABLES	SN	TYPE	RELOCATION	1	LAY	INTEGER	ARRAY	/
0 LAX		INTEGER	/	0	LIFT	REAL	ARRAY	SET8
240 LESWP		REAL	SFT5	0	MACH	REAL	ARRAY	SET11
1435 LINE		INTEGER		120	MOMENT	REAL	ARRAY	SET8
1413 MAX		INTEGER		22	NMACH	INTEGER		SET11
23 NALPHA		INTEGER	SET11	3	NPANAS	INTEGER		SET14
0 NPAN		INTEGER	SET20	1	NT	INTEGER		SET14
360 NPP		INTEGER	SET5	0	NXS	INTEGER		SET18
620 NVOR		REAL	SET18	2	NZS	INTEGER		SET18
1 NYS		INTEGER	SET16	170	PDL	REAL	ARRAY	SETS
3720 ONSET		REAL	SET20	1407	PI	REAL		
50 PHIMED		REAL	/	5	PSI	REAL		/
6 PITCHQ		REAL	/	214	RCS	REAL	ARRAY	SET20
550 PSPAN		REAL	SET5	5	RLM	REAL	ARRAY	SET13
7640 RFLAG		REAL	SET3	0	RNCV	REAL	ARRAY	SET7
620 RM		REAL	SETH	7	RULLG	REAL		/
24 RMAX		REAL	SET7	1441	R1V	REAL		
1442 R1		REAL		1454	R11	REAL		
1453 R10		REAL		1456	R13	REAL		
1455 R12		REAL		1443	R2	REAL		
1457 R14		REAL		1445	R4	REAL		
1444 R3		REAL		1447	R6	REAL		
1446 R5		REAL		1451	R8	REAL		
1450 R7		REAL		50	SLE	REAL	ARRAY	SET19
1452 R9		REAL		24	SLE2	REAL	ARRAY	SET19
0 SLE1		REAL	SET19	2	SMAX	REAL		SET14
3720 SLOPE		REAL	SET2	3	SMEF	REAL		SET12
310 SPC		REAL	SET17	3720	SX	INTEGER	ARRAY	SET3
1130 SURF		REAL	SFT8	500	TAPEX	REAL	ARRAY	SETS
310 SYNTH		REAL	SET5	454	TNL	REAL	ARRAY	SET10
0 TITLE		INTEGER	SFT6	21	VINF	REAL	ARRAY	SET11
620 TNT		REAL	SET10	310	VSS	REAL	ARRAY	SET10
7640 VSP		REAL	SFT2	4	XSPAN	REAL	ARRAY	SET13
10270 VST		REAL	SET20	0	XAPEX	REAL	ARRAY	SETS
0 X		REAL	SET1	7	X5	REAL	ARRAY	SET18
3 XBAR		REAL	SET15	764	XTE	REAL	ARRAY	SET10
1060 XSUC		REAL	SET8	50	YAPEX	REAL	ARRAY	SETS
3720 Y		REAL	SET1	740	YM	REAL	ARRAY	SET8
10 YAWU		REAL	/	430	YY	REAL	ARRAY	SET20
3 YNOT		REAL	SET18	4230	7C	REAL	ARRAY	SETS
4064 Z		REAL	SET1	0	7LE1	REAL	ARRAY	SET1
4 ZBAK		REAL	SET11	5	7NOT	REAL	ARRAY	SET20
214 ZETA		REAL	SET15					
24 ZLE2		REAL	SET19					
4350 ZZ		REAL	SET20					

FILE NAMES MODE
TAPE6 FMT

EXTERNALS TYPE ARGS
COS REAL 1 LIBRARY
SOKT REAL 1 LIBRARY
ZNORM 3

STATEMENT LABELS

26 10	FMT	504 20	FMT	514 30	FMT
551 40	FMT	0 50	FMT	561 60	FMT
574 70	FMT	607 80	FMT	616 90	FMT

STATEMENT LABELS	INDEX	FROM-TO	LENGTH	PROPERTIES
0 100			130	110
673 130	FMT		701	140
733 160	FMT		745	170
777 190	FMT		1004	200
1042 220	FMT		1046	230
0 250			223	260
0 280			235	290
1112 310	FMT		1124	320
262 340			1162	350
403 370			1227	380
430 400			435	410
1313 430	FMT		1331	440
0 460			1361	470
0 490			1377	500

COMMON BLOCKS	LENGTH
SET1	2250
SET2	6000
SET3	8000
SET4	840
SET5	440
SET6	2220
SET7	240
SET8	640
SET9	200
SET10	700
SET11	20
SET12	7
SET13	6
SET14	4
SET15	5
SET16	4000
SET17	240
SET18	27
SET19	240
SET20	6280

STATISTICS	PROGRAM LENGTH	CM LABELED COMMON LENGTH	CM BLANK COMMON LENGTH
	54148	771478	168
	2828	32359	14

LOOPS LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
33 50	* I	94 98	278	EXT HLFS
63 100	* I	100 113	438	EXT REFS
264 460	* I	203 270	1578	EXT REFS

STATEMENT LABELS	INDEX	FROM-TO	LENGTH	PROPERTIES
642 120				FMT
715 150				FMT
763 180				FMT
1026 210				FMT
170 240				FMT
225 270				FMT
242 300				FMT
1151 330				FMT
1175 360				FMT
421 390				FMT
1275 420				FMT
1342 450				FMT
446 480				FMT

```

CONTROL*VRLX.SURVEY
C.... SURROUTINE SURVEY (EM, EWX, EMY, ITOTAL)
C....
C.... PURPOSE
C.... TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT
C.... MATRICES (1) THE UPWASH AT THE FLOW FIELD SURVEY
C.... POINTS (EM / UNIT 3) (2) THE AXIALWASH AT THE FLOW
C.... FIELD SURVEY POINTS (EMX / UNIT 4) AND (3) THE
C.... SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EMY / UNIT 7).
C.... THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELD
C.... DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW
C.... FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED
C.... 3-D GRID.
C....
C.... CALLING SEQUENCES
C.... ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C.... COMMONS
C.... X, BZ, CX, DL, NI, SX, XS, YZ, Z7, HAG, LAX, NXS,
C.... NYS, NZS, PSI, TNT, VSP, VSI, XTF, ALFA, YNOT, XPAR,
C.... ZBAR, ZNOT, CHORD, RMAX, DELTAY, DELTAZ, FLOATX,
C.... FLOATY, LATRAL.
C....
C.... CALLING SEQUENCES
C.... EM = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)
C.... EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4)
C.... EMY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7)
C.... COMMONS
C.... NONE.
C....
C.... SUBROUTINES
C.... CALLED WASH, UXVEL.
C....
C.... DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE
C.... GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW
C.... FIELD SURVEY POINT BY THE (K, J) HORSESHOE VORTEX OF
C.... UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT IS
C.... WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING
C.... HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS
C.... COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW
C.... FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-n GRID
C.... PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT,
C.... DELTAY, ZNOT, AND DELTAZ.
C....
C.... DIMENSION EM (ITOTAL)
C.... DIMENSION EMX (ITOTAL)
C.... DIMENSION EMY (ITOTAL)
C.... COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHO, ROLLQ, YAWU, HAG,
C.... * FLOATX, FLOATY
C.... COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)
C.... COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)
C.... COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)
C.... COMMON /SET7 /RNCV (20), RMAX (100), ITS (20), JTS (100)
C.... COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),
C.... * TNT (100), ATE (100), IPAN (100)

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10/04/76 10.15.13
VORLAX 3055
VORLAX 3056
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VORLAX 3059
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VORLAX 3107
VORLAX 3108
VORLAX 3109
VORLAX 3110
VORLAX 3111

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10/04/76 10.15.13

FTN 4.5*410A

SUBROUTINE SURVEY 74/74 OPT=1

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COMMON /SET11 /MACH (R), ALPHA (R), ALFA (R), VINF, NMACH, NALPHA
COMMON /SET14 /NPAN, NT, SMAX, NPNAS
COMMON /SET15 /B2, BETA, CHAR, XBAR, ZBAR
COMMON /SET18 /NX, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)
COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMFD (100), RCS (100),
* NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST(2000)
INTEGER CA, SX
C
PI = 3.14159
DTR = 0.01745329
C
C
REWIND 3
REWIND 4
REWIND 7
C
FLAX = LAX
C
C...COMPUTE GEOMETRIC PARAMETERS RELATED TO WAKE FLOATATION.
C
FAL = FLOATX *ALFA
FBL = FLOATY *PSI * DTR
MM = 0
IF (FAL .NE. 0.0 .OR. FBL .NE. 0.0) MM = 1
C
C...COMPUTE GEOMETRIC PARAMETERS RELATED TO GROUND EFFECT.
C
SZA = SIN (2.0 *ALFA)
COZA = COS (2.0 *ALFA)
HIM = HAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)
XIMO = 2.0 *HIM *SIN (ALFA)
ZIMO = - 2.0 *HIM *COS (ALFA)
TANZA = SZA /COZA
C
C...THERE ARE TWO MAJOR NESTED DO-LOOP SYSTEMS THAT GENERATE THE
C...COEFFICIENTS OF THE AERODYNAMIC INFLUENCE MATRICES (1) LABEL 150
C...SYSTEM, AND (2) LABEL 140 SYSTEM. LABEL 140 LOOPS ARE INTERNAL TO
C...LABEL 150 LOOPS. THE LATTER ARE RELATED TO THE FLOW FIELD SURVEY
C...GRID POINTS, AND THE FORMER TO THE HORSESHOE VORTEX LATTICE. THE
C...VORTEX LATTICE IS COVERED STREAMWISE STRIP BY STREAMWISE STRIP.
C...THE SAME CODE LOGIC USED IN SUBROUTINE MATRX IS APPLIED HERE.
C
DO 150 I = 1, NX5
C
C...LOCATE CROSS-FLOW PLANE.
C
XCNTL = KS (I)
DO 150 J1 = 1, NZS
C
C...LOCATE WATERLINE PLANE.
C
RJI = J1
ZK1 = ZNOT + DELTAZ *(RJI - 1.)
DO 150 K1 = 1, NYS
C
C...COMPUTE GRID POINT BUTT LINE.

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VORLAX 3112
VORLAX 3113
VORLAX 3114
VORLAX 3115
VORLAX 3116
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VORLAX 3165
VORLAX 3166
VORLAX 3167
VORLAX 3168

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115 C          RK1 = KI
      YK1 = YNOT + DELTAY *(RK1 - 1.)
C
120 C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE, STRIP BY
      C...STRIP, I.E., THE OUTER 60-LOOP RELATES TO A CHORDWISE STRIP, AND
      C...THE INNER 60-LOOP RELATES TO A HORSESHOE WITHIN THE STRIP (FROM
      C...LEADING EDGE TO TRAILING EDGE).
      IR = 0
      DU 140 K = 1, NT
C
125 C...COMPUTE PARAMETERS COMMON TO A GIVEN STRIP.
      PION2 = PI *.5 /RNMAX (K)
      PION3 = 0.5 *PION2
      PION4 = PION2 /R.0
      DELX = CHORD (K) /RNMAX (K)
      WEIGHT = 1.0
      WT1 = 0.25 *DELX
      CDL = COS (DTR*DL (K))
      SDL = SIN (DTR * DL (K))
      COS1 = COS (DTR * DL (K))
      COS2 = COS1
      SIN1 = SIN (- DTR *DL (K))
      SIN2 = - SIN1
      CUSIM = COS (2.0 *DTR *DL (K))
      SINIM = SIN (2.0 *DTR *DL (K))
      MAX2 = RNMAX (K)
C
135 C          AA = FAL *CDL - FAL *SDL
      AM = FHL *CDL + FAL *SDL
C
140 DO 140 J = 1, MAX2
      IM = IR + J
      XLOAD = X (IR)
      X1 = XCNTL - XLOAD
      YP = YK1 + YY (IR)
      ZS = ZK1 - ZZ (IR)
      Y1 = YS *CDL + ZS *SDL
      Z1 = ZS *CDL - YS *SDL
      Y2 = YP *CDL - ZS *SDL
      Z2 = ZS *CDL + YP *SDL
      RYZ1 = Y1 *Y1 + Z1 *Z1
      RYZ2 = Y2 *Y2 + Z2 *Z2
      X1SQ = X1 *X1
      RS1 = X1SQ - B2 *RYZ1
      RS2 = X1SQ - B2 *RYZ2
      IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)
      IF (RS2 .GT. 0.0) RS2 = SQRT (RS2)
      IF (LAK.EQ. 1) GO TO 20
      RJ = 2 *J - 1
      RJI = 4 *J - 3
      DELX = 1.0
      WEIGHT = PION2 *SIN (RJ *PION2) *CHORD (K)
      WT1 = PION3 *SIN (RJI *PION3) *CHORD (K)
      VORLAX 3169
      VORLAX 3170
      VORLAX 3171
      VORLAX 3172
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      VORLAX 3214
      VORLAX 3215
      VORLAX 3216
      VORLAX 3217
      VORLAX 3218
      VORLAX 3219
      VORLAX 3220
      VORLAX 3221
      VORLAX 3222
      VORLAX 3223
      VORLAX 3224
      VORLAX 3225

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20  XU1 = XLOAD - WT1
    CT = XTE (K) - XLOAD
    TESP = TNT (K)
    ESP = VSP (IR)
    VOSS = VST (IR)
    TOLZ = WEIGHT *DELX *1.0E-1
C
C...IF FIELD POINT IS WITHIN A GIVEN NEAR FIELD RADIUS (RNF) OF
C...HORSESHOE THEN COMPUTE AXIALWASH (U1) BY INTERDIGITATED VORTEX
C...SPLITTING.
C
    UVEL = 0.0
    IDIT = 0
    RNF = 4.0 *WEIGHT *DELX
    IF (RS1 .LE. 0.0) GO TO 60
    IF (RS1 .GT. RNF) GO TO 60
    RJM = J - 1
    COSM = COS (2.0 *PION2 *RJM)
    DO 50 L = 1, 8
    IF (LAX .EQ. 0) GO TO 30
    RVL = 4 *L - 3
    XDIF = RVL *DELX /32.0
    WFR = 0.1250
    GO TO 40
30  RVL = 16 *(J - 1) + 2 *L - 1
    XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)
    WFR = PION4 *SIN (PION4 *RVL)
40  XINT = XCNTL - XU1 - XDIF
    CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, H2, TOLZ, UDV)
    UVEL = UVEL + UDV *WFR
50  CONTINUE
    DCW = 1.0
    IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT
    UVEL = UVEL * DCW
    IDIT = 1
C
C...SUBROUTINE WASH COMPUTES THE VELOCITY COMPONENTS INDUCED BY A
C...GENERALIZED HORSESHOE VORTEX OF UNIT STRNGTH.
C
60  CALL WASH (X1,Y1,Z1,VOSS,ESP,H2,U1,V1,W1,AA,AM,TESP,CT,MM)
    IF (IDIT .EQ. 1) U1 = UVEL
C
C...IF CONFIGURATION IS IN GROUND EFFECT (HAG = 0.) THEN COMPUTE THE
C...INDUCTION DUE TO IMAGE OF HORSESHOE MIRRORED ABOUT GROUND PLANE.
C
    IF (HAG .EQ. 0.0) GO TO 70
    XIM = XIMO + X (IR) *CO2A + ZZ (IR) *SI2A
    ZIM = ZIMO + X (IR) *SI2A - ZZ (IR) *CO2A
    XII = XCNTL - XIM - XII *TANZA
    YII = YS *CDL - ZSI *SDL
    ZII = ZSI *CDL + YS *SDL
    CALL WASH (XII,YII,ZII,VOSS,ESP,B2,U1I,V1I,W1I,AA,AM,TESP,CT,MM)
    U1 = U1 - U1I
    V1 = V1 - V1I *COSIM - W1I *SINIM
    W1 = W1 + V1I *SINIM - W1I *COSIM
70  IF (LATRAL .EQ. 1) GO TO 130

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VORLAX 3226
 VORLAX 3227
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 VORLAX 3229
 VORLAX 3230
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 VORLAX 3278
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 VORLAX 3280
 VORLAX 3281
 VORLAX 3282

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230 C
230 C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN
230 C...COMPUTE INFLUENCE OF IMAGE OF HORSESHOE MIRRORED ABOUT PLANE OF
230 C...SYMMETRY, I.E., X-Z PLANE.
230 C
235 C
235 UVEL = 0.0
235 IDIT = 0
235 IF (RS2.LE. 0.0) GO TO 110
235 IF (RS2.GT. RNF) GO TO 110
235 RJM = J - 1
235 COSM = COS (2.0 *PION2 *RJM)
235 DO 100 L = 1, 8
235 .IF (LAX.EQ. 0) GO TO 80
235 RVL = 4 *L - 3
235 XDIF = RVL *DELX /32.0
235 *WFR = 0.1250
235 GO TO 90
235 80 RVL = 16 *(J - 1) + 2 *L - 1
235 XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)
235 WFR = PION4 *SIN (PION4 *RVL)
235 XINT = XCNTL - XU1 - XDIF
235 CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)
235 UVEL = UVEL + UDV *WFR
235 100 CONTINUE
235 DCW = 1.0
235 IF (LAX.EQ. 0) DCW = CHORD (K) /WEIGHT
235 UVEL = UVEL *DCW
235 IDIT = 1
235 C
235 110 CALL WASH (X1,Y2,Z2,VOSS, - ESP,B2,U2,V2,W2,AA,AM, -TESP,CT,MM)
235 IF (IDIT.EQ. 1) U2 = UVEL
235 C
235 C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND
235 C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF
235 C...IMAGE OF HORSESHOE MIRRORED ABOUT CENTER PLANE (X-Z PLANE) AND
235 C...MIRRORED ONCE MORE ABOUT GROUND PLANE.
235 C
235 IF (HAG.EQ. 0.0) GO TO 120
235 Y2I = YP *CDL + ZSI *SDL
235 Z2I = ZSI *CDL - YP *SOL
235 CALL WASH(X1I,Y2I,Z2I,VOSS,-ESP,B2,U2I,V2I,W2I,AA,AM,-TESP,CT,MM)
235 U2 = U2 - U2I
235 V2 = V2 - V2I *COSIM + W2I *SINIM
235 W2 = W2 - V2I *SINIM - W2I *COSIM
235 C
235 120 EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT
235 EWY (IR) = (V1 *COS1 + V2 *COS2 - W1 *SIN1 - W2 *SIN2) *WEIGHT
235 EWX (IR) = (U1 + U2) *WEIGHT
235 GO TO 140
235 C
235 130 EW (IR) = (W1 *COS1 - V1 *SIN1) *WEIGHT
235 EWY (IR) = (V1 *COS1 - W2 *SIN2) *WEIGHT
235 EWX (IR) = U1 *WEIGHT
235 140 CONTINUE
235 C
235 C
235 285 C

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VORLAX 3283
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VORLAX 3339

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WRITE (3) EW
WRITE (4) EWX
WRITE (7) EWY
C
C 150 CONTINUE
C
C
REWIND 3
REWIND 4
REWIND 7
C
C
RETURN
END
290
295
300
VORLAX 3340
VORLAX 3341
VORLAX 3342
VORLAX 3343
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VORLAX 3353
VORLAX 3354

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SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 SURVEY

VARIABLES	SN	TYPE	HELOCATION
1026 AA	10	REAL	SET11
1 ALPHA	1	REAL	SET15
BETA	2	REAL	SET15
CBAR	0	REAL	SET10
CHORD	0	REAL	
COSM	1062	REAL	
COS2	1020	REAL	
CT	1051	REAL	
DCP	0	REAL	SET2
DELTA	4	REAL	SET18
DELX	1012	REAL	
DTR	762	REAL	
EW	0	REAL	F.P.
EWY	0	REAL	F.P.
FBL	765	REAL	
FLOATX	12	REAL	
HAG	11	REAL	
I	775	INTEGER	
IDIT	1057	INTEGER	
INTRAC	404	INTEGER	SET20
IQ	2	INTEGER	F.P.
ITOTAL	0	INTEGER	
J	1030	INTEGER	
J1	777	INTEGER	
K1	1002	INTEGER	
LATRAL	4	INTEGER	
LAY	1	INTEGER	
MAX2	1025	INTEGER	
NALPHA	23	INTEGER	SET11
NPAN	0	INTEGER	SET14
NPP	360	INTEGER	SET20
ALFA	20	REAL	
AM	1027	REAL	SET11
R2	0	REAL	SET15
CDL	1015	REAL	
COSIM	1023	REAL	
COS1	1017	REAL	
COS2	770	REAL	
CK	0	INTEGER	ARRAY
OCW	1071	REAL	
DELTAZ	6	REAL	
DL	144	REAL	ARRAY
FSP	1053	REAL	
FWX	0	REAL	ARRAY
FAL	764	REAL	F.P.
FLAX	763	REAL	
FLOATY	13	REAL	
HIM	771	REAL	
IDES	13560	INTEGER	ARRAY
IH	3	INTEGER	SET3
IPAN	1130	INTEGER	/ /
IR	1005	INTEGER	SET10
ITS	170	INTEGER	SET7
JTS	214	INTEGER	SET7
K	1006	INTEGER	ARRAY
L	1063	INTEGER	ARRAY
LAX	0	INTEGER	/ /
MACH	0	INTEGER	ARRAY
MM	766	INTEGER	SET11
NMACH	22	INTEGER	SET14
NPANAS	3	INTEGER	SET20
NT	1	INTEGER	

74/74 OPT=1

SUBROUTINE SURVEY

VARIABLES	SN	TYPE	RELOCATION	OPT=1	FILE NAMES	TAPE3	MODE
0 NXS		INTEGER	SET1R				UNFMT
2 NZS		INTEGER	SET1R				UNFMT
761 PI		REAL					
1010 PION3		REAL					
6 PITCH3		REAL					
214 RCS		REAL					
1047 RJ		REAL					
1000 RJI		REAL					
0 RNCV		REAL					
.24 RNMAX		REAL					
1045 RSI		REAL					
1064 RVL		REAL					
1043 RYZ2		REAL					
1024 SINIM		REAL					
1022 SIN2		REAL					
3720 SLOPE		REAL					
3720 SX		REAL					
1052 TESP		INTEGER					
620 TNT		REAL					
1070 UDV		REAL					
1072 UJ		REAL					
1106 U2		REAL					
21 VINP		REAL					
7640 VSP		REAL					
10270 VST		REAL					
1104 V11		REAL					
1114 V21		REAL					
1066 WPK		REAL					
1074 W1		REAL					
1110 W2		REAL					
0 X		REAL					
776 XCNTL		REAL					
1075 XIM		REAL					
1067 XINT		REAL					
7 XS		REAL					
1050 XU1		REAL					
1077 X11		REAL					
3720 Y		REAL					
1004 YK1		REAL					
1033 YP		REAL					
430 YY		REAL					
1101 Y11		REAL					
1111 Y21		REAL					
4 ZBAR		REAL					
1076 ZIM		REAL					
1001 ZK1		REAL					
24 ZLE2		REAL					
1035 ZS		REAL					
4350 ZZ		REAL					
1102 Z11		REAL					
1112 Z21		REAL					

INTEGER	ARRAY	SET18	SET20	REAL	ARRAY	SET11	SET18	REAL	ARRAY	SET11	SET18	REAL	ARRAY	SET11	SET18	REAL	ARRAY	SET11	SET18
1 NYS																			
50 PHIMED																			
1007 PION2																			
1011 PION4																			
5 PSI																			
7640 RFLAG																			
1041 RJM																			
1003 RK1																			
1060 RNF																			
7 ROLLLG																			
1046 RS2																			
1042 RYZ1																			
1016 SDL																			
1021 SIN1																			
747 S12A																			
2 SMAX																			
774 TANZA																			
454 TNL																			
1055 TOLZ																			
1056 UVEL																			
1103 U11																			
1113 U21																			
1054 VOSS																			
310 VSS																			
1073 V1																			
1107 V2																			
1013 WIGHT																			
1014 W11																			
1105 W11																			
1115 W21																			
3 XBAR																			
1045 XDIF																			
772 XIMD																			
1031 XLOAD																			
764 XTE																			
1032 Y1																			
1044 X1SQ																			
10 YAWO																			
3 YNOT																			
1034 YS																			
1036 Y1																			
1040 Y2																			
4044 Z																			
4230 ZC																			
773 ZIMO																			
0 ZLE1																			
5 ZNOT																			
1100 ZS1																			
1037 Z1																			
1041 Z2																			

EXTERNALS TYPE ARGS
 COS REAL 1 LIBRARY
 SORT REAL 1 LIBRARY
 WASH 14

SIN UAXVEL
 REAL 1 LIBRARY
 8

STATEMENT LABELS INACTIVE 233 20
 0 10 0 50
 307 40 374 70 420 80
 0 100 460 110
 533 130 544 140

LOOPS LABEL INDEX FROM-TO LENGTH PROPERTIES
 65 150 * I 101 291 513B EXT REFS NOT INNER
 70 150 * J1 106 291 505B EXT REFS NOT INNER
 76 150 * K1 112 291 475B EXT REFS NOT INNER
 105 140 * K 125 283 444B EXT REFS NOT INNER
 153 140 * J 148 283 374B EXT REFS NOT INNER
 262 50 * L 190 202 37B EXT REFS NOT INNER
 410 100 * L 241 253 40B EXT REFS

COMMON BLOCKS LENGTH
 SET1 12
 SET2 2250
 SET3 6000
 SET7 8000
 SET10 240
 SET11 700
 SET14 20
 SET15 4
 SET18 5
 SET20 27
 6280

STATISTICS
 PROGRAM LENGTH 11368 606
 CM LABELED COMMON LENGTH 557468 23526
 CM BLANK COMMON LENGTH 148 12

```

1 CONTROL*VRLX,UXVEL          9/14/76
C.... SUBROUTINE UXVEL (X, Y, Z, S, T, B2, TOLZ, U)
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3411

5 C.... CALLING SEQUENCES
C.... X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF
RECEIVING POINT MEASURED IN A REFERENCE FRAME
CENTERED AT THE MIDPOINT OF VORTEX SEGMENT*
10 C.... THE X-AXIS IS PARALLEL TO THE X-AXIS OF THE
MASTER (CONFIGURATION) COORDINATE SYSTEM. THE
Y-AXIS IS NORMAL TO THE X-AXIS BUT LIES IN
15 C.... THE PLANE DETERMINED BY THE X-AXIS AND THE
VORTEX SEGMENT, AND THE Z-AXIS IS NORMAL TO
SUCH PLANE.
C.... S = SEMISPAN OF VORTEX SEGMENT.
C.... T = TANGENT OF SWEEP ANGLE OF VORTEX SEGMENT.
20 C.... B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).
TOLZ = NUMERICAL TOLERANCE CONSTANT.
COMMONS
NONE.

25 C.... CALLING SEQUENCES
C.... U = X-AXIS VELOCITY COMPONENT (AXIALWASH) INDUCED BY
SKEWED VORTEX SEGMENT OF UNIT INTENSITY.
COMMONS
NONE.

30 C.... SUBROUTINES
C.... CALLED
NONE.

35 C.... DISCUSSION THIS SUBROUTINE IS CALLED WHEN THE AXIALWASH IS
COMPUTED IN ACCORDANCE WITH VORTEX SPLITTING SCHEMF.
ONLY THE AXIALWASH IS COMPUTED, AND ONLY THE TRANS
VERSE SEGMENT OF THE HORSESHOE IS TAKEN INTO ACCOUNT.
C.... THE SAME COMMENTS PRESENTED IN SUBROUTINE WASH
REGARDING THE NUMERICAL SINGULARITY IN THE VICINITY
40 C.... OF THE CHARACTERISTIC SURFACES (MACH CONES) ARE
ALSO APPLICABLE HERE. SUBROUTINE UXVEL IS A DIRECT
COPY OF PARTS OF SUBROUTINE WASH.

45 C.... CUTOFF = 0.80
C.... X1 = X + T*S
C.... Y1 = Y + S
C.... X2 = X - T*S
C.... Y2 = Y - S
C.... XTY = X - T * Y
C.... U = 0.
C.... TOL = TOLZ
C.... TOLSO = TOL * TOL
55 C.... ZSQ = Z **2
C.... RZQ = R2 * ZSQ
IF (ARS (BZU) .LT. TOLSO) GO TO 90

```

```

60      YSQ1 = Y1 *Y1
        YSQ2 = Y2 *Y2
        RTV1 = YSQ1 + ZSQ
        RTV2 = YSQ2 + ZSQ
        R01 = B2 *RTV1
        R02 = B2 *RTV2
        RAD1 = 0.0
        RAD2 = 0.0
        XSQ1 = X1 *X1
        XSQ2 = X2 *X2
        IF (B2) 10, 40, 40
C
C
C...SUBSONIC FLOW COMPUTATION.
C
10      CPI = 12.56636
        ARG = XSQ1 - R01
        RAD1 = SORT (ARG)
        ARG = XSQ2 - R02
        RAD2 = SORT (ARG)
        FB1 = 0.0
        FB2 = 0.0
        XBSQ = XTY *XTY
        TBZ = (T *T - B2) *ZSQ
        DENOM = XBSQ + TRZ
        IF (ABS (DENOM) .LT. TOLSQ) DENOM = TOLSQ
        FB1 = (T *X1 - B2 *Y1) /RAD1
        FB2 = (T *X2 - B2 *Y2) /RAD2
        QB = (FB1 - FB2) /DENOM
        ZETAPI = Z /CPI
        U = ZETAPI *QB
        GO TO 90
C
C
C...SUPERSONIC FLOW COMPUTATION.
C
40      CPI = 6.28318
        IF (X1 .LT. TOL) GO TO 50
        ARG = XSQ1 - R01
        IF (ARG .GT. 0.0) RAD1 = SORT (ARG)
        IF (X2 .LT. TOL) GO TO 60
        ARG = XSQ2 - R02
        IF (ARG .GT. 0.0) RAD2 = SORT (ARG)
        ZETAPI = Z /CPI
        FB1 = 0.0
        FB2 = 0.0
        XBSQ = XTY *XTY
        TBZ = (T *T - B2) *ZSQ
        DENOM = XBSQ + TRZ
        SIGN = 1.0
        IF (DENOM .LT. 0.0) SIGN = - 1.0
        IF (ABS (DENOM) .LT. TOLSQ) DENOM = SIGN *TOLSQ
        IF (X1 .LT. TOL) GO TO 70
        IF (RAD1 .EQ. 0.0) GO TO 70

```

VORLAX 3412
VORLAX 3413
VORLAX 3414
VORLAX 3415
VORLAX 3416
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VORLAX 3450
VORLAX 3451
VORLAX 3452
VORLAX 3453
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VORLAX 3457
VORLAX 3458
VORLAX 3459
VORLAX 3460
VORLAX 3461
VORLAX 3462
VORLAX 3463
VORLAX 3464
VORLAX 3465
VORLAX 3466
VORLAX 3467


```

115      FRAD = RAD1
      IF (R01 .GT. REPS) GO TO 70
      FB1 = (T *X1 - RP *Y1) /FRAD
      IF (X2 .LT. TOL) GO TO 80
      IF (RAD2 .EQ. U.0) GO TO 80
      REPS = CUTOFF *XS02
      FMAD = RAD2
      IF (R02 .GT. REPS) GO TO 80
      FB2 = (T *X2 - RP *Y2) /FRAD
      QB = (FR1 - FH2) /DENOM
      U = ZETAPI *QB
      C
      C
      90      RETURN
      END
    
```

```

      VORLAX 3469
      VORLAX 3470
      VORLAX 3471
      VORLAX 3472
      VORLAX 3473
      VORLAX 3474
      VORLAX 3475
      VORLAX 3476
      VORLAX 3477
      VORLAX 3478
      VORLAX 3479
      VORLAX 3480
      VORLAX 3481
      VORLAX 3482
      VORLAX 3483
    
```

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 UXVEL

VARIABLES	SN	TYPE	RELOCATION
235 ARG		REAL	
0 B2		REAL	
210 CUTOFF		REAL	F.P.
236 FB1		REAL	
247 FRAD		REAL	
230 RAD1		REAL	
246 REPS		REAL	
227 R02		REAL	
225 RTV2		REAL	
245 SIGN		REAL	
241 TB2		REAL	
217 TOLSO		REAL	
0 U		REAL	
240 XBS0		REAL	F.P.
233 XS02		REAL	
211 X1		REAL	
0 Y		REAL	
223 YS02		REAL	F.P.
214 Y2		REAL	
244 ZETAPI		REAL	
221 HZ0		REAL	
234 CPT		REAL	
242 DENOM		REAL	
237 FB2		REAL	
243 OB		REAL	
231 RAD2		REAL	
226 R01		REAL	
224 RTV1		REAL	
0 S		REAL	F.P.
0 T		REAL	F.P.
216 TUL		REAL	
0 TOLZ		REAL	
0 X		REAL	
232 XS01		REAL	F.P.
215 XY		REAL	
213 X2		REAL	
222 YS01		REAL	F.P.
212 Y1		REAL	
0 Z		REAL	F.P.
220 Z50		REAL	

EXTERNALS
SORT REAL TYPE ARGS
1 LIBRARY

INLINE FUNCTIONS
REAL TYPE ARGS
1 INTRIN

STATEMENT LABELS
0 10 INACTIVE
104 40
162 70

INACTIVE
0 30
125 60
202 90

SUBROUTINE UXVEL

74/74 OPT=1

FTN 4.5+410A

10/04/76 10.15.13

PAGE

4

STATISTICS
PROGRAM LENGTH

2508 168

```

1 CONTROL*VRLX,VECTOR          9/14/76  VORLAX 3484
C... SUBROUTINE VECTOR (ITOTAL, NX1, AV, EM, VOR1, VORK, VORL)  VORLAX 3485
C                                     VORLAX 3486
C                                     VORLAX 3487
5 C...PURPOSE TO SOLVE THE LINEAR SYSTEM OF BOUNDARY CONDITION  VORLAX 3488
C...EQUATIONS BY PURCELL'S VECTOR ORTHOGONALIZATION  VORLAX 3489
C...METHOD.  VORLAX 3490
C...  VORLAX 3491
10 C...INPUT CALLING SEQUENCES  VORLAX 3492
C...ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.  VORLAX 3493
C...NX1 = ITOTAL + 1.  VORLAX 3494
C...EM = ROW OF NORMAL WASH INFLUENCE COEFFICIENT MATRIX.  VORLAX 3495
C...COMMONS  VORLAX 3496
C...ALOC.  VORLAX 3497
15 C...CALLING SEQUENCES  VORLAX 3498
C...VOR1 = AUXILIARY COMPUTATIONAL ROW VECTOR.  VORLAX 3499
C...VORK = EXTENDED SOLUTION ROW VECTOR.  VORLAX 3500
C...VORL = AUXILIARY COMPUTATIONAL ROW VECTOR.  VORLAX 3501
C...COMMONS  VORLAX 3502
C...GAMMA.  VORLAX 3503
20 C...SUBROUTINES  VORLAX 3504
C...CALLED NONE.  VORLAX 3505
C...DISCUSSION THE BOUNDARY CONDITION EQUATIONS ARE SOLVED DIRECTLY  VORLAX 3506
C...BY A VECTOR ORTHOGONALIZATION PROCEDURE (PURCELL'S  VORLAX 3507
C...VECTOR METHOD). SETS OF LINEARLY INDEPENDENT VECTORS  VORLAX 3508
C...ARE CONSTRUCTED WHICH ARE SUCCESSIVELY ORTHOGONAL TO  VORLAX 3509
C...EACH ROW. WHEN ALL ROWS HAVE BEEN CONSIDERED THERE IS  VORLAX 3510
C...ONE VECTOR WHICH IS NORMAL (ORTHOGONAL) TO ALL ROWS  VORLAX 3511
C...AND CONTAINS THE SOLUTION VECTOR. NO MATRIX INVERSION  VORLAX 3512
C...IS INVOLVED AND ONLY ONE ROW OF THE COEFFICIENT MATRIX  VORLAX 3513
C...IS REQUIRED AT A TIME. AND ONCE OPERATED ON CAN BE  VORLAX 3514
C...OVERWRITTEN. IN ADDITION, TWO AUXILIARY ROW VECTORS  VORLAX 3515
C...ARE NEEDED FOR TEMPORARY STORAGE OF INTERMEDIATE VECTOR  VORLAX 3516
C...VECTOR DATA.  VORLAX 3517
C...  VORLAX 3518
C...  VORLAX 3519
C...  VORLAX 3520
C...  VORLAX 3521
C...  VORLAX 3522
40 COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)  VORLAX 3523
COMMON /SET16 /GAMMA ( 2000 ) , ONSET (2000)  VORLAX 3524
C...  VORLAX 3525
C...  VORLAX 3526
45 DIMENSION AV (NX1), VOR1 (NX1), VORK (NX1), VORL (NX1)  VORLAX 3527
DIMENSION EM (ITOTAL)  VORLAX 3528
C...  VORLAX 3529
C...  VORLAX 3530
50 C***** SOLUTION BY VECTOR METHOD *****  VORLAX 3531
C...  VORLAX 3532
C...  VORLAX 3533
C...  VORLAX 3534
C...  VORLAX 3535
C...  VORLAX 3536
55 C...UNITS 11 AND 12 ARE TEMPORARY DATA STORAGE. DATA STORED IN THESE  VORLAX 3537
C...UNITS ARE NOT USED ANYWHERE ELSE IN THE PROGRAM.  VORLAX 3538
C...  VORLAX 3539
C...  VORLAX 3540
C...  VORLAX 3541
C...  VORLAX 3542
C...  VORLAX 3543
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C...  VORLAX 3998
C...  VORLAX 3999
C...  VORLAX 4000

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C
C
60 C...ALL VECTORS ARE EXTENDED. I.E., THEY HAVE A DIMENSION EQUAL TO
C...THE NUMBER OF UNKNOWN PLUS ONE.
C
C      NX1 = ITOTAL + 1
C
65 C...DEFINE INITIAL SET OF VECTORS WITH #DIAGONAL* ELEMENTS EQUAL TO
C...UNITY, AND ALL OTHER ELEMENTS ZEROED OUT.
C
      DO 20 K = 1, NX1
      DO 10 J = 1, NX1
      VORK (J) = 0.0
      IF (J.EQ. K) VORK (J) = 1.0
10  CONTINUE
      WRITE (11) VORK
20  CONTINUE
C
75 C
C...COMPUTE SUCCESSIVE SETS OF INTERMEDIATE VECTORS. THE JTH SET
C...CONTAINS (NX1 - J) VECTORS WHICH ARE NORMAL (ORTHOGONAL) TO THE
C...FIRST J VECTORS. CONSEQUENTLY THE LAST SET (J = ITOTAL) IS ORTHO
C...GONAL TO ALL THE VECTORS AND IT CONTAINS THE SOLUTION OF THE
C...LINEAR SYSTEM (THE FIRST ITOTAL OF THE NX1 ELEMENTS, I.E., ALL
C...THE ELEMENTS BUT THE LAST ONE ARE THE VALUES OF THE UNKNOWN(S).
C
      REWIND 11
      IN = 11
      DO 80 JJ = 1, ITOTAL
      IM = 23 - IN
      READ (1) EW
      READ (IN) VORI
      DO 30 I = 1, NX1
      IF (I.LT. NX1) AV (I) = EW (I)
      IF (I.EQ. NX1) AV (I) = - ALOC (JJ)
30  CONTINUE
      RDEN = 0.0
      DO 40 I = 1, NX1
      RDEN = RDEN + AV (I) *VORI (I)
40  CONTINUE
      NTOP = NX1 - JJ
      DO 70 KK = 1, NTOP
      READ (IN) VORL
      RNUM = 0.0
      DO 50 I = 1, NX1
      RNUM = RNUM + AV (I) *VORL (I)
50  CONTINUE
      CJK = - RNUM /RDEN
      DO 60 I = 1, NX1
      VORK (I) = CJK *VORI (I) + VORL (I)
60  CONTINUE
      WRITE (1M) VORK
70  CONTINUE
      REWIND 11
      REWIND 12
      IN = 1M
80  CONTINUE

```

```

VORLAX 3541
VORLAX 3542
VORLAX 3543
VORLAX 3544
VORLAX 3545
VORLAX 3546
VORLAX 3547
VORLAX 3548
VORLAX 3549
VORLAX 3550
VORLAX 3551
VORLAX 3552
VORLAX 3553
VORLAX 3554
VORLAX 3555
VORLAX 3556
VORLAX 3557
VORLAX 3558
VORLAX 3559
VORLAX 3560
VORLAX 3561
VORLAX 3562
VORLAX 3563
VORLAX 3564
VORLAX 3565
VORLAX 3566
VORLAX 3567
VORLAX 3568
VORLAX 3569
VORLAX 3570
VORLAX 3571
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VORLAX 3573
VORLAX 3574
VORLAX 3575
VORLAX 3576
VORLAX 3577
VORLAX 3578
VORLAX 3579
VORLAX 3580
VORLAX 3581
VORLAX 3582
VORLAX 3583
VORLAX 3584
VORLAX 3585
VORLAX 3586
VORLAX 3587
VORLAX 3588
VORLAX 3589
VORLAX 3590
VORLAX 3591
VORLAX 3592
VORLAX 3593
VORLAX 3594
VORLAX 3595
VORLAX 3596
VORLAX 3597

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115      C
      C      WORK IS THE EXTENDED SOLUTION ROW VECTOR
      C ***** END OF SOLUTION BY VECTOR METHOD *****
      C
      C      DO 100 IR = 1, ITOTAL
      C      GAMMA (IR) = VORK (IR)
      C      CONTINUE
      C
      C      REWIND 1
      C      RETURN
      C      END
      C
      C      VORLAX 3598
      C      VORLAX 3599
      C      VORLAX 1600
      C      VORLAX 1601
      C      VORLAX 1602
      C      VORLAX 1603
      C      VORLAX 1604
      C      VORLAX 1605
      C      VORLAX 1606
      C      VORLAX 1607
      C      VORLAX 1608
      C      VORLAX 1609
      C      VORLAX 1610

```

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 VECTOR

VARIABLES	SN	TYPE	RELOCATION	ARRAY	SET6	0	AV	REAL	F.P.	ARRAY	F.P.
334 ALOC		REAL	SET6			0	FM	REAL		ARRAY	F.P.
244 CJK		REAL				24	HEAD	REAL		ARRAY	F.P.
0 GAMMA		REAL	SET16			236	TR	INTEGER		ARRAY	F.P.
237 I		INTEGER				245	TR	INTEGER		ARRAY	F.P.
234 IN		INTEGER				233	I	INTEGER		ARRAY	F.P.
0 ITOTAL		INTEGER				232	K	INTEGER		ARRAY	F.P.
235 JJ		INTEGER				241	NTOP	INTEGER		ARRAY	F.P.
242 KK		INTEGER				3720	ONSET	REAL		ARRAY	F.P.
0 NX1		INTEGER				243	RNU4	REAL		ARRAY	F.P.
240 RDN		REAL				0	DRK	REAL		ARRAY	F.P.
0 TITLE		REAL				0	VOP1	REAL		ARRAY	F.P.
0 VORL		REAL				0		REAL		ARRAY	F.P.

FILE NAMES
TAPE1 UNFMT
TAPE11 UNFMT
TAPE12

STATEMENT LABELS

0	10	20	30	40	50	60	70	80	90
0	10	20	30	40	50	60	70	80	90

LOOPS	LABEL	INDEX	FROM-TU	LENGTH	PROPERTIES	FXT REFS	NOT INNER	EXT REFS	NOT INNER	EXT REFS	NOT INNER
24	20	* K	68 74	208	INSTACK						
27	10	J	69 72	48	INSTACK						
47	80	* JJ	86 114	1168	INSTACK						
71	30	I	90 93	78	INSTACK						
105	40	I	95 97	48	INSTACK						
115	70	* KK	99 110	418	INSTACK						
127	50	I	102 104	48	INSTACK						
142	60	I	106 108	36	INSTACK						
171	100	IR	120 122	28	INSTACK						

SUBROUTINE VECTOR 74/74 OPT=1
COMMON BLOCKS LENGTH
SET6 2220
SET16 4000
STATISTICS
PROGRAM LENGTH 3118 201
CM LABELED COMMON LENGTH 141148 6220

```

1 CONTROL*VRLX*WASH
C.... SUBROUTINE WASH (X, Y, Z, S, T, HZ, U, V, W, AA, AM, TE, CT, MM)
9/14/76
5 C....PURPOSE
C.... TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A
C.... GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT
C.... STRENGTH.
3611 VORLAX
3612 VORLAX
3613 VORLAX
3614 VORLAX
3615 VORLAX
3616 VORLAX
3617 VORLAX
3618 VORLAX
3619 VORLAX
3620 VORLAX
3621 VORLAX
3622 VORLAX
3623 VORLAX
3624 VORLAX
3625 VORLAX
3626 VORLAX
3627 VORLAX
3628 VORLAX
3629 VORLAX
3630 VORLAX
10 C....INPUT
C.... X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF
RECEIVING (FIELD OR CONTROL) POINT MEASURED
3631 VORLAX
3632 VORLAX
3633 VORLAX
3634 VORLAX
3635 VORLAX
3636 VORLAX
3637 VORLAX
3638 VORLAX
3639 VORLAX
3640 VORLAX
3641 VORLAX
3642 VORLAX
3643 VORLAX
3644 VORLAX
3645 VORLAX
3646 VORLAX
3647 VORLAX
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3659 VORLAX
3660 VORLAX
3661 VORLAX
3662 VORLAX
3663 VORLAX
3664 VORLAX
3665 VORLAX
3666 VORLAX
3667 VORLAX
15 C....
C.... CALLING SEQUENCES
C.... X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF
RECEIVING (FIELD OR CONTROL) POINT MEASURED
IN A REFERENCE FRAME CENTERED AT THE MIDPOINT
OF THE TRANSVERSE VORTEX SEGMENT (HORSESHOE
VORTEX CENTROID). THE X-AXIS IS PARALLEL TO
THE X-AXIS OF THE MASTER (CONFIGURATION)
COORDINATE SYSTEM. THE Y-AXIS IS NORMAL TO
THE X-AXIS BUT LIES IN THE PLANE DETERMINED
BY THE X-AXIS ITSELF AND THE TRANSVERSE LEG
OF THE HORSESHOE, AND THE Z-AXIS IS NORMAL
TO SUCH PLANE.
3631 VORLAX
3632 VORLAX
3633 VORLAX
3634 VORLAX
3635 VORLAX
3636 VORLAX
3637 VORLAX
3638 VORLAX
3639 VORLAX
3640 VORLAX
3641 VORLAX
3642 VORLAX
3643 VORLAX
3644 VORLAX
3645 VORLAX
3646 VORLAX
3647 VORLAX
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3649 VORLAX
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3661 VORLAX
3662 VORLAX
3663 VORLAX
3664 VORLAX
3665 VORLAX
3666 VORLAX
3667 VORLAX
20 C....
C.... S = HORSESHOE VORTEX SEMISPAN.
C.... T = TANGENT OF SWEEP ANGLE OF TRANSVERSE LEG. POSITIVE
FOR SWEEPBACK.
3631 VORLAX
3632 VORLAX
3633 VORLAX
3634 VORLAX
3635 VORLAX
3636 VORLAX
3637 VORLAX
3638 VORLAX
3639 VORLAX
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3661 VORLAX
3662 VORLAX
3663 VORLAX
3664 VORLAX
3665 VORLAX
3666 VORLAX
3667 VORLAX
25 C....
C.... B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).
C.... AA, AM = DIRECTION ANGLES (ANGLES OF FLOATATION) OF
FREE (WAKE) TRAILING LEGS.
3631 VORLAX
3632 VORLAX
3633 VORLAX
3634 VORLAX
3635 VORLAX
3636 VORLAX
3637 VORLAX
3638 VORLAX
3639 VORLAX
3640 VORLAX
3641 VORLAX
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3667 VORLAX
30 C....
C.... TE = TANGENT OF TRAILING EDGE SWEEP ANGLE.
C.... CT = AVERAGE LENGTH OF ROUND TRAILING LEGS OF HORSESHOE
(EDGE MEASURED ALONG X-AXIS).
C.... MM = FLOATING WAKE COMPUTATION FLAG.
COMMONS
NONE.
3631 VORLAX
3632 VORLAX
3633 VORLAX
3634 VORLAX
3635 VORLAX
3636 VORLAX
3637 VORLAX
3638 VORLAX
3639 VORLAX
3640 VORLAX
3641 VORLAX
3642 VORLAX
3643 VORLAX
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3667 VORLAX
35 C....OUTPUT
C.... U, V, W = ORTHOGONAL VELOCITY COMPONENTS INDUCED BY
GENERALIZED HORSESHOE VORTEX OF UNIT
CIRCULATION INTENSITY.
3631 VORLAX
3632 VORLAX
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3634 VORLAX
3635 VORLAX
3636 VORLAX
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3638 VORLAX
3639 VORLAX
3640 VORLAX
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3664 VORLAX
3665 VORLAX
3666 VORLAX
3667 VORLAX
40 C....SUBROUTINES
C....CALLED NONE.
C....
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3667 VORLAX
45 C....DISCUSSION THE GENERALIZED HORSESHOE VORTEX ELEMENT CONSISTS OF
FIVE LEGS OR SEGMENTS, OF WHICH THREE ARE (ROUND) AND
TWO ARE (FREE) OR (FLOATING). THE ROUND LEGS ARE THE
SKEWED, OR SWEEP, TRANSVERSE SEGMENT AND THE TWO
TRAILING, OR CHORDWISE, FILAMENTS EXTENDING FROM THE
ENDS OF THE TRANSVERSE LEG TO THE TRAILING EDGE. THE
FLOATING TRAILING LEGS ARE THE SEMI-INFINITE LINES
WHICH START AT THE TRAILING EDGE AND CONTINUE TO
DOWNSTREAM INFINITY ACCORDING TO A PRESCRIBED DIRECTION
DETERMINED BY THE FLOATATION ANGLES AA AND AM. THESE
FLOATING TRAILING LEGS CONSTITUTE THE CONTINUATION
IN THE WAKE OF THE ROUND TRAILING SEGMENTS.
AT SUPersonic MACH NUMBERS THE VELOCITY INDUCED BY A
DISCRETE HORSESHOE VORTEX BECOMES VERY LARGE IN THE
VICINITY OF THE MACH WAKES GENERATED BY THE SKEWED
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3664 VORLAX
3665 VORLAX
3666 VORLAX
3667 VORLAX

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C....
C....
60 C.... LEG OF THE HORSESHOE. AT THE CHARACTERISTIC ENVELOPE
C.... ITSELF. THE INDUCED VELOCITY VANISHES DUE TO THE FINITE
C.... PART CONCEPT. THIS SINGULAR BEHAVIOR OCCURS ONLY FOR
C.... FIELD POINTS OFF THE PLANE OF THE HORSESHOE. TO AVOID
C.... THIS NUMERICAL SINGULARITY THE CHARACTERISTIC SURFACES
C.... (MACH CONES) ARE TAKEN TO BE GIVEN BY
C.... (X - X1) **2 = B2 * ((Y - Y1) **2 + (Z - Z1) **2) / CUTOFF
65 C.... WHERE CUTOFF IS A NUMERICAL CONSTANT WHOSE VALUE IS
C.... LESS THAN. BUT CLOSE TO. 1.0.
C....
C.... CUTOFF = 0.80
70 C....
C....
C.... COMPUTE COORDINATES OF RECEIVING POINT WITH RESPECT TO
C.... END POINTS OF SKEWED LEG.
C....
75 C.... X1 = X + T * S
C.... Y1 = Y + S
C.... X2 = X - T * S
C.... Y2 = Y - S
C....
80 C.... CALCULATE AXIAL DISTANCE BETWEEN PROJECTION OF RECEIVING POINT
C.... ONTO HORSESHOE PLANE AND EXTENSION OF SKEWED LEG.
C....
C.... XTY = X - T * Y
85 C....
C.... ZERO-OUT PERTURBATION VELOCITY COMPONENTS.
C....
90 C....
C....
C.... SET VALUES OF NUMERICAL TOLERANCE CONSTANTS.
C....
95 C.... TOL = S / 500.0
C.... TOLSQ = TOL * TOL
C.... TOLSQ2 = 2500.0 * TOLSQ
C.... ZSQ = Z * Z
C.... BZQ = B2 * ZSQ
C.... YSQ1 = Y1 * Y1
100 C.... YSQ2 = Y2 * Y2
C.... RTV1 = YSQ1 + ZSQ
C.... RTV2 = YSQ2 + ZSQ
C.... R01 = B2 * RTV1
C.... R02 = B2 * RTV2
C.... RAD1 = 0.0
105 C.... RAD2 = 0.0
C.... XSQ1 = X1 * X1
C.... XSQ2 = X2 * X2
C.... IF (R02) 10, 50, 50
C....
110 C....
C.... COMPUTATION FOR SUBSONIC HORSESHOE VORTEX.
C....
110 C....
C....
110 CPI = 12.5663

```

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VORLAX 3668
VORLAX 3669
VORLAX 3670
VORLAX 3671
VORLAX 3672
VORLAX 3673
VORLAX 3674
VORLAX 3675
VORLAX 3676
VORLAX 3677
VORLAX 3678
VORLAX 3679
VORLAX 3680
VORLAX 3681
VORLAX 3682
VORLAX 3683
VORLAX 3684
VORLAX 3685
VORLAX 3686
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VORLAX 3688
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VORLAX 3700
VORLAX 3701
VORLAX 3702
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VORLAX 3705
VORLAX 3706
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VORLAX 3711
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VORLAX 3715
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VORLAX 3719
VORLAX 3720
VORLAX 3721
VORLAX 3722
VORLAX 3723
VORLAX 3724

```



```

115 ARG = XSQ1 - R01
    RAD1 = SQRT (ARG)
    ARG = XSQ2 - R02
    RAD2 = SQRT (ARG)
    FH1 = 0.0
    FB2 = 0.0
    FT1 = 0.0
    FT2 = 0.0
    XBSQ = XTY *XTY
    TBZ = (T *T - B2) *ZSQ
    DENOM = XBSQ + TRZ
    IF (ARS (DENOM) .LT. TOLSO) DENOM = TOLSO
    FB1 = (T *X1 - B2 *Y1) /RAD1
    RTV = RTV1
    IF (RTV .LT. TOLSO) GO TO 20
    FT1 = (X1 + RAD1) / (RAD1 *RTV)
    FB2 = (T *X2 - B2 *Y2) /RAD2
    RTV = RTV2
    IF (RTV .LT. TOLSO) GO TO 30
    FH = (FH1 - RAD2) / (RAD2 *RTV)
    ZETAPI = Z /CPI
    IF (ZSQ .LT. TOLSO) GO TO 40
    U = ZETAPI *QB
    V = ZETAPI * (FT1 - FT2 - QB *T)
    W = - (QB *XTY + FT1 *Y1 - FT2 *Y2) /CPI
    GO TO 110
C
C
C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX.
C
50 CPI = 6.28318
    IF (X1 .LT. TOL) GO TO 60
    ARG = XSQ1 - R01
    IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)
    IF (X2 .LT. TOL) GO TO 70
    ARG = XSQ2 - R02
    IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)
    ZETAPI = Z /CPI
    IF (ZSQ .LT. TOLSQ2) GO TO 100
    FB1 = 0.0
    FB2 = 0.0
    FT1 = 0.0
    FT2 = 0.0
    XBSQ = XTY *XTY
    TBZ = (T *T - B2) *ZSQ
    DENOM = XBSQ + TBZ
    SIGN = 1.0
    IF (DENOM .LT. 0.0) SIGN = - 1.0
    IF (ARS (DENOM) .LT. TOLSO) DENOM = SIGN *TOLSO
    IF (X1 .LT. TOL) GO TO 80
    IF (RAD1 .EQ. 0.0) GO TO 80
    REPS = CUTOFF *XSQ1
    FMAD = RAD1
    IF (R01 .GT. REPS) GO TO 80
    FB1 = (T *X1 - B2 *Y1) /FRAD
    VORLAX 3725
    VORLAX 3726
    VORLAX 3727
    VORLAX 3728
    VORLAX 3729
    VORLAX 3730
    VORLAX 3731
    VORLAX 3732
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    VORLAX 3754
    VORLAX 3755
    VORLAX 3756
    VORLAX 3757
    VORLAX 3758
    VORLAX 3759
    VORLAX 3760
    VORLAX 3761
    VORLAX 3762
    VORLAX 3763
    VORLAX 3764
    VORLAX 3765
    VORLAX 3766
    VORLAX 3767
    VORLAX 3768
    VORLAX 3769
    VORLAX 3770
    VORLAX 3771
    VORLAX 3772
    VORLAX 3773
    VORLAX 3774
    VORLAX 3775
    VORLAX 3776
    VORLAX 3777
    VORLAX 3778
    VORLAX 3779
    VORLAX 3780
    VORLAX 3781

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```

175      RTV = RTV1
          IF (RTV .LT. TOLSQ) GO TO 80
          FT1 = X1 / (FRAD * RTV)
180      IF (X2 .LT. TOL) GO TO 90
          IF (RAD2 .EQ. 0.0) GO TO 90
          REPS = CUTOFF * XSQ2
          F*AD = RAD2
          IF (R02 .GT. REPS) GO TO 90
          F*2 = (T * X2 - R2 * Y2) / FRAD
          RTV = RTV2
          IF (RTV .LT. TOLSQ) GO TO 90
185      FT2 = X2 / (FRAD * RTV)
          QB = (FB1 - FB2) / DENOM
          U = ZETAPI * QB
          W = - (QB * XTY + FT1 * Y1 - FT2 * Y2) / CPI
          GO TO 110
C
C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX WHEN RECEIVING POINT
C...IS IN THE PLANE OF THE HORSESHOE.
C
190      F1 = 0.
          F2 = 0.
          IF (ABS (Y1) .GT. TOL) F1 = RAD1 / Y1
          IF (ABS (Y2) .GT. TOL) F2 = RAD2 / Y2
          IF (ABS (XTY) .GT. TOL) W = (- F1 + F2) / XTY / CPI
200      IF (MM .EQ. 0) GO TO 200
C
C...IF THE FREE TRAILING LEGS DO NOT CONTINUE TO DOWNSTREAM INFINITY
C...PARALLEL TO X-AXIS, I.E., WAKE FLOATATION FLAG MM IS NOT ZERO.
C...THEN THE EFFECT OF WAKE FLOATATION ANGLES IS COMPUTED BY FIRST
C...SUBTRACTING THE VELOCITY INDUCED BY THE SEMI-INFINITE SEGMENTS
C...PARALLEL TO THE X-AXIS AND EMANATING FROM THE TRAILING EDGE, AND
C...LATER ADDING THE INFLUENCE INDUCED BY THE SEMI-INFINITE PAIR
C...ORIGINATING AT THE SAME POINTS BUT TRAILING TO DOWNSTREAM INFINITY
C...PARALLEL TO THE DIRECTION DEFINED BY THE FLOATATION ANGLES AA AND
C...AM.
C
210      XMP = X - CT
          X1 = XMP + TE * S
          X2 = XMP - TE * S
          ZZ = Z - XMP * AA
          DELU = 0.0
          DELV = 0.0
          DELW = 0.0
          ZSQ = ZZ * ZZ
          BZQ = B2 * ZSQ
          R01 = B2 * YS01 + BZQ
          R02 = B2 * YS02 + BZQ
          RAD1 = 0.0
          RAD2 = 0.0
          XS01 = X1 * X1
          XS02 = X2 * X2
          XMY1 = AM * X1 - Y1
          XMY2 = AM * X2 - Y2
          VORLAX 3742
          VORLAX 3743
          VORLAX 3744
          VORLAX 3745
          VORLAX 3746
          VORLAX 3747
          VORLAX 3748
          VORLAX 3749
          VORLAX 3790
          VORLAX 3791
          VORLAX 3792
          VORLAX 3793
          VORLAX 3794
          VORLAX 3795
          VORLAX 3796
          VORLAX 3797
          VORLAX 3798
          VORLAX 3799
          VORLAX 3800
          VORLAX 3801
          VORLAX 3802
          VORLAX 3803
          VORLAX 3804
          VORLAX 3805
          VORLAX 3806
          VORLAX 3807
          VORLAX 3808
          VORLAX 3809
          VORLAX 3810
          VORLAX 3811
          VORLAX 3812
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          VORLAX 3814
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          VORLAX 3816
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          VORLAX 3832
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          VORLAX 3835
          VORLAX 3836
          VORLAX 3837
          VORLAX 3838
          VORLAX 3839

```

```

230      IF (B2) 120, 130, 130
        ARG = XSQ1 - R01
        RAD1 = SQRT (ARG)
        ARG = XSQ2 - R02
        RAD2 = SQRT (ARG)
        GO TO 150
235      IF (X1 .LT. TOL) GO TO 140
        ARG = XSQ1 - R01
        IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)
140      IF (X2 .LT. TOL) GO TO 150
        ARG = XSQ2 - R02
        IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)
240      GG1 = 0.0
        GG2 = 0.0
        R1 = SQRT ((1. - CUTOFF) *XSQ1)
        R2 = SQRT ((1. - CUTOFF) *XSQ2)
        DR1 = 0.0
        DR2 = 0.0
        IF (RAD1 .GT. R1) DR1 = 1.0 /RAD1
        IF (RAD2 .GT. R2) DR2 = 1.0 /RAD2
        RAM = 1.0 - R2 *AM *AM
        RMZ = B4M *Z50
        DG1 = XMY1 *XMY1 + BMZ
        DG2 = XMY2 *XMY2 + BMZ
        GN1 = X1 - B2 *AM *Y1
        GN2 = X2 - B2 *AM *Y2
        IF (ABS (DG1) .LT. TOLSQ) DG1 = TOLSQ
        IF (ABS (DG2) .LT. TOLSQ) DG2 = TOLSQ
        GINF = 0.0
        IF (B2 .LT. 0.0) GINF = - SQRT (B4M)
        GG1 = (GN1*DR1 - GINF) /DG1
        GG2 = (GN2*DR2 - GINF) /DG2
        FZETA1 = 0.0
        FZETA2 = 0.0
        ETA1 = 0.0
        ETA2 = 0.0
        IF (RTV1 .LT. TOLSQ) GO TO 160
        FZETA1 = ZETAPI /RTV1
        ETA1 = Y1 /CPI /RTV1
        IF (RTV2 .LT. TOLSQ) GO TO 170
        FZETA2 = ZETAPI /RTV2
        ETA2 = Y2 /CPI /RTV2
270      IF (B2 .GE. 0.0) GO TO 180
        DELV = DELW - FZTA1 + FZETA2
        DELW = DELW + ETA1 - ETA2
        DELV = DELV - DR1 *X1 *FZETA1 + DR2 *X2 *FZETA2
275      DELW = DELW + DR1 *X1 *ETA1 - DR2 *X2 *ETA2
        DELV = DELV + (GG2 - GG1) *AM *ZZ /CPI
        DELW = DELW - (GG2 - GG1) *ZZ /CPI
        DELV = DELW + (GG1 *XMY1 - GG2 *XMY2) /CPI
        U = U + DELV
        V = V + DELV
        W = W + DELW
280      RETURN
        END

```

VORLAX 3839
VORLAX 3840
VORLAX 3841
VORLAX 3842
VORLAX 3843
VORLAX 3844
VORLAX 3845
VORLAX 3846
VORLAX 3847
VORLAX 3848
VORLAX 3849
VORLAX 3850
VORLAX 3851
VORLAX 3852
VORLAX 3853
VORLAX 3854
VORLAX 3855
VORLAX 3856
VORLAX 3857
VORLAX 3858
VORLAX 3859
VORLAX 3860
VORLAX 3861
VORLAX 3862
VORLAX 3863
VORLAX 3864
VORLAX 3865
VORLAX 3866
VORLAX 3867
VORLAX 3868
VORLAX 3869
VORLAX 3870
VORLAX 3871
VORLAX 3872
VORLAX 3873
VORLAX 3874
VORLAX 3875
VORLAX 3876
VORLAX 3877
VORLAX 3878
VORLAX 3879
VORLAX 3880
VORLAX 3881
VORLAX 3882
VORLAX 3883
VORLAX 3884
VORLAX 3885
VORLAX 3886
VORLAX 3887
VORLAX 3888
VORLAX 3889
VORLAX 3890
VORLAX 3891
VORLAX 3892
VORLAX 3893

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 WASH

VARIABLES	SN	TYPE	RELOCATION	F.P.
0 AA		REAL		
562 ARG		REAL		
620 BMZ		REAL		
0 R2		REAL		
0 CT		REAL		
604 DELU		REAL		
606 DELW		REAL		
621 DG1		REAL		
615 DR1		REAL		
630 ETA1		REAL		
563 FB1		REAL		
577 FRAD		REAL		
566 FT2		REAL		
627 FZETA2		REAL		
601 F2		REAL		
612 GG2		REAL		
623 GN1		REAL		
0 MM		INTEGER		
555 RAD1		REAL		
576 RPS		REAL		
554 R02		REAL		
551 RTV1		REAL		
613 R1		REAL		
0 S		REAL		
0 T		REAL		
0 TE		REAL		
543 TOLSO		REAL		
0 U		REAL		
0 W		REAL		
567 XBSO		REAL		
607 XMY1		REAL		
557 XSO1		REAL		
541 XY1		REAL		
537 X2		REAL		
547 YSO1		REAL		
536 Y1		REAL		
0 Z		REAL		
545 Z50		REAL		
0 AM		REAL		
617 RAM		REAL		
546 HZO		REAL		
561 CPI		REAL		
534 CUTOFF		REAL		
605 DELV		REAL		
571 DENOM		REAL		
622 DG2		REAL		
616 DR2		REAL		
631 FIA2		REAL		
564 FB2		REAL		
565 FT1		REAL		
626 FZETA1		REAL		
600 F1		REAL		
611 GG1		REAL		
625 GINF		REAL		
624 GN2		REAL		
573 OR		REAL		
556 RAD2		REAL		
553 R01		REAL		
572 RTV		REAL		
552 RIV2		REAL		
614 R2		REAL		
575 SIGN		REAL		
570 TBZ		REAL		
542 TOL		REAL		
544 TOLSG2		REAL		
0 V		REAL		
0 X		REAL		
602 YMP		REAL		
610 XMY2		REAL		
560 XSO2		REAL		
535 X1		REAL		
0 Y		REAL		
550 YSO2		REAL		
540 Y2		REAL		
574 ZETAP1		REAL		
603 Z2		REAL		

EXTERNALS	TYPE	ARGS
0	REAL	1
LIBRARY		
0	REAL	1
INTRIN		
0	REAL	1

STATEMENT LABELS	INACTIVE
0	10
126	40
156	70
256	100
342	130
100	20
135	50
221	80
300	110
352	140

111	30
146	60
240	90
0	120
362	150

INACTIVE

SUBROUTINE ZNORM
COMMON BLOCKS LENGTH
SET19 240

STATISTICS
PROGRAM LENGTH 1308 88
CM LABELED COMMON LENGTH 204528 8490
CM BLANK COMMON LENGTH 18 1

```

1 CONTROL*VRLX,ZNORM          9/14/76          3894
C.... SUBROUTINE ZNORM (I, IS, RTOP)          3895
5 C.... PURPOSE              TO INTEGRATE THE CHORDWISE SLOPE DISTRIBUTION IN ORDER
C.... TO OBTAIN THE SURFACE CAMBER (OR WARP) ORDINATES.          3897
C          CALLING SEQUENCES          3898
C          I = ELEMENT INDEX (TOTAL COUNT).          3900
C          IS = STRIP INDEX (SPANWISE COUNTY).          3901
C          MNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP          3902
C          COMMONS          3903
C          LAX, SLF, SLOPE.          3904
C          CALLING SEQUENCES          3905
C          NONE.          3906
C          COMMONS          3907
C          ZC.          3908
20 C.... SUBROUTINES          3909
C.... CALLED          NONE.          3910
C.... DISCUSSION THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES
C          BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS          3911
C          TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY          3912
C          CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS          3913
C          IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS          3914
C          TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED          3915
C          TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS          3916
C          DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS          3917
C          EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD          3918
C          LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL          3919
C          SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST.          3920
C          SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE          3921
C          STRIP OR ROW OF HORSESHOE VORTICES.          3922
C          COMMON LAX          3923
C          COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)          3924
C          COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)          3925
C          COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)          3926
C          FEQL = LAX          3927
C          FCOS = 1.0 - FEQL          3928
C          PION = (3.14159 *FCOS + FEQL) /RTOP          3929
C          F1 = .75 *FCOS + .8333 *FEQL          3930
C          F2 = .25 *FCOS + .1667 *FEQL          3931
C          TSTART = F1 *SLE (IS) + F2 *SLOPE (I)          3932
C          DEL1 = .25 *PION          3933
C          DELX = DEL1 * (SIN (DEL1 *FCOS) + FEQL)          3934
C          ZOR = TSTART *DELX          3935
          3936
          3937
          3938
          3939
          3940
          3941
          3942
          3943
          3944
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          3946
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          3948
          3949
          3950

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        VORLAX 3951
        VORLAX 3952
        VORLAX 3953
        VORLAX 3954
        VORLAX 3955
        VORLAX 3956
        VORLAX 3957
        VORLAX 3958
        VORLAX 3959
        VORLAX 3960
        VORLAX 3961
        VORLAX 3962
        VORLAX 3963
        VORLAX 3964
        VORLAX 3965
        VORLAX 3966
        VORLAX 3967
    
```

```

        60      C
              DEL = PION *.5
              LTOP = RTOP
              DO 30 L = 1, LTOP
              IL = I + L - 1
              RL = L
              IF (LAX .EQ. 1) GO TO 10
              DELXI = SIN (PION * (RL - 1.0))
              GO TO 20
              10  DELXI = 2.0
              20  ZC (L) = ZOR + DEL * DELXI * SLOPE (IL)
              ZOR = ZC (L)
              30  CONTINUE
              C
              RETURN
              END
    
```

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 ZNORM

VARIABLES	SN	TYPE	RELOCATION
0 DCP		REAL	SET2
112 DELX	114	REAL	DEL
111 DEL1	121	REAL	DELXI
103 FEUL	104	REAL	FCOS
107 F2	106	REAL	F1
117 IL	0	REAL	I
116 L	0	INTEGER	IS
115 LTOP	0	INTEGER	LAX
120 RL	105	REAL	PION
50 SLE	0	REAL	RTOP
24 SLE2	0	REAL	SLE1
110 TSTART	3720	REAL	SLOPE
0 X	7640	REAL	VSP
4064 Z	3720	REAL	Y
214 ZETA	4230	REAL	ZC
	113	REAL	ZOR

EXTERNALS
SIN REAL 1 LIBRARY

STATEMENT LABELS
60 10

LOOPS LABEL INDEX FROM-TO LENGTH PROPERTIES EXT REFS
47 30 * L 61 70 238 62 20

COMMON BLOCKS LENGTH
/ / 1
SET1 2250
SET2 6000

U 30

SIMROUTINE ZNORM 7474 OPT=J FTN 4.5+410A 10/04/76 10.15.13 PAGE 3

COMMON BLOCKS LENGTH
SET19 240

STATISTICS

PROGRAM LENGTH	130H	88
CM LARELED COMMON LENGTH	20452H	8490
CM BLANK COMMON LENGTH	1H	1

LOAD MAP - VORLAX

FWA OF THE LOAD 101
LWA+1 OF THE LOAD 205576

TRANSFER ADDRESS -- VORLAX 124001

PROGRAM AND BLOCK ASSIGNMENTS.

BLOCK	ADDRESS	LENGTH	FILE	DATE	PROCSSR	VER LEVEL	HARDWARE	COMMENTS
/SET1/	101	4312						
/SET2/	441J	13560						
/SET3/	2017J	17500						
/SET4/	37673	1510						
/SET5/	41403	670						
/SET6/	42273	4254						
/SET7/	46547	360						
/SET8/	47127	1200						
/SET9/	50327	310						
/SET10/	50637	1274						
/SET11/	52133	24						
/SET12/	52157	7						
/SET13/	52166	6						
/SET14/	52174	4						
/SET15/	52200	5						
/SET16/	52205	7640						
/SET17/	62045	360						
/SET18/	62425	33						
/SET19/	62460	360						
/SET20/	63040	14210						
VORLAX	77250	51231	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
AERO	150501	1022	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
ROUNDY	151523	204	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
GAUSS	151727	342	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
GEOM	152271	605	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
INPUT	153076	2750	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
HAP	156046	534	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
MATRIX	156602	1345	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
PRESS	160147	570	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
PRINT	160737	5414	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
SURVEY	166353	1136	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
UXVEL	167511	250	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
VECTOR	167761	311	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
WASH	170272	632	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
ZNORM	171124	130	LG0	10/04/76	FTN	4.5 410A	666X I	OPT=1
/FCL.C./	171254	23						
/08.10./	171277	131						
COMIO=	171430	64	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		COMMON CODED I/O ROUTINES AND CONSTANTS.
QBNTRY=	171430	0	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		FCL INITIALIZATION ROUTINE.
EOF	171514	16	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		TEST FOR END OF FILE STATUS.
FLTN=	171532	154	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		COMMON FLOATING INPUT CONVERIER.
FMTAP=	171706	352	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		CRACK APLIST AND FORMAT FOR KODER/KHAKCH.
FORUL=	172260	16	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		FCL MISC. UTILITIES.
GETFIT=	172276	42	SL-FORTRAN	03/23/76	COMPASS	3. 2-410		LOCATE AN FIT GIVEN A FILE NAME.
/IO.BUF./	172340	227						

INPB=	172567	314	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	BINARY READ FORTRAN RECORD.
KRAKER=	173103	406	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	PROCESS FORMATTED FORTRAN INPUT.
OUTB=	173511	203	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	BINARY WRITE FORTRAN RECORD.
OUTCOM=	173714	154	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	COMMON OUTPUT CODE
REWIND=	174070	37	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	POSITION FILE AT BEGINNING-OF-INFORMATION.
GOTOER=	174127	14	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	COMPUTED GO TO ERROR PROCESSOR.
ALOG	174143	73	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	EXPONENTIAL FUNCTION. E TO POWER X. OPT=ALL.
ATAN2	174236	73	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	TRIGONOMETRIC SINE OR COSINE OF X. OPT=ALL.
EXP	174331	75	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	LINK BETWEEN SYS=AID AND INITIALIZATION CUN
SINCOS=	174426	66	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	AUXILIARY MATH LIBRARY LINK FOR ERRORS.
SYS=AID=	174514	1	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	TANGENT OF X.
SYS=AID	174514	7	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	REAL TO REAL EXPONENTIATION.
TAN=	174524	74	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	INITIALIZE CONSTANTS.
XTOY=	174620	7	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	COMMON FLOATING OUTPUT CODE
FECMSK=	174627	41	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	FORTRAN OBJECT LIBRARY UTILITIES.
FLTOU=	174670	310	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	COMMON INPUT FORMATTING CODE
FORSYS=	175200	600	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	FORMATTED READ FORTRAN RECORD.
INCOM=	176000	277	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	OUTPUT FORMAT INTERPRETER.
INPC=	176277	160	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	FORMATTED WRITE FORTRAN RECORD.
KODER=	176457	456	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	COMPUTE THE SQUARE ROOT OF X. OPT=ALL.
OUTC=	177135	172	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	MATH LIBRARY LINK TO ERROR MESSAGE PROCESSOR.
SYS=IST	177327	43	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	PROCESS SYSTEM REQUEST.
SORT	177372	62	SL-FORTRAN	03/23/76	COMPASS	3.	2-410	
SYS=RM	177454	37	SL-SYSIO	03/12/75	COMPASS	3.	75010	
/CON.RM/	177513	6	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
CIO.RM	177521	40	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/A08.RM/	177561	10	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
MOVE.RM	177571	64	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
MCT.RM	177655	227	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/JMPS.RM/	200104	11						
/HEMC.RM/	200115	3						
/OPES.FO/	200120	1						
/OPEN.FO/	200121	1						
OPEN.RM	200130	231	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/TERM.RM/	200361	1						
/PUT.FO/	200362	7						
PUT.SQ	200371	1360	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
WAR.SQ	201751	260	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/CLSF.FO/	202231	7						
CLSF.RM	202240	23	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/GET.BT/	202263	5						
BRT.SQ	202270	114	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
WEOX.SQ	202404	142	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/SKFL.FO/	202546	7						
SKFL.SQ	202555	47	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
ERR.RM	202624	404	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
CHMR.SQ	203230	7	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
OSUB.RM	203237	65	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
OPEN.SQ	203324	262	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
OPEX.SQ	203606	14	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/PUT.RT/	203622	11						
RLEQ.RM	203633	42	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
CLSF.SQ	203675	131	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/CLSV.FO/	204026	7						
CLSV.SQ	204035	123	SL-SYSIO	06/16/76	COMPASS	3.	2-410	
/REM.FO/	204160	7						
REW.SQ	204167	31	SL-SYSIO	06/16/76	COMPASS	3.	2-410	

/GET.FO/	204220	7		
/GET.RT/	204227	11		
GET.SQ	204240	1041	SL-SYSIO	06/16/76 COMPASS 3. 2-410
Z.SQ	205301	101	SL-SYSIO	06/16/76 COMPASS 3. 2-410
W.SQ	205402	50	SL-SYSIO	06/16/76 COMPASS 3. 2-410
FSU.SQ	205452	106	SL-SYSIO	06/16/76 COMPASS 3. 2-410
//	205560	16		

345 TABLE MOVES

221700B CM STORAGE USED

.615 CP SECONDS

```

***** INPUT DECK *****
NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING
0 0 1 .10 -0.00 -0.00 1.00 99
1 .151
4 0.000 4.000 8.000 12.000
1 5.000 0.000 0.000 1.000
1 598.00 9.8500 31.6000 17.2500 68.0000
***** 1 *****
24.4000 0.0000 18.9500 14.1000 ASYM WING PANEL A3C
85.8500 34.0000 18.9500 3.5000 A3C
10.0000 5.0000 1.0000 0.0000
-.0566 -.0668 0 0 2 -0 -0
-0 -0 -0
***** END OF INPUT DECK *****

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NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

PANEL GEOMETRY

I	XAPEX(I)	YAPEX(I)	ZAPEX(I)	PDL(I)	LESWP(I)	CSTART(I)	TAPER(I)	PSPAN(I)	NVOR(I)	RNCV(I)	SPC(I)
1	24.4000	0.0000	18.9500	0.0000	61.0445	14.1000	.2482	34.0000	10.	5.	1.00

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL 1

-0.0566	.0668
0.0000	0.0000
0.0000	0.0000

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151

ALPHA = 0.000 DEG.

PSI = 5.000 DEG.

PITCH RATE = 0.00 DEG /SEC

ROLL RATE = 0.00 DEG /SEC

YAW RATE = 0.00 DEG /SEC

ANALYSIS (DIRECT) CASE (INVERS = 0)

MOMENT AND ROTATION CENTER S XBAR = .31600E+02 ZBAR = .17250E+02 ***** VINFL = .10000E+01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS S FLOATX =-0.00 FLOATY = 1.00

I	SURF/SREF	CN(I)	CL(I)	CY(I)	CD(I)	CT(I)	CS(I)	CM(I)	CRM(I)	CYM(I)
1	.5003E+00	.08692	-.04352	-.00001	.00006	.00179	.00370	-.6875E-01	.5441E-02	.4313E-04
** 1	.5003E+00	.10819	.05415	-.00006	.00065	.00176	.00363	-.6840E-01	-.9337E-02	.4484E-04
	SREF	WSPAN	CBAR	CLTOT	CNTOT	CNTOT	CYTOT	CMTOT	CRMTOT	CYMTOT
	.59800E+03	-.68000E+02	.98500E+01	.0976A	.00071	-.00006	-.13714E+00	-.38959E-02	.87966E-04	

CD/CL**2 = .0748 E = .5502

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 0.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
ASYM #ING PANEL A3C																
PANEL NO. 1																
1	1	.0245	27.805	1.700	18.950	13.570	-0.550	0	.325	1.339	.099	0.00	-.0052	.1939E+00	.04001	.03345
1	2	.2061	30.269	1.700	18.950	13.570	-0.550	0	.117					.6857E-01		
1	3	.5000	34.257	1.700	18.950	13.570	-0.550	0	.076					.4330E-01		
1	4	.7939	38.246	1.700	18.950	13.570	-0.550	0	.046					.2540E+01		
1	5	.9755	40.710	1.700	18.950	13.570	-0.550	0	.017					.8731E-02		
2	1	.0245	33.924	5.100	18.950	12.510	-0.514	0	.396	1.337	.107	0.00	-.0024	.2361E+00	.05590	.01276
2	2	.2061	36.196	5.100	18.950	12.510	-0.514	0	.131					.7698E-01		
2	3	.5000	39.872	5.100	18.950	12.510	-0.514	0	.074					.4169E-01		
2	4	.7939	43.549	5.100	18.950	12.510	-0.514	0	.041					.2199E-01		
2	5	.9755	45.821	5.100	18.950	12.510	-0.514	0	.015					.6966E-02		
3	1	.0245	40.043	8.500	18.950	11.450	-0.472	0	.422	1.266	.111	0.00	-.0017	.2515E+00	.05834	.00136
3	2	.2061	42.122	8.500	18.950	11.450	-0.472	0	.137					.8013E-01		
3	3	.5000	45.487	8.500	18.950	11.450	-0.472	0	.073					.4156E-01		
3	4	.7939	48.853	8.500	18.950	11.450	-0.472	0	.040					.2168E-01		
3	5	.9755	50.932	8.500	18.950	11.450	-0.472	0	.015					.6931E-02		
4	1	.0245	46.162	11.900	18.950	10.390	-0.421	0	.423	1.144	.110	0.00	-.0015	.2522E+00	.05331	-.00516
4	2	.2061	48.049	11.900	18.950	10.390	-0.421	0	.136					.7986E-01		
4	3	.5000	51.102	11.900	18.950	10.390	-0.421	0	.072					.4102E-01		
4	4	.7939	54.156	11.900	18.950	10.390	-0.421	0	.040					.2136E-01		
4	5	.9755	56.043	11.900	18.950	10.390	-0.421	0	.015					.6962E-02		
5	1	.0245	52.281	15.300	18.950	9.330	-0.358	0	.406	.985	.106	0.00	-.0014	.2419E+00	.04402	-.00877
5	2	.2061	53.975	15.300	18.950	9.330	-0.358	0	.131					.7659E-01		
5	3	.5000	56.717	15.300	18.950	9.330	-0.358	0	.069					.3921E-01		
5	4	.7939	59.460	15.300	18.950	9.330	-0.358	0	.038					.2041E-01		
5	5	.9755	61.154	15.300	18.950	9.330	-0.358	0	.015					.6561E-02		
6	1	.0245	58.400	18.700	18.950	8.270	-0.279	0	.369	.793	.096	0.00	-.0013	.2197E+00	.03217	-.01001
6	2	.2061	59.902	18.700	18.950	8.270	-0.279	0	.119					.6971E-01		
6	3	.5000	62.332	18.700	18.950	8.270	-0.279	0	.064					.3569E-01		
6	4	.7939	64.763	18.700	18.950	8.270	-0.279	0	.035					.1852E-01		
6	5	.9755	66.265	18.700	18.950	8.270	-0.279	0	.013					.5944E-02		
7	1	.0245	64.519	22.100	18.950	7.210	-0.177	0	.306	.575	.080	0.00	-.0011	.1824E+00	.01931	-.00911
7	2	.2061	65.829	22.100	18.950	7.210	-0.177	0	.099					.5805E-01		
7	3	.5000	67.947	22.100	18.950	7.210	-0.177	0	.053					.2979E-01		
7	4	.7939	70.066	22.100	18.950	7.210	-0.177	0	.029					.1537E-01		
7	5	.9755	71.376	22.100	18.950	7.210	-0.177	0	.011					.4913E-02		
8	1	.0245	70.638	25.500	18.950	6.150	-0.039	0	.207	.334	.054	0.00	-.0008	.1235E+00	.00753	-.00620
8	2	.2061	71.755	25.500	18.950	6.150	-0.039	0	.067					.3950E-01		
8	3	.5000	73.562	25.500	18.950	6.150	-0.039	0	.036					.2041E-01		
8	4	.7939	75.370	25.500	18.950	6.150	-0.039	0	.019					.1042E-01		
8	5	.9755	76.487	25.500	18.950	6.150	-0.039	0	.007					.3304E-02		
9	1	.0245	76.757	28.900	18.950	5.090	.0155	0	.051	.071	.014	0.00	-.0003	.3064E-01	.00038	-.00148

NASH VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 0.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	UL	CMT	GAMMA	CTC	CDC
9	2	.2061	77.682	28.900	18.950	5.090	.0155	0	.018					.1034E-01		
9	3	.5000	79.177	28.900	18.950	5.090	.0155	0	.010					.5542E-02		
9	4	.7939	80.673	28.900	18.950	5.090	.0155	0	.005					.2736E-02		
9	5	.9755	81.598	28.900	18.950	5.090	.0155	0	.002					.8462E-03		
10	1	.0245	82.876	32.300	18.950	4.030	.0452	0	-.195	-.194	-.048	0.00	-.0002	-.1171E+00	.00450	.00426
10	2	.2061	83.608	32.300	18.950	4.030	.0452	0	-.061					-.3556E-01		
10	3	.5000	84.792	32.300	18.950	4.030	.0452	0	-.030					-.1700E-01		
10	4	.7939	85.977	32.300	18.950	4.030	.0452	0	-.015					-.7691E-02		
10	5	.9755	86.709	32.300	18.950	4.030	.0452	0	-.005					-.2147E-02		
11	1	.0245	27.805	-1.700	18.950	13.570	-.0550	0	.428	1.749	.129	0.00	-.0047	.1939E+00	.00003	.05590
11	2	.2061	30.269	-1.700	18.950	13.570	-.0550	0	.136					.6858E-01		
11	3	.5000	34.257	-1.700	18.950	13.570	-.0550	0	.097					.4330E-01		
11	4	.7939	38.246	-1.700	18.950	13.570	-.0550	0	.055					.2538E-01		
11	5	.9755	40.710	-1.700	18.950	13.570	-.0550	0	.016					.8224E-02		
12	1	.0245	33.924	-5.100	18.950	12.510	-.0514	0	.545	1.744	.139	0.00	-.0006	.2360E+00	.05587	.03361
12	2	.2061	36.196	-5.100	18.950	12.510	-.0514	0	.175					.7691E-01		
12	3	.5000	39.872	-5.100	18.950	12.510	-.0514	0	.092					.4159E-01		
12	4	.7939	43.549	-5.100	18.950	12.510	-.0514	0	.046					.2182E-01		
12	5	.9755	45.821	-5.100	18.950	12.510	-.0514	0	.012					.6867E-02		
13	1	.0245	40.043	-8.500	18.950	11.450	-.0472	0	.579	1.639	.143	0.00	.0007	.2510E+00	.05813	.01908
13	2	.2061	42.122	-8.500	18.950	11.450	-.0472	0	.181					.7971E-01		
13	3	.5000	45.487	-8.500	18.950	11.450	-.0472	0	.091					.4103E-01		
13	4	.7939	48.853	-8.500	18.950	11.450	-.0472	0	.044					.2073E-01		
13	5	.9755	50.932	-8.500	18.950	11.450	-.0472	0	.011					.6380E-02		
14	1	.0245	46.162	-11.900	18.950	10.390	-.0421	0	.578	1.464	.141	0.00	.0013	.2506E+00	.05266	.00887
14	2	.2061	48.049	-11.900	18.950	10.390	-.0421	0	.180					.7892E-01		
14	3	.5000	51.102	-11.900	18.950	10.390	-.0421	0	.088					.3977E-01		
14	4	.7939	54.156	-11.900	18.950	10.390	-.0421	0	.041					.1959E-01		
14	5	.9755	56.043	-11.900	18.950	10.390	-.0421	0	.010					.5933E-02		
15	1	.0245	52.281	-15.300	18.950	9.330	-.0358	0	.549	1.239	.133	0.00	.0017	.2381E+00	.04271	.00160
15	2	.2061	53.975	-15.300	18.950	9.330	-.0358	0	.170					.7472E-01		
15	3	.5000	56.717	-15.300	18.950	9.330	-.0358	0	.082					.3713E-01		
15	4	.7939	59.460	-15.300	18.950	9.330	-.0358	0	.038					.1787E-01		
15	5	.9755	61.154	-15.300	18.950	9.330	-.0358	0	.009					.5338E-02		
16	1	.0245	58.400	-18.700	18.950	8.270	-.0279	0	.451	.974	.118	0.00	.0018	.2127E+00	.03024	-.00307
16	2	.2061	59.902	-18.700	18.950	8.270	-.0279	0	.152					.6661E-01		
16	3	.5000	62.332	-18.700	18.950	8.270	-.0279	0	.072					.3269E-01		
16	4	.7939	64.763	-18.700	18.950	8.270	-.0279	0	.032					.1532E-01		
16	5	.9755	66.265	-18.700	18.950	8.270	-.0279	0	.007					.4498E-02		
17	1	.0245	64.519	-22.100	18.950	7.210	-.0177	0	.355	.677	.094	0.00	.0018	.1714E+00	.01713	-.00514
17	2	.2061	65.829	-22.100	18.950	7.210	-.0177	0	.122					.5348E-01		
17	3	.5000	67.947	-22.100	18.950	7.210	-.0177	0	.057					.2581E-01		
17	4	.7939	70.066	-22.100	18.950	7.210	-.0177	0	.024					.1160E-01		

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 0.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	UCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
17	5	.9755	71.376	-22.100	18.950	7.210	-.0177	0	.005					.3300E-02		
18	1	.0245	70.638	-25.500	18.950	6.150	-.0039	0	.249	.354	.057	0.00	.0017	.1077E+00	.00578	-.00437
18	2	.2061	71.755	-25.500	18.950	6.150	-.0039	0	.076					.3328E-01		
18	3	.5000	73.562	-25.500	18.950	6.150	-.0039	0	.034					.1537E-01		
18	4	.7939	75.370	-25.500	18.950	6.150	-.0039	0	.013					.6156E-02		
18	5	.9755	76.487	-25.500	18.950	6.150	-.0039	0	.002					.1575E-02		
19	1	.0245	76.757	-28.900	18.950	5.090	.0155	0	.022	.009	.002	0.00	.0014	.9486E-02	.00004	-.00018
19	2	.2061	77.682	-28.900	18.950	5.090	.0155	0	.005					.2280E-02		
19	3	.5000	79.177	-28.900	18.950	5.090	.0155	0	-.001					-.5112E-03		
19	4	.7939	80.673	-28.900	18.950	5.090	.0155	0	-.004					-.1859E-02		
19	5	.9755	81.598	-28.900	18.950	5.090	.0155	0	-.002					-.9290E-03		
20	1	.0245	82.876	-32.300	18.950	4.030	.0452	0	-.329	-.328	-.081	0.00	-.0003	-.1428E+00	.00665	.00215
20	2	.2061	83.608	-32.300	18.950	4.030	.0452	0	-.102					-.4501E-01		
20	3	.5000	84.792	-32.300	18.950	4.030	.0452	0	-.052					-.2343E-01		
20	4	.7939	85.977	-32.300	18.950	4.030	.0452	0	-.025					-.1199E-01		
20	5	.9755	86.709	-32.300	18.950	4.030	.0452	0	-.006					-.3695E-02		

ITRMAX = 99

EPS = .00047

ITER = 9

RIG = .00043

CONVERGENCE FACTOR = .40424

END OF CASE

ALPHA = 4.0°

OUTPUT DATA

DELETED HERE

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151

ALPHA = 8.000 DEG.

PSI = 5.000 DEG.

PITCH RATE = 0.00 DEG / SEC

ROLL RATE = 0.00 DEG / SEC

YAW RATE = 0.00 DEG / SEC

ANALYSIS (DIRECT) CASE (INVERS = 0)

MOMENT AND ROTATION CENTER XBAR = .31600E+02 ZBAR = .17250E+02 ***** VINP = .10000E+01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS FLOATX = 0.00 FLOATY = 1.00

CN REFERENCED TO SURF+		CL,CY,CD,CT,CS REFERENCED TO SREF+		CM REFERENCED TO SREF+CBAR+		CRM,CYM REFERENCED TO SREF+MSPAN			
I	SURF/SREF	CN(I)	CL(I)	CY(I)	CD(I)	CS(I)	CM(I)	CRM(I)	CYM(I)
1	.5003E+00	.42751	.21700	.00268	-.00041	.03742	.07730	-.4882E+00	.3750E-01
** 1	.5003E+00	.54741	.27594	.00242	.01090	.03647	.07532	-.5391E+00	-.6628E-01
	SREF	WSPAN	CBAR	CLTOT	CDTOT	CYTOT	CSTOT	CRMTOT	CYMTOT
	.59800E+03	.68000E+02	.98500E+01	.49294	.01049	.00509	-.10273E+01	-.28773E-01	.46488E-02

CD/CL**2 = .0432 E = .9537

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 8.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S
 S C X/C X Y Z CHORD SLOPE ITS DCP CNC CN D/L CMT GAMMA CTC CDC

PANEL NO.		ASYM WING PANEL A3C														
1	1	.0245	27.805	1.700	18.950	13.570	-0.0550	0	1.155	4.827	.356	0.00	-0.0200	.6955E+00	.51394	.43009
1	2	.2061	30.269	1.700	18.950	13.570	-0.0550	0	.420					.2485E+00		
1	3	.5000	34.257	1.700	18.950	13.570	-0.0550	0	.277					.1596E+00		
1	4	.7939	38.246	1.700	18.950	13.570	-0.0550	0	.172					.9497E-01		
1	5	.9755	40.710	1.700	18.950	13.570	-0.0550	0	.064					.3099E-01		
2	1	.0245	33.924	5.100	18.950	12.510	-0.0514	0	1.450	4.944	.395	0.00	-0.0099	.8730E+00	.76362	.19072
2	2	.2061	36.196	5.100	18.950	12.510	-0.0514	0	.484					.2863E+00		
2	3	.5000	39.872	5.100	18.950	12.510	-0.0514	0	.275					.1577E+00		
2	4	.7939	43.549	5.100	18.950	12.510	-0.0514	0	.155					.8408E-01		
2	5	.9755	45.821	5.100	18.950	12.510	-0.0514	0	.058					.2663E-01		
3	1	.0245	40.043	8.500	18.950	11.450	-0.0472	0	1.608	4.867	.425	0.00	-0.0076	.9680E+00	.86409	.05710
3	2	.2061	42.122	8.500	18.950	11.450	-0.0472	0	.523					.3095E+00		
3	3	.5000	45.487	8.500	18.950	11.450	-0.0472	0	.286					.1634E+00		
3	4	.7939	48.853	8.500	18.950	11.450	-0.0472	0	.159					.8604E-01		
3	5	.9755	50.932	8.500	18.950	11.450	-0.0472	0	.060					.2741E-01		
4	1	.0245	46.162	11.900	18.950	10.390	-0.0421	0	1.705	4.649	.447	0.00	-0.0072	.1026E+01	.88215	-.02522
4	2	.2061	48.049	11.900	18.950	10.390	-0.0421	0	.551					.3260E+00		
4	3	.5000	51.102	11.900	18.950	10.390	-0.0421	0	.298					.1704E+00		
4	4	.7939	54.156	11.900	18.950	10.390	-0.0421	0	.165					.8953E-01		
4	5	.9755	56.043	11.900	18.950	10.390	-0.0421	0	.063					.2862E-01		
5	1	.0245	52.281	15.300	18.950	9.330	-0.0358	0	1.767	4.322	.463	0.00	-0.0073	.1064E+01	.85127	-.08143
5	2	.2061	53.975	15.300	18.950	9.330	-0.0358	0	.571					.3377E+00		
5	3	.5000	56.717	15.300	18.950	9.330	-0.0358	0	.308					.1761E+00		
5	4	.7939	59.460	15.300	18.950	9.330	-0.0358	0	.171					.9250E-01		
5	5	.9755	61.154	15.300	18.950	9.330	-0.0358	0	.065					.2959E-01		
6	1	.0245	58.600	18.700	18.950	8.270	-0.0279	0	1.802	3.909	.473	0.00	-0.0076	.1084E+01	.78418	-.11895
6	2	.2061	59.902	18.700	18.950	8.270	-0.0279	0	.583					.3447E+00		
6	3	.5000	62.332	18.700	18.950	8.270	-0.0279	0	.315					.1798E+00		
6	4	.7939	64.763	18.700	18.950	8.270	-0.0279	0	.174					.9443E-01		
6	5	.9755	66.265	18.700	18.950	8.270	-0.0279	0	.066					.3019E-01		
7	1	.0245	64.519	22.100	18.950	7.210	-0.0177	0	1.806	3.423	.475	0.00	-0.0078	.1087E+01	.68687	-.13988
7	2	.2061	65.829	22.100	18.950	7.210	-0.0177	0	.585					.3461E+00		
7	3	.5000	67.947	22.100	18.950	7.210	-0.0177	0	.317					.1811E+00		
7	4	.7939	70.066	22.100	18.950	7.210	-0.0177	0	.176					.9503E-01		
7	5	.9755	71.376	22.100	18.950	7.210	-0.0177	0	.067					.3031E-01		
8	1	.0245	70.638	25.500	18.950	6.150	-0.0039	0	1.772	2.871	.467	0.00	-0.0079	.1067E+01	.56385	-.14527
8	2	.2061	71.755	25.500	18.950	6.150	-0.0039	0	.575					.3399E+00		
8	3	.5000	73.562	25.500	18.950	6.150	-0.0039	0	.313					.1788E+00		
8	4	.7939	75.370	25.500	18.950	6.150	-0.0039	0	.173					.9384E-01		
8	5	.9755	76.487	25.500	18.950	6.150	-0.0039	0	.066					.2984E-01		
9	1	.0245	76.757	28.900	18.950	5.090	.0155	0	1.679	2.256	.443	0.00	-0.0078	.1010E+01	.41858	-.13442

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 8.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
9	2	.2061	77.682	28.900	18.950	5.090	.0155	0	.545	1.553	.385	0.00	-.0060	.3224E+00		
9	3	.5000	79.177	28.900	18.950	5.090	.0155	0	.254					.1704E+00		
9	4	.7939	80.673	28.900	18.950	5.090	.0155	0	.165					.8946E-01		
9	5	.9755	81.598	28.900	18.950	5.090	.0155	0	.062					.2835E-01		
10	1	.0245	82.876	32.300	18.950	4.030	.0452	0	1.467	6.312	.465	0.00	-.0189	.8832E+00	.25344	-.10463
10	2	.2061	83.608	32.300	18.950	4.030	.0452	0	.476					.2815E+00		
10	3	.5000	84.792	32.300	18.950	4.030	.0452	0	.254					.1476E+00		
10	4	.7939	85.977	32.300	18.950	4.030	.0452	0	.141					.7598E-01		
10	5	.9755	86.709	32.300	18.950	4.030	.0452	0	.052					.2353E-01		
11	1	.0245	27.805	-1.700	18.950	13.570	-.0550	0	1.590	6.471	.517	0.00	-.0046	.6957E+00	.51419	.71657
11	2	.2061	30.269	-1.700	18.950	13.570	-.0550	0	.561					.2484E+00		
11	3	.5000	34.257	-1.700	18.950	13.570	-.0550	0	.353					.1598E+00		
11	4	.7939	38.246	-1.700	18.950	13.570	-.0550	0	.203					.9506E-01		
11	5	.9755	40.710	-1.700	18.950	13.570	-.0550	0	.058					.3106E-01		
12	1	.0245	33.924	-5.100	18.950	12.510	-.0514	0	1.995	6.471	.517	0.00	-.0046	.8730E+00	.76369	.48036
12	2	.2061	36.196	-5.100	18.950	12.510	-.0514	0	.646					.2864E+00		
12	3	.5000	39.872	-5.100	18.950	12.510	-.0514	0	.348					.1579E+00		
12	4	.7939	43.549	-5.100	18.950	12.510	-.0514	0	.179					.8490E-01		
12	5	.9755	45.821	-5.100	18.950	12.510	-.0514	0	.048					.2718E-01		
13	1	.0245	40.043	-8.500	18.950	11.450	-.0472	0	2.212	6.350	.555	0.00	.0001	.9680E+00	.86396	.33222
13	2	.2061	42.122	-8.500	18.950	11.450	-.0472	0	.698					.3094E+00		
13	3	.5000	45.487	-8.500	18.950	11.450	-.0472	0	.358					.1630E+00		
13	4	.7939	48.853	-8.500	18.950	11.450	-.0472	0	.179					.8509E-01		
13	5	.9755	50.932	-8.500	18.950	11.450	-.0472	0	.047					.2680E-01		
14	1	.0245	46.162	-11.900	18.950	10.390	-.0421	0	2.341	6.028	.580	0.00	.0021	.1024E+01	.87928	.72659
14	2	.2061	48.049	-11.900	18.950	10.390	-.0421	0	.733					.3248E+00		
14	3	.5000	51.102	-11.900	18.950	10.390	-.0421	0	.370					.1684E+00		
14	4	.7939	54.156	-11.900	18.950	10.390	-.0421	0	.181					.8650E-01		
14	5	.9755	56.043	-11.900	18.950	10.390	-.0421	0	.046					.2698E-01		
15	1	.0245	52.281	-15.300	18.950	9.330	-.0358	0	2.416	5.562	.596	0.00	.0031	.1057E+01	.84176	.14397
15	2	.2061	53.975	-15.300	18.950	9.330	-.0358	0	.755					.3346E+00		
15	3	.5000	56.717	-15.300	18.950	9.330	-.0358	0	.378					.1721E+00		
15	4	.7939	59.460	-15.300	18.950	9.330	-.0358	0	.183					.8743E-01		
15	5	.9755	61.154	-15.300	18.950	9.330	-.0358	0	.046					.2712E-01		
16	1	.0245	58.400	-18.700	18.950	8.270	-.0279	0	2.447	4.983	.603	0.00	.0036	.1071E+01	.76576	.07512
16	2	.2061	59.902	-18.700	18.950	8.270	-.0279	0	.764					.3487E+00		
16	3	.5000	62.332	-18.700	18.950	8.270	-.0279	0	.381					.1737E+00		
16	4	.7939	64.763	-18.700	18.950	8.270	-.0279	0	.183					.8761E-01		
16	5	.9755	66.265	-18.700	18.950	8.270	-.0279	0	.046					.2707E-01		
17	1	.0245	64.519	-22.100	18.950	7.210	-.0177	0	2.433	4.314	.598	0.00	.0037	.1064E+01	.65947	.02563
17	2	.2061	65.829	-22.100	18.950	7.210	-.0177	0	.759					.3364E+00		
17	3	.5000	67.947	-22.100	18.950	7.210	-.0177	0	.379					.1725E+00		
17	4	.7939	70.066	-22.100	18.950	7.210	-.0177	0	.181					.8666E-01		

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH = .151 ALPHA = 8.000 DG PSI = 5.000 DG PITCH RATE = 0.00 D/S ROLL RATE = 0.00 D/S YAW RATE = 0.00 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
17	5	.9755	71.376	-22.100	18.950	7.210	-.0177	0	.045					.2671E-01		
18	1	.0245	70.638	-25.500	18.950	6.150	-.0039	0	2.354	3.568	.580	0.00	.0036	.1032E+01	.52883	-.01101
18	2	.2061	71.755	-25.500	18.950	6.150	-.0039	0	.735					.3260E+00		
18	3	.5000	73.562	-25.500	18.950	6.150	-.0039	0	.367					.1673E+00		
18	4	.7939	75.370	-25.500	18.950	6.150	-.0039	0	.176					.8399E-01		
18	5	.9755	76.487	-25.500	18.950	6.150	-.0039	0	.044					.2585E-01		
19	1	.0245	76.757	-28.900	18.950	5.090	.0155	0	2.196	2.750	.540	0.00	.0033	.9611E+00	.37960	-.03464
19	2	.2061	77.682	-28.900	18.950	5.090	.0155	0	.684					.3035E+00		
19	3	.5000	79.177	-28.900	18.950	5.090	.0155	0	.343					.1560E+00		
19	4	.7939	80.673	-28.900	18.950	5.090	.0155	0	.164					.7835E-01		
19	5	.9755	81.598	-28.900	18.950	5.090	.0155	0	.041					.2403E-01		
20	1	.0245	82.876	-32.300	18.950	4.030	.0452	0	1.865	1.833	.455	0.00	.0042	.8163E+00	.21719	-.04219
20	2	.2061	83.608	-32.300	18.950	4.030	.0452	0	.579					.2566E+00		
20	3	.5000	84.792	-32.300	18.950	4.030	.0452	0	.286					.1302E+00		
20	4	.7939	85.977	-32.300	18.950	4.030	.0452	0	.133					.6393E-01		
20	5	.9755	86.709	-32.300	18.950	4.030	.0452	0	.032					.1907E-01		

ITRMAX = 99

EPS = .00231

ITER = 9

BIG = .00145

CONVERGENCE FACTOR = .48035

END OF CASE

ALPHA = 12°

OUTPUT DATA

DELETED HERE

APPENDIX C

WAVE DRAG TO VORLAX INPUT
CONVERSION PROGRAM



SUMMARY

The purpose of a program called WDTVOR, developed to convert the Wave Drag input geometry into the VORLAX input geometry description, is to save time, improve accuracy, and reduce human drudgery when configurations for which the geometry was first digitized in the Wave Drag format are also to be analyzed on the VORLAX program.

The present version of WDTVOR contains the option to convert fuselages to flat plates having the correct planform area or to a simulation having hexagonal cross sections. All wings and planer surfaces are converted to zero thickness panels although the wing camber effects are preserved. Engine pods are converted as curved panels approximated by hexagons.

INTRODUCTION

In the analysis of an airplane design, what is basically the same geometric body is described by several different geometric models, each of which is unique to the discipline for which it is designed; yet at the same time there exist certain elements common to all models. For example, the NASA Wave Drag format (Reference 12) emphasizes the enclosed volume of the aircraft and correct spatial relationship of components while the VORLAX method of aerodynamic analysis (unified subsonic and supersonic) uses a paneling procedure similar to but different in detail from the NASA Wave Drag format in order to reduce computation time.

The program described herein, called WDTVOR, is for direct transformation from WAVE DRAG to VORLAX input format. A comparison program, called VORTWD, transforms data from VORLAX to WAVE DRAG formats and is documented in Appendix D.

Presently the simulation form into which Wave Drag data is converted is limited to that most commonly used in VORLAX analysis as follows:

GENERAL

Cosine law spacing of streamwise vortices and equal interval spacing of lateral vortices is assumed.

A single Mach number from the first wave drag case card is picked up and output in the VORLAX dataset. Three angles-of-attack, 0, 5, and 10 are also included.

Symmetric Flight is assumed.

The value of CBAR is arbitrarily set to 1.0. The moment center coordinates, XBAR and ZBAR, are set to zero.

All major planar panels are set up for three spanwise vortices (NVØR = 3) and 10 chordwise vortices (RNCV = 10). Full leading edge suction is assumed on each panel (SPC = 1.0) except for the fuselage panel.

WINGS

- Wing camber is preserved in the transformation.
- Wing thickness is not preserved. Converted wing panels are zero thickness.

FUSELAGE

- Both circular and noncircular cross section fuselages may be converted to a single zero thickness panel of trapezoidal shape. The planform area of the zero thickness fuselage is made equivalent to the planform area of the Wave Drag simulation and the vertical location of the fuselage is set equal to that of the leading edge of the wing root chord so as to effectively "seal" the wing-fuselage juncture in the VORLAX simulation.
- Optionally fuselages which are circular in the Wave Drag simulation may be transformed to a hexagonal cross-section simulation in VORLAX. With this option transverse vortices are located on the actual body surface. Also a wing-fuselage seal is assured by holding the fuselage diameter constant in the region from leading to trailing edge of the first wing chord and by assuming that one vortex of the reference polygon lies in the plane of the first wing chord.
- If the Wave Drag simulation was a cambered circular one, the fuselage camber is preserved in the VORLAX simulation.
- If the fuselage was of arbitrary cross section in Wave Drag no camber information is transferred to VORLAX. At present it is possible to convert arbitrary fuselages into only the zero thickness planform simulation in VORLAX.

NACELLES

- Circular nacelles are transformed as closed hexagonal panels using the option that transverse vortices are located on the actual body surface.

FINS

- Each fin is treated as a single panel of zero thickness.

CANARDS

- Each canard is treated as a single panel of zero thickness.

After a Wave Drag data set has been converted to VORLAX format it may be validated by converting it back into Wave Drag format and a configuration plot made. This plot will, of course, be different from a plot of the original Wave Drag dataset by virtue of the zero thickness panel representations.

NOMENCLATURE

CPU	Central Processor Unit.
FUSTYP	Flag for fuselage type. Use 0 for single trapezoidal panel fuselage simulation. Use 1 for hexagonal (curved) panel fuselage simulation.
VORLAX	A Unified Non-Planar Vortex Lattice Method for Subsonic and Supersonic Flow Described in this report.
WDTVOR	Wave Drag to VORLAX data conversion Program described in this appendix.
VORTWD	VORLAX to Wave Drag data conversion program described in Appendix D.

PROCEDURE

1. Prepare a dataset in WAVE DRAG format if it does not already exist. See Reference 12 for the WAVE DRAG input description. Be sure at least one case card is included with the dataset. It is necessary to instruct the conversion program as to whether the VORLAX simulation of the fuselage is to be a single trapezoidal panel or a curved (hexagonal) panel. This is accomplished by appending to the front of the WAVE DRAG dataset a card in namelist format specifying either FUSTYP = 0 for a single trapezoidal or FUSTYP = 1 for curved (hexagonal) simulation. Figure C-1 is a listing of an example WAVE DRAG dataset showing how the namelist input is placed at its beginning. Figure C-2 is a graphic representation of the Figure C-1 dataset obtained from the Configuration Plot Program of Reference 12.

2. Submit the dataset with the WDTVOR program. A compilation listing of the program is included at the end of this appendix.
3. Examine the output from the above submittal. Output consists of a listing of the input dataset in card image form (see Figure C-1) followed by a listing of the output dataset in the VORLAX format. Figures C-3 and C-8 are sample datasets as output from WDTVOR program. Figure C-3 was based on the curved (hexagonal) panel VORLAX fuselage simulation while Figure C-8 was derived from the single trapezoidal panel fuselage.
4. Because of the simplification that takes place in WDTVOR, e.g., zero thickness panels, it may be desirable to generate a graphic representation of the VORLAX dataset. This is accomplished by using the VORLAX to WAVE DRAG conversion program described in Appendix B followed by the Configuration Plot Program described in Reference 12. Figure C-4 is a sample of a simplified dataset after transformation back into WAVE DRAG format. Figure C-5 is a plot of the Figure C-4 dataset. Figure C-6 is a listing of the WAVE DRAG format for the single trapezoidal panel fuselage simulation and Figure C-7 is the corresponding plot.
5. Generally, a certain amount of editing is required to prepare a VORLAX dataset generated by transformation via the WDTVOR program for an actual run on VORLAX. Figure C-8 is a listing of a converted dataset as output from the conversion program and Figure C-9 is the same dataset after it has been edited preparatory to a VORLAX run.

An explanation of the notes of Figure C-9 follows:

NOTE 1 - The value of the over relaxation parameter, REXPAR was changed from -0.02 to 0.0 implying that the program is to compute internally the optimum over relaxation value.

NOTE 2 - The number of angles of attack, NALPHA, was reduced from 3 to 1 and the single ALPHA selected was 5.0 degrees.

NOTE 3 - The number of major panels, NPAN, was changed from 12 to 13. The pitching moment reference length, CBAR, was changed from 1.0 to 1022.28. The XBAR and ZBAR of the moment reference point were changed from zero to 1910.4 and -800.4, respectively.

NOTE 4 - The number of spanwise vortices, NVOR, and the number of chordwise vortices, RNCV, were adjusted to provide a better subpaneling representation.

NOTE 5 - Wing Panel Number 5 was completely eliminated. It was actually a null panel having little or no span which was included in the original WAVE DRAG simulation for another purpose but which would have caused errors in VORLAX if it has been retained.

NOTE 6 - A vertical panel was added to simulate a nacelle pylon which was not included in the original WAVE DRAG simulation.

NOTE 7 - The spanwise location of the nacelle was moved outboard from 214. to 233.94 to coincide with a major panel break in the wing. Alternatives to this procedure would be to create an extra major panel having an edge at the 214. span location or making sure that one of the wing vortices resulting from subpaneling coincides precisely with the engine pylon spanwise location. The above precautions must be taken whenever major panels intersect.

NOTE 8 - The variable area nacelles were changed to fixed area ones by setting the ZCI values to 100. This makes each nacelle cross-section equal to that of the reference polygon, in this case the inlet area. This was a compromise made to simplify the nacelle pylon simulation. With constant area nacelles the pylon could be simulated by a single rectangular panel. Retention of the variable area nacelles would have required several panels to seal the pylon area between the wing and engine.

NOTE 9 - The location of the nacelle was moved outboard from 204. to 233.94, otherwise, Note 7 applies.

NOTE 10 - Fin Panel #2 which was on the aircraft centerline was completely eliminated. Since the desired VORLAX run was to be symmetric about the pitch plane the centerline fin was not required. Furthermore, its inclusion would have unnecessarily increased computing cost because its presence alone triggers off certain asymmetric calculations.

NOTE 11 - The horizontal tail (labeled canard) root chord dimensions were changed to coincide with the side of the fuselage. Actually, only that portion of the horizontal tail outboard of the VORLAX fuselage simulation is included.

NOTE 12 - A vertical panel was added to seal the gap between the plane of the horizontal tail ($Z = -40.$) and that of the fuselage ($Z = 54.96$).

6. It is a good idea to submit the edited dataset to the VORTWD program (Appendix D) to recheck the editing just done. This step is optional. It probably wouldn't be done if only minor editing was involved in Step 5. If major editing was done, such as the addition of pylons and sealer panels as in Figure C-9, then it is recommended. The results of converting and plotting the dataset of Figure C-9 is shown in Figure C-10. Note the absence of centerline fin, the addition of engine pylons and horizontal tail sealer panels and the constant diameter nacelle simulation.

7. The edited dataset may then be submitted to the VORLAX program. A portion of the VORLAX output resulting from this submittal is presented in Figure C-11.

1200.	1320.	1440.	1560.	1680.	1920.	2120.	2240.	2360.	2480.	XFUS 20
2664.3	2720.75	2840.	2960.	3080.	3200.	3320.	3440.	3524.		XFUS 30
-38.73	-40.53	-23.75	-18.5	-16.2	-15.9	-17.2	-20.9	-26.84	-32.75	ZFUS 10
-76.8	-76.6	-45.07	-49.39	-53.68	-61.59	-68.9	-72.9	-75.0	-76.6	ZFUS 20
0	830	287.5	-71.3	-66.7	-60.9	-53.3	-44.3	-37.7		ZFUS 30
19670.	19670.	20016.	5242.	8136.	10944.	13752.	16128.	18547.	19584.	AFUS 10
16272.	15408.	13248.	20304.	20548.	20767.	20404.	20073.	19397.	18346.	AFUS 20
2094.	214.	-34.	10485.	7085.	4464.	2477.	878.	0.		AFUS 30
0	137.	393.								PODOCK 1
33.92	35.65	35.65								PODOCK 2
2091.	204.	-136.								PODOCK 1
0	136.65	394.65								PODOCK 2
32.	35.65	35.65								PODOCK 1
2480.	645.	-100.								PODOCK 2
0	10.	20.								PODOCK 1
0	466	846								PODOCK 2
3183.9	0.	-27.								FINORG 1
0	10.	20.								FINORG 2
0	466	846								FINORG 1
3116.4	33.	-40.								FINORG 2
0.0	10.	20.								FINORG 1
0	553	948								FINORG 2
267	2550	20								CANORG
268	1200	20								XCAN
269	1000	1								CANORD

INPUT DATA LISTED

Figure C-1.- Concluded

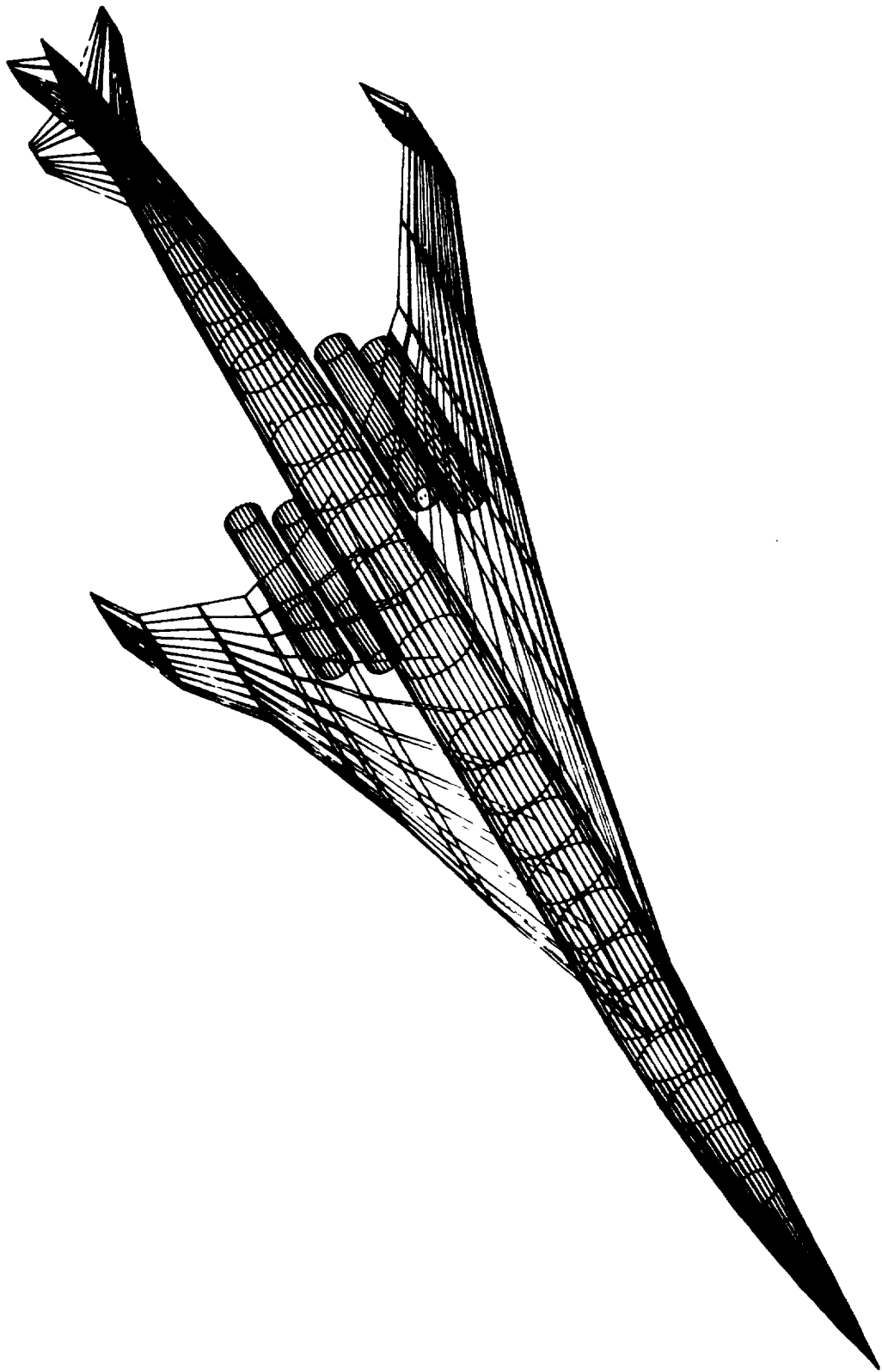


Figure C-2.- Graphic representation of WAVE DRAG dataset

2091.0000	304.0000	-104.0000	394.0000	NACELLE PANEL NO. 2	
2091.0000	304.0000	-104.0000	394.0000	NACELLE PANEL NO. 2	
0.0000	0.0000	0.0	0.0000	NVOR,RNCV,SPC,PDL	
90.0000	30.0000	30.0000	30.0000		-90.0000
-150.0000	30.0000	-210.0000	30.0000		32.0000
0.0	0.0	0	0		32.0000
0.0	11.9149	100.0000	0		0
100.0000	11.4062	111.4062			1
2480.0000	645.0000	-100.0000	194.5000	FIN PANEL NO. 1	
2595.3999	645.0000	-28.0000	141.1000	FIN PANEL NO. 1	
2.0000	10.0000	1.0000	0.0	NVOR,RNCV,SPC,PDL	
0.0	0.0	0	0		0
3183.8999	0.0	-27.0000	294.0999	FIN PANEL NO. 2	
3403.2000	0.0	66.5000	67.7000	FIN PANEL NO. 2	
2.0000	10.0000	1.0000	0.0	NVOR,RNCV,SPC,PDL	
0.0	0.0	0	0		0
3116.3999	33.0000	-40.0000	283.7998	CANARD PANEL NO. 1	
3354.0000	174.4000	-40.0000	76.4000	CANARD PANEL NO. 1	
2.0000	10.0000	1.0000	0.0	NVOR,RNCV,SPC,PDL	
0.0	0.0	0	0		0
0	0	0	0	NXS,NYS,NZS	

Figure C-3. - Concluded

2094.00	214.00	-0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORG	1
0.0	47.76	393.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	XPOD	1
33.92	34.77	34.77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORD	1
2091.00	204.00	-104.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PGDORG	2
0.0	46.94	394.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	XPOD	2
32.00	33.78	33.78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORD	2
2480.00	645.00	-100.00	194.5	2595.4	645.0	-28.0	141.1							FINORG	2
0.0	100.00	0.0												XFIN	2
0.0	0.0	0.0	294.1	3403.2	0.0	66.5	67.7							FINORD	
3183.9	0.0	-27.0												FINORD	
0.0	100.00	0.0												XFIN	
0.0	0.0	0.0												FINORD	
3116.4	33.0	-40.0	283.8	3354.0	174.4	-40.0	76.4							CANORG	
0.0	100.00	0.0												XCAN	
0.0	0.0	0.0												CANORD	
X	Y	Z	26.62	-24.139.23				10.000RT							
								12.250RT							

Figure C-4. - Concluded

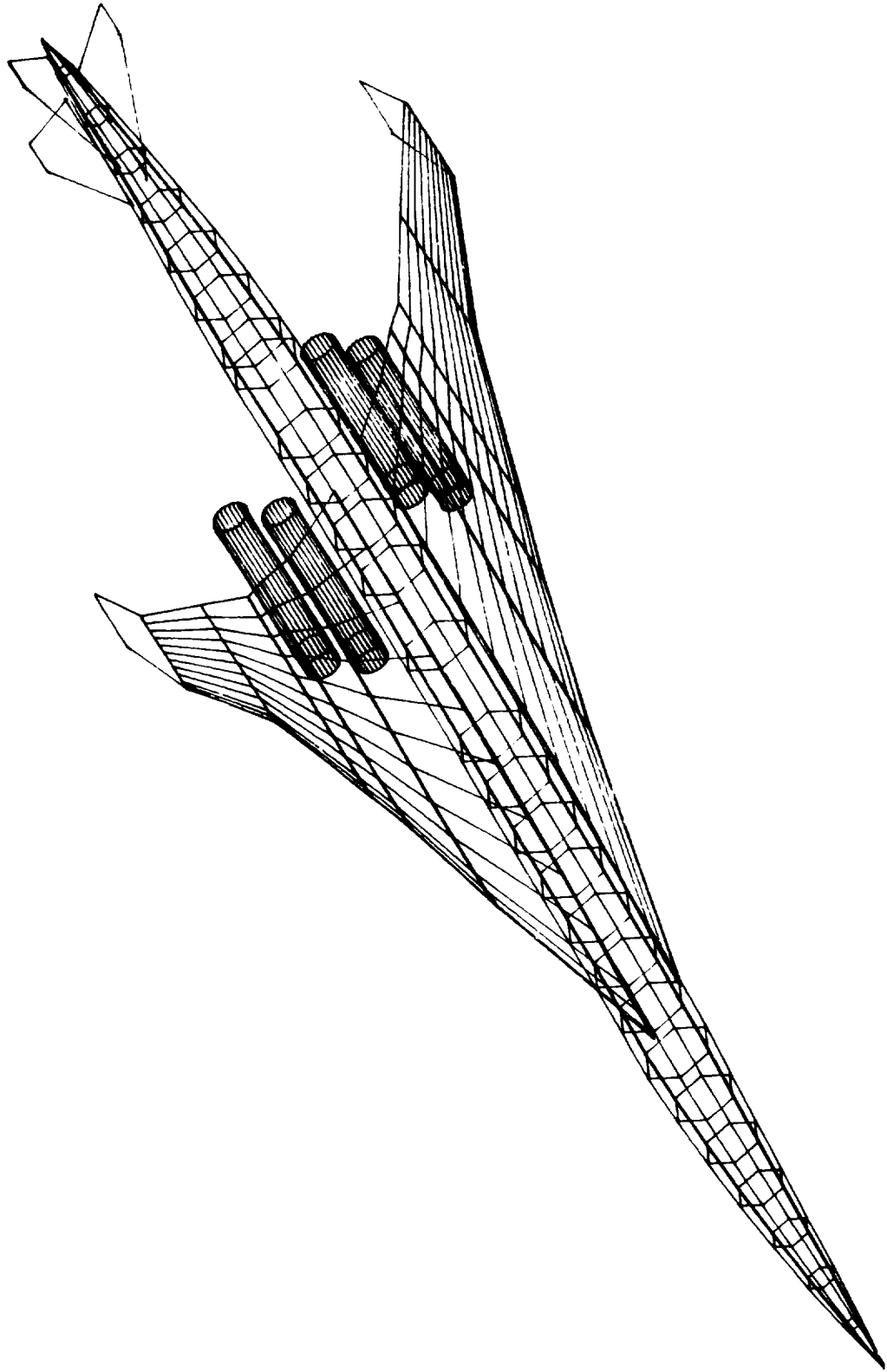


Figure C-5.- Plot of figure C-4 dataset

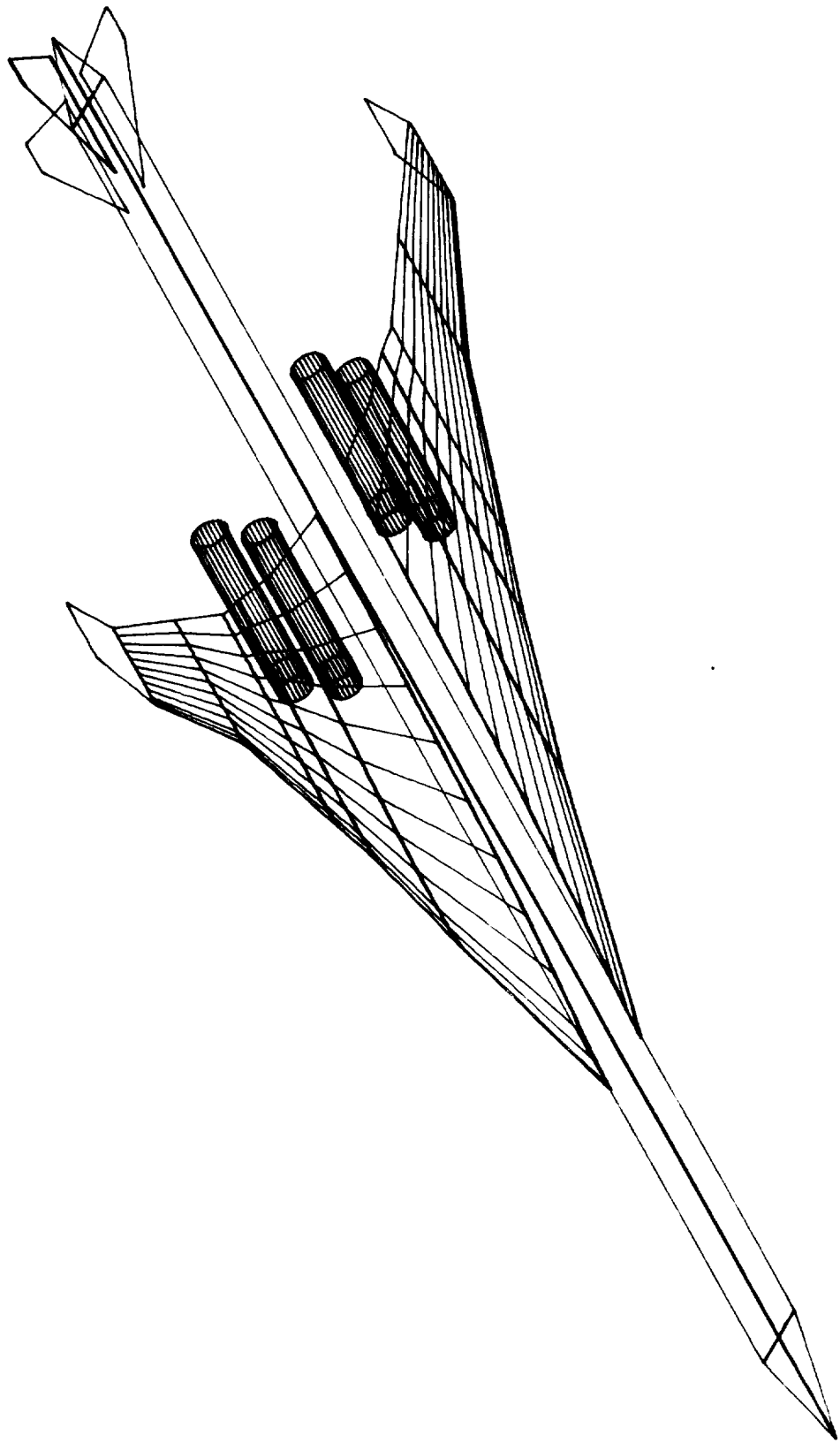


Figure C-7.- Plot of figure C-6 dataset

2225.7998	486.8298	-89.7400	311.7200	20.0000	30.0000	40.0000	50.0000	
2225.7998	486.8799	-89.7400	311.7200	100.0000	0.1283	0.1925	0.2310	WING PANEL NO. 5
3.0000	10.0000	1.0000	0.0	0	0	0	0	NVOR,RNCV,SPC,PDL
0.0	0.0	0.0	0.0	0	0	0	0	
60.0000	70.0000	80.0000	90.0000	100.0000	0.0513	0.1283	0.1925	
0.0	-0.0257	-0.1123	-0.1155	0.0513	0.3368	0.1283	0.1893	
0.2631	0.2919	0.3112	0.3272	0.0513	0.3368	0.1283	0.1893	
0.0	-0.0257	-0.1123	-0.1155	0.0513	0.3368	0.1283	0.1893	
0.2631	0.2919	0.3112	0.3272	0.0513	0.3368	0.1283	0.1893	
2225.7998	486.8799	-89.7400	311.7200	20.0000	30.0000	40.0000	50.0000	
2479.2998	645.0498	-99.9600	194.4500	100.0000	0.1283	0.1893	0.2310	WING PANEL NO. 6
3.0000	10.0000	1.0000	0.0	0	0	0	0	NVOR,RNCV,SPC,PDL
0.0	0.0	0.0	0.0	0	0	0	0	
0.0	1.0000	5.0000	10.0000	20.0000	0.1283	0.1893	0.2310	
0.0	80.0000	-0.1123	-0.1155	0.0513	0.3368	0.1283	0.1893	
60.0000	-0.0257	0.3112	0.3272	0.0513	0.3368	0.1283	0.1893	
0.2631	0.2919	0.3112	0.3272	0.0513	0.3368	0.1283	0.1893	
0.0	-0.0411	-0.1800	-0.3137	-0.4371	-0.4371	-0.4628	-0.3651	
-0.2057	-0.0051	0.2674	0.5811	0.9103	0.9103	0.4628	0.3651	
0.0	0.0	-54.9600	35.24.0000	0	0	0	0	FUSELAGE PANEL
257.7026	65.7400	-54.9600	3104.8645	100.0000	0.1283	0.1893	0.2310	FUSELAGE PANEL
3.0000	2.0000	1.0000	0.0	0	0	0	0	NVOR,RNCV,SPC,PDL
0.0	0.0	0.0	0.0	0	0	0	0	
0.0	3.4052	6.8104	10.2157	13.6209	17.0261	20.4313	23.8365	
27.2414	30.6470	34.0522	37.4574	40.8627	44.2679	47.6731	54.4835	
60.1589	63.5641	66.9693	70.3746	75.6044	77.1850	80.5902	83.9955	
87.4007	90.8059	94.2111	97.6163	100.0000	0.9325	0.9694	1.0743	
-1.5596	-1.3739	-1.1552	-1.0062	-0.8410	-1.8828	-2.0045	-2.2200	
-1.2429	-1.4109	-1.6095	-1.6549	-1.7602	-1.8828	-2.0045	-2.2200	
-2.3764	-2.5494	-2.6095	-2.7384	-2.6606	-2.6549	-2.6067	-2.5045	
-1.3740	-1.2094	-1.1552	-1.0062	-0.8410	-0.9325	-0.9694	-1.0743	
-1.2429	-1.4109	-1.6095	-1.6549	-1.7602	-1.8828	-2.0045	-2.2200	
-2.3764	-2.5494	-2.6095	-2.7384	-2.6606	-2.6549	-2.6067	-2.5045	
2094.0000	214.0000	-10.0000	-1.7384	-1.5312	-0.9325	-0.9694	-1.0743	
2094.0000	214.0000	-10.0000	-1.7384	-1.5312	-0.9325	-0.9694	-1.0743	
6.0000	215.0000	30.0000	33.9200	-50.0000	33.9200	-0.0000	33.9200	
-150.0000	33.9200	-20.0000	33.9200	-270.0000	33.9200	-0.0000	33.9200	
0.0	0.0	0.0	0.0	0	0	0	0	
0.0	12.1522	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	
100.0000	105.1001	105.1001	105.1001	105.1001	105.1001	105.1001	105.1001	

Figure C-8.- Continued

2091.0000	207.0000	-104.0000	394.0000	NACELLE PANEL NO 2	
2091.0000	207.0000	-104.0000	394.0000	NACELLE PANEL NO	
90.0000	32.0000	30.0000	32.0000	NVOR, RNCV, SPC, PDL	32.0000
-150.0000	32.0000	-210.0000	32.0000		-90.0000
0.00	0.00	0.00	0.00		
0.00	-11.9148	100.0000			1
100.0000	111.4082	111.4062			
2480.0000	645.0000	-100.0000	194.5000	FIN PANEL NO: 1	
2593.3999	645.0000	-28.0000	141.1000	FIN PANEL NO: 1	
2.0000	10.0000	1.0000	0.00	NVOR, RNCV, SPC, PDL	
0.0000	0.00	0.00	0.00		
3183.8999	0.00	-27.0000	294.0999	FIN PANEL NO: 2	
3403.2000	0.00	66.5000	67.7000	FIN PANEL NO: 2	
2.0000	10.0000	1.0000	0.00	NVOR, RNCV, SPC, PDL	
0.0000	0.00	0.00	0.00		
3116.3999	33.0000	-40.0000	283.7998	CANARD PANEL NO: 1	
3354.0000	174.4000	-40.0000	76.4000	CANARD PANEL NO: 1	
2.0000	10.0000	1.0000	0.00	NVOR, RNCV, SPC, PDL	
0.00	0.00	0.00	0.00		
0	0	0	0	NXS, NYS, NZS	

Figure C-8.- Concluded

CL1607-32	(-24 PLANFORM)	VC121	ENGINE	NOTE 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0			0.0									
1	2.550		5.0									
13	967680.00	1022.28	1910.4		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
944.0999	65.7400	-54.9600	1448.9399		-800.4	1290.0996						
1462.5000	223.9400	-54.4700	925.9700									
4.0000	16.0000	1.0000	0.0									
0.0	0.0	NOTE 4 13	0									
0.0	1.0000	5.0000	10.0000		20.0000	30.0000						50.0000
60.0000	70.0000	80.0000	90.0000		100.0000							
0.0	-0.0129	-0.1367	-0.4893		-1.2589	-1.9373						-2.8862
-3.1954	-3.4439	-3.6668	-3.9008		-4.1644							
0.0	0.0529	0.2700	0.3078		0.1145	-0.2430						-1.1609
-1.6545	-2.1469	-2.6232	-3.0692		-3.4807							
1462.5000	223.9400	-54.4700	925.9700									
1768.7998	317.4099	-69.0000	650.0098									
3.0000	16.0000	1.0000	0.0									
0.0	0.0	NOTE 4 13	0									
0.0	1.0000	5.0000	10.0000		20.0000	30.0000						50.0000
60.0000	70.0000	80.0000	90.0000		100.0000							
0.0	0.0529	0.2700	0.3078		0.1145	-0.2430						-1.1609
-1.6545	-2.1469	-2.6232	-3.0692		-3.4807							
0.0	0.0138	0.1708	0.3492		0.4138	0.3277						-0.0785
-0.3554	-0.6585	-0.9846	-1.3231		-1.6677							
1768.7998	317.4099	-69.0000	650.0098									
1905.3999	368.0398	-77.1600	529.8699									
2.0000	16.0000	1.0000	0.0									
0.0	0.0	NOTE 4 13	0									
0.0	1.0000	5.0000	10.0000		20.0000	30.0000						50.0000
60.0000	70.0000	80.0000	90.0000		100.0000							
0.0	0.0138	0.1708	0.3492		0.4138	0.3277						-0.0785
-0.3554	-0.6585	-0.9846	-1.3231		-1.6677							
0.0	0.0151	0.0774	0.2623		0.3095	0.2567						-0.0226
-0.2227	-0.4511	-0.7002	-0.9606		-1.2362							

Figure C-9.- Converted dataset after editing for VORLAX run

1905.3999	368.0398	-77.1600	529.6699	WING PANEL NO. 4	0	20.0000	30.0000	40.0000	50.0000
225.7998	486.8298	-89.7400	311.7200	WING PANEL NO. 4	0	100.0000	0.2567	0.1378	-0.0226
4.0000	16.0000	1.0000	0.0	NVOR,RNCV,SPC,PDL	0	0.3095	0.1283	0.1925	0.2310
0.0	0.0	NOTE 4 13	0	0	0	-1.2362	0.3368		
0.0	1.0000	5.0000	10.0000			0.0513			
50.0000	70.0000	80.0000	90.0000			0.3272			
0.0	0.0151	0.0774	0.2623						
-0.2227	-0.4511	-0.7002	-0.9606						
0.0	-0.0257	-0.1123	-0.1155						
0.2631	0.2919	0.3112	0.3272						
225.7998	436.8799	-89.7400	311.7200	WING PANEL NO. 6	0	20.0000	30.0000	40.0000	50.0000
479.2998	645.0499	-99.9600	194.4500	WING PANEL NO. 6	0	100.0000	0.1283	0.1893	0.2310
5.0000	16.0000	1.0000	0.0	NVOR,RNCV,SPC,PDL	0	0.0513	0.1283	0.1893	0.2310
0.0	0.0	NOTE 4 13	0	0	0	0.3368	-0.4731	-0.4628	-0.3651
0.0	1.0000	5.0000	10.0000			0.9103			
60.0000	70.0000	80.0000	90.0000						
0.0	-0.0257	-0.1123	-0.1155						
0.2631	0.2951	0.3112	0.3272						
0.0	-0.0411	-0.1800	-0.3137						
-0.2057	-0.0051	0.2674	0.5811						
0.0	0.0	-54.9600	3524.0000	FUSELAGE PANEL	0	20.0000	30.0000	40.0000	50.0000
257.7026	65.7400	-54.9600	3104.8645	FUSELAGE PANEL	0	100.0000	0.1283	0.1893	0.2310
3.0000	24.0000	0.0	0.0	NVOR,RNCV,SPC,PDL	0	0.0513	0.1283	0.1893	0.2310
0.0	0.0	NOTE 4 29	0	0	0	0.3368	-0.4731	-0.4628	-0.3651
0.0	3.4052	6.8104	10.2157						
27.2418	30.6470	34.0522	37.4574						
60.1584	63.5641	66.9693	70.2746						
87.4007	90.8059	94.2111	97.6163						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
0.0	0.0	NOTE 4 29	0	0	0				
0.0	3.4052	6.8104	10.2157						
27.2418	30.6470	34.0522	37.4574						
60.1584	63.5641	66.9693	70.2746						
87.4007	90.8059	94.2111	97.6163						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
0.0	0.0	NOTE 4 29	0	0	0				
0.0	3.4052	6.8104	10.2157						
27.2418	30.6470	34.0522	37.4574						
60.1584	63.5641	66.9693	70.2746						
87.4007	90.8059	94.2111	97.6163						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
0.0	0.0	NOTE 4 29	0	0	0				
0.0	3.4052	6.8104	10.2157						
27.2418	30.6470	34.0522	37.4574						
60.1584	63.5641	66.9693	70.2746						
87.4007	90.8059	94.2111	97.6163						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						
0.0	0.0	NOTE 4 29	0	0	0				
0.0	3.4052	6.8104	10.2157						
27.2418	30.6470	34.0522	37.4574						
60.1584	63.5641	66.9693	70.2746						
87.4007	90.8059	94.2111	97.6163						
-1.5596	-1.3534	-1.1552	-1.0062						
-1.2429	-1.4106	-1.5236	-1.6314						
-2.4364	-2.5499	-2.6095	-2.6549						
-2.3740	-2.2094	-1.9938	-1.7384						

Figure C-9.- Continued

3171.3600	65.7396	-40.0000	235.7760
3354.0000	174.4000	-40.0000	75.4000
NOTE 4	6.0000	1.0000	0.0
0.0	0.0	0	0
3171.36	65.7396	-40.	235.776
3171.36	65.7396	-54.96	235.776
1.	8.	0.	
0.	0.	0	
0	0	0	

NOTE 11 CANARD PANEL NG. 1
 CANARD PANEL NO. 1
 NVOR, RNCV, SPC, PDL

0
 HORIZONTAL TAIL SEAL
 HORIZONTAL TAIL SEAL
 NX, NYS, NZS

NOTE 12

Figure C-9.- Concluded

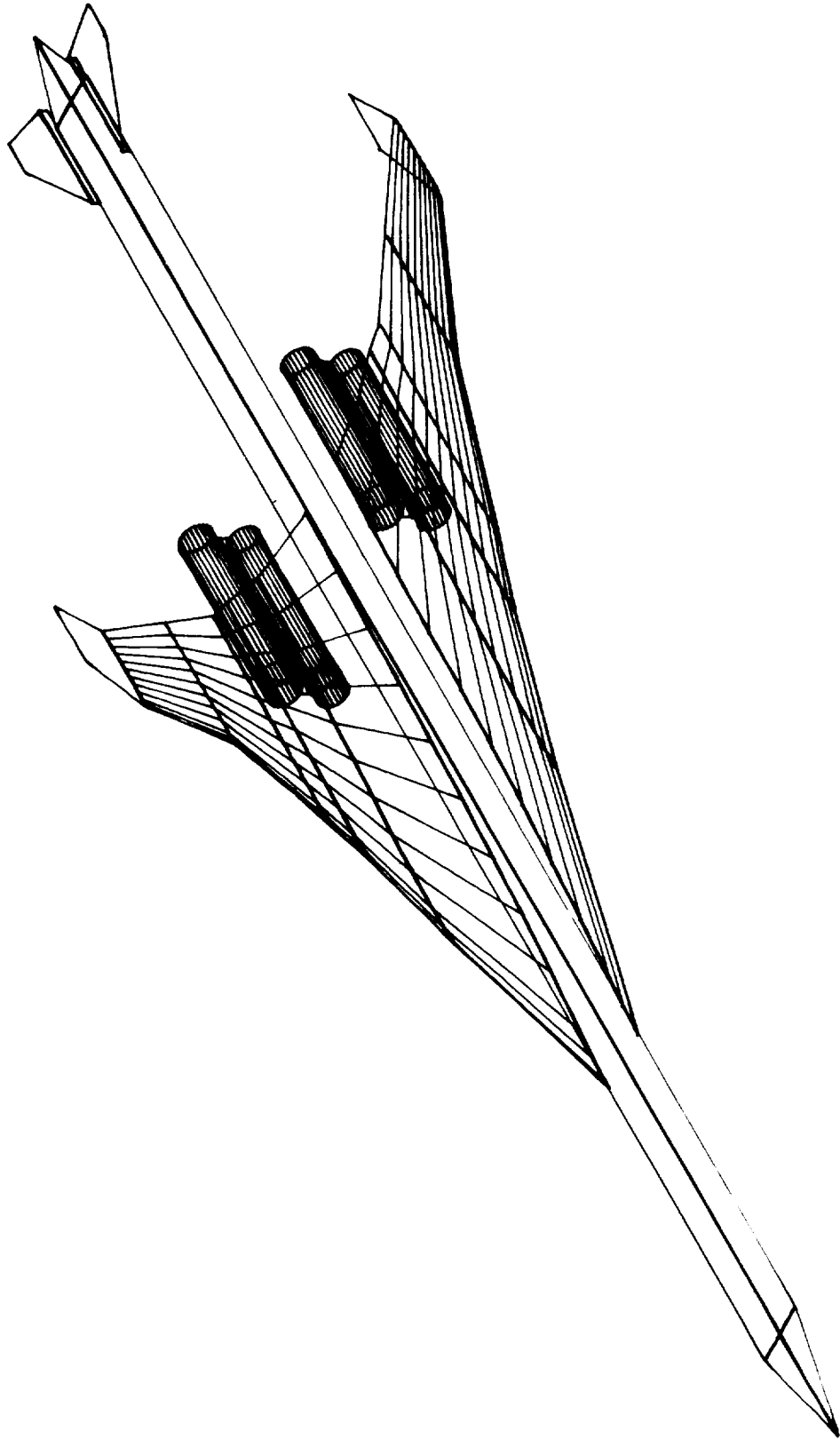


Figure C-10.- Plot of dataset edited for submittal to VORLAX

CL1607-32 (-24 PLANFORM) VC121 ENGINE

MACH = 2.550

ALPHA = 5.000 DEG.
PSI = 0.0 DEG.

PITCH RATE = 0.0 DEG /SEC
ROLL RATE = 0.0 DEG /SEC
YAW RATE = 0.0 DEG /SEC

ANALYSIS (DIRECT) CASE (INVERS = 0)

MOMENT AND ROTATION CENTER XBAR = 0.19104E 04 ZBAR = -0.80040E 03 ***** VINFL = 0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS FLOATX = 0.0 FLOATY = 0.0

CM REFERENCED TO SURF	CL,CY,CD,CT,CS REFERENCED TO SREF	CM REFERENCED TO SREF*CBAR	CRM,CYM REFERENCED TO SREF*WSPAN					
I SURF/SREF	CM(I)	CL(I)	CY(I)	CS(I)	CT(I)	CM(I)	CRM(I)	CYM(I)
1 0.1941E 00	0.14128	0.02728	-0.00008	0.00292	0.00033	0.00112	0.3075E-02	-0.3071E-03
2 0.7703E-01	0.19490	0.01478	0.00231	0.00126	0.00026	0.00089	-0.1703E-03	-0.1311E-03
3 0.3126E-01	0.24326	0.00749	0.00121	0.00059	0.00012	0.00035	-0.1320E-02	0.4924E-04
4 0.5194E-01	0.28885	0.01489	0.00158	0.00100	0.00033	0.00096	-0.4675E-02	0.4065E-02
5 0.4145E-01	0.33273	0.01372	0.00089	0.00113	0.00000	0.00000	-0.7390E-02	-0.7114E-04
6 0.2252E 00	0.04841	0.01083	0.00000	0.00130	0.00000	0.00000	0.6821E-02	-0.3344E-04
7 0.8313E-02	0.00493	0.00000	0.00004	0.00000	0.00000	0.00000	-0.4939E-10	-0.2125E-04
8 0.8265E-01	0.00264	0.00100	-0.00025	0.00009	0.00000	0.00000	-0.3387E-03	0.3213E-03
9 0.7138E-02	0.00597	0.00000	0.00004	0.00000	0.00000	0.00000	-0.2699E-11	-0.2410E-04
10 0.7817E-01	0.00153	0.00052	0.00012	0.00005	0.00000	0.00000	-0.1211E-03	0.3802E-05
11 0.1249E-01	0.14285	0.00000	-0.00018	0.00000	0.00000	0.00000	-0.1598E-08	0.3274E-04
12 0.1753E-01	0.03454	0.00060	0.00000	0.00005	0.00000	0.00000	-0.8343E-03	-0.1083E-02
13 0.3645E-02	0.01976	0.00000	0.00007	0.00000	0.00000	0.00000	-0.1234E-09	-0.5263E-05
SREF	WSPAN	CBAR	CLTOT	CDTOT	CYTOT	CRMTOT	CYMTOT	
0.96768E 06	0.12901E 04	0.10223E 04	0.18220	0.01681	0.00000	-0.24120E-02	0.00000	0.0

CD/CL**2 = 0.5063 E = 0.3656

Figure C-11.- Portion of output from submittal to VORLAX



PROGRAM
WAVE DRAG TO VORLAX
INPUT CONVERSION PROGRAM
(WDTVOR)

COMPLETE COMPILE
AND EXECUTION
IN IBM FORTRAN IV LEVEL H

1

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```

COMPILER OPTIONS - NAME= MAIN,OPT=01,LINECNT=55,SIZE=0000K,
SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NCEDIT,1D,XREF
CONTROL*VRLX,MOTVORN 9/21/76 00000010
C 00000020
C 00000030
C 00000040
C 00000050
C 00000060
C 00000070
C 00000080
C 00000090
C 00000100
C 00000110
C 00000120
C 00000130
C 00000140
C 00000150
C 00000160
C 00000170
C 00000180
C 00000190
C 00000200
C 00000210
C 00000220
C 00000230
C 00000240
C 00000250
C 00000260
C 00000270
C 00000280
C 00000290
C 00000300
C 00000310
C 00000320
C 00000330
C 00000350
C 00000360
C 00000370
C 00000380
C 00000390
C 00000400
C 00000410

C...THIS PROGRAM IS BASED ON NASA LRC PROGRAM D2500 -- HAVE DRAG
COMMON ABC (20), J0, J1, J2, J3, J4, J5, J6, NMAF, NMAFOR, NFUS,
* NMAX (4), MFORX (4), NP, NPOOR, NF, NFINOR, NCAN, NCANOR,
* JZTEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,
* XZEST (10), SKL
COMMON/BLKZV, XFUS1, XFUSN
COMMON/BLACK/XAF (30), WAFORG (20, 4), WAFORD (20, 3, 30),
* TZORD (20, 30), XFUS (30, 4), ZFUS (30, 4), SFUS (30, 30, 1),
* FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30),
* PODORD (9, 30), NPTSPS (5), PDES (30, 30, 10), FINORG (6, 2, 4),
* XFIN (6, 10), FINRD (6, 2, 10), CANDRG (2, 2, 4), XCAN (2, 10),
* CANDRD (2, 2, 10), CANDRI (2, 2, 10)
C DIMENSION ALPHA (7), YFUSMX (4, 30), AFUS (4, 29), XFPC (50),
* ZC12 (50), ROPUS(50)
DIMENSION ABCD (20)
DIMENSION ZCPI2 (9, 30), PHI (10)
C DTR = .017*53
INTEGER FUSTYP
C DATA L3 /3/
CALL LSTD18
FUSTYP = 0
NSNVOR = 20
C READ NAMELIST CARDS
C NAMELIST /INPUT/FUSTYP, NSMVOR
READ (5, INPUT, END=760)
C INPUT 1ST TWO CARDS (TITLE CARD & CONTROL FLAGS)
C 10 FORMAT (20A4)
READ (5, 10) ABC
C 20 FORMAT (1H1, 20A4)
READ (5, 30) J0, J1, J2, J3, J4, J5, J6, NMAF, NMAFOR, NFUS,

```

```

* (NRADX (I), NFORX (I), I = 1, 4) , NP, NPQDOR, NF, NFINDR,
  NCAN, NCANOR
  FORMAT (24I3)
  00000420
  00000430
  00000440
  00000450
  00000460
  00000470
  00000480
  00000490
  00000500
  00000510
  00000520
  00000530
  00000540
  00000550
  00000560
  00000570
  00000580
  00000590
  00000600
  00000610
  00000620
  00000630
  00000640
  00000650
  00000660
  00000670
  00000680
  00000690
  00000700
  00000710
  00000720
  00000730
  00000740
  00000750
  00000760
  00000770
  00000780
  00000790
  00000800
  00000810
  00000820
  00000830
  00000840
  00000850
  00000860
  00000870
  00000880
  00000890
  00000900
  00000910
  00000920
  00000930
  00000940

ISN 0020
  30
  C INPUT CONFIGURATION DESCRIPTION AND INITIALIZE
  C CALL START
  C   MKODE = 0
  C   INPUT CASE CARD
  C   READ (5, 40) NCASE, MACH, MX, MTHETA, NREST, MCON, MPLT
  C   KEY = 0
  C   FORMAT (A4, 5I4, 8I1)
  C   XMACH = FLOAT (MACH) /1000.
  C   LERR = 0
  C   INPUT RESTRAINT POINTS
  C   IF (.NOT. (MKODE .EQ. 0 .AND. NREST .NE. 0)) GO TO 70
  C   READ (5, 50) XREST
  C   FORMAT (10F7.0)
  C   DO 60 I = 1, 10
  C   XREST (I) = XREST (I) /SKL
  C   CONTINUE
  C   MKODE = 1
  C   CONTINUE
  C
  C IN VORLAX SOME 19 CARDS ARE DESCRIBED. HOWEVER, THIS DOES NOT MEAN
  C THAT INPUT FOR A CASE CONSISTS OF 19 CARDS. RATHER THESE SHOULD BE
  C THOUGHT OF AS "CARD TYPES." FURTHERMORE, NOT ALL CARD TYPES WILL
  C BE INCLUDED IN A GIVEN CASE, THOSE TO BE INCLUDED OR DELETED
  C BEING A FUNCTION OF SOME OF THE INPUT CONTROL VALUES.
  C
  C THE FOLLOWING CARD NUMBERS ARE COMPATIBLE WITH THE VORLAX INPUT
  C FORMAT AND A COMPLETE DESCRIPTION CAN BE FOUND IN THE VORLAX PROGRAM
  C MANUAL LR 26299 SECTION 3-2.
  C
  C START CONSTRUCTION OF VORLAX DATASET
  C PUTTING OUT TITLE CARD 1
  C
  C WRITE (L3, 10) ABC
  C WRITE (6, 20) ABC
  C
  C SETTING UP FOR CARD 2 (CONTROLS)
  C
  C ISOLV = 0
  C LAX = 0
  C LAY = 1
  C REKPAR = -.02
  C MAG = 0.0
  C FLOATX = 0.0
  C FLOATY = 0.0

ISN 0037
ISN 0038

ISN 0039
ISN 0040
ISN 0041
ISN 0042
ISN 0043
ISN 0044
ISN 0045

```

ISN 0046	IBCON = 0	0000950
ISN 0047	ITRMAX = 0	0000960
ISN 0048	WRITE (L3, 500) ISOLV, LAX, LAY, REXPAR, MAG, FLOATX, FLOATY,	0000970
	* IBCON, ITRMAX	0000980
ISN 0049	WRITE (6, 510) ISOLV, LAX, LAY, REXPAR, MAG, FLOATX, FLOATY,	0000990
	* IBCON, ITRMAX	0001000
		0001010
		0001020
		0001030
ISN 0050	NMACH = 1	0001040
ISN 0051	WRITE (L3, 520) NMACH, XMACH	0001050
ISN 0052	WRITE (6, 530) NMACH, XMACH	0001060
		0001070
		0001080
		0001090
		0001100
ISN 0053	NALPHA = 3	0001110
ISN 0054	ALPHA (1) = 0.	0001120
ISN 0055	ALPHA (2) = 5.	0001130
ISN 0056	ALPHA (3) = 10.	0001140
ISN 0057	WRITE (L3, 520) NALPHA, (ALPHA (1), I = 1, NALPHA)	0001150
ISN 0058	WRITE (6, 530) NALPHA, (ALPHA (1), I = 1, NALPHA)	0001160
		0001170
		0001180
ISN 0059	LATRAL = 0	0001190
ISN 0060	PSI = 0	0001200
ISN 0061	PITCHQ = 0	0001210
ISN 0062	ROLLQ = 0	0001220
ISN 0063	YANQ = 0	0001230
ISN 0064	VINF = 0	0001240
ISN 0065	WRITE (L3, 520) LATRAL, PSI, PITCHQ, ROLLQ, YANQ, VINF	0001250
ISN 0066	WRITE (6, 530) LATRAL, PSI, PITCHQ, ROLLQ, YANQ, VINF	0001260
		0001270
		0001280
		0001290
ISN 0067	NFUSP = 0	0001300
ISN 0068	IF (NFUS .GT. 0) NFUSP = 1	0001310
ISN 0070	NPAN = NNAF - 1 + NF + NCAN + NFUSP + NP	0001320
ISN 0071	SREF = REFA	0001330
ISN 0072	CBAR = 1.0	0001340
ISN 0073	XBAR = 0.	0001350
ISN 0074	ZBAR = 0.	0001360
ISN 0075	WSPAN = WAFORG (NNAF, 2) *2.0	0001370
ISN 0076	WRITE (L3, 540) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN	0001380
ISN 0077	WRITE (6, 550) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN	0001390
		0001400
		0001410
		0001420
		0001430
ISN 0078	IF (J1 .EQ. 0) GO TO 110	0001440
ISN 0080	NMPAN = NNAF - 1	0001450
ISN 0081	DO 90 NN = 1, NNAF	0001460
		0001470

```

ISN 0082      DO 80 II = 1, NMAFOR
ISN 0083      TZORD (NN, II) = TZORD (NN, II) /MAFORG (NN, 4) *100.
ISN 0084      CONTINUE
ISN 0085      CONTINUE
ISN 0086      DO 100 IT = 1, MNPAN
ISN 0087      WRITE (L3, 560) (MAFORG (IT, J), J = 1, 4), IT
ISN 0088      WRITE (6, 570) (MAFORG (IT, J), J = 1, 4), IT
C
C      SETTING UP FOR CARD 8 (COORDS. OF OTHER SIDE OF MAJOR WING PANEL)
C
ISN 0089      WRITE (L3, 560) (MAFORG (IT + 1, J), J = 1, 4), IT
ISN 0090      WRITE (6, 570) (MAFORG (IT + 1, J), J = 1, 4), IT
C
C      SETTING UP FOR CARD 9 (WING SUB PANEL CONTROLS)
C
ISN 0091      TNVOR = 3.0
ISN 0092      RNCV = 10.
ISN 0093      SPC = 1.
ISN 0094      CURV = 0.
ISN 0095      WRITE (L3, 580) TNVOR, RNCV, SPC, CURV
ISN 0096      WRITE (6, 590) TNVOR, RNCV, SPC, CURV
C
C      SETTING UP FOR CARD 11 (ADDITIONAL WING CONTROL PARAMETERS)
C
ISN 0097      AINC1 = 0.
ISN 0098      AINC2 = 0.
ISN 0099      ITS = 0
ISN 0100      NAP = NMAFOR
ISN 0101      IQUANT = 0
ISN 0102      ISYNT = 0
ISN 0103      NPP = 0
ISN 0104      WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
ISN 0105      WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
C
C      SETTING UP FOR CARD 14 (WING PER CENT CHORD STATIONS)
C
ISN 0106      IF (NAP .EQ. 0) GO TO 110
ISN 0108      WRITE (L3, 620) (XAF (J), J = 1, NAP)
ISN 0109      WRITE (6, 630) (XAF (J), J = 1, NAP)
C
C      SETTING UP FOR CARD 16 (WING CAMBER ORDINATES)
C
ISN 0110      WRITE (L3, 640) (TZORD (IT, JJ), JJ = 1, NMAFOR)
ISN 0111      WRITE (6, 650) (TZORD (IT, JJ), JJ = 1, NMAFOR)
ISN 0112      WRITE (L3, 640) (TZORD (IT + 1, JJ), JJ = 1, NMAFOR)
ISN 0113      WRITE (6, 650) (TZORD (IT + 1, JJ), JJ = 1, NMAFOR)
ISN 0114      CONTINUE
C
C      FUSELAGE TREATMENT
C
ISN 0115      IF (J2 .EQ. 0) GO TO 380
C
C      J2TEST = 1 FUSELAGE IS CIRCULAR AND UNCAMBERED
00001480
00001490
00001500
00001510
00001520
00001530
00001540
00001550
00001560
00001570
00001580
00001590
00001600
00001610
00001620
00001630
00001640
00001650
00001660
00001670
00001680
00001690
00001700
00001710
00001720
00001730
00001740
00001750
00001760
00001770
00001780
00001790
00001800
00001810
00001820
00001830
00001840
00001850
00001860
00001870
00001880
00001890
00001900
00001910
00001920
00001930
00001940
00001950
00001960
00001970
00001980
00001990
00002000

```

```

00002010
00002020
00002030
00002040
00002050
00002060
00002070
00002080
00002090
00002100
00002110
00002120
00002130
00002140
00002150
00002160
00002170
00002180
00002190
00002200
00002210
00002220
00002230
00002240
00002250
00002260
00002270
00002280
00002290
00002300
00002310
00002320
00002330
00002340
00002350
00002360
00002370
00002380
00002390
00002400
00002410
00002420
00002430
00002440
00002450
00002460
00002470
00002480
00002490
00002500
00002510
00002520
00002530

C JZTEST = 2 FUSELAGE IS CIRCULAR AND CAMBERED
C JZTEST = 3 FUSELAGE IS ARBITRARY IN CROSS SECTION
C
C GO TO (230, 230, 120), JZTEST
C
C TREATMENT OF ARBITRARY FUSELAGE SECTIONS
C GETTING THE MAX Y VALUE AT EACH STATION
C
120 DO 130 KI = 1, NFUS
    KISS = NFORX (KI)
    KUSS = NRADX (KI)
    DO 130 LN = 1, KISS
    DO 130 IC = 1, KUSS
    KEY = 2 * (KI - 1) + 1
    IF (IC .EQ. 1) TEMP = 0.
    IF (IC .GT. 1) TEMP = YFUSMX (KI, LN)
    IF (IC .EQ. NRADX (KI)) GO TO 130
    YFUSMX (KI, LN) = AMAX1 (SFUS (IC, LN, KEY), TEMP)
130 CONTINUE
C
C GETTING THE INCREMENTAL FUSELAGE PLATFORM AREAS
C
140 DO 160 KI = 1, NFUS
    KISS = NFORX (KI) - 1
    DO 150 LN = 1, KISS
    AFUS (KI, LN) = (YFUSMX (KI, LN + 1) + YFUSMX (KI, LN))
    * (XFUS (LN + 1, KI) - XFUS (LN, KI)) / 2.0
150 CONTINUE
160 CONTINUE
C
C SOLVING FOR ZERO THICKNESS FUSELAGE PANEL COORDINATES
C
    XMID = WAFORG (1, 1) + WAFORG (1, 4) / 2.0
    DO 180 KI = 1, NFUS
    KISS = NFORX (KI)
    DO 170 LN = 1, KISS
    DXMID = XMID - XFUS (LN, KI)
    IF (DXMID .LE. 0.) GO TO 190
170 CONTINUE
180 CONTINUE
190 KIMID = KI
    LNMID = LN
    XDIV = XFUS (LNMID, KIMID)
C
C INTEGRATE AREAS OF FWD FUSELAGE
C
    A1 = 0.
    DO 200 KI = 1, KIMID
    KISS = NFORX (KI) - 1
    IF (KI .EQ. KIMID) KISS = LNMID - 1
    DO 200 LN = 1, KISS
    A1 = A1 + AFUS (KI, LN)
200 CONTINUE

```

ISN 0117

ISN 0118
ISN 0119
ISN 0120
ISN 0121
ISN 0122
ISN 0123
ISN 0124
ISN 0126
ISN 0128
ISN 0130
ISN 0131

ISN 0132
ISN 0133
ISN 0134
ISN 0135
ISN 0136
ISN 0137

ISN 0138
ISN 0139
ISN 0140
ISN 0141
ISN 0142
ISN 0143
ISN 0145
ISN 0146
ISN 0147
ISN 0148
ISN 0149

ISN 0150
ISN 0151
ISN 0152
ISN 0153
ISN 0155
ISN 0156
ISN 0157

```

ISN 0158 DX1 = 2.0 *A1 /MAFORG (1, 2) - 1XDIV - XFUS (1, 1)
ISN 0159 XONE = XDIV - DX1
C
C INTEGRATE AREAS OF AFT FUSELAGE PLANFORM
C
A2 = 0.
DO 220 KI = KIMID, MFUS
KISS = NFORX (KI) - 1
DO 210 LN = LNMID, KISS
A2 = A2 + AFUS (KI, LN)
210 CONTINUE
220 CONTINUE
DX2 = 2.0 *A2 /MAFORG (1, 2) - XFUS (NFORX (MFUS), MFUS) + XDIV
XFUSS1 = XFUS (1, 1)
YFUSS1 = YFUSMX (1, 1)
ZFUSS = WAFORG (1, 3)
CORDF1 = XFUS (NFORX (MFUS), MFUS) - XFUS (1, 1)
XFUSS2 = XONE
YFUSS2 = WAFORG (1, 2)
CORDF2 = DX1 + DX2
C
C CARD 7 OF FUSELAGE PANEL (COORDS. OF FUSELAGE PANEL CENTER LINE)
C
WRITE (L3, 720) XFUSS1, YFUSS1, ZFUSS, CORDF1
WRITE (6, 730) XFUSS1, YFUSS1, ZFUSS, CORDF1
C
C CARD 8 OF FUSELAGE PANEL (COORDS. OF FUSE. PANEL AT WING JUNCTURE)
C
WRITE (L3, 720) XFUSS2, YFUSS2, ZFUSS, CORDF2
WRITE (6, 730) XFUSS2, YFUSS2, ZFUSS, CORDF2
C
C CARD 9 OF FUSELAGE (SUB PANELLING CONTROLS)
C
TNVOR = 3.
RNCV = 2.0
SPC = 1.
CURV = 0.
WRITE (L3, 580) TNVOR, RNCV, SPC, CURV
WRITE (6, 590) TNVOR, RNCV, SPC, CURV
C
C SET UP FOR CARD 11 (ADDITIONAL CONTROL PARAMETERS FOR FUSELAGE)
C
AINC1 = 0.
AINC2 = 0.
JITS = 0.
MAP = 0.
IF (J2TEST .EQ .2) MAP=NFORX(1)+NFORX(2)+NFORX(3)+NFORX(4)-MFUS+1
IQANT = 0
ISYNT = 0
MPP = 0
WRITE (L3, 600) AINC1, AINC2, ITS, MAP, IQANT, ISYNT, MPP
WRITE (6, 610) AINC1, AINC2, ITS, MAP, IQANT, ISYNT, MPP
IF (MAP .NE. 0) GO TO 360
00002540
00002550
00002560
00002570
00002580
00002590
00002600
00002610
00002620
00002630
00002640
00002650
00002660
00002670
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ISN 0198      C      GO TO 380
C
C      START OF CIRCULAR FUSELAGE TREATMENT
C
C      DO 240 KI = 1, MFUS
C      KISS = NFORX (KI)
C      DO 240 LN = 1, KISS
C      YFUSHX (KI, LN) = FUSRAD (LN, KI)
C      240 CONTINUE
C
C      IF CIRCULAR FUSELAGE IS CAMBERED THEN GO TO GET FUSE, CAMBER ORDS.
C
C      IF (FUSTYP .EQ. 1) GO TO 250
C      GO TO (140, 340, 140), J2TEST
C
C      BEGIN HEXAGONAL FUSELAGE TREATMENT
C
C      250 XFUS1 = XFUS (1, 1)
C
C      DETERMINE WHICH TWO FUSE STNS BRACKET X OF WING ROOT L E
C
C      DO 260 KI = 1, MFUS
C      KISS = NFORX (KI)
C      DO 260 LN = 1, KISS
C      DXMLE = WAFORG (1,1) - XFUS (LN, KI)
C      IF (DXMLE .LE. 0) GO TO 270
C      CONTINUE
C      260 XAFT = XFUS (LN, KI)
C      270 IF (LN .GT. 1) XFWD = XFUS (LN-1, KI)
C      IF (LN .EQ. 1) XFWD = XFUS (KISS, KI - 1)
C
C      DETERMINE FUSELAGE CAMBER AT WING ROOT L E
C
C      ZAFT = ZFUS (LN, KI)
C      IF (LN .GT. 1) ZFWD = ZFUS (LN - 1, KI)
C      IF (LN .EQ. 1) ZFWD = ZFUS (KISS, KI - 1)
C      SLOPE = (ZAFT - ZFWD) / (XAFT - XFWD)
C      ZFWLE = ZFWD + (WAFORG (1,1) - XFWD) * SLOPE
C
C      DETERMINE PHI & RHO FROM FUSE C-LINE TO WING L E ROOT
C
C      RHOREF = SQRT ((WAFORG (1,3) - ZFWLE) **2 + WAFORG (1,2) **2)
C      PHIREF = ATAN ((WAFORG (1,3) - ZFWLE) / WAFORG (1,2)) / DTR
C
C      SET UP CARDS 7 & 8 OF HEXAGONAL FUSELAGE
C
C      XFUS1 = XFUS (1,1)
C      YFUS1 = 0.
C      ZFUS1 = ZFWLE + RHOREF
C      7FUS12 = ZFWLE - RHOREF
C      CORDF1 = XFUS (NFORX (MFUS), MFUS) - XFUS (1,1)

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ISN 0234      C CARD 7 & 8 OF HEXAGONAL FUSELAGE
ISN 0235      C
ISN 0236      WRITE (L3,720) XFUS1, YFUS1, ZFUS1, CORDFI
ISN 0237      WRITE (6,750) XFUS1, YFUS1, ZFUS1, CORDFI
                WRITE (L3,720) XFUS1, YFUS1, ZFUS2, CORDFI
                WRITE (6,730) XFUS1, YFUS1, ZFUS2, CORDFI
C
C CARD 9 ISUB PANEL CONTROLS OF HEXAGONAL FUSELAGE)
C
ISN 0238      TNVOR = 3
ISN 0239      RNCV = NFORX (1) + NFORX (2) + NFORX (3) + NFORX (4) - NFUS
ISN 0240      SPC = 1.0
ISN 0241      CURV = 999.
ISN 0242      WRITE (L3, 580) TNVOR, RNCV, SPC, CURV
ISN 0243      WRITE(6, 590) TNVOR, RNCV, SPC, CURV
C
C SET UP POLAR COORDINATES FOR REFERENCE HEXAGON
C
ISN 0244      DUPER = 90 - PHIREF
ISN 0245      PANUP = DUPER /60.
ISN 0246      IPANUP = PANUP + .5
ISN 0247      DPHEU = DUPER /IPANUP
ISN 0248      DPHLO = (180 - DUPER) / (3 - IPANUP)
ISN 0249      DO 290 JK=1,4
ISN 0250      IF (JK .LE. IPANUP) PHI (JK) = 90 - (JK -1) *DPHEU
ISN 0251      IF (JK .GT. IPANUP) PHI (JK) = 90-IPANUP*DPHEU-DPHLO*(JK-1-IPANUP)
ISN 0252      290 CONTINUE
ISN 0253      WRITE (L3, 620) ((PHI (JK), RHOREF), JK = 1, 4)
ISN 0254      IF (JK .GT. IPANUP) PHI (JK) = 90-IPANUP*DPHEU-DPHLO*(JK-1-IPANUP)
ISN 0255      WRITE (6, 630) ((PHI(JK), RHOREF), JK = 1, 4)
ISN 0256
C
C SET UP FOR CARD 11 OF HEXAGONAL FUSE.(ADDITIONAL CONTROL PARAMETERS)
C
ISN 0257      AINC1 = 0.
ISN 0258      AINC2 = 0.
ISN 0259      ITS = 1
ISN 0260      NAP = RNCV + 1
ISN 0261      IF (J2TEST .EQ. 1) NAP = 0
ISN 0262      IQANT = 0
ISN 0263      ISYNT = 0
ISN 0264      NPP = 1
ISN 0265      WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQANT, ISYNT, NPP
ISN 0266      WRITE(6, 610) AINC1, AINC2, ITS, NAP, IQANT, ISYNT, NPP
ISN 0267      IF (INAP .EQ. 0) GO TO 380
ISN 0268
C
C CARD 14 OF HEXAGONAL FUSELAGE(PERCENT LENGTH STATION OF FUSELAGE)
C
ISN 0270      JJ = 1
ISN 0271      DO 310 KI = 1, NFUS
ISN 0272      KISS = NFORX (KI) -1
ISN 0273      IF (KI .EQ. MFUS) KISS = NFORX (NFUS)
ISN 0274      DO 300 LN = 1, KISS
ISN 0275      XFPCT (JJ) = XFUS (LN, KI) / (XFUSN - XFUS1) *100.
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ISN 0277      ZC12 (JJ) = ZFUS (LN, KI)/(XFUSN-XFUS1)*100.
ISN 0278      ROFUS (JJ) = FUSRAD (LN, KI)
ISN 0279      JJ = JJ + 1
ISN 0280      300 CONTINUE
ISN 0281      310 CONTINUE
ISN 0282      DO 320 JJ = 1, NAP
ISN 0283      IF (XFCT(JJ)*1)*(XFUSN-XFUS1)/100.) .GT. WAFORG (1,1) .AND.
              * (XFCT(JJ-1)*(XFUSN-XFUS1)/100.) .LT.
              * (WAFORG (1,1) + WAFORG (1,4)) ROFUS (JJ) = RHOREF
ISN 0285      320 CONTINUE
ISN 0286      WRITE (6,630) (XFCT (J), J = 1, NAP)
ISN 0287      WRITE (6,630) (XFCT (J), J = 1,NAP)

C
C   SETTING UP FOR CARD 16 OF HEXAGONAL FUSELAGE (AREA RATIOS WRT.
C   REFERENCE HEXAGON)
C
DO 330 LL = 1, NAP
ROFUS (LL) = (ROFUS (LL) /RHOREF) **2 *100.
330 CONTINUE
WRITE (6, 630) (ZC12 (JJ), JJ = 1, NAP)
WRITE (6, 630) (ZC12(JJ), JJ = 1, NAP)
WRITE (6, 620) (ROFUS (LL), LL = 1, NAP)
WRITE (6, 630) (ROFUS (LL), LL = 1, NAP)
GO TO 380

C
C   SET UP FOR CARDS 14, 16, 18 OF ZERO THICKNESS FUSELAGE TREATMENT
C
340 JJ = 1
DO 350 KI = 1, NFUS
KISS = NFORX (KI) -1
IF (KI .EQ. NFUS) KISS = NFORX (NFUS)
DO 350 LN = 1, KISS
XFCT (JJ) = XFUS (LN, KI) / (XFUSN - XFUS1) *100.
ZC12(JJ)=(ZFUS(LN,KI)-(ZFUS(1,1)-WAFORG(1,3)))/(XFUSN-XFUS1)*100.
JJ = JJ + 1
350 CONTINUE
GO TO 140
360 WRITE (6, 620) (XFCT (J), J = 1, NAP)
WRITE (6, 630) (XFCT (J), J = 1, NAP)
DO 370 I = 1, 2
WRITE (6, 620) (ZC12 (J), J = 1, NAP)
WRITE (6, 630) (ZC12 (J), J = 1, NAP)
370 CONTINUE
C
C   MACELLE TREATMENT
C   SETTING UP FOR CARD 7 & 8
C
380 IF (J3 .EQ. 0) GO TO 450
DO 440 JJ = 1, NP
X1 = PODORG (JJ, 1)
Y1 = PODORG (JJ, 2)
Z1 = PODORG (JJ, 3) + PODORD (JJ, 1)
CORD1 = XPOD (JJ, MPODOR) - XPOD (JJ, 1)

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ISN 0358	WRITE (L3, 620) (ZCP12 (JJ, LL), LL = 1, MAP)	00005180
ISN 0359	WRITE (6, 630) (ZCP12 (JJ, LL), LL = 1, MAP)	00005190
ISN 0360	CONTINUE	00005200
	440	00005210
	C	00005220
	C	00005230
	C	00005240
	C	00005250
	C	00005260
ISN 0361	450 IF (J4 -EQ- 0) GO TO 470	00005270
ISN 0363	DO 460 NN = 1, NF	00005280
ISN 0364	WRITE (L3, 660) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)	00005290
ISN 0365	WRITE (6, 670) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)	00005300
	C	00005310
	C	00005320
	C	00005330
ISN 0366	TNVOR = 2.0	00005340
ISN 0367	RNCV = 10.	00005350
ISN 0368	SPC = 1.	00005360
ISN 0369	CURV = 0.	00005370
ISN 0370	WRITE (L3, 580) TNVOR, RNCV, SPC, CURV	00005380
ISN 0371	WRITE (6, 590) TNVOR, RNCV, SPC, CURV	00005390
	C	00005400
	C	00005410
	C	00005420
ISN 0372	AINC1 = 0.	00005430
ISN 0373	AINC2 = 0.	00005440
ISN 0374	ITS = 0	00005450
ISN 0375	NAP = 0	00005460
ISN 0376	IQUANT = 0	00005470
ISN 0377	ISYNT = 0	00005480
ISN 0378	NPP = 0	00005490
ISN 0379	WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP	00005500
ISN 0380	WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP	00005510
ISN 0381	CONTINUE	00005520
ISN 0382	470 IF (J5 -EQ- 0) GO TO 490	00005530
	C	00005540
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ISN 0433
ISN 0434

C      SETTING UP FOR CARD 11 (ADDITIONAL CONTROL PANELS FOR CANARDS)

      AINC1 = 0.
      AINC2 = 0.
      ITS = 0
      NAP = 0
      IQUANT = 0
      ISYNT = 0
      WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
      WRITE (L6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
      CONTINUE
      NXS = 0
      NYS = 0
      NZS = 0
      WRITE (L3, 700) NXS, NYS, NZS
      WRITE (L6, 710) NXS, NYS, NZS
      FORMAT (3 (I2, 8X), 4F10.4, I2, 5X, I3)
      FORMAT (1H, 3 (I2, 8X), 4F10.4, I2, 5X, I3)
      FORMAT (I2, 8X, 7F10.3)
      FORMAT (1H, I2, 8X, 7F10.3)
      FORMAT (I2, 8X, F10.2, 4F10.4)
      FORMAT (1H, I2, 8X, F10.2, 4F10.4)
      FORMAT (4F10.4, 10X, *HING PANEL NO., I2)
      FORMAT (1H, 4F10.4, 10X, 14HWING PANEL NO., I2)
      FORMAT (4F10.4, 10X, 17HNVOR.RNCV.SPC.PDL)
      FORMAT (1H, 4F10.4, 10X, 17HNVOR.RNCV.SPC.PDL)
      FORMAT (2F10.4, 5 (I2, 8X))
      FORMAT (1H, 2F10.4, 5 (I2, 8X))
      FORMAT (8F10.4)
      FORMAT (1H, 8F10.4)
      FORMAT (8F10.4)
      FORMAT (1H, 8F10.4)
      FORMAT (4F10.4, 10X, 13HFIN PANEL NO., I2)
      FORMAT (1H, 4F10.4, 10X, 13HFIN PANEL NO., I2)
      FORMAT (4F10.4, 10X, 16HCANARD PANEL NO., I2)
      FORMAT (1H, 4F10.4, 10X, 16HCANARD PANEL NO., I2)
      FORMAT (3 (I2, 8X), 10X, 11HNXS,NYS,NZS)
      FORMAT (1H, 3 (I2, 8X), 10X, 11HNXS,NYS,NZS)
      FORMAT (4F10.4, 10X, 14HFUSELAGE PANEL)
      FORMAT (1H, 4F10.4, 10X, 14HFUSELAGE PANEL)
      FORMAT (4F10.4, 10X, 16HNACELLE PANEL NO, I2)
      FORMAT (1H, 4F10.4, 10X, 16HNACELLE PANEL NO, I2)
      STOP
      END

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00061200
00061300
00061400

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*****O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS	CROSS REFERENCE	LISTING
NPP	0375 0379 0380 0396 0399 0400	0265 0266 0267 0344 0345 0346 0378 0379 0380 0399 0400	
NXS	0402 0405 0406		
NYS	0403 0405 0406		
NZS	0404 0405 0406		
PHI	0007 0250 0252		
PSI	0060 0065 0066		
RHO	0334 0336 0337		
SKL	0002 0033		
SPC	0093 0095 0096		
XAF	0004 0108 0109 0348 0350 0351	0240 0242 0243 0328 0330 0331 0368 0370 0371 0389 0391 0392	
ARCD	0006		
AFUS	0005 0135 0156 0164		
ATAN	0228		
CBAR	0072 0076 0077		
CURV	0094 0095 0096		
JITS	0187		
KISS	0119 0121 0133 0134 0140 0141 0152 0153 0155 0162 0163 0200 0201 0209 0210 0218 0223 0272 0273		
KUSS	0275 0298 0299 0301		
LERR	0120 0122		
LERR	0002 0027		
MACH	0023 0026		
NEAN	0002 0019		
NCON	0023		
NFUS	0002 0019 0118 0132 0139 0161 0167 0167 0171 0171 0189 0199 0208 0233 0233 0239 0271 0273		
NPAN	0273 0297 0299 0299		
NPLT	0070 0076 0077		
NPLT	0023		
NWAF	0002 0019 0070 0075 0080 0081		
PDES	0004		
PEFA	0002 0071		
RNCV	0092 0095 0096 0180 0183 0184 0239 0242 0243 0260 0325 0326 0326 0330 0331 0367 0370 0371 0388		
SFUS	0391 0392		
SORT	0004 0130		
SORT	0227		
SREF	0071 0076 0077		
TEMP	0124 0126 0130		
VINF	0064 0065 0066		
XAFT	0215 0225		
XBAR	0073 0076 0077		
XCAN	0004		
XDIV	0149 0158 0159 0167		
XFIN	0004		
XFUS	0004 0135 0135 0142 0149 0158 0167 0168 0171 0171 0207 0211 0215 0216 0218 0229 0233 0233 0276		
XFWD	0302		
XMID	0216 0218 0225 0226		
XONE	0138 0142		
XPOD	0159 0172		
YAHQ	0004 0319 0319 0348 0348 0348 0365 0066		

***** O R T R A N C R O S S R E F E R E N C E L I S T I N G *****

SYMBOL	INTERNAL STATEMENT NUMBERS
ZAFY	0220 0225
ZBAR	0074 0076 0077
ZC12	0005 0277 0291 0292 0303 0310 0311
ZERO	0355 0356 0357
ZFUS	0004 0220 0221 0223 0225 0226
ZFWD	0221 0223 0225 0226
AINC1	0097 0104 0105 0185 0194 0195 0257 0258 0266 0267 0338 0345 0346 0372 0379 0380 0393 0399 0400
AINC2	0098 0104 0105 0186 0194 0195 0266 0267 0339 0345 0346 0373 0379 0380 0394 0399 0400
ALPHA	0005 0054 0055 0056 0057 0058
AMAX1	0130
COPD1	0319 0321 0322
UPHEU	0247 0250 0252
DPHLO	0248 0252
DUPER	0244 0245 0247 0248
UXMID	0142 0143
DXWLE	0211 0212
FLOAT	0026
IBCDN	0046 0048 0049
INPUT	0014 0015
ISOLV	0039 0048 0049
ISYNT	0102 0104 0105 0192 0194 0195 0264 0266 0267 0343 0345 0346 0377 0379 0380 0398 0399 0400
KIMID	0147 0149 0151 0153 0161
LNHID	0148 0149 0153 0163
NCASE	0002 0023
NFORX	0002 0019 0119 0133 0140 0152 0162 0167 0171 0189 0189 0189 0200 0209 0233 0239 0239 0239
	0239 0272 0273 0298 0299
NFUSP	0067 0068 0070
NKODE	0022 0028 0035
NMACH	0050 0051 0052
*NRDX	0002 0019 0120 0128
NREST	0002 0023 0028
NRICH	0002
NWPAN	0080 0086
PANUP	0245 0246
POFUS	0005 0278 0283 0289 0289 0289 0293 0294
ROLLO	0062 0065 0066
SLOPE	0275 0226
START	0021
INVOK	0091 0095 0096 0179 0183 0184 0238 0242 0243 0324 0330 0331 0366 0370 0371 0387 0391 0392
IZORD	0004 0083 0083 0110 0111 0112 0113
WSPAN	0075 0076 0077
XFECT	0005 0276 0283 0283 0283 0287 0302 0308
XFUSN	0003 0276 0277 0283 0283 0283 0302 0303
XFUS1	0003 0276 0277 0283 0283 0302 0303
XMACH	0002 0026 0051 0052
XREST	0002 0030 0033 0033
ZCP12	0007 0353 0358 0359
ZFUSS	0170 0175 0176 0177 0178
ZFWLE	0226 0227 0228 0231 0232
CANORD	0004

*****O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

INTERNAL STATEMENT NUMBERS	
CANDRG	0004 0385 0386
CANDM1	0004
CORDF1	0171 0175 0176 0233 0234 0235 0236 0237
CORDF2	0174 0177 0178
FINORD	0004
FINDRG	0004 0364 0365
FLOATX	0044 0048 0049
FLOATY	0045 0048 0049
FUSARD	0004
FUSRAD	0004 0202 0278
FUSTYP	0009 0012 0014 0204
IPANJP	0246 0247 0248 0250 0252 0252 0252
IQUANT	0101 0104 0105 0191 0194 0195 0263 0266 0267 0342 0345 0346 0376 0379 0380 0397 0399 0400
ITRMAX	0047 0048 0049
JZTEST	0002 0117 0189 0206 0261
LATRAL	0059 0065 0066
LSTD18	0011
NALPHA	0053 0057 0057 0058 0058
MCANDR	0002 0019
MFINOR	0002 0019
NPODOR	0002 0019 0319 0325 0341
NP1SPS	0004
NSWVDR	0013 0014
NTHETA	0002 0023
NWAFOR	0002 0019 0082 0100 0110 0111 0112 0113
PHIREF	0228 0244
PITCHQ	0061 0065 0066
PODOR0	0004 0316 0334 0353 0353
PODOR1	0004 0316 0317 0318
HEXPAR	0042 0048 0049
RHOREF	0227 0231 0232 0255 0256 0283 0289
WAFORD	0004
WAFORG	0004 0075 0083 0087 0088 0089 0090 0138 0138 0138 0158 0167 0170 0173 0211 0226 0227 0227 0228 0228
XFUSS1	0283 0283 0283
XFUSS2	0168 0175 0176 0207 0229 0234 0235 0236 0237
YFUSMX	0005 0126 0130 0135 0135 0169 0202
YFUSS1	0169 0175 0176 0230 0234 0235 0236 0237
YFUSS2	0173 0177 0178
ZFUSS1	0231 0234 0235
ZFUSS2	0232 0236 0237

****FORTRAN CROSS REFERENCE LISTING****

LABEL	DEFINED	REFERENCES
10	0016	0017 0037
20	0018	0036
30	0020	0019
40	0025	0023
50	0031	0030
60	0034	0032
70	0036	0028
80	0064	0082
90	0065	0081
100	0114	0086
110	0115	0078 0106
120	0118	0117
130	0131	0118 0121 0122 0128
140	0132	0206 0206 0306
150	0136	0134
160	0137	0132
170	0145	0141
180	0146	0139
190	0147	0143
200	0157	0151 0155
210	0165	0163
220	0166	0161
230	0199	0117 0117
240	0203	0199 0201
250	0207	0204
260	0214	0208 0210
270	0215	0212
290	0254	0249
300	0280	0275
310	0281	0271
320	0285	0282
330	0290	0288
340	0296	0206
350	0305	0297 0301
360	0307	0196
370	0312	0309
380	0313	0115 0198 0268 0295
390	0323	0320
400	0335	0332
410	0349	0347
420	0354	0352
440	0360	0315
450	0361	0313
460	0381	0363
470	0382	0361
480	0401	0384
490	0402	0382
500	0407	0048
510	0408	0049
520	0409	0051 0057 0065
530	0410	0052 0058 0066
540	0411	0076

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES
550	0412	0077
560	0413	0087 0089
570	0414	0088 0090
580	0415	0095 0183 0242 0330 0370 0391
590	0416	0096 0184 0243 0331 0371 0392
600	0417	0104 0194 0266 0345 0379 0399
610	0418	0105 0195 0267 0346 0380 0400
620	0419	0108 0255 0286 0291 0293 0307 0310 0336 0350 0356 0357 0358
630	0420	0109 0256 0287 0292 0294 0308 0310 0337 0351 0359
640	0421	0110 0112
650	0422	0111 0113
660	0423	0364
670	0424	0365
680	0425	0385
690	0426	0386
700	0427	0405
710	0428	0406
720	0429	0175 0177 0234 0236
730	0430	0176 0178 0235 0237
740	0431	0321
750	0432	0322
760	0433	0015

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I SF		I**	00039C	J F		I**	0003A0	V		C		AI SF		R**	0003A4
A2 SF		R**	0003AB	IC SFA		I**	0003AC	II SF		R**	N.R.	IT SF		I**	0003B4
JJ SF		I**	0003B8	JK SF		I**	0003BC	JO S		C	000050	J1 S		I**	0*7054
J2 S	C	I**	000058	J3 S	C	I**	00005C	J4 S		C	000060	J5 S		I**	0..J064
J6 S	C	I**	000068	KI SF		I**	00006C	KK SF		C	0003C4	LL SF		I**	0003CB
LN SFA		I**	0003CC	L3 F		I**	0003D0	LF SF		C	0000A0	NN SF		I**	0003D4
NP SF	C	I**	000098	NX S	C	I**	0000C8	NI SF		C	0003D8	Y1 SF		R**	0003DC
Z1 SF		R**	0003E0	ABC SF	C	R**	000000	X1 SF		R**	0003E4	DX1 SF		R**	0003E8
DX2 SF		R**	0003EC	MAG SF		R**	0003F0	ITS SF		I**	0003F4	KEY SFA		I**	0003FB
LAX SF		I**	0003FC	LAY SF		I**	000400	NAP SF		I**	000404	NPP SF		I**	000408
PSI SF		R**	00040C	NYS SF		I**	000410	NZS SF		I**	000414	PHI SF		R**	000538
XAF SF	C	R**	000000	RHD SF		R**	00041C	SKL F		C	0000FC	SPC SF		R**	000420
CURV SF		R**	000428	ABCD		R**	N.R.	AFUS SF		R**	000560	CBAR SF		R**	000424
LERR S	C	I**	000084	JITS S		I**	00042C	KISS SF		I**	000430	KUSS SF		I**	000434
NFUS SF	C	I**	000074	MACH SFA		I**	000438	NLAN SF		C	0000A8	NCON S		I**	00043C
PDES	C	R**	N.R.	NPAN SF		I**	000440	NPLT S		I**	000444	NWAF SF		I**	00006C
SREF SF		R**	00044C	REFA F	C	R**	00008C	RNCV SF		R**	000448	SFUS FA		R**	602AF8
XBAR SF		R**	00045C	TEMP SFA		R**	000450	VINF SF		R**	000454	XAFT SF		R**	000458
XFUS F	C	R**	002738	XCAN		R**	N.R.	XDIV SF		R**	000460	XFIN		C	N.R.
ZC12 SF	C	R**	000730	XFWD SF		R**	000464	XMID SF		R**	000468	XONE SF		R**	00046C
AINC1 SF		R**	000484	YAMQ SF		R**	000470	ZAFT SF		R**	000474	ZBAR SF		R**	000478
DPHEU SF		R**	000490	ZERO SF		R**	00047C	ALPHA SF		C	002918	ZFWD SF		R**	000480
DXWLE S		R**	0004A0	AINC2 SF		R**	000488	DUPER SF		R**	000494	CORD1 SF		R**	0C048C
ISYNT SF	C	I**	0004AC	DPHLO SF		R**	000494	INPUT SF		R**	501003	DXMID S		R**	00049C
NRADX SF	C	I**	000078	IBCON SF		I**	0004A4	LNMIID SF		I**	000484	ISOLV SF		I**	0004AB
PANUP SF		R**	0004CB	KIMID SF		I**	000480	NKODE S		C	00048C	NCASE S		I**	0000C0
START SF	XF	R**	000000	NFUSP SF	C	I**	000000	NRICH		I**	N.R.	NMPAN SF		I**	0004C4
XFECT SF		R**	0008DC	ROFUS SF		R**	000814	ROLLQ SF		C	0004CC	SLOPE SF		R**	0004D0
XREST SF	C	R**	0000D4	THVOR SF		R**	0004D4	TZORD SF		C	0010D8	WSPAN SF		R**	0004D8
ATAN	XF	R**	000000	XFUSN F	C	R**	000008	XFUS1 F		C	000004	XMACH SF		C	0000C4
CANDR1	C	R**	N.R.	ZCP12 SF		R**	0009A4	ZFUS2 SF		C	0004DC	ZFWLE SFA		R**	0004E0
FINORG	F	R**	000898	CORDF1 SF	XF	R**	000000	CANORD		C	N.R.	CANORG F		R**	000C28
IPANUP SF		C	0004F8	FLOATX SF		R**	0004E4	CORDF2 SF		R**	0004E8	FINORD		C	N.R.
LATRAL SF		I**	000504	FUSRAD F	C	R**	0004EC	FLOATY SF		R**	0004F0	FRONL#		XF	000000
NFINDR S	C	I**	0000A4	IQUANT SF		I**	003AEB	FUSTYP S		I**	0004F4	IBCOM#		XF	000000
NTHETA S	C	I**	0000CC	LSTD8 SF	XF	I**	000000	ITRMAX SF		I**	000500	JZTEST F		C	0000B0
PODDRD F	C	R**	0047AC	NPODR SF	C	I**	00009C	NALPHA SF		C	000508	NCANOR S		C	0000AC
WAFORD	N.R.	R**	0000DC	NMAFOR SF	C	I**	000070	NP1TSP		R**	N.R.	NSWVOR S		R**	00050C
ZFUS2 SF		R**	000534	PODDRG F	C	R**	004308	PH1REF SF		R**	000510	PITCHQ SF		R**	000514
				WAFDRG FA	C	R**	000078	REXPAN SF		R**	000518	RHOREF SF		R**	00051C
				YFUS1 SF		R**	000528	XFUS1 SF		R**	000520	XFUS2 SF		R**	000524
								YFUS2 SF		R**	00052C	ZFUS1 SF		R**	000530

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * * SIZE OF BLOCK 000100 HEXADECIMAL BYTES
 VAR. NAME TYPE REL. ADDR. VAR. NAME TYPE REL. ADDR. VAR. NAME TYPE REL. ADDR.

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
60	00128C	70	0012A8	80	0016FE	90	001716
100	0018CA	110	0018DE	120	001C08	130	001CF0
140	001D30	150	001D00	160	001DE4	170	001E5A
180	001E6E	190	001E86	200	001F14	210	001FB6
220	001FCA	230	0022E2	240	002336	250	00238A
260	0023E4	270	002410	290	0028D8	300	002B70
310	002B84	320	002C0A	330	002CCA	340	002DE4
350	002EBA	360	002EEA	370	002FF4	380	003008
390	00310C	400	003242	410	00341C	420	003500
440	0035EA	450	003602	460	003854	470	00386C
480	003ABC	490	003AD4	760	00383C		

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 LIMITATION MAY BE REMOVED OCTOBER 1977.

LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*   NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,XREF
*STATISTICS*         SOURCE STATEMENTS =  433 ,PROGRAM SIZE =  15224
*STATISTICS*         NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****
```

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```

COMPILER OPTIONS - NAME= MAIN,OPT=01,LINECNT=55,SIZE=0000K,
SOURCE=BCD,NOLIST,NODECK,LOAD,MAP,NODEDIT,IO,XREF
ISN 0002 C SUBROUTINE START 00006150
ISN 0003 C INPUTS AND INITIALIZES CONFIGURATION DESCRIPTION 00006160
C REFERENCE NASA TM X-2074, SEPT 1970 00006170
C 00006180
C COMMON ABC (20), J0, J1, J2, J3, J4, J5, J6, NMAF, NMAFOR, NFUS,
* NRADX (4), NFORX (4), NP, NPOOR, NF, NFINOR, NCAN, NCANDR,
* J2TEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,
* XREST (10), SKL 00006190
C COMMON/BLK2/V,XFUS1,XFUSN 00006200
C COMMON/BLACK/XAF (30), WAFORD (20, 4), WAFORD (20, 3, 30), 00006210
* TZORD (20, 30), XFUS (30, 4), ZFUS (30, 30, 30, 1), 00006220
* FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30), 00006230
* PODORD (9, 30), NPTSPS (5), PDES (30, 30, 10), FINORG (6, 2, 4), 00006240
* XFIN (6, 10), FINORD (6, 2, 10), CANDRG (2, 2, 4), XCAN (2, 10), 00006250
* CANDRD (2, 2, 10), CANDR1 (2, 2, 10) 00006260
C DIMENSION ABCD (20), FORAG (4), PARND (5), PARBA (5) 00006270
C DATA PI/3-.14159265/ 00006280
C FORMAT (10F7.0) 00006290
C REFERENCE AREA 00006300
C IF (J0 .NE. 1) GO TO 140 00006310
C READ (5, 10) REFA, SKL 00006320
C IF (SKL .EQ. 0.) SKL = 1. 00006330
C WING 00006340
C IF (J1 .NE. 2) GO TO 20 00006350
C GO TO 110 00006360
C V = 0. 00006370
C N = IABS (NMAFOR) 00006380
C NREC = (N + 9) / 10 00006390
C I1 = -9 00006400
C I2 = 0 00006410
C DO 30 NW = 1, NREC 00006420
ISN 0014 00006430
ISN 0016 00006440
ISN 0017 00006450
ISN 0018 00006460
ISN 0020 00006470
ISN 0021 00006480
ISN 0022 00006490
ISN 0023 00006500
ISN 0024 00006510
00006520
00006530
00006540

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ISN 0025
ISN 0026
ISN 0027
ISN 0028
ISN 0029
ISN 0030
ISN 0031
ISN 0032
ISN 0033
ISN 0034
ISN 0036
ISN 0037
ISN 0038
ISN 0039
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ISN 0070
ISN 0071

ISN 0072
ISN 0074
ISN 0075
ISN 0077
ISN 0078
ISN 0080

11 = I1 + 10
I2 = I2 + 10
READ (5, 10) (XAF (I), I = I1, I2)
CONTINUE
DO 40 I = 1, NMAF
READ (5, 10) (WAFORG (I, J), J = 1, 4)
DO 40 J = 1, 4
WAFORG (I, J) = WAFORG (I, J) / SKL
CONTINUE
IF (J1 .LT. 0) GO TO 70
DO 60 NN = 1, NMAF
I1 = -9
I2 = 0
DO 50 N1 = 1, NREC
I1 = I1 + 10
I2 = I2 + 10
READ (5, 10) (TZORD (NN, I), I = I1, I2)
DO 50 I = I1, I2
TZORD (NN, I) = TZORD (NN, I) / SKL
CONTINUE
CONTINUE
GO TO 90
DO 80 I = 1, NMAF
DO 80 K = 1, N
L = 1
DO 80 L = 1, L
IF (NMAFOR .LT. 0) L = 2
DO 110 NN = 1, NMAF
DO 110 K = 1, L
I1 = -9
I2 = 0
DO 100 N1 = 1, NREC
I1 = I1 + 10
I2 = I2 + 10
READ (5, 10) (WAFORD (NN, K, I), I = I1, I2)
CONTINUE
CONTINUE
IF (NMAFOR .LT. 0) GO TO 130
DO 120 NN = 1, NMAF
DO 120 K = 1, N
WAFORD (NN, 2, K) = WAFORD (NN, 1, K)
CONTINUE
NMAFOR = IABS (NMAFOR)
J1 = IABS (J1)
FUSELAGE
C
C
140 IF (J2 .NE. 2) GO TO 150
GO TO 310
150 IF (J2 .EQ. 0) GO TO 310
JZTEST = 3
IF (J2 .EQ. -1 .AND. J6 .EQ. -1) JZTEST = 1
IF (J2 .EQ. -1 .AND. J6 .EQ. 0) JZTEST = 2

```

```

00006550
00006560
00006570
00006580
00006590
00006600
00006610
00006620
00006630
00006640
00006650
00006660
00006670
00006680
00006690
00006700
00006710
00006720
00006730
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00006760
00006770
00006780
00006790
00006800
00006810
00006820
00006830
00006840
00006850
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00006870
00006880
00006890
00006900
00006910
00006920
00006930
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00006960
00006970
00006980
00006990
00007000
00007010
00007020
00007030
00007040
00007050
00007060
00007070

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ISM 0082      IF (.J6 .EQ. 1) JZTEST = 1
ISM 0084      JZ = 1
ISM 0085      NSUM = 1
ISM 0086      DO 160 MFU = 1, NFUS
ISM 0087      NSUM = NSUM + NFORX (MFU) -1
ISM 0088      IF (NSUM .LE. 101) GO TO 180
ISM 0090      WRITE (6, 170)
ISM 0091      FORMAT (//
                * 60H CONSECUTIVE FUSELAGE POINTS EXCEED ALLOWABLE STORAGE OF 101
                * 1H1)
ISM 0092      STOP
ISM 0093      CONTINUE
ISM 0094      DO 270 MFU = 1, NFUS
ISM 0095      N = NFORX (MFU)
ISM 0096      NRAD = NRADX (MFU)
ISM 0097      NREC = (N + 9) /10
ISM 0098      I1 = -9
ISM 0099      I2 = 0
ISM 0100      DO 190 N1 = 1, NREC
ISM 0101      I1 = I1 + 10
ISM 0102      I2 = I2 + 10
ISM 0103      READ (5, 10) (XFUS (I, MFU), I = I1, I2)
ISM 0104      DO 190 I = I1, I2
ISM 0105      XFUS (I, MFU) = XFUS (I, MFU) /SKL
ISM 0106      CONTINUE
ISM 0107      IF (NFU .NE. 1) GO TO 200
ISM 0109      XFUS1 = XFUS (1, 1)
ISM 0110      XFUSN = XFUS (N, 1)
ISM 0111      XFUS1 = AMIN1 (XFUS1, XFUS (1, MFU))
ISM 0112      XFUSN = AMAX1 (XFUSN, XFUS (N, MFU))
ISM 0113      IF (JZTEST .NE. 2) GO TO 220
ISM 0115      I1 = -9
ISM 0116      I2 = 0
ISM 0117      DO 210 N1 = 1, NREC
ISM 0118      I1 = I1 + 10
ISM 0119      I2 = I2 + 10
ISM 0120      READ (5, 10) (ZFUS (I, MFU), I = I1, I2)
ISM 0121      DO 210 I = I1, I2
ISM 0122      ZFUS (I, MFU) = ZFUS (I, MFU) /SKL
ISM 0123      CONTINUE
ISM 0124      GO TO 240
ISM 0125      DO 230 I = 1, N
ISM 0126      ZFUS (I, MFU) = 0.
ISM 0127      IF (JZTEST .NE. 3) GO TO 280
ISM 0129      NCARD = (NRAD + 9) /10
ISM 0130      DO 270 LN = 1, N
ISM 0131      DO 260 K = 1, 2
ISM 0132      KK = K + (NFU - 1) *2
ISM 0133      I1 = 10
ISM 0134      I2 = 0
ISM 0135      I1 = -9
ISM 0136      DO 250 NN = 1, NCARD
ISM 0137      IF (NN .EQ. NCARD) I1 = MOD (NRAD, 10)
00007080
00007090
00007100
00007110
00007120
00007130
00007140
00007150
00007160
00007170
00007180
00007190
00007200
00007210
00007220
00007230
00007240
00007250
00007260
00007270
00007280
00007290
00007300
00007310
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00007330
00007340
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00007360
00007370
00007380
00007390
00007400
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00007490
00007500
00007510
00007520
00007530
00007540
00007550
00007560
00007570
00007580
00007590
00007600

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ISN 0139
ISN 0141
ISN 0142
ISN 0143
ISN 0144
ISN 0145
ISN 0146
ISN 0147
ISN 0148
ISN 0149
ISN 0150
ISN 0151
ISN 0152
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ISN 0163
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ISN 0166
ISN 0167
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ISN 0169
ISN 0170
ISN 0171
ISN 0172
ISN 0173
ISN 0174
ISN 0175
ISN 0176
ISN 0177
ISN 0178
ISN 0179
ISN 0180
ISN 0181

ISN 0183
ISN 0184
ISN 0185
ISN 0186

IF (J1 .EQ. 0) I1 = 10
I1 = I1 + 10
I2 = I2 + I1
READ (5, 10) (SFUS (I, LN, KK), I = 11, I2)
DO 250 I = 11, I2
SFUS (I, LN, KK) = SFUS (I, LN, KK) /SKL
CONTINUE
250 CONTINUE
260 CONTINUE
270 CONTINUE
GO TO 310
280 I1 = -9
I2 = 0
DO 290 N1 = 1, NREC
I1 = I1 + 10
I2 = I2 + 10
READ (5, 10) (FUSARD (I, NFU), I = 11, I2)
DO 290 I = 11, I2
FUSARD (I, NFU) = FUSARD (I, NFU) /SKL**2
CONTINUE
290
DO 300 I = 1, N
FUSRAD (I, NFU) = SQRT (FUSARD (I, NFU) /PI)
C
C
C
MACELLES
310 IF (J3 .NE. 2) GO TO 320
GO TO 440
320 IF (J3 .EQ. 0) GO TO 440
N = NPDDR
NREC = (N + 9) /10
DO 410 NN = 1, NP
READ (5, 10) (PODRG (NN, I), I = 1, 3)
DO 330 I = 1, 3
PODRG (NN, I) = PODRG (NN, I) /SKL
I1 = -9
I2 = 0
DO 340 N1 = 1, NREC
I1 = I1 + 10
I2 = I2 + 10
READ (5, 10) (XPOD (NN, I), I = 11, I2)
DO 340 I = 11, I2
XPOD (NN, I) = XPOD (NN, I) /SKL
CONTINUE
340
IF (J3 .NE. -1) GO TO 390
C
C
C
ARBITRARILY DEFINED POD --READ NO. PTS FOR EACH STATION/POD
C
C
C
READ (5, 10) AN
NPTS (NN) = AN
NPTS = NPTS (NN)
NCARD = (NPTS (NN) + 9) /10
C
C
C
NCARD = NO. CARDS AT EACH STATION(I) FOR EACH POD (NN)
C
C
C

```

```

ISN 0187      DO 380 LN = 1, MPODOR.
C             LN STATION LOOP
C
ISN 0188      DO 370 K = 1, 2
ISN 0189      KK = K + (NN - 1) * 2.
ISN 0190      EY = 2 * K - 3
ISN 0191      II = 10
ISN 0192      I1 = -9
ISN 0193      I2 = 0
ISN 0194      DO 360 NA = 1, NCARD
ISN 0195      IF (NA .EQ. NCARD) II = MOD (MPTSPS (NN), 10)
ISN 0197      IF (I1 .EQ. 0) I1 = 10
ISN 0199      I1 = 11 + 10
ISN 0200      I2 = 12 + 11
ISN 0201      READ (5, 10) (PDES (I, LN, K + (NN - 1) * 2), I = I1, I2)
ISN 0202      DO 350 I = I1, I2
ISN 0203      IF (PODORG (NN, 2) .EQ. 0.) GO TO 350
ISN 0205      IF (I .EQ. MPTS) GO TO 350
ISN 0207      PDES ( (MPTS - I) * 2 + I, LN, KK) = EY * PDES (I, LN, KK) / SKL +
              * PODORG (NN, K + 1)
ISN 0208      350 PDES (I, LN, K + (NN - 1) * 2) = PDES (I, LN, K + (NN - 1) * 2)
              * /SKL + PODORG (NN, K + 1)
ISN 0209      360 CONTINUE
ISN 0210      370 CONTINUE
ISN 0211      380 CONTINUE
ISN 0212      LPF = 1
ISN 0213      IF (PODORG (NN, 2) .NE. 0.) MPTSPS (NN) = MPTSPS (NN) * 2 - 1
ISN 0215      GO TO 410
ISN 0216      390 LPF = 0
ISN 0217      I1 = -9
ISN 0218      I2 = 0
ISN 0219      DO 400 N1 = 1, NREC
ISN 0220      I1 = 11 + 10
ISN 0221      I2 = 12 + 10
ISN 0222      READ (5, 10) (PODORD (NN, I), I = I1, I2)
ISN 0223      DO 400 I = I1, I2
ISN 0224      PODORD (NN, I) = PODORD (NN, I) / SKL
ISN 0225      400 CONTINUE
ISN 0226      410 CONTINUE
ISN 0227      IF (LPF .EQ. 0) GO TO 440
ISN 0229      DO 430 NN = 1, N
C             COMPUTE POD AREAS
C
ISN 0230      KK = 1 + (NN - 1) * 2
ISN 0231      DO 420 I = 1, MPODOR
ISN 0232      PSI = 0.
ISN 0233      MPTS = MPTSPS (NN)
ISN 0234      DO 420 K = 2, MPTS
ISN 0235      ABAR = PDES (K - 1, I, KK) * PDES (K, I, KK + 1) - PDES (K, I, KK)
              * * PDES (K - 1, I, KK + 1)
ISN 0236      PSI = PSI + ABAR
              00008140
              00008150
              00008160
              00008170
              00008180
              00008190
              00008200
              00008210
              00008220
              00008230
              00008240
              00008250
              00008260
              00008270
              00008280
              00008290
              00008300
              00008310
              00008320
              00008330
              00008340
              00008350
              00008360
              00008370
              00008380
              00008390
              00008400
              00008410
              00008420
              00008430
              00008440
              00008450
              00008460
              00008470
              00008480
              00008490
              00008500
              00008510
              00008520
              00008530
              00008540
              00008550
              00008560
              00008570
              00008580
              00008590
              00008600
              00008610
              00008620
              00008630
              00008640
              00008650
              00008660

```


***** O R T R A N C R O S S R E F E R E N C E L I S T I N G *****

SYMBOL	INTERNAL STATEMENT NUMBERS	CROSS REFERENCE
LEBR	0003 0261	
KCAN	0003 0086	
NFUS	0185 0205 0207 0233 0234	
NPTS	0096 0129 0137	
NRAD	0021 0024 0039 0058 0097 0100 0117 0152 0167 0174 0219	
NREC	0085 0087 0088	
NSUM	0003 0029 0036 0048 0054 0066	
NMAF	0005 0201 0207 0208 0235 0235 0235 0235	
PDES	0003 0011	
REFA	0005 0143 0145 0145	
SFUS	0005 0143	
SQRT	0160	
XCAN	0005 0266	
XFIN	0005 0252	
XFUS	0005 0103 0105 0105 0109 0110 0111 0112	
XPOD	0005 0177 0179 0179	
ZFUS	0005 0120 0122 0122 0126	
AMAXI	0112	
AMINI	0111	
FKRAG	0006	
NCARD	0129 0136 0137 0186 0194 0195	
NCASE	0003 0087 0095	
NFORX	0003 0087 0096	
NRADX	0003 0096	
NKEST	0003	
NKICH	0003	
PARBA	0006 0240	
PARPD	0006 0237	
START	0002	
TZORD	0005 0042 0044 0044 0050	
XFUS4	0004 0110 0112 0112	
XFUS1	0004 0109 0111 0111	
YMACH	0003	
AREST	0003	
CANORD	0005 0267 0272	
CANORG	0005 0262 0265 0265 0265	
CAYOR1	0005 0272 0275 0276	
FIORD	0005 0253	
FINORG	0005 0248 0251 0251	
FUSARD	0005 0155 0157 0157 0160	
FUSRAD	0005 0160	
J2TEST	0003 0077 0078 0080 0082 0113 0127	
NCANOR	0003 0260 0268 0278 0278	
NFINOR	0003 0246	
NPDDOR	0003 0166 0187 0231	
NPTSPS	0005 0184 0185 0186 0195 0213 0213 0233	
NIMETA	0003	
NMAFOR	0003 0020 0052 0064 0070 0070	
PUDORD	0005 0222 0224 0224	
PODDRG	0005 0169 0171 0171 0203 0207 0208 0213	

***** D R T R A N C R O S S R E F E R E N C E L I S T I N G *****

SYMBOL INTERNAL STATEMENT NUMBERS
WAFORD 0005 0041 0048 0068
WAFORG 0005 0030 0032 0032

****F O R T R A N C R O S S R E F E R E N C E L I S T I N G****

LABEL	DEFINED	REFERENCES
10	0008	0011 0027 0030 0042 0061 0103 0120 0143 0155 0169 0177 0183 0201 0222 0248 0252 0253
20	0017	0262 0266 0267 0275 0276
30	0028	0014
40	0033	0024
50	0045	0029 0031
60	0046	0039 0043
70	0048	0036
80	0050	0034
90	0051	0048 0049
100	0062	0047
110	0063	0058
120	0068	0016 0054 0055
130	0069	0066 0067
140	0072	0064
150	0075	0009 0018
160	0087	0072
170	0091	0086
180	0093	0090
190	0106	0088
200	0111	0100 0104
210	0123	0107 0121
220	0125	0117 0121
230	0126	0113
240	0127	0125
250	0146	0124
260	0147	0136 0144
270	0148	0131
280	0150	0094 0130
290	0158	0127
300	0160	0152 0156
310	0161	0159
320	0164	0074 0075 0149
330	0171	0161
340	0180	0170
350	0208	0174 0178 0178 0203 0205
360	0209	0202 0203 0205
370	0210	0194
380	0211	0188
390	0216	0187
400	0225	0181
410	0226	0219
420	0239	0168 0215
430	0240	0231 0234
440	0241	0229
450	0244	0163 0164 0227
460	0251	0241
470	0254	0249 0250
480	0255	0247
490	0258	0243 0244
500	0265	0255
510	0273	0263 0264
		0270 0271

***** D R T R A N . C R O S S R E F E R E N C E L I S T I N G *****

LABEL	DEFINED	REFERENCES
520	0275	0268
530	0277	0261 0274
540	0279	0257 0258

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I SFA	C	R4	000124	J SF	C	R4	000128	K SF	C	R4	00012C	L SF	C	R4	000130
M SFA	C	R4	000134	V S	C	R4	000000	AN SF	C	R4	000138	EY SF	C	R4	00013C
II SF	C	R4	000140	II SF	C	R4	000144	I2 SF	C	R4	000148	J0	C	R4	000050
J1 SFA	C	R4	000054	J2 S	C	R4	000058	J3	C	R4	00005C	J4	C	R4	000060
J5	C	R4	000064	J6	C	R4	000068	KK SF	C	R4	00014C	LN SF	C	R4	000150
NA SF	C	R4	000154	NF F	C	R4	0000A0	NP SFA	C	R4	000158	NP F	C	R4	000098
NX	C	R4	N.R.	NI SF	C	R4	00015C	PI FA	C	R4	000160	ABC	C	R4	N.R.
LPF S	C	R4	000164	NFU SFA	C	R4	000168	PSI SF	C	R4	00016C	SKL SF	C	R4	0000FC
XAF S	C	R4	000000	ABAR SF	C	R4	000170	ABCD	C	R4	N.R.	LERR	C	R4	N.R.
NCAN F	C	R4	0000A8	NFUS F	C	R4	000074	NPTS SF	C	R4	000174	NRAD SFA	C	R4	000178
NREC SF	C	R4	00017C	NSUM SF	C	R4	000180	NWAF F	C	R4	00006C	POES SF	C	R4	0048F8
REFA S	C	R4	0000BC	SFUS SF	C	R4	002AF8	XCAN S	C	R4	000068	XFIN S	C	R4	000958
XFUS SFA	C	R4	002738	XPOD SF	C	R4	004374	NFORX F	C	R4	002918	FDRAG	C	R4	N.R.
NCARD SF	C	R4	000184	NCASE	C	R4	N.R.	PARBA S	C	R4	000088	NRADX F	C	R4	000078
NREST	C	R4	N.R.	NRICH	C	R4	N.R.	XFUSN SFA	C	R4	00018C	PARNO S	C	R4	0001A0
START	C	R4	000188	TZDRD SF	C	R4	0010DB	SQRT	C	R4	000008	XFUSI SFA	C	R4	000004
XMACH	C	R4	N.R.	XREST	C	R4	N.R.	FINORD S	C	R4	000A48	CANORD SF	C	R4	000C88
CANORG SF	C	R4	000C28	CANDRI S	C	R4	00DD58	IBCOM# F	C	R4	000000	FINORG SF	C	R4	000898
FUSARD SFA	C	R4	003908	FUSRAD S	C	R4	003AEB	NPDDOR F	C	R4	00009C	JZTEST S	C	R4	0000B0
NCANOR SFA	C	R4	0000AC	NFINOR F	C	R4	0000A4	PDODRD SF	C	R4	0047AC	NPTS#S SFA	C	R4	0048E4
NTHETA	C	R4	N.R.	NWAFOR SFA	C	R4	000070					PDODRG SF	C	R4	004308
WAFORD SF	C	R4	000188	WAFORG SF	C	R4	000078								

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * * SIZE OF BLOCK 000100 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
ABC	R4	N.R.	J0	I4	000050	J1	I4	000054	J2	I4	000058
J3	I4	00005C	J4	I4	000060	J5	I4	000064	J6	I4	000068
NWAF	I4	00006C	NWAFOR	I4	000070	NFUS	I4	000074	NRADX	I4	000078
NFORX	I4	000088	NP	I4	000098	NPDDOR	I4	00009C	NF	I4	0000A0
NFINOR	I4	0000A4	NCAN	I4	0000A8	NCANOR	I4	0000AC	JZTEST	I4	0000B0
LERR	I4	N.R.	NRICH	I4	N.R.	REFA	R4	0000FC	NCASE	I4	N.R.
XMACH	R4	N.R.	NX	I4	N.R.	NTHETA	I4	N.R.	NREST	I4	N.R.
XREST	R4	N.R.	SKL	R4	0000FC						

NAME OF COMMON BLOCK * * BLK2* SIZE OF BLOCK 00000C HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
V	R4	000000	XFUS1	R4	000004	XFUSN	R4	000008			

NAME OF COMMON BLOCK * * BLACK* SIZE OF BLOCK 0000F8 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XAF	R4	000000	WAFORG	R4	000078	WAFORD	R4	0001B8	TZORD	R4	001DD8
XFUS	R4	002738	ZFUS	R4	002918	SFUS	R4	002AF8	FUSARD	R4	003908
FUSRAD	R4	003AEB	PDODRG	R4	004308	XPOD	R4	004374	PDODRD	R4	0047AC

NPYSPS I** 004BE4 PDES 004BF8 FINORG R** 00D898 XFIN R** 00D958
FINORD R** 00DA48 CANORG R** 00DC28 XCAN R** 00DC68 CANORD R** 00DC88
CANORI R** 00DD58

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
20	00024A	30	0002EE	40	000394	50	00046C
60	000490	70	0004A6	80	0004AE	90	0004F0
100	000592	110	0005A4	120	0005DA	130	00062E
140	000642	150	000652	160	000680	180	000706
190	0007F4	200	000848	210	00095C	220	000984
230	000988	240	0009B8	250	000AFE	260	000822
270	000834	280	00085C	290	000C18	300	000C40
310	000CA4	320	000CB4	330	000D28	340	000E24
350	001080	360	001104	370	001116	380	001128
390	00117A	400	001238	410	00125C	420	001366
430	00138A	440	0013AC	450	00139C	460	001444
470	001540	480	001552	490	001562	500	0015EC
510	00173E	520	001766	530	0017F8	540	001814

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*   NAME= MAIN,OPT=01,LINECNT=55,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT, ID,XREF
*STATISTICS*         SOURCE STATEMENTS = 279 , PROGRAM SIZE = 6204
*STATISTICS*         NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****
```

25K BYTES OF CORE NOT USED

LEVEL 21.8 (JUN 74)

05/360 FORTRAN H

DATE 77.061/21.08.39

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LOCKHEED PROPRIETARY DATA

```

ISN 0002      C
ISN 0003      DIMENSION A (20)
ISN 0004      WRITE (6, 40)
ISN 0005      10 I = 0
ISN 0006      20 READ (5, 50, END=30) A
ISN 0007      WRITE (6, 80) A
ISN 0008      I = I + 1
ISN 0009      IF (I .NE. 44) GO TO 20
ISN 0011      WRITE (6, 60)
ISN 0012      GO TO 10
ISN 0013      30 REWIND 5
ISN 0014      WRITE (6, 70)
ISN 0015      RETURN
ISN 0016      40 FORMAT (1H1, 26MINPUT DATA LISTING FOLLOWS /1H )
ISN 0017      50 FORMAT (20A4)
ISN 0018      60 FORMAT (1H1)
ISN 0019      70 FORMAT (1H0, 17MINPUT DATA LISTED)
ISN 0020      80 FORMAT (1H , 20A4)
ISN 0021      END
00009110
00009120
00009130
00009140
00009150
00009160
00009180
00009190
00009200
00009210
00009220
00009230
00009240
00009250
00009260
00009270
00009280
00009290
00009300
00009310
    
```

O R T R A M C R O S S R E F E R E N C E L I S T I N G *****

INTERNAL STATEMENT NUMBERS
SYMBOL 0003 0006 0007
A 0005 0008 0008 0009
I LSTD78 0002

*****FORTRAN CROSS REFERENCE LISTING*****

LABEL	DEFINED	REFERENCES
10	0005	0012
20	0006	0009
30	0013	0006
40	0016	0004
50	0017	0006
60	0018	0011
70	0019	0014
80	0020	0007

SIZE OF PROGRAM 00021C HEXADECIMAL BYTES PAGE 004

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
A SF		Req	0000E4	I SF		I*	0000DC	IBCOM#	F XF	I*	000000
								LSTDTS		I*	0000E0

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
10	000168	20	00016C	30	0001D8

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```

*OPTIONS IN EFFECT*   NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
*STATISTICS*          SOURCE STATEMENTS = 20 ,PROGRAM SIZE = 540
*STATISTICS*          NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****
*STATISTICS*          NO DIAGNOSTICS THIS STEP
  
```

93K BYTES OF CORE NOT USED

F128-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LIST-MAP
 DEFAULT OPTION(S) USED - SIZE=(131072,18432)
 IEW0000 INCLUDE COMPIL
 IEW0000 ENTRY MAIN

MODULE MAP

CONTROL SECTION			ENTRY									
NAME	ORIGIN	LENGTH	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
MAIN	00	3878	ATANZ	5508	ATAN	55EC	VFI0CS	7070	INTSW	716E		
START	3878	183C	FRDNL#	57A8	FWRNL#	5D90						
LSTDTR	5388	21C	I8COM#	6250	FDI0CS#	630C						
IHC SATN2*	55D8	1CB	INTSWTCH	716E								
IHCNAMEL*	57A8	AA7	SEQDASD	7410								
IHC ECOMH*	6250	F31	SORT	76F8								
IHC COMH2*	7188	56D	ADCON#	7840	FCVADUTP	78EA	FCVLOUTP	797A	FCVZOUTP	7ACA		
IHCSSORT*	76F8	145	FCVIOUYP	7E70	FCVEDUTP	8372	FCVCOUTP	858C	INT6SWCH	8673		
IHCFCVTH*	7840	1195	ARITH#	89D8	ADJSWTCH	8D44	MULFLS	90AC				
IHC EFNTH*	89D8	512	FIOCS#	8EFO	FIOCSBEP	8EF6						
IHC EFIOS*	8EFO	1390	ERRMON	A280	IHCERRE	A298						
IHCERRH *	A280	58C	IHCTRCH	AB90	ERRTRA	AB98						
IHC UOPT *	A840	350										
IHCETRCH*	AB90	28E										
IHC UATBL*	AE20	648										
\$BLANKCOM	B468	100										
BLK2	B568	C										
BLACK	B578	DOF8										
ENTRY ADDRESS	00											
TOTAL LENGTH	19370											

***COMMODULE DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

APPENDIX D

VORLAX TO WAVE DRAG INPUT CONVERSION
PROGRAM (VORTWD)

SUMMARY

A program developed to convert the VORLAX input geometry description into the Wave Drag input geometry description has two purposes: 1) to permit plotting of the configuration geometry in wire frame form as a check on input errors; 2) to save time and reduce human drudgery when configurations for which the geometry was first digitized in the VORLAX format is also to be analyzed for wave drag.

While the present version of VORTWD does not convert all VORLAX input options, it does handle the most common ones. It is recommended that all newly created VORLAX data sets be converted and plotted to validate the input geometry.

INTRODUCTION

In the analysis of an airplane design, what is basically the same geometric body is described by several different geometric models, each of which is unique to the discipline for which it is designed; yet at the same time there exist certain elements common to all models. For example, the NASA Wave Drag format (Reference 12) emphasizes the enclosed volume of the aircraft and correct spatial relationship of components while the VORLAX method of aerodynamic analysis uses a paneling procedure similar to but different in detail from the Wave Drag format.

The program described herein, called VORTWD is for direct transformation from VORLAX to Wave Drag input format. To accomplish this, certain data must be added to the VORLAX dataset to give the program sufficient "smarts" as to which VORLAX panels are associated with which Wave Drag components.

A companion program called WDTVOR converts data from the Wave Drag to VORLAX formats and is described in Appendix C.

Presently the VORTWD program is limited as to the types of VORLAX data sets it can handle as follows:

WINGS

- Wings may have camber but not thickness.
- All wing panels must have the same number (NAP) and values (XAP) of percent chord stations for the camber definition. Flat wings without camber can also be handled.

- All wing panels must span the distance from leading to trailing edge of the wing. That is, separate panels representing leading or trailing edge flaps are not properly treated at present.
- Twist applied to a panel via AINC1 and AINC2 in VORLAX is ignored in the transformation.

FUSELAGE

- VORLAX fuselage simulations consisting of either a single trapezoidal panel of zero thickness or a curved panel having polygonal cross sections may be converted.

NACELLES

- Circular nacelles represented by curved panels in VORLAX can be converted. Nine is the maximum number of nacelles. Nacelles treated as vertical flat plates are better treated as fins.

FINS

- Zero thickness panels without camber are treated; one panel per fin maximum. Six is the maximum number of fins and fin panels.

CANARDS (Horizontal Tail)

- Zero thickness panels without camber are treated; one panel per canard maximum. Two is the minimum number of canards and canard panels.

Two plot control cards compatible with the Configuration Plot Program (Reference 1) are automatically added to the converted dataset.

NOMENCLATURE

Symbol	<u>Description</u>
NWNGP	Total number of VORLAX panels making up the wing description. If wing is cambered, then all panels must have the same number of percent chords (NAP) and the same values of percent chords (XAF) in the camber description. This is a Wave Drag requirement but not a VORLAX requirement. Input as an integer, no decimal point. Maximum value is 20.

<u>Symbol</u>	<u>Description</u>
NWING	VORLAX panel numbers making up the wing. VORLAX panels are numbered according to their input sequence, not by any alpha-numeric description appearing to the right of the VORLAX data cards. Wing panel numbers need not be consecutive but they must be listed in a sequence proceeding from root to tip. Input as integers separated by commas. The maximum number of values is 20 and the number listed must be equal to the NWNGP value.
NFUSP	The total number of panels making up the fuselage. The fuselage is assumed to consist of only one major fuselage segment in terms of Wave Drag. Input one as an integer.
NFUSE	The VORLAX panel number describing the fuselage.
NP	Number of curved panels describing pods or engine nacelles. Maximum value is 9.
NPPAN	List of VORLAX panel numbers making up the pod or nacelle descriptions. One panel per pod. Presently, such panels should be curved panels, i.e., $PDL > 360$. If a nacelle is being simulated as a vertical flat plate or plates, then it would be more appropriately treated as a fin or fins for Wave Drag purposes.
NF	Number of fins to be described. Symmetric fins need be described only once. Maximum value is 6.
NFPAN	List of VORLAX panel numbers making up the fin descriptions. Maximum number is 6 and number listed must be equal to the NF value. That is, one panel per fin.
NCAN	Number of canards (horizontal tails) to be described. Maximum value is 2.
NCANP	List of VORLAX panel numbers making up the canard (horizontal tail) descriptions. Maximum number is 2 and number listed must be equal to NCAN. That is one panel per canard.
PLOTSZ	The maximum dimension in inches of the plot to be made from the plot cards appended to the converted dataset. Same definition as PLOTSZ in the Configuration Plot program (Reference 1).

PROCEDURE

1. Create a VORLAX dataset if it does not exist already.

2. Add smarts cards to the front of the VORLAX dataset. A typical dataset with smarts cards included is shown in Figure D-1. Note that all such cards are input in namelist format in which nothing may be entered in column one; only columns 2 through 80 may be used. The first namelist card must contain &INPUT and the last card &END. Input quantities are input as VARIABLE NAME = VALUE, as shown in Figure D-1. Variables may be named in any order. Definitions for the various smarts variables are found in the nomenclature section.
3. Submit smartened dataset to the VORTWD conversion program. Figure D-2 shows the output resulting from conversion to Wave Drag format.
4. Validate the converted dataset by submitting it to the Configuration Plot program (Reference 1). Figure D-3 and D-4 shows the plotted results of the Figure D-2 dataset.
5. If the configuration is to be analyzed for Wave Drag; the converted dataset must be edited to supply thickness distributions for the wing and tail surfaces and if the VORLAX fuselage simulation was the single trapezoidal kind, then it must be given volume.

2091.0000	204.0000	-104.0000	394.0000	NACELLE PANEL NO 2
2091.0000	204.0000	-104.0000	394.0000	NACELLE PANEL NO 2
8.0000	5.0000	0.0	999.0000	NVOR,RNCV,SPC,PDL
90.0000	32.0000	45.0000	32.0000	32.0000 -45.0000
-270.0000	32.0000	-135.0000	32.0000	32.0000 -225.0000
0.0	0.0	0	0	0
0.0	11.9148	100.0000	3	1
0.0	111.4062	111.4062	194.5000	FIN PANEL NO: 1
100.0000	645.0000	-100.0000	141.1000	FIN PANEL NO: 1
2480.0000	645.0000	-28.0000	0.0	NVOR,RNCV,SPC,PDL
2595.3999	10.0000	1.0000	0	0
2.0000	0.0	0	294.0999	FIN PANEL NO: 2
0.0	0.0	-27.0000	67.7000	FIN PANEL NO: 2
3183.8999	0.0	66.5000	0.0	NVOR,RNCV,SPC,PDL
3403.2000	0.0	1.0000	0	0
2.0000	10.0000	0	283.7998	CANARD PANEL NO: 1
0.0	0.0	0	76.4000	CANARD PANEL NO: 1
3116.3999	33.0000	-40.0000	0.0	NVOR,RNCV,SPC,PDL
3354.0000	174.4000	-40.0000	0	0
2.0000	10.0000	1.0000	0	0
0.0	0.0	0	0	NXS,NYS,NZS
0	0	0	0	0

INPUT DATA LISTED

Figure D-1.- Concluded

2094.00	214.00	-0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORG	1
0.0	47.76	393.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	XPOD	1
33.92	34.77	34.77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORD	1
2091.00	204.00	-104.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORG	2
0.0	46.94	394.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	XPOD	2
32.00	33.78	33.78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PODORD	2
2480.00	645.00	-100.00	194.5	2595.4	645.0	-28.0	141.1						FINORG	
0.0	100.0												XFIN	
0.0	0.0												FINORD	
3183.9	0.0	-27.0	294.1	3403.2	0.0	66.5	67.7						FINORG	
0.0	100.0												XFIN	
0.0	0.0												FINORD	
3116.4	33.0	-40.0	283.8	3354.0	174.4	-40.0	76.4						CANORG	
0.0	100.0												XCAN	
0.0	0.0												CANORD	
X Y								10.00ORT						
X Z	26.62-24.139.23							12.25ORT						
														1

Figure D-2.- Concluded

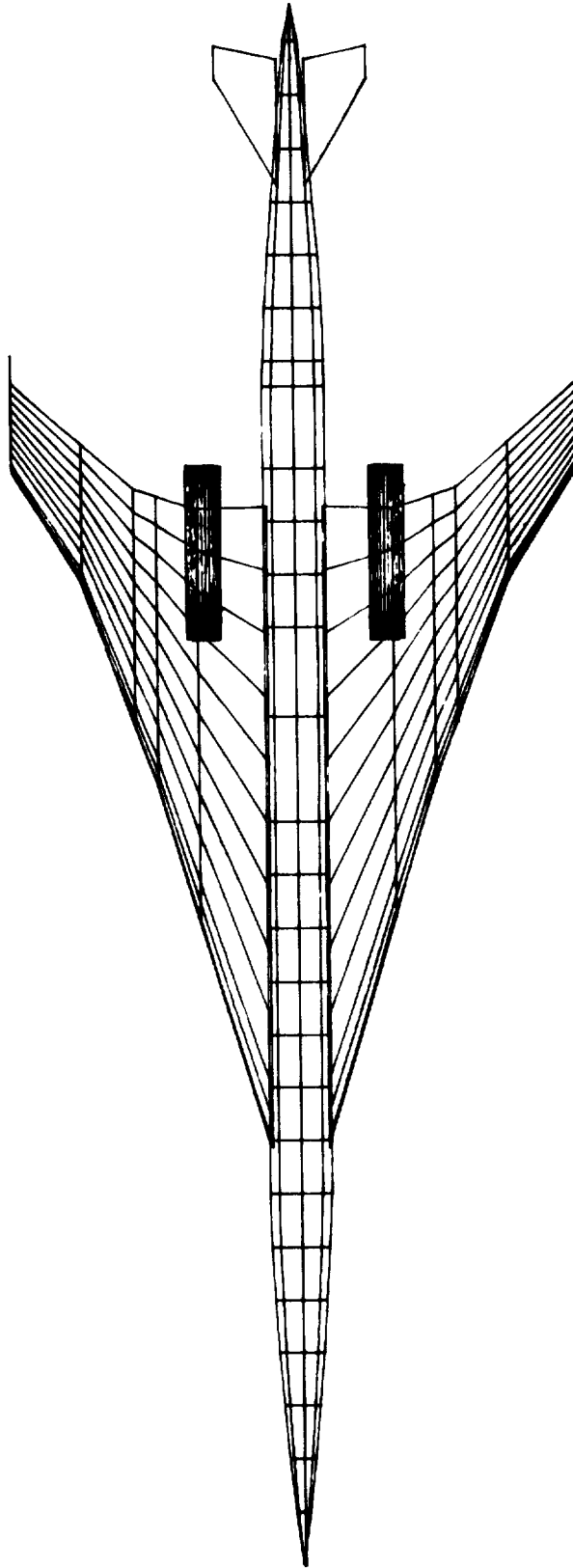


Figure D-3.- Planform plot from figure D-2 dataset

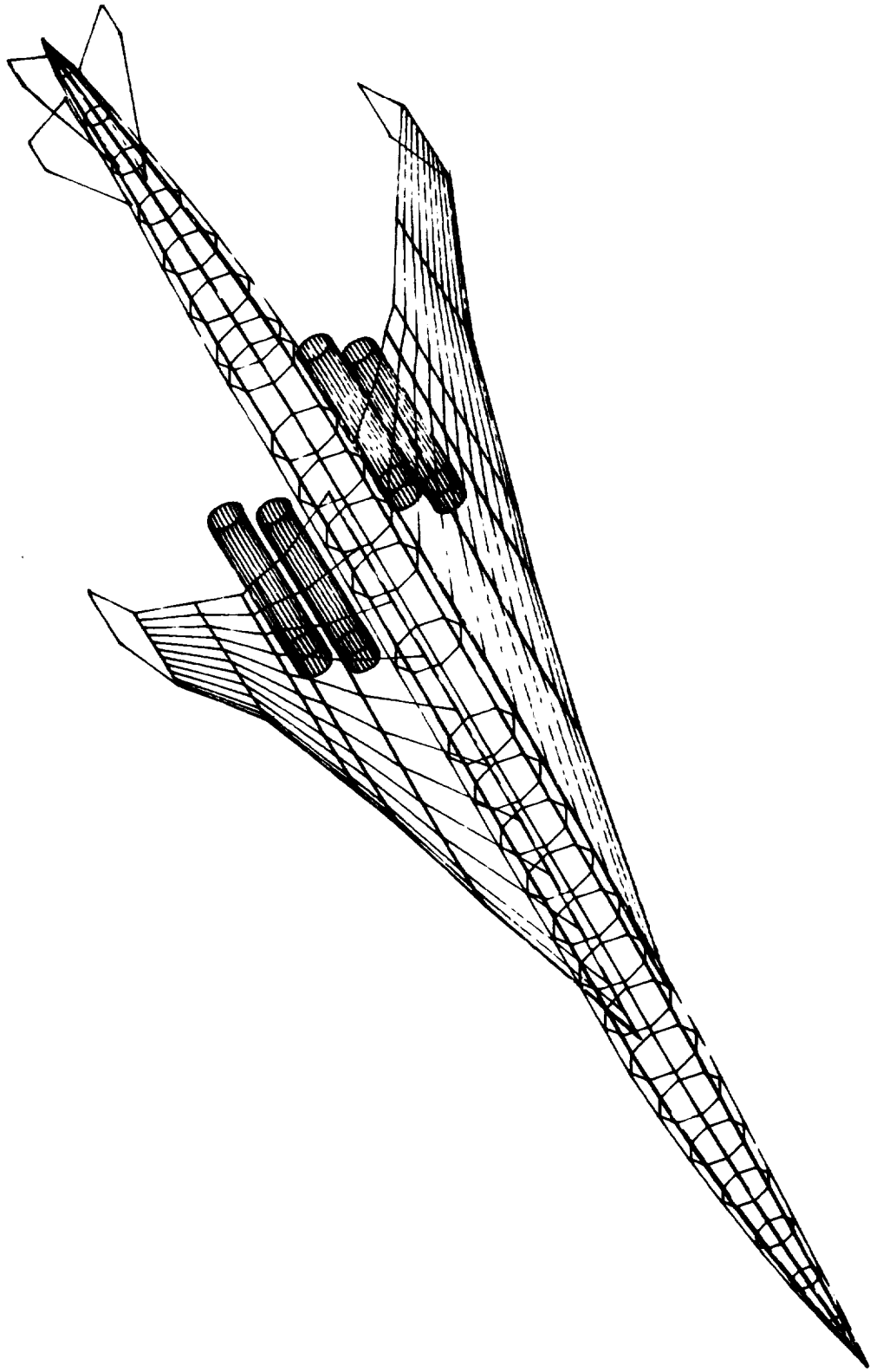


Figure D-4.- Isometric plot from figure D-2 dataset



PROGRAM

VORLAX TO WAVE DRAG
INPUT CONVERSION PROGRAM
(VORTWD)

COMPLETE COMPILE
AND EXECUTION
IN IBM FORTRAN IV LEVEL H

LOCKHEED PROPRIETARY DATA

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COMPILER OPTIONS - NAME= MAIN,OPT=1,LINECNT=55,SIZE=0000K,
SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT, ID,XREF          9/21/76 00000010
CONTROL*VRLX.VORTWON
C....
C.... PROGRAM TO CONVERT DATA FROM VORLAY PROGRAM OUTPUT INTO 00000020
C.... WAVEDRAG INPUT. THERE ARE MANY RESTRICTIONS IN THIS CONVERSION 00000030
C.... AND THE USERS GUIDE SHOULD BE CONSULTED FOR AN EXPLANATION. 00000040
C....
C.... DIMENSION NHING (20), II (24), NMPX (40), XY7C2 (4, 40), 00000050
* ZC12 (2, 30, 40), XAFX (30, 40), NFUSE (6), YFUS (6, 30), 00000060
* ZFUS (6, 30), XFUS (30), ABCD (6, 2, 4), NFPAN (6), XFIN (10), 00000070
* FINDRD(10), XCAN(10), CANDRD(10), NCANP(2), NPPAN(9), RHO(20), 00000080
* PDDORG (3), PHEE (20), XPPD (9,10), PDDORD (9,10), NPP(20) 00000090
NAMELIST/INPUT/NHNGP, NHING, NFUSP, NFUSE, NF, NFPAN, NCAN, NCANP 00000100
*, PLOTSZ, NP, NPPAN 00000110
* FORMAT (10A4) 00000120
* DIMENSION XAF (50), ZC1 (50), ZC2 (50), AFUS(30), ZFUSS(30) 00000130
* TITLE (20), XS (20), CI (20), C2 (20) 00000140
REAL*4 MACH, NVOR, LESWP 00000150
COMMON /SET4 /AJNC1 (20), AJNC2 (20) 00000160
COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40), 00000170
* LESWP (40), SYNTH (40), IQUANT (40) 00000180
COMMON /SET7 /RNCV (20), ITS (20) 00000190
COMMON /SET12 /CSTART (40), TAPER (40), PSPAN (40), NVOR (40) 00000200
COMMON /SET13 /MACH (8) 00000210
COMMON /SET23 /SLE1 (20), SLE2 (20), SPC (40) 00000220
CALL LSTOT8 00000230
PI = 3.14159 00000240
L3 = 3 00000250
DO 40 I = 1, 10 00000260
XFIN (I) = 0. 00000270
FINORD (I) = 0. 00000280
XCAN (I) = 0. 00000290
CANDRD (I) = 0. 00000300
IF (I .LE. 6) XFUS (I) = 0. 00000310
CONTINUE 00000320
DO 50 I = 1, 30 00000330
DO 50 J = 1, 6 00000340
XFUS (I) = 0. 00000350
AFUS (I) = 0. 00000360
ISN 0002
ISN 0004
ISN 0005
ISN 0006
ISN 0007
ISN 0008
ISN 0009
ISN 0010
ISN 0011
ISN 0012
ISN 0013
ISN 0014
ISN 0015
ISN 0016
ISN 0017
ISN 0018
ISN 0019
ISN 0020
ISN 0021
ISN 0022
ISN 0023
ISN 0024
ISN 0026
ISN 0027
ISN 0028
ISN 0029
    
```

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ISN 0030      YFUS (J, I) = 0.
ISN 0031      ZFUS (J, I) = 0.
ISN 0032      CONTINUE
ISN 0033      DO 60 I = 1, 6
ISN 0034      DO 60 J = 1, 2
ISN 0035      DO 60 K = 1, 4
ISN 0036      ARCD (I, J, K) = 0.
ISN 0037      CONTINUE
ISN 0038      DO 70 I = 1, 2
ISN 0039      DO 70 J = 1, 30
ISN 0040      DO 70 K = 1, 40
ISN 0041      ZC12 (I, J, K) = 0.
ISN 0042      CONTINUE
ISN 0043      NMRNGP = 0
ISN 0044      NF = 0
ISN 0045      NCMAN = 0
ISN 0046      NFUSP = 0
ISN 0047      NP=0
ISN 0048      NPPAN(1)=0
ISN 0049      DTR = .017453
ISN 0050      PLOTSZ = 10.
ISN 0051      READ (5, INPUT,END=940)
ISN 0052      READ (5, 10) TITLE
ISN 0053      WRITE (L3, 10) TITLE
ISN 0054      READ (5, 80) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY, ITRMAX
ISN 0055      FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)
ISN 0056      READ (5, 90) NMACH, (MACH (I), I = 1, NMACH)
ISN 0057      FORMAT (I2, 8X, 7F10.0)
ISN 0058      WRITE (6, 20) TITLE
ISN 0059      READ (5, 90) NALPHA, (ALPHA (I), I = 1, NALPHA)
ISN 0060      READ (5, 90) LATRAL, PSI, PITCHO, ROLLO, YAWO, VINP
ISN 0061      IF (PSI .NE. 0.) LATRAL = 1
ISN 0062      IF (ROLLQ .NE. 0.) LATRAL = 1
ISN 0063      IF (YAWQ .NE. 0.) LATRAL = 1
ISN 0064      IF (VINP .LE. 0.001) VINP = 1.0
ISN 0065      READ (5, 100) NSPAN, SREF, CBAR, XBAR, ZBAR, WSPAN
ISN 0066      FORMAT (I2, 8X, 5F10.0)
ISN 0067      IF (WSPAN .LE. 0.0001) WSPAN = 2.0
ISN 0068      C
ISN 0069      110  FORMAT (8F10.0)
ISN 0070      INVERS = 0
ISN 0071      DO 200 I = 1, NSPAN
ISN 0072      READ (5, 120) X1, Y1, Z1, CORD1, DESCRP
ISN 0073      READ (5, 120) X2, Y2, Z2, CORD2, DESCRP
ISN 0074      XY7C2 (1, I) = X2
ISN 0075      XY7C2 (2, I) = Y2
ISN 0076      XY7C2 (3, I) = Z2
ISN 0077      XY7C2 (4, I) = CORD2
ISN 0078      READ (5, 120) NVDR (I), RNCV (I), SPC (I), CURV (I), DESCRP
ISN 0079      PDL (I) = 0.
ISN 0080      IF (CURV (I) .NE. 0.) PDL (I) = 999.
ISN 0081      IF (CURV (I) .GT. 500.0) CURV (I) = 0.0
ISN 0082      120  FORMAT (4F10.0, 10A4)
ISN 0083
ISN 0084
ISN 0085
ISN 0086
ISN 0087
ISN 0088
00000410
00000420
00000430
00000440
00000450
00000460
00000470
00000480
00000490
00000500
00000510
00000520
00000530
00000540
00000550
00000560
00000570
00000572
00000574
00000580
00000590
00000600
00000620
00000630
00000640
00000650
00000660
00000670
00000680
00000690
00000700
00000710
00000720
00000730
00000740
00000750
00000760
00000770
00000780
00000790
00000800
00000810
00000820
00000830
00000840
00000850
00000860
00000870
00000880
00000890
00000900
00000910
00000920

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ISN 0089 INTRAC = 1
ISN 0090 IF (PDL (I) .EQ. 0.) INTRAC = 0
ISN 0091 XAPEX (I) = XI
ISN 0092 XAPEX (I) = YI
ISN 0093 XAPEX (I) = ZI
ISN 0094 CSTART (I) = CORDI
ISN 0095 DELTAY = Y2 - Y1
ISN 0096 DELTAZ = Z2 - Z1
ISN 0097 IF (INTRAC .EQ. 0) PDL (I) = 1./DTR *ATAN2 (DELTAZ, DELTAY)
ISN 0100 IF (INTRAC .EQ. 0) GO TO 150
ISN 0101 NV = NVDR (I)
ISN 0102 IBOT = 1
ISN 0103 IF (I .EQ. 1) GO TO 140
ISN 0104 ITOP = I - 1
ISN 0106 DO 130 J = 1, ITOP
ISN 0107 INV = NVDR (J)
ISN 0108 IBOT = IBOT + INV
ISN 0109 130 CONTINUE
ISN 0110 ITOP = IBOT + NV - 1
ISN 0111 JJTOP = NVDR (I) + 1
ISN 0112 READ (5, 110) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)
ISN 0113 PHEE (I) = PHI (I)
ISN 0114 RMO (I) = RO (I)
ISN 0115 150 READ (5, 160) AINC1 (I), AINC2 (I), ITS (I), NAP, IQUANT(I),
ISN 0116 * ISYNT, NPP (I)
ISN 0117 NAPX (I) = NAP
ISN 0118 160 FORMAT (2F10.0, 5 (I2, 8X))
ISN 0119 SYNTH (I) = ISYNT
ISN 0120 MAX = RNCV (I)
ISN 0121 IF (ISYNT .EQ. 0) GO TO 170
ISN 0123 READ (5, 110) (C1 (K), K = 1, MAX)
ISN 0124 READ (5, 110) (C2 (K), K = 1, MAX)
ISN 0125 INVERS = 1
ISN 0126 SLE1 (I) = 0.
ISN 0127 SLE2 (I) = 0.
ISN 0128 GO TO 200
ISN 0129 170 IF (NAP .LT. 3) GO TO 200
ISN 0131 ILE = ITS (I) * (1 - INTRAC)
ISN 0132 RLE1 = 0.
ISN 0133 RLE2 = 0.
ISN 0134 READ (5, 110) (XAF (JJ), JJ = 1, NAP)
ISN 0135 DO 180 JJ = 1, NAP
ISN 0136 XAFX (JJ, I) = XAF (JJ)
ISN 0137 IF (ILE .NE. 0) READ (5, 110) RLE1
ISN 0139 READ (5, 110) (ZC1 (JJ), JJ = 1, NAP)
ISN 0140 IF (ILE .NE. 0) READ (5, 110) RLE2
ISN 0142 READ (5, 110) (ZC2 (JJ), JJ = 1, NAP)
ISN 0143 DO 190 JJ = 1, NAP
ISN 0144 ZC12 (1, JJ, I) = ZC1 (JJ)
ISN 0145 ZC12 (2, JJ, I) = ZC2 (JJ)
ISN 0146 190 CONTINUE
ISN 0147 200 CONTINUE
ISN 0148 READ (5, 210) NXS, NYS, NZS
ISN 0149 210 FORMAT (3 (I2, 8X))
00000930
00000940
00000950
00000960
00000970
00000980
00000990
0001000
0001010
0001020
0001030
0001040
0001050
0001060
0001070
0001080
0001090
0001100
0001110
0001120
0001130
0001140
0001150
0001160
0001170
0001180
0001190
0001200
0001210
0001220
0001230
0001240
0001250
0001260
0001270
0001280
0001290
0001300
0001310
0001320
0001330
0001340
0001350
0001360
0001370
0001380
0001390
0001400
0001410
0001420
0001430
0001440
0001450

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ISN 0149 IF (NXS .GT. 0) READ (5, 110) (XS (I), I = 1, NXS)
ISN 0151 IF (NXS .GT. 0) READ (5, 110) YNOT, DELTAV, ZNOT, DELTAZ
ISN 0153 DO 220 I = 1, 24
ISN 0154 II (I) = 0
ISN 0155 CONTINUE
ISN 0156 II (1) = 1
ISN 0157 IF (NMGPP .GT. 0) II (2) = 1
ISN 0159 IF (NMGPP .GT. 0) NAP = NAPX (NMING (1))
ISN 0161 IF (NFUSP .GT. 0) II (3) = 1
ISN 0163 IF (PDL (NFUSE (1)) .GT. 360.) II (3) = -1
ISN 0165 IF (NMGPP .GT. 0) II (8) = NMGPP + 1
ISN 0167 II (10) = 1
ISN 0168 IF (NFUSP .EQ. 0) GO TO 230
ISN 0170 IF (NFUSE (1))
ISN 0171 IF (PDL (IB) .EQ. 0) II (11) = 3
ISN 0173 IF (PDL (IB) .GT. 360.) II (11) = NVOR (IB) + 1
ISN 0175 ITNOSE = 0
ISN 0176 ITAFT = 0
ISN 0177 IF (ABS ((XYZC2 (1, IB) + XYZC2 (4, IB)) - (XAPEX (IB) + CSTART (IB))) .GE. .01) ITNOSE = 1
ISN 0179 IF (ABS ((XYZC2 (1, IB) + XYZC2 (4, IB)) - (XAPEX (IB) + CSTART (IB))) .GE. .01)
* ITAFT = 1

220 IF (NMGPP .GT. 0) II (9) = NAP
IF (NAPX (NMING (1)) .EQ. 0) II (9) = 2
IF (II (9) .EQ. 2) NAP = 2
IF (NFUSP .GT. 0 .AND. PDL (IB) .LT. 360.) II (12) = 2 + ITNOSE + ITAFT
IF (PDL (IB) .GT. 360.) II (12) = NAPX (IB)
IF (NF .GT. 0) II (5) = 1
II (21) = NF
IF (NF .GT. 0) II (22) = 2
IF (NCAN .GT. 0) II (6) = 1
II (23) = NCAN
IF (NCAN .GT. 0) II (24) = 2
IF (NP .GT. 0) II (4) = 1
II (19) = NP
IF (NP .GT. 0) NPODOR = NAPX (NPPAW (1))
IF (NP .GT. 0) II (20) = NPODOR
WRITE (L3, 480) II
WRITE (6, 610) II
ISREF = SREF
WRITE (L3, 490) ISREF
WRITE (6, 620) ISREF
IF (NMGPP .EQ. 0) GO TO 290
IF (II (9) .NE. 2) GO TO 240
XAFX (1, NMING (1)) = 0.
XAFX (2, NMING (1)) = 100.
WRITE (L3, 500) (XAFX (JJ, NMING (1)), JJ = 1, NAP)
WRITE (6, 630) (XAFX (JJ, NMING (1)), JJ = 1, NAP)
DO 250 I = 1, NMGPP
IW = NMING (I)
WRITE (6, 640) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW)
ISN 0223 WRITE (L3, 510) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW)
ISN 0224 1WT = NMING (NMGPP)
ISN 0225 WRITE (L3, 510) (XYZC2 (I, IMT), I = 1, 4)

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00001460
00001470
00001480
00001490
00001500
00001510
00001520
00001530
00001540
00001550
00001560
00001570
00001580
00001590
00001600
00001610
00001620
00001630
00001640
00001650
00001660
00001670
00001680
00001690
00001700
00001710
00001720
00001730
00001740
00001750
00001760
00001770
00001780
00001790
00001800
00001810
00001820
00001830
00001840
00001850
00001860
00001870
00001880
00001890
00001900
00001910
00001920
00001930
00001940
00001950
00001960
00001970
00001980

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ISN 0227 WRITE (6, 640) (XYZC2 (I, IW), I = 1, 4)
ISN 0228 ZERO = 0.
ISN 0229 DO 270 I = 1, NMINGP
ISN 0230 IW = NMINGP (I)
ISN 0231 DO 260 JJ = 1, NAP
ISN 0232 ZC12 (1, JJ, IW) = ZC12 (1, JJ, IW) *CSTART (IW) /100.
ISN 0233 ZC12 (2, JJ, IW) = ZC12 (2, JJ, IW) *XYZC2 (4, IW) /100.
ISN 0234 260 CONTINUE
ISN 0235 WRITE (L3, 520) (ZC12 (1, JJ, IW), JJ = 1, NAP)
ISN 0236 WRITE (6, 650) (ZC12 (1, JJ, IW), JJ = 1, NAP)
ISN 0237 270 CONTINUE
ISN 0238 WRITE (L3, 520) (ZC12 (2, JJ, IW), JJ = 1, NAP)
ISN 0239 NMINGP1 = NMINGP + 1
ISN 0240 DO 280 I = 1, NMINGP1
ISN 0241 WRITE (6, 660) (ZERO, JJ = 1, NAP)
ISN 0242 WRITE (L3, 530) (ZERO, JJ = 1, NAP)
ISN 0243 280 CONTINUE
ISN 0244

C GETTING THE X VALUES FOR THE FUSELAGE
C
C 290 NFORX = II (12)
C IF (NFUSP .EQ. 0) GO TO 370
C IB = NFUSE (1)
C IF (PDL (IB) .GT. 360.) GO TO 330
C XFUS (1) = XAPEX (IB)
C IF (ITNOSE .GT. 0) XFUS (2) = XYZC2 (1, IB)
C XFEND = XYZC2 (1, IB) + XYZC2 (4, IB)
C IF (ITNOSE .GT. 0 .AND. ITAFT .GT. 0) XFUS (3) = XFEND
C IF (ITNOSE .EQ. 0 .AND. ITAFT .GT. 0) XFUS (2) = XFEND
C XFUS (NFORX) = XAPEX (IB) + CSTART (IB)
C NWDS = NFORX
C IF (NFORX .LT. 6) NWDS = 6
C WRITE (L3, 540) (XFUS (JJ), JJ = 1, NWDS)
C WRITE (6, 670) (XFUS (JJ), JJ = 1, NWDS)

C GETTING THE Y & Z VALUES FOR THE FUSELAGE
C
C YFUS (1, 1) = YAPEX (IB)
C YFUS (1, 2) = XYZC2 (2, IB)
C IF (ITNOSE .GT. 0) YFUS (1, 2) = YAPEX (IB)
C YFUS (1, 3) = YAPEX (IB)
C ZFUS (1, 1) = ZAPEX (IB)
C ZFUS (1, 2) = XYZC2 (3, IB)
C IF (ITNOSE .GT. 0) ZFUS (1, 2) = ZAPEX (IB)
C ZFUS (1, 3) = ZAPEX (IB)
C IF (ITNOSE .EQ. 0) GO TO 300
C YFUS (2, 1) = YAPEX (IB)
C YFUS (2, 2) = XYZC2 (2, IB)
C YFUS (2, 3) = YAPEX (IB)
C ZFUS (2, 1) = ZAPEX (IB)
C ZFUS (2, 2) = XYZC2 (3, IB)
C ZFUS (2, 3) = ZAPEX (IB)

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00001990
00002000
00002010
00002020
00002030
00002040
00002050
00002060
00002070
00002080
00002090
00002100
00002110
00002120
00002130
00002140
00002150
00002160
00002170
00002180
00002190
00002200
00002210
00002220
00002230
00002240
00002250
00002260
00002270
00002280
00002290
00002300
00002310
00002320
00002330
00002340
00002350
00002360
00002370
00002380
00002390
00002400
00002410
00002420
00002430
00002440
00002450
00002460
00002470
00002480
00002490
00002500
00002510

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ISN 0283
ISN 0285
ISN 0286
ISN 0287
ISN 0288
ISN 0289
ISN 0290
ISN 0291
ISN 0292
ISN 0293
ISN 0294
ISN 0296
ISN 0297
ISN 0298
ISN 0299
ISN 0301
ISN 0302
ISN 0303
ISN 0304
ISN 0305
ISN 0307
ISN 0308
ISN 0309
ISN 0310
ISN 0311
ISN 0312

ISN 0313
ISN 0314
ISN 0315
ISN 0316
ISN 0317
ISN 0318

ISN 0319
ISN 0320
ISN 0322
ISN 0323
ISN 0324
ISN 0325
ISN 0326

ISN 0327
ISN 0328
ISN 0330

300 IF (ITAFT .EQ. 0) GO TO 310
      YFUS (3, 1) = YAPEX (IB)
      YFUS (3, 2) = XYZC2 (2, IB)
      YFUS (3, 3) = YAPEX (IB)
      ZFUS (3, 1) = ZAPEX (IB)
      ZFUS (3, 2) = XYZC2 (3, IB)
      ZFUS (3, 3) = ZAPEX (IB)
310 CONTINUE
      YFUS (NFORX, 1) = YAPEX (IB)
      YFUS (NFORX, 2) = XYZC2 (2, IB)
      IF (ITAFT .GT. 0) YFUS (NFORX, 2) = YAPEX (IB)
      YFUS (NFORX, 3) = YAPEX (IB)
      ZFUS (NFORX, 1) = ZAPEX (IB)
      ZFUS (NFORX, 2) = XYZC2 (3, IB)
      IF (ITAFT .GT. 0) ZFUS (NFORX, 2) = ZAPEX (IB)
      ZFUS (NFORX, 3) = ZAPEX (IB)
      DO 320 I = 1, NFORX
      NRADX = II (11)
      NWDS = NRADX
      IF (NRADX .LT. 10) NWDS = 10
      WRITE (L3, 560) (YFUS (I, JJ), JJ = 1, NWDS)
      WRITE (L6, 690) (YFUS (I, JJ), JJ = 1, NWDS)
      WRITE (L3, 570) (ZFUS (I, JJ), JJ = 1, NWDS)
      WRITE (L6, 700) (ZFUS (I, JJ), JJ = 1, NWDS)
320 CONTINUE
      GO TO 370
C
C TREATMENT OF CURVED PANEL FUSELAGE
C GETTING X VALUES OF FUSELAGE
C
330 NXFUS = II (12)
      DO 340 JJ = 1, NXFUS
      XFUS (JJ) = XAPEX(NFUSE(1)) + XAFX (JJ, IB) * CSTART (IB) / 100.
340 CONTINUE
      WRITE (L3, 550) (XFUS (JJ), JJ = 1, NXFUS)
      WRITE (L6, 680) (XFUS (JJ), JJ = 1, NXFUS)
C
C GETTING THE FUSELAGE CAMBER LINE
C
      ZRATIO = 0.
      IF (NPP (IB) .GT. 0) ZRATIO = 1.0
      DO 350 JJ = 1, NXFUS
      ZFUSS (JJ) = ZC12 (1, JJ, IB) * ZRATIO * CSTART (IB) / 100.
350 CONTINUE
      WRITE (L3, 900) (ZFUSS (JJ), JJ = 1, NXFUS)
      WRITE (L6, 910) (ZFUSS (JJ), JJ = 1, NXFUS)
C
C GETTING THE FUSELAGE CROSS-SECTIONAL AREAS, AFUS
C EACH VORLAX CROSS SECTION IS ASSUMED HAVE A CONSTANT RADIUS
C
      DO 360 JJ = 1, NXFUS
      IF (NPP (IB) .GT. 0) ARATIO = ZC12 (2, JJ, IB) / 100.
      IF (NPP (IB) .EQ. 0) ARATIO = 1.
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AFUS (JJ) = ARATIO *PI *RMD (IB) **2
CONTINUE
WRITE (L3, 920) (AFUS (JJ), JJ = 1, NXFUS)
WRITE (6, 930) (AFUS (JJ), JJ = 1, NXFUS)

C
C   SETTING UP FOR MACELLES
C
370 IF (II (19) .EQ. 0) GO TO 410
DO 400 JK = 1, NP
NW = NPPAN (JK)
PODORG (1) = XAPEX (NW)
PODORG (2) = YAPEX (NW)
PODORG (3) = ZAPEX (NW) - RMD (NW) *COS (DTR*PHEE (NW))
WRITE (L3, 840) ((PODORG (KL), KL = 1, 3), JK)
WRITE (6, 850) ((PODORG (KL), KL = 1, 3), JK)
DO 380 KK = 1, 10
XPOD (JK, KK) = 0.
IF (KK .GT. NPODOR) GO TO 380
XPOD (JK, KK) = XAFX (KK, NW) *CSTART (NW) /100.
CONTINUE
380 WRITE (L3, 860) (XPOD (JK, KK), KK = 1, 10), JK
WRITE (6, 870) (XPOD (JK, KK), KK = 1, 10), JK
DO 390 KK = 1, 10
PODORD (JK, KK) = 0.
IF (KK .GT. NPODOR) GO TO 390
PODORD (JK, KK) = ZC12 (2, KK, NW)
IF (NPPAN(NW) .NE. 0) PODORD (JK, KK) = SQRT(ZC12(2, KK, NW) /100.) *RMD (NW)
CONTINUE
390 WRITE (L3, 880) (PODORD (JK, KK), KK = 1, 10), JK
WRITE (6, 890) (PODORD (JK, KK), KK = 1, 10), JK
CONTINUE
400 CONTINUE
C
C   SETTING UP FOR FINS
C
410 IF (NF .EQ. 0) GO TO 440
DO 420 NN = 1, NF
IB = NFPAN (NN)
ABCD (NN, 1, 1) = XAPEX (IB)
ABCD (NN, 1, 2) = YAPEX (IB)
ABCD (NN, 1, 3) = ZAPEX (IB)
ABCD (NN, 1, 4) = CSTART (IB)
ABCD (NN, 2, 1) = XYZC2 (1, IB)
ABCD (NN, 2, 2) = XYZC2 (2, IB)
ABCD (NN, 2, 3) = XYZC2 (3, IB)
ABCD (NN, 2, 4) = XYZC2 (4, IB)
CONTINUE
420 XFIN (1) = 0.
XFIN (2) = 100.
FINORD (1) = 0.
FINORD (2) = 0.
DO 430 NN = 1, NF
WRITE (6, 710) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)
WRITE (L3, 580) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)

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640 FORMAT (1H , 4F7.2, 42X, 6H WORG)
650 FORMAT (1H , 10F7.2, 7H TZORD)
660 FORMAT (1H , 10F7.3, 6H WORD)
670 FORMAT (1H , 6F7.2, 28X, 6H XFUS)
680 FORMAT (1H , 10F7.2, 6H XFUS)
690 FORMAT (1H , 10F7.2, 6H XFUS)
700 FORMAT (1H , 10F7.2, 6H ZFUS)
710 FORMAT (1H , 8F7.1, 14X, 8H FINORG)
720 FORMAT (1H , 2F7.1, 56X, 6H XFIN)
730 FORMAT (1H , 2F7.1, 56X, 8H FINORD)
740 FORMAT (8F7.1, 14X, 8H CANORG)
750 FORMAT (1H , 8F7.1, 14X, 8H CANORG)
760 FORMAT (2F7.1, 56X, 6H XCAN)
770 FORMAT (1H , 2F7.1, 56X, 6H XCAN)
780 FORMAT (2F7.1, 56X, 8H CANORD)
790 FORMAT (1H , 2F7.1, 56X, 8H CANORD)
800 FORMAT (3HX Y, 44X, F5.2, 3HORT)
810 FORMAT (1H , 3HX Y, 44X, F5.2, 3HORT)
820 FORMAT (3HX Z, 44X, F5.2, 7HCRTISOL, 12X, 1H1)
830 FORMAT (1H , 3HX Z, 44X, F5.2, 7HCRTISOL, 12X, 1H1)
840 FORMAT (3F7.2, 51X, 6HPDDORG, I2)
850 FORMAT (1H , 3F7.2, 51X, 6HPDDORG, I2)
860 FORMAT (10F7.2, 2X, 6HXPOD , I2)
870 FORMAT (1H , 10F7.2, 2X, 6HXPOD , I2)
880 FORMAT (10F7.2, 2X, 6HPDDORD, I2)
890 FORMAT (1H , 10F7.2, 2X, 6HPDDORD, I2)
900 FORMAT (10F7.2, 6H ZFUS)
910 FORMAT (1H , 10F7.2, 6H ZFUS)
920 FORMAT (10F7.1, 6H AFUS)
930 FORMAT (1H , 10F7.1, 6H AFUS)

940 STOP
      GO TO 30
      END

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*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS
ITS	0011 0116 0131
IWT	0225 0226 0227
LAX	0054
LAY	0054
MAX	0120 0123 0124
NAP	0116 0117 0129 0134 0135 0139 0142 0143 0159 0181 0185 0219 0220 0231 0235 0236 0238 0239 0242
NPP	0243
NXS	0002 0116 0320 0328 0330 0358
NYS	0147 0149 0151
NZS	0147
PDL	0010 0083 0084 0090 0098 0163 0171 0173 0187 0189 0249
PHI	0007 0113 0114
PSI	0060 0061
RMD	0002 0115 0332 0342 0358
SPC	0014 0082
XAF	0006 0134 0136
ZCI	0006 0139 0144
ZCZ	0006 0142 0145
ABCD	0302 0336 0368 0369 0370 0371 0372 0373 0374 0375 0382 0383 0393 0394 0395 0396 0397 0398 0399
AFUS	0400 0407 0408 0332 0334 0335
CBAR	0006 0029 0332 0334 0335
CURV	0007 0082 0084 0086 0086
IBOT	0103 0109 0109 0111
JTOP	0106 0107 0111
MACH	0008 0013 0056
NAPX	0002 0117 0159 0183 0189 0204
NCAN	0003 0045 0196 0198 0199 0389 0391 0406
NPAN	0069 0075
NVOR	0008 0012 0082 0102 0108 0112 0173
NWDS	0260 0261 0263 0264 0304 0305 0307 0308 0309 0310
PHEE	0002 0114 0342
RLE1	0132 0137
RLE2	0133 0140
PYCV	0011 0082 0120
SLE1	0014 0126
SLE2	0014 0127
SGRT	0358
SREF	0069 0210
VINF	0060 0067 0067
XAFX	0002 0136 0217 0218 0219 0220 0315 0349
XBAR	0069
XCAN	0002 0021 0402 0403 0409 0410
XFIN	0002 0019 0377 0378 0384 0385
XFUS	0002 0023 0028 0251 0252 0255 0257 0259 0263 0264 0315 0317 0318
XP00	0002 0346 0349 0351 0352
YAWQ	0060 0065
YFUS	0002 0030 0265 0266 0267 0269 0277 0278 0279 0285 0286 0287 0292 0293 0294 0296 0307 0308
YK0T	0151

***** O R T R A N . C R O S S R E F E R E N C E L I S T I N G *****

INTERNAL STATEMENT NUMBERS		INTERNAL STATEMENT NUMBERS													
SYMBOL	0069	0041	0144	0232	0232	0233	0233	0235	0236	0238	0239	0323	0328	0357	0358
ZBAR	0002	0242	0270	0271	0272	0274	0280	0281	0282	0288	0289	0290	0297	0298	0299
ZC12	0002	0243	0270	0271	0272	0274	0280	0281	0282	0288	0289	0290	0297	0298	0299
ZERO	0002	0031	0270	0271	0272	0274	0280	0281	0282	0288	0289	0290	0297	0298	0299
ZFUS	0151	0116	0270	0271	0272	0274	0280	0281	0282	0288	0289	0290	0297	0298	0299
ZNOT	0009	0009	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116
AINC1	0009	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116
AINC2	0009	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116	0116
ALPHA	0007	0059	0007	0059	0007	0059	0007	0059	0007	0059	0007	0059	0007	0059	0007
ATAN2	0098	0095	0095	0095	0095	0095	0095	0095	0095	0095	0095	0095	0095	0095	0095
CORD1	0076	0081	0076	0081	0076	0081	0076	0081	0076	0081	0076	0081	0076	0081	0076
CORD2	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077
CORD2	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077	0081	0077
INPUT	0003	0051	0003	0051	0003	0051	0003	0051	0003	0051	0003	0051	0003	0051	0003
ISOLV	0054	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212
ISREF	0210	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212	0211	0212
ISYNT	0116	0119	0121	0119	0121	0119	0121	0119	0121	0119	0121	0119	0121	0119	0121
ITAFY	0176	0179	0187	0255	0257	0283	0294	0299	0255	0257	0283	0294	0299	0255	0257
JJTOP	0112	0113	0187	0255	0257	0283	0294	0299	0255	0257	0283	0294	0299	0255	0257
LESWP	0008	0010	0392	0261	0292	0293	0294	0296	0297	0298	0299	0301	0302	0392	0261
NCANP	0002	0003	0392	0261	0292	0293	0294	0296	0297	0298	0299	0301	0302	0392	0261
NFORX	0245	0259	0260	0261	0292	0293	0294	0296	0297	0298	0299	0301	0302	0260	0261
NFPAN	0002	0003	0367	0170	0248	0315	0170	0248	0315	0170	0248	0315	0170	0248	0315
MFUSE	0002	0003	0367	0170	0248	0315	0170	0248	0315	0170	0248	0315	0170	0248	0315
MFUSP	0003	0046	0161	0168	0187	0246	0168	0187	0246	0168	0187	0246	0168	0187	0246
NMACH	0056	0056	0048	0204	0339	0048	0204	0339	0048	0204	0339	0048	0204	0339	0048
NPPAN	0002	0003	0048	0204	0339	0048	0204	0339	0048	0204	0339	0048	0204	0339	0048
NRADX	0303	0304	0305	0183	0217	0218	0219	0220	0222	0225	0230	0225	0230	0225	0230
NWING	0002	0003	0159	0183	0217	0218	0219	0220	0222	0225	0230	0225	0230	0225	0230
NWNGP	0003	0043	0159	0159	0165	0181	0213	0221	0225	0229	0240	0225	0229	0240	0225
NXFUS	0313	0314	0317	0318	0322	0325	0326	0327	0334	0335	0335	0334	0335	0335	0335
PSPAN	0012	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063
KOLLO	0060	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063	0063
SYNTH	0010	0119	0010	0119	0010	0119	0010	0119	0010	0119	0010	0119	0010	0119	0010
TAPER	0012	0052	0053	0058	0052	0053	0058	0052	0053	0058	0052	0053	0058	0052	0053
TITLE	0007	0052	0053	0058	0052	0053	0058	0052	0053	0058	0052	0053	0058	0052	0053
WSPAN	0069	0071	0071	0179	0223	0224	0251	0259	0315	0340	0368	0393	0393	0393	0393
XAPEX	0010	0092	0177	0179	0223	0224	0251	0259	0315	0340	0368	0393	0393	0393	0393
XFEND	0254	0255	0257	0080	0081	0177	0179	0179	0226	0227	0233	0252	0254	0254	0266
XYZC2	0002	0078	0079	0080	0081	0177	0179	0179	0226	0227	0233	0252	0254	0254	0266
YAPEX	0289	0293	0298	0372	0373	0374	0375	0397	0398	0399	0400	0400	0400	0400	0400
ZAPEX	0010	0093	0223	0224	0265	0267	0269	0277	0279	0285	0287	0292	0294	0296	0341
ZFUS5	0010	0094	0223	0224	0270	0272	0274	0280	0282	0288	0290	0297	0299	0301	0342
ZFUS5	0006	0323	0324	0326	0326	0326	0326	0326	0326	0326	0326	0326	0326	0326	0326
ARATIO	0328	0330	0332	0405	0411	0412	0412	0412	0412	0412	0412	0412	0412	0412	0412
CANORD	0002	0022	0404	0405	0411	0412	0412	0412	0412	0412	0412	0412	0412	0412	0412
CSTART	0012	0095	0179	0223	0224	0232	0259	0315	0323	0349	0371	0396	0396	0396	0396
DELTAZ	0096	0098	0151	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082
DELTAZ	0097	0098	0151	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082
DESCRP	0007	0076	0077	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082	0082
FINORD	0002	0020	0379	0380	0386	0387	0387	0387	0387	0387	0387	0387	0387	0387	0387
FLOATX	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054	0054

***** O R T R A N C R O S S R E F E R E N C E L I S T I N G *****

INTERNAL STATEMENT NUMBERS	
SYMBOL	0054
FLOATY	0089 0090 0098 0100 0131
INTRAC	0074 0125
INVERS	0010 0116
IQUANT	0175 0177 0187 0252 0255 0257 0267 0272 0275
ITNOSE	0054
ITRMAX	0061 0063 0065
LATRAL	0060 0061 0063 0065
LSTDIB	0015
NALPHA	0059 0059
NPCCOR	0204 0206 0347 0355
NMNSP1	0240 0241
PISSOZ	0416 0417 0418
PITCHQ	0060
PLOTSZ	0003 0050 0414 0415 0416
PCDDRD	0002 0354 0357 0358 0361 0362
PCDDRG	0002 0340 0341 0342 0343 0344
REXPAP	0054
ZRATIO	0319 0320 0323

****FORTRAN CROSS REFERENCE LISTING****

LABEL	DEFINED	REFERENCES
10	0004	0052 0053
20	0005	0058
30	0017	0465
40	0025	0018
50	0032	0026 0027
60	0037	0033 0034 0035
70	0042	0038 0039 0040
80	0055	0054
90	0057	0056 0059 0060
100	0070	0069
110	0073	0113 0123 0124 0134 0137 0139 0140 0142 0149 0151
120	0088	0076 0077 0082
130	0110	0107
140	0111	0104
150	0116	0100
160	0118	0116
170	0129	0121
180	0136	0135
190	0145	0143
200	0146	0075 0128 0129
210	0148	0147
220	0155	0153
230	0181	0168
240	0219	0215
250	0224	0221
260	0234	0231
270	0237	0229
280	0244	0241
290	0245	0213
300	0283	0275
310	0291	0283
320	0311	0302
330	0313	0249
340	0316	0314
350	0324	0322
360	0333	0327
370	0336	0246 0312
380	0350	0345 0347
390	0360	0353 0355
400	0363	0338
410	0364	0336
420	0376	0366
430	0388	0381
440	0389	0364
450	0401	0391
460	0413	0406
470	0414	0389
480	0419	0208
490	0420	0211
500	0421	0219
510	0422	0224 0226
520	0423	0235 0238

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I SF		I**	0004E0	J SF		I**	0004E1	K SF		I**	0004EB	C1 S		R**	000634
G2 S		R**	000694	IB SFA		I**	0004E2	II SF		I**	0006D4	IM SF		I**	0004F0
JJ SF		I**	0004F4	JK SF		I**	0004E8	KN SFA		I**	0004FC	KL F		I**	000500
L3 SF		I**	000504	NF SF		I**	000508	NN SFA		I**	00050C	NP SF		I**	000510
NV SF		I**	000514	NW SFA		I**	000518	PI SF		R**	00051C	RO SF		R**	000734
XS S		R**	000800	X1 SF		R**	000520	Y2 SF		R**	000524	Y1 SF		R**	000528
YZ SF		R**	00052C	Z1 SF		R**	000530	Z2 SF		R**	000534	DTR SFA		R**	000538
HAG S		R**	00053C	ILE S		I**	000540	INW SF		I**	000544	ITS SF	C	I**	000550
IMT SF		I**	000548	LAX S		I**	00054C	LAY S		I**	000550	MAX SF		I**	000554
NAP SF		I**	000558	NPP S		I**	000850	NXS SF		I**	00055C	NYS S		I**	000560
NZS S		I**	000564	PDL S		C	0001E0	PHI SF		R**	0008A0	PSI S		R**	000568
RHO SF		R**	00096C	SPC S		C	0009A0	XAF SF		R**	0009BC	ZC1 SF		R**	000A84
ZC2 SF		R**	00084C	ABCD SF		R**	000C14	AFUS SF		R**	000CD4	CBAR S		R**	00056C
CURV S		R**	000D4C	IBOT SF		I**	000370	ITDP SF		I**	000574	MACH S		R**	000000
NAPX SF		I**	000DEC	NCAN SF		I**	000578	NPAN SF		I**	00057C	NVGR SF		R**	0001FC
NWDS SF		I**	000580	PHEE SFA		C	000EBC	RLE1 S		R**	000584	RLE2 S		R**	000588
RNCV SF	C	R**	000000	SLE1 S		R**	000000	SLE2 S		R**	000050	SREF SF		R**	00059C
VINF S		R**	000590	XAFX SF		R**	000EDC	XBAR S		R**	000594	XCAN SF		R**	00219C
XFIN SF		R**	0021C4	XFUS SF		R**	0021EC	XPOD SF		R**	002264	YAWO S		R**	000598
YFUS SF		R**	0023CC	YNOT S		R**	00059C	ZBAR S		R**	0005A0	ZC12 SFA		R**	00269C
ZERO SF		R**	0005A4	ZFUS SF		R**	004C1C	ZNOT S		R**	0005AB	AINC1 S		R**	000000
AINC2 S	C	R**	000050	ALPHA S		R**	004BEC	CORD1 SF		R**	0005AC	CORD2 SF		R**	000580
INPUT F		R**	000001	ISOLV S		I**	000584	ISREF SF		I**	000588	ISYNT SF		I**	00059C
ITFT SF		I**	0005C0	JJTOP SF		I**	0005C4	LESMP		C	N.R.	NCAMP F		I**	004FOC
NFORX SF		I**	0005C8	NFPAN F		I**	004F14	NFUSE F		I**	004F2C	NFUSP S		I**	0065CC
NMACH SF		I**	0005D0	NPPAN SF		I**	004F44	NRADX SF		I**	0005D4	NWING F		I**	004F58
NWNGP SF		I**	0005D8	NXFUS SF		I**	0005DC	PSPAN		C	N.R.	ROLLQ S		R**	0005E0
SYNTH S	C	R**	000320	TAPER		C	N.R.	TITLE SF		R**	004F88	WSPAN S		R**	0005E4
XAPEX SFA	C	R**	000000	XFEND SF		R**	0005E8	XYZC2 SFA		R**	000508	YAPEX SF		C	0000A0
ZAPEX SF	C	R**	000140	ZFUSS SF		R**	005288	SQRT		XF	000700	COS		XF	000000
ATAM2	XF	R**	000000	ARATIO SF		R**	0005EC	CANORD SF		R**	005300	CSTART SFA		C	000000
DELTAY SFA		R**	0005F0	DELTAZ SFA		R**	0005F4	DESCRP S		R**	005328	FINORD SF		C	000350
FLOATX S		R**	0005F8	FLOATY S		R**	0005FC	FRDNL# F		XF	000000	IBCOM# F		XF	000000
INTRAC SF		I**	000600	INVERS S		I**	000604	IQUANT S		C	0003C0	ITHOSE SF		I**	000608
ITRMAX S		I**	00060C	LATRAL S		I**	000610	LSTDTR SF		XF	000000	NALPHA SF		I**	000614
NPDDOR SF		I**	000618	NWNGPI SF		I**	00061C	PISOSZ SF		R**	000620	PITCHQ S		R**	000624
PLOTSZ SF		R**	000628	PODDRD SF		R**	000578	PODDRC SF		R**	0054E0	REXPAN S		R**	00062C
ZRATIO SF		R**	000630												

**** COMMON INFORMATION ****

NAME OF COMMON BLOCK		* SET4*	SIZE OF BLOCK	0000A0	HEXADECIMAL BYTES
VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
AINC1	R**	000000	AINC2	R**	000050

NAME OF COMMON BLOCK		* SET5*	SIZE OF BLOCK	000460	HEXADECIMAL BYTES
VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.

YAPEX LES&P	R*4 R*4	000000 N.R.	YAPEX SYNTH	R*4 R*4	0000A0 000320	ZAPEX IQUANT	R*4 I*4	000140 0003C0	POL	R*4	0001E0
----------------	------------	----------------	----------------	------------	------------------	-----------------	------------	------------------	-----	-----	--------

NAME OF COMMON BLOCK * SET7* SIZE OF BLOCK 0000A0 HEXADECIMAL BYTES											
VAR. NAME RNCV	TYPE R*4	REL. ADDR. 000000	VAR. NAME ITS	TYPE I*4	REL. ADDR. 000050	VAR. NAME ZAPEX	TYPE I*4	REL. ADDR. 000140	VAR. NAME POL	TYPE R*4	REL. ADDR. 0001E0

NAME OF COMMON BLOCK * SET12* SIZE OF BLOCK 000280 HEXADECIMAL BYTES											
VAR. NAME CSTART	TYPE R*4	REL. ADDR. 000000	VAR. NAME TAPER	TYPE R*4	REL. ADDR. N.R.	VAR. NAME PSPAN	TYPE R*4	REL. ADDR. N.R.	VAR. NAME NYOR	TYPE R*4	REL. ADDR. 0001E0

NAME OF COMMON BLOCK * SET13* SIZE OF BLOCK 000020 HEXADECIMAL BYTES											
VAR. NAME MACH	TYPE R*4	REL. ADDR. 000000	VAR. NAME MACH	TYPE R*4	REL. ADDR. 000000	VAR. NAME MACH	TYPE R*4	REL. ADDR. 000000	VAR. NAME MACH	TYPE R*4	REL. ADDR. 000000

NAME OF COMMON BLOCK * SET23* SIZE OF BLOCK 000140 HEXADECIMAL BYTES											
VAR. NAME SLE1	TYPE R*4	REL. ADDR. 000000	VAR. NAME SLE2	TYPE R*4	REL. ADDR. 000050	VAR. NAME SPC	TYPE R*4	REL. ADDR. 0000A0	VAR. NAME POL	TYPE R*4	REL. ADDR. 0001E0

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
30	005618	40	005698	50	003718	60	00577C
70	0057F8	130	005D9A	140	005DAE	150	005E5C
170	006008	180	006088	190	00618A	200	0061F4
220	006208	230	00647E	240	006682	250	006794
260	006966	270	006A1A	280	006854	290	006868
300	006E5E	310	006EF0	320	00715E	330	007176
340	0071D4	350	0072DC	360	0073F2	370	007488
380	007632	390	0077CC	400	00788E	410	0078A2
420	007982	430	0078B4	440	0078C8	450	007CAB
460	007ED8	470	007EEC	940	007F6C		

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*   NAME= MAIN,OPT=01,LINECNT=55,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
*STATISTICS*   SOURCE STATEMENTS = 466 ,PROGRAM SIZE = 32680
*STATISTICS*   NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****
```


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```

ISN 0002      C
ISN 0003      COMPILER OPTIONS - NAME= MAIN,OPT=01,LINECNT=55,SIZE=0000K,
ISN 0004      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NODEDIT,IO,XREF
ISN 0005      SUBROUTINE LSTD18
ISN 0006      DIMENSION A (20)
ISN 0007      WRITE (6, 40)
ISN 0008      I = 0
ISN 0009      20 READ (5, 50,END=30) A
ISN 0010      WRITE (6, 80) A
ISN 0011      I = I + 1
ISN 0012      IF (I .NE. 44) GO TO 20
ISN 0013      GO TO 10
ISN 0014      30 REWIND 5
ISN 0015      WRITE (6, 70)
ISN 0016      RETURN
ISN 0017      40 FORMAT (1H1, 26HINPUT DATA LISTING FOLLOWS /1H )
ISN 0018      50 FORMAT (20A4)
ISN 0019      60 FORMAT (1H1)
ISN 0020      70 FORMAT (1H0, 17HINPUT DATA LISTED)
ISN 0021      80 FORMAT (1H , 20A4)
                END
00004440
00004450
00004460
00004470
00004480
00004490
00004510
00004520
00004530
00004540
00004550
00004560
00004570
00004580
00004590
00004600
00004610
00004620
00004630
00004640

```

*****FORTRAN CROSS REFERENCE LISTING*****

INTERNAL STATEMENT NUMBERS

SYMBOL	0003	0006	0007
A	0005	0008	0008
I	0005	0008	0008
LSTD0	0002		

*****FORTRAN CROSS REFERENCE LISTING*****

LABEL	DEFINED	REFERENCES
10	0005	0012
20	0006	0009
30	0013	0006
40	0016	0004
50	0017	0006
60	0018	0011
70	0019	0014
80	0020	0007

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
10	000168	20	00016C	30	0001D8

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LOCKHEED PROPRIETARY DATA

```

*OPTIONS IN EFFECT*   NAME= MAIN,OPT=01,L,LINECNT=55,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,BCD,NOLIST,MODECK,LOAD,MAP,NOEDIT,IO,XREF
*STATISTICS*         SOURCE STATEMENTS = 20 ,PROGRAM SIZE = 540
*STATISTICS* NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****
*STATISTICS* NO DIAGNOSTICS THIS STEP
  
```

93K BYTES OF CORE NOT USED

F126-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LIST,MAP
 DEFAULT OPTION(S) USED - SIZE=(131072,18432)
 IEW0000 INCLUDE COMPIL
 IEW0000 ENTRY MAIN

MODULE MAP

CONTROL SECTION			ENTRY									
NAME	ORIGIN	LENGTH	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
MAIN	00	7FAB	ATAN2	81C8	ATAN	81DC						
LSTDT8	7FAB	21C	COS	8398	SIN	8380						
IHC SATN2*	81C8	1CB	FRDNL#	8578	FWRNL#	8B60						
IHCSSCN *	8398	1D9	IBCOM#	9020	FDIOCS#	900C						
IHCNAMEL*	8578	AA7	INTSWTCH	9F3E								
IHC ECOMH*	9020	F31	SEQDASD	A1E0								
IHC COMH2*	9F58	56D	SQRT	A4C8								
IHCSSQRT*	A4C8	145	ADCON#	A610	FCVADUTP	A68A						
IHCFCVTH*	A610	1195	FCVIOUPT	AC40	FCVEOUTP	8142						
IHCENFTH*	B7AB	512	ARITH#	B7AB	ADJSWTCH	B814						
IHC EFIOS*	BCC0	1390	FIOCS#	BCC0	FIOCSBEP	BCC6						
IHCERRM *	D050	58C	ERRMON	D050	IHCERRE	D068						
IHC UOPT *	D610	350	IHC TRCH	D960	ERRTRA	D968						
IHC TRCH*	D960	28E										
IHC UATBL*	D8F0	648										
SET4	E238	A0										
SET5	E208	460										
SET7	E738	A0										
SET12	E708	280										
SET13	EA58	20										
SET23	EA78	140										

ENTRY ADDRESS 00
 TOTAL LENGTH E888

***GOMODULE DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

INPUT DATA LISTING FOLLOWS

```

INPUT
NNGP=5,NWING=1,2,3,4,5,NFUSP=1,NFUZE=6,NF=2,NFPAN=9,10,
NCAN=1,NCANP=11,NP=2,NPAN=7,8,PLOTSZ=10,,
CENC
CL1607-32 (-24 PLANFORM) VC121 ENGINE
0 1 2.550 5.000 10.000 0.0 0.0 0.0 0.0 0.0 0
1 0 0.0 0.0 0.0 0.0 0.0 1290.0996 ND. 1
11 944.0998 96789.00 -1.0000 0.0 0.0 WING PANEL NO. 1
1462.5000 53.5400 -54.4700 148.9398 WING PANEL NO. 1
3.0000 1.0000 1.0000 925.9700 NVDR,RNCV,SPC,PDL
0 0 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0129 -0.1367 -0.4893 -1.2589 -1.9373 -2.4770 -2.8862
-3.1954 -3.6668 -3.9008 -4.1644 -4.4545 -4.7700 -5.1145
0 0 0.0529 0.2700 0.3078 0.1145 -0.2430 -0.6825 -1.1609
-1.6545 -2.1469 -2.6232 -3.0692 -3.4807 WING PANEL NO. 2
1768.7998 223.5400 -54.4700 925.9700 NVDR,RNCV,SPC,PDL
3.0000 10.0000 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 1.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0529 -0.2700 0.3078 0.1145 -0.2430 -0.6825 -1.1609
-1.6545 -2.1469 -2.6232 -3.0692 -3.4807 WING PANEL NO. 2
1765.3998 317.4099 -69.0000 650.0098 NVDR,RNCV,SPC,PDL
3.0000 10.0000 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 1.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0138 0.1708 0.3492 0.4138 0.3277 0.1538 -0.0785
-0.3554 -0.6385 -0.9846 -1.3231 -1.6677 -1.9373 -2.1469
1905.3998 368.0398 -77.1600 529.8699 WING PANEL NO. 3
3.0000 10.0000 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 1.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0151 0.0774 0.2623 0.3095 0.3277 0.1538 -0.0785
-0.2227 -0.4511 -0.7002 -0.9606 -1.2362 -1.5362 -1.8298
1905.3998 486.8298 -89.7400 311.7200 WING PANEL NO. 4
3.0000 10.0000 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 1.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0138 0.1708 0.3492 0.4138 0.3277 0.1538 -0.0785
-0.3554 -0.6385 -0.9846 -1.3231 -1.6677 -1.9373 -2.1469
2225.7998 548.8298 -99.7400 311.7200 WING PANEL NO. 4
3.0000 10.0000 1.0000 0 13 10.0000 20.0000 30.0000 40.0000 50.0000
0 0 1.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000
0 0 0.0138 0.1708 0.3492 0.4138 0.3277 0.1538 -0.0785
-0.3554 -0.6385 -0.9846 -1.3231 -1.6677 -1.9373 -2.1469

```

0.0	1.0000	5.0000	10.0000	20.0000	30.0000	40.0000	50.0000
60.0000	70.0000	80.0000	90.0000	100.0000	100.0000	100.0000	100.0000
0.0227	0.0151	0.0774	0.2623	-0.2372	0.2567	0.1376	-0.0226
0.0	-0.4517	-0.7092	-0.7959	-1.0652	0.1283	0.1925	0.2310
223.7998	0.2719	0.1175	0.1175	0.3368	WING PANEL NO. 6		
2473.2998	49.8798	0.7400	311.7200	0.3368	WING PANEL NO. 6		
0.0	10.0000	1.0000	0.0	0	NVDR,RNCV,SPL,PDL		
0.0	0.0	0.0	0.0	0	0		
60.0000	1.0000	5.0000	10.0000	20.0000	30.0000	40.0000	50.0000
0.0	70.0000	80.0000	90.0000	100.0000	100.0000	100.0000	100.0000
0.2631	-0.0257	-0.1123	-0.0513	0.1283	0.1893	0.1893	0.2310
0.0	0.2951	0.3112	0.2772	0.3368	-0.4731	-0.4628	-0.3651
0.0	-0.0411	-0.1800	-0.2137	-0.4371			
-0.2057	-0.0051	0.2654	0.1811	-0.9103	FUSELAGE PANEL		
0.0	0.0	45.7619	324.0000	0.9103	FUSELAGE PANEL		
0.0	0.0	47.8617	3524.0000	0.9103	NVDR,RNCV,SPL,PDL		
90.0000	21.0000	1.0000	999.0000	14.1758	71.8149	-23.7363	71.8148
-90.0000	71.8148	52.0879	71.8148	0	0	0	0
0.0	0.0	6.8104	10.2157	0	0	0	0
0.0	3.4052	34.0522	37.4574	13.6209	17.0291	20.4313	23.8365
27.2418	30.6470	66.9623	70.3746	40.8627	44.2679	47.6731	54.4832
60.1589	63.5641	94.2111	97.6163	75.6044	77.1850	80.5402	83.9955
87.4007	90.8059	-0.6733	-1.0423	100.0000	-0.4512	-0.4881	-0.5231
-1.0783	-0.8726	-1.0423	-1.1501	-0.4597	-1.4013	-1.5523	-1.7031
-1.7616	-0.9293	-2.1283	-2.1737	-1.2789	-2.1737	-2.1254	-2.0253
-1.9552	-2.0687	-1.7227	-1.5125	-1.0499	67.5458	84.8766	100.0000
-1.8927	-1.7227	17.7443	32.2533	50.2150	100.0000	100.0000	100.0000
0.0	100.0000	100.0000	100.0000	100.0000	95.0974	81.7659	64.7005
100.0000	100.0000	100.0000	100.0000	0.0	0	0	0
43.7282	27.5516	15.2879	5.4190	0.0	MACELLE PANEL NO 1		
2094.0000	214.0000	-0.0800	393.0000	0.0	MACELLE PANEL NO 1		
8.0000	215.0000	0.0	999.0000	0.0	NVDR,RNCV,SPL,PDL		
90.0000	33.9200	43.0000	33.9200	-180.0000	33.9200	-225.0000	33.9200
-90.0000	33.9200	-135.0000	33.9200	0	0	0	0
-270.0000	0.0	0.0	0.0	0	0	0	0
0.0	0.0	12.1522	100.0000	0	0	0	0
0.0	0.0	0.0	0.0	0	0	0	0
100.0000	105.1001	105.1001	105.1001	0	0	0	0

2091.0000	206.0000	-104.0000	394.0000	NACELLE PANEL NO 2	
2091.0000	206.0000	-104.0000	394.0000	NACELLE PANEL NO 2	
8.0000	32.0000	45.0000	32.0000	NACELLE RNCV, SPC, PDL	
-90.0000	32.0000	-135.0000	32.0000	NACELLE RNCV, SPC, PDL	32.0000
-270.0000	32.0000	0.0	32.0000	NACELLE RNCV, SPC, PDL	32.0000
0.0	11.9148	0.0	0.0		
0.0	11.9148	0.0	0.0		
100.0000	111.4062	111.4062	194.5000	FIN PANEL NO. 1	
240.0000	64.0000	-100.0000	141.1000	FIN PANEL NO. 1	
2595.3999	64.0000	-128.0000	0.0	NVCR, RNCV, SPC, PDL	
0.0	10.0000	0.0	294.9999	FIN PANEL NO. 2	
3183.8999	0.0	-27.0000	67.7000	FIN PANEL NO. 2	
3403.2000	0.0	66.5000	0.0	NVCR, RNCV, SPC, PDL	
0.0	10.0000	1.0000	0.0		
0.0	0.0	0.0	283.7998	CANARD PANEL NO. 1	
3116.3999	33.0000	-40.0000	76.4000	CANARD PANEL NO. 1	
3354.0000	174.4000	-40.0000	0.0	NVCR, RNCV, SPC, PDL	
2.0000	10.0000	1.0000	0.0		
0.0	0.0	0.0	0.0	NXS, MYS, NZS	

INPUT DATA LISTED

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1. REPORT NO. NASA CR-2865	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.	
4. TITLE AND SUBTITLE A GENERALIZED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS		5. REPORT DATE December 1977	6. PERFORMING ORG CODE
		8. PERFORMING ORG REPORT NO. LR 28112	
7. AUTHOR(S) Luis R. Miranda, Robert D. Elliott, and William M. Baker		10. WORK UNIT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS LOCKHEED-CALIFORNIA COMPANY P.O. BOX 551 BURBANK, CALIFORNIA 91520		11. CONTRACT OR GRANT NO. NAS 1-12972	
		13. TYPE OF REPORT AND PERIOD COVERED	
12. SPONSORING AGENCY NAME AND ADDRESS NASA Langley Research Center Hampton, Virginia 23665		14. SPONSORING AGENCY CODE	
		15. SUPPLEMENTARY NOTES Langley Technical Monitor: Harry H. Heyson Topical Report	
16. ABSTRACT A vortex lattice method applicable to both subsonic and supersonic flow is described. It is shown that if the discrete vortex lattice is considered as an approximation to the surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vorticity-induced velocity field. The proper incorporation of this term to the velocity field generated by the discrete vortex lines renders the present vortex lattice method valid for supersonic flow. Special techniques for simulating nonzero thickness lifting surfaces and fusiform bodies with vortex lattice elements are included. Thickness effects of wing-like components are simulated by a double (biplanar) vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentric cylindrical surfaces. The analysis of sideslip effects by the subject method is described. Numerical considerations peculiar to the application of these techniques are also discussed. A summary comparison of the results obtained by the method of this report with other theoretical and experimental results is presented. The method has been implemented in a digital computer code identified as VORLAX. A users manual is included along with a complete Fortran compilation and executed case. Also included are conversion programs useful for transforming input between VORLAX and the NASA Wave Drag program.			
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