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A Generalized Vortex Lattice Method for Subsonic and Supersonic Flow Applications

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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:

$$\nabla \times \overline{v} = \overline{\omega}, \qquad \nabla . \overline{w} = Q, \qquad \overline{w} = \Psi . \overline{v} \tag{1}$$

on the assumption that the vorticity $\overline{\omega}$ and the source intensity Q are known functions of the point whose position vector is $\overline{R}$. The vector $\overline{v}$ 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

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

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

$$\rho \, \overline{u} = \rho_\infty \overline{u}_\infty + \rho_\infty \overline{w} + \text{higher order terms} \tag{3}$$

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

$$\overline{w} = (\rho \, \overline{u} - \rho_\infty \overline{u}_\infty) \, / \rho_\infty \tag{4}$$

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 $\overline{v}\,(\overline{R})$, 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:

$K = 2$ for $\beta^2 > 0$

$K = 1$ for $\beta^2 < 0$

R_β = Real part of $\left\{ (x-x_1)^2 + \beta^2 \left[(y-y_1)^2 + (z-z_1)^2 \right] \right\}^{1/2}$

$\fint$ = 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

$$\bar{v}\,(\bar{R}_1) = -\frac{1}{2\pi K}\fint_S \bar{n}\cdot\bar{w}\,(\bar{R})\,\nabla\frac{1}{R_\beta}\,dS + \frac{\beta^2}{2\pi K}\fint_S \{\bar{n}\times\bar{v}\,(\bar{R})\}\times\frac{\bar{R}-\bar{R}_1}{R_\beta^3}\,dS + \frac{1}{2\pi K}\fint_V Q(\bar{R})\,\nabla\frac{1}{R_\beta}\,dV + \frac{\beta^2}{2\pi K}\fint_V \frac{\bar{R}-\bar{R}_1}{R^3_\beta}\times\bar{\omega}(\bar{R})\,dV \quad (5)$$

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 ($\bar{\omega}\equiv 0$) flow, equation (5) reduces to

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

This is a relation between $\bar{v}$ inside S and the values of $\bar{n}.\bar{w}$ and $\bar{n}\times\bar{v}$ 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:

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

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

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

where $\bar{\gamma}(\bar{R}) = \bar{N} \times \Delta \bar{v}$ 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

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

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

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:

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

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:

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

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 $\gamma_J\, \delta_J$. 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, $A_{\tau-\varepsilon}$ and A_ε. Obviously, the integral over $A_{\tau-\varepsilon}$ has no Cauchy-type singularity, Hadamard's finite part concept being sufficient to perform the indicated integration. Thus,

$$\int_{\tau} \bar{\gamma} \times \frac{\bar{R}-\bar{R}_1}{R_{\beta}^3}\, dS = \lim_{\epsilon \to 0} \int_{A_\epsilon} + \lim_{\epsilon \to 0} \int_{A_{\tau-\epsilon}}$$

$$= \lim_{\epsilon \to 0} I(\epsilon) + \bar{\gamma}\, \delta \times \int_{C} \frac{\bar{R}-\bar{R}_1}{R_{\beta}^3}\, d\ell \qquad (13)$$

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 $\bar{\gamma}$,

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

where Λ is the angle between the y-axis and the direction of the vorticity in τ, and $B^2 = -\beta^2 \geq 0$ (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 $\epsilon \to 0$ 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,

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

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 $\phi = \epsilon^2(1+2B)-2(1+B)\epsilon t y -(B^2-t^2)\, y^2$, then the finite part of the x-integration yields

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

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

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(ϵ) can be written as

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

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

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

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

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

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

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

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

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

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_o, y_o, z_o) is given, in Cartesian components, by the following expressions

$$\begin{aligned}
u &= +\frac{\Gamma z_o}{2\pi K}\,\beta^2 {\int\!\!\!\!\!-}_{C} \frac{dy}{\left\{ (x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right) \right\}^{3/2}} \\
v &= -\frac{\Gamma z_o}{2\pi K}\,\beta^2 {\int\!\!\!\!\!-}_{C} \frac{dx}{\left\{ (x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right) \right\}^{3/2}} \qquad (22) \\
w &= +\frac{\Gamma}{2\pi K}\,\beta^2 {\int\!\!\!\!\!-}_{C} \frac{(x-x_o)\,dy - (y-y_o)\,dx}{\left\{ (x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right) \right\}^{3/2}}
\end{aligned}$$

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

$$(x - x_o)^2 + \beta^2 ((y - y_o)^2 + z_o^2) > 0$$

and

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

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

$$x_1 = x_o + ts \qquad x_2 = x_o - ts$$

$$y_1 = y_o + s \qquad y_2 = y_o - s$$

$$X^* = x_o - ty_o$$

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

$$u = + \frac{\Gamma z}{2\pi K} \cdot \frac{1}{x^{*2} + (t^2+\beta^2) z_o^2} \cdot \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2+z_o^2)}} \right]$$

$$v = - \frac{\Gamma z}{2\pi K} \cdot \frac{t}{x^{*2} + (t^2+\beta^2) z_o^2} \cdot \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2+z_o^2)}} \right] \quad (23)$$

$$w = - \frac{\Gamma}{2\pi K} \frac{x^*}{x^{*2} + (t^2+\beta^2) z_o^2} \left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2+z_o^2)}} \right]$$

In the above expressions, the coordinates (x_o, y_o, z_o) 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

$$u = 0$$

$$v = -\frac{\Gamma^{z_o}}{2\pi K}\beta^2 \;-\!\!\!\!\!\!\int_c \frac{dx}{\left\{(x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right)\right\}^{3/2}} \qquad (24)$$

$$w = -\frac{\Gamma^{(y-y_o)}}{2\pi K}\beta^2 \;-\!\!\!\!\!\!\int_c \frac{dx}{\left\{(x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right)\right\}^{3/2}}$$

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

$$u = 0$$

$$v = -\frac{\Gamma^{z_o}}{2\pi K}\left[\frac{x_o - x_i}{\sqrt{(x_o-x_i)^2 + \beta^2\left((y_o-y)^2 + z_o^2\right)}} - \frac{x_o - x_f}{\sqrt{(x_o-x_f)^2 + \beta^2\left((y_o-y) + z_o^2\right)}}\right]\frac{1}{(y_o-y)^2 + z_o^2} \qquad (25)$$

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

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

$x_i = \infty$ if $M_\infty < 1$

$x_i = x_o - \sqrt{-\beta^2\left((y_o+s)^2 + z_o^2\right)}$ if $M_\infty > 1$

$x_f = -ts$

$y = -s$

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

$$x_i = +ts$$

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

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

$$y = +s$$

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

$$\begin{aligned}
F_1 &= \frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} \quad ; \\
F_2 &= \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} \quad ; \\
G_1 &= \frac{x_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1:\ C = 1;\ M_\infty > 1:\ C = 0) \\
G_2 &= \frac{x_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1:\ C = 1;\ M_\infty > 1:\ C = 0)
\end{aligned} \tag{26}$$

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

$$u\ (x_o,\ y_o,\ z_o) = + \frac{\Gamma}{2\pi K} \frac{z_o}{x^{*2} + (t^2 + \beta^2)\ z_o^2} (F_1 - F_2)$$

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

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

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

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

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

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

Since $x^* = x_o - ty_o = x_1 - ty_1 = x_2 - ty_2$, 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

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

When the field point $(x_o, y_o, 0)$ 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

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

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

$$x_J^V - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right] \tag{32}$$

where $x_J^V - x_o$ represents the distance from the leading edge to the midpoint of the swept leg of the Jth 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

$$x_J^C - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{J}{N}\right)\right] \tag{33}$$

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

$$\bar{v} \cdot \bar{n}' = -\bar{u}_\infty \cdot \bar{n} \tag{34}$$

is applied at the control points. In equation (34), $\bar{n} = \ell\bar{i} + m\bar{j} + n\bar{k}$, 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 $|\ell u| \ll |mv + nw|$. 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 concentrical 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.

$$\bar{w} \cdot \bar{n} = - \bar{u}_{\infty} \cdot \bar{n} \tag{35}$$

where all the components of the scalar product $\bar{w} \cdot \bar{n} = \beta^2 \ell u + mv + nw$ 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

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

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

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

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 concentrical 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_ν and β_ν 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, $\Delta Cp = 2\gamma \cos\Lambda$;
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

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

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

$$-\gamma_{I-1}^{*} + 2\,\gamma_{I}^{*} - \gamma_{I+1}^{*} = 0 \qquad (39)$$

where γ_I^* is the circulation strength of the critical horseshoe vortex, and γ_{I-1}^* and γ_{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 concentrical 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.

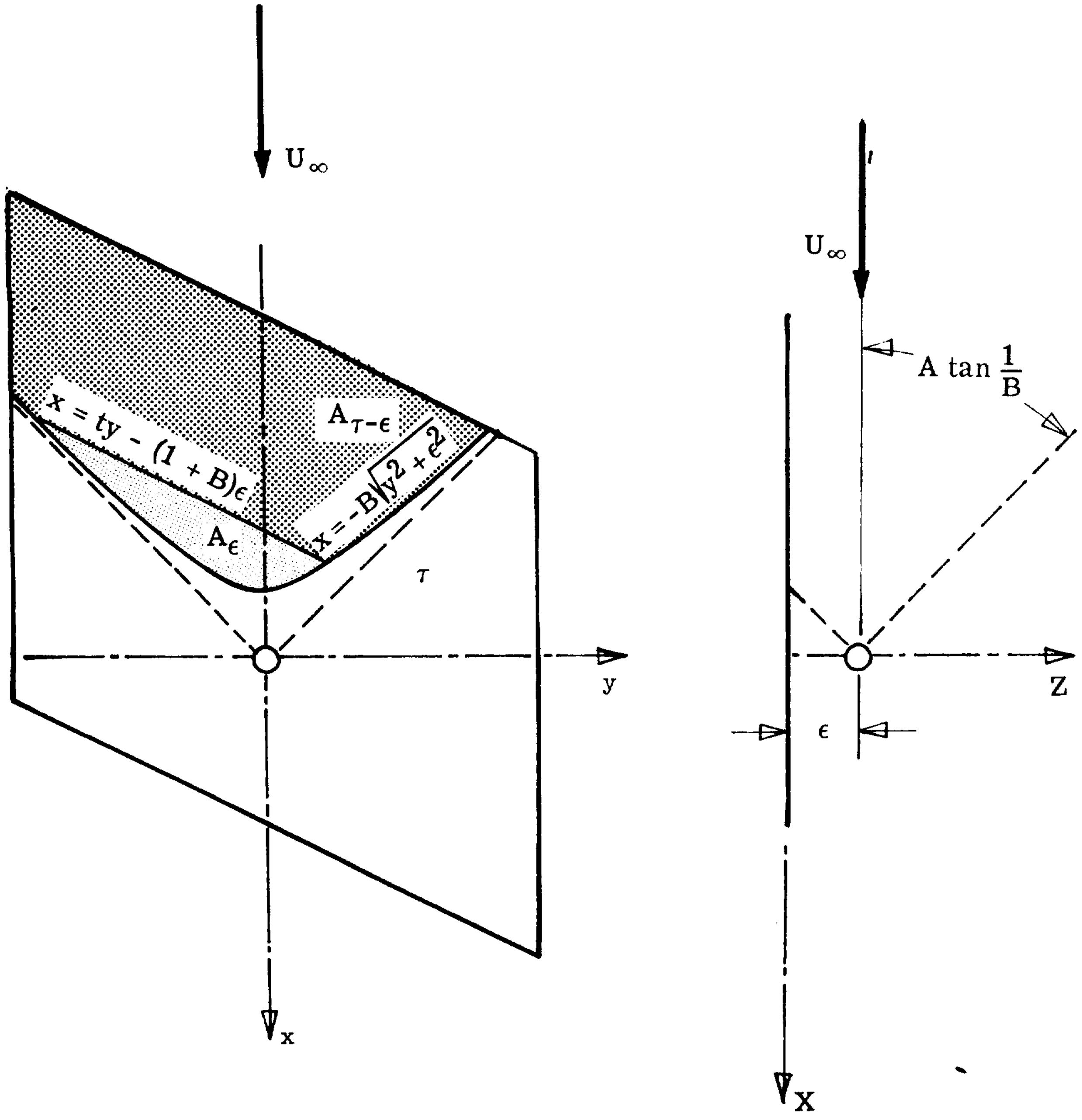


Figure 1.- Definition of integration regions for the computation of principal part.

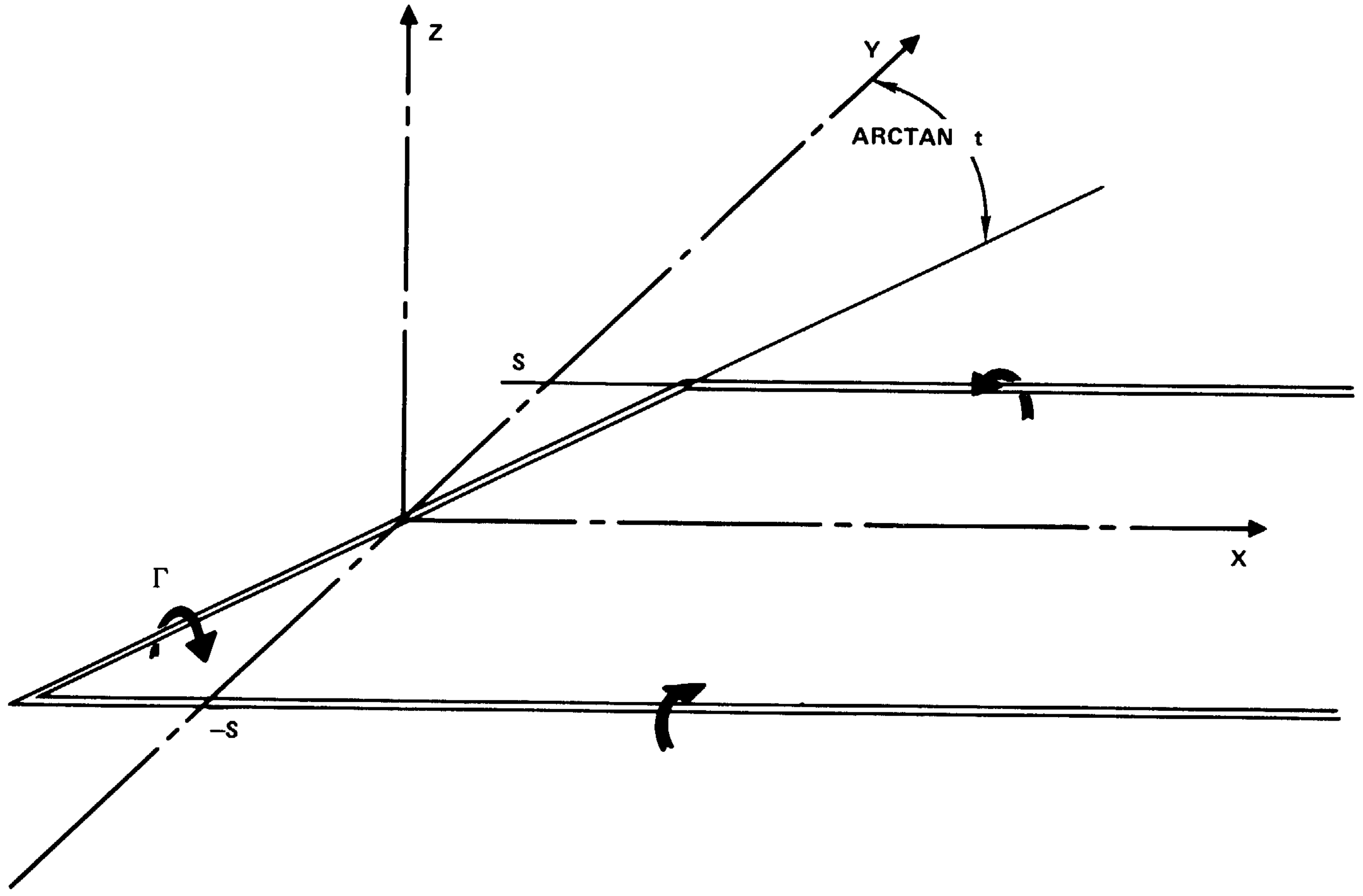
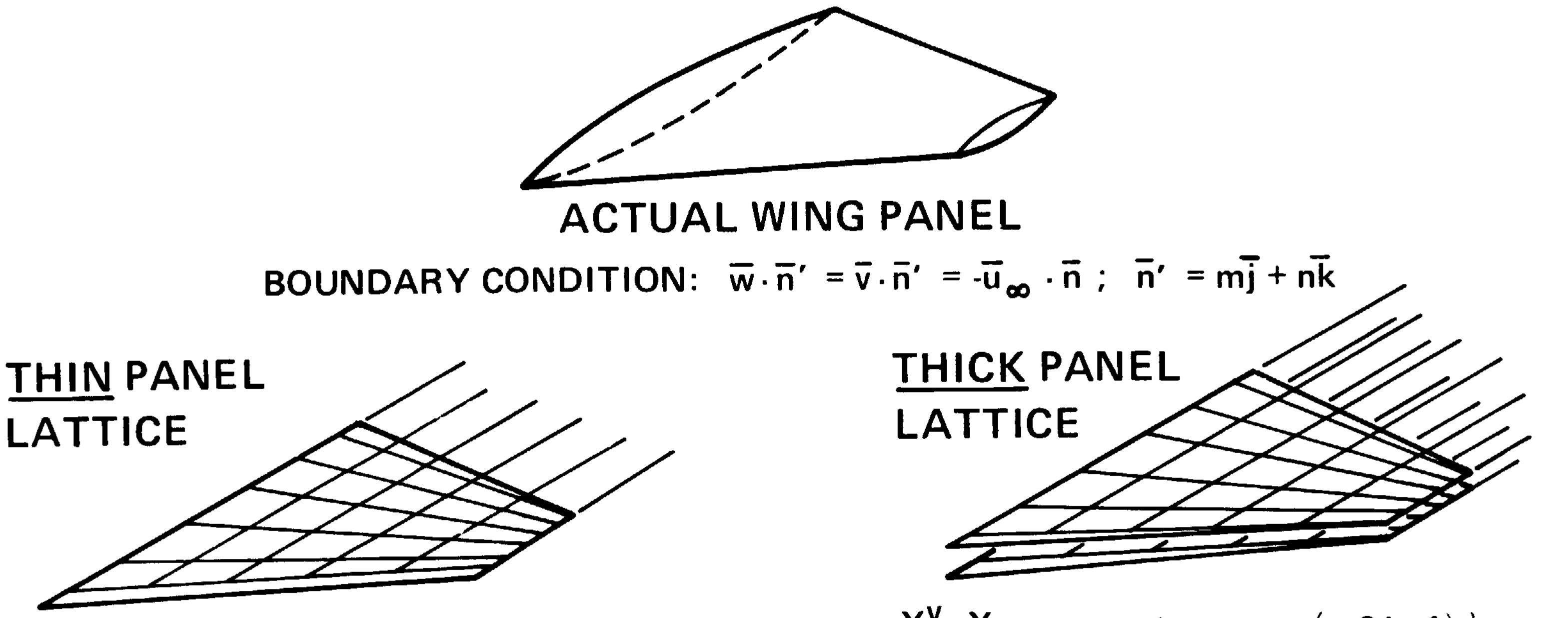


Figure 2.- Sweptback horseshoe vortex



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

CHORDWISE DISTRIBUTION OF VORTEX LINES: $$\frac{X_j^v - X_o}{C} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right\}$$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS: $$\frac{X_j^c - X_o}{C} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{J}{N}\right)\right\}$$

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

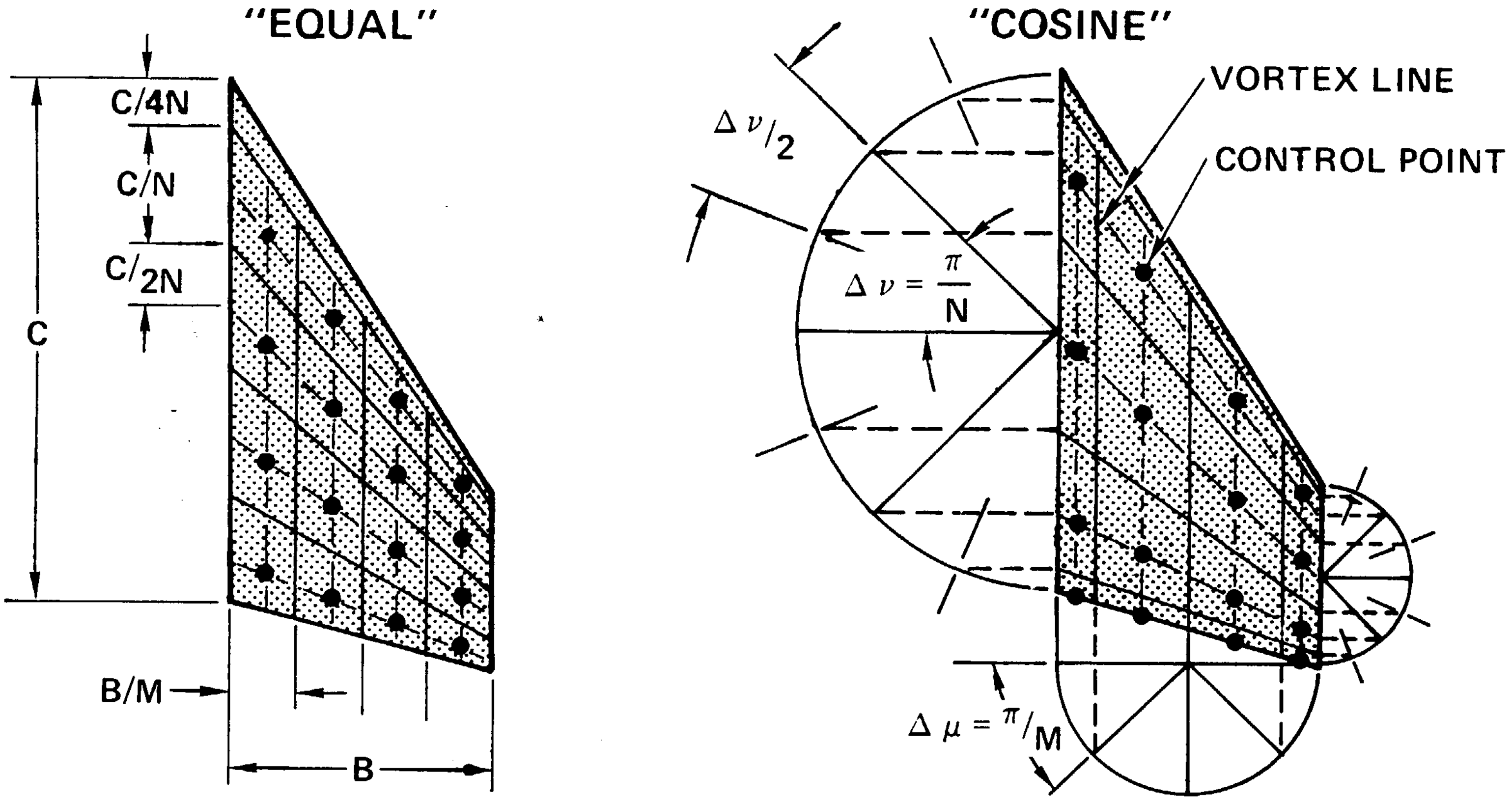
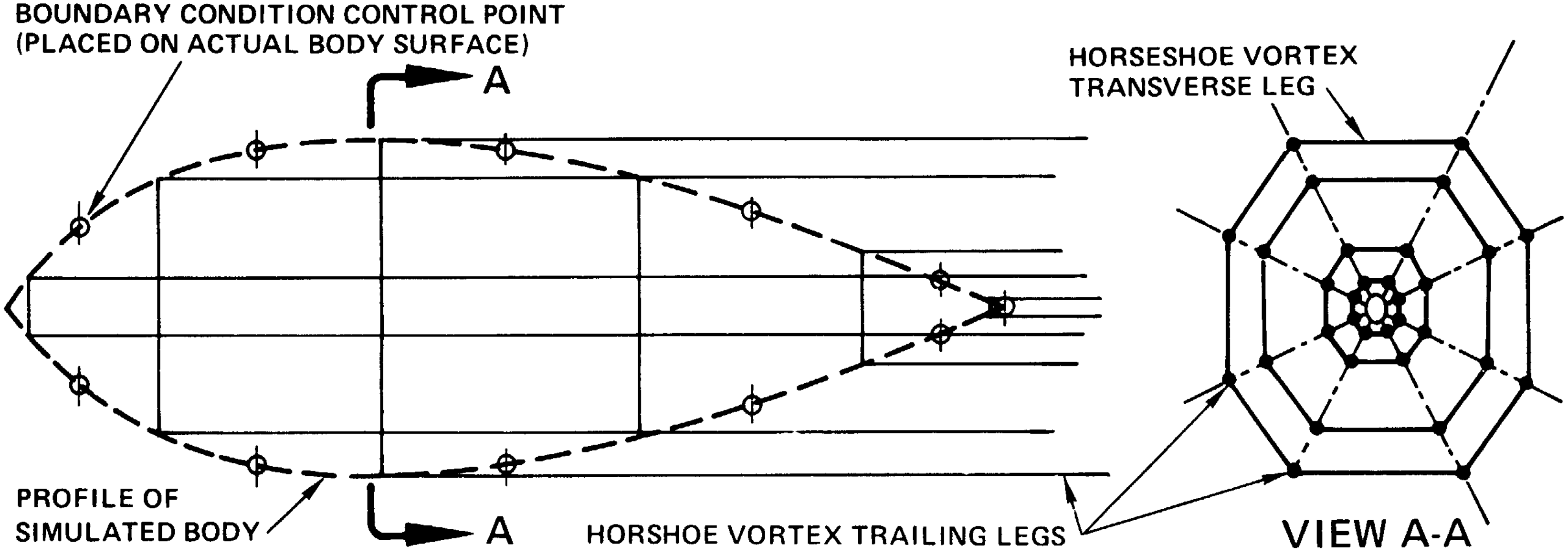


Figure 4.- Vortex lattice collocation.

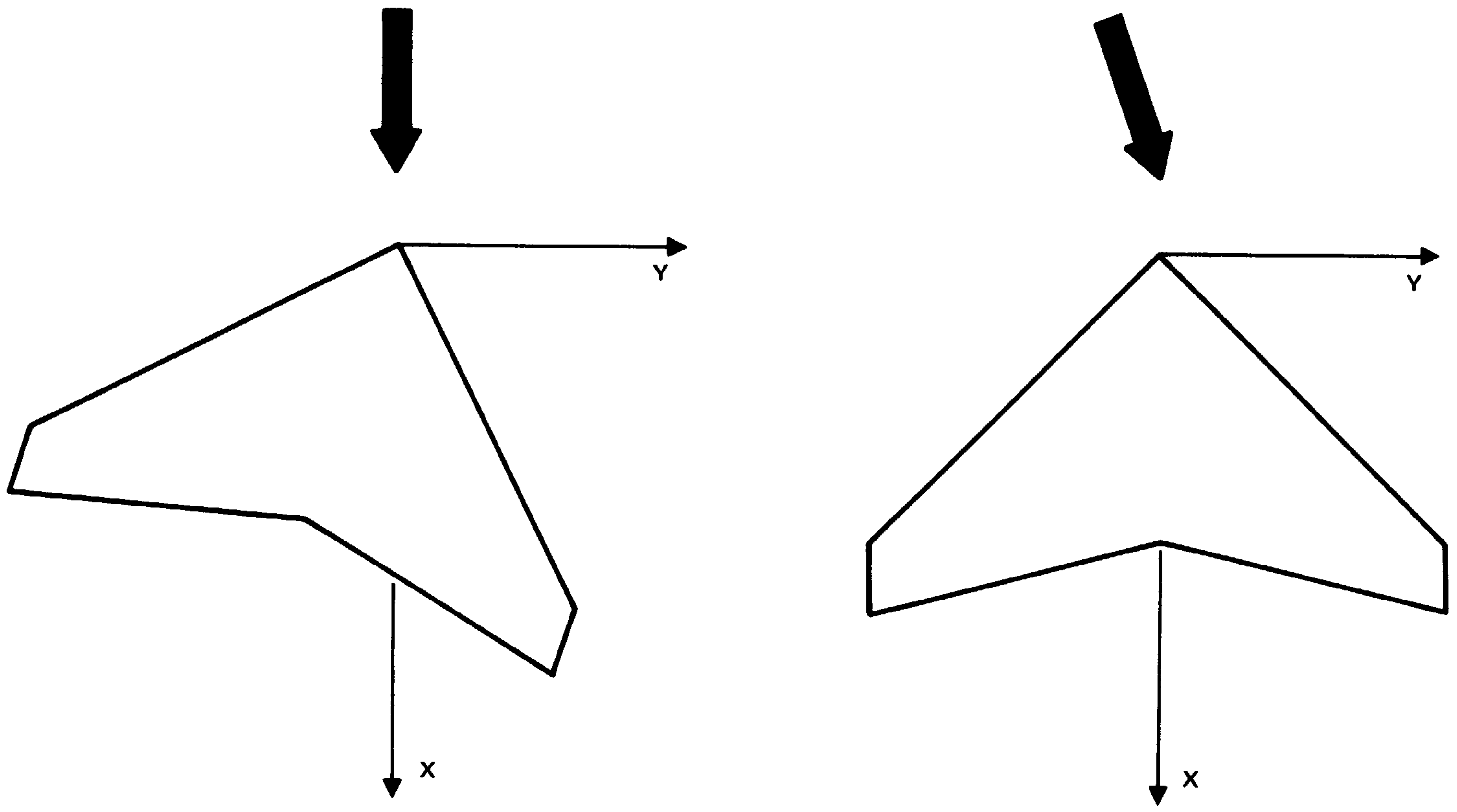
BOUNDARY CONDITION: $\bar{w} \cdot \bar{n} = -\bar{u}_{\infty} \cdot \bar{n}$; $\bar{n} = \ell \bar{i} + m \bar{j} + n \bar{k}$



AXIAL DISTRIBUTION OF VORTEX LINES: $\frac{X_j^V - X_0}{L} = \frac{1}{2} \left\{ 1 - \cos\left(\pi \frac{2J-1}{2N} \right) \right\}$

AXIAL DISTRIBUTION OF B.C. CONTROL POINTS: $\frac{X_j^c - X_o}{L} = \frac{1}{2} \left\{ 1 - \cos\left(\pi \frac{J}{N} \right) \right\}$

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



SKEWED WING

SKEWED FREE-STREAM

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

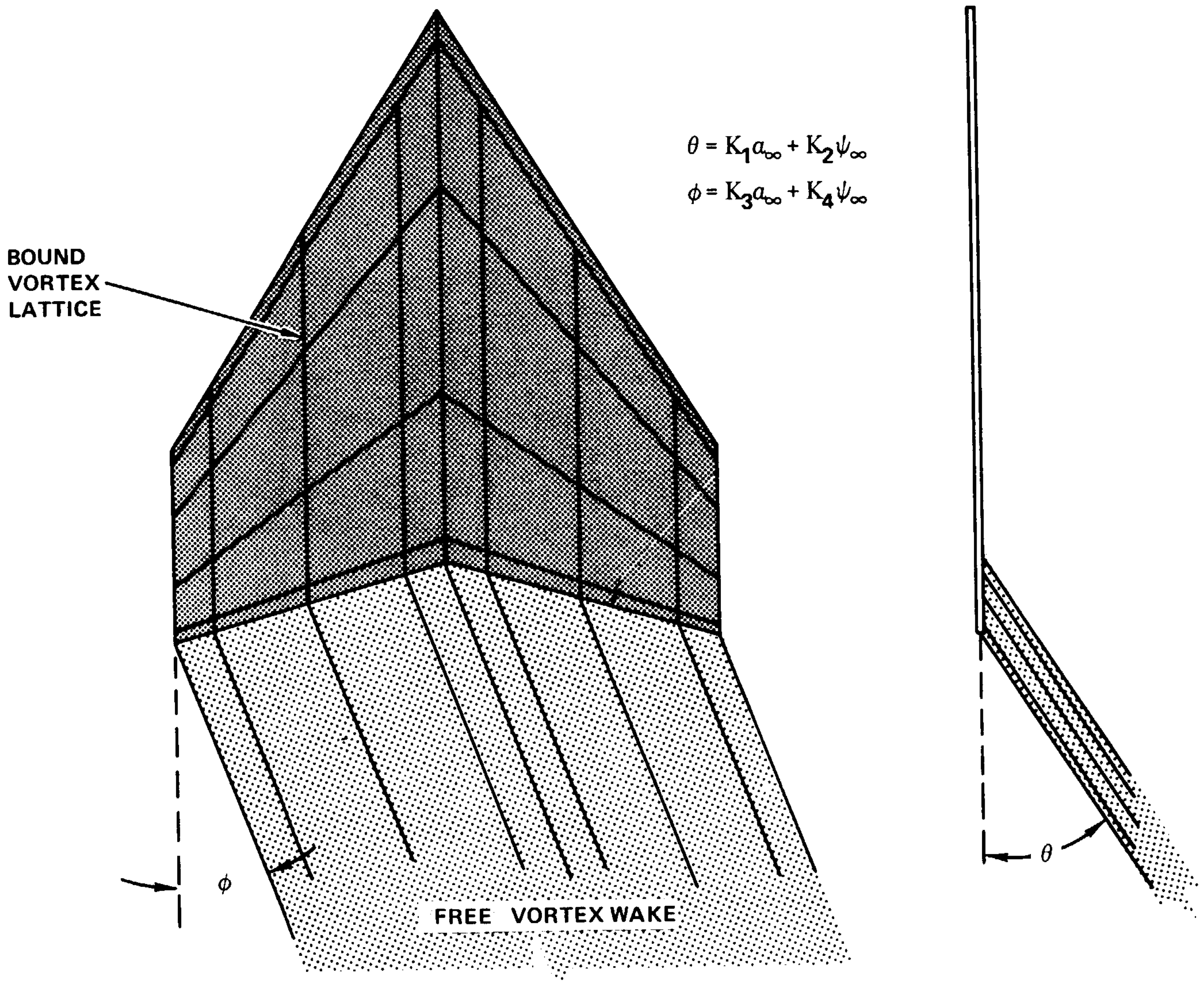


Figure 7.- Lattice geometry for analysis of wing in sideslip.

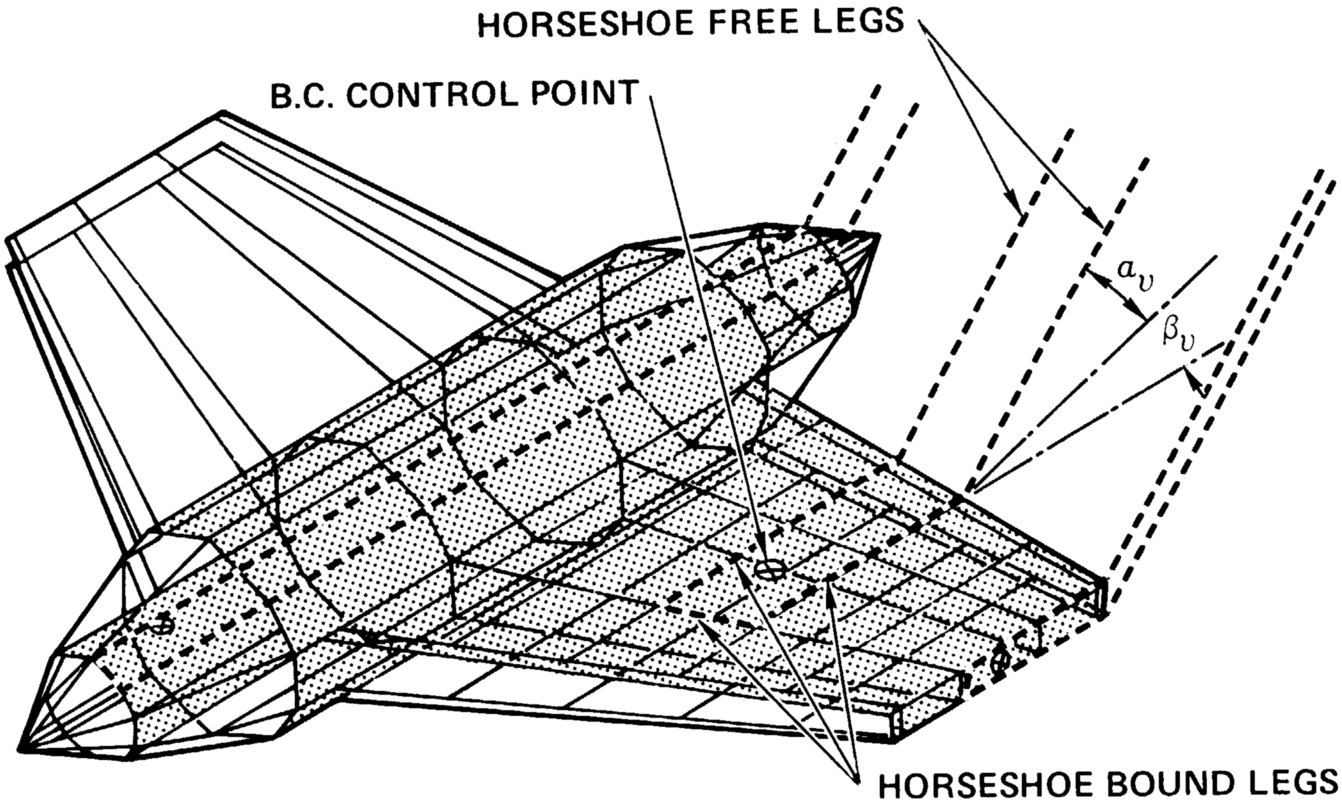


Figure 8.- Generalized vortex lattice model of wing-body configuration.

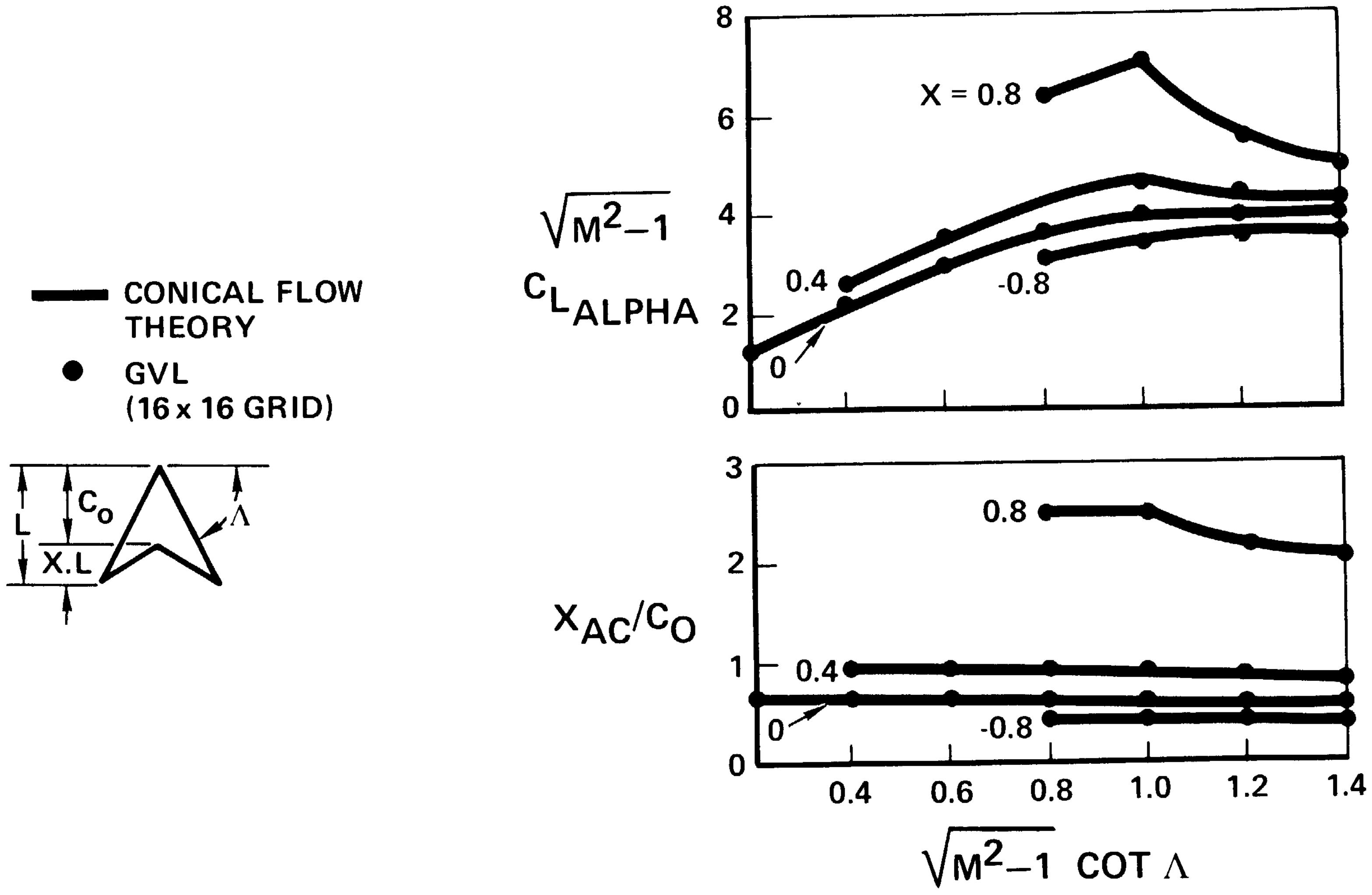


Figure 9.- Theoretical comparison of arrow wing lift slope and aerodynamic center location.

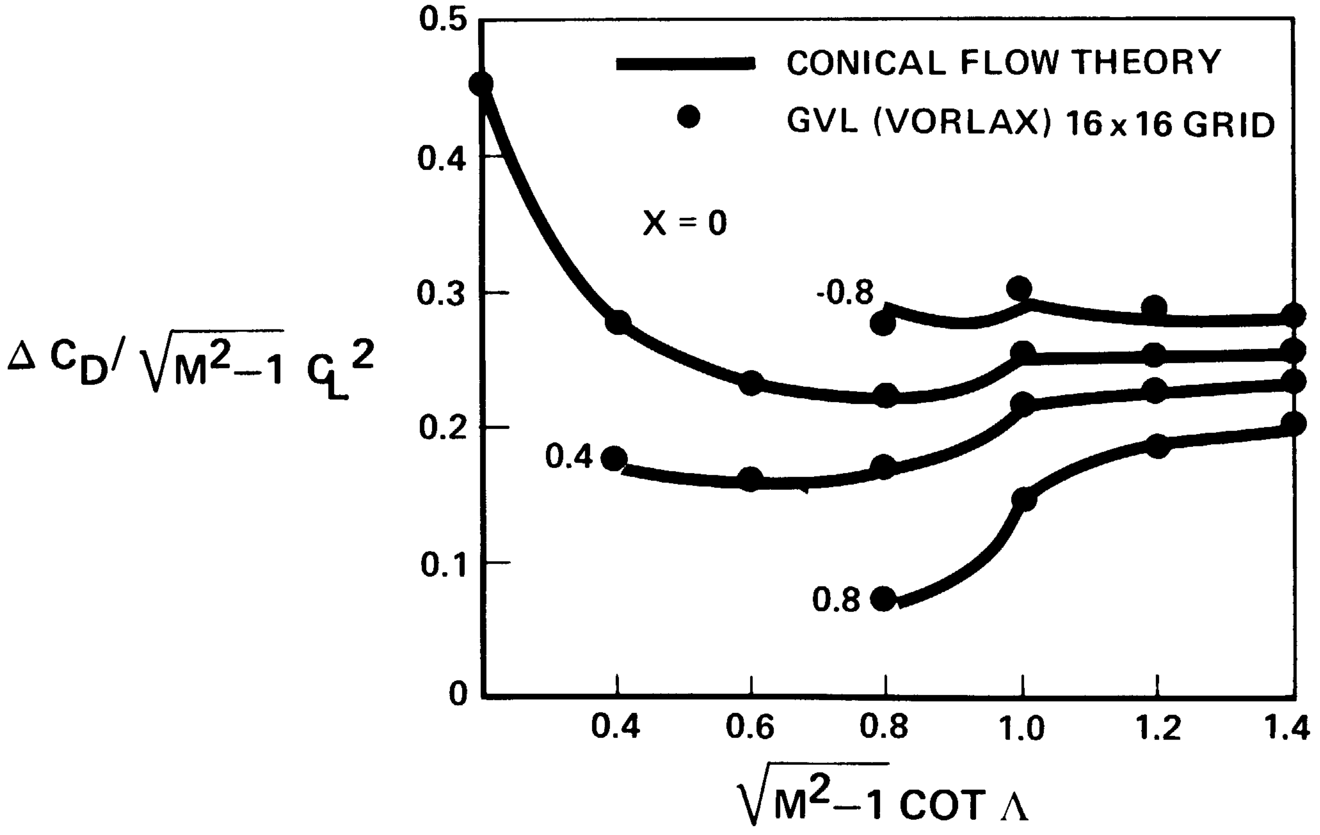


Figure 10.- Theoretical comparison of arrow wing drag-due-to-lift factor.
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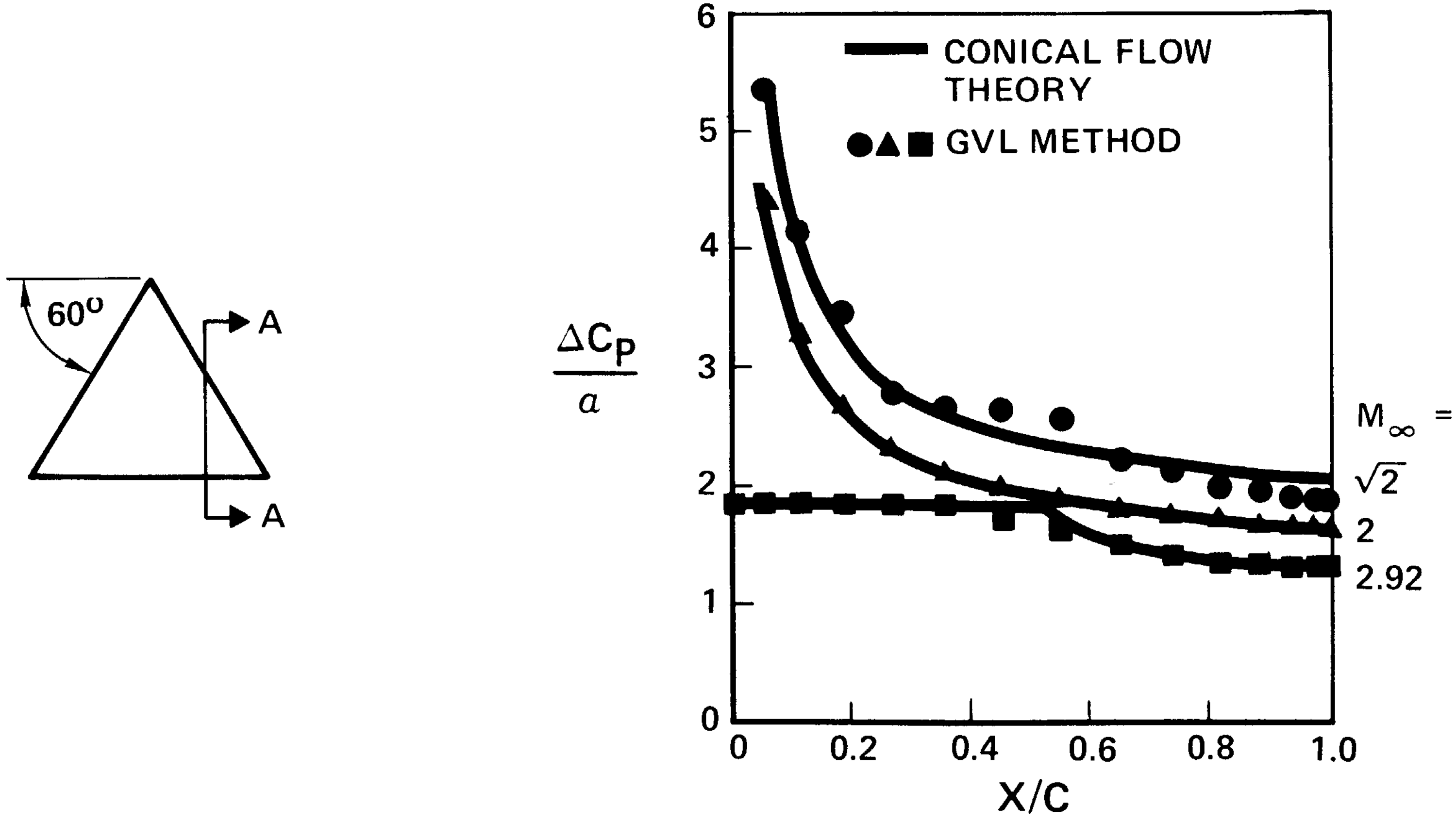


Figure 11.- Theoretical comparison of chordwise loading for delta wing.

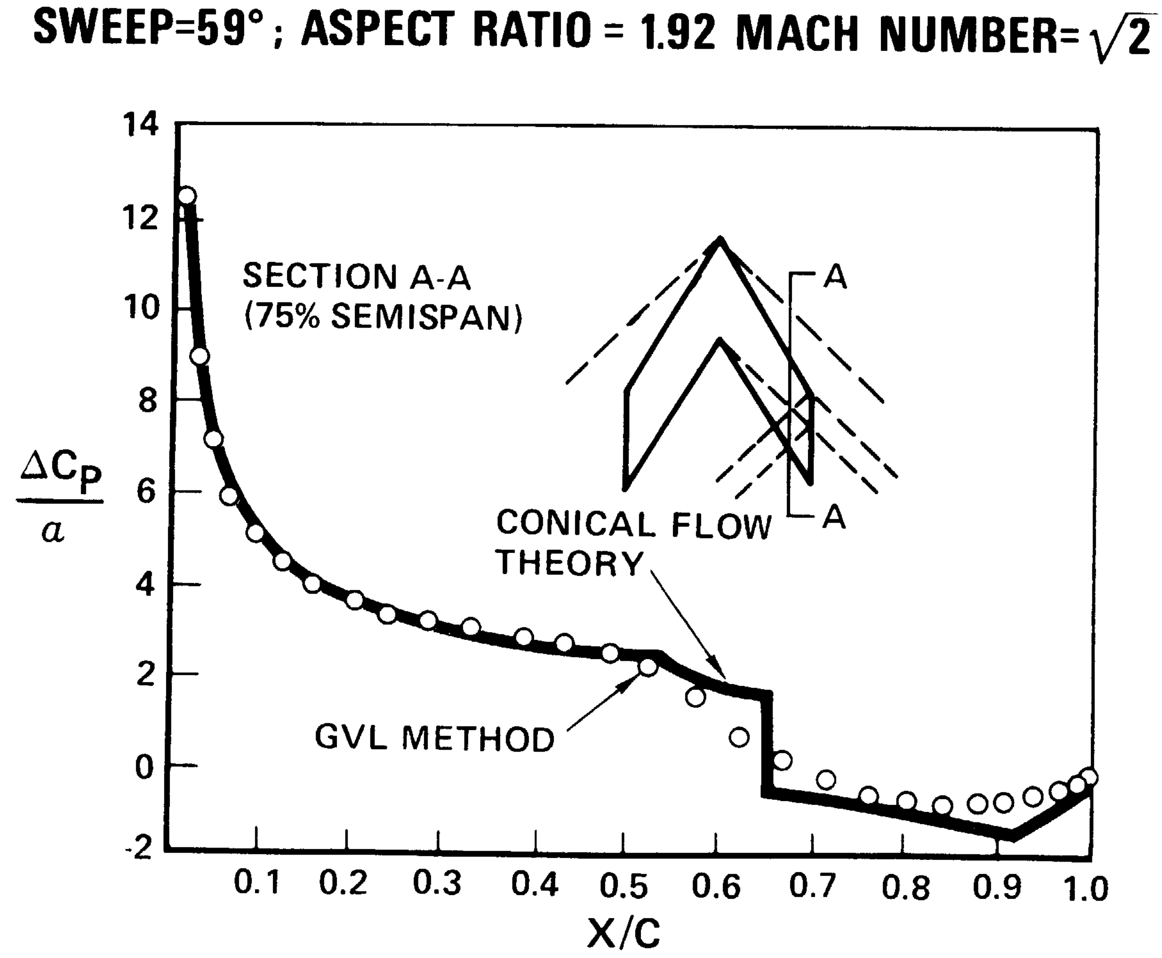


Figure 12.- Theoretical comparison of chordwise loading for sweptback rectangular wing.

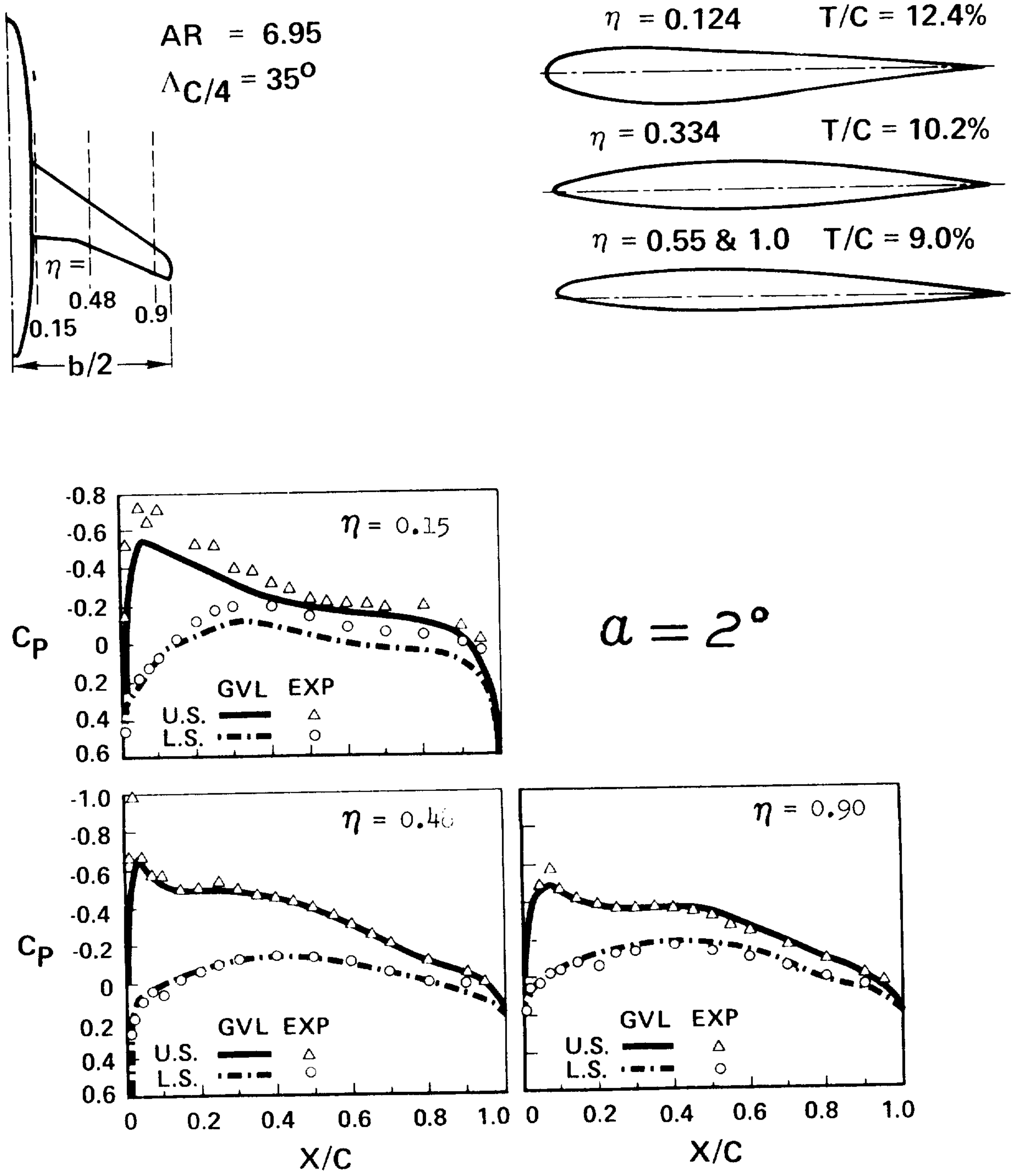


Figure 13.- Comparison with experimental pressure distribution on wing-body model at Mach = 0.5.

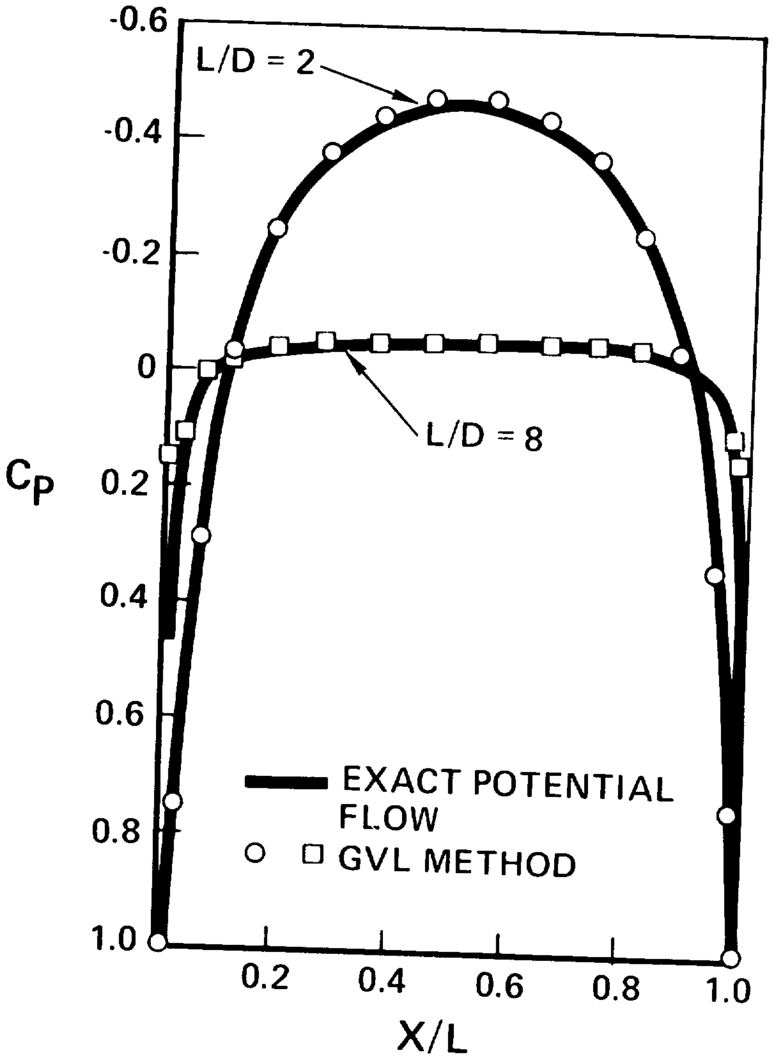


Figure 14.- Theoretical comparison of pressure distribution on ellipsoids at zero angle of attack in incompressible flow.

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

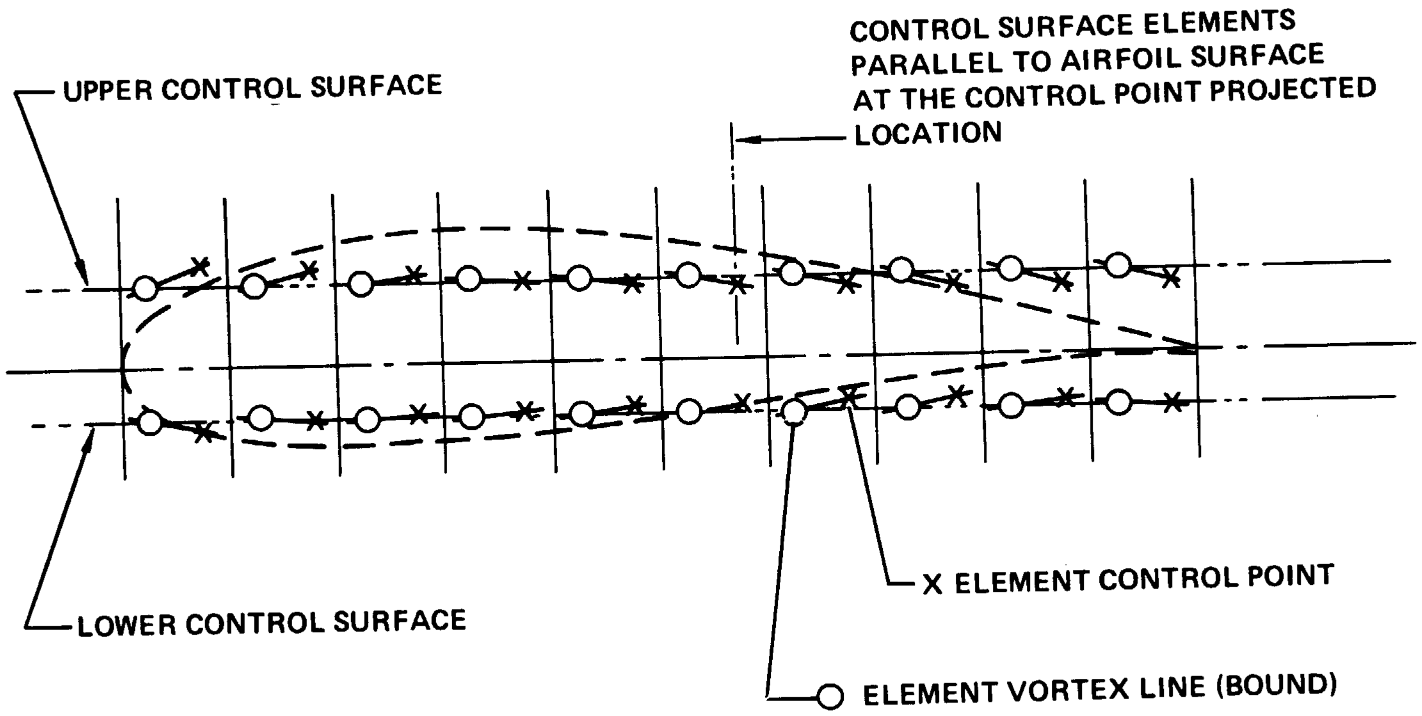
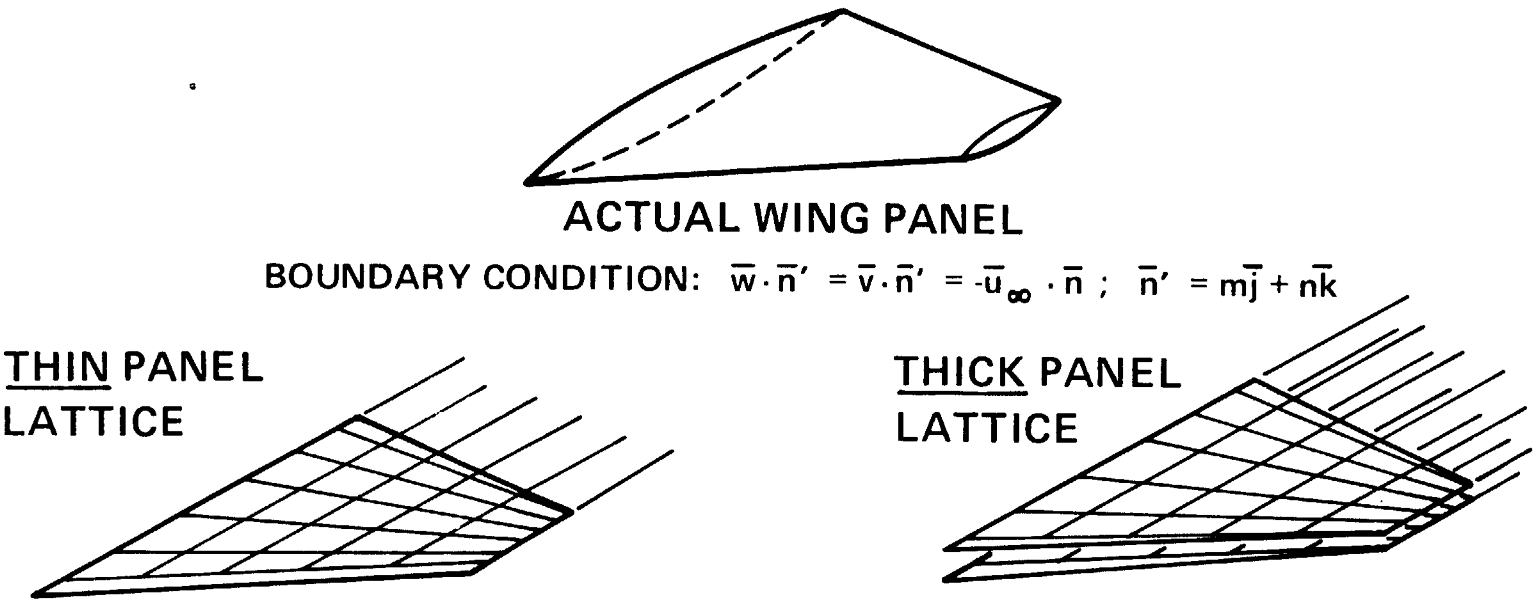


Figure A-1. - Control surface nomenclature



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

CHORDWISE DISTRIBUTION OF VORTEX LINES: $\dfrac{X_j^v - X_o}{C} = \dfrac{1}{2} \left\{ 1 - \cos\left(\pi \dfrac{2J - 1}{2N} \right) \right\}$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS: $\dfrac{X_j^c - X_o}{C} = \dfrac{1}{2} \left\{ 1 - \cos\left(\pi \dfrac{J}{N} \right) \right\}$

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 Jth 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.

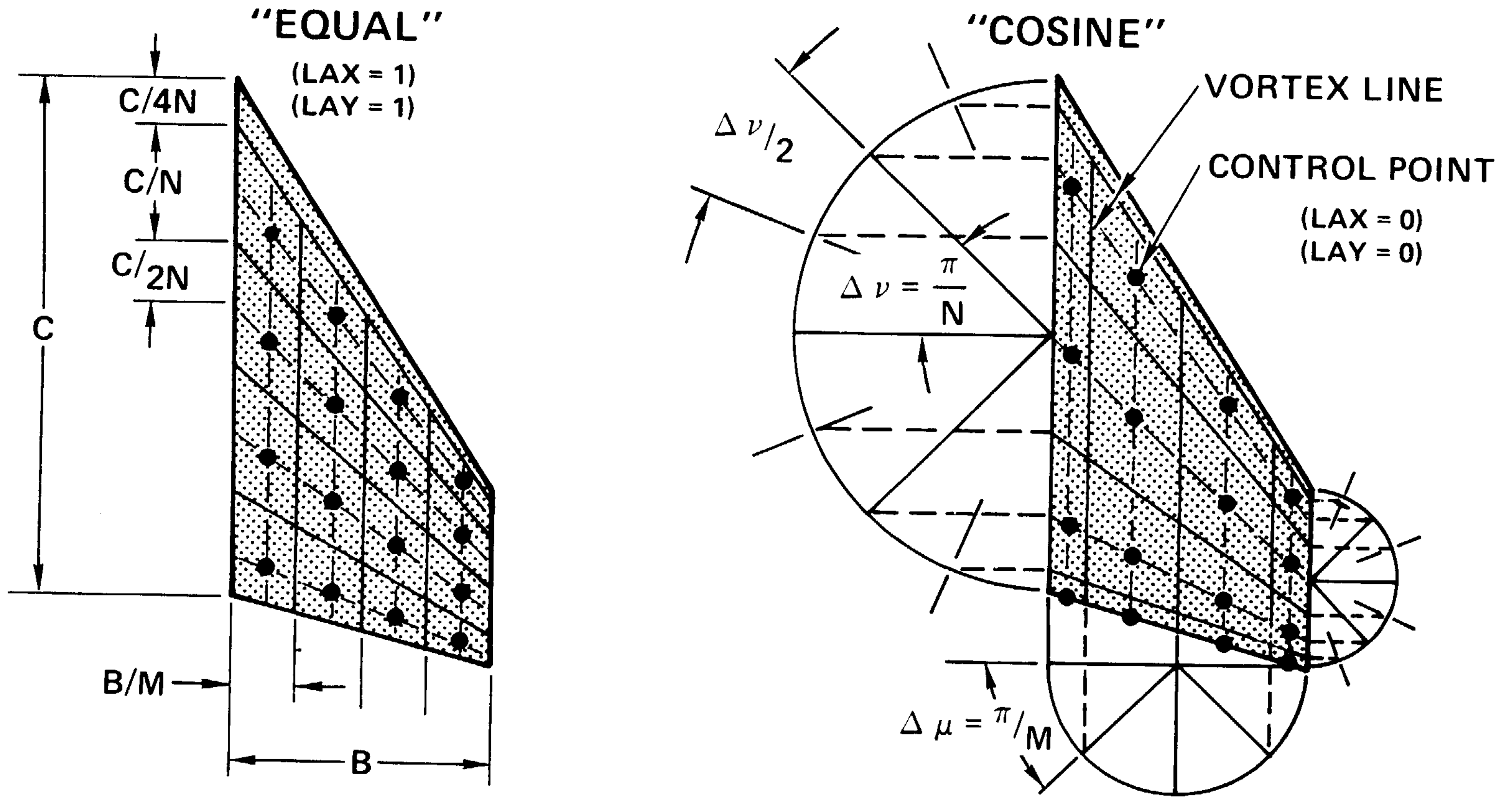
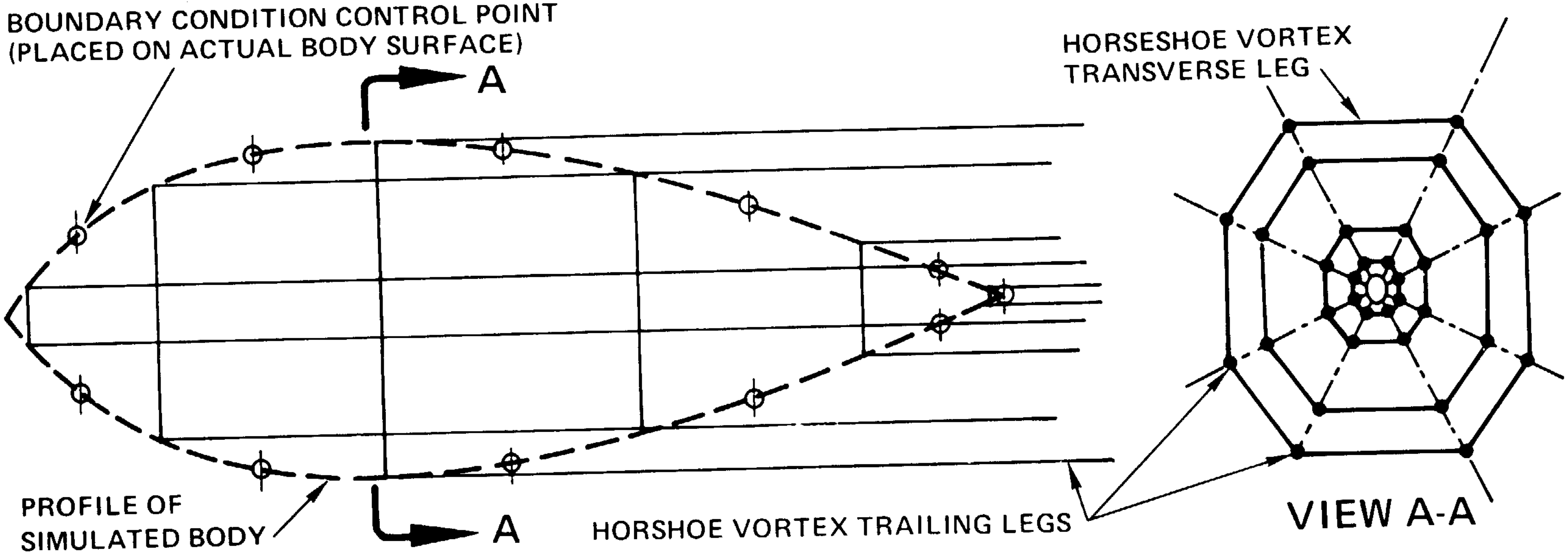


Figure A-3. - Vortex lattice collocation

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



AXIAL DISTRIBUTION OF VORTEX LINES: $$\frac{X_j^v - X_o}{L} = \frac{1}{2} \left\{ 1 - \cos\left(\pi \frac{2J-1}{2N} \right) \right\}$$

AXIAL DISTRIBUTION OF B.C. CONTROL POINTS: $$\frac{X_j^c - X_o}{L} = \frac{1}{2} \left\{ 1 - \cos\left(\pi \frac{J}{N} \right) \right\}$$

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

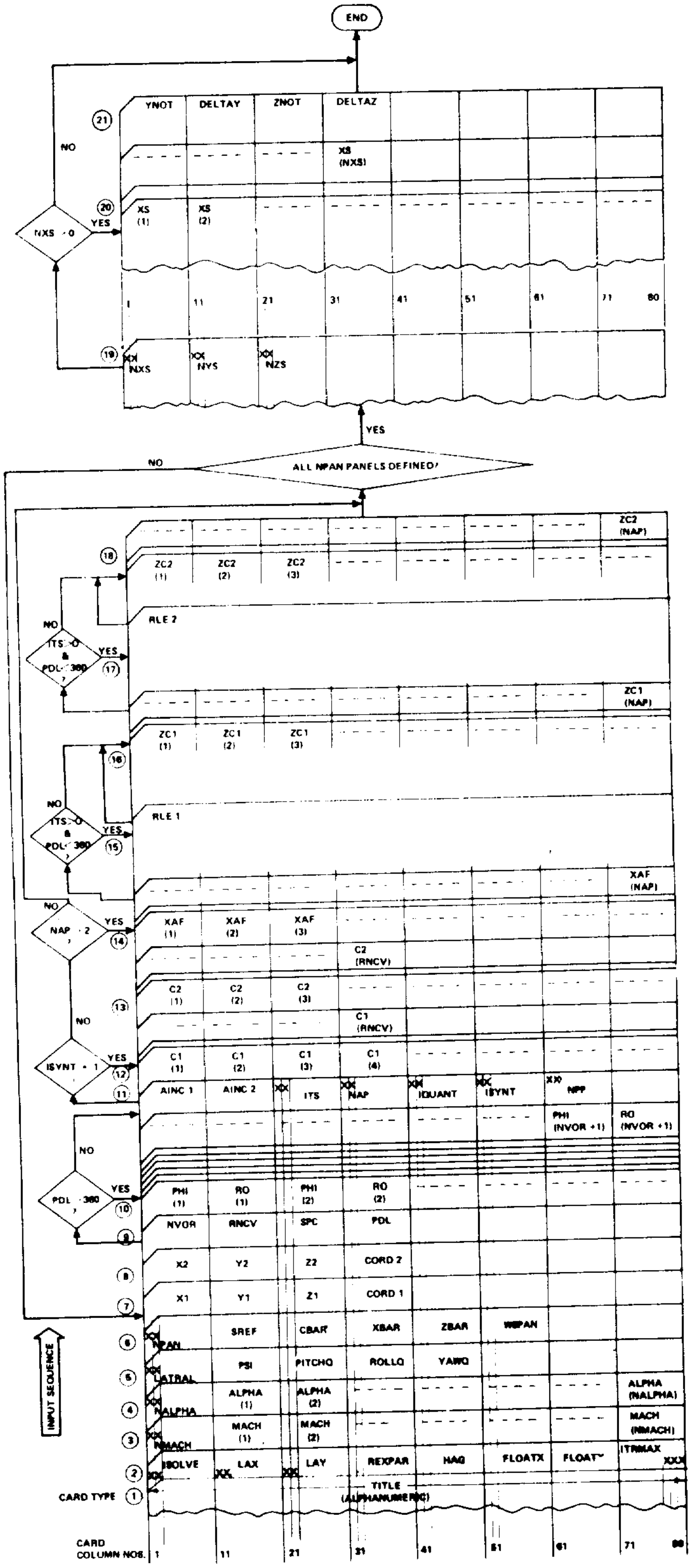


Figure A-5. - VORLAX case data deck setup

	for most cases the difference in the results between cosine spanwise spacing and even spanwise spacing is negligible.
REXPAR	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 convergen 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 α_V=FLØATX·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

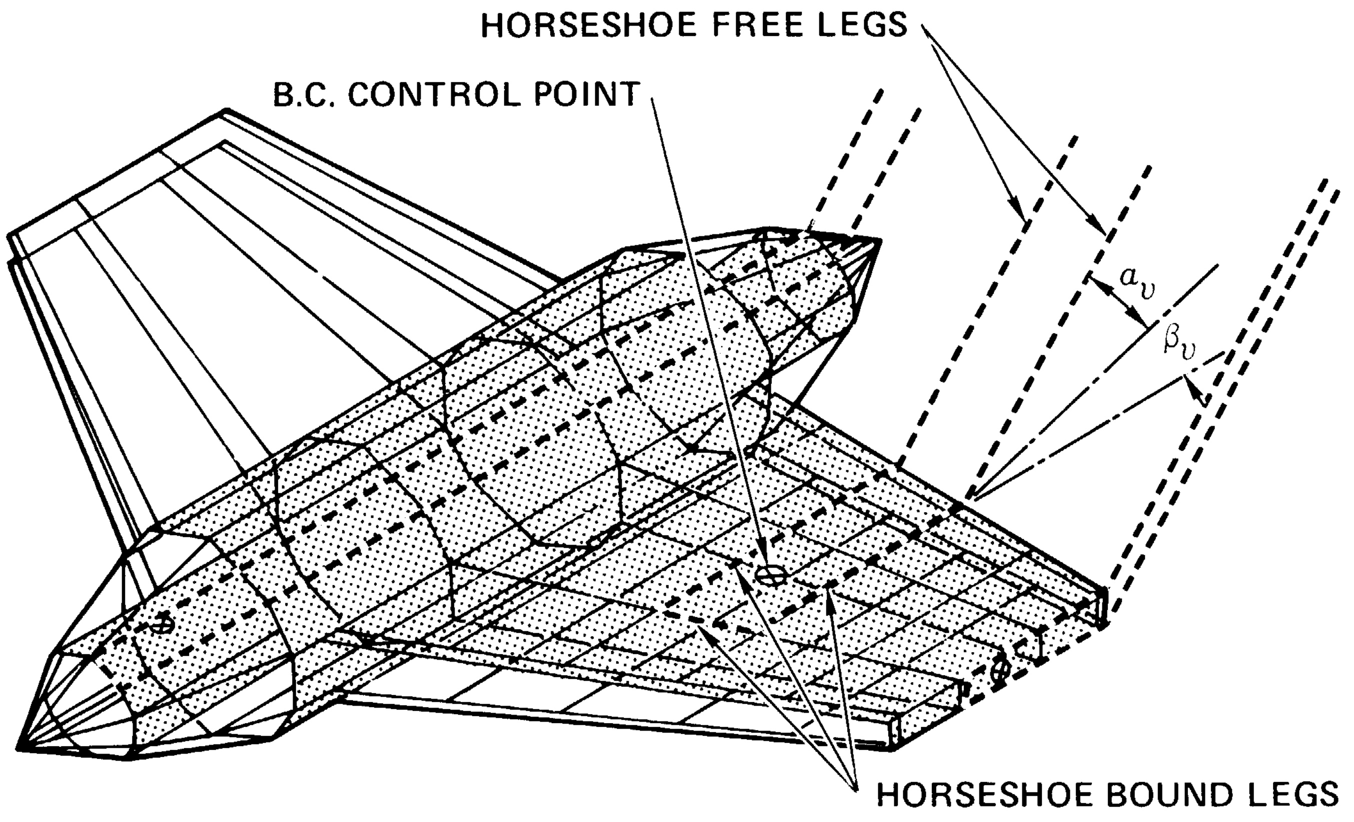


Figure A-6. Generalized vortex lattice model of wing body configuration

		β_v = FLØATY·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 ISØLV = 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 ≤ 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 ≤ 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 Cm_q, C_{L_q}, etc. LATRAL may be 0 when PITCHQ is nonzero.
	RØLLQ	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 airstream 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 semispan) 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	Abscissa 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 $(X/C)_{control} = 0.5\ (1-\cos\ (K\pi/N))$, 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 $(X/C)_{control} = (4K-1)/(4N)$, 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 NVOR and RNCV, if more than one major panel is used in the description of the configuration, the following should be observed:

$$\text{If LATRAL=0,}\quad \sum_{1}^{NPAN} NVOR \times RNCV \le 2000$$

$$\text{If LATRAL=1,}\quad \sum_{1}^{NPAN} NVOR \times RNCV \times IQUANT \le 2000$$

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 RO 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 airfoil being a good average value to use.
NAP	Number of percent chords or stations along the chord (CØRD1 and CØRD2) 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 on 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 ≠ 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 ≠ 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 ar 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 x NYS x NZS ≤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. Omit this card if NXS=0. 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. Omit this card if NXS = 0.
	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 LATRAL = 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	=C0RD1 (see input terminology).
TAPER	Panel taper ratio, C0RD2/C0RD1.

PSPAN	Panel span.
NV0R	=NV0R (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).
CLT0T	Total (summation over all panels) lift coefficient referenced to SREF.
CDT0T	Total pressure drag coefficient, referenced to SREF.
CYT0T	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 ($\Delta C_p = C_{p\ell} - C_{pu}$) 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).
EPSLØN	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

```
[illegible] INPUT DECK **********

SUPERSONIC 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
    0.0     0.0529   0.2700    0.3078    0.1145   -0.2430   -0.6925   -1.1609
 -1.6545   -2.1469  -2.6232   -3.0692   -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   -0.2430   -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   52.9870            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   -1.2362
```

TABLE A-1. - Continued

```
**********   5 **********
  190.5400    36.8040    -7.7160    52.9870            WING PANEL NO. 4
  222.5800    48.6830    -8.9740    31.1720            WING PANEL NO. 4
    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        0.0151     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    19.4500            WING PANEL NO. 5
    5.0000    10.0000     0.0        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       -0.0257    -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

**********   8 **********
  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            NVOR,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

********** 10 **********
  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            NVOR,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    19.45000            FIN PANEL NO. 1
  259.5398    64.5000    -2.8000    14.1100            FIN PANEL NO. 1
    4.0000    10.0000     0.0        0.0               NVOR,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/-14 WING) WITH O/U NACELLES. (1/10 SCALE).


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    0.0       0.0       4.5762    999.0000    0.0     352.3999    1.0000   21.5263      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  146.2500   22.3940   -5.4470     -8.1360   72.8381   92.5970    0.7020    9.4593      3.      10.       1.00
 4  176.8800   31.7410   -6.9000     -9.1556   69.4225   65.0010    0.8152    5.1283      7.      10.       1.00
 5  190.5400   36.8040   -7.7160     -6.0452   64.5531   52.9870    0.5983   11.9454      4.      10.       1.00
 6  222.5900   43.6930   -3.9740     -3.7114   58.0550   31.1720    0.6240   15.8502      5.      10.       0.0
 7  209.4000   22.3940   -3.4000    -90.0000    0.0      39.3000    1.0000    2.0470      1.      10.       0.0
 8  209.4000   22.3940    3.3340    999.0000    0.0      39.7000    1.0000   20.3520      6.      10.       0.0
 9  209.1000   22.3940   -5.4470    -90.0000    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   19.2000      6.      10.       0.0
11  248.0000   64.5000  -10.0000     90.0000   58.0288   19.4500    0.7254    7.2000      4.      10.       0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     1

    0.0        0.0
    0.0614     0.0517     0.0609     0.0604     0.0598     0.0639     0.0581     0.0515     0.0443     0.0269
    0.0168     0.0052    -0.0009    -0.0157    -0.0313    -0.0495    -0.0542    -0.0339    -0.0325    -0.0340
   -0.0372    -0.0359    -0.0354    -0.0323    -0.0342    -0.0371    -0.0348    -0.0283    -0.0165    -0.0120
   -0.0022     0.0017     0.0041     0.0714     0.0316     0.0374     0.0417     0.0508     0.0601     0.0661
    0.0706     0.0762     0.0909     0.0843     0.0879     0.0901     0.0914     0.0418
   33.9357    16.8519    11.1051     8.1970     6.4117     4.9135     4.3401     3.9974     3.5486     3.2451
    2.8080     2.4013     2.0086     2.1629     2.2044    -0.0001    -0.0001     0.0002     0.0002     0.0001
   -0.0000     0.0002    -0.0000    -0.0031    -0.0001     0.0        0.0        0.0001     0.0001    -0.0000
   -0.0004    -0.0004    -2.3432    -2.2180    -2.1524    -2.2966    -2.7042    -2.9884    -3.3901    -3.6802
   -3.0517    -4.6004    -6.4996    -9.0663   -13.0301   -20.5287   -42.3857  -100.0000

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     2

    0.0        0.0
   -0.0261    -0.0723    -0.0739    -0.0546    -0.0359    -0.0247    -0.0229    -0.0250    -0.0271    -0.0278
    0.0600     0.0002    -0.0322    -0.0439    -0.0496    -0.0492    -0.0463    -0.0427    -0.0403    -0.0394

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     3

    0.0        0.0
    0.0600     0.0002    -0.0322    -0.0439    -0.0486    -0.0492    -0.0463    -0.0427    -0.0403    -0.0394
    0.0397     0.0277    -0.0048    -0.0171    -0.0255    -0.0304    -0.0332    -0.0342    -0.0346    -0.0348

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     4

    0.0        0.0
    0.0377     0.0277    -0.0048    -0.0171    -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    -0.0279    -0.0283
```

TABLE A-1. - Continued

```
 INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     5

   0.0        0.0
   0.0129     0.0282    -0.0024    -0.0117    -0.0180    -0.0229    -0.0254    -0.0269    -0.0279    -0.0283
  -0.0242     0.0241     0.0013     0.0065     0.0035     0.0028     0.0018     0.0013     0.0008     0.0006

 INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     6

   0.0        0.0
  -0.0242     0.0041     0.0054  ,  0.0062     0.0037     0.0031     0.0016     0.0013     0.0008     0.0006


 -0.0357    -0.0225    -0.0056     0.0006     0.0129     0.0204     0.0291     0.0422     0.0353     0.0327
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     7

  0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     8

  0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0000     0.0000     0.0000     0.0000     0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     9

  0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL    10

  0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
 -0.0000    -0.0000    -0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL    11

  0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
```

TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (CL1697-227-24 WING) WITH [illegible] NACELLES. (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   (INVERS = 0)


MOMENT AND ROTATION CENTER  :   XBAR =  0.19104E 03     ZBAR = -0.54500E 01  ***** VINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOATATION PARAMETERS :  FLOATX = 0.0      FLOATY = 0.0


CN 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      CN(I)       CL(I)       CY(I)       CD(I)      CT(I)      CS(I)       CM(I)        CRM(I)       CYM(I)

  1  0.7839E 00     0.00229     0.00962     0.00256     0.00128    0.0        0.0        0.4681E-02  -0.8690E-04  -0.2451E-03
  2  0.1941E 00     0.16358     0.03164    -0.00010     0.00270    0.00096    0.00328    0.8474E-02   0.3571E-02  -0.2670E-03
  3  0.7703E-01     0.21512     0.01638     0.00255     0.00067    0.00086    0.00291    0.7174E-03   0.3438E-02  -0.2254E-03
  4  0.3126E-01     0.26704     0.00926     0.00133     0.00019    0.00054    0.00153   -0.9000E-03   0.2221E-02   0.6381E-04
  5  0.5194E-01     0.32202     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     0.01524     0.00099     0.00148    0.0        0.0       -0.7380E-02   0.6671E-02  -0.2670E-03
  7  0.8313E-02    -0.04564    -0.00000    -0.00038    -0.00000    0.0        0.0        0.9647E-10  -0.1704E-05  -0.5411E-04
  8  0.8255E-01     0.03916    -0.00014    -0.00043    -0.00001    0.0        0.0        0.1909E-04  -0.8790E-05  -0.3386E-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  0.7817E-01    -0.04563    -0.00000     0.00012    -0.00000    0.0        0.0       -0.4594E-04   0.3690E-05  -0.2815E-05
 11  0.1249E-01     0.23383     0.00000    -0.00292     0.00000    0.0        0.0       -0.2350E-08  -0.1631E-03  -0.1461E-02

      SREF          WSPAN          CHAR            CLTOT          CDTOT         CYTOT     CMTOT          CRMTOT         CYMTOT

  0.96768E 04   0.12900E 03   0.10223E 03       0.19538        0.01254        0.0     0.22025E-02   0.0            0.0


 CD/CL**2 = 0.3285     E = 0.5635
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-327-24 WING) WITH 2/D 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  D/S

 S  C  X/C      X       Y        Z      CHORD   SLOPE  ITS     DCP      CNC     CN       DL       CMT        GAMMA      CTC      CDC


                           PANEL NO.   1              FUSELAGE (FUSIFORM PANEL)

 1  1 0.0003    0.094   0.107  -2.400 352.400  0.6679  1    -4.000    5.431  0.015  -27.50   -0.0022  0.1391E 03  0.0       0.64334
 1  2 0.0024    0.848   0.321  -1.969 352.400  0.3589  1     0.350                                     0.1741E 02
 1  3 0.0067    2.353   0.532  -1.533 352.400  0.2547  1     0.459                                     0.7369E 01
 1  4 0.0131    4.603   0.741  -1.132 352.400  0.2017  1     0.190                                     0.4561E 01
 1  5 0.0215    7.587   0.945  -0.790 352.400  0.1690  1     0.076                                     0.3392E 01
 1  6 0.0320   11.293   1.143  -0.409 352.400  0.1455  1     0.052                                     0.2787E 01
 1  7 0.0446   15.706   1.327  -0.057 352.400  0.1306  1     0.032                                     0.2442E 01
 1  8 0.0590   20.905   1.512   0.298 352.400  0.1161  1     0.024                                     0.2213E 01
 1  9 0.0754   26.570   1.701   0.663 352.400  0.1025  1     0.019                                     0.2049E 01
 1 10 0.0936   32.976   1.891   1.027 352.400  0.0826  1     0.009                                     0.1934E 01
 1 11 0.1135   39.995   2.078   1.386 352.400  0.0656  1     0.002                                     0.1847E 01
 1 12 0.1351   47.590   2.256   1.724 352.400  0.0480  1    -0.002                                     0.1782E 01
 1 13 0.1582   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 0.2088   73.567   2.756   2.699 352.400  0.0121  1    -0.022                                     0.1654E 01
 1 16 0.2360   83.154   2.933   3.029 352.400 -0.0439  1    -0.048                                     0.1639E 01
 1 17 0.2643   93.140   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 -0.0288  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   2.942   3.045 352.400 -0.0319  1    -0.048                                     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    -0.054                                     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 -0.0026  1    -0.009                                     0.1526E 01
 1 32 0.7357  259.259   2.941   3.045 352.400  0.0015  1    -0.011                                     0.1513E 01
 1 33 0.7640  269.245   2.950   3.063 352.400 -0.0343  1    -0.027                                     0.1507E 01
 1 34 0.7912  278.832   2.808   2.790 352.400 -0.0211  1     0.007                                     0.1460E 01
 1 35 0.8172  287.979   2.644   2.474 352.400 -0.0108  1     0.016                                     0.1450E 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   2.333   1.875 352.400 -0.0119  1     0.018                                     0.1447E 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 -0.0079  1     0.033                                     0.1440E 01
 1 41 0.9410  331.594   1.630   0.525 352.400  0.0075  1     0.039                                     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                                     0.9836E 00
 1 48 0.9997  352.305   0.133  -2.351 352.400 -1.7262  1     0.715                                    -0.1169E 00
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH U/W 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  D/S
  S  C  X/C        X        Y         Z     CHORD   SLOPE  ITS     CCP     CNC    CN      DL       CMT        GAMMA      CTC       CDC

 2   1 0.0003    0.094    0.227   -2.583 352.400  0.6087  1    -4.000    7.015  0.020  -84.37   -0.0044   0.1369E 03  0.0      0.16316
 2   2 0.0024    0.848    0.679   -2.538 352.400  0.3053  1     0.964                                     0.1724E 02
 2   3 0.0067    2.353    1.177   -2.494 352.400  0.2037  1     0.427                                     0.7311E 01
 2   4 0.0131    4.605    1.569   -2.451 352.400  0.1514  1     0.148                                     0.4531E 01
 2   5 0.0215    7.567    2.001   -2.408 352.400  0.1197  1     0.061                                     0.3369E 01
 2   6 0.0320   11.293    2.421   -2.367 352.400  0.0935  1     0.038                                     0.2770E 01
 2   7 0.0446   15.706    2.809   -2.328 352.400  0.0828  1     0.023                                     0.2427E 01
 2   8 0.0590   20.805    3.201   -2.290 352.400  0.0743  1     0.019                                     0.2199E 01
 2   9 0.0754   26.570    3.602   -2.250 352.400  0.0674  1     0.016                                     0.2035E 01
 2  10 0.0936   32.976    4.004   -2.210 352.400  0.0603  1     0.012                                     0.1917E 01
 2  11 0.1135   39.995    4.400   -2.171 352.400  0.0515  1     0.008                                     0.1932E 01
 2  12 0.1351   47.596    4.777   -2.134 352.400  0.0432  1     0.005                                     0.1768E 01
 2  13 0.1582   55.751    5.124   -2.100 352.400  0.0356  1     0.003                                     0.1719E 01
 2  14 0.1828   64.420    5.454   -2.067 352.400  0.0369  1     0.003                                     0.1674E 01
 2  15 0.2089   73.567    5.836   -2.036 352.400  0.0361  1    -0.003                                     0.1637E 01
 2  16 0.2360   83.154    6.211   -1.993 352.400 -0.0049  1    -0.022                                     0.1624E 01
 2  17 0.2643   93.140    6.228   -1.991 352.400 -0.0053  1    -0.025                                     0.1608E 01
 2  18 0.2936  103.481    6.228   -1.991 352.400 -0.0033  1    -0.064                                     0.1638E 01
 2  19 0.3239  114.133    6.229   -1.991 352.400 -0.0032  1    -0.084                                     0.1658E 01
 2  20 0.3549  125.051    6.229   -1.991 352.400 -0.0033  1    -0.097                                     0.1677E 01
 2  21 0.3865  136.189    6.228   -1.991 352.400 -0.0037  1    -0.089                                     0.1678E 01
 2  22 0.4186  147.497    6.229   -1.991 352.400 -0.0035  1    -0.049                                     0.1655E 01
 2  23 0.4510  158.924    6.228   -1.991 352.400 -0.0035  1    -0.013                                     0.1631E 01
 2  24 0.4836  170.434    6.228   -1.991 352.400 -0.0032  1    -0.016                                     0.1625E 01
 2  25 0.5164  181.965    6.228   -1.991 352.400 -0.0034  1    -0.033                                     0.1624E 01
 2  26 0.5490  193.470    6.228   -1.991 352.400 -0.0036  1    -0.040                                     0.1607E 01
 2  27 0.5814  204.902    6.228   -1.991 352.400 -0.0034  1    -0.083                                     0.1636E 01
 2  28 0.6135  216.710    6.229   -1.991 352.400 -0.0028  1    -0.025                                     0.1582E 01
 2  29 0.6451  227.348    6.229   -1.991 352.400 -0.0016  1    -0.074                                     0.1567E 01
 2  30 0.6761  238.266    6.228   -1.991 352.400 -0.0012  1    -0.032                                     0.1559E 01
 2  31 0.7064  248.918    6.228   -1.991 352.400 -0.0002  1    -0.004                                     0.1525E 01
 2  32 0.7357  259.259    6.228   -1.991 352.400  0.0002  1    -0.008                                     0.1513E 01
 2  33 0.7640  269.245    6.248   -1.989 352.400 -0.0407  1    -0.028                                     0.1512E 01
 2  34 0.7912  278.832    5.947   -2.019 352.400 -0.0373  1    -0.001                                     0.1472E 01
 2  35 0.8172  287.979    5.599   -2.053 352.400 -0.0351  1     0.005                                     0.1463E 01
 2  36 0.8418  296.648    5.270   -2.086 352.400 -0.0371  1     0.006                                     0.1461E 01
 2  37 0.8649  304.801    4.939   -2.119 352.400 -0.0439  1     0.005                                     0.1460E 01
 2  38 0.8865  312.404    4.581   -2.154 352.400 -0.0481  1     0.008                                     0.1457E 01
 2  39 0.9064  319.473    4.210   -2.190 352.400 -0.0543  1     0.010                                     0.1457E 01
 2  40 0.9246  325.829    3.826   -2.228 352.400 -0.0589  1     0.014                                     0.1457E 01
 2  41 0.9410  331.594    3.451   -2.265 352.400 -0.0473  1     0.019                                     0.1455E 01
 2  42 0.9554  336.694    3.168   -2.293 352.400 -0.0742  1    -0.002                                     0.1474E 01
 2  43 0.9680  341.106    2.810   -2.328 352.400 -0.1075  1    -0.008                                     0.1480E 01
 2  44 0.9785  344.813    2.385   -2.370 352.400 -0.1527  1    -0.001                                     0.1485E 01
 2  45 0.9869  347.797    1.907   -2.417 352.400 -0.2228  1     0.021                                     0.1492E 01
 2  46 0.9933  350.046    1.389   -2.468 352.400 -0.3557  1     0.063                                     0.1503E 01
 2  47 0.9976  351.551    0.844   -2.522 352.400 -0.7438  1     0.066                                     0.1680E 01
 2  48 0.9997  352.305    0.281   -2.578 352.400 -1.7670  1     0.643                                     0.1530E 01

 3   1 0.0003    0.094    0.120   -2.789 352.400  0.5277  1.   -4.000   -8.668 -0.025 -146.87    0.0037   0.1363E 03  0.0      0.89241
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH J/U 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  D/S

  S  C  X/C       X        Y        Z      CHORD    SLOPE  ITS     DCP       CNC      CN        DL       CMT        GAMMA        CTC      CDC


  3  2 0.0024    0.948    0.358   -3.154 352.400  0.2364   1    -0.931                                           0.1696E 02
  3  3 0.0067    2.353    0.595   -3.517 352.400  0.1386   1     0.447                                           0.7251E 01
  3  4 0.0131    4.603    0.829   -3.874 352.400  0.0892   1     0.152                                           0.4496E 01
  3  5 0.0215    7.567    1.056   -4.223 352.400  0.0593   1     0.071                                           0.3343E 01
  3  6 0.0320   11.293    1.278   -4.563 352.400  0.0303   1     0.046                                           0.2750E 01
  3  7 0.0446   15.706    1.483   -4.877 352.400  0.0254   1     0.022                                           0.2411E 01
  3  8 0.0590   20.805    1.689   -5.193 352.400  0.0234   1     0.030                                           0.2182E 01
  3  9 0.0754   26.570    1.901   -5.518 352.400  0.0234   1     0.029                                           0.2019E 01
  3 10 0.0936   32.976    2.113   -5.841 352.400  0.0229   1     0.029                                           0.1898E 01
  3 11 0.1135   39.995    2.322   -6.163 352.400  0.0234   1     0.021                                           0.1815E 01
  3 12 0.1351   47.598    2.521   -6.463 352.400  0.0367   1     0.019                                           0.1751E 01
  3 13 0.1582   55.751    2.704   -6.749 352.400  0.0350   1     0.015                                           0.1704E 01
  3 14 0.1828   64.420    2.879   -7.015 352.400  0.0501   1     0.018                                           0.1656E 01
  3 15 0.2088   73.567    3.080   -7.225 352.400  0.0638   1     0.012                                           0.1616E 01
  3 16 0.2360   83.154    3.278   -7.627 352.400  0.0415   1    -0.004                                           0.1605E 01
  3 17 0.2643   93.140    3.287   -7.641 352.400  0.0454   1     0.021                                           0.1585E 01
  3 18 0.2936 103.481    3.287   -7.641 352.400  0.0283   1     0.047                                           0.1582E 01
  3 19 0.3239 114.133    3.287   -7.642 352.400  0.0272   1     0.073                                           0.1577E 01
  3 20 0.3549 125.051    3.287   -7.642 352.400  0.0285   1     0.072                                           0.1588E 01
  3 21 0.3865 136.185    3.287   -7.641 352.400  0.0312   1     0.076                                           0.1582E 01
  3 22 0.4186 147.497    3.287   -7.642 352.400  0.0301   1     0.050                                           0.1603E 01
  3 23 0.4510 158.929    3.287   -7.641 352.400  0.0246   1     0.038                                           0.1606E 01
  3 24 0.4836 170.434    3.287   -7.641 352.400  0.0271   1     0.040                                           0.1595E 01
  3 25 0.5164 181.965    3.287   -7.641 352.400  0.0287   1     0.049                                           0.1575E 01
  3 26 0.5490 193.470    3.287   -7.641 352.400  0.0311   1     0.060                                           0.1556E 01
  3 27 0.5814 204.902    3.287   -7.641 352.400  0.0242   1     0.064                                           0.1543E 01
  3 28 0.6135 216.210    3.287   -7.641 352.400  0.0237   1     0.036                                           0.1554E 01
  3 29 0.6451 227.348    3.287   -7.642 352.400  0.0139   1     0.035                                           0.1539E 01
  3 30 0.6761 238.266    3.287   -7.641 352.400  0.0101   1     0.038                                           0.1517E 01
  3 31 0.7064 248.918    3.287   -7.641 352.400  0.0018   1     0.012                                           0.1520E 01
  3 32 0.7357 259.254    3.287   -7.641 352.400 -0.0014   1    -0.002                                           0.1511E 01
  3 33 0.7640 269.245    3.297   -7.657 352.400 -0.0476   1    -0.028                                           0.1517E 01
  3 34 0.7912 278.832    3.138   -7.414 352.400 -0.0558   1    -0.006                                           0.1486E 01
  3 35 0.8172 287.979    2.955   -7.132 352.400 -0.0632   1    -0.001                                           0.1478E 01
  3 36 0.8418 296.648    2.781   -6.867 352.400 -0.0705   1     0.001                                           0.1475E 01
  3 37 0.8649 304.801    2.607   -6.594 352.400 -0.0811   1     0.000                                           0.1475E 01
  3 38 0.8865 312.404    2.418   -6.310 352.400 -0.0936   1     0.001                                           0.1475E 01
  3 39 0.9064 319.423    2.222   -6.010 352.400 -0.1082   1     0.003                                           0.1478E 01
  3 40 0.9246 325.829    2.019   -5.699 352.400 -0.1181   1     0.009                                           0.1478E 01
  3 41 0.9410 331.594    1.821   -5.395 352.400 -0.1112   1     0.014                                           0.1476E 01
  3 42 0.9554 336.694    1.672   -5.167 352.400 -0.1423   1    -0.011                                           0.1498E 01
  3 43 0.9680 341.106    1.483   -4.877 352.400 -0.1787   1    -0.021                                           0.1514E 01
  3 44 0.9785 344.813    1.259   -4.534 352.400 -0.2258   1    -0.029                                           0.1537E 01
  3 45 0.9869 347.797    1.007   -4.148 352.400 -0.2960   1    -0.041                                           0.1581E 01
  3 46 0.9933 350.046    0.733   -3.729 352.400 -0.4258   1    -0.063                                           0.1683E 01
  3 47 0.9976 351.551    0.445   -3.288 352.400 -0.7999   1     0.039                                           0.1872E 01
  3 48 0.9997 352.305    0.148   -2.832 352.400 -1.7835   1     0.817                                           0.1344E 01

                                 PANEL NO.   2                WING PANEL NO. 1

  4  1 0.0062 101.742    8.551   -5.490 138.357 -0.0153   0     0.693    19.142   0.138     0.18   -0.0192   0.3478E 00   0.34968  2.07499
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-327-24 WING) WITH C/D 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  D/S

  S  C  X/C       X        Y         Z      CHORD    SLOPE  ITS     DCP      CNC      CN      DL       CMT        GAMMA       CTC      CDC


  4  2 0.0545 109.430   9.551   -5.490 139.357 -0.0622  0     0.204                                          0.1023E 00
  4  3 0.1464 121.152   9.551   -5.490 139.357 -0.0667  0     0.249                                          0.1248E 00
  4  4 0.2730 138.562   9.551   -5.490 139.357 -0.0552  0     0.200                                          0.1005E 00
  4  5 0.4218 159.746   9.551   -5.490 139.357 -0.0375  0    -0.019                                         -0.9461E-02
  4  6 0.5782 180.390   9.551   -5.490 139.357 -0.0279  0     0.044                                          0.2429E-01
  4  7 0.7270 201.474   9.551   -5.490 139.357 -0.0257  0     0.215                                          0.1079E 00
  4  8 0.8536 219.985   9.551   -5.490 139.357 -0.0272  0    -0.011                                         -0.5766E-02
  4  9 0.9455 231.707   9.551   -5.490 139.357 -0.0288  0     0.098                                          0.4395E-01
  4 10 0.9938 239.395   9.551   -5.490 139.357 -0.0293  0     0.467                                          0.2342E 00

  5  1 0.0062 114.621  12.506   -5.478 125.283  0.0062  0     0.756    19.155  0.153    0.19   -0.0158   0.3797E 00  0.54511  1.72378
  5  2 0.0545 120.677  12.506   -5.478 125.283 -0.0451  0     0.329                                          0.1696E 00
  5  3 0.1464 132.197  12.506   -5.478 125.283 -0.0582  0     0.229                                          0.1202E 00
  5  4 0.2730 148.052  12.506   -5.478 125.283 -0.0505  0     0.140                                          0.7039E-01
  5  5 0.4218 165.632  12.506   -5.478 125.283 -0.0407  0     0.077                                          0.3875E-01
  5  6 0.5782 184.290  12.506   -5.478 125.283 -0.0334  0     0.104                                          0.5196E-01
  5  7 0.7270 204.924  12.506   -5.478 125.283 -0.0316  0     0.158                                          0.7949E-01
  5  8 0.8536 220.785  12.506   -5.478 125.283 -0.0317  0     0.065                                          0.3266E-01
  5  9 0.9455 232.305  12.506   -5.478 125.283 -0.0320  0     0.067                                          0.3332E-01
  5 10 0.9938 239.361  12.506   -5.478 125.283 -0.0327  0     0.092                                          0.4641E-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 143.242  16.461   -5.465 112.208 -0.0473  0     0.245                                          0.1228E 00
  6  4 0.2730 157.443  16.461   -5.465 112.208 -0.0476  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 -0.0375  0     0.191                                          0.9066E-01
  6  8 0.8536 222.585  16.461   -5.465 112.208 -0.0361  0     0.079                                          0.3951E-01
  6  9 0.9455, 232.903  16.461   -5.465 112.208 -0.0353  0     0.061                                          0.3047E-01
  6 10 0.9938 238.327  16.461   -5.465 112.208 -0.0351  0     0.031                                          0.1548E-01

  7  1 0.0062 140.380  20.416   -5.453  99.134  0.0443  0     0.976    19.839  0.200    0.18   -0.0221   0.4900E 00  0.75394  1.33710
  7  2 0.0545 145.172  20.416   -5.453  99.134 -0.0068  0     0.407                                          0.2045E 00
  7  3 0.1464 154.287  20.416   -5.453  99.134 -0.0374  0     0.264                                          0.1325E 00
  7  4 0.2730 166.834  20.416   -5.453  99.134 -0.0451  0     0.186                                          0.9339E-01
  7  5 0.4218 181.582  20.416   -5.453  99.134 -0.0470  0     0.155                                          0.7796E-01
  7  6 0.5782 197.096  20.416   -5.453  99.134 -0.0461  0     0.142                                          0.7113E-01
  7  7 0.7270 211.839  20.416   -5.453  99.134 -0.0434  0     0.240                                          0.1203E 00
  7  8 0.8536 224.366  20.416   -5.453  99.134 -0.0405  0     0.081                                          0.4047E-01
  7  9 0.9455 233.501  20.416   -5.453  99.134 -0.0336  0     0.055                                          0.2753E-01
  7 10 0.9938 238.292  20.416   -5.453  99.134 -0.0380  0     0.016                                          0.8018E-02

                                 PANEL NO.   3                 WING PANEL NO. 2

  8  1 0.0062 151.897  23.952   -5.689  87.998  0.0566  0     1.065    17.259  0.196   -8.84   -0.0131   0.5346E 00  0.79970  0.85042
  8  2 0.0545 156.151  23.952   -5.689  87.998  0.0048  0     0.427                                          0.2168E 00
  8  3 0.1464 164.242  23.952   -5.689  87.998 -0.0276  0     0.289                                          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
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/I 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  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  23.952  -5.689  57.998 -0.0441  0    0.097                                     0.4618E-01
 8  8 0.8536 226.466  23.952  -5.689  57.998 -0.0417  0    0.084                                     0.4730E-01
 8  9 0.9455 234.557  23.952  -5.689  57.998 -0.0393  0    0.059                                     0.2956E-01
 8 10 0.9938 238.811  23.952  -5.689  57.998 -0.0386  0    0.076                                     0.1302E-01

 9  1 0.0062 162.050  27.067  -6.173  78.799  0.0494  0    1.166  16.999  0.216  -8.84  -0.0152  0.5951E 00  0.87132  0.69443
 9  2 0.0545 165.859  27.067  -6.173  78.799  0.0140  0    0.454                                     0.2279E 00
 9  3 0.1464 173.165  27.067  -6.173  78.799 -0.0195  0    0.317                                     0.1590E 00
 9  4 0.2730 183.077  27.067  -6.173  78.799 -0.0306  0    0.246                                     0.1234E 00
 9  5 0.4218 194.901  27.067  -6.173  78.799 -0.0370  0    0.199                                     0.9967E-01
 9  6 0.5782 207.126  27.067  -6.173  78.799 -0.0395  0    0.140                                     0.7039E-01
 9  7 0.7270 218.851  27.067  -6.173  78.799 -0.0397  0    0.121                                     0.6077E-01
 9  8 0.8536 229.924  27.067  -6.173  78.799 -0.0384  0    0.105                                     0.5259E-01
 9  9 0.9455 236.070  27.067  -6.173  78.799 -0.0374  0    0.064                                     0.3216E-01
 9 10 0.9938 239.379  27.067  -6.173  78.799 -0.0371  0    0.022                                     0.1109E-01

10  1 0.0062 172.203  30.183  -6.658  69.600  0.0431  0    1.798  16.546  0.239  -8.84  -0.0166  0.6515E 00  0.96421  0.49674
10  2 0.0545 175.568  30.183  -6.658  69.600  0.0231  0    0.492                                     0.2475E 00
10  3 0.1464 181.968  30.183  -6.658  69.600 -0.0093  0    0.359                                     0.1800E 00
10  4 0.2730 190.776  30.183  -6.658  69.600 -0.0216  0    0.270                                     0.1356E 00
10  5 0.4218 201.131  30.183  -6.658  69.600 -0.0293  0    0.209                                     0.1049E 00
10  6 0.5782 212.019  30.183  -6.658  69.600 -0.0335  0    0.159                                     0.7998E-01
10  7 0.7270 222.374  30.183  -6.658  69.600 -0.0353  0    0.140                                     0.7015E-01
10  8 0.8536 231.182  30.183  -6.658  69.600 -0.0356  0    0.111                                     0.5567E-01
10  9 0.9455 237.582  30.183  -6.658  69.600 -0.0356  0    0.069                                     0.3469E-01
10 10 0.9938 240.947  30.183  -6.659  69.600 -0.0355  0    0.023                                     0.1173E-01

                                 PANEL NO.   4                 WING PANEL NO. 3

11  1 0.0062 180.677  33.007  -7.104  61.997  0.0330  0    1.517  16.069  0.259  -9.16  -0.0171  0.7612E 00  0.98688  0.39914
11  2 0.0545 183.674  33.007  -7.104  61.997  0.0278  0    0.542                                     0.2724E 00
11  3 0.1464 189.374  33.007  -7.104  61.997 -0.0042  0    0.382                                     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 -0.0236  0    0.212                                     0.1096E 00
11  6 0.5782 216.143  33.007  -7.104  61.997 -0.0285  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 233.213  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 187.470  35.538  -7.512  55.990  0.0196  0    1.654  15.439  0.276  -9.16  -0.0184  0.8300E 00  1.04207  0.31782
12  2 0.0545 190.176  35.538  -7.512  55.990  0.0280  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 -0.0194  0    0.232                                     0.1166E 00
12  6 0.5782 219.500  35.538  -7.512  55.990 -0.0248  0    0.196                                     0.9861E-01
12  7 0.7270 227.830  35.538  -7.512  55.990 -0.0273  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

                                 PANEL NO.   5                 WING PANEL NO. 4

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
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TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U 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 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	CCP	CNC	CN	CL	CMT	GAMMA	CTC	CDC
13	2	0.0545	197.294	38.289	-7.873	50.260	0.0252	0	0.612					0.3071E 00		
13	3	0.1464	201.905	38.289	-7.873	50.260	-0.0010	0	0.420					0.2107E 00		
13	4	0.2730	208.266	38.289	-7.873	50.260	-0.0094	0	0.308					0.1544E 00		
13	5	0.4218	215.744	38.289	-7.873	50.260	-0.0153	0	0.250					0.1253E 00		
13	6	0.5782	223.606	38.289	-7.873	50.260	-0.0197	0	0.217					0.1067E 00		
13	7	0.7270	231.084	38.289	-7.872	50.260	-0.0220	0	0.172					0.3653E-01		
13	8	0.8536	237.445	38.289	-7.873	50.260	-0.0234	0	0.126					0.6329E-01		
13	9	0.9455	242.066	38.289	-7.873	50.260	-0.0244	0	0.076					0.3920E-01		
13	10	0.9938	244.456	38.284	-7.873	50.260	-0.0247	0	0.025					0.1247E-01		
14	1	0.0062	202.831	41.259	-8.188	44.806	-0.0010	0	1.477	12.979	0.312	-6.05	-0.0175	0.9920E 00	1.19411	0.05440
14	2	0.0545	204.997	41.259	-8.188	44.806	0.0191	0	0.660					0.3311E 00		
14	3	0.1464	209.117	41.259	-8.188	44.806	0.0016	0	0.440					0.2207E 00		
14	4	0.2730	214.787	41.259	-8.188	44.806	-0.0049	0	0.329					0.1652E 00		
14	5	0.4218	221.452	41.259	-8.188	44.806	-0.0094	0	0.273					0.1372E 00		
14	6	0.5782	229.463	41.259	-8.188	44.806	-0.0135	0	0.227					0.1141E 00		
14	7	0.7270	235.129	41.259	-8.188	44.806	-0.0152	0	0.175					0.8773E-01		
14	8	0.8536	240.799	41.259	-8.188	44.806	-0.0162	0	0.121					0.6097E-01		
14	9	0.9455	244.819	41.259	-8.188	44.806	-0.0172	0	0.070					0.3533E-01		
14	10	0.9938	247.085	41.259	-8.188	44.806	-0.0175	0	0.023					0.1157E-01		
15	1	0.0062	210.807	44.228	-8.502	39.353	-0.0103	0	2.172	13.167	0.335	-6.05	-0.0152	0.1390E 01	1.27486	-0.09027
15	2	0.0545	212.704	44.228	-8.502	39.353	0.0171	0	0.719					0.3610E 00		
15	3	0.1464	216.328	44.228	-8.502	39.353	0.0043	0	0.472					0.2369E 00		
15	4	0.2730	221.309	44.228	-8.502	39.353	-0.0003	0	0.367					0.1839E 00		
15	5	0.4218	227.163	44.228	-8.502	39.353	-0.0046	0	0.302					0.1519E 00		
15	6	0.5782	233.314	44.228	-8.502	39.353	-0.0068	0	0.234					0.1177E 00		
15	7	0.7270	239.174	44.226	-8.502	39.353	-0.0084	0	0.171					0.8587E-01		
15	8	0.8536	244.154	44.229	-8.502	39.353	-0.0093	0	0.115					0.5756E-01		
15	9	0.9455	247.773	44.228	-8.502	39.353	-0.0100	0	0.066					0.3299E-01		
15	10	0.9938	249.675	44.229	-8.502	39.353	-0.0102	0	0.022					0.1083E-01		
16	1	0.0062	218.783	47.198	-8.817	33.899	-0.0196	0	2.449	12.336	0.364	-6.05	-0.0093	0.1229E 01	1.39289	-0.27624
16	2	0.0545	220.422	47.198	-8.817	33.899	0.0071	0	0.820					0.4116E 00		
16	3	0.1464	223.539	47.199	-8.817	33.599	0.0064	0	0.555					0.2788E 00		
16	4	0.2730	227.824	47.198	-8.817	32.899	0.0043	0	0.417					0.2095E 00		
16	5	0.4218	232.873	47.198	-8.817	33.899	0.0009	0	0.312					0.1566E 00		
16	6	0.5782	238.176	47.198	-8.817	32.899	-0.0004	0	0.227					0.1139E 00		
16	7	0.7270	243.219	47.199	-8.817	33.899	-0.0016	0	0.161					0.8059E-01		
16	8	0.8536	247.504	47.198	-8.817	33.899	-0.0023	0	0.106					0.5310E-01		
16	9	0.9455	250.626	47.193	-8.817	33.899	-0.0028	0	0.060					0.3032E-01		
16	10	0.9938	252.265	47.198	-8.817	33.899	-0.0030	0	0.020					0.9965E-02		

PANEL NO. 6 WING PANEL NO. 5

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	CCP	CNC	CN	CL	CMT	GAMMA	CTC	CDC
17	1	0.0062	225.307	50.265	-9.077	30.000	-0.0254	0	3.125	11.331	0.378	-3.71	0.0005	0.1568E 01	0.0	1.05437
17	2	0.0945	226.757	50.265	-9.077	30.000	0.0014	0	0.974					0.4887E 00		
17	3	0.1464	229.515	50.265	-9.077	30.000	0.0070	0	0.572					0.2871E 00		
17	4	0.2730	233.312	50.265	-9.077	30.000	0.0056	0	0.401					0.2012E 00		
17	5	0.4218	237.775	50.265	-9.077	30.000	0.0046	0	0.290					0.1455E 00		
17	6	0.5782	242.468	50.265	-9.077	30.000	0.0049	0	0.206					0.1036E 00		

TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U 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  D/S

 S  C  X/C      X        Y       Z      CHORD   SLOPE ITS     DCP     CNC     CN      DL      CMT       GAMMA     CTC       CDC

17  7 0.7270 246.932  50.265  -9.077  30.000  0.0044  0     0.144                                 0.7243E-01
17  8 0.8536 250.728  50.265  -9.077  30.000  0.0043  0     0.094                                 0.4693E-01
17  9 0.9455 253.487  50.265  -9.077  30.000  0.0040  0     0.053                                 0.2669E-01
17 10 0.9938 254.937  50.265  -9.077  30.000  0.0039  0     0.017                                 0.9696E-02

18  1 0.0062 230.376  53.428  -9.282  27.655 -0.0277  0     3.196  10.361  0.375  -3.71   0.0043  0.1604E 01  0.0      0.98182
18  2 0.0545 231.713  53.428  -9.282  27.655 -0.0040  0     1.006                                 0.5052E 00
18  3 0.1464 234.256  53.428  -9.282  27.655  0.0042  0     0.581                                 0.2914E 00
18  4 0.2730 237.756  53.428  -9.282  27.655  0.0045  0     0.397                                 0.1991E 00
18  5 0.4218 241.870  53.428  -9.282  27.655  0.0064  0     0.276                                 0.1388E 00
18  6 0.5782 246.197  53.428  -9.282  27.655  0.0083  0     0.192                                 0.9641E-01
18  7 0.7270 250.311  53.428  -9.282  27.655  0.0098  0     0.131                                 0.6558E-01
18  8 0.8536 253.811  53.428  -9.282  27.655  0.0105  0     0.085                                 0.4279E-01
18  9 0.9455 256.354  53.428  -9.282  27.655  0.0106  0     0.049                                 0.2457E-01
18 10 0.9938 257.691  53.428  -9.282  27.655  0.0106  0     0.016                                 0.8019E-02

19  1 0.0062 235.446  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 236.669  56.591  -9.487  25.311 -0.0094  0     1.031                                 0.5174E 00
19  3 0.1464 238.997  56.591  -9.487  25.311  0.0014  0     0.583                                 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                                 0.8949E-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     0.046                                 0.2299E-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                                 0.2885E 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   7.392  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                                 0.5131E 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  0.0012  0     0.395                                 0.1983E 00
21  5 0.4218 254.156  62.918  -9.897  20.622  0.0119  0     0.269                                 0.1350E 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 260.450  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

                               PANEL NO.   7              UPPER NACELLE PYLON

[illegible]  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
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-22/-24 WING) WITH (2) 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  D/S

 S  C  X/C        X        Y        Z      CHORD   SLOPE  ITS    DCP      CNC     CM      DL      CMT       GAMMA        CTC      CDC

22  2 0.0545 211.542  22.394  -4.423  39.300  0.0      0    -0.406                                     -0.2037E 00
22  3 0.1464 215.155  22.394  -4.423  39.300  0.0      0    -0.025                                     -0.1418E-01
22  4 0.2730 220.129  22.394  -4.423  39.300  0.0      0     0.005                                      0.2490E-02
22  5 0.4218 225.976  22.394  -4.423  39.300  0.0      0     0.007                                      0.1001E-02
22  6 0.5782 232.124  22.394  -4.423  39.300  0.0      0     0.004                                      0.1871E-02
22  7 0.7270 237.971  22.394  -4.423  39.300  0.0      0     0.009                                      0.4084E-02
22  8 0.8536 242.945  22.394  -4.423  39.300  0.0      0     0.005                                      0.2484E-02
22  9 0.9455 246.558  22.394  -4.423  39.300  0.0      0     0.002                                      0.1159E-02
22 10 0.9938 248.458  22.394  -4.423  39.300  0.0      0     0.000                                      0.2236E-03

                              PANEL NO.   8                UPPER NACELLE

23  1 0.0062 209.642  23.863   2.536  39.300  0.0000  1    -0.011   1.442  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    -0.045                                     0.1241E-01
23  3 0.1464 215.155  23.863   2.536  39.300  0.0000  1    -0.050                                     0.2170E-01
23  4 0.2730 220.129  23.863   2.536  39.300  0.0000  1    -0.049                                     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    -0.029                                     0.1045E-01
23  8 0.8536 242.945  23.863   2.536  39.300 -0.0000  1    -0.022                                     0.6180E-02
23  9 0.9455 246.558  23.863   2.536  39.300 -0.0000  1    -0.019                                     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   1.206  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    -0.053                                     0.2302E-01
24  5 0.4218 225.976  25.332  -0.008  39.300  0.0000  1    -0.052                                     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                                     0.4655E-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    -0.043                                     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   2.249  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    -0.046                                     0.2575E-01
26  6 0.5782 232.124  20.925  -2.552  39.300 -0.0000  1    -0.028                                     0.1094E-01
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TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH D/U 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 D/S

S	C	X/C	X	Y	Z	CHORD	SLOPE	ITS	DCP	CNC	CN	DL	CMT	GAMMA	CTC	CDC
26	7	0.7270	237.971	20.925	-2.552	39.300	-0.0000	1	-0.013					0.2081E-02		
26	8	0.8536	242.945	20.925	-2.552	39.300	-0.0000	1	-0.003					-0.3606E-02		
26	9	0.9455	246.558	20.925	-2.552	39.300	-0.0000	1	-0.003					-0.3010E-02		
26	10	0.9938	248.458	20.925	-2.552	39.300	-0.0000	1	-0.005					-0.1065E-02		
27	1	0.0062	209.642	19.456	-0.008	39.300	0.0000	1	-0.371	1.867	0.047	90.00	-0.0011	0.3705E 00	0.0	-0.00000
27	2	0.0545	211.542	19.456	-0.008	39.300	0.0000	1	-0.119					0.8428E-01		
27	3	0.1464	215.155	19.456	-0.008	39.300	0.0000	1	-0.067					0.3247E-01		
27	4	0.2730	220.129	19.456	-0.008	39.300	0.0000	1	-0.044					0.1629E-01		
27	5	0.4218	225.976	19.456	-0.008	39.300	0.0000	1	-0.040					0.1981E-01		
27	6	0.5782	232.124	19.456	-0.008	39.300	-0.0000	1	-0.029					0.1150E-01		
27	7	0.7270	237.971	19.456	-0.008	39.300	-0.0000	1	-0.024					0.8465E-02		
27	8	0.8536	242.945	19.456	-0.008	39.300	-0.0000	1	-0.013					0.7704E-03		
27	9	0.9455	246.558	19.456	-0.008	39.300	-0.0000	1	-0.011					0.3280E-03		
27	10	0.9938	248.458	19.456	-0.008	39.300	-0.0000	1	-0.010					0.5667E-03		
28	1	0.0062	209.642	20.925	2.536	39.300	0.0000	1	-0.229	1.292	0.033	30.00	-0.0013	0.2024E 00	0.0	0.09750
28	2	0.0545	211.542	20.925	2.536	39.300	0.0000	1	-0.073					0.5311E-01		
28	3	0.1464	215.155	20.925	2.536	39.300	0.0000	1	-0.046					0.2695E-01		
28	4	0.2730	220.129	20.925	2.536	39.300	0.0000	1	-0.034					0.1860E-01		
28	5	0.4218	225.976	20.925	2.536	39.300	0.0000	1	-0.030					0.1930E-01		
28	6	0.5782	232.124	20.925	2.536	39.300	-0.0000	1	-0.027					0.1349E-01		
28	7	0.7270	237.971	20.925	2.536	39.300	-0.0000	1	-0.017					0.9304E-02		
28	8	0.8536	242.945	20.925	2.536	39.300	-0.0000	1	-0.010					0.4754E-02		
28	9	0.9455	246.558	20.925	2.536	39.300	-0.0000	1	-0.007					0.2843E-02		
28	10	0.9938	248.458	20.925	2.536	39.300	-0.0000	1	-0.004					0.1072E-02		
					PANEL NO. 9				LOWER NACELLE PYLON							
29	1	0.0062	209.343	22.394	-6.323	39.400	0.0	0	0.151	0.774	0.020	-90.00	0.0038	0.7593E-01	0.0	0.00000
29	2	0.0545	211.747	22.394	-6.323	39.400	0.0	0	0.192					0.9640E-01		
29	3	0.1464	214.870	22.394	-6.323	39.400	0.0	0	0.031					0.1538E-01		
29	4	0.2730	219.856	22.394	-6.323	39.400	0.0	0	-0.006					-0.3160E-02		
29	5	0.4218	225.718	22.394	-6.323	39.400	0.0	0	-0.008					-0.4180E-02		
29	6	0.5782	231.882	22.394	-6.323	39.400	0.0	0	0.007					0.3650E-02		
29	7	0.7270	237.744	22.394	-6.323	39.400	0.0	0	-0.005					-0.2505E-02		
29	8	0.8536	242.730	22.394	-6.323	39.400	0.0	0	0.004					0.1822E-02		
29	9	0.9455	246.353	22.394	-6.323	39.400	0.0	0	0.002					0.1040E-02		
29	10	0.9938	248.257	22.394	-6.323	39.400	0.0	0	0.000					0.2113E-03		
					PANEL NO. 10				LOWER NACELLE							
30	1	0.0062	209.343	23.780	-8.000	39.400	-0.0000	1	0.108	-1.580	-0.040	-30.00	0.0021	-0.7645E-01	0.0	-0.11927
30	2	0.0545	211.247	23.780	-8.000	39.400	-0.0000	1	0.060					-0.3404E-01		
30	3	0.1464	214.870	23.780	-8.000	39.400	-0.0000	1	0.082					-0.5859E-01		
30	4	0.2730	219.856	23.780	-8.000	39.400	0.0000	1	0.050					-0.2494E-01		
30	5	0.4218	225.718	23.780	-8.000	39.400	0.0000	1	0.063					-0.4403E-01		
30	6	0.5782	231.882	23.780	-8.000	39.400	0.0000	1	0.032					-0.1635E-01		
30	7	0.7270	237.744	23.780	-8.000	39.400	0.0000	1	0.017					-0.9219E-02		
30	8	0.8536	242.730	23.780	-8.000	39.400	0.0000	1	0.000					0.1367E-02		
30	9	0.9455	246.353	23.780	-8.000	39.400	0.0000	1	-0.002					0.2310E-02		

TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U 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  D/S

 S  C  X/C        X         Y          Z       CHORD    SLOPE   ITS    DCP      CNC     CN       DL       CMT        GAMMA       CTC        CDC

                                                                                                                0.1073E-02
30 10 0.9938 248.257   23.780   -8.000   39.400  0.0000  1   -0.001

31  1 0.0062 209.343   25.165 -10.400   39.400 -0.0000  1   -0.076   -1.718 -0.044  -40.00    0.0068  0.1174E 00  0.0      -0.00000
31  2 0.0545 211.247   25.165 -10.400   39.400 -0.0000  1    0.056                                   -0.2153E-01
31  3 0.1464 214.870   25.165 -10.400   39.400 -0.0000  1    0.071                                   -0.4249E-01
31  4 0.2730 219.856   25.165 -10.400   39.400  0.0000  1    0.069                                   -0.4063E-01
31  5 0.4218 225.718   25.165 -10.400   39.400  0.0000  1    0.063                                   -0.3916E-01
31  6 0.5782 231.862   25.165 -10.400   39.400  0.0000  1    0.047                                   -0.2656E-01
31  7 0.7270 237.744   25.165 -10.400   39.400  0.0000  1    0.030                                   -0.1477E-01
31  8 0.8536 242.730   25.165 -10.400   39.400  0.0000  1    0.016                                   -0.5988E-02
31  9 0.9455 246.353   25.165 -10.400   39.400  0.0000  1    0.009                                   -0.2345E-02
31 10 0.9938 248.257   25.165 -10.400   39.400  0.0000  1    0.007                                   -0.6535E-03

32  1 0.0062 209.343   23.780 -12.800   39.400 -0.0000  1    0.012   -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    0.061                                   -0.2999E-01
32  3 0.1464 214.870   23.780 -12.800   39.400 -0.0000  1    0.066                                   -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    0.056                                   -0.3621E-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    0.023                                   -0.4811E-02
32  9 0.9455 246.353   23.780 -12.800   39.400  0.0000  1    0.016                                   -0.5653E-02
32 10 0.9938 248.257   23.780 -12.800   39.400  0.0000  1    0.012                                   -0.1958E-02

33  1 0.0062 209.343   21.008 -12.800   39.400 -0.0000  1    0.179   -1.823 -0.046  150.00    0.0049 -0.1559E 00  0.0       0.13762
33  2 0.0545 211.247   21.008 -12.800   39.400 -0.0000  1    0.082                                   -0.5676E-01
33  3 0.1464 214.870   21.008 -12.800   39.400 -0.0000  1    0.063                                   -0.3925E-01
33  4 0.2730 219.856   21.008 -12.800   39.400  0.0000  1    0.054                                   -0.3232E-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    0.039                                   -0.2273E-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    0.015                                   -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   -1.938 -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                                   -0.3930E-01
34  4 0.2730 219.856   19.623 -10.400   39.400  0.0000  1    0.050                                   -0.2832E-01
34  5 0.4218 225.718   19.623 -10.400   39.400  0.0000  1    0.045                                   -0.3063E-01
34  6 0.5782 231.882   19.623 -10.400   39.400  0.0000  1    0.035                                   -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    0.092                                   -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
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U 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  D/S

  S  C  X/C       X        Y         Z       CHORD    SLOPE  ITS     DCP      CNC     CN      DL       CMT        GAMMA       CTC       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      0.013                                       -0.4627E-02
 35  8 0.8536 242.730  21.008  -8.000   39.400   0.0000  1      0.003                                       -0.1426E-03
 35  9 0.9455 246.353  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           FIN PANEL NO. 1

 36  1 0.0062 249.558  64.500  -9.100   18.782   0.0      0      2.454     5.477  0.292   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      0.835                                       0.4189E 00
 36  3 0.1464 252.193  64.500  -9.100   18.782   0.0      0      0.513                                       0.2576E 00
 36  4 0.2730 254.570  64.500  -9.100   18.782   0.0      0      0.329                                       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      0.126                                       0.6327E-01
 36  7 0.7270 263.097  64.500  -9.100   18.782   0.0      0      0.069                                       0.3486E-01
 36  8 0.8536 265.474  64.500  -9.100   18.782   0.0      0      0.035                                       0.1769E-01
 36  9 0.9455 267.201  64.500  -9.100   18.782   0.0      0      0.015                                       0.7774E-02
 36 10 0.9938 268.109  64.500  -9.100   18.782   0.0      0      0.005                                       0.2289E-02

 37  1 0.0062 252.435  64.500  -7.300   17.447   0.0      0      2.352     4.457  0.255   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      0.794                                       0.3987E 00
 37  3 0.1464 254.862  64.500  -7.300   17.447   0.0      0      0.455                                       0.2284E 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 259.696  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      0.091                                       0.4554E-01
 37  7 0.7270 265.011  64.500  -7.300   17.447   0.0      0      0.046                                       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

 38  1 0.0062 255.311  64.500  -5.500   16.112   0.0      0      2.275     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 264.524  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      0.013                                       0.6685E-02
 38  9 0.9455 270.447  64.500  -5.500   16.112   0.0      0      0.006                                       0.3165E-02
 38 10 0.9938 271.226  64.500  -5.500   16.112   0.0      0      0.002                                       0.9604E-03

 39  1 0.0062 258.188  64.500  -3.700   14.778   0.0      0      2.046     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      0.620                                       0.3161E 00
 39  3 0.1464 260.261  64.500  -3.700   14.778   0.0      0      0.272                                       0.1367E 00
 39  4 0.2730 262.131  64.500  -3.700   14.779   0.0      0      0.111                                       0.5551E-01
 39  5 0.4218 264.330  64.500  -3.700   14.778   0.0      0      0.046                                       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                                       0.5905E-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 272.069  64.500  -3.700   14.778   0.0      0      0.003                                       0.1456E-02
 39 10 0.9938 272.783  64.500  -3.700   14.778   0.0      0      0.001                                       0.4500E-03
END OF CASE
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH F/U NACELLES. (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  :   XBAR =  0.19104E 03     ZBAR = -0.54500E 01  ***** VINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS :  FLOATX = 0.0      FLOATY = 0.0


CN 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      CN(I)       CL(I)       CY(I)       CD(I)      CT(I)       CS(I)         CM(I)       CRM(I)       CYM(I)

  1  0.7839E 00    -0.00129     0.00664     0.00080     0.00195    0.0         0.0          0.2739E-02  0.1020E-02   0.1185E-01
  2  0.1941E 00     0.14962     0.02885    -0.00009     0.00304    0.00036     0.00122      0.6352E-02  0.3245E-02  -0.3192E-03
  3  0.7703E-01     0.20611     0.01563     0.00244     0.00132    0.00026     0.00030     -0.5579E-04  0.3289E-02  -0.2688E-03
  4  0.3126E-01     0.25130     0.00773     0.00125     0.00060    0.00005     0.00022     -0.9304E-03  0.2091E-02  -0.4279E-04
  5  0.5194E-01     0.30532     0.01574     0.00167     0.00111    0.00031     0.00089     -0.4599E-02  0.5263E-02   0.2622E-04
  6  0.4146E-01     0.36326     0.01448     0.00097     0.00124    0.0         0.0         -0.7995E-02  0.6560E-02  -0.1306E-03
  7  0.8313E-02    -0.01778    -0.00000    -0.00016    -0.00000    0.0         0.0          0.3722E-10 -0.8562E-06  -0.2329E-04
  8  0.8265E-01    -0.00575     0.00022    -0.00007     0.00003    0.0         0.0         -0.5924E-04  0.5659E-04  -0.1811E-04
  9  0.7136E-02    -0.00304    -0.00000    -0.00002    -0.00000    0.0         0.0          0.1567E-10 -0.1000E-05  -0.9749E-05
 10  0.7817E-01    -0.00922     0.00009     0.00014     0.00001    0.0         0.0          0.1419E-04  0.2749E-04   0.6441E-04
 11  0.1249E-01     0.14356     0.00000    -0.00179     0.00000    0.0         0.0         -0.1596E-08 -0.1107E-03  -0.9918E-03

   SREF         WSPAN        CBAR          CLTOT        CDTOT        CYTOT     CMTOT          CRMTOT       CYMTOT

 0.96768E 04  0.12900E 03  0.10223E 03    0.13003      0.01859      0.0      -0.92462E-02   0.0          0.0


CD/CL**2 = 0.5736    E = 0.3227
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-22/-24 WING) WITH O/U NACELLES. (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      CL       CMT          GAMMA       CTC        CDC


                               PANEL NO.   1             FUSELAGE (FUSIFORM PANEL)

  1  1 0.0003   0.094   0.107   -2.400 352.400   0.6679  1    1.435    2.401  0.207  -27.50   -0.0088 -0.4169E 00  0.0        0.75721
  1  2 0.0024   0.848   0.321   -1.985 352.400   0.3589  1    0.716                                  -0.2249E 00
  1  3 0.0067   2.353   0.532   -1.583 352.400   0.2547  1    0.292                                  -0.1379E 00
  1  4 0.0131   4.603   0.741   -1.182 352.400   0.2017  1    0.229                                  -0.1463E 00
  1  5 0.0215   7.597   0.945   -0.790 352.400   0.1690  1    0.165                                  -0.1138E 00
  1  6 0.0320  11.293   1.143   -0.409 352.400   0.1455  1    0.137                                  -0.9129E-01
  1  7 0.0446  15.706   1.327   -0.057 352.400   0.1300  1    0.142                                  -0.9295E-01
  1  8 0.0590  20.805   1.512    0.248 352.400   0.1161  1    0.131                                  -0.8117E-01
  1  9 0.0754  26.570   1.701    0.662 352.400   0.1035  1    0.114                                  -0.6701E-01
  1 10 0.0936  32.976   1.891    1.027 352.400   0.0826  1    0.085                                  -0.4865E-01
  1 11 0.1135  39.995   2.078    1.386 352.400   0.0656  1    0.073                                  -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   0.0355  1    0.042                                  -0.1284E-01
  1 14 0.1828  64.420   2.576    2.343 352.400   0.0251  1    0.031                                  -0.4529E-02
  1 15 0.2088  73.567   2.756    2.689 352.400   0.0121  1    0.023                                  -0.1698E-02
  1 16 0.2360  83.154   2.933    3.029 352.400  -0.0439  1   -0.015                                   0.2974E-01
  1 17 0.2643  93.140   2.941    3.045 352.400  -0.0481  1   -0.010                                   0.2170E-01
  1 18 0.2936 103.481   2.941    3.045 352.400  -0.0300  1    0.014                                   0.2209E-02
  1 19 0.3239 114.133   2.941    3.045 352.400  -0.0288  1    0.017                                   0.4363E-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   -0.029                                   0.1942E-01
  1 22 0.4186 147.497   2.942    3.045 352.400  -0.0319  1   -0.032                                   0.1869E-01
  1 23 0.4510 158.929   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 259.259   2.941    3.045 352.400   0.0015  1   -0.010                                   0.1604E-01
  1 33 0.7640 269.745   2.950    3.063 352.400  -0.0343  1   -0.043                                   0.4749E-01
  1 34 0.7912 278.832   2.808    2.790 352.400  -0.0211  1   -0.009                                   0.1003E-01
  1 35 0.8172 287.979   2.644    2.474 352.400  -0.0108  1   -0.022                                   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  -0.0089  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 325.829   1.807    0.865 352.400  -0.0079  1   -0.057                                   0.4492E-01
  1 41 0.9410 331.594   1.630    0.525 352.400   0.0075  1   -0.057                                   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                                   0.1044E 00
  1 44 0.9785 344.813   1.126   -0.442 352.400  -0.0887  1   -0.154                                   0.1695E 00
  1 45 0.9869 347.797   0.901   -0.875 352.400  -0.1576  1   -0.154                                   0.2872E 00
  1 46 0.9933 350.046   0.656   -1.345 352.400  -0.2912  1   -0.154                                   0.2466E 00
  1 47 0.9976 351.551   0.399   -1.840 352.400  -0.6851  1   -0.062                                   0.1325E 00
  1 48 0.9997 352.305   0.133   -2.351 352.400  -1.7262  1    1.486                                   0.5511E-01
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TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (LL1607-32/-24 WING) WITH C/U NACELLES. (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
2	1	0.0003	0.094	0.227	-2.583	352.400	0.6087	1	1.378	4.553	0.013	-84.37	-0.0117	-0.4354E 00	0.0	0.57313
2	2	0.0024	0.842	0.679	-2.538	352.400	0.3062	1	0.668					-0.2410E 00		
2	3	0.0067	2.353	1.127	-2.494	352.400	0.2037	1	0.280					-0.1594E 00		
2	4	0.0131	4.603	1.569	-2.451	352.400	0.1514	1	0.193					-0.1430E 00		
2	5	0.0215	7.587	2.001	-2.408	352.400	0.1197	1	0.142					-0.1123E 00		
2	6	0.0320	11.293	2.421	-2.367	352.400	0.0935	1	0.169					-0.1377E 00		
2	7	0.0446	15.706	2.809	-2.329	352.400	0.0828	1	0.122					-0.1043E 00		
2	8	0.0590	20.905	3.201	-2.290	352.400	0.0743	1	0.113					-0.8598E-01		
2	9	0.0754	26.570	3.602	-2.250	352.400	0.0674	1	0.114					-0.8397E-01		
2	10	0.0936	32.976	4.004	-2.210	352.400	0.0603	1	0.109					-0.7695E-01		
2	11	0.1135	39.495	4.400	-2.171	352.400	0.0515	1	0.091					-0.6320E-01		
2	12	0.1351	47.598	4.777	-2.134	352.400	0.0437	1	0.049					-0.2787E-01		
2	13	0.1582	55.751	5.124	-2.100	352.400	0.0356	1	0.061					-0.3600E-01		
2	14	0.1828	64.420	5.454	-2.067	352.400	0.0369	1	0.058					-0.3248E-01		
2	15	0.2088	73.567	5.836	-2.030	352.400	0.0361	1	0.054					-0.3123E-01		
2	16	0.2360	83.154	6.211	-1.993	352.400	-0.0049	1	0.012					0.3473E-02		
2	17	0.2643	93.140	6.228	-1.991	352.400	-0.0053	1	0.012					0.5023E-02		
2	18	0.2936	103.481	6.228	-1.991	352.400	-0.0033	1	-0.013					0.2628E-01		
2	19	0.3239	114.133	6.229	-1.991	352.400	-0.0032	1	-0.038					0.4095E-01		
2	20	0.3549	125.051	6.229	-1.991	352.400	-0.0033	1	-0.048					0.3924E-01		
2	21	0.3865	136.189	6.228	-1.991	352.400	-0.0037	1	-0.026					0.9064E-02		
2	22	0.4186	147.497	6.229	-1.991	352.400	-0.0035	1	-0.053					0.4101E-01		
2	23	0.4510	158.929	6.228	-1.991	352.400	-0.0035	1	-0.021					0.9813E-02		
2	24	0.4836	170.424	6.228	-1.991	352.400	-0.0032	1	-0.042					0.3927E-01		
2	25	0.5164	181.965	6.228	-1.991	352.400	-0.0034	1	-0.067					0.3971E-01		
2	26	0.5490	193.470	6.228	-1.991	352.400	-0.0036	1	-0.046					0.9032E-02		
2	27	0.5814	204.902	6.228	-1.991	352.400	-0.0034	1	-0.089					0.7698E-01		
2	28	0.6135	216.210	6.228	-1.991	352.400	-0.0028	1	-0.014					-0.5549E-02		
2	29	0.6451	227.346	6.229	-1.991	352.400	-0.0016	1	-0.020					0.1957E-01		
2	30	0.6761	238.266	6.228	-1.991	352.400	-0.0012	1	-0.043					0.4460E-01		
2	31	0.7064	248.918	6.228	-1.991	352.400	-0.0002	1	-0.006					-0.2392E-02		
2	32	0.7357	259.259	6.228	-1.991	352.400	0.0002	1	-0.003					0.5548E-02		
2	33	0.7640	269.245	6.249	-1.989	352.400	-0.0407	1	-0.020					0.2630E-01		
2	34	0.7912	278.832	5.947	-2.019	352.400	-0.0773	1	-0.035					0.4740E-01		
2	35	0.8172	287.974	5.599	-2.053	352.400	-0.0351	1	-0.031					0.4501E-01		
2	36	0.8418	296.648	5.270	-2.086	352.400	-0.0371	1	-0.034					0.4509E-01		
2	37	0.8649	304.901	4.939	-2.118	352.400	-0.0439	1	-0.054					0.6368E-01		
2	38	0.8865	312.404	4.581	-2.154	352.400	-0.0481	1	-0.060					0.6350E-01		
2	39	0.9064	319.423	4.210	-2.190	352.400	-0.0543	1	-0.063					0.5969E-01		
2	40	0.9246	325.829	3.826	-2.228	352.400	-0.0589	1	-0.070					0.6145E-01		
2	41	0.9410	331.594	3.451	-2.265	352.400	-0.0473	1	-0.075					0.6611E-01		
2	42	0.9554	336.694	3.168	-2.293	352.400	-0.0742	1	-0.086					0.7758E-01		
2	43	0.9680	341.106	2.810	-2.328	352.400	-0.1075	1	-0.120					0.1273E 00		
2	44	0.9785	344.813	2.385	-2.370	352.400	-0.1527	1	-0.146					0.1910E 00		
2	45	0.9869	347.797	1.407	-2.417	352.400	-0.2228	1	-0.154					0.3029E 00		
2	46	0.9933	350.046	1.389	-2.468	352.400	-0.3557	1	-0.154					0.2270E 00		
2	47	0.9976	351.551	0.844	-2.522	352.400	-0.7438	1	0.035					0.1219E 00		
2	48	0.9997	352.305	0.281	-2.578	352.400	-1.7670	1	1.681					0.7176E-01		
3	1	0.0003	0.094	0.120	-2.789	352.400	0.5277	1	1.282	-7.356	-0.021	-146.87	-0.0041	-0.4515E 00	0.0	1.25124

TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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       FL       CMT        GAMMA        CTC      CDC


 3  2 0.0024    0.848    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   0.1386  1     0.275                                          -0.1881E 00
 3  4 0.0131    4.603    0.828   -3.874 352.400   0.0392  1     0.197                                          -0.1689E 00
 3  5 0.0215    7.557    1.056   -4.223 352.400   0.0493  1     0.172                                          -0.1617E 00
 3  6 0.0320   11.293    1.278   -4.563 352.400   0.0303  1     0.127                                          -0.1272E 00
 3  7 0.0446   15.706    1.483   -4.877 352.400   0.0254  1     0.118                                          -0.1143E 00
 3  8 0.0590   20.805    1.689   -5.193 352.400   0.0234  1     0.129                                          -0.1122E 00
 3  9 0.0754   26.576    1.901   -5.515 352.400   0.0234  1     0.114                                          -0.9825E-01
 3 10 0.0936   32.976    2.117   -5.843 352.400   0.0328  1     0.117                                          -0.9740E-01
 3 11 0.1135   39.995    2.322   -6.163 352.400   0.0235  1     0.093                                          -0.7546E-01
 3 12 0.1351   47.598    2.521   -6.466 352.400   0.0367  1     0.086                                          -0.5916E-01
 3 13 0.1582   55.751    2.704   -6.749 352.400   0.0350  1     0.070                                          -0.5299E-01
 3 14 0.1828   64.420    2.878   -7.015 352.400   0.0501  1     0.079                                          -0.6044E-01
 3 15 0.2088   73.567    3.080   -7.325 352.400   0.0639  1     0.077                                          -0.6141E-01
 3 16 0.2360   83.154    3.278   -7.627 352.400   0.0415  1     0.041                                          -0.3384E-01
 3 17 0.2643   93.140    3.287   -7.641 352.400   0.0454  1     0.022                                          -0.1618E-01
 3 18 0.2936  103.481    3.287   -7.641 352.400   0.0283  1     0.001                                           0.9614E-02
 3 19 0.3239  114.133    3.287   -7.642 352.400   0.0272  1     0.022                                          -0.7916E-02
 3 20 0.3549  125.051    3.287   -7.642 352.400   0.0258  1     0.032                                          -0.1718E-01
 3 21 0.3865  136.189    3.287   -7.641 352.400   0.0312  1     0.024                                          -0.1235E-01
 3 22 0.4186  147.497    3.287   -7.642 352.400   0.0301  1     0.052                                          -0.3361E-01
 3 23 0.4510  158.929    3.287   -7.641 352.400   0.0296  1     0.039                                          -0.2597E-01
 3 24 0.4836  170.434    3.287   -7.641 352.400   0.0271  1     0.049                                          -0.3706E-01
 3 25 0.5164  181.965    3.287   -7.641 352.400   0.0287  1     0.030                                          -0.2146E-01
 3 26 0.5490  193.470    3.287   -7.641 352.400   0.0311  1     0.032                                          -0.2433E-01
 3 27 0.5814  204.902    3.287   -7.641 352.400   0.0292  1     0.067                                          -0.4193E-01
 3 28 0.6135  216.210    3.287   -7.641 352.400   0.0237  1     0.032                                          -0.1122E-01
 3 29 0.6451  227.348    3.287   -7.642 352.400   0.0138  1     0.011                                          -0.6829E-02
 3 30 0.6761  238.266    3.287   -7.641 352.400   0.0101  1     0.036                                          -0.2694E-01
 3 31 0.7064  248.918    3.287   -7.641 352.400   0.0016  1     0.006                                           0.3594E-02
 3 32 0.7357  259.259    3.287   -7.641 352.400  -0.0014  1     0.030                                          -0.2146E-01
 3 33 0.7640  269.245    3.297   -7.657 352.400  -0.0476  1    -0.024                                           0.3513E-01
 3 34 0.7912  278.832    3.138   -7.414 352.400  -0.0558  1    -0.034                                           0.5268E-01
 3 35 0.8172  287.979    2.955   -7.132 352.400  -0.0632  1    -0.047                                           0.7341E-01
 3 36 0.8418  296.646    2.781   -6.867 352.400  -0.0705  1    -0.050                                           0.7428E-01
 3 37 0.8649  304.901    2.607   -6.599 352.400  -0.0911  1    -0.061                                           0.8461E-01
 3 38 0.8865  312.404    2.419   -6.310 352.400  -0.0936  1    -0.066                                           0.9045E-01
 3 39 0.9064  319.423    2.222   -6.010 352.400  -0.1082  1    -0.072                                           0.9759E-01
 3 40 0.9246  325.829    2.019   -5.699 352.400  -0.1161  1    -0.071                                           0.9289E-01
 3 41 0.9410  331.594    1.821   -5.345 352.400  -0.1112  1    -0.076                                           0.9597E-01
 3 42 0.9554  336.694    1.672   -5.167 352.400  -0.1423  1    -0.082                                           0.1052E 00
 3 43 0.9680  341.106    1.483   -4.877 352.400  -0.1787  1    -0.104                                           0.1485E 00
 3 44 0.9785  344.813    1.259   -4.534 352.400  -0.2258  1    -0.132                                           0.2208E 00
 3 45 0.9869  347.797    1.007   -4.148 352.400  -0.2960  1    -0.107                                           0.1878E 00
 3 46 0.9933  350.046    0.733   -3.729 352.400  -0.4258  1    -0.103                                           0.2161E 00
 3 47 0.9976  351.551    0.445   -3.288 352.400  -0.7499  1     0.185                                           0.1090E 00
 3 48 0.9997  352.305    0.149   -2.832 352.400  -1.7835  1     1.922                                           0.2966E-01
                                  PANEL NO.   2                WING PANEL NO. 1

 4  1 0.0062  101.742    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

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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    CCP      CNC     CN      DL      CMT        GAMMA        CTC      CDC

                                                                                                          0.1157E 00
 4  2 0.0545 108.430   8.551   -5.490 138.357 -0.0632  0     0.231                                        0.6258E-01
 4  3 0.1464 121.152   8.551   -5.490 138.357 -0.0687  0     0.125                                        0.5756E-01
 4  4 0.2730 139.662   8.551   -5.490 138.357 -0.0532  0     0.115                                        0.5253E-01
 4  5 0.4218 159.246   8.551   -5.490 138.357 -0.0375  0     0.105                                        0.4751E-01
 4  6 0.5782 180.890   8.551   -5.490 138.357 -0.0276  0     0.045                                        0.7605E-01
 4  7 0.7270 201.474   8.551   -5.490 138.357 -0.0257  0     0.152                                        0.2995E-01
 4  8 0.8536 218.985   8.551   -5.490 138.357 -0.0272  0     0.067                                        0.6325E-01
 4  9 0.9455 231.707   8.551   -5.490 138.357 -0.0288  0     0.126                                        0.1342E-01
 4 10 0.9938 238.395   8.551   -5.490 138.357 -0.0293  0     0.227

 5  1 0.0062 114.621  12.506   -5.478 125.283  0.0062  0     0.555   17.920  0.142   0.18   -0.0220   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 -0.0583  0     0.159                                        0.7974E-01
 5  4 0.2730 148.052  12.506   -5.478 125.283 -0.0505  0     0.136                                        0.6817E-01
 5  5 0.4218 166.692  12.506   -5.478 125.283 -0.0407  0     0.113                                        0.5661E-01
 5  6 0.5782 186.290  12.506   -5.478 125.233 -0.0335  0     0.090                                        0.4504E-01
 5  7 0.7270 204.925  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  0.0277  0     0.651   18.266  0.163   0.16   -0.0261   0.3268E 00   0.23781  1.85533
 6  2 0.0545 132.925  16.461   -5.465 112.208 -0.0270  0     0.269                                        0.1345E 00
 6  3 0.1464 143.242  16.461   -5.465 112.208 -0.0478  0     0.204                                        0.1024E 00
 6  4 0.2730 157.443  16.461   -5.465 112.208 -0.0476  0     0.169                                        0.8458E-01
 6  5 0.4218 174.137  16.461   -5.465 112.208 -0.0438  0     0.123                                        0.6682E-01
 6  6 0.5782 191.640  16.461   -5.465 112.208 -0.0400  0     0.099                                        0.4905E-01
 6  7 0.7270 208.394  16.461   -5.465 112.208 -0.0375  0     0.125                                        0.6284E-01
 6  8 0.8536 222.584  16.461   -5.465 112.208 -0.0361  0     0.121                                        0.6068E-01
 6  9 0.9455 232.903  16.461   -5.465 112.208 -0.0352  0     0.177                                        0.5909E-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 140.380  20.416   -5.453  99.134  0.0443  0     0.662   17.296  0.175   0.18   -0.0254   0.3324E 00   0.23325  1.66739
 7  2 0.0545 145.172  20.416   -5.453  99.134 -0.0083  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 166.934  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                                        0.7594E-01
 7  6 0.5782 197.040  20.416   -5.453  99.134 -0.0461  0     0.111                                        0.5567E-01
 7  7 0.7270 211.939  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 -0.0405  0     0.157                                        0.7865E-01
 7  9 0.9455 233.501  20.416   -5.453  99.134 -0.0386  0     0.084                                        0.4229E-01
 7 10 0.9938 238.293  20.416   -5.453  99.134 -0.0380  0     0.117                                        0.5858E-01

                                PANEL NO.   3               WING PANEL NO. 2

 8  1 0.0062 151.897  23.952   -5.689  87.998  0.0566  0     0.700   16.509  0.188  -9.84   -0.0244   0.3513E 00   0.23583  1.47703
 8  2 0.0545 156.151  23.952   -5.689  87.998  0.0045  0     0.290                                        0.1408E 00
 8  3 0.1464 164.242  23.952   -5.689  87.998 -0.0276  0     0.270                                        0.1357E 00
 8  4 0.2730 175.379  23.952   -5.689  87.998 -0.0393  0     0.226                                        0.1132E 00
 8  5 0.4218 188.471  23.952   -5.689  87.998 -0.0447  0     0.181                                        0.9069E-01
 8  6 0.5782 202.237  23.952   -5.689  87.998 -0.0460  0     0.136                                        0.6817E-01
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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  23.952   -5.689   87.998 -0.0441  0      0.133                                        0.6685E-01
  8  8 0.8536 226.466  23.952   -5.689   87.998 -0.0412  0      0.085                                        0.4268E-01
  8  9 0.9455 234.557  23.952   -5.689   87.998 -0.0393  0      0.130                                        0.6514E-01
  8 10 0.9938 238.811  23.952   -5.689   87.998 -0.0386  0      0.112                                        0.5624E-01

  9  1 0.0062 162.050  27.067   -6.173   78.799  0.0449  0      0.566   16.237  0.297   -6.84   -0.0278   0.4344E 00  0.29429  1.33561
  9  2 0.0545 165.859  27.067   -6.173   78.799  0.0140  0      0.226                                        0.1136E 00
  9  3 0.1464 173.105  27.067   -6.173   78.799 -0.0195  0      0.305                                        0.1531E 00
  9  4 0.2730 183.077  27.067   -6.173   78.799 -0.0305  0      0.256                                        0.1284E 00
  9  5 0.4218 194.801  27.067   -6.173   78.799 -0.0370  0      0.206                                        0.1036E 00
  9  6 0.5782 207.128  27.067   -6.173   78.799 -0.0398  0      0.157                                        0.7879E-01
  9  7 0.7270 218.851  27.067   -6.173   78.799 -0.0397  0      0.146                                        0.7338E-01
  9  8 0.8536 228.924  27.067   -6.173   78.799 -0.0384  0      0.123                                        0.6165E-01
  9  9 0.9455 236.070  27.067   -6.173   78.799 -0.0374  0      0.091                                        0.4584E-01
  9 10 0.9938 239.879  27.067   -6.173   78.799 -0.0371  0      0.148                                        0.7405E-01

 10  1 0.0062 172.203  30.183   -6.658   69.600  0.0431  0      0.750   15.979  0.228   -6.84   -0.0284   0.3766E 00  0.26394  1.23159
 10  2 0.0545 175.568  30.183   -6.658   69.600  0.0231  0      0.368                                        0.1848E 00
 10  3 0.1464 181.966  30.183   -6.658   69.600 -0.0043  0      0.233                                        0.1671E 00
 10  4 0.2730 190.776  30.183   -6.658   69.600 -0.0216  0      0.279                                        0.1399E 00
 10  5 0.4218 201.131  30.183   -6.658   69.600 -0.0293  0      0.224                                        0.1127E 00
 10  6 0.5782 212.019  30.183   -6.658   69.600 -0.0335  0      0.170                                        0.9542E-01
 10  7 0.7270 222.374  30.183   -6.658   69.600 -0.0353  0      0.157                                        0.7871E-01
 10  8 0.8536 231.182  30.183   -6.658   69.600 -0.0356  0      0.131                                        0.6565E-01
 10  9 0.9455 237.582  30.183   -6.658   69.600 -0.0356  0      0.108                                        0.5429E-01
 10 10 0.9938 240.947  30.183   -6.658   69.600 -0.0355  0      0.091                                        0.4554E-01

                                  PANEL NO.    4                WING PANEL NO. 3

 11  1 0.0062 180.677  33.007   -7.104   61.997  0.0330  0      0.966   15.236  0.246   -9.16   -0.0217   0.4947E 00  0.11176  1.20229
 11  2 0.0545 183.674  33.007   -7.104   61.997  0.0278  0      0.694                                        0.3483E 00
 11  3 0.1464 189.374  33.007   -7.104   61.997 -0.0042  0      0.422                                        0.2119E 00
 11  4 0.2730 197.221  33.007   -7.104   61.997 -0.0158  0      0.150                                        0.7545E-01
 11  5 0.4218 206.444  33.007   -7.104   61.997 -0.0236  0      0.177                                        0.9904E-01
 11  6 0.5782 216.143  33.007   -7.104   61.997 -0.0285  0      0.205                                        0.1029E 00
 11  7 0.7270 225.367  33.007   -7.104   61.997 -0.0312  0      0.133                                        0.6665E-01
 11  8 0.8536 233.213  33.007   -7.104   61.997 -0.0324  0      0.123                                        0.6191E-01
 11  9 0.9455 238.914  33.007   -7.104   61.997 -0.0329  0      0.133                                        0.6664E-01
 11 10 0.9938 241.911  33.007   -7.104   61.997 -0.0332  0      0.145                                        0.7291E-01

 12  1 0.0062 187.470  35.538   -7.512   55.990  0.0196  0      1.010   14.415  0.257   -9.16   -0.0200   0.5068E 00  0.18205  1.07213
 12  2 0.0545 190.176  35.538   -7.512   55.990  0.0280  0      0.734                                        0.3682E 00
 12  3 0.1464 195.325  35.538   -7.512   55.990 -0.0030  0      0.458                                        0.2297E 00
 12  4 0.2730 202.411  35.538   -7.512   55.990 -0.0131  0      0.182                                        0.9116E-01
 12  5 0.4218 210.741  35.538   -7.512   55.990 -0.0199  0      0.212                                        0.1063E 00
 12  6 0.5782 219.500  35.538   -7.512   55.990 -0.0248  0      0.163                                        0.9159E-01
 12  7 0.7270 227.830  35.538   -7.512   55.990 -0.0273  0      0.122                                        0.6132E-01
 12  8 0.8536 234.916  35.538   -7.512   55.990 -0.0287  0      0.143                                        0.7167E-01
 12  9 0.9455 240.064  35.538   -7.512   55.990 -0.0296  0      0.135                                        0.6767E-01
 12 10 0.9938 242.771  35.538   -7.512   55.990 -0.0299  0      0.144                                        0.7237E-01

                                  PANEL NO.    5                WING PANEL NO. 4

 13  1 0.0062 194.854  39.289   -7.873   50.260  0.0083  0      1.016   13.737  0.273   -6.05   -0.0248   0.5101E 00  0.18381  1.03845
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH C/U NACELLES. (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


13  2 0.0545 197.284  38.289   -7.873  50.260  0.0252  0      0.690                                          0.3412E 00
13  3 0.1464 201.965  38.289   -7.873  50.260 -0.0010  0      0.494                                          0.2482E 00
13  4 0.2730 208.266  38.289   -7.873  50.260 -0.0094  0      0.309                                          0.1552E 00
13  5 0.4218 215.744  38.289   -7.873  50.260 -0.0153  0      0.124                                          0.6222E-01
13  6 0.5782 223.606  38.289   -7.873  50.260 -0.0197  0      0.157                                          0.7899E-01
13  7 0.7270 231.084  38.289   -7.873  50.260 -0.0220  0      0.177                                          0.8863E-01
13  8 0.8536 237.445  38.289   -7.873  50.260 -0.0234  0      0.146                                          0.7331E-01
13  9 0.9455 242.066  38.289   -7.873  50.260 -0.0244  0      0.193                                          0.9198E-01
13 10 0.9938 244.496  38.289   -7.873  50.260 -0.0247  0      0.167                                          0.8386E-01

14  1 0.0062 202.831  41.259   -8.188  44.806 -0.0010  0      1.000     13.159  0.294   -6.05    -0.0349     0.5018E 00  0.29710  0.89619
14  2 0.0545 204.997  41.259   -8.188  44.806  0.0191  0      0.595                                          0.2988E 00
14  3 0.1464 209.117  41.259   -8.188  44.806  0.0016  0      0.466                                          0.2340E 00
14  4 0.2730 214.787  41.259   -8.188  44.806 -0.0049  0      0.337                                          0.1691E 00
14  5 0.4218 221.453  41.259   -8.188  44.806 -0.0094  0      0.208                                          0.1042E 00
14  6 0.5782 228.463  41.259   -8.188  44.806 -0.0133  0      0.184                                          0.9232E-01
14  7 0.7270 235.124  41.259   -8.188  44.806 -0.0152  0      0.206                                          0.1034E 00
14  8 0.8536 240.794  41.259   -8.188  44.806 -0.0163  0      0.187                                          0.9396E-01
14  9 0.9455 244.919  41.259   -8.188  44.806 -0.0172  0      0.197                                          0.9389E-01
14 10 0.9938 247.085  41.259   -8.188  44.806 -0.0175  0      0.163                                          0.9168E-01

15  1 0.0062 210.807  44.228   -8.502  39.353 -0.0103  0      1.470     12.667  0.322   -6.05    -0.0438     0.7377E 00  0.22370  0.91602
15  2 0.0545 212.709  44.228   -8.502  39.353  0.0131  0      0.479                                          0.2401E 00
15  3 0.1464 216.326  44.228   -8.502  39.353  0.0043  0      0.415                                          0.2081E 00
15  4 0.2730 221.308  44.228   -8.502  39.353 -0.0007  0      0.351                                          0.1762E 00
15  5 0.4218 227.163  44.228   -8.502  39.353 -0.0046  0      0.287                                          0.1442E 00
15  6 0.5782 233.319  44.228   -8.502  39.353 -0.0066  0      0.229                                          0.1147E 00
15  7 0.7270 239.174  44.228   -8.502  39.353 -0.0084  0      0.239                                          0.1197E 00
15  8 0.8536 244.154  44.228   -8.502  39.353 -0.0092  0      0.219                                          0.1097E 00
15  9 0.9455 247.773  44.228   -8.502  39.353 -0.0100  0      0.199                                          0.1001E 00
15 10 0.9938 249.675  44.228   -8.502  39.353 -0.0102  0      0.176                                          0.8846E-01

16  1 0.0062 218.763  47.198   -8.817  33.899 -0.0196  0      1.734     11.929  0.349   -6.05    -0.0403     0.9702E 00  0.31655  0.73223
16  2 0.0545 220.422  47.198   -8.817  33.899  0.0071  0      0.452                                          0.2268E 00
16  3 0.1464 223.539  47.198   -8.817  33.899  0.0069  0      0.439                                          0.2205E 00
16  4 0.2730 227.829  47.198   -8.817  33.899  0.0043  0      0.427                                          0.2142E 00
16  5 0.4218 232.873  47.198   -8.817  33.899  0.0008  0      0.414                                          0.2079E 00
16  6 0.5782 238.176  47.198   -8.817  33.899 -0.0004  0      0.220                                          0.1106E 00
16  7 0.7270 243.219  47.198   -8.817  33.899 -0.0016  0      0.201                                          0.1011E 00
16  8 0.8536 247.509  47.198   -8.817  33.899 -0.0023  0      0.192                                          0.9139E-01
16  9 0.9455 250.626  47.198   -8.817  33.899 -0.0028  0      0.189                                          0.9488E-01
16 10 0.9938 252.265  47.198   -8.817  33.899 -0.0030  0      0.190                                          0.9543E-01

                                  PANEL NO.    6               WING PANEL NO. 5

17  1 0.0062 225.307  50.265   -9.077  30.000 -0.0254  0      0.690     10.910  0.364   -3.71    -0.0378     0.3461E 00  0.0      0.95477
17  2 0.0545 226.757  50.265   -9.077  30.000  0.0014  0      1.001                                          0.5023E 00
17  3 0.1464 229.515  50.265   -9.077  30.000  0.0070  0      0.523                                          0.2624E 00
17  4 0.2730 233.312  50.265   -9.077  30.000  0.0056  0      0.429                                          0.2152E 00
17  5 0.4218 237.775  50.265   -9.077  30.000  0.0046  0      0.318                                          0.1595E 00
17  6 0.5782 242.468  50.265   -9.077  30.000  0.0049  0      0.294                                          0.1475E 00
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH D/U NACELLES. (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

 17  7 0.7270 246.932   50.265   -9.077   30.000  0.0044  0     0.155                                        0.7794E-01
 17  8 0.8536 250.728   50.265   -9.077   30.000  0.0043  0     0.175                                        0.8804E-01
 17  9 0.9455 253.487   50.265   -9.077   30.000  0.0040  0     0.221                                        0.1108E 00
 17 10 0.9938 254.937   50.265   -9.077   30.000  0.0039  0     0.219                                        0.1098E 00

 18  1 0.0062 230.376   53.429   -9.282   27.655 -0.0277  0     0.338  10.266  0.371   -3.71   -0.0616   0.1696E 00  0.0       0.86006
 18  2 0.0545 231.713   53.428   -9.282   27.655 -0.0040  0     0.320                                        0.1608E 00
 18  3 0.1464 234.256   53.428   -9.282   27.655  0.0042  0     0.511                                        0.2563E 00
 18  4 0.2730 237.756   53.428   -9.282   27.655  0.0045  0     0.657                                        0.3296E 00
 18  5 0.4218 241.870   53.428   -9.282   27.655  0.0064  0     0.377                                        0.1893E 00
 18  6 0.5782 246.197   53.428   -9.282   27.655  0.0083  0     0.331                                        0.1660E 00
 18  7 0.7270 250.311   53.428   -9.282   27.655  0.0098  0     0.325                                        0.1629E 00
 18  8 0.8536 253.811   53.428   -9.282   27.655  0.0105  0     0.199                                        0.1001E 00
 18  9 0.9455 256.354   53.428   -9.282   27.655  0.0106  0     0.150                                        0.7513E-01
 18 10 0.9938 257.691   53.428   -9.282   27.655  0.0106  0     0.136                                        0.6837E-01

 19  1 0.0062 235.446   56.591   -9.487   25.311 -0.0300  0     0.327   9.427  0.372   -3.71   -0.0783   0.1640E 00  0.0       0.77525
 19  2 0.0545 236.669   56.591   -9.487   25.311 -0.0094  0     0.286                                        0.1434E 00
 19  3 0.1464 238.997   56.591   -9.467   25.311  0.0014  0     0.355                                        0.1782E 00
 19  4 0.2730 242.200   56.591   -9.487   25.311  0.0034  0     0.474                                        0.2378E 00
 19  5 0.4218 245.966   56.591   -9.487   25.311  0.0083  0     0.564                                        0.2832E 00
 19  6 0.5782 249.925   56.591   -9.487   25.311  0.0118  0     0.401                                        0.2013E 00
 19  7 0.7270 253.691   56.591   -9.487   25.311  0.0153  0     0.251                                        0.1258E 00
 19  8 0.8536 256.894   56.591   -9.487   25.311  0.0167  0     0.273                                        0.1371E 00
 19  9 0.9455 259.221   56.591   -9.487   25.311  0.0171  0     0.224                                        0.1123E 00
 19 10 0.9938 260.445   56.591   -9.487   25.311  0.0172  0     0.294                                        0.1474E 00

 20  1 0.0062 240.515   59.755   -9.692   22.967 -0.0323  0     0.302   8.160  0.355   -3.71   -0.0813   0.1513E 00  0.0       0.65824
 20  2 0.0545 241.625   59.755   -9.692   22.967 -0.0147  0     0.280                                        0.1407E 00
 20  3 0.1464 243.737   59.755   -9.692   22.967 -0.0014  0     0.270                                        0.1356E 00
 20  4 0.2730 246.644   59.755   -9.692   22.967  0.0023  0     0.369                                        0.1851E 00
 20  5 0.4218 250.061   59.755   -9.692   22.967  0.0101  0     0.624                                        0.3131E 00
 20  6 0.5782 253.653   59.755   -9.692   22.967  0.0152  0     0.303                                        0.1520E 00
 20  7 0.7270 257.070   59.755   -9.692   22.967  0.0208  0     0.400                                        0.2008E 00
 20  8 0.8536 259.977   59.755   -9.692   22.967  0.0229  0     0.234                                        0.1174E 00
 20  9 0.9455 262.089   59.755   -9.692   22.967  0.0236  0     0.211                                        0.1060E 00
 20 10 0.9938 263.199   59.755   -9.692   22.967  0.0238  0     0.222                                        0.1114E 00

 21  1 0.0062 245.585   62.918   -9.897   20.622 -0.0346  0     0.303   7.213  0.350   -3.71   -0.1046   0.1518E 00  0.0       0.54842
 21  2 0.0545 246.582   62.918   -9.897   20.622 -0.0201  0     0.268                                        0.1343E 00
 21  3 0.1464 248.478   62.918   -9.897   20.622 -0.0042  0     0.237                                        0.1189E 00
 21  4 0.2730 251.088   62.918   -9.897   20.622  0.0012  0     0.259                                        0.1298E 00
 21  5 0.4218 254.156   62.918   -9.897   20.622  0.0119  0     0.309                                        0.1548E 00
 21  6 0.5782 257.382   62.918   -9.897   20.622  0.0187  0     0.433                                        0.2174E 00
 21  7 0.7270 260.450   62.918   -9.897   20.622  0.0263  0     0.541                                        0.2717E 00
 21  8 0.8536 263.060   62.918   -9.847   20.622  0.0291  0     0.336                                        0.1685E 00
 21  9 0.9455 264.956   62.918   -9.897   20.622  0.0301  0     0.350                                        0.1758E 00
 21 10 0.9938 265.953   62.918   -9.897   20.622  0.0304  0     0.311                                        0.1561E 00

                              PANEL NO.    7                   UPPER NACELLE PYLON

 22  1 0.0062 209.642   22.394   -4.423   39.300  0.0     0    -0.020  -0.699 -0.018  -90.00   -0.0036 -0.9957E-02  0.0      -0.00000
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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


 22  2 0.0545 211.542  22.394   -4.423   39.300   0.0      0   -0.008                                      -0.4203E-02
 22  3 0.1464 215.155  22.394   -4.423   39.300   0.0      0   -0.065                                      -0.3245E-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   -0.029                                      -0.1475E-01
 22  7 0.7270 237.971  22.394   -4.423   39.300   0.0      0    0.045                                       0.2249E-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 246.556  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.   8               UPPER NACELLE

 23  1 0.0062 209.642  23.863    2.536   39.300   0.0000  1   -0.016   -0.079 -0.002  -30.00    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                                       0.1926E-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   -0.013                                       0.1669E-01
 23  5 0.4218 225.976  23.863    2.536   39.300   0.0000  1    0.008                                      -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    0.009                                      -0.7634E-02
 23  9 0.9455 246.558  23.863    2.536   39.300  -0.0000  1    0.028                                      -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   -0.202 -0.005  -90.00    0.0025  -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    0.006                                       0.2437E-02
 24 10 0.9938 248.458  25.332   -0.008   39.300  -0.0000  1    0.022                                      -0.7874E-02

 25  1 0.0062 209.642  23.863   -2.552   39.300   0.0000  1    0.025   -0.562 -0.017 -150.00    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    0.005                                      -0.8813E-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    0.026                                      -0.2005E-01

 26  1 0.0062 209.642  20.925   -2.552   39.300   0.0000  1    0.012   -0.276 -0.007  150.00   -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    0.026                                      -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
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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

 26  7 0.7270 237.971  20.925  -2.552  39.300 -0.0000  1   -0.014                                      0.2177E-01
 26  8 0.8536 242.945  20.925  -2.552  39.300 -0.0000  1    0.035                                     -0.2527E-01
 26  9 0.9455 246.558  20.925  -2.552  39.300 -0.0000  1   -0.010                                      0.2043E-01
 26 10 0.9938 248.458  20.925  -2.552  39.300 -0.0000  1   -0.012                                      0.2407E-01

 27  1 0.0062 209.642  19.456  -0.008  39.300  0.0000  1   -0.002   -0.328 -0.008   90.00   0.0039   0.8857E-02  0.0      0.00000
 27  2 0.0545 211.542  19.456  -0.008  39.300  0.0000  1    0.005                                      0.9230E-02
 27  3 0.1464 215.155  19.456  -0.008  39.300  0.0000  1    0.010                                     -0.1787E-02
 27  4 0.2730 220.129  19.456  -0.008  39.300  0.0000  1    0.004                                      0.3713E-03
 27  5 0.4218 225.976  19.456  -0.008  39.300  0.0000  1   -0.002                                      0.1157E-01
 27  6 0.5782 232.124  19.456  -0.008  39.300 -0.0000  1   -0.010                                      0.7928E-02
 27  7 0.7270 237.971  19.456  -0.008  39.300 -0.0000  1    0.009                                      0.6485E-02
 27  8 0.8536 242.945  19.456  -0.008  39.300 -0.0000  1    0.021                                      0.4300E-02
 27  9 0.9455 246.558  19.456  -0.008  39.300 -0.0000  1    0.039                                     -0.1664E-01
 27 10 0.9938 248.458  19.456  -0.008  39.300 -0.0000  1    0.010                                      0.1211E-01

 28  1 0.0062 209.642  20.925   2.536  39.200  0.0000  1   -0.030    0.187  0.005   30.00   0.0035   0.2593E-01  0.0      0.01410
 28  2 0.0545 211.542  20.925   2.536  39.300  0.0000  1   -0.020                                      0.2877E-01
 28  3 0.1464 215.155  20.925   2.535  39.300  0.0000  1   -0.023                                      0.3186E-01
 28  4 0.2730 220.129  20.925   2.536  39.300  0.0000  1   -0.002                                      0.2686E-02
 28  5 0.4218 225.976  20.925   2.536  39.300  0.0000  1   -0.004                                      0.5838E-02
 28  6 0.5782 232.124  20.925   2.536  39.300 -0.0000  1   -0.027                                      0.2498E-01
 28  7 0.7270 237.971  20.925   2.536  39.300 -0.0000  1    0.005                                     -0.6421E-02
 28  8 0.8536 242.945  20.925   2.536  39.300 -0.0000  1    0.031                                     -0.1664E-01
 28  9 0.9455 246.558  20.925   2.536  39.350 -0.0000  1    0.025                                     -0.3397E-02
 28 10 0.9938 248.458  20.925   2.536  39.300 -0.0000  1    0.017                                      0.5915E-02

                                     PANEL NO.   9              LOWER NACELLE PYLON

 29  1 0.0062 209.343  22.394  -6.323  39.400  0.0     0   -0.028   -0.120 -0.003  -90.00   0.0023  -0.1422E-01  0.0     -0.00000
 29  2 0.0545 211.247  22.394  -6.323  39.400  0.0     0   -0.021                                     -0.1035E-01
 29  3 0.1464 214.870  22.394  -6.323  39.400  0.0     0    0.004                                      0.1949E-02
 29  4 0.2730 219.856  22.394  -6.323  39.400  0.0     0   -0.013                                     -0.6361E-02
 29  5 0.4218 225.716  22.394  -6.323  39.400  0.0     0    0.021                                      0.1033E-01
 29  6 0.5782 231.862  22.394  -6.323  39.400  0.0     0    0.007                                      0.3546E-02
 29  7 0.7270 237.744  22.394  -6.323  39.400  0.0     0    0.012                                      0.6200E-02
 29  8 0.8536 242.730  22.394  -6.323  39.400  0.0     0    0.049                                      0.2437E-01
 29  9 0.9455 246.353  22.394  -6.323  39.400  0.0     0   -0.122                                     -0.6108E-01
 29 10 0.9938 248.257  22.394  -6.323  39.400  0.0     0   -0.091                                     -0.4591E-01

                                     PANEL NO.  10           LOWER NACELLE

 30  1 0.0062 209.343  23.780  -8.000  39.400 -0.0000  1   -0.011   -0.129 -0.005  -30.00   0.0018   0.1210E-01  0.0     -0.01425
 30  2 0.0545 211.247  23.780  -8.000  39.400 -0.0000  1    0.002                                      0.1473E-01
 30  3 0.1464 214.870  23.780  -8.000  39.400 -0.0000  1   -0.001                                      0.2626E-01
 30  4 0.2730 219.856  23.780  -8.000  39.400  0.0000  1   -0.011                                      0.1367E-01
 30  5 0.4218 225.718  23.780  -8.000  39.400  0.0000  1    0.016                                     -0.7615E-02
 30  6 0.5782 231.882  23.780  -8.000  39.400  0.0000  1    0.018                                      0.1278E-01
 30  7 0.7270 237.744  23.780  -8.000  39.400  0.0000  1    0.011                                      0.1191E-01
 30  8 0.8536 242.730  23.780  -8.000  39.400  0.0000  1    0.006                                     -0.2079E-02
 30  9 0.9455 246.353  23.780  -8.000  39.400  0.0000  1   -0.010                                      0.1380E-01
```

TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (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      CL       CMT       GAMMA      CTC      CDC

                                                                                                       0.1158E-01
 30 10 0.9938 249.257  23.780  -8.000  39.400  0.0000  1   -0.011

 31  1 0.0062 209.343  25.165 -10.400  39.400 -0.0000  1    0.012   -0.314 -0.008  -90.00   -0.0010 -0.5065E-02  0.0     -0.00000
 31  2 0.0545 211.247  25.165 -10.400  39.400 -0.0000  1    0.025                                   -0.6157E-02
 31  3 0.1464 214.870  25.165 -10.400  39.400 -0.0000  1    0.042                                   -0.4952E-02
 31  4 0.2730 219.856  25.165 -10.400  39.400  0.0000  1    0.014                                    0.7460E-02
 31  5 0.4218 225.718  25.165 -10.400  39.400  0.0000  1   -0.006                                    0.5866E-03
 31  6 0.5782 231.882  25.165 -10.400  39.400  0.0000  1   -0.002                                    0.1064E-01
 31  7 0.7270 237.744  25.165 -10.400  39.400  0.0000  1    0.006                                    0.1984E-01
 31  8 0.8536 242.730  25.165 -10.400  39.400  0.0000  1    0.005                                    0.1746E-01
 31  9 0.9455 246.353  25.165 -10.400  39.400  0.0000  1   -0.007                                    0.1709E-01
 31 10 0.9938 248.257  25.165 -10.400  39.400  0.0000  1   -0.014                                    0.9430E-02

 32  1 0.0062 209.343  23.780 -12.800  39.400 -0.0000  1    0.026   -0.323 -0.008 -150.00   -0.0036 -0.1077E-01  0.0      0.02442
 32  2 0.0545 211.247  23.780 -12.800  39.400 -0.0000  1    0.052                                   -0.2325E-01
 32  3 0.1464 214.870  23.780 -12.800  39.400 -0.0000  1    0.050                                   -0.2660E-01
 32  4 0.2730 219.856  23.780 -12.800  39.400  0.0000  1    0.025                                   -0.2101E-01
 32  5 0.4218 225.718  23.780 -12.800  39.400  0.0000  1   -0.012                                    0.1715E-01
 32  6 0.5782 231.882  23.780 -12.800  39.400  0.0000  1    0.002                                   -0.6464E-02
 32  7 0.7270 237.744  23.780 -12.800  39.400  0.0000  1   -0.015                                    0.9837E-02
 32  8 0.8536 242.730  23.780 -12.800  39.400  0.0000  1   -0.007                                    0.1098E-01
 32  9 0.9455 246.353  23.780 -12.800  39.400  0.0000  1   -0.006                                    0.1375E-01
 32 10 0.9938 248.257  23.780 -12.800  39.400  0.0000  1   -0.012                                    0.1223E-01

 33  1 0.0062 209.343  21.008 -12.800  39.400 -0.0000  1    0.023   -0.459 -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    0.024                                   -0.2255E-01
 33  3 0.1464 214.870  21.008 -12.800  39.400 -0.0000  1    0.026                                   -0.2602E-01
 33  4 0.2730 219.856  21.008 -12.800  39.400  0.0000  1   -0.002                                    0.1314E-01
 33  5 0.4218 225.718  21.008 -12.800  39.400  0.0000  1    0.002                                   -0.1517E-01
 33  6 0.5782 231.882  21.008 -12.800  39.400  0.0000  1    0.001                                   -0.2319E-02
 33  7 0.7270 237.744  21.008 -12.800  39.400  0.0000  1    0.007                                   -0.2482E-02
 33  8 0.8536 242.730  21.008 -12.800  39.400  0.0000  1   -0.006                                    0.6878E-02
 33  9 0.9455 246.353  21.008 -12.800  39.400  0.0000  1    0.006                                   -0.1127E-01
 33 10 0.9938 248.257  21.008 -12.800  39.400  0.0000  1    0.006                                   -0.9297E-02

 34  1 0.0062 209.343  19.623 -10.400  39.400 -0.0000  1   -0.002   -0.633 -0.016   90.00    0.0053  0.1907E-04  0.0      0.00000
 34  2 0.0545 211.247  19.623 -10.400  39.400 -0.0000  1    0.015                                   -0.5357E-03
 34  3 0.1464 214.870  19.623 -10.400  39.400 -0.0000  1    0.007                                    0.1467E-01
 34  4 0.2730 219.856  19.623 -10.400  39.400  0.0000  1    0.003                                    0.7015E-02
 34  5 0.4218 225.718  19.623 -10.400  39.400  0.0000  1    0.022                                   -0.6678E-02
 34  6 0.5782 231.882  19.623 -10.400  39.400  0.0000  1    0.023                                   -0.3972E-02
 34  7 0.7270 237.744  19.623 -10.400  39.400  0.0000  1    0.032                                   -0.1174E-01
 34  8 0.8536 242.730  19.623 -10.400  39.400  0.0000  1    0.012                                   -0.2154E-02
 34  9 0.9455 246.353  19.623 -10.400  39.400  0.0000  1    0.011                                   -0.1264E-01
 34 10 0.9938 248.257  19.623 -10.400  39.400  0.0000  1    0.015                                   -0.9677E-02

 35  1 0.0062 209.343  21.008  -8.000  39.400 -0.0000  1    0.010   -0.263 -0.007   30.00    0.0039  0.2861E-01  0.0     -0.01984
 35  2 0.0545 211.247  21.008  -8.000  39.400 -0.0000  1   -0.010                                    0.3247E-01
 35  3 0.1464 214.870  21.008  -8.000  39.400 -0.0000  1   -0.017                                    0.2615E-01
 35  4 0.2730 219.856  21.008  -8.000  39.400  0.0000  1    0.002                                    0.1586E-01
 35  5 0.4218 225.718  21.008  -8.000  39.400  0.0000  1    0.006                                    0.1264E-01
```

TABLE A-1. - Concluded

```
SUPERSONIC CRUISE VEHICLE (CL1607-3/7-74 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  2.500    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

  S  C  X/C       X         Y         Z       CHORD    SLOPE  ITS    DCP      CNC     CN      DL      CMT        GAMMA      CTC      CDC


 35  6 0.5782 231.990   21.004   -8.000   39.400   0.0000  1    0.024                                    -0.1155E-01
 35  7 0.7270 237.744   21.002   -8.000   39.400   0.0000  1    0.022                                    -0.1440E-01
 35  8 0.8536 242.730   21.008   -8.000   39.400   0.0000  1   -0.003                                     0.8530E-02
 35  9 0.9455 246.353   21.004   -8.000   39.400   0.0000  1    0.012                                    -0.3491E-02
 35 10 0.9938 248.257   21.000   -8.000   39.400   0.0000  1    0.021                                    -0.9582E-02

                                   PANEL NO.  11     (             FIN PANEL NO. 1

 36  1 0.0062 249.550   64.500   -4.100   19.792   0.0     0   -0.004    2.357  0.215   90.00  -0.0770 -0.4136E-02  0.0      0.00000
 36  2 0.0545 250.466   64.500   -4.100   19.792   0.0     0    0.019                                     0.9038E-02
 36  3 0.1464 252.193   64.500   -4.100   19.792   0.0     0    0.126                                     0.6347E-01
 36  4 0.2730 254.570   64.500   -4.100   19.792   0.0     0    0.157                                     0.7877E-01
 36  5 0.4218 257.265   64.500   -4.100   19.792   0.0     0    0.214                                     0.1072E 00
 36  6 0.5782 260.303   64.500   -4.100   19.792   0.0     0    0.233                                     0.1556E 00
 36  7 0.7270 263.097   64.500   -4.100   19.792   0.0     0    0.206                                     0.1035E 00
 36  8 0.8536 265.474   64.500   -4.100   19.792   0.0     0    0.185                                     0.9441E-01
 36  9 0.9455 267.201   64.500   -4.100   19.792   0.0     0    0.402                                     0.2019E 00
 36 10 0.9938 268.104   64.500   -4.100   19.792   0.0     0    0.350                                     0.1756E 00

 37  1 0.0062 252.435   64.500   -7.300   17.447   0.0     0   -0.001    2.550  0.144   90.00  -0.0507 -0.5214E-03  0.0      0.00000
 37  2 0.0545 253.273   64.500   -7.300   17.447   0.0     0   -0.000                                    -0.1323E-03
 37  3 0.1464 254.882   64.500   -7.300   17.447   0.0     0    0.044                                     0.2216E-01
 37  4 0.2730 257.091   64.500   -7.300   17.447   0.0     0    0.105                                     0.5253E-01
 37  5 0.4218 259.596   64.500   -7.300   17.447   0.0     0    0.172                                     0.9549E-01
 37  6 0.5782 262.416   64.500   -7.300   17.447   0.0     0    0.359                                     0.1797E 00
 37  7 0.7270 265.011   64.500   -7.300   17.447   0.0     0   -0.036                                    -0.1790E-01
 37  8 0.8536 267.220   64.500   -7.300   17.447   0.0     0    0.277                                     0.1196E 00
 37  9 0.9455 268.924   64.500   -7.300   17.447   0.0     0    0.211                                     0.1050E 00
 37 10 0.9938 269.067   64.500   -7.300   17.447   0.0     0    0.222                                     0.1112E 00

 38  1 0.0062 255.311   64.500   -5.500   16.112   0.0     0    0.004    1.979  0.117   90.00  -0.0399  0.1774E-02  0.0      0.00000
 38  2 0.0545 256.090   64.500   -5.500   16.112   0.0     0    0.003                                     0.1399E-02
 38  3 0.1464 257.570   64.500   -5.500   16.112   0.0     0    0.027                                     0.1340E-01
 38  4 0.2730 259.611   64.500   -5.500   16.112   0.0     0    0.079                                     0.3947E-01
 38  5 0.4218 262.008   64.500   -5.500   16.112   0.0     0    0.158                                     0.7920E-01
 38  6 0.5782 264.529   64.500   -5.500   16.112   0.0     0    0.222                                     0.1152E 00
 38  7 0.7270 266.926   64.500   -5.500   16.112   0.0     0    0.212                                     0.1066E 00
 38  8 0.8536 268.968   64.500   -5.500   16.112   0.0     0    0.009                                     0.4476E-02
 38  9 0.9455 270.447   64.500   -5.500   16.112   0.0     0    0.097                                     0.4991E-01
 38 10 0.9938 271.226   64.500   -5.500   16.112   0.0     0    0.197                                     0.9406E-01

 39  1 0.0062 258.167   64.500   -3.700   14.778   0.0     0    0.029    1.790  0.061   90.00  -0.0281  0.1472E-01  0.0      0.00000
 39  2 0.0545 258.902   64.500   -3.700   14.778   0.0     0    0.026                                     0.1285E-01
 39  3 0.1464 260.761   64.500   -3.700   14.778   0.0     0    0.024                                     0.1192E-01
 39  4 0.2730 262.131   64.500   -3.700   14.778   0.0     0    0.056                                     0.2813E-01
 39  5 0.4218 264.330   64.500   -3.700   14.778   0.0     0    0.185                                     0.9298E-01
 39  6 0.5782 266.641   64.500   -3.700   14.778   0.0     0    0.146                                     0.7306E-01
 39  7 0.7270 268.940   64.500   -3.700   14.778   0.0     0    0.101                                     0.5048E-01
 39  8 0.8536 270.710   64.500   -3.700   14.778   0.0     0    0.096                                     0.4835E-01
 39  9 0.9455 272.069   64.500   -3.700   14.778   0.0     0    0.065                                     0.3249E-01
 39 10 0.9938 272.753   64.500   -3.700   14.778   0.0     0    0.029                                     0.1474E-01

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 resolution 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.

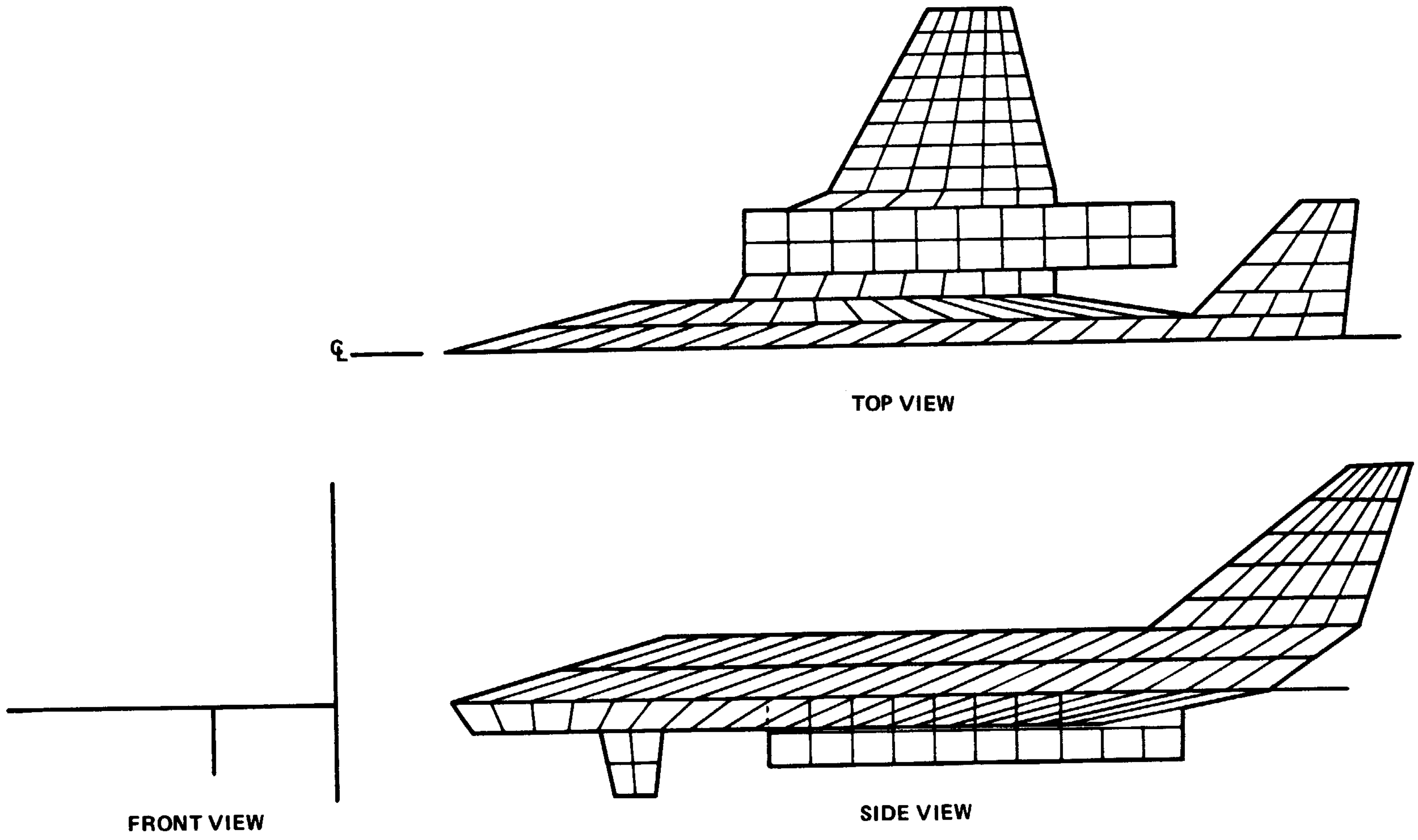

Figure A-7. - Vortex lattice panel representation for twin engine fighter

APPENDIX B

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

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 inefficiences. 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

```
                                                                 9/16/7  VORLAX
CONTROL*VRLX.AAMAINCD                                                    VORLAX
C*********************************************************************** VORLAX
C                                                                        VORLAX
C                                                                        VORLAX
C       L        OOO     CCCC  K    K  H    H  EEEEE  EEEEE  DDDD        VORLAX
C       L       O   O   C      K   K   H    H  E      E      D   D       VORLAX
C       L       O   O   C      K  K    H    H  E      E      D   D       VORLAX
C       L       O   O   C      KK      HHHHH   EEEEE  EEEEE  D   D       VORLAX
C       L       O   O   C      K  K    H    H  E      E      D   D       VORLAX
C       L       O   O   C      K   K   H    H  E      E      D   D       VORLAX
C       LLLLL    OOO     CCCC  K    K  H    H  EEEEE  EEEEE  DDDDD       VORLAX
C                                                                        VORLAX
C                                                                        VORLAX
C                                                                        VORLAX
C   PPPPP RRRRR  OOO  PPPPP RRRRR IIIII EEEEE TTTTT  AAA  RRRRR Y   Y   VORLAX
C   P   P R   R O   O P   P R   R   I   E       T   A   A R   R  Y Y    VORLAX
C   PPPPP RRRRR O   O PPPPP RRRRR   I   EEEEE   T   AAAAA RRRRR   Y     VORLAX
C   P     R  R  O   O P     R  R    I   E       T   A   A R  R    Y     VORLAX
C   P     R   R O   O P     R   R   I   E       T   A   A R   R   Y     VORLAX
C   P     R   R  OOO  P     R   R IIIII EEEEE   T   A   A R   R   Y     VORLAX
C                                                                        VORLAX
C*********************************************************************** VORLAX
```

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                                                                          VORLAX
C*********************************************************************** VORLAX
C                                                                         VORLAX
C  GENERALIZED VORTEX LATTICE PROGRAM (SUBSONIC/SUPERSONIC NONPLANAR)     VORLAX
C  LUIS R. MIRANDA (DEPT. 75-41) /BLDG. 63G /(213) 847-6812/              VORLAX
C  WILLIAM M. BAKER (DEPT. 80-34) /BLDG. 67 /(213) 847-3537/              VORLAX
C  ***** LOCKHEED-CALIFORNIA COMPANY, BURBANK, CALIFORNIA *****           VORLAX
C  COMPUTER SERVICES JOB NUMBER  4565                                     VORLAX
C                                                                         VORLAX
C*********************************************************************** VORLAX
C                                                                         VORLAX
C                                                                         VORLAX
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX
C                                                                         VORLAX
C          V       V   OOO   RRRRR  L          A       X   X              VORLAX
C           V     V   O   O  R   R  L         A A       X X               VORLAX
C            V   V    O   O  RRRRR  L        AAAAA       X                VORLAX
C             V V     O   O  R  R   L       A     A     X X               VORLAX
C              V       OOO   R   R  LLLLL  A       A   X   X              VORLAX
C                                                                         VORLAX
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX
C                                                                         VORLAX
C                                                                         VORLAX
      PROGRAM VORLAX(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2,    VORLAX
     *TAPE3,TAPE4,TAPE7,TAPE9,TAPE11,TAPE12)                              VORLAX
C...                                                                      VORLAX
C...DEFINITION OF VARIABLES STORED IN COMMON BLOCKS.                      VORLAX
C...
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C...B2               COMPRESSIBILITY FACTOR (M **2 - 1.)                 VORLAX
C...CD, CL, CM, CN   PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL       VORLAX
C...                 FORCE COEFFICIENTS.                                 VORLAX
C...CX, CY           PANEL X- AND Y-FORCE COEFFICIENTS.                  VORLAX
C...DL               DIHEDRAL OF CHORDWISE ROW OF HORSESHOE VORTI        VORLAX
C...                 CES.                                                VORLAX
C...FN, FY           PANEL NORMAL AND Y-FORCE PER UNIT Q.                VORLAX
C...IH, IQ           ANGLE OF ATTACK AND MACH NUMBER INDICES.            VORLAX
C...NT               TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES.         VORLAX
C...RM               PANEL ROLLING MOMENT PER UNIT Q.                    VORLAX
C...SX               SPANWISE LOCATION INDEX.                            VORLAX
C...XS               ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES.        VORLAX
C...YM               PANEL YAWING MOMENT PER UNIT Q.                     VORLAX
C...YY               Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS.         VORLAX
C...ZC               NORMAL CAMBER COORDINATE IN FRACTION OF CHORD.      VORLAX
C...ZZ               Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.         VORLAX
C...BIG              MAXIMUM CHANGE PER RELAXATION CYCLE.                VORLAX
C...CDC, CNC         CHORDWISE CD AND CN TIMES LOCAL CHORD.              VORLAX
C...CRM, CYM         PANEL ROLLING AND YAWING MOMENT COEFFICIENTS.       VORLAX
C...DCP              PRESSURE COEFFICIENTS (EITHER LOAD OR               VORLAX
C...                 SURFACE).                                           VORLAX
C...EPS              ACCEPTABLE FINAL RELAXATION CYCLE CHANGE.           VORLAX
C...HAG              HEIGHT ABOVE GROUND OF MOMENT REFERENCE             VORLAX
C...                 CENTER.                                             VORLAX
C...ITS, JTS         PANEL AND STRIP FLOW EXPOSURE FLAGS.                VORLAX
C...LAX,LAY          LATTICE CHORDWISE AND SPANWISE DISTRIBUTION         VORLAX
C...                 FLAGS.                                              VORLAX
C...NPP              PANEL CHORDWISE NONPLANARITY FLAG.                  VORLAX
C...NXS, NYS, NZS    NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGO         VORLAX
C...                 NAL TO THE COORDINATE AXES).                        VORLAX
C...PDL              PANEL SPANWISE NONPLANARITY FLAG. ALSO PANEL        VORLAX
C...                 PANEL DIHEDRAL IF PANEL IS FLAT IN THE SPAN         VORLAX
C...                 WISE DIRECTION.                                     VORLAX
C...PSI              YAW ANGLE (POSITIVE WHEN FLOW COMES FROM            VORLAX
C...                 PORTSIDE).                                          VORLAX
C...RCS              CROSS-SECTION RADIUS VECTOR.                        VORLAX
C...RLM              APPROXIMATE VALUE OF EIGENVALUE RADIUS OF           VORLAX
C...                 NORMALWASH MATRIX.                                  VORLAX
C...SLE              SLOPE AT LEADING EDGE.                              VORLAX
C...SPC              PANEL LEADING EDGE SUCTION FACTOR.                  VORLAX
C...TNL              TANGENT OF LEADING EDGE SWEEP.                      VORLAX
C...TNT              TANGENT OF TRAILING EDGE SWEEP.                     VORLAX
C...VSP              TANGENT OF SKEWED VORTEX LINE.                      VORLAX
C...VSS              SEMISPAN OF CHORDWISE VORTEX ROW.                   VORLAX
C...VST              ACTUAL HORSESHOE VORTEX SEMISPAN.                   VORLAX
C...XAF              CHORDWISE PERCENT COORDINATES AT WHICH CAMBER       VORLAX
C...                 IS INPUT.                                           VORLAX
C...XTE              TRAILING EDGE ABSCISSA OF VORTEX ROW.               VORLAX
C...ALFA             ANGLE OF ATTACK (IN RADIANS).                       VORLAX
C...ALOC             COMPONENT OF FREE-STREAM AND ONSET FLOWS NOR        VORLAX
C...                 MAL TO THE SURFACE AT THE CONTROL POINTS. ALSO      VORLAX
C...                 AUXILIARY ARRAY.                                    VORLAX
C...BETA             PRANDTL-GLAUERT FACTOR.                             VORLAX
C...CBAR             REFERENCE CHORD.                                    VORLAX
C...CMTC             CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD      VORLAX
C...                 TIMES LOCAL CHORD.                                  VORLAX
C...CSUC             PANEL LEADING EDGE THRUST PER UNIT Q.               VORLAX
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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       VORLAX
C...                      GIVEN PANEL.                                       VORLAX
C...SLE1, SLE2            SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE       VORLAX
C...                      EDGES.                                             VORLAX
C...SMAX                  NT.                                                VORLAX
C...SREF                  CONFIGURATION REFERENCE AREA.                      VORLAX
C...SURF                  PANEL SURFACE AREA (PLANFORM AREA).                VORLAX
C...VINF                  REFERENCE FREE STREAM VELOCITY.                    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...ZBAR                  ORDINATE OF MOMENT REFERENCE CENTER.               VORLAX
C...ZETA                  INCIDENCE OF STREAMWISE VORTEX ROW (STRIP)         VORLAX
C...                      CHORDLINE.                                         VORLAX
C...ZLE1, ZLE2            LEADING EDGE OFFSET OF CAMBERLINE AT THE           VORLAX
C...                      PANEL SIDE EDGES.                                  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           VORLAX
C...                      STREAMWISE ROW OF HORSESHOE VORTICES.              VORLAX
C...CLTOT                 TOTAL LIFT COEFFICIENT.                            VORLAX
C...CMTOT                 TOTAL PITCHING MOMENT COEFFICIENT.                 VORLAX
C...CNTOT                 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      VORLAX
C...                      ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN        VORLAX
C...                      VOKED, THEY ARE THE LOAD COEFFICIENTS AT THE       VORLAX
C...                      LOAD POINTS ALONG THE PANEL SIDE EDGES.            VORLAX
C...GAMMA                 HORSESHOE VORTEX CIRCULATION . ALSO USED           VORLAX
C...                      AS TEMPORARY DATA STORAGE.                         VORLAX
C...ISOLV                 FLAG DETERMINING SYSTEM OF SOLUTION FOR THE        VORLAX
C...                      BOUNDARY CONDITION EQUATIONS.                      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             VORLAX
C...                      ROTATION OF THE CONFIGURATION ABOUT THE            VORLAX
C...                      MOMENT REFERENCE CENTER.                           VORLAX
C...PSPAN                 PANEL SPAN.                                        VORLAX
C...RFLAG                 COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY       VORLAX
C...                      CONDITION EQUATIONS.                               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
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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      BUTTLINE 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...NPANAS              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...PITCHQ              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
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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 SEQUENCE≤                                       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, B2, DL, SX, YY, ZZ, DCP, JTS, LAX, PSI,        VORLAX   319
C...            SPC, VSS, VST, XTE, ALFA, MACH, NPAN, NVOR, SREF,       VORLAX   320
C...            VINF, XBAR, 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 SEQUENCE≤                                       VORLAX   325
C...            NONE.                                                   VORLAX   326
C...            COMMON<                                                 VORLAX   327
C...            CD, CL, CM, CN, CX, CY, FN, FY, RM, YM, CDC, CNC,       VORLAX   328
C...            CRM, CYM, CMTC, 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...            (2) 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
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CONTROL*VRLX.BOUNDY                                              9/17/76
C...
      SUBROUTINE BOUNDY (ITOTAL)
C...
C...PURPOSE    TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO
C...           THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON
C...           TROL POINTS.
C...
C...INPUT      CALLING SEQUENCE <
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C...           COMMON <
C...           ALFA, PSI, VINF, PITCHQ, ROLLQ, YAWQ, LAX, RNMAX,
C...           SX, CX, X, YY, ZZ, DL, CHORD, XBAR, ZBAR, SLOPE,
C...           RFLAG.
C...
C...OUTPUT     COMMON ≤
C...           ALOC, ONSET.
C...
C...SUBROUTINES
C...CALLED     NONE.
C...
C...DISCUSSION THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY
C...           AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED
C...           BY PROJECTING THE FREE-STREAM VELOCITY VECTOR
C...           ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT
C...           A RIGID BODY ROTATION ABOUT THE POINT (XBAR, 0,
C...           ZBAR). THE ONSET FLOW NORMAL COMPMONENT IS ALOC.
C...           ONSET DENOTES THE RIGID BODY ROTATION INDUCED
C...           VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY
C...           ALOC AND ONSET, ARE DIMENSIONLESS, I.E., THEY ARE
C...           REFERENCED TO THE FREE-STREAM VELOCITY.
C...
C...
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CONTROL*VRLX.GAUSS                                             9/13/76  VORLAX     856
C...                                                                    VORLAX     857
      SUBROUTINE GAUSS (ITOTAL, REXPAR, EW, XRT)                        VORLAX     858
C...                                                                    VORLAX     859
C...PURPOSE     TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE        VORLAX     860
C...            METHOD OF (CONTOLLED SUCCESSIVE OVER-RELAXATION(.       VORLAX     861
C...                                                                    VORLAX     862
C...INPUT       CALLING SEQUENCE<                                       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, RNMAX, INVERS,          VORLAX     868
C...            ITRMAX.                                                 VORLAX     869
C...                                                                    VORLAX     870
C...OUTPUT      CALLING SEQUENCE<                                       VORLAX     871
C...            XRT = AUXILIARY VECTOR USED IN C.S.O.R. SOLUTION.       VORLAX     872
C...            COMMON<                                                 VORLAX     873
C...            BIG, DCP, EPS, RLM, SLE, ITER, GAMMA, SLOPE.            VORLAX     874
C...            GAMMA IS THE SOLUTION VECTOR OF ROUDARY CONDITION       VORLAX     875
C...            EQUATIONS, I. E., HORSESHOE VORTEX CIRCULATION          VORLAX     876
C...            STRENGTHS.                                              VORLAX     877
C...            NOTE< 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
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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 SEQUENCE≤                                        VORLAX  1086
C...           NONE.                                                    VORLAX  1087
C...           COMMON≤                                                  VORLAX  1088
C...           DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR,       VORLAX  1089
C...           RNCV, SLE1, SLE2, ZLE1, ZLE2, 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 SEQUENCE≤                                        VORLAX  1095
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.             VORLAX  1096
C...           COMMON≤                                                  VORLAX  1097
C...           X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,          VORLAX  1098
C...           TNL, TNT, VSP, VSS, VST, XTE, ALOC, IPAN, SMAX,          VORLAX  1099
C...           ZETA, CHORD, RNMAX, SLOPE, NPANAS.                       VORLAX  1100
C...           NOTE≤ 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 LEGS    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
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C...        360.0 THEN THE TRANSVERSE VORTEX SEGMENTS OF SAME CX,       VORLAX   1134
C...        THOUGH STILL CONTINUOUS, FORM A POLYGONAL LINE              VORLAX   1135
C...        WHEN PROJECTED ON A PLANE NORMAL TO THE X-AXIS. IF          VORLAX   1136
C...        NPP = 0 THEN ALL THE TRANSVERSE VORTEX SEGMENTS             VORLAX   1137
C...        OF A GIVEN ROW (SAME SX) LIE IN THE SAME PLANE,             VORLAX   1138
C...        BUT IF NPP = 1 THEN THE TRANSVERSE SEGMENTS OF A            VORLAX   1139
C...        ROW ARE LAID ON THE ACTUAL BODY SURFACE. THE BOUND          VORLAX   1140
C...        TRAILING LEGS OR SEGMENTS ARE ALWAYS PARALLEL TO            VORLAX   1141
C...        THE X-AXIS (UP TO THE TRAILING EDGE OF THE GIVEN            VORLAX   1142
C...        STRIP OR ROW).                                              VORLAX   1143
C...                                                                    VORLAX   1144
C...                                                                    VORLAX   1145
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CONTROL*VRLX.MAP                                                   9/14/76 VORLAX    1971
C...                                                                      VORLAX    1972
      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 SEQUENCE≤                                         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...            COMMON≤                                                   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 SEQUENCE≤                                         VORLAX    1989
C...            NONE.                                                     VORLAX    1990
C...            COMMON≤                                                   VORLAX    1991
C...            NONE.                                                     VORLAX    1992
C...            DIRECT PRINT≤                                             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...            EPSLON = 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...                                                                      VORLAX    2008
C...SUBROUTINES                                                           VORLAX    2009
C...CALLED      NONE.                                                     VORLAX    2010
C...                                                                      VORLAX    2011
C...DISCUSSION FLOW FIELD QUANTITIES ARE COMPUTED AT THE NODAL POINTS     VORLAX    2012
C...            OF A 3-D GRID DEFINED AROUND THE CONFIGURATION BY A SET   VORLAX    2013
C...            OF ORTHOGONAL PLANES ( X = CONST., Y = CONST., AND        VORLAX    2014
C...            Z = CONST. PLANES). THE VELOCITIES ARE CALCULATED BY      VORLAX    2015
C...            THE USE OF INFLUENCE COEFFICIENT MATRICES BASED ON THE    VORLAX    2016
C...            VORTEX LATTICE REPRESENTATION OF THE CONFIGURATION.       VORLAX    2017
C...            THESE MATRICES ARE COMPUTED IN SUBROUTINE SURVEY AND      VORLAX    2018
C...            STORED IN UNITS 3, 4, AND 7 (ONE MATRIX AND ONE UNIT      VORLAX    2019
C...            PER VELOCITY COMPONET). THE PRESSURE RATIOS AND RELATED   VORLAX    2020
C...            FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF ISEN      VORLAX    2021
C...            TROPIC FLOW RELATIONSHIPS.                                VORLAX    2022
C                                                                         VORLAX    2023
C
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CONTROL*VRLX.MATRX                                             9/16/76 VORLAX  2147
C...                                                                   VORLAX  2148
      SUBROUTINE MATRX (EW, EU, ITOTAL)                                VORLAX  2149
C....                                                                  VORLAX  2150
C...PURPOSE    TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI    VORLAX  2151
C...           CESS (1) THE NORMALWASH AT THE CONTROL POINTS           VORLAX  2152
C...           (EW / UNIT 1), (2) THE AXIALWASH AT THE CONTROL POINTS  VORLAX  2153
C...           (EU / UNIT 2), AND (3) THE NORMALWASH AT THE LEAD. EDGE VORLAX  2154
C...           (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED     VORLAX  2155
C...           VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE     VORLAX  2156
C...           LATTICE.                                                VORLAX  2157
C...                                                                   VORLAX  2158
C...INPUT      CALLING SEQUENCES                                       VORLAX  2159
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.            VORLAX  2160
C...           COMMONS                                                 VORLAX  2161
C...           X, B2, CX, DL, NT, SX, YY, ZZ, HAG, LAX, NPP, PSI, TNT, VORLAX  2162
C...           VSP, VST, XTE, ALFA, IPAN, XBAR, ZBAR, CHORD, RFLAG,    VORLAX  2163
C...           PNMAX, SLOPE, FLOATX, FLOATY, INVERS, LATRAL.           VORLAX  2164
C...                                                                   VORLAX  2165
C...OUTPUT     CALLING SEQUENCES                                       VORLAX  2166
C...           EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY     VORLAX  2167
C...                ROW IN UNIT 1).                                    VORLAX  2168
C...           EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY      VORLAX  2169
C...                ROW IN UNIT 9).                                    VORLAX  2170
C...           EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2).    VORLAX  2171
C...           COMMONS                                                 VORLAX  2172
C...           NONE.                                                   VORLAX  2173
C...                                                                   VORLAX  2174
C...SUBROUTINES                                                        VORLAX  2175
C...CALLED     WASH, UXVEL.                                            VORLAX  2176
C...                                                                   VORLAX  2177
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES      VORLAX  2178
C...           ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY   VORLAX  2179
C...           INDUCED AT THE (K1,J1) CONTROL POINT BY THE (K,J)       VORLAX  2180
C...           HORSESHOE VORTEX OF UNIT STRENGTH. IF K = K1 AND        VORLAX  2181
C...           J = J1 (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF      VORLAX  2182
C...           THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF    VORLAX  2183
C...           THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL   VORLAX  2184
C...           POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE        VORLAX  2185
C...           INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION   VORLAX  2186
C...           IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.         VORLAX  2187
C...                                                                   VORLAX  2188
C...                                                                   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, SLE1,  VORLAX    1433
C...             SLE2, SREF, VINF, XBAR, YAWQ, YNOT, ZBAR, ZLE1,      VORLAX    1434
C...             ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2,       VORLAX    1435
C...             GAMMA, IESWP, NMACH, PSPAN, ROLLQ, SYNTH, TAPER,     VORLAX    1436
C...             WSPAN, XAPEX, YAPEX, ZAPEX, CSTART, DELTAY, DELTAZ,  VORLAX    1437
C...             INTRAC, INVERS, IQUANT, LATRAL, NALPHA, PHIMED,      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 CONVEVIENT 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 GEOM 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
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C...          SURFACE OF THE SAME AIRFOIL.                          VORLAX   1473
C...          FUSIFORM BODIES ARE MODELLED BY DEFINING AN AUXILIARY VORLAX   1474
C...          BODYIDENTICAL 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
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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 (CPLOWER        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...            COMMONS                                               VORLAX    2538
C...            B2, CX, DL, SX, JTS, PSI, TNL, TNT, 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...            COMMONS                                               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...            ASSUMMED 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
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CONTROL*VRLX.PRINT                                                   9/17/76  VORLAX    2768
C...                                                                          VORLAX    2769
      SUBROUTINE PRINT (ITOTAL, EW, EWX, EWY)                                 VORLAX    2770
C...                                                                          VORLAX    2771
C...PURPOSE    TO PRINT PROGRAM DATA.                                         VORLAX    2772
C                                                                             VORLAX    2773
C...INPUT      CALLING SEQUENCE<                                              VORLAX    2774
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.                   VORLAX    2775
C...           EW, EWX, EWY = STORAGE ARRAYS SET ASIDE FOR CALLING            VORLAX    2776
C...                          SUBROUTINE MAP.                                 VORLAX    2777
C...           COMMON<                                                        VORLAX    2778
C...           CD, CL, CM, CM, CX, CY, DL, IH, IQ, YY, ZC, ZZ,                VORLAX    2779
C...           BIG, CDC, CNC, CRM, CYM, DCP, EPS, HAG, JTS, LAX,              VORLAX    2780
C...           NXS, PDL, PSI, RLM, SPC, CBAR, CMTC, CSUC, HEAD,               VORLAX    2781
C...           IPAN, ITER, LIFT, MACH, NPAN, NVOR, RNCV, SREF,                VORLAX    2782
C...           SURF, VINF, XBAR, XSUC, YAWQ, ZBAR, AINC1, AINC2,              VORLAX    2783
C...           ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CRTOT, CYTOT,               VORLAX    2784
C...           DNDX1, DNDX2, GAMMA, ISOLV, LESWP, PSPAN, RNMAX,               VORLAX    2785
C...           ROLLQ, SLOPE, SYNTH, TAPER, TITLE, WSPAN, XAPEX,               VORLAX    2786
C...           YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVERS,                  VORLAX    2787
C...           IQUANT, ITRMAX, LATRAL, MOMENT, PITCHQ.                        VORLAX    2788
C...                                                                          VORLAX    2789
C...OUTPUT     CALLING SEQUENCE<                                              VORLAX    2790
C...           NONE.                                                          VORLAX    2791
C...           COMMON<                                                        VORLAX    2792
C...           NONE.                                                          VORLAX    2793
C...                                                                          VORLAX    2794
C...SUBROUTINES                                                               VORLAX    2795
C...CALLED     ZNORM, MAP.                                                    VORLAX    2796
C...                                                                          VORLAX    2797
C...DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED           VORLAX    2798
C...           IN THREE GROUPS, AS FOLLOWS<                                   VORLAX    2799
C...           (1) INPUT DATA, THESE ARE DATA WHICH ARE TAKEN FROM            VORLAX    2800
C...               THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT         VORLAX    2801
C...               SUITABLE FOR USE BY THE PROGRAM.                           VORLAX    2802
C...           (2) PANEL AND TOTAL CONFIGURATION FORCE AND MOMENT             VORLAX    2803
C...               COEFFICIENT DATA.                                          VORLAX    2804
C...           (3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS          VORLAX    2805
C...               OR TO INDIVIDUAL HORSESHOE VORTICES.                       VORLAX    2806
C...           THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.              VORLAX    2807
C...           IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES          VORLAX    2808
C...           PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.           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)                                  VORLAX    3057
C...                                                                            VORLAX    3058
C...PURPOSE      TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT            VORLAX    3059
C...             MATRICES≤ (1) THE UPWASH AT THE FLOW FIELD SURVEY              VORLAX    3060
C...             POINTS (EW / UNIT 3), (2) THE AXIALWASH AT THE FLOW            VORLAX    3061
C...             FIELD SURVEY POINTS (EWX / UNIT 4), AND (3) THE                VORLAX    3062
C...             SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EWY / UNIT 7).       VORLAX    3063
C...             THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELD            VORLAX    3064
C...             DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW        VORLAX    3065
C...             FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED           VORLAX    3066
C...             3-D GRID.                                                      VORLAX    3067
C...                                                                            VORLAX    3068
C...INPUT        CALLING SEQUENCE≤                                              VORLAX    3069
C...             ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.                   VORLAX    3070
C...             COMMON≤                                                        VORLAX    3071
C...             X, B2, CX, DL, NT, SX, XS, YY, ZZ, HAG, LAX, NXS,              VORLAX    3072
C...             NYS, NZS, PSI, TNT, VSP, VST, XTE, ALFA, YNOT, XBAR,           VORLAX    3073
C...             ZBAR, ZNOT, CHORD, RNMAX, DELTAY, DELTAZ, FLOATX,              VORLAX    3074
C...             FLOATY, LATRAL.                                                VORLAX    3075
C...                                                                            VORLAX    3076
C...OUTPUT       CALLING SEQUENCE≤                                              VORLAX    3077
C...             EW = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)               VORLAX    3078
C...             EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4)           VORLAX    3079
C...             EWY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7)            VORLAX    3080
C...             COMMON≤                                                        VORLAX    3081
C...             NONE.                                                          VORLAX    3082
C...                                                                            VORLAX    3083
C...SUBROUTINES                                                                 VORLAX    3084
C...CALLED       WASH, UXVEL.                                                   VORLAX    3085
C...                                                                            VORLAX    3086
C...DISCUSSION   THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE         VORLAX    3087
C...             GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW          VORLAX    3088
C...             FIELD SURVEY POINT BY THE (K, J) HORSESHOE VORTEX OF           VORLAX    3089
C...             UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT I=               VORLAX    3090
C...             WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING               VORLAX    3091
C...             HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS            VORLAX    3092
C...             COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW          VORLAX    3093
C...             FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-D GRID         VORLAX    3094
C...             DEFINED BY A SET OF THREE ORTHOGONAL PLANES. THESE             VORLAX    3095
C...             PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT,          VORLAX    3096
C...             DELTAY, ZNOT, AND DELTAZ.                                      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
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CONTROL*VRLX.VECTOR                                              9/14/76  VORLAX     3484
C...                                                                      VORLAX     3485
      SUBROUTINE VECTOR (ITOTAL, NX1, AV, EW, VOR1, 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 SEQUENCE≤                                         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...            COMMON≤                                                   VORLAX     3497
C...            ALOC.                                                     VORLAX     3498
C...                                                                      VORLAX     3499
C...OUTPUT      CALLING SEQUENCE≤                                         VORLAX     3500
C...            VOR1 = AUXILIARY COMPUTATIONAL ROW VECTOR.                VORLAX     3501
C...            VORK = EXTENDED SOLUTION ROW VECTOR.                      VORLAX     3502
C...            VORL = AUXILIARY COMPUTATIONAL ROW VECTOR.                VORLAX     3503
C...            COMMON≤                                                   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 SUCCESIVELY 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...                                                                 VORLAX    3612
      SUBROUTINE WASH (X, Y, Z, S, T, B2, U, V, W, AA, AM, TE, CT, MM)  VORLAX    3613
C...                                                                 VORLAX    3614
C...PURPOSE     TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A  VORLAX    3615
C...            GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT  VORLAX    3616
C...            STRENGTH.                                            VORLAX    3617
C                                                                    VORLAX    3618
C...INPUT       CALLING SEQUENCE≤                                    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...            B2 = 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...            COMMON≤                                              VORLAX    3642
C...            NONE.                                                VORLAX    3643
C...                                                                 VORLAX    3644
C...OUTPUT      CALLING SEQUENCE≤                                    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 SWEPT, 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 AFTCONES 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) /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...                                                                VORLAX   3895
      SUBROUTINE ZNORM (I, IS, RTOP)                                VORLAX   3896
C...                                                                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                                                                   VORLAX   3900
C...INPUT       CALLING SEQUENCE≤                                   VORLAX   3901
C...            I = ELEMENT INDEX (TOTAL COUNT).                    VORLAX   3902
C...            IS = STRIP INDEX (SPANWISE COUNT).                  VORLAX   3903
C...            RNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP VORLAX   3904
C...                    (CHORDWISE ROW).                            VORLAX   3905
C...            COMMON≤                                             VORLAX   3906
C...            LAX, SLE, SLOPE.                                    VORLAX   3907
C                                                                   VORLAX   3908
C...OUTPUT      CALLING SEQUENCE≤                                   VORLAX   3909
C...            NONE.                                               VORLAX   3910
C...            COMMON≤                                             VORLAX   3911
C...            ZC.                                                 VORLAX   3912
C...                                                                VORLAX   3913
C...SUBROUTINES                                                     VORLAX   3914
C...CALLED      NONE.                                               VORLAX   3915
C...                                                                VORLAX   3916
C...DISCUSSION THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES VORLAX   3917
C...            BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS VORLAX   3918
C...            TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY  VORLAX   3919
C...            CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS VORLAX   3920
C...            IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS VORLAX   3921
C...            TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED VORLAX   3922
C...            TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS VORLAX   3923
C...            DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS    VORLAX   3924
C...            EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD    VORLAX   3925
C...            LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL VORLAX   3926
C...            SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST.   VORLAX   3927
C...            SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE  VORLAX   3928
C...            STRIP OR ROW OF HORSESHOE VORTICES.                 VORLAX   3929
C                                                                   VORLAX   3930
C                                                                   VORLAX   3931
C                                                                   VORLAX   3932
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CONTROL*VRLX.AAMAINCD                                                       9/16/7 VORLAX    2
C****************************************************************************** VORLAX    3
C                                                                              VORLAX    4
C                                                                              VORLAX    5
C      L      000   CCCC  K   K  H   H  EEEFE  EEEEE  DDDD                     VORLAX    6
C      L     0   0 C      K  K   H   H  E      E      D   D                    VORLAX    7
C      L     0   0 C      K K    H   H  E      E      D   D                    VORLAX    8
C      L     0   0 C      KK     HHHHH  EEEFE  EEEEE  D   D                    VORLAX    9
C      L     0   0 C      K K    H   H  E      E      D   D                    VORLAX   10
C      L     0   0 C      K  K   H   H  E      E      D   D                    VORLAX   11
C      LLLLL  000   CCCC  K   K  H   H  EEEFE  EEEEE  DDDDD                    VORLAX   12
C                                                                              VORLAX   13
C                                                                              VORLAX   14
C                                                                              VORLAX   15
C   PPPPP RRRRR  000  PPPPP RRRRR IIIII EEEEE TTTTT  AAA  RRRRR Y   Y          VORLAX   16
C   P   P R   R 0   0 P   P R   R   I   E       T   A   A R   R  Y Y           VORLAX   17
C   PPPPP RRRRR 0   0 PPPPP RRRRR   I   EEEEE   T   AAAAA RRRRR   Y            VORLAX   18
C   P     R  R  0   0 P     R  R    I   E       T   A   A R  R    Y            VORLAX   19
C   P     R   R 0   0 P     R   R   I   E       T   A   A R   R   Y            VORLAX   20
C   P     R   R  000  P     R   R IIIII EEEEE   T   A   A R   R   Y            VORLAX   21
C                                                                              VORLAX   22
C****************************************************************************** VORLAX   23
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C****************************************************************************** VORLAX   30
C                                                                              VORLAX   31
C  GENERALIZED VORTEX LATTICE PROGRAM (SUBSONIC/SUPERSONIC NONPLANAR)          VORLAX   32
C  LUIS R. MIRANDA (DEPT. 75-41) /BLDG. 63G /(213) 847-6812/                   VORLAX   33
C  WILLIAM M. BAKER (DEPT. 80-34) /BLDG. 67 /(213) 847-3537/                   VORLAX   34
C  ***** LOCKHEED-CALIFORNIA COMPANY, BURBANK, CALIFORNIA *****                VORLAX   35
C  COMPUTER SERVICES JOB NUMBER  4565                                          VORLAX   36
C                                                                              VORLAX   37
C****************************************************************************** VORLAX   38
C                                                                              VORLAX   39
C                                                                              VORLAX   40
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX   41
C                                                                              VORLAX   42
C          V       V   000   RRRRR  L          A       X   X                   VORLAX   43
C           V     V   0   0  R   R  L         A A       X X                    VORLAX   44
C            V   V    0   0  RRRRR  L        AAAAA       X                     VORLAX   45
C             V V     0   0  R  R   L       A     A     X X                    VORLAX   46
C              V       000   R   R  LLLLL  A       A   X   X                   VORLAX   47
C                                                                              VORLAX   48
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX   49
C                                                                              VORLAX   50
C                                                                              VORLAX   51
      PROGRAM VORLAX(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2,         VORLAX   52
     *TAPE3,TAPE4,TAPE7,TAPE9,TAPE11,TAPE12)                                   VORLAX   53
C...                                                                           VORLAX   54
C...DEFINITION OF VARIABLES STORED IN COMMON BLOCKS.                           VORLAX   55
C...                                                                           VORLAX   56
C...X, Y, Z                 COORDINATES OF HORSESHOE VORTEX CENTROIDS          VORLAX   57
C...                        (MIDPOINTS OF TRANSVERSE LEGS).                    VORLAX   58
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C...B2                 COMPRESSIBILITY FACTOR (M **2 - 1.)              VORLAX   59
C...CD, CL, CM, CN     PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL    VORLAX   60
C...                   FORCE COEFFICIENTS.                              VORLAX   61
C...CX, CY             PANEL X- AND Y-FORCE COEFFICIENTS.               VORLAX   62
C...DL                 DIHEDRAL OF CHORDWISE ROW OF HORSESHOE VORTI     VORLAX   63
C...                   CES.                                             VORLAX   64
C...FN, FY             PANEL NORMAL AND Y-FORCE PER UNIT Q.             VORLAX   65
C...IH, IQ             ANGLE OF ATTACK AND MACH NUMBER INDICES.         VORLAX   66
C...NT                 TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES.      VORLAX   67
C...RM                 PANEL ROLLING MOMENT PER UNIT Q.                 VORLAX   68
C...SX                 SPANWISE LOCATION INDEX.                         VORLAX   69
C...XS                 ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES.     VORLAX   70
C...YM                 PANEL YAWING MOMENT PER UNIT Q.                  VORLAX   71
C...YY                 Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS.      VORLAX   72
C...ZC                 NORMAL CAMBER COORDINATE IN FRACTION OF CHORD.   VORLAX   73
C...ZZ                 Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.      VORLAX   74
C...BIG                MAXIMUM CHANGE PER RELAXATION CYCLE.             VORLAX   75
C...CDC, CNC           CHORDWISE CD AND CN TIMES LOCAL CHORD.           VORLAX   76
C...CRM, CYM           PANEL ROLLING AND YAWING MOMENT COEFFICIENTS.    VORLAX   77
C...DCP                PRESSURE COEFFICIENTS (EITHER LOAD OR            VORLAX   78
C...                   SURFACE).                                        VORLAX   79
C...EPS                ACCEPTABLE FINAL RELAXATION CYCLE CHANGE.        VORLAX   80
C...HAG                HEIGHT ABOVE GROUND OF MOMENT REFERENCE          VORLAX   81
C...                   CENTER.                                          VORLAX   82
C...ITS, JTS           PANEL AND STRIP FLOW EXPOSURE FLAGS.             VORLAX   83
C...LAX,LAY            LATTICE CHORDWISE AND SPANWISE DISTRIBUTION      VORLAX   84
C...                   FLAGS.                                           VORLAX   85
C...NPP                PANEL CHORDWISE NONPLANARITY FLAG.               VORLAX   86
C...NXS, NYS, NZS      NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGO      VORLAX   87
C...                   NAL TO THE COORDINATE AXES).                     VORLAX   88
C...PDL                PANEL SPANWISE NONPLANARITY FLAG. ALSO PANEL     VORLAX   89
C...                   PANEL DIHEDRAL IF PANEL IS FLAT IN THE SPAN      VORLAX   90
C...                   WISE DIRECTION.                                  VORLAX   91
C...PSI                YAW ANGLE (POSITIVE WHEN FLOW COMES FROM         VORLAX   92
C...                   PORTSIDE).                                       VORLAX   93
C...RCS                CROSS-SECTION RADIUS VECTOR.                     VORLAX   94
C...RLM                APPROXIMATE VALUE OF EIGENVALUE RADIUS OF        VORLAX   95
C...                   NORMALWASH MATRIX.                               VORLAX   96
C...SLE                SLOPE AT LEADING EDGE.                           VORLAX   97
C...SPC                PANEL LEADING EDGE SUCTION FACTOR.               VORLAX   98
C...TNL                TANGENT OF LEADING EDGE SWEEP.                   VORLAX   99
C...TNT                TANGENT OF TRAILING EDGE SWEEP.                  VORLAX  100
C...VSP                TANGENT OF SKEWED VORTEX LINE.                   VORLAX  101
C...VSS                SEMISPAN OF CHORDWISE VORTEX ROW.                VORLAX  102
C...VST                ACTUAL HORSESHOE VORTEX SEMISPAN.                VORLAX  103
C...XAF                CHORDWISE PERCENT COORDINATES AT WHICH CAMBER    VORLAX  104
C...                   IS INPUT.                                        VORLAX  105
C...XTE                TRAILING EDGE ABSCISSA OF VORTEX ROW.            VORLAX  106
C...ALFA               ANGLE OF ATTACK (IN RADIANS).                    VORLAX  107
C...ALOC               COMPONENT OF FREE-STREAM AND ONSET FLOWS NOR     VORLAX  108
C...                   MAL TO THE SURFACE AT THE CONTROL POINTS. ALSO   VORLAX  109
C...                   AUXILIARY ARRAY.                                 VORLAX  110
C...BETA               PRANDTL-GLAUERT FACTOR.                          VORLAX  111
C...CBAR               REFERENCE CHORD.                                 VORLAX  112
C...CMTC               CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD   VORLAX  113
C...                   TIMES LOCAL CHORD.                               VORLAX  114
C...CSUC               PANEL LEADING EDGE THRUST PER UNIT Q.            VORLAX  115
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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
C...LIFT            PANEL LIFT PER UNIT Q.                                VORLAX    121
C...MACH            FREE-STREAM MACH NUMBER.                              VORLAX    122
C...NPAN            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          VORLAX    125
C...                GIVEN PANEL.                                          VORLAX    126
C...SLE1, SLE2      SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE          VORLAX    127
C...                EDGES.                                                VORLAX    128
C...SMAX            NT.                                                   VORLAX    129
C...SREF            CONFIGURATION REFERENCE AREA.                         VORLAX    130
C...SURF            PANEL SURFACE AREA (PLANFORM AREA).                   VORLAX    131
C...VINF            REFERENCE FREE STREAM VELOCITY.                       VORLAX    132
C...XBAR            ABSCISSA OF MOMENT REFERENCE CENTER.                  VORLAX    133
C...XSUC            PANEL LEADING EDGE THRUST PER UNIT Q.                 VORLAX    134
C...YAWQ            YAW RATE (DEGS/SEC).                                  VORLAX    135
C...YNOT            BUTTLINE ORIGIN OF FLOW FIELD SURVEY GRID.            VORLAX    136
C...ZBAR            ORDINATE OF MOMENT REFERENCE CENTER.                  VORLAX    137
C...ZETA            INCIDENCE OF STREAMWISE VORTEX ROW (STRIP)            VORLAX    138
C...                CHORDLINE.                                            VORLAX    139
C...ZLE1, ZLE2      LEADING EDGE OFFSET OF CAMBERLINE AT THE              VORLAX    140
C...                PANEL SIDE EDGES.                                     VORLAX    141
C...ZNOT            WATERLINE ORIGIN OF FLOW FIELD SURVEY GRID.           VORLAX    142
C...AINC1, AINC2    CHORDLINE INCIDENCE AT SIDE EDGES OF PANEL.           VORLAX    143
C...ALPHA           ANGLE OF ATTACK (DEGS).                               VORLAX    144
C...CDTOT           TOTAL INDUCED DRAG COEFFICIENT.                       VORLAX    145
C...CHORD           CHORD LENGTH MEASURED ALONG CENTRLINE OF              VORLAX    146
C...                STREAMWISE ROW OF HORSESHOE VORTICES.                 VORLAX    147
C...CLTOT           TOTAL LIFT COEFFICIENT.                               VORLAX    148
C...CMTOT           TOTAL PITCHING MOMENT COEFFICIENT.                    VORLAX    149
C...CNTOT           TOTAL YAWING MOMENT COEFFICIENT.                      VORLAX    150
C...CRTOT           TOTAL ROLLING MOMENT COEFFICIENT.                     VORLAX    151
C...CYTOT           TOTAL SIDE FORCE COEFFICIENT.                         VORLAX    152
C...DNDX1, DNDX2    SURFACE SLOPES AT THE CONTROL POINTS MEASURED         VORLAX    153
C...                ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN           VORLAX    154
C...                VOKED, THEY ARE THE LOAD COEFFICIENTS AT THE          VORLAX    155
C...                LOAD POINTS ALONG THE PANEL SIDE EDGES.               VORLAX    156
C...GAMMA           HORSESHOE VORTEX CIRCULATION . ALSO USED              VORLAX    157
C...                AS TEMPORARY DATA STORAGE.                            VORLAX    158
C...ISOLV           FLAG DETERMINING SYSTEM OF SOLUTION FOR THE           VORLAX    159
C...                BOUNDARY CONDITION EQUATIONS.                         VORLAX    160
C...LESWP           PANEL LEADING EDGE SWEEP (DEGS).                      VORLAX    161
C...NMACH           NUMBER OF MACH NUMBERS PER CASE.                      VORLAX    162
C...ONSET           ONSET FLOW VELOCITIES GENERATED BY THE                VORLAX    163
C...                ROTATION OF THE CONFIGURATION ABOUT THE               VORLAX    164
C...                MOMENT REFERENCE CENTER.                              VORLAX    165
C...PSPAN           PANEL SPAN.                                           VORLAX    166
C...RFLAG           COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY          VORLAX    167
C...                CONDITION EQUATIONS.                                  VORLAX    168
C...RNMAX           NUMBER OF VORTICES FOR A GIVEN CHORDWISE ROW.         VORLAX    169
C...ROLLQ           ROLL RATE (DEGS/SEC).                                 VORLAX    170
C...SLOPE           SURFACE SLOPE AT THE LATTICE CONTROL POINTS.          VORLAX    171
C...SYNTH           PANEL SYNTHESIS (DESIGN) FLAG.                        VORLAX    172
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C...TAPER              PANEL TAPER RATIO.                             VORLAX    173
C...TITLE              CASE TITLE.                                    VORLAX    174
C...WSPAN              CONFIGURATION REFERENCE WING SPAN.             VORLAX    175
C...XAPEX. YAPEX. ZAPE- COORDINATES OF PANEL FIRST SIDE EDGE LEADING  VORLAX    176
C...                   EDGE (PANEL APEX).                             VORLAX    177
C...CSTART             CHORD LENGTH OF PANEL FIRST SIDE EDGE.         VORLAX    178
C...DELTAY, DELTAZ     BUTTLINE AND WATERLINE SPACING OF FLOW FIELD   VORLAX    179
C...                   SURVEY GRID.                                   VORLAX    180
C...FLOATX. FLOATY     VORTEX WAKE FLOATATION PARAMETERS.             VORLAX    181
C...INTRAC             PANEL LATERAL NONPLANARITY PARAMETER.          VORLAX    182
C...INVERS             DESIGN (SYNTHESIS) FLAG.                       VORLAX    183
C...IQUANT             PANEL SYMMETRY FLAG.                           VORLAX    184
C...ITRMAX             MAXIMUM ALLOWABLE NUMBER OF RELAXATION CYCLES. VORLAX    185
C...LATRAL             CONFIGURATION OR FLIGHT CONDITION SYMMETRY     VORLAX    186
C...                   FLAG.                                          VORLAX    187
C...MOMENT             PANEL PITCHING MOMENT PER UNIT Q.              VORLAX    188
C...NALPHA             NUMBER OF ANGLES OF ATTACK PER CASE.           VORLAX    189
C...NPANAS             TOTAL NUMBER OF PANELS THAT HAVE TO BE TAKEN   VORLAX    190
C...                   INTO ACCOUNT IN THE ACTUAL COMPUTATION         VORLAX    191
C...                   PROCESS.                                       VORLAX    192
C...PHIMED             ANGULAR COORDINATE OF CROSS-SECTION RADIUS     VORLAX    193
C...                   VECTOR.                                        VORLAX    194
C...PITCHQ             PITCH RATE (DEGS/SEC).                         VORLAX    195
C...                                                                  VORLAX    196
C......................(PER UNIT Q( MEANS (PER UNIT FREE-STREAM       VORLAX    197
C......................DYNAMIC PRESSURE(.                             VORLAX    198
C...                                                                  VORLAX    199
C                                                                     VORLAX    200
C                                                                     VORLAX    201
      DIMENSION C1 (50). C2 (50). RO (51). PHI (51)                   VORLAX    202
      DIMENSION XAF (50). ZC1 (50). ZC2 (50)                          VORLAX    203
      DIMENSION EW (2000). EWX (2001). EWY (2001). EU (2001). AV (2001) VORLAX  204
      DIMENSION DESCRP (10)                                           VORLAX    205
C                                                                     VORLAX    206
      INTEGER TITLE. CX. SX                                           VORLAX    207
      REAL MACH. NVOR. LIFT. MOMENT. LESWP                            VORLAX    208
C                                                                     VORLAX    209
C...                                                                  VORLAX    210
C...                                                                  VORLAX    211
      COMMON LAX. LAY. IQ. IH. LATRAL. PSI. PITCHQ. ROLLQ. YAWQ. HAG. VORLAX    212
     * FLOATX. FLOATY. INVERS. ISOLV                                  VORLAX    213
      COMMON /SET1 /X (2000). Y (100). Z (100). ZC (50)               VORLAX    214
      COMMON /SET2 /DCP (2000). SLOPE (2000). VSP (2000)              VORLAX    215
      COMMON /SET3 /CX (2000). SX (2000). RFLAG (2000). IDES (2000)   VORLAX    216
      COMMON /SET4 /DNDX1 (400). DNDX2 (400). AINC1 (20). AINC2 (20)  VORLAX    217
      COMMON /SET5 /XAPEX (40). YAPEX (40). ZAPEX (40). PDL (40).     VORLAX    218
     * LESWP (40). SYNTH (40). IQUANT (40). CSTART (40). TAPER (40).  VORLAX    219
     * PSPAN (40). NVOR (40)                                          VORLAX    220
      COMMON /SET6 /TITLE (20). HEAD (200). ALOC (2000)               VORLAX    221
      COMMON /SET7 /RNCV (20). RNMAX (100). IIS (20). JTS (100)       VORLAX    222
      COMMON /SET8 /LIFT (40). DRAG (40). MOMENT (40). CL (40).       VORLAX    223
     * CD (40). CM (40). FN (40). CN (40), FY (40). CY (40).          VORLAX    224
     * RM (40). CRM (40). YM (40). CYM (40). ASUC (40). SURF (40)     VORLAX    225
      COMMON /SET9 /CDC (100). CNC (100)                              VORLAX    226
      COMMON /SET10 /CHORD (100). DL (100). VSS (100). TNL (100).     VORLAX    227
     * TNT (100). XTE (100). IPAN (100)                               VORLAX    228
      COMMON /SET11 /MACH (8). ALPHA (8). ALFA. VINF. NMACH. NALPHA   VORLAX    229
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      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT        VORLAX    230
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                   VORLAX    231
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                               VORLAX    232
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                            VORLAX    233
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                       VORLAX    234
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                      VORLAX    235
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)    VORLAX    236
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)           VORLAX    237
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),        VORLAX    238
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)               VORLAX    239
C...                                                                       VORLAX    240
C...                                                                       VORLAX    241
C...                                                                       VORLAX    242
C...                                                                       VORLAX    243
      PI = 3.14159                                                         VORLAX    244
      DTR = .01745329                                                      VORLAX    245
C                                                                          VORLAX    246
C                                                                          VORLAX    247
 10   READ (5, 20) TITLE                                                   VORLAX    248
      WRITE (6, 50) TITLE                                                  VORLAX    249
      IF(EOF(5).NE.0) GO TO 110                                            VORLAX    250
 20   FORMAT (20A4)                                                        VORLAX    251
      READ (5, 30) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,           VORLAX    252
     * ITRMAX                                                              VORLAX    253
      IF (ITRMAX .EQ. 0 ) ITRMAX = 99                                      VORLAX    254
      IF (REXPAR .LT. 0.01) REXPAR = 0.10                                  VORLAX    255
      WRITE (6, 40) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,          VORLAX    256
     * ITRMAX                                                              VORLAX    257
 30   FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)                                  VORLAX    258
 40   FORMAT (1H , 3 (I2, 8X), 4F10.2, 7X, I3)                             VORLAX    259
 50   FORMAT (1H1, 32H********** INPUT DECK **********,///1H , 20A4)       VORLAX    260
C                                                                          VORLAX    261
C...                                                                       VORLAX    262
C...                                                                       VORLAX    263
C...                                                                       VORLAX    264
      CALL INPUT                                                           VORLAX    265
      CALL GEOM (ITOTAL)                                                   VORLAX    266
C                                                                          VORLAX    267
 60   DO 100 IQ = 1, NMACH                                                 VORLAX    268
      B2 = MACH (IQ) **2 - 1.0                                             VORLAX    269
      BETA = SQRT (ABS (B2))                                               VORLAX    270
      ALFA = 0.0                                                           VORLAX    271
      ICALL = 0                                                            VORLAX    272
      IF (FLOATX .NE. 0.0 .OR. HAG .NE. 0.0) ICALL = 1                     VORLAX    273
      IM = ICALL + NXS                                                     VORLAX    274
      IF (ICALL .EQ. 0) CALL MATRX (EW, EU, ITOTAL)                        VORLAX    275
      IF(IM .EQ. NXS .AND. IM .GT. 0) CALL SURVEY(EW, EWX, EWY, ITOTAL)    VORLAX    276
C                                                                          VORLAX    277
      DO 90 IH = 1, NALPHA                                                 VORLAX    278
      ALFA = ALPHA (IH) *DTR                                               VORLAX    279
      IF (ICALL .EQ. 1) CALL MATRX (EW, EU, ITOTAL)                        VORLAX    280
      IF(IM.GT.NXS .AND. NXS .GT. 0) CALL SURVEY(EW, EWX, EWY, ITOTAL)     VORLAX    281
      NX1 = ITOTAL + 1                                                     VORLAX    282
      CALL BOUNDY (ITOTAL)                                                 VORLAX    283
      IF (ISOLV .EQ. 0) CALL GAUSS (ITOTAL, REXPAR, EW, EWX)               VORLAX    284
      IF (ISOLV .EQ. 1) CALL VECTOR (ITOTAL, NX1, AV, EW, EU, EWX, EWY)    VORLAX    285
      CALL PRESS (ITOTAL, EU)                                              VORLAX    286
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                CALL AERO (EW, ITOTAL)                                                          VORLAX     287
                CALL PRINT (ITOTAL, EW, EWX, EWY)                                               VORLAX     288
          C                                                                                     VORLAX     289
                IPASS = 1 - INVERS                                                              VORLAX     290
 290            INVERS = 0                                                                      VORLAX     291
                IF (IPASS .EQ. 1) GO TO 90                                                      VORLAX     292
                DO 70 IRR = 1, ITOTAL                                                           VORLAX     293
            70  IDES (IRR) = 0                                                                  VORLAX     294
                GO TO 60                                                                        VORLAX     295
 295      C                                                                                     VORLAX     296
           80   FORMAT (1H1 , 20A4)                                                             VORLAX     297
           90   CONTINUE                                                                        VORLAX     298
          C                                                                                     VORLAX     299
          100   CONTINUE                                                                        VORLAX     300
 300      C                                                                                     VORLAX     301
                GO TO 10                                                                        VORLAX     302
          110   WRITE (6, 80)                                                                   VORLAX     303
                STOP                                                                            VORLAX     304
          C                                                                                     VORLAX     305
 305            END                                                                             VORLAX     306

CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

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


      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
 24531  VORLAX

 VARIABLES       SN  TYPE            RELOCATION
  1440  AINC1        REAL        ARRAY    SET4           1464  AINC2      REAL       ARRAY    SET4
    20  ALFA         REAL                 SET11           334  ALOC       REAL       ARRAY    SET6
    10  ALPHA        REAL        ARRAY    SET11         45276  AV         REAL       ARRAY
     1  BETA         REAL                 SET15             0  BIG        REAL                SET13
     0  B2           REAL                 SET15             2  CHAR       REAL                SET15
   240  CD           REAL        ARRAY    SET8              0  CDC        REAL       ARRAY    SET9
     1  CDTOT        REAL                 SET12             0  CHORD      REAL       ARRAY    SET10
   170  CL           REAL        ARRAY    SET8              0  CLTOT      REAL                SET12
   310  CM           REAL        ARRAY    SET8            144  CMTC       REAL       ARRAY    SET17
     2  CMTOT        REAL                 SET12           430  CN         REAL       ARRAY    SET8
   144  CNC          REAL        ARRAY    SET9              6  CNTOT      REAL                SET12
   670  CRM          REAL        ARRAY    SET8              5  CRTOT      REAL                SET12
   430  CSTART       REAL        ARRAY    SET5              0  CSUC       REAL       ARRAY    SET17
     0  CX           INTEGER     ARRAY    SET3            550  CY         REAL       ARRAY    SET8
  1010  CYM          REAL        ARRAY    SET8              4  CYTOT      REAL                SET12
 25033  C1           REAL       *UNDEF                  25115  C2         REAL      *UNDEF
     0  DCP          REAL        ARRAY    SET2              4  DELTAY     REAL                SET18
     6  DELTAZ       REAL                 SET18         51217  DESCRP     REAL      *UNDEF
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          PROGRAM VORLAX       74/74    OPT=1                             FTN 4.5+410A       10/04/76  10.15.13        PAGE      7

VARIABLES       SN  TYPE              RELOCATION
   144  DL          REAL        ARRAY    SET10            0  DNDX1      REAL         ARRAY     SET4
   620  DNDX2       REAL        ARRAY    SET4            50  DRAG       REAL         ARRAY     SET8
 25023  DTR         REAL                                  3  EPS        REAL                   SET13
 41355  EU          REAL        ARRAY                 25573  FW         REAL         ARRAY
 31513  EWX         REAL        ARRAY                 35434  FWY        REAL         ARRAY
    12  FLOATX      REAL                 / /             13  FLOATY     REAL                   / /
   360  FN          REAL        ARRAY    SET8           500  FY         REAL         ARRAY     SET8
     0  GAMMA       REAL        ARRAY    SET16           11  HAG        REAL                   / /
    24  HEAD        REAL        ARRAY    SET6         25026  ICALL      INTEGER
 13560  IDES        INTEGER     ARRAY    SET3             3  IH         INTEGER                / /
 25027  IM          INTEGER                             404  INTRAC     INTEGER      ARRAY     SET20
    14  INVERS      INTEGER              / /           1130  IPAN       INTEGER      ARRAY     SET10
 25031  IPASS       INTEGER                               2  IQ         INTEGER                / /
   360  IQUANT      INTEGER     ARRAY    SET5         25032  IRR        INTEGER
    15  ISOLV       INTEGER              / /              1  ITER       INTEGER                SET13
 25025  ITOTAL      INTEGER                               2  ITRMAX     INTEGER                SET13
   170  ITS         INTEGER     ARRAY    SET7           214  JTS        INTEGER      ARRAY     SET7
     4  LATRAL      INTEGER              / /              0  LAX        INTEGER                / /
     1  LAY         INTEGER              / /            240  LESWP      REAL         ARRAY     SET5
     0  LIFT        REAL        ARRAY    SET8             0  MACH       REAL         ARRAY     SET11
   120  MOMENT      REAL        ARRAY    SET8            23  NALPHA     INTEGER                SET11
    22  NMACH       INTEGER              SET11            0  NPAN       INTEGER                SET14
     3  NPANAS      INTEGER              SET14          360  NPP        INTEGER      ARRAY     SET20
     1  NT          INTEGER              SET14          620  NVOR       REAL         ARRAY     SET5
     0  NXS         INTEGER              SET18        25030  NX1        INTEGER
     1  NYS         INTEGER              SET18            2  NZS        INTEGER                SET18
  3720  ONSET       REAL        ARRAY    SET16          170  PDL        REAL         ARRAY     SET5
 25262  PHI         REAL       *UNDEF                    50  PHIMED     REAL         ARRAY     SET20
 25022  PI          REAL                                  6  PITCHQ     REAL                   / /
     5  PSI         REAL                 / /            550  PSPAN      REAL         ARRAY     SET5
   214  RCS         REAL        ARRAY    SET20        25024  REXPAR     REAL
  7640  RFLAG       REAL        ARRAY    SET3             5  RLM        REAL                   SET13
   620  RM          REAL        ARRAY    SET8             0  RNCV       REAL         ARRAY     SET7
    24  RNMAX       REAL        ARRAY    SET7         25177  RO         REAL        *UNDEF
     7  ROLLQ       REAL                 / /             50  SLE        REAL         ARRAY     SET19
     0  SLE1        REAL        ARRAY    SET19           24  SLE2       REAL         ARRAY     SET19
  3720  SLOPE       REAL        ARRAY    SET2             2  SMAX       REAL                   SET14
   310  SPC         REAL        ARRAY    SET17            3  SREF       REAL                   SET12
  1130  SURF        REAL        ARRAY    SET8          3720  SX         INTEGER      ARRAY     SET3
   310  SYNTH       REAL        ARRAY    SET5           500  TAPER      REAL         ARRAY     SET5
     0  TITLE       INTEGER     ARRAY    SET6           454  TNL        REAL         ARRAY     SET10
   620  TNT         REAL        ARRAY    SET10           21  VINF       REAL                   SET11
  7640  VSP         REAL        ARRAY    SET2           310  VSS        REAL         ARRAY     SET10
 10270  VST         REAL        ARRAY    SET20            4  WSPAN      REAL                   SET13
     0  X           REAL        ARRAY    SET1         25345  XAF        REAL        *UNDEF
     0  XAPEX       REAL        ARRAY    SET5             3  XBAR       REAL                   SET15
     7  XS          REAL        ARRAY    SET18         1060  XSUC       REAL         ARRAY     SET8
   764  XTE         REAL        ARRAY    SET10         3720  Y          REAL         ARRAY     SET1
    50  YAPEX       REAL        ARRAY    SET5            10  YAWQ       REAL                   / /
   740  YM          REAL        ARRAY    SET8             3  YNOT       REAL                   SET18
   430  YY          REAL        ARRAY    SET20         4064  Z          REAL         ARRAY     SET1
   120  ZAPEX       REAL        ARRAY    SET5             4  ZBAR       REAL                   SET15
  4230  ZC          REAL        ARRAY    SET1         25427  ZC1        REAL        *UNDEF
 25511  ZC2         REAL       *UNDEF                   214  ZETA       REAL         ARRAY     SET19
     0  ZLE1        REAL        ARRAY    SET20           24  ZLE2       REAL         ARRAY     SET20
     5  ZNOT        REAL                 SET18         4350  ZZ         REAL         ARRAY     SET20
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        PROGRAM VORLAX      74/74    OPT=1                                    FTN 4.5+410A       10/04/76  10.15.13        PAGE     8

FILE NAMES          MODE
     0  INPUT                       2041  OUTPUT                    4102  TAPE1                       20410  TAPE11
 22451  TAPE12                      6143  TAPE2                    10204  TAPE3                       12245  TAPE4
     0  TAPE5       FMT             2041  TAPE6       FMT          14306  TAPE7                       16347  TAPE9

EXTERNALS            TYPE    ARGS
         AERO                  2                               BOUNDY                 1
         EOF        REAL       1                               GAUSS                  4
         GEOM                  1                               INPUT                  0
         MATRX                 3                               PRESS                  2
         PRINT                 4                               SQRT        REAL       1 LIBRARY
         SURVEY                4                               VECTOR                 7

INLINE FUNCTIONS     TYPE    ARGS
         ABS        REAL       1  INTRIN

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

LOOPS   LABEL      INDEX      FROM-TO    LENGTH    PROPERTIES
 24561  100      * IQ         267 299      76B                  EXT REFS     EXITS     NOT INNER
 24605   90      * IH         277 297      50B                  EXT REFS     EXITS     NOT INNER
 24646   70        IRR        292 293       2B       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                 24516B      10574
   BUFFER LENGTH                  24513B      10571
   CM LABELED COMMON LENGTH       77147B      32359
   CM BLANK COMMON LENGTH            16B         14
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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 SEQUENCE≤                                         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, B2, DL, SX, YY, ZZ, DCP, JTS, LAX, PSI,          VORLAX    319
C...             SPC, VSS, VST, XTE, ALFA, MACH, NPAN, NVOR, SREF,         VORLAX    320
C...             VINF, XBAR, 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 SEQUENCE≤                                         VORLAX    325
C...             NONE.                                                     VORLAX    326
C...             COMMON<                                                   VORLAX    327
C...             CD, CL, CM, CN, CX, CY, FN, FY, RM, YM, CDC, CNC,         VORLAX    328
C...             CRM, CYM, CMTC, 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...             (2) 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
      DIMENSION EW (ITOTAL)                                                VORLAX    349
C                                                                          VORLAX    350
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,      VORLAX    351
     * FLOATX, FLOATY, INVERS                                              VORLAX    352
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                    VORLAX    353
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                   VORLAX    354
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)        VORLAX    355
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),          VORLAX    356
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),       VORLAX    357
     * PSPAN (40), NVOR (40)                                               VORLAX    358
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)            VORLAX    359
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),            VORLAX    360
     * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),               VORLAX    361
     * RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SURF (40)          VORLAX    362
      COMMON /SET9 /CDC (100), CNC (100)                                   VORLAX    363
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      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),        VORLAX     364
     * TNT (100), XTE (100), IPAN (100)                                  VORLAX     365
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA      VORLAX     366
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT      VORLAX     367
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                 VORLAX     368
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                             VORLAX     369
      COMMON /SET15 /B2, BETA, CHAR, XBAR, ZBAR                          VORLAX     370
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                     VORLAX     371
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                    VORLAX     372
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)         VORLAX     373
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMFD (100), RCS (100),      VORLAX     374
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)             VORLAX     375
C                                                                        VORLAX     376
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                               VORLAX     377
      INTEGER CX, SX                                                     VORLAX     378
      PI = 3.14159                                                       VORLAX     379
      DTR = 0.01745329                                                   VORLAX     380
C                                                                        VORLAX     381
      PSIRAD = PSI *DTR                                                  VORLAX     382
      FLAX = LAX                                                         VORLAX     383
C                                                                        VORLAX     384
C...UNIT 9 CONTAINS THF LEADING EDGE NORMALWASH INFLUENCE COEFFICIENT    VORLAX     385
C...MATRIX AS COMPUTED IN SUBROUTINE MATRIX. MATRIX STORED BY ROWS.      VORLAX     386
C                                                                        VORLAX     387
      REWIND 9                                                           VORLAX     388
C                                                                        VORLAX     389
C...ALFA = ANGLE OF ATTACK IN RADIANS.                                   VORLAX     390
C...PSIRAD = ANGLE OF YAW IN RADIANS.                                    VORLAX     391
C                                                                        VORLAX     392
      SINALF = SIN (ALFA)                                                VORLAX     393
      COSALF = COS (ALFA)                                                VORLAX     394
      SINPSI = SIN (PSIRAD)                                              VORLAX     395
      COPSI = COS (PSIRAD)                                               VORLAX     396
      COSIN = COSALF *SINPSI *2.0                                        VORLAX     397
      COSINP = COSALF *SINPSI                                            VORLAX     398
      COSCOS = COSALF *COPSI                                             VORLAX     399
      PITCH = DTR *PITCHQ /VINF                                          VORLAX     400
      ROLL = DTR *ROLLQ /VINF                                            VORLAX     401
      YAW = DTR *YAWQ /VINF                                              VORLAX     402
C                                                                        VORLAX     403
C...LIFT = PANEL LIFT PER UNIT Q                                         VORLAX     404
C...DRAG = PANEL DRAG PER UNIT Q                                         VORLAX     405
C...XSUC = PANEL LEADING EDGE THRUST PER UNIT Q                          VORLAX     406
C...MOMENT = PANEL PITCHING MOMENT ABOUT REF. CENTER PER UNIT Q          VORLAX     407
C...FN = PANEL NORMAL FORCE PER UNIT Q                                   VORLAX     408
C...FY = PANEL SIDE FORCE PER UNIT Q                                     VORLAX     409
C...RM = PANEL ROLLING MOMENT PER UNIT Q                                 VORLAX     410
C...YM = PANEL YAWING MOMENT PER UNIT Q                                  VORLAX     411
C...ALL ABOVE PANEL FORCES ARE REFERENCED TO WIND AXES EXCEPT FOR FN     VORLAX     412
C...WHICH IS IN BODY AXES.                                               VORLAX     413
C                                                                        VORLAX     414
C...INITIALIZE PANEL FORCE ARRAYS                                        VORLAX     415
C                                                                        VORLAX     416
      DO 10 IX = 1, NPANAS                                               VORLAX     417
      LIFT (IX) = 0.                                                     VORLAX     418
      DRAG (IX) = 0.                                                     VORLAX     419
      XSUC (IX) = 0.                                                     VORLAX     420
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      MOMENT (IX) = 0.                                                  VORLAX    421
      FN (IX) = 0.                                                      VORLAX    422
      FY (IX) = 0.                                                      VORLAX    423
      RM (IX) = 0.                                                      VORLAX    424
      YM (IX) = 0.                                                      VORLAX    425
   10 CONTINUE                                                          VORLAX    426
C                                                                       VORLAX    427
C                                                                       VORLAX    428
C...HORSESHOE VORTEX STREAMWISE STRIPS ARE IDENTIFIED BY                 VORLAX    429
C...A SPANWISE OR LATERAL INDEX, IR. EACH HORSESHOE VORTEX IS           VORLAX    430
C...IDENTIFIED BY AN ELEMENT INDEX, IRT. EACH MAJOR PANEL IS            VORLAX    431
C...IDENTIFIED BY AN INDEX (IR) WHICH GENERATES AN AUXILIARY INDEX (I).  VORLAX    432
C...WHEN I = IX THEN INPUT HALF OF CONFIGURATION IS BEING DEALT WITH.   VORLAX    433
C...WHEN I   IX THEN MIRRORED (ABOUT X-Z PLANE) COMPONENTS ARE BEING    VORLAX    434
C...CONSIDERED. I AND IX ARE DIFFERENT ONLY FOR ASYMMETRICAL            VORLAX    435
C...CONFIGURATIONS AND/OR FLIGHT CONDITIONS. ICYCLE IS AN AUXILIARY     VORLAX    436
C...INDEX  ICYCLE = 1 FOR IX = I: ICYCLE = 2 FOR IX .GT. I.             VORLAX    437
C...                                                                    VORLAX    438
C...                                                                    VORLAX    439
C...INITIALIZE INDICES<                                                 VORLAX    440
C...                                                                    VORLAX    441
      IRT = 0                                                           VORLAX    442
      IR = 0                                                            VORLAX    443
      I = 1                                                             VORLAX    444
      IX = 0                                                            VORLAX    445
      ICYCLE = 1                                                        VORLAX    446
   20 IX = IX + 1                                                       VORLAX    447
C...                                                                    VORLAX    448
C...COMPUTE PANEL REFERENCE AREA, TANGENT OF LEADING EDGE SWEEP (TLE),  VORLAX    449
C...TANGENT OF TRAILING EDGE SWEEP (TTE), AND THE PRINCIPAL PART        VORLAX    450
C...PARAMETER (STB).                                                    VORLAX    451
C...                                                                    VORLAX    452
      SURF (IX) = CSTART (I) *(1. + TAPER (I)) /2. *PSPAN (I)           VORLAX    453
      TEPAR = 2. *SURF (IX) /PSPAN (I) **2                              VORLAX    454
      TEPAR = TEPAR *(1. - TAPER (I)) / (1. + TAPER (I))                VORLAX    455
      NV = NVOR (I)                                                     VORLAX    456
      TLE = TAN (DTR *LESWP (I))                                        VORLAX    457
      TTE = TLE - TEPAR                                                 VORLAX    458
      IF (ICYCLE .EQ. 2) TLE = - TLE                                    VORLAX    459
      IF (ICYCLE .EQ. 2) TTE = - TTE                                    VORLAX    460
      T2 = TLE **2                                                      VORLAX    461
      STB = 0.0                                                         VORLAX    462
      IF (B2 .LT. T2) STB = SQRT (T2 - B2)                              VORLAX    463
C                                                                       VORLAX    464
C...THERE ARE NV STREAMWISE STRIPS OF HORSESHOE VORTICES FOR THE        VORLAX    465
C...PANEL (IX) UNDER CONSIDERATION. THE DO-LOOP ENDED BY LABEL 110      VORLAX    466
C...COMPUTES THE FORCE AND MOMENT CONTRIBUTION OF EACH STRIP AND        VORLAX    467
C...THEN PERFORMS THE CORRESPONDING SUMMATIONS TO OBTAIN THE            VORLAX    468
C...INTEGRATED PANEL FORCES AND MOMENTS (PER UNIT Q).                   VORLAX    469
C...                                                                    VORLAX    470
      DO 110 J = 1, NV                                                  VORLAX    471
      IR = IR + 1                                                       VORLAX    472
C...                                                                    VORLAX    473
C...DL IS THE DIHEDRAL ANGLE (WITH RESPECT TO THE X-Y PLANE) OF         VORLAX    474
C...THE IR STREAMWISE STRIP OF HORSESHOE VORTICES.                      VORLAX    475
C...                                                                    VORLAX    476
      SID = SIN (DTR *DL (IR))                                          VORLAX    477
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      COD = COS (DTR *DL (IR))                                          VORLAX    478
C...                                                                    VORLAX    479
C...STRIPWISE PARAMETERS OR COEFFICIENTS<                               VORLAX    480
C...CNC = NORMAL (TO LOCAL CHORDLINE) FORCE COEFF. TIMES LOCAL           VORLAX    481
C...        CHORD LENGTH+                                               VORLAX    482
C...CDC = DRAG COEFF. (WIND AXES) TIMES LOCAL CHORD LENGTH+             VORLAX    483
C...CSUC = LEADING EDGE THRUST COEFF. MEASURED IN A PLANE               VORLAX    484
C...        PARALLEL TO THE X-X AXIS AND ALONG THE TANGENT              VORLAX    485
C...        TO THE CAMBER LINE IN SAME PLANE+                           VORLAX    486
C...CMTC = PITCHING MOMENT (BODY AXES) ABOUT LOCAL QUARTER CHORD        VORLAX    487
C...        TIMES LOCAL CHORD LENGTH+                                   VORLAX    488
C...                                                                    VORLAX    489
C...INITIALIZE COEFFICIENTS ≤                                           VORLAX    490
C...                                                                    VORLAX    491
C...                                                                    VORLAX    492
      CNC (IR) = 0.                                                     VORLAX    493
      CDC (IR) = 0.0                                                    VORLAX    494
      CSUC (IR) = 0.                                                    VORLAX    495
      CMTC (IR) = 0.0                                                   VORLAX    496
C                                                                       VORLAX    497
      MAX = RNMAX (IR)                                                  VORLAX    498
      PION = (PI *(1.0 - FLAX) + 2.0 *FLAX) /RNMAX (IR)                 VORLAX    499
      ADC = 0.5 *PION                                                   VORLAX    500
      IF (JTS (IR) .GT. 0) ADC = - 0.5 *PION                            VORLAX    501
C...                                                                    VORLAX    502
C...XLE = LOCATION OF FIRST VORTEX MIDPOINT IN FRACTION OF CHORD.       VORLAX    503
C...                                                                    VORLAX    504
      XLE=.5 *(1.0 - COS (.5 *PION)) *(1.0 - FLAX) + 0.125 *PION *FLAX  VORLAX    505
C...                                                                    VORLAX    506
C...BMLE = PITCHING MOMENT ABOUT FIRST VORTEX MIDPOINT IN BODY AXES.    VORLAX    507
C...CAXL = AXIAL (X-AXIS) FORCE COEFFICIENT.                            VORLAX    508
C...SICPLE = COUPLE (ABOUT STRIP CENTERLINE) DUE TO SIDESLIP.           VORLAX    509
C...                                                                    VORLAX    510
      BMLE = 0.                                                         VORLAX    511
      CAXL = 0.0                                                        VORLAX    512
      SICPLE = 0.0                                                      VORLAX    513
C                                                                       VORLAX    514
      RJTS = JTS (IR)                                                   VORLAX    515
      GAF = 0.5 + 0.5 *RJTS **2                                         VORLAX    516
C                                                                       VORLAX    517
C...THE DO-LOOP ENDED BY LABEL 60 PERFORMS PRESSURE COEFF.              VORLAX    518
C...INTGRATIONS ALONG THE STRIP TO OBTAIN CNC (PRESENTLY TREATED        VORLAX    519
C...AS CN). CAXL. BMLE. AND SICPLE.                                     VORLAX    520
C...                                                                    VORLAX    521
C                                                                       VORLAX    522
      DO 60 K = 1. MAX                                                  VORLAX    523
      IRT = IRT + 1                                                     VORLAX    524
      RK = K                                                            VORLAX    525
C...                                                                    VORLAX    526
C...CORMED IS LENGTH OF STRIP CENTERLINE BETWEEN LOAD POINT             VORLAX    527
C...AND TRAILING EDGE+ THIS PARAMETER IS USED IN THE COMPUTATION        VORLAX    528
C...OF THE STRIP ROLLING COUPLE CONTRIBUTION DUE TO SIDESLIP.           VORLAX    529
C...                                                                    VORLAX    530
      CORMED = XTE (IR) - X (IRT)                                       VORLAX    531
C...                                                                    VORLAX    532
C...SINF REFERENCES THE LOAD CONTRIBUTION OF IRT-VORTEX TO THE          VORLAX    533
C...STRIP NOMINAL AREA. I.E.. AREA OF STRIP ASSUMING CONSTANT           VORLAX    534
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C...(CHORDWISE) HORSESHOE SPAN.                                          VORLAX   535
C...                                                                     VORLAX   536
      SINF = (FLAX + (1.0 - FLAX) *SIN ((RK - .5) *PION)) *ADC           VORLAX   537
     * *DCP (IRT) *VST (IRT) /VSS (IR)                                   VORLAX   538
      CNC (IR) = CNC (IR) + SINF                                         VORLAX   539
      SICPLE = SICPLE + SINF *CORMED                                     VORLAX   540
C...                                                                     VORLAX   541
C...COMPUTE SLOPE (TX) WITH RESPECT TO X-AXIS AT LOAD POINTS BY INTER     VORLAX   542
C...POLATING BETWEEN CONTROL POINTS AND TAKING INTO ACCOUNT THE LOCAL     VORLAX   543
C...INCIDENCE.                                                            VORLAX   544
C...                                                                     VORLAX   545
      XX = .5 *(1. - COS ((RK - .5) *PION))                              VORLAX   546
      XX = XX *(1.0 - FLAX) + (RK - .75) *PION /2.0 *FLAX                VORLAX   547
      IF (K .GT.1) GO TO 30                                              VORLAX   548
      KX = K                                                             VORLAX   549
      IRTX = IRT                                                         VORLAX   550
      GO TO 40                                                           VORLAX   551
   30 KX = K - 1                                                         VORLAX   552
      IRTX = IRT - 1                                                     VORLAX   553
   40 RKX = KX                                                           VORLAX   554
      X1 = .5 *(1. - COS (RKX *PION))                                    VORLAX   555
      X1 = X1 *(1.0 - FLAX) + (RKX - .25) *PION /2.0 *FLAX               VORLAX   556
      X2 = .5 *(1. - COS ((RKX + 1.) *PION))                             VORLAX   557
      X2 = X2 *(1.0 - FLAX) + (RKX + .75) *PION /2.0 *FLAX               VORLAX   558
      F1 = SLOPE (IRTX)                                                  VORLAX   559
      F2 = SLOPE (IRTX + 1)                                              VORLAX   560
      TANX = (XX - X2) /(X1 - X2) *F1 + (XX - X1) /(X2 - X1) *F2         VORLAX   561
      TX = TANX - ZETA (IR)                                              VORLAX   562
      CAXL = CAXL - SINF *TX /(1.0 + TX **2)                             VORLAX   563
   50 BMLE = BMLE + (XLE - XX) *SINF                                     VORLAX   564
   60 CONTINUE                                                           VORLAX   565
C                                                                        VORLAX   566
      SICPLE = - SICPLE *COSIN *COD *GAF                                 VORLAX   567
C                                                                        VORLAX   568
C...                                                                     VORLAX   569
C...IRTLE = VALUE OF IRT INDEX FOR FIRST (ALONG CHORD) HORSESHOE          VORLAX   570
C...VORTEX, I.E., LEADING EDGE ELEMENT.                                   VORLAX   571
C...                                                                     VORLAX   572
      IRTLE = IRT - MAX + 1                                              VORLAX   573
C...                                                                     VORLAX   574
C...                                                                     VORLAX   575
C...COMPUTE LEADING EDGE THRUST COEFF. (CSUC) BY CALCULATING             VORLAX   576
C...THE TOTAL INDUCED FLOW AT THE LEADING EDGE. THIS COMPUTATION         VORLAX   577
C...ONLY PERFORMED FOR COSINE CHORDWISE SPACING (LAX = 0).               VORLAX   578
C...                                                                     VORLAX   579
C...                                                                     VORLAX   580
      CLE = 0.0                                                          VORLAX   581
      IF (LAX .EQ. 1) GO TO 90                                           VORLAX   582
C                                                                        VORLAX   583
      READ (9) EW                                                        VORLAX   584
C                                                                        VORLAX   585
      DO 70 II = 1, ITOTAL                                               VORLAX   586
      CLE = CLE + EW (II) *GAMMA (II)                                    VORLAX   587
   70 CONTINUE                                                           VORLAX   588
C                                                                        VORLAX   589
C...XGIRO, YGIRO, ZGIRO ARE THE COORDINATES OF THE STRIP LEADING EDGE    VORLAX   590
C...MIDPOINT WITH RESPECT TO THE POINT OF AIRCRAFT ROTATION (IF ANY).    VORLAX   591
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C...                                                                    VORLAX   592
      XGIRO = X (IRTLE) - CHORD (IR) *XLF - XHAR                        VORLAX   593
      YGIRO = YY (IRTLE)                                                VORLAX   594
      ZGIRO = ZZ (IRTLE) - ZBAR                                         VORLAX   595
C...                                                                    VORLAX   596
C...VX, VY, VZ ARE THE FLOW ONSET VELOCITY COMPONENTS AT THE LEADING    VORLAX   597
C...EDGE (STRIP MIDPOINT). VX, VY, VZ AND THE ROTATION RATES ARE        VORLAX   598
C...REFERENCED TO THE FREE STREAM VELOCITY.                             VORLAX   599
C...                                                                    VORLAX   600
      VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO                           VORLAX   601
      VY = COSINP - YAW *XGIRO + ROLL *ZGIRO                            VORLAX   602
      VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO                          VORLAX   603
C...                                                                    VORLAX   604
C...CCNTL AND SCNTL ARE DIRECTION COSINE PARAMETERS OF TANGENT TO       VORLAX   605
C...CAMBERLINE AT LEADING EDGE.                                         VORLAX   606
C...                                                                    VORLAX   607
      CCNTL = 1. /SQRT (1.0 + SLE (IR) **2)                             VORLAX   608
      SCNTL = SLE (IR) *CCNTL                                           VORLAX   609
C...                                                                    VORLAX   610
C...EFFINC = COMPONENT OF ONSET FLOW ALONG NORMAL TO CAMBERLINE AT      VORLAX   611
C...          LEADING EDGE.                                             VORLAX   612
C...                                                                    VORLAX   613
      EFFINC = VX *SCNTL + VY *CCNTL *SIO - VZ *CCNTL *COD              VORLAX   614
      CLE = CLE - EFFINC                                                VORLAX   615
   80 IF (STB .GT. 0.0) CLE = CLE /RNMAX (IR) /STB                      VORLAX   616
   90 XA = XLE                                                          VORLAX   617
      CLE = CLE + 0.5 *DCP (IRTLE) *SQRT (XX) *FLAX                     VORLAX   618
      CSUC (IR) = 0.5 *PI *ABS (SPC (I)) *CLE **2 *STB                  VORLAX   619
C...                                                                    VORLAX   620
C...END OF L.E. THRUST COEFF. (CSUC) COMPUTATION FOR STRIP IR.          VORLAX   621
C...                                                                    VORLAX   622
C...                                                                    VORLAX   623
C...ORIENT L.E. THRUST VECTOR ACCORDING TO SIGN OF SPC PARAMETERS       VORLAX   624
C...IF SPC % 0 THEN L.E. THRUST VECTOR IS TANGENTIAL TO CAMBER          VORLAX   625
C...SURFACE, OTHERWISE IT IS NORMAL TO IT. IF THE FIRST ELEMENT         VORLAX   626
C...CARRIES A POSITIVE LOAD THEN THE THRUST VECTOR IS NORMAL TO THE     VORLAX   627
C...CAMBER SURFACE ALONG THE POSITIVE NORMAL DIRECTION, OTHERWISE       VORLAX   628
C...IT IS ALONG THE NEGATIVE NORMAL (THE PARAMETER FKEY DETER-          VORLAX   629
C...-MINES THIS DIRECTION ≤ FKEY = + 1, POSITIVE NORMAL,                VORLAX   630
C...FKEY = - 1, NEGATIVE NORMAL).                                       VORLAX   631
C...TFX AND TFZ ARE THE COMPONENTS OF LEADING EDGE FORCE VECTOR ALONG   VORLAX   632
C...ALONG THE X AND Z BODY AXES.                                        VORLAX   633
C...                                                                    VORLAX   634
      FKEY = 1 - JTS (IR) *(1 + JTS (IR))                               VORLAX   635
      XCOS = 1.0 /SQRT (1.0 + (SLE (IR) - ZETA (IR)) **2)               VORLAX   636
      XSIN = (SLE (IR) - ZETA (IR)) *XCOS                               VORLAX   637
      TFX = XCOS                                                        VORLAX   638
      IF (SPC (I) .LT.  .0 ) TFX = XSIN *SIGN (1.0, DCP (IRTLE)) *FKEY  VORLAX   639
      CAXL = CAXL - TFX *CSUC (IR)                                      VORLAX   640
      TFZ = - XSIN                                                      VORLAX   641
      IF (SPC (I) .LT. 0.0) TFZ = SIGN (XCOS, DCP(IRTLE)) *FKEY         VORLAX   642
      CNC (IR) = CNC (IR) + CSUC (IR) *SQRT (1.0 + T2) *TFZ             VORLAX   643
C...                                                                    VORLAX   644
C...FCOS AND FSIN ARE THE COSINE AND SINE OF THE ANGLE BETWEEN          VORLAX   645
C...THE CHORDLINE OF THE IR-STRIP AND THE X-AXIS                        VORLAX   646
C...                                                                    VORLAX   647
  100 FCOS = 1. /SQRT (1. + ZETA (IR) *ZETA (IR))                       VORLAX   648
```

```
            FSIN = FCOS *ZETA (IR)                                           VORLAX     649
      C...                                                                   VORLAX     650
      C...BFX, BFY, AND BFZ ARE THE COMPONENTS ALONG THE BODY AXES           VORLAX     651
      C...OF THE STRIP FORCE CONTRIBUTION.                                   VORLAX     652
      C...                                                                   VORLAX     653
            BFX = - CNC (IR) *FSIN + CAXL *FCOS                              VORLAX     654
            BFY = - (CNC (IR) *FCOS + CAXL *FSIN) *SID                       VORLAX     655
            BFZ = (CNC (IR) *FCOS + CAXL *FSIN) *COD                         VORLAX     656
      C...                                                                   VORLAX     657
      C...CONVERT CNC FROM CN INTO CNC (COEFF. *CHORD).                      VORLAX     658
      C...                                                                   VORLAX     659
            CNC (IR) = CNC (IR) *CHORD (IR)                                  VORLAX     660
            BMLE = BMLE *CHORD (IR)                                          VORLAX     661
      C...                                                                   VORLAX     662
      C...BMX, BMY, AND BMZ ARE THE COMPONENTS ALONG THE BODY AXES           VORLAX     663
      C...OF THE STRIP MOMENT (ABOUT MOM. REF. POINT) CONTRIBUTION.          VORLAX     664
      C...                                                                   VORLAX     665
            BMX = BFZ *Y (IR) - BFY *(Z (IR) - ZBAR)                         VORLAX     666
            BMX = BMX + SICPLE                                               VORLAX     667
            BMY = BMLE *COD + BFX * (Z (IR) - ZBAR) - BFZ * (X (IRTLE) -XBAR) VORLAX    668
            BMZ = BMLE *SID - BFX *Y (IR) + BFY * (X (IRTLE) - XBAR)         VORLAX     669
            CDC (IR) = BFZ *SINALF +  (BFX *COPSI + BFY *SINPSI) *COSALF     VORLAX     670
            CDC (IR) = CDC (IR) *CHORD (IR)                                  VORLAX     671
            CMTC (IR) = BMLE + CNC (IR) * (0.25 - XLE)                       VORLAX     672
      C                                                                      VORLAX     673
            ES = 2.0 *VSS (IR)                                               VORLAX     674
            STRIP = ES *CHORD (IR)                                           VORLAX     675
            LIFT (IX) = (BFZ *COSALF - (BFX *COPSI + BFY *SINPSI) *SINALF)   VORLAX     676
           * *STRIP + LIFT (IX)                                              VORLAX     677
            DRAG (IX) = CDC (IR) *ES + DRAG (IX)                             VORLAX     678
            FY (IX) = (BFY *COPSI - BFX *SINPSI) *STRIP + FY (IX)            VORLAX     679
      C                                                                      VORLAX     680
            FN (IX) = FN (IX) + CNC (IR) *ES                                 VORLAX     681
      C                                                                      VORLAX     682
            MOMENT (IX) = MOMENT (IX) + STRIP *(BMY *COPSI - BMX *SINPSI)    VORLAX     683
            RM (IX) = RM (IX) + STRIP *(BMX *COSALF *COPSI + BMY *COSALF     VORLAX     684
           * *SINPSI + BMZ *SINALF)                                          VORLAX     685
            YM (IX) = YM (IX) + STRIP *(BMZ *COSALF - (BMX *COPSI + BMY      VORLAX     686
           * *SINPSI) *SINALF)                                               VORLAX     687
            XSUC (IX) = XSUC (IX) + CSUC (IR) *STRIP /SURF (IX)              VORLAX     688
      C                                                                      VORLAX     689
        110 CONTINUE                                                         VORLAX     690
      C                                                                      VORLAX     691
      C                                                                      VORLAX     692
            IF (ICYCLE .EQ. 2) GO TO 130                                     VORLAX     693
            I = I + 1                                                        VORLAX     694
            IF (I - NPAN) 20, 20, 120                                        VORLAX     695
        120 IF (LATRAL .EQ. 0) GO TO 140                                     VORLAX     696
            ICYCLE = 2                                                       VORLAX     697
            I = 0                                                            VORLAX     698
        130 I = I + 1                                                        VORLAX     699
            IF (I .GT. NPAN) GO TO 140                                       VORLAX     700
            IF (IQUANT (I) .EQ. 1) GO TO 130                                 VORLAX     701
            GO TO 20                                                         VORLAX     702
      C                                                                      VORLAX     703
      C...INITIALIZE TOTAL FORCE AND MOMENT COEFFICIENTS.                    VORLAX     704
      C                                                                      VORLAX     705
```

```
                                                                                VORLAX     706
               140  CLTOT = 0.                                                  VORLAX     707
                    CDTOT = 0.0                                                 VORLAX     708
                    CMTOT = 0.0                                                 VORLAX     709
                    CYTOT = 0.0                                                 VORLAX     710
                    CRTOT = 0.0                                                 VORLAX     711
                    CNTOT = 0.0                                                 VORLAX     712
              C...                                                              VORLAX     713
              C...THE PARAMETERS AX AND AY INTRODUCE THE PROPER REFERENCE AREA  VORLAX     714
              C...AND DETERMINE WHETHER A PANEL CONTRIBUTION HAS TO BE DUPLICA  VORLAX     715
              C...TED (SYMMETRICAL CASE) OR NOT.                                VORLAX     716
              C...                                                              VORLAX     717
                    AX = 1.0 /SREF                                              VORLAX     718
                    IF (LATRAL .EQ. 0) AX = 2.0 *AX                             VORLAX     719
                    AY = 1.0 /SREF                                              VORLAX     720
                    IF (LATRAL .EQ. 0) AY = 0.0                                 VORLAX     721
              C                                                                 VORLAX     722
              C...THE DO-LOOP ENDED RY LABEL 150 COMPUTES PANFL AND TOTAL       VORLAX     723
              C...FORCE AND MOMENT COEFFICIENTS. MOMENT COEFFICIENTS ARE NOT    VORLAX     724
              C...DIMENSIONLESS YET+ THEY STILL CARRY A LENGTH DIMENSION.       VORLAX     725
              C...                                                              VORLAX     726
                    DO 150 IX = 1, NPANAS                                       VORLAX     727
                    CL (IX) = LIFT (IX) /SURF (IX)                              VORLAX     728
                    CD (IX) = DRAG (IX) /SURF (IX)                              VORLAX     729
                    CM (IX) = MOMENT (IX) /SURF (IX)                            VORLAX     730
                    CN (IX) = FN (IX) /SURF (I<)                                VORLAX     731
                    CY (IX) = FY (IX) /SURF (IX)                                VORLAX     732
                    CRM (IX) = RM (IX) /SURF (IX)                               VORLAX     733
                    CYM (IX) = YM (IX) /SURF (IX)                               VORLAX     734
                    CLTOT = CLTOT + LIFT (IX) *AX                               VORLAX     735
                    CDTOT = CDTOT + DRAG (IX) *AX                               VORLAX     736
                    CMTOT = CMTOT + MOMENT (IX) *AX                             VORLAX     737
                    CYTOT = CYTOT + FY (IX) *AY                                 VORLAX     738
                    CRTOT = CRTOT + RM (IX) *AY                                 VORLAX     739
                    CNTOT = CNTOT + YM (IX) *AY                                 VORLAX     740
               150  CONTINUE                                                    VORLAX     741
              C                                                                 VORLAX     742
                    REWIND 9                                                    VORLAX     743
              C                                                                 VORLAX     744
              C                                                                 VORLAX     745
                    RETURN                                                      VORLAX     746
                    END


     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
   3  AERO

VARIABLES      SN  TYPE          RELOCATION
   732  ADC          REAL                                20  ALFA      REAL             SET11
    10  ALPHA        REAL       ARRAY     SET11        1012  AX        REAL
  1013  AY           REAL                                 1  BETA      REAL             SET15
  1002  BFX          REAL                              1003  BFY       REAL
  1004  BFZ          REAL                                 0  BIG       REAL             SET13
```

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        SUBROUTINE AERO         74/74    OPT=1                         FTN 4.5+410A          10/04/76  10.15.13        PAGE      9

VARIABLES      SN   TYPE               RELOCATION
    734   BMLE        REAL                                       1005   BMX        REAL           .
   1006   BMY         REAL                                       1007   BMZ        REAL
      0   B2          REAL                     SET15              735   CAXL       REAL
      2   CBAR        REAL                     SET15              770   CCNTL      REAL
    240   CD          REAL         ARRAY       SET8                 0   CDC        REAL       ARRAY      SET9
      1   CDTOT       REAL                     SET12                0   CHORD      REAL       ARRAY      SET10
    170   CL          REAL         ARRAY       SET8               760   CLE        REAL
      0   CLTOT       REAL                     SET12              310   CM         REAL       ARRAY      SET8
    144   CMTC        REAL         ARRAY       SET17                2   CMTOT      REAL                  SET12
    430   CN          REAL         ARRAY       SET8               144   CNC        REAL       ARRAY      SET9
      6   CNTOT       REAL                     SET12              727   COD        REAL
    703   COPSI       REAL                                        743   CORMED     REAL
    701   COSALF      REAL                                        706   COSCOS     REAL
    704   COSIN       REAL                                        715   COSINP     REAL
    670   CRM         REAL         ARRAY       SET8                 5   CRTOT      REAL                  SET12
    430   CSTART      REAL         ARRAY       SET5                 0   CSUC       REAL       ARRAY      SET17
      0   CX          INTEGER      ARRAY       SET3               550   CY         REAL       ARRAY      SET8
   1010   CYM         REAL         ARRAY       SET8                 4   CYTOT      REAL                  SET12
      0   DCP         REAL         ARRAY       SET2               144   DL         REAL       ARRAY      SET10
     50   DRAG        REAL         ARRAY       SET8               675   DTR        REAL
    772   EFFINC      REAL                                          3   EPS        REAL                  SET13
   1010   ES          REAL                                          0   EW         REAL       ARRAY       F.P.
   1000   FCOS        REAL                                        773   FKEY       REAL
    677   FLAX        REAL                                         12   FLOATX     REAL                  / /
     13   FLOATY      REAL                     / /                360   FN         REAL       ARRAY      SET8
   1001   FSIN        REAL                                        500   FY         REAL       ARRAY      SET8
    753   F1          REAL                                        754   F2         REAL
    740   GAF         REAL                                          0   GAMMA      REAL       ARRAY      SET16
     11   HAG         REAL                     / /                715   I          INTEGER
    716   ICYCLE      INTEGER                                   13560   IDES       INTEGER    ARRAY      SET3
      3   IH          INTEGER                  / /                761   II         INTEGER
    404   INTRAC      INTEGER      ARRAY       SET20               14   INVERS     INTEGER               / /
   1130   IPAN        INTEGER      ARRAY       SET10                2   IQ         INTEGER               / /
    360   IQUANT      INTEGER      ARRAY       SET5               714   IR         INTEGER
    713   IRT         INTEGER                                     757   IRTLE      INTEGER
    747   IRTX        INTEGER                                       1   ITER       INTEGER               SET13
      0   ITOTAL      INTEGER                   F.P.                2   ITRMAX     INTEGER               SET13
    170   ITS         INTEGER      ARRAY       SET7               712   IX         INTEGER
    725   J           INTEGER                                     214   JTS        INTEGER    ARRAY      SET7
    741   K           INTEGER                                     746   KX         INTEGER
      4   LATRAL      INTEGER                  / /                  0   LAX        INTEGER               / /
      1   LAY         INTEGER                  / /                240   LESWP      REAL       ARRAY      SET5
      0   LIFT        REAL         ARRAY       SET8                 0   MACH       REAL       ARRAY      SET11
    730   MAX         INTEGER                                     120   MOMENT     REAL       ARRAY      SET8
     23   NALPHA      INTEGER                  SET11               22   NMACH      INTEGER               SET11
      0   NPAN        INTEGER                  SET14                3   NPANAS     INTEGER               SET14
    360   NPP         INTEGER      ARRAY       SET20                1   NT         INTEGER               SET14
    720   NV          INTEGER                                     620   NVOR       REAL       ARRAY      SET5
   3720   ONSET       REAL         ARRAY       SET16              170   PDL        REAL       ARRAY      SET5
     50   PHIMED      REAL         ARRAY       SET20              674   PI         REAL
    731   PION        REAL                                        707   PITCH      REAL
      6   PITCHQ      REAL                     / /                  5   PSI        REAL                  / /
    676   PSIRAD      REAL                                        550   PSPAN      REAL       ARRAY      SET5
    214   RCS         REAL         ARRAY       SET20             7640   RFLAG      REAL       ARRAY      SET3
    737   RJTS        REAL                                        742   RK         REAL
    750   RKX         REAL                                          5   RLM        REAL                  SET13
    620   RM          REAL         ARRAY       SET8                 0   RNCV       REAL       ARRAY      SET7
```

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VARIABLES      SN  TYPE              RELOCATION
   24  RNMAX       REAL       ARRAY     SET7            710  ROLL       REAL
    7  ROLLQ       REAL                 / /             771  SCNTL      REAL
  736  SICPLE      REAL                                 726  SID        REAL
  700  SINALF      REAL                                 744  SINF       REAL
  702  SINPSI      REAL                                  50  SLE        REAL        ARRAY     SET19
    0  SLE1        REAL       ARRAY     SET19            24  SLE2       REAL        ARRAY     SET19
 3720  SLOPE       REAL       ARRAY     SET2              2  SMAX       REAL                  SET14
  310  SPC         REAL       ARRAY     SET17             3  SREF       REAL                  SET12
  724  STB         REAL                                1011  STRIP      REAL
 1130  SURF        REAL       ARRAY     SET8           3720  SX         INTEGER     ARRAY     SET3
  310  SYNTH       REAL       ARRAY     SET5            755  TANX       REAL
  500  TAPER       REAL       ARRAY     SET5            717  TEPAR      REAL
  776  TFX         REAL                                 777  TFZ        REAL
  721  TLE         REAL                                 454  TNL        REAL        ARRAY     SET10
  620  TNT         REAL       ARRAY     SET10           722  TTE        REAL
  756  TX          REAL                                 723  T2         REAL
   21  VINF        REAL                 SET11          7640  VSP        REAL        ARRAY     SET2
  310  VSS         REAL       ARRAY     SET10         10270  VST        REAL        ARRAY     SET20
  765  VX          REAL                                 766  VY         REAL
  767  VZ          REAL                                   4  WSPAN      REAL                  SET13
    0  X           REAL       ARRAY     SET1              0  XAPEX      REAL        ARRAY     SET5
    3  XBAR        REAL                 SET15           774  XCOS       REAL
  762  XGIRO       REAL                                 733  XLE        REAL
  775  XSIN        REAL                                1060  XSUC       REAL        ARRAY     SET8
  764  XTE         REAL       ARRAY     SET10           745  XX         REAL
  751  X1          REAL                                 752  X2         REAL
 3720  Y           REAL       ARRAY     SET1             50  YAPEX      REAL        ARRAY     SET5
  711  YAW         REAL                                  10  YAWQ       REAL                  / /
  763  YGIRO       REAL                                 740  YM         REAL        ARRAY     SET8
  430  YY          REAL       ARRAY     SET20          4064  Z          REAL        ARRAY     SET1
  120  ZAPEX       REAL       ARRAY     SET5              4  ZBAR       REAL                  SET15
 4230  ZC          REAL       ARRAY     SET1            214  ZETA       REAL        ARRAY     SET19
  764  ZGIRO       REAL                                   0  ZLE1       REAL        ARRAY     SET20
   24  ZLE2        REAL       ARRAY     SET20          4350  ZZ         REAL        ARRAY     SET20

FILE NAMES        MODE
       TAPE9     UNFMT

EXTERNALS          TYPE    ARGS
       COS        REAL       1 LIBRARY                          SIN        REAL        1 LIBRARY
       SQRT       REAL       1 LIBRARY                          TAN        REAL        1 LIBRARY

INLINE FUNCTIONS   TYPE    ARGS
       ABS        REAL       1  INTRIN                          SIGN       REAL        2  INTRIN

STATEMENT LABELS
    0  10                                      62  20                                       221  30
  225  40                                       0  50          INACTIVE                       0  60
    0  70                                       0  80          INACTIVE                     364  90
    0  100          INACTIVE                    0  110                                        0  120         INACTIVE
  572  130                                    577  140                                        0  150

LOOPS  LABEL    INDEX     FROM-TO     LENGTH    PROPERTIES
   50  10       IX        111 120        6B      INSTACK
  116  110    * J         165 384      445B                 EXT REFS  NOT INNER
  157  60     * K         217 259      115B                 EXT REFS
  314  70       II        280 282        4B      INSTACK
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        SUBROUTINE AERO        74/74    OPT=1                          FTN 4.5+410A        10/04/76  10.15.13       PAGE     11

LOOPS  LABEL     INDEX       FROM-TO      LENGTH      PROPERTIES
  615  150       IX           420 434        33B          OPT

COMMON BLOCKS   LENGTH
       / /          13
       SET1       2250
       SET2       6000
       SET3       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              1022B      530
  CM LABELED COMMON LENGTH   71130B    29272
  CM BLANK COMMON LENGTH        15B       13
```

```
      CONTROL*VRLX.BOUNDY                                       9/17/76  VORLAX     747
      C...                                                               VORLAX     748
            SUBROUTINE BOUNDY (ITOTAL)                                   VORLAX     749
      C...                                                               VORLAX     750
      C...PURPOSE    TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO     VORLAX     751
      C...           THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON      VORLAX     752
      C...           TROL POINTS.                                        VORLAX     753
      C...                                                               VORLAX     754
      C...INPUT      CALLING SEQUENCE <                                  VORLAX     755
      C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.        VORLAX     756
      C...           COMMON <                                            VORLAX     757
      C...           ALFA, PSI, VINF, PITCHQ, ROLLQ, YAWQ, LAX, RNMAX,   VORLAX     758
      C...           SX, CX, X, YY, ZZ, DL, CHORD, XBAR, ZBAR, SLOPE,    VORLAX     759
      C...           RFLAG.                                              VORLAX     760
      C...                                                               VORLAX     761
      C...OUTPUT     COMMON <                                            VORLAX     762
      C...           ALOC, ONSET.                                        VORLAX     763
      C...                                                               VORLAX     764
      C...SUBROUTINES                                                    VORLAX     765
      C...CALLED     NONE.                                               VORLAX     766
      C...                                                               VORLAX     767
      C...DISCUSSION THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY     VORLAX     768
      C...           AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED  VORLAX     769
      C...           BY PROJECTING THE FREE-STREAM VELOCITY VECTOR       VORLAX     770
      C...           ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT    VORLAX     771
      C...           A RIGID BODY ROTATION ABOUT THE POINT (XBAR, 0,     VORLAX     772
      C...           ZBAR). THE ONSET FLOW NORMAL COMPONENT IS ALOC.     VORLAX     773
      C...           ONSET DENOTES THE RIGID BODY ROTATION INDUCED       VORLAX     774
      C...           VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY     VORLAX     775
      C...           ALOC AND ONSET, ARE DIMENSIONLESS, I.E., THEY ARE   VORLAX     776
      C...           REFERENCED TO THE FREE-STREAM VELOCITY.             VORLAX     777
      C...                                                               VORLAX     778
      C...                                                               VORLAX     779
            COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,  VORLAX     780
           * FLOATX, FLOATY, INVERS                                      VORLAX     781
            COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)            VORLAX     782
            COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)           VORLAX     783
            COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)   VORLAX     784
            COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)            VORLAX     785
            COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)    VORLAX     786
            COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),  VORLAX     787
           * TNT (100), XTE (100), IPAN (100)                            VORLAX     788
            COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA   VORLAX     789
            COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM           VORLAX     790
            COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                    VORLAX     791
            COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)               VORLAX     792
            COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),   VORLAX     793
           * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)       VORLAX     794
            INTEGER CX, SX                                               VORLAX     795
      C                                                                  VORLAX     796
            PI = 3.14159                                                 VORLAX     797
            DTR = 0.01745329                                             VORLAX     798
            PITCH = DTR *PITCHQ /VINF                                    VORLAX     799
            ROLL = DTR *ROLLQ /VINF                                      VORLAX     800
            YAW = DTR *YAWQ /VINF                                        VORLAX     801
            PSIRAD = DTR *PSI                                            VORLAX     802
            SINALF = SIN (ALFA)                                          VORLAX     803
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            COSIN = COS (ALFA) *SIN (PSIRAD)                                   VORLAX    804
            COSCOS = COS (ALFA) *COS (PSIRAD)                                  VORLAX    805
            FLAX = LAX                                                         VORLAX    806
      C                                                                        VORLAX    807
            DO 10 IR = 1, ITOTAL                                               VORLAX    808
      C...                                                                     VORLAX    809
      C...LOCATE VORTEX LATTICE CONTROL POINT WITH RESPECT TO THE              VORLAX    810
      C...ROTATION CENTER (XBAR, 0, ZBAR). THE RELATIVE COORDINATES            VORLAX    811
      C...ARE XGIRO, YGIRO, AND ZGIRO.                                         VORLAX    812
      C...                                                                     VORLAX    813
            PION = PI /RNMAX (SX (IR))                                         VORLAX    814
            RCX = CX (IR)                                                      VORLAX    815
            RSX = SX (IR)                                                      VORLAX    816
            DELTAX = 0.5 * (COS ((RCX - .5) *PION) - COS (RCX *PION))          VORLAX    817
            DELTAX = DELTAX *(1. - FLAX) + 0.5/RNMAX (SX (IR)) *FLAX           VORLAX    818
            XGIRO = X (IR) + CHORD (SX (IR)) *DELTAX - XBAR                    VORLAX    819
            YGIRO = YY (IR)                                                    VORLAX    820
            ZGIRO = ZZ (IR) - ZBAR                                             VORLAX    821
      C                                                                        VORLAX    822
      C...COMPUTE ONSET FLOW (FREE-STREAM + RIGID BODY ROTATION)               VORLAX    823
      C...VELOCITY COMPONENTS ALONG BODY AXES, VX, VY, AND VZ.                 VORLAX    824
      C...                                                                     VORLAX    825
            VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO                            VORLAX    826
            VY = COSIN - YAW *XGIRO + ROLL *ZGIRO                              VORLAX    827
            VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO                           VORLAX    828
      C                                                                        VORLAX    829
      C...COMPUTE DIRECTION COSINES.                                           VORLAX    830
      C                                                                        VORLAX    831
            SCNTL = SLOPE (IR) /SQRT (1. + SLOPE (IR) **2)                     VORLAX    832
            CCNTL = SQRT (1.0 - SCNTL **2)                                     VORLAX    833
            COD = COS (DTR *DL (SX (IR)))                                      VORLAX    834
            SID = SIN (DTR *DL (SX (IR)))                                      VORLAX    835
      C                                                                        VORLAX    836
      C...COMPUTE ONSET FLOW COMPONENT ALONG THE OUTWARD NORMAL TO             VORLAX    837
      C...THE SURFACE AT THE CONTROL POINT, ALOC.                              VORLAX    838
      C...                                                                     VORLAX    839
            ALOC (IR) = VX *SCNTL + VY *CCNTL *SID - VZ *CCNTL *COD            VORLAX    840
      C...                                                                     VORLAX    841
      C...THE VALUE OF RFLAG (0. OR 1.) DETERMINES WHETHER THE HORSE           VORLAX    842
      C...SHOE VORTEX IS SONIC (RFLAG = 0.) OR NOT (RFLAG = 1.). FOR           VORLAX    843
      C...A SONIC VORTEX THE BOUNDARY CONDITION EQUATION IS REPLACED           VORLAX    844
      C...BY AN AVERAGING PROCESS AND THEREFORE THE VALUE OF ALOC HAS          VORLAX    845
      C...TO BE ZEROED OUT.                                                    VORLAX    846
      C...                                                                     VORLAX    847
            ALOC (IR) = ALOC (IR) *RFLAG (IR)                                  VORLAX    848
      C...                                                                     VORLAX    849
      C...COMPUTE VELOCITY COMPONENT ALONG X-AXIS INDUCED BY THE RIGID         VORLAX    850
      C...BODY ROTATION, ONSET.                                                VORLAX    851
      C...                                                                     VORLAX    852
            ONSET (IR) = - PITCH *ZGIRO + YAW *YGIRO                           VORLAX    853
         10 CONTINUE                                                           VORLAX    854
      C                                                                        VORLAX    855
      C                                                                        VORLAX    856
            RETURN                                                             VORLAX    857
            END                                                                VORLAX    858
```

```
     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  BOUNDY

VARIABLES      SN  TYPE              RELOCATION
    20  ALFA        REAL                SET11            334  ALOC       REAL        ARRAY     SET6
    10  ALPHA       REAL       ARRAY    SET11              1  BETA       REAL                  SET15
     0  BIG         REAL                SET13              0  B2         REAL                  SET15
     2  CBAR        REAL                SET15            177  CCNTL      REAL
     0  CHORD       REAL       ARRAY    SET10            200  COD        REAL
   161  COSCOS      REAL                                 160  COSIN      REAL
     0  CX          INTEGER    ARRAY    SET3               0  DCP        REAL        ARRAY     SET2
   167  DELTAX      REAL                                 144  DL         REAL        ARRAY     SET10
   152  DTR         REAL                                   3  FPS        REAL                  SET13
   162  FLAX        REAL                                  12  FLOATX     REAL                  / /
    13  FLOATY      REAL                / /                0  GAMMA      REAL        ARRAY     SET16
    11  HAG         REAL                / /               24  HEAD       REAL        ARRAY     SET6
 13560  IDES        INTEGER    ARRAY    SET3               3  IH         INTEGER               / /
   404  INTRAC      INTEGER    ARRAY    SET20             14  INVERS     INTEGER               / /
  1130  IPAN        INTEGER    ARRAY    SET10              2  IQ         INTEGER               / /
   163  IR          INTEGER                                1  ITER       INTEGER               SET13
     0  ITOTAL      INTEGER              F.P.              2  ITRMAX     INTEGER               SET13
   170  ITS         INTEGER    ARRAY    SET7             214  JTS        INTEGER     ARRAY     SET7
     4  LATRAL      INTEGER             / /                0  LAX        INTEGER               / /
     1  LAY         INTEGER             / /                0  MACH       INTEGER     ARRAY     SET11
    23  NALPHA      INTEGER             SET11             22  NMACH      INTEGER               SET11
   360  NPP         INTEGER    ARRAY    SET20           3720  ONSET      REAL        ARRAY     SET16
    50  PHIMED      REAL       ARRAY    SET20            151  PI         REAL
   164  PION        REAL                                 153  PITCH      REAL
     6  PITCHQ      REAL                / /                5  PSI        REAL                  / /
   156  PSIRAD      REAL                                 214  RCS        REAL        ARRAY     SET20
   165  RCX         REAL                                7640  RFLAG      REAL        ARRAY     SET3
     5  RLM         REAL                SET13              0  RNCV       REAL        ARRAY     SET7
    24  RNMAX       REAL       ARRAY    SET7             154  ROLL       REAL
     7  ROLLQ       REAL                / /              166  RSX        REAL
   176  SCNTL       REAL                                 201  SID        REAL
   157  SINALF      REAL                                3720  SLOPE      REAL        ARRAY     SET2
  [illegible]  SX   INTEGER    ARRAY    SET3               0  TITLE      REAL        ARRAY     SET6
  [illegible]  TNL  REAL       ARRAY    SET10            620  TNT        REAL        ARRAY     SET10
    21  VINF        REAL                SET11           7640  VSP        REAL        ARRAY     SET12
  [illegible]  VSS  REAL       ARRAY    SET10          10270  VST        REAL        ARRAY     SET20
  [illegible]  VX   REAL                                 174  VY         REAL
  [illegible]  VZ   REAL                                   4  WSPAN      REAL                  SET13
  [illegible]  X    REAL       ARRAY    SET1               3  XBAR       REAL                  SET15
  [illegible]  [illegible]  REAL                         764  XTE        REAL        ARRAY     SET10
  [illegible]  [illegible]  REAL       ARRAY    SET1     155  YAW        REAL
  [illegible]  [illegible]  REAL                / /      171  YGIRO      REAL
  [illegible]  [illegible]  REAL       ARRAY    SET20   4064  Z          REAL        ARRAY     SET1
  [illegible]  [illegible]  REAL                SET15   4230  ZC         REAL        ARRAY     SET1
  [illegible]  [illegible]  REAL                           0  ZLE1       REAL        ARRAY     SET20
  [illegible]  [illegible]  REAL       ARRAY    SET20   4350  ZZ         REAL        ARRAY     SET20

EXTERNALS           TYPE     ARGS
          [illegible]     REAL      1 LIBRARY                SIN        REAL        1 LIBRARY
          [illegible]     REAL      1 LIBRARY
```

```
          SUBROUTINE BOUNDY      74/74    OPT=1                            FTN 4.5+410A       10/04/76  10.15.13        PAGE     4

STATEMENT LABELS
    0  10

LOOPS  LABEL    INDEX      FROM-TO    LENGTH     PROPERTIES
   44  10     * IR          62 10B     100B                EXT REFS

COMMON BLOCKS   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                204B      132
  CM LABELED COMMON LENGTH    72031B    29721
  CM BLANK COMMON LENGTH         15B       13
```

```
CONTROL*VRLX.GAUSS                                              9/13/76  VORLAX    856
C...                                                                     VORLAX    857
      SUBROUTINE GAUSS (ITOTAL, REXPAR, EW, XRT)                         VORLAX    858
C...                                                                     VORLAX    859
C...PURPOSE    TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE          VORLAX    860
C...           METHOD OF (CONTOLLED SUCCESSIVE OVER-RELAXATION).         VORLAX    861
C...                                                                     VORLAX    862
C...                                                                     VORLAX    863
C...INPUT      CALLING SEQUENCE<                                         VORLAX    864
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.              VORLAX    865
C...           REXPAR = RELAXATION PARAMETER.                            VORLAX    866
C...           EW = ROW OF NORMALWASH MATRIX.                            VORLAX    867
C...           COMMON<                                                   VORLAX    868
C...           CX, SX, LAX, ALOC, IDES, CHORD, RNMAX, INVERS,            VORLAX    869
C...           ITRMAX.                                                   VORLAX    870
C...                                                                     VORLAX    871
C...OUTPUT     CALLING SEQUENCE<                                         VORLAX    872
C...           XRT = AUXILIARY VECTOR USED IN C.S.O.R. SOLUTION.         VORLAX    873
C...           COMMON<                                                   VORLAX    874
C...           BIG, DCP, EPS, RLM, SLE, ITER, GAMMA, SLOPE.              VORLAX    875
C...           GAMMA IS THE SOLUTION VECTOR OF ROUDARY CONDITION         VORLAX    876
C...           EQUATIONS, I. E., HORSESHOE VORTEX CIRCULATION            VORLAX    877
C...           STRENGTHS.                                                VORLAX    878
C...           NOTE< IF INVERS = 1 (DESIGN PROCESS) THEN GAMMA IS        VORLAX    879
C...           PART INPUT AND PART OUTPUT.                               VORLAX    880
C...                                                                     VORLAX    881
C...SUBROUTINES                                                          VORLAX    882
C...CALLED     NONE.                                                     VORLAX    883
C...                                                                     VORLAX    884
C...DISCUSSION THIS SUBROUTINE SOLVES FOR THE CIRCULATION STRENGTH       VORLAX    885
C...           OF THE HORSESHOE VORTICES THAT SATISFY THE B.C. OF        VORLAX    886
C...           NO MASS-FLUX ALONG THE NORMAL TO THE SURFACE AT THE       VORLAX    887
C...           CONTROL POINTS. THIS SOLUTION IS PERFORMED ITERA          VORLAX    888
C...           TIVELY ROW BY ROW BY USING THE C.S.O.R. METHOD. IF        VORLAX    889
C...           A GIVEN ROW IS PART OF A PANEL TO BE DESIGNED, I.E.,      VORLAX    890
C...           IDES = 1, THEN INSTEAD OF SOLVING FOR GAMMA(= XPO),       VORLAX    891
C...           THE COMPUTATION OF THE SLOPE DISTRIBUTION ALONG           VORLAX    892
C...           THAT ROW IS PERFORMED BY MATRIX MULTIPLICATION.           VORLAX    893
C...           SLOPE = EW *GAMMA.                                        VORLAX    894
C...                                                                     VORLAX    895
C...                                                                     VORLAX    896
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,    VORLAX    897
     * FLOATX, FLOATY, INVERS                                            VORLAX    898
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                 VORLAX    899
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)      VORLAX    900
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                  VORLAX    901
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)          VORLAX    902
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),        VORLAX    903
     * TNT (100), XTE (100), IPAN (100)                                  VORLAX    904
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                 VORLAX    905
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                     VORLAX    906
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)         VORLAX    907
      INTEGER CX, SX                                                     VORLAX    908
C                                                                        VORLAX    909
      DIMENSION EW (ITOTAL), XRT (ITOTAL)                                VORLAX    910
C                                                                        VORLAX    911
      REWIND 1                                                           VORLAX    912
C
```

```
C...INITIALIZE ARRAYS.                                                    VORLAX    916
C...                                                                      VORLAX    917
      DO 20 IR = 1, ITOTAL                                                VORLAX    918
C...                                                                      VORLAX    919
C...GAMMA IS THE SOLUTION VECTOR  AND XRT IS AN AUXILIARY                 VORLAX    920
C...VECTOR TO BE USED IN THE RELAXATION SOLUTION.                         VORLAX    921
C...                                                                      VORLAX    922
      GAMMA (IR) = 0.0                                                    VORLAX    923
      XRT (IR) = 0.0                                                      VORLAX    924
C...                                                                      VORLAX    925
C...IF THE IR-HORSESHOE VORTEX IS PART OF A DESIGN PANEL THEN             VORLAX    926
C...ITS CIRCULATION STRENGTH IS DIRECTLY COMPUTED FROM THE INPUT          VORLAX    927
C...LOAD DISTRIBUTION AND NO SOLUTION BY RELAXATION IS REQUIRED           VORLAX    928
C...FOR THE IR-ELEMENT.                                                   VORLAX    929
C...                                                                      VORLAX    930
      IF (IDES (IR) .EQ. 0) GO TO 20                                      VORLAX    931
      IF (LAX .EQ. 1) GO TO 10                                            VORLAX    932
      GAMMA (IR) = 0.5 *DCP (IR)                                          VORLAX    933
      GO TO 20                                                            VORLAX    934
   10 GAMMA (IR) = .5*DCP (IR) *CHORD (SX (IR)) /RNMAX (SX (IR))          VORLAX    935
   20 CONTINUE                                                            VORLAX    936
C                                                                         VORLAX    937
C     **********  GAUSS-SEIDEL OVER-RELAXATION  **********                VORLAX    938
C                                                                         VORLAX    939
C                                                                         VORLAX    940
      RX1 = 1.0 + REXPAR                                                  VORLAX    941
      RX2 = 1.0 - REXPAR                                                  VORLAX    942
      BIGO = 1.0                                                          VORLAX    943
      ITER = 1                                                            VORLAX    944
C                                                                         VORLAX    945
C...BEGIN THE ITERATION SCHEME.                                           VORLAX    946
C...                                                                      VORLAX    947
   30 BIG = 0.0                                                           VORLAX    948
      COUNT = 0.0                                                         VORLAX    949
      EPSUM = 0.1E-11                                                     VORLAX    950
C...                                                                      VORLAX    951
C...INDEX IRR SELECTS A ROW.                                              VORLAX    952
C...                                                                      VORLAX    953
      DO 90 IRR = 1, ITOTAL                                               VORLAX    954
C...                                                                      VORLAX    955
C...FROM HERE THROUGH LABEL 70 THE SUM OF THE PRODUCTS OF INFLU-          VORLAX    956
C...ENCE COEFF. TIMES CIRCULATION STRENGTH FOR A ROW IS COMPUTED          VORLAX    957
C...EXCLUDING THE DIAGONAL TERM.                                          VORLAX    958
C...                                                                      VORLAX    959
   40 SUM = 0.0                                                           VORLAX    960
C...                                                                      VORLAX    961
C...UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE         VORLAX    962
C...COEFF. MATRIX.                                                        VORLAX    963
C...                                                                      VORLAX    964
      READ (1) EW                                                         VORLAX    965
      IF (IDES (IRR) .EQ. 1) GO TO 90                                     VORLAX    966
      IF (IRR .EQ. 1) GO TO 60                                            VORLAX    967
      LAST = IRR - 1                                                      VORLAX    968
      DO 50 IR = 1, LAST                                                  VORLAX    969
   50 SUM = SUM + EW (IR) *GAMMA (IR)                                     VORLAX    970
      IF (IRR .EQ. ITOTAL) GO TO 80                                       VORLAX    971
   60 INITL  = IRR  + 1                                                   VORLAX    972
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            DO 70 IR = INITL, ITOTAL                                     VORLAX     973
   70       SUM = SUM + EW (IR) *GAMMA (IR)                              VORLAX     974
C...                                                                     VORLAX     975
C...DETERMINE NEW VALUE OF A VARIABLE.                                   VORLAX     976
C...                                                                     VORLAX     977
   80       TEMP = (ALOC (IRR) - SUM) /EW (IRR)                          VORLAX     978
C...                                                                     VORLAX     979
C...APPLY OVER-RELAXATION USING A RELAXATION PARAMETER BASED ON          VORLAX     980
C...VARIABLE VALUES FROM PREVIOUS CYCLE.                                 VORLAX     981
C...                                                                     VORLAX     982
            TEMP1 = TEMP - GAMMA (IRR)                                   VORLAX     983
            RAX = RX1                                                    VORLAX     984
            IF (TEMP1 *XRT (IRR) .LT. 0.) RAX =RX2                       VORLAX     985
            XRT (IRR) = TEMP1                                            VORLAX     986
            TEMP2 = RAX *TEMP1                                           VORLAX     987
            GAMMA (IRR) = GAMMA (IRR) + TEMP2                            VORLAX     988
C...                                                                     VORLAX     989
C...PUT LARGEST RELAXATION RESIDUAL IN BIG.                              VORLAX     990
C...                                                                     VORLAX     991
            VARMOD = ABS (TEMP2)                                         VORLAX     992
            IF (VARMOD .GT. BIG) BIG = VARMOD                            VORLAX     993
C...                                                                     VORLAX     994
C...COUNT DETERMINES THE NUMBER OF VARIABLES THAT ARE BEING              VORLAX     995
C...SOLVED FOR.                                                          VORLAX     996
C...                                                                     VORLAX     997
            COUNT = COUNT + 1.0                                          VORLAX     998
C...                                                                     VORLAX     999
C...EPSUM IS TO BE USED IN CONJUCTION WITH COUNT TO DETERMINE A          VORLAX    1000
C...ROOT MEAN SQUARE VALUE OF ALL VARIABLES.                             VORLAX    1001
C...                                                                     VORLAX    1002
            EPSUM = EPSUM + GAMMA (IRR) *GAMMA (IRR)                     VORLAX    1003
   90       CONTINUE                                                     VORLAX    1004
            REWIND 1                                                     VORLAX    1005
C...                                                                     VORLAX    1006
C...RLM GIVES APPROXIMATE VALUE OF CONVERGENCE RATE OR MAGNIFI           VORLAX    1007
C...CATION FACTOR (MODULUS OF LARGEST EIGEN-VALUE).                      VORLAX    1008
C...                                                                     VORLAX    1009
            RLM = BIG /BIGO                                              VORLAX    1010
C...                                                                     VORLAX    1011
C...ESTABLISH TOLERANCE LEVEL (EPS) AS A SMALL PERCENTAGE OF ROOT        VORLAX    1012
C...MEAN SQUARE VALUE OF ALL VARIABLES.                                  VORLAX    1013
C...                                                                     VORLAX    1014
            EPS = SQRT (EPSUM /(COUNT + 1.0)) /200.0                     VORLAX    1015
C...                                                                     VORLAX    1016
C...IF LARGEST RESIDUAL IS LESS THEN EPS, PROCESS HAS CONVERGED.         VORLAX    1017
C...                                                                     VORLAX    1018
            IF (BIG .LT. EPS .OR. COUNT .LT. 0.5) GO TO 100              VORLAX    1019
C...                                                                     VORLAX    1020
C...IF ITERATION COUNTER EXCEEDS MAXIMUM ALLOWABLE, END RELAXATION.      VORLAX    1021
C...                                                                     VORLAX    1022
            IF (ITER .GE. ITRMAX) GO TO 100                              VORLAX    1023
            ITER = ITER + 1                                              VORLAX    1024
            BIGO = BIG                                                   VORLAX    1025
            GO TO 30                                                     VORLAX    1026
C                                                                        VORLAX    1027
C           **********  END OF GAUSS-SEIDEL OVER-RELAXATION  **********  VORLAX    1028
C                                                                        VORLAX    1029
```

```
C...FROM HERE TO END OF SUBROUTINE THE DESIGN PROCESS IS PERFORMED.     VORLAX   1030
C...IF NO DESIGN IS INVOLVED (INVERS = 0) THEN THIS SEGMENT IS BY-      VORLAX   1031
C...PASSED.                                                             VORLAX   1032
C                                                                       VORLAX   1033
 100  IF (INVERS .EQ. 0) GO TO 150                                      VORLAX   1034
C...                                                                    VORLAX   1035
C...UNIT 9 CONTAINS THE LEADING EDGE NORMALWASH INFLUENCE COEFF.        VORLAX   1036
C...MATRIX.                                                             VORLAX   1037
C...                                                                    VORLAX   1038
      REWIND 9                                                          VORLAX   1039
      DO 140 IRR = 1, ITOTAL                                            VORLAX   1040
C...                                                                    VORLAX   1041
C...UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE       VORLAX   1042
C...COEFF. MATRIX.                                                      VORLAX   1043
C...                                                                    VORLAX   1044
      READ (1) EW                                                       VORLAX   1045
C...                                                                    VORLAX   1046
C...THE LEADING EDGE NORMALWASH INFLUENCE COEFF. MATRIX IS ONLY         VORLAX   1047
C...DEFINED FOR LEADING EDGE ELEMENTS (CX = 1). THEREFORE ITS           VORLAX   1048
C...READING IN IS BYPASSED IF THE ELEMENT IS NOT AT THE L. E..          VORLAX   1049
C...                                                                    VORLAX   1050
      IF (CX (IRR) .GT. 1) GO TO 110                                    VORLAX   1051
      READ (9) XRT                                                      VORLAX   1052
 110  IF (IDES (IRR) .EQ. 0) GO TO 140                                  VORLAX   1053
C...                                                                    VORLAX   1054
C...COMPUTE SURFACE SLOPE AT VORTEX CONTROL POINT LOCATION, SLOPE.      VORLAX   1055
C...                                                                    VORLAX   1056
      THETA = 0.                                                        VORLAX   1057
      DO 120 IR = 1, ITOTAL                                             VORLAX   1058
      THETA = THETA + EW (IR) *GAMMA (IR)                               VORLAX   1059
 120  CONTINUE                                                          VORLAX   1060
      SLOPE (IRR) = THETA                                               VORLAX   1061
C...                                                                    VORLAX   1062
C...COMPUTE SURFACE SLOPE AT LEADING EDGE OF VORTEX STRIP               VORLAX   1063
C...CENTERLINE, SLE.                                                    VORLAX   1064
C...                                                                    VORLAX   1065
      IF (CX (IRR) .GT. 1) GO TO 140                                    VORLAX   1066
      THETA = 0.0                                                       VORLAX   1067
      DO 130 IR = 1, ITOTAL                                             VORLAX   1068
      THETA = THETA + XRT (IR) *GAMMA (IR)                              VORLAX   1069
 130  CONTINUE                                                          VORLAX   1070
      SLE (SX (IRR)) = THETA                                            VORLAX   1071
 140  CONTINUE                                                          VORLAX   1072
      REWIND 1                                                          VORLAX   1073
      REWIND 9                                                          VORLAX   1074
 150  RETURN                                                            VORLAX   1075
      END                                                               VORLAX   1076
```

```
    SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  GAUSS
```

```
VARIABLES      SN  TYPE             RELOCATION
   334  ALOC        REAL        ARRAY     SET6              0   BIG         REAL                   SET13
   275  BIGO        REAL                                    0   CHORD       REAL         ARRAY     SET10
   276  COUNT       REAL                                    0   CX          INTEGER      ARRAY     SET3
     0  DCP         REAL        ARRAY     SET2            144   DL          REAL         ARRAY     SET10
     3  EPS         REAL                  SET13           277   EPSUM       REAL
     0  EW          REAL        ARRAY      F.P.            12   FLOATX      REAL                   / /
    13  FLOATY      REAL                  / /               0   GAMMA       REAL         ARRAY     SET16
    11  HAG         REAL                  / /              24   HEAD        REAL         ARRAY     SET6
 13560  IDES        INTEGER     ARRAY     SET3              3   IH          INTEGER                / /
   303  INITL       INTEGER                                14   INVERS      INTEGER                / /
  1130  IPAN        INTEGER     ARRAY     SET10             2   IQ          INTEGER                / /
   272  IR          INTEGER                               300   IRR         INTEGER
     1  ITER        INTEGER               SET13             0   ITOTAL      INTEGER                 F.P.
     2  ITRMAX      INTEGER               SET13           170   ITS         INTEGER      ARRAY     SET7
   214  JTS         INTEGER     ARRAY     SET7            302   LAST        INTEGER
     4  LATRAL      INTEGER               / /               0   LAX         INTEGER                / /
     1  LAY         INTEGER               / /            3720   ONSET       REAL         ARRAY     SET16
     6  PITCHQ      REAL                  / /               5   PSI         REAL                   / /
   306  RAX         REAL                                    0   REXPAR      REAL                    F.P.
  7640  RFLAG       REAL        ARRAY     SET3              5   RLM         REAL                   SET13
     0  RNCV        REAL        ARRAY     SET7             24   RNMAX       REAL         ARRAY     SET7
     7  ROLLQ       REAL                  / /             273   RX1         REAL
   274  RX2         REAL                                   50   SLE         REAL         ARRAY     SET19
     0  SLE1        REAL        ARRAY     SET19            24   SLE2        REAL         ARRAY     SET19
  3720  SLOPE       REAL        ARRAY     SET2            311   SUM         REAL
  3720  SX          INTEGER     ARRAY     SET3            304   TEMP        REAL
   305  TEMP1       REAL                                  307   TEMP2       REAL
   311  THETA       REAL                                    0   TITLE       REAL         ARRAY     SET6
   454  TNL         REAL        ARRAY     SET10           620   TNT         REAL         ARRAY     SET10
   310  VARMOD      REAL                                 7640   VSP         REAL         ARRAY     SET2
   310  VSS         REAL        ARRAY     SET10             4   WSPAN       REAL                   SET13
     0  XRT         REAL        ARRAY      F.P.           764   XTE         REAL         ARRAY     SET10
    10  YAWQ        REAL                  / /             214   ZETA        REAL         ARRAY     SET19

FILE NAMES       MODE
      TAPE1      UNFMT                  TAPE9     UNFMT

EXTERNALS          TYPE    ARGS
      SQRT       REAL       1 LIBRARY

INLINE FUNCTIONS   TYPE    ARGS
      ABS        REAL       1  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       4B        INSTACK
  103   70        IR         115 116       4B        INSTACK
  166  140      * IRR        182 214      50B                 EXT REFS   NOT  INNER
  211  120        IR         200 202       4B        INSTACK
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        SUBROUTINE GAUSS       74/74    OPT=1                                  FTN 4.5+410A        10/04/76  10.15.13        PAGE

LOOPS  LABEL      INDEX      FROM-TO      LENGTH     PROPERTIES
  224  130        IR          210 212         4B      INSTACK

COMMON BLOCKS    LENGTH
        / /          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            15B        13
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      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 SEQUENCE≤                                VORLAX   1086
      C...            NONE.                                            VORLAX   1087
      C...            COMMON≤                                          VORLAX   1088
      C...            DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR, VORLAX   1089
      C...            RNCV, SLE1, SLE2, ZLE1, ZLE2, 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 SEQUENCE≤                                VORLAX   1095
      C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.     VORLAX   1096
      C...            COMMON≤                                          VORLAX   1097
      C...            X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,   VORLAX   1098
      C...            TNL, TNT, VSP, VSS, VST, XTE, ALOC, IPAN, SMAX,   VORLAX   1099
      C...            ZETA, CHORD, RNMAX, SLOPE, NPANAS.               VORLAX   1100
      C...            NOTE≤ 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 LEGS 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
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C...            360.0 THEN THE TRANSVERSE VORTEX SEGMENTS OF SAME CX,           VORLAX  1134
C...            THOUGH STILL CONTINUOUS, FORM A POLYGONAL LINE                  VORLAX  1135
C...            WHEN PROJECTED ON A PLANE NORMAL TO THE X-AXIS. IF              VORLAX  1136
C...            NPP = 0 THEN ALL THE TRANSVERSE VORTEX SEGMENTS                 VORLAX  1137
C...            OF A GIVEN ROW (SAME SX) LIE IN THE SAME PLANE,                 VORLAX  1138
C...            BUT IF NPP = 1 THEN THE TRANSVERSE SEGMENTS OF A                VORLAX  1139
C...            ROW ARE LAID ON THE ACTUAL BODY SURFACE. THE ROUND              VORLAX  1140
C...            TRAILING LEGS OR SEGMENTS ARE ALWAYS PARALLEL TO                VORLAX  1141
C...            THE X-AXIS (UP TO THE TRAILING EDGE OF THE GIVEN                VORLAX  1142
C...            STRIP OR ROW).                                                  VORLAX  1143
C...                                                                            VORLAX  1144
C...                                                                            VORLAX  1145
      COMMON LAX, LAY, IO, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,           VORLAX  1146
     * FLOATX, FLOATY, INVERS                                                   VORLAX  1147
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                         VORLAX  1148
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                        VORLAX  1149
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)             VORLAX  1150
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)            VORLAX  1151
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),               VORLAX  1152
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),             VORLAX  1153
     * PSPAN (40), NVOR (40)                                                    VORLAX  1154
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                         VORLAX  1155
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)                 VORLAX  1156
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),               VORLAX  1157
     * TNT (100), XTE (100), IPAN (100)                                         VORLAX  1158
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                                    VORLAX  1159
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                            VORLAX  1160
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)                VORLAX  1161
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),             VORLAX  1162
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)                    VORLAX  1163
      INTEGER TITLE, CX, SX                                                     VORLAX  1164
      REAL NVOR, LESWP                                                          VORLAX  1165
      PI = 3.14159                                                              VORLAX  1166
      DTR = 0.01745329                                                          VORLAX  1167
C                                                                               VORLAX  1168
C  LATTICE GEOMETRY                                                             VORLAX  1169
C                                                                               VORLAX  1170
C...INITIALIZE INDICES.                                                         VORLAX  1171
C...                                                                            VORLAX  1172
      IR = 0                                                                    VORLAX  1173
      IRR = 0                                                                   VORLAX  1174
      SMAX = 0.                                                                 VORLAX  1175
      NPANAS = 0                                                                VORLAX  1176
      KED = 0                                                                   VORLAX  1177
      KEG = 0                                                                   VORLAX  1178
      SIGN = 1.0                                                                VORLAX  1179
      I = 1                                                                     VORLAX  1180
      ICYCLE = 1                                                                VORLAX  1181
      JUMP = 0                                                                  VORLAX  1182
C                                                                               VORLAX  1183
C...IN DEFINING THE VORTEX LATTICE GEOMETRY, THE COMPUTATION IS                 VORLAX  1184
C...PERFORMED ONE PANEL AT A TIME (STATEMENTS INCLUDED BETWEEN                   VORLAX  1185
C...LABELS 10 AND 80). IF THE CONFIGURATION IS SYMMETRICAL THE                  VORLAX  1186
C...COMPUTATION EXTENDS OVER ONE HALF OF IT ONLY (MIRROR SYM                    VORLAX  1187
C...METRY IS ASSUMED). OTHERWISE THE COMPUTATIONAL CYCLE IS RE                  VORLAX  1188
C...PEATED FOR THE OTHER HALF OF THE CONFIGURATION.                             VORLAX  1189
C...                                                                            VORLAX  1190
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      C                                                                 VORLAX   1191
      C                                                                 VORLAX   1192
       10   SMAX = SMAX + NVOR (I)                                      VORLAX   1193
            NPANAS = NPANAS + 1                                         VORLAX   1194
            DELTA = 0.5 *PSPAN (I) /NVOR (I)                            VORLAX   1195
            ETA = 0.                                                    VORLAX   1196
            TAD = TAN (DTR * LESWP (I)) *SIGN                           VORLAX   1197
            NV = NVOR (I)                                               VORLAX   1198
            XNOT = XAPEX (I)                                            VORLAX   1199
            YNOT = YAPEX (I) *SIGN                                      VORLAX   1200
            ZNOT = ZAPEX (I)                                            VORLAX   1201
      C                                                                 VORLAX   1202
      C                                                                 VORLAX   1203
            KEOOR = KED                                                 VORLAX   1204
            KEGOR = KEG                                                 VORLAX   1205
      C                                                                 VORLAX   1206
      C                                                                 VORLAX   1207
            DO 80 J = 1, NV                                             VORLAX   1208
            IR = IR + 1                                                 VORLAX   1209
            IPAN (IR) = I                                               VORLAX   1210
            RNMAX (IR) = RNCV (I)                                       VORLAX   1211
      C...                                                              VORLAX   1212
      C...DETERMINE DISTRIBUTION OF VORTEX TRAILING LFGS (LATERAL VORTEX VORLAX   1213
      C...SPACING)+ IF LAY = 0 ≤ COSINE SPACING+ IF LAY = 1 ≤ EQUAL     VORLAX   1214
      C...SPACING. DELTA IS HALF THE LATERAL VORTEX SPACING.            VORLAX   1215
      C...                                                              VORLAX   1216
            IF (LAY .EQ. 0 ) DELTA = 0.25 *PSPAN (I) *(COS (PI *FLOAT(J-1)/ VORLAX   1217
           * NVOR (I)) - COS (PI *FLOAT (J) /NVOR (I)))                 VORLAX   1218
      C...                                                              VORLAX   1219
      C...IF PDL .LE. 360.0 THEN VSS AND DL HAVE TO BE COMPUTED+ OTHER  VORLAX   1220
      C...WISE (PDL .GT. 360.) THEY HAVE ALREADY BEEN COMPUTED DURING THE VORLAX   1221
      C...INPUT PROCESS (INPUT SUBROUTINE). THE INDEX JUMP HELPS DETER  VORLAX   1222
      C...MINE THE VALUES TO BE MIRRORED WHEN BOTH LEFT AND RIGHT HALVES VORLAX   1223
      C...OF THE CONFIGURATION ARE BEING LATTICED (ASYMMETRICAL CASE,   VORLAX   1224
      C...I. E., LATRAL = 1).                                           VORLAX   1225
      C...                                                              VORLAX   1226
            IF (PDL (I) .LE. 360.) VSS (IR) = DELTA                     VORLAX   1227
            IF (PDL (I) .LE. 360.0 ) DL (IR) = PDL (I)                  VORLAX   1228
            VSS (IR) = VSS (IR - JUMP)                                  VORLAX   1229
            RCS (IR) = RCS (IR - JUMP)                                  VORLAX   1230
            DL (IR) = DL (IR - JUMP) *SIGN                              VORLAX   1231
            PHIMED (IR) = PHIMED (IR - JUMP) *SIGN - 90.0 *(SIGN - 1.0) VORLAX   1232
            SID = SIN (DTR *DL (IR))                                    VORLAX   1233
            COD = COS (DTR *DL (IR))                                    VORLAX   1234
            DTJ = VSS (IR)                                              VORLAX   1235
            IF (J - 1) 30, 30, 20                                       VORLAX   1236
       20   XNOT = XLE + VSS (IR - 1) *TAD *SIGN                        VORLAX   1237
            YNOT = Y (IR - 1) + VSS (IR - 1) *COS (DTR *DL(IR - 1)) *SIGN VORLAX   1238
            ZNOT = Z (IR - 1) + VSS (IR - 1) *SIN (DTR *DL (IR -1)) *SIGN VORLAX   1239
            ETA = ETA + VSS (IR - 1) /PSPAN (I)                         VORLAX   1240
      C...                                                              VORLAX   1241
      C...DETERMINE LATERAL COORDINATES (Y, Z) OF STRIP CENTERLINE OR   VORLAX   1242
      C...VORTEX ROW REFERENCE LINE. BY DEFINITION THIS LINE IS PARALLEL VORLAX   1243
      C...TO X-AXIS.                                                    VORLAX   1244
      C...                                                              VORLAX   1245
       30   Y (IR) = YNOT + DTJ *COD *SIGN                              VORLAX   1246
            Z (IR) = ZNOT + DTJ *SID *SIGN                              VORLAX   1247
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            XLE = XNOT + DTJ *TAD *SIGN                                         VORLAX   1248
            ETA = ETA + DTJ /PSPAN (I)                                          VORLAX   1249
      C...                                                                      VORLAX   1250
      C...COMPUTE TANGENT OF LOCAL INCIDENCE (ANGLE BETWEEN CHORDLINE           VORLAX   1251
      C...AND STRIP REFERENCE LINE) BY ASSUMING STRAIGHT ELEMENT LINE           VORLAX   1252
      C...LOFTING (THE TANGENT IS CALLED DINC).                                 VORLAX   1253
      C...                                                                      VORLAX   1254
            DINC = AINC1 (I) *(1. - ETA) + AINC2 (I) *TAPER (I) *ETA            VORLAX   1255
            DINC = DINC /(1.0 - ETA + TAPER (I) *ETA)                           VORLAX   1256
      C...                                                                      VORLAX   1257
      C...THE PARAMETER INTRAC DETERMINES WHETHER THE PANEL UNDER CON           VORLAX   1258
      C...SIDERATION IS PART OF A QUASI-CYLINDRICAL BODY OR PART OF A           VORLAX   1259
      C...OR PART OF A FUSIFORM BODY (INTRAC = 1). FOR A FUSIFORM BODY          VORLAX   1260
      C...AINC1 IS THE TANGENT OF THE INCIDENCE OF THE BODY AXIS WITH           VORLAX   1261
      C...RESPECT TO THE X-Y PLANE, AND AINC2 IS THE TANGENT OF THE             VORLAX   1262
      C...INCIDENCE OF THE BODY AXIS WITH RESPECT TO THE X-Z PLANE.             VORLAX   1263
      C...                                                                      VORLAX   1264
            IF (INTRAC (I) .EQ. 1)  DINC = AINC1 (I) *COD + AINC2 (I) *SID      VORLAX   1265
      C...                                                                      VORLAX   1266
      C...COMPUTE CHORD LENGTH (CHORD) ALONG STRIP CENTERLINE BY                VORLAX   1267
      C...ASSUMING STRAIGHT PANEL LEADING AND TRAILING EDGES AND                VORLAX   1268
      C...NEGLECTING THE EFFECT OF TWIST.                                       VORLAX   1269
      C...                                                                      VORLAX   1270
            CHORD (IR) = CSTART (I) *(1.0 + ETA *(TAPER (I) - 1.0))             VORLAX   1271
      C...                                                                      VORLAX   1272
      C...COMPUTE LEADING EDGE SLOPE (SLE).                                     VORLAX   1273
      C...                                                                      VORLAX   1274
            SLE (IR) = SLE1 (I) *(1. - ETA) + SLE2 (I) *ETA + DINC              VORLAX   1275
            IF (INTRAC (I) .EQ. 0)  GO TO  40                                   VORLAX   1276
            FRC = RCS (IR) /CHORD (IR)                                          VORLAX   1277
            CODIF = COS (DTR *(90.0 - PHIMED (IR) + DL (IR)))                   VORLAX   1278
       40   JTS (IR) = ITS (I)                                                  VORLAX   1279
            ZETA (IR) = DINC                                                    VORLAX   1280
      C...                                                                      VORLAX   1281
      C...COMPUTE TANGENT OF LEADING EDGE SWEEP (TNL), TANGENT OF               VORLAX   1282
      C...TRAILING EDGE SWEEP (TNT), AND X-ORDINATE OF TRAILING EDGE            VORLAX   1283
      C...OF STRIP CENTERLINE (XTE).                                            VORLAX   1284
      C...                                                                      VORLAX   1285
            TNL (IR) = TAD                                                      VORLAX   1286
            TNT (IR) = TAD - SIGN *CSTART (I) *(1. - TAPER (I)) /PSPAN (I)      VORLAX   1287
            XTE (IR) = XLE + CHORD (IR)                                         VORLAX   1288
            MAX = RNMAX (IR)                                                    VORLAX   1289
            PION = PI /RNMAX (IR)                                               VORLAX   1290
      C                                                                         VORLAX   1291
      C                                                                         VORLAX   1292
      C...THE DO-LOOP ENDED BY LABEL 70 COMPUTES FOR A GIVEN STRIP OR           VORLAX   1293
      C...VORTEX ROW THE VALUES OF TRANSVERSE SEGMENT MIDPOINT X-ORDI           VORLAX   1294
      C...NATES (X), THE TANGENT OF THE SWEEP OF THOSE SEGMENTS (VSP),          VORLAX   1295
      C...THE SLOPE OF THE SURFACE AT THE CONTROL POINTS (SLOPE) AS             VORLAX   1296
      C...DETERMINED BY STRAIGHT ELEMENT LINE LOFTING, OR IF A DESIGN           VORLAX   1297
      C...PROCESS IS INVOKED (SYNTH = 1.), THE VALUE OF THE LOAD COEFF.         VORLAX   1298
      C...(DCP) AT VORTEX MIDPOINT IS DETERMINED BY LINEAR INTERPOLATION.       VORLAX   1299
      C...ALSO EACH HORSESHOE VORTEX IS GIVEN A VALUE OF IDES WHICH DE          VORLAX   1300
      C...TERMINES WHETHER ITS LOAD COEFFICIENT IS A KNOWN (INPUT)              VORLAX   1301
      C...QUANTITY (IDES = 1) OR IT IS TO BE SOLVED FOR (IDES = 0).             VORLAX   1302
      C...IN ADDITION, THE HORSESHOE VORTICES ARE TAGGED WITH THE PROPER        VORLAX   1303
      C...CX - SX VALUES. ALOC IS AN AUXILIARY ARRAY WHICH CONTAINS THE         VORLAX   1304
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      C...THE DISPLACEMENTS OF THE VORTEX MIDPOINTS (LOAD POINTS) WITH          VORLAX  1305
      C...RESPECT TO THE STRIP REFERENCE LINE, IN PERCENT OF LOCAL               VORLAX  1306
      C...CHORD LENGTH.                                                          VORLAX  1307
      C...                                                                       VORLAX  1308
            DO 70 K = 1, MAX                                                     VORLAX  1309
            KEDK = KEDOR + K                                                     VORLAX  1310
            KEGK = KEGOR + K                                                     VORLAX  1311
            IF (J .GT. 1)  GO TO 50                                              VORLAX  1312
            KED = KED + 1                                                        VORLAX  1313
            KEG = KEG + 1                                                        VORLAX  1314
       50   IRR = IRR + 1                                                        VORLAX  1315
            CX (IRR) = K                                                         VORLAX  1316
            SX (IRR) = IR                                                        VORLAX  1317
            RK = K                                                               VORLAX  1318
            DTJ = .5 * (1.0 - COS ((RK - .5) *PION))                             VORLAX  1319
            IF (LAX .EQ. 1) DTJ = (RK - 0.75) /RNMAX (IR)                        VORLAX  1320
            X (IRR) = XLE + DTJ *CHORD (IR)                                      VORLAX  1321
            VSP(IRR) = TAD -DTJ *CSTART(I) *(1.-TAPER(I))/ABS(PSPAN(I)) *SIGN    VORLAX  1322
            ALOC (IRR) = 0.0                                                     VORLAX  1323
            IF (SYNTH (I) .GT. 0.5) GO TO 60                                     VORLAX  1324
            IDES (IRR) = 0                                                       VORLAX  1325
            SLOPE (IRR) = DNDX1 (KEDK) *(1. - ETA) + DNDX2 (KEDK) *ETA + DINC    VORLAX  1326
            KEGK2 = KEGK + MAX                                                   VORLAX  1327
            ALOC (IRR) = GAMMA (KEGK) *(1. - ETA) + GAMMA (KEGK2) *ETA           VORLAX  1328
            ALOC (IRR) = ALOC (IRR) +  DINC *DTJ *100.                           VORLAX  1329
            IF (INTRAC (I) .EQ. 0)  GO TO 70                                     VORLAX  1330
            SLOPE (IRR) = DNDX1 (KEDK) *COD + FRC *DNDX2 (KEDK) *CODIF + DINC    VORLAX  1331
            ALOC (IRR) = GAMMA (KEGK2)                                           VORLAX  1332
            GO TO 70                                                             VORLAX  1333
       60   DCP (IRR) = DNDX1 (KEDK) + (DNDX2 (KEDK) - DNDX1 (KEDK)) *ETA        VORLAX  1334
            IDES (IRR) = 1                                                       VORLAX  1335
            SLOPE (IRR) = 0.0                                                    VORLAX  1336
       70   CONTINUE                                                             VORLAX  1337
      C                                                                          VORLAX  1338
      C                                                                          VORLAX  1339
       80   CONTINUE                                                             VORLAX  1340
      C                                                                          VORLAX  1341
      C                                                                          VORLAX  1342
      C                                                                          VORLAX  1343
            KEG = KEG + MAX                                                      VORLAX  1344
      C                                                                          VORLAX  1345
      C                                                                          VORLAX  1346
            IF (ICYCLE .EQ. 2) GO TO 100                                         VORLAX  1347
            I = I + 1                                                            VORLAX  1348
            IF (I - NPAN) 10, 10, 90                                             VORLAX  1349
       90   IF (LATRAL .EQ. 0) GO TO 110                                         VORLAX  1350
      C...                                                                       VORLAX  1351
      C...                                                                       VORLAX  1352
      C...IF CONFIGURATION OR FLIGHT CONDITION IS ASYMMETRICAL (LATRAL           VORLAX  1353
      C...= 1) THEN DETERMINE PANEL HAS TO BE DUPLICATED FOR OPPOSSITE           VORLAX  1354
      C...HALF OF CONFIGURATION.                                                 VORLAX  1355
      C...                                                                       VORLAX  1356
      C...                                                                       VORLAX  1357
            ICYCLE = 2                                                           VORLAX  1358
            JUMP = IR                                                            VORLAX  1359
            I = 0                                                                VORLAX  1360
            SIGN = - 1.0                                                         VORLAX  1361
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      KED = 0                                                           VORLAX  1362
      KEG = 0                                                           VORLAX  1363
  100 I = I + 1                                                         VORLAX  1364
      IF (I .GT. NPAN) GO TO 110                                        VORLAX  1365
      NV = NVOR (I)                                                     VORLAX  1366
      NCORD = RNCV (I)                                                  VORLAX  1367
      IF (IQUANT(I) .EQ. 1)  KED = KED + NCORD                          VORLAX  1368
      IF (IQUANT(I) .EQ. 1)  KEG = KEG + 2 *NCORD                       VORLAX  1369
      JUMP = JUMP + NV * (IQUANT (I) - 2)                               VORLAX  1370
      IF (IQUANT (I) .EQ. 1) GO TO 100                                  VORLAX  1371
      GO TO 10                                                          VORLAX  1372
  110 ITOTAL = IRR                                                      VORLAX  1373
      NT = SMAX                                                         VORLAX  1374
C                                                                       VORLAX  1375
C                                                                       VORLAX  1376
      IRR = 0                                                           VORLAX  1377
C                                                                       VORLAX  1378
C...THE DO-LOOP ENDED BY LABEL 190 COMPUTES THE LATERAL COORDI          VORLAX  1379
C...NATES OF VORTEX MIDPOINTS (YY AND ZZ) AND THE SEMISPAN OF           VORLAX  1380
C...EACH HORSESHOE. IF NPP = 0 THE VORTEX MIDPOINT LATERAL CO           VORLAX  1381
C...ORDINATES COINCIDE WITH THOSE OF STRIP CENTERLINE.                  VORLAX  1382
C...                                                                    VORLAX  1383
      DO 190 IR = 1, NT                                                 VORLAX  1384
      MAX = RNMAX (IR)                                                  VORLAX  1385
      DNORM = CHORD (IR) *0.010                                         VORLAX  1386
      INX = IPAN (IR)                                                   VORLAX  1387
      ISEND = 1 + INTRAC (INX)                                          VORLAX  1388
      GO TO (120, 130), ISEND                                           VORLAX  1389
  120 CDL = COS (DTR *DL (IR))                                          VORLAX  1390
      SDL = SIN (DTR *DL (IR))                                          VORLAX  1391
      GO TO 140                                                         VORLAX  1392
  130 CDL = SIN (DTR *PHIMED (IR))                                      VORLAX  1393
      SDL = - COS (DTR *PHIMED (IR))                                    VORLAX  1394
  140 DO 180 L = 1, MAX                                                 VORLAX  1395
      IRR = IRR + 1                                                     VORLAX  1396
      YY (IRR) = Y (IR)                                                 VORLAX  1397
      ZZ (IRR) = Z (IR)                                                 VORLAX  1398
      VST (IRR) = VSS (IR)                                              VORLAX  1399
      IF (NPP (INX) .EQ. 0) GO TO 180                                   VORLAX  1400
      GO TO (150, 160), ISEND                                           VORLAX  1401
  150 DELTA = ALOC (IRR) *DNORM                                         VORLAX  1402
      GO TO 170                                                         VORLAX  1403
  160 DELTA = RCS (IR) *(0.1 *SQRT (ALOC (IRR)) - 1.0)                  VORLAX  1404
  170 YY (IRR) = Y (IR) - DELTA *SDL                                    VORLAX  1405
      ZZ (IRR) = Z (IR) + DELTA *CDL                                    VORLAX  1406
      VOREX = 1.0                                                       VORLAX  1407
      IF (INTRAC (INX) .EQ. 1)  VOREX = (RCS (IR) + DELTA) /RCS (IR)    VORLAX  1408
      VST (IRR) = VOREX *VSS (IR)                                       VORLAX  1409
  180 CONTINUE                                                          VORLAX  1410
  190 CONTINUE                                                          VORLAX  1411
C                                                                       VORLAX  1412
C                                                                       VORLAX  1413
      RETURN                                                            VORLAX  1414
      END                                                               VORLAX  1415
```

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      SUBROUTINE GEOM       74/74    OPT=1                            FTN 4.5+410A        10/04/76  10.15.13        PAGE     7

 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
  1440  AINC1         REAL       ARRAY    SET4          1464  AINC2       REAL       ARRAY     SET4
   334  ALOC          REAL       ARRAY    SET6           601  COL         REAL
     0  CHORD         REAL       ARRAY    SET10          560  COD         REAL
   565  CODIF         REAL                               430  CSTART      REAL       ARRAY     SET5
     0  CX            INTEGER    ARRAY    SET3             0  DCP         REAL       ARRAY     SET2
   545  DELTA         REAL                               563  DINC        REAL
   144  DL            REAL       ARRAY    SET10            0  DNDX1       REAL       ARRAY     SET4
   620  DNDX2         REAL       ARRAY    SET4           576  DNORM       REAL
   561  DTJ           REAL                               534  DTR         REAL
   546  ETA           REAL                                12  FLOATX      REAL                 / /
    13  FLOATY        REAL                / /            564  FRC         REAL
     0  GAMMA         REAL       ARRAY    SET16           11  HAG         REAL                 / /
    24  HEAD          REAL       ARRAY    SET6           542  I           INTEGER
   543  ICYCLE        INTEGER                          13560  IDES        INTEGER    ARRAY     SET3
     3  IH            INTEGER             / /            404  INTRAC      INTEGER    ARRAY     SET20
    14  INVERS        INTEGER             / /            577  INX         INTEGER
  1130  IPAN          INTEGER    ARRAY    SET10            2  IQ          INTEGER              / /
   360  IQUANT        INTEGER    ARRAY    SET5           535  IR          INTEGER
   536  IRR           INTEGER                            600  ISEND       INTEGER
     0  ITOTAL        INTEGER              F.P.          170  ITS         INTEGER    ARRAY     SET7
   556  J             INTEGER                            214  JTS         INTEGER    ARRAY     SET7
   544  JUMP          INTEGER                            570  K           INTEGER
   537  KED           INTEGER                            571  KEDK        INTEGER
   554  KEDOR         INTEGER                            540  KEG         INTEGER
   572  KEGK          INTEGER                            574  KEGK2       INTEGER
   555  KEGOR         INTEGER                            603  L           INTEGER
     4  LATRAL        INTEGER             / /              0  LAX         INTEGER              / /
     1  LAY           INTEGER             / /            240  LESWF       REAL       ARRAY     SET5
   566  MAX           INTEGER                            575  NCORD       INTEGER
     0  NPAN          INTEGER             SET14            3  NPANAS      INTEGER              SET14
   360  NPP           INTEGER    ARRAY    SET20            1  NT          INTEGER              SET14
   550  NV            INTEGER                            620  NVOR        REAL       ARRAY     SET5
  3720  ONSET         REAL       ARRAY    SET16          170  POL         REAL       ARRAY     SET5
    50  PHIMED        REAL       ARRAY    SET20          533  PI          REAL
   567  PION          REAL                                 6  PITCHW      REAL                 / /
     5  PSI           REAL                / /            550  PSPAN       REAL       ARRAY     SET5
   214  RCS           REAL       ARRAY    SET20         7640  PFLAG       REAL       ARRAY     SET3
   573  RK            REAL                                 0  RNCV        REAL       ARRAY     SET7
    24  RNMAX         REAL       ARRAY    SET7             7  ROLLG       REAL                 / /
   602  SDL           REAL                               557  SIO         REAL
   541  SIGN          REAL                                50  SLE         REAL       ARRAY     SET19
     0  SLE1          REAL       ARRAY    SET19           24  SLE2        REAL       ARRAY     SET19
  3720  SLOPE         REAL       ARRAY    SET2             2  SMAX        REAL                 SET14
```

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        SUBROUTINE GEOM       74/74    OPT=1                           FTN 4.5+410A       10/04/76  10.15.13       PAGE     8

VARIABLES      SN  TYPE            RELOCATION
  3720  SX         INTEGER     ARRAY    SET3               310  SYNTH     REAL        ARRAY     SET5
   547  TAD        REAL                                    500  TAPER     REAL        ARRAY     SET5
     0  TITLE      INTEGER     ARRAY    SET6               454  TNL       REAL        ARRAY     SET10
   620  TNT        REAL        ARRAY    SET10              604  VOREX     REAL
  7640  VSP        REAL        ARRAY    SET2               310  VSS       REAL        ARRAY     SET10
 10270  VST        REAL        ARRAY    SET20                0  X         REAL        ARRAY     SET1
     0  XAPEX      REAL        ARRAY    SET5               562  XLE       REAL
   551  XNOT       REAL                                    764  XTE       REAL        ARRAY     SET10
  3720  Y          REAL        ARRAY    SET1                50  YAPEX     REAL        ARRAY     SET5
    10  YAWQ       REAL                 / /                552  YNOT      REAL
   430  YY         REAL        ARRAY    SET20             4064  Z         REAL        ARRAY     SET1
   120  ZAPEX      REAL        ARRAY    SET5              4230  ZC        REAL        ARRAY     SET1
   214  ZETA       REAL        ARRAY    SET19                0  ZLE1      REAL        ARRAY     SET20
    24  ZLE2       REAL        ARRAY    SET20              553  ZNOT      REAL
  4350  ZZ         REAL        ARRAY    SET20

EXTERNALS          TYPE    ARGS
       COS         REAL     1 LIBRARY                          SIN       REAL        1 LIBRARY
       SQRT        REAL     1 LIBRARY                          TAN       REAL        1 LIBRARY

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

STATEMENT LABELS
    17  10                                  0  20        INACTIVE            142  30
   211  40                                241  50                            322  60
   331  70                                  0  80                              0  90           INACTIVE
   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      272B               EXT REFS  NOT INNER
  232  70       * K         233 261      102B               EXT REFS
  404  190      * IR        308 335      111B               EXT REFS  NOT INNER
  440  180      * L         319 334       53B               EXT REFS

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                     605B       389
  CM LABELED COMMON LENGTH        74756B     31214
  CM BLANK COMMON LENGTH             15B        13
```

```
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, SLE1,         VORLAX   1433
C...            SLE2, SREF, VINF, XBAR, YAWQ, YNOT, ZBAR, ZLE1,             VORLAX   1434
C...            ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2,              VORLAX   1435
C...            GAMMA, LESWP, NMACH, PSPAN, ROLLQ, SYNTH, TAPER,            VORLAX   1436
C...            WSPAN, XAPEX, YAPEX, ZAPEX, CSTART, DELTAY, DELTAZ,         VORLAX   1437
C...            INTRAC, INVERS, IQUANT, LATRAL, NALPHA, PHIMED,             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 CONVEVIENT 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 GEOM 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
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C...           SURFACE OF THE SAME AIRFOIL.                         VORLAX    1473
C...           FUSIFORM BODIES ARE MODELLED BY DEFINING AN AUXILIARY VORLAX    1474
C...           BODYIDENTICAL 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
      DIMENSION C1 (50), C2 (50), RO (51), PHI (51)                 VORLAX    1490
      DIMENSION XAF (50), ZC1 (50), ZC2 (50)                        VORLAX    1491
      DIMENSION DESCRP (10)                                         VORLAX    1492
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                          VORLAX    1493
      INTEGER TITLE, CX, SX                                         VORLAX    1494
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG, VORLAX    1495
     * FLOATX, FLOATY, INVERS, ISOLV                                VORLAX    1496
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (20)             VORLAX    1497
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)            VORLAX    1498
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000) VORLAX    1499
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20) VORLAX    1500
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),   VORLAX    1501
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40), VORLAX    1502
     * PSPAN (40), NVOR (40)                                        VORLAX    1503
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)             VORLAX    1504
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)     VORLAX    1505
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),     VORLAX    1506
     * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),        VORLAX    1507
     * RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SURF (40)   VORLAX    1508
      COMMON /SET9 /CDC (100), CMC (100)                            VORLAX    1509
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),   VORLAX    1510
     * TNT (100), XTE (100), IPAN (100)                             VORLAX    1511
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA VORLAX    1512
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT VORLAX    1513
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM            VORLAX    1514
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                        VORLAX    1515
      CQMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                     VORLAX    1516
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                VORLAX    1517
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)               VORLAX    1518
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20) VORLAX    1519
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)    VORLAX    1520
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100), VORLAX    1521
     * NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST(2000)       VORLAX    1522
C                                                                   VORLAX    1523
      PI = 3.14159                                                  VORLAX    1524
      DTR = 0.01745329                                              VORLAX    1525
C                                                                   VORLAX    1526
C...FLIGHT CONDITIONS AND CONFIGURATION REFERENCE PARAMETERS ARE    VORLAX    1527
C...ARE READ IN FIRST.                                              VORLAX    1528
                                                                    VORLAX    1529
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      C                                                                 VORLAX    1530
            READ (5, 10) NMACH, (MACH (I), I = 1, NMACH)                VORLAX    1531
            WRITE (6, 20) NMACH, (MACH (I), I = 1, NMACH)               VORLAX    1532
         10 FORMAT (I2, 8X, 7F10.0)                                     VORLAX    1533
         20 FORMAT (1H0 , I2, 8X, 7F10.3)                               VORLAX    1534
      C...                                                              VORLAX    1535
      C...                                                              VORLAX    1536
      C...                                                              VORLAX    1537
            READ (5, 10) NALPHA, (ALPHA (I) , I = 1, NALPHA)            VORLAX    1538
            WRITE (6, 20) NALPHA, (ALPHA (I) , I = 1, NALPHA)           VORLAX    1539
      C...                                                              VORLAX    1540
      C...                                                              VORLAX    1541
      C...                                                              VORLAX    1542
            READ (5, 10) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF         VORLAX    1543
            IF (PSI .NE. 0.) LATRAL = 1                                 VORLAX    1544
            IF (ROLLQ .NE. 0.) LATRAL = 1                               VORLAX    1545
            IF (YAWQ .NE. 0.) LATRAL = 1                                VORLAX    1546
            IF (VINF .LE. 0.001) VINF = 1.0                             VORLAX    1547
            WRITE (6, 20) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF        VORLAX    1548
      C...                                                              VORLAX    1549
      C...                                                              VORLAX    1550
            READ (5, 30) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN            VORLAX    1551
         30 FORMAT (I2, 8X, 5F10.0)                                     VORLAX    1552
         40 FORMAT (1H0 , I2, 8X, F10.2, 4F10.4)                        VORLAX    1553
            IF (WSPAN .LE. 0.0001) WSPAN = 2.0                          VORLAX    1554
            WRITE (6, 40 ) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN          VORLAX    1555
         50 FORMAT (8F10.0)                                             VORLAX    1556
         60 FORMAT (1H , 4 (F10.2, F10.4))                              VORLAX    1557
      C                                                                 VORLAX    1558
      C...                                                              VORLAX    1559
      C...                                                              VORLAX    1560
            INVERS = 0                                                  VORLAX    1561
            KED = 0                                                     VORLAX    1562
            KEG = 0                                                     VORLAX    1563
            KEGR = 0                                                    VORLAX    1564
      C...                                                              VORLAX    1565
      C...THE DO-LOOP ENDED BY LABEL 365 READS IN THE COMPLETE DEFINITION VORLAX  1566
      C...OF EACH MAJOR PANEL MAKING UP THE CONFIGURATION, THERE BEING  VORLAX    1567
      C...NPAN SUCH PANELS.                                             VORLAX    1568
      C...                                                              VORLAX    1569
      C...                                                              VORLAX    1570
            DO 390 I = 1, NPAN                                          VORLAX    1571
            WRITE (6, 70 ) I                                            VORLAX    1572
         70 FORMAT (1H0, 10H**********, I3, 11H **********)             VORLAX    1573
         80 FORMAT (1H , 8F10.4)                                        VORLAX    1574
      C...                                                              VORLAX    1575
      C...DEFINE STREAMWISE EDGES (2) OF PANEL BY SPECIFYING COORDINATES VORLAX   1576
      C...OF LEADING EDGES (X1, Y1, Z1, X2, Y2, Z2) AND CHORD LENGTHS   VORLAX    1577
      C...(CORD1, CORD2). CHORD LENGTHS ARE MEASURED PARALLEL TO X-AXIS. VORLAX   1578
      C...DESCRP IS ANY PANEL IDENTIFICATION LABEL.                     VORLAX    1579
      C...                                                              VORLAX    1580
            READ (5, 100) X1, Y1, Z1, CORD1, DESCRP                     VORLAX    1581
      C                                                                 VORLAX    1582
      C...SAVE PANEL DESCRIPTION INFORMATION FOR IDENTIFICATION IN      VORLAX    1583
      C...PRINTOUT OF DATA IN SUBROUTINE PRINT.                         VORLAX    1584
      C                                                                 VORLAX    1585
            ISTART = (I - 1) *10                                        VORLAX    1586
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            DO 90 IL = 1, 10                                                  VORLAX  1587
            IM = ISTART + IL                                                  VORLAX  1588
            HEAD (IM) = DESCRP (IL)                                           VORLAX  1589
   90       CONTINUE                                                          VORLAX  1590
      C                                                                       VORLAX  1591
            WRITE (6, 110) X1, Y1, Z1, CORD1, DESCRP                          VORLAX  1592
            READ (5, 100) X2, Y2, Z2, CORD2, DESCRP                           VORLAX  1593
            WRITE (6, 110) X2, Y2, Z2, CORD2, DESCRP                          VORLAX  1594
      C...                                                                    VORLAX  1595
      C...DEFINE PANEL VORTEX LATTICE DENSITY BY SPECIFYING SPANWISE          VORLAX  1596
      C...(NVOR) AND CHORDWISE (RNCV) NUMBERS OF HORSFSHOE VORTICES.          VORLAX  1597
      C...ALSO SPECIFY LEADING EDGE SUCTION CHARACTERISTICS FOR PANEL         VORLAX  1598
      C...(SPC) AND PANEL LATERAL (OR SPANWISE) CURVATURE (OR SHAPE)          VORLAX  1599
      C...CHARACTERISTIC (PDL).                                               VORLAX  1600
      C...                                                                    VORLAX  1601
            READ (5, 100) NVOR (I), RNCV (I), SPC (I), PDL (I), DESCRP        VORLAX  1602
            WRITE (6, 110) NVOR (I), RNCV (I), SPC (I), PDL (I), DESCRP       VORLAX  1603
      C...                                                                    VORLAX  1604
      C...                                                                    VORLAX  1605
      C...PARAMETER INTRAC INDICATES WHETHER PANEL IS STRAIGHT IN THE         VORLAX  1606
      C...LATERAL (OR SPANWISE) DIRECTION (INTRAC = 0), OR CURVED             VORLAX  1607
      C...(POLYGONALLY SEGMENTED) IN SAME DIRECTION (INTRAC = 1).             VORLAX  1608
      C...                                                                    VORLAX  1609
      C...                                                                    VORLAX  1610
            INTRAC (I) = 1                                                    VORLAX  1611
            IF (PDL (I) .EQ. 0.0) INTRAC (I) = 0                              VORLAX  1612
  100       FORMAT (4F10.0, 10A4)                                             VORLAX  1613
  110       FORMAT (1H , 4F10.4, 10A4)                                        VORLAX  1614
            XAPEX (I) = X1                                                    VORLAX  1615
            YAPEX (I) = Y1                                                    VORLAX  1616
            ZAPEX (I) = Z1                                                    VORLAX  1617
            CSTART (I) = CORD1                                                VORLAX  1618
            DELTAY = Y2 - Y1                                                  VORLAX  1619
            DELTAZ = Z2 - Z1                                                  VORLAX  1620
      C...                                                                    VORLAX  1621
      C...IF PANEL IS LATERALLY FLAT (INTRAC = 0) THEN MAKE PDL EQUAL         VORLAX  1622
      C...TO PANEL DIHEDRAL AND COMPUTE PANEL SPAN (PSPAN) AND LEADING        VORLAX  1623
      C...EDGE SWEEP.                                                         VORLAX  1624
      C...                                                                    VORLAX  1625
      C...                                                                    VORLAX  1626
      C...                                                                    VORLAX  1627
            IF (INTRAC (I) .EQ. 0) PDL (I) = 1. /DTR *ATAN2 (DELTAZ, DELTAY)  VORLAX  1628
            IF (INTRAC (I) .EQ. 0) PSPAN (I) = SQRT (DELTAY **2 + DELTAZ **2) VORLAX  1629
            DELTAX = X2 - X1                                                  VORLAX  1630
            IF(INTRAC (I) .EQ. 0) LESWP (I) = 1./DTR*ATAN2 (DELTAX, PSPAN(I)) VORLAX  1631
            TAPER (I) = CORD2 /CORD1                                          VORLAX  1632
      C...                                                                    VORLAX  1633
      C...                                                                    VORLAX  1634
      C...IF PANEL IS LATERALLY CURVED OR SEGMENTED (INTRAC = 1) THEN         VORLAX  1635
      C...DETERMINE THE VALUE OF LATERAL (OR SPANWISE) INDEX (EQUIVALENT      VORLAX  1636
      C...TO SX. SEE SUBROUTINE GEOM) OF ITS FIRST STREAMWISE STRIP OR        VORLAX  1637
      C...ROW OF VORTICES, IBOT.                                              VORLAX  1638
      C...                                                                    VORLAX  1639
      C...                                                                    VORLAX  1640
            IF ( INTRAC (I) .EQ. 0) GO TO 150                                 VORLAX  1641
            NV = NVOR (I)                                                     VORLAX  1642
            IBOT = 1                                                          VORLAX  1643
```

```
      IF (I .EQ. 1) GO TO 130                                           VORLAX  1644
      ITOP = I - 1                                                      VORLAX  1645
      DO 120 J = 1, ITOP                                                VORLAX  1646
      INV = NVOR (J)                                                    VORLAX  1647
      IBOT = IBOT + INV                                                 VORLAX  1648
 120  CONTINUE                                                          VORLAX  1649
C...                                                                    VORLAX  1650
C...                                                                    VORLAX  1651
C...READ IN POLAR COORDINATES OF CONTROL SURFACE CYLINDER CROSS         VORLAX  1652
C...SECTION, OR AUXILIARY BODY MASTER CROSS-SECTION. ONLY               VORLAX  1653
C...APPLICABLE IF INTRAC = 1.                                           VORLAX  1654
C...                                                                    VORLAX  1655
C...                                                                    VORLAX  1656
 130  ITOP = IBOT + NV - 1                                              VORLAX  1657
      JJTOP = NVOR (I) + 1                                              VORLAX  1658
      READ (5, 50) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                   VORLAX  1659
      WRITE (6, 60) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                  VORLAX  1660
      PSPAN (I) = 0.0                                                   VORLAX  1661
C...                                                                    VORLAX  1662
C...                                                                    VORLAX  1663
C...COMPUTE CROSS-SECTIONAL PARAMETERS OF CONTROL SURFACE CYLINDER      VORLAX  1664
C...OR AUXILIARY BODY.                                                  VORLAX  1665
C...                                                                    VORLAX  1666
C...                                                                    VORLAX  1667
      DO 140 IR = IBOT, ITOP                                            VORLAX  1668
      JJ = IR - IBOT + 1                                                VORLAX  1669
      DELTAZ = RO (JJ + 1) *SIN (DTR*PHI(JJ+ 1)) - RO (JJ) *            VORLAX  1670
     * SIN (DTR * PHI (JJ))                                             VORLAX  1671
      DELTAY = RO (JJ + 1) *COS (DTR*PHI(JJ + 1)) - RO (JJ) *           VORLAX  1672
     * COS (DTR * PHI (JJ))                                             VORLAX  1673
      DL (IR) = 1. /DTR *ATAN2 (DELTAZ, DELTAY)                         VORLAX  1674
      DMZ = RO (JJ) * SIN (DTR*PHI (JJ)) + 0.5 * DELTAZ                 VORLAX  1675
      DMY = RO (JJ) * COS (DTR * PHI (JJ)) + 0.5 * DELTAY               VORLAX  1676
      PHIMED (IR) = ATAN2 (DMZ, DMY) /DTR                               VORLAX  1677
      RCS (IR) = SQRT (DMY **2 + DMZ **2)                               VORLAX  1678
      VSS (IR) = 0.5 *SQRT (DELTAY **2 + DELTAZ **2)                    VORLAX  1679
      PSPAN (I) = PSPAN (I) + 2.0 *VSS (IR)                             VORLAX  1680
 140  CONTINUE                                                          VORLAX  1681
C...                                                                    VORLAX  1682
C...                                                                    VORLAX  1683
      LESWP (I) = 1. /DTR *ATAN2 (DELTAX, PSPAN (I))                    VORLAX  1684
C...                                                                    VORLAX  1685
C...                                                                    VORLAX  1686
C...CONTINUE READING IN DATA APPLICABLE TO BOTH INTRAC = 0 AND          VORLAX  1687
C...INTRAC = 1.                                                         VORLAX  1688
C...                                                                    VORLAX  1689
C...                                                                    VORLAX  1690
 150  READ(5,160) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)   VORLAX  1691
C...                                                                    VORLAX  1692
C...MAKE APPROPRIATE INPUT PARAMETERS COMPATIBLE WITH PANEL CHARAC      VORLAX  1693
C...TERISTICS TO PREVENT EXECUTION ERRORS.                              VORLAX  1694
C...                                                                    VORLAX  1695
      IF (INTRAC (I) .EQ. 1 .AND. NAP .LT. 3) NPP (I) = 0               VORLAX  1696
      IF (IQUANT (I) .EQ. 0) IQUANT (I) = 2                             VORLAX  1697
      IF (IQUANT (I) .EQ. 1) LATRAL = 1                                 VORLAX  1698
C...                                                                    VORLAX  1699
      WRITE(6,170) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)  VORLAX  1700
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      C...                                                                VORLAX  1701
       160  FORMAT (2F10.0, 5 (I2, 8X))                                   VORLAX  1702
       170  FORMAT (1H , 2F10.4, 5 (I2, 8X))                              VORLAX  1703
      C...                                                                VORLAX  1704
            SYNTH (I) = ISYNT                                             VORLAX  1705
            MAX = RNCV (I)                                                VORLAX  1706
            ZLE1 (I) = 0.0                                                VORLAX  1707
            ZLE2 (I) = 0.0                                                VORLAX  1708
      C...                                                                VORLAX  1709
      C...CLEAR OUT APPROPIATE SECTION OF ARRAY GAMMA WHICH IS TO BE      VORLAX  1710
      C...USED AS TEMPORARY INPUT DATA STORAGE FOR LATER MANIPULATION     VORLAX  1711
      C...IN SUBROUTINE GEOM.                                             VORLAX  1712
      C...                                                                VORLAX  1713
            DO 180 L1 = 1, MAX                                            VORLAX  1714
            KEG = KEG + 1                                                 VORLAX  1715
            KEG2 = KEG + MAX                                              VORLAX  1716
            GAMMA (KEG) = 0.0                                             VORLAX  1717
            GAMMA (KEG2) = 0.0                                            VORLAX  1718
       180  CONTINUE                                                      VORLAX  1719
      C...                                                                VORLAX  1720
      C...                                                                VORLAX  1721
      C...IF PANEL SURFACE WARP WILL NOT BE DESIGNED (ANALYSIS CASE)      VORLAX  1722
      C...THEN BYPASS READING IN OF LOAD COEFFICIENTS.                    VORLAX  1723
      C...                                                                VORLAX  1724
      C...                                                                VORLAX  1725
            IF (ISYNT .EQ. 0) GO TO 190                                   VORLAX  1726
            READ (5, 50) (C1 (K), K = 1, MAX)                             VORLAX  1727
            WRITE (6, 80) (C1 (K), K = 1, MAX)                            VORLAX  1728
            READ (5, 50) (C2 (K), K = 1, MAX)                             VORLAX  1729
            WRITE (6, 80) (C2 (K), K = 1, MAX)                            VORLAX  1730
      C...                                                                VORLAX  1731
      C...INVERS INDICATES WHETHER THERE IS ONE (OR MORE) PANEL IN THE    VORLAX  1732
      C...CONFIGURATION WHICH IS TO BE DESIGNED IN TERMS OF SURFACE WARP. VORLAX  1733
      C...INVERS = 1 ≤ CAMBER DESIGN REQUIRED FOR ONE OR MORE PANELS.     VORLAX  1734
      C...INVERS = 0 ≤ NO PANEL IS TO BE DESIGNED.                        VORLAX  1735
      C...                                                                VORLAX  1736
            INVERS = 1                                                    VORLAX  1737
            SLE1 (I) = 0.                                                 VORLAX  1738
            SLE2 (I) = 0.                                                 VORLAX  1739
            GO TO 300                                                     VORLAX  1740
      C...                                                                VORLAX  1741
      C...                                                                VORLAX  1742
      C...IF PANEL IS A FLAT PLATE THEN SKIP READING OF PANEL CAMBER      VORLAX  1743
      C...DEFINITION DATA. IF NAP .LT. 3 PANEL IS ASSUMED TO BE FLAT .    VORLAX  1744
      C...                                                                VORLAX  1745
      C...                                                                VORLAX  1746
       190  IF (NAP .LT. 3) GO TO 280                                     VORLAX  1747
      C                                                                   VORLAX  1748
      C...IF PANEL IS EITHER UPPER SURFACE OR LOWER SURFACE OF AN AIRFOIL VORLAX  1749
      C...(ILE .EQ. 1 .OR. ILE .EQ. - 1) THEN THE CORRESPONDING LEADING   VORLAX  1750
      C...EDGE RADII (RLE1, RLE2) HAVE TO BE READ IN.                     VORLAX  1751
      C...                                                                VORLAX  1752
            ILE = ITS (I) *(1 - INTRAC (I))                               VORLAX  1753
            READ (5, 50) (XAF (JJ), JJ = 1, NAP)                          VORLAX  1754
            WRITE (6, 80) (XAF (JJ), JJ = 1, NAP)                         VORLAX  1755
            RLE1 = 0.0                                                    VORLAX  1756
            RLE2 = 0.0                                                    VORLAX  1757
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      IF (ILE .NE. 0)  READ (5, 50) RLE1                                VORLAX  1758
      IF (ILE .NE. 0) WRITE (6, 80) RLE1                                VORLAX  1759
      READ (5, 50) (ZC1 (JJ), JJ = 1, NAP)                              VORLAX  1760
      WRITE (6, 80) (ZC1 (JJ) , JJ = 1, NAP)                            VORLAX  1761
      IF (ILE .NE. 0) READ (5, 50) RLE2                                 VORLAX  1762
      IF (ILE .NE. 0) WRITE (6, 80) RLE2                                VORLAX  1763
      READ (5, 50) (ZC2 (JJ), JJ = 1, NAP)                              VORLAX  1764
      WRITE (6, 80) (ZC2 (JJ), JJ = 1, NAP)                             VORLAX  1765
      ZLE1 (I) = ZC1 (1)                                                VORLAX  1766
      ZLE2 (I) = ZC2 (1)                                                VORLAX  1767
C                                                                       VORLAX  1768
C                                                                       VORLAX  1769
      JC = 2                                                            VORLAX  1770
      MAXIM = MAX + 1                                                   VORLAX  1771
C...                                                                    VORLAX  1772
C...THE DO-LOOP ENDED BY LABEL 270 COMPUTES THE SLOPE OF THE            VORLAX  1773
C...SURFACE AT THE CORRESPONDING CONTROL POINTS ALONG THE               VORLAX  1774
C...STREAMWISE EDGES OF THE PANEL. THESE SLOPES ARE STORED IN           VORLAX  1775
C...ARRAYS DNDX1 (EDGE 1) AND DNDX2 (EDGE 2). THE SLOPE COMPUTATION     VORLAX  1776
C...IS DONE BY USING 3-POINT LAGRANGE POLYNOMIALS. IF ILE .NE. 0        VORLAX  1777
C...THEN SQUARE ROOT TYPE LAGRANGE POLYNOMIAL IS USED FOR THE           VORLAX  1778
C...COMPUTATION OF SLOPE NEAR THE LEADING EDGE.                         VORLAX  1779
C...                                                                    VORLAX  1780
      DO 270 JJX = 1, MAXIM                                             VORLAX  1781
      JX = JJX - 1                                                      VORLAX  1782
      IF (LAX .EQ. 1) GO TO 200                                         VORLAX  1783
      XX = (1. - COS (PI *FLOAT (JX) /RNCV (I))) *50.0                  VORLAX  1784
      GO TO 210                                                         VORLAX  1785
  200 XX = (FLOAT (JX) - 0.25) /RNCV (I) *100.0                         VORLAX  1786
      IF (XX .LT. 0.) XX = 0.                                           VORLAX  1787
  210 IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC)) GO TO 220        VORLAX  1788
      IF (JC .EQ. (NAP - 1)) GO TO 220                                  VORLAX  1789
      JC = JC + 1                                                       VORLAX  1790
      GO TO 210                                                         VORLAX  1791
  220 XX1 = XAF (JC - 1)                                                VORLAX  1792
      XX2 = XAF (JC)                                                    VORLAX  1793
      XX3 = XAF (JC + 1)                                                VORLAX  1794
      D1 = (XX1 - XX2) *(XX1 - XX3)                                     VORLAX  1795
      D2 = (XX2  - XX3) *(XX2 - XX1)                                    VORLAX  1796
      D3 = (XX3 - XX1) *(XX3 - XX2)                                     VORLAX  1797
      P1 = (XX2 + XX3) /D1                                              VORLAX  1798
      P2 = (XX3 + XX1) /D2                                              VORLAX  1799
      P3 = (XX1 + XX2) /D3                                              VORLAX  1800
      VI1 = ZC1 (JC - 1)                                                VORLAX  1801
      VI2 = ZC1 (JC)                                                    VORLAX  1802
      VI3 = ZC1 (JC + 1)                                                VORLAX  1803
      VO1 = ZC2 (JC - 1)                                                VORLAX  1804
      VO2 = ZC2 (JC)                                                    VORLAX  1805
      VO3 = ZC2 (JC + 1)                                                VORLAX  1806
      IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 240                          VORLAX  1807
      IF (XX .LE. 0.0) GO TO 230                                        VORLAX  1808
C                                                                       VORLAX  1809
      SIGN1 = 1.0                                                       VORLAX  1810
      SIGN2 = 1.0                                                       VORLAX  1811
      IF (VI2 .LT. VI1) SIGN1 = -1.0                                    VORLAX  1812
      IF (VO2 .LT. VO1) SIGN2 = -1.0                                    VORLAX  1813
      BIAO = SIGN1 *SQRT (2.0 *RLE1)                                    VORLAX  1814
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      B2A0 = SIGN2 *SQRT (2.0 *RLE2)                                    VORLAX  1815
      B1C2 = VI2 - B1A0 *SQRT (XX2) - VI1                               VORLAX  1816
      B2C2 = V02 - B2A0 *SQRT (XX2) - V01                               VORLAX  1817
      B1C3 = VI3 - B1A0 *SQRT (XX3) - VI1                               VORLAX  1818
      B2C3 = V03 - B2A0 *SQRT (XX3) - V01                               VORLAX  1819
      B1A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX  1820
      B2A1 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX  1821
      B1A2 = (B1C2 /XX2 - B1C3 /XX3) /(XX2 - XX3)                       VORLAX  1822
      B2A2 = (B2C2 /XX2 - B2C3 /XX3) /(XX2 - XX3)                       VORLAX  1823
      C1VAL = 0.5 *B1A0 /SQRT (XX) + B1A1 + 2. *B1A2 *XX                VORLAX  1824
      C2VAL = 0.5 *B2A0 /SQRT (XX) + B2A1 + 2. *B2A2 *XX                VORLAX  1825
C                                                                       VORLAX  1826
      GO TO 250                                                         VORLAX  1827
  230 C1VAL = 0.0                                                       VORLAX  1828
      C2VAL = 0.0                                                       VORLAX  1829
      GO TO 250                                                         VORLAX  1830
  240 C1VAL = 2.0*(VI1/D1+VI2/D2+VI3/D3)*XX-P1*VI1-P2*VI2-P3*VI3        VORLAX  1831
      C2A = V01 /D1 + V02 /D2 + V03 /D3                                 VORLAX  1832
      C2B = P1 *V01 + P2 *V02 + P3 *V03                                 VORLAX  1833
      C2VAL = 2.0 *C2A *XX - C2B                                        VORLAX  1834
      IF (INTRAC (I) .EQ. 0) GO TO 250                                  VORLAX  1835
      C2C = V01 *XX2 *XX3/D1 + V02 *XX3 *XX1/D2 + V03 *XX1 *XX2/D3      VORLAX  1836
      FTEMP = C2A *XX **2 - C2B *XX + C2C                               VORLAX  1837
      IF (FTEMP .GT. 0.0) C2VAL = 5.0 *C2VAL /SQRT (FTEMP)              VORLAX  1838
      IF (FTEMP .LE. 0.0) C2VAL = -100.                                 VORLAX  1839
  250 IF (JJX .GT. 1) GO TO 260                                         VORLAX  1840
      SLE1 (I) = C1VAL                                                  VORLAX  1841
      SLE2 (I) = C2VAL                                                  VORLAX  1842
      GO TO 270                                                         VORLAX  1843
  260 C1 (JX) = C1VAL                                                   VORLAX  1844
      C2 (JX) = C2VAL                                                   VORLAX  1845
  270 CONTINUE                                                          VORLAX  1846
      GO TO 300                                                         VORLAX  1847
C...                                                                    VORLAX  1848
C...                                                                    VORLAX  1849
C...FOR FLAT PLATE PANEL MAKE SLOPES EQUAL TO ZERO.                      VORLAX  1850
C...                                                                    VORLAX  1851
C...                                                                    VORLAX  1852
  280 DO 290 K = 1, MAX                                                 VORLAX  1853
      C1 (K) = 0.0                                                      VORLAX  1854
      C2 (K) = 0.0                                                      VORLAX  1855
  290 CONTINUE                                                          VORLAX  1856
      SLE1 (I) = 0.                                                     VORLAX  1857
      SLE2 (I) = 0.                                                     VORLAX  1858
C...                                                                    VORLAX  1859
C...                                                                    VORLAX  1860
C...STORE SLOPES OR LOAD COEFFICIENTS (AS CASE MAY BE) IN ARRAYS        VORLAX  1861
C...DNDX1 AND DNDX2.                                                    VORLAX  1862
C...                                                                    VORLAX  1863
C...                                                                    VORLAX  1864
  300 DO 310 K = 1, MAX                                                 VORLAX  1865
      KED = KED + 1                                                     VORLAX  1866
      DNDX1 (KED) = C1 (K)                                              VORLAX  1867
      DNDX2 (KED) = C2 (K)                                              VORLAX  1868
  310 CONTINUE                                                          VORLAX  1869
C...                                                                    VORLAX  1870
C...                                                                    VORLAX  1871
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C...IF VORTEX LATTICE IS TO BE LAID OUT ON BODY SURFACE RATHER          VORLAX 1872
C...THAN ON SOME CYLINDRICAL CONTROL SURFACE (NON = 1), THEN THE        VORLAX 1873
C...PROFILE OF THIS SURFACE AT THE PANEL EDGES IS COMPUTED IN THE       VORLAX 1874
C...DO-LOOP ENDED BY LABEL 370. THE RESULTS ARE STORED IN THE ARRAY     VORLAX 1875
C...GAMMA FOR USE IN SUBROUTINE GEOM. FOR FUSIFORM BODIES, BODY         VORLAX 1876
C...SURFACE IMPLIES AUXILIARY BODY SURFACE.                             VORLAX 1877
C...                                                                    VORLAX 1878
      NON = 1                                                           VORLAX 1879
      IF (NPP (I) .EQ. 0) NON = 0                                       VORLAX 1880
      IF (NAP .LT. 3) NON = 0                                           VORLAX 1881
      IF (ISYNT .EQ. 1) NON = 0                                         VORLAX 1882
      IF (NON .EQ. 0) GO TO 380                                         VORLAX 1883
C...                                                                    VORLAX 1884
C...                                                                    VORLAX 1885
      JC = 2                                                            VORLAX 1886
C...                                                                    VORLAX 1887
      DO 370 JX = 1, MAX                                                VORLAX 1888
      KEGR = KEGR + 1                                                   VORLAX 1889
      RJX = JX                                                          VORLAX 1890
      IF (LAX .EQ. 1) GO TO 320                                         VORLAX 1891
      XX = (1.0 - COS ((RJX - 0.5) *PI /RNCV (I))) *50.0                VORLAX 1892
      GO TO 330                                                         VORLAX 1893
  320 XX = (RJX - 0.75) /RNCV (I) *100.0                                VORLAX 1894
  330 IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC))  GO TO 340       VORLAX 1895
      IF (JC .EQ. (NAP - 1)) GO TO 340                                  VORLAX 1896
      JC = JC + 1                                                       VORLAX 1897
      GO TO 330                                                         VORLAX 1898
  340 XX1 = XAF (JC - 1)                                                VORLAX 1899
      XX2 = XAF (JC)                                                    VORLAX 1900
      XX3 = XAF (JC + 1)                                                VORLAX 1901
      D1 = (XX1 - XX2) *(XX1 - XX3)                                     VORLAX 1902
      D2 = (XX2 - XX3) *(XX2 - XX1)                                     VORLAX 1903
      D3 = (XX3 - XX1) *(XX3 - XX2)                                     VORLAX 1904
      P1 = (XX2 + XX3) /D1                                              VORLAX 1905
      P2 = (XX3 + XX1) /D2                                              VORLAX 1906
      P3 = (XX1 + XX2) /D3                                              VORLAX 1907
      F1 = ZC1 (JC - 1)                                                 VORLAX 1908
      F2 = ZC1 (JC)                                                     VORLAX 1909
      F3 = ZC1 (JC + 1)                                                 VORLAX 1910
      FF1 = ZC2 (JC - 1)                                                VORLAX 1911
      FF2 = ZC2 (JC)                                                    VORLAX 1912
      FF3 = ZC2 (JC + 1)                                                VORLAX 1913
      C1A = F1 /D1 + F2 /D2 + F3 /D3                                    VORLAX 1914
      C1B = F1 *P1 + F2 *P2 + F3 *P3                                    VORLAX 1915
      C1C = F1 *XX2 *XX3 /D1 + F2 *XX3 *XX1 /D2 + F3 *XX1 *XX2 /D3      VORLAX 1916
      C2A = FF1 /D1 + FF2 /D2 + FF3 /D3                                 VORLAX 1917
      C2B = FF1 *P1 + FF2 *P2 + FF3 *P3                                 VORLAX 1918
      C2C = FF1 *XX2 *XX3 /D1 + FF2 *XX3 *XX1 /D2 + FF3 *XX1 *XX2 /D3   VORLAX 1919
      IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 350                          VORLAX 1920
      B1A0 = SQRT (2.0 *RLE1)                                           VORLAX 1921
      B2A0 = SQRT (2.0 *RLE2)                                           VORLAX 1922
      B1C2 = F2 - B1A0 *SQRT (XX2) - F1                                 VORLAX 1923
      B2C2 = FF2 - B2A0 *SQRT (XX2) - FF1                               VORLAX 1924
      B1C3 = F3 - B1A0 *SQRT (XX3) - F1                                 VORLAX 1925
      B2C3 = FF3 - B2A0 *SQRT (XX3) - FF1                               VORLAX 1926
      B1A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX 1927
      B2A1 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX 1928
```

```
            B1A2 = (B1C2 /XX2 - B1C3 /XX3) /(XX2 - XX3)                       VORLAX    1929
            B2A2 = (B2C2 /XX2 - B2C3 /XX3) /(XX2 - XX3)                       VORLAX    1930
            C1VAL = F1 + B1A0 *SQRT (XX) + B1A1 *XX + B1A2 *XX **2            VORLAX    1931
            C2VAL = FF1 + B2A0 *SQRT (XX) + B2A1 *XX + B2A2 *XX **2           VORLAX    1932
            GO TO 360                                                         VORLAX    1933
        350 C1VAL = C1A *XX **2 - C1B *XX + C1C                               VORLAX    1934
            C2VAL = C2A *XX **2 - C2B *XX + C2C                               VORLAX    1935
        360 KEGR2 = KEGR + MAX                                                VORLAX    1936
            GAMMA (KEGR) = C1VAL                                              VORLAX    1937
            GAMMA (KEGR2) = C2VAL                                             VORLAX    1938
        370 CONTINUE                                                          VORLAX    1939
      C...                                                                    VORLAX    1940
      C...                                                                    VORLAX    1941
      C...INDICES KEG AND KEGR DETERMINE LOCATION WITHIN GAMMA OF             VORLAX    1942
      C...CORRESPONDING PROFILE OR BODY GEOMETRY DATA.                        VORLAX    1943
      C...                                                                    VORLAX    1944
      C...ADJUST VALUES OF KEG AND KEGR.                                      VORLAX    1945
      C...                                                                    VORLAX    1946
        380 KEG = KEG + MAX                                                   VORLAX    1947
            KEGR = KEG                                                        VORLAX    1948
        390 CONTINUE                                                          VORLAX    1949
      C...                                                                    VORLAX    1950
      C...END OF PANEL GEOMETRY DEFINITION.                                   VORLAX    1951
      C...                                                                    VORLAX    1952
      C...                                                                    VORLAX    1953
      C...                                                                    VORLAX    1954
      C...READ IN FLOW FIELD SURVEY INFORMATION, IF ANY.                      VORLAX    1955
      C...                                                                    VORLAX    1956
            READ (5, 400) NXS, NYS, NZS                                       VORLAX    1957
            WRITE (6, 410) NXS, NYS, NZS                                      VORLAX    1958
        400 FORMAT (3 (I2, 8X))                                               VORLAX    1959
        410 FORMAT (1H0 , 3 (I2, 8X))                                         VORLAX    1960
            IF (NXS .GT. 0) READ (5, 50) (XS (I), I = 1, NXS)                 VORLAX    1961
            IF (NXS .GT. 0) WRITE (6, 80) (XS (I), I = 1, NXS)                VORLAX    1962
            IF (NXS .GT. 0) READ (5, 50) YNOT, DELTAY, ZNOT, DELTAZ           VORLAX    1963
            IF (NXS .GT. 0) WRITE (6, 80) YNOT, DELTAY, ZNOT, DELTAZ          VORLAX    1964
            WRITE (6, 420)                                                    VORLAX    1965
        420 FORMAT (1H0, 39H********* END OF INPUT DECK ********** )          VORLAX    1966
      C                                                                       VORLAX    1967
      C                                                                       VORLAX    1968
            RETURN                                                            VORLAX    1969
            END                                                               VORLAX    1970
```

```
      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     1   INPUT

 VARIABLES       SN   TYPE            RELOCATION
  1440   AINC1          REAL        ARRAY    SET4          1464   AINC2       REAL        ARRAY     SET4
    20   ALFA           REAL                 SET11          334   ALOC        REAL        ARRAY     SET6
    10   ALPHA          REAL        ARRAY    SET11            1   BETA        REAL                  SET15
     0   BIG            REAL                 SET13         2142   B1A0        REAL
```

```
VARIABLES     SN  TYPE            RELOCATION
 2150  B1A1       REAL                                 2152  B1A2       REAL
 2144  B1C2       REAL                                 2146  B1C3       REAL
    0  B2         REAL                SET15            2143  B2A0       REAL
 2151  B2A1       REAL                                 2153  B2A2       REAL
 2145  B2C2       REAL                                 2147  B2C3       REAL
    2  CBAR       REAL                SET15             240  CD         REAL        ARRAY    SET8
    0  CDC        REAL       ARRAY    SET9                1  CDTOT      REAL                 SET12
    0  CHORD      REAL       ARRAY    SET10             170  CL         REAL        ARRAY    SET8
    0  CLTOT      REAL                SET12             310  CM         REAL        ARRAY    SET8
  144  CMTC       REAL       ARRAY    SET17               2  CMTOT      REAL                 SET12
  430  CN         REAL       ARRAY    SET8              144  CNC        REAL        ARRAY    SET9
    6  CNTOT      REAL                SET12            2060  CORD1      REAL
 2067  CORD2      REAL                                  670  CRM        REAL        ARRAY    SET9
    5  CRTOT      REAL                SET12             430  CSTART     REAL        ARRAY    SET5
    0  CSUC       REAL       ARRAY    SET17               0  CX         INTEGER     ARRAY    SET3
  550  CY         REAL       ARRAY    SET8             1010  CYM        REAL        ARRAY    SET8
    4  CYTOT      REAL                SET12            2176  C1         REAL        ARRAY
 2172  C1A        REAL                                 2173  C1B        REAL
 2174  C1C        REAL                                 2154  C1VAL      REAL
 2260  C2         REAL       ARRAY                     2156  C2A        REAL
 2157  C2B        REAL                                 2160  C2C        REAL
 2155  C2VAL      REAL                                    0  DCP        REAL        ARRAY    SET2
 2070  DELTAX     REAL                                    4  DELTAY     REAL                 SET18
    6  DELTAZ     REAL                SET18            2736  DESCRP     REAL        ARRAY
  144  DL         REAL       ARRAY    SET10            2102  DMY        REAL
 2101  DMZ        REAL                                    0  DNDX1      REAL        ARRAY    SET4
  620  DNDX2      REAL       ARRAY    SET4               50  DRAG       REAL        ARRAY    SET8
 2050  DTR        REAL                                 2124  D1         REAL
 2125  D2         REAL                                 2126  D3         REAL
    3  EPS        REAL                SET13            2167  FF1        REAL
 2170  FF2        REAL                                 2171  FF3        REAL
   12  FLOATX     REAL                / /                13  FLOATY     REAL                 / /
  360  FN         REAL       ARRAY    SET8             2161  FTEMP      REAL
  500  FY         REAL       ARRAY    SET8             2164  F1         REAL
 2165  F2         REAL                                 2166  F3         REAL
    0  GAMMA      REAL       ARRAY    SET16              11  HAG        REAL                 / /
   24  HEAD       REAL       ARRAY    SET6             2051  I          INTEGER
 2072  IBOT       INTEGER                             13560  IDES       INTEGER     ARRAY    SET3
    3  IH         INTEGER             / /              2062  IL         INTEGER
 2111  ILE        INTEGER                              2063  IM         INTEGER
  404  INTRAC     INTEGER    ARRAY    SET20            2075  INV        INTEGER
   14  INVERS     INTEGER             / /              1130  IPAN       INTEGER     ARRAY    SET10
    2  IQ         INTEGER             / /               360  IQUANT     INTEGER     ARRAY    SET5
 2100  IR         INTEGER                                15  ISOLV      INTEGER              / /
 2061  ISTART     INTEGER                              2104  ISYNT      INTEGER
    1  ITER       INTEGER             SET13            2073  ITOP       INTEGER
    2  ITRMAX     INTEGER             SET13             170  ITS        INTEGER     ARRAY    SET7
 2074  J          INTEGER                              2114  JC         INTEGER
 2077  JJ         INTEGER                              2076  JJTOP      INTEGER
 2116  JJX        INTEGER                               214  JTS        INTEGER     ARRAY    SET7
 2117  JX         INTEGER                              2110  K          INTEGER
 2052  KED        INTEGER                              2053  KEG        INTEGER
 2054  KEGR       INTEGER                              2175  KEGR2      INTEGER
 2107  KEG2       INTEGER                                 4  LATRAL     INTEGER              / /
    0  LAX        INTEGER             / /                 1  LAY        INTEGER              / /
  240  LESWP      REAL       ARRAY    SET5                0  LIFT       REAL        ARRAY    SET8
 2106  L1         INTEGER                                 0  MACH       REAL        ARRAY    SET11
```

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        SUBROUTINE INPUT        74/74    OPT=1                                      FTN 4.5+410A        10/04/76  10.15.13        PAGE     12

 VARIABLES      SN  TYPE                 RELOCATION
  2105  MAX           INTEGER                                  2115  MAXIM       INTEGER
   120  MOMENT        REAL          ARRAY     SET8               23  NALPHA      INTEGER                SET11
  2103  NAP           INTEGER                                    22  NMACH       INTEGER                SET11
  2162  NON           INTEGER                                     0  NPAN        INTEGER                SET14
     3  NPANAS        INTEGER                 SET14             360  NPP         INTEGER      ARRAY     SET20
     1  NT            INTEGER                 SET14            2071  NV          INTEGER
   620  NVOR          REAL          ARRAY     SET5                0  NXS         INTEGER                SET18
     1  NYS           INTEGFR                 SET18               2  NZS         INTEGER                SET18
  3720  ONSET         REAL          ARRAY     SET16             170  PDL         REAL         ARRAY     SET5
  2425  PHI           REAL          ARRAY                        50  PHIMED      REAL         ARRAY     SET20
  2047  P1            REAL                                        6  PITCHQ      REAL                   / /
     5  PSI           REAL                    / /               550  PSPAN       REAL         ARRAY     SET5
  2127  P1            REAL                                     2130  P2          REAL
  2131  P3            REAL                                      214  RCS         REAL         ARRAY     SET20
  7640  RFLAG         REAL          ARRAY     SET3             2163  RJX         REAL
  2112  RLE1          REAL                                     2113  RLE2        REAL
     5  RLM           REAL                    SET13             620  RM          REAL         ARRAY     SET8
     0  RNCV          REAL          ARRAY     SET7               24  RNMAX       REAL         ARRAY     SET7
  2342  RO            REAL          ARRAY                         7  ROLLQ       REAL                   / /
  2140  SIGN1         REAL                                     2141  SIGN2       REAL
    50  SLE           REAL          ARRAY     SET19               0  SLE1        REAL         ARRAY     SET19
    24  SLE2          REAL          ARRAY     SET19            3720  SLOPE       REAL         ARRAY     SET2
     2  SMAX          REAL                    SET14             310  SPC         REAL         ARRAY     SET17
     3  SREF          REAL                    SET12            1130  SURF        REAL         ARRAY     SET8
  3720  SX            INTEGER       ARRAY     SET3              310  SYNTH       REAL         ARRAY     SET5
   500  TAPER         REAL          ARRAY     SET5                0  TITLE       INTEGER      ARRAY     SET6
   454  TNL           REAL          ARRAY     SET10             620  TNT         REAL         ARRAY     SET10
    21  VINF          REAL                    SET11            2132  VI1         REAL
  2133  VI2           REAL                                     2134  VI3         REAL
  2135  VO1           REAL                                     2136  VO2         REAL
  2137  VO3           REAL                                     7640  VSP         REAL         ARRAY     SET2
   310  VSS           REAL          ARRAY     SET10           10270  VST         REAL         ARRAY     SET20
     4  WSPAN         REAL                    SET13               0  X           REAL         ARRAY     SET1
  2510  XAF           REAL          ARRAY                         0  XAPEX       REAL         ARRAY     SET5
     3  XBAR          REAL                    SET15               7  XS          REAL         ARRAY     SET18
  1060  XSUC          REAL          ARRAY     SET8              764  XTE         REAL         ARRAY     SET10
  2120  XX            REAL                                     2121  XX1         REAL
  2122  XX2           REAL                                     2123  XX3         REAL
  2055  X1            REAL                                     2064  X2          REAL
  3720  Y             REAL          ARRAY     SET1               50  YAPEX       REAL         ARRAY     SET5
    10  YAWQ          REAL                    / /               740  YM          REAL         ARRAY     SET8
     3  YNOT          REAL                    SET18             430  YY          REAL         ARRAY     SET20
  2056  Y1            REAL                                     2065  Y2          REAL
  4064  Z             REAL          ARRAY     SET1              120  ZAPEX       REAL         ARRAY     SET5
     4  ZBAR          REAL                    SET15            4230  ZC          REAL         ARRAY     SET1
  2572  ZC1           REAL          ARRAY                      2654  ZC2         REAL         ARRAY
   214  ZETA          REAL          ARRAY     SET19               0  ZLE1        REAL         ARRAY     SET20
    24  ZLE2          REAL          ARRAY     SET20               5  ZNOT        REAL                   SET18
  4350  ZZ            REAL          ARRAY     SET20            2057  Z1          REAL
  2066  Z2            REAL

FILE NAMES         MODE
      TAPE5        FMT                     TAPE6      FMT

EXTERNALS           TYPE     ARGS
      ATAN2         REAL       2 LIBRARY                      COS         REAL          1 LIBRARY
      SIN           REAL       1 LIBRARY                      SQRT        REAL          1 LIBRARY
```

```
INLINE FUNCTIONS   TYPE     ARGS
       FLOAT      REAL        1  INTRIN

STATEMENT LABELS
 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                                     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
  66   390     * I          156 534    1222B               EXT REFS  NOT INNER
 101   90        IL         172 175      4B      INSTACK
 205   120       J          231 234      4B      INSTACK
 223           * JJ         244 244     10B                EXT REFS
 237           * JJ         245 245     10B                EXT REFS
 253   140     * IR         253 266     65B                EXT REFS
 420   180       L1         299 304      4B      INSTACK
 544   270     * JJX        366 431    250B                EXT REFS
1017   290       K          438 441      3B      INSTACK
1031   310       K          450 454      4B      INSTACK
1053   370     * JX         473 524    230B                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     77111B    32329
```

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        SUBROUTINE INPUT       74/74    OPT=1                              FTN 4.5+410A        10/04/76  10.15.13        PAGE     14
STATISTICS
  CM BLANK COMMON LENGTH          16B       14
```

```
      CONTROL*VRLX.MAP                                              9/14/76  VORLAX    1971
      C...                                                                   VORLAX    1972
            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 SEQUENCE≤                                       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...           COMMON≤                                                 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 SEQUENCE≤                                       VORLAX    1989
      C...           NONE.                                                   VORLAX    1990
      C...           COMMON≤                                                 VORLAX    1991
      C...           NONE.                                                   VORLAX    1992
      C...           DIRECT PRINT≤                                           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...           EPSLON = 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...           PPIOT = (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 COMPONET). THE PRESSURE RATIOS AND RELATED VORLAX    2019
      C...           FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF ISEN    VORLAX    2020
      C...           TROPIC FLOW RELATIONSHIPS.                              VORLAX    2021
      C                                                                      VORLAX    2022
      C                                                                      VORLAX    2023
      C...                                                                   VORLAX    2024
            DIMENSION EW (ITOTAL), EWX (ITOTAL), EWY (ITOTAL)                VORLAX    2025
            COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,  VORLAX    2026
           * FLOATX                                                          VORLAX    2027
```

```
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                  VORLAX  2028
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)          VORLAX  2029
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA      VORLAX  2030
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                             VORLAX  2031
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                     VORLAX  2032
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)  VORLAX  2033
      INTEGER TITLE                                                      VORLAX  2034
      REAL MACH                                                          VORLAX  2035
C                                                                        VORLAX  2036
      PI = 3.14159                                                       VORLAX  2037
      DTR = 0.01745329                                                   VORLAX  2038
C                                                                        VORLAX  2039
C                                                                        VORLAX  2040
      REWIND 3                                                           VORLAX  2041
      REWIND 4                                                           VORLAX  2042
      REWIND 7                                                           VORLAX  2043
      COSA = COS (ALFA)                                                  VORLAX  2044
      SINA = SIN (ALFA)                                                  VORLAX  2045
      COPSI = COS (DTR * PSI)                                            VORLAX  2046
      SIPSI = SIN (DTR * PSI)                                            VORLAX  2047
C                                                                        VORLAX  2048
C...LINE IS AN OUTPUT LINE COUNTER USED TO DETERMINE WHEN TO SWITCH      VORLAX  2049
C...TO A NEW PRINTOUT PAGE.                                             VORLAX  2050
C                                                                        VORLAX  2051
      LINE = 1                                                           VORLAX  2052
      DO 80 I = 1, NXS                                                   VORLAX  2053
      DO 70 J1 = 1, NZS                                                  VORLAX  2054
      RJ1 = J1                                                           VORLAX  2055
C                                                                        VORLAX  2056
C...COMPUTE COORDINATES IN CROSS-FLOW PLANE, ZK1 AND YK1.                VORLAX  2057
C                                                                        VORLAX  2058
      ZK1 = ZNOT + DELTAZ * (RJ1 - 1.)                                   VORLAX  2059
      DO 70 K1 = 1, NYS                                                  VORLAX  2060
      RK1 = K1                                                           VORLAX  2061
      YK1 = YNOT + DELTAY * (RK1 - 1.)                                   VORLAX  2062
C                                                                        VORLAX  2063
C...READ IN INDUCED VELOCITY COMPONENT INFLUENCE COEFFICIENTS.           VORLAX  2064
C                                                                        VORLAX  2065
      READ (3) EW                                                        VORLAX  2066
      READ (4) EWX                                                       VORLAX  2067
      READ (7) EWY                                                       VORLAX  2068
C                                                                        VORLAX  2069
C...COMPUTE INDUCED VELOCITY COMPONENTS.                                 VORLAX  2070
C                                                                        VORLAX  2071
      IR = 0                                                             VORLAX  2072
      UF = 0.                                                            VORLAX  2073
      VF = 0.                                                            VORLAX  2074
      WF = 0.                                                            VORLAX  2075
      DO 10 K = 1, NT                                                    VORLAX  2076
      MAX = RNMAX (K)                                                    VORLAX  2077
      DO 10 J = 1, MAX                                                   VORLAX  2078
      IR = IR + 1                                                        VORLAX  2079
      UF = UF + GAMMA (IR) *EWX (IR)                                     VORLAX  2080
      VF = VF + GAMMA (IR) *EWY (IR)                                     VORLAX  2081
      WF = WF + GAMMA (IR) *EW (IR)                                      VORLAX  2082
   10 CONTINUE                                                           VORLAX  2083
      VX = COSA *COPSI + UF                                              VORLAX  2084
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      VF = COSA *SIPSI + VF                                             VORLAX   2085
      WF = SINA + WF                                                    VORLAX   2086
C                                                                       VORLAX   2087
C...IF AN INCOMPRESSIBLE CASE IS BEING CONSIDERED (MACH = 0.) THEN       VORLAX   2088
C...THE FLOW IS MADE SLIGHTLY COMPRESSIBLE (MACH = 0.01) TO ALLOW THE    VORLAX   2089
C...USE OF COMPRESSIBLE ISENTROPIC FLOW FORMULAS.                        VORLAX   2090
C                                                                       VORLAX   2091
      XM = 0.01                                                         VORLAX   2092
      IF (MACH (IQ) .GT. XM) XM = MACH (IQ)                             VORLAX   2093
      XM2 = XM **2                                                      VORLAX   2094
      A2 = (1. + .2 *XM2) /(1.2 *XM2)                                   VORLAX   2095
      VR2 = VX **2 + VF **2 + WF **2                                    VORLAX   2096
      VRATIO = VR2 /A2                                                  VORLAX   2097
      VCAL = VRATIO                                                     VORLAX   2098
      IF (VRATIO .GT. 5.5) VRATIO = 5.5                                 VORLAX   2099
C                                                                       VORLAX   2100
C...THE VELOCITIES INDUCED BY THE VORTEX LATTICE MAY BE TOO HIGH DUE     VORLAX   2101
C...TO THE NUMERICAL SINGULARITIES INHERENT TO A LATTICE GEOMETRY. CAL   VORLAX   2102
C...IS A CORRECTION APPLIED TO PREVENT LESS-THAN-VACUUM PRESSURES        VORLAX   2103
C...DUE TO SUCH SINGULARITIES.                                          VORLAX   2104
C                                                                       VORLAX   2105
      CAL = 1.0                                                         VORLAX   2106
      IF (VCAL .GT. 0.0) CAL = SQRT (VRATIO /VCAL)                      VORLAX   2107
      VX = VX *CAL                                                      VORLAX   2108
      VF = VF *CAL                                                      VORLAX   2109
      WF = WF *CAL                                                      VORLAX   2110
      VR2 = VR2 *CAL *CAL                                               VORLAX   2111
      EPSLON = 1. /DTR *ATAN2 (WF, VX)                                  VORLAX   2112
      SIGMA = 1. /DTR *ATAN2 (VF, VX)                                   VORLAX   2113
      RM2 = 2. *VRATIO /(2.4 - .4 *VRATIO)                              VORLAX   2114
      PPTOT = (1.0 - .4 *VRATIO /2.4 ) **3.5                            VORLAX   2115
      PIPT = (1.0 - 0.4 /(2.4 *A2)) **3.5                               VORLAX   2116
      PIF = PPTOT /PIPT                                                 VORLAX   2117
      CP = ((1.0 + 0.2 *XM2 * (1. - VR2)) **3.5 - 1.) /(.7 * XM2)       VORLAX   2118
      IF (XM .LE. 0.1) CP = 1. - VR2                                    VORLAX   2119
      RM = SQRT (RM2)                                                   VORLAX   2120
      IF (LINE .EQ. 1) WRITE (6, 20) TITLE                              VORLAX   2121
   20 FORMAT (1H1 , 20A4)                                               VORLAX   2122
      IF (LINE .EQ. 1) WRITE (6, 30) MACH (IQ), ALPHA (IH)              VORLAX   2123
   30 FORMAT (1H0, 6HMACH =,  F7.3, 6X,7HALPHA =,  F7.3,5H DEG.)        VORLAX   2124
      IF (LINE .EQ. 1) LINE = 3                                         VORLAX   2125
      IF (LINE .EQ. 3) WRITE (6, 40)                                    VORLAX   2126
   40 FORMAT (1H0,40H      X          Y          Z          U           VORLAX   2127
     * 40H       V          W      EPSILON     SIGMA  ,                 VORLAX   2128
     * 40H      CP        MLOC      P/PTOT     P/PINF)                  VORLAX   2129
      IF (LINE .EQ. 3) WRITE (6, 50)                                    VORLAX   2130
   50 FORMAT (1H0 )                                                     VORLAX   2131
      IF (LINE .EQ. 3) LINE = 7                                         VORLAX   2132
      WRITE (6, 60 ) XS (I), YK1, ZK1, VX, VF, WF, EPSLON, SIGMA, CP,   VORLAX   2133
     * RM, PPTOT, PIF                                                   VORLAX   2134
   60 FORMAT (1H1 , 6F10.4, F8.2, F10.2, F12.4, 3F10.4)                 VORLAX   2135
      LINE = LINE + 1                                                   VORLAX   2136
      IF (LINE .GT. 45) LINE = 1                                        VORLAX   2137
   70 CONTINUE                                                          VORLAX   2138
      WRITE (6, 50)                                                     VORLAX   2139
      IF (LINE .NE. 1) LINE = LINE + 2                                  VORLAX   2140
   80 CONTINUE                                                          VORLAX   2141
```

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        SUBROUTINE MAP         74/74    OPT=1                         FTN 4.5+410A       10/04/76  10.15.13         PAGE      4

                          REWIND 3                                                                    VORLAX    2142
                          REWIND 4                                                                    VORLAX    2143
                          REWIND 7                                                                    VORLAX    2144
    175                   RETURN                                                                      VORLAX    2145
                          END                                                                         VORLAX    2146


        SYMBOLIC REFERENCE MAP (R=1)

  ENTRY POINTS
      3  MAP

  VARIABLES      SN  TYPE            RELOCATION
     20  ALFA        REAL                 SET11            334  ALOC     REAL          ARRAY    SET6
     10  ALPHA       REAL        ARRAY    SET11            502  A2       REAL
    506  CAL         REAL                                  456  COPSI    REAL
    454  COSA        REAL                                  515  CP       REAL
      4  DELTAY      REAL                 SET18              6  DELTAZ   REAL                   SET18
    453  DTR         REAL                                  507  EPSLON   REAL
      0  EW          REAL        ARRAY     F.P.              0  EWX      REAL          ARRAY     F.P.
      0  EWY         REAL        ARRAY     F.P.             12  FLOATX   REAL                   / /
      0  GAMMA       REAL        ARRAY    SET16             11  HAG      REAL                   / /
     24  HEAD        REAL        ARRAY    SET6             461  I        INTEGER
      3  IH          INTEGER              / /                2  IQ       INTEGER                / /
    470  IR          INTEGER                                 0  ITOTAL   INTEGER                 F.P.
    170  ITS         INTEGER     ARRAY    SET7             476  J        INTEGER
    214  JTS         INTEGER     ARRAY    SET7             462  J1       INTEGER
    474  K           INTEGER                               465  K1       INTEGER
      4  LATRAL      INTEGER              / /                0  LAX      INTEGER                / /
      1  LAY         INTEGER              / /              460  LINE     INTEGER
      0  MACH        REAL        ARRAY    SET11            475  MAX      INTEGER
     23  NALPHA      INTEGER              SET11             22  NMACH    INTEGER                SET11
      0  NPAN        INTEGER              SET14              3  NPANAS   INTEGER                SET14
      1  NT          INTEGER              SET14              0  NXS      INTEGER                SET18
      1  NYS         INTEGER              SET18              2  NZS      INTEGER                SET18
   3720  ONSET       REAL        ARRAY    SET16            452  PI       REAL
    514  PIF         REAL                                  513  PIPT     REAL
      6  PITCHQ      REAL                 / /              512  PPTOT    REAL
      5  PSI         REAL                 / /              463  RJ1      REAL
    466  RK1         REAL                                  516  RM       REAL
    511  RM2         REAL                                    0  RNCV     REAL          ARRAY    SET7
     24  RNMAX       REAL        ARRAY    SET7               7  ROLLQ    REAL                   / /
    510  SIGMA       REAL                                  455  SINA     REAL
    457  SIPSI       REAL                                    2  SMAX     REAL                   SET14
      0  TITLE       INTEGER     ARRAY    SET6             471  UF       REAL
    505  VCAL        REAL                                  472  VF       REAL
     21  VINF        REAL                 SET11            504  VRATIO   REAL
    503  VR2         REAL                                  477  VX       REAL
    473  WF          REAL                                  500  XM       REAL
    501  XM2         REAL                                    7  XS       REAL          ARRAY    SET18
     10  YAWQ        REAL                 / /              467  YK1      REAL
      3  YNOT        REAL                 SET18            464  ZK1      REAL
      5  ZNOT        REAL                 SET18
```

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      SUBROUTINE MAP         74/74   OPT=1                              FTN 4.5+410A        10/04/76  10.15.13        PAGE

FILE NAMES          MODE
      TAPE3       UNFMT                   TAPE4      UNFMT                 TAPE6      FMT                  TAPE7      UNFMT

EXTERNALS            TYPE    ARGS
      ATAN2       REAL        2 LIBRARY                          COS        REAL         1 LIBRARY
      SIN         REAL        1 LIBRARY                          SQRT       REAL         1 LIBRARY

STATEMENT LABELS
    0  10                                     336  20       FMT                          345  30       FMT
  356  40        FMT                          400  50       FMT                          421  60       FMT
    0  70                                       0  80

LOOPS  LABEL     INDEX       FROM-TO     LENGTH     PROPERTIES
   40  80      * I            83 171      245B                EXT REFS  NOT INNER
   41  70      * J1           84 168      234B                EXT REFS  NOT INNER
   47  70      * K1           90 168      224B                EXT REFS  NOT INNER
   77  10      * K           106 113       23B                NOT INNER
  107  10        J           108 113        7B       INSTACK

COMMON BLOCKS    LENGTH
      / /           11
      SET6        2220
      SET7         240
      SET11         20
      SET14          4
      SET16       4000
      SET18         27

STATISTICS
  PROGRAM LENGTH               534B       348
  CM LABELED COMMON LENGTH   14557B      6511
  CM BLANK COMMON LENGTH        13B        11
```

```
CONTROL*VRLX.MATRX                                                    9/16/76  VORLAX    2147
C...                                                                           VORLAX    2148
      SUBROUTINE MATRX (EW, EU, ITOTAL)                                        VORLAX    2149
C....                                                                          VORLAX    2150
C...PURPOSE    TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI            VORLAX    2151
C...           CESS (1) THE NORMALWASH AT THE CONTROL POINTS                   VORLAX    2152
C...           (EW / UNIT 1), (2) THE AXIALWASH AT THE CONTROL POINTS          VORLAX    2153
C...           (EU / UNIT 2), AND (3) THE NORMALWASH AT THE LEAD. EDGE         VORLAX    2154
C...           (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED             VORLAX    2155
C...           VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE             VORLAX    2156
C...           LATTICE.                                                        VORLAX    2157
C...                                                                           VORLAX    2158
C...INPUT      CALLING SEQUENCES                                               VORLAX    2159
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.                    VORLAX    2160
C...           COMMONS                                                         VORLAX    2161
C...           X, B2, CX, DL, NT, SX, YY, ZZ, HAG, LAX, NPP, PSI, TNT,         VORLAX    2162
C...           VSP, VST, XTE, ALFA, IPAN, XBAR, ZBAR, CHORD, RFLAG,            VORLAX    2163
C...           RNMAX, SLOPE, FLOATX, FLOATY, INVERS, LATRAL.                   VORLAX    2164
C...                                                                           VORLAX    2165
C...OUTPUT     CALLING SEQUENCES                                               VORLAX    2166
C...           EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY             VORLAX    2167
C...                ROW IN UNIT 1).                                            VORLAX    2168
C...           EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY              VORLAX    2169
C...                ROW IN UNIT 9).                                            VORLAX    2170
C...           EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2).            VORLAX    2171
C...           COMMONS                                                         VORLAX    2172
C...           NONE.                                                           VORLAX    2173
C...                                                                           VORLAX    2174
C...SUBROUTINES                                                                VORLAX    2175
C...CALLED     WASH, UXVEL.                                                    VORLAX    2176
C...                                                                           VORLAX    2177
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES              VORLAX    2178
C...           ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY           VORLAX    2179
C...           INDUCED AT THE (K1,J1) CONTROL POINT BY THE (K,J)               VORLAX    2180
C...           HORSESHOE VORTEX OF UNIT STRENGTH. IF K = K1 AND                VORLAX    2181
C...           J = J1 (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF              VORLAX    2182
C...           THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF            VORLAX    2183
C...           THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL           VORLAX    2184
C...           POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE                VORLAX    2185
C...           INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION           VORLAX    2186
C...           IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.                 VORLAX    2187
C...                                                                           VORLAX    2188
C...                                                                           VORLAX    2189
      DIMENSION EW (ITOTAL), EU (ITOTAL)                                       VORLAX    2190
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,          VORLAX    2191
     * FLOATX, FLOATY, INVERS, ISOLV                                           VORLAX    2192
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                        VORLAX    2193
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                       VORLAX    2194
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)            VORLAX    2195
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)                VORLAX    2196
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),              VORLAX    2197
     * TNT (100), XTE (100), IPAN (100)                                        VORLAX    2198
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA            VORLAX    2199
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                                   VORLAX    2200
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                                VORLAX    2201
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),            VORLAX    2202
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)                   VORLAX    2203
```

```
      INTEGER CX, SX , FLAG                                             VORLAX   2204
C                                                                       VORLAX   2205
      PI = 3.14159                                                      VORLAX   2206
      DTR = 0.01745329                                                  VORLAX   2207
C                                                                       VORLAX   2208
C                                                                       VORLAX   2209
      REWIND 1                                                          VORLAX   2210
      REWIND 2                                                          VORLAX   2211
      REWIND 9                                                          VORLAX   2212
      FLAX = LAX                                                        VORLAX   2213
      FAL = FLOATX *ALFA                                                VORLAX   2214
      FBL = FLOATY *PSI * DTR                                           VORLAX   2215
      MM = 0                                                            VORLAX   2216
      IF (FAL .NE. 0.0 .OR. FBL .NE. 0.0) MM = 1                        VORLAX   2217
      SI2A = SIN  (2.0 *ALFA)                                           VORLAX   2218
      CO2A = COS (2.0 *ALFA)                                            VORLAX   2219
      HIM = HAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)                   VORLAX   2220
      XIMO = 2.0 *HIM *SIN (ALFA)                                       VORLAX   2221
      ZIMO = - 2.0 *HIM *COS (ALFA)                                     VORLAX   2222
      TAN2A = SI2A /CO2A                                                VORLAX   2223
C                                                                       VORLAX   2224
C                                                                       VORLAX   2225
C...THERE ARE TWO MAJOR DOUBLE DO-LOOPS THAT GENERATE THE COEFFICIENTS  VORLAX   2226
C...OF THE AERODYNAMIC INFLUENCE MATRICES ≤ (1) THOSE ENDED BY LABEL    VORLAX   2227
C...230 AND (2) THOSE ENDED BY LABEL 210. THE FIRST (OUTER) 230-LOOP    VORLAX   2228
C...DETERMINES THE VORTEX STRIP, AND THE SECOND (INNER) 230-LOOP        VORLAX   2229
C...LOCATES THE POINT WITHIN THAT STRIP AT WHICH THE INDUCED            VORLAX   2230
C...VELOCITIES WILL BE COMPUTED. THE FIRST (OUTER) 210-LOOP             VORLAX   2231
C...ESTABLISHES THE STRIP, AND THE SECOND (INNER) 210-LOOP DETERMINES   VORLAX   2232
C...THE HORSESHOE VORTEX WITHIN THAT STRIP WHOSE INFLUENCE IS TO BE     VORLAX   2233
C...COMPUTED. THE 210-LOOPS ARE NESTED WITHIN THE 130-LOOPS.            VORLAX   2234
C                                                                       VORLAX   2235
C                                                                       VORLAX   2236
      IRR = 1                                                           VORLAX   2237
C                                                                       VORLAX   2238
C                                                                       VORLAX   2239
C                                                                       VORLAX   2240
      DO 230 K1 = 1, NT                                                 VORLAX   2241
      KEY = IPAN(K1)                                                    VORLAX   2242
      MAX = RNMAX (K1)                                                  VORLAX   2243
      COX = 1.0 - FLAX + FLAX *CHORD (K1) /RNMAX (K1)                   VORLAX   2244
      PION = PI /RNMAX (K1)                                             VORLAX   2245
      MAXIM = MAX + 1                                                   VORLAX   2246
C                                                                       VORLAX   2247
      DO 230 JJ1 = 1, MAXIM                                             VORLAX   2248
C                                                                       VORLAX   2249
C...JJ1 = 1 CORRESPONDS TO THE VERY LEADING EDGE. IT IS NOT A CONTROL   VORLAX   2250
C...POINT IN THE CONVENTIONAL SENSE, BUT THE NORMALWASH INFLUENCE       VORLAX   2251
C...COEFFICIENT IS NEEDED FOR THE COMPUTATION OF THE LEADING EDGE       VORLAX   2252
C...SUCTION IN ACCORDANCE WITH LAN≠S PROCEDURE.                         VORLAX   2253
C                                                                       VORLAX   2254
      J1 = JJ1 - 1                                                      VORLAX   2255
      RJ1 = J1                                                          VORLAX   2256
C                                                                       VORLAX   2257
C...LOCATE SENSING, OR RECEIVING, POINT ON CORRESPONDING CONTROL        VORLAX   2258
C...SURFACE, EITHER ON ACTUAL BODY SURFACE (NPP = 1) OR ON CYLINDRICAL  VORLAX   2259
C...SURFACE IN THE PROXIMITY OF BODY (NPP = 0).                         VORLAX   2260
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      C                                                                 VORLAX  2261
            DELTAX = .5 *(COS ((RJ1 - .5) *PION) - COS (RJ1*PION))      VORLAX  2262
            IF (J1 .EQ. 0) J1 = 1                                       VORLAX  2263
            IF (LAX .EQ. 1) DELTAX = .5 /RNMAX (K1)                     VORLAX  2264
            XCNTL = X (IRR) + DELTAX *CHORD (K1)                        VORLAX  2265
      C                                                                 VORLAX  2266
            IRRB = IRR                                                  VORLAX  2267
            IF (CX(IRR) .LT. MAX) IRRB = IRR + 1                        VORLAX  2268
            IRRA = IRRB - 1                                             VORLAX  2269
            RATIO = (XCNTL - X (IRRA)) /( X (IRRB) - X (IRRA))          VORLAX  2270
            YCNTL = YY (IRRA) *(1.0 - RATIO) + YY (IRRB) *RATIO         VORLAX  2271
            ZCNTL = ZZ (IRRA) *(1.0 - RATIO) + ZZ (IRRB) *RATIO         VORLAX  2272
      C                                                                 VORLAX  2273
      C...IF NPP = 1 THEN THE SURFACE NORMAL DIRECTION COSINES ARE COMPUTED VORLAX  2274
      C...EXACTLY+ OTHERWISE THE USUAL TRIGONOMETRIC APPROXIMATIONS ARE VORLAX  2275
      C...APPLIED. E.G.. SINE = TANGENT = ARGUMENT.                     VORLAX  2276
      C                                                                 VORLAX  2277
            COSINE = 1.0                                                VORLAX  2278
            SINE = 0.0                                                  VORLAX  2279
            IF (NPP (KEY)  .EQ. 0)  GO TO 10                            VORLAX  2280
            SINE = SLOPE (IRR) /SQRT (1.0 + SLOPE (IRR) **2)            VORLAX  2281
            COSINE = SQRT (1.0 - SINE **2)                              VORLAX  2282
       10   CONTINUE                                                    VORLAX  2283
      C                                                                 VORLAX  2284
            IF (JJ1 .EQ. 1) GO TO 30                                    VORLAX  2285
      C                                                                 VORLAX  2286
      C...DETERMINE IF TRANSVERSE VORTEX LEG OF HORSESHOE ASSOCIATED TO THE VORLAX  2287
      C...CONTROL POINT UNDER CONSIDERATION IS SONIC (SWEPT PARALLEL TO MACH VORLAX  2288
      C...LINE)+ IF SO THEN RFLAG = 0.0. OTHERWISE RFLAG = 1.0.         VORLAX  2289
      C                                                                 VORLAX  2290
            FLAG = 0                                                    VORLAX  2291
            ESP1 = VSP (IRR)                                            VORLAX  2292
            T2 = ESP1 *ESP1                                             VORLAX  2293
            IF (B2 .LE. 0.0) GO TO 20                                   VORLAX  2294
            IF (J1 .EQ. 1) GO TO 20                                     VORLAX  2295
            IF (J1 .EQ. MAX) GO TO 20                                   VORLAX  2296
            ESPF = VSP (IRR - 1)                                        VORLAX  2297
            T2F = ESPF *ESPF                                            VORLAX  2298
            ESPA = VSP (IRR + 1)                                        VORLAX  2299
            T2A = ESPA *ESPA                                            VORLAX  2300
            TRANS = (B2 - T2F) * (B2 - T2A)                             VORLAX  2301
            IF (TRANS .LT. 0.0) FLAG = 1                                VORLAX  2302
       20   RFLAG (IRR) = 1 - FLAG                                      VORLAX  2303
      C                                                                 VORLAX  2304
      C...COMPUTE THE GENERALIZED PRINCIPAL PART OF THE VORTEX-INDUCED  VORLAX  2305
      C...VELOCITY INTEGRAL, WWAVE.                                     VORLAX  2306
      C                                                                 VORLAX  2307
            WWAVE = 0.0                                                 VORLAX  2308
            IF (B2 .GT. T2) WWAVE = - 0.5 *SQRT (B2 - T2) /COX          VORLAX  2309
       30   IR = 0                                                      VORLAX  2310
      C                                                                 VORLAX  2311
      C                                                                 VORLAX  2312
      C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE ALONG A VORLAX  2313
      C...GIVEN STRIP, STRIP BY STRIP, I.E.. THE OUTER 210-LOOP REFERS TO VORLAX  2314
      C...A CHORDWISE STRIP OF HORSESHOE VORTICES, AND THE INNER 210-LOOP VORLAX  2315
      C...RELATES TO A PARTICULAR HORSESHOE ON THE STRIP.               VORLAX  2316
      C                                                                 VORLAX  2317
```

```
C                                                                       VORLAX   2318
      DO 210 K = 1, NT                                                  VORLAX   2319
C                                                                       VORLAX   2320
C...COMPUTE PARAMETERS COMMON TO A GIVEN CHORDWISE STRIP OF HORSESHOE   VORLAX   2321
C...VORTICES.                                                           VORLAX   2322
C                                                                       VORLAX   2323
      PION2 = PI *.5 /RNMAX (K)                                         VORLAX   2324
      PION3 = 0.5 *PION2                                                VORLAX   2325
      PION4 = PION2 /8.0                                                VORLAX   2326
      DELX = CHORD (K) /RNMAX (K)                                       VORLAX   2327
      WEIGHT = 1.0                                                      VORLAX   2328
      WT1 = 0.25 *DELX                                                  VORLAX   2329
      CDL = COS (DTR *DL (K))                                           VORLAX   2330
      SDL = SIN (DTR *DL (K))                                           VORLAX   2331
      COS1 = COS (DTR *(DL (K1) - DL (K)))                              VORLAX   2332
      SIN1 = SIN (DTR *(DL (K1) - DL (K)))                              VORLAX   2333
      COS2 = COS (DTR *(DL (K1) + DL (K)))                              VORLAX   2334
      SIN2 = SIN (DTR *(DL (K1) + DL (K)))                              VORLAX   2335
      COSIM = COS (2.0 *DTR *DL (K))                                    VORLAX   2336
      SINIM = SIN (2.0 *DTR *DL (K))                                    VORLAX   2337
      MAX2 = RNMAX (K)                                                  VORLAX   2338
C                                                                       VORLAX   2339
      AA = FAL *CDL - FBL *SDL                                          VORLAX   2340
      AM = FBL *CDL + FAL *SDL                                          VORLAX   2341
C                                                                       VORLAX   2342
C                                                                       VORLAX   2343
 40   DO 210  J = 1, MAX2                                               VORLAX   2344
      IR = IR + 1                                                       VORLAX   2345
      XLOAD  = X (IR)                                                   VORLAX   2346
      X1 = XCNTL - XLOAD                                                VORLAX   2347
      YP = YCNTL + YY (IR)                                              VORLAX   2348
      YS = YCNTL - YY (IR)                                              VORLAX   2349
      ZS = ZCNTL - ZZ (IR)                                              VORLAX   2350
      Y1 = YS *CDL + ZS *SDL                                            VORLAX   2351
      Z1 = ZS *CDL - YS *SDL                                            VORLAX   2352
      Y2 = YP *CDL - ZS *SDL                                            VORLAX   2353
      Z2 = ZS *CDL + YP *SDL                                            VORLAX   2354
      RYZ1 = Y1 *Y1 + Z1 *Z1                                            VORLAX   2355
      RYZ2 = Y2 *Y2 + Z2 *Z2                                            VORLAX   2356
      X1SQ = X1 *X1                                                     VORLAX   2357
      RS1 = X1SQ - B2 *RYZ1                                             VORLAX   2358
      RS2 = X1SQ - B2 *RYZ2                                             VORLAX   2359
      IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)                                VORLAX   2360
      IF (RS2 .GT. 0.0) RS2 = SQRT(RS2)                                 VORLAX   2361
      IF (LAX .EQ. 1) GO TO 50                                          VORLAX   2362
      RJ = 2 *J - 1                                                     VORLAX   2363
      RJ1 = 4 *J - 3                                                    VORLAX   2364
      DELX = 1.0                                                        VORLAX   2365
      WEIGHT = PION2 *SIN (RJ *PION2) *CHORD (K)                        VORLAX   2366
      WT1 = PION3 *SIN (RJ1 *PION3) *CHORD (K)                          VORLAX   2367
 50   XU1 = XLOAD - WT1                                                 VORLAX   2368
      CT = XTE (K) - XLOAD                                              VORLAX   2369
      TESP = TNT (K)                                                    VORLAX   2370
      ESP = VSP (IR)                                                    VORLAX   2371
      VOSS = VST (IR)                                                   VORLAX   2372
      TOLZ = WEIGHT *DELX *1.0E-1                                       VORLAX   2373
C                                                                       VORLAX   2374
```

```
      C...IF CONTROL, OR RECEIVING, POINT IS WITHIN A GIVEN NEAR FIELD          VORLAX  2375
      C...RADIUS (RNF) OF SENDING ELEMENT, THEN COMPUTE AXIALWASH (U1) BY        VORLAX  2376
      C...INTERDIGITATED VORTEX SPLITTING.                                      VORLAX  2377
      C                                                                         VORLAX  2378
            UVEL = 0.0                                                          VORLAX  2379
            IDIT = 0                                                            VORLAX  2380
            RNF = 4.0 *WEIGHT *DELX                                             VORLAX  2381
            IF (SX (IR) .EQ. SX (IRR)) GO TO 90                                 VORLAX  2382
            IF (RS1 .LE. 0.0) GO TO 90                                          VORLAX  2383
            IF (RS1 .GT. RNF) GO TO 90                                          VORLAX  2384
            RJM = J - 1                                                         VORLAX  2385
            COSM = COS (2.0 *PION2 *RJM)                                        VORLAX  2386
            DO 80 L = 1, 8                                                      VORLAX  2387
            IF (LAX .EQ. 0) GO TO 60                                            VORLAX  2388
            RVL = 4 *L - 3                                                      VORLAX  2389
            XDIF = RVL *DELX /32.0                                              VORLAX  2390
            WFR = 0.1250                                                        VORLAX  2391
            GO TO 70                                                            VORLAX  2392
       60   RVL = 16 *(J - 1) + 2 *L - 1                                        VORLAX  2393
            XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                    VORLAX  2394
            WFR = PION4 *SIN (PION4 *RVL)                                       VORLAX  2395
       70   XINT = XCNTL - X01 - XDIF                                           VORLAX  2396
            CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, B2, TOLZ, UDV)                 VORLAX  2397
            UVEL = UVEL + UDV *WFR                                              VORLAX  2398
       80   CONTINUE                                                            VORLAX  2399
            DCW = 1.0                                                           VORLAX  2400
            IF (LAX .EQ. 0)  DCW = CHORD (K) /WEIGHT                            VORLAX  2401
            UVEL = UVEL * DCW                                                   VORLAX  2402
            IDIT = 1                                                            VORLAX  2403
      C                                                                         VORLAX  2404
      C...SUBROUTINE WASH COMPUTES THE VELOCITIES INDUCED BY A GENERALIZED      VORLAX  2405
      C...HORSESHOE VORTEX OF UNIT INTENSITY.                                   VORLAX  2406
      C                                                                         VORLAX  2407
       90   CALL WASH (X1,Y1,Z1,VOSS,ESP,B2,U1,V1,W1,AA,AM,TESP,CT,MM)          VORLAX  2408
            IF (IDIT .EQ. 1) U1 = UVEL                                          VORLAX  2409
      C                                                                         VORLAX  2410
      C...IF CONFIGURATION IS IN GROUND EFFECT (HAG % 0.) THEN COMPUTE THE      VORLAX  2411
      C...VELOCITIES INDUCED BY THE HORSESHOE IMAGE MIRRORED ABOUT THE          VORLAX  2412
      C...GROUND PLANE.                                                         VORLAX  2413
      C                                                                         VORLAX  2414
            IF (HAG .EQ. 0.0) GO TO 100                                         VORLAX  2415
            XIM = XIMO + X (IR) *CO2A + ZZ (IR) *SI2A                           VORLAX  2416
            ZIM = ZIMO + X (IR) *SI2A - ZZ (IR) *CO2A                           VORLAX  2417
            X1I = XCNTL - XIM                                                   VORLAX  2418
            ZSI = ZCNTL - ZIM - X1I *TAN2A                                      VORLAX  2419
            Y1I = YS *CDL - ZSI *SDL                                            VORLAX  2420
            Z1I = ZSI *CDL + YS *SDL                                            VORLAX  2421
            CALL WASH (X1I,Y1I,Z1I,VOSS,ESP,B2,U1I,V1I,W1I,AA,AM,TESP,CT,MM)    VORLAX  2422
            U1 = U1 - U1I                                                       VORLAX  2423
            V1 = V1 - V1I *COSIM - W1I *SINIM                                   VORLAX  2424
            W1 = W1 + V1I *SINIM - W1I *COSIM                                   VORLAX  2425
      100   IF (LATRAL .EQ. 1) GO TO 160                                        VORLAX  2426
      C                                                                         VORLAX  2427
      C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN            VORLAX  2428
      C...COMPUTE INFLUENCE OF HORSESHOE VORTEX IMAGE MIRRORED ABOUT            VORLAX  2429
      C...CENTER PLANE, I.E., X-Z PLANE.                                        VORLAX  2430
      C                                                                         VORLAX  2431
```

```
      UVEL = 0.0                                                        VORLAX  2432
      IDIT = 0                                                          VORLAX  2433
      IF (RS2 .LE. 0.0) GO TO 140                                       VORLAX  2434
      IF (RS2 .GT. RNF) GO TO 140                                       VORLAX  2435
      RJM = J - 1                                                       VORLAX  2436
      COSM = COS (2.0 *PION2 *RJM)                                      VORLAX  2437
      DO 130 L = 1, 8                                                   VORLAX  2438
      IF (LAX .EQ. 0) GO TO 110                                         VORLAX  2439
      RVL = 4 *L - 3                                                    VORLAX  2440
      XDIF = RVL *DELX /32.0                                            VORLAX  2441
      WFR = 0.1250                                                      VORLAX  2442
      GO TO 120                                                         VORLAX  2443
  110 RVL = 16 *(J - 1) + 2 *L - 1                                      VORLAX  2444
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                  VORLAX  2445
      WFR = PION4 *SIN (PION4 *RVL)                                     VORLAX  2446
  120 XINT = XCNTL - XU1 - XDIF                                         VORLAX  2447
      CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)              VORLAX  2448
      UVEL = UVEL + UDV *WFR                                            VORLAX  2449
  130 CONTINUE                                                          VORLAX  2450
      DCW = 1.0                                                         VORLAX  2451
      IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT                           VORLAX  2452
      UVEL = UVEL *DCW                                                  VORLAX  2453
      IDIT = 1                                                          VORLAX  2454
C                                                                       VORLAX  2455
  140 CALL WASH (X1,Y2,Z2,VOSS, - ESP,B2,U2,V2,W2,AA,AM, -TESP,CT,MM)   VORLAX  2456
      IF (IDIT .EQ. 1) U2 = UVEL                                        VORLAX  2457
C                                                                       VORLAX  2458
      IF  (HAG  .EQ. 0.0) GO TO 150                                     VORLAX  2459
C                                                                       VORLAX  2460
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND          VORLAX  2461
C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF        VORLAX  2462
C...DOUBLE-MIRRORED HORSESHOE IMAGE (ONCE ABOUT CENTER PLANE, AND       VORLAX  2463
C...ANOTHER ABOUT GROUND PLANE).                                        VORLAX  2464
C                                                                       VORLAX  2465
      Y2I  = YP *CDL  + ZSI *SDL                                        VORLAX  2466
      Z2I  = ZSI *CDL  - YP *SDL                                        VORLAX  2467
      CALL WASH(X1I,Y2I,Z2I,VOSS,- ESP,B2,U2I,V2I,W2I,AA,AM,-TESP,CT,MM) VORLAX  2468
      U2 = U2 - U2I                                                     VORLAX  2469
      V2 = V2 - V2I *COSIM + W2I *SINIM                                 VORLAX  2470
      W2 = W2 - V2I *SINIM - W2I *COSIM                                 VORLAX  2471
C                                                                       VORLAX  2472
  150 EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT     VORLAX  2473
      EU (IR) = (U1 + U2) *WEIGHT                                       VORLAX  2474
      GO TO 170                                                         VORLAX  2475
C                                                                       VORLAX  2476
  160 EW (IR) = (W1 *COS1 - V1 *SIN1) *WEIGHT                           VORLAX  2477
      EU (IR) = U1 *WEIGHT                                              VORLAX  2478
  170 IF (JJ1 .EQ. 1) GO TO 210                                         VORLAX  2479
C                                                                       VORLAX  2480
  180 ENORM = EW (IR) *COSINE + B2 *EU(IR) *SINE                        VORLAX  2481
      ETAN = EW (IR) *SINE + EU (IR) *COSINE                            VORLAX  2482
      EW (IR) = ENORM                                                   VORLAX  2483
      EU (IR) = ETAN                                                    VORLAX  2484
C                                                                       VORLAX  2485
      IF  (IR  .NE. IRR) GO TO 190                                      VORLAX  2486
      EW (IR) = EW (IR) + WWAVE                                         VORLAX  2487
  190 CONTINUE                                                          VORLAX  2488
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               IF  (FLAG .EQ. 0) GO TO 210                                           VORLAX    2489
               IF (INVERS .EQ. 1) GO TO 210                                          VORLAX    2490
         C                                                                           VORLAX    2491
         C...IF CONTROL POINT RELONGS TO A SONIC HORSESHOE VORTEX, AND THE           VORLAX    2492
         C...SENDING ELEMENT IS SUCH HORSESHOE, THEN MODIFY THE NORMALWASH           VORLAX    2493
         C...COEFFICIENTS IN SUCH A WAY THAT THE STRENGTH OF THE SONIC VORTEX        VORLAX    2494
         C...WILL BE THE AVERAGE OF THE STRENGTHS OF THE HORSESHOES IMMEDIATELY      VORLAX    2495
         C...IN FRONT OF AND BEHIND IT.                                              VORLAX    2496
         C                                                                           VORLAX    2497
               RCC = 0.                                                              VORLAX    2498
               IF (K .NE. K1) GO TO 200                                              VORLAX    2499
               IF (IABS (J - J1) .GT. 1) GO TO 200                                   VORLAX    2500
               RCC = - 1.0                                                           VORLAX    2501
               IF (J .EQ. J1) RCC = 2.0                                              VORLAX    2502
           200 EW (IR) = RCC                                                         VORLAX    2503
           210 CONTINUE                                                              VORLAX    2504
         C                                                                           VORLAX    2505
         C                                                                           VORLAX    2506
               IF  (JJ1  .GT. 1) GO TO 220                                           VORLAX    2507
               WRITE  (9) EW                                                         VORLAX    2508
               GO TO 230                                                             VORLAX    2509
           220 WRITE (1) EW                                                          VORLAX    2510
               WRITE (2) EU                                                          VORLAX    2511
               IRR = IRR + 1                                                         VORLAX    2512
           230 CONTINUE                                                              VORLAX    2513
         C                                                                           VORLAX    2514
         C                                                                           VORLAX    2515
         C                                                                           VORLAX    2516
               REWIND 1                                                              VORLAX    2517
               REWIND 2                                                              VORLAX    2518
               REWIND 9                                                              VORLAX    2519
         C                                                                           VORLAX    2520
         C                                                                           VORLAX    2521
               RETURN                                                                VORLAX    2522
               END                                                                   VORLAX    2523


    SYMBOLIC REFERENCE MAP (R=1)

ENTRY POENTBY
    3  MATRX3

VARIABLESARIABSN  TYPESN  TYPE   RELOCATIOBLOC
 1231   AA        REAL    REAL                      20   ALFA      REAL     REA          SET11
   10   ALPHA     REAL       ARRAY    SET11       1232   AM        REAL
    1   BETA      REAL                SET15          0   R2        REAL                  SET15
    2   CBAR      REAL                SET15       1220   CDL       REAL
    0   CHORD     REAL       ARRAY    SET10       1226   COSIM     REAL
 1176   COSINE    REAL                            1265   COSM      REAL
 1222   COS1      REAL                            1224   COS2      REAL
 1161   COX       REAL                            1150   CO2A      REAL
 1254   CT        REAL                               0   CX        INTEGER     ARRAY     SET3
    0   DCP       REAL       ARRAY    SET2        1274   DCW       REAL
 1167   DELTAX    REAL                            1215   DELX      REAL
```

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VARIABLES     SN  TYPE             RELOCATION
   144  DL         REAL        ARRAY     SET10          1142  DTR       REAL
  1321  ENORM      REAL                                 1256  ESP       REAL
  1204  ESPA       REAL                                 1202  ESPF      REAL
  1200  ESP1       REAL                                 1322  ETAN      REAL
     0  EU         REAL        ARRAY      F.P.             0  EW        REAL        ARRAY     F.P.
  1144  FAL        REAL                                 1145  FBL       REAL
  1140  FLAG       INTEGER                              1143  FLAX      REAL
    12  FLOATX     REAL                  / /              13  FLOATY    REAL                  / /
    11  HAG        REAL                  / /            1151  HIM       REAL
 13560  IDES       INTEGER     ARRAY     SET3           1262  IDIT      INTEGER
     3  IH         INTEGER               / /             404  INTRAC    INTEGER     ARRAY     SET20
    14  INVERS     INTEGER               / /            1130  IPAN      INTEGER     ARRAY     SET10
     2  IQ         INTEGER               / /            1210  IR        INTEGER
  1155  IRR        INTEGER                              1172  IRRA      INTEGER
  1171  IRRB       INTEGER                                15  ISOLV     INTEGER               / /
     0  ITOTAL     INTEGER                F.P.           170  ITS       INTEGER     ARRAY     SET7
  1233  J          INTEGER                              1164  JJ1       INTEGER
   214  JTS        INTEGER     ARRAY     SET7           1165  J1        INTEGER
  1211  K          INTEGER                              1157  KEY       INTEGER
  1156  K1         INTEGER                              1266  L         INTEGER
     4  LATRAL     INTEGER               / /               0  LAX       INTEGER               / /
     1  LAY        INTEGER               / /               0  MACH      INTEGER     ARRAY     SET11
  1160  MAX        INTEGER                              1163  MAXIM     INTEGER
  1230  MAX2       INTEGER                              1146  MM        INTEGER
    23  NALPHA     INTEGER               SET11            22  NMACH     INTEGER               SET11
     0  NPAN       INTEGER               SET14             3  NPANAS    INTEGER               SET14
   360  NPP        INTEGER     ARRAY     SET20             1  NT        INTEGER               SET14
    50  PHIMED     REAL        ARRAY     SET20          1141  PI        REAL
  1162  PION       REAL                                 1212  PION2     REAL
  1213  PION3      REAL                                 1214  PION4     REAL
     6  PITCHQ     REAL                  / /               5  PSI       REAL                  / /
  1173  RATIO      REAL                                 1323  RCC       REAL
   214  RCS        REAL        ARRAY     SET20          7640  RFLAG     REAL        ARRAY     SET3
  1252  RJ         REAL                                 1264  RJM       REAL
  1166  RJ1        REAL                                    0  RNCV      REAL        ARRAY     SET7
  1263  RNF        REAL                                   24  RNMAX     REAL        ARRAY     SET7
     7  ROLLQ      REAL                  / /            1250  RS1       REAL
  1251  RS2        REAL                                 1267  RVL       REAL
  1245  RYZ1       REAL                                 1246  RYZ2      REAL
  1221  SDL        REAL                                 1177  SINE      REAL
  1227  SINIM      REAL                                 1223  SIN1      REAL
  1225  SIN2       REAL                                 1147  SI2A      REAL
  3720  SLOPE      REAL        ARRAY     SET2              2  SMAX      REAL                  SET14
  3720  SX         INTEGER     ARRAY     SET3           1154  TAN2A     REAL
  1255  TESP       REAL                                  454  TNL       REAL        ARRAY     SET10
   620  TNT        REAL        ARRAY     SET10          1260  TOLZ      REAL
  1206  TRANS      REAL                                 1201  T2        REAL
  1205  T2A        REAL                                 1203  T2F       REAL
  1273  UDV        REAL                                 1261  UVEL      REAL
  1275  U1         REAL                                 1306  U1I       REAL
  1311  U2         REAL                                 1316  U2I       REAL
    21  VINF       REAL                  SET11          1257  VOSS      REAL
  7640  VSP        REAL        ARRAY     SET2            310  VSS       REAL        ARRAY     SET10
 10270  VST        REAL        ARRAY     SET20          1276  V1        REAL
  1307  V1I        REAL                                 1312  V2        REAL
  1317  V2I        REAL                                 1216  WEIGHT    REAL
  1271  WFR        REAL                                 1217  WT1       REAL
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        SUBROUTINE MATRX        74/74    OPT=1                               FTN 4.5+410A        10/04/76  10.15.13        PAGE    9

   VARIABLES       SN  TYPE            RELOCATION
     1207  WWAVE        REAL                                  1277  W1           REAL
     1310  W1I          REAL                                  1313  W2           REAL
     1320  W2I          REAL                                     0  X            REAL        ARRAY     SET1
        3  XBAR         REAL                SET15             1170  XCNTL        REAL
     1270  XDIF         REAL                                  1300  XIM          REAL
     1152  XIMO         REAL                                  1272  XINT         REAL
     1234  XLOAD        REAL                                   764  XTE          REAL        ARRAY     SET10
     1253  XU1          REAL                                  1235  X1           REAL
     1302  X1I          REAL                                  1247  X1SQ         REAL
     3720  Y            REAL        ARRAY   SET1                10  YAWQ         REAL                  / /
     1174  YCNTL        REAL                                  1236  YP           REAL
     1237  YS           REAL                                   430  YY           REAL        ARRAY     SET20
     1241  Y1           REAL                                  1304  Y1I          REAL
     1243  Y2           REAL                                  1314  Y2I          REAL
     4064  Z            REAL        ARRAY   SET1                 4  ZBAR         REAL                  SET15
     4230  ZC           REAL        ARRAY   SET1              1175  ZCNTL        REAL
     1301  ZIM          REAL                                  1153  ZIMO         REAL
        0  ZLE1         REAL        ARRAY   SET20               24  ZLE2         REAL        ARRAY     SET20
     1240  ZS           REAL                                  1303  ZSI          REAL
     4350  ZZ           REAL        ARRAY   SET20             1242  Z1           REAL
     1305  Z1I          REAL                                  1244  Z2           REAL
     1315  Z2I          REAL

   FILE NAMES          MODE
          TAPE1        UNFMT                TAPE2      UNFMT                 TAPE9     UNFMT

   EXTERNALS            TYPE    ARGS
          COS          REAL       1 LIBRARY                      SIN        REAL         1 LIBRARY
          SQRT         REAL       1 LIBRARY                      UXVEL                   8
          WASH                   14

   INLINE FUNCTIONS     TYPE    ARGS
          IABS         INTEGER    1  INTRIN

   STATEMENT LABELS
     160  10                                  202  20                                   214  30
       0  40           INACTIVE               360  50                                   423  60
     440  70                                    0  80                                   462  90
     525  100                                 551  110                                  566  120
       0  130                                 611  140                                  645  150
     660  160                                 666  170                                    0  180          INACTIVE
     702  190                                 715  200                                  717  210
     734  220                                 750  230

   LOOPS   LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
     65    230      * K1          95 367      670B                EXT REFS  NOT INNER
     77    230      * JJ1        102 367      654B                EXT REFS  NOT INNER
    216    210      * K          173 358      506B                EXT REFS  NOT INNER
    300    210      * J          198 358      422B                EXT REFS  NOT INNER
    413    80       * L          241 253       37B                EXT REFS
    541    130      * L          292 304       40B                EXT REFS

   COMMON BLOCKS    LENGTH
          / /           14
          SET1        2250
          SET2        6000
          SET3        8000
```

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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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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 (CPLOWER           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 SEQUENCE≤                                        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, TNT, ALFA, YAWQ, CHORD,   VORLAX   2539
C...             GAMMA, ONSET, RNMAX, SLOPE, WSPAN.                       VORLAX   2540
C...                                                                      VORLAX   2541
C...OUTPUT       CALLING SEQUENCE≤                                        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...           ASSUMMED 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
C                                                                         VORLAX   2575
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,     VORLAX   2576
     * FLOATX, FLOATY, INVERS                                             VORLAX   2577
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                  VORLAX   2578
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)       VORLAX   2579
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)           VORLAX   2580
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            COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),          VORLAX   2581
           * TNT (100), XTE (100), IPAN (100)                                    VORLAX   2582
            COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA        VORLAX   2583
            COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                   VORLAX   2584
            COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                            VORLAX   2585
            COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                       VORLAX   2586
            INTEGER CX, SX                                                       VORLAX   2587
      C                                                                          VORLAX   2588
            DIMENSION EU (ITOTAL)                                                VORLAX   2589
      C                                                                          VORLAX   2590
            REWIND 2                                                             VORLAX   2591
      C                                                                          VORLAX   2592
            PI = 3.14159                                                         VORLAX   2593
            DTR = 0.01745329                                                     VORLAX   2594
      C                                                                          VORLAX   2595
      C...COMPUTE ISENTROPIC FLOW PARAMETERS AND CUTOFF VALUES FOR               VORLAX   2596
      C...SURFACE PRESSURE COEFFICIENTS (CPSTAG AND CPVAC).                      VORLAX   2597
      C                                                                          VORLAX   2598
            CPSTAG = 1.0                                                         VORLAX   2599
            XM1 = 1.0                                                            VORLAX   2600
            XM2 = 0.0                                                            VORLAX   2601
            XM3 = 1.0                                                            VORLAX   2602
            XM4 = 1.0                                                            VORLAX   2603
            XM5 = 0.0                                                            VORLAX   2604
            CPVAC = - 142.86                                                     VORLAX   2605
            IF (B2 .LT. -.98) GO TO 10                                           VORLAX   2606
      C                                                                          VORLAX   2607
            CPSTAG = ((1.2 + .2 *B2) **3.5 - 1.) /(.7*(1.+B2))                   VORLAX   2608
            CPVAC = - 1.0 /(1.0 + B2)                                            VORLAX   2609
            XM1 = 1.4286 /(1.0 + B2)                                             VORLAX   2610
            XM2 = 1.0                                                            VORLAX   2611
            XM3 = 0.2 *(1.0 + B2)                                                VORLAX   2612
            XM4 = 3.5                                                            VORLAX   2613
            XM5 = 1.0                                                            VORLAX   2614
      C                                                                          VORLAX   2615
       10   CONTINUE                                                             VORLAX   2616
      C                                                                          VORLAX   2617
      C                                                                          VORLAX   2618
      C...COMPUTE FREE-STREAM AND ONSET FLOW PARAMETERS.                         VORLAX   2619
      C                                                                          VORLAX   2620
            YAW = DTR *YAWQ *2.0 /WSPAN                                          VORLAX   2621
            COSALF = 1.0 /SQRT (1. + ALFA **2)                                   VORLAX   2622
            SINPSI = SIN (DTR *PSI)                                              VORLAX   2623
            COPSI = COS (DTR *PSI)                                               VORLAX   2624
            FORAXL = COSALF *COPSI                                               VORLAX   2625
            FORLAT = COSALF *SINPSI *2.0                                         VORLAX   2626
            FLAX = LAX                                                           VORLAX   2627
      C                                                                          VORLAX   2628
            DO 90 IR = 1, ITOTAL                                                 VORLAX   2629
            KC = CX (IR)                                                         VORLAX   2630
            KS = SX (IR)                                                         VORLAX   2631
            RC = KC                                                              VORLAX   2632
            RS = RC                                                              VORLAX   2633
            PION = PI /RNMAX (KS)                                                VORLAX   2634
            MAX = RNMAX (KS)                                                     VORLAX   2635
            DCPSID = 0.0                                                         VORLAX   2636
            IF (PSI .EQ. 0.0) GO TO 40                                           VORLAX   2637
```

```
      C                                                                 VORLAX  2638
      C...COMPUTE EFFECT OF SIDESLIP.                                   VORLAX  2639
      C                                                                 VORLAX  2640
            XIA = 0.5 *(1. - COS ((RC - 1.) *PION)) *(1. - FLAX)        VORLAX  2641
            XIA = XIA + (RC - 1.0) /RNMAX (KS) *FLAX                    VORLAX  2642
            XIB = 0.5 * (1. - COS (RC *PION)) *(1. - FLAX)              VORLAX  2643
            XIB = XIB + RC /RNMAX (KS) *FLAX                            VORLAX  2644
            TANA = TNL (KS) *(1. - XIA) + TNT (KS) *XIA                 VORLAX  2645
            TANB = TNL (KS) *(1. - XIB) + TNT (KS) *XIB                 VORLAX  2646
            KTOP = KC - 1                                               VORLAX  2647
            GANT = 0.0                                                  VORLAX  2648
            IF (KTOP .EQ. 0) GO TO 30                                   VORLAX  2649
            DO 20 KK = 1, KTOP                                          VORLAX  2650
            KIR = IR - KC + KK                                          VORLAX  2651
            RKK = KK                                                    VORLAX  2652
            GFX = .5 *PION *SIN ((RKK - .5) *PION) *(1. - FLAX)         VORLAX  2653
            GFX = GFX + FLAX /CHORD (KS)                                VORLAX  2654
            GANT = GANT + GFX *GAMMA (KIR)                              VORLAX  2655
       20   CONTINUE                                                    VORLAX  2656
       30   GLAT = GANT *(TANA - TANB)                                  VORLAX  2657
            GFX = .5 *PION *SIN ((RC - .5) *PION) *(1. - FLAX)          VORLAX  2658
            GFX = GFX + FLAX /CHORD (KS)                                VORLAX  2659
            GLAT = GLAT - GFX *GAMMA (IR) *TANH                         VORLAX  2660
            DCPSID = FORLAT *COS (DTR *DL (KS)) *GLAT /(XIB - XIA)      VORLAX  2661
       40   FACTOR = FORAXL + ONSET (IR)                                VORLAX  2662
      C                                                                 VORLAX  2663
      C...COMPUTE LOAD COEFFICIENT.                                     VORLAX  2664
      C                                                                 VORLAX  2665
            GNET = GAMMA (IR) *FACTOR                                   VORLAX  2666
            IF (LAX .EQ. 1) GNET = GNET *RNMAX (SX (IR)) /CHORD (SX (IR))  VORLAX  2667
            DCP (IR) = 2.0 *GNET + DCPSID                               VORLAX  2668
      C                                                                 VORLAX  2669
            READ (2) EU                                                 VORLAX  2670
            IF (JTS (SX (IR)) .EQ. 0) GO TO 90                          VORLAX  2671
      C                                                                 VORLAX  2672
      C                                                                 VORLAX  2673
      C...COMPUTATION OF SURFACE PRESSURE COEFFICIENT.                  VORLAX  2674
      C                                                                 VORLAX  2675
      C                                                                 VORLAX  2676
      C...COMPUTE TOTAL INDUCED AXIALWASH AT CONTROL POINT RELATED TO   VORLAX  2677
      C...HORSESHOE VORTEX UNDER CONSIDERATION (UB).                    VORLAX  2678
      C                                                                 VORLAX  2679
            UB = 0.0                                                    VORLAX  2680
            DO 50 IRR = 1, ITOTAL                                       VORLAX  2681
            UBF = EU (IRR)                                              VORLAX  2682
            UB = UB + UBF *GAMMA (IRR)                                  VORLAX  2683
       50   CONTINUE                                                    VORLAX  2684
      C                                                                 VORLAX  2685
            F2 = UB                                                     VORLAX  2686
      C                                                                 VORLAX  2687
            FS2 = SLOPE (IR)                                            VORLAX  2688
      C                                                                 VORLAX  2689
            IF (KC  .EQ. 1) GO TO 80                                    VORLAX  2690
      C                                                                 VORLAX  2691
      C...COMPUTE AXIALWASH AT VORTEX CENTROID (LOAD POINT) BY INTERPOLATING  VORLAX  2692
      C...(EXTRAPOLATING FOR THE FIRST CHORDWISE ELEMENT) BETWEEN CONTROL     VORLAX  2693
      C...POINTS.                                                       VORLAX  2694
```

```
C                                                                       VORLAX  2695
      IF  (LAX  .EQ. 1) GO TO 60                                        VORLAX  2696
      XX = .5 *(1.0 - COS ((RC  - 0.5) *PION))                          VORLAX  2697
      X1 = .5 *(1.0 - COS ((RC - 1.0) *PION))                           VORLAX  2698
      X2 = .5 *(1.0 - COS (RC *PION))                                   VORLAX  2699
      GO TO 70                                                          VORLAX  2700
   60 XX = (RC - 0.75) /RNMAX (KS)                                      VORLAX  2701
      X1 = (RC - 1.25) /RNMAX (KS)                                      VORLAX  2702
      X2 = (RC + 0.75) /RNMAX (KS)                                      VORLAX  2703
   70 UB = (XX - X2) /(X1 - X2) *F1 + (XX - X1)/ (X2 - X1) *F2          VORLAX  2704
C                                                                       VORLAX  2705
C...COMPUTE AXIALWASH DUE TO THE DISTRIBUTED VORTICITY WHICH HAS BEEN   VORLAX  2706
C...CONCENTRATED IN TRANSVERSE LEG OF THE HORSESHOE UNDER CONSIDERA     VORLAX  2707
C...TION (UG). THIS COMPONENT HAS NOT BEEN INCLUDED IN UB.              VORLAX  2708
C                                                                       VORLAX  2709
      UG = 0.25 *FLOAT (JTS (KS)) *DCP (IR)                             VORLAX  2710
C                                                                       VORLAX  2711
C...ADD UG TO FREE-STREAM X-VELOCITY COMPONENT, ACCOUNT FOR SURFACE     VORLAX  2712
C...INCLINATION IN ORDER TO OBTAIN TRUE TANGENTIAL COMPONENT, AND ADD   VORLAX  2713
C...TO UB TO COMPUTE TOTAL TANGENTIAL VELOCITY (VELOX). THIS IS ONLY    VORLAX  2714
C...AN APPROXIMATION BECAUSE SIDEWASH CONTRIBUTION IS NOT INCLUDED.     VORLAX  2715
C                                                                       VORLAX  2716
      FTAN = (XX - X2) /(X1 - X2) *FS1 + (XX - X1) /(X2 - X1) *FS2      VORLAX  2717
      FSQ = 1.0 /SQRT (1.0 + FTAN **2)                                  VORLAX  2718
      VELOX = UB + (UG + COSALF) *FSQ                                   VORLAX  2719
C                                                                       VORLAX  2720
C...COMPUTE SURFACE PRESSURE COEFFICIENT USING ISENTROPIC FLOW          VORLAX  2721
C...FLOW FORMULAS, AND APPLY ESTABLISHED PHYSICAL LIMITS (CPSTAG AND    VORLAX  2722
C...CPVAC) TO IT.                                                       VORLAX  2723
C                                                                       VORLAX  2724
      RADVEX = XM2 + XM3 *(1.0 - VELOX *VELOX)                          VORLAX  2725
      DCP (IR) = CPVAC                                                  VORLAX  2726
      IF (RADVEX .GT. 0.0) DCP (IR) = XM1 *(RADVEX **XM4 - XM5)         VORLAX  2727
      IF (B2 .LT. -.98) DCP (IR) = RADVEX                               VORLAX  2728
C                                                                       VORLAX  2729
      IF (KC .GT. 2) GO TO 80                                           VORLAX  2730
C                                                                       VORLAX  2731
C                                                                       VORLAX  2732
C...CARRY OUT COMPUTATIONS RELATED TO FIRST CHORDWISE ELEMENT.          VORLAX  2733
C...EXTRAPOLATE USING FIRST AND SECOND CHORDWISE CONTROL POINTS.        VORLAX  2734
C                                                                       VORLAX  2735
      XX = .5 * (1.0 - COS (0.5 *PION))                                 VORLAX  2736
      IF (LAX .EQ. 1) XX = 0.25 /RNMAX (KS)                             VORLAX  2737
      UB = (XX - X2) /(X1 - X2) *F1 + (XX - X1) /(X2 - X1) *F2          VORLAX  2738
      FTAN = (XX-X2) /(X1-X2) *FS1 + (XX-X1) /(X2-X1) *FS2              VORLAX  2739
      UG = 0.25 *FLOAT (JTS (KS)) *DCP (IR - KC + 1)                    VORLAX  2740
      FSQ = 1.0 /SQRT (1.0 + FTAN **2)                                  VORLAX  2741
      VELOX = UB + (UG + COSALF) *FSQ                                   VORLAX  2742
      RADVEX = XM2 + XM3 *(1.0 - VELOX *VELOX)                          VORLAX  2743
      DCP (IR - KC + 1) = CPVAC                                         VORLAX  2744
      IF (RADVEX .GT. 0.) DCP (IR - KC + 1) = XM1 *(RADVEX **XM4 - XM5) VORLAX  2745
      IF (B2 .LT. -.98)  DCP (IR - KC + 1) = RADVEX                     VORLAX  2746
C                                                                       VORLAX  2747
      IF (DCP (IR - KC + 1) .GT. CPSTAG) DCP (IR - KC + 1) = CPSTAG     VORLAX  2748
      IF (DCP (IR - KC + 1) .LT. CPVAC ) DCP (IR - KC + 1) = CPVAC      VORLAX  2749
C                                                                       VORLAX  2750
C...END OF COMPUTATIONS PARTICULAR TO FIRST CHORDISE ELEMENT ONLY.      VORLAX  2751
```

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      SUBROUTINE PRESS      74/74   OPT=1                       FTN 4.5+410A      10/04/76  10.15.13        PAGE     5

           C
            80   F1 = F2                                                                   VORLAX    2752
                 FS1 = FS2                                                                 VORLAX    2753
                 IF (KC .EQ. 1) GO TO 90                                                   VORLAX    2754
                 IF (DCP (IR) .GT. CPSTAG) DCP (IR) = CPSTAG                               VORLAX    2755
                 IF (DCP (IR) .LT. CPVAC) DCP (IR) = CPVAC                                 VORLAX    2756
           C                                                                               VORLAX    2757
           C                                                                               VORLAX    2758
           C...END OF SURFACE PRESSURE COEFFICIENT COMPUTATION                             VORLAX    2759
           C                                                                               VORLAX    2760
           C                                                                               VORLAX    2761
            90   CONTINUE                                                                  VORLAX    2762
           C                                                                               VORLAX    2763
                 REWIND 2                                                                  VORLAX    2764
                 RETURN                                                                    VORLAX    2765
                 END                                                                       VORLAX    2766
                                                                                           VORLAX    2767

      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3  PRESS

 VARIABLES       SN   TYPE              RELOCATION
    20  ALFA          REAL                   SET11         10  ALPHA     REAL       ARRAY    SET11
     1  BETA          REAL                   SET15          0  BIG       REAL                SET13
     0  B2            REAL                   SET15          2  CBAR      REAL                SET15
     0  CHORD         REAL         ARRAY     SET10        511  COPSI     REAL
   507  COSALF        REAL                                477  CPSTAG    REAL
   505  CPVAC         REAL                                  0  CX        INTEGER    ARRAY    SET3
     0  DCP           REAL         ARRAY     SET2         524  DCPSID    REAL
   144  DL            REAL         ARRAY     SET10        476  DIR       REAL
     3  EPS           REAL                   SET13          0  FU        REAL       ARRAY    F.P.
   540  FACTOR        REAL                                514  FLAX      REAL
    12  FLOATX        REAL                   / /           13  FLOATY    REAL                / /
   512  FORAXL        REAL                                513  FORLAT    REAL
   556  FSQ           REAL                                555  FS1       REAL
   546  FS2           REAL                                554  FTAN      REAL
   552  F1            REAL                                545  F2        REAL
     0  GAMMA         REAL         ARRAY     SET16        532  GANT      REAL
   536  GFX           REAL                                537  GLAT      REAL
   541  GNET          REAL                                 11  HAG       REAL                / /
 13560  IDES          INTEGER      ARRAY     SET3           3  IH        INTEGER             / /
    14  INVERS        INTEGER                / /         1130  IPAN      INTEGER    ARRAY    SET10
     2  IQ            INTEGER                / /          515  IR        INTEGER
   543  IRR           INTEGER                               1  ITER      INTEGER             SET13
     0  ITOTAL        INTEGER                 F.P.          2  ITRMAX    INTEGER             SET13
   170  ITS           INTEGER      ARRAY     SET7         214  JTS       INTEGER    ARRAY    SET7
   516  KC            INTEGER                             534  KIR       INTEGER
   533  KK            INTEGER                             517  KS        INTEGER
   531  KTOP          INTEGER                               4  LATRAL    INTEGER             / /
     0  LAX           INTEGER                / /            1  LAY       INTEGER             / /
     0  MACH          INTEGER      ARRAY     SET11        523  MAX       INTEGER
    23  NALPHA        INTEGER                SET11         22  NMACH     INTEGER             SET11
```

```
VARIABLES     SN  TYPE           RELOCATION
 3720  ONSET      REAL      ARRAY    SET16            475  PI           REAL
  522  PION       REAL                                  6  PITCHQ       REAL                    / /
    5  PSI        REAL               / /              560  RADVEX       REAL
  520  RC         REAL                               7640  RFLAG        REAL       ARRAY     SET3
  535  RKK.       REAL                                  5  RLM          REAL                 SET13
    0  RNCV       REAL      ARRAY    SET7              24  RNMAX        REAL       ARRAY     SET7
    7  ROLLQ      REAL               / /              521  RS           REAL
  510  SINPSI     REAL                               3720  SLOPE        REAL       ARRAY     SET2
 3720  SX         INTEGER   ARRAY    SET3             527  TANA         REAL
  530  TANB       REAL                                454  TNL          REAL       ARRAY     SET10
  620  TNT        REAL      ARRAY    SET10            542  UB           REAL
  544  UBF        REAL                                553  UG           REAL
  557  VELOX      REAL                                 21  VINF         REAL                 SET11
 7640  VSP        REAL      ARRAY    SET2             310  VSS          REAL       ARRAY     SET10
    4  WSPAN      REAL               SET13              3  XBAR         REAL                 SET15
  525  XIA        REAL                                526  XIB          REAL
  500  XM1        REAL                                501  XM2          REAL
  502  XM3        REAL                                503  XM4          REAL
  504  XM5        REAL                                764  XTE          REAL       ARRAY     SET10
  547  XX         REAL                                550  X1           REAL
  551  X2         REAL                                506  YAW          REAL
   10  YAWQ       REAL               / /                4  ZBAR         REAL                 SET15

FILE NAMES      MODE
       TAPE2    UNFMT

EXTERNALS          TYPE    ARGS
       COS        REAL      1 LIBRARY                     SIN          REAL        1 LIBRARY
       SQRT       REAL      1 LIBRARY

INLINE FUNCTIONS   TYPE    ARGS
       FLOAT      REAL      1  INTRIN

STATEMENT LABELS
   47  10                                   0  20                                     156  30
  203  40                                   0  50                                     265  60
  274  70                                 426  80                                     441  90

LOOPS  LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
   71  90      * IR         106 240      353B               EXT REFS  NOT INNER
  135  20      * KK         127 133      21B                EXT REFS
  232  50        IRR        158 161       5B       INSTACK

COMMON BLOCKS    LENGTH
       / /           13
       SET2        6000
       SET3        8000
       SET7         240
       SET10        700
       SET11         20
       SET13          6
       SET15          5
       SET16       4000

STATISTICS
  PROGRAM LENGTH                5708B      376
  CM LABELED COMMON LENGTH    45033B     18971
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        SUBROUTINE PRESS        74/74   OPT=1                      FTN 4.5+410A        10/04/76  10.15.13        PAGE      7
  STATISTICS
    CM BLANK COMMON LENGTH           15B        13
```

```
CONTROL*VRLX.PRINT                                              9/17/76  VORLAX   2768
C...                                                                     VORLAX   2769
      SUBROUTINE PRINT (ITOTAL, EW, EWX, EWY)                            VORLAX   2770
C...                                                                     VORLAX   2771
C...PURPOSE    TO PRINT PROGRAM DATA.                                    VORLAX   2772
C                                                                        VORLAX   2773
C...INPUT      CALLING SEQUENCE≤                                         VORLAX   2774
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.              VORLAX   2775
C...           EW, EWX, EWY = STORAGE ARRAYS SET ASIDE FOR CALLING       VORLAX   2776
C...                          SUBROUTINE MAP.                            VORLAX   2777
C...           COMMON≤                                                   VORLAX   2778
C...           CD, CL, CM, CM, CX, CY, DL, IH, IQ, YY, ZC, ZZ,           VORLAX   2779
C...           BIG, CDC, CNC, CRM, CYM, DCP, EPS, HAG, JTS, LAX,         VORLAX   2780
C...           NXS, PDL, PSI, RLM, SPC, CBAR, CMTC, CSUC, HEAD,          VORLAX   2781
C...           IPAN, ITER, LIFT, MACH, NPAN, NVOR, RNCV, SREF,           VORLAX   2782
C...           SURF, VINF, XBAR, XSUC, YAWQ, ZBAR, AINC1, AINC2,         VORLAX   2783
C...           ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CRTOT, CYTOT,          VORLAX   2784
C...           DNDX1, DNDX2, GAMMA, ISOLV, LESWP, PSPAN, RNMAX,          VORLAX   2785
C...           ROLLQ, SLOPE, SYNTH, TAPER, TITLE, WSPAN, XAPEX,          VORLAX   2786
C...           YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVERS,             VORLAX   2787
C...           IQUANT, ITRMAX, LATRAL, MOMENT, PITCHQ.                   VORLAX   2788
C...                                                                     VORLAX   2789
C...OUTPUT     CALLING SEQUENCE≤                                         VORLAX   2790
C...           NONE.                                                     VORLAX   2791
C...           COMMON≤                                                   VORLAX   2792
C...           NONE.                                                     VORLAX   2793
C...                                                                     VORLAX   2794
C...SUBROUTINES                                                          VORLAX   2795
C...CALLED     ZNORM, MAP.                                               VORLAX   2796
C...                                                                     VORLAX   2797
C...DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED      VORLAX   2798
C...           IN THREE GROUPS, AS FOLLOWS≤                              VORLAX   2799
C...           (1) INPUT DATA+ THESE ARE DATA WHICH ARE TAKEN FROM       VORLAX   2800
C...               THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT    VORLAX   2801
C...               SUITABLE FOR USE BY THE PROGRAM.                      VORLAX   2802
C...           (2) PANEL AND TOTAL CONFIGURATION FORCE AND MOMENT        VORLAX   2803
C...               COEFFICIENT DATA.                                     VORLAX   2804
C...           (3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS     VORLAX   2805
C...               OR TO INDIVIDUAL HORSESHOE VORTICES.                  VORLAX   2806
C...           THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.         VORLAX   2807
C...           IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES     VORLAX   2808
C...           PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.      VORLAX   2809
C...                                                                     VORLAX   2810
C                                                                        VORLAX   2811
      DIMENSION EW (2000), EWX (2001), EWY (2001), EU (2001)             VORLAX   2812
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                               VORLAX   2813
      INTEGER TITLE, CX, SX                                              VORLAX   2814
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,    VORLAX   2815
     *FLOATX, FLOATY, INVERS, ISOLV                                      VORLAX   2816
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                  VORLAX   2817
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                 VORLAX   2818
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)      VORLAX   2819
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)     VORLAX   2820
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),        VORLAX   2821
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),     VORLAX   2822
     * PSPAN (40), NVOR (40)                                             VORLAX   2823
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                  VORLAX   2824
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       COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)              VORLAX   2825
       COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),              VORLAX   2826
      * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),                 VORLAX   2827
      * RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SURF (40)            VORLAX   2828
       COMMON /SET9 /CDC (100), CNC (100)                                     VORLAX   2829
       COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),            VORLAX   2830
      * TNT (100), XTE (100), IPAN (100)                                      VORLAX   2831
       COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA          VORLAX   2832
       COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT          VORLAX   2833
       COMMON /SET13 /BIG, ITER, ITRMAX, EPS , NSPAN, RLM                     VORLAX   2834
       COMMON /SET14 /NPAN, NT, SMAX , NPANAS                                 VORLAX   2835
       COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                              VORLAX   2836
       COMMON /SET16 /GAMMA (2000), ONSET (2000)                              VORLAX   2837
       COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                        VORLAX   2838
       COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)      VORLAX   2839
       COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)             VORLAX   2840
       COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),          VORLAX   2841
      * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)                 VORLAX   2842
C                                                                             VORLAX   2843
       PI = 3.14159                                                           VORLAX   2844
       DTR = 0.01745329                                                       VORLAX   2845
C                                                                             VORLAX   2846
C                                                                             VORLAX   2847
       IF (IQ .EQ. 1 .AND. IH .EQ. 1) GO TO 10                                VORLAX   2848
       WRITE (6, 350) TITLE                                                   VORLAX   2849
       GO TO 110                                                              VORLAX   2850
C                                                                             VORLAX   2851
C...PRINTOUT FIRST DATA GROUP, I.E., INPUT DATA REARRANGED IN A FORMAT        VORLAX   2852
C...SUITABLE FOR USE BY THE PROGRAM.                                          VORLAX   2853
C                                                                             VORLAX   2854
 10    WRITE (6, 20) TITLE                                                    VORLAX   2855
 20    FORMAT (1H1, 20A4////1H , 14HPANEL GEOMETRY)                           VORLAX   2856
       WRITE (6, 30)                                                          VORLAX   2857
 30    FORMAT  (1H0, 44H I  XAPEX(I)  YAPEX(I)  ZAPEX(I)     PDL(I)  ,        VORLAX   2858
      * 56HLESWP(I) CSTART(I)  TAPER(I)  PSPAN(I)  NVOR(I)  RNCV(I),          VORLAX   2859
      * 9H   SPC(I)/)                                                         VORLAX   2860
       DO 50 I = 1, NPAN                                                      VORLAX   2861
       WRITE (6, 40) I, XAPEX(I), YAPEX(I), ZAPEX(I), PDL(I), LESWP(I),       VORLAX   2862
      * CSTART(I), TAPER(I), PSPAN(I), NVOR(I), RNCV(I), SPC(I)               VORLAX   2863
 40    FORMAT (1H , I2, 8F10.4, 2F8.0, F10.2)                                 VORLAX   2864
 50    CONTINUE                                                               VORLAX   2865
       KED1 = 1                                                               VORLAX   2866
       DO 100 I = 1, NPAN                                                     VORLAX   2867
       IF (SYNTH (I) .LT. 0.5) WRITE (6, 60) I                                VORLAX   2868
 60    FORMAT  (1H0, 43HINCIDENCE AND CAMBER SLOPE INPUT FOR PANEL ,I4)       VORLAX   2869
       IF  (SYNTH  (I)  .GT. 0.5 ) WRITE  (6, 70 ) I                          VORLAX   2870
 70    FORMAT  (1H0 , 38HPRESSURE DISTRIBUTION INPUT FOR PANEL , I4)          VORLAX   2871
       MAX = RNCV (I)                                                         VORLAX   2872
       KED2 = KED1 + MAX - 1                                                  VORLAX   2873
       WRITE (6, 80) AINC1 (I), AINC2 (I)                                     VORLAX   2874
 80    FORMAT (1H0, 2F10.4)                                                   VORLAX   2875
       WRITE (6, 90) (DNDX1 (J), J = KED1, KED2)                              VORLAX   2876
 90    FORMAT (1H , 10F10.4)                                                  VORLAX   2877
       WRITE (6, 90) (DNDX2 (J), J = KED1, KED2)                              VORLAX   2878
       KED1 = KED1 + MAX                                                      VORLAX   2879
 100   CONTINUE                                                               VORLAX   2880
C                                                                             VORLAX   2881
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      C...PRINTOUT PANEL AND TOTAL CONFIGURATION DATA (SECOND DATA GROUP).      VORLAX   2882
      C                                                                         VORLAX   2883
            WRITE (6, 350) TITLE                                                VORLAX   2884
        110 WRITE (6, 120) MACH (IQ), ALPHA (IH), PSI, PITCHQ, ROLLQ, YAWQ       VORLAX   2885
        120 FORMAT (1H0,6HMACH =, F7.3 //1H ,7HALPHA =, F7.3,5H DEG./1H ,       VORLAX   2886
           * 5HPSI =,  F7.3,5H DEG.//1H ,12HPITCH RATE =, F7.2,                 VORLAX   2887
           * 10H DEG /SEC /1H ,11HROLL RATE =, F7.2, 10H DEG /SEC  /1H ,        VORLAX   2888
           * 10HYAW RATE =, F7.2, 9H DEG /SEC ///)                              VORLAX   2889
            IF (INVERS  .EQ. 0) WRITE (6,130)                                   VORLAX   2890
            IF (INVERS  .EQ. 1) WRITE (6,140)                                   VORLAX   2891
        130 FORMAT (1H , 37HANALYSIS (DIRECT) CASE    (INVERS = 0)////)         VORLAX   2892
        140 FORMAT (1H , 37HDESIGN (INVERSE) CASE    (INVERS  = 1)////)         VORLAX   2893
            WRITE (6, 150) XBAR, ZBAR, VINF                                     VORLAX   2894
        150 FORMAT (1H , 39HMOMENT AND ROTATION CENTER  ≤   XBAR = , F12.5,     VORLAX   2895
           * 5X, 7HZBAR = , E12.5, 15H  ***** VINF = , E12.5)                   VORLAX   2896
            IF (HAG .EQ. 0.) WRITE (6, 160)                                     VORLAX   2897
        160 FORMAT (1H0, 37HCONFIGURATION IS OUT OF GROUND EFFECT)              VORLAX   2898
            IF (HAG .GT. 0.) WRITE (6, 170) HAG                                 VORLAX   2899
        170 FORMAT (1H0, 58HHEIGHT OF MOMENT REFERENCE CENTER ABOVE GROUND  ≤   VORLAX   2900
           *  HAG =   , E10.4)                                                  VORLAX   2901
            WRITE  (6, 180 ) FLOATX, FLOATY                                     VORLAX   2902
        180 FORMAT (/1H0, 45HVORTEX WAKE FLOATATION PARAMETERS ≤  FLOATX =,     VORLAX   2903
           * F5.2, 5X,  8HFLOATY =, F5.2)                                       VORLAX   2904
            WRITE (6, 190)                                                      VORLAX   2905
        190 FORMAT (/1H0/)                                                      VORLAX   2906
            WRITE (6, 200)                                                      VORLAX   2907
        200 FORMAT (1H , 39HCN REFERENCED TO SURF+  CL ,CY,CD,CT,CS ,           VORLAX   2908
           * 58HREFERENCED TO SREF+  CM REFERENCED TO SREF*CBAR+  CRM.CYM ,     VORLAX   2909
           * 24HREFERENCED TO SREF*WSPAN/)                                      VORLAX   2910
            WRITE  (6, 210 )                                                    VORLAX   2911
        210 FORMAT (1H ,7H   I    , 9HSURF/SREF, 7X, 5HCN(I), 7X, 5HCL(I),      VORLAX   2912
           * 7X, 5HCY(I), 7X, 5HCD(I), 7X, 5HCT(I), 7X, 5HCS(I), 10X,           VORLAX   2913
           * 5HCM(I), 7X, 6HCRM(I), 7X, 6HCYM(I) /)                             VORLAX   2914
        220 FORMAT (1H , I4, E12.4, 6F12.5, 2X, 3E13.4)                         VORLAX   2915
        230 FORMAT (1H , 2H**, I2, E12.4, 6F12.5, 2X, 3E13.4)                   VORLAX   2916
            I = 1                                                               VORLAX   2917
            IX = 0                                                              VORLAX   2918
            ICYCLE = 1                                                          VORLAX   2919
        240 IX = IX + 1                                                         VORLAX   2920
            CS = XSUC (IX) *SQRT (1.0 + (TAN (DTR *LESWP (I))) **2)             VORLAX   2921
            F1 = SURF (IX) /SREF                                                VORLAX   2922
            F2 = CN (IX)                                                        VORLAX   2923
            F3 = CL (IX) *F1                                                    VORLAX   2924
            F4 = CY (IX) *F1                                                    VORLAX   2925
            F5 = CD (IX) *F1                                                    VORLAX   2926
            F6 = XSUC (IX) *F1                                                  VORLAX   2927
            F7 = CS *F1                                                         VORLAX   2928
            F8 = CM (IX) *F1 /CBAR                                              VORLAX   2929
            F9 = CRM (IX) *F1 /WSPAN                                            VORLAX   2930
            F10 = CYM (IX) *F1 /WSPAN                                           VORLAX   2931
            IF (ICYCLE - 1) 250, 250, 260                                       VORLAX   2932
        250 WRITE (6, 220) I, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10           VORLAX   2933
            GO TO 270                                                           VORLAX   2934
        260 WRITE (6, 230) I, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10           VORLAX   2935
        270 IF (ICYCLE .EQ. 2) GO TO 290                                        VORLAX   2936
            I = I + 1                                                           VORLAX   2937
            IF (I - NPAN) 240, 240, 280                                         VORLAX   2938
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  280  IF  (LATRAL  .EQ. 0 ) GO TO 300                                   VORLAX   2939
       ICYCLE = 2                                                        VORLAX   2940
       I = 0                                                             VORLAX   2941
  290  I = I + 1                                                         VORLAX   2942
       IF (I .GT. NPAN) GO TO 300                                        VORLAX   2943
       IF (IQUANT (I) .EQ. 1) GO TO 290                                  VORLAX   2944
       GO TO 240                                                         VORLAX   2945
  300  WRITE (6, 310)                                                    VORLAX   2946
  310  FORMAT(1H0,6X, 4HSREF, 9X, 5HWSPAN, 10X, 4HCBAR, 13X, 5HCLTOT,9X, VORLAX   2947
      * 5HCDTOT, 9X, 5HCYTOT, 5X, 5HCMTOT, 9X, 6HCRMTOT, 8X, 6HCYMTOT /) VORLAX   2948
  320  FORMAT (1H , 3E14.5, 3F14.5, 3E14.5 //)                           VORLAX   2949
       CMTOT = CMTOT /CBAR                                               VORLAX   2950
       CRTOT = CRTOT /WSPAN                                              VORLAX   2951
       CNTOT = CNTOT /WSPAN                                              VORLAX   2952
       WRITE (6, 320) SREF, WSPAN, CBAR, CLTOT, CDTOT, CYTOT, CMTOT,     VORLAX   2953
      * CRTOT, CNTOT                                                     VORLAX   2954
       IF (CLTOT .EQ. 0.) GO TO 340                                      VORLAX   2955
       CDCL = CDTOT /(CLTOT **2)                                         VORLAX   2956
       E = (SREF *CLTOT **2) /(WSPAN **2 *PI *CDTOT)                     VORLAX   2957
       WRITE (6, 330) CDCL, E                                            VORLAX   2958
  330  FORMAT (1H0, 10HCD/CL**2 =, F7.4, 4X, 3HE =, F7.4)                VORLAX   2959
C                                                                        VORLAX   2960
C                                                                        VORLAX   2961
C...PRINTOUT DATA PERTAINING TO THE CHORDWISE LATTICE STRIPS AND         VORLAX   2962
C...TO THE INDIVIDUAL HORSESHOE VORTICES (AERODYNAMIC LOAD DISTRIBUTION  VORLAX   2963
C...DATA, THIRD DATA GROUP).                                             VORLAX   2964
C...                                                                     VORLAX   2965
C...INDEX LINE IS AN OUTPUT LINE COUNTER TO DETERMINE PAGE SWITCH        VORLAX   2966
C...CONTROL.                                                             VORLAX   2967
C...                                                                     VORLAX   2968
  340  LINE = 1                                                          VORLAX   2969
       DO 460 I = 1, ITOTAL                                              VORLAX   2970
       IF (LINE .EQ. 1) WRITE (6, 350) TITLE                             VORLAX   2971
  350  FORMAT (1H1, 20A4)                                                VORLAX   2972
       IF (LINE .EQ. 1) WRITE (6, 360) MACH (IQ), ALPHA (IH), PSI,       VORLAX   2973
      * PITCHQ, ROLLQ, YAWQ                                              VORLAX   2974
  360  FORMAT (1H0, 6HMACH =, F7.3, 4X, 7HALPHA =, F7.3, 3H DG, 4X,      VORLAX   2975
      * 5HPSI =, F7.3, 3H DG, 4X, 12HPITCH RATE =, F6.2, 4H D/S, 4X,     VORLAX   2976
      * 11HROLL RATE =, F6.2, 4H D/S, 4X, 10HYAW RATE =, F6.2, 4H D/S)   VORLAX   2977
       IF (LINE .EQ. 1) LINE = 3                                         VORLAX   2978
       IF (LINE .EQ. 3 .AND. INVERS .EQ. 0) WRITE (6, 420)               VORLAX   2979
       IF (LINE .EQ. 3 .AND. INVERS .EQ. 1) WRITE (6, 430)               VORLAX   2980
       IF (LINE .EQ. 3) LINE = 7                                         VORLAX   2981
       IS = SX (I)                                                       VORLAX   2982
       IC = CX (I)                                                       VORLAX   2983
       ILEX  = INVERS *IC                                                VORLAX   2984
C                                                                        VORLAX   2985
C...IF DESIGN PROCESS HAS BEEN INVOKED (INVERS = 1) THEN CALL            VORLAX   2986
C...SUBROUTINE ZNORM TO GENERATE THE CAMBERLINE THAT CORRESPONDS TO      VORLAX   2987
C...THE COMPUTED SLOPE DISTRIBUTION.                                     VORLAX   2988
C                                                                        VORLAX   2989
       IF (ILEX .EQ. 1) CALL ZNORM (I, IS, RNMAX (IS))                   VORLAX   2990
       R1V = IC                                                          VORLAX   2991
       R1 = .5 * (1. - COS ((R1V - .5) *PI /RNMAX (IS)))                 VORLAX   2992
       IF (LAX .EQ. 1) R1 = (R1V - 0.75) /RNMAX (IS)                     VORLAX   2993
       R2 = X (I)                                                        VORLAX   2994
       R3 = YY (I)                                                       VORLAX   2995
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      R4 = ZZ (I)                                                       VORLAX  2996
      R5 = CHORD (IS)                                                   VORLAX  2997
      R6 = SLOPE (I)                                                    VORLAX  2998
      R7 = DCP (I)                                                      VORLAX  2999
      R8  = CNC  (IS)                                                   VORLAX  3000
      R9 = R8 /R5                                                       VORLAX  3001
      R10 = DL (IS)                                                     VORLAX  3002
      R11 = CMTC (IS) /R5                                               VORLAX  3003
      R12 = GAMMA (I)                                                   VORLAX  3004
      IF (INVERS .EQ. 1) R12 = ZC (IC)                                  VORLAX  3005
      R13 = CSUC  (IS) *R5                                              VORLAX  3006
      R14 = CDC (IS)                                                    VORLAX  3007
      IF (IC .NE. 1) GO TO 400                                          VORLAX  3008
C                                                                       VORLAX  3009
      IF (IS .EQ. 1) GO TO 370                                          VORLAX  3010
      IF (IPAN (IS) .EQ. IPAN (IS - 1)) GO TO 390                       VORLAX  3011
  370 IM1 = (IPAN (IS) - 1) *10 + 1                                     VORLAX  3012
      IM2 = IM1 + 9                                                     VORLAX  3013
      WRITE (6, 380) IPAN (IS), (HEAD (JJ), JJ = IM1, IM2)              VORLAX  3014
      LINE = LINE + 2                                                   VORLAX  3015
  380 FORMAT (1H0, 30X, 9HPANEL NO., 2X, I2, 5X, 10A4)                  VORLAX  3016
C                                                                       VORLAX  3017
  390 WRITE (6, 440) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS) , R7,     VORLAX  3018
     * R8, R9, R10 , R11, R12, R13, R14                                 VORLAX  3019
      LINE = LINE + 1                                                   VORLAX  3020
      GO TO 410                                                         VORLAX  3021
  400 WRITE (6, 450) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS), R7, R12  VORLAX  3022
  410 LINE = LINE + 1                                                   VORLAX  3023
      IF (LINE .GT. 57) LINE = 1                                        VORLAX  3024
  420 FORMAT (1H0, 2X, 1HS, 2X, 1HC, 2X, 3HX/C, 6X, 1HX, 6X, 1HY,       VORLAX  3025
     * 8X, 1HZ, 5X, 5HCHORD, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,     VORLAX  3026
     * 3HCNC, 5X, 2HCN, 6X, 2HDL, 6X, 3HCMT, 8X, 5HGAMMA, 6X, 3HCTC,    VORLAX  3027
     * 6X, 3HCDC/1H0)                                                   VORLAX  3028
  430 FORMAT (1H0, 2X, 1HS, 2X, 1HC, 2X, 3HX/C, 6X, 1HX, 6X, 1HY,       VORLAX  3029
     * 8X, 1HZ, 5X, 5HCHORD, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,     VORLAX  3030
     * 3HCNC, 5X, 2HCN, 6X, 2HDL, 6X, 3HCMT, 8X, 4HZC/C, 6X, 3HCTC,     VORLAX  3031
     * 6X, 3HCDC/1H0)                                                   VORLAX  3032
  440 FORMAT (1H0, 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, I3, 1X, F8.3,  VORLAX  3033
     * F10.3, F7.3, F8.2, F10.4, E12.4, 2F9.5 )                         VORLAX  3034
  450 FORMAT (1H , 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, I3, 1X, F8.3,  VORLAX  3035
     * 35X, E12.4)                                                      VORLAX  3036
  460 CONTINUE                                                          VORLAX  3037
      IF (ISOLV .EQ. 1) GO TO 480                                       VORLAX  3038
C                                                                       VORLAX  3039
C...PRINTOUT RELAXATION SOLUTION PARAMETERS.                            VORLAX  3040
C                                                                       VORLAX  3041
      WRITE (6, 470) ITRMAX, EPS, ITER, BIG , RLM                       VORLAX  3042
  470 FORMAT (1H0, 8HITRMAX =, I3/1H0, 5HEPS =, F10.5/1H0, 6HITER =,    VORLAX  3043
     * I3/1H0, 5HBIG =, F10.5/1H0, 20HCONVERGENCE FACTOR =, F10.5)      VORLAX  3044
C                                                                       VORLAX  3045
C...IF FLOW FIELD SURVEY HAS BEEN REQUESTED (NXS % 0) THEN CALL         VORLAX  3046
C...SUBROUTINE MAP TO COMPUTE AND PRINT THE FLOW QUANTITIES AT          VORLAX  3047
C...THE NODAL POINTS OF THE SURVEY GRID.                                VORLAX  3048
C                                                                       VORLAX  3049
  480 IF  (NXS  .GT. 0) CALL MAP  (EW, EWX, EWY, ITOTAL)                VORLAX  3050
  490 WRITE (6, 500)                                                    VORLAX  3051
  500 FORMAT (1H0, 11HEND OF CASE)                                      VORLAX  3052
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                            RETURN                                                                     VORLAX    3053
                            END                                                                        VORLAX    3054


         SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3  PRINT

 VARIABLES        SN  TYPE             RELOCATION
  1440   AINC1          REAL        ARRAY     SET4           1464   AINC2        REAL        ARRAY     SET4
    20   ALFA           REAL                  SET11           334   ALOC         REAL        ARRAY     SET6
    10   ALPHA          REAL        ARRAY     SET11             1   BETA         REAL                  SET15
     0   BIG            REAL                  SET13             0   B2           REAL                  SET15
     2   CBAR           REAL                  SET15           240   CD           REAL        ARRAY     SET8
     0   CDC            REAL        ARRAY     SET9           1433   CDCL         REAL
     1   CDTOT          REAL                  SET12             0   CHORD        REAL        ARRAY     SET10
   170   CL             REAL        ARRAY     SET8              0   CLTOT        REAL                  SET12
   310   CM             REAL        ARRAY     SET8            144   CMTC         REAL        ARRAY     SET17
     2   CMTOT          REAL                  SET12           430   CN           REAL        ARRAY     SET8
   144   CNC            REAL        ARRAY     SET9              6   CNTOT        REAL                  SET12
   670   CRM            REAL        ARRAY     SET8              5   CRTOT        REAL                  SET12
  1420   CS             REAL                                  430   CSTARI       REAL        ARRAY     SET5
     0   CSUC           REAL        ARRAY     SET17             0   CX           INTEGER     ARRAY     SET3
   550   CY             REAL        ARRAY     SET8           1010   CYM          REAL        ARRAY     SET8
     4   CYTOT          REAL                  SET12             0   DCP          REAL        ARRAY     SET2
     4   DELTAY         REAL                  SET18             6   DELTAZ       REAL                  SET18
   144   DL             REAL        ARRAY     SET10             0   DNDX1        REAL        ARRAY     SET4
   620   DNDX2          REAL        ARRAY     SET4             50   DRAG         REAL        ARRAY     SET8
  1410   DTR            REAL                                 1434   E            REAL
     3   EPS            REAL                  SET13          1463   FU           REAL       *UNDEF
     0   EW             REAL        ARRAY      F.P.             0   FWX          REAL        ARRAY      F.P.
     0   EWY            REAL        ARRAY      F.P.            12   FLOATX       REAL                  / /
    13   FLOATY         REAL                  / /             360   FN           REAL        ARRAY     SET8
   500   FY             REAL        ARRAY     SET8           1421   F1           REAL
  1432   F10            REAL                                 1422   F2           REAL
  1423   F3             REAL                                 1424   F4           REAL
  1425   F5             REAL                                 1426   F6           REAL
  1427   F7             REAL                                 1430   F8           REAL
  1431   F9             REAL                                    0   GAMMA        REAL        ARRAY     SET16
    11   HAG            REAL                  / /              24   HEAD         REAL        ARRAY     SET6
  1411   I              INTEGER                              1437   IC           INTEGER
  1417   ICYCLE         INTEGER                             13560   IDES         INTEGER     ARRAY     SET3
     3   IH             INTEGER               / /            1440   ILEX         INTEGER
  1460   IM1            INTEGER                              1461   IM2          INTEGER
   404   INTRAC         INTEGER     ARRAY     SET20            14   INVERS       INTEGER               / /
  1130   IPAN           INTEGER     ARRAY     SET10             2   IQ           INTEGER               / /
   360   IQUANT         INTEGER     ARRAY     SET5           1436   IS           INTEGER
    15   ISOLV          INTEGER               / /               1   ITER         INTEGER               SET13
     0   ITOTAL         INTEGER                F.P.             2   ITRMAX       INTEGER               SET13
   170   ITS            INTEGER     ARRAY     SET7           1416   IX           INTEGER
  1415   J .            INTEGER                              1462   JJ           INTEGER
   214   JTS            INTEGER     ARRAY     SET7           1412   KED1         INTEGER
  1414   KED2           INTEGER                                 4   LATRAL       INTEGER               / /
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      SUBROUTINE PRINT      74/74    OPT=1                        FTN 4.5+410A       10/04/76  10.15.13         PAGE      7

VARIABLES      SN  TYPE            RELOCATION
     0  LAX         INTEGER                 / /             1  LAY        INTEGER              / /
   240  LESWP       REAL        ARRAY       SET5            0  LIFT       REAL       ARRAY     SET8
  1435  LINE        INTEGER                                 0  MACH       REAL       ARRAY     SET11
  1413  MAX         INTEGER                               120  MOMENT     REAL       ARRAY     SET8
    23  NALPHA      INTEGER                 SET11          22  NMACH      INTEGER              SET11
     0  NPAN        INTEGER                 SET14           3  NPANAS     INTEGER              SET14
   360  NPP         INTEGER     ARRAY       SET20           1  NT         INTEGER              SET14
   620  NVOR        REAL        ARRAY       SET5            0  NXS        INTEGER              SET18
     1  NYS         INTEGER                 SET18           2  NZS        INTEGER              SET18
  3720  ONSET       REAL        ARRAY       SET16         170  PDL        REAL       ARRAY     SET5
    50  PHIMED      REAL        ARRAY       SET20        1407  PI         REAL
     6  PITCHQ      REAL                    / /             5  PSI        REAL                 / /
   550  PSPAN       REAL        ARRAY       SET5          214  RCS        REAL       ARRAY     SET20
  7640  RFLAG       REAL        ARRAY       SET3            5  RLM        REAL                 SET13
   620  RM          REAL        ARRAY       SET8            0  RNCV       REAL       ARRAY     SET7
    24  RNMAX       REAL        ARRAY       SET7            7  ROLLG      REAL                 / /
  1442  R1          REAL                                 1441  R1V        REAL
  1453  R10         REAL                                 1454  R11        REAL
  1455  R12         REAL                                 1456  R13        REAL
  1457  R14         REAL                                 1443  R2         REAL
  1444  R3          REAL                                 1445  R4         REAL
  1446  R5          REAL                                 1447  R6         REAL
  1450  R7          REAL                                 1451  R8         REAL
  1452  R9          REAL                                   50  SLE        REAL       ARRAY     SET19
     0  SLE1        REAL        ARRAY       SET19          24  SLE2       REAL       ARRAY     SET19
  3720  SLOPE       REAL        ARRAY       SET2            2  SMAX       REAL                 SET14
   310  SPC         REAL        ARRAY       SET17           3  SREF       REAL                 SET12
  1130  SURF        REAL        ARRAY       SET8         3720  SX         INTEGER    ARRAY     SET3
   310  SYNTH       REAL        ARRAY       SET5          500  TAPER      REAL       ARRAY     SET5
     0  TITLE       INTEGER     ARRAY       SET6          454  TNL        REAL       ARRAY     SET10
   620  TNT         REAL        ARRAY       SET10          21  VINF       REAL                 SET11
  7640  VSP         REAL        ARRAY       SET2          310  VSS        REAL       ARRAY     SET10
 10270  VST         REAL        ARRAY       SET20           4  WSPAN      REAL                 SET13
     0  X           REAL        ARRAY       SET1            0  XAPEX      REAL       ARRAY     SET5
     3  XBAR        REAL                    SET15           7  XS         REAL       ARRAY     SET18
  1060  XSUC        REAL        ARRAY       SET8          764  XTE        REAL       ARRAY     SET10
  3720  Y           REAL        ARRAY       SET1           50  YAPEX      REAL       ARRAY     SET5
    10  YAWQ        REAL                    / /           740  YM         REAL       ARRAY     SET8
     3  YNOT        REAL                    SET18         430  YY         REAL       ARRAY     SET20
  4064  Z           REAL        ARRAY       SET1          120  ZAPEX      REAL       ARRAY     SET5
     4  ZBAR        REAL                    SET15        4230  ZC         REAL       ARRAY     SET1
   214  ZETA        REAL        ARRAY       SET19           0  ZLE1       REAL       ARRAY     SET20
    24  ZLE2        REAL        ARRAY       SET20           5  ZNOT       REAL                 SET18
  4350  ZZ          REAL        ARRAY       SET20

FILE NAMES         MODE
      TAPE6        FMT

EXTERNALS            TYPE    ARGS
      COS          REAL        1 LIBRARY                    MAP                  4
      SQRT         REAL        1 LIBRARY                    TAN       REAL       1 LIBRARY
      ZNORM                    3

STATEMENT LABELS
    26  10                             504  20     FMT                       514  30     FMT
   551  40     FMT                       0  50                               561  60     FMT
   574  70     FMT                     607  80     FMT                       616  90     FMT
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      SUBROUTINE PRINT      74/74    OPT=1                          FTN 4.5+410A       10/04/76  10.15.13        PAGE     8

STATEMENT LABELS
    0  100                                      130  110                                    642  120      FMT
  673  130     FMT                              701  140      FMT                           715  150      FMT
  733  160     FMT                              745  170      FMT                           763  180      FMT
  777  190     FMT                             1004  200      FMT                          1026  210      FMT
 1042  220     FMT                             1046  230      FMT                           170  240
    0  250        INACTIVE                      223  260                                    225  270
    0  280        INACTIVE                      235  290                                    242  300
 1112  310     FMT                             1124  320      FMT                          1151  330      FMT
  262  340                                     1162  350      FMT                          1175  360      FMT
  403  370                                     1227  380      FMT                           421  390
  430  400                                      435  410                                   1275  420      FMT
 1313  430     FMT                             1331  440      FMT                          1342  450      FMT
    0  460                                     1361  470      FMT                           446  480
    0  490        INACTIVE                     1377  500      FMT

LOOPS  LABEL    INDEX     FROM-TO     LENGTH     PROPERTIES
   33  50      * I          94 98        27B                EXT REFS
   63  100     * I         100 113       43B                EXT REFS
  264  460     * I         203 270      157B                EXT REFS

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                  5414B     2828
  CM LABELED COMMON LENGTH       77147B    32359
  CM BLANK COMMON LENGTH            16B       14
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      CONTROL*VRLX.SURVEY                                         9/17/76 VORLAX  3055
C...                                                                      VORLAX  3056
      SUBROUTINE SURVEY (EW, EWX, EWY, ITOTAL)                            VORLAX  3057
C...                                                                      VORLAX  3058
C...PURPOSE    TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT        VORLAX  3059
C...           MATRICESS (1) THE UPWASH AT THE FLOW FIELD SURVEY          VORLAX  3060
C...           POINTS (EW / UNIT 3), (2) THE AXIALWASH AT THE FLOW        VORLAX  3061
C...           FIELD SURVEY POINTS (EWX / UNIT 4), AND (3) THE            VORLAX  3062
C...           SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EWY / UNIT 7).   VORLAX  3063
C...           THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELD        VORLAX  3064
C...           DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW    VORLAX  3065
C...           FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED       VORLAX  3066
C...           3-D GRID.                                                  VORLAX  3067
C...                                                                      VORLAX  3068
C...INPUT      CALLING SEQUENCES                                          VORLAX  3069
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.               VORLAX  3070
C...           COMMONS                                                    VORLAX  3071
C...           X, B2, CX, DL, NT, SX, XS, YY, ZZ, HAG, LAX, NXS,          VORLAX  3072
C...           NYS, NZS, PSI, TNT, VSP, VST, XTE, ALFA, YNOT, XBAR,       VORLAX  3073
C...           ZBAR, ZNOT, CHORD, RNMAX, DELTAY, DELTAZ, FLOATX,          VORLAX  3074
C...           FLOATY, LATRAL.                                            VORLAX  3075
C...                                                                      VORLAX  3076
C...OUTPUT     CALLING SEQUENCES                                          VORLAX  3077
C...           EW = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)           VORLAX  3078
C...           EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4)       VORLAX  3079
C...           EWY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7)        VORLAX  3080
C...           COMMONS                                                    VORLAX  3081
C...           NONE.                                                      VORLAX  3082
C...                                                                      VORLAX  3083
C...SUBROUTINES                                                           VORLAX  3084
C...CALLED     WASH, UXVEL.                                               VORLAX  3085
C...                                                                      VORLAX  3086
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE     VORLAX  3087
C...           GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW      VORLAX  3088
C...           FIELD SURVEY POINT BY THE (K, J) HORSESHOE VORTEX OF       VORLAX  3089
C...           UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT I=           VORLAX  3090
C...           WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING           VORLAX  3091
C...           HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS        VORLAX  3092
C...           COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW      VORLAX  3093
C...           FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-D GRID     VORLAX  3094
C...           DEFINED BY A SET OF THREE ORTHOGONAL PLANES. THESE         VORLAX  3095
C...           PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT,      VORLAX  3096
C...           DELTAY, ZNOT, AND DELTAZ.                                  VORLAX  3097
C...                                                                      VORLAX  3098
C...                                                                      VORLAX  3099
C...                                                                      VORLAX  3100
C...                                                                      VORLAX  3101
      DIMENSION EW (ITOTAL)                                               VORLAX  3102
      DIMENSION EWX (ITOTAL)                                              VORLAX  3103
      DIMENSION EWY (ITOTAL)                                              VORLAX  3104
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,     VORLAX  3105
     * FLOATX, FLOATY                                                     VORLAX  3106
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                   VORLAX  3107
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                  VORLAX  3108
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)       VORLAX  3109
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)           VORLAX  3110
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),         VORLAX  3111
     * TNT (100), XTE (100), IPAN (100)
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      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA      VORLAX  3112
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                             VORLAX  3113
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                          VORLAX  3114
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)  VORLAX  3115
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),      VORLAX  3116
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)             VORLAX  3117
      INTEGER CX, SX                                                     VORLAX  3118
C                                                                        VORLAX  3119
      PI = 3.14159                                                       VORLAX  3120
      DTR = 0.01745329                                                   VORLAX  3121
C                                                                        VORLAX  3122
C                                                                        VORLAX  3123
      REWIND 3                                                           VORLAX  3124
      REWIND 4                                                           VORLAX  3125
      REWIND 7                                                           VORLAX  3126
C                                                                        VORLAX  3127
C                                                                        VORLAX  3128
      FLAX = LAX                                                         VORLAX  3129
C                                                                        VORLAX  3130
C...COMPUTE GEOMETRIC PARAMETERS RELATED TO WAKE FLOATATION.             VORLAX  3131
C                                                                        VORLAX  3132
      FAL = FLOATX *ALFA                                                 VORLAX  3133
      FBL = FLOATY *PSI * DTR                                            VORLAX  3134
      MM = 0                                                             VORLAX  3135
      IF (FAL .NE. 0.0  .OR. FBL .NE. 0.0) MM = 1                        VORLAX  3136
C                                                                        VORLAX  3137
C...COMPUTE GEOMETRIC PARAMETERS RELATED TO GROUND EFFECT.               VORLAX  3138
C                                                                        VORLAX  3139
      SI2A = SIN (2.0 *ALFA)                                             VORLAX  3140
      CO2A = COS (2.0 *ALFA)                                             VORLAX  3141
      HIM = HAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)                    VORLAX  3142
      XIMO = 2.0 *HIM *SIN (ALFA)                                        VORLAX  3143
      ZIMO = - 2.0 *HIM *COS (ALFA)                                      VORLAX  3144
      TAN2A = SI2A /CO2A                                                 VORLAX  3145
C                                                                        VORLAX  3146
C...THERE ARE TWO MAJOR NESTED DO-LOOP SYSTEMS THAT GENERATE THE         VORLAX  3147
C...COEFFICIENTS OF THE AERODYNAMIC INFLUENCE MATRICESS (1) LABEL 150    VORLAX  3148
C...SYSTEM, AND (2) LABEL 140 SYSTEM. LABEL 140 LOOPS ARE INTERNAL TO    VORLAX  3149
C...LABEL 150 LOOPS. THE LATTER ARE RELATED TO THE FLOW FIELD SURVEY     VORLAX  3150
C...GRID POINTS, AND THE FORMER TO THE HORSESHOE VORTEX LATTICE. THE     VORLAX  3151
C...VORTEX LATTICE IS COVERED STREAMWISE STRIP BY STREAMWISE STRIP.      VORLAX  3152
C...THE SAME CODE LOGIC USED IN SUBROUTINE MATRIX IS APPLIED HERE.       VORLAX  3153
C                                                                        VORLAX  3154
      DO 150 I = 1, NXS                                                  VORLAX  3155
C                                                                        VORLAX  3156
C...LOCATE CROSS-FLOW PLANE.                                             VORLAX  3157
C                                                                        VORLAX  3158
      XCNTL = XS (I)                                                     VORLAX  3159
      DO 150 J1 = 1, NZS                                                 VORLAX  3160
C.                                                                       VORLAX  3161
C...LOCATE WATERLINE PLANE.                                              VORLAX  3162
C                                                                        VORLAX  3163
      RJ1 = J1                                                           VORLAX  3164
      ZK1 = ZNOT + DELTAZ *(RJ1 - 1.)                                    VORLAX  3165
      DO 150 K1 = 1, NYS                                                 VORLAX  3166
C                                                                        VORLAX  3167
C...COMPUTE GRID POINT BUTT LINE.                                        VORLAX  3168
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      C                                                                 VORLAX  3169
            RK1 = K1                                                    VORLAX  3170
            YK1 = YNOT + DELTAY *(RK1  - 1.)                            VORLAX  3171
      C                                                                 VORLAX  3172
      C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE, STRIP BY VORLAX  3173
      C...STRIP, I.E., THE OUTER 60-LOOP RELATES TO A CHORDWISE STRIP, AND VORLAX  3174
      C...THE INNER 60-LOOP RELATES TO A HORSESHOE WITHIN THE STRIP (FROM VORLAX  3175
      C...LEADING EDGE TO TRAILING EDGE).                               VORLAX  3176
      C                                                                 VORLAX  3177
            IR = 0                                                      VORLAX  3178
            DO 140 K = 1, NT                                            VORLAX  3179
      C                                                                 VORLAX  3180
      C...COMPUTE PARAMETERS COMMON TO A GIVEN STRIP.                   VORLAX  3181
      C                                                                 VORLAX  3182
            PION2 = PI *.5 /RNMAX (K)                                   VORLAX  3183
            PION3 = 0.5 *PION2                                          VORLAX  3184
            PION4 = PION2 /8.0                                          VORLAX  3185
            DELX = CHORD (K) /RNMAX (K)                                 VORLAX  3186
            WEIGHT = 1.0                                                VORLAX  3187
            WT1 = 0.25 *DELX                                            VORLAX  3188
            CDL = COS (DTR* DL (K))                                     VORLAX  3189
            SDL = SIN (DTR * DL (K))                                    VORLAX  3190
            COS1 = COS (DTR * DL (K))                                   VORLAX  3191
            COS2 = COS1                                                 VORLAX  3192
            SIN1 = SIN (- DTR *DL (K))                                  VORLAX  3193
            SIN2 = - SIN1                                               VORLAX  3194
            COSIM = COS (2.0 *DTR *DL (K))                              VORLAX  3195
            SINIM = SIN (2.0 *DTR *DL (K))                              VORLAX  3196
            MAX2 = RNMAX (K)                                            VORLAX  3197
      C                                                                 VORLAX  3198
            AA = FAL *CDL - FBL *SDL                                    VORLAX  3199
            AM = FBL *CDL + FAL *SDL                                    VORLAX  3200
      C                                                                 VORLAX  3201
       10   DO 140 J = 1, MAX2                                          VORLAX  3202
            IR = IR + 1                                                 VORLAX  3203
            XLOAD  = X (IR)                                             VORLAX  3204
            X1 = XCNTL - XLOAD                                          VORLAX  3205
            YP = YK1 + YY(IR)                                           VORLAX  3206
            YS = YK1 - YY (IR)                                          VORLAX  3207
            ZS = ZK1 - ZZ (IR)                                          VORLAX  3208
            Y1 = YS *CDL + ZS *SDL                                      VORLAX  3209
            Z1 = ZS *CDL - YS *SDL                                      VORLAX  3210
            Y2 = YP *CDL - ZS *SDL                                      VORLAX  3211
            Z2 = ZS *CDL + YP *SDL                                      VORLAX  3212
            RYZ1 = Y1 *Y1 + Z1 *Z1                                      VORLAX  3213
            RYZ2 = Y2 *Y2 + Z2 *Z2                                      VORLAX  3214
            X1SQ = X1 *X1                                               VORLAX  3215
            RS1 = X1SQ - B2 *RYZ1                                       VORLAX  3216
            RS2 = X1SQ - B2 *RYZ2                                       VORLAX  3217
            IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)                          VORLAX  3218
            IF (RS2 .GT. 0.0) RS2 = SQRT(RS2)                           VORLAX  3219
            IF (LAX .EQ. 1) GO TO 20                                    VORLAX  3220
            RJ = 2 *J - 1                                               VORLAX  3221
            RJ1 = 4 *J - 3                                              VORLAX  3222
            DELX = 1.0                                                  VORLAX  3223
            WEIGHT = PION2 *SIN (RJ *PION2) *CHORD (K)                  VORLAX  3224
            WT1 = PION3 *SIN (RJ1 *PION3) *CHORD (K)                    VORLAX  3225
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   20 XU1 = XLOAD - WT1                                                   VORLAX  3226
      CT = XTE (K) - XLOAD                                                VORLAX  3227
      TESP = TNT (K)                                                      VORLAX  3228
      ESP = VSP (IR)                                                      VORLAX  3229
      VOSS = VST (IR)                                                     VORLAX  3230
      TOLZ = WEIGHT *DELX *1.0E-1                                         VORLAX  3231
C                                                                         VORLAX  3232
C...IF FIELD POINT IS WITHIN A GIVEN NEAR FIELD RADIUS (RNF) OF           VORLAX  3233
C...HORSESHOE THEN COMPUTE AXIALWASH (U1) BY INTERDIGITATED VORTEX        VORLAX  3234
C...SPLITTING.                                                            VORLAX  3235
C                                                                         VORLAX  3236
      UVEL = 0.0                                                          VORLAX  3237
      IDIT = 0                                                            VORLAX  3238
      RNF = 4.0 *WEIGHT *DELX                                             VORLAX  3239
      IF (RS1 .LE. 0.0) GO TO 60                                          VORLAX  3240
      IF (RS1 .GT. RNF) GO TO 60                                          VORLAX  3241
      RJM = J - 1                                                         VORLAX  3242
      COSM = COS (2.0 *PION2 *RJM)                                        VORLAX  3243
      DO 50 L = 1, 8                                                      VORLAX  3244
      IF (LAX .EQ. 0) GO TO 30                                            VORLAX  3245
      RVL = 4 *L - 3                                                      VORLAX  3246
      XDIF = RVL *DELX /32.0                                              VORLAX  3247
      WFR = 0.1250                                                        VORLAX  3248
      GO TO 40                                                            VORLAX  3249
   30 RVL = 16 *(J - 1) + 2 *L - 1                                        VORLAX  3250
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                    VORLAX  3251
      WFR = PION4 *SIN (PION4 *RVL)                                       VORLAX  3252
   40 XINT = XCNTL - XU1 - XDIF                                           VORLAX  3253
      CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, B2, TOLZ, UDV)                 VORLAX  3254
      UVEL = UVEL + UDV *WFR                                              VORLAX  3255
   50 CONTINUE                                                            VORLAX  3256
      DCW = 1.0                                                           VORLAX  3257
      IF (LAX .EQ. 0)  DCW = CHORD (K) /WEIGHT                            VORLAX  3258
      UVEL = UVEL * DCW                                                   VORLAX  3259
      IDIT = 1                                                            VORLAX  3260
C                                                                         VORLAX  3261
C...SUBROUTINE WASH COMPUTES THE VELOCITY COMPONENTS INDUCED BY A         VORLAX  3262
C...GENERALIZED HORSESHOE VORTEX OF UNIT STRNGTH.                         VORLAX  3263
C                                                                         VORLAX  3264
   60 CALL WASH (X1,Y1,Z1,VOSS,ESP,B2,U1,V1,W1,AA,AM,TESP,CT,MM)          VORLAX  3265
      IF (IDIT .EQ. 1) U1 = UVEL                                          VORLAX  3266
C                                                                         VORLAX  3267
C...IF CONFIGURATION IS IN GROUND EFFECT (HAG . 0.) THEN COMPUTE THE      VORLAX  3268
C...INDUCTION DUE TO IMAGE OF HORSESHOE MIRRORED ABOUT GROUND PLANE.      VORLAX  3269
C                                                                         VORLAX  3270
      IF (HAG .EQ. 0.0) GO TO 70                                          VORLAX  3271
      XIM = XIMO + X (IR) *CO2A + ZZ (IR) *SI2A                           VORLAX  3272
      ZIM = ZIMO + X (IR) *SI2A - ZZ (IR) *CO2A                           VORLAX  3273
      X1I = XCNTL - XIM                                                   VORLAX  3274
      ZSI = ZK1 - ZIM - X1I *TAN2A                                        VORLAX  3275
      Y1I = YS *CDL - ZSI *SDL                                            VORLAX  3276
      Z1I = ZSI *CDL + YS *SDL                                            VORLAX  3277
      CALL WASH (X1I,Y1I,Z1I,VOSS,ESP,B2,U1I,V1I,W1I,AA,AM,TESP,CT,MM)    VORLAX  3278
      U1 = U1 - U1I                                                       VORLAX  3279
      V1 = V1 - V1I *COSIM - W1I *SINIM                                   VORLAX  3280
      W1 = W1 + V1I *SINIM - W1I *COSIM                                   VORLAX  3281
   70 IF (LATRAL .EQ. 1) GO TO 130                                        VORLAX  3282
```

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C                                                                         VORLAX   3283
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN            VORLAX   3284
C...COMPUTE INFLUENCE OF IMAGE OF HORSESHOE MIRRORED ABOUT PLANE OF       VORLAX   3285
C...SYMMETRY, I.E., X-Z PLANE.                                            VORLAX   3286
C                                                                         VORLAX   3287
C                                                                         VORLAX   3288
      UVEL = 0.0                                                          VORLAX   3289
      IDIT = 0                                                            VORLAX   3290
      IF (RS2 .LE. 0.0) GO TO 110                                         VORLAX   3291
      IF (RS2 .GT. RNF) GO TO 110                                         VORLAX   3292
      RJM = J - 1                                                         VORLAX   3293
      COSM = COS (2.0 *PION2 *RJM)                                        VORLAX   3294
      DO 100 L = 1, 8                                                     VORLAX   3295
      IF (LAX .EQ. 0) GO TO 80                                            VORLAX   3296
      RVL = 4 *L - 3                                                      VORLAX   3297
      XDIF = RVL *DELX /32.0                                              VORLAX   3298
      WFR = 0.1250                                                        VORLAX   3299
      GO TO 90                                                            VORLAX   3300
   80 RVL = 16 *(J - 1) + 2 *L - 1                                        VORLAX   3301
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                    VORLAX   3302
      WFR = PION4 *SIN (PION4 *RVL)                                       VORLAX   3303
   90 XINT = XCNTL - XU1 - XDIF                                           VORLAX   3304
      CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)                VORLAX   3305
      UVEL = UVEL + UDV *WFR                                              VORLAX   3306
  100 CONTINUE                                                            VORLAX   3307
      DCW = 1.0                                                           VORLAX   3308
      IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT                             VORLAX   3309
      UVEL = UVEL *DCW                                                    VORLAX   3310
      IDIT = 1                                                            VORLAX   3311
C                                                                         VORLAX   3312
  110 CALL WASH (X1,Y2,Z2,VOSS, - ESP,B2,U2,V2,W2,AA,AM, -TESP,CT,MM)     VORLAX   3313
      IF (IDIT .EQ. 1) U2 = UVEL                                          VORLAX   3314
C                                                                         VORLAX   3315
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND            VORLAX   3316
C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF          VORLAX   3317
C...IMAGE OF HORSESHOE MIRRORED ABOUT CENTER PLANE (X-Z PLANE) AND        VORLAX   3318
C...MIRRORED ONCE MORE ABOUT GROUND PLANE.                                VORLAX   3319
C                                                                         VORLAX   3320
      IF (HAG  .EQ. 0.0) GO TO 120                                        VORLAX   3321
      Y2I = YP *CDL + ZSI *SDL                                            VORLAX   3322
      Z2I = ZSI *CDL - YP *SDL                                            VORLAX   3323
      CALL WASH(X1I,Y2I,Z2I,VOSS,-ESP,B2,U2I,V2I,W2I,AA,AM,-TESP,CT,MM)   VORLAX   3324
      U2 = U2 - U2I                                                       VORLAX   3325
      V2 = V2 - V2I *COSIM + W2I *SINIM                                   VORLAX   3326
      W2 = W2 - V2I *SINIM - W2I *COSIM                                   VORLAX   3327
C                                                                         VORLAX   3328
  120 EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT       VORLAX   3329
      EWY (IR) = (V1 *COS1 + V2 *COS2 - W1 *SIN1 - W2 *SIN2) *WEIGHT      VORLAX   3330
      EWX (IR) = (U1 + U2) *WEIGHT                                        VORLAX   3331
      GO TO 140                                                           VORLAX   3332
C                                                                         VORLAX   3333
  130 EW (IR) = (W1 *COS1 - V1 *SIN1) *WEIGHT                             VORLAX   3334
      EWY (IR) = (V1 *COS1 - W2 *SIN2) *WEIGHT                            VORLAX   3335
      EWX (IR) = U1 *WEIGHT                                               VORLAX   3336
  140 CONTINUE                                                            VORLAX   3337
C                                                                         VORLAX   3338
C                                                                         VORLAX   3339
```

```
        SUBROUTINE SURVEY      74/74    OPT=1                                     FTN 4.5+410A       10/04/76  10.15.13         PAGE      6

                      WRITE (3) EW                                                                          VORLAX    3340
                      WRITE (4) EWX                                                                         VORLAX    3341
                      WRITE (7) EWY                                                                         VORLAX    3342
                C                                                                                           VORLAX    3343
  290           C                                                                                           VORLAX    3344
                 150  CONTINUE                                                                              VORLAX    3345
                C                                                                                           VORLAX    3346
                C                                                                                           VORLAX    3347
                      REWIND 3                                                                              VORLAX    3348
  295                 REWIND 4                                                                              VORLAX    3349
                      REWIND 7                                                                              VORLAX    3350
                C                                                                                           VORLAX    3351
                C                                                                                           VORLAX    3352
                      RETURN                                                                                VORLAX    3353
  300                 END                                                                                   VORLAX    3354


        SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  SURVEY

VARIABLES      SN  TYPE           RELOCATION
 1026  AA           REAL                              20  ALFA      REAL                 SET11
   10  ALPHA        REAL      ARRAY    SFT11        1027  AM        REAL
    1  BETA         REAL               SET15           0  B2        REAL                 SET15
    2  CBAR         REAL               SET15        1015  CDL       REAL
    0  CHORD        REAL      ARRAY    SET10        1023  COSIM     REAL
 1062  COSM         REAL                            1017  COS1      REAL
 1020  COS2         REAL                             770  CO2A      REAL
 1051  CT           REAL                               0  CX        INTEGER   ARRAY      SET3
    0  DCP          REAL      ARRAY    SET2         1071  DCW       REAL
    4  DELTAY       REAL               SET18           6  DELTAZ    REAL                 SET18
 1012  DELX         REAL                             144  DL        REAL      ARRAY      SET10
  762  DTR          REAL                            1053  ESP       REAL
    0  EW           REAL      ARRAY     F.P.           0  EWX       REAL      ARRAY       F.P.
    0  EWY          REAL      ARRAY     F.P.         764  FAL       REAL
  765  FBL          REAL                             763  FLAX      REAL
   12  FLOATX       REAL               / /            13  FLOATY    REAL                 / /
   11  HAG          REAL               / /           771  HIM       REAL
  775  I            INTEGER                        13560  IDES      INTEGER   ARRAY      SET3
 1057  IDIT         INTEGER                            3  IH        INTEGER              / /
  404  INTRAC       INTEGER   ARRAY    SET20        1130  IPAN      INTEGER   ARRAY      SET10
    2  IQ           INTEGER            / /          1005  IR        INTEGER
    0  ITOTAL       INTEGER             F.P.         170  ITS       INTEGER   ARRAY      SET7
 1030  J            INTEGER                          214  JTS       INTEGER   ARRAY      SET7
  777  J1           INTEGER                         1006  K         INTEGER
 1002  K1           INTEGER                         1063  L         INTEGER
    4  LATRAL       INTEGER            / /             0  LAX       INTEGER              / /
    1  LAY          INTEGER            / /             0  MACH      INTEGER   ARRAY      SET11
 1025  MAX2         INTEGER                          766  MM        INTEGER
   23  NALPHA       INTEGER            SET11          22  NMACH     INTEGER              SET11
    0  NPAN         INTEGER            SET14           3  NPANAS    INTEGER              SET14
  360  NPP          INTEGER   ARRAY    SET20           1  NT        INTEGER              SET14
```

```
      SUBROUTINE SURVEY     74/74    OPT=1                        FTN 4.5+410A       10/04/76  10.15.13        PAGE      7

VARIABLES      SN  TYPE             RELOCATION
    0  NXS         INTEGER               SET18          1  NYS         INTEGER                 SET18
    2  NZS         INTEGER               SET18         50  PHIMED      REAL         ARRAY      SET20
  761  PI          REAL                              1007  PION2       REAL
 1010  PION3       REAL                              1011  PION4       REAL
    6  PITCHO      REAL                  / /            5  PSI         REAL                    / /
  214  RCS         REAL         ARRAY    SET20       7640  RFLAG       REAL         ARRAY      SET3
 1047  RJ          REAL                              1061  RJM         REAL
 1000  RJ1         REAL                              1003  RK1         REAL
    0  RNCV        REAL         ARRAY    SET7        1060  RNF         REAL
   24  RNMAX       REAL         ARRAY    SET17          7  ROLLG       REAL                    / /
 1045  RS1         REAL                              1046  RS2         REAL
 1064  RVL         REAL                              1042  RYZ1        REAL
 1043  RYZ2        REAL                              1016  SOL         REAL
 1024  SIN1M       REAL                              1021  SIN1        REAL
 1022  SIN2        REAL                               747  S12A        REAL
 3720  SLOPE       REAL         ARRAY    SET2           2  SMAX        REAL                    SET14
 3720  SX          INTEGER      ARRAY    SET3         774  TAN2A       REAL
 1052  TESP        REAL                               454  TNL         REAL         ARRAY      SET10
  620  TNT         REAL         ARRAY    SET10       1055  TOLZ        REAL
 1070  UDV         REAL                              1056  UVEL        REAL
 1072  U1          REAL                              1103  U1I         REAL
 1106  U2          REAL                              1113  U2I         REAL
   21  VINF        REAL                  SET11       1054  VOSS        REAL
 7640  VSP         REAL         ARRAY    SET2         310  VSS         REAL         ARRAY      SET10
10270  VST         REAL         ARRAY    SET20       1073  V1          REAL
 1104  V1I         REAL                              1107  V2          REAL
 1114  V2I         REAL                              1013  WEIGHT      REAL
 1066  WFR         REAL                              1014  WT1         REAL
 1074  W1          REAL                              1105  W1I         REAL
 1110  W2          REAL                              1115  W2I         REAL
    0  X           REAL         ARRAY    SET1           3  XBAR        REAL                    SET15
  776  XCNTL       REAL                              1065  XDIF        REAL
 1075  XIM         REAL                               772  XIMO        REAL
 1067  XINT        REAL                              1031  XLOAD       REAL
    7  XS          REAL         ARRAY    SET18        764  XTE         REAL         ARRAY      SET10
 1050  XU1         REAL                              1032  X1          REAL
 1077  X1I         REAL                              1044  X1SQ        REAL
 3720  Y           REAL         ARRAY    SET1          10  YAWO        REAL                    / /
 1004  YK1         REAL                                 3  YNOT        REAL                    SET18
 1033  YP          REAL                              1034  YS          REAL
  430  YY          REAL         ARRAY    SET20       1036  Y1          REAL
 1101  Y1I         REAL                              1040  Y2          REAL
 1111  Y2I         REAL                              4064  Z           REAL         ARRAY      SET1
    4  ZBAR        REAL                  SET15       4230  ZC          REAL         ARRAY      SET1
 1076  ZIM         REAL                               773  ZIMO        REAL
 1001  ZK1         REAL                                 0  ZLE1        REAL         ARRAY      SET20
   24  ZLE2        REAL         ARRAY    SET20          5  ZNOT        REAL                    SET18
 1035  ZS          REAL                              1100  ZSI         REAL
 4350  ZZ          REAL         ARRAY    SET20       1037  Z1          REAL
 1102  Z1I         REAL                              1041  Z2          REAL
 1112  Z2I         REAL

FILE NAMES        MODE
      TAPE3       UNFMT               TAPE4     UNFMT               TAPE7     UNFMT
```

```
      SUBROUTINE SURVEY      74/74    OPT=1                           FTN 4.5+410A        10/04/76  10.15.13        PAGE      8

EXTERNALS         TYPE    ARGS
        COS      REAL       1 LIBRARY                            SIN       REAL         1 LIBRARY
        SQRT     REAL       1 LIBRARY                            UXVEL                  8
        WASH               14

STATEMENT LABELS
    0  10          INACTIVE               233  20                                 272  30
  307  40                                   0  50                                 331  60
  374  70                                 420  80                                 435  90
    0  100                                460  110                                514  120
  533  130                                544  140                                  0  150

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
  410  100     * L          241 253        40B               EXT REFS

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

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

```
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 SEHMENT 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
C                                                                          VORLAX  3399
      CUTOFF = 0.80                                                        VORLAX  3400
      X1 = X + T*S                                                         VORLAX  3401
      Y1 = Y + S                                                           VORLAX  3402
      X2 = X - T*S                                                         VORLAX  3403
      Y2  = Y  - S                                                         VORLAX  3404
      XTY = X - T *Y                                                       VORLAX  3405
      U = 0.                                                               VORLAX  3406
      TOL = TOLZ                                                           VORLAX  3407
      TOLSQ  = TOL *TOL                                                    VORLAX  3408
      ZSQ  = Z *Z                                                          VORLAX  3409
      BZQ  = B2 *ZSQ                                                       VORLAX  3410
      IF (ABS (BZQ) .LT. TOLSQ) GO TO 90                                   VORLAX  3411
```

```
      YSQ1 = Y1 *Y1                                                     VORLAX    3412
      YSQ2 = Y2 *Y2                                                     VORLAX    3413
      RTV1 = YSQ1 + ZSQ                                                 VORLAX    3414
      RTV2 = YSQ2 + ZSQ                                                 VORLAX    3415
      RO1 = B2 *RTV1                                                    VORLAX    3416
      RO2 = B2 *RTV2                                                    VORLAX    3417
      RAD1 = 0.0                                                        VORLAX    3418
      RAD2 = 0.0                                                        VORLAX    3419
      XSQ1 = X1 *X1                                                     VORLAX    3420
      XSQ2 = X2 *X2                                                     VORLAX    3421
      IF (B2) 10, 40, 40                                                VORLAX    3422
C                                                                       VORLAX    3423
C                                                                       VORLAX    3424
C...SUBSONIC FLOW COMPUTATION.                                          VORLAX    3425
C                                                                       VORLAX    3426
C                                                                       VORLAX    3427
 10   CPI = 12.56636                                                    VORLAX    3428
      ARG = XSQ1 - RO1                                                  VORLAX    3429
      RAD1 = SQRT (ARG)                                                 VORLAX    3430
      ARG = XSQ2 - RO2                                                  VORLAX    3431
      RAD2 = SQRT (ARG)                                                 VORLAX    3432
      FB1 = 0.0                                                         VORLAX    3433
      FB2 = 0.0                                                         VORLAX    3434
      XBSQ = XTY *XTY                                                   VORLAX    3435
      TBZ = (T *T - B2) *ZSQ                                            VORLAX    3436
      DENOM = XBSQ + TBZ                                                VORLAX    3437
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = TOLSQ                         VORLAX    3438
      FB1 = (T *X1 - B2 *Y1) /RAD1                                      VORLAX    3439
 20   FB2 = (T *X2 - B2 *Y2) /RAD2                                      VORLAX    3440
 30   QB = (FB1 - FB2) /DENOM                                           VORLAX    3441
      ZETAPI = Z /CPI                                                   VORLAX    3442
      U = ZETAPI *QB                                                    VORLAX    3443
      GO TO 90                                                          VORLAX    3444
C                                                                       VORLAX    3445
C                                                                       VORLAX    3446
C...SUPERSONIC FLOW COMPUTATION.                                        VORLAX    3447
C                                                                       VORLAX    3448
C                                                                       VORLAX    3449
 40   CPI = 6.28318                                                     VORLAX    3450
      IF (X1 .LT. TOL) GO TO 50                                         VORLAX    3451
      ARG = XSQ1 - RO1                                                  VORLAX    3452
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)                               VORLAX    3453
 50   IF (X2 .LT. TOL) GO TO 60                                         VORLAX    3454
      ARG = XSQ2 - RO2                                                  VORLAX    3455
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)                               VORLAX    3456
 60   ZETAPI = Z /CPI                                                   VORLAX    3457
      FB1 = 0.0                                                         VORLAX    3458
      FB2 = 0.0                                                         VORLAX    3459
      XBSQ = XTY *XTY                                                   VORLAX    3460
      TBZ = (T *T - B2) *ZSQ                                            VORLAX    3461
      DENOM = XBSQ + TBZ                                                VORLAX    3462
      SIGN = 1.0                                                        VORLAX    3463
      IF (DENOM .LT. 0.0) SIGN = - 1.0                                  VORLAX    3464
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = SIGN *TOLSQ                   VORLAX    3465
      IF (X1 .LT. TOL) GO TO 70                                         VORLAX    3466
      IF (RAD1 .EQ. 0.0) GO TO 70                                       VORLAX    3467
```

```
 115                 FRAD = RAD1                                                  VORLAX    3469
                     IF (RO1 .GT. REPS) GO TO 70                                  VORLAX    3470
                     FB1 = (T *X1 - B2 *Y1) /FRAD                                 VORLAX    3471
               70    IF (X2 .LT. TOL) GO TO 80                                    VORLAX    3472
                     IF (RAD2 .EQ. 0.0) GO TO 80                                  VORLAX    3473
 120                 REPS = CUTOFF *XSQ2                                          VORLAX    3474
                     FRAD = RAD2                                                  VORLAX    3475
                     IF (RO2 .GT. REPS) GO TO 80                                  VORLAX    3476
                     FB2 = (T *X2 - B2 *Y2) /FRAD                                 VORLAX    3477
               80    QB = (FB1 - FB2) /DENOM                                      VORLAX    3478
 125                 U = ZETAPI *QB                                               VORLAX    3479
               C                                                                  VORLAX    3480
               C                                                                  VORLAX    3481
               90    RETURN                                                       VORLAX    3482
                     END                                                          VORLAX    3483


       SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  UXVEL

VARIABLES      SN  TYPE            RELOCATION
  235  ARG         REAL                              221  BZO         REAL
    0  B2          REAL                 F.P.         234  CPT         REAL
  210  CUTOFF      REAL                              242  DENOM       REAL
  236  FB1         REAL                              237  FB2         REAL
  247  FRAD        REAL                              243  QB          REAL
  230  RAD1        REAL                              231  RAD2        REAL
  246  REPS        REAL                              226  RO1         REAL
  227  RO2         REAL                              224  RTV1        REAL
  225  RTV2        REAL                                0  S           REAL          F.P.
  245  SIGN        REAL                                0  T           REAL          F.P.
  241  TBZ         REAL                              216  TOL         REAL
  217  TOLSQ       REAL                                0  TOLZ        REAL          F.P.
    0  U           REAL                 F.P.           0  X           REAL          F.P.
  240  XBSQ        REAL                              232  XSQ1        REAL
  233  XSQ2        REAL                              215  XTY         REAL
  211  X1          REAL                              213  X2          REAL
    0  Y           REAL                 F.P.         222  YSQ1        REAL
  223  YSQ2        REAL                              212  Y1          REAL
  214  Y2          REAL                                0  Z           REAL          F.P.
  244  ZETAPI      REAL                              220  ZSQ         REAL

EXTERNALS          TYPE    ARGS
       SQRT        REAL       1 LIBRARY

INLINE FUNCTIONS   TYPE    ARGS
       ABS         REAL       1  INTRIN

STATEMENT LABELS
    0  10           INACTIVE              0  20           INACTIVE              0  30           INACTIVE
  104  40                               115  50                               125  60
  162  70                               175  80                               202  90
```

```
STATISTICS
  PROGRAM LENGTH               250B      168
```

```
      CONTROL*VRLX.VECTOR                                               9/14/76  VORLAX    3484
C...                                                                             VORLAX    3485
      SUBROUTINE VECTOR (ITOTAL, NX1, AV, EW, VOR1, 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...            VOR1 = 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
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                          VORLAX    3524
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                             VORLAX    3525
C                                                                                VORLAX    3526
      DIMENSION AV (NX1), VOR1 (NX1), VORK (NX1), VORL (NX1)                     VORLAX    3527
      DIMENSION EW (ITOTAL)                                                      VORLAX    3528
C                                                                                VORLAX    3529
C                                                                                VORLAX    3530
C                                                                                VORLAX    3531
C ***************** SOLUTION BY VECTOR METHOD **********************             VORLAX    3532
C                                                                                VORLAX    3533
      REWIND 1                                                                   VORLAX    3534
C                                                                                VORLAX    3535
C...UNITS 11 AND 12 ARE TEMPORARY DATA STORAGE. DATA STORED IN THESE             VORLAX    3536
C...UNITS ARE NOT USED ANYWHERE ELSE IN THE PROGRAM.                             VORLAX    3537
C                                                                                VORLAX    3538
      REWIND 11                                                                  VORLAX    3539
      REWIND 12                                                                  VORLAX    3540
```

```
C                                                                        VORLAX   3541
C                                                                        VORLAX   3542
C...ALL VECTORS ARE EXTENDED, I.E., THEY HAVE A DIMENSION EQUAL TO       VORLAX   3543
C...THE NUMBER OF UNKNOWNS PLUS ONE.                                     VORLAX   3544
C                                                                        VORLAX   3545
C      NX1 = ITOTAL + 1                                                  VORLAX   3546
C                                                                        VORLAX   3547
C...DEFINE INITIAL SET OF VECTORS WITH ≠DIAGONAL≠ ELEMENTS EQUAL TO      VORLAX   3548
C...UNITY, AND ALL OTHER ELEMENTS ZEROED OUT.                            VORLAX   3549
C                                                                        VORLAX   3550
      DO 20 K = 1, NX1                                                   VORLAX   3551
      DO 10 J = 1, NX1                                                   VORLAX   3552
      VORK (J) = 0.0                                                     VORLAX   3553
      IF (J .EQ. K) VORK (J) = 1.0                                       VORLAX   3554
   10 CONTINUE                                                           VORLAX   3555
      WRITE (11) VORK                                                    VORLAX   3556
   20 CONTINUE                                                           VORLAX   3557
C                                                                        VORLAX   3558
C                                                                        VORLAX   3559
C...COMPUTE SUCCESSIVE SETS OF INTERMEDIATE VECTORS. THE JTH SET         VORLAX   3560
C...CONTAINS (NX1 - J) VECTORS WHICH ARE NORMAL (ORTHOGONAL) TO THE      VORLAX   3561
C...FIRST J VECTORS. CONSEQUENTLY THE LAST SET (J = ITOTAL) IS ORTHO     VORLAX   3562
C...GONAL TO ALL THE VECTORS AND IT CONTAINS THE SOLUTION OF THE         VORLAX   3563
C...LINEAR SYSTEM (THE FIRST ITOTAL OF THE NX1 ELEMENTS, I.E., ALL       VORLAX   3564
C...THE ELEMENTS BUT THE LAST ONE ARE THE VALUES OF THE UNKNOWNS).       VORLAX   3565
C                                                                        VORLAX   3566
      REWIND 11                                                          VORLAX   3567
      IN = 11                                                            VORLAX   3568
      DO 80 JJ = 1, ITOTAL                                               VORLAX   3569
      IM = 23 - IN                                                       VORLAX   3570
      READ (1) EW                                                        VORLAX   3571
      READ (IN) VOR1                                                     VORLAX   3572
      DO 30 I = 1, NX1                                                   VORLAX   3573
      IF (I .LT. NX1) AV (I) = EW (I)                                    VORLAX   3574
      IF (I .EQ. NX1) AV (I) = - ALOC (JJ)                               VORLAX   3575
   30 CONTINUE                                                           VORLAX   3576
      RDEN = 0.0                                                         VORLAX   3577
      DO 40 I = 1, NX1                                                   VORLAX   3578
      RDEN = RDEN + AV (I) *VOR1 (I)                                     VORLAX   3579
   40 CONTINUE                                                           VORLAX   3580
      NTOP = NX1 - JJ                                                    VORLAX   3581
      DO 70 KK = 1, NTOP                                                 VORLAX   3582
      READ (IN) VORL                                                     VORLAX   3583
      RNUM = 0.0                                                         VORLAX   3584
      DO 50 I = 1, NX1                                                   VORLAX   3585
      RNUM = RNUM + AV (I) *VORL (I)                                     VORLAX   3586
   50 CONTINUE                                                           VORLAX   3587
      CJK = - RNUM /RDEN                                                 VORLAX   3588
      DO 60 I = 1, NX1                                                   VORLAX   3589
      VORK (I) = CJK *VOR1 (I) + VORL (I)                                VORLAX   3590
   60 CONTINUE                                                           VORLAX   3591
      WRITE (IM) VORK                                                    VORLAX   3592
   70 CONTINUE                                                           VORLAX   3593
      REWIND 11                                                          VORLAX   3594
      REWIND 12                                                          VORLAX   3595
      IN = IM                                                            VORLAX   3596
   80 CONTINUE                                                           VORLAX   3597
```

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           C                                                                      VORLAX   3598
           C     VORK  IS  THE  FXTENDED  SOLUTION  ROW  VFCTOR                   VORLAX   3599
           C                                                                      VORLAX   3600
           C  **************** END OF SOLUTION BY VECTOR METHOD *****************  VORLAX   3601
           C                                                                      VORLAX   3602
            90   DO 100 IR = 1, ITOTAL                                            VORLAX   3603
                 GAMMA (IR) = VORK (IR)                                           VORLAX   3604
           100   CONTINUE                                                         VORLAX   3605
           C                                                                      VORLAX   3606
                 REWIND 1                                                         VORLAX   3607
           C                                                                      VORLAX   3608
                 RETURN                                                           VORLAX   3609
                 END                                                              VORLAX   3610


    SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  VECTOR

VARIABLES     SN  TYPE           RELOCATION
  334  ALOC      REAL       ARRAY    SET6             0  AV        REAL       ARRAY     F.P.
  244  CJK       REAL                                 0  FW        REAL       ARRAY     F.P.
    0  GAMMA     REAL       ARRAY    SET16           24  HEAD      REAL       ARRAY     SET6
  237  I         INTEGER                            236  IM        INTEGER
  234  IN        INTEGER                            245  IR        INTEGER
    0  ITOTAL    INTEGER              F.P.          233  J         INTEGER
  235  JJ        INTEGFR                            232  K         INTEGER
  242  KK        INTEGER                            241  NTOP      INTEGER
    0  NX1       INTEGER              F.P.         3720  ONSET     REAL       ARRAY     SET16
  240  RDEN      REAL                               243  RNUM      REAL
    0  TITLE     REAL       ARRAY    SET6             0  VORK      REAL       ARRAY     F.P.
    0  VORL      REAL       ARRAY     F.P.            0  VOR1      REAL       ARRAY     F.P.

FILE NAMES       MODE
     TAPE1      UNFMT                TAPE11    UNFMT              TAPE12

STATEMENT LABELS
    0  10                          0  20                                0  30
    0  40                          0  50                                0  60
    0  70                          0  80                                0  90          INACTIVE
    0  100

LOOPS  LABEL    INDEX     FROM-TO    LENGTH     PROPERTIES
   24   20     * K        68  74       20B                 FXT REFS  NOT INNER
   27   10       J        69  72        4B       INSTACK
   47   80     * JJ       86 114      116B                 EXT REFS  NOT INNER
   71   30       I        90  93        7B       INSTACK
  105   40       I        95  97        4B       INSTACK
  115   70     * KK       99 110       41B                 EXT REFS  NOT INNER
  127   50       I       102 104        4B       INSTACK
  142   60       I       106 108        3B       INSTACK
  171  100       IR      120 122        2B       INSTACK
```

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        SUBROUTINE VECTOR      74/74    OPT=1                          FTN 4.5+410A        10/04/76  10.15.13        PAGE     4

COMMON BLOCKS   LENGTH
        SET6       2220
        SET16      4000

STATISTICS
  PROGRAM LENGTH                  311B      201
  CM LABELED COMMON LENGTH      14114B     6220
```

```
CONTROL*VRLX.WASH                                               9/14/76  VORLAX    3611
C...                                                                     VORLAX    3612
      SUBROUTINE WASH (X, Y, Z, S, T, B2, U, V, W, AA, AM, TE, CT, MM)   VORLAX    3613
C...                                                                     VORLAX    3614
C...PURPOSE    TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A     VORLAX    3615
C...           GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT     VORLAX    3616
C...           STRENGTH.                                                 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...           B2 = 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 SWEPT, 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 AFTCONES 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) /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
      CUTOFF = 0.80                                                     VORLAX   3680
C                                                                       VORLAX   3681
C...COMPUTE COORDINATES OF RECEIVING POINT WITH RESPECT TO              VORLAX   3682
C...END POINTS OF SKEWED LEG.                                           VORLAX   3683
C                                                                       VORLAX   3684
      X1 = X + T *S                                                     VORLAX   3685
      Y1 = Y + S                                                        VORLAX   3686
      X2 = X - T *S                                                     VORLAX   3687
      Y2 = Y - S                                                        VORLAX   3688
C                                                                       VORLAX   3689
C...CALCULATE AXIAL DISTANCE BETWEEN PROJECTION OF RECEIVING POINT      VORLAX   3690
C...ONTO HORSESHOE PLANE AND EXTENSION OF SKEWED LEG.                   VORLAX   3691
C                                                                       VORLAX   3692
      XTY = X - T *Y                                                    VORLAX   3693
C                                                                       VORLAX   3694
C...ZERO-OUT PERTURBATION VELOCITY COMPONENTS.                          VORLAX   3695
C                                                                       VORLAX   3696
      U = 0.                                                            VORLAX   3697
      V = 0.                                                            VORLAX   3698
      W = 0.                                                            VORLAX   3699
C                                                                       VORLAX   3700
C...SET VALUES OF NUMERICAL TOLERANCE CONSTANTS.                        VORLAX   3701
C                                                                       VORLAX   3702
      TOL = S /500.0                                                    VORLAX   3703
      TOLSQ = TOL *TOL                                                  VORLAX   3704
      TOLSQ2 = 2500.0 *TOLSQ                                            VORLAX   3705
      ZSQ = Z *Z                                                        VORLAX   3706
      BZQ = B2 *ZSQ                                                     VORLAX   3707
      YSQ1 = Y1 *Y1                                                     VORLAX   3708
      YSQ2 = Y2 *Y2                                                     VORLAX   3709
      RTV1 = YSQ1 + ZSQ                                                 VORLAX   3710
      RTV2 = YSQ2 + ZSQ                                                 VORLAX   3711
      RO1  = B2 *RTV1                                                   VORLAX   3712
      RO2  = B2 *RTV2                                                   VORLAX   3713
      RAD1 = 0.0                                                        VORLAX   3714
      RAD2 = 0.0                                                        VORLAX   3715
      XSQ1 = X1 *X1                                                     VORLAX   3716
      XSQ2 = X2 *X2                                                     VORLAX   3717
      IF (B2) 10, 50, 50                                                VORLAX   3718
C                                                                       VORLAX   3719
C                                                                       VORLAX   3720
C...COMPUTATION FOR SUBSONIC HORSESHOE VORTEX.                          VORLAX   3721
C                                                                       VORLAX   3722
C                                                                       VORLAX   3723
 10   CPI = 12.56636                                                    VORLAX   3724
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      ARG = XSQ1 - RO1                                                VORLAX  3725
      RAD1 = SQRT (ARG)                                               VORLAX  3726
      ARG = XSQ2 - RO2                                                VORLAX  3727
      RAD2 = SQRT (ARG)                                               VORLAX  3728
      FB1 = 0.0                                                       VORLAX  3729
      FB2 = 0.0                                                       VORLAX  3730
      FT1 = 0.0                                                       VORLAX  3731
      FT2 = 0.0                                                       VORLAX  3732
      XBSQ = XTY *XTY                                                 VORLAX  3733
      TBZ = (T *T - B2) *ZSQ                                          VORLAX  3734
      DENOM = XBSQ + TBZ                                              VORLAX  3735
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = TOLSQ                       VORLAX  3736
      FB1 = (T *X1 - B2 *Y1) /RAD1                                    VORLAX  3737
      RTV = RTV1                                                      VORLAX  3738
      IF (RTV .LT. TOLSQ) GO TO 20                                    VORLAX  3739
      FT1 = (X1 + RAD1) /(RAD1 *RTV)                                  VORLAX  3740
   20 FB2 = (T *X2 - B2 *Y2) /RAD2                                    VORLAX  3741
      RTV = RTV2                                                      VORLAX  3742
      IF (RTV .LT. TOLSQ) GO TO 30                                    VORLAX  3743
      FT2 = (X2 + RAD2) /(RAD2 *RTV)                                  VORLAX  3744
   30 QB = (FB1 - FB2) /DENOM                                         VORLAX  3745
      ZETAPI = Z /CPI                                                 VORLAX  3746
      IF (ZSQ .LT. TOLSQ) GO TO 40                                    VORLAX  3747
      U = ZETAPI *QB                                                  VORLAX  3748
      V = ZETAPI * (FT1 - FT2 - QB *T)                                VORLAX  3749
   40 W = - (QB *XTY + FT1 *Y1 - FT2 *Y2) /CPI                        VORLAX  3750
      GO TO 110                                                       VORLAX  3751
C                                                                     VORLAX  3752
C                                                                     VORLAX  3753
C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX.                       VORLAX  3754
C                                                                     VORLAX  3755
C                                                                     VORLAX  3756
   50 CPI = 6.28318                                                   VORLAX  3757
      IF (X1 .LT. TOL) GO TO 60                                       VORLAX  3758
      ARG = XSQ1 - RO1                                                VORLAX  3759
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)                             VORLAX  3760
   60 IF (X2 .LT. TOL) GO TO 70                                       VORLAX  3761
      ARG = XSQ2 - RO2                                                VORLAX  3762
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)                             VORLAX  3763
   70 ZETAPI = Z /CPI                                                 VORLAX  3764
      IF (ZSQ .LT. TOLSQ2) GO TO 100                                  VORLAX  3765
      FB1 = 0.0                                                       VORLAX  3766
      FB2 = 0.0                                                       VORLAX  3767
      FT1 = 0.0                                                       VORLAX  3768
      FT2 = 0.0                                                       VORLAX  3769
      XBSQ = XTY *XTY                                                 VORLAX  3770
      TBZ = (T *T - B2) *ZSQ                                          VORLAX  3771
      DENOM = XBSQ + TBZ                                              VORLAX  3772
      SIGN = 1.0                                                      VORLAX  3773
      IF (DENOM .LT. 0.0) SIGN = - 1.0                                VORLAX  3774
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = SIGN *TOLSQ                 VORLAX  3775
      IF (X1 .LT. TOL) GO TO 80                                       VORLAX  3776
      IF (RAD1 .EQ. 0.0) GO TO 80                                     VORLAX  3777
      REPS = CUTOFF *XSQ1                                             VORLAX  3778
      FRAD = RAD1                                                     VORLAX  3779
      IF (RO1 .GT. REPS) GO TO 80                                     VORLAX  3780
      FB1 = (T *X1 - B2 *Y1) /FRAD                                    VORLAX  3781
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```
            RTV = RTV1                                                        VORLAX   3782
            IF (RTV .LT. TOLSQ) GO TO 80                                      VORLAX   3783
            FT1 = X1 /(FRAD *RTV)                                             VORLAX   3784
     80     IF (X2 .LT. TOL) GO TO 90                                         VORLAX   3785
            IF (RAD2 .EQ. 0.0) GO TO 90                                       VORLAX   3786
            REPS = CUTOFF *XSQ2                                               VORLAX   3787
            FRAD = RAD2                                                       VORLAX   3788
            IF (RO2 .GT. REPS) GO TO 90                                       VORLAX   3789
            FB2 = (T *X2 - B2 *Y2) /FRAD                                      VORLAX   3790
            RTV = RTV2                                                        VORLAX   3791
            IF (RTV .LT. TOLSQ) GO TO 90                                      VORLAX   3792
            FT2 = X2 /(FRAD *RTV)                                             VORLAX   3793
     90     QB = (FB1 - FB2) /DENOM                                           VORLAX   3794
            U = ZETAPI *QB                                                    VORLAX   3795
            V = ZETAPI *(FT1 - FT2 - QB *T)                                   VORLAX   3796
            W = - (QB *XTY + FT1 *Y1 - FT2 *Y2) /CPI                          VORLAX   3797
            GO TO 110                                                         VORLAX   3798
      C                                                                       VORLAX   3799
      C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX WHEN RECEIVING POINT    VORLAX   3800
      C...IS IN THE PLANE OF THE HORSESHOE.                                   VORLAX   3801
      C                                                                       VORLAX   3802
      100   F1 = 0.                                                           VORLAX   3803
            F2 = 0.                                                           VORLAX   3804
            IF (ABS (Y1) .GT. TOL) F1 = RAD1 /Y1                              VORLAX   3805
            IF (ABS (Y2) .GT. TOL) F2 = RAD2 /Y2                              VORLAX   3806
            IF (ABS (XTY) .GT. TOL) W = (- F1 + F2) /XTY /CPI                 VORLAX   3807
      110   IF (MM .EQ. 0) GO TO 200                                          VORLAX   3808
      C                                                                       VORLAX   3809
      C                                                                       VORLAX   3810
      C...IF THE FREE TRAILING LEGS DO NOT CONTINUE TO DOWNSTREAM INFINITY    VORLAX   3811
      C...PARALLEL TO X-AXIS, I.E., WAKE FLOATATION FLAG MM IS NOT ZERO.      VORLAX   3812
      C...THEN THE EFFECT OF WAKE FLOATATION ANGLES IS COMPUTED BY FIRST      VORLAX   3813
      C...SUBTRACTING THE VELOCITY INDUCED BY THE SEMI-INFINITE SEGMENTS      VORLAX   3814
      C...PARALLEL TO THE X-AXIS AND EMANATING FROM THE TRAILING EDGE, AND    VORLAX   3815
      C...LATER ADDING THE INFLUENCE INDUCED BY THE SEMI-INFINITE PAIR        VORLAX   3816
      C...ORIGINATING AT THE SAME POINTS BUT TRAILING TO DOWNSTREAM INFINITY  VORLAX   3817
      C...PARALLEL TO THE DIRECTION DEFINED BY THE FLOATATION ANGLES AA AND   VORLAX   3818
      C...AM.                                                                 VORLAX   3819
      C                                                                       VORLAX   3820
      C                                                                       VORLAX   3821
            XMP = X - CT                                                      VORLAX   3822
            X1 = XMP + TE *S                                                  VORLAX   3823
            X2 = XMP - TE *S                                                  VORLAX   3824
            ZZ = Z - XMP *AA                                                  VORLAX   3825
            DELU = 0.0                                                        VORLAX   3826
            DELV = 0.0                                                        VORLAX   3827
            DELW = 0.0                                                        VORLAX   3828
            ZSQ = ZZ *ZZ                                                      VORLAX   3829
            BZQ = B2 *ZSQ                                                     VORLAX   3830
            RO1 = B2 *YSQ1 + BZQ                                              VORLAX   3831
            RO2 = B2 *YSQ2 + BZQ                                              VORLAX   3832
            RAD1 = 0.0                                                        VORLAX   3833
            RAD2 = 0.0                                                        VORLAX   3834
            XSQ1 = X1 *X1                                                     VORLAX   3835
            XSQ2 = X2 *X2                                                     VORLAX   3836
            XMY1 = AM *X1 - Y1                                                VORLAX   3837
            XMY2 = AM *X2 - Y2                                                VORLAX   3838
```

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      IF (B2) 120, 130, 130                                VORLAX   3839
  120 ARG = XSQ1 - RO1                                     VORLAX   3840
      RAD1 = SQRT (ARG)                                    VORLAX   3841
      ARG = XSQ2 - RO2                                     VORLAX   3842
      RAD2 = SQRT (ARG)                                    VORLAX   3843
      GO TO 150                                            VORLAX   3844
  130 IF (X1 .LT. TOL) GO TO 140                           VORLAX   3845
      ARG = XSQ1 - RO1                                     VORLAX   3846
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)                  VORLAX   3847
  140 IF (X2 .LT. TOL) GO TO 150                           VORLAX   3848
      ARG = XSQ2 - RO2                                     VORLAX   3849
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)                  VORLAX   3850
  150 GG1 = 0.0                                            VORLAX   3851
      GG2 = 0.0                                            VORLAX   3852
      R1 = SQRT ((1. - CUTOFF) *XSQ1)                      VORLAX   3853
      R2 = SQRT ((1. - CUTOFF) *XSQ2)                      VORLAX   3854
      DR1 = 0.0                                            VORLAX   3855
      DR2 = 0.0                                            VORLAX   3856
      IF (RAD1 .GT. R1) DR1 = 1.0 /RAD1                    VORLAX   3857
      IF (RAD2 .GT. R2) DR2 = 1.0 /RAD2                    VORLAX   3858
      BAM = 1.0 - B2 *AM *AM                               VORLAX   3859
      BMZ = BAM *ZSQ                                       VORLAX   3860
      DG1 = XMY1 *XMY1 + BMZ                               VORLAX   3861
      DG2 = XMY2 *XMY2 + BMZ                               VORLAX   3862
      GN1 = X1 - B2 *AM *Y1                                VORLAX   3863
      GN2 = X2 - B2 *AM *Y2                                VORLAX   3864
      IF (ABS (DG1) .LT. TOLSQ) DG1 = TOLSQ                VORLAX   3865
      IF (ABS (DG2) .LT. TOLSQ) DG2 = TOLSQ                VORLAX   3866
      GINF = 0.0                                           VORLAX   3867
      IF (B2 .LT. 0.0) GINF = - SQRT (BAM)                 VORLAX   3868
      GG1 = (GN1*DR1 - GINF) /DG1                          VORLAX   3869
      GG2 = (GN2 *DR2 - GINF) /DG2                         VORLAX   3870
      FZETA1 = 0.0                                         VORLAX   3871
      FZETA2 = 0.0                                         VORLAX   3872
      ETA1 = 0.0                                           VORLAX   3873
      ETA2 = 0.0                                           VORLAX   3874
      IF (RTV1 .LT. TOLSQ) GO TO 160                       VORLAX   3875
      FZETA1 = ZETAPI /RTV1                                VORLAX   3876
      ETA1 = Y1 /CPI /RTV1                                 VORLAX   3877
  160 IF (RTV2 .LT. TOLSQ) GO TO 170                       VORLAX   3878
      FZETA2 = ZETAPI /RTV2                                VORLAX   3879
      ETA2 = Y2 /CPI /RTV2                                 VORLAX   3880
  170 IF (B2 .GE. 0.0) GO TO 180                           VORLAX   3881
      DELV = DELV - FZETA1 + FZETA2                        VORLAX   3882
      DELW = DELW + ETA1 - ETA2                            VORLAX   3883
  180 DELV = DELV - DR1 *X1 *FZETA1 + DR2 *X2 *FZETA2      VORLAX   3884
      DELW = DELW + DR1 *X1 *ETA1 - DR2 *X2 *ETA2          VORLAX   3885
  190 DELU = DELU + (GG2 - GG1) *AM *ZZ /CPI               VORLAX   3886
      DELV = DELV - (GG2 - GG1) *ZZ /CPI                   VORLAX   3887
      DELW = DELW + (GG1 *XMY1 - GG2 *XMY2) /CPI           VORLAX   3888
      U = U + DELU                                         VORLAX   3889
      V = V + DELV                                         VORLAX   3890
      W = W + DELW                                         VORLAX   3891
  200 RETURN                                               VORLAX   3892
      END                                                  VORLAX   3893
```

```
        SUBROUTINE WASH        74/74    OPT=1                            FTN 4.5+410A        10/04/76  10.15.13        PAGE    6

        SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3  WASH

 VARIABLES      SN  TYPE              RELOCATION
      0  AA         REAL                  F.P.           0  AM          REAL                F.P.
    562  ARG        REAL                               617  BAM         REAL
    620  BMZ        REAL                               546  BZQ         REAL
      0  B2         REAL                  F.P.         561  CPI         REAL
      0  CT         REAL                  F.P.         534  CUTOFF      REAL
    604  DELU       REAL                               605  DELV        REAL
    606  DELW       REAL                               571  DENOM       REAL
    621  DG1        REAL                               622  DG2         REAL
    615  DR1        REAL                               616  DR2         REAL
    630  ETA1       REAL                               631  ETA2        REAL
    563  FB1        REAL                               564  FB2         REAL
    577  FRAD       REAL                               565  FT1         REAL
    566  FT2        REAL                               626  FZETA1      REAL
    627  FZETA2     REAL                               600  F1          REAL
    601  F2         REAL                               611  GG1         REAL
    612  GG2        REAL                               625  GINF        REAL
    623  GN1        REAL                               624  GN2         REAL
      0  MM         INTEGER               F.P.         573  QR          REAL
    555  RAD1       REAL                               556  RAD2        REAL
    576  REPS       REAL                               553  RO1         REAL
    554  RO2        REAL                               572  RTV         REAL
    551  RTV1       REAL                               552  RTV2        REAL
    613  R1         REAL                               614  R2          REAL
      0  S          REAL                  F.P.         575  SIGN        REAL
      0  T          REAL                  F.P.         570  TBZ         REAL
      0  TE         REAL                  F.P.         542  TOL         REAL
    543  TOLSQ      REAL                               544  TOLSQ2      REAL
      0  U          REAL                  F.P.           0  V           REAL                F.P.
      0  W          REAL                  F.P.           0  X           REAL                F.P.
    567  XBSQ       REAL                               602  XMP         REAL
    607  XMY1       REAL                               610  XMY2        REAL
    557  XSQ1       REAL                               560  XSQ2        REAL
    541  XTY        REAL                               535  X1          REAL
    537  X2         REAL                                 0  Y           REAL                F.P.
    547  YSQ1       REAL                               550  YSQ2        REAL
    536  Y1         REAL                               540  Y2          REAL
      0  Z          REAL                  F.P.         574  ZETAP1      REAL
    545  ZSQ        REAL                               603  ZZ          REAL

 EXTERNALS          TYPE    ARGS
        SQRT       REAL       1 LIBRARY

 INLINE FUNCTIONS   TYPE    ARGS
        ABS        REAL       1   INTRIN

 STATEMENT LABELS
      0  10            INACTIVE                100  20                                         111  30
    126  40                                    135  50                                         146  60
    156  70                                    221  80                                         240  90
    256  100                                   300  110                                          0  120           INACTIVE
    342  130                                   352  140                                        362  150
```

```
      SUBROUTINE ZNORM       74/74    OPT=1                              FTN 4.5+410A        10/04/76  10.15.13       PAGE      3

COMMON BLOCKS    LENGTH
      SET19         240

STATISTICS
  PROGRAM LENGTH                 130B       88
  CM LABELED COMMON LENGTH    20452B     8490
  CM BLANK COMMON LENGTH          1B        1
```

```
                74/74   OPT=1                            FTN 4.5+410A      10/04/76  10.15.13         PAGE   1

CONTROL*VRLX.ZNORM                                                           9/14/76  VORLAX    3894
C...                                                                                  VORLAX    3895
      SUBROUTINE ZNORM (I, IS, RTOP)                                                  VORLAX    3896
C...                                                                                  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                                                                                     VORLAX    3900
C...INPUT      CALLING SEQUENCE≤                                                      VORLAX    3901
C...           I = ELEMENT INDEX (TOTAL COUNT).                                       VORLAX    3902
C...           IS = STRIP INDEX (SPANWISE COUNT).                                     VORLAX    3903
C...           RNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP                  VORLAX    3904
C...                   (CHORDWISE ROW).                                               VORLAX    3905
C...           COMMON≤                                                                VORLAX    3906
C...           LAX, SLF, SLOPE.                                                       VORLAX    3907
C                                                                                     VORLAX    3908
C...OUTPUT     CALLING SEQUENCE≤                                                      VORLAX    3909
C...           NONE.                                                                  VORLAX    3910
C...           COMMON≤                                                                VORLAX    3911
C...           ZC.                                                                    VORLAX    3912
C...                                                                                  VORLAX    3913
C...SUBROUTINES                                                                       VORLAX    3914
C...CALLED     NONE.                                                                  VORLAX    3915
C...                                                                                  VORLAX    3916
C...DISCUSSION THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES                   VORLAX    3917
C...           BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS                    VORLAX    3918
C...           TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY                     VORLAX    3919
C...           CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS                   VORLAX    3920
C...           IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS                  VORLAX    3921
C...           TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED                  VORLAX    3922
C...           TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS                 VORLAX    3923
C...           DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS                       VORLAX    3924
C...           EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD                       VORLAX    3925
C...           LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL                   VORLAX    3926
C...           SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST.                      VORLAX    3927
C...           SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE                     VORLAX    3928
C...           STRIP OR ROW OF HORSESHOE VORTICES.                                    VORLAX    3929
C                                                                                     VORLAX    3930
C                                                                                     VORLAX    3931
C                                                                                     VORLAX    3932
      COMMON LAX                                                                      VORLAX    3933
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                               VORLAX    3934
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                              VORLAX    3935
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)                      VORLAX    3936
C                                                                                     VORLAX    3937
C                                                                                     VORLAX    3938
C                                                                                     VORLAX    3939
      FEQL = LAX                                                                      VORLAX    3940
      FCOS = 1.0 - FEQL                                                               VORLAX    3941
      PION = (3.14159 *FCOS + FEQL) /RTOP                                             VORLAX    3942
      F1 = .75 *FCOS + .8333 *FEQL                                                    VORLAX    3943
      F2 = .25 *FCOS + .1667 *FEQL                                                    VORLAX    3944
C                                                                                     VORLAX    3945
      TSTART = F1 *SLE (IS) + F2 *SLOPE (I)                                           VORLAX    3946
C                                                                                     VORLAX    3947
      DEL1 = .25 *PION                                                                VORLAX    3948
      DELX = DEL1 * (SIN (DEL1 *FCOS) + FEQL)                                         VORLAX    3949
      ZOR = TSTART *DELX                                                              VORLAX    3950
```

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      SUBROUTINE ZNORM      74/74    OPT=1                           FTN 4.5+410A       10/04/76  10.15.13          PAGE     2

                        DEL = PION *.5                                                               VORLAX    3951
                        LTOP = RTOP                                                                  VORLAX    3952
   60             C                                                                                  VORLAX    3953
                        DO 30 L = 1, LTOP                                                            VORLAX    3954
                        IL = I + L - 1                                                               VORLAX    3955
                        RL = L                                                                       VORLAX    3956
                        IF (LAX .EQ. 1) GO TO 10                                                     VORLAX    3957
   65                   DELXI = SIN (PION * (RL - 1.0))                                              VORLAX    3958
                        GO TO 20                                                                     VORLAX    3959
                     10 DELXI = 2.0                                                                  VORLAX    3960
                     20 ZC (L) = ZOR + DEL *DELXI *SLOPE (IL)                                        VORLAX    3961
                        ZOR = ZC (L)                                                                 VORLAX    3962
   70                30 CONTINUE                                                                     VORLAX    3963
                  C                                                                                  VORLAX    3964
                  C                                                                                  VORLAX    3965
                        RETURN                                                                       VORLAX    3966
                        END                                                                          VORLAX    3967


      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
    3  ZNORM

 VARIABLES     SN  TYPE          RELOCATION
    0  DCP         REAL       ARRAY    SET2          114  DEL       REAL
  112  DELX        REAL                              121  DELXI     REAL
  111  DEL1        REAL                              104  FCOS      REAL
  103  FEQL        REAL                              106  F1        REAL
  107  F2          REAL                                0  I         INTEGER               F.P.
  117  IL          INTEGER                             0  IS        INTEGER               F.P.
  116  L           INTEGER                             0  LAX       INTEGER               / /
  115  LTOP        INTEGER                           105  PION      REAL
  120  RL          REAL                                0  RTOP      REAL                  F.P.
   50  SLE         REAL       ARRAY    SET19           0  SLE1      REAL       ARRAY      SET19
   24  SLE2        REAL       ARRAY    SET19        3720  SLOPE     REAL       ARRAY      SET2
  110  TSTART      REAL                             7640  VSP       REAL       ARRAY      SET2
    0  X           REAL       ARRAY    SET1         3720  Y         REAL       ARRAY      SET1
 4064  Z           REAL       ARRAY    SET1         4230  ZC        REAL       ARRAY      SET1
  214  ZETA        REAL       ARRAY    SET19         113  ZOR       REAL

 EXTERNALS          TYPE    ARGS
        SIN         REAL       1 LIBRARY

 STATEMENT LABELS
   60  10                                  62  20                                0  30

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

 COMMON BLOCKS   LENGTH
        / /            1
        SET1        2250
        SET2        6000
```

```
        SUBROUTINE ZNORM        74/74    OPT=1                          FTN 4.5+410A        10/04/76  10.15.13        PAGE     3

COMMON BLOCKS    LENGTH
       SET19        240

STATISTICS
  PROGRAM LENGTH                  130B       88
  CM LABELED COMMON LENGTH      20452B     8490
  CM BLANK COMMON LENGTH            1B        1
```

```
LOAD MAP - VORLAX                                          CYBER LOADER 1.0-410      10/04/76  10.19.53.      PAGE      1


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/         4413    13560
/SET3/        20173    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     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
AERO         150501     1022     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
BOUNDY       151523      204     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
GAUSS        151727      342     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
GEOM         152271      605     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
INPUT        153076     2750     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
MAP          156046      534     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
MATRX        156602     1345     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
PRESS        160147      570     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
PRINT        160737     5414     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
SURVEY       166353     1136     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
UXVEL        167511      250     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
VECTOR       167761      311     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
WASH         170272      632     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
ZNORM        171124      130     LGO      10/04/76 FTN      4.5 410A    666X I     OPT=1
/FCL.C./     171254       23
/Q8.IO./     171277      131
COMIO=       171430       64  SL-FORTRAN  03/23/76 COMPASS  3. 2-410                COMMON CODED I/O ROUTINES AND CONSTANTS.
Q8NTRY=      171430        0  SL-FORTRAN  03/23/76 COMPASS  3. 2-410                FCL INITILALIZATION ROUTINE.
EOF          171514       16  SL-FORTRAN  03/23/76 COMPASS  3. 2-410                TEST FOR END OF FILE STATUS.
FLTIN=       171532      154  SL-FORTRAN  03/23/76 COMPASS  3. 2-410                COMMON FLOATING INPUT CONVERTER.
FMTAP=       171706      352  SL-FORTRAN  03/23/76 COMPASS  3. 2-410                CRACK APLIST AND FORMAT FOR KODER/KRAKER.
FORUTL=      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
```

```
LOAD MAP - VORLAX                                              CYBER LOADER 1.0-410      10/04/76  10.19.53.      PAGE     2

 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          COMPUTE COMMON AND NATURAL LOGARITHMS. OPT=
 ATAN2        174236      73  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          ARCTAN OF RATIO OF Y TO X. OPT = ALL.
 EXP          174331      75  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          EXPONENTIAL FUNCTION. E TO POWER X. OPT=ALL
 SINCOS=      174426      66  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          TRIGONOMETRIC SINE OR COSINE OF X. OPT=ALL.
 SYSAID=      174514       1  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          LINK BETWEEN SYS=AID AND INITIALIZATION COD
 SYS=AID      174515       7  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          AUXILIARY MATH LIBRARY LINK FOR ERRORS.
 TAN=         174524      74  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          TANGENT OF X.
 XTOY=        174620       7  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          REAL TO REAL EXPONENTIATION.
 FECMSK=      174627      41  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          INITIALIZE CONSTANTS.
 FLTOUT=      174670     310  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          COMMON FLOATING OUTPUT CODE
 FORSYS=      175200     600  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          FORTRAN OBJECT LIBRARY UTILITIES.
 INCOM=       176000     277  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          COMMON INPUT FORMATTING CODE
 INPC=        176277     160  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          FORMATTED READ FORTRAN RECORD.
 KODER=       176457     456  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          OUTPUT FORMAT INTERPRETER.
 OUTC=        177135     172  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          FORMATTED WRITE FORTRAN RECORD.
 SQRT         177327      43  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          COMPUTE THE SQUARE ROOT OF X. OPT=ALL.
 SYS=1ST      177372      62  SL-FORTRAN  03/23/76 COMPASS  3. 2-410          MATH LIBRARY LINK TO ERROR MESSAGE PROCESS
 SYS.RM       177454      37  SL-SYSIO    03/12/75 COMPASS  3. 75010          PROCESS SYSTEM REQUEST.
 /CON.RM/     177513       6
 CIO.RM       177521      40  SL-SYSIO    06/16/76 COMPASS  3. 2-410
 /A0B.RM/     177561      10
 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
 /MEMC.RM/    200115       3
 /OPES.FO/    200120       1
 /OPEN.FO/    200121       7
 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
 BTRT.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
 CHWR.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
 /REW.FO/     204160       7
 REW.SQ       204167      31  SL-SYSIO    06/16/76 COMPASS  3. 2-410
```

```
LOAD MAP - VORLAX                                      CYBER LOADER 1.0-410       10/04/76  10.19.53.       PAGE

/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

      .615 CP SECONDS           221700B CM STORAGE USED                   345 TABLE MOVES
```

```
********** 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     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
   10.0000    5.0000    1.0000    0.0000                        A3C
    -.0566     .0668 0         0         2        -0        -0

-0        -0        -0

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

```
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

    -.0566     .0668
    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000    0.0000
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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  ≤   XBAR =    .31600E+02      ZBAR =    .17250E+02  ***** VINF =    .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 REFFRENCED TO SREF*CBAR,  CRM,CYM REFERENCED TO SREF*WSPAN
   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          CDTOT          CYTOT     CMTOT          CRMTOT         CYMTOT

     .59800E+03    .68000E+02    .98500E+01        .09768         .00071        -.00006   -.13714E+00    -.38959E-02     .87966E-04


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


                                 PANEL NO.   1                    ASYM WING PANEL  A3C

 1  1  .0245   27.805    1.700   18.950   13.570   -.0550  0       .325     1.339    .099     0.00    -.0052     .1939E+00    .04001    .03345
 1  2  .2061   30.269    1.700   18.950   13.570   -.0550  0       .117                                          .6857E-01
 1  3  .5000   34.257    1.700   18.950   13.570   -.0550  0       .076                                          .4330E-01
 1  4  .7939   38.246    1.700   18.950   13.570   -.0550  0       .046                                          .2540E-01
 1  5  .9755   40.710    1.700   18.950   13.570   -.0550  0       .017                                          .8231E-02

 2  1  .0245   33.924    5.100   18.950   12.510   -.0514  0       .396     1.337    .107     0.00    -.0024     .2361E+00    .05590    .01276
 2  2  .2061   36.196    5.100   18.950   12.510   -.0514  0       .131                                          .7698E-01
 2  3  .5000   39.872    5.100   18.950   12.510   -.0514  0       .074                                          .4169E-01
 2  4  .7939   43.549    5.100   18.950   12.510   -.0514  0       .041                                          .2199E-01
 2  5  .9755   45.821    5.100   18.950   12.510   -.0514  0       .015                                          .6966E-02

 3  1  .0245   40.043    8.500   18.950   11.450   -.0472  0       .422     1.266    .111     0.00    -.0017     .2515E+00    .05834    .00136
 3  2  .2061   42.122    8.500   18.950   11.450   -.0472  0       .137                                          .8003E-01
 3  3  .5000   45.487    8.500   18.950   11.450   -.0472  0       .073                                          .4156E-01
 3  4  .7939   48.853    8.500   18.950   11.450   -.0472  0       .040                                          .2168E-01
 3  5  .9755   50.932    8.500   18.950   11.450   -.0472  0       .015                                          .6931E-02

 4  1  .0245   46.162   11.900   18.950   10.390   -.0421  0       .423     1.144    .110     0.00    -.0015     .2522E+00    .05331   -.00516
 4  2  .2061   48.049   11.900   18.950   10.390   -.0421  0       .136                                          .7986E-01
 4  3  .5000   51.102   11.900   18.950   10.390   -.0421  0       .072                                          .4102E-01
 4  4  .7939   54.156   11.900   18.950   10.390   -.0421  0       .040                                          .2136E-01
 4  5  .9755   56.043   11.900   18.950   10.390   -.0421  0       .015                                          .6862E-02

 5  1  .0245   52.281   15.300   18.950    9.330   -.0358  0       .406      .985    .106     0.00    -.0014     .2419E+00    .04402   -.00877
 5  2  .2061   53.975   15.300   18.950    9.330   -.0358  0       .131                                          .7659E-01
 5  3  .5000   56.717   15.300   18.950    9.330   -.0358  0       .069                                          .3921E-01
 5  4  .7939   59.460   15.300   18.950    9.330   -.0358  0       .038                                          .2041E-01
 5  5  .9755   61.154   15.300   18.950    9.330   -.0358  0       .015                                          .6561E-02

 6  1  .0245   58.400   18.700   18.950    8.270   -.0279  0       .369      .793    .096     0.00    -.0013     .2197E+00    .03217   -.01001
 6  2  .2061   59.902   18.700   18.950    8.270   -.0279  0       .119                                          .6971E-01
 6  3  .5000   62.332   18.700   18.950    8.270   -.0279  0       .063                                          .3569E-01
 6  4  .7939   64.763   18.700   18.950    8.270   -.0279  0       .035                                          .1852E-01
 6  5  .9755   66.265   18.700   18.950    8.270   -.0279  0       .013                                          .5944E-02

 7  1  .0245   64.519   22.100   18.950    7.210   -.0177  0       .306      .575    .080     0.00    -.0011     .1824E+00    .01931   -.00911
 7  2  .2061   65.829   22.100   18.950    7.210   -.0177  0       .099                                          .5805E-01
 7  3  .5000   67.947   22.100   18.950    7.210   -.0177  0       .053                                          .2979E-01
 7  4  .7939   70.066   22.100   18.950    7.210   -.0177  0       .029                                          .1537E-01
 7  5  .9755   71.376   22.100   18.950    7.210   -.0177  0       .011                                          .4913E-02

 8  1  .0245   70.638   25.500   18.950    6.150   -.0039  0       .207      .334    .054     0.00    -.0008     .1235E+00    .00753   -.00620
 8  2  .2061   71.755   25.500   18.950    6.150   -.0039  0       .067                                          .3950E-01
 8  3  .5000   73.562   25.500   18.950    6.150   -.0039  0       .036                                          .2041E-01
 8  4  .7939   75.370   25.500   18.950    6.150   -.0039  0       .019                                          .1042E-01
 8  5  .9755   76.487   25.500   18.950    6.150   -.0039  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
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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

  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    .448   1.749   .129    0.00   -.0047    .1939E+00   .04003   .05590
 11  2  .2061   30.269   -1.700   18.950  13.570  -.0550   0    .156                                     .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    .491    .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    .395    .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
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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

 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   .00815
 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

BIG =     .00043

CONVERGENCE FACTOR =     .40424

END OF CASE
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ALPHA = 4.0°

OUTPUT DATA

DELETED HERE

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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  ***** VINF =   .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 REFFRENCED TO SREF*CBAR+  CRM+CYM REFERENCED TO SREF*WSPAN
   I   SURF/SREF      CN(I)       CL(I)       CY(I)       CD(I)       CT(I)       CS(I)        CM(I)       CRM(I)       CYM(I)

   1   .5003E+00      .42751      .21700      .00268     -.00041      .03742      .07730    -.4882E+00    .3750E-01    .2440E-02
** 1   .5003E+00      .54741      .27594      .00242      .01090      .03647      .07532    -.5391E+00   -.6628E-01    .2209E-02

       SREF        WSPAN        CBAR           CLTOT          CDTOT          CYTOT    CMTOT         CRMTOT        CYMTOT

     .59800E+03   .68000E+02   .98500E+01       .49294         .01049         .00509  -.10273E+01   -.28773E-01    .46488E-02


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


                              PANEL NO.   1                     ASYM WING PANEL  A3C

  1  1  .0245   27.805    1.700    18.950   13.570   -.0550   0    1.155    4.827   .356    0.00   -.0200   .6955E+00    .51394   .43009
  1  2  .2061   30.269    1.700    18.950   13.570   -.0550   0     .420                                   .2485E+00
  1  3  .5000   34.257    1.700    18.950   13.570   -.0550   0     .277                                   .1596E+00
  1  4  .7939   38.246    1.700    18.950   13.570   -.0550   0     .172                                   .9497E-01
  1  5  .9755   40.710    1.700    18.950   13.570   -.0550   0     .064                                   .3099E-01

  2  1  .0245   33.924    5.100    18.950   12.510   -.0514   0    1.450    4.944   .395    0.00   -.0099   .8730E+00    .76362   .19072
  2  2  .2061   36.196    5.100    18.950   12.510   -.0514   0     .484                                   .2863E+00
  2  3  .5000   39.872    5.100    18.950   12.510   -.0514   0     .275                                   .1577E+00
  2  4  .7939   43.549    5.100    18.950   12.510   -.0514   0     .155                                   .8408E-01
  2  5  .9755   45.821    5.100    18.950   12.510   -.0514   0     .058                                   .2663E-01

  3  1  .0245   40.043    8.500    18.950   11.450   -.0472   0    1.608    4.867   .425    0.00   -.0076   .9680E+00    .86409   .05710
  3  2  .2061   42.122    8.500    18.950   11.450   -.0472   0     .523                                   .3095E+00
  3  3  .5000   45.487    8.500    18.950   11.450   -.0472   0     .286                                   .1634E+00
  3  4  .7939   48.853    8.500    18.950   11.450   -.0472   0     .159                                   .8604E-01
  3  5  .9755   50.932    8.500    18.950   11.450   -.0472   0     .060                                   .2741E-01

  4  1  .0245   46.162   11.900    18.950   10.390   -.0421   0    1.705    4.649   .447    0.00   -.0072   .1026E+01    .88215  -.02522
  4  2  .2061   48.049   11.900    18.950   10.390   -.0421   0     .551                                   .3260E+00
  4  3  .5000   51.102   11.900    18.950   10.390   -.0421   0     .298                                   .1704E+00
  4  4  .7939   54.156   11.900    18.950   10.390   -.0421   0     .165                                   .8953E-01
  4  5  .9755   56.043   11.900    18.950   10.390   -.0421   0     .063                                   .2862E-01

  5  1  .0245   52.281   15.300    18.950    9.330   -.0358   0    1.767    4.322   .463    0.00   -.0073   .1064E+01    .85127  -.08143
  5  2  .2061   53.975   15.300    18.950    9.330   -.0358   0     .571                                   .3377E+00
  5  3  .5000   56.717   15.300    18.950    9.330   -.0358   0     .308                                   .1761E+00
  5  4  .7939   59.460   15.300    18.950    9.330   -.0358   0     .171                                   .9250E-01
  5  5  .9755   61.154   15.300    18.950    9.330   -.0358   0     .065                                   .2959E-01

  6  1  .0245   58.400   18.700    18.950    8.270   -.0279   0    1.802    3.909   .473    0.00   -.0076   .1084E+01    .78418  -.11895
  6  2  .2061   59.902   18.700    18.950    8.270   -.0279   0     .583                                   .3447E+00
  6  3  .5000   62.332   18.700    18.950    8.270   -.0279   0     .315                                   .1798E+00
  6  4  .7939   64.763   18.700    18.950    8.270   -.0279   0     .174                                   .9443E-01
  6  5  .9755   66.265   18.700    18.950    8.270   -.0279   0     .066                                   .3019E-01

  7  1  .0245   64.519   22.100    18.950    7.210   -.0177   0    1.806    3.423   .475    0.00   -.0078   .1087E+01    .68687  -.13988
  7  2  .2061   65.829   22.100    18.950    7.210   -.0177   0     .585                                   .3461E+00
  7  3  .5000   67.947   22.100    18.950    7.210   -.0177   0     .317                                   .1811E+00
  7  4  .7939   70.066   22.100    18.950    7.210   -.0177   0     .176                                   .9503E-01
  7  5  .9755   71.376   22.100    18.950    7.210   -.0177   0     .067                                   .3031E-01

  8  1  .0245   70.638   25.500    18.950    6.150   -.0039   0    1.772    2.871   .467    0.00   -.0079   .1067E+01    .56385  -.14527
  8  2  .2061   71.755   25.500    18.950    6.150   -.0039   0     .575                                   .3399E+00
  8  3  .5000   73.562   25.500    18.950    6.150   -.0039   0     .313                                   .1788E+00
  8  4  .7939   75.370   25.500    18.950    6.150   -.0039   0     .173                                   .9384E-01
  8  5  .9755   76.487   25.500    18.950    6.150   -.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   -.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                                          .3224E+00
  9  3  .5000  79.177  28.900   18.950    5.090    .0155  0      .298                                          .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     1.553   .385    0.00    -.0060      .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      .258                                          .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     6.312   .465    0.00    -.0189      .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    .22659
 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    .76570    .07852
 16  2  .2061  59.902 -18.700   18.950    8.270   -.0279  0      .764                                          .3387E+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    .02663
 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    2.359   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 (NV0R = 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 abritrary 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 trapdzoidal 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.

```
INPUT DATA LISTING FOLLOWS
 ②←  COL
 &INPUT
 FUSTYP=1, } NAMELIST INPUT
 &END
CL1607-32   (-24 PLANFORM)   VC121  ENGINE
  1  1 -1   1   1   1  0  7 13   1 17 29                                  2   3   2 10   1 10
 967680
0.        1.        5.        10.       20.       30.       40.       50.       60.       70.          XAF  10
80.       90.       100.                                                                               XAF  13
944.1     65.74     -54.96    1448.94                                                                  WORG 02
1462.5    223.94    -54.47    925.97                                                                   WORG 06
1768.6    317.41    -69.00    650.01                                                                   WORG 08
1905.4    368.04    -77.16    529.87                                                                   WORG 09
2225.8    486.83    -89.74    311.72                                                                   WORG 11
2225.8    486.88    -89.74    311.72                                                                   WORG 12
2479.3    645.05    -99.96    194.45                                                                   WORG 13
0.        -.187     -1.98     -7.09     -18.24    -28.07    -35.89    -41.82    -46.3     -49.9        TZOR 02
-53.13    -56.52    -60.34                                                                             TZOR 02
0.        .49       2.5       2.85      1.06      -2.25     -6.32     -10.75    -15.32    -19.88       TZOR 06
-24.29    -28.42    -32.23                                                                             TZOR 06
0.        .09       1.11      2.27      2.69      2.13      1.        -.51      -2.31     -4.28        TZOR 08
-6.4      -8.6      -10.84                                                                             TZOR 08
0.        .08       .41       1.39      1.64      1.36      .73       -.12      -1.18     -2.39        TZOR 09
-3.71     -5.09     -6.55                                                                              TZOR 09
0.        -.08      -.35      -.36      .16       .4        .6        .72       .82       .91          TZOR 11
.97       1.02      1.05                                                                               TZOR 11
0.        -.08      -.35      -.36      .16       .4        .59       .72       .82       .92          TZOR 12
.97       1.02      1.05                                                                               TZOR 12
0.        -.08      -.35      -.61      -.85      -.92      -.9       -.71      -.4       -.01         TZOR 13
.52       1.13      1.77                                                                               TZOR 13
0.        .46       .89       1.07      1.27      1.4       1.48      1.52      1.55      1.44         WORD  2
1.14      .66       0.                                                                                 WORD  2
0.        .54       .99       1.16      1.34      1.44      1.5       1.51      1.46      1.28         WORD  6
.98       .55       0.                                                                                 WORD  6
0.        .49       .89       1.04      1.18      1.27      1.33      1.351     1.297     1.134        WORD  8
.864      .486      0.                                                                                 WORD  8
0.        .47       .716      .879      1.065     1.192     1.292     1.329     1.276     1.116        WORD  9
.851      .476      0.                                                                                 WORD  9
0.        .47       .723      .903      1.128     1.268     1.364     1.403     1.347     1.179        WORD 11
.898      .507      0.                                                                                 WORD 11
0.        .056      .267      .505      .898      1.179     1.347     1.403     1.347     1.179        WORD 12
.898      .505      0.                                                                                 WORD 12
0.        .056      .271      .512      .911      1.196     1.367     1.424     1.367     1.196        WORD 13
.911      .512      0.                                                                                 WORD 13
0.0       120.      240.      360.      480.      600.      720.      840.      960.      1080.        XFUS 10
```

Figure C-1.- Typical WAVE DRAG format dataset

```
1200.    1320.    1440.    1560.    1680.    1920.    2120.    2240.    2360.    2480.        XFUS 20
2664.3   2720.    2840.    2960.    3080.    3200.    3320.    3440.    3524.                 XFUS 30
-38.     -30.75   -23.75   -18.5    -16.2    -15.9    -17.2    -20.9    -26.84   -32.75       ZFUS 10
-36.73   -40.53   -45.07   -49.39   -53.68   -61.59   -68.9    -72.9    -75.0    -76.6        ZFUS 20
-76.8    -76.6    -74.9    -71.3    -66.7    -60.9    -53.3    -44.3    -37.                  ZFUS 30
0.       830.     2875.    5242.    8136.    10944.   13752.   16128.   18547.   19584.       AFUS 10
19670.   19670.   20016.   20304.   20548.   20707.   20404.   20073.   19397.   18346.       AFUS 20
16272.   15408.   13248.   10483.   7085.    4464.    2477.    878.     0.                    AFUS 30
2094.    214.     -34.                                                                       PODORG 1
0.       137.     393.                                                                       PODX 1
33.92    35.65    35.65                                                                      PODR 1
2091.    204.     -136.                                                                      PODORG 2
0.       136.     394.                                                                       PODX 2
32.      35.65    35.65                                                                      PODR 2
2480.    645.     -100.    194.5    2595.4   645.     -28.     141.1                          FINORG 1
0.       10.      20.      30.      40.      50.      60.      70.      90.      100.         XFIN
0.       .466     .846     1.138    1.345    1.465    1.498    1.390    .641     0.0          FINORD
3183.9   0.       -27.     294.1    3403.2   0.       66.5     67.7                           FINORG 2
0.       10.      20.      30.      40.      50.      60.      70.      90.      100.         XFIN
0.       .466     .846     1.136    1.345    1.465    1.498    1.390    .641     0.0          FINORD
3116.4   33.      -40.     283.8    3354.    174.4    -40.     76.4                           CANORG
0.0      10.      20.      30.      40.      50.      70.      80.      90.      100.         XCAN
0.0      .553     .948     1.264    1.448    1.5      1.264    .948     .553     0.0          CANORD
267 2550   50     20     0    00000000
268 1200   50     20     0    00000000
269 1000   50      1     0    01000000

INPUT DATA LISTED
```

Figure C-1.- Concluded

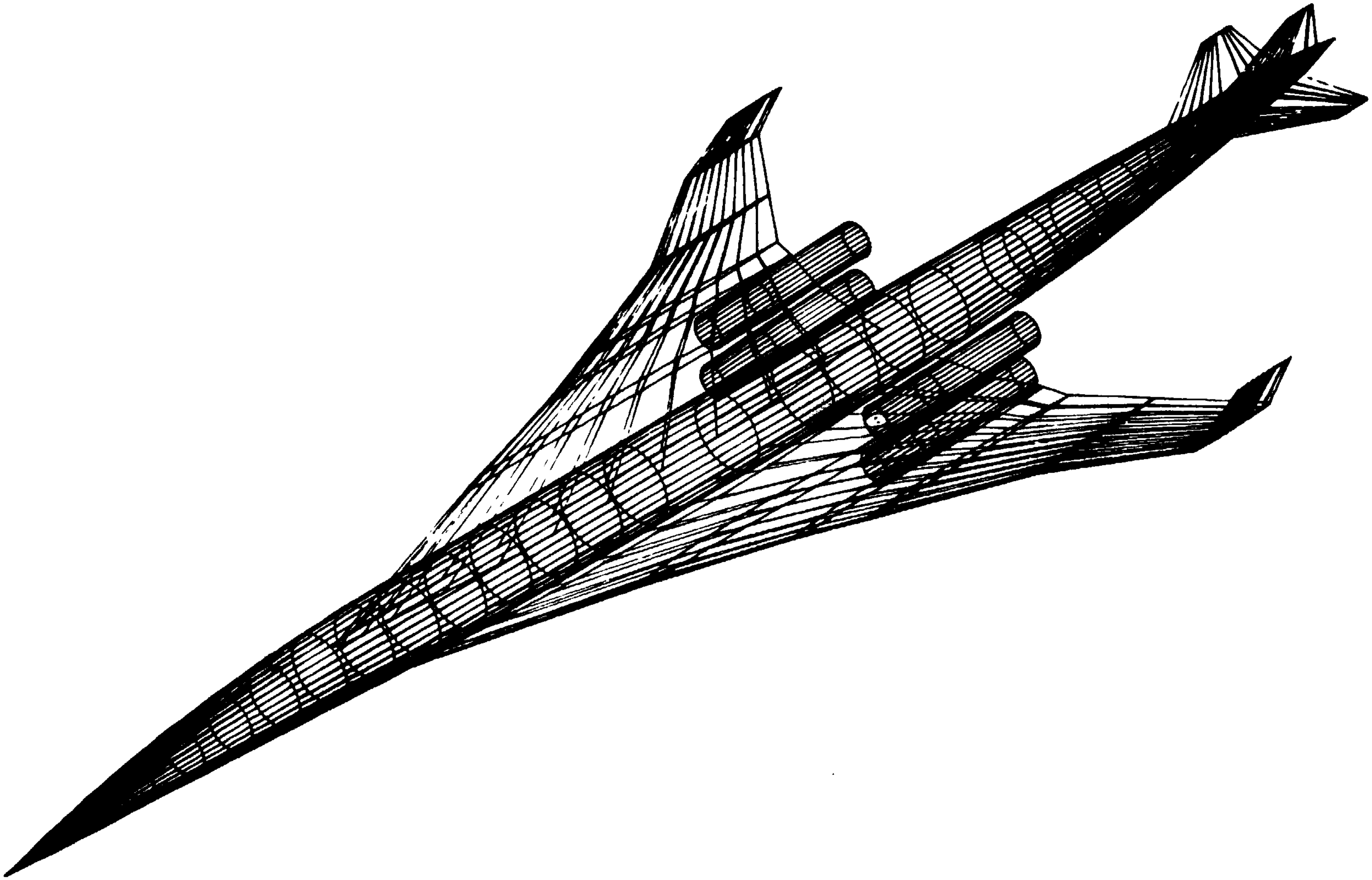


Figure C-2.- Graphic representation of WAVE DRAG dataset

```
CL1607-32   (-24 PLANFORM)   VC121  ENGINE
 0         0          1        -0.0200     0.0        0.0        0.0      0        0
 1            2.550
 3            0.0        5.000     10.000
 0            0.0        0.0        0.0        0.0        0.0
12      967680.00        1.0000     0.0        0.0     1290.0996
  944.0999   65.7400   -54.9600  1448.9399           WING PANEL NO. 1
 1462.5000  223.9400   -54.4700   925.9700           WING PANEL NO. 1
    3.0000   10.0000     1.0000     0.0              NVOR,RNCV,SPC,PDL
    0.0       0.0      0        13        0          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
    0.0       0.0529     0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
   -1.6545   -2.1469    -2.6232    -3.0692    -3.4807
 1462.5000  223.9400   -54.4700   925.9700           WING PANEL NO. 2
 1768.7998  317.4099   -69.0000   650.0098           WING PANEL NO. 2
    3.0000   10.0000     1.0000     0.0              NVOR,RNCV,SPC,PDL
    0.0       0.0      0        13        0          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    -0.2430    -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
 1768.7998  317.4099   -69.0000   650.0098           WING PANEL NO. 3
 1905.3999  368.0398   -77.1600   529.8699           WING PANEL NO. 3
    3.0000   10.0000     1.0000     0.0              NVOR,RNCV,SPC,PDL
    0.0       0.0      0        13        0          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    -1.2362
 1905.3999  368.0398   -77.1600   529.8699           WING PANEL NO. 4
 2225.7998  486.8298   -89.7400   311.7200           WING PANEL NO. 4
    3.0000   10.0000     1.0000     0.0              NVOR,RNCV,SPC,PDL
    0.0       0.0      0        13        0          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
```

Figure C-3.- Listing of output dataset in VORLAX format

```
 2225.7998  486.8298  -89.7400  311.7200            WING PANEL NO. 5
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 5
    3.0000   10.0000    1.0000       0.0            NVOR,RNCV,SPC,PDL
       0.0       0.0    0     13        0           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    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368
       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
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500            WING PANEL NO. 6
    3.0000   10.0000    1.0000       0.0            NVOR,RNCV,SPC,PDL
       0.0       0.0    0     13        0           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
       0.0       0.0   45.7619 3524.0000            FUSELAGE PANEL
       0.0       0.0  -97.8677 3524.0000            FUSELAGE PANEL
    4.0000   28.0000    1.0000  999.0000            NVOR,RNCV,SPC,PDL
   90.0000   71.8148   33.1318   71.8148  -23.7363   71.8148  -90.0000   71.8148
       0.0       0.0    1     29        0           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   54.4335
   60.1589   63.5641   66.9693   70.3746   75.6044   77.1850   80.5902   93.9955
   87.4007   90.8059   94.2111   97.6163  100.0000
   -1.0783   -0.3724   -0.6729   -0.5250   -0.4597   -0.4512   -0.4881   -0.5931
   -0.7616   -0.9297   -1.0423   -1.1501   -1.2784   -1.4015   -1.5233   -1.7477
   -1.9552   -2.0687   -2.1733   -2.1737   -2.1793   -2.1737   -2.1254   -2.0233
   -1.8927   -1.7281   -1.5125   -1.2571   -1.0499
       0.0    5.1227   17.7443   32.3533   50.2150   67.5458   84.8766  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  100.4297   95.0974   81.7659   54.7005
   42.7282   27.5516   15.2879    5.4190       0.0
 2094.0000  234.0000   -0.0300  393.0000            NACELLE PANEL NO 1
 2094.0000  234.0000   -0.0300  393.0000            NACELLE PANEL NO 1
    6.0000    5.0000       0.0  999.0000            NVOR,RNCV,SPC,PDL
   90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
 -150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
       0.0       0.0    0      3        0           0         1
       0.0   12.1527  100.0000
       0.0
  100.0000  165.1001  165.1001
```

Figure C-3.- Continued

```
 2091.0000  204.0000 -164.0000  394.0000           NACELLE PANEL NO 2
 2091.0000  204.0000 -164.0000  394.0000           NACELLE PANEL NO 2
    6.0000    5.0000       0.0  444.0000           NVOR,RNCV,SPC,PDL
   90.0000   32.0000   30.0000   32.0000  -30.0000   32.0000  -90.0000   32.0000
 -150.0000   32.0000 -210.0000   32.0000 -270.0000   32.0000
       0.0       0.0 0         5         0         0         1
       0.0   11.9149  100.0000
      0.0
  101.0000  111.4062  111.4062
 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          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          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         0                    NXS,NYS,NZS
```

Figure C-3.- Concluded

```
CL1607-32    (-24 PLANFORM)   VC121 ENGINE
  1  1 -1  1  1  1  0  6 13  1  5 29  0  0  0  0  0  0  2  3  2  2  1  2
 967680                                                                          REFA
    0.0      1.00      5.00     10.00     20.00     30.00     40.00     50.00     60.00     70.00  XAF
  80.00     90.00    100.00
 944.10     65.74    -54.961448.94                                                               WORG
1462.50    223.94    -54.47  925.97                                                              WORG
1758.80    317.41    -69.00  650.01                                                              WORG
1905.40    368.04    -77.16  529.87                                                              WORG
2225.80    496.38    -89.74  311.72                                                              WORG
2479.30    645.05    -99.96  194.45                                                              WORG
    0.0     -0.19     -1.99     -7.09    -18.24    -28.07    -35.89    -41.82    -46.30    -49.90  TZORD
 -53.13    -56.52    -60.34
    0.0      0.49      2.50      2.95      1.06     -2.25     -6.32    -10.75    -15.32    -19.88  TZORD
 -24.29    -28.42    -32.23
    0.0      0.04      1.11      2.27      2.64      2.13      1.00     -0.51     -2.31     -4.28  TZORD
  -6.40     -8.60    -10.84
    0.0      0.08      0.41      1.39      1.64      1.36      0.73     -0.12     -1.18     -2.39  TZORD
  -3.71     -5.09     -6.55
    0.0     -0.08     -0.35     -0.36      0.16      0.40      0.59      0.72      0.82      0.92  TZORD
   0.97      1.02      1.05
    0.0     -0.08     -0.35     -0.61     -0.85     -0.92     -0.90     -0.71     -0.40     -0.01  TZORD
   0.52      1.13      1.77
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0  WORD
    0.0       0.0       0.0
    0.0    120.00    240.00    360.00    480.00    600.00    720.00    840.00    960.001080.00  XFUS
1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00  XFUS
2664.302720.002840.002960.003080.003200.003320.003440.003524.00
 -39.00    -30.75    -23.75    -19.50    -16.20    -15.90    -17.20    -20.90    -26.84    -32.75  ZFUS
 -36.72    -40.53    -45.07    -49.39    -53.68    -61.59    -68.90    -72.90    -75.00    -76.60  ZFUS
 -76.80    -76.60    -74.90    -71.30    -66.70    -60.90    -53.30    -44.30    -37.00
    0.0     930.0    2875.0    5242.0    8136.010944.013752.016202.316202.316202.3  AFUS
16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3  AFUS
16271.915408.013248.010483.0   7085.0    4464.0    2477.0     878.0       0.0
```

Figure C-4.- Result of converting circular fuselage VORLAX dataset back to WAVE DRAG format

```
2094.00 214.00  -0.08                                                          PODORG 1
   0.0   47.76 393.00   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    PODORD 1
2091.00 204.00-104.00                                                          PODORG 2
   0.0   46.94 394.00   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    PODORD 2
 2480.0  645.0 -100.0 194.5 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                                           10.000RT
X Z     26.62-24.139.23                       12.250RT
                                                                         1
```

Figure C-4.- Concluded

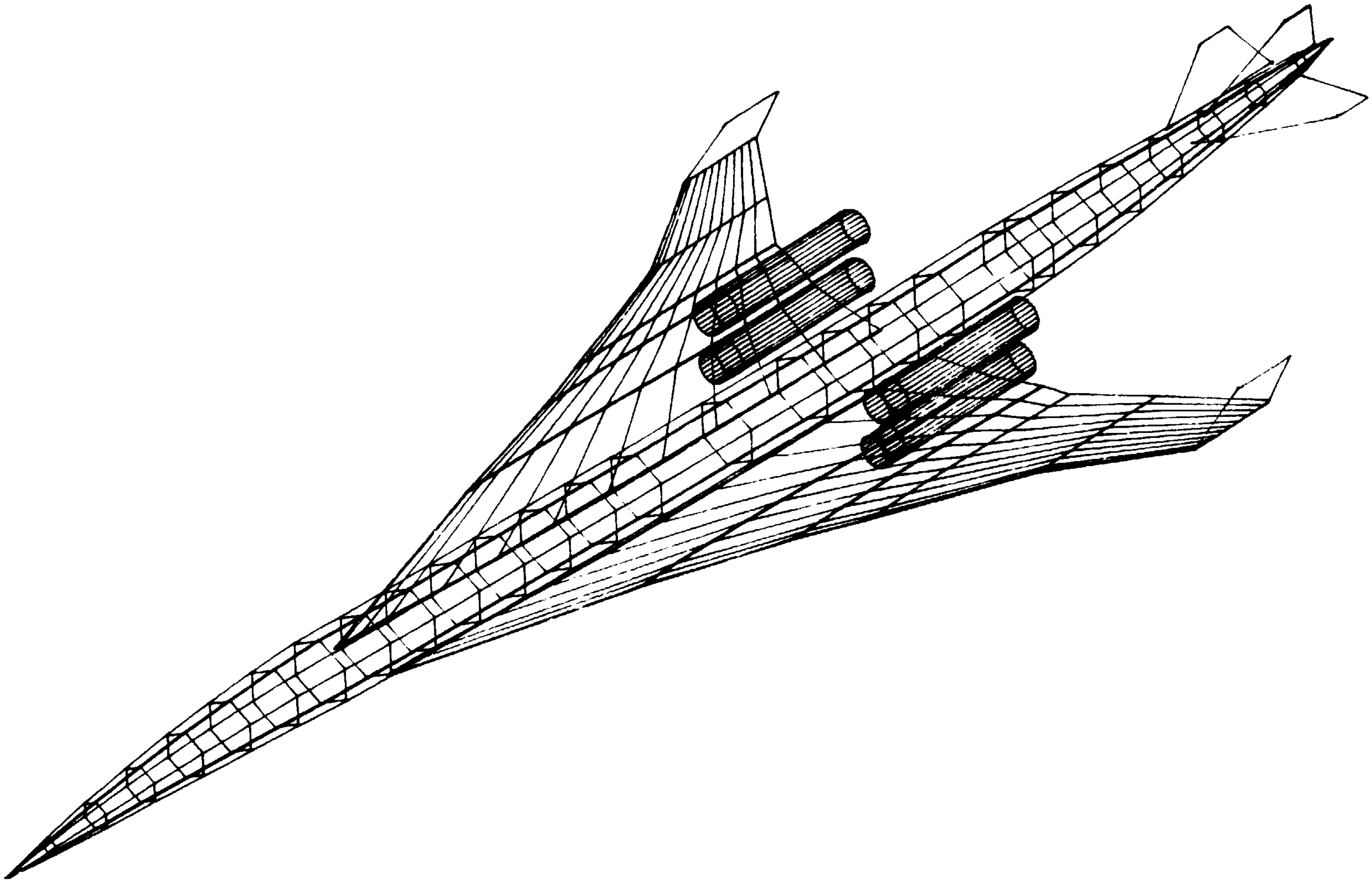


Figure C-5.- Plot of figure C-4 dataset

```
 CL1607-32   (-24 PLANFORM)  VC1?1 ENGINE
   1   1   1   1   1   1   0   6  13   1   3   4   0   0   0   0   0   0   2   3   4   2   1   2
 967680
     0.0     1.00     5.00    10.00    20.00    30.00    40.00    50.00    60.00    70.00   REFA
   80.00    90.00   100.00                                                                   XAF
  944.10    65.74   -54.961448.94                                                            WORG
 1462.50   223.94   -54.47  925.97                                                           WORG
 1768.80   317.41   -69.00  650.01                                                           WORG
 1905.40   368.04   -77.16  529.87                                                           WORG
 2225.80   486.88   -89.74  311.72                                                           WORG
 2479.30   645.05   -99.96  194.45                                                           WORG
     0.0    -0.19    -1.98    -7.09   -18.24   -28.07   -35.89   -41.82   -46.30   -49.90   TZORD
  -53.13   -56.52   -60.34
     0.0     0.49     2.50     2.85     1.06    -2.25    -6.32   -10.75   -15.32   -19.88   TZORD
  -24.29   -28.42   -32.23
     0.0     0.09     1.11     2.27     2.69     2.13     1.00    -0.51    -2.31    -4.28   TZORD
   -6.40    -8.60   -10.84
     0.0     0.08     0.41     1.39     1.64     1.36     0.73    -0.12    -1.18    -2.39   TZORD
   -3.71    -5.09    -6.55
     0.0    -0.08    -0.35    -0.36     0.16     0.40     0.59     0.72     0.82     0.92   TZORD
    0.97     1.02     1.05
     0.0    -0.08    -0.35    -0.61    -0.85    -0.92    -0.90    -0.71    -0.40    -0.01   TZORD
    0.52     1.13     1.77
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   WORD
     0.0      0.0      0.0
     0.0   257.703362.573524.00        0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0                                     XFUS
  -54.96   -54.96   -54.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0   YFUS
     0.0    65.74      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   ZFUS
  -54.96   -54.96   -54.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0   YFUS
     0.0    65.74      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   ZFUS
  -54.96   -54.96   -54.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0   YFUS
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0   ZFUS
  -54.96   -54.96   -54.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0   YFUS
 2094.00   223.94    -0.08                        0.0      0.0      0.0      0.0   ZFUS
     0.0    47.76   393.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0   PODORG 1
   33.92    33.92    33.92      0.0      0.0      0.0      0.0      0.0      0.0      0.0   XPOD   1
                                                                                       PODORD 1
```

Figure C-6 - Result of converting flat fuselage dataset back to WAVE DRAG format

```
2091.00 223.94-104.00                                                   PODORG 2
  0.0    46.94 394.00    0.0    0.0    0.0    0.0    0.0    0.0    0.0  XPOD   2
  32.00  32.00  32.00    0.0    0.0    0.0    0.0    0.0    0.0    0.0  PODORD 2
 2094.0  223.9  -34.0  393.0 2094.0  223.9  -54.6  393.0                FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 2091.0  223.9  -54.6  394.0 2091.0  223.9  -72.0  394.0                FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 2480.0  645.0 -100.0  194.5 2595.4  645.0  -28.0  141.1                FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 3171.4   65.7  -40.0  235.8 3171.4   65.7  -55.0  235.8                FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 3171.4   65.7  -40.0  235.8 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 C-6.- Concluded

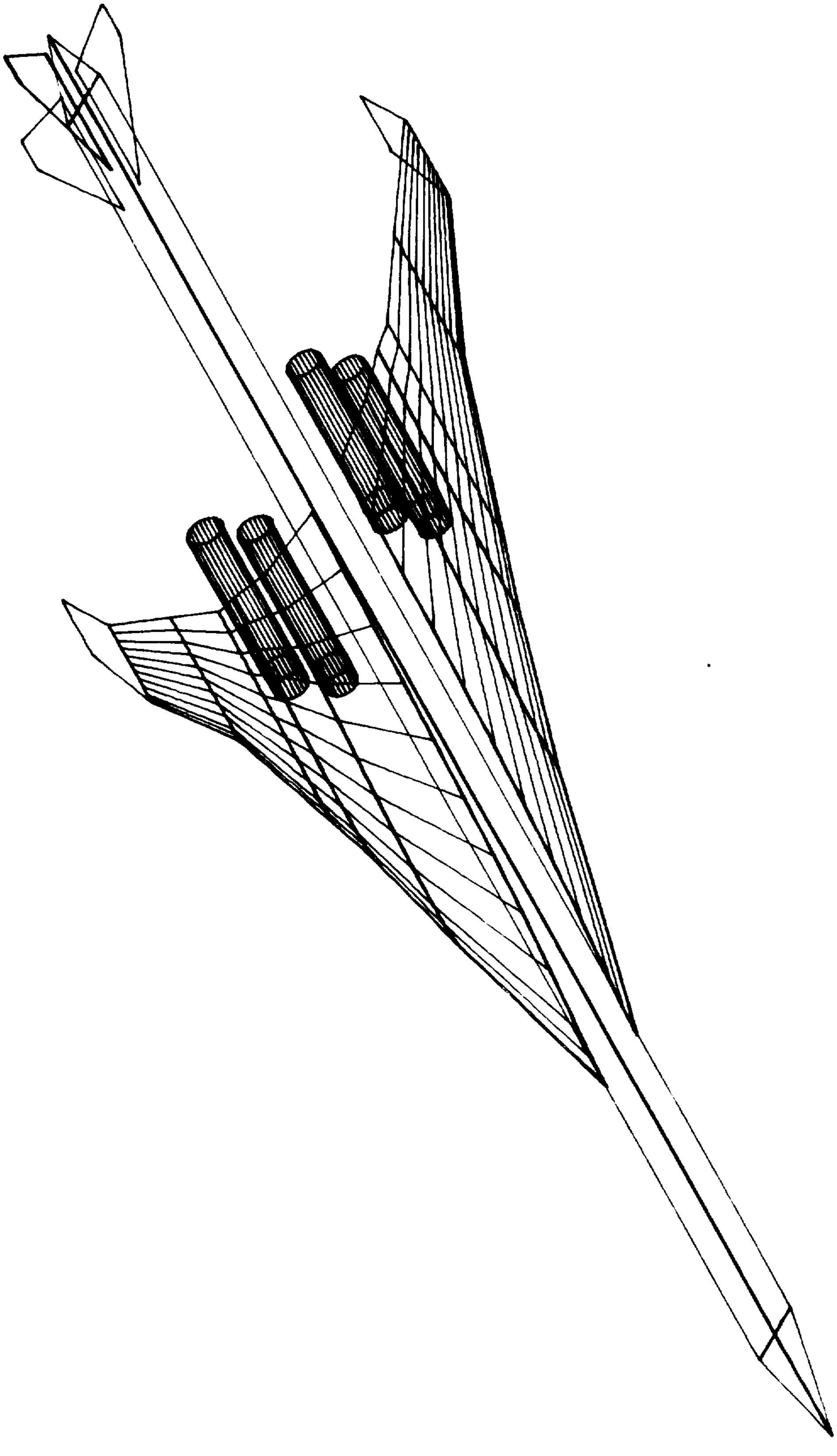


Figure C-7.- Plot of figure C-6 dataset

```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
0         0         1            -0.0200       0.0       0.0       0.0   0         0
1                 2.550
3                   0.0     5.000    10.000
0                   0.0       0.0       0.0       0.0       0.0
12            967680.00    1.0000       0.0       0.0 1290.0996
  944.0999   65.7400  -54.9600 1448.9399          WING PANEL NO. 1
 1462.5000  223.9400  -54.4700  925.9700          WING PANEL NO. 1
    3.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         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
       0.0    0.0529    0.2700    0.3078    0.1145   -0.2430   -0.6825   -1.1609
   -1.6545   -2.1469   -2.6232   -3.0692   -3.4807
 1462.5000  223.9400  -54.4700  925.9700          WING PANEL NO. 2
 1768.7998  317.4099  -69.0000  650.0099          WING PANEL NO. 2
    3.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         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   -0.2430   -0.6825   -1.1609
   -1.6545   -2.1469   -2.6232   -3.0692   -3.4807
       0.0    0.0133    0.1708    0.3492    0.4138    0.3277    0.1538   -0.0785
   -0.3554   -0.6585   -0.9846   -1.3231   -1.6677
 1768.7998  317.4099  -69.0000  650.0098          WING PANEL NO. 3
 1905.3999  368.0398  -77.1600  529.8699          WING PANEL NO. 3
    3.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         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   -1.2362
 1905.3999  368.0398  -77.1600  529.8699          WING PANEL NO. 4
 2225.7998  486.8298  -89.7400  311.7200          WING PANEL NO. 4
    3.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         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
```

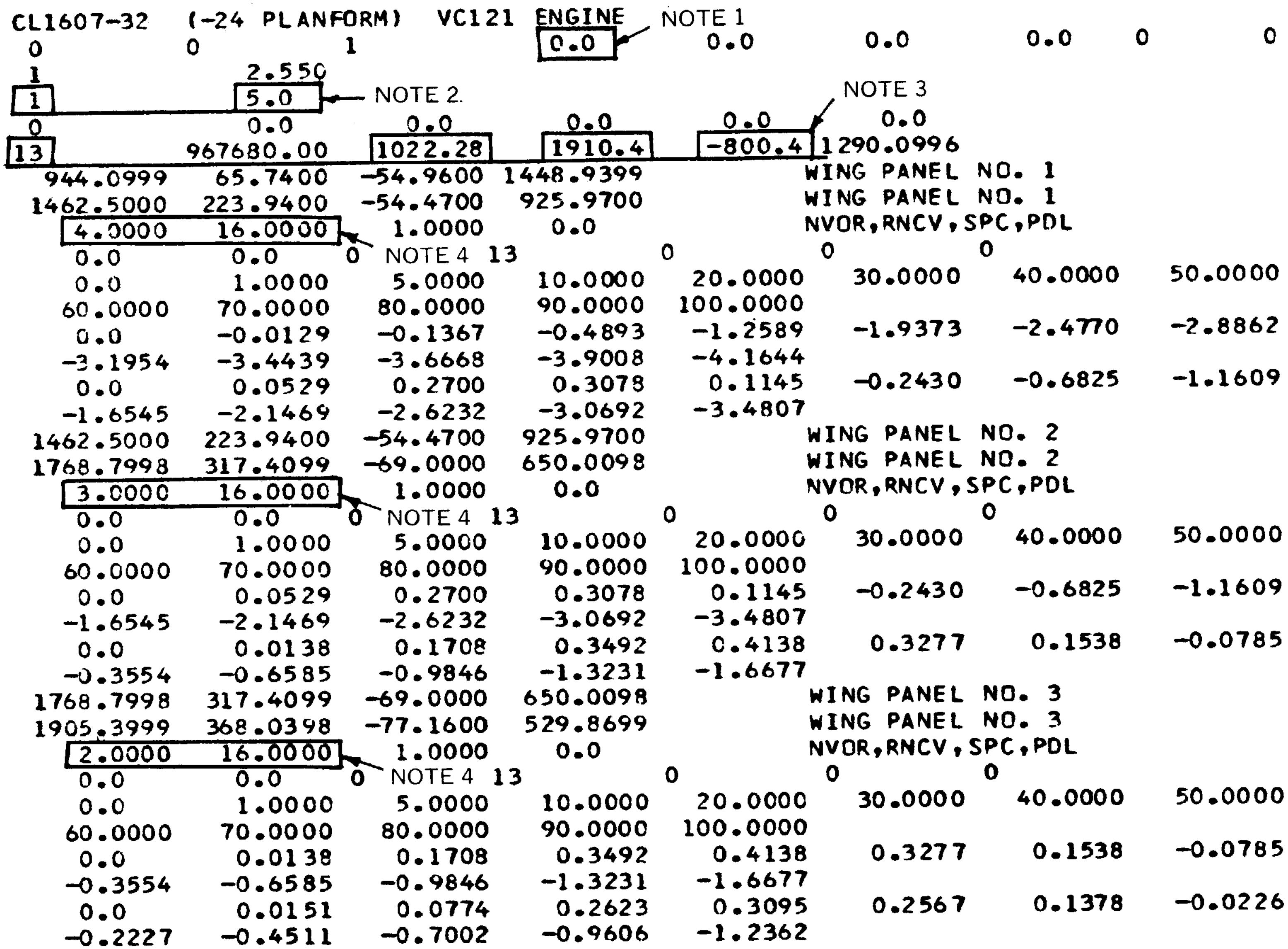
Figure C-8.- Converted dataset before editing for VORLAX run

```
2225.7998  486.8298  -89.7400  311.7200          WING PANEL NO. 5
2225.7998  486.8799  -89.7400  311.7200          WING PANEL NO. 5
   3.0000   10.0000    1.0000    0.0             NVOR,RNCV,SPC,PDL
   0.0       0.0    0         13          0         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    0.1925    0.2310
   0.2631    0.2919    0.3112    0.3272    0.3368
   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
2225.7998  486.8799  -89.7400  311.7200          WING PANEL NO. 6
2479.2998  645.0498  -99.9600  194.4500          WING PANEL NO. 6
   3.0000   10.0000    1.0000    0.0             NVOR,RNCV,SPC,PDL
   0.0       0.0    0         13          0         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
   0.0       0.0     -54.9600 3524.0000          FUSELAGE PANEL
 257.7026   65.7400  -54.9600 3104.8645          FUSELAGE PANEL
   3.0000    2.0000    1.0000    0.0             NVOR,RNCV,SPC,PDL
   0.0       0.0    0         29          0         0         0
   0.0       3.4057    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   54.4835
  60.1589   63.5641   66.9693   70.3746   75.6044   77.1859   80.5902   83.9955
  87.4007   90.8059   94.2111   97.6163  100.0000
  -1.5596   -1.3539   -1.1552   -1.0062   -0.9410   -0.9325   -0.9694   -1.0743
  -1.2429   -1.4106   -1.5236   -1.6314   -1.7602   -1.8828   -2.0045   -2.2290
  -2.4364   -2.5499   -2.6095   -2.6549   -2.6606   -2.6549   -2.6067   -2.5045
  -2.3740   -2.2094   -1.9928   -1.7384   -1.5312
  -1.5596   -1.3539   -1.1552   -1.0062   -0.9410   -0.9325   -0.9694   -1.0743
  -1.2429   -1.4106   -1.5236   -1.6314   -1.7602   -1.8828   -2.0045   -2.2290
  -2.4364   -2.5499   -2.6095   -2.6549   -2.6606   -2.6549   -2.6067   -2.5045
  -2.3740   -2.2094   -1.9938   -1.7384   -1.5312
2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
   6.0000    5.0000    0.0     600.0000          NVOR,RNCV,SPC,PDL
  90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
-150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
   0.0       0.0    0          3          0         0         1
   0.0      12.1522  100.0000
   0.0
 100.0000  105.1001  105.1001
```

Figure C-8.- Continued

```
2091.0000   204.0000 -104.0000   394.0000              NACELLE PANEL NO 2
2091.0000   204.0000 -104.0000   394.0000              NACELLE PANEL NO 2
   6.0000     5.0000    0.0      999.0000              NVOR,RNCV,SPC,PDL
  90.0000    32.0000   30.0000    32.0000  -30.0000    32.0000  -90.0000    32.0000
-150.0000    32.0000 -210.0000    32.0000 -270.0000    32.0000
   0.0        0.0      0         3         0          0           1
   0.0      -11.9148  100.0000
  0.0
 100.0000   111.4062  111.4062
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            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            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           0                   NXS,NYS,NZS
```

Figure C-8.- Concluded



```
CL1607-32    (-24 PLANFORM)   VC121  ENGINE    NOTE 1
  0            0          1          0.0         0.0         0.0         0.0      0        0
  1                    2.550
  1                     5.0      NOTE 2
  0                     0.0         0.0         0.0         0.0       NOTE 3   0.0
 13               967680.00     1022.28     1910.4      -800.4   1290.0996
   944.0999      65.7400    -54.9600   1448.9399                WING PANEL NO. 1
  1462.5000     223.9400    -54.4700    925.9700                WING PANEL NO. 1
      4.0000     16.0000      1.0000      0.0                   NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13             0             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
      0.0         0.0529      0.2700      0.3078      0.1145     -0.2430     -0.6825     -1.1609
     -1.6545     -2.1469     -2.6232     -3.0692     -3.4807
  1462.5000     223.9400    -54.4700    925.9700                WING PANEL NO. 2
  1768.7998     317.4099    -69.0000    650.0098                WING PANEL NO. 2
      3.0000     16.0000      1.0000      0.0                   NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13             0             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     -0.2430     -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
  1768.7998     317.4099    -69.0000    650.0098                WING PANEL NO. 3
  1905.3999     368.0398    -77.1600    529.8699                WING PANEL NO. 3
      2.0000     16.0000      1.0000      0.0                   NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13             0             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     -1.2362
```

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

```
1965.3999   368.0398   -77.1600   529.8699              WING PANEL NO. 4
2225.7998   486.8298   -89.7400   311.7200              WING PANEL NO. 4
   4.0000    16.0000     1.0000     0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0     0 NOTE 4 13           0         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 ———————————————————————————— NOTE 5
2225.7998   486.8799   -89.7400   311.7200              WING PANEL NO. 6
2479.2998   645.0499   -99.9600   194.4500              WING PANEL NO. 6
   5.0000    16.0000     1.0000     0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0     0 NOTE 4 13           0         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
    0.0       0.0      -54.9600  3524.0000              FUSELAGE PANEL
  257.7026   65.7400   -54.9600  3104.8645              FUSELAGE PANEL
   3.0000    24.0000     0.0        0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0     0 NOTE 4 29           0         0         0
    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    54.4835
   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
   -1.5596   -1.3539    -1.1552    -1.0062    -0.9410    -0.9325    -0.9694    -1.0743
   -1.2429   -1.4106    -1.5236    -1.6314    -1.7602    -1.9828    -2.0045    -2.2290
   -2.4364   -2.5499    -2.6095    -2.6549    -2.6606    -2.6549    -2.6067    -2.5045
   -2.3740   -2.2094    -1.9938    -1.7384    -1.5312
   -1.5596   -1.3539    -1.1552    -1.0062    -0.9410    -0.9325    -0.9694    -1.0743
   -1.2429   -1.4106    -1.5236    -1.6314    -1.7602    -1.8828    -2.0045    -2.2290
   -2.4364   -2.5499    -2.6095    -2.6549    -2.6606    -2.6549    -2.6067    -2.5045
   -2.3740   -2.2094    -1.9938    -1.7394    -1.5312
```

Figure C-9.- Continued

```
2094.        223.94     -34.       393.                       UPPER NACELLE PYLON  }
2094.        223.94     -54.470    393.                       UPPER NACELLE PYLON  } NOTE 6
1.           10.
0.                             NOTE 7
  2094.0000   223.9400   -0.0800   393.0000                   NACELLE PANEL NO 1
  2094.0000   223.9400   -0.0800   393.0000                   NACELLE PANEL NO 1
NOTE 4 8.0000   10.000     0.0      999.0000                   NVOR,RNCV,SPC,PDL
    90.0000   33.9200    30.0000    33.9200   -30.0     33.9200   -90.0000    33.9200
  -150.000    33.9200  -210.0000    33.9200 -270.0000   33.9200
    0.0        0.0        0          3          0          0          1
    0.0       12.1522   100.0000
0.
  100.0000   100.0000   100.0000 <- NOTE 8
2091.        223.94     -54.470    394.                       LOWER NACELLE PYLON
2091.        223.94     -72.00     394.                       LOWER NACELLE PYLON
1.           10.
0.           0.                NOTE 9
  2091.0000   223.9400 -104.0000   394.0000                   NACELLE PANEL NO 2
  2091.0000   223.9400 -104.0000   394.0000                   NACELLE PANEL NO 2
NOTE 4 6.0000   10.000     0.0      999.0000                   NVOR,RNCV,SPC,PDL
    90.0000   32.0000    30.0000    32.0000   -30.0     32.0000   -90.0000    32.0000
  -150.000    32.0000  -210.0000    32.0000 -270.0000   32.0000
    0.0        0.0        0          3          0          0          1
    0.0       11.9148   100.0000
0.                                NOTE 8
  100.0000   100.0000   100.0000
  2480.0000   645.0000 -100.0000   194.5000                   FIN PANEL NO. 1
  2595.3999   645.0000  -28.0000   141.1000                   FIN PANEL NO. 1
    4.0000    10.0000     1.0000     0.0                      NVOR,RNCV,SPC,PDL
    0.0        0.0        0          0          0          0          0

                                                      <------ NOTE 10
```

Figure C-9.- Continued

```
       3171.3600    65.7396   -40.0000   235.7760  <- NOTE 11 CANARD PANEL NO. 1
        3354.0000   174.4000   -40.0000    76.4000            CANARD PANEL NO. 1
NOTE 4  6.0000      9.00000     1.0000      0.0               NVOR,RNCV,SPC,PDL
          0.0         0.0     0          0          0          0          0
      3171.36     65.7396    -40.       235.776               HORIZONTAL TAIL SEAL
      3171.36     65.7396    -54.96     235.776               HORIZONTAL TAIL SEAL   NOTE 12
      1.          8.         0.
      0.          0.         0          0          0          0          0
       0           0         0                   NXS,NYS,NZS
```

Figure C-9.- Concluded

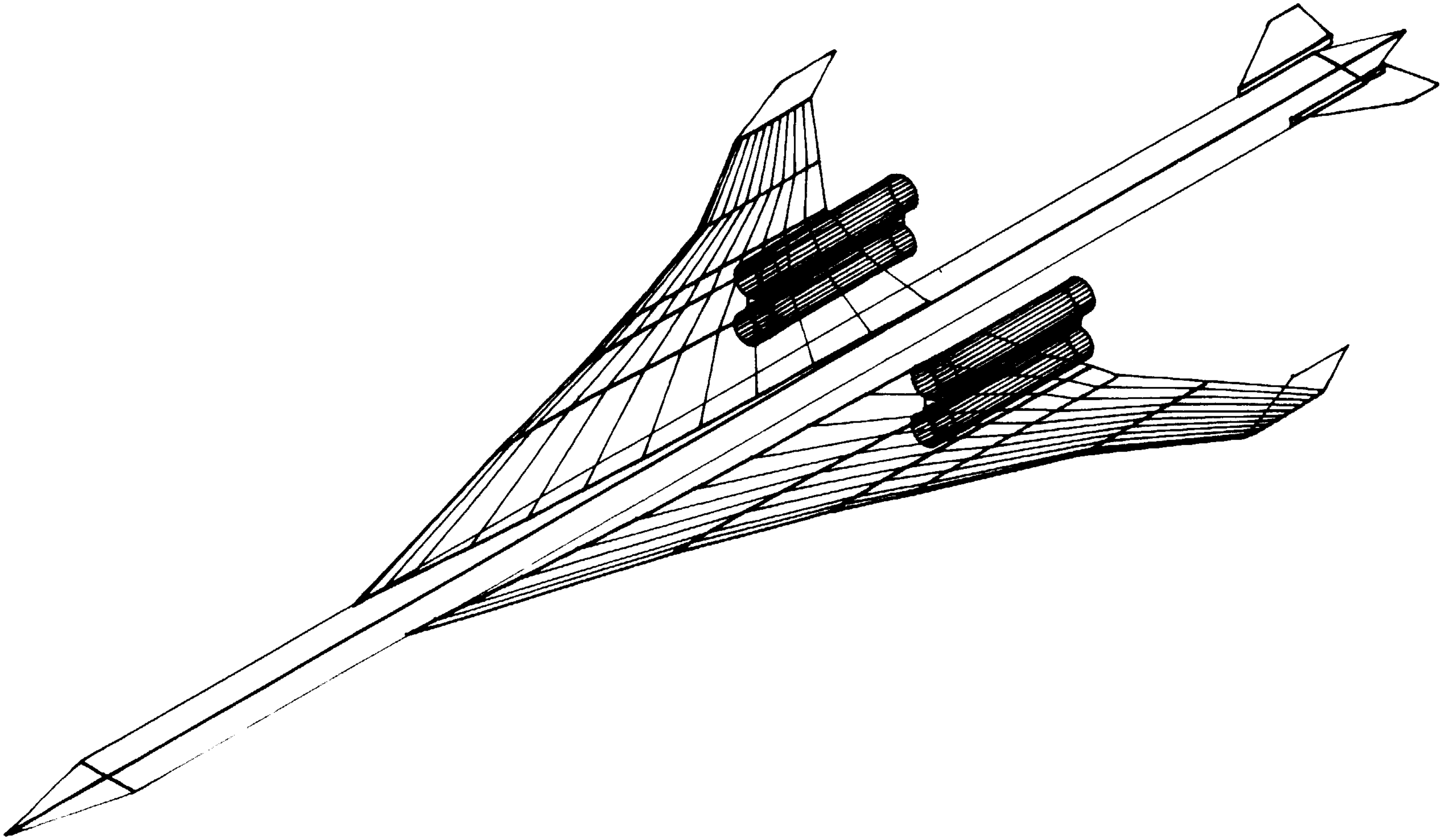


Figure C-10.- Plot of dataset edited for submittal to VORLAX

```
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  ***** VINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT

VORTEX WAKE FLOATATION PARAMETERS    FLOATX = 0.0      FLOATY = 0.0


CN 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       CN(I)       CL(I)       CY(I)       CD(I)       CT(I)       CS(I)         CM(I)        CRM(I)        CYM(I)

  1  0.1941E 00     0.14128     0.02728    -0.00008     0.00292     0.00033     0.00112      0.6703E-02    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    0.1788E-02   -0.1311E-03
  3  0.3126E-01     0.24326     0.00749     0.00121     0.00059     0.00012     0.00035     -0.1201E-02    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    0.1205E-03
  5  0.4145E-01     0.33273     0.01372     0.00089     0.00113     0.0         0.0         -0.7390E-02    0.5485E-02   -0.7114E-04
  6  0.2252E 00     0.04841     0.01083     0.0         0.00130     0.0         0.0          0.6821E-02    0.2771E-03   -0.3344E-04
  7  0.8313E-02     0.00493     0.00000     0.00004     0.00000     0.0         0.0         -0.4939E-10   -0.2125E-04    0.3285E-04
  8  0.8265E-01     0.00264     0.00100    -0.00025     0.00009     0.0         0.0         -0.3387E-03    0.3213E-03   -0.4456E-04
  9  0.7138E-02     0.00597     0.00000     0.00004     0.00000     0.0         0.0         -0.2699E-11   -0.2410E-04    0.3802E-05
 10  0.7817E-01     0.00153     0.00052     0.00012     0.00005     0.0         0.0         -0.1211E-03    0.3259E-04    0.3226E-04
 11  0.1249E-01     0.14285     0.00000    -0.00178     0.00000     0.0         0.0         -0.1598E-08    0.9159E-03   -0.1083E-02
 12  0.1753E-01     0.03454     0.00060     0.0         0.00005     0.0         0.0         -0.8343E-03    0.6015E-04   -0.5263E-05
 13  0.3645E-02     0.01976     0.00000     0.00007     0.00000     0.0         0.0         -0.1234E-09   -0.3516E-04    0.8051E-04

     SREF          WSPAN          CBAR            CLTOT          CDTOT          CYTOT      CMTOT          CRMTOT          CYMTOT

  0.96768E 06   0.12901E 04   0.10223E 04       0.18220        0.01681         0.0      -0.24120E-02   0.0             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

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      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                         SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
             CONTROL*VRLX.WDTVORN                                         9/21/76 00000010
             C                                                                    00000020
             C...THIS PROGRAM IS BASED ON NASA LRC PROGRAM D2500 -- WAVE DRAG     00000030
             C                                                                    00000040
ISN 0002           COMMON ABC (20) , J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS, 00000050
                  * NRADX  (4) , NFORX  (4) , NP, NPODOR, NF, NFINOR, NCAN, NCANOR,  00000060
                  * J2TEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,      00000070
                  * XREST (10), SKL                                                  00000080
ISN 0003           COMMON/BLK2/V, XFUS1, XFUSN                                       00000090
ISN 0004           COMMON/BLACK/XAF (30), WAFORG (20, 4), WAFORD (20, 3, 30),        00000100
                  * TZORD (20, 30), XFUS (30, 4), ZFUS (30, 4), SFUS (30, 30, 1),    00000110
                  * FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30),    00000120
                  * PODORD (9, 30), NPTSPS (5), PDES (30, 30, 10), FINORG (6, 2, 4), 00000130
                  * XFIN (6, 10), FINORD (6, 2, 10), CANORG (2, 2, 4), XCAN (2, 10), 00000140
                  * CANORD (2, 2, 10), CANOR1 (2, 2, 10)                             00000150
             C                                                                    00000160
ISN 0005           DIMENSION ALPHA (7), YFUSMX (4, 30), AFUS (4, 29), XFPCT (50),    00000170
                  * ZC12 (50), ROFUS(50)                                             00000180
ISN 0006           DIMENSION ABCD (20)                                               00000190
ISN 0007           DIMENSION ZCP12 (9, 30), PHI (10)                                 00000200
             C                                                                    00000210
ISN 0008           DTR = .017453                                                     00000220
ISN 0009           INTEGER FUSTYP                                                    00000230
             C                                                                    00000240
ISN 0010           DATA L3 /3/                                                       00000250
ISN 0011           CALL LSTDT8                                                       00000260
ISN 0012           FUSTYP = 0                                                        00000270
ISN 0013           NSWVOR = 20                                                       00000280
             C                                                                    00000290
             C  READ NAMELIST CARDS                                               00000300
             C                                                                    00000310
ISN 0014           NAMELIST /INPUT/FUSTYP, NSWVOR                                    00000320
ISN 0015           READ (5, INPUT, END=760)                                          00000330
             C                                                                    00000350
             C   INPUT 1ST TWO CARDS (TITLE CARD & CONTROL FLAGS)                 00000360
             C                                                                    00000370
ISN 0016      10   FORMAT (20A4)                                                     00000380
ISN 0017           READ (5, 10) ABC                                                  00000390
ISN 0018      20   FORMAT (1H1, 20A4)                                                00000400
ISN 0019           READ (5, 30) J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS,      00000410
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                    * (NRADX (I), NFORX (I), I = 1, 4) , NP, NPODOR, NF, NFINOR,       00000420
                    * NCAN, NCANOR                                                     00000430
ISN 0020       30     FORMAT (24I3)                                                    00000440
              C                                                                        00000450
              C     INPUT CONFIGURATION DESCRIPTION AND INITIALIZE                     00000460
              C                                                                        00000470
ISN 0021              CALL START                                                       00000480
ISN 0022              NKODE = 0                                                        00000490
              C                                                                        00000500
              C         INPUT CASE CARD                                                00000510
              C                                                                        00000520
ISN 0023              READ (5, 40) NCASE, MACH, NX, NTHETA, NREST, NCON, NPLT          00000530
ISN 0024              KEY = 0                                                          00000540
ISN 0025       40     FORMAT (A4, 5I4, 8I1)                                            00000550
ISN 0026              XMACH = FLOAT (MACH) /1000.                                      00000560
ISN 0027              LERR = 0                                                         00000570
              C                                                                        00000580
              C         INPUT RESTRAINT POINTS                                         00000590
              C                                                                        00000600
ISN 0028              IF (.NOT. (NKODE .EQ. 0 .AND. NREST .NE. 0)) GO TO 70            00000610
ISN 0030              READ (5, 50) XREST                                               00000620
ISN 0031       50     FORMAT (10F7.0)                                                  00000630
ISN 0032              DO 60 I = 1, 10                                                  00000640
ISN 0033              XREST (I) = XREST (I) /SKL                                       00000650
ISN 0034       60     CONTINUE                                                         00000660
ISN 0035              NKODE = 1                                                        00000670
ISN 0036       70     CONTINUE                                                         00000680
              C                                                                        00000690
              C     IN  VORLAX SOME 19 CARDS ARE DESCRIBED. HOWEVER, THIS DOES NOT MEAN 00000700
              C     THAT INPUT FOR A CASE CONSISTS OF 19 CARDS.  RATHER THESE SHOULD BE 00000710
              C     THOUGHT OF AS "CARD TYPES."  FURTHERMORE, NOT ALL CARD TYPES WILL   00000720
              C     BE INCLUDED IN A GIVEN CASE.  THOSE TO BE INCLUDED OR DELETED       00000730
              C     BEING A FUNCTION OF SOME OF THE INPUT CONTROL VALUES.              00000740
              C                                                                        00000750
              C     THE FOLLOWING CARD NUMBERS ARE COMPATIBLE WITH THE VORLAX INPUT     00000760
              C     FORMAT AND A COMPLETE DESCRIPTION CAN BE FOUND IN THE VORLAX PROGRAM00000770
              C     MANUAL LR 26299 SECTION 3.2.                                       00000780
              C                                                                        00000790
              C        START CONSTRUCTION OF VORLAX DATASET                            00000800
              C     PUTTING OUT TITLE CARD 1                                           00000810
              C                                                                        00000820
ISN 0037              WRITE (L3, 10) ABC                                               00000830
ISN 0038              WRITE (6, 20) ABC                                                00000840
              C                                                                        00000850
              C     SETTING UP FOR CARD 2 (CONTROLS)                                   00000860
              C                                                                        00000870
ISN 0039              ISOLV = 0                                                        00000880
ISN 0040              LAX = 0                                                          00000890
ISN 0041              LAY = 1                                                          00000900
ISN 0042              REXPAR = -.02                                                    00000910
ISN 0043              HAG = 0.0                                                        00000920
ISN 0044              FLOATX = 0.0                                                     00000930
ISN 0045              FLOATY = 0.0                                                     00000940
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ISN 0046          IBCON = 0                                                        00000950
ISN 0047          ITRMAX = 0                                                       00000960
ISN 0048          WRITE (L3, 500) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,    00000970
                 * IBCON, ITRMAX                                                   00000980
ISN 0049          WRITE (6, 510) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,     00000990
                 * IBCON, ITRMAX                                                   00001000
            C                                                                      00001010
            C    SET UP FOR CARD 3 (MACH NUMBERS)                                  00001020
            C                                                                      00001030
ISN 0050          NMACH = 1                                                        00001040
ISN 0051          WRITE (L3, 520) NMACH, XMACH                                     00001050
ISN 0052          WRITE (6, 530) NMACH, XMACH                                      00001060
            C                                                                      00001070
            C    SET UP FOR CARD 4 (ALPHA'S)                                       00001080
            C                                                                      00001090
ISN 0053          NALPHA = 3                                                       00001100
ISN 0054          ALPHA (1) = 0.                                                   00001110
ISN 0055          ALPHA (2) = 5.                                                   00001120
ISN 0056          ALPHA (3) = 10.                                                  00001130
ISN 0057          WRITE (L3, 520) NALPHA, (ALPHA (I), I = 1, NALPHA)               00001140
ISN 0058          WRITE (6, 530) NALPHA, (ALPHA (I) , I = 1, NALPHA)               00001150
            C                                                                      00001160
            C    SET UP FOR CARD 5 (ASYMMETRIC CONTROLS)                           00001170
            C                                                                      00001180
ISN 0059          LATRAL = 0                                                       00001190
ISN 0060          PSI = 0                                                          00001200
ISN 0061          PITCHQ = 0                                                       00001210
ISN 0062          ROLLQ = 0                                                        00001220
ISN 0063          YAWQ = 0                                                         00001230
ISN 0064          VINF = 0                                                         00001240
ISN 0065          WRITE (L3, 520) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF           00001250
ISN 0066          WRITE (6, 530 ) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF           00001260
            C                                                                      00001270
            C    SET UP FOR CARD 6 (REFERENCE DIMENSIONS)                          00001280
            C                                                                      00001290
ISN 0067          NFUSP = 0                                                        00001300
ISN 0068          IF  (NFUS  .GT. 0) NFUSP = 1                                     00001310
ISN 0070          NPAN = NWAF - 1 + NF + NCAN + NFUSP + NP                         00001320
ISN 0071          SREF = REFA                                                      00001330
ISN 0072          CBAR = 1.0                                                       00001340
ISN 0073          XBAR = 0.                                                        00001350
ISN 0074          ZBAR = 0.                                                        00001360
ISN 0075          WSPAN = WAFORG (NWAF, 2) *2.0                                    00001370
ISN 0076          WRITE (L3, 540) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN              00001380
ISN 0077          WRITE (6, 550) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN               00001390
            C                                                                      00001400
            C    WING TREATMENT                                                    00001410
            C                                                                      00001420
            C    SET UP FOR CARDS 7 (COORDS. OF ONE SIDE OF MAJOR PANEL)           00001430
            C                                                                      00001440
ISN 0078          IF (J1 .EQ. 0) GO TO 110                                         00001450
ISN 0080          NWPAN = NWAF - 1                                                 00001460
ISN 0081          DO 90 NN = 1, NWAF                                               00001470
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ISN 0082          DO 80 II = 1, NWAFOR                                          00001480
ISN 0083          TZORD (NN, II) = TZORD (NN, II) /WAFORG (NN, 4) *100.         00001490
ISN 0084     80   CONTINUE                                                      00001500
ISN 0085     90   CONTINUE                                                      00001510
ISN 0086          DO 100 IT = 1, NWPAN                                          00001520
ISN 0087          WRITE (L3, 560) (WAFORG (IT, J), J = 1, 4), IT                00001530
ISN 0088          WRITE (6, 570) (WAFORG (IT, J), J = 1, 4), IT                 00001540
            C                                                                   00001550
            C   SETTING UP FOR CARD 8 (COORDS. OF OTHER SIDE OF MAJOR WING PANEL) 00001560
            C                                                                   00001570
ISN 0089          WRITE (L3, 560) (WAFORG (IT + 1, J), J = 1, 4), IT            00001580
ISN 0090          WRITE (6, 570) (WAFORG (IT + 1, J), J = 1, 4), IT             00001590
            C                                                                   0C001600
            C   SETTING UP FOR CARD 9 (WING SUB PANEL CONTROLS)                 00001610
            C                                                                   00001620
ISN 0091          TNVOR = 3.0                                                   00001630
ISN 0092          RNCV = 10.                                                    00001640
ISN 0093          SPC = 1.                                                      00001650
ISN 0094          CURV = 0.                                                     00001660
ISN 0095          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                        00001670
ISN 0096          WRITE (6, 590 ) TNVOR, RNCV, SPC, CURV                        00001680
            C                                                                   00001690
            C   SETTING UP FOR CARD 11 (ADDITIONAL WING CONTROL PARAMETERS)     00001700
            C                                                                   00001710
ISN 0097          AINC1 = 0.                                                    00001720
ISN 0098          AINC2 = 0.                                                    00001730
ISN 0099          ITS = 0                                                       00001740
ISN 0100          NAP = NWAFOR                                                  00001750
ISN 0101          IQUANT = 0                                                    00001760
ISN 0102          ISYNT = 0                                                     00001770
ISN 0103          NPP = 0                                                       00001780
ISN 0104          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP    00001790
ISN 0105          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP     00001800
            C                                                                   00001810
            C   SETTING UP FOR CARD 14 (WING PER CENT CHORD STATIONS)           00001820
            C                                                                   00001830
ISN 0106          IF (NAP .EQ. 0) GO TO 110                                     00001840
ISN 0108          WRITE (L3, 620) (XAF (J), J = 1, NAP)                         00001850
ISN 0109          WRITE (6, 630 )  (XAF (J) , J = 1, NAP)                       00001860
            C                                                                   00001870
            C   SETTING UP FOR CARD 16 (WING CAMBER ORDINATES)                  00001880
            C                                                                   00001890
ISN 0110          WRITE (L3, 640) (TZORD (IT, JJ) , JJ = 1, NWAFOR)             00001900
ISN 0111          WRITE (6, 650) (TZORD (IT, JJ) , JJ = 1, NWAFOR)              00001910
ISN 0112          WRITE (L3, 640) (TZORD (IT + 1, JJ) , JJ = 1, NWAFOR)         00001920
ISN 0113          WRITE (6, 650) (TZORD (IT + 1, JJ) , JJ = 1, NWAFOR)          00001930
ISN 0114    100   CONTINUE                                                      00001940
            C                                                                   00001950
            C   FUSELAGE TREATMENT                                              00001960
            C                                                                   00001970
ISN 0115    110   IF (J2  .EQ. 0) GO TO 380                                     00001980
            C                                                                   00001990
            C   J2TEST = 1 FUSELAGE IS CIRCULAR AND UNCAMBERED                  00002000
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               C    J2TEST = 2 FUSELAGE IS CIRCULAR AND CAMBERED                    00002010
               C    J2TEST = 3 FUSELAGE IS ARBITRARY IN CROSS SECTION              00002020
               C                                                                    00002030
ISN 0117              GO TO (230, 230, 120), J2TEST                                00002040
               C                                                                    00002050
               C    TREATMENT OF ARBITRARY FUSELAGE SECTIONS                        00002060
               C    GETTING THE MAX Y VALUE AT EACH STATION                         00002070
               C                                                                    00002080
ISN 0118        120  DO 130 KI = 1, NFUS                                            00002090
ISN 0119             KISS = NFORX (KI)                                              00002100
ISN 0120             KUSS = NRADX (KI)                                              00002110
ISN 0121             DO 130 LN = 1, KISS                                            00002120
ISN 0122             DO 130 IC = 1, KUSS                                            00002130
ISN 0123             KEY = 2 *(KI - 1) + 1                                          00002140
ISN 0124             IF (IC  .EQ. 1) TEMP = 0.                                      00002150
ISN 0126             IF  (IC  .GT. 1) TEMP = YFUSMX (KI, LN)                        00002160
ISN 0128             IF  (IC  .EQ. NRADX (KI) ) GO TO 130                           00002170
ISN 0130             YFUSMX (KI, LN) = AMAX1 (SFUS (IC, LN, KEY), TEMP)             00002180
ISN 0131        130  CONTINUE                                                       00002190
               C                                                                    00002200
               C GETTING THE INCREMENTAL FUSELAGE PLANFORM AREAS                    00002210
               C                                                                    00002220
ISN 0132        140  DO 160 KI = 1, NFUS                                            00002230
ISN 0133             KISS = NFORX (KI) - 1                                          00002240
ISN 0134             DO 150 LN = 1, KISS                                            00002250
ISN 0135             AFUS (KI, LN) = (YFUSMX (KI, LN + 1) + YFUSMX (KI, LN))        00002260
                    * *(XFUS (LN + 1, KI) - XFUS (LN, KI)) /2.0                     00002270
ISN 0136        150  CONTINUE                                                       00002280
ISN 0137        160  CONTINUE                                                       00002290
               C                                                                    00002300
               C  SOLVING FOR ZERO THICKNESS FUSELAGE PANEL COORDINATES             00002310
               C                                                                    00002320
ISN 0138             XMID = WAFORG (1, 1) + WAFORG (1, 4) /2.0                      00002330
ISN 0139             DO 180 KI = 1, NFUS                                            00002340
ISN 0140             KISS = NFORX (KI)                                              00002350
ISN 0141             DO 170 LN = 1, KISS                                            00002360
ISN 0142             DXMID = XMID - XFUS (LN, KI)                                   00002370
ISN 0143             IF (DXMID .LE. 0.) GO TO 190                                   00002380
ISN 0145        170  CONTINUE                                                       00002390
ISN 0146        180  CONTINUE                                                       00002400
ISN 0147        190  KIMID = KI                                                     00002410
ISN 0148             LNMID = LN                                                     00002420
ISN 0149             XDIV = XFUS (LNMID, KIMID)                                     00002430
               C                                                                    00002440
               C   INTEGRATE AREAS OF FWD FUSELAGE                                  00002450
               C                                                                    00002460
ISN 0150             A1 = 0.                                                        00002470
ISN 0151             DO 200 KI = 1, KIMID                                           00002480
ISN 0152             KISS = NFORX (KI) -1                                           00002490
ISN 0153             IF  (KI  .EQ. KIMID) KISS = LNMID -1                           00002500
ISN 0155             DO 200 LN = 1, KISS                                            00002510
ISN 0156             A1 = A1 + AFUS (KI, LN)                                        00002520
ISN 0157        200  CONTINUE                                                       00002530
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ISN 0158          DX1 = 2.0 *A1 /WAFORG (1, 2) - (XDIV - XFUS (1, 1))          00002540
ISN 0159          XONE = XDIV - DX1                                            00002550
            C                                                                  00002560
            C   INTEGRATE AREAS OF AFT FUSELAGE PLANFORM                       00002570
            C                                                                  00002580
ISN 0160          A2 = 0.                                                      00002590
ISN 0161          DO 220 KI = KIMID, NFUS                                      00002600
ISN 0162          KISS = NFORX (KI) -1                                         00002610
ISN 0163          DO 210 LN = LNMID, KISS                                      00002620
ISN 0164          A2 = A2 + AFUS (KI, LN)                                      00002630
ISN 0165      210 CONTINUE                                                     00002640
ISN 0166      220 CONTINUE                                                     00002650
ISN 0167          DX2 = 2.0 *A2 /WAFORG (1, 2) - XFUS (NFORX (NFUS), NFUS) + XDIV  00002660
ISN 0168          XFUSS1 = XFUS (1, 1)                                         00002670
ISN 0169          YFUSS1 = YFUSMX (1, 1)                                       00002680
ISN 0170          ZFUSS = WAFORG (1, 3)                                        00002690
ISN 0171          CORDF1 = XFUS (NFORX (NFUS), NFUS) - XFUS (1, 1)             00002700
ISN 0172          XFUSS2 = XONE                                                00002710
ISN 0173          YFUSS2 = WAFORG (1, 2)                                       00002720
ISN 0174          CORDF2 = DX1 + DX2                                           00002730
            C                                                                  00002740
            C   CARD 7 OF FUSELAGE PANEL (COORDS. OF FUSELAGE PANEL CENTER LINE)   00002750
            C                                                                  00002760
ISN 0175          WRITE (L3, 720) XFUSS1, YFUSS1, ZFUSS, CORDF1                00002770
ISN 0176          WRITE (6, 730) XFUSS1, YFUSS1, ZFUSS, CORDF1                 00002780
            C                                                                  00002790
            C   CARD 8 OF FUSELAGE PANEL (COORDS. OF FUSE. PANEL AT WING JUNCTURE) 00002800
            C                                                                  00002810
ISN 0177          WRITE (L3, 720) XFUSS2, YFUSS2, ZFUSS, CORDF2                00002820
ISN 0178          WRITE (6, 730) XFUSS2, YFUSS2, ZFUSS, CORDF2                 00002830
            C                                                                  00002840
            C   CARD 9 OF FUSELAGE (SUB PANELLING CONTROLS)                    00002850
            C                                                                  00002860
ISN 0179          TNVOR = 3.                                                   00002870
ISN 0180          RNCV = 2.0                                                   00002880
ISN 0181          SPC = 1.                                                     00002890
ISN 0182          CURV = 0.                                                    00002900
ISN 0183          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                       00002910
ISN 0184          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                        00002920
            C                                                                  00002930
            C   SET UP FOR CARD 11 (ADDITIONAL CONTROL PARAMETERS FOR FUSELAGE)    00002940
            C                                                                  00002950
ISN 0185          AINC1 = 0.                                                   00002960
ISN 0186          AINC2 = 0.                                                   00002970
ISN 0187          JITS = 0                                                     00002980
ISN 0188          NAP = 0                                                      00002990
ISN 0189          IF (J2TEST .EQ .2) NAP=NFORX(1)+NFORX(2)+NFORX(3)+NFORX(4)-NFUS+1 00003000
ISN 0191          IQUANT = 0                                                   00003010
ISN 0192          ISYNT = 0                                                    00003020
ISN 0193          NPP = 0                                                      00003030
ISN 0194          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP   00003040
ISN 0195          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP    00003050
ISN 0196          IF (NAP .NE. 0) GO TO 360                                    00003060
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                C                                                                          00003070
                C                                                                          00003080
ISN 0198              GO TO 380                                                            00003090
                C                                                                          00003100
                C    START OF CIRCULAR FUSELAGE TREATMENT                                  00003110
                C                                                                          00003120
ISN 0199         230  DO 240 KI = 1, NFUS                                                  00003130
ISN 0200              KISS = NFORX (KI)                                                    00003140
ISN 0201              DO 240 LN = 1, KISS                                                  00003150
ISN 0202              YFUSMX (KI, LN) = FUSRAD (LN, KI)                                    00003160
ISN 0203         240  CONTINUE                                                             00003170
                C                                                                          00003180
                C    IF CIRCULAR FUSELAGE IS CAMBERED THEN GO TO GET FUSE. CAMBER ORDS.    00003190
                C                                                                          00003200
ISN 0204              IF (FUSTYP .EQ. 1) GO TO 250                                         00003210
ISN 0206              GO TO (140, 340, 140), J2TEST                                        00003220
                C                                                                          00003230
                C    BEGIN HEXAGONAL FUSELAGE TREATMENT                                    00003240
                C                                                                          00003250
ISN 0207         250  XFUSS1 = XFUS (1, 1)                                                 00003260
                C                                                                          00003270
                C    DETERMINE WHICH TWO FUSE STNS BRACKET X OF WING ROOT L E              00003280
                C                                                                          00003290
ISN 0208              DO 260 KI = 1, NFUS                                                  00003300
ISN 0209              KISS = NFORX (KI)                                                    00003310
ISN 0210              DO 260  LN = 1, KISS                                                 00003320
ISN 0211              DXWLE = WAFORG (1,1) - XFUS (LN, KI)                                 00003330
ISN 0212              IF (DXWLE .LE. 0) GO TO 270                                          00003340
ISN 0214         260  CONTINUE                                                             00003350
ISN 0215         270  XAFT = XFUS (LN, KI)                                                 00003360
ISN 0216              IF (LN .GT.1) XFWD = XFUS (LN- 1, KI)                                00003370
ISN 0218              IF (LN .EQ. 1) XFWD = XFUS (KISS, KI - 1)                            00003380
                C                                                                          00003390
                C   DETERMINE FUSELAGE CAMBER AT WING ROOT L E                             00003400
                C                                                                          00003410
ISN 0220              ZAFT = ZFUS (LN, KI)                                                 00003420
ISN 0221              IF (LN .GT. 1) ZFWD = ZFUS (LN - 1, KI)                              00003430
ISN 0223              IF (LN. EQ. 1) ZFWD = ZFUS (KISS, KI - 1)                            00003440
ISN 0225              SLOPE = (ZAFT - ZFWD) /(XAFT - XFWD)                                 00003450
ISN 0226              ZFWLE = ZFWD + (WAFORG (1,1) - XFWD) *SLOPE                          00003460
                C                                                                          00003470
                C    DETERMINE PHI & RHO FROM FUSE C-LINE TO WING L E ROOT                 00003480
                C                                                                          00003490
ISN 0227              RHOREF  = SQRT ((WAFORG (1,3) - ZFWLE) **2 + WAFORG (1,2) **2)       00003500
ISN 0228              PHIREF = ATAN ((WAFORG (1,3) - ZFWLE) /WAFORG (1,2)) /DTR            00003510
                C                                                                          00003520
                C    SET UP CARDS 7 & 8 OF HEXAGONAL FUSELAGE                              00003530
                C                                                                          00003540
ISN 0229              XFUSS1 = XFUS (1,1)                                                  00003550
ISN 0230              YFUSS1 = 0.                                                          00003560
ISN 0231              ZFUSS1 = ZFWLE + RHOREF                                              00003570
ISN 0232                ZFUSS2=ZFWLE-RHOREF                                                00003572
ISN 0233              CORDF1 = XFUS (NFORX (NFUS), NFUS) - XFUS (1,1)                      00003580
```

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            C                                                                       00003590
            C CARD 7 & 8 OF HEXAGONAL FUSELAGE                                      00003600
            C                                                                       00003610
ISN 0234          WRITE (L3,720) XFUSS1, YFUSS1, ZFUSS1, CORDF1                     00003630
ISN 0235          WRITE (6,730) XFUSS1, YFUSS1, ZFUSS1, CORDF1                      00003640
ISN 0236           WRITE (L3,720) XFUSS1, YFUSS1, ZFUSS2, CORDF1                    00003650
ISN 0237           WRITE (6,730)  XFUSS1, YFUSS1, ZFUSS2, CORDF1                    00003652
            C                                                                       00003660
            C   CARD 9 (SUB PANEL CONTROLS OF HEXAGONAL FUSELAGE)                   00003670
            C                                                                       00003680
ISN 0238          TNVOR = 3                                                         00003690
ISN 0239          RNCV = NFORX (1) + NFORX (2) + NFORX (3) + NFORX (4) - NFUS       00003700
ISN 0240          SPC = 1.0                                                         00003710
ISN 0241          CURV = 999.                                                       00003720
ISN 0242          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                            00003730
ISN 0243          WRITE(6, 590) TNVOR, RNCV, SPC, CURV                              00003740
            C                                                                       00003750
            C   SET UP POLAR COORDINATES FOR REFERENCE HEXAGON                      00003760
            C                                                                       00003770
ISN 0244          DUPER = 90 - PHIREF                                               00003780
ISN 0245          PANUP = DUPER /60.                                                00003790
ISN 0246          IPANUP = PANUP + .5                                               00003800
ISN 0247          DPHEU = DUPER /IPANUP                                             00003810
ISN 0248          DPHLO = (180 - DUPER) /(3 - IPANUP)                               00003820
ISN 0249          DO 290 JK=1,4                                                     00003830
ISN 0250          IF (JK .LE. IPANUP) PHI (JK) = 90 - (JK -1) *DPHEU                00003840
ISN 0252          IF (JK .GT. IPANUP) PHI (JK) = 90-IPANUP*DPHEU-DPHLO*(JK-1-IPANUP)00003850
ISN 0254      290 CONTINUE                                                          00003860
ISN 0255          WRITE (L3, 620) ((PHI (JK), RHOREF), JK = 1, 4)                   00003870
ISN 0256          WRITE (6, 630) ((PHI(JK), RHOREF), JK = 1, 4)                     00003880
            C                                                                       00003890
            C  SET UP FOR CARD 11 OF HEXAGONAL FUSE.(ADDITIONAL CONTROL PARAMETERS) 00003900
            C                                                                       00003910
ISN 0257          AINC1 = 0.                                                        00003920
ISN 0258          AINC1 = 0.                                                        00003930
ISN 0259          ITS = 1                                                           00003940
ISN 0260          NAP = RNCV + 1                                                    00003950
ISN 0261          IF (J2TEST .EQ. 1) NAP = 0                                        00003960
ISN 0263          IQUANT = 0                                                        00003970
ISN 0264          ISYNT = 0                                                         00003980
ISN 0265          NPP = 1                                                           00003990
ISN 0266          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP        00004000
ISN 0267          WRITE(6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP          00004010
ISN 0268          IF (NAP .EQ. 0) GO TO 380                                         00004020
            C                                                                       00004030
            C   CARD 14 OF HEXAGONAL FUSELAGE(PERCENT LENGTH STATION OF FUSELAGE)   00004040
            C                                                                       00004050
ISN 0270          JJ = 1                                                            00004060
ISN 0271          DO 310 KI = 1, NFUS                                               00004070
ISN 0272          KISS = NFORX (KI) -1                                              00004080
ISN 0273          IF (KI .EQ. NFUS) KISS = NFORX (NFUS)                             00004090
ISN 0275          DO 300 LN = 1, KISS                                               00004100
ISN 0276          XFPCT (JJ) = XFUS (LN, KI) /(XFUSN - XFUS1) *100.                 00004110
```

```
ISN 0277          ZC12 (JJ) = ZFUS (LN, KI)/(XFUSN-XFUS1)*100.                  00004120
ISN 0278          ROFUS (JJ) = FUSRAD (LN, KI)                                  00004130
ISN 0279          JJ = JJ + 1                                                   00004140
ISN 0280     300  CONTINUE                                                      00004150
ISN 0281     310  CONTINUE                                                      00004160
ISN 0282          DO 320 JJ = 1, NAP                                            00004170
ISN 0283          IF ((XFPCT(JJ+1)*(XFUSN-XFUS1)/100.) .GT. WAFORG (1,1) .AND.  00004180
                * (XFPCT(JJ-1)*(XFUSN-XFUS1)/100.) .LT.                         00004190
                * (WAFORG (1,1) + WAFORG (1,4))) ROFUS (JJ) = RHOREF            00004200
ISN 0285     320  CONTINUE                                                      00004210
ISN 0286          WRITE (L3, 620) (XFPCT (J), J = 1, NAP)                       00004220
ISN 0287          WRITE (6,630) (XFPCT (J), J = 1,NAP)                          00004230
            C                                                                   00004240
            C   SETTING UP FOR CARD 16 OF HEXAGONAL FUSELAGE (AREA  RATIOS WRT. 00004250
            C   REFERENCE HEXAGON)                                              00004260
            C                                                                   00004270
ISN 0288          DO 330 LL = 1, NAP                                            00004280
ISN 0289          ROFUS (LL) = (ROFUS (LL) /RHOREF) **2 *100.                   00004290
ISN 0290     330  CONTINUE                                                      00004300
ISN 0291          WRITE (L3, 620) (ZC12 (JJ), JJ = 1, NAP)                      00004310
ISN 0292          WRITE (6, 630) (ZC1 2(JJ), JJ = 1, NAP)                       00004320
ISN 0293          WRITE (L3, 620) (ROFUS (LL), LL = 1, NAP)                     00004330
ISN 0294          WRITE (6, 630) (ROFUS (LL), LL = 1, NAP)                      00004340
ISN 0295          GO TO 380                                                     00004350
            C                                                                   00004360
            C   SET UP FOR CARDS 14, 16, 18 OF ZERO THICKNESS FUSELAGE TREATMENT 00004370
            C                                                                   00004380
ISN 0296     340  JJ = 1                                                        00004390
ISN 0297          DO 350 KI = 1, NFUS                                           00004400
ISN 0298          KISS = NFORX (KI) -1                                          00004410
ISN 0299          IF (KI .EQ. NFUS) KISS = NFORX (NFUS)                         00004420
ISN 0301          DO 350 LN = 1, KISS                                           00004430
ISN 0302          XFPCT (JJ) = XFUS (LN, KI) /(XFUSN - XFUS1) *100.             00004440
ISN 0303          ZC12(JJ)=(ZFUS(LN,KI)-(ZFUS(1,1)-WAFORG(1,3)))/(XFUSN-XFUS1)*100. 00004450
ISN 0304          JJ = JJ + 1                                                   00004460
ISN 0305     350  CONTINUE                                                      00004470
ISN 0306          GO TO 140                                                     00004480
ISN 0307     360  WRITE (L3, 620) (XFPCT (J), J = 1, NAP)                       00004490
ISN 0308          WRITE (6, 630) (XFPCT (J), J = 1, NAP)                        00004500
ISN 0309          DO 370 I = 1, 2                                               00004510
ISN 0310          WRITE (L3, 620) (ZC12 (J), J = 1, NAP)                        00004520
ISN 0311          WRITE (6, 630) (ZC12 (J), J = 1, NAP)                         00004530
ISN 0312     370  CONTINUE                                                      00004540
            C                                                                   00004550
            C    NACELLE TREATMENT                                              00004560
            C  SETTING UP FOR CARD 7 & 8                                        00004570
            C                                                                   00004580
ISN 0313     380  IF (J3 .EQ. 0) GO TO 450                                      00004590
ISN 0315          DO 440 JJ = 1, NP                                             00004600
ISN 0316          X1 = PODORG (JJ, 1)                                           00004610
ISN 0317          Y1 = PODORG (JJ, 2)                                           00004620
ISN 0318          Z1 = PODORG (JJ, 3) + PODORD (JJ, 1)                          00004630
ISN 0319          CORD1 = XPOD (JJ, NPODOR) - XPOD (JJ, 1)                      00004640
```

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ISN 0320            DO 390 KK = 1, 2                                                 00004650
ISN 0321            WRITE (L3, 740 ) X1, Y1, Z1, CORD1, JJ                           00004660
ISN 0322            WRITE (6, 750 ) X1, Y1, Z1, CORD1, JJ                            00004670
ISN 0323        390 CONTINUE                                                         00004680
              C                                                                      00004690
              C SETTING UP FOR NACELLE CARD 9                                        00004700
              C                                                                      00004710
ISN 0324            TNVOR = 6                                                        00004720
ISN 0325            RNCV = NPODOR -1                                                 00004730
ISN 0326            IF (RNCV .LT. 5) RNCV = 5                                        00004740
ISN 0328            SPC = 0.                                                         00004750
ISN 0329            CURV = 999.                                                      00004760
ISN 0330            WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                           00004770
ISN 0331            WRITE (6, 590) TNVOR, RNCV, SPC, CURV                            00004780
              C                                                                      00004790
              C   SET UP FOR NACELLE CARD 10 (POLAR COORDS. OF CURVED PANELS)        00004800
              C                                                                      00004810
ISN 0332            DO 400 JK = 1, 7                                                 00004820
ISN 0333            PHI (JK) = 90. - (JK -1) *60.                                    00004830
ISN 0334            RHO = PODORD (JJ, 1)                                             00004840
ISN 0335        400 CONTINUE                                                         00004850
ISN 0336            WRITE (L3, 620) ((PHI (JK), RHO), JK = 1, 7)                     00004860
ISN 0337            WRITE (6, 630) ((PHI (JK), RHO), JK = 1, 7)                      00004870
              C                                                                      00004880
              C   SET UP FOR CARD 11 (ADDITIONAL CONTROL PARAMETERS)                 00004890
              C                                                                      00004900
ISN 0338            AINC1 = 0.                                                       00004910
ISN 0339            AINC2 = 0.                                                       00004920
ISN 0340            ITS = 0                                                          00004930
ISN 0341            NAP = NPODOR                                                     00004940
ISN 0342            IQUANT = 0                                                       00004950
ISN 0343            ISYNT = 0                                                        00004960
ISN 0344            NPP = 1                                                          00004970
ISN 0345            WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP       00004980
ISN 0346            WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP        00004990
              C                                                                      00005000
              C   SET UP FOR NACELLE CARD 14 (PERCENT LENGTH STATIONS)               00005010
              C                                                                      00005020
ISN 0347            DO 410 LL = 1, NAP                                               00005030
ISN 0348            XAF (LL) = ((XPOD (JJ, LL) - XPOD (JJ, 1)) /(XPOD (JJ, NAP)      00005040
                  * - XPOD (JJ, 1))) **2 *100.                                       00005050
ISN 0349        410 CONTINUE                                                         00005060
ISN 0350            WRITE (L3, 620) (XAF (J), J = 1, NAP)                            00005070
ISN 0351            WRITE (6, 630) (XAF (J), J = 1, NAP)                             00005080
              C                                                                      00005090
              C   SETTING UP FOR NACELLE CARD 16 & 18 (PERCENT OF REFERENCE HEXAGON) 00005100
              C                                                                      00005110
ISN 0352            DO 420 LL = 1, NAP                                               00005120
ISN 0353            ZCP12 (JJ, LL) = PODORD (JJ, LL) /PODORD (JJ, 1) *100.           00005130
ISN 0354        420 CONTINUE                                                         00005140
ISN 0355            ZERO = 0.                                                        00005150
ISN 0356            WRITE (L3, 620) (ZERO)                                           00005160
ISN 0357            WRITE (6, 620) (ZERO)                                            00005170
```

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ISN 0358          WRITE (L3, 620) (ZCP12 (JJ, LL), LL = 1, NAP)                    00005180
ISN 0359          WRITE (6, 630) (ZCP12 (JJ, LL), LL = 1, NAP)                     00005190
ISN 0360      440 CONTINUE                                                         00005200
             C                                                                     00005210
             C     FINS TREATMENT                                                  00005220
             C                                                                     00005230
             C    SET FOR CARDS 7 & 8 (BOTH SIDES OF MAJOR PANEL)                  00005240
             C                                                                     00005250
ISN 0361      450 IF  (J4  .EQ. 0) GO TO 470                                       00005260
ISN 0363          DO 460 NN = 1, NF                                                00005270
ISN 0364          WRITE (L3, 660) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)    00005280
ISN 0365          WRITE (6, 670) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)     00005290
             C                                                                     00005300
             C    SETTING UP FOR CARD 9 (SUB PANEL CONTROLS)                       00005310
             C                                                                     00005320
ISN 0366          TNVOR = 2.0                                                      00005330
ISN 0367          RNCV = 10.                                                       00005340
ISN 0368          SPC = 1.                                                         00005350
ISN 0369          CURV = 0.                                                        00005360
ISN 0370          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                           00005370
ISN 0371          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                            00005380
             C                                                                     00005390
             C    SETTING UP FOR CARD 11 (ADDITIONAL CONTROL PANEL FOR FINS)       00005400
             C                                                                     00005410
ISN 0372          AINC1 = 0.                                                       00005420
ISN 0373          AINC2 = 0.                                                       00005430
ISN 0374          ITS = 0                                                          00005440
ISN 0375          NAP = 0                                                          00005450
ISN 0376          IQUANT = 0                                                       00005460
ISN 0377          ISYNT = 0                                                        00005470
ISN 0378          NPP = 0                                                          00005480
ISN 0379          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP       00005490
ISN 0380          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP        00005500
ISN 0381      460 CONTINUE                                                         00005510
ISN 0382      470 IF (J5 .EQ. 0) GO TO 490                                         00005520
             C                                                                     00005530
             C    SETUP FOR CANARDS                                                00005540
             C                                                                     00005550
             C    SET UP FOR CARDS 7 & 8 (BOTH SIDES OF MAJOR PANELS)              00005560
             C                                                                     00005570
ISN 0384          DO 480 NN = 1, NCAN                                              00005580
ISN 0385          WRITE (L3, 680) ((CANORG (NN, I, J), J = 1, 4), NN, I = 1, 2)    00005590
ISN 0386          WRITE (6, 690) ((CANORG (NN, I, J), J = 1, 4), NN, I = 1, 2)     00005600
             C                                                                     00005610
             C    SETTING UP FOR CARD 9 (SUB PANEL CONTROLS)                       00005620
             C                                                                     00005630
ISN 0387          TNVOR = 2.0                                                      00005640
ISN 0388          RNCV = 10.                                                       00005650
ISN 0389          SPC = 1.                                                         00005660
ISN 0390          CURV = 0.                                                        00005670
ISN 0391          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                           00005680
ISN 0392          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                            00005690
             C                                                                     00005700
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              C     SETTING UP FOR CARD 11 (ADDITIONAL CONTROL PANELS FOR CANARDS)         00005710
              C                                                                           00005720
ISN 0393              AINC1 = 0.                                                          00005730
ISN 0394              AINC2 = 0.                                                          00005740
ISN 0395              ITS = 0                                                             00005750
ISN 0396              NAP = 0                                                             00005760
ISN 0397              IQUANT = 0                                                          00005770
ISN 0398              ISYNT = 0                                                           00005780
ISN 0399              WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP          00005790
ISN 0400              WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP           00005800
ISN 0401       480    CONTINUE                                                            00005810
ISN 0402       490    NXS = 0                                                             00005820
ISN 0403              NYS = 0                                                             00005830
ISN 0404              NZS = 0                                                             00005840
ISN 0405              WRITE (L3, 700) NXS, NYS, NZS                                       00005850
ISN 0406              WRITE (6, 710) NXS, NYS, NZS                                        00005860
ISN 0407       500    FORMAT (3 (I2, 8X), 4F10.4, I2, 5X, I3)                             00005870
ISN 0408       510    FORMAT (1H , 3 (I2, 8X) , 4F10.4, I2, 5X, I3)                       00005880
ISN 0409       520    FORMAT (I2, 8X, 7F10.3)                                             00005890
ISN 0410       530    FORMAT (1H , I2, 8X, 7F10.3)                                        00005900
ISN 0411       540    FORMAT (I2, 8X, F10.2, 4F10.4)                                      00005910
ISN 0412       550    FORMAT (1H , I2, 8X, F10.2, 4F10.4)                                 00005920
ISN 0413       560    FORMAT (4F10.4, 10X, 'WING PANEL NO.', I2)                          00005930
ISN 0414       570    FORMAT (1H , 4F10.4, 10X, 14HWING PANEL NO., I2)                    00005940
ISN 0415       580    FORMAT (4F10.4, 10X, 17HNVOR,RNCV,SPC,PDL)                          00005950
ISN 0416       590    FORMAT (1H , 4F10.4, 10X, 17HNVOR,RNCV,SPC,PDL)                     00005960
ISN 0417       600    FORMAT (2F10.4, 5 (I2, 8X))                                         00005970
ISN 0418       610    FORMAT (1H , 2F10.4, 5 (I2, 8X))                                    00005980
ISN 0419       620    FORMAT (8F10.4)                                                     00005990
ISN 0420       630    FORMAT (1H , 8F10.4)                                                00006000
ISN 0421       640    FORMAT (8F10.4)                                                     00006010
ISN 0422       650    FORMAT (1H , 8F10.4)                                                00006020
ISN 0423       660    FORMAT (4F10.4, 10X, 13HFIN PANEL NO., I2)                          00006030
ISN 0424       670    FORMAT (1H , 4F10.4, 10X, 13HFIN PANEL NO., I2)                     00006040
ISN 0425       680    FORMAT (4F10.4, 10X, 16HCANARD PANEL NO., I2)                       00006050
ISN 0426       690    FORMAT (1H , 4F10.4, 10X,16HCANARD PANEL NO., I2)                   00006060
ISN 0427       700    FORMAT (3 (I2, 8X) , 10X, 11HNXS,NYS,NZS)                           00006070
ISN 0428       710    FORMAT (1X, 3 (I2, 8X) , 10X, 11HNXS,NYS,NZS)                       00006080
ISN 0429       720    FORMAT (4F10.4, 10X, 14HFUSELAGE PANEL)                             00006090
ISN 0430       730    FORMAT (1H , 4F10.4, 10X, 14HFUSELAGE PANEL)                        00006100
ISN 0431       740    FORMAT (4F10.4, 10X, 16HNACELLE PANEL NO, 12)                       00006110
ISN 0432       750    FORMAT (1H , 4F10.4, 10X, 16HNACELLE PANEL NO, I2)                  00006120
ISN 0433       760    STOP                                                                00006130
ISN 0434              END                                                                 00006140
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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*****              PAGE 013

SYMBOL  INTERNAL STATEMENT NUMBERS
I       0019 0019 0019 0019 0032 0033 0033 0057 0057 0057 0058 0058 0058 0309 0364 0364 0364 0365 0365
        0365 0385 0385 0385 0386 0386 0386
J       0087 0087 0087 0088 0088 0088 0089 0089 0089 0090 0090 0090 0108 0108 0108 0109 0109 0109 0286
        0286 0286 0287 0287 0287 0307 0307 0307 0308 0308 0308 0310 0310 0310 0311 0311 0311 0350 0350
        0350 0351 0351 0351 0364 0364 0364 0365 0365 0365 0385 0385 0385 0386 0386 0386
V       0003
A1      0150 0156 0156 0158
A2      0160 0164 0164 0167
IC      0122 0124 0126 0128 0130
I1      0082 0083 0083
IT      0086 0087 0087 0088 0088 0089 0089 0090 0090 0110 0111 0112 0113
JJ      0110 0110 0110 0111 0111 0111 0112 0112 0112 0113 0113 0113 0270 0276 0277 0278 0279 0279 0282
        0283 0283 0283 0291 0291 0291 0292 0292 0292 0296 0302 0303 0304 0304 0315 0316 0317 0318 0318
        0319 0319 0321 0322 0334 0348 0348 0348 0348 0353 0353 0353 0358 0359
JK      0249 0250 0250 0250 0252 0252 0252 0255 0255 0255 0256 0256 0256 0332 0333 0333 0336 0336 0336
        0337 0337 0337
J0      0002 0019
J1      0002 0019 0078
J2      0002 0019 0115
J3      0002 0019 0313
J4      0002 0019 0361
J5      0002 0019 0382
J6      0002 0019
KI      0118 0119 0120 0123 0126 0128 0130 0132 0133 0135 0135 0135 0135 0135 0139 0140 0142 0147 0151
        0152 0153 0156 0161 0162 0164 0199 0200 0202 0202 0208 0209 0211 0215 0216 0218 0220 0221 0223
        0271 0272 0273 0276 0277 0278 0297 0298 0299 0302 0303
KK      0320
.LL     0288 0289 0289 0293 0293 0293 0294 0294 0294 0347 0348 0348 0352 0353 0353 0358 0358 0358 0359
        0359 0359
LN      0121 0126 0130 0130 0134 0135 0135 0135 0135 0135 0141 0142 0148 0155 0156 0163 0164 0201 0202
        0202 0210 0211 0215 0216 0216 0218 0220 0221 0221 0223 0275 0276 0277 0278 0301 0302 0303
L3      0010 0037 0048 0051 0057 0065 0076 0087 0089 0095 0104 0108 0110 0112 0175 0177 0183 0194 0234
        0236 0242 0255 0266 0286 0291 0293 0307 0310 0321 0330 0336 0345 0350 0356 0358 0364 0370 0379
        0385 0391 0399 0405
NF      0002 0019 0070 0363
NN      0081 0083 0083 0083 0363 0364 0364 0365 0365 0384 0385 0385 0386 0386
NP      0002 0019 0070 0315
NX      0002 0023
X1      0316 0321 0322
Y1      0317 0321 0322
Z1      0318 0321 0322
ABC     0002 0017 0037 0038
DTR     0008 0228
DX1     0158 0159 0174
DX2     0167 0174
HAG     0043 0048 0049
ITS     0099 0104 0105 0194 0195 0259 0266 0267 0340 0345 0346 0374 0379 0380 0395 0399 0400
KEY     0024 0123 0130
LAX     0040 0048 0049
LAY     0041 0048 0049
NAP     0100 0104 0105 0106 0108 0109 0188 0189 0194 0195 0196 0260 0261 0266 0267 0268 0282 0286 0287
        0288 0291 0292 0293 0294 0307 0308 0310 0311 0341 0345 0346 0347 0348 0350 0351 0352 0358 0359
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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
        0375 0379 0380 0396 0399 0400
NPP     0103 0104 0105 0193 0194 0195 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 0255 0256 0333 0336 0337
PSI     0060 0065 0066
RHO     0334 0336 0337
SKL     0002 0033
SPC     0093 0095 0096 0181 0183 0184 0240 0242 0243 0328 0330 0331 0368 0370 0371 0389 0391 0392
XAF     0004 0108 0109 0348 0350 0351
ABCD    0006
AFUS    0005 0135 0156 0164
ATAN    0228
CBAR    0072 0076 0077
CURV    0094 0095 0096 0182 0183 0184 0241 0242 0243 0329 0330 0331 0369 0370 0371 0390 0391 0392
JITS    0187
KISS    0119 0121 0133 0134 0140 0141 0152 0153 0155 0162 0163 0200 0201 0209 0210 0218 0223 0272 0273
        0275 0298 0299 0301
KUSS    0120 0122
LERR    0002 0027
MACH    0023 0026
NCAN    0002 0019 0070 0384
NCON    0023
NFUS    0002 0019 0068 0118 0132 0139 0161 0167 0167 0171 0171 0189 0199 0208 0233 0233 0239 0271 0273
        0273 0297 0299 0299
NPAN    0070 0076 0077
NPLT    0023
NWAF    0002 0019 0070 0075 0080 0081
PDES    0004
REFA    0002 0071
RNCV    0092 0095 0096 0180 0183 0184 0239 0242 0243 0260 0325 0326 0326 0330 0331 0367 0370 0371 0388
        0391 0392
SFUS    0004 0130
SQRT    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
        0302
XFWD    0216 0218 0225 0226
XMID    0138 0142
XONE    0159 0172
XPOD    0004 0319 0319 0348 0348 0348 0348
YAWQ    0063 0065 0066
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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
ZAFT    0220 0225
ZBAR    0074 0076 0077
ZC12    0005 0277 0291 0292 0303 0310 0311
ZERO    0355 0356 0357
ZFUS    0004 0220 0221 0223 0277 0303 0303
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
DPHEU   0247 0250 0252
DPHLO   0248 0252
DUPER   0244 0245 0247 0248
DXMID   0142 0143
DXWLE   0211 0212
FLOAT   0026
IBCON   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
LNMID   0148 0149 0153 0163
NCASE   0002 0023
NFORX   0002 0019 0119 0133 0140 0152 0162 0167 0171 0189 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
NRADX   0002 0019 0120 0128
NREST   0002 0023 0028
NRICH   0002
NWPAN   0080 0086
PANUP   0245 0246
ROFUS   0005 0278 0283 0289 0289 0293 0294
ROLLQ   0062 0065 0066
SLOPE   0225 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
XFPCT   0005 0276 0283 0283 0286 0287 0302 0307 0308
XFUSN   0003 0276 0277 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
```

```
                         *****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
CANORG  0004  0385  0386
CANOR1  0004
CORDF1  0171  0175  0176  0233  0234  0235  0236  0237
CORDF2  0174  0177  0178
FINORD  0004
FINORG  0004  0364  0365
FLOATX  0044  0048  0049
FLOATY  0045  0048  0049
FUSARD  0004
FUSRAD  0004  0202  0278
FUSTYP  0009  0012  0014  0204
IPANUP  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
J2TEST  0002  0117  0189  0206  0261
LATRAL  0059  0065  0066
LSTDT8  0011
NALPHA  0053  0057  0057  0058  0058
NCANOR  0002  0019
NFINOR  0002  0019
NPODOR  0002  0019  0319  0325  0341
NPTSPS  0004
NSWVOR  0013  0014
NTHETA  0002  0023
NWAFOR  0002  0019  0082  0100  0110  0111  0112  0113
PHIREF  0228  0244
PITCHQ  0061  0065  0066
PODORD  0004  0318  0334  0353  0353
PODORG  0004  0316  0317  0318
REXPAR  0042  0048  0049
RHOREF  0227  0231  0232  0255  0256  0283  0289
WAFORD  0004
WAFORG  0004  0075  0083  0087  0088  0089  0090  0138  0138  0158  0167  0170  0173  0211  0226  0227  0227  0228  0228
        0283  0283  0283  0303
XFUSS1  0168  0175  0176  0207  0229  0234  0235  0236  0237
XFUSS2  0172  0177  0178
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
```

```
                    *****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     0016     0017  0037
  20     0018     0038
  30     0020     0019
  40     0025     0023
  50     0031     0030
  60     0034     0032
  70     0036     0028
  80     0084     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  0311  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
```

```
                                                     /     MAIN /     SIZE OF PROGRAM 003B78 HEXADECIMAL BYTES PAGE 019

  NAME TAG     TYPE   ADD.      NAME TAG     TYPE   ADD.      NAME TAG     TYPE   ADD.      NAME TAG     TYPE   ADD.
     I SF      I*4  00039C         J  F      I*4  0003A0         V      C  R*4    N.R.        A1 SF      R*4  0003A4
    A2 SF      R*4  0003A8        IC SFA     I*4  0003AC        II SF      I*4  0003B0        IT SF      I*4  0003B4
    JJ SF      I*4  0003B8        JK SF      I*4  0003BC        J0 S    C  I*4  000050        J1 S    C  I*4  000054
    J2 S    C  I*4  000058        J3 S    C  I*4  00005C        J4 S    C  I*4  000060        J5 S    C  I*4  000064
    J6 S    C  I*4  000068        KI SF      I*4  0003C0        KK SF      I*4  0003C4        LL SF      I*4  0003C8
    LN SFA     I*4  0003CC        L3  F      I*4  0003D0        NF SF   C  I*4  0000A0        NN SF      I*4  0003D4
    NP SF   C  I*4  000098        NX S    C  I*4  0000C8        X1 SF      R*4  0003D8        Y1 SF      R*4  0003DC
    Z1 SF      R*4  0003E0       ABC SF   C  R*4  000000       DTR SF      R*4  0003E4       DX1 SF      R*4  0003E8
   DX2 SF      R*4  0003EC       HAG SF      R*4  0003F0       ITS SF      I*4  0003F4       KEY SFA     I*4  0003F8
   LAX SF      I*4  0003FC       LAY SF      I*4  000400       NAP SF      I*4  000404       NPP SF      I*4  000408
   NXS SF      I*4  00040C       NYS SF      I*4  000410       NZS SF      I*4  000414       PHI SF      R*4  000538
   PSI SF      R*4  000418       RHO SF      R*4  00041C       SKL  F   C  R*4  0000FC       SPC SF      R*4  000420
   XAF SF   C  R*4  000000      ABCD         R*4    N.R.      AFUS SF      R*4  000560      CBAR SF      R*4  000424
  CURV SF      R*4  000428      JITS S       I*4  00042C      KISS SF      I*4  000430      KUSS SF      I*4  000434
  LERR S    C  I*4  0000B4      MACH SFA     I*4  000438      NCAN SF   C  I*4  0000A8      NCON S       I*4  00043C
  NFUS SF   C  I*4  000074      NPAN SF      I*4  000440      NPLT S       I*4  000444      NWAF SF   C  I*4  00006C
  PDES      C  R*4    N.R.      REFA  F   C  R*4  0000BC      RNCV SF      R*4  000448      SFUS  FA  C  R*4  002AF8
  SREF SF      R*4  00044C      TEMP SFA     R*4  000450      VINF SF      R*4  000454      XAFT SF      R*4  000458
  XBAR SF      R*4  00045C      XCAN      C  R*4    N.R.      XDIV SF      R*4  000460      XFIN      C  R*4    N.R.
  XFUS  F   C  R*4  002738      XFWD SF      R*4  000464      XMID SF      R*4  000468      XONE SF      R*4  00046C
  XPOD  F   C  R*4  004374      YAWQ SF      R*4  000470      ZAFT SF      R*4  000474      ZBAR SF      R*4  000478
  ZC12 SF      R*4  000730      ZERO SF      R*4  00047C      ZFUS  F   C  R*4  002918      ZFWD SF      R*4  000480
 AINC1 SF      R*4  000484     AINC2 SF      R*4  000488     ALPHA SF      R*4  0007F8     CORD1 SF      R*4  00048C
 DPHEU SF      R*4  000490     DPHLO SF      R*4  000494     DUPER SF      R*4  000498     DXMID S       R*4  00049C
 DXWLE S       R*4  0004A0     IBCON SF      I*4  0004A4     INPUT  F           501003     ISOLV SF      I*4  0004A8
 ISYNT SF      I*4  0004AC     KIMID SF      I*4  0004B0     LNMID SF      I*4  000484     NCASE S    C  I*4  0000C0
 NFORX SF   C  I*4  000088     NFUSP SF      I*4  0004B8     NKODE S       I*4  0004BC     NMACH SF      I*4  0004C0
 NRADX SF   C  I*4  000078     NREST S    C  I*4  0000D0     NRICH      C  I*4    N.R.     NWPAN SF      I*4  0004C4
 PANUP SF      R*4  0004C8     ROFUS SF      R*4  000814     ROLLQ SF      R*4  0004CC     SLOPE SF      R*4  0004D0
 START SF  XF  R*4  000000     TNVOR SF      R*4  0004D4     TZORD SF   C  R*4  001DD8     WSPAN SF      R*4  0004D8
 XFPCT SF      R*4  0008DC     XFUSN  F   C  R*4  000008     XFUS1  F   C  R*4  000004     XMACH SF   C  R*4  0000C4
 XREST SF   C  R*4  0000D4     ZCP12 SF      R*4  0009A4     ZFUSS SF      R*4  0004DC     ZFWLE SFA     R*4  0004E0
  ATAN     XF  R*4  000000      SQRT     XF  R*4  000000    CANORD      C  R*4    N.R.    CANORG  F   C  R*4  000C28
CANOR1      C  R*4    N.R.    CORDF1 SF      R*4  0004E4    CORDF2 SF      R*4  0004E8    FINORD      C  R*4    N.R.
FINORG  F   C  R*4  00D898    FLOATX SF      R*4  0004EC    FLOATY SF      R*4  0004F0    FRONL#  F  XF  I*4  000000
FUSARD      C  R*4    N.R.    FUSRAD  F   C  R*4  003AE8    FUSTYP S       I*4  0004F4    IBCOM#  F  XF  I*4  000000
IPANUP SF      I*4  0004F8    IQUANT SF      I*4  0004FC    ITRMAX SF      I*4  000500    J2TEST  F   C  I*4  C00080
LATRAL SF      I*4  000504    LSTDT8 SF  XF  I*4  000000    NALPHA SF      I*4  000508    NCANOR S    C  I*4  0000AC
NFINOR S    C  I*4  0000A4    NPODOR SF   C  I*4  00009C    NPTSPS      C  I*4    N.R.    NSWVOR S       I*4  00050C
NTHETA S    C  I*4  0000CC    NWAFOR SF   C  I*4  000070    PHIREF SF      R*4  000510    PITCHQ SF      R*4  000514
PODORD  F   C  R*4  0047AC    PODORG  F   C  R*4  004308    REXPAR SF      R*4  000518    RHOREF SF      R*4  00051C
WAFORD      C  R*4    N.R.    WAFORG  FA  C  R*4  000078    XFUSS1 SF      R*4  000520    XFUSS2 SF      R*4  000524
YFUSMX SF      R*4  00000C    YFUSS1 SF      R*4  000528    YFUSS2 SF      R*4  00052C    ZFUSS1 SF      R*4  000530
ZFUSS2 SF      R*4  000534

                                   *****  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    R*4   000000          J0    I*4   000050          J1    I*4   000054          J2    I*4   000058
       J3    I*4   00005C          J4    I*4   000060          J5    I*4   000064          J6    I*4   000068
     NWAF    I*4   00006C      NWAFOR    I*4   000070        NFUS    I*4   000074       NRADX    I*4   000078
    NFORX    I*4   000088          NP    I*4   000098      NPODOR    I*4   00009C          NF    I*4   0000A0
   NFINOR    I*4   0000A4        NCAN    I*4   0000A8      NCANOR    I*4   0000AC      J2TEST    I*4   0000B0
     LERR    I*4   0000B4       NRICH    I*4     N.R.        REFA    R*4   0000BC       NCASE    I*4   0000C0
    XMACH    R*4   0000C4          NX    I*4   0000C8      NTHETA    I*4   0000CC       NREST    I*4   0000D0
    XREST    R*4   0000D4         SKL    R*4   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   R*4     N.R.         XFUS1   R*4   000004         XFUSN   R*4   000008

  NAME OF COMMON BLOCK  * BLACK*   SIZE OF BLOCK    000DF8 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.
      XAF   R*4   000000        WAFORG   R*4   000078        WAFORD   R*4     N.R.          TZORD   R*4   001DD8
     XFUS   R*4   002738          ZFUS   R*4   002918          SFUS   R*4   002AF8         FUSARD   R*4     N.R.
   FUSRAD   R*4   003AE8        PODORG   R*4   004308          XPOD   R*4   004374         PODORD   R*4   0047AC
   NPTSPS   I*4     N.R.          PDES   R*4     N.R.        FINORG   R*4   00D898           XFIN   R*4     N.R.
   FINORD   R*4     N.R.        CANORG   R*4   00DC28          XCAN   R*4     N.R.         CANORD   R*4     N.R.
   CANOR1   R*4     N.R.
```

```
    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   001DD0          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   003B3C
```

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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 =      433 ,PROGRAM SIZE =     15224

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******
```

LOCKHEED PROPRIETARY DATA

THIS DATA CONTAINS INFORMATION AND/OR DESIGNS WHICH ARE THE PROPERTY OF 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.

LOCKHEED PROPRIETARY DATA

```
          COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                             SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002                SUBROUTINE START                                            00006150
                C                                                                   00006160
                C     INPUTS AND INITIALIZES CONFIGURATION DESCRIPTION              00006170
                C     REFERENCE NASA TM X-2074, SEPT 1970                           00006180
                C                                                                   00006190
ISN 0003                COMMON ABC (20), J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS, 00006200
                       *  NRADX (4), NFORX (4), NP, NPODOR, NF, NFINOR, NCAN, NCANOR,    00006210
                       * J2TEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,     00006220
                       * XREST (10), SKL                                            00006230
ISN 0004                  COMMON/BLK2/V,XFUS1,XFUSN                                 00006240
ISN 0005                COMMON/BLACK/XAF (30), WAFORG (20, 4), WAFORD (20, 3, 30),  00006250
                       * TZORD (20, 30), XFUS (30, 4), ZFUS (30, 4), SFUS (30, 30, 1),   00006260
                       * FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30),   00006270
                       * PODORD (9, 30), NPTSPS (5), PDES (30, 30, 10), FINORG (6, 2, 4), 00006280
                       * XFIN (6, 10), FINORD (6, 2, 10), CANORG (2, 2, 4), XCAN (2, 10), 00006290
                       * CANORD (2, 2, 10), CANOR1 (2, 2, 10)                       00006300
                C                                                                   00006310
ISN 0006                DIMENSION ABCD (20), FORAG (4), PARNO (5), PARBA (5)        00006320
                C                                                                   00006330
ISN 0007                DATA PI/3.14159265/                                         00006340
                C                                                                   00006350
ISN 0008          10    FORMAT (10F7.0)                                             00006360
                C                                                                   00006370
                C           REFERENCE AREA                                          00006380
                C                                                                   00006390
ISN 0009                IF (J0 .NE. 1) GO TO 140                                    00006400
ISN 0011                READ (5, 10) REFA, SKL                                      00006410
ISN 0012                IF (SKL .EQ. 0.) SKL = 1.                                   00006420
                C                                                                   00006430
                C           WING                                                    00006440
                C                                                                   00006450
ISN 0014                IF (J1 .NE. 2) GO TO 20                                     00006460
ISN 0016                GO TO 110                                                   00006470
ISN 0017          20    V = 0.                                                      00006480
ISN 0018                IF (J1 .EQ. 0) GO TO 140                                    00006490
ISN 0020                N = IABS (NWAFOR)                                           00006500
ISN 0021                NREC = (N + 9) /10                                          00006510
ISN 0022                I1 = -9                                                     00006520
ISN 0023                I2 = 0                                                      00006530
ISN 0024                DO 30 NN = 1, NREC                                          00006540
```

```
ISN 0025          I1 = I1 + 10                                               00006550
ISN 0026          I2 = I2 + 10                                               00006560
ISN 0027          READ (5, 10) (XAF (I), I = I1, I2)                         00006570
ISN 0028     30   CONTINUE                                                   00006580
ISN 0029          DO 40 I = 1, NWAF                                          00006590
ISN 0030          READ (5, 10) (WAFORG (I, J), J  = 1, 4)                    00006600
ISN 0031          DO 40 J = 1, 4                                             00006610
ISN 0032          WAFORG (I, J) = WAFORG (I, J) /SKL                         00006620
ISN 0033     40   CONTINUE                                                   00006630
ISN 0034          IF  (J1  .LT. 0) GO TO 70                                  00006640
ISN 0036          DO 60 NN  = 1, NWAF                                        00006650
ISN 0037          I1 = -9                                                    00006660
ISN 0038          I2 = 0                                                     00006670
ISN 0039          DO 50 N1 = 1, NREC                                         00006680
ISN 0040          I1 = I1 + 10                                               00006690
ISN 0041          I2 = I2 + 10                                               00006700
ISN 0042          READ (5, 10) (TZORD (NN, I), I = I1, I2)                   00006710
ISN 0043          DO 50 I = I1, I2                                           00006720
ISN 0044          TZORD (NN, I) = TZORD (NN, I) /SKL                         00006730
ISN 0045     50   CONTINUE                                                   00006740
ISN 0046     60   CONTINUE                                                   00006750
ISN 0047          GO TO 90                                                   00006760
ISN 0048     70   DO 80 I = 1, NWAF                                          00006770
ISN 0049          DO 80 K = 1, N                                             00006780
ISN 0050     80   TZORD (I, K) = 0.                                          00006790
ISN 0051     90   L = 1                                                      00006800
ISN 0052          IF (NWAFOR .LT. 0) L = 2                                   00006810
ISN 0054          DO 110 NN = 1, NWAF                                        00006820
ISN 0055          DO 110 K = 1, L                                            00006830
ISN 0056          I1 = -9                                                    00006840
ISN 0057          I2 = 0                                                     00006850
ISN 0058          DO 100 N1 = 1, NREC                                        00006860
ISN 0059          I1 = I1 + 10                                               00006870
ISN 0060          I2 = I2 + 10                                               00006880
ISN 0061          READ (5, 10) (WAFORD (NN, K, I), I = I1, I2)               00006890
ISN 0062    100   CONTINUE                                                   00006900
ISN 0063    110   CONTINUE                                                   00006910
ISN 0064          IF (NWAFOR .LT. 0) GO TO 130                               00006920
ISN 0066          DO 120 NN = 1, NWAF                                        00006930
ISN 0067          DO 120 K = 1, N                                            00006940
ISN 0068    120   WAFORD (NN, 2, K) = WAFORD (NN, 1, K)                      00006950
ISN 0069    130   CONTINUE                                                   00006960
ISN 0070          NWAFOR = IABS (NWAFOR)                                     00006970
ISN 0071          J1 = IABS (J1)                                             00006980
             C                                                               00006990
             C        FUSELAGE                                               00007000
             C                                                               00007010
ISN 0072    140   IF (J2 .NE. 2) GO TO 150                                   00007020
ISN 0074          GO TO 310                                                  00007030
ISN 0075    150   IF (J2 .EQ. 0) GO TO 310                                   00007040
ISN 0077          J2TEST = 3                                                 00007050
ISN 0078          IF (J2 .EQ. -1 .AND. J6 .EQ. -1) J2TEST = 1                00007060
ISN 0080          IF (J2 .EQ. -1 .AND. J6 .EQ. 0) J2TEST = 2                 00007070
```

```
ISN 0082          IF (J6 .EQ. 1) J2TEST = 1                                             00007080
ISN 0084          J2 = 1                                                                00007090
ISN 0085          NSUM = 1                                                              00007100
ISN 0086          DO 160 NFU = 1, NFUS                                                  00007110
ISN 0087      160 NSUM = NSUM + NFORX (NFU) -1                                          00007120
ISN 0088          IF  (NSUM  .LE. 101) GO TO 180                                        00007130
ISN 0090          WRITE  (6, 170)                                                       00007140
ISN 0091      170 FORMAT  (//                                                           00007150
                 * 60H CONSECUTIVE FUSELAGE POINTS EXCEED ALLOWABLE STORAGE OF 101 /00007160
                 * 1H1)                                                                 00007170
ISN 0092          STOP                                                                  00007180
ISN 0093      180 CONTINUE                                                              00007190
ISN 0094          DO 270 NFU = 1, NFUS                                                  00007200
ISN 0095          N = NFORX (NFU)                                                       00007210
ISN 0096          NRAD = NRADX (NFU)                                                    00007220
ISN 0097          NREC = (N + 9) /10                                                    00007230
ISN 0098          I1 = -9                                                               00007240
ISN 0099          I2 = 0                                                                00007250
ISN 0100          DO 190 N1 = 1, NREC                                                   00007260
ISN 0101          I1 = I1 + 10                                                          00007270
ISN 0102          I2 = I2 + 10                                                          00007280
ISN 0103          READ (5, 10) (XFUS (I, NFU), I = I1, I2)                              00007290
ISN 0104          DO 190 I = I1, I2                                                     00007300
ISN 0105          XFUS (I, NFU) = XFUS (I, NFU) /SKL                                    0C007310
ISN 0106      190 CONTINUE                                                              00007320
ISN 0107          IF (NFU .NE. 1) GO TO 200                                             00007330
ISN 0109          XFUS1 = XFUS (1, 1)                                                   00007340
ISN 0110          XFUSN = XFUS (N, 1)                                                   00007350
ISN 0111      200 XFUS1 = AMIN1 (XFUS1, XFUS  (1, NFU))                                 00007360
ISN 0112          XFUSN = AMAX1 (XFUSN, XFUS (N, NFU))                                  00007370
ISN 0113          IF (J2TEST .NE. 2) GO TO 220                                          00007380
ISN 0115          I1 = -9                                                               00007390
ISN 0116          I2 = 0                                                                00007400
ISN 0117          DO 210 N1 = 1, NREC                                                   00007410
ISN 0118          I1 = I1 + 10                                                          00007420
ISN 0119          I2 = I2 + 10                                                          00007430
ISN 0120          READ (5, 10) (ZFUS (I, NFU), I = I1, I2)                              00007440
ISN 0121          DO 210 I = I1, I2                                                     00007450
ISN 0122          ZFUS (I, NFU) = ZFUS (I, NFU) /SKL                                    00007460
ISN 0123      210 CONTINUE                                                              00007470
ISN 0124          GO TO 240                                                             00007480
ISN 0125      220 DO 230 I = 1, N                                                       00007490
ISN 0126      230 ZFUS (I, NFU) = 0.                                                    00007500
ISN 0127      240 IF (J2TEST .NE. 3) GO TO 280                                          00007510
ISN 0129          NCARD = (NRAD + 9) /10                                                00007520
ISN 0130          DO 270 LN = 1, N                                                      00007530
ISN 0131          DO 260 K = 1, 2                                                       00007540
ISN 0132          KK = K + (NFU - 1) *2                                                 00007550
ISN 0133          II = 10                                                               00007560
ISN 0134          I1 = -9                                                               00007570
ISN 0135          I2 = 0                                                                00007580
ISN 0136          DO 250 NN = 1, NCARD                                                  00007590
ISN 0137          IF (NN .EQ. NCARD) II = MOD (NRAD, 10)                                00007600
```

```
ISN 0139          IF (II .EQ. 0) II = 10                                  00007610
ISN 0141          I1 = I1 + 10                                            00007620
ISN 0142          I2 = I2 + II                                            00007630
ISN 0143          READ (5, 10) (SFUS (I, LN, KK), I = I1, I2)             00007640
ISN 0144          DO 250 I = I1, I2                                       00007650
ISN 0145          SFUS (I, LN, KK) = SFUS (I, LN, KK) /SKL                00007660
ISN 0146      250 CONTINUE                                                00007670
ISN 0147      260 CONTINUE                                                00007680
ISN 0148      270 CONTINUE                                                00007690
ISN 0149          GO TO 310                                               00007700
ISN 0150      280 I1 = -9                                                 00007710
ISN 0151          I2 = 0                                                  00007720
ISN 0152          DO 290 N1 = 1, NREC                                     00007730
ISN 0153          I1 = I1 + 10                                            00007740
ISN 0154          I2 = I2 + 10                                            00007750
ISN 0155          READ (5, 10) (FUSARD (I, NFU), I = I1, I2)              00007760
ISN 0156          DO 290 I = I1, I2                                       00007770
ISN 0157          FUSARD (I, NFU) = FUSARD (I, NFU) /SKL**2               00007780
ISN 0158      290 CONTINUE                                                00007790
ISN 0159          DO 300 I = 1, N                                         00007800
ISN 0160      300 FUSRAD (I, NFU) = SQRT (FUSARD (I, NFU) /PI)            00007810
                C                                                         00007820
                C        NACELLES                                         00007830
                C                                                         00007840
ISN 0161      310 IF (J3 .NE. 2) GO TO 320                                00007850
ISN 0163          GO TO 440                                               00007860
ISN 0164      320 IF (J3 .EQ. 0) GO TO 440                                00007870
ISN 0166          N = NPODOR                                              00007880
ISN 0167          NREC = (N + 9) /10                                      00007890
ISN 0168          DO 410 NN = 1, NP                                       00007900
ISN 0169          READ (5, 10) (PODORG (NN, I), I = 1, 3)                 00007910
ISN 0170          DO 330 I = 1, 3                                         00007920
ISN 0171      330 PODORG (NN, I)  = PODORG (NN, I) /SKL                   00007930
ISN 0172          I1 = -9                                                 00007940
ISN 0173          I2 = 0                                                  00007950
ISN 0174          DO 340 N1 = 1, NREC                                     00007960
ISN 0175          I1 = I1 + 10                                            00007970
ISN 0176          I2 = I2 + 10                                            00007980
ISN 0177          READ (5, 10) (XPOD (NN, I), I = I1, I2)                 00007990
ISN 0178          DO 340 I = I1, I2                                       00008000
ISN 0179          XPOD (NN, I) = XPOD (NN, I) /SKL                        00008010
ISN 0180      340 CONTINUE                                                00008020
ISN 0181          IF (J3 .NE. -1) GO TO 390                               00008030
                C                                                         00008040
                C ARBITRARILY DEFINED POD --READ NO. PTS FOR EACH STATION/POD  00008050
                C                                                         00008060
ISN 0183          READ (5, 10 ) AN                                        00008070
ISN 0184          NPTSPS (NN) = AN                                        00008080
ISN 0185          NPTS = NPTSPS (NN)                                      00008090
ISN 0186          NCARD = (NPTSPS (NN) + 9) /10                           00008100
                C                                                         00008110
                C   NCARD = NO. CARDS  AT EACH STATION(I ) FOR EACH POD(NN)   00008120
                C                                                         00008130
```

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

```
ISN 0237          IF (I .EQ. 1) PARNO (NN) = PSI                                            00008670
ISN 0239     420  CONTINUE                                                                  00008680
ISN 0240     430  PARBA (NN) = PSI                                                          00008690
            C                                                                               00008700
            C         FINS                                                                  00008710
            C                                                                               00008720
ISN 0241     440  IF (J4 .NE. 2) GO TO 450                                                  00008730
ISN 0243          GO TO 480                                                                 00008740
ISN 0244     450  IF (J4 .EQ. 0) GO TO 480                                                  00008750
ISN 0246          N = NFINOR                                                                00008760
ISN 0247          DO 470 NN  = 1, NF                                                        00008770
ISN 0248          READ (5, 10) ((FINORG (NN, I, J), J = 1, 4), I = 1, 2)                    00008780
ISN 0249          DO 460 I = 1, 2                                                           00008790
ISN 0250          DO 460 J = 1, 4                                                           00008800
ISN 0251     460  FINORG (NN, I, J) = FINORG (NN, I, J) /SKL                                00008810
ISN 0252          READ (5, 10) (XFIN (NN, I), I = 1, N)                                     00008820
ISN 0253          READ (5, 10) (FINORD (NN, 1, J) , J = 1, N)                               00008830
ISN 0254     470  CONTINUE                                                                  00008840
            C                                                                               00008850
            C         CANARDS                                                               00008860
            C                                                                               00008870
ISN 0255     480  IF (J5 .NE. 2) GO TO 490                                                  00008880
ISN 0257          GO TO 540                                                                 00008890
ISN 0258     490  IF (J5 .EQ. 0) GO TO 540                                                  00008900
ISN 0260          N = IABS (NCANOR)                                                         00008910
ISN 0261          DO 530 NN  = 1, NCAN                                                      00008920
ISN 0262          READ (5, 10) ((CANORG (NN, I, J), J = 1, 4), I = 1, 2)                    00008930
ISN 0263          DO 500 I = 1, 2                                                           00008940
ISN 0264          DO 500 J = 1, 4                                                           00008950
ISN 0265     500  CANORG (NN, I, J) = CANORG (NN, I, J) /SKL                                00008960
ISN 0266          READ (5, 10) (XCAN (NN, I), I = 1, N)                                     00008970
ISN 0267          READ (5, 10) (CANORD (NN, 1, J), J = 1, N)                                00008980
ISN 0268          IF (NCANOR .LT. 0) GO TO 520                                              00008990
ISN 0270          DO 510 J = 1, N                                                           00009000
ISN 0271          DO 510 I = 1, 2                                                           00009010
ISN 0272          CANOR1 (NN, I, J) = CANORD (NN, I, J)                                     00009020
ISN 0273     510  CONTINUE                                                                  00009030
ISN 0274          GO TO 530                                                                 00009040
ISN 0275     520  READ (5, 10) (CANOR1 (NN, 1, J), J = 1, N)                                00009050
ISN 0276          READ (5, 10) (CANOR1 (NN, 2, J), J = 1, N)                                00009060
ISN 0277     530  CONTINUE                                                                  00009070
ISN 0278          NCANOR = IABS (NCANOR)                                                    00009080
ISN 0279     540  RETURN                                                                    00009090
ISN 0280          END                                                                       00009100
```

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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*****                PAGE 007
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0027 0027 0027 0029 0030 0032 0032 0042 0042 0042 0043 0044 0044 0048 0050 0061 0061 0061 0103
        0103 0103 0104 0105 0105 0120 0120 0120 0121 0122 0122 0125 0126 0143 0143 0143 0144 0145 0145
        0155 0155 0155 0156 0157 0157 0159 0160 0160 0169 0169 0169 0170 0171 0171 0177 0177 0177 0178
        0179 0179 0201 0201 0201 0202 0205 0207 0207 0207 0208 0208 0222 0222 0222 0223 0224 0224 0231
        0235 0235 0235 0235 0237 0248 0248 0248 0249 0251 0251 0252 0252 0252 0262 0262 0262 0263 0265
        0265 0266 0266 0266 0271 0272 0272
J       0030 0030 0030 0031 0032 0032 0248 0248 0248 0250 0251 0251 0253 0253 0253 0262 0262 0262 0264
        0265 0265 0267 0267 0267 0270 0272 0272 0275 0275 0275 0276 0276 0276
K       0049 0050 0055 0061 0067 0068 0068 0131 0132 0188 0189 0190 0201 0207 0208 0208 0208 0234 0235
        0235 0235 0235
L       0051 0052 0055
N       0020 0021 0049 0067 0095 0097 0110 0112 0125 0130 0159 0166 0167 0246 0252 0253 0260 0266 0267
        0270 0275 0276
V       0004 0017
AN      0183 0184
EY      0190 0207
II      0133 0137 0139 0139 0142 0191 0195 0197 0197 0200
I1      0022 0025 0025 0027 0037 0040 0040 0042 0043 0056 0059 0059 0061 0098 0101 0101 0103 0104 0115
        0118 0118 0120 0121 0134 0141 0141 0143 0144 0150 0153 0153 0155 0156 0172 0175 0175 0177 0178
        0192 0199 0199 0201 0202 0217 0220 0220 0222 0223
I2      0023 0026 0026 0027 0038 0041 0041 0042 0043 0057 0060 0060 0061 0099 0102 0102 0103 0104 0116
        0119 0119 0120 0121 0135 0142 0142 0143 0144 0151 0154 0154 0155 0156 0173 0176 0176 0177 0178
        0193 0200 0200 0201 0202 0218 0221 0221 0222 0223
J0      0003 0009
J1      0003 0014 0018 0034 0071 0071
J2      0003 0072 0075 0078 0080 0084
J3      0003 0161 0164 0181
J4      0003 0241 0244
J5      0003 0255 0258
J6      0003 0078 0080 0082
KK      0132 0143 0145 0145 0189 0207 0207 0230 0235 0235 0235 0235
LN      0130 0143 0145 0145 0187 0201 0207 0207 0208 0208
NA      0194 0195
NF      0003 0247
NN      0024 0036 0042 0044 0044 0054 0061 0066 0068 0068 0136 0137 0168 0169 0171 0171 0177 0179 0179
        0184 0185 0186 0189 0195 0201 0203 0207 0208 0208 0208 0213 0213 0213 0222 0224 0224 0229 0230
        0233 0237 0240 0247 0248 0251 0251 0252 0253 0261 0262 0265 0265 0266 0267 0272 0272 0275 0276
NP      0003 0168 0229
NX      0003
N1      0039 0058 0100 0117 0152 0174 0219
PI      0007 0160
ABC     0003
LPF     0212 0216 0227
MOD     0137 0195
NFU     0086 0087 0094 0095 0096 0103 0105 0105 0107 0111 0112 0120 0122 0122 0126 0132 0155 0157 0157
        0160 0160
PSI     0232 0236 0236 0237 0240
SKL     0003 0011 0012 0012 0032 0044 0105 0122 0145 0157 0171 0179 0207 0208 0224 0251 0265
XAF     0005 0027
ABAR    0235 0236
ABCD    0006
IABS    0020 0070 0071 0260 0278
```

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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
LERR    0003
NCAN    0003  0261
NFUS    0003  0086  0094
NPTS    0185  0205  0207  0233  0234
NRAD    0096  0129  0137
NREC    0021  0024  0039  0058  0097  0100  0117  0152  0167  0174  0219
NSUM    0085  0087  0087  0088
NWAF    0003  0029  0036  0048  0054  0066
PDES    0005  0201  0207  0207  0208  0208  0235  0235  0235  0235
REFA    0003  0011
SFUS    0005  0143  0145  0145
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
AMAX1   0112
AMIN1   0111
FDRAG   0006
NCARD   0129  0136  0137  0186  0194  0195
NCASE   0003
NFORX   0003  0087  0095
NRADX   0003  0096
NREST   0003
NRICH   0003
PARBA   0006  0240
PARNO   0006  0237
START   0002
TZORD   0005  0042  0044  0044  0050
XFUSN   0004  0110  0112  0112
XFUS1   0004  0109  0111  0111
YMACH   0003
XREST   0003
CANORD  0005  0267  0272
CANORG  0005  0262  0265  0265
CANOR1  0005  0272  0275  0276
FINORD  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
NPODOR  0003  0166  0187  0231
NPTSPS  0005  0184  0185  0186  0195  0213  0213  0233
NTHETA  0003
NWAFOR  0003  0020  0052  0064  0070  0070
PODORD  0005  0222  0224  0224
PODORG  0005  0169  0171  0171  0203  0207  0208  0213
```

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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
WAFORD  0005  0061  0068  0068
WAFORG  0005  0030  0032  0032
```

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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*****                PAGE 010

LABEL  DEFINED   REFERENCES
  10   0008      0011  0027  0030  0042  0061  0103  0120  0143  0155  0169  0177  0183  0201  0222  0248  0252  0253
                 0262  0266  0267  0275  0276
  20   0017      0014
  30   0028      0024
  40   0033      0029  0031
  50   0045      0039  0043
  60   0046      0036
  70   0048      0034
  80   0050      0048  0049
  90   0051      0047
 100   0062      0058
 110   0063      0016  0054  0055
 120   0068      0066  0067
 130   0069      0064
 140   0072      0009  0018
 150   0075      0072
 160   0087      0086
 170   0091      0090
 180   0093      0088
 190   0106      0100  0104
 200   0111      0107
 210   0123      0117  0121
 220   0125      0113
 230   0126      0125
 240   0127      0124
 250   0146      0136  0144
 260   0147      0131
 270   0148      0094  0130
 280   0150      0127
 290   0158      0152  0156
 300   0160      0159
 310   0161      0074  0075  0149
 320   0164      0161
 330   0171      0170
 340   0180      0174  0178
 350   0208      0202  0203  0205
 360   0209      0194
 370   0210      0188
 380   0211      0187
 390   0216      0181
 400   0225      0219  0223
 410   0226      0168  0215
 420   0239      0231  0234
 430   0240      0229
 440   0241      0163  0164  0227
 450   0244      0241
 460   0251      0249  0250
 470   0254      0247
 480   0255      0243  0244
 490   0258      0255
 500   0265      0263  0264
 510   0273      0270  0271
```

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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*****

LABEL   DEFINED   REFERENCES
 520    0275      0268
 530    0277      0261  0274
 540    0279      0257  0258
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                                     /    START /     SIZE OF PROGRAM 00183C HEXADECIMAL BYTES PAGE 012

 NAME    TAG    TYPE  ADD.        NAME    TAG    TYPE  ADD.        NAME    TAG    TYPE  ADD.        NAME    TAG    TYPE  ADD.
     I SFA      I*4  000124           J SF       I*4  000128           K SF       I*4  00012C           L SF       I*4  000130
     N SFA      I*4  000134           V S     C  R*4  000000          AN SF       R*4  000138          EY SF       R*4  00013C
    II SF       I*4  000140          I1 SF       I*4  000144          I2 SF       I*4  000148          J0       C  I*4  000050
    J1 SFA   C  I*4  000054          J2 S     C  I*4  000058          J3       C  I*4  00005C          J4       C  I*4  000060
    J5       C  I*4  000064          J6       C  I*4  000068          KK SF       I*4  00014C          LN SF       I*4  000150
    NA SF       I*4  000154          NF  F    C  I*4  0000A0          NN SFA      I*4  000158          NP  F    C  I*4  000098
    NX       C  I*4    N.R.          N1 SF       I*4  00015C          PI  FA      R*4  000160         ABC       C  R*4    N.R.
   LPF S        I*4  000164         NFU SFA      I*4  000168         PSI SF       R*4  00016C         SKL SF    C  R*4  0000FC
   XAF S     C  R*4  000000        ABAR SF       R*4  000170        ABCD          R*4    N.R.        LERR       C  I*4    N.R.
  NCAN  F    C  I*4  0000A8        NFUS  F    C  I*4  000074        NPTS SF       I*4  000174        NRAD SFA      I*4  000178
  NREC SF       I*4  00017C        NSUM SF       I*4  000180        NWAF  F    C  I*4  00006C        PDES SF    C  R*4  0048F8
  REFA S     C  K*4  0000BC        SFUS SF    C  K*4  002AF8        XCAN S     C  R*4  000C68        XFIN S     C  R*4  000958
  XFUS SFA   C  R*4  002738        XPOD SF    C  R*4  004374        ZFUS SF    C  R*4  002918       FDRAG          R*4    N.R.
 NCARD SF       I*4  000184       NCASE       C  I*4    N.R.       NFORX  F    C  I*4  000088       NRADX  F    C  I*4  000078
 NREST       C  I*4    N.R.       NRICH       C  I*4    N.R.       PARBA S        R*4  00018C       PARNO S        R*4  0001A0
 START          R*4  000188       TZORD SF    C  R*4  001DD8       XFUSN SFA   C  R*4  000008       XFUS1 SFA   C  K*4  000004
 XMACH       C  R*4    N.R.       XREST       C  R*4    N.R.        SQRT      XF  R*4  000000      CANORD SF    C  K*4  000CB8
CANORG SF    C  R*4  000C28      CANOR1 S     C  R*4  000D58      FINORD S     C  R*4  000A48      FINORG SF    C  R*4  000898
FUSARD SFA   C  R*4  003908      FUSRAD S     C  R*4  003AE8      IBCOM#  F   XF  I*4  000000      J2TEST S     C  I*4  0000B0
NCANOR SFA   C  I*4  0000AC      NFINOR  F    C  I*4  0000A4      NPODOR  F    C  I*4  00009C      NPTSPS SFA   C  I*4  0048E4
NTHETA       C  I*4    N.R.      NWAFOR SFA   C  I*4  000070      PODORD SF    C  R*4  0047AC      PODORG SF    C  R*4  004308
WAFORD SF    C  R*4  000188      WAFORG SF    C  R*4  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   R*4      N.R.            J0   I*4    000050            J1   I*4    000054            J2   I*4    000058
        J3   I*4    00005C            J4   I*4    000060            J5   I*4    000064            J6   I*4    000068
      NWAF   I*4    00006C        NWAFOR   I*4    000070          NFUS   I*4    000074         NRADX   I*4    000078
     NFORX   I*4    000088            NP   I*4    000098        NPODOR   I*4    00009C            NF   I*4    0000A0
    NFINOR   I*4    0000A4          NCAN   I*4    0000A8        NCANOR   I*4    0000AC        J2TEST   I*4    0000B0
      LERR   I*4      N.R.         NRICH   I*4      N.R.          REFA   R*4    0000BC         NCASE   I*4      N.R.
     XMACH   R*4      N.R.            NX   I*4      N.R.        NTHETA   I*4      N.R.         NREST   I*4      N.R.
     XREST   R*4      N.R.           SKL   R*4    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   R*4    000000         XFUS1   R*4    000004         XFUSN   R*4    000008

   NAME OF COMMON BLOCK  * BLACK*   SIZE OF BLOCK     000DF8 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
       XAF   R*4    000000        WAFORG   R*4    000078        WAFORD   R*4    000188         TZORD   R*4    001DD8
      XFUS   R*4    002738          ZFUS   R*4    002918          SFUS   R*4    002AF8        FUSARD   R*4    003908
    FUSRAD   R*4    003AE8        PODORG   R*4    004308          XPOD   R*4    004374        PODORD   R*4    0047AC
```

```
NPTSPS    I*4   004BE4      PDES     R*4   004BF8      FINORG   R*4   00D898       XFIN    R*4   00D958
FINORD    R*4   00DA48    CANORG     R*4   00DC28        XCAN   R*4   00DC68     CANORD    R*4   00DCB8
CANOR1    R*4   00DD58
```

```
 LABEL   ADDR             LABEL   ADDR             LABEL   ADDR             LABEL   ADDR

    20  00024A              30  0002EE              40  000384              50  00046C
    60  000490              70  0004A6              80  0004AE              90  0004F0
   100  000592             110  0005A4             120  0005DA             130  00062E
   140  000642             150  000652             160  0006B0             180  000706
   190  0007F4             200  000848             210  00095C             220  000984
   230  000988             240  0009B8             250  000AFE             260  000B22
   270  000B34             280  000B5C             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  00138C             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 )                    OS/360  FORTRAN H                    DATE  77.061/21.08.39
```

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LOCKHEED PROPRIETARY DATA

```
      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                         SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002            SUBROUTINE LSTDT8                                        00009110
             C                                                               00009120
ISN 0003            DIMENSION A (20)                                         00009130
ISN 0004            WRITE (6, 40)                                            00009140
ISN 0005         10 I = 0                                                    00009150
ISN 0006         20 READ (5, 50,END=30) A                                    00009160
ISN 0007            WRITE (6, 80) A                                          00009180
ISN 0008            I = I + 1                                                00009190
ISN 0009            IF (I .NE. 44) GO TO 20                                  00009200
ISN 0011            WRITE (6, 60)                                            00009210
ISN 0012            GO TO 10                                                 00009220
ISN 0013         30 REWIND 5                                                 00009230
ISN 0014            WRITE (6, 70)                                            00009240
ISN 0015            RETURN                                                   00009250
ISN 0016         40 FORMAT (1H1, 26HINPUT DATA LISTING FOLLOWS /1H )         00009260
ISN 0017         50 FORMAT (20A4)                                            00009270
ISN 0018         60 FORMAT (1H1)                                             00009280
ISN 0019         70 FORMAT (1H0, 17HINPUT DATA LISTED)                       00009290
ISN 0020         80 FORMAT (1H , 20A4)                                       00009300
ISN 0021            END                                                      00009310
```

```
                    *****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
A       0003  0006  0007
I       0005  0008  0008  0009
LSTDT8  0002
```

```
                    *****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     0005      0012
  20     0006      0009
  30     0013      0006
  40     0016      0004
  50     0017      0006
  60     0018      0011
  70     0019      0014
  80     0020      0007
```

```
                                           /   LSTDT8 /     SIZE OF PROGRAM 00021C HEXADECIMAL BYTES PAGE 004

      NAME     TAG    TYPE  ADD.        NAME     TAG    TYPE  ADD.        NAME    TAG   TYPE  ADD.        NAME     TAG    TYPE  ADD.
         A SF         R*4  0000E4          I SF         I*4  00000C      IBCOM#  F  XF  I*4  000000      LSTDT8           I*4  0000E0
```

```
LABEL    ADDR              LABEL    ADDR              LABEL    ADDR              LABEL    ADDR            PAGE 005

   10   000168                20   00016C                30   0001D8
```

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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 =      20 ,PROGRAM SIZE =      540

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                              93K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
```

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

                                                     MODULE MAP

  CONTROL SECTION                          ENTRY

    NAME      ORIGIN  LENGTH                 NAME      LOCATION      NAME     LOCATION      NAME     LOCATION      NAME     LOCATION

  MAIN           00    3B78
  START        3B78    183C
  LSTDTB       53B8     21C
  IHCSATN2*    55D8     1C8                ATAN2        55D8        ATAN        55EC

  IHCNAMEL*    57A8     AA7                FRDNL#       57A8        FWRNL#      5D90

  IHCECOMH*    6250     F31                IBCOM#       6250        FDIOCS#     630C        VFIOCS      7070        INTSW       716E
                                           INTSWTCH     716E
  IHCCOMH2*    7188     56D
                                           SEQDASD      7410
  IHCSSQRT*    76F8     145
                                           SQRT         76F8
  IHCFCVTH*    7840    1195
                                           ADCON#       7840        FCVAOUTP    78EA        FCVLOUTP    797A        FCVZOUTP    7ACA
                                           FCVIOUTP     7E70        FCVEOUTP    8372        FCVCOUTP    858C        INT6SWCH    8873
  IHCEFNTH*    89D8     512
                                           ARITH#       89D8        ADJSWTCH    8D44
  IHCEFIOS*    8EF0    1390
                                           FIOCS#       8EF0        FIOCSBEP    8EF6        MULFLS      90AC
  IHCERRM *    A280     58C
                                           ERRMON       A280        IHCERRE     A298
  IHCUOPT *    A840     350
  IHCETRCH*    AB90     28E                IHCTRCH      AB90        ERRTRA      AB98

  IHCUATBL*    AE20     648
 $BLANKCOM     B468     100
  BLK2         B568       C
  BLACK        B578    D0F8

 ENTRY ADDRESS        00
 TOTAL LENGTH      19370

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

```
INPUT DATA LISTING FOLLOWS

 &INPUT
 FUSTYP=1,
 &END
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
  1  1 -1  1  1  1  0  7 13  1 17 29                                     2  3  2 10  1 10
 967680
0.       1.       5.       10.      20.      30.      40.      50.      60.      70.        XAF 10
80.      90.      100.                                                                      XAF 13
944.1    65.74   -54.96   1448.94                                                           WORG 02
1462.5   223.94  -54.47   925.97                                                            WORG 06
1768.8   317.41  -69.00   650.01                                                            WORG 08
1905.4   368.04  -77.16   529.87                                                            WORG 09
2225.8   486.83  -89.74   311.72                                                            WORG 11
2225.8   486.88  -89.74   311.72                                                            WORG 12
2479.3   645.05  -99.96   194.45                                                            WORG 13
0.       -.187   -1.98    -7.09    -18.24   -28.07   -35.89   -41.82   -46.3    -49.9       TZOR 02
-53.13   -56.52  -60.34                                                                     TZOR 02
C.       .49      2.5     2.85     1.06     -2.25    -6.32    -10.75   -15.32   -19.88      TZOR 06
-24.29   -28.42  -32.23                                                                     TZOR 06
0.       .09      1.11    2.27     2.69     2.13     1.       -.51     -2.31    -4.28       TZOR 08
-6.4     -8.6    -10.84                                                                     TZOR 08
0.       .08      .41     1.39     1.64     1.36     .73      -.12     -1.18    -2.39       TZOR 09
-3.71    -5.09   -6.55                                                                      TZOR 09
0.       -.08    -.35     -.36     .16      .4       .6       .72      .82      .91         TZOR 11
.97      1.02    1.05                                                                       TZOR 11
0.       -.08    -.35     -.36     .16      .4       .59      .72      .82      .92         TZOR 12
.97      1.02    1.05                                                                       TZOR 12
0.       -.08    -.35     -.61     -.85     -.92     -.9      -.71     -.4      -.01        TZOR 13
.52      1.13    1.77                                                                       TZOR 13
0.       .48      .89     1.07     1.27     1.4      1.48     1.52     1.55     1.44        WORD  2
1.14     .66     0.                                                                         WORD  2
0.       .54      .99     1.16     1.34     1.44     1.5      1.51     1.46     1.28        WORD  6
.98      .55     0.                                                                         WORD  6
0.       .49      .89     1.04     1.18     1.27     1.33     1.351    1.297    1.134       WORD  8
.864     .486    0.                                                                         WORD  8
0.       .47      .716    .879     1.065    1.192    1.292    1.329    1.276    1.116       WORD  9
.851     .478    0.                                                                         WORD  9
0.       .47      .723    .903     1.128    1.268    1.364    1.403    1.347    1.179       WORD 11
.898     .507    0.                                                                         WORD 11
0.       .056     .267    .505     .898     1.179    1.347    1.403    1.347    1.179       WORD 12
.898     .505    0.                                                                         WORD 12
0.       .056     .271    .512     .911     1.196    1.367    1.424    1.367    1.196       WORD 13
.911     .512    0.                                                                         WORD 13
0.0      120.    240.     360.     480.     600.     720.     840.     960.     1080.       XFUS 10
```

```
1200.  1320.  1440.  1560.  1680.  1920.  2120.  2240.  2360.  2480.     XFUS 20
2664.3 2720.  2840.  2960.  3080.  3200.  3320.  3440.  3524.            XFUS 30
-38.   -30.75 -23.75 -18.5  -16.2  -15.9  -17.2  -20.9  -26.84 -32.75    ZFUS 10
-36.73 -40.53 -45.07 -49.39 -53.68 -61.59 -68.9  -72.9  -75.0  -76.6     ZFUS 20
-76.8  -76.6  -74.9  -71.3  -66.7  -60.9  -53.3  -44.3  -37.             ZFUS 30
0.     830.   2875.  5242.  8136.  10944. 13752. 16128. 18547. 19584.    AFUS 10
19670. 19670. 20016. 20304. 20548. 20707. 20404. 20073. 19397. 18346.    AFUS 20
16272. 15408. 13248. 10483. 7085.  4464.  2477.  878.   0.               AFUS 30
2094.  214.   -34.                                                       PODORG 1
0.     137.   393.                                                       PODX 1
33.92  35.65  35.65                                                      PODR 1
2091.  204.   -136.                                                      PODORG 2
0.     136.   394.                                                       PODX 2
32.    35.65  35.65                                                      PODR 2
2480.  645.   -100.  194.5  2595.4 645.   -28.   141.1                   FINORG 1
0.     10.    20.    30.    40.    50.    60.    70.    90.    100.      XFIN
0.     .466   .846   1.138  1.345  1.465  1.498  1.390  .641   0.0       FINORD
3183.9 0.     -27.   294.1  3403.2 0.     66.5   67.7                    FINORG 2
0.     10.    20.    30.    40.    50.    60.    70.    90.    100.      XFIN
0.     .466   .846   1.138  1.345  1.465  1.498  1.390  .641   0.0       FINORD
3116.4 33.    -40.   283.8  3354.  174.4  -40.   76.4                    CANORG
0.0    10.    20.    30.    40.    50.    70.    80.    90.    100.      XCAN
0.0    .553   .948   1.264  1.448  1.5    1.264  .948   .553   0.0       CANORD
267 2550   50  20    0   00000000
268 1200   50  20    0   00000000
269 1000   50   1    0   01000000

INPUT DATA LISTED
```

```
CL1607-32   (-24 PLANFORM)  VC121  ENGINE
 0          0           1          -0.0200     0.0        0.0        0.0    0        0
 1            2.550
 3            0.0        5.000      10.000
 0            0.0        0.0         0.0        0.0        0.0
12          967680.00    1.0000      0.0        0.0      1290.0996
  944.0999    65.7400  -54.9600 1448.9399                WING PANEL NO. 1
 1462.5000   223.9400  -54.4700  925.9700                WING PANEL NO. 1
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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
    0.0        0.0529    0.2700    0.3078    0.1145    -0.2430    -0.6825    -1.1609
   -1.6545    -2.1469   -2.6232   -3.0692   -3.4807
 1462.5000   223.9400  -54.4700  925.9700                WING PANEL NO. 2
 1768.7998   317.4099  -69.0000  650.0098                WING PANEL NO. 2
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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    -0.2430    -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
 1768.7998   317.4099  -69.0000  650.0098                WING PANEL NO. 3
 1905.3999   368.0398  -77.1600  529.8699                WING PANEL NO. 3
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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   -1.2362
 1905.3999   368.0398  -77.1600  529.8699                WING PANEL NO. 4
 2225.7998   486.8298  -89.7400  311.7200                WING PANEL NO. 4
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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
 2225.7998   486.8298  -89.7400  311.7200                WING PANEL NO. 5
 2225.7998   486.8799  -89.7400  311.7200                WING PANEL NO. 5
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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     0.1925     0.2310
    0.2631     0.2919    0.3112    0.3272    0.3368
    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
 2225.7998   486.8799  -89.7400  311.7200                WING PANEL NO. 6
 2479.2998   645.0498  -99.9600  194.4500                WING PANEL NO. 6
    3.0000    10.0000    1.0000    0.0                   NVOR,RNCV,SPC,PDL
    0.0        0.0     0         13          0            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
    0.0        0.0      45.7619 3524.0000                FUSELAGE PANEL
    0.0        0.0     -97.8677 3524.0000                FUSELAGE PANEL
    3.0000    28.0000    1.0000  999.0000                NVOR,RNCV,SPC,PDL
   90.0000    71.8148   33.1318   71.8148  -23.7363    71.8148   -90.0000    71.8148
```

```
       0.0       0.0         1        29         0         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   54.4835
   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
   -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    5.1227   17.7443   32.3533   50.2150   67.5458   84.8766  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  100.4297   95.0974   81.7659   64.7005
   43.7282   27.5516   15.2879    5.4190       0.0
 2094.0000  214.0000   -0.0800  393.0000           NACELLE PANEL NO 1
 2094.0000  214.0000   -0.0800  393.0000           NACELLE PANEL NO 1
    6.0000    5.0000       0.0  999.0000           NVOR,RNCV,SPC,PDL
   90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
 -150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
       0.0       0.0         0         3         0         0         1
       0.0   12.1522  100.0000
       0.0
  100.0000  105.1001  105.1001
 2091.0000  204.0000 -104.0000  394.0000           NACELLE PANEL NO 2
 2091.0000  204.0000 -104.0000  394.0000           NACELLE PANEL NO 2
    6.0000    5.0000       0.0  999.0000           NVOR,RNCV,SPC,PDL
   90.0000   32.0000   30.0000   32.0000  -30.0000   32.0000  -90.0000   32.0000
 -150.0000   32.0000 -210.0000   32.0000 -270.0000   32.0000
       0.0       0.0         0         3         0         0         1
       0.0   11.9148  100.0000
       0.0
  100.0000  111.4062  111.4062
 2460.0000  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         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         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         0                     NXS,NYS,NZS
```

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 polyagonal 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	Description
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.

Symbol	Description
NWING	VORLAX panel numbers making up the wing. VORLAX panels are numbered according to their input sequence, not by any alphanumeric 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.

```
INPUT DATA LISTING FOLLOWS

 &INPUT
 NWNGP=5,NWING=1,2,3,4,5, NFUSP=1, NFUSE=6,NF=2,NFPAN=9,10,    SMARTS CARDS
 NCAN=1,NCANP=11,NP=2,NPPAN=7,8, PLOTSZ=10.,
 &END
CL1607-32    (-24 PLANFORM)  VC121  ENGINE
0            0          1           -0.0200      0.0         0.0         0.0    0        0
1               2.550
3               0.0         5.000     10.000
C               0.0         0.0        0.0       0.0         0.0
11          967680.00       1.0000     0.0       0.0       1290.0996
  944.0999     65.7400    -54.9600  1448.9399              WING PANEL NO. 1
 1462.5000    223.9400    -54.4700   925.9700              WING PANEL NO. 1
    3.0000     10.0000      1.0000     0.0                 NVOR,RNCV,SPC,PDL
    0.0         0.0     0          13        0              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
    0.0         0.0529      0.2700     0.3078    0.1145    -0.2430    -0.6825    -1.1609
   -1.6545     -2.1469     -2.6232    -3.0692   -3.4807
 1462.5000    223.9400    -54.4700   925.9700              WING PANEL NO. 2
 1768.7998    317.4099    -69.0000   650.0098              WING PANEL NO. 2
    3.0000     10.0000      1.0000     0.0                 NVOR,RNCV,SPC,PDL
    0.0         0.0     0          13        0              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    -0.2430    -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
 1768.7998    317.4099    -69.0000   650.0098              WING PANEL NO. 3
 1905.3999    368.0398    -77.1600   529.8699              WING PANEL NO. 3
    3.0000     10.0000      1.0000     0.0                 NVOR,RNCV;SPC,PDL
    0.0         0.0     0          13        0              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   -1.2362
 1905.3999    368.0398    -77.1600   529.8699              WING PANEL NO. 4
 2225.7998    486.8298    -89.7400   311.7200              WING PANEL NO. 4
    3.0000     10.0000      1.0000     0.0                 NVOR,RNCV,SPC,PDL
    0.0         0.0     0          13        0              0         0
```

Figure D-1.- VORLAX dataset with smarts cards included

```
    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
 2225.7998  486.8799  -89.7400  311.7200          WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500          WING PANEL NO. 6
    3.0000   10.0000    1.0000    0.0             NVOR,RNCV,SPC,PDL
    0.0       0.0     0        13         0         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
    0.0       0.0      45.7619 3524.0000          FUSELAGE PANEL
    0.0       0.0     -97.8677 3524.0000          FUSELAGE PANEL
    4.0000   28.0000    1.0000  999.0000          NVOR,RNCV,SPC,PDL
   90.0000   71.8148   52.0879   71.8148   14.1758   71.8148  -23.7363   71.8148
  -90.0000   71.8148
    0.0       0.0     1        29         0         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   54.4835
   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
   -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       5.1227   17.7443   32.3533   50.2150   67.5458   84.8766  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  100.4297   95.0974   81.7659   64.7005
   43.7282   27.5516   15.2879    5.4190    0.0
 2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
 2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
    8.0000    5.0000    0.0     999.0000          NVOR,RNCV,SPC,PDL
   90.0000   33.9200   45.0000   33.9200    0.0      33.9200  -45.0000   33.9200
  -90.0000   33.9200 -135.0000   33.9200 -180.0000   33.9200 -225.0000   33.9200
 -270.0000   33.9200
    0.0       0.0     0         3         0         0         1
    0.0      12.1522  100.0000
    0.0
  100.0000  105.1001  105.1001
```

Figure D-1.- Continued

```
 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    0.0      32.0000  -45.0000   32.0000
  -90.0000   32.0000 -135.0000   32.0000 -180.0000   32.0000 -225.0000   32.0000
 -270.0000   32.0000
    0.0       0.0     0          3          0         0         1
    0.0      11.9148  100.0000
    0.0
  100.0000  111.4062  111.4062
 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         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         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         0                    NXS,NYS,NZS

INPUT DATA LISTED
```

Figure D-1.- Concluded

```
CL1607-32   (-24 PLANFORM)   VC121 ENGINE
  1  1 -1  1  1  1  0  6 13  1  5 29  0  0  0  0  0  0  2  3  2  2  1  2
 967680                                                                 REFA
    0.0   1.00   5.00  10.00  20.00  30.00  40.00  50.00  60.00  70.00  XAF
  80.00  90.00 100.00
 944.10  65.74 -54.961448.94                                            WORG
1462.50 223.94 -54.47 925.97                                            WORG
1768.80 317.41 -69.00 650.01                                            WORG
1905.40 368.04 -77.16 529.87                                            WORG
2225.80 486.88 -89.74 311.72                                            WORG
2479.30 645.05 -99.96 194.45                                            WORG
    0.0  -0.19  -1.98  -7.09 -18.24 -28.07 -35.89 -41.82 -46.30 -49.90  TZORD
 -53.13 -56.52 -60.34
    0.0   0.49   2.50   2.85   1.06  -2.25  -6.32 -10.75 -15.32 -19.88  TZORD
 -24.29 -28.42 -32.23
    0.0   0.09   1.11   2.27   2.69   2.13   1.00  -0.51  -2.31  -4.28  TZORD
  -6.40  -8.60 -10.84
    0.0   0.08   0.41   1.39   1.64   1.36   0.73  -0.12  -1.18  -2.39  TZORD
  -3.71  -5.09  -6.55
    0.0  -0.08  -0.35  -0.36   0.16   0.40   0.59   0.72   0.82   0.92  TZORD
   0.97   1.02   1.05
    0.0  -0.08  -0.35  -0.61  -0.85  -0.92  -0.90  -0.71  -0.40  -0.01  TZORD
   0.52   1.13   1.77
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  WORD
    0.0    0.0    0.0
    0.0 120.00 240.00 360.00 480.00 600.00 720.00 840.00 960.001080.00  XFUS
1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00  XFUS
2664.302720.002840.002960.003080.003200.003320.003440.003524.00
 -38.00 -30.75 -23.75 -18.50 -16.20 -15.90 -17.20 -20.90 -26.84 -32.75  ZFUS
 -36.73 -40.53 -45.07 -49.39 -53.68 -61.59 -68.90 -72.90 -75.00 -76.60  ZFUS
 -76.80 -76.60 -74.90 -71.30 -66.70 -60.90 -53.30 -44.30 -37.00
    0.0  830.0 2875.0 5242.0 8136.010944.013752.016202.316202.316202.3  AFUS
16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3  AFUS
16271.915408.013248.010483.0 7085.0 4464.0 2477.0  878.0    0.0
```

Figure D-2.- WAVE DRAG format dataset resulting from conversion

```
2094.00 214.00  -0.08                                                   PODORG 1
    0.0  47.76 393.00    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  PODORD 1
2091.00 204.00-104.00                                                   PODORG 2
    0.0  46.94 394.00    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  PODORD 2
 2480.0  645.0 -100.0  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                                             10.000RT
X Z    26.62-24.139.23                          12.250RT                1
```

Figure D-2.- Concluded

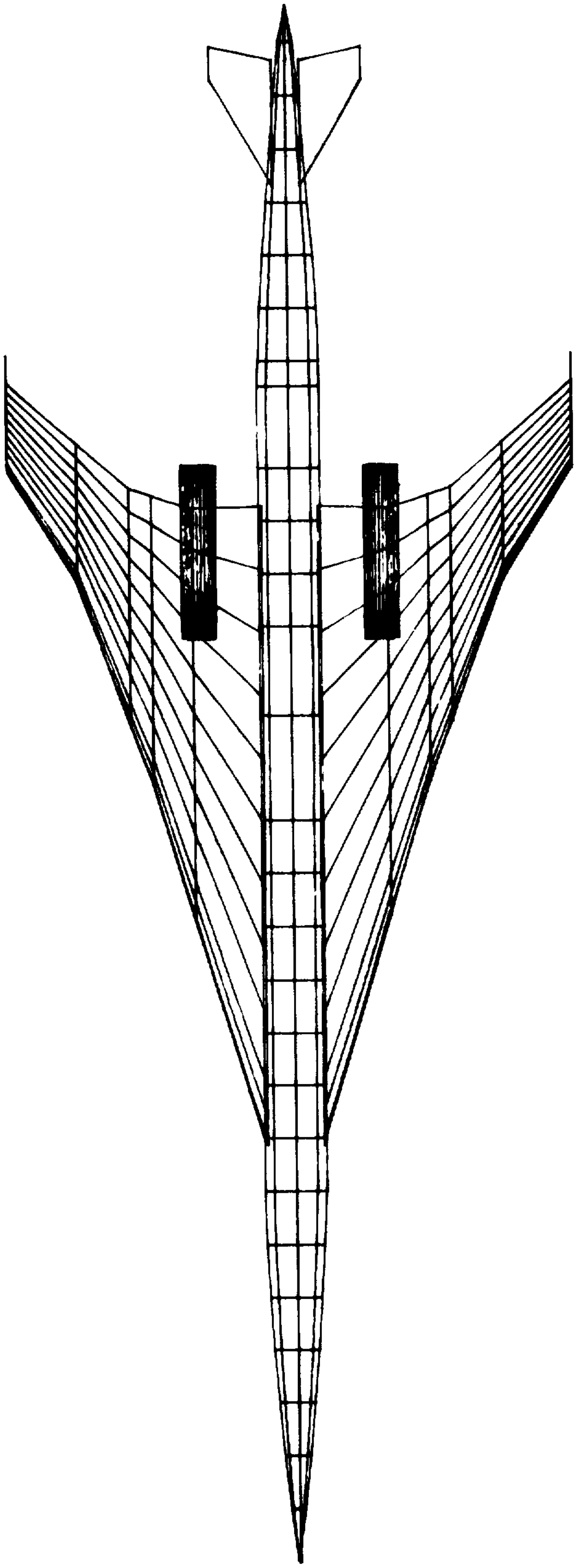

Figure D-3.- Planform plot from figure D-2 dataset

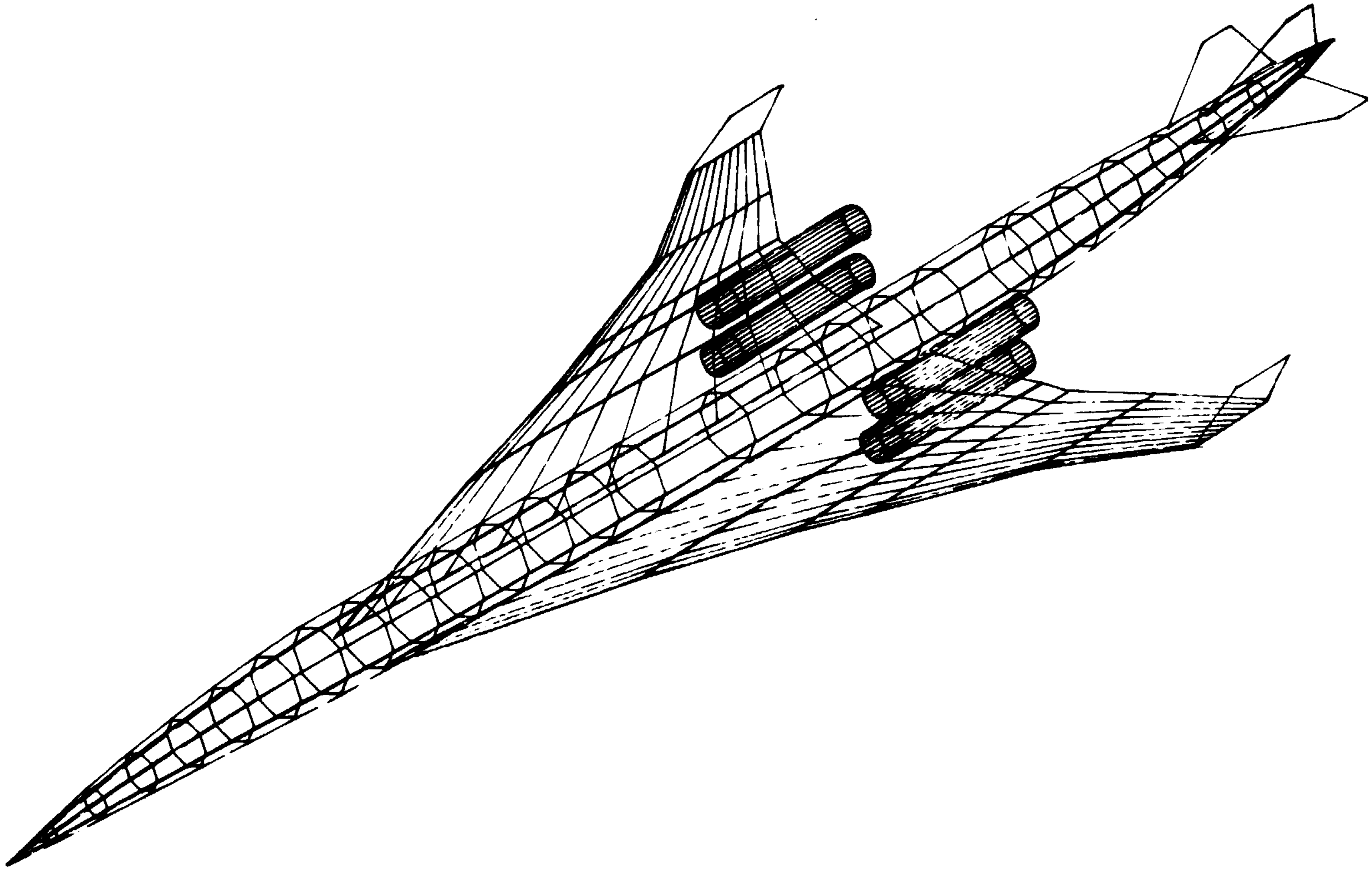

Figure D-4.- Isometric plot from figure D-2 dataset

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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LOCKHEED PROPRIETARY DATA

```
          COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                             SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
                     CONTROL*VRLX.VORTWON                                          9/21/76 00000010
                     C...                                                                  00000020
                     C... PROGRAM TO CONVERT DATA FROM VORLAX PROGRAM OUTPUT INTO          00000030
                     C...WAVEDRAG INPUT.  THERE ARE MANY RESTRICTIONS IN THIS CONVERSION   00000040
                     C...AND THE USERS GUIDE SHOULD BE CONSULTED FOR AN EXPLANATION.       00000050
                     C...                                                                  00000060
ISN 0002                   DIMENSION NWING (20), II (24), NAPX (40), XYZC2 (4, 40),        00000070
                          * ZC12 (2, 30, 40), XAFX (30, 40), NFUSE (6), YFUS (6, 30),      00000080
                          * ZFUS (6, 30), XFUS (30), ABCD (6, 2, 4), NFPAN (6), XFIN (10), 00000090
                          * FINORD(10), XCAN(10), CANORD(10), NCANP(2), NPPAN(9), RHO(20), 00000100
                          * PODORG (3), PHEE (20), XPOD (9,10), PODORD (9,10), NPP(20)     00000110
ISN 0003                   NAMELIST/INPUT/NWNGP, NWING, NFUSP, NFUSE, NF, NFPAN, NCAN, NCANP 00000120
                          *, PLOTSZ, NP, NPPAN                                             00000130
ISN 0004            10     FORMAT (20A4)                                                   00000140
ISN 0005            20     FORMAT (1H1, 20A4)                                              00000150
ISN 0006                   DIMENSION XAF (50), ZC1 (50), ZC2 (50), AFUS(30), ZFUSS(30)     00000160
ISN 0007                   DIMENSION DESCRP (10), ALPHA (8), PHI (51), RO (51), CURV (40), 00000170
                          * TITLE (20), XS (20), C1 (20), C2 (20)                          00000180
ISN 0008                   REAL*4 MACH, NVOR, LESWP                                        00000190
ISN 0009                   COMMON /SET4 /AINC1 (20), AINC2 (20)                            00000200
ISN 0010                   COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),     00000210
                          * LESWP (40), SYNTH (40), IQUANT (40)                            00000220
ISN 0011                   COMMON /SET7 /RNCV (20), ITS (20)                               00000230
ISN 0012                   COMMON /SET12 /CSTART (40), TAPER (40), PSPAN (40), NVOR (40)   00000240
ISN 0013                   COMMON /SET13 /MACH (8)                                         00000250
ISN 0014                   COMMON /SET23 /SLE1 (20), SLE2 (20), SPC (40)                   00000260
ISN 0015                   CALL LSTDT8                                                     00000270
ISN 0016                   PI = 3.14159                                                    00000280
ISN 0017            30     L3 = 3                                                          00000290
ISN 0018                   DO 40 I = 1, 10                                                 00000300
ISN 0019                   XFIN (I) = 0.                                                   00000310
ISN 0020                   FINORD (I) = 0.                                                 00000320
ISN 0021                   XCAN (I) = 0.                                                   00000330
ISN 0022                   CANORD (I) = 0.                                                 00000340
ISN 0023                   IF (I .LE. 6) XFUS (I) = 0.                                     00000350
ISN 0025            40     CONTINUE                                                        00000360
ISN 0026                   DO 50 I = 1, 30                                                 00000370
ISN 0027                   DO 50 J = 1, 6                                                  00000380
ISN 0028                   XFUS (I) = 0.                                                   00000390
ISN 0029                   AFUS (I) = 0.                                                   00000400
```

```
ISN 0030          YFUS (J, I) = 0.                                            00000410
ISN 0031          ZFUS (J, I) = 0.                                            00000420
ISN 0032     50   CONTINUE                                                    00000430
ISN 0033          DO 60 I = 1, 6                                              00000440
ISN 0034          DO 60 J = 1, 2                                              00000450
ISN 0035          DO 60 K = 1, 4                                              00000460
ISN 0036          ABCD (I, J, K) = 0.                                         00000470
ISN 0037     60   CONTINUE                                                    00000480
ISN 0038          DO 70 I = 1, 2                                              00000490
ISN 0039          DO 70 J = 1, 30                                             00000500
ISN 0040          DO 70 K = 1, 40                                             00000510
ISN 0041          ZC12 (I, J, K) = 0.                                         00000520
ISN 0042     70   CONTINUE                                                    00000530
ISN 0043          NWNGP = 0                                                   00000540
ISN 0044          NF = 0                                                      00000550
ISN 0045          NCAN = 0                                                    00000560
ISN 0046          NFUSP = 0                                                   00000570
ISN 0047           NP=0                                                       00000572
ISN 0048           NPPAN(1)=0                                                 00000574
ISN 0049          DTR = .017453                                               00000580
ISN 0050          PLOTSZ = 10.                                                00000590
ISN 0051          READ (5, INPUT,END=940)                                     00000600
ISN 0052          READ (5, 10) TITLE                                          00000620
ISN 0053          WRITE (L3, 10) TITLE                                        00000630
ISN 0054          READ (5, 80) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY, ITRMAX 00000640
ISN 0055     80   FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)                         00000650
ISN 0056          READ (5, 90) NMACH, (MACH (I), I = 1, NMACH)                00000660
ISN 0057     90   FORMAT (I2, 8X, 7F10.0)                                     00000670
ISN 0058          WRITE (6, 20) TITLE                                         00000680
ISN 0059          READ (5, 90) NALPHA, (ALPHA (I), I = 1, NALPHA)             00000690
ISN 0060          READ (5, 90) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF         00000700
ISN 0061          IF (PSI .NE. 0.) LATRAL = 1                                 00000710
ISN 0063          IF (ROLLQ .NE. 0.) LATRAL = 1                               00000720
ISN 0065          IF (YAWQ .NE. 0.) LATRAL = 1                                00000730
ISN 0067          IF (VINF .LE. 0.001) VINF = 1.0                             00000740
ISN 0069          READ (5, 100) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN           00000750
ISN 0070    100   FORMAT (I2, 8X, 5F10.0)                                     00000760
ISN 0071          IF (WSPAN .LE. 0.0001) WSPAN = 2.0                          00000770
                C                                                             00000780
ISN 0073    110   FORMAT (8F10.0)                                             00000790
ISN 0074          INVERS = 0                                                  00000800
ISN 0075          DO 200 I = 1, NPAN                                          00000810
ISN 0076          READ (5, 120) X1, Y1, Z1, CORD1, DESCRP                     00000820
ISN 0077          READ (5, 120) X2, Y2, Z2, CORD2, DESCRP                     00000830
ISN 0078          XYZC2 (1, I) = X2                                           00000840
ISN 0079          XYZC2 (2, I) = Y2                                           00000850
ISN 0080          XYZC2 (3, I) = Z2                                           00000860
ISN 0081          XYZC2 (4, I) = CORD2                                        00000870
ISN 0082          READ (5, 120) NVOR (I), RNCV (I), SPC (I), CURV (I), DESCRP 00000880
ISN 0083          PDL (I) = 0.                                                00000890
ISN 0084          IF (CURV (I) .NE. 0.) PDL (I) = 999.                        00000900
ISN 0086          IF (CURV (I) .GT. 500.0) CURV (I) = 0.0                     00000910
ISN 0088    120   FORMAT (4F10.0, 10A4)                                       00000920
```

```
ISN 0089          INTRAC = 1                                                       00000930
ISN 0090          IF (PDL (I)  .EQ. 0.) INTRAC = 0                                 00000940
ISN 0092          XAPEX (I) = X1                                                   00000950
ISN 0093          YAPEX (I) = Y1                                                   00000960
ISN 0094          ZAPEX (I) = Z1                                                   00000970
ISN 0095          CSTART (I) = CORD1                                               00000980
ISN 0096          DELTAY = Y2 - Y1                                                 00000990
ISN 0097          DELTAZ = Z2 - Z1                                                 00001000
ISN 0098          IF (INTRAC .EQ. 0) PDL (I) = 1./DTR *ATAN2 (DELTAZ, DELTAY)      00001010
ISN 0100          IF (INTRAC .EQ. 0) GO TO 150                                     00001020
ISN 0102          NV = NVOR (I)                                                    00001030
ISN 0103          IBOT = 1                                                         00001040
ISN 0104          IF (I .EQ. 1) GO TO 140                                          00001050
ISN 0106          ITOP = I - 1                                                     00001060
ISN 0107          DO 130 J = 1, ITOP                                               00001070
ISN 0108          INV = NVOR (J)                                                   00001080
ISN 0109          IBOT = IBOT + INV                                                00001090
ISN 0110     130  CONTINUE                                                         00001100
ISN 0111     140  ITOP = IBOT + NV - 1                                             00001110
ISN 0112          JJTOP = NVOR (I) + 1                                             00001120
ISN 0113          READ (5, 110) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                 00001130
ISN 0114          PHEE (I) = PHI (1)                                               00001140
ISN 0115          RHO (I) = RO (1)                                                 00001150
ISN 0116     150  READ (5, 160) AINC1 (I), AINC2 (I), ITS (I), NAP, IQUANT(I),     00001160
                 * ISYNT, NPP (I)                                                  00001170
ISN 0117          NAPX (I) = NAP                                                   00001180
ISN 0118     160  FORMAT (2F10.0, 5 (I2, 8X))                                      00001190
ISN 0119          SYNTH (I) = ISYNT                                                00001200
ISN 0120          MAX = RNCV (I)                                                   00001210
ISN 0121          IF (ISYNT .EQ. 0) GO TO 170                                      00001220
ISN 0123          READ (5, 110) (C1 (K), K = 1, MAX)                               00001230
ISN 0124          READ (5, 110) (C2 (K), K = 1, MAX)                               00001240
ISN 0125          INVERS = 1                                                       00001250
ISN 0126          SLE1 (I) = 0.                                                    00001260
ISN 0127          SLE2 (I) = 0.                                                    00001270
ISN 0128          GO TO 200                                                        00001280
ISN 0129     170  IF (NAP .LT. 3) GO TO 200                                        00001290
ISN 0131          ILE = ITS (I) *(1 - INTRAC)                                      00001300
ISN 0132          RLE1 = 0.0                                                       00001310
ISN 0133          RLE2 = 0.0                                                       00001320
ISN 0134          READ (5, 110) (XAF (JJ), JJ = 1, NAP)                            00001330
ISN 0135          DO 180 JJ = 1, NAP                                               00001340
ISN 0136     180  XAFX (JJ, I) = XAF (JJ)                                          00001350
ISN 0137          IF  (ILE .NE. 0) READ (5, 110) RLE1                              00001360
ISN 0139          READ (5, 110) (ZC1 (JJ), JJ = 1, NAP)                            00001370
ISN 0140          IF (ILE .NE. 0) READ (5, 110) RLE2                               00001380
ISN 0142          READ (5, 110) (ZC2 (JJ), JJ = 1, NAP)                            00001390
ISN 0143          DO 190 JJ = 1, NAP                                               00001400
ISN 0144          ZC12 (1, JJ, I) = ZC1 (JJ)                                       00001410
ISN 0145     190  ZC12 (2, JJ, I) = ZC2 (JJ)                                       00001420
ISN 0146     200  CONTINUE                                                         00001430
ISN 0147          READ (5, 210) NXS, NYS, NZS                                      00001440
ISN 0148     210  FORMAT (3 (I2, 8X))                                              00001450
```

```
ISN 0149          IF (NXS .GT. 0) READ (5, 110) (XS (I), I = 1, NXS)              00001460
ISN 0151          IF (NXS .GT. 0) READ (5, 110) YNOT, DELTAY, ZNOT, DELTAZ        00001470
ISN 0153          DO 220 I = 1, 24                                                00001480
ISN 0154          II (I) = 0                                                      00001490
ISN 0155     220  CONTINUE                                                        00001500
ISN 0156          II (1) = 1                                                      00001510
ISN 0157          IF (NWNGP .GT. 0) II (2) = 1                                    00001520
ISN 0159          IF (NWNGP .GT. 0) NAP = NAPX (NWING (1))                        00001530
ISN 0161          IF (NFUSP .GT. 0) II (3) = 1                                    00001540
ISN 0163          IF (PDL (NFUSE (1)) .GT. 360.)  II (3) = -1                     00001550
ISN 0165          IF (NWNGP .GT. 0) II (8) = NWNGP + 1                            00001560
ISN 0167          II (10) = 1                                                     00001570
ISN 0168          IF (NFUSP .EQ. 0) GO TO 230                                     00001580
ISN 0170          IB = NFUSE (1)                                                  00001590
ISN 0171          IF (PDL (IB) .EQ. 0) II (11) = 3                                00001600
ISN 0173          IF (PDL (IB) .GT. 360.) II (11) = NVOR (IB) + 1                 00001610
ISN 0175          ITNOSE = 0                                                      00001620
ISN 0176          ITAFT = 0                                                       00001630
ISN 0177          IF (ABS ((XYZC2 (1, IB) - XAPEX (IB))) .GE. .01) ITNOSE = 1     00001640
ISN 0179          IF (ABS((XYZC2(1,IB)+XYZC2(4,IB))-(XAPEX(IB)+CSTART(IB))).GE.01) 00001650
                 * ITAFT = 1                                                      00001660
ISN 0181     230  IF (NWNGP .GT. 0) II (9) = NAP                                  00001670
ISN 0183          IF (NAPX(NWING(1)) .EQ. 0) II (9) = 2                           00001680
ISN 0185          IF (II (9) .EQ. 2) NAP = 2                                      00001690
ISN 0187          IF (NFUSP .GT. 0 .AND. PDL(IB) .LT. 360.) II(12)= 2+ITNOSE+ITAFT 00001700
ISN 0189          IF (PDL (IB) .GT. 360.) II (12) = NAPX (IB)                     00001710
ISN 0191          IF (NF .GT. 0) II (5) = 1                                       00001720
ISN 0193          II (21) = NF                                                    00001730
ISN 0194          IF (NF .GT. 0) II (22) = 2                                      00001740
ISN 0196          IF (NCAN .GT. 0) II (6) = 1                                     00001750
ISN 0198          II (23) = NCAN                                                  00001760
ISN 0199          IF (NCAN .GT. 0) II (24) = 2                                    00001770
ISN 0201          IF (NP .GT. 0) II (4) = 1                                       00001780
ISN 0203          II (19) = NP                                                    00001790
ISN 0204          IF (NP .GT. 0) NPODOR = NAPX (NPPAN (1))                        00001800
ISN 0206          IF (NP .GT. 0) II (20) = NPODOR                                 00001810
ISN 0208          WRITE (L3, 480) II                                              00001820
ISN 0209          WRITE (6, 610) II                                               00001830
ISN 0210          ISREF = SREF                                                    00001840
ISN 0211          WRITE (L3, 490) ISREF                                           00001850
ISN 0212          WRITE (6, 620) ISREF                                            00001860
ISN 0213          IF (NWNGP .EQ. 0) GO TO 290                                     00001870
ISN 0215          IF (II (9) .NE. 2) GO TO 240                                    00001880
ISN 0217          XAFX (1, NWING (1)) = 0.                                        00001890
ISN 0218          XAFX (2, NWING (1)) = 100.                                      00001900
ISN 0219     240  WRITE (L3, 500) (XAFX (JJ, NWING (1)), JJ = 1, NAP)             00001910
ISN 0220          WRITE (6, 630) (XAFX (JJ, NWING (1)), JJ = 1, NAP)              00001920
ISN 0221          DO 250 I = 1, NWNGP                                             00001930
ISN 0222          IW = NWING (I)                                                  00001940
ISN 0223          WRITE (6, 640) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW)  00001950
ISN 0224     250  WRITE (L3, 510) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW) 00001960
ISN 0225          IWT = NWING (NWNGP)                                             00001970
ISN 0226          WRITE (L3, 510) (XYZC2 (I, IWT), I = 1, 4)                      00001980
```

```
ISN 0227          WRITE (6, 640) (XYZC2 (I, IWT), I = 1, 4)                       00001990
ISN 0228          ZERO = 0.                                                       00002000
ISN 0229          DO 270 I = 1, NWNGP                                             00002010
ISN 0230          IW = NWING (I)                                                  00002020
ISN 0231          DO 260 JJ = 1, NAP                                              00002030
ISN 0232          ZC12 (1, JJ, IW) = ZC12 (1, JJ, IW) *CSTART (IW) /100.          00002040
ISN 0233          ZC12 (2, JJ, IW) = ZC12 (2, JJ, IW) *XYZC2 (4, IW) /100.        00002050
ISN 0234     260  CONTINUE                                                        00002060
ISN 0235          WRITE (L3, 520) (ZC12 (1, JJ, IW), JJ = 1, NAP)                 00002070
ISN 0236          WRITE (6, 650) (ZC12 (1, JJ, IW), JJ = 1, NAP)                  00002080
ISN 0237     270  CONTINUE                                                        00002090
ISN 0238          WRITE (L3, 520) (ZC12 (2, JJ, IW), JJ = 1, NAP)                 00002100
ISN 0239          WRITE (6, 650) (ZC12 (2, JJ, IW), JJ = 1, NAP)                  00002110
ISN 0240          NWNGP1 = NWNGP + 1                                              00002120
ISN 0241          DO 280 I = 1, NWNGP1                                            00002130
ISN 0242          WRITE (6, 660) (ZERO, JJ = 1, NAP)                              00002140
ISN 0243          WRITE (L3, 530) (ZERO, JJ = 1, NAP)                             00002150
ISN 0244     280  CONTINUE                                                        00002160
            C                                                                     00002170
            C  GETTING THE X VALUES FOR THE FUSELAGE                              00002180
            C                                                                     00002190
ISN 0245     290  NFORX = II (12)                                                 00002200
ISN 0246          IF (NFUSP  .EQ. 0) GO TO 370                                    00002210
ISN 0248          IB = NFUSE (1)                                                  00002220
ISN 0249          IF (PDL (IB) .GT. 360.) GO TO 330                               00002230
ISN 0251          XFUS (1) = XAPEX (IB)                                           00002240
ISN 0252          IF (ITNOSE .GT. 0) XFUS (2) = XYZC2 (1, IB)                     00002250
ISN 0254          XFEND = XYZC2 (1, IB) + XYZC2 (4, IB)                           00002260
ISN 0255          IF (ITNOSE .GT. 0 .AND. ITAFT .GT. 0) XFUS (3) = XFEND          00002270
ISN 0257          IF (ITNOSE .EQ. 0 .AND. ITAFT .GT. 0) XFUS (2) = XFEND          00002280
ISN 0259          XFUS (NFORX) = XAPEX (IB) + CSTART (IB)                         00002290
ISN 0260          NWDS = NFORX                                                    00002300
ISN 0261          IF (NFORX .LT. 6) NWDS = 6                                      00002310
ISN 0263          WRITE (L3, 540) (XFUS (JJ), JJ = 1, NWDS)                       00002320
ISN 0264          WRITE (6, 670) (XFUS (JJ), JJ = 1, NWDS)                        00002330
            C                                                                     00002340
            C  GETTING THE Y & Z VALUES FOR THE FUSELAGE                          00002350
            C                                                                     00002360
ISN 0265          YFUS (1, 1) = YAPEX (IB)                                        00002370
ISN 0266          YFUS (1, 2) = XYZC2 (2, IB)                                     00002380
ISN 0267          IF (ITNOSE .GT. 0) YFUS (1, 2) = YAPEX (IB)                     00002390
ISN 0269          YFUS (1, 3) = YAPEX (IB)                                        00002400
ISN 0270          ZFUS (1, 1) = ZAPEX (IB)                                        00002410
ISN 0271          ZFUS (1, 2) = XYZC2 (3, IB)                                     00002420
ISN 0272          IF (ITNOSE .GT. 0) ZFUS (1, 2) = ZAPEX (IB)                     00002430
ISN 0274          ZFUS (1, 3) = ZAPEX (IB)                                        00002440
ISN 0275          IF (ITNOSE .EQ. 0) GO TO 300                                    00002450
ISN 0277          YFUS (2, 1) = YAPEX (IB)                                        00002460
ISN 0278          YFUS (2, 2) = XYZC2 (2, IB)                                     00002470
ISN 0279          YFUS (2, 3) = YAPEX (IB)                                        00002480
ISN 0280          ZFUS (2, 1) = ZAPEX (IB)                                        00002490
ISN 0281          ZFUS (2, 2) = XYZC2 (3, IB)                                     00002500
ISN 0282          ZFUS (2, 3) = ZAPEX (IB)                                        00002510
```

```
ISN 0283      300  IF (ITAFT .EQ. 0) GO TO 310                                        00002520
ISN 0285           YFUS (3, 1) = YAPEX (IB)                                           00002530
ISN 0286           YFUS (3, 2) = XYZC2 (2, IB)                                        00002540
ISN 0287           YFUS (3, 3) = YAPEX (IB)                                           00002550
ISN 0288           ZFUS (3, 1) = ZAPEX (IB)                                           00002560
ISN 0289           ZFUS (3, 2) = XYZC2 (3, IB)                                        00002570
ISN 0290           ZFUS (3, 3) = ZAPEX (IB)                                           00002580
ISN 0291      310  CONTINUE                                                           00002590
ISN 0292           YFUS (NFORX, 1) = YAPEX (IB)                                       00002600
ISN 0293           YFUS (NFORX, 2) = XYZC2 (2, IB)                                    00002610
ISN 0294           IF (ITAFT .GT. 0) YFUS (NFORX, 2) = YAPEX (IB)                     00002620
ISN 0296           YFUS (NFORX, 3) = YAPEX (IB)                                       00002630
ISN 0297           ZFUS (NFORX, 1) = ZAPEX (IB)                                       00002640
ISN 0298           ZFUS (NFORX, 2) = XYZC2 (3, IB)                                    00002650
ISN 0299           IF (ITAFT .GT. 0) ZFUS (NFORX, 2) = ZAPEX (IB)                     00002660
ISN 0301           ZFUS (NFORX, 3) = ZAPEX (IB)                                       00002670
ISN 0302           DO 320 I = 1, NFORX                                                00002680
ISN 0303           NRADX = II (11)                                                    00002690
ISN 0304           NWDS = NRADX                                                       00002700
ISN 0305           IF (NRADX  .LT. 10) NWDS = 10                                      00002710
ISN 0307           WRITE (L3, 560) (YFUS (I, JJ), JJ = 1, NWDS)                       00002720
ISN 0308           WRITE (6, 690) (YFUS (I, JJ), JJ = 1, NWDS)                        00002730
ISN 0309           WRITE (L3, 570) (ZFUS (I, JJ), JJ = 1, NWDS)                       00002740
ISN 0310           WRITE (6, 700) (ZFUS (I, JJ), JJ = 1, NWDS)                        00002750
ISN 0311      320  CONTINUE                                                           00002760
ISN 0312           GO TO 370                                                          00002770
             C                                                                        00002780
             C   TREATMENT OF CURVED PANEL FUSELAGE                                   00002790
             C   GETTING X VALUES OF FUSELAGE                                         00002800
             C                                                                        00002810
ISN 0313      330  NXFUS = II (12)                                                    00002820
ISN 0314           DO 340 JJ = 1, NXFUS                                               00002830
ISN 0315           XFUS (JJ) =XAPEX(NFUSE(1))+ XAFX (JJ, IB) *CSTART (IB) /100.       00002840
ISN 0316      340  CONTINUE                                                           00002850
ISN 0317           WRITE (L3, 550) (XFUS (JJ), JJ = 1, NXFUS)                         00002860
ISN 0318           WRITE (6, 680) (XFUS (JJ), JJ = 1, NXFUS)                          00002870
             C                                                                        00002880
             C   GETTING THE FUSELAGE CAMBER LINE                                     00002890
             C                                                                        00002900
ISN 0319           ZRATIO = 0.                                                        00002910
ISN 0320           IF (NPP (IB) .GT. 0) ZRATIO = 1.0                                  00002920
ISN 0322           DO 350 JJ = 1, NXFUS                                               00002930
ISN 0323           ZFUSS (JJ) = ZC12 (1, JJ, IB) *ZRATIO *CSTART (IB) /100.           00002940
ISN 0324      350  CONTINUE                                                           00002950
ISN 0325           WRITE (L3, 900) (ZFUSS (JJ), JJ = 1, NXFUS)                        00002960
ISN 0326           WRITE (6, 910) (ZFUSS (JJ), JJ = 1, NXFUS)                         00002970
             C                                                                        00002980
             C   GETTING THE FUSELAGE CROSS-SECTIONAL AREAS, AFUS                     00002990
             C   EACH VORLAX CROSS SECTION IS ASSUMED HAVE A CONSTANT RADIUS          00003000
             C                                                                        00003010
ISN 0327           DO 360  JJ = 1, NXFUS                                              00003020
ISN 0328           IF (NPP (IB) .GT. 0) ARATIO = ZC12 (2, JJ, IB) /100.               00003030
ISN 0330           IF (NPP (IB) .EQ. 0) ARATIO = 1.                                   00003040
```

```
ISN 0332          AFUS (JJ) = ARATIO *PI *RHO (IB) **2                         00003050
ISN 0333     360  CONTINUE                                                     00003060
ISN 0334          WRITE (L3, 920) (AFUS (JJ), JJ = 1, NXFUS)                   00003070
ISN 0335          WRITE (6, 930) (AFUS (JJ), JJ = 1, NXFUS)                    00003080
             C                                                                 00003090
             C    SETTING UP FOR NACELLES                                      00003100
             C                                                                 00003110
ISN 0336     370  IF (II (19) .EQ. 0) GO TO 410                                00003120
ISN 0338          DO 400 JK = 1, NP                                            00003130
ISN 0339          NW = NPPAN (JK)                                              00003140
ISN 0340          PODORG (1) = XAPEX (NW)                                      00003150
ISN 0341          PODORG (2) = YAPEX (NW)                                      00003160
ISN 0342          PODORG (3) = ZAPEX (NW) - RHO (NW) *COS (DTR*PHEE (NW))      00003170
ISN 0343          WRITE (L3, 840) ((PODORG (KL), KL = 1, 3) , JK)              00003180
ISN 0344          WRITE (6, 850) ((PODORG (KL), KL = 1, 3), JK)                00003190
ISN 0345          DO 380 KK = 1, 10                                            00003200
ISN 0346          XPOD (JK, KK) = 0.                                           00003210
ISN 0347          IF (KK .GT. NPODOR) GO TO 380                                00003220
ISN 0349          XPOD (JK, KK) = XAFX (KK, NW) *CSTART (NW) /100.             00003230
ISN 0350     380  CONTINUE                                                     00003240
ISN 0351          WRITE (L3, 860) (XPOD (JK, KK), KK = 1, 10) , JK             00003250
ISN 0352          WRITE (6, 870) (XPOD (JK, KK) , KK = 1, 10) , JK             00003260
ISN 0353          DO 390 KK = 1, 10                                            00003270
ISN 0354          PODORD (JK, KK)  = 0.                                        00003280
ISN 0355          IF (KK  .GT. NPODOR) GO TO 390                               00003290
ISN 0357          PODORD (JK, KK) = ZC12 (2, KK, NW)                           00003300
ISN 0358          IF (NPP(NW).NE.0) PODORD(JK, KK)=SQRT(ZC12(2,KK,NW)/100.)*RHO(NW) 00003310
ISN 0360     390  CONTINUE                                                     00003320
ISN 0361          WRITE (L3, 880) (PODORD (JK, KK), KK = 1, 10), JK            00003330
ISN 0362          WRITE (6, 890) (PODORD (JK, KK), KK = 1, 10), JK             00003340
ISN 0363     400  CONTINUE                                                     00003350
             C                                                                 00003360
             C SETTING UP FOR FINS                                             00003370
             C                                                                 00003380
ISN 0364     410  IF (NF .EQ. 0) GO TO 440                                     00003390
ISN 0366          DO 420 NN = 1, NF                                            00003400
ISN 0367          IB = NFPAN (NN)                                              00003410
ISN 0368          ABCD (NN, 1, 1) = XAPEX (IB)                                 00003420
ISN 0369          ABCD (NN, 1, 2) = YAPEX (IB)                                 00003430
ISN 0370          ABCD (NN, 1, 3) = ZAPEX (IB)                                 00003440
ISN 0371          ABCD (NN, 1, 4) = CSTART (IB)                                00003450
ISN 0372          ABCD (NN, 2, 1) = XYZC2 (1, IB)                              00003460
ISN 0373          ABCD (NN, 2, 2) = XYZC2 (2, IB)                              00003470
ISN 0374          ABCD (NN, 2, 3) = XYZC2 (3, IB)                              00003480
ISN 0375          ABCD (NN, 2, 4) = XYZC2 (4, IB)                              00003490
ISN 0376     420  CONTINUE                                                     00003500
ISN 0377          XFIN (1) = 0.                                                00003510
ISN 0378          XFIN (2) = 100.                                              00003520
ISN 0379          FINORD (1) = 0.                                              00003530
ISN 0380          FINORD (2) = 0.                                              00003540
ISN 0381          DO 430 NN = 1, NF                                            00003550
ISN 0382          WRITE (6, 710) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)       00003560
ISN 0383          WRITE (L3, 580) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)      00003570
```

```
ISN 0384          WRITE (L3, 590) (XFIN (I), I = 1, 2)                                00003580
ISN 0385          WRITE (6, 720) (XFIN (I), I = 1, 2)                                 00003590
ISN 0386          WRITE (L3, 600) (FINORD (I), I = 1, 2)                              00003600
ISN 0387          WRITE (6, 730) (FINORD (I), I = 1, 2)                               00003610
ISN 0388     430  CONTINUE                                                            00003620
            C                                                                         00003630
            C SETTING UP FOR CANARDS                                                  00003640
            C                                                                         00003650
ISN 0389     440  IF (NCAN .EQ. 0) GO TO 470                                          00003660
ISN 0391          DO 450 NN = 1, NCAN                                                 00003670
ISN 0392          IB = NCANP (NN)                                                     00003680
ISN 0393          ABCD (NN, 1, 1) = XYZC1 (1, IB)                                     00003690
ISN 0394          ABCD (NN, 1, 2) = XYZC1 (2, IB)                                     00003700
ISN 0395          ABCD (NN, 1, 3) = XYZC1 (3, IB)                                     00003710
ISN 0396          ABCD (NN, 1, 4) = XYZC1 (4, IB)                                     00003720
ISN 0397          ABCD (NN, 2, 1) = XYZC2 (1, IB)                                     00003730
ISN 0398          ABCD (NN, 2, 2) = XYZC2 (2, IB)                                     00003740
ISN 0399          ABCD (NN, 2, 3) = XYZC2 (3, IB)                                     00003750
ISN 0400          ABCD (NN, 2, 4) = XYZC2 (4, IB)                                     00003760
ISN 0401     450  CONTINUE                                                            00003770
ISN 0402          XCAN (1) = 0.                                                       00003780
ISN 0403          XCAN (2) = 100.                                                     00003790
ISN 0404          CANORD (1) = 0.                                                     00003800
ISN 0405          CANORD (2) = 0.                                                     00003810
ISN 0406          DO 460 NN = 1, NCAN                                                 00003820
ISN 0407          WRITE (6, 750) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)              00003830
ISN 0408          WRITE (L3, 740) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)             00003840
ISN 0409          WRITE (L3, 760) (XCAN (I), I = 1, 2)                                00003850
ISN 0410          WRITE (6, 770) (XCAN (I), I = 1, 2)                                 00003860
ISN 0411          WRITE (L3, 780) (CANORD (I), I = 1, 2)                              00003870
ISN 0412          WRITE (6, 790) (CANORD (I), I = 1, 2)                               00003880
ISN 0413     460  CONTINUE                                                            00003890
ISN 0414     470  WRITE (L3, 800) (PLOTSZ)                                            00003900
ISN 0415          WRITE (6, 810) (PLOTSZ)                                             00003910
ISN 0416          PISOSZ = PLOTSZ *1.2247                                             00003920
ISN 0417          WRITE (L3, 820) (PISOSZ)                                            00003930
ISN 0418          WRITE (6, 830) (PISOSZ)                                             00003940
ISN 0419     480  FORMAT (24I3)                                                       00003950
ISN 0420     490  FORMAT (I7, 65X, 4HREFA)                                            00003960
ISN 0421     500  FORMAT (10F7.2,5H  XAF)                                             00003970
ISN 0422     510  FORMAT (4F7.2, 42X, 6H  WORG)                                       00003980
ISN 0423     520  FORMAT (10F7.2, 7H  TZORD)                                          00003990
ISN 0424     530  FORMAT (10F7.3, 6H  WORD)                                           00004000
ISN 0425     540  FORMAT (6F7.2, 28X, 6H  XFUS)                                       00004010
ISN 0426     550  FORMAT(10F7.2, 6H  XFUS)                                            00004020
ISN 0427     560  FORMAT (10F7.2, 6H  YFUS)                                           00004030
ISN 0428     570  FORMAT (10F7.2, 6H  ZFUS)                                           00004040
ISN 0429     580  FORMAT (8F7.1, 14X, 8H  FINORG)                                     00004050
ISN 0430     590  FORMAT (2F7.1, 56X, 6H  XFIN)                                       00004060
ISN 0431     600  FORMAT (2F7.1, 56X, 8H  FINORD)                                     00004070
ISN 0432     610  FORMAT (1H , 24I3)                                                  00004080
ISN 0433     620  FORMAT (1H , I7, 65X, 4HREFA)                                       00004090
ISN 0434     630  FORMAT (1H , 10F7.2, 5H  XAF)                                       00004100
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ISN 0435        640  FORMAT (1H , 4F7.2, 42X, 6H  WORG)                                        00004110
ISN 0436        650  FORMAT (1H , 10F7.2, 7H  TZORD)                                           00004120
ISN 0437        660  FORMAT (1H , 10F7.3, 6H  WORD)                                            00004130
ISN 0438        670  FORMAT (1H , 6F7.2, 28X, 6H  XFUS)                                        00004140
ISN 0439        680  FORMAT (1H , 10F7.2, 6H  XFUS)                                            00004150
ISN 0440        690  FORMAT (1H , 10F7.2, 6H  YFUS)                                            00004160
ISN 0441        700  FORMAT (1H , 10F7.2, 6H  ZFUS)                                            00004170
ISN 0442        710  FORMAT (1H , 8F7.1, 14X, 8H  FINORG)                                      00004180
ISN 0443        720  FORMAT (1H , 2F7.1, 56X, 6H  XFIN)                                        00004190
ISN 0444        730  FORMAT (1H , 2F7.1, 56X, 8H  FINORD)                                      00004200
ISN 0445        740  FORMAT (8F7.1, 14X, 8H  CANORG)                                           00004210
ISN 0446        750  FORMAT (1H , 8F7.1, 14X, 8H  CANORG)                                      00004220
ISN 0447        760  FORMAT (2F7.1, 56X, 6H  XCAN)                                             00004230
ISN 0448        770  FORMAT (1H , 2F7.1, 56X, 6H  XCAN)                                        00004240
ISN 0449        780  FORMAT (2F7.1, 56X, 8H  CANORD)                                           00004250
ISN 0450        790  FORMAT (1H , 2F7.1, 56X, 8H  CANORD)                                      00004260
ISN 0451        800  FORMAT (3HX Y, 44X, F5.2, 3HORT)                                          00004270
ISN 0452        810  FORMAT (1H , 3HX Y, 44X, F5.2, 3HORT)                                     00004280
ISN 0453        820  FORMAT (3HX Z, 44X, F5.2, 7HORTISO1, 12X,1H1)                             00004290
ISN 0454        830  FORMAT (1H ,3HX Z,4X,'26.62-24.139.23',25X, F5.2, 3HORT, 16X,1H1 )00004300
ISN 0455        840  FORMAT (3F7.2, 51X, 6HPODORG, I2)                                         00004310
ISN 0456        850  FORMAT (1H , 3F7.2, 51X, 6HPODORG, I2)                                    00004320
ISN 0457        860  FORMAT (10F7.2, 2X, 6HXPOD  , I2)                                         00004330
ISN 0458        870  FORMAT (1H , 10F7.2, 2X, 6HXPOD  , I2)                                    00004340
ISN 0459        880  FORMAT (10F7.2, 2X, 6HPODORD, I2)                                         00004350
ISN 0460        890  FORMAT (1H , 10F7.2, 2X, 6HPODORD, I2)                                    00004360
ISN 0461        900  FORMAT (10F7.2, 6H  ZFUS)                                                 00004370
ISN 0462        910  FORMAT (1H ,10F7.2, 6H  ZFUS)                                             00004380
ISN 0463        920  FORMAT (10F7.1, 6H  AFUS)                                                 00004390
ISN 0464        930  FORMAT (1H ,10F7.1, 6H  AFUS)                                             00004400
ISN 0465             GO TO 30                                                                  00004410
ISN 0466        940  STOP                                                                      00004420
ISN 0467             END                                                                       00004430
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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*****              PAGE 010

SYMBOL  INTERNAL STATEMENT NUMBERS
I       0018 0019 0020 0021 0022 0023 0023 0026 0028 0029 0030 0031 0033 0036 0038 0041 0056 0056 0056
        0059 0059 0059 0075 0078 0079 0080 0081 0082 0082 0082 0082 0083 0084 0084 0086 0086 0090 0092
        0093 0094 0095 0098 0102 0104 0106 0112 0114 0115 0116 0116 0116 0116 0116 0117 0119 0120 0126
        0127 0131 0136 0144 0145 0149 0149 0149 0153 0154 0221 0222 0226 0226 0226 0227 0227 0227 0229
        0230 0241 0302 0307 0308 0309 0310 0382 0382 0382 0383 0383 0383 0384 0384 0384 0385 0385 0385
        0386 0386 0386 0387 0387 0387 0407 0407 0407 0408 0408 0408 0409 0409 0409 0410 0410 0410 0411
        0411 0411 0412 0412 0412
J       0027 0030 0031 0034 0036 0039 0041 0107 0108 0382 0382 0382 0383 0383 0383 0407 0407 0407 0408
        0408 0408
K       0035 0036 0040 0041 0123 0123 0123 0124 0124 0124
C1      0007 0123
C2      0007 0124
IB      0170 0171 0173 0173 0177 0177 0179 0179 0179 0179 0187 0189 0189 0248 0249 0251 0252 0254 0254
        0259 0259 0265 0266 0267 0269 0270 0271 0272 0274 0277 0278 0279 0280 0281 0282 0285 0286 0287
        0288 0289 0290 0292 0293 0294 0296 0297 0298 0299 0301 0315 0315 0320 0323 0323 0328 0328 0330
        0332 0367 0368 0369 0370 0371 0372 0373 0374 0375 0392 0393 0394 0395 0396 0397 0398 0399 0400
II      0002 0154 0156 0157 0161 0163 0165 0167 0171 0173 0181 0183 0185 0187 0189 0191 0193 0194 0196
        0198 0199 0201 0203 0206 0208 0209 0215 0245 0303 0313 0336
IW      0222 0223 0223 0223 0223 0224 0224 0224 0224 0230 0232 0232 0232 0233 0233 0233 0235 0236 0238
        0239
JJ      0113 0113 0113 0113 0134 0134 0134 0135 0136 0136 0139 0139 0139 0142 0142 0142 0143 0144 0144
        0145 0145 0219 0219 0219 0220 0220 0220 0231 0232 0232 0233 0233 0235 0235 0235 0236 0236 0236
        0238 0238 0238 0239 0239 0239 0242 0242 0243 0243 0263 0263 0263 0264 0264 0264 0307 0307 0307
        0308 0308 0308 0309 0309 0309 0310 0310 0310 0314 0315 0315 0317 0317 0317 0318 0318 0318 0322
        0323 0323 0325 0325 0325 0326 0326 0326 0327 0328 0332 0334 0334 0334 0335 0335 0335
JK      0338 0339 0343 0344 0346 0349 0351 0351 0352 0352 0354 0357 0358 0361 0361 0362 0362
KK      0345 0346 0347 0349 0349 0351 0351 0351 0352 0352 0352 0353 0354 0355 0357 0357 0358 0358 0361
        0361 0361 0362 0362 0362
KL      0343 0343 0343 0344 0344 0344
L3      0017 0053 0208 0211 0219 0224 0226 0235 0238 0243 0263 0307 0309 0317 0325 0334 0343 0351 0361
        0383 0384 0386 0408 0409 0411 0414 0417
NF      0003 0044 0191 0193 0194 0364 0366 0381
NN      0366 0367 0368 0369 0370 0371 0372 0373 0374 0375 0381 0382 0383 0391 0392 0393 0394 0395 0396
        0397 0398 0399 0400 0406 0407 0408
NP      0003 0047 0201 0203 0204 0206 0338
NV      0102 0111
NW      0339 0340 0341 0342 0342 0342 0349 0349 0357 0358 0358 0358
PI      0016 0332
RO      0007 0113 0115
XS      0007 0149
X1      0076 0092
X2      0077 0078
Y1      0076 0093 0096
Y2      0077 0079 0096
Z1      0076 0094 0097
Z2      0077 0080 0097
ABS     0177 0179
COS     0342
CTR     0049 0098 0342
MAG     0054
ILE     0131 0137 0140
INV     0108 0109
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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
        0243
NPP     0002  0116  0320  0328  0330  0358
NXS     0147  0149  0149  0151
NYS     0147
NZS     0147
PDL     0010  0083  0084  0090  0098  0163  0171  0173  0187  0189  0249
PHI     0007  0113  0114
PSI     0060  0061
RHO     0002  0115  0332  0342  0358
SPC     0014  0082
XAF     0006  0134  0136
ZC1     0006  0139  0144
ZC2     0006  0142  0145
ABCD    0002  0036  0368  0369  0370  0371  0372  0373  0374  0375  0382  0383  0393  0394  0395  0396  0397  0398  0399
        0400  0407  0408
AFUS    0006  0029  0332  0334  0335
CBAR    0069
CURV    0007  0082  0084  0086  0086
IBOT    0103  0109  0109  0111
ITOP    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
PNCV    0011  0082  0120
SLE1    0014  0126
SLE2    0014  0127
SQRT    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
XPOD    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
YNOT    0151
```

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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
ZBAR    0069
ZC12    0002  0041  0144  0145  0232  0232  0233  0233  0235  0236  0238  0239  0323  0328  0357  0358
ZERO    0228  0242  0243
ZFUS    0002  0031  0270  0271  0272  0274  0280  0281  0282  0288  0289  0290  0297  0298  0299  0301  0309  0310
ZNOT    0151
AINC1   0009  0116
AINC2   0009  0116
ALPHA   0007  0059
ATAN2   0098
CORD1   0076  0095
CORD2   0077  0081
INPUT   0003  0051
ISOLV   0054
ISREF   0210  0211  0212
ISYNT   0116  0119  0121
ITAFT   0176  0179  0187  0255  0257  0283  0294  0299
JJTCP   0112  0113
LESWP   0008  0010
NCANP   0002  0003  0392
NFORX   0245  0259  0260  0261  0292  0293  0294  0296  0297  0298  0299  0301  0302
NFPAN   0002  0003  0367
NFUSE   0002  0003  0163  0170  0248  0315
NFUSP   0003  0046  0161  0168  0187  0246
NMACH   0056  0056
NPPAN   0002  0003  0048  0204  0339
NRADX   0303  0304  0305
NWING   0002  0003  0159  0183  0217  0218  0219  0220  0222  0225  0230
NWNGP   0003  0043  0157  0159  0165  0165  0181  0213  0221  0225  0229  0240
NXFUS   0313  0314  0317  0318  0322  0325  0326  0327  0334  0335
PSPAN   0012
ROLLO   0060  0063
SYNTH   0010  0119
TAPER   0012
TITLE   0007  0052  0053  0058
WSPAN   0069  0071  0071
XAPEX   0010  0092  0177  0179  0223  0224  0251  0259  0315  0340  0368  0393
XFEND   0254  0255  0257
XYZC2   0002  0078  0079  0080  0081  0177  0179  0179  0226  0227  0233  0252  0254  0254  0266  0271  0278  0281  0286
        0289  0293  0298  0372  0373  0374  0375  0397  0398  0399  0400
YAPEX   0010  0093  0223  0224  0265  0267  0269  0277  0279  0285  0287  0292  0294  0296  0341  0369  0394
ZAPEX   0010  0094  0223  0224  0270  0272  0274  0280  0282  0288  0290  0297  0299  0301  0342  0370  0395
ZFUSS   0006  0323  0325  0326
ARATIO  0328  0330  0332
CANORD  0002  0022  0404  0405  0411  0412
CSTART  0012  0095  0179  0223  0224  0232  0259  0315  0323  0349  0371  0396
DELTAY  0096  0098  0151
DELTAZ  0097  0098  0151
DESCRP  0007  0076  0077  0082
FINORD  0002  0020  0379  0380  0386  0387
FLOATX  0054
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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
FLOATY  0054
INTRAC  0089  0090  0098  0100  0131
INVERS  0074  0125
IQUANT  0010  0116
ITNOSE  0175  0177  0187  0252  0255  0257  0267  0272  0275
ITRMAX  0054
LATRAL  0060  0061  0063  0065
LSTDT8  0015
NALPHA  0059  0059
NPCDOR  0204  0206  0347  0355
NWNGP1  0240  0241
PISOSZ  0416  0417  0418
PITCHQ  0060
PLOTSZ  0003  0050  0414  0415  0416
PCDORD  0002  0354  0357  0358  0361  0362
PCDORG  0002  0340  0341  0342  0343  0344
REXPAR  0054
ZRATIO  0319  0320  0323
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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*****
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
```

```
*****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
 530    0424      0243
 540    0425      0263
 550    0426      0317
 560    0427      0307
 570    0428      0309
 580    0429      0383
 590    0430      0384
 600    0431      0386
 610    0432      0209
 620    0433      0212
 630    0434      0220
 640    0435      0223  0227
 650    0436      0236  0239
 660    0437      0242
 670    0438      0264
 680    0439      0318
 690    0440      0308
 700    0441      0310
 710    0442      0382
 720    0443      0385
 730    0444      0387
 740    0445      0408
 750    0446      0407
 760    0447      0409
 770    0448      0410
 780    0449      0411
 790    0450      0412
 800    0451      0414
 810    0452      0415
 820    0453      0417
 830    0454      0418
 840    0455      0343
 850    0456      0344
 860    0457      0351
 870    0458      0352
 880    0459      0361
 890    0460      0362
 900    0461      0325
 910    0462      0326
 920    0463      0334
 930    0464      0335
 940    0466      0051
```

```
                                        /   MAIN /    SIZE OF PROGRAM 007FA8 HEXADECIMAL BYTES PAGE 016

 NAME    TAG    TYPE  ADD.       NAME    TAG    TYPE  ADD.       NAME    TAG    TYPE  ADD.       NAME    TAG    TYPE  ADD.
     I SF       I*4  0004E0          J SF       I*4  0004E4          K SF       I*4  0004E8         C1 S        R*4  000634
    C2 S        R*4  000694         IB SFA      I*4  0004EC         II SF       I*4  0006D4         IW SF       I*4  0004F0
    JJ SF       I*4  0004F4         JK SF       I*4  0004F8         KK SFA      I*4  0004FC         KL  F       I*4  000500
    L3 SF       I*4  000504         NF SF       I*4  000508         NN SF       I*4  00050C         NP SF       I*4  000510
    NV SF       I*4  000514         NW SFA      I*4  000518         PI SF       R*4  00051C         RO SF       R*4  000734
    XS S        R*4  000800         X1 SF       R*4  000520         X2 SF       R*4  000524         Y1 SF       R*4  000528
    Y2 SF       R*4  00052C         Z1 SF       R*4  000530         Z2 SF       R*4  000534        DTR SFA      R*4  000538
   HAG S        R*4  00053C        ILE S        I*4  000540        INV SF       I*4  000544        ITS SF    C  I*4  000050
   IWT SF       I*4  000548        LAX S        I*4  00054C        LAY S        I*4  000550        MAX SF       I*4  000554
   NAP SF       I*4  000558        NPP S        I*4  000850        NXS SF       I*4  00055C        NYS S        I*4  000560
   NZS S        I*4  000564        PDL S     C  R*4  0001E0        PHI SF       R*4  0008A0        PSI S        R*4  000568
   RHO SF       R*4  00096C        SPC S     C  R*4  0000A0        XAF SF       R*4  00098C        ZC1 SF       R*4  000A84
   ZC2 SF       R*4  000B4C       ABCD SF       R*4  000C14       AFUS SF       R*4  000CD4       CBAR S        R*4  00056C
  CURV S        R*4  000D4C       IBOT SF       I*4  000570       ITOP SF       I*4  000574       MACH S     C  R*4  000000
  NAPX SF       I*4  000DEC       NCAN SF       I*4  000578       NPAN SF       I*4  00057C       NVOR SF    C  R*4  0001E0
  NWDS SF       I*4  000580       PHEE SFA      R*4  000E8C       RLE1 S        R*4  000584       RLE2 S        R*4  000588
  RNCV SF    C  R*4  000000       SLE1 S     C  R*4  000000       SLE2 S     C  R*4  000050       SREF SF       R*4  00058C
  VINF S        R*4  000590       XAFX SF       R*4  000EDC       XBAR S        R*4  000594       XCAN SF       R*4  00219C
  XFIN SF       R*4  0021C4       XFUS SF       R*4  0021EC       XPOD SF       R*4  002264       YAWQ S        R*4  000598
  YFUS SF       R*4  0023CC       YNOT S        R*4  00059C       ZBAR S        R*4  0005A0       ZC12 SFA      R*4  00269C
  ZERO SF       R*4  0005A4       ZFUS SF       R*4  004C1C       ZNOT S        R*4  0005A8      AINC1 S     C  R*4  000000
 AINC2 S     C  R*4  000050      ALPHA S        R*4  004EEC      CORD1 SF       R*4  0005AC      CORD2 SF       R*4  0005B0
 INPUT  F            000001      ISOLV S        I*4  0005B4      ISREF SF       I*4  0005B8      ISYNT SF       I*4  0005BC
 ITAFT SF       I*4  0005C0      JJTOP SF       I*4  0005C4      LESWP       C  R*4    N.R.      NCANP  F       I*4  004F0C
 NFORX SF       I*4  0005C8      NFPAN  F       I*4  004F14      NFUSE  F       I*4  004F2C      NFUSP S        I*4  0005CC
 NMACH SF       I*4  0005D0      NPPAN SF       I*4  004F44      NRADX SF       I*4  0005D4      NWING  F       I*4  004F68
 NWNGP SF       I*4  0005D8      NXFUS SF       I*4  0005DC      PSPAN       C  R*4    N.R.      ROLLQ S        R*4  0005E0
 SYNTH S     C  R*4  000320      TAPER       C  R*4    N.R.      TITLE SF       R*4  004F88      WSPAN S        R*4  0005E4
 XAPEX SFA   C  R*4  000000      XFEND SF       R*4  0005E8      XYZC2 SFA      R*4  005008      YAPEX SF    C  R*4  0000A0
 ZAPEX SF    C  R*4  000140      ZFUSS SF       R*4  005288       SQRT      XF  R*4  000000        COS      XF  R*4  000000
 ATAN2      XF  R*4  000000     ARATIO SF       R*4  0005EC     CANORD SF       R*4  005300     CSTART SFA   C  R*4  000000
DELTAY SFA      R*4  0005F0     DELTAZ SFA      R*4  0005F4     DESCRP S        R*4  005328     FINORD SF       R*4  005350
FLOATX S        R*4  0005F8     FLOATY S        R*4  0005FC     FRONL#  F   XF  I*4  000000     IBCOM#  F   XF  R*4  000000
INTRAC SF       I*4  000600     INVERS S        I*4  000604     IQUANT S     C  I*4  0003C0     ITNOSE SF       I*4  000608
ITRMAX S        I*4  00060C     LATRAL S        I*4  000610     LSTDT8 SF   XF  I*4  000000     NALPHA SF       I*4  000614
NPODOR SF       I*4  000618     NWNGP1 SF       I*4  00061C     PISOSZ SF       R*4  000620     PITCHQ S        R*4  000624
PLOTSZ SF       R*4  000628     PODORD SF       R*4  005378     PODORG SF       R*4  0054E0     REXPAR S        R*4  00062C
ZRATIO SF       R*4  000630

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

  NAME OF COMMON BLOCK  *  SET4*    SIZE OF BLOCK     0000A0 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
    AINC1    R*4   000000         AINC2    R*4   000050

  NAME OF COMMON BLOCK  *  SET5*    SIZE OF BLOCK     000460 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
```

```
  XAPEX     R*4    000000          YAPEX     R*4    0000A0          ZAPEX     R*4    000140          POL      R*4    0001E0
  LESWP     R*4      N.R.          SYNTH     R*4    000320          IQUANT    I*4    0003C0

 NAME OF COMMON BLOCK  *  SET7*    SIZE OF BLOCK     0000A0 HEXADECIMAL BYTES

VAR. NAME   TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.
  RMCV       R*4   000000          ITS      I*4   000050

 NAME OF COMMON BLOCK  *  SET12*   SIZE OF BLOCK     000280 HEXADECIMAL BYTES

VAR. NAME   TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.
 CSTART      R*4   000000         TAPER     R*4     N.R.          PSPAN     R*4     N.R.          NVOR      R*4   0001E0

 NAME OF COMMON BLOCK  *  SET13*   SIZE OF BLOCK     000020 HEXADECIMAL BYTES

VAR. NAME   TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.
  MACH       R*4   000000

 NAME OF COMMON BLOCK  *  SET23*   SIZE OF BLOCK     000140 HEXADECIMAL BYTES

VAR. NAME   TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.
  SLE1       R*4   000000          SLE2     R*4   000050           SPC      R*4   0000A0
```

```
LABEL   ADDR          LABEL   ADDR          LABEL   ADDR          LABEL   ADDR

   30  005618            40  005698            50  005718            60  00577C
   70  0057F8           130  005D9A           140  005DAE           150  005E5C
  170  006008           180  006088           190  0061BA           200  0061F4
  220  006208           230  00647E           240  006682           250  006794
  260  006966           270  006A1A           280  006854           290  006B68
  300  006E5E           310  006EF0           320  00715E           330  007176
  340  007104           350  00720C           360  0073F2           370  007488
  380  007632           390  0077CC           400  00788E           410  0078A2
  420  007982           430  0078B4           440  0078C8           450  007CA8
  460  007ED8           470  007EEC           940  007F6C
```

LOCKHEED PROPRIETARY DATA

THIS DATA CONTAINS INFORMATION AND/OR DESIGNS WHICH ARE THE PROPERTY OF 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.

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 ******
```

```
LEVEL 21.8 ( JUN 74 )                    OS/360  FORTRAN H                              DATE  77.061/21.16.12
```

LOCKHEED PROPRIETARY DATA

THIS DATA CONTAINS INFORMATION AND/OR DESIGNS WHICH ARE THE PROPERTY OF 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.

LOCKHEED PROPRIETARY DATA

```
      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                        SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002            SUBROUTINE LSTDT8                                                00004440
              C                                                                      00004450
ISN 0003            DIMENSION A (20)                                                 00004460
ISN 0004            WRITE (6, 40)                                                    00004470
ISN 0005         10 I = 0                                                            00004480
ISN 0006         20 READ (5, 50,END=30) A                                            00004490
ISN 0007            WRITE (6, 80) A                                                  00004510
ISN 0008            I = I + 1                                                        00004520
ISN 0009            IF (I .NE. 44) GO TO 20                                          00004530
ISN 0011            WRITE (6, 60)                                                    00004540
ISN 0012            GO TO 10                                                         00004550
ISN 0013         30 REWIND 5                                                         00004560
ISN 0014            WRITE (6, 70)                                                    00004570
ISN 0015            RETURN                                                           00004580
ISN 0016         40 FORMAT (1H1, 26HINPUT DATA LISTING FOLLOWS /1H )                 00004590
ISN 0017         50 FORMAT (20A4)                                                    00004600
ISN 0018         60 FORMAT (1H1)                                                     00004610
ISN 0019         70 FORMAT (1H0, 17HINPUT DATA LISTED)                               00004620
ISN 0020         80 FORMAT (1H , 20A4)                                               00004630
ISN 0021            END                                                              00004640
```

```
                 *****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
A       0003  0006  0007
I       0005  0008  0008  0009
LSTDTB  0002
```

```
                    *****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   0005     0012
  20   0006     0009
  30   0013     0006
  40   0016     0004
  50   0017     0006
  60   0018     0011
  70   0019     0014
  80   0020     0007
```

```
                                          /   LSTDT8 /     SIZE OF PROGRAM 00021C HEXADECIMAL BYTES PAGE 004

     NAME     TAG   TYPE  ADD.       NAME     TAG   TYPE  ADD.       NAME    TAG   TYPE  ADD.       NAME     TAG   TYPE  ADD.
        A SF        R*4   0000E4         I SF       I*4   0000DC     IBCOM#  F  XF  I*4   000000     LSTDT8         I*4   0000E0
```

```
  LABEL    ADDR               LABEL    ADDR               LABEL    ADDR               LABEL    ADDR             PAGE 005
     10  000168                  20  00016C                  30  0001D8
```

```
*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 ******                                    93K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
```

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

                                                             MODULE MAP

 CONTROL SECTION                    ENTRY

   NAME      ORIGIN  LENGTH           NAME     LOCATION    NAME     LOCATION    NAME     LOCATION    NAME     LOCATION

MAIN              00    7FA8
LSTDT8          7FA8     21C
IHCSATN2*       81C8     1C8
                                    ATAN2       81C8        ATAN        81DC
IHCSSCN *       8398     109
                                    COS         8398        SIN         8380
IHCNAMEL*       8578     AA7
                                    FRDNL#      8578        FWRNL#      8B60
IHCECOMH*       9020     F31
                                    IBCOM#      9020        FDIOCS#     900C        VFIOCS      9E40        INTSW       9F3E
                                    INTSWTCH    9F3E
IHCCOMH2*       9F58     56D
                                    SEQDASD     A1E0
IHCSSQRT*       A4C8     145
                                    SQRT        A4C8
IHCFCVTH*       A610    1195
                                    ADCON#      A610        FCVAOUTP    A6BA        FCVLOUTP    A74A        FCVZOUTP    A89A
                                    FCVIOUTP    AC40        FCVEOUTP    B142        FCVCOUTP    B35C        INT6SWCH    B643
IHCEFNTH*       B7A8     512
                                    ARITH#      B7A8        ADJSWTCH    BB14
IHCEFIOS*       BCC0    1390
                                    FIOCS#      BCC0        FIOCSBEP    BCC6        MULFLS      BE7C
IHCERRM *       D050     5BC
                                    ERRMON      D050        IHCERRE     D068
IHCUOPT *       D610     350
IHCETRCH*       D960     28E
                                    IHCTRCH     D960        ERRTRA      D968
IHCUATBL*       DBF0     648
SET4            E238      A0
SET5            E2D8     460
SET7            E738      A0
SET12           E7D8     280
SET13           EA58      20
SET23           EA78     140

ENTRY ADDRESS       00
TOTAL LENGTH      EBB8

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

```
INPUT DATA LISTING FOLLOWS

 &INPUT
 NWNGP=5,NWING=1,2,3,4,5, NFUSP=1, NFUSE=6,NF=2,NFPAN=9,10,
 NCAN=1,NCANP=11,NP=2,NPPAN=7,8, PLOTSZ=10.,
 &END
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
0          0         1           -0.0200    0.0       0.0       0.0   0       0
1              2.550
3               0.0      5.000    10.000
0               0.0      0.0       0.0       0.0       0.0
11         967680.00    1.0000    0.0       0.0    1290.0996
  944.0999   65.7400  -54.9600 1448.9399         WING PANEL NO. 1
 1462.5000  223.9400  -54.4700  925.9700         WING PANEL NO. 1
    3.0000   10.0000    1.0000    0.0            NVOR,RNCV,SPC,PDL
    0.0       0.0    0        13         0         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
    0.0       0.0529    0.2700    0.3078    0.1145   -0.2430   -0.6825   -1.1609
   -1.6545   -2.1469   -2.6232   -3.0692   -3.4807
 1462.5000  223.9400  -54.4700  925.9700         WING PANEL NO. 2
 1768.7998  317.4099  -69.0000  650.0098         WING PANEL NO. 2
    3.0000   10.0000    1.0000    0.0            NVOR,RNCV,SPC,PDL
    0.0       0.0    0        13         0         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   -0.2430   -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
 1769.7998  317.4099  -69.0000  650.0098         WING PANEL NO. 3
 1905.3999  368.0398  -77.1600  529.8699         WING PANEL NO. 3
    3.0000   10.0000    1.0000    0.0            NVOR,RNCV,SPC,PDL
    0.0       0.0    0        13         0         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   -1.2362
 1905.3999  368.0398  -77.1600  529.8699         WING PANEL NO. 4
 2225.7998  486.8298  -89.7400  311.7200         WING PANEL NO. 4
    3.0000   10.0000    1.0000    0.0            NVOR,RNCV,SPC,PDL
    0.0       0.0    0        13         0         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
 2225.7998  436.8799  -89.7400  311.7200          WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500          WING PANEL NO. 6
    3.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0    0        13        0         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
       0.0       0.0   45.7619 3524.0000          FUSELAGE PANEL
       0.0       0.0  -97.8677 3524.0000          FUSELAGE PANEL
    4.0000   28.0000    1.0000  999.0000          NVOR,RNCV,SPC,PDL
   90.0000   71.8148   52.0879   71.8148   14.1758   71.8149  -23.7363   71.8148
  -90.0000   71.8148
       0.0       0.0    1        29        0         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   54.4835
   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
   -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    5.1227   17.7443   32.3533   50.2150   67.5458   84.8766  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  100.4297   95.0974   81.7659   64.7005
   43.7282   27.5516   15.2879    5.4190       0.0
 2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
 2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
    8.0000    5.0000       0.0  999.0000          NVOR,RNCV,SPC,PDL
   90.0000   33.9200   45.0000   33.9200       0.0   33.9200  -45.0000   33.9200
  -90.0000   33.9200 -135.0000   33.9200 -180.0000   33.9200 -225.0000   33.9200
 -270.0000   33.9200
       0.0       0.0    0         3        0         0         1
       0.0   12.1522  100.0000
       0.0
  100.0000  105.1001  105.1001
```

```
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     0.0     32.0000  -45.0000   32.0000
 -90.0000   32.0000 -135.0000   32.0000 -180.0000   32.0000 -225.0000   32.0000
-270.0000   32.0000
   0.0       0.0    0         3         0         0         1
   0.0      11.9148  100.0000
   0.0
 100.0000  111.4062  111.4062
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           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           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         0                   NXS,NYS,NZS

INPUT DATA LISTED
```

```
CL1607-32   (-24 PLANFORM)   VC121 ENGINE
  1  1 -1  1  1  1  0  6 13  1  5 29  0  0  0  0  0  0  2  3  2  2  1  2
                                                                          REFA
 967680
     0.0     1.00     5.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00  XAF
   80.00    90.00   100.00
  944.10    65.74  -54.961448.94                                                    WORG
 1462.50   223.94  -54.47  925.97                                                   WORG
 1768.80   317.41  -69.00  650.01                                                   WORG
 1905.40   368.04  -77.16  529.87                                                   WORG
 2225.80   486.88  -89.74  311.72                                                   WORG
 2479.30   645.05  -99.96  194.45                                                   WORG
     0.0    -0.19    -1.98   -7.09  -18.24  -28.07  -35.89  -41.82  -46.30  -49.90  TZORD
  -53.13   -56.52   -60.34
     0.0     0.49     2.50    2.85    1.06   -2.25   -6.32  -10.75  -15.32  -19.88  TZORD
  -24.29   -28.42   -32.23
     0.0     0.09     1.11    2.27    2.69    2.13    1.00   -0.51   -2.31   -4.28  TZORD
   -6.40    -8.60   -10.84
     0.0     0.08     0.41    1.39    1.64    1.36    0.73   -0.12   -1.18   -2.39  TZORD
   -3.71    -5.09    -6.55
     0.0    -0.08    -0.35   -0.36    0.16    0.40    0.59    0.72    0.82    0.92  TZORD
    0.97     1.02     1.05
     0.0    -0.08    -0.35   -0.61   -0.85   -0.92   -0.90   -0.71   -0.40   -0.01  TZORD
    0.52     1.13     1.77
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
    0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   WORD
    0.0      0.0      0.0
     0.0  120.00  240.00  360.00  480.00  600.00  720.00  840.00  960.001080.00   XFUS
 1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00   XFUS
 2664.302720.002840.002960.003080.003200.003320.003440.003524.00
  -38.00  -30.75  -23.75  -18.50  -16.20  -15.90  -17.20  -20.90  -26.84  -32.75   ZFUS
  -36.73  -40.53  -45.07  -49.39  -53.68  -61.59  -68.90  -72.90  -75.00  -76.60   ZFUS
  -76.80  -76.60  -74.90  -71.30  -66.70  -60.90  -53.30  -44.30  -37.00
     0.0   830.0  2875.0  5242.0  8136.010944.013752.016202.316202.316202.3   AFUS
 16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3   AFUS
 16271.915408.013248.010483.0  7085.0  4464.0  2477.0   878.0     0.0
 2094.00  214.00    -0.08                                                   PODORG  1
     0.0   47.76   393.00     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   PODORD  1
 2091.00  204.00-104.00                                                     PODORG  2
     0.0   46.94   394.00     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   PODORD  2
  2480.0   645.0  -100.0   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                                             10.000RT
 X Z    26.62-24.139.23                          12.25ORT                   1
```

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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 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. 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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