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A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, α- AND q- STABILITY DERIVATIVES

APPENDIX A

A COMPUTER PROGRAM FOR CALCULATING α- AND q- STABILITY DERIVATIVES AND INDUCED DRAG FOR THIN ELASTIC AEROPLANES AT SUBSONIC AND SUPERSONIC SPEEDS

by

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1. INTRODUCTION

The computer program used to determine the rigid and elastic stability derivatives presented in the summary report (Ref. 1) is listed in this appendix along with instructions for its use, sample input data and answers. This program represents the airplane at subsonic and supersonic speeds as (a) thin surface(s) (without dihedral) composed of discrete panels of constant pressure according to the method of Woodward (Ref. 2) for the aerodynamic effects and slender beam(s) for the structural effects.

Given a set of input data, the computer program calculates an aerodynamic influence coefficient matrix [A] and a structural influence coefficient matrix [C] by the methods specified above. In a different option [C] can be read in from tape.

The stability derivatives determined by this program and the equations used in their calculation are given in Table 1. From the table it can be seen that for rigid stability derivatives (as well as ΔC_p) [A] is needed, whereas for elastic stability derivatives both [A] and [C] are required.

The program is compatible with the geometry requirements and definitions of reference 3, using assumptions defined in the Appendix to this report.

Using the method of Reference 4 the program is also capable of computing C_{D_i}/C_L^2 for rigid and elastic wings.

Stability Derivatives for a Rigid Airplane

Derivatives	Formulas	Dimension
C_{L_α}	$\frac{1}{S} \{1\}^T [A] \{1\}$	radian $^{-1}$
C_{L_q}	$-\frac{2}{S\bar{c}} \{1\}^T [A]\{x_i\}$	radian $^{-1}$
C_{m_α}	$\frac{1}{S\bar{c}} \{x_i\}^T [A] \{1\}$	radian $^{-1}$
C_{m_q}	$-\frac{2}{S\bar{c}^2} \{x_i\}^T [A]\{x_i\}$	radian $^{-1}$

Stability Derivatives for an Equivalent Elastic Airplane

	Derivatives	Formulas	Dimension
Zero mass (constant load factor)	$C_{L_{\bar{\alpha}_E}}$	$\frac{1}{S}\{1\}^T [B][A] \{1\}$	radian $^{-1}$
	$C_{L_{\bar{q}_E}}$	$-\frac{2}{S\bar{c}}\{1\}^T [B][A]\{x_i\}$	radian $^{-1}$
	$C_{m_{\bar{\alpha}_E}}$	$\frac{1}{S\bar{c}} \{x_i\}^T [B][A] \{1\}$	radian $^{-1}$
	$C_{m_{\bar{q}_E}}$	$-\frac{2}{S\bar{c}^2} \{x_i\}^T [B][A] \{x_i\}$	radian $^{-1}$

Table 1 Longitudinal Stability Derivatives for Rigid and Elastic Airplanes

Stability Derivatives for an Equivalent Elastic Airplane (continued)

	Derivatives	Formulas	Dimension
Inertial (varying load factor)	$C_{L_{q_I}}$	$\frac{2}{S\bar{c}} \{1\}^T [B][A][C]\{m_i\}U_1^2$	non-dim.
	$C_{m_{q_I}}$	$\frac{2}{S\bar{c}^2} \{x_i\}^T [B][A][C]\{m_i\} U_1^2$	non-dim.
	$C_{L_{\ddot{\theta}_I}}$	$\frac{1}{S} \{1\}^T [B][A][C]\{m_i x_i\}$	sec^2
	$C_{m_{\ddot{\theta}_I}}$	$\frac{1}{S\bar{c}} \{x_i\}^T [B][A][C]\{m_i x_i\}$	sec^2
	$C_{L_{\dot{w}_I}}$	$-\frac{1}{S} \{1\}^T [B][A][C]\{m_i\}$	$sec^2 ft^{-1}$
	$C_{m_{\dot{w}_I}}$	$-\frac{1}{S\bar{c}} \{x_i\}^T [B][A][C]\{m_i\}$	$sec^2 ft^{-1}$
	$\frac{\partial C_L}{\partial n}$	$-g\, C_{L_{\dot{w}_I}}$	non-dim.
	$\frac{\partial C_m}{\partial n}$	$-g\, C_{m_{\dot{w}_I}}$	non-dim.
	$C_{L_{\alpha_E}}$	$\left(1 - \frac{\partial C_L}{\partial n} \frac{1}{C_{L_{trim}}}\right)^{-1} C_{L_{\alpha_{\bar{E}}}}$	$radian^{-1}$
	$C_{m_{\alpha_E}}$	$C_{m_{\alpha_{\bar{E}}}} + \frac{\partial C_m}{\partial n} \left(\frac{C_{L_{\alpha_{\bar{E}}}}}{C_{L_{trim}} - \frac{\partial C_L}{\partial n}} \right)$	$radian^{-1}$

Note: $[B] = \left[[1] - \bar{q}_1 [A][C] \right]^{-1}$

Table 1 Longitudinal Stability Derivatives for Rigid and Elastic Airplanes (Concluded)

2. TABLE OF SYMBOLS

The units used for the physical quantities defined in this paper are given both in the International System of Units (SI) and the U.S. Customary Units.

Input Data

Symbols	Description	Dimension
ALT	Altitude	Feet (m.)
ALTNUM	Number of altitude runs to be made	
AM	Mach Number	
AMASS (I)	Mass of panel "I"	slugs (Kgm)
[C]	Structural influence coefficient matrix	rad/lb. (rad/N.)
c_{ij}	Structural influence coefficient, angle of attack induced on panel i due to a unit load on panel j	rad/lb (rad/N)
CLDES	Desired lift coefficient	
CPCWL	Constant percent chord-wise lines	
CPSWL	Constant percent stream-wise lines	
CREF	Reference Chord	Feet (m.)
CSHT	Structural root chord of the horizontal tail	Feet (m.)
CSMW	Structural root chord of the main wing	Feet (m.)
EI (I)	EI value of the Ith elastic axis segment	lb - inch^2 (N-m^2) or lb - ft^2
GJ (I)	GJ value of the Ith elastic axis segment	lb - inch^2 or lb - ft^2 (N-m^2)
IASIGN (K)	The Kth element of the array IASIGN and the number of an elastic axis end-point to which the Kth panel is attached	
KON1L	= 1 for fuselage geometry data	
	= 2 for wing geometry data	
	= 3 for horizontal tail geometry data	
	= 4 for canard geometry data	

Symbols	Description	Dimension
LPNL (1)	Number of panels on front fuselage	
LPNL (2)	Number of panels on rear fuselage	
LPNL (3)	Numbers of panels on main wing	
LPNL (4)	Number of panels on horizontal tail	
M	Maximum number of elastic axis end-points	
MOVTEL	= 0, Non-movable tail = 1, Movable tail	
N	Total number of panels or, total number of unit loading points	
N1	Attachment point of horizontal tail elastic axis to rear fuselage elastic axis, point number	
NC	Number of sections of the aerodynamic surface	
NCNTL	See Sec. 4 for complete description	
NCONT	= 0 if geometry data are input according to the present program = 1 if geometry data are prepared according to Ref. 1	
NCONTL	= 1 for front fuselage data = 2 for rear fuselage data = 3 for main wing data = 4 for horizontal t..l data	
NCP1	Number of CPCWL on fuselage	
NCP2	Number of CPCWL on wing	
NCP3	Number of CPCWL on horizontal tail	
NCP4	Number of CPCWL on canard	
NCPSWL	Number of constant pe cent stream-wise lines	
NEA	Number of elastic axis end-points	

Symbols	Description	Dimension
NEI GJ	= 0 if EI and GJ values are in lb-inch^2 = 1 if EI and GJ values are in lb-ft^2	
RHO	Air density	Slugs/ft^3 (Kg/m^3)
SOS	Speed of sound	ft/sec. (m/sec)
SREF	Reference area	ft^2 (m^2)
TITLE	Any title for computer run	
W	Total weight of the airplane	lb. (N.)
WDTHHT	One-half the width of the fuselage at the horizontal tail	Feet (m)
WDTHMW	One-half the width of the fuselage at the main wing	Feet (m)
XCG (I)	x-coordinate of the loading point "I"	Feet (m)
XEA (I)	x-coordinate of the elastic axis end-point "I"	Feet (m)
XREF	Attachment point of the main wing elastic axis to the fuselage elastic axis, x-coordinate	Feet (m)
XXL (1)	x-coordinate of the L.E. of inboard chord	Feet (m)
XXL (2)	x-coordinate of L.E. of outboard chord	Feet (m)
XXT (1)	x-coordinate of T.E. of inboard chord	Feet (m)
XXT (2)	x-coordinate of T.E. of outboard chord	Feet (m)
YCG (I)	y-coordinate of the loading point "I"	Feet (m)
YEA (I)	y-coordinate of the elastic axis end-point "I"	Feet (m)
YL (1)	y-coordinate of inboard chord	Feet (m)
YL (2)	y-coordinate of outboard chord	Feet (m)
Z	Z-coordinate of the section under consideration	Feet (m)

Output Data

Symbols	Description	Dimension
[A]	Aerodynamic influence coefficient matrix	$ft^2 rad^{-1} (m^2 rad^{-1})$
a_{ij}	Aerodynamic influence coefficient, load on panel i resulting from a unit angle of attack on panel j	$ft^2 rad^{-1} (m^2 rad^{-1})$
ALTITUDE	Altitude	Feet (m)
AREA	Area of a panel	$(Feet)^2$ (m^2)
CD	Total induced drag coefficient	
CDI	Sectional induced drag coefficient (C_{d_i})	
CL	Total lift coefficient	
CLALPA	$C_{L_{\alpha_E}}$, Variation of lift coefficient with angle of attack for the elastic case with zero mass	per rad.
CLALPE	$C_{L_{\alpha_E}}$, Variation of lift coefficient with angle of attack for the elastic case including mass effect	per rad.
CLALPR	C_{L_α}, Airplane lift curve slope	per rad.
CLI	Sectional lift coefficient (C_l)	
CLQ	C_{L_q}, Variation of lift coefficient with pitch rate	per rad.
CLQEBR	$C_{L_{q_E}}$, Variation of lift coefficient with pitch rate for the elastic case with zero mass	per rad.
CLQI	$C_{L_{q_I}}$, Inertially induced variation of lift coefficient with pitch rate	
CLTDDI	$C_{L_{\ddot{\theta}_I}}$, Inertially induced variation of lift coefficient with pitch angular acceleration	$sec.^2$
CLTRIM	$C_{L_{Trim}}$	

Symbols	Description		Dimension
CLWDI	$C_{L_{\dot{w}_I}}$,	Inertially induced variation of lift coefficient with rate of downward velocity perturbation	$sec.^2$ per ft. (sec^2/m)
CMALPA	$C_{m_{\alpha_{\bar{E}}}}$,	Variation of pitching moment coefficient with angle of attack for the elastic case with zero mass	per rad.
CMALPE	$C_{m_{\alpha_E}}$,	Variation of pitching moment coefficient with angle of attack for the elastic case including mass effect	per rad.
CMALPR	C_{m_α},	Variation of pitching moment coefficient with angle of attack (i.e., static longitudinal stability)	per rad.
CMQ	C_{m_q},	Variation of pitching moment coefficient with pitch rate	per rad.
CMQEBR	$C_{m_{q_{\bar{E}}}}$,	Variation of pitching moment coefficient with pitch rate for the elastic case with zero mass	per rad.
CMQI	$C_{m_{q_I}}$,	Inertially induced variation of pitching moment coefficient with pitch rate	
CMTDDI	$C_{m_{\ddot{\theta}_I}}$,	Inertially induced variation of pitching moment coefficient with pitch angular acceleration	$sec.^2$
CMWDI	$C_{m_{\dot{w}_I}}$,	Inertially induced variation of pitching moment coefficient with rate of downward velocity perturbation	$sec.^2$ per ft ($sec.^2/m$)
CP	ΔC_p,	Change in pressure coefficient between upper and lower surfaces	
CT	Sectional leading edge thrust coefficient		
DCLDN	$\partial C_L/\partial n$,	Variation of lift coefficient with load factor	

Symbols	Description	Dimension
DCMDN	$\partial C_m / \partial n$, Variation of pitching moment coefficient with load factor	
DYNAMIC PRESSURE	Dynamic pressure	lb per ft^2 (N/m^2)
EI (I)	EI Value for the Ith elastic axis segment	lb-ft^2 (N-m^2)
GAMMA	Non-dimensional local circulation ($C_{ic}/2b$)	
GJ (I)	GJ value for the Ith elastic axis segment	lb-ft^2 (N-m^2)
IASIGN (I)	Number of elastic axis end-point to which panel "I" is attached	
MASS (I)	Mass of Ith panel	Slugs (Kg)
REF. AREA	Reference area	$(Feet)^2$ (m^2)
REF. CHORD	Reference chord	Feet (m)
RHO	Air density	Slugs/ft^3 (Kg/m^3)
SOS	Speed of sound	ft. per. sec. (m/sec)
VELOCITY	= (Mach Number) x (speed of sound)	ft. per. sec. (m/sec)
WEIGHT	Weight of the airplane	lb. (N)
XCG (I)	x-coordinate of the centroid of Ith panel or the Ith unit loading point	Feet (m)
XCP (I)	x-coordinate of the control point of Ith panel	Feet (m)
YEA (I)	x-coordinate of the Ith elastic axis end-point	Feet (m)
Y	Non-dimensional spanwise location	
YCG (I)	y-coordinate of the centroid of Ith panel or the Ith unit loading point	Feet (m)
YCP (I)	y-coordinate of the control point of Ith panel	Feet (m)
YEA (I)	-coordinate of the Ith elastic axis end-point	Feet (m)
ZCP (I)	z-coordinate of the control point of Ith panel	Feet (m)

3. PREPARATION OF INPUT DATA

The preparation of input data for this computer program is done in three steps:

<u>Step 1</u> Preparation of planform geometry data (Sec. 3.1)

<u>Step 2</u> Preparation of mass distribution data (Sec. 3.2)

<u>Step 3</u> Preparation of structural data (Sec. 3.3)

3.1 Preparation of Planform Geometry Data

The ground rules for defining the planform geometry and for dividing a planform into aerodynamic panels are described below.

A general planform is taken as an example. Its projections in the x-y plane and the x-z plane are given in Figure 1.

The following paneling definitions should be observed.

1 Break Lines

A break line on a planform is a stream line which connects the leading and trailing edges and occurs when either the leading - or trailing - edge has a slope discontinuity. Root and tip chords are also considered as break lines. A break line on one lifting surface creates a break line on the others. (See Figure 1.)

Referring to the x-y plane view of the planform, there are 14 break lines. Table 2 defines these break lines precisely.

TABLE 2

Break Line	Explanation
1-1'	Root chord of fuselage
2-2'	Tip chord of fuselage
3-3'	Root chord of wing
4-4'	Due to fuselage-wing overlapping
5-5'	Due to break line 12-12' on horizontal tail
6-6'	Due to slope discontinuity at 6'
7-7'	Due to break line 14-14' on horizontal tail
8-8'	Due to slope discontinuity at 8
9-9'	Tip chord of wing
10-10'	Root chord of horizontal tail
11-11'	Due to horizontal tail-fuselage overlapping
12-12'	Due to slope discontinuity at 12
13-13'	Due to break line 6-6'
14-14'	Tip chord of horizontal tail

2 Sections

A section is a region on the configuration between two consecutive break lines. For the example planform of Figure 1 there are seen to be 11 sections.

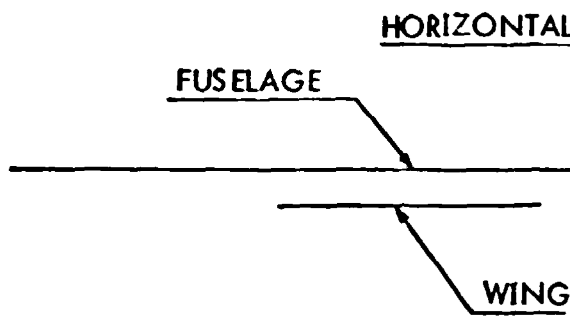
The variable NC on input card 4 sets the number of sections.

3 Constant Percent Chordwise Lines (CPCWL)

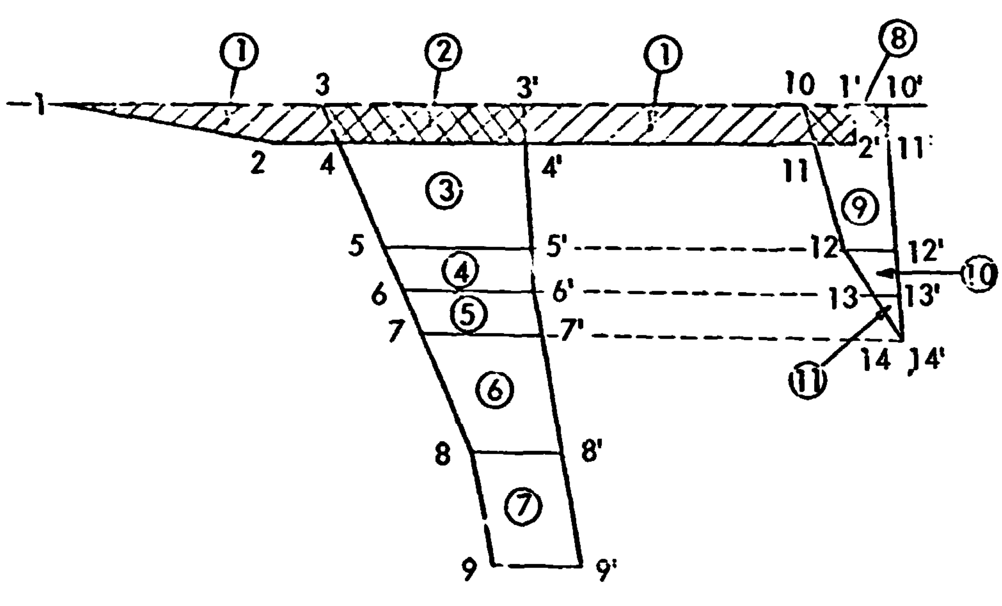
These are the lines which divide the sections in the chordwise direction. In general there could be any number of CPCWL's in a section. In the current program it is limited to 35. These can be different on different aerodynamic surfaces. The 0% and 100% lines are the leading and trailing edges of the section. For accurate values of C_{D_i} / C_L^2, these lines are selected by using the scheme given in Ref. 3.

4 Constant Percent Streamwise Lines (CPSWL)

These are the lines which divide the section in the streamwise direction. In general



X-Z PLANE VIEW



X-Y PLANE VIEW

Figure 1. Example Planform

there could be any number of CPSWL's in a section. In the current program it is limited to 35. However, in case one section is behind another section in the streamwise direction, or one section is directly above another section, it is desirable to use the same CPSWL's. The 0% and 100% lines are the inboard and outboard chords of the section.

5 Panel Numbers

Panels are numbered in the increasing order of section numbers, from inboard to outboard of the section and from the leading edge to the trailing edge.

6 Total Number of Panels (N)

The present computer program is limited to 300 panels.

7 Control Point of a Panel

In all cases the downwash control point is located at 0.95 of the local chord which passes through the centroid of the panel.

3.2 Preparation of Mass Distribution Data

In the wing-body-tail program there are three different types of mass distributions to be considered: wing mass, body mass and tail mass. A procedure for determining these masses cannot be given such that all types of airplanes are covered by it. For the family of parametric wings studied herein, a detailed procedure for the calculation of mass distribution is included in Appendix D of the Summary Report (Ref. 5). It is possible to develop such procedures for tails and fuselages of parametric families of airplanes.

The user of this complete WBH program has the following options:

a) read in a complete mass matrix from an external source.

b) use the procedure developed for the parametric family of wings in Ref. 1 to find the wing part of the mass matrix. Read in the other mass contributions from an external source.

c) neglect the effect of mass and mass distribution.

Whether or not option c) is realistic depends on the type of airplane under study. In Ref. 1 it was shown that in many instances the effect of mass is negligible. For transport type (low load-factor type) airplanes this is definitely not so.

3.3 Preparation of Structural Data

Given an EI distribution for fuselage and EI and GJ distribution for wing and horizontal tail, the method given in Appendix E of the Summary Report (Ref. 6) is used to determine all the input data for structural matrix.

4. INPUT DATA FORMAT

This computer program has five different options, depending upon the value of "NCNTL", which appears on input data card number 1.

NCNTL	Input Cards	Program Computes	Program Outputs
0	All cards except 16	[A], Rigid derivatives, Δ Cp, [C], Elastic derivatives	Rigid derivatives, Δ Cp, Elastic derivatives
1	Cards 0, 1 thru 11	[A], Rigid derivatives, Δ Cp	Rigid derivatives, Δ Cp
2	Cards 0, 1 and 13 thru 20	[C]	[C]
3	Cards 0 thru 12 and 21 and 22	[A], Rigid derivatives, Δ Cp, Elastic derivatives	Rigid derivatives, Δ Cp, Elastic derivatives
4	All cards except 16	[A], Rigid derivatives, Δ Cp, [C], Elastic derivatives	Rigid derivatives, Δ Cp, [C], Elastic derivatives

Card Number	Format	Code	Explanation
0	(16A5)	TITLE	Any title for computer run
1	(3I3)	N *	Total number of panels or number of unit loading points
		M	Number of elastic axis end points of that elastic axis which has the the maximum number of end points.
		NCNTL	= 0 Calculates [A] , Δ Cp, [C] and all the derivatives
			= 1 Calculates [A] , Δ Cp and rigid derivatives
			= 2 Calculates only [C] with printout
			= 3 Calculates [A] , Δ Cp, rigid derivatives then reads [C] from tape and calculates elastic derivatives
			= 4 Calculates [A] , Δ Cp, [C] and all the derivatives. Also prints out [C] .
2	(I2)	NCONT	= 0 Input to be prepared according to the present program
			= 1 Use configuration data cards of Ref. 3 (except card 1). (For assumptions of data reduction see Appendix)
3	(4I2)	NCP1	Number of constant percent chordwise lines on fuselage.
		NCP2	Number of constant percent chordwise lines on wing.
		NCP3	Number of constant percent chordwise lines on horizontal tail.
		NCP4	Number of constant percent chordwise lines on canard.

If NCONT = 1, skip to card number 7

Card Number	Format	Code	Explanation
4	(I2)	NC	Number of sections of the aerodynamic surfaces.

*'N' must be inputted if NCNTL = 2

Card Number	Format	Code	Explanation
5	(2I2)	NCPSWL	Number of constant percent streamwise lines
		KONTL	= 1 for fuselage data = 2 for wing data = 3 for horizontal tail data = 4 for canard data
6	(7F10.5)	XXL (1) XXT (1) YL (1) XXL (2) XXT (2) YL (2) Z	Array of points defining x- and y- coordinates of leading and trailing edges of break lines arranged in order from inboard to outboard, and corresponding z- coordinate
7	(8F10.5)	CPCWL (1) CPCWL (2) (3) (4) (5) (6) (7) (8)	An array defining the locations of constant percent chordwise lines. This card is used only the first time the value of KONTL is defined for each aerodynamic surface. There must be NN* numbers; 8 numbers per card. *NN = NCP1, if KONTL = 1, i.e. fuselage = NCP2, if KONTL = 2, i.e. wing = NCP3, if KONTL = 3, i.e. horizontal tail = NCP4, if KONTL = 4, i.e. canard If NCONT = 1, the CPCWL's are inputted for fuselage, wing, horizontal tail and canard respectively.
	If NCONT = 1, skip to card number 10		
8	(8F10.5)	CPSWL (1)	An array defining the locations of constant percent streamwise lines for a section of the aerodynamic surface. There must be NCPSWL numbers; 8 numbers per card.

Card Number	Format	Code	Explanation
		CPSWL (2)	
		(3)	
		(4)	
		(5)	
		(6)	
		(7)	
		(8)	
Cards 5 thru 8 are repeated NC times.			
9	(2F10.5)	SREF	Reference wing area
		CCREF	Reference chord
If NCONT = 0, skip to card number 11.			
10	(F10.5)	CCREF	Reference chord
			If SREF = 0 Program takes the true area as reference area.
			If CCREF = 0 Program takes the inboard chord of the last processed region as reference chord.
11	(2F10.5)	AM	Mach Number

Card Number	Format	Code	Explanation
		CLDES	Desired lift coefficient for ΔC_p values. If CLDES = 0 ΔC_p values are calculated for $\alpha = 1.0$ radian.
12	(8F10.5)	AMASS (1)	An array defining masses of panels. There must be "N" numbers, 8 numbers per card.
		AMASS (2) (3) (4) (5) (6) (7) (8)	
13	(7I3)	LPNL (1) (2) (3) (4)	Number of panels on front fuselage Number of panels on rear fuselage Number of panels on wing Number of panels on horizontal tail
		N1	Attachment point of horizontal tail elastic axis to rear fuselage elastic axis, point number on the rear fuselage elastic axis.
		MOVTEL	= 0, Non-movable tail = 1, Movable tail
		NEIGJ	= 0, If wing dimensions are in feet and EI and GJ values are in lb-inch^2. = 1, If wing dimensions and EI and GJ are in consistent units (feet only). In case other units are used card number 19 is to be changed

Card Number	Format	Code	Explanation
14	(40I2)	IASIGN (1)	IASIGN (k) is the kth element of the array IASIGN and is the number of an elastic axis end-point to which the kth panel is attached. There must be "N" numbers; 40 numbers per card.
		IASIGN (2) (3) (4) (5) . . . (40)	
15	(5F10.5)	CSMW	Structural root chord of the main wing
		CSHT	Structural root chord of the horizontal tail
		WDTHMW	One-half the width of the fuselage at the main wing
		WDTHHT	One-half the width of the fuselage at the horizontal tail
		XREF	Attachment point of main wing elastic axis to fuselage elastic axis, x- coordinate.
	If NCNTL $\neq$ 2, skip to card number 17.		
16	(8F10.5)	XCG (1)	x- and y- coordinates of loading points. There must be "2N" numbers, 8 numbers per card.
		YCG (1) (2) (2) (3) (3) (4) (4)	
17	(2I2)	NCONTL	Control number to represent the part of airplane for which XEA, YEA, EI and GJ values are being inputted in next cards. = 1 Front fuselage = 2 Rear fuselage = 3 Main wing = 4 Horizontal tail

Card Number	Format	Code	Explanation
		NEA	Number of end-points of elastic axis segments of part of airplane under consideration
18	(8F10.5)	XEA (1) YEA (1) (2) (2) (3) (3) (4) (4)	x- and y- coordinates of end-points of elastic axis. There must be "2XNEA" numbers; 8 numbers per card.
19	(4E15.8)	EI (1) GJ (1) EI (2) GJ (2)	EI and GJ values of elastic axis segments for part of airplane under consideration. There must be "2X(NEA - 1)" numbers, 4 numbers per card.

To obtain [C] for complete airplane, cards 17, 18, and 19 must be repeated with "NCONTL" equal to 1, 2, 3 and 4, with corresponding values of NEA, XEA, YEA, EI and GJ.

Card Number	Format	Code	Explanation
20	Blank card		Indicates that structural data is over
21	(2F10.5)	W ALTNUM	Total weight of aircraft Number of altitude cases to be run.
22	(3F10.5)	RHO SOS ALT	Density (Slugs per ft^3) Speed of sound (ft. per second) Altitude (ft.)

Card 22 is repeated "ALTNUM" times.

5. OUTPUT DATA FORMAT

The output data are divided into five sections.

1. Geometry data

The planform geometry data is outputted exactly in the same way as it was inputted. The format is self-explanatory in the output printout. The output variables are:

a) The number of sections into which the planform is divided.

b) For each section inboard and outboard chord coordinates are given along with the constant percent chordwise lines and constant percent streamwise lines for that section.

c) REF. AREA and REF. CHORD represent the reference area and the reference chord respectively.

2. Rigid longitudinal derivatives

Computer Variable	Explanation
CLALPR	C_{L_α}
CMALPR	C_{m_α}
CLQ	C_{L_q}
CMQ	C_{m_q}

3. Sectional $C_{d_i}/C_L{}^2$ and the total induced drag parameter $C_{D_i}/C_L{}^2$ for rigid configuration

Computer Variable	Explanation
Y	Non-dimensional spanwise location
CDI	Sectional induced drag coefficient (C_{d_i})
CLI	Sectional lift coefficient (C_ℓ)
GAMMA	$= C_\ell C/2b$ where C = local chord
CT	Sectional leading edge thrust
CDI/CL* * 2	$= C_{di}/C_L{}^2$
CD/(CL * CL)	$= \dfrac{\text{Total Induced Drag Coefficient}}{C_L{}^2}$

4. ΔCp values for $C_{L_{des.}}$ or $\alpha = 1.0$ radians

Computer Variable	Explanation
PANEL NUMBER	Panel number
(XCP, YCP, ZCP)	Control point location
(XCG, YCP = YCG)	Panel centroid location
AREA	Panel area
CP	Δ Cp
MASS	Mass of the panel

5. Panel assignment output

Computer Variable	Explanation
I	Panel number or unit loading point number
(XCG, YCG)	Panel centroid location or unit loading point location
IASIGN	Number of elastic axis end-point to which panel "I" is attached.

6. Elastic axis data

Computer Variable	Explanation
I	Elastic axis end-point number
(XEA, YEA)	Elastic axis end-point location
EI	EI value of the Ith elastic axis segment.
GJ	GJ value of the Ith elastic axis segment.

7. Elastic longitudional derivatives

Computer Variable	Explanation
WEIGHT	Total weight of the airplane
RHO SOS ALTITUDE	Air density and speed of sound at that altitude
VELOCITY	= (Mach Number X Speed of sound)

DYNAMIC PRESSURE	Dynamic pressure
CLTRIM	$C_{L_{trim}}$
CLALPA	$C_{L_{\alpha_E}}$
CMALPA	C_{m_r}
CLQEBR	$C_{L_{q_E}}$
CMQEBR	$C_{m_{q_E}}$
CLQI	$C_{L_{q_I}}$
CMQI	$C_{m_{q_I}}$
CLWDI	$C_{L_{\dot{w}_I}}$
CMWDI	$C_{m_{\dot{w}_I}}$
CLTDDI	$C_{L_{\ddot{\theta}_I}}$
CMTDDI	$C_{m_{\ddot{\theta}_I}}$
DCLDN	$\partial C_{L/\partial n}$
DCMDN	$\partial C_{m/\partial n}$
CLALPE	$C_{L_{\alpha_E}}$
CMALPE	$C_{m_{\alpha_E}}$

8. Cp values for deformed shape

Computer Variables	Explanation
PANEL NUMBER	Panel Number
THETA (E)	θ_E, ... at
CP (E)	ΔC_p

9. Sectional C_{di}/C_L^2 and the total induced drag parameter C_{Di}/C_L^2 for elastic configuration

Computer Variables	Explanation
Y	Non-dimensional spanwise location
CDI	Sectional induced drag coefficient (C_{di})
CLI	Sectional lift coefficient (C_ℓ)
GAMMA	$= C_\ell C/2b$
$CDI/C_L ** 2$	$= C_{di}/C_L^2$
CD/(CL * CL)	$= \frac{\text{Total Induced Drag Coefficient}}{C_L^2}$

6. TEST CASE 1

This test case deals with Wing 5 of Ref. 1 (see Fig. 2). An input data cards listing is given in Table 3. Output data for this test case are presented in Table 4.

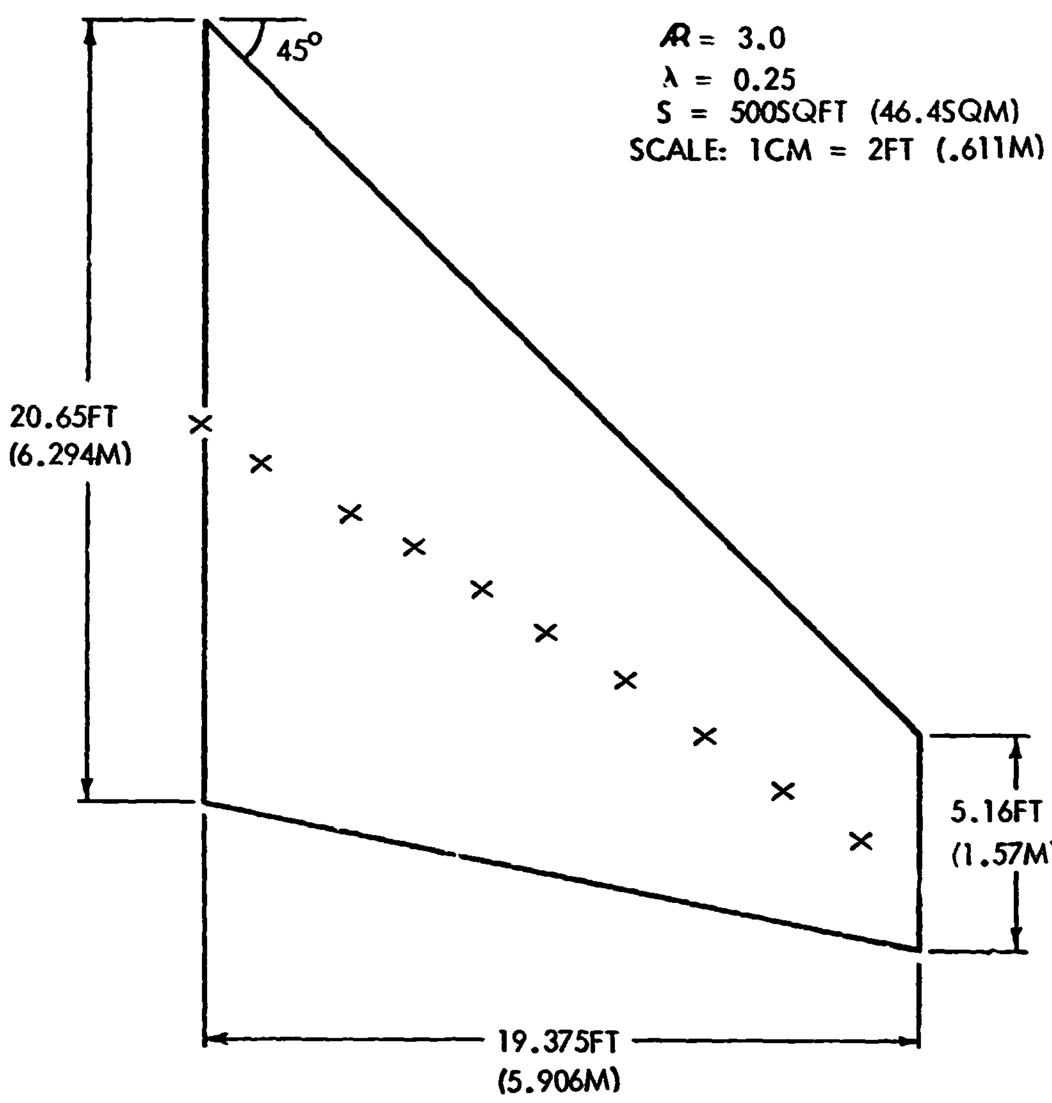


Figure 2. Test Case 1 Planform

Table 3. Listing of Input Data Cards for Test Case 1

Card								
0				TEST CASE 1				
1	10							
2								
3	0009							
4	01							
5	1102							
6	0.	20.65	0.	19.375	24.535	19.375	0.	
7	0.	1.02	12.	21.	33.	48.	63.	81.
7	100.							
8	0.	10.	20.	30.	40.	50.	60.	70.
8	80.	90.	100.					
9								
11	1.5	0.						
12	0.05274	0.56760	0.74961	9.78339	12.22919	12.22919	6.55827	2.42984
12	0.05140	0.55315	0.73052	8.87890	11.09857	11.09857	6.07640	2.39232
12	0.05000	0.53814	0.71070	7.97039	9.96294	9.96294	5.59139	2.35336
12	0.0481	0.51868	0.68500	7.04972	8.81210	8.81210	5.09118	2.30285
12	0.04582	0.49310	0.65123	6.11485	7.64351	7.64351	4.57134	2.23648
12	0.04298	0.46253	0.61085	5.16380	6.45471	6.45471	4.03316	2.15711
12	0.03962	0.42639	0.56313	4.19757	5.24692	5.24692	3.47600	2.06332
12	0.03533	0.38025	0.50219	3.20649	4.00808	4.00808	2.88591	1.94355
12	0.02855	0.30742	0.40601	2.14000	2.67498	2.67498	2.20343	1.75451
12	0.01296	0.13953	0.18482	0.81376	1.01719	1.01719	1.19627	1.31873
13	0000000800000000000000							
14	0202020202020203030202020203030404020203030404050503040404050506070505050506060707							
14	0606060606070707080807070707080808090808080809090910090909091010101010101010101010							
15								
17	0310							
18	10.6717	0.	11.6527	1.58	12.8427	3.93	13.8427	5.78
18	14.9027	7.59	16.0427	9.40	17.3727	11.43	18.7627	13.57

Table 3 (Continued) Listing of Input Data Cards for Test Case 1

Card						
18	20.1827	15.67	21.5827	17.95		
19	1.43	E0101.22	E0101.15		E0109.9	E009
19	7.9	E0096.4	E0095.3		E0094.0	E009
19	3.5	E0092.8	E0092.2		E0091.8	E009
19	1.1	E0099.0	E0084.6		E0083.9	E008
19	1.8	E0081.6	E008			
20						
21	40000.	1.				
22	0.002378	1116.89	0.			

Table 4. Output for Test Case 1

```
                              TEST CASE 1

 ***********************************************
 * GEOMETRY DATA IS DIVIDED IN TO 1 SECTIONS *
 ***********************************************


 DEFINITION OF SECTION 1
 ***********************

 X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
    0.                  20.65000            0.                  0.
   19.37500             24.53500           19.37500             0.
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.        1.020     12.000     21.000     33.000     48.000     63.000     81.000    100.000
THERE ARE 11 CONSTANT PERCENT STREAMWISE LINES AT
     0.       10.000     20.000     30.000     40.000     50.000     60.000     70.000     80.000     90.000    100.000
REF, AREA= 0.50007E 03
REF, CHORD= 0.20650E 02
CLALPR  = 0.34357E 01
CMALPR  =-0.24549E 01
CLO     = 0.40350E 01
CMO     =-0.39753E 01

SECTIONAL CD/CL**2 FOR WING
     Y              CDI            CLI            GAMMA          CT          CD/CL**2
  0.04935         2.53450        2.53450        0.65032        0.           0.21471
  0.14930         2.73837        2.73837        0.64793        0.           0.23190
  0.24923         2.97042        2.97042        0.64391        0.           0.25164
  0.34915         3.22645        3.22645        0.63453        0.           0.27333
  0.44906         3.51039        3.51039        0.62028        0.           0.29739
  0.54894         3.82783        3.82783        0.59996        0.           0.32478
  0.64879         4.18985        4.18985        0.57308        0.           0.35495
  0.74857         4.59807        4.59807        0.53721        0.           0.38953
  0.84828         4.90074        4.90074        0.47491        0.           0.41517
  0.94782         4.40561        4.40561        0.33927        0.           0.37323

TOTAL LEADING EDGE THRUST COEFFICIENT= 0.
TOTAL INDUCED DRAG COEFFICIENT= 0.34357E 01
CD/(CL*CL)= 0.27106E 00
```

MACH NUMBER= 1.50

CP VALUES ARE FOR ALPHA= 1.000000 RADIANS

PANEL NUMBER	XCP	YCP	ZCP	XCG	AREA	CP	MASS
1	1.14986	0.95617	0.	1.05758	0.39279	0.73627E 01	0.0527400
2	3.23326	0.95617	0.	2.25072	4.22826	0.29781E 01	0.5676000
3	5.34255	0.95617	0.	4.23728	3.46579	0.25459E 01	0.7496100
4	7.39709	0.95617	0.	6.32527	4.62105	0.24591E 01	9.7933900
5	10.35209	0.95617	0.	9.00982	5.77632	0.24226E 01	12.2291900
6	13.33493	0.95617	0.	11.99265	5.77632	0.24075E 01	12.2291900
7	16.98450	0.95617	0.	15.27377	6.93158	0.23959E 01	6.5582700
8	20.55281	0.95617	0.	18.95260	7.31667	0.23886E 01	2.4298400
9	3.37029	2.89250	0.	2.98612	0.36218	0.79970E 01	0.0514000
10	4.39242	2.89250	0.	4.08637	3.99873	0.34973E 01	0.5531500
11	6.56394	2.89260	0.	5.91828	3.19568	0.29500E 01	0.7305200
12	8.33392	2.89250	0.	7.84370	4.26091	0.25581E 01	8.9709001
13	11.55703	2.89250	0.	10.31925	5.32614	0.25255E 01	11.0985700
14	14.30754	2.89250	0.	13.06987	5.32614	0.24695E 01	11.0985700
15	17.58387	2.89260	0.	16.09554	6.39137	0.24350E 01	6.0764000
16	21.35591	2.89250	0.	19.48796	6.74644	0.24152E 01	2.3927200
17	4.79153	4.82894	0.	4.91447	0.33157	0.79979E 01	0.0500000
18	6.75140	4.82884	0.	5.92183	3.56920	0.47206E 01	0.5381400
19	8.27737	4.82894	0.	7.59910	2.92558	0.34374E 01	0.7107000
20	10.76351	4.82884	0.	9.36199	3.90077	0.27396E 01	7.9703900
21	12.76184	4.82894	0.	11.62856	4.87596	0.25920E 01	9.9629400
22	15.29326	4.82894	0.	14.14697	4.87596	0.25749E 01	9.9629400
23	18.27717	4.82884	0.	16.91722	5.85115	0.25099E 01	5.5913700
24	21.45376	4.82894	0.	20.02327	6.17622	0.24653E 01	2.3853600
25	6.71252	6.76493	0.	6.84256	0.30095	0.79999E 01	0.0481900
26	8.51315	6.76493	0.	7.75706	3.23967	0.54505E 01	0.5146900
27	9.39598	6.76493	0.	9.27970	2.65547	0.37764E 01	0.6350000
28	11.70311	6.76493	0.	10.89007	3.54063	0.32779E 01	7.0477200
29	13.76550	6.76493	0.	12.93769	4.42578	0.27051E 01	8.8121001
30	16.25274	6.76493	0.	15.22593	4.42578	0.27291E 01	8.6121001
31	18.37337	6.76493	0.	17.73880	5.31094	0.25123E 01	5.0711800
32	21.36166	6.76493	0.	20.55850	5.60599	0.25424E 01	2.3028500
33	8.93316	8.70047	0.	8.77031	0.27034	0.80007E 01	0.0458200
34	10.26358	8.70047	0.	9.59195	2.91014	0.61069E 01	0.4931000
35	11.31461	8.70047	0.	10.96000	2.38536	0.45724E 01	0.5512300
36	13.13736	8.70047	0.	12.39788	3.18048	0.35559E 01	6.1144500
37	15.17394	8.70047	0.	14.24658	3.97560	0.31654E 01	7.6435100
38	17.72305	8.70047	0.	16.30070	3.97560	0.27156E 01	7.6435100
39	19.56745	8.70047	0.	18.56023	4.77073	0.27506E 01	4.5713400
40	22.25449	8.70047	0.	21.09364	5.03577	0.25504E 01	2.2364800
41	10.75334	10.63563	0.	10.69758	0.23973	0.80000E 01	0.0429800
42	12.32558	10.63563	0.	11.42640	2.58061	0.67046E 01	0.4625300
43	13.13164	10.63563	0.	12.63988	2.11526	0.52122E 01	0.6108500
44	14.37126	10.63563	0.	13.91532	2.92034	0.41010E 01	5.1638000
45	16.37508	10.63563	0.	15.55516	3.52543	0.34897E 01	6.4547100
46	18.19713	10.63563	0.	17.37721	3.52543	0.31525E 01	6.4547100
47	20.36337	10.63563	0.	19.38146	4.23051	0.29363E 01	4.0331600
48	22.56722	10.63563	0.	21.62865	4.46554	0.27852E 01	2.1571100

49	12.37283	12.57011	0.	12.62418	0.20912	0.80000E 01	0.0396200
50	13.78397	12.57011	0.	13.26020	2.25108	0.71471E 01	0.4257900
51	14.74350	12.57011	0.	14.31918	1.84515	0.57295E 01	0.5631300
52	16.30454	12.57011	0.	15.43222	2.46020	0.46595E 01	4.1275700
53	17.37980	12.57011	0.	16.86328	3.07525	0.39854E 01	5.2459200
54	19.16396	12.57011	0.	18.45333	3.07525	0.34595E 01	5.2469200
55	21.35103	12.57011	0.	20.20240	3.69030	0.31639E 01	3.4760000
56	23.36781	12.57011	0.	22.16547	3.89532	0.29722E 01	2.0633200
57	14.37130	14.50356	0.	14.54974	0.17851	0.80000E 01	0.0353300
58	15.34341	14.50356	0.	15.09302	1.92155	0.75011E 01	0.3802500
59	16.36429	14.50356	0.	15.99758	1.57504	0.66723E 01	0.5921900
60	17.43726	14.50356	0.	16.94831	2.10006	0.53699E 01	3.2064900
61	18.78188	14.50356	0.	18.17069	2.62507	0.43771E 01	4.0080800
62	20.14307	14.50356	0.	19.52488	2.62507	0.35613E 01	4.0080800
63	21.75533	14.50356	0.	21.02290	3.15008	0.34697E 01	2.9959100
64	23.47219	14.50356	0.	22.67801	3.32509	0.31970E 01	1.9435500
65	16.50910	16.43533	0.	16.47363	0.14789	0.80000E 01	0.0755600
66	17.29533	16.43533	0.	16.92425	1.59202	0.77333E 01	0.3074200
67	17.97968	16.43533	0.	17.67452	1.30494	0.72613E 01	0.4000100
68	18.96954	16.43533	0.	18.46309	1.73991	0.62359E 01	2.1400000
69	19.99391	16.43533	0.	19.47697	2.17489	0.50664E 01	2.6749800
70	21.11344	16.43533	0.	20.60550	2.17489	0.43579E 01	2.6719500
71	22.45102	16.43533	0.	21.84269	2.60987	0.37043E 01	2.7034300
72	23.97420	16.43533	0.	23.23208	2.75486	0.26593E 01	1.7545100
73	18.42194	18.36411	0.	18.39454	0.11728	0.80000E 01	0.0129600
74	19.04752	18.36411	0.	18.75264	1.26249	0.79800E 01	0.1395300
75	19.59357	18.36411	0.	19.34886	1.03483	0.76537E 01	0.1848200
76	20.29780	18.36411	0.	19.97552	1.37977	0.70879E 01	0.9137600
77	21.18403	18.36411	0.	20.78122	1.72471	0.54812E 01	1.0171900
78	22.37931	18.36411	0.	21.67645	1.72471	0.35499E 01	1.0171900
79	23.14453	18.36411	0.	22.66121	2.06966	0.19902E 01	1.1962700
80	24.27560	18.36411	0.	23.76532	2.18464	0.12185E 01	1.3167300

FIRST PANEL NUMBER ON MAIN WING = 1
LAST PANEL NUMBER ON MAIN WING = 80
X-COORDINATE OF FIXED POINT= 0.

COORDINATES OF UNIT LOADING POINTS AND LOADING POINT ASSIGNMENTS

I	XCG	YCG	IASIGN
1	1,05758	0,95517	2
2	2,25072	0,95517	2
3	4,23728	0,95517	2
4	6,32527	0,95517	2
5	9,00982	0,95517	2
6	11,99265	0,95517	2
7	15,27377	0,95517	3
8	18,95260	0,95517	3
9	2,98612	2,99260	2
10	4,98537	2,99260	2
11	5,91828	2,39260	2
12	7,84370	2,99260	2
13	10,31925	2,99260	3
14	13,06987	2,39260	3
15	16,09554	2,39260	4
16	19,48796	2,99260	4
17	4,91447	4,92384	2
18	5,92193	4,92394	2
19	7,59910	4,32384	3
20	9,36199	4,92394	3
21	11,62856	4,92394	4
22	14,14497	4,92394	4
23	16,91722	4,92394	5
24	20,92327	4,92394	5
25	6,84256	6,76493	3
26	7,75706	6,76493	4
27	9,27970	6,76493	4
28	10,98007	6,76493	4
29	12,93769	6,76493	5
30	15,22393	6,76493	5
31	17,73980	6,76493	6
32	20,55850	6,76493	7
33	8,77031	8,70347	5
34	9,59195	8,70347	5
35	10,96030	8,70347	5
36	12,39788	8,70347	5
37	14,24658	8,70347	6
38	16,30070	8,70347	6
39	18,56023	8,70347	7
40	21,09364	8,70347	7
41	10,69758	10,53563	6
42	11,42640	10,53563	6
43	12,63998	10,53563	6
44	13,91532	10,53563	6
45	15,55516	10,53563	7
46	17,37721	10,53563	7
47	19,38146	10,53563	8
48	21,62865	10,53563	8
49	12,62418	12,37011	7
50	13,26020	12,37011	7
51	14,31918	12,37011	7
52	15,43222	12,37011	7
53	16,86328	12,37011	8
54	18,45333	12,37011	8
55	20,20240	12,37011	8
56	22,16347	12,37011	9

57	14,94974	14,30356	8
58	15,99302	14,30356	8
59	15,99708	14,30356	8
60	16,94831	14,30356	8
61	18,17359	14,30356	9
62	19,52868	14,30356	9
63	21,02290	14,30356	9
64	22,69801	14,30356	10
65	16,47363	16,43333	9
66	16,92425	16,43333	9
67	17,47452	16,43333	9
68	18,46309	16,43333	9
69	19,47697	16,43333	10
70	20,60350	16,43333	10
71	21,84269	16,43333	10
72	23,23208	16,43333	10
73	18,39454	18,36411	10
74	18,75264	18,36411	10
75	19,34886	18,36411	10
76	19,97552	18,36411	10
77	20,78122	18,36411	10
78	21,67645	18,36411	10
79	22,66121	18,36411	10
80	23,76532	18,36411	10

NUMBER OF ELASTIC AXIS POINTS ON MAIN WING =10

COORDINATES OF ELASTIC AXIS SEGMENTS

I	XEA	YEA
1	10,67170	0,
2	11,65270	1,58000
3	12,84270	3,93000
4	13,84270	5,78000
5	14,90270	7,59000
6	16,04270	9,40000
7	17,37270	11,43000
8	18,76270	13,57000
9	20,18270	15,57000
10	21,58270	17,75000

ELASTIC AXIS TORSIONAL AND BENDING STIFFNESS

I	EI	GJ
1	0.9931E 09	0.8472E 09
2	0.7986E 09	0.6375E 09
3	0.5486E 09	0.4444E 09
4	0.3681E 09	0.2778E 08
5	0.2431E 09	0.1744E 08
6	0.1529E 09	0.1250E 08
7	0.7437E 07	0.6250E 07
8	0.3173E 07	0.2708E 07
9	0.1250E 07	0.1111E 07

ELASTIC DERIVATIVES FOR MACH NUMBER= 1.50

```
WEIGHT=    43000.
RHO=  0.0023780      S.O.S.=  1116.890      ALTITUDE=    0.
VELOCITY= 0.16753E 04
DYNAMIC PRESSURE= 0.33372E 04
FLTRIM=    1.7239

CLALPA= 0.20437E 01
CMALPA=-0.12973E 01
CLDEER= 0.19200E 01
CMDEER=-0.14557E 01
CLQI   =-0.30321E 02
CMQI   = 0.25712E 02
CLMDI  = 0.11339E-03
CMMDI  =-0.94587E-04
CLTDDI= 0.22965E-02
CMTDDI=-0.19225E-02
DCLDN =-0.36508E-02
DCMDN = 0.30457E-02
CLALPE= 0.17735E 01
CMALPE=-0.10719E 01
```

PANEL NUMBER	THETA(E)	CP(F)
1	-0.52732E-01	0.69744E 01
2	-0.52732E-01	0.28210E 01
3	-0.52732E-01	0.24116E 01
4	-0.52732E-01	0.23761E 01
5	-0.52732E-01	0.21992E 01
6	-0.52732E-01	0.19056E 01
7	-0.17414E 00	0.13593E 01
8	-0.17414E 00	0.12727E 01
9	-0.52732E-01	0.75374E 01
10	-0.52732E-01	0.36917E 01
11	-0.52732E-01	0.27949E 01
12	-0.52732E-01	0.24[illegible]4E 01
13	-0.17414E 00	0.19991E 01
14	-0.17414E 00	0.18610E 01
15	-0.25442E 00	0.13504E 01
16	-0.25442E 00	0.12766E 01
17	-0.52732E-01	0.75761E 01
18	-0.52732E-01	0.44717E 01
19	-0.17414E 00	0.27786E 01
20	-0.17414E 00	0.24407E 01
21	-0.25442E 00	0.18957E 01
22	-0.25442E 00	0.18366E 01
23	-0.35757E 00	0.13103E 01
24	-0.35757E 00	0.11152E 01
25	-0.17414E 00	0.66374E 01
26	-0.25442E 00	0.45950E 01
27	-0.25442E 00	0.32207E 01
28	-0.25442E 00	0.25964E 01
29	-0.35757E 00	0.18943E 01
30	-0.35757E 00	0.17704E 01
31	-0.45949E 00	0.12311E 01
32	-0.53905E 00	0.77673E 00
33	-0.35757E 00	0.51627E 01
34	-0.35757E 00	0.47000E 01
35	-0.35757E 00	0.35352E 01

36	-0.35757E 00	0.27226E 01
37	-0.45949E 00	0.18877E 01
38	-0.45949E 00	0.16944E 01
39	-0.53905E 00	0.10802E 01
40	-0.53905E 00	0.89197E 00
41	-0.45949E 00	0.43261E 01
42	-0.45949E 00	0.45880E 01
43	-0.45949E 00	0.37463E 01
44	-0.45949E 00	0.28060E 01
45	-0.53905E 00	0.19039E 01
46	-0.53905E 00	0.15939E 01
47	-0.72758E 00	0.96465E 00
48	-0.72758E 00	0.96467E 00
49	-0.53905E 00	0.32976E 01
50	-0.53905E 00	0.41406E 01
51	-0.53905E 00	0.38231E 01
52	-0.53905E 00	0.29139E 01
53	-0.72758E 00	0.17259E 01
54	-0.72758E 00	0.15426E 01
55	-0.72758E 00	0.12427E 01
56	-0.83371E 00	0.78759E 00
57	-0.72758E 00	0.21794E 01
58	-0.72758E 00	0.33621E 01
59	-0.72758E 00	0.36580E 01
60	-0.72758E 00	0.30629E 01
61	-0.83371E 00	0.18105E 01
62	-0.83371E 00	0.15469E 01
63	-0.83371E 00	0.13896E 01
64	-0.87113E 00	0.99843E 00
65	-0.83371E 00	0.13303E 01
66	-0.83371E 00	0.24453E 01
67	-0.83371E 00	0.31396E 01
68	-0.83371E 00	0.31461E 01
69	-0.87113E 00	0.22590E 01
70	-0.87113E 00	0.17063E 01
71	-0.87113E 00	0.14777E 01
72	-0.87113E 00	0.11382E 01
73	-0.87113E 00	0.10310E 01
74	-0.87113E 00	0.17008E 01
75	-0.87113E 00	0.23751E 01
76	-0.87113E 00	0.29215E 01
77	-0.87113E 00	0.26861E 01
78	-0.87113E 00	0.18784E 01
79	-0.87113E 00	0.98268E 00
80	-0.87113E 00	0.51049E 00

SECTIONAL CD/CL**2 FOR WING

Y	CDI	CLI	GAMMA	CT	CD/CL**2
0.04935	1.81491	1.97826	0.50760	0.	0.57679
0.14930	1.79593	2.06393	0.48835	0.	0.56778
0.24923	1.69392	2.11576	0.45835	0.	0.53532
0.34915	1.40372	2.09374	0.41177	0.	0.44627
0.44906	1.21892	2.11400	0.37354	0.	0.38751
0.54894	0.95574	2.08552	0.32687	0.	0.30703
0.64878	0.70391	2.04177	0.27927	0.	0.22375
0.74857	0.44514	2.02664	0.23678	0.	0.14152
0.84828	0.29428	2.01111	0.19489	0.	0.09356
0.94782	0.22043	1.71044	0.13172	0.	0.07008

```
TOTAL LEADING EDGE THRUST COEFFICIENT= 0.
TOTAL INDUCED DRAG COEFFICIENT= 0.12549E 01
CD/(CL*CL)= 0.37876F 00
```

```
THIS CASE IS COMPLETE
*********************
```

7. TEST CASE 2

This test case deals with a complete elastic wing, body and horizontal tail configuration. Figure 3 defines the overall geometry for this case. Figure 4 defines the elastic axis location. Input data cards are listed in Table 5. Output data listing for this case is given in Table 6.

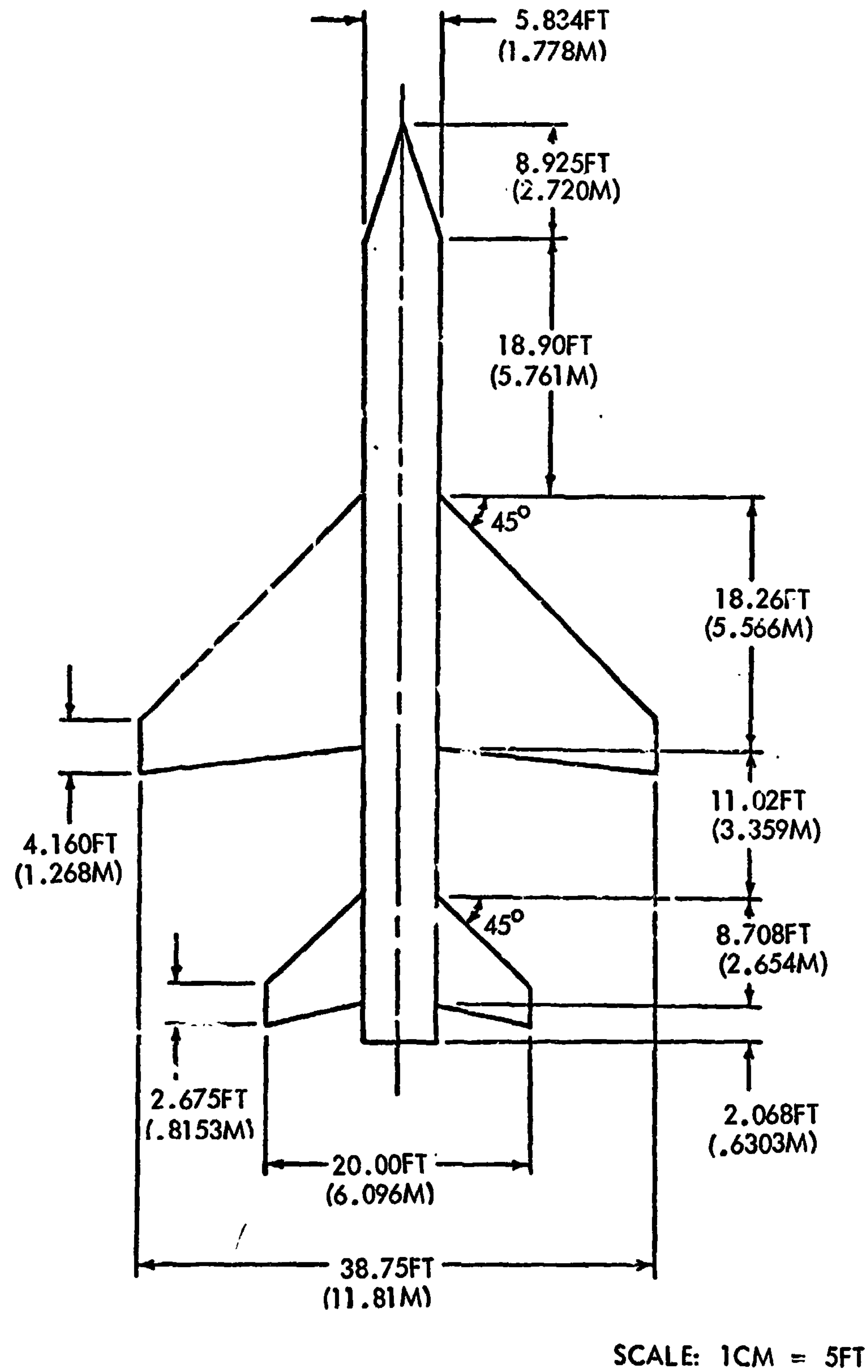


Figure 3. Test Case 2 Planform.

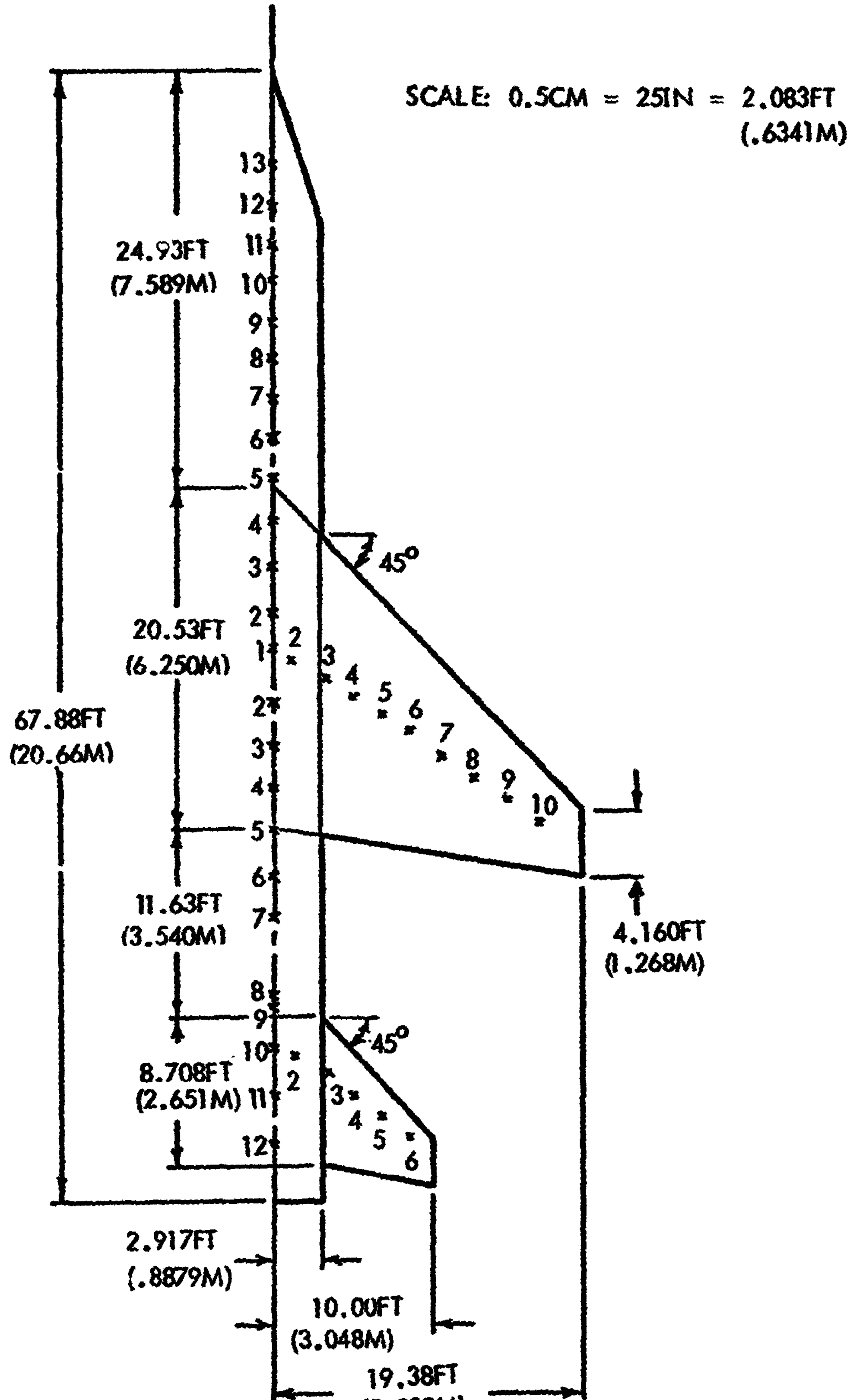


Figure 4. Elastic Axis End Points for Test Case 2.

Table 5. Listing of Input Data Cards for Test Case 2

Card								
0				TEST CASE-2				
1	128013000							
2	00							
3	190907							
4	03							
5	0201							
6	0.	67.87917	0.	8.925	67.87917	2.91667	0.	
7	0.	5.5555556	11.111111	16.666667	22.222222	27.777778	33.333333	38.888889
7	44.444444	50.	55.555556	61.111111	66.666667	72.222222	77.777778	83.3333333
7	88.888889	94.444444	100.					
8	0.	100.						
5	1102							
6	27.825	46.08333	2.91667	44.47917	48.63917	19.375	0.	
7	0.	1.0203	12.	21.	33.	48.	63.	81.
7	100.							
8	0.	8.8607	17.7214	26.5821	35.4428	44.3035	55.4427	66.5819
8	77.7211	88.8603	100.					
5	0603							
6	57.10417	65.8125	2.91667	64.34583	67.02083	10.	0.	
7	0.	5.613	15.	30.	50.	75.	100.	
8	0.	20.	40.	60.	80.	100.		
9	500.11719	14.455						
11	1.5	0.						
12	2.5	10.79	18.954	20.522	22.05	33.415	62.484	94.720
12	127.05	104.94	45.045	39.27	40.96	38.75	37.785	34.3
12	24.8	10.89	0.04547	0.48989	0.64702	8.48499	10.60619	10.60619
12	5.67917	2.09387	0.04439	0.44807	0.63166	7.84316	9.80390	9.80390
12	5.33442	2.06369	0.04345	0.43858	0.61836	7.20557	9.00692	9.00692
12	4.99498	2.03753	0.04223	0.42626	0.60095	6.52464	8.15577	8.1577
12	4.62752	2.00333	0.04072	0.41102	0.57945	6.60738	7.27224	7.27224

Table 5 (Continued) Listing of Input Data Cards for Test Case 2

Card								
12	4.24075	1.96107	0.05094	0.51418	0.72492	6.62124	8.27650	8.27650
12	4.86817	2.24699	0.04704	0.47481	0.66937	5.36289	6.74866	6.74866
12	4.17083	2.1378	0.04209	0.42485	0.59891	4.14585	5.18227	5.1827
12	3.43494	1.99931	0.03447	0.34793	0.49051	2.81425	3.51777	3.51777
12	2.60095	1.78626	0.01866	0.18835	0.26558	1.17233	1.46540	1.46540
12	1.43098	1.34418	0.19152	0.32024	1.16015	1.70609	2.04489	2.11749
12	0.17771	0.29715	1.07648	1.58306	1.90709	2.02521	0.16068	0.26866
12	0.97330	1.43131	1.73713	1.91140	0.13581	0.22709	0.82270	1.20965
12	1.48909	1.74530	0.07811	0.120610	0.47317	0.69583	0.91339	1.35979
13	00900908003000001000C							
14	13121009070604030202030506070810111202020202020203040202020203030404020203030404							
14	0505030304040505060604040505060607070505060607070808060607070808080907070808080							
14	0910080809091010101009091010101010100202020203030303030304040404040405040405							
14	050505050505060606							
15	8.33333	4.16667	2.91667	2.91667	35.609			
17	0113							
18	35.609	0.	33.3333	0.	30.4167	0.	27.6042	0.
18	25.	0.	22.5	0.	20.	0.	17.5	0.
18	15.4167	0.	12.7083	0.	10.4167	0.	8.125	0.
18	5.4167	0.						
19	2.8512	E011	E	2.4192	E011	E		
19	2.00	E011	E	1.656	E011	E		
19	1.3824	E011	E	1.0732	E011	E		
19	8.928	E010	E	7.2	E010	E		
19	5.348	E010	E	3.744	E010	E		
19	2.88	E010	E	1.728	E010	E		
17	0212							
18	35.609	0.	38.95	0.	41.75	0.	44.375	0.
18	47.0833	0.	49.7916	0.	52.5	0.	57.2917	0.
18	57.7083	0.	60.625	0.	63.5417	0.	66.4583	0.

Table 5 (Continued) Listing of Input Data Cards for Test Case 2

Card	19	3.168	E011		E	3.168	E011		E	
	19	3.1392	E011		E	2.9952	E011		E	
	19	2.2752	E011		E	1.6416	E011		E	
	19	1.152	E011		E	8.064	E010		E	
	19	5.472	E010		E	2.304	E010		E	
	19	2.8	E009		E					
	17	0310								
	18	35.609	0.	36.59		1.58	37.78	3.93	38.78	5.78
	18	39.84	7.59	40.98		9.40	42.31	11.43	43.70	13.67
	18	45.12	15.67	46.52		17.95				
	19	1.43	E0101.22		E0101.15		E0109.9		E009	
	19	7.9	E0096.4		E0095.3		E0094.0		E009	
	19	3.5	E0092.8		E0092.2		E0091.8		E009	
	19	1.1	E0099.0		E0084.6		E0083.9		E008	
	19	1.8	E0081.6		E008					
	17	0406								
	18	60.625	0.	61.25		1.43	62.57	3.72	63.63	5.51
	18	64.84	7.29	65.89		9.07				
	19	4.5	E0093.9		E0093.4		E0092.7		E009	
	19	2.0	E0091.4		E0091.0		E0097.5		E008	
	19	5.0	E0083.5		E008					
	20									
	21	76000.	1.							
	22	0.002378	1116.89	0.						

Table 6. Output for Test Case 2

```
TEST CASE 2

*********************************************
* GEOMETRY DATA IS DIVIDED IN TO 3 SECTIONS *
*********************************************

DEFINITION OF SECTION 1
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
    0.                 47.87917            0.                  0.
    9.92500            47.87917            2.91667             0.
 THERE ARE 19 CONSTANT PERCENT CHORDWISE LINES AT
    0.        5.556     11.111     16.667     22.222     27.778     33.333     38.889     44.444     50.000     55.556     61.111
66.667   72.222   77.778   83.333   88.889   94.444   100.000
 THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
    0.       100.000

DEFINITION OF SECTION 2
***********************

X-LEADING EDGE     Y-TRAILING EDGE     Y-LEADING EDGE          Z
  27.92500             46.08333            2.91667             0.
  44.47917             48.63917           19.37500             0.
 THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
    0.        1.000     12.000     21.000     33.000     48.000     63.000     81.000    100.000
 THERE ARE 11 CONSTANT PERCENT STREAMWISE LINES AT
    0.        4.861     17.721     26.582     35.443     44.304     55.443     66.582     77.721     88.960    100.000

DEFINITION OF SECTION 3
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
  57.10417             45.01250            2.91667             0.
  54.34583             47.02083           13.70000             0.
 THERE ARE  7 CONSTANT PERCENT CHORDWISE LINES AT
    0.        3.513     15.000     31.000     50.000     75.000    100.000
 THERE ARE  6 CONSTANT PERCENT STREAMWISE LINES AT
    0.       20.000     40.000     60.000     80.000    100.000
REF. AREA= 0.53312E 03
REF. CHORD= 0.14456E 02
CLALPR  = 0.58345E 01
CMALPR  =-0.11742E 02
CL0     = 0.24596E 02
CM0     =-0.78797E 02
```

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

SECTIONAL CD/CL**2 FOR WING

Y	CCL	CL	GAMMA	CT	CD/CL**2
0.13773	2.55742	2.55752	0.51722	0.	0.17597
0.25294	2.87519	2.88519	0.51433	0.	0.19024
0.33129	3.10375	3.10375	0.51553	0.	0.20454
0.41341	3.33672	3.33672	0.59626	0.	0.21929
0.49953	3.57510	3.57433	0.53613	0.	0.23719
0.57399	3.90713	3.90713	0.55693	0.	0.25750
0.66753	4.30736	4.33736	0.53799	0.	0.29398
0.76191	4.79622	4.79502	0.50073	0.	0.31554
0.85515	5.20798	5.23730	0.44656	0.	0.34857
0.95019	5.09973	5.12993	0.32356	0.	0.33162

SECTIONAL CD/CL**2 FOR HORIZONTAL TAIL

Y	CCL	CL	GAMMA	CT	CD/CL**2
0.36074	2.17516	2.17544	0.44182	0.	0.14349
0.52211	2.23731	2.23731	0.38691	0.	0.14794
0.64333	2.32720	2.32720	0.33238	0.	0.15343
0.78437	2.42847	2.42857	0.27396	0.	0.15012
0.92482	2.22548	2.22559	0.13447	0.	0.14674

TOTAL LEADING EDGE THRUST COEFFICIENT= 0.
TOTAL INDUCED DRAG COEFFICIENT= 0.39945E 01
CD/(CL*CL)= 0.25677E 00

MACH NUMBER= 1.50

CP VALUES ARE FOR ALPHA= 1.000000 RADIANS

PANEL NUMBER	XCP	YCP	ZCP	XCT	AREA	CP	MASS
1	7.71034	1.42413	0.	6.12231	10.27585	0.20971E 01	2.5300000
2	11.23731	1.42413	0.	9.65127	10.27585	0.11084E 01	10.7300000
3	14.76927	1.42413	0.	13.18024	10.27585	0.57335E 00	19.9540000
4	18.29723	1.42413	0.	16.70920	10.27585	0.25210E 00	29.5220001
5	21.82521	1.42413	0.	20.23816	10.27586	0.11074E 00	22.0300000
6	25.35316	1.42413	0.	23.76713	10.27585	0.11174E 00	33.4150000
7	28.88412	1.42413	0.	27.29609	10.27585	0.32670E 00	52.4340002
8	32.41317	1.42413	0.	30.82505	10.27586	0.12516E 01	34.7200003
9	35.94203	1.42413	0.	34.35402	10.27585	0.18722E 01	27.0500002
10	39.47100	1.42413	0.	37.88298	10.27586	0.21232E 01	34.9599976
11	42.99793	1.42413	0.	41.41194	10.27585	0.22374E 01	45.0150001
12	46.52894	1.42413	0.	44.94091	10.27585	0.23012E 01	39.2700000
13	50.05791	1.42413	0.	48.46987	10.27585	0.17136E 01	40.9500000
14	53.58687	1.42413	0.	51.99883	10.27585	0.47019E 00	38.7250000
15	57.11583	1.42413	0.	55.52780	10.27585	0.79532E-01	37.7349998
16	60.64480	1.42413	0.	59.05676	10.27586	0.66556E 00	34.3330002
17	64.17376	1.42413	0.	62.58572	10.27586	0.12523E 01	24.9300000
18	67.70272	1.42413	0.	66.11469	10.27585	0.11375E 01	10.8700000
19	23.72512	3.63722	0.	28.64412	0.26233	0.17624E 02	0.0454700
20	31.57421	3.63722	0.	29.70259	2.42351	0.46433E 01	0.4978000
21	32.17737	3.63722	0.	31.46491	2.31441	0.25391E 01	0.6470200
22	34.26241	3.63722	0.	33.31722	3.08568	0.20925E 01	8.4342500
23	36.45755	3.63722	0.	35.60677	3.05735	0.21132E 01	10.6351900
24	39.35371	3.63722	0.	38.34494	3.05735	0.22024E 01	10.6351900
25	42.48465	3.63722	0.	41.25572	4.62982	0.22735E 01	5.6771700
26	45.12754	3.63722	0.	44.51932	4.98399	0.23315E 01	2.0345700
27	31.15505	5.09489	0.	30.11276	0.24379	0.12714E 02	0.0443900
28	31.70624	5.09489	0.	31.07631	2.62349	0.53670E 01	0.4131700
29	33.39773	5.09489	0.	32.71399	2.13043	0.32118E 01	0.6316600
30	35.34327	5.09489	0.	34.45510	2.96727	0.25159E 01	7.9431610
31	37.77457	5.09489	0.	36.66008	3.54409	0.23241E 01	9.8150000
32	40.23344	5.09489	0.	39.12695	3.54409	0.23317E 01	9.8137000
33	43.15749	5.09489	0.	41.83170	4.30091	0.23672E 01	5.3344200
34	46.25585	5.09489	0.	44.86431	4.53984	0.23872E 01	2.0536200
35	31.55103	6.55245	0.	31.58130	0.22520	0.10517E 02	0.0434500
36	33.23417	6.55245	0.	32.49993	2.42346	0.59613E 01	0.4385900
37	34.51511	6.55245	0.	34.00278	1.90547	0.37733E 01	0.6183400
38	36.41166	6.55245	0.	35.59249	2.54865	0.28860E 01	7.2255700
39	38.65753	6.55243	0.	37.61732	3.31082	0.25276E 01	9.0369200
40	40.73112	6.55245	0.	39.90890	3.31082	0.24616E 01	9.0369200
41	43.53131	6.55245	0.	42.40765	3.97292	0.24624E 01	4.9349800
42	45.56117	6.55245	0.	45.20927	4.19371	0.24432E 01	2.9375300
43	33.11349	8.00987	0.	33.04969	0.20562	0.96879E 01	0.0472300
44	34.56797	8.00987	0.	33.88342	2.22343	0.64533E 01	0.4262600
45	35.93432	8.00987	0.	35.27155	1.82254	0.43271E 01	0.6309500
46	37.46193	8.00987	0.	36.73058	2.43005	0.32613E 01	6.5246400
47	39.54441	8.00987	0.	38.60646	3.03756	0.27623E 01	9.1557699
48	41.62873	8.00987	0.	40.69378	3.03756	0.26354E 01	8.1576999

49	44.10297	8.01337	0.	42.79333	5.64507	0.25517E 01	4.6275200
50	46.74235	8.00387	0.	45.55419	5.84759	0.25035E 01	2.0333300
51	34.37577	9.44711	0.	34.51721	3.18305	0.92747E 01	0.9417200
52	35.21152	9.44711	0.	35.27674	2.02341	0.69439E 01	0.4110700
53	37.35231	9.44711	0.	36.54017	1.95359	0.47438E 01	0.5724500
54	39.55177	9.44711	0.	37.94312	2.71144	0.36045E 01	6.6273000
55	40.42317	9.44711	0.	39.57949	2.76430	0.30415E 01	7.2722400
56	42.32525	9.44711	0.	41.47247	2.74430	0.27930E 01	7.2722400
57	44.36177	9.44711	0.	43.57915	3.31715	0.25719E 01	4.2497500
58	46.78141	9.44711	0.	45.49708	3.30145	0.24459E 01	1.9510700
59	35.21031	11.11358	0.	35.16649	3.21001	0.90174E 01	0.0209400
60	37.49715	11.11358	0.	36.84142	2.25994	0.75218E 01	0.5141800
61	39.42123	11.11358	0.	37.94401	1.75245	0.54554E 01	0.7249200
62	37.75232	11.11358	0.	39.14557	2.46294	0.41714E 01	6.6212400
63	41.42775	11.11358	0.	40.44370	5.38743	0.33941E 01	0.2765000
64	43.19754	11.11358	0.	42.35050	5.38743	0.29443E 01	0.2765000
65	45.11545	11.11358	0.	44.20599	5.70491	0.28471E 01	4.9581200
66	47.24745	11.11358	0.	46.28678	5.71074	0.27171E 01	2.2365200
67	38.35175	12.91313	0.	38.01132	3.18063	0.89612E 01	0.0470400
68	39.36217	12.91343	0.	38.59100	1.74382	0.80877E 01	0.4749100
69	37.94775	12.91343	0.	39.55740	1.39334	0.64310E 01	0.6523200
70	41.03453	12.91343	0.	40.57378	2.12445	0.48226E 01	5.3524200
71	42.33375	12.91343	0.	41.88030	2.55555	0.39515E 01	6.7484600
72	43.75544	12.91343	0.	43.33218	2.55555	0.33512E 01	6.7186600
73	45.71293	12.91343	0.	44.92904	5.18567	0.30126E 01	4.1708300
74	47.54521	12.91343	0.	46.71945	5.46471	0.27220E 01	2.1578000
75	37.90738	14.74193	0.	39.85249	3.13125	0.87414E 01	0.0420200
76	40.74207	14.74193	0.	40.33229	1.52774	0.83459E 01	0.4240500
77	41.47311	14.74193	0.	41.14942	1.33421	0.73374E 01	0.5909100
78	42.43734	14.74193	0.	42.09134	1.77993	0.57432E 01	4.1153500
79	43.64494	14.74193	0.	43.07640	2.22367	0.44579E 01	5.1322700
80	44.66167	14.74193	0.	44.31314	2.22367	0.39427E 01	5.1372000
81	45.30857	14.74193	0.	45.65155	2.56443	0.33945E 01	3.4349400
82	47.54874	14.74193	0.	47.13220	2.31667	0.31024E 01	1.9393100
83	41.72257	16.59911	0.	41.69231	1.12183	0.84578E 01	0.0344700
84	42.40384	16.59911	0.	42.01535	1.31159	0.85114E 01	0.3479300
85	43.03424	16.59911	0.	42.73941	1.37307	0.80673E 01	0.4205100
86	43.76345	16.59911	0.	43.42498	1.13145	0.63332E 01	2.8142500
87	44.75271	16.59911	0.	44.31076	1.73182	0.53418E 01	3.5177700
88	45.73177	16.59911	0.	45.27225	1.79182	0.44735E 01	3.5177700
89	46.73344	16.59911	0.	46.37315	2.15019	0.38476E 01	2.6355500
90	48.14417	16.59911	0.	47.51440	2.26764	0.27959E 01	1.7367600
91	43.35006	18.40977	0.	43.52790	1.19291	0.86416E 01	0.0186600
92	44.07350	18.40977	0.	43.82711	1.29549	0.88995E 01	0.1333500
93	44.52725	18.40977	0.	44.32528	1.31500	0.84352E 01	0.2555000
94	45.11817	18.40977	0.	44.84890	1.08800	0.79474E 01	1.1723300
95	45.75973	18.40977	0.	45.52212	1.36000	0.67297E 01	1.4554000
96	46.60573	18.40977	0.	46.27214	1.36000	0.44419E 01	1.4554000
97	47.49491	18.40977	0.	47.09297	1.53200	0.24459E 01	1.4309800
98	48.44191	18.40977	0.	48.01353	1.72267	0.12745E 01	1.3441300
99	59.24435	3.60743	0.	58.03825	1.54449	0.92250E 01	0.1215200
100	59.79023	3.60743	0.	58.64725	1.07782	0.43615E 01	0.3202400
101	60.18545	3.60743	0.	59.63736	1.72231	0.23317E 01	1.1521500
102	61.78717	3.60743	0.	61.05835	2.29641	0.14835E 01	1.7360900
103	63.79824	3.60743	0.	62.85535	2.87052	0.12350E 01	2.0446900
104	65.32384	3.60743	0.	64.91534	2.87052	0.11851E 01	2.1174200
105	59.62434	5.02102	0.	59.44965	1.54354	0.73459E 01	0.4777100
106	60.26048	5.02102	0.	59.96835	1.91735	0.47471E 01	0.2771500
107	61.27844	5.02102	0.	60.81164	1.46389	0.26274E 01	1.0754300
108	62.54436	5.02102	0.	62.02192	1.95453	0.17155E 01	1.5930600

109	64.35503	5.02102	0.	63.57801	2.44315	0.124322E 01	1.9370900
110	65.06503	5.02102	0.	65.30699	2.44315	0.115762E 01	2.0252100
111	61.03403	6.44331	0.	60.84275	0.45257	0.658568E 01	0.1586800
112	61.52356	6.44331	0.	61.29122	0.75083	0.505367E 01	0.2586800
113	62.37144	6.44331	0.	61.99403	1.20749	0.396491E 01	0.9713000
114	63.45377	6.44331	0.	62.99441	1.51264	0.132792E 01	1.4513900
115	64.21274	6.44331	0.	64.27103	2.11580	0.140709E 01	1.3371300
116	65.34099	6.44331	0.	65.60827	2.01580	0.114148E 01	1.9114000
117	62.36144	7.84324	0.	62.26749	0.35564	0.405306E 01	0.1358100
118	62.75649	7.84324	0.	62.50599	0.59543	0.521355E 01	0.2276300
119	63.40264	7.84324	0.	63.15607	0.95305	0.359422E 01	0.8227000
120	64.35177	7.84324	0.	63.94548	1.27075	0.223177E 01	1.2396500
121	65.16556	7.84324	0.	64.95069	1.58944	0.157355E 01	1.4370600
122	65.59651	7.84324	0.	66.00891	1.58944	0.121344E 01	1.7453000
123	63.75402	9.24921	0.	63.67028	0.26063	0.311117E 01	0.0781100
124	64.05959	9.24921	0.	63.91894	0.43595	0.418735E 01	0.1306100
125	64.34495	9.24921	0.	64.32319	0.69565	0.404245E 01	0.4731700
126	65.20175	9.24921	0.	64.90378	0.92985	0.297383E 01	0.6756300
127	66.02231	9.24921	0.	65.64933	1.16109	0.145346E 01	0.9133900
128	66.35114	9.24921	0.	66.47817	1.16109	0.545325E 00	1.3597900

```
FIRST PANEL NUMBER ON FRONT FUSELAGE =  1
LAST PANEL NUMBER ON FRONT FUSELAGE  =  9
FIRST PANEL NUMBER ON REAR FUSELAGE  = 10
LAST PANEL NUMBER ON REAR FUSELAGE   = 19
FIRST PANEL NUMBER ON MAIN WING      = 19
LAST PANEL NUMBER ON MAIN WING       = 98
FIRST PANEL NUMBER ON HORIZONTAL TAIL= 99
LAST PANEL NUMBER ON HORIZONTAL TAIL =129
     STRUCTURAL CHORD FOR MAIN WING      =  8.33333
     STRUCTURAL CHORD FOR HORIZONTAL TAIL=  4.15667
HALF THE WIDTH OF FUSELAGE AT ROOT CHORD OF THE MAINWING       =   2.91667
HALF THE WIDTH OF FUSELAGE AT ROOT CHORD OF THE HORIZONTAL TAIL=   2.91667
X-COORDINATE OF FIXED POINT=  35.50900
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COORDINATES OF UNIT LOADING POINTS AND LOADING POINT ASSIGNMENTS

I	XCG	YCG	IASIGN
1	6.17231	1.42413	13
2	9.65127	1.42413	12
3	13.18 24	1.42413	10
4	16.7092	1.42413	9
5	20.23916	1.42413	7
6	23.76713	1.42413	6
7	27.29509	1.42413	4
8	30.82505	1.42413	3
9	34.35402	1.42413	2
10	37.88298	1.42413	2
11	41.41194	1.42413	3
12	44.94 91	1.42413	5
13	48.46987	1.42413	6
14	51.99893	1.42413	7
15	55.5279	1.42413	8
16	59.05674	1.42413	10
17	62.58572	1.42413	11
18	66.11459	1.42413	12
19	28.54412	3.63722	2
20	29.70259	3.63722	2
21	31.46491	3.63722	2
22	33.31722	3.63722	2
23	35.59877	3.63722	2
24	38.34494	3.63722	2
25	41.25672	3.63722	3
26	44.51732	3.63722	4
27	30.11776	5.09489	2
28	31.79631	5.09489	2
29	32.73339	5.09489	2
30	34.4551	5.09489	2
31	36.56938	5.09489	3
32	39.12595	5.09489	3
33	41.9317	5.09489	4
34	44.85131	5.09489	4
35	31.5815	6.55245	2
36	32.48793	6.55245	2
37	34.00278	6.55245	3
38	35.59739	6.55245	3
39	37.63732	6.55245	4
40	39.9099	6.55245	4
41	42.40765	6.55245	5
42	45.20327	6.55245	5
43	33.04959	8.00987	3
44	33.89342	8.00987	3
45	35.27155	8.00987	4
46	36.73 39	8.00987	4
47	38.63646	8.00987	5
48	40.69 78	8.00987	5
49	42.93153	8.00987	6
50	45.55419	8.00987	6
51	34.01791	9.46711	4
52	35.27574	9.46711	4
53	36.54 17	9.46711	5
54	37.96912	9.46711	5
55	39.57549	9.46711	6
56	41.47257	9.46711	6

57	43.55935	9.46711	7
58	45.99908	9.46711	7
59	35.19459	11.10359	5
60	36.54142	11.10359	5
61	37.96491	11.10359	6
62	39.14557	11.10359	6
63	4[illegible].6517	11.10359	7
64	42.35[illegible]5	11.10359	7
65	44.20379	11.10359	8
66	44.78639	11.10359	8
67	38.[illegible]1 32	12.93343	6
68	38.5910[illegible]	12.93343	6
69	39.5578	12.93343	7
70	40.57199	12.93343	7
71	41.98[illegible]5	12.93343	8
72	43.33218	12.93343	8
73	44.92904	12.93343	8
74	46.71945	12.93343	9
75	39.85259	14.76193	7
76	40.33929	14.76193	7
77	41.14357	14.76193	8
78	42.00134	14.76193	8
79	43.5954	14.76193	9
80	44.31314	14.76193	9
81	45.65155	14.76193	9
82	47.1522	14.76193	10
83	41.69251	16.56811	8
84	42.08535	16.56811	8
85	42.73941	16.56811	9
86	43.42599	16.56811	9
87	44.31.76	16.56811	10
88	45.29295	16.56811	10
89	46.37115	16.56811	10
90	47.5944	16.56811	10
91	43.527[illegible]	18.40977	9
92	43.82711	18.40977	9
93	44.32529	18.40977	10
94	44.8439	18.40977	10
95	45.52712	18.40977	10
96	46.27 14	18.40977	10
97	47.09297	18.40977	10
98	49.01553	18.40977	10
99	54.03925	3.60743	2
100	59.64725	3.60743	2
101	59.63736	3.60743	2
102	61.05535	3.60743	2
103	62.99335	3.60743	3
104	64.91534	3.60743	3
105	59.44965	5.02[illegible] 2	3
106	59.96575	5.02[illegible] 2	3
107	60.91154	5.02[illegible] 2	3
108	62.02[illegible]92	5.02[illegible] 2	3
109	63.57501	5.02[illegible] 2	3
110	65.30499	5.02[illegible] 2	4
111	60.95979	6.45331	4
112	61.28922	6.45331	4
113	61.96483	6.45331	4
114	62.99461	6.45331	4
115	64.27[illegible]03	6.45331	4
116	65.59927	6.45331	5

117	62.75747	7.84324	4
119	62.50597	7.94324	4
119	63.15507	7.94324	5
120	63.34559	7.94324	5
121	64.96 99	7.94324	5
122	65.09331	7.94324	5
123	63.67129	9.24821	5
124	63.91994	9.24821	5
125	64.32319	9.24821	5
126	64.90339	9.24821	6
127	65.64933	9.24821	6
128	66.47917	9.24821	6

NUMBER OF ELASTIC AXIS POINTS ONFRONT FUSELAGE =13

COORDINATES OF ELASTIC AXIS SEGMENTS

I	XEA	YEA
1	35.5093	0.
2	33.3333	0.
3	30.4167	0.
4	27.6042	0.
5	25.0000	0.
6	22.5000	0.
7	20.0000	0.
8	17.5000	0.
9	15.4167	0.
10	12.7083	0.
11	10.4167	0.
12	8.1250	0.
13	5.4167	0.

ELASTIC AXIS TORSIONAL AND BENDING STIFFNESS

I	EI	KGJ
1	0.198 E 10	0.
2	0.149 E 10	0.
3	0.1397E 10	0.
4	0.115 E 10	0.
5	0.950 E 9	0.
6	0.7453E 9	0.
7	0.520 E 9	0.
8	0.500 E 9	0.
9	0.3714E 9	0.
10	0.290 E 9	0.
11	0.2000E 9	0.
12	0.1200E 9	0.

NUMBER OF ELASTIC AXIS POINTS ON REAR FUSELAGE =12

COORDINATES OF ELASTIC AXIS SEGMENTS

I	XEA	YEA
1	35.6093	0.
2	38.9500	0.
3	41.7500	0.
4	44.3750	0.
5	47.0833	0.
6	49.7916	0.
7	52.5000	0.
8	57.2917	0.
9	57.7083	0.
10	60.6250	0.
11	63.5417	0.
12	66.4583	0.

ELASTIC AXIS TORSIONAL AND BENDING STIFFNESS

I	EI	KGJ
1	0.2200E 10	0.
2	0.2200E 10	0.
3	0.2190E 10	0.
4	0.2080E 10	0.
5	0.1580E 10	0.
6	0.1140E 10	0.
7	0.8000E 9	0.
8	0.5600E 9	0.
9	0.3800E 9	0.
10	0.1600E 9	0.
11	0.1944E 8	0.

NUMBER OF ELASTIC AXIS POINTS ON MAIN WING =10

COORDINATES OF ELASTIC AXIS SEGMENTS

I	XEA	YEA
1	35.60990	0.
2	36.59[illegible]	1.5[illegible]0
3	37.7800[illegible]	3.9[illegible]0
4	38.78[illegible]	5.7[illegible]0
5	[illegible]840[illegible]	7.5[illegible]0
6	[illegible]0	9.4[illegible]0
7	[illegible]	11.4[illegible]0
8	43.70[illegible]	13.6[illegible]0
9	45.12[illegible]	15.6[illegible]0
10	[illegible]6.52[illegible]	17.9[illegible]0

EL# AXIS TORSIONAL AND BENDING STIFFNESS

.	I		KGJ	
1	0.9931E	8	[illegible].8472E	08
2	0.7986E	8	[illegible].6875E	08
3	0.5486E	8	0.4444E	08
4	0.3681E	8	0.27[illegible]E	08
5	0.2431E	8	0.1944E	08
6	[illegible].1529E	8	0.1250E	08
7	[illegible].7639E	7	0.625[illegible]E	07
[illegible]	[illegible].3194E	7	0.27[illegible]E	07
9	[illegible].125[illegible]E	7	0.1111E	07

NUMBER OF ELASTIC AXIS POINTS ON HORIZONTAL TAIL = 6

COORDINATES OF ELASTIC AXIS SEGMENTS

I	XEA	YEA
1	60.6250	0.
2	61.25[illegible]	1.4[illegible]0
3	62.57[illegible]	3.72[illegible]
4	63.[illegible]300	5.510[illegible]0
5	64.9400	7.290[illegible]0
6	65.99[illegible]	[illegible].0[illegible]0

ELASTIC AXIS TORSIONAL AND BENDING STIFFNESS

I	EI	KGJ
1	[illegible].3125E 8	0.27[illegible]8E 08
2	0.2361E 8	[illegible].1875E 08
3	0.1389E 8	[illegible].9722E 07
4	0.6944E 7	0.52[illegible]8E 07
5	0.3472E 7	0.2431E 07

ELASTIC DERIVATIVES FOR MACH NUMBER= 1.50

WEIGHT= 74000.
RHO= 0.002378 S.O.S.= 1115.990 ALTITUDE= 0.
VELOCITY= 0.16739E 04
DYNAMIC PRESSURE= 0.33372E 04
CLTRIM= 0.04654
CLA_PA= 0.25938E 01
CMA_PA=-0.72066E 01
CLDERR= 0.16306E 02
CMDERR=-0.51153E 02
CLQI =-0.51019E 02
CMQI = 0.19770E 03
CLWDI = 0.15717E-03
CMWDI =-0.56275E-03
CLTDDI= 0.75963E-02
CMTDDI=-0.24201E-01
DCLDN =-0.51779E-02
DCMDN = 0.16397E-01
CLA_PE= 0.23306E 01
CMA_PE=-0.53619E 01

PANEL NUMBER	THETA(F)	CP(F)
1	0.57972E-01	0.22114E 01
2	0.54543E-01	0.11912E 01
3	0.50054E-01	0.58595E 00
4	0.44223E-01	0.24023E 00
5	0.33777E-01	0.90913E-01
6	0.27747E-01	0.77277E-01
7	0.15375E-01	0.28047E 00
8	0.10443E-01	0.11915E 01
9	0.45076E-02	0.17557E 01
10	-0.13395E-01	0.19697E 01
11	-0.15773E-01	0.17417E 01
12	-0.15771E-01	0.14514E 01
13	-0.20118E-01	0.99795E 00
14	-0.21793E-01	0.20321E 00
15	-0.24642E-01	-0.12764E 00
16	-0.26875E-01	0.25944E 00
17	-0.29953E-01	0.57159E 00
18	-0.33175E-01	0.74991E 00
19	-0.50975E-01	0.17474E 02
20	-0.52553E-01	0.45795E 01
21	-0.54508E-01	0.24475E 01
22	-0.57315E-01	0.19762E 01
23	-0.65912E-01	0.19895E 01
24	-0.73774E-01	0.19044E 01
25	-0.17467E 00	0.15341E 01
26	-0.30159E 00	0.13412E 01
27	-0.54975E-01	0.12337E 02
28	-0.57749E-01	0.52197E 01
29	-0.59174E-01	0.30795E 01
30	-0.60406E-01	0.22892E 01
31	-0.19574E 00	0.17297E 01
32	-0.19654E 00	0.17574E 01
33	-0.29407E 00	0.14195E 01
34	-0.27579E 00	0.13472E 01
35	-0.61387E-01	0.10870E 02
36	-0.61541E-01	0.57455E 01

37	-0.18146E 00	0.32991E 01
38	-0.19134E 00	0.24352E 01
39	-0.25726E 00	0.15914E 01
40	-0.28572E 00	0.17221E 01
41	-0.35775E 00	0.13195E 01
42	-0.35474E 00	0.12477E 01
43	-0.19171E 00	0.52669E 01
44	-0.19171E 00	0.39569E 01
45	-0.28635E 00	0.34451E 01
46	-0.28635E 00	0.25593E 01
47	-0.39613E 00	0.16594E 01
48	-0.39613E 00	0.15703E 01
49	-0.49332E 00	0.11997E 01
50	-0.49332E 00	0.11614E 01
51	-0.28636E 00	0.69459E 01
52	-0.28636E 00	0.59123E 01
53	-0.39613E 00	0.36717E 01
54	-0.39613E 00	0.26752E 01
55	-0.49332E 00	0.17063E 01
56	-0.49332E 00	0.15454E 01
57	-0.61213E 00	0.10637E 01
58	-0.61213E 00	0.10547E 01
59	-0.39613E 00	0.57714E 01
60	-0.39613E 00	0.58725E 01
61	-0.49332E 00	0.39553E 01
62	-0.49332E 00	0.27977E 01
63	-0.61213E 00	0.15777E 01
64	-0.61213E 00	0.14428E 01
65	-0.74571E 00	0.91655E 00
66	-0.74571E 00	0.10153E 01
67	-0.49332E 00	0.47152E 01
68	-0.49332E 00	0.55610E 01
69	-0.61213E 00	0.40674E 01
70	-0.61213E 00	0.29361E 01
71	-0.74571E 00	0.15317E 01
72	-0.74571E 00	0.14191E 01
73	-0.74571E 00	0.11523E 01
74	-0.83269E 00	0.85244E 00
75	-0.61213E 00	0.36162E 01
76	-0.61213E 00	0.49384E 01
77	-0.74571E 00	0.40724E 01
78	-0.74571E 00	0.32169E 01
79	-0.83269E 00	0.18481E 01
80	-0.83269E 00	0.15979E 01
81	-0.83269E 00	0.13502E 01
82	-0.81332E 00	0.11994E 01
83	-0.74571E 00	0.24792E 01
84	-0.74571E 00	0.37507E 01
85	-0.83269E 00	0.38454E 01
86	-0.83269E 00	0.33412E 01
87	-0.81332E 00	0.26750E 01
88	-0.81332E 00	0.18176E 01
89	-0.81332E 00	0.15499E 01
90	-0.81332E 00	0.12474E 01
91	-0.83269E 00	0.16434E 01
92	-0.93269E 00	0.25199E 01
93	-0.81332E 00	0.34731E 01
94	-0.81332E 00	0.37895E 01
95	-0.81332E 00	0.33314E 01
96	-0.81332E 00	0.23644E 01

97	-0.81372E 00	0.11792E 01
98	-0.81372E 00	0.44913E 00
99	-0.41063E-01	0.52253E 01
100	-0.47113E-01	0.24412E 01
101	-0.47511E-01	0.12977E 01
102	-0.43047E-01	0.84127E 00
103	-0.69872E-01	0.72949E 00
104	-0.71455E-01	0.80491E 00
105	-0.57272E-01	0.30595E 01
106	-0.57272E-01	0.29741E 01
107	-0.57272E-01	0.16747E 01
108	-0.57272E-01	0.11791E 01
109	-0.57272E-01	0.93991E 00
110	-0.65874E-01	0.94203E 00
111	-0.65874E-01	0.53415E 01
112	-0.65874E-01	0.37610E 01
113	-0.65874E-01	0.22329E 01
114	-0.63874E-01	0.16725E 01
115	-0.65874E-01	0.12769E 01
116	-0.67597E-01	0.11517E 01
117	-0.65874E-01	0.59979E 01
118	-0.65874E-01	0.49154E 01
119	[illegible]	0.31401E 01
120	-0.67597E-01	0.21575E 01
121	-0.67539E-01	0.17739E 01
122	-0.69559E-01	0.13421E 01
123	-0.69559E-01	0.59399E 01
124	-0.67589E-01	0.51279E 01
125	-0.69559E-01	0.45902E 01
126	-0.64953E-01	0.31924E 01
127	-0.66993E-01	0.14719E 01
128	-0.64951E-01	0.53414E 00

SECTIONAL CD/CL**2 FOR WING

Y	CM	CLT	GAMMA	CT	CD/CL**2
0.19773	1.77421	2.22499	0.50645	0.	0.36715
0.24224	1.74315	2.28494	0.49330	0.	0.36141
0.33919	1.52203	2.30386	0.45019	0.	0.33505
0.41341	1.57445	2.29344	0.41156	0.	0.29949
0.49853	1.32043	2.25327	0.35934	0.	0.24309
0.57319	1.05478	2.22713	0.32243	0.	0.19418
0.65733	0.81079	2.26924	0.27576	0.	0.14977
0.74131	0.57728	2.29533	0.23922	0.	0.10625
0.85416	0.45099	2.39035	0.20196	0.	0.08457
0.95018	0.49423	2.20043	0.14159	0.	0.07455

SECTIONAL CD/CL**2 FOR HORIZONTAL TAIL

Y	CDI	CLI	GAMMA	CT	CD/CL**2
0.36074	1.20603	1.27064	0.25794	0.	0.22403
0.50210	1.42072	1.51159	0.26140	0.	0.26159
0.64333	1.77221	1.70703	0.27256	0.	0.32810
0.79432	2.22915	2.46797	0.27839	0.	0.42327
0.99432	2.57831	2.76795	0.22942	0.	0.47466

TOTAL LEADING EDGE THRUST COEFFICIENT= 0.
TOTAL INDUCED DRAG COEFFICIENT= 0.18991E 01
CD/(CL*CL)= 0.34963E 00

THIS CASE IS COMPLETE
****

8. TEST CASE 3

In this test case the geometry data of one of the examples given in Ref. 3 is used. This geometry data is reduced by the program to calculated rigid stability derivatives and ΔC_p values. Figure 5 gives the actual geometrical description and geometry assumed by the program. Input data cards are listed in Table 7 and output data are listed in Table 8.

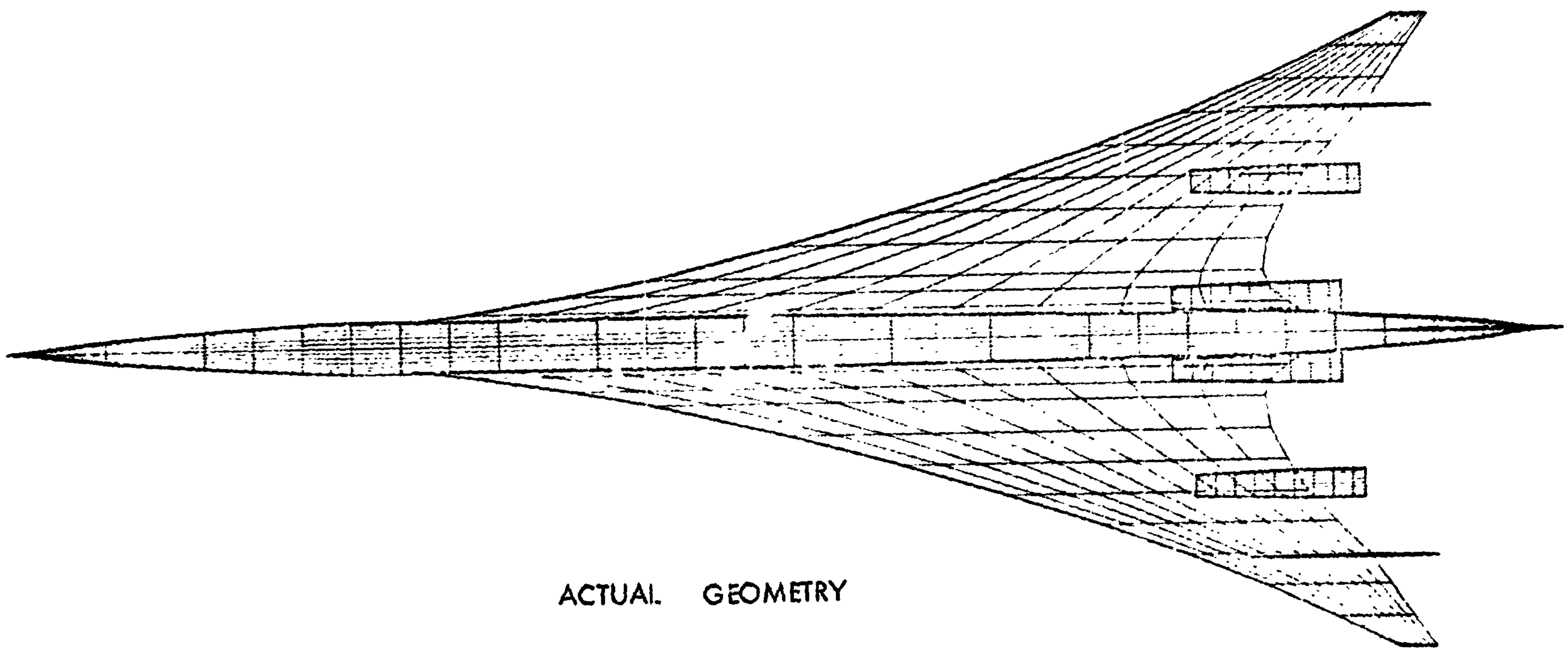


Figure 5. Actual and Assumed Planform Geometry for Test Case 3.

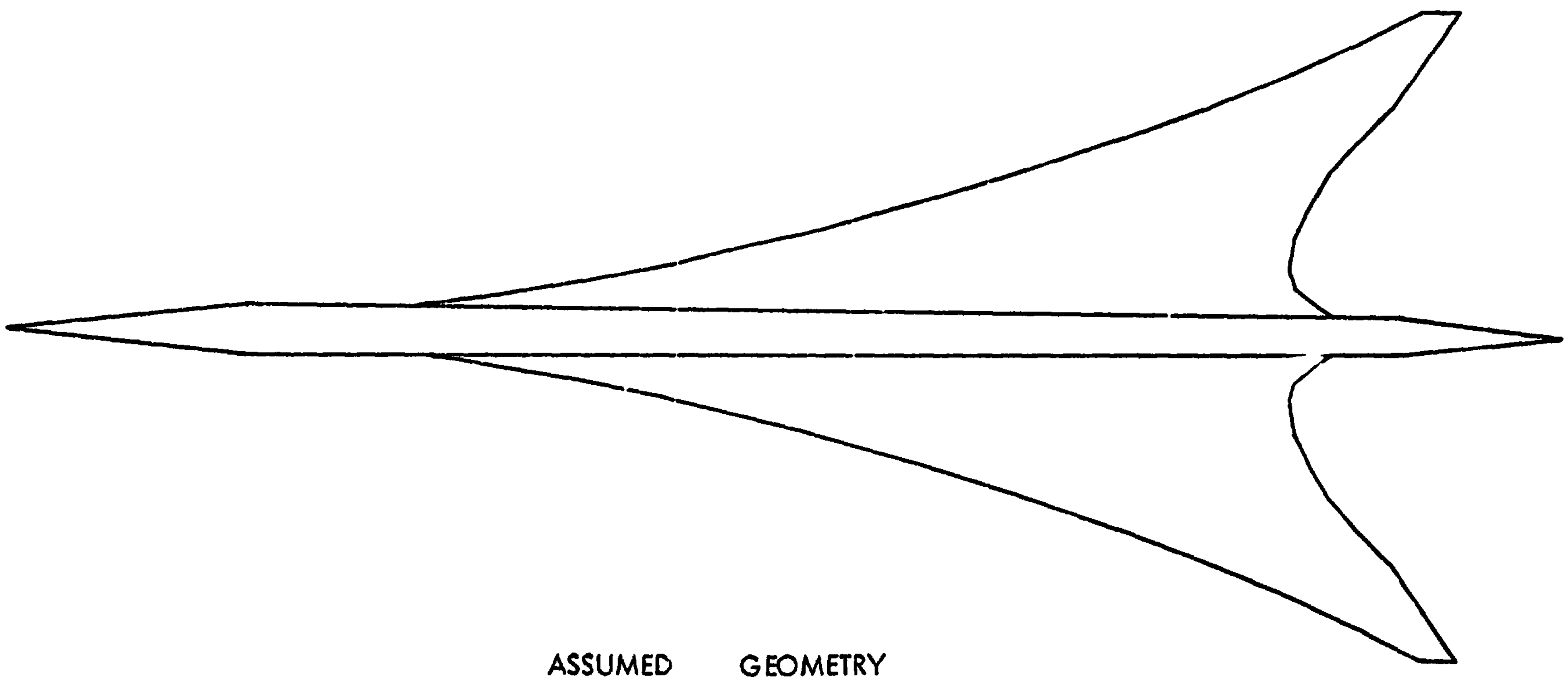


Figure 5 (Continued) Actual and Assumed Planform Geometry for Test Case 3

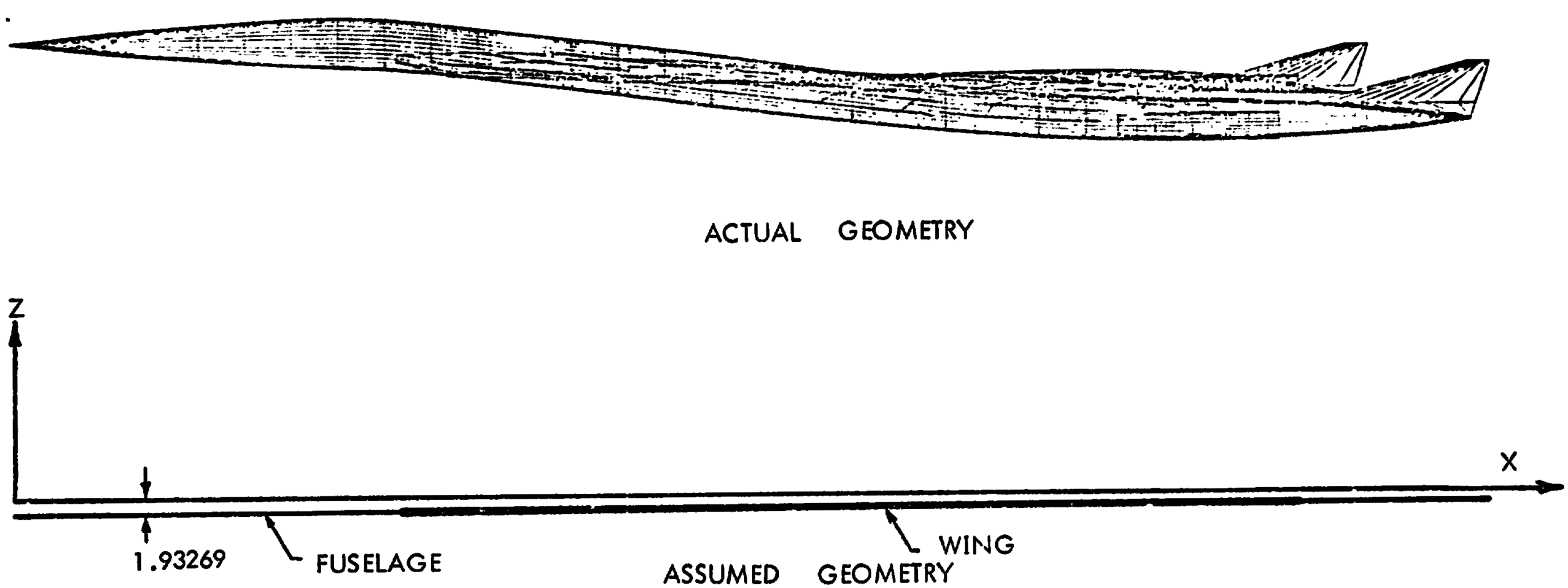


Figure 5 (Continued) Actual and Assumed Planform Geometry for Test Case 3

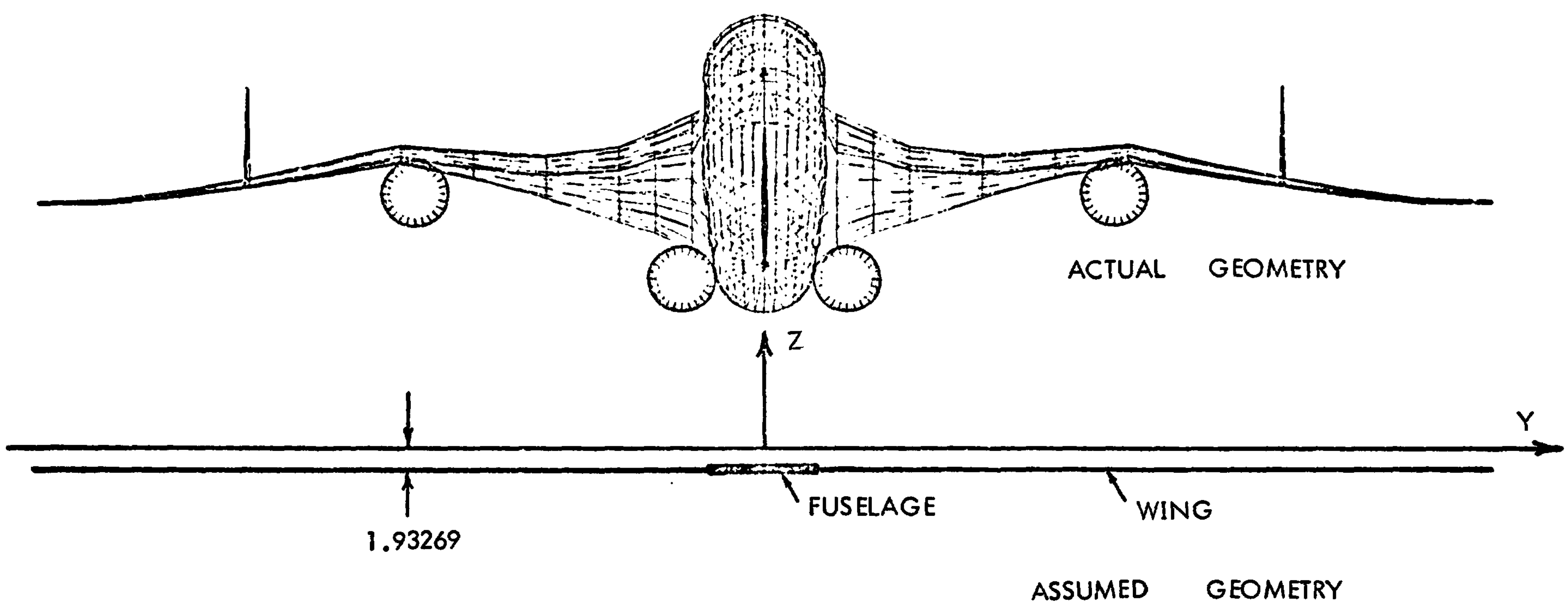


Figure 5 (Continued) Actual and Assumed Planform Geometry for Test Case 2

Table 7. Listing of Input Data Cards for Test Case 3

```
Card 0   SST CONFIGURATION WITH CAMBERED CIRCULAR BODY (NASA-TMX-2074) AT MACH 1.6
     1             1
     2   01
     2   001001-01001001      012013001017026                           2010003010
     2   9494.                                                                        REFA
     2   0.      0.1     0.6     10.     20.     30.     40.     50.     60.     70.     XAF    10
     2   80.     90.     100.                                                         XAF    13
     2   82.3    5.05    0.      180.1                                                WAFORG 1
     2   93.8    6.6     0.      166.201                                              WAFORG 2
     2   114.1999.9      -0.45   142.351                                              WAFORG 3
     2   130.62913.2     -1.4    124.87                                               WAFORG 4
     2   157.98  19.8    -1.85   98.57                                                WAFORG 5
     2   181.29  26.4    -1.15   78.51                                                WAFORG 6
     2   202.41  33.     -0.35   61.241                                               WAFORG 7
     2   221.63  39.6    -1.6    47.819                                               WAFORG 8
     2   239.18  46.2    -2.8    36.719                                               WAFORG 9
     2   255.    52.8    -3.75   25.35                                                WAFORG10
     2   269.23  59.4    -4.3    15.67                                                WAFORG11
     2   282.    66.     -4.4    7.4                                                  WAFORG12
     2   3.6     3.7     3.9     3.75    2.75    0.95    -1.35   -3.45   -5.3    -6.8    TZORD  1
     2   -8.2    -9.1    -9.4                                                         TZORD  1
     2   0.1     0.5     1.75    2.      2.1     1.2     -.05    -1.85   -3.25   -4.7    TZORD  2
     2   -6.3    -7.7    -8.8                                                         TZORD  2
     2   0.      0.35    0.9     1.2     1.35    0.7     -0.2    -1.2    -2.35   -3.45   TZORD  3
     2   -4.55   -5.75   -6.8                                                         TZORD  3
     2   0.      0.165   0.72    0.93    1.      0.6875  0.15    -0.56   -1.35   -2.205  TZORD  4
     2   -3.07   -3.9375-4.801                                                        TZORD  4
     2   0.      .1      .45     .6      .72     .695    .4      .0875   -.295   -.7825  TZORD  5
     2   -1.15   -1.685  -2.173                                                       TZORD  5
     2   0.      .05     .285    .42     .5925   .625    .47     .3125   .12     -.1     TZORD  6
     2   -.345   -.6175  -.8989                                                       TZORD  6
     2   0.      .04     .1935   .2765   .395    .4395   .433    .386    .3085   .2075   TZORD  7
     2   .0915   -.039   -.182                                                        TZORD  7
```

Table 7 (Continued) Listing of Input Data Cards for Test Case 3

Card												
2	0.	.0225	.1085	.16	.249	.298	.3135	.304	.278	.238	TZORD	8
2	.185	.1235	.0568								TZORD	8
2	0.	.02	.1055	.158	.248	.2858	.305	.311	.308	.2995	TZORD	9
2	.2845	.2635	.2385								TZORD	9
2	0.	.0085	.049	.0695	.1175	.144	.155	.158	.1595	.1585	TZORD	1C
2	.1545	.148	.1398								TZORD	10
2	0.	-.003	-0.014	-.023	-.043	-.061	-.077	-.09	-.1005	-.11	TZORD	11
2	-.1155	-.119	-.1224								TZORD	11
2	0.	-.0025	-.01	-.017	-.0325	-.047	-.062	-.075	-.088	-.1	TZORD	12
2	-.1115	-.122	-.1324								TZORD	12
2	0.	.304	.491	.803	1.069	1.28	1.43	1.518	1.55	1.451	WAFORD	1
2	1.162	.678	0.								WAFORD	1
2	0.	.265	.423	.71	.962	1.156	1.296	1.373	1.396	1.294	WAFORD	2
2	1.028	.593	0.								WAFORD	2
2	0.	.226	.338	.635	.889	1.079	1.204	1.272	1.263	1.136	WAFORD	3
2	.886	.506	0.								WAFORD	3
2	0.	.204	.274	.596	.87	1.074	1.2	1.25	1.234	1.083	WAFORD	4
2	.832	.472	0.								WAFORD	4
2	0.	.144	.175	.559	.886	1.111	1.246	1.294	1.242	1.087	WAFORD	5
2	.828	.466	0.								WAFORD	5
2	0.	.066	.09	.522	.886	1.145	1.289	1.341	1.285	1.125	WAFORD	6
2	.852	.48	0.								WAFORD	6
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD	7
2	.88	.495	0.								WAFORD	7
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD	8
2	.88	.495	0.								WAFORD	8
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD	9
2	.88	.495	0.								WAFORD	9
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD10	
2	.88	.495	0.								WAFORD10	
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD11	
2	.88	.495	0.								WAFORD11	
2	0.	.006	.033	.495	.88	1.155	1.32	1.375	1.32	1.155	WAFORD12	

Table 7 (Continued) Listing of Input Data Cards for Test Case 3

Card												
2	.88	.495	0.								WAFORD	12
2	0.	20.	40.	50.	60.	70.	80.	90.	100.	120.	XFUS	10
2	130.	140.	150.	160.	180.	200.	220.	230.	240.	250.	XFUS	20
2	260.	270.	280.	290.	300.	312.					XFUS	26
2	7.4	7.4	7.4	7.4	7.4	7.4	7.	6.15	5.	2.5	ZFUS	10
2	1.25	0.	-1.3	-2.5	-5.	-7.45	-9.2	-9.75	-10.	-10.15	ZFUS	20
2	-10.2	-10.2	-10.2	-10.2	-10.2	-10.2					ZFUS	26
2	0.	18.5	48.	65.	83.	96.	95.5	92.2	92.5	96.	AFUS	10
2	98.	100.7	101.	98.	89.5	79.	70.	68.5	68.5	67.3	AFUS	20
2	62.	50.5	37.	24.	11.5	0.					AFUS	26
2	236.8	7.5	-11.55								PODORG	1
2	0.	4.	8.	12.	16.	20.	24.	28.	32.	34.5	XPOD	1
2	2.292	2.477	2.644	2.791	2.915	3.012	3.076	3.097	3.1	3.1	PODR	1
2	241.	31.75	-3.6								PODORG	2
2	0.	4.	8.	12.	16.	20.	24.	28.	32.	34.5	XPOD	2
2	2.292	2.477	2.644	2.791	2.915	3.012	3.076	3.097	3.1	3.1	PODR	2
2	252.	47.	-2.95	35.3	285.36	47.	6.31	4.77			FINORG	1
2	0.	10.	20.	30.	40.	50.	60.	70.	90.	100.	XFIN	1
2	0.	.311	.564	.759	.897	.977	.999	.927	.427	0.	FINORD	1
2	277.9	0.	-6.77	35.3	311.3	0.	2.49	4.77			FINORG	2
2	0.	10.	20.	30.	40.	50.	60.	70.	90.	100.	XFIN	2
2	0.	.311	.564	.759	.897	.977	.999	.927	.427	0.	FINORD	2
2											FINORG	3
2											XFIN	3
2											FINORD	3
3	1309											
7	0.	4.16667	12.5	20.83333	9.16667	37.5	45.83333	54.16667				
7	62.5	70.83333	79.16667	87.5	100.							
7	0.	3.4289	12.	21.	33.	48.	63.	81.				
7	100.											
10	0.											
11	1.6	0.										

Table 8. Output for Test Case 3

```
SST CONFIGURATION WITH CAMBERED CIRCULAR BODY (NASA-TMX-2074) AT MACH 2.6

*************************************************
* GEOMETRY DATA IS DIVIDED IN  5 SECTIONS *
*************************************************

DEFINITION OF SECTION 1
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
  0.                 312.00000           0.                   -1.93269
 44.73134            255.54817           5.05000              -1.93269
THERE ARE 13 CONSTANT PERCENT CHORDWISE LINES AT
    0.        4.167    12.500    20.833    29.167    37.500    45.833    54.167    62.500    70.833    79.167    87.500
  100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
    0.      100.000

DEFINITION OF SECTION 2
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
 82.30000            262.40000           5.05000              -1.93269
 93.80000            260.00100           5.50000              -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
    0.        3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
    0.      100.000

DEFINITION OF SECTION 3
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
 93.80000            250.00100           5.50000              -1.93269
114.19900            256.55000           9.90000              -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
    0.        3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
    0.      100.000

DEFINITION OF SECTION 4
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
114.19900            256.55000           9.70000              -1.93269
130.62900            255.49900          13.20000              -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
    0.        3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
    0.      100.000

DEFINITION OF SECTION 5
***********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
130.62900            255.49900          13.20000              -1.93269
157.98000            256.55000          19.50000              -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
```

```
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION 6
 ***********************

 X-LEADING EDGE      X-TRAILING EDGE     Y-LEADING EDGE          Z
   157.98000          256.95000          19.30000           -1.93269
   181.29000          259.80000          26.40000           -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION 7
 ***********************

 X-LEADING EDGE      X-TRAILING EDGE     Y-LEADING EDGE          Z
   181.29000          259.80000          26.40000           -1.93269
   202.41000          263.65130          33.00000           -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION 8
 ***********************

 X-LEADING EDGE      X-TRAILING EDGE     Y-LEADING EDGE          Z
   202.41000          263.65130          33.00000           -1.93269
   221.63000          269.44930          39.50000           -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION 9
 ***********************

 X-LEADING EDGE      X-TRAILING EDGE     Y-LEADING EDGE          Z
   221.63000          269.44930          39.50000           -1.93269
   239.16000          275.89930          46.20000           -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION10
 ***********************

 X-LEADING EDGE      X-TRAILING EDGE     Y-LEADING EDGE          Z
   239.16000          275.89930          46.20000           -1.93269
   255.00000          280.35030          52.50000           -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
     0.       3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
     0.     100.000

 DEFINITION OF SECTION11
```

```
**********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
 255.00000           280.35000             52.90000         -1.93269
 269.23000           284.90000             59.40000         -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
   0.      3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
   0.     100.000

DEFINITION OF SECTION12
**********************

X-LEADING EDGE     X-TRAILING EDGE     Y-LEADING EDGE          Z
 269.23000           284.90000             59.40000         -1.93269
 292.00000           299.40000             86.00000         -1.93269
THERE ARE  9 CONSTANT PERCENT CHORDWISE LINES AT
   0.      3.429    12.000    21.000    33.000    48.000    63.000    81.000   100.000
THERE ARE  2 CONSTANT PERCENT STREAMWISE LINES AT
   0.     100.000
REF. AREA= 0.94940E 04
REF. CHORD= 0.18013E 03


CLALPR  = 0.19707E 01
CMALPR  =-0.23159E 01
CLO     = 0.50422E 01
CMO     =-0.62947E 01
```

SECTIONAL CD/CL**2 FOR WING

Y	CDI	C-L	GAMMA	CT	CD/CL**2
0.05910	0.71648	0.73534	0.51576	-0.20185	0.13974
0.12436	0.89140	1.15347	0.52672	-0.18907	0.23704
0.17445	0.96437	1.23455	0.52550	-0.26798	0.24154
0.24904	1.05942	1.43535	0.51056	-0.37596	0.28732
0.34911	1.16835	1.74234	0.59674	-0.57369	0.31696
0.44794	1.24265	2.13512	0.55028	-0.86407	0.33695
0.54799	1.30590	2.55799	0.53302	-1.26198	0.35409
0.64781	1.54335	3.13514	0.50533	-1.79480	0.34432
0.74595	1.32785	3.99773	0.45216	-2.56008	0.36012
0.84607	1.02837	5.35534	0.40008	-4.02757	0.27870
0.94403	-0.49757	6.94133	0.31172	-7.33990	-0.13494

```
TOTAL LEADING EDGE THRUST COEFFICIENT=-0.52493E 00
TOTAL INDUCED DRAG COEFFICIENT= 0.13937E 01
CD/(CL*CL)= 0.29716E 00
```

MACH NUMBER= 1.60

CP VALUES ARE FOR ALPHA= 1.000000 RADIANS

PANEL NUMBER	XCP	YCP	ZCP	XCS	AREA	CP
1	31,73811	2,38096	-1,93259	26,69419	50,05482	0,91872E 00
2	53,[illegible]	2,38096	-1,93259	43,50726	112,11350	0,46623E 00
3	76,01[illegible]	2,38096	-1,93259	65,90468	112,11350	0,21329E 00
4	98,42797	2,38096	-1,93259	88,34212	112,11363	0,27516E 00
5	120,84749	2,38096	-1,93259	110,7[illegible]56	112,11350	0,[illegible] 00
6	143,26482	2,38096	-1,93259	133,17678	112,11350	0,7523[illegible] 00
7	165,66227	2,38096	-1,93259	155,59441	112,11363	0,93275E 00
8	188,09969	2,38096	-1,93259	178,01195	112,11350	0,99828E 00
9	210,51711	2,38096	-1,93259	200,42927	112,11350	0,997[illegible]E 00
10	232,93456	2,38096	-1,93259	222,84671	112,11363	0,69977E 00
11	255,35199	2,38096	-1,93259	245,26414	112,11350	0,[illegible]E 00
12	288,41769	2,38096	-1,93259	273,27573	16[illegible],17[illegible]1	0,29771E 00
13	93,41549	5,81463	-1,93259	90,94325	9,20257	0,19903E 01
14	108,01985	5,81463	-1,93259	101,33796	23,70347	0,96124E 00
15	127,57461	5,81463	-1,93259	116,55025	24,15449	0,77548E 00
16	144,10394	5,81463	-1,93259	134,74891	32,20397	0,86017E 00
17	169,93062	5,81463	-1,93259	156,13648	40,25749	0,99342E 00
18	195,91714	5,81463	-1,93259	194,17320	40,25749	0,10219E 01
19	225,74110	5,81463	-1,93259	212,70838	49,30999	0,97665E 00
20	253,57074	5,81463	-1,93259	244,78612	50,39282	0,71242E 00
21	109,77219	8,20749	-1,93259	106,30696	17,45590	0,23110E 01
22	121,52422	8,20749	-1,93259	115,64175	45,53440	0,12631E 01
23	135,50359	8,20749	-1,93259	129,24294	47,41997	0,1[illegible]E 01
24	153,92158	8,20749	-1,93259	145,47418	61,79327	0,1[illegible]E 01
25	175,77727	8,20749	-1,93259	156,34292	79,36562	0,10573E 01
26	199,96479	8,20749	-1,93259	199,91011	79,36562	0,10715E 01
27	227,55769	8,20749	-1,93259	215,03655	91,43794	0,10340E 01
28	256,85142	8,20749	-1,93259	243,67455	90,73105	0,[illegible]E 00
29	125,59737	11,51402	-1,93259	124,50892	17,11952	0,30200E 01
30	137,71759	11,51402	-1,93259	132,58698	37,79124	0,14640E 01
31	149,73097	11,51402	-1,93259	144,31204	39,46232	0,13409E 01
32	165,58647	11,51402	-1,93259	158,34116	52,20775	0,12075E 01
33	185,45509	11,51402	-1,93259	176,47431	65,13729	0,11505E 01
34	205,52605	11,51402	-1,93259	176,49447	65,13729	0,11310E 01
35	229,40754	11,51402	-1,93259	218,57165	79,36464	0,10949E 01
36	254,76485	11,51402	-1,93259	243,32496	83,77379	0,94515E 00
37	147,42399	16,37052	-1,93259	145,69217	23,28307	0,41775E 01
38	155,75924	16,37052	-1,93259	152,47633	63,19917	0,22193E 01
39	164,93243	16,37052	-1,93259	162,20697	69,36169	0,16071E 01
40	180,13739	16,37052	-1,93259	174,07159	88,48224	0,14160E 01
41	195,79949	16,37052	-1,93259	189,27350	110,50281	0,12974E 01
42	213,63401	16,37052	-1,93259	206,05899	110,50277	0,12347E 01
43	233,56893	16,37052	-1,93259	224,57792	132,72534	0,11783E 01
44	254,93764	16,37052	-1,93259	245,34147	140,09589	0,19775E 01
45	172,05139	22,97539	-1,93259	170,71937	29,03725	0,55370E 01
46	179,48409	22,97539	-1,93259	176,05449	59,08542	0,29976E 01
47	187,40779	22,97539	-1,93259	193,86649	52,59275	0,20552E 01
48	198,00457	22,97539	-1,93259	193,20296	70,12369	0,17405E 01

49	211.20900	22.97539	-1.93259	205.20679	87.45461	0.15296E 01
50	224.54682	22.97539	-1.93259	218.54490	87.45461	0.14110E 01
51	240.41981	22.97539	-1.93259	233.21639	107.19352	0.13142E 01
52	257.20391	22.97539	-1.93259	249.66536	111.72717	0.12216E 01
53	193.70274	29.56407	-1.93259	192.61911	17.91535	0.72735E 01
54	199.54180	29.56407	-1.93259	196.87798	34.92402	0.37819E 01
55	205.94754	29.56407	-1.93259	203.00318	41.30903	0.29798E 01
56	214.16791	29.56407	-1.93259	210.37745	59.44139	0.21200E 01
57	224.59925	29.56407	-1.93259	219.84865	69.17573	0.19324E 01
58	235.13393	29.56407	-1.93259	230.39333	69.17573	0.16242E 01
59	247.47919	29.56407	-1.93259	241.98147	83.01207	0.15291E 01
60	260.97700	29.56407	-1.93259	254.97423	87.52389	0.13663E 01
61	213.41102	36.16462	-1.93259	212.54537	12.34155	0.92045E 01
62	217.90751	36.16462	-1.93259	215.85569	30.94721	0.47742E 01
63	222.90924	36.16462	-1.93259	220.64854	32.35982	0.32276E 01
64	229.35268	36.16462	-1.93259	226.42320	43.18773	0.23772E 01
65	237.52127	36.16462	-1.93259	233.92151	53.35179	0.22112E 01
66	245.74237	36.16462	-1.93259	242.04271	53.78470	0.17473E 01
67	255.52482	36.16462	-1.93259	251.08559	64.78164	0.17849E 01
68	265.31042	36.16462	-1.93259	261.22457	67.39162	0.14344E 01
69	231.40575	42.75557	-1.93259	230.74979	4.56379	0.11544E 02
70	234.94017	42.75557	-1.93259	233.30950	23.31125	0.57718E 01
71	239.75714	42.75557	-1.93259	237.03541	29.10779	0.41021E 01
72	243.79469	42.75557	-1.93259	241.49916	33.47705	0.31423E 01
73	250.10702	42.75557	-1.93259	247.23827	41.94431	0.27203E 01
74	254.48469	42.75557	-1.93259	253.61505	41.94431	0.23875E 01
75	264.07299	42.75557	-1.93259	260.67952	50.21955	0.21246E 01
76	272.12499	42.75557	-1.93259	258.49422	35.90531	0.19072E 01
77	247.52927	49.29852	-1.93259	247.14507	7.72534	0.14927E 02
78	250.25935	49.29852	-1.93259	249.02777	17.55599	0.77155E 01
79	253.15546	49.29852	-1.93259	251.78501	19.43459	0.51396E 01
80	256.77469	49.29852	-1.93259	255.08007	24.57733	0.35597E 01
81	261.43464	49.29852	-1.93259	259.31659	30.72415	0.32696E 01
82	244.14708	49.29852	-1.93259	264.07392	30.72415	0.27554E 01
83	271.74369	49.29852	-1.93259	269.20178	36.96599	0.23907E 01
84	277.69053	49.29852	-1.93259	275.00737	39.71725	0.22175E 01
85	262.23503	55.84042	[illegible]259	261.91349	4.54155	0.20171E 02
86	263.97267	55.84042	[illegible]259	253.14693	11.50235	0.10451E 02
87	265.94837	55.84042	[illegible]3259	249.00230	12.18294	0.57074E 01
88	268.32392	55.84042	-1.93259	257.19582	19.24592	0.32613E 01
89	271.42619	55.84042	-1.93259	270.01607	20.30469	0.41913E 01
90	274.55980	55.84042	-1.93259	273.14957	20.30490	0.39111E 01
91	278.20987	55.84042	-1.93259	276.59665	24.36987	0.32837E 01
92	282.24757	55.84042	-1.93259	280.44143	29.71353	0.29625E 01
93	275.24369	62.30568	-1.93259	275.05828	2.51349	0.23717E 02
94	275.24397	62.30568	-1.93259	275.70003	6.52527	0.15413E 02
95	277.32403	62.30568	-1.93259	276.83695	9.95179	0.11210E 02
96	278.74949	62.30568	-1.93259	278.09990	9.13573	0.77870E 01
97	280.53560	62.30568	-1.93259	279.72393	11.41765	0.61415E 01
98	287.34014	62.30568	-1.93259	281.52820	11.41965	0.47842E 01
99	284.40735	62.30568	-1.93259	283.51300	13.70559	0.39347E 01
100	286.76687	62.30568	-1.93259	285.73838	14.46489	0.32150E 01

THIS CASE IS COMPLETE

9. COMPUTER PROGRAM LISTING

The computer program was originally written by members of the Flight Research Laboratory at the University of Kansas for the Honeywell 635 computer system. The version listed in this document is a revised version as optimized by Computer Sciences Corporation of Hampton, Virginia for the CDC 6600 computer at NASA Langley Research Center.

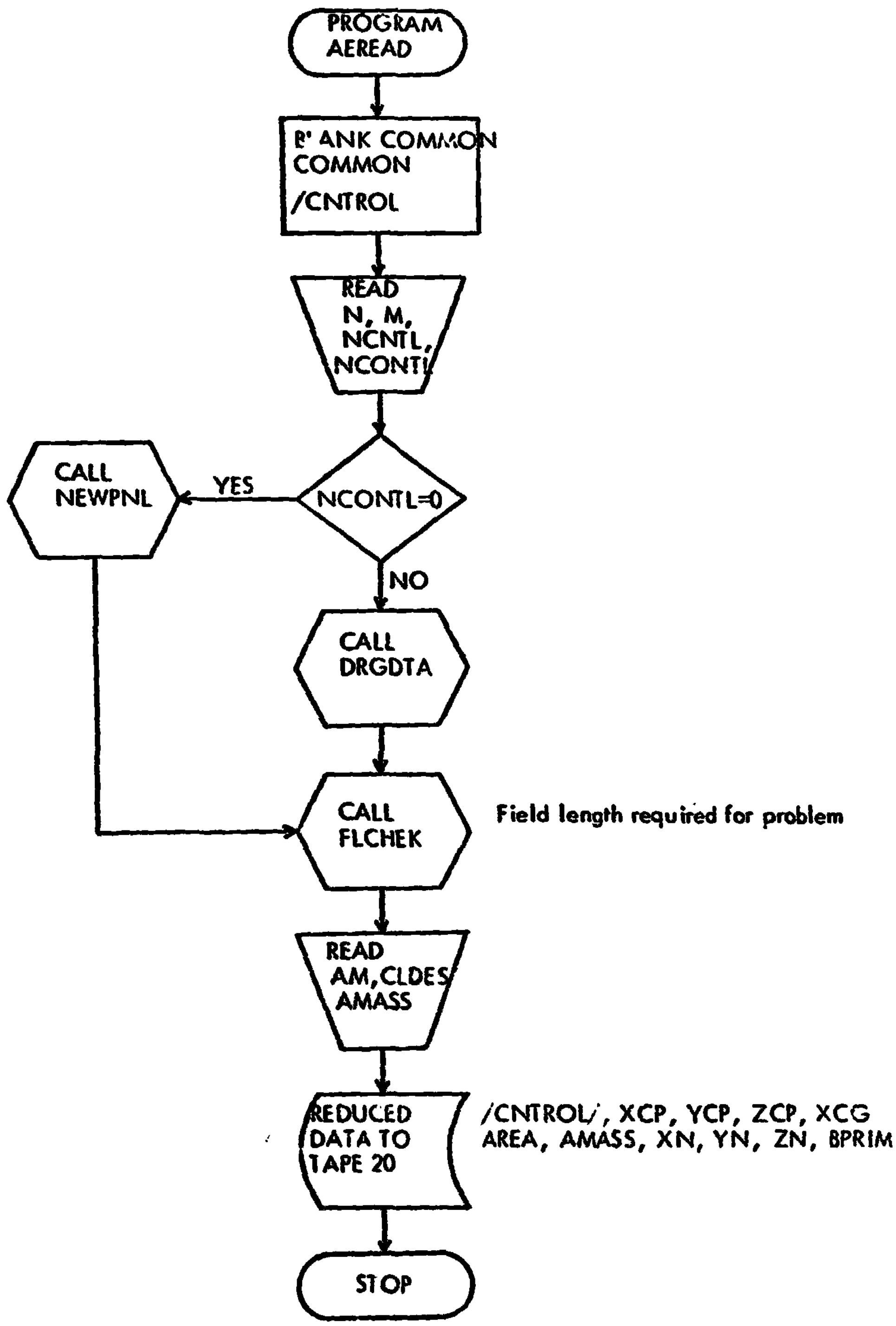


FIGURE 6. FLOW CHART FOR MAIN LINE

FIGURE 6. (continued)

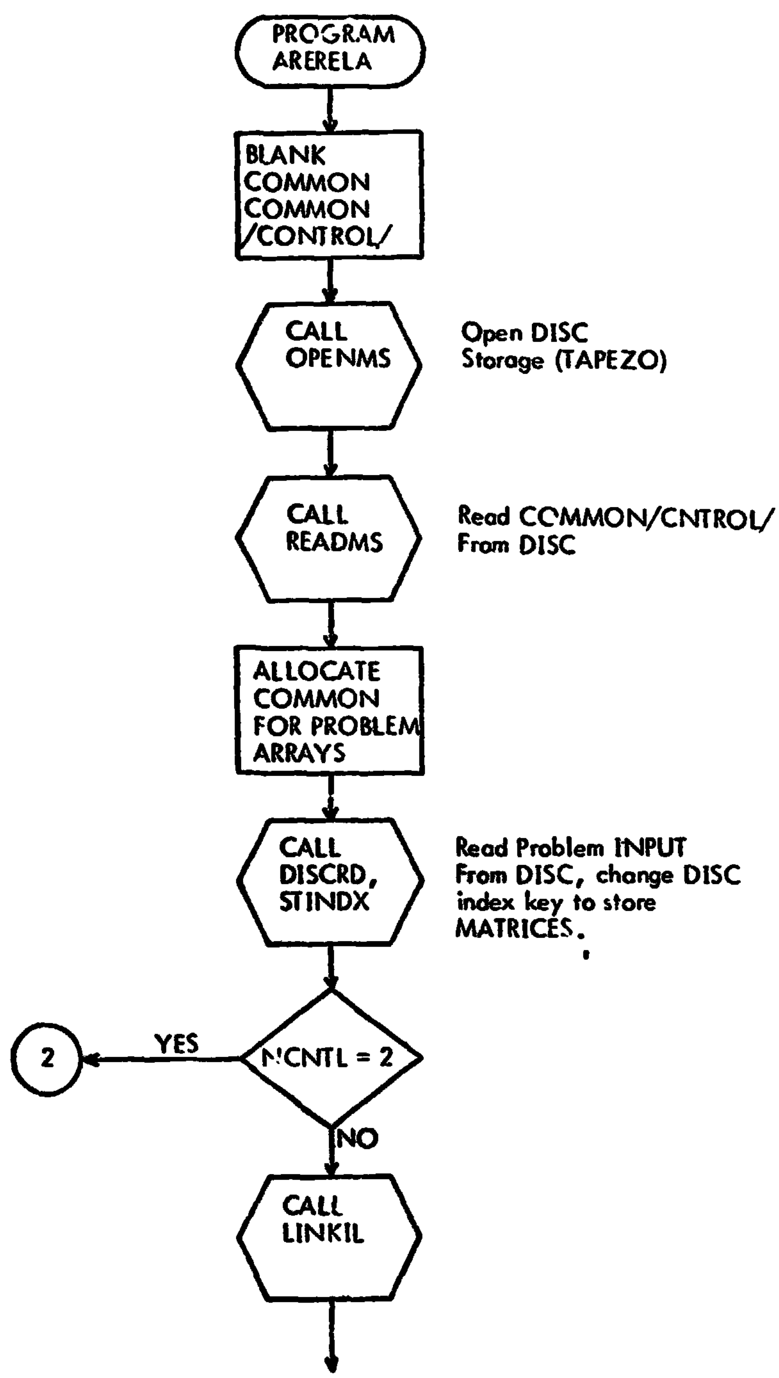


FIGURE 6. (continued)

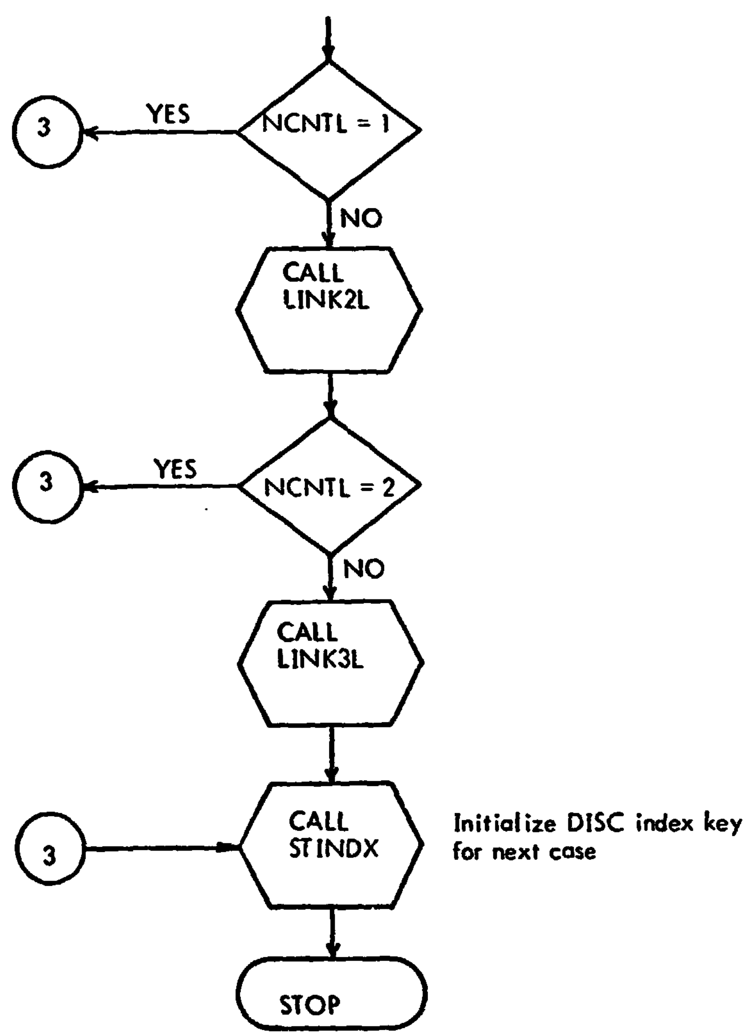


FIGURE 6. (continued)

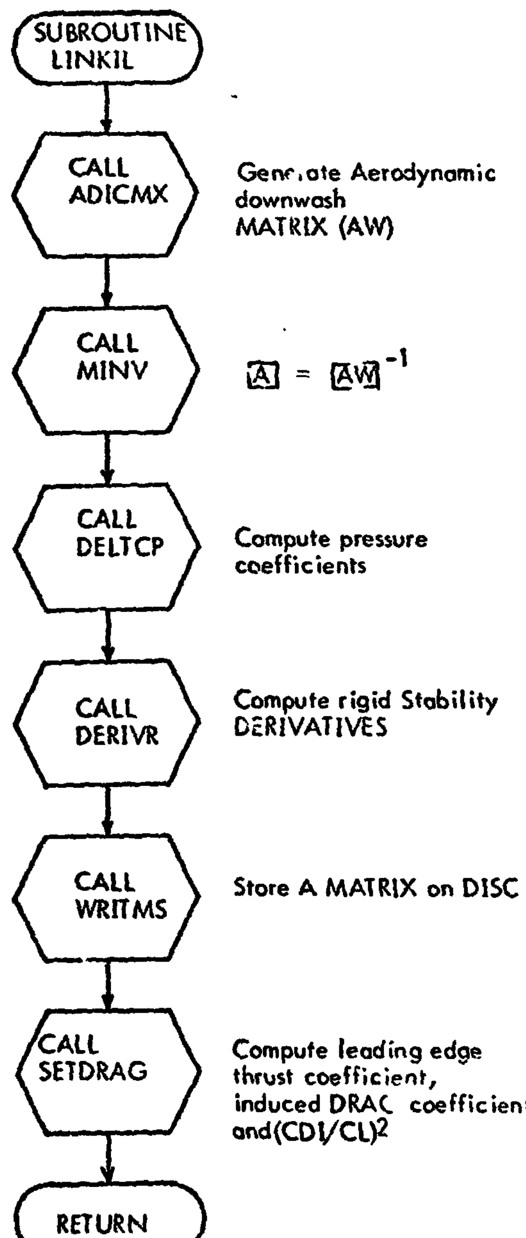


FIGURE 6. (continued)

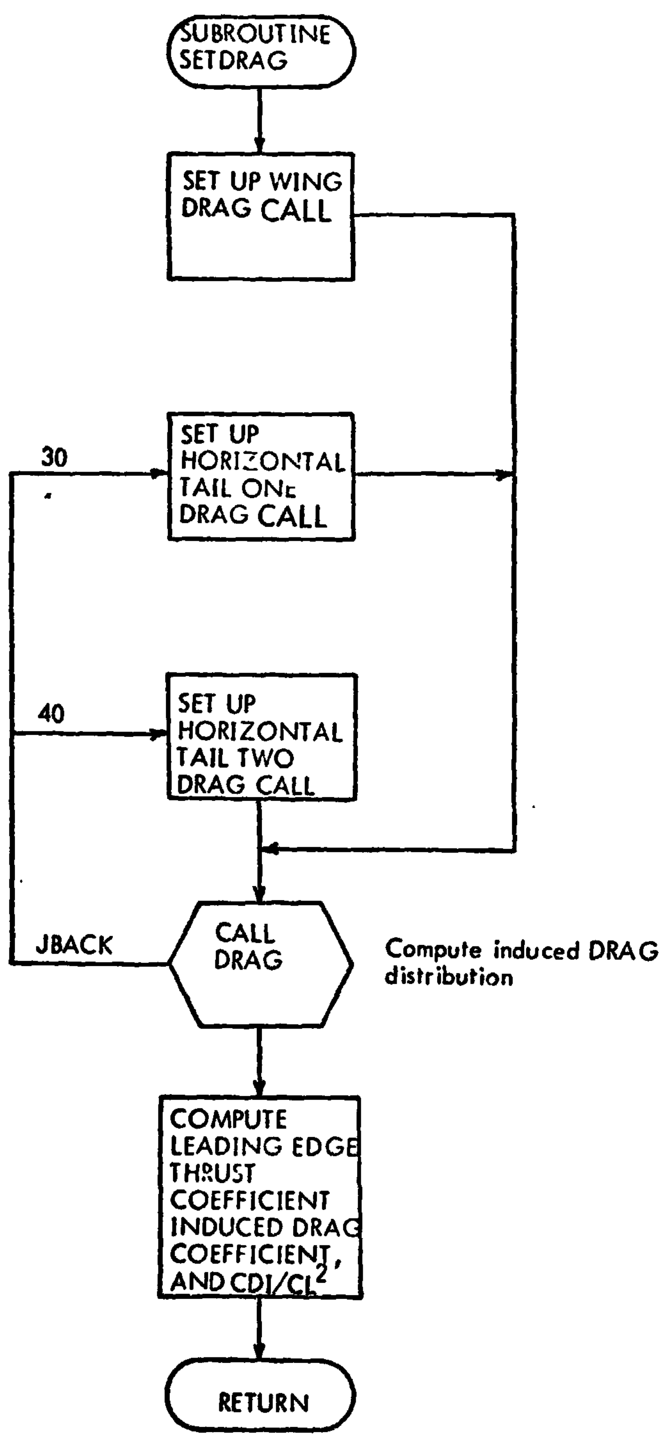
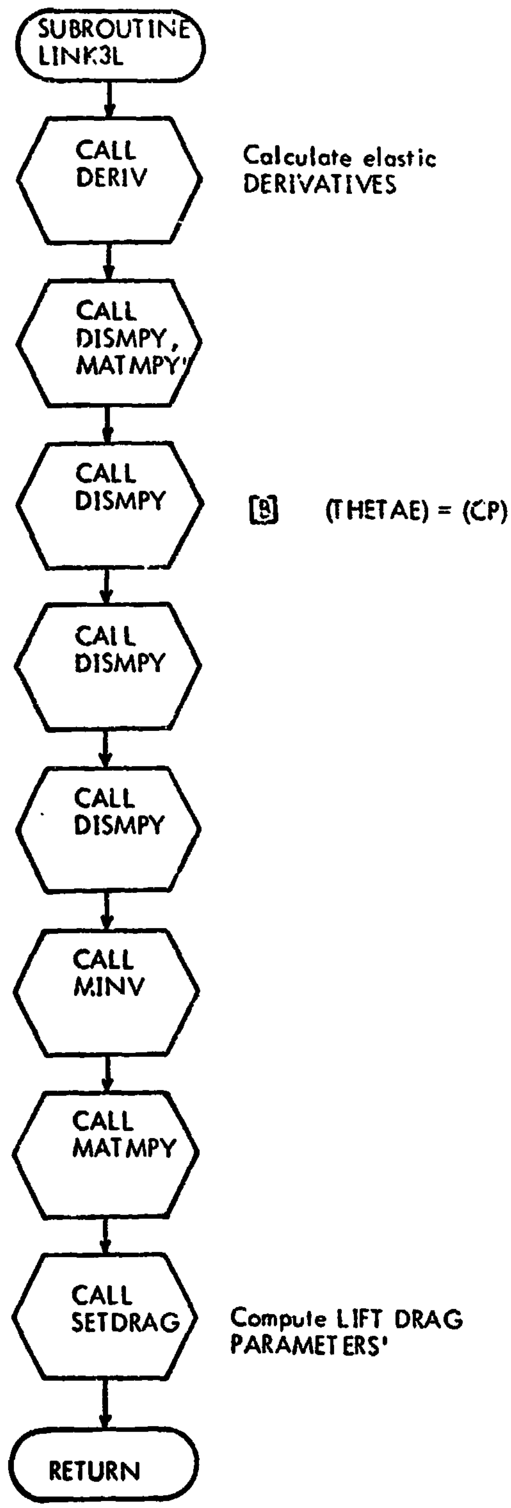


FIGURE 6. (continued)



```
      PROGRAM AEREAD(INPUT=201,OUTPUT=201,TAPE5=INPUT,TAPE6=OUTPUT,     AERE0010
     1 TAPE20=401)                                                      AERE0020
C.......................................................................AERE0030
C                                                                       AERE0040
C**TWO-STEP PROGRAM FOR CALCULATING ALPHA- AND Q-STABILITY              AERE0050
C  DERIVATIVES AND INDUCED DRAG FOR THIN ELASTIC AIRPLANES AT           AERE0060
C  SUBSONIC AND SUPERSONIC SPEEDS.  MAX PROBLEM SIZE IS 300 PANELS.     AERE0070
C**WRITTEN BY MEMBERS OF FLIGHT RESEARCH LABORATORY, UNIV. OF KANSAS.   AERE0075
C                                                                       AERE0080
C  JOBSTEP AEREAD PROCESSES THE INPUT DATA FOR DIVIDING THE             AERE0090
C  LIFTING SURFACES INTO AERODYNAMIC PANELS.  THE REDUCED DATA          AERE0100
C  IS STORED ON A DISC FILE (TAPE20) WHICH IS ACCESSED BY THE           AERE0110
C  STABILITY DERIVATIVE COMPUTATION JOBSTEP AERELA.                     AERE0120
C                                                                       AERE0130
C**OPTIMIZED BY COMPUTER SCIENCES CORPORATION FOR NASA LANGLEY          AERE0140
C  RESEARCH CENTER.                                                     AERE0150
C                                                                       AERE0160
C**THE RANDOM-ACCESS DISC I/O CALLS TO OPENMS, READMS, WRITMS,          AERE0162
C  WRITIN AND STINDX ARE CDC 6000 DEPENDENT AND MUST BE CHANGED         AERE0164
C  FOR USE ON OTHER COMPUTERS.                                          AERE0166
C  MODIFICATIONS BY C.BOLZ AND B.PARKER JUNE 1972.                      AERE0170
C      LIFTING SURFACES INTO AERODYNAMIC PANELS                         AERE0180
C                                                                       AERE0190
C                                                                       AERE0200
C      IF    NCONTL=0   DATA IS INPUTTED ACCORDING TO THE PRESENT       AERE0210
C                       FORMAT                                          AERE0220
C      IF    NCONTL=1   DATA IS INPUTTED ACCORDING TO THE FORMAT        AERE0230
C                       GIVEN IN NASA-TMX-2074                          AERE0240
C                                                                       AERE0250
C.......................................................................AERE0260
```

```
      DIMENSION IND(12)
      DIMENSION RANDOM(4,300)
      DIMENSION TITLF(16)
      COMMON/CNTROL/ LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,
     2 NHT1P,NHT2P,HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX
C**READ PROGRAM COMMON SET UP FOR 300 PANEL PROBLEM
      COMMON XCG(300),XCP(300),YCP(300),ZCP(300),AREA(300),AMASS(300),
     1 XN(300,4),YN(300,4),ZN(300,4),BPRIM(300,4)
      INTEGER WNGPNL,HT1PNL,HT2PNL
      EQUIVALENCE(LPANEL,N,NUM), (NEAMAX,M)
      EQUIVALENCE (XCG(1),RANDOM(1,1))
      DIMENSION DUM(25)
      EQUIVALENCE (LPANEL,DUM(1))
      DO 10 I=1,25
   10 DUM(I)=0.
      MAX=300
C*************************************************************************
      READ (5,4) TITLE
      READ (5,5) N,M,NCNTL
      READ (5,7) NCONTL
C*************************************************************************
      WRITE (6,6) TITLE
C
C      SUBROUTINE DRGDTA READS THE GEOMETRY DATA ACCORDING TO THE
C      FORMAT GIVEN IN NASA-TMX-2074 AND MAKES AERODYNAMIC PANELS
C      CONFORMAL TO THIS PROGRAM
C
      IF(NCONTL.GT.0)CALL DRGDTA
C
C      SUBROUTINE NEWPNL USES THE INPUT DATA FORMAT OF THE PRESENT
C      PROGRAM FOR FINDING OUT AERODYNAMIC PANELS
C
      IF(NCONTL.EQ.0)CALL NEWPNL
C** FLCHEK CHECKS THE FIELD LENGTH REQUIRED FOR AN N PANEL PROBLEM AND
```

```
C   STOPS EXECUTION IF THE FIELD LENGTH IS EXCEEDED                     AERE0620
      CALL FLCHEK(N)                                                    AERE0630
C***********************************************************************AERE0640
      READ (5,8) AM,CLDES                                               AERE0650
      IF(NCNTL.NE.1)READ(5,8)(AMASS(I),I=1,LPANEL)                      AERE0660
C***********************************************************************AERE0670
      N4=4*N                                                            AERE0680
C                                                                       AERE0690
C       SUBROUTINE OPENMS OPENS UP A RANDOM ACCESS FILE FOR DATA STORAGE AERE0700
C                                                                       AERE0710
C       SUBROUTINE WRITMS WRITES THE ARRAY ONTO THE RANDOM ACCESS FILE   AERE0720
C                                                                       AERE0730
      CALL OPENMS(20,IND,12,0)                                          AERE0740
      CALL WRITMS(20,LPANEL,25, 1)                                      AERE0750
      CALL WRITMS(20,  XCP(1),N, 2)                                     AERE0760
      CALL WRITMS(20,  YCP(1),N, 3)                                     AERE0770
      CALL WRITMS(20,  ZCP(1),N, 4)                                     AERE0780
      CALL WRITMS(20,  XCG(1),N, 5)                                     AERE0790
      CALL WRITMS(20, AREA(1),N, 6)                                     AERE0800
      CALL WRITMS(20,AMASS(1),N, 7)                                     AERE0810
C                                                                       AERE0820
C**ARRAYS XN,YN,ZN AND BPRIM ARE STORED WITH ROWS AND COLUMNS           AERE0830
C  REVERSED TO FIT DATA STRUCTURE OF JOBSTEP AERELA.                    AERE0840
C                                                                       AERE0850
      DO 20 I=1,300                                                     AERE0860
      DO 20 J=1,4                                                       AERE0870
   20 RANDOM(J,I)=   XN(I,J)                                            AERE0880
      CALL WRITMS(20,RANDOM(1,1),N4, 8)                                 AERE0890
      DO 21 I=1,300                                                     AERE0900
      DO 21 J=1,4                                                       AERE0910
   21 RANDOM(J,I)=   YN(I,J)                                            AERE0920
      CALL WRITMS(20,RANDOM(1,1),N4, 9)                                 AERE0930
      DO 22 I=1,300                                                     AERE0940
      DO 22 J=1,4                                                       AERE0950
   22 RANDOM(J,I)=   ZN(I,J)                                            AERE0960
```

```
      CALL WRITMS(20,RANDOM(1,1),N4,10)                              AERE0970
      DO 23 I=1,300                                                  AERE0980
      DO 23 J=1,4                                                    AERE0990
   23 RANDOM(J,I)=BPRIM(I,J)                                         AERE1000
      CALL WRITMS(20,RANDOM(1,1),N4,11)                              AERE1010
    4 FORMAT (16A5)                                                  AERE1020
    5 FORMAT (3I3)                                                   AERE1030
    6 FORMAT (1H1,/////,25X,16A5,//////)                             AERE1040
    7 FORMAT (I2)                                                    AERE1050
    8 FORMAT(8F10.5)                                                 AERE1060
      STOP                                                           AERE1070
      END                                                            AERE1080
```

```
      SUBROUTINE FLCHEK(N)
C..........................................................................
C**FLCHEK DETERMINES PROBLEM FIELD LENGTH REQUIREMENT AND STOPS
C  EXECUTION IF FIELD LENGTH IS INSUFFICIENT.
C..........................................................................
      DIMENSION NFL(1),O(4),L(6)
      INTEGER CFL,RFL,FL,O
      DATA CFL/10835/,O/32768,4096,512,64/,L(5),L(6)/2*0/
C**CFL IS OBJECT CODE LENGTH.  RFL IS FL REQUIRED BY N-PANEL PROBLEM.
C  FL IS USER-ASSIGNED FIELD LENGTH.
C
      RFL=CFL+28*N+N*N
      RFL=MAXO(RFL,19264)
      K=LOCF(NFL)
      FL=NFL(63-K)
      RFL=((RFL-1)/64 + 1)*64
      IF(FL.EQ.RFL) RETURN
C
C**CONVERT FIELD LENGTH TO OCTAL
      L(1)=RFL/O(1)
      DO 10 I=2,4
      MFL=MOD(RFL,O(I-1))
 10   L(I)=MFL/O(I)
 900 OFORMAT(1HO,*THE MINIMUM FIELD LENGTH REQUIREMENT FOR THIS PROBLEM
     1IS *,6I1,* OCTAL WORDS.*)
      WRITE(6,900) L
C
C**STOP JOB IF FIELD LENGTH IS TOO SMALL FOR PROBLEM.
      IF(FL.GE.RFL) RETURN
      WRITE(6,901)
 901 OFORMAT(1HO,*YOUR FIELD LENGTH IS TOO SMALL FOR THIS PROBLEM.  EXEC
     1UTION TERMINATED*)
      STOP
      END
```

```
      S.  OUTINE BREAK(X,Y,Z,N,YY,NN,NNN)
C                           B*R*E*A*K
C.................................. ........................
C       SUBROUTINE BREAK GENERATES BREAK LINES ON WING DUE TO
C       HORIZONTAL TAIL AND VICE VERSA
C.................................................................
      DIMENSION X(1),Y(1),Z(1),YY(1)
      NNN=N
      DO 2 I=1,NN
      YYY=YY(I)
      DO 1 J=1,N
      IF (Y(J).GE.YYY) GO TO 2
      IF (Y(J).LT.YYY.AND.Y(J+1).GT.YYY) GO TO 3
      GO TO 1
    3 NNN=NNN+1
C
C       SUBROUTINE NEWBRK FINDS OUT THE COORDINATES OF BREAK LINES
C
      CALL NEWBRK(X(J),X(J+1),Y(J),Y(J+1),Z(J),Z(J+1),YYY,X(NNN),Y(NNN),
     1Z(NNN))
    1 CONTINUE
    2 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE DRGDTA
C                            D*R*G*D*T*A
C.......................................................................
C       SUBROUTINE DRGDTA READS THE GEOMETRY DATA ACCORDING TO THE
C       FORMAT GIVEN IN NASA-TMX-2074 AND MAKES AERODYNAMIC PANELS
C       CONFORMAL TO THIS PROGRAM
C
C       THIS COMPUTER PROGRAM CAN REDUCE DATA ONLY FOR FOUR CASES
C           (1) WING, FUSELAGE AND HORIZONTAL TAIL
C           (2) WING AND FUSELAGE
C           (3) WING AND HORIZONTAL TAIL
C           (4) WING ONLY
C
C.......................................................................
      COMMON/CNTROL/ LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,
     2 NHT1P,NHT2P,HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX
      COMMON XCG(300),XCP(300),YCP(300),ZCP(300),AREA(300),AMASS(300),
     1 XN(300,4),YN(300,4),ZN(300,4),BPRIM(300,4)
      COMMON/PNL/CPCWL(35),CPSWL(35),IPANEL
      DIMENSION XHT1LE(35),XHT1TE(35),YHT1(35),XHLE(2),YHLE(2),XHTE(2)
     1 ,XWLE1(2),XWTE1(2),YL1(2),XHT2LE(35),XHT2TE(35),YHT2(35)
      DIMENSION X(20),Y(20),Z(20),CHORD(20),XFUS(120),YFUS(120),ZFUS(120
     1),NRADX(4),NFORX(4),DUMMY(30),ZHT(2,2),SLOPLE(19),SLOPTE(19),ZAVHT
     2(2),XHT(2,20),YHT(2,20),CHRDHT(2,20),XFL(2),XFT(2),YF(2),YL(30),XW
     3LE(30),XWTE(30),XFUS1(25),YFUS1(25),ZFUS1(25)
      INTEGER WNGPNL,HT1PNL,HT2PNL
      PAI=3.141592654
C***********************************************************************
      READ (5,57)J0,J1,J2,J3,J4,J5,J6,NWAF,NWAFOR,NFUS,(NRADX(I),NFORX(I
     1),I=1,4),NP,NPODOR,NF,NFINOR,NCAN,NCANOR
C***********************************************************************
      IF (J1.NE.0.AND.J2.NE.0.AND.J5.NE.0) NOPTON=1
      IF (J1.NE.0.AND.J2.NE.0.AND.J5.EQ.0) NOPTON=2
      IF (J1.NE.0.AND.J2.EQ.0.AND.J5.NE.0) NOPTON=3
```

```
      IF (J1.NE.0.AND.J2.EQ.0.AND.J5.EQ.0) NOPTON=4
      IF (J1.EQ.0.AND.J2.NE.0.AND.J5.NE.0) GO TO 53
      IF (J1.EQ.0.AND.J2.NE.0.AND.J5.EQ.0) GO TO 54
      IF (J1.EQ.0.AND.J2.EQ.0.AND.J5.NE.0) GO TO 55
      IF (J1.EQ.0.AND.J2.EQ.0.AND.J5.EQ.0) GO TO 56
C
C      J0  (REFERENCE AREA)
C
C*********************************************************************
      IF (J0.EQ.1) READ (5,58) REFA
C*********************************************************************
C
C      J1  (WING DATA)
C
      IF (J1.EQ.0) GO TO 6
C*********************************************************************
      READ (5,58)(GARB,I=1,NWAFOR)
      DO 1 I=1,NWAF
      READ (5,58)X(I),Y(I),Z(I),CHORD(I)
    1 CHORD(I)=CHORD(I)+X(I)
      IF (J1.EQ.(-1)) GO TO 3
      DO 2 I=1,NWAF
    2 READ (5,58)(GARB,K=1,NWAFOR)
    3 DO 4 I=1,NWAF
    4 READ (5,58)(GARB,K=1,NWAFOR)
C*********************************************************************
C
C      ZAVWNG   (AVERAGE HEIGHT OF WING)
C
      SUM1=0.
      DO 5 I=1,NWAF
    5 SUM1=SUM1+Z(I)
      ZAVWNG=SUM1/(FLOAT(NWAF))
      NEWAF=NWAF
C
```

```
C       J2   (FUSELAGE DATA)
C       J6   (FUSELAGE DATA)
C
      FUSWTH=0.
    6 IF (J2.EQ.0) GO TO 20
C*********************************************************************
      NFUSXI=1
      DO 8 I=1,NFUS
      NRAD=NRADX(I)
      NFUSXF=NFUSXI+NFORX(I)-1
      READ (5,58)(XFUS(K),K=NFUSXI,NFUSXF)
      IF (J2.EQ.1) GO TO 9
      GO TO 100
    9 DO 10 K=NFUSXI,NFUSXF
      READ (5,58)(DUMMY(L),L=1,NRAD)
C
C       SUBROUTINE  MAXVLU  FINDS THE VALUE OF THE LARGEST ELEMENT
C       OF ARRAY DUMMY
C
      CALL MAXVLU(DUMMY,NRAD,YMAX,KK)
      YFUS(K)=YMAX
      READ (5,58)(DUMMY(L),L=1,NRAD)
      ZFUS(K)=DUMMY(KK)
   10 CONTINUE
      GO TO 8
  100 IF (J6.EQ.0) READ (5,58)(ZFUS(K),K=NFUSXI,NFUSXF)
      READ (5,58)(YFUS(K),K=NFUSXI,NFUSXF)
      DO 7 K=NFUSXI,NFUSXF
    7 YFUS(K)=SQRT(YFUS(K)/PAI)
    8 NFUSXI=NFUSXF
C*********************************************************************
C
C       ZAVFU     (AVERAGE HEIGHT OF FUSELAGE)
C
      SUM2=0.
```

```
      DO 12 K=1,NFUSXF
   12 SUM2=SUM2+ZFUS(K)
      ZAVFUS=SUM2/FLOAT(NFUSXF)
      XLE=X(1)
      XTE=CHORD(1)
C
C       FIND WIDTH OF FUSELAGE
C
C
C       SUBROUTINE WIDTH FINDS OUT THE AVERAGE FUSELAGE WIDTH BETWEEN
C       THE GIVEN TWO STATIONS
C
      CALL WIDTH(XFUS,YFUS,NFUSXF,XLE,XTE,FUSWTH)
      RAD2=FUSWTH/2.
      DIFF=ABS(ZAVWNG-ZAVFUS)
      IF (DIFF.GT.RAD2) GO TO 13
C
C       WING AND FUSELAGE ARE IN THE SAME PLANE
C
      ZAVWNG=ZAVFUS
      FUSWTH=Y(1)
      GO TO 14
C
C       CHECK FOR WING INTERSECTION WITH CENTER LINE
C
   13 NEWAF=NEWAF+1
      Y(NEWAF)=0.
      X(NEWAF)=X(1)-Y(1)*SIN(SLOPLE(1))/COS(SLOPLE(1))
      CHORD(NEWAF)=CHORD(1)-Y(1)*SIN(SLOPTE(1))/COS(SLOPTE(1))
      X(1)=X(1)-(Y(1)-FUSWTH)*SIN(SLOPLE(1))/COS(SLOPLE(1))
      CHORD(1)=CHORD(1)-(Y(1)-FUSWTH)*SIN(SLOPTE(1))/COS(SLOPTE(1))
      Y(1 =FUSWTH
   14 CONTINUE
      NCOUNT=1
      NFUSX1=NFUSXF-1
```

```
C
C      FRONT AND REAR FUSELAGE MODIFICATION (STARTS)
C
      AREAR=0.
      AREAF=0.
      DO 19 I=1,NFUSX1
      IF (XFUS(I).LT.XLE) GO TO 15
      IF (XFUS(I).GE.XTE) GO TO 16
      GO TO 19
   15 AREAF=AREAF+(YFUS(I)+YFUS(I+1,))*(XFUS(I+1)-XFUS(I))/2.
      XF=XFUS(I+1)-XFUS(1)
      GO TO 19
   16 AREAR=AREAR+(YFUS(I)+YFUS(I+1))*(XFUS(I+1)-XFUS(I))/2.
      IF (NCOUNT.EQ.1) GO TO 17
      GO TO 19
   17 IF (XTE.GT.XFUS(I-1).AND.XTE.LT.XFUS(I)) GO TO 18
      XR=XFUS(I)
      NCOUNT=2
      GO TO 19
   18 AREAR=AREAR+(YFUS(I-1)+YFUS(I))*(XFUS(I)-XFUS(I-1))/2.
      XR=XFUS(I-1)
      NCOUNT=2
   19 CONTINUE
      A=2.*XF-2.*AREAF/FUSWTH
      XFL(2)=XFUS(1)+A
      XX=XFUS(NFUSXF)-XR
      A=2.*XX-2.*AREAR/FUSWTH
      XFT(2)=XFUS(NFUSXF)-A
      XFL(1)=XFUS(1)
      XFT(1)=XFUS(NFUSXF)
      YF(1)=0.
      YF(2)=FUSWTH
C
C      FRONT AND REAR FUSFLAGE MODIFICATION (ENDS)
C
```

```
C                                                                       DRGD1760
C        J3   (POD DATA)                                                DRGD1770
C                                                                       DRGD1780
   20 IF (J3.EQ.0) GO TO 22                                             DRGD1790
C***********************************************************************DRGD1800
      DO 21 K=1,NP                                                      DRGD1810
      READ (5,58)(GARB,I=1,3)                                           DRGD1820
      READ (5,58)(GARB,I=1,NPODOR)                                      DRGD1830
   21 READ (5,58)(GARB,I=1,NPODOR)                                      DRGD1840
C***********************************************************************DRGD1850
C                                                                       DRGD1860
C        J4   (FIN DATA)                                                DRGD1870
C                                                                       DRGD1880
   22 IF (J4.EQ.0) GO TO 24                                             DRGD1890
C***********************************************************************DRGD1900
      DO 23 K=1,NF                                                      DRGD1910
      READ (5,58)(GARB,I=1,8)                                           DRGD1920
      READ (5,58)(GARB,I=1,NFINOR)                                      DRGD1930
   23 READ (5,58)(GARB,I=1,NFINOR)                                      DRGD1940
C***********************************************************************DRGD1950
C                                                                       DRGD1960
C        J5   (CANARD DATA)                                             DRGD1970
C                                                                       DRGD1980
   24 IF (J5.EQ.0) GO TO 37                                             DRGD1990
C***********************************************************************DRGD2000
      DO 26 K=1,NCAN                                                    DRGD2010
      READ (5,58)(XHT(K,I),YHT(K,I),ZHT(K,I),CHRDHT(K,I),I=1,2)         DRGD2020
      CHRDHT(K,1)=CHRDHT(K,1)+XHT(K,1)                                  DRGD2030
      CHRDHT(K,2)=CHRDHT(K,2)+XHT(K,2)                                  DRGD2040
      IF (NCANOR.LT.0) GO TO 25                                         DRGD2050
      READ (5,58)(GARB,I=1,NCANOR)                                      DRGD2060
      READ (5,58)(GARB,I=1,NCANOR)                                      DRGD2070
      GO TO 26                                                          DRGD2080
   25 NCANO1=-NCANOR                                                    DRGD2090
      READ (5,58)(GARB,I=1,NCANO1)                                      DRGD2100
```

```
      READ (5,58)(GARB,I=1,NCANO1)                                      DRGD2110
      READ (5,58)(GARB,I=1,NCANO1)                                      DRGD2120
   26 CONTINUE                                                          DRGD2130
C***********************************************************************DRGD2140
      WIDTH1=0.                                                         DRGD2150
      WIDTH2=0.                                                         DRGD2160
      IF (J2.EQ.0) GO TO 27                                             DRGD2170
      XLE=XHT(1,1)                                                      DRGD2180
      XTE=CHRDHT(1,1)                                                   DRGD2190
      CALL WIDTH(XFUS,YFUS,NFUSXF,XLE,XTE,WDTH1)                        DRGD2200
      IF (NCAN.EQ.1) GO TO 27                                           DRGD2210
      XLE=XHT(2,1)                                                      DRGD2220
      XTE=CHRDHT(2,1)                                                   DRGD2230
      CALL WIDTH(XFUS,YFUS,NFUSXF,XLE,XTE,WDTH2)                        DRGD2240
   27 CONTINUE                                                          DRGD2250
      MAA=2                                                             DRGD2260
      DO 28 I=1,2                                                       DRGD2270
      XFUS(I)=XHT(1,I)                                                  DRGD2280
      YFUS(I)=YHT(1,I)                                                  DRGD2290
   28 ZFUS(I)=CHRDHT(1,I)                                               DRGD2300
      ZAVHT(1)=(ZHT(1,1)+ZHT(1,2))/2.                                   DRGD2310
      IF (NCAN.EQ.1) GO TO 29                                           DRGD2320
      NCONTL=0                                                          DRGD2330
      IF (XHT(1,2).EQ.XHT(2,1).AND.YHT(1,2).EQ.YHT(2,1).AND.ZHT(1,2).EQ.DRGD2340
     1ZHT(2,1).AND.CHRDHT(1,2).EQ.CHRDHT(2,1)) NCONTL=1                 DRGD2350
      IF (NCONTL.EQ.0) GO TO 30                                         DRGD2360
   29 XFUS(1)=XFUS(1)-(XFUS(2)-XFUS(1))*(YFUS(1)-FUSWTH)/(YFUS(2)-YFUS(1DRGD2370
     1))                                                                DRGD2380
      ZFUS(1)=ZFUS(1)-(ZFUS(2)-ZFUS(1))*(YFUS(1)-FUSWTH)/(YFUS(2)-YFUS(1DRGD2390
     1))                                                                DRGD2400
      YFUS(1)=FUSWTH                                                    DRGD2410
      IF (NCAN.EQ.1) GO TO 33                                           DRGD2420
      XFUS(3)=XHT(2,2)                                                  DRGD2430
      YFUS(3)=YHT(2,2)                                                  DRGD2440
      ZFUS(3)=CHRDHT(2,2)                                               DRGD2450
```

```
      ZAVHT(1)=(ZHT(1,1)+ZHT(1,2)+ZHT(2,2))/3.                           DRGD2460
      NCAN=1                                                             DRGD2470
      MAA=3                                                              DRGD2480
      GO TO 33                                                           DRGD2490
   30 DO 31 I=1,2                                                        DRGD2500
      XFUS1(I)=XHT(2,I)                                                  DRGD2510
      YFUS1(I)=YHT(2,I)                                                  DRGD2520
   31 ZFUS1(I)=CHRDHT(2,I)                                               DRGD2530
      XFUS1(1)=XFUS1(1)-(XFUS1(2)-XFUS1(1))*(YFUS1(1)-FUSWTH)/(YFUS1(2)-DRGD2540
     1YFUS1(1))                                                          DRGD2550
      ZFUS1(1)=ZFUS1(1)-(ZFUS1(2)-ZFUS1(1))*(YFUS1(1)-FUSWTH)/(YFUS1(2)-DRGD2560
     1YFUS1(1))                                                          DRGD2570
      YFUS1(1)=FUSWTH                                                    DRGD2580
      ZAVHT(2)=(ZHT(2,1)+ZHT(2,2))/2.                                    DRGD2590
C                                                                        DRGD2600
C       SUBROUTINE  BREAK  FINDS OUT BREAK LINES ON ONE LIFTING          DRGD2610
C       SURFACE DUE TO THE BREAK LINES ON THE OTHER LIFTING SURFACE      DRGD2620
C                                                                        DRGD2630
C                                                                        DRGD2640
C       BREAK LINES ON TAIL 1 DUE TO TAIL 2                              DRGD2650
C                                                                        DRGD2660
      CALL BREAK(XFUS,YFUS,ZFUS,2,YFUS1,2,NN1)                           DRGD2670
C                                                                        DRGD2680
C       BREAK LINES ON TAIL 2 DUE TO TAIL 1                              DRGD2690
C                                                                        DRGD2700
      CALL BREAK(XFUS1,YFUS1,ZFUS1,2,YFUS,NN1,NN2)                       DRGD2710
C                                                                        DRGD2720
C       BREAK LINES ON WING DUE TO TAIL 1                                DRGD2730
C                                                                        DRGD2740
      CALL BREAK(X,Y,CHORD,NEWAF,YFUS,NN1,NEWAF1)                        DRGD2750
C                                                                        DRGD2760
C       BREAK LINES ON WING DUE TO TAIL 2                                DRGD2770
C                                                                        DRGD2780
      CALL BREAK(X,Y,CHORD,NEWAF1,YFUS1,NN2,NEWAF2)                      DRGD2790
C                                                                        DRGD2800
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C      BREAK LINES ON TAIL 1 DUE TO WING                                DRGD2810
C                                                                       DRGD2820
      CALL BREAK(XFUS,YFUS,ZFUS,NN1,Y,NEWAF2,NN3)                       DRGD2830
C                                                                       DRGD2840
C      BREAK LINES ON TAIL 2 DUE TO WING                                DRGD2850
C                                                                       DRGD2860
      CALL BREAK(XFUS1,YFUS1,ZFUS1,NN2,Y,NEWAF2,NN4)                    DRGD2870
      NN2=NN3                                                           DRGD2880
      NEWAF=NEWAF2                                                      DRGD2890
      WDTH2=WDTH2/2.                                                    DRGD2900
      DIFF=ABS(ZAVFUS-ZAVHT(2))                                         DRGD2910
      IF (DIFF.LT.WDTH2) GO TO 32                                       DRGD2920
      NN4=NN4+1                                                         DRGD2930
      YFUS1(NN4)=0.                                                     DRGD2940
      XFUS1(NN4)=XFUS1(1)-(XFUS1(2)-XFUS1(1))*YFUS1(1)/(YFUS1(2)-YFUS1(1DRGD2950
     1))                                                                DRGD2960
      ZFUS1(NN4)=ZFUS1(1)-(ZFUS1(2)-ZFUS1(1))*YFUS1(1)/(YFUS1(2)-YFUS1(1DRGD2970
     1))                                                                DRGD2980
      NN4=NN4+1                                                         DRGD2990
      YFUS1(NN4)=FUSWTH                                                 DRGD3000
      YFUS11=YFUS''1)-FUSWTH                                            DRGD3010
      XFUS1(NN4)=  US1(1)-(XFUS1(2)-XFUS1(1))*YFUS11/(YFUS1(2)-YFUS1(1))DRGD3020
      ZFUS1(NN4)=ZFUS1(1)-(ZFUS1(2)-ZFUS1(1))*YFUS11/(YFUS1(2)-YFUS1(1))DRGD3030
      NHT2=NN4                                                          DRGD3040
      GO TO 34                                                          DRGD3050
   32 IF (J2.NE.0) ZAVHT(2)=ZAVFUS                                      DRGD3060
      GO TO 34                                                          DRGD3070
   33 CONTINUE                                                          DRGD3080
C                                                                       DRGD3090
C      BREAK LINES ON WING DUE TO TAIL                                  DRGD3100
C                                                                       DRGD3110
      CALL BREAK(X,[illegible],CHORD,NEWAF,YFUS,MAA,NEWAF2)             DRGD3120
C                                                                       DRGD3130
C      BREAK LINES ON TAIL DUE TO WING                                  DRGD3140
-                                                                       DRGD3150
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```
      CALL BREAK(XFUS,YFUS,ZFUS,MAA,Y,NEWAF2,NN2)                       DRGD3160
      NEWAF=NEWAF2                                                      DRGD3170
   34 CONTINUE                                                          DRGD3180
      WDTH1=WDTH1/2.                                                    DRGD3190
      DIFF=ABS(ZAVFUS-ZAVHT(1))                                         DRGD3200
      IF (DIFF.LT.WDTH1) GO TO 35                                       DRGD3210
      NN2=NN2+1                                                         DRGD3220
      YFUS(NN2)=0.                                                      DRGD3230
      XFUS(NN2)=XFUS(1)-(XFUS(2)-XFUS(1))*YFUS(1)/(YFUS(2)-YFUS(1))     DRGD3240
      ZFUS(NN2)=ZFUS(1)-(ZFUS(2)-ZFUS(1))*YFUS(1)/(YFUS(2)-YFUS(1))     DRGD3250
      NN2=NN2+1                                                         DRGD3260
      YFUS(NN2)=FUSWTH                                                  DRGD3270
      YFUS11=YFUS(1)-FUSWTH                                             DRGD3280
      XFUS(NN2)=XFUS(1)-(XFUS(2)-XFUS(1))*YFUS11/(YFUS(2)-YFUS(1))      DRGD3290
      ZFUS(NN2)=ZFUS(1)-(ZFUS(2)-ZFUS(1))*YFUS11/(YFUS(2)-YFUS(1))      DRGD3300
      NHT1= N2                                                          DRGD3310
      GO TO 36                                                          DRGD3320
   35 IF (J2.NE.0) ZAVHT(1)=ZAVFUS                                      DRGD3330
   36 CONTINUE                                                          DRGD3340
C                                                                       DRGD3350
C       SUBROUTINE  ORDER  ARRANGES ALL THE BREAK LINES IN ORDER        DRGD3360
C       FROM INBOARD TO OUTBOARD OF WING                                DRGD3370
C                                                                       DRGD3380
C       COMPARE FOR ALL THE OPTIONS                                     DRGD3390
   37 CONTINUE                                                          DRGD3400
      CALL ORDER(X,Y,CHORD,NEWAF,XWLE,XWTE,YL,IWNG)                     DRGD3410
      IF (NOPTON.EQ.2.OR.NOPTON.EQ.4) GO TO 38                          DRGD3420
      IF (NCAN.NE.0) CALL ORDER(XFUS,YFUS,ZFUS,NN2,XHT1LE,XHT1TE,YHT1,IHDRGD3430
     1T1)                                                               DRGD3440
      IF (NCAN.EQ.2) CALL ORDER(XFUS1,YFUS1,ZFUS1,NN4,XHT2LE,XHT2TE,YHT2DRGD3450
     1,IHT2)                                                            DRGD3460
   38 CONTINUE                                                          DRGD3470
      NEWAF=IWNG                                                        DRGD3480
      NC=NEWAF-1                                                        DRGD3490
      IF (J2.NE.0) NC=NC+1                                              DRGD3500
```

```
      IF (IHT1.NE.0) NC=NC+IHT1-1                                       DRGD3510
      IF (IHT2.NE.0) NC=NC+IHT2-1                                       DRGD3520
      WRITE (6,65) NC                                                   DRGD3530
      KKK=0                                                             DRGD3540
      IPANEL=1                                                          DRGD3550
C***********************************************************************DRGD3560
      READ (5,59) NCP1,NCP2,NCP3,NCP4                                   DRGD3570
C***********************************************************************DRGD3580
      NPNLF=NCP1                                                        DRGD3590
      NPNLW=NCP2                                                        DRGD3600
      NPNLT1=NCP3                                                       DRGD3610
      NPNLT2=NCP4                                                       DRGD3620
      NWNGP=0                                                           DRGD3630
      NHT1P=0                                                           DRGD.640
      NHT2P=0                                                           DRGD3650
      NPNLF1=NPNLF                                                      DRGD3660
      NPNLW1=NPNLW                                                      [ GD3670
      NPNL11=NPNLT1                                                     DRGD3680
      NPNL22=NPNLT2                                                     DRGD3690
      IF (NOPTON.GT.2) GO TO 39                                         DRGD3700
C                                                                       DRGD3710
C      FUSELAGE ANALYSIS                                                DRGD3720
C                                                                       DRGD3730
C***********************************************************************DRGD3740
      READ (5,60) (CPCWL(I),I=1,NPNLF1)                                 DRGD3750
C***********************************************************************DRGD3760
      CPSWL(1)=0.                                                       DRGD3770
      CPSWL(2)=100.                                                     DRGD3780
C                                                                       DRGD3790
C      SUBROUTINE  RITXYZ  WRITES THE MODIFIED GEOMETRY DATA            DRGD3800
C                                                                       DRGD3810
      CALL RITXYZ(KKK,XFL,XFT,YF,CPCWL,NPNLF1,CPSWL,2,ZAVFUS)           DRGD3820
C                                                                       DRGD3830
C      SUBROUTINE PANEL DIVIDES A LIFTING SURFACE INTO AERODYNAMIC      DRGD3840
C      PANELS                                                           DRGD3850
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```
C                                                                       DRGD3860
      CALL PANFL(XFL,YF,XFT,NPNLF1,2,ZAVFUS)                            DRGD3870
      IPANEL=LPANEL+1                                                   DRGD3880
C                                                                       DRGD3890
C       WING ANALYSIS                                                   DRGD3900
C                                                                       DRGD3910
      CRFF=XWTE(1)-XWLE(1)                                              DRGD3920
   39 IST=1                                                             DRGD3930
      WNGPNL=IPANEL                                                     DRGD3940
      NEWAF1=NEWAF-1                                                    DRGD3950
C***********************************************************************DRGD3960
      READ (5,60) (CPCWL(I),I=1,NPNLW1)                                 DRGD3970
C***********************************************************************DRGD3980
      HALFB=YL(NEWAF)                                                   DRGD3990
      W1=(YL(NEWAF)-YL(1))/10.                                          DRGD4000
      IF (ZAVFUS.NE.ZAVWNG) GO TO 42                                    DRGD4010
   40 DO 41 I=IST,NEWAF1                                                DRGD4020
C                                                                       DRGD4030
C       SUBROUTINE  NEWCOR  OUTPUTS THE INBOARD AND OUTBOARD CHORD      DRGD4040
C       OF LIFTING SURFACE UNDER CONSIDERATION                          DRGD4050
C                                                                       DRGD4060
      CALL NEWCOR(XWLE,XWTE,YL,I,XWLE1,XWTE1,YL1)                       DRGD4070
      INT=(YL(I+1)-YL(I))/W1+0.5                                        DRGD4080
      IF (INT.EQ.0) INT=1                                               DRGD4090
C                                                                       DRGD4100
C       SUBROUTINE  GNCCWL  FINDS OUT THE CONSTANT PERCENT STREAMWISE   DRGD4110
C       LINES (CPSWL) FOR THE LIFTING SURFACE                           DRGD4120
C                                                                       DRGD4130
      CALL GNCCWL(INT,CPSWL,1.)                                         DRGD4140
      INT1=INT+1                                                        DRGD4150
      CALL RITXYZ(KKK,XWLE1,XWTE1,YL1,CPCWL,NPNLW1,CPSWL,INT1,ZAVWNG)   DRGD4160
      CALL PANEL(XWLE1,YL1,XWTE1,NPNLW1,INT1,ZAVWNG)                    DRGD4170
      IPANEL=LPANEL+1                                                   DRGD4180
      NWNGP=NWNGP+INT1-1                                                DRGD4190
   41 CONTINUE                                                          DRGD4200
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      GO TO 43                                                          DRGD4210
   42 CPSWL(1)=0.                                                       DRGD4220
      CPSWL(2)=100.                                                     DRGD4230
      CALL NEWCOR(XWLE,XWTE,YL,1,XWLE1,XWTE1,YL1)                       DRGD4240
      CALL RITXYZ(KKK,XWLE1,XWTE1,YL1,CPCWL,NPNLW1,CPSWL,2,ZAVWNG)      DRGD4250
      CALL PANEL(XWLE1,YL1,XWTE1,NPNLW1,2.ZAVWNG)                       DRGD4260
      IPANEL=LPANEL+1                                                   DRGD4270
      IST=2                                                             DRGD4280
      NWNGP=1                                                           DRGD4290
      GO TO 40                                                          DRGD4300
   43 CONTINUE                                                          DRGD4310
      IF (NOPTON.EQ.2.OR.NOPTON.EQ.4) GO TO 48                          DRGD4320
C                                                                       DRGD4330
C      HORIZONTAL TAIL ANALYSIS                                         DRGD4340
C                                                                       DRGD4350
      IST=1                                                             DRGD4360
      HALFB1=YHT1(IHT1)                                                 DRGD4370
      IHT11=IHT1-1                                                      DRGD4380
      HT1PNL=IPANEL                                                     DRGD4390
C***********************************************************************DRGD4400
      READ (5,60) (CPCWL(I),I=1,NPNL11)                                 DRGD4410
C***********************************************************************DRGD4420
      IF (NOPTON.LE.2.AND.ZAVFUS.NE.ZAVHT(1)) GO TO 51                  DRGD4430
   44 DO 45 I=IST,IHT11                                                 DRGD4440
      INT=(YHT1(I+1)-YHT1(I))/W1+0.5                                    DRGD4450
      CALL NEWCOR(XHT1LE,XHT1TE,YHT1,I,XHLE,XHTE,YHLE)                  DRGD4460
      IF (INT.EQ.0) INT=1                                               DRGD4470
      INT1=INT+1                                                        DRGD4480
      CALL GNCCWL(INT,CPSWL,1.)                                         DRGD4490
      CALL RITXYZ(KKK,XHLE,XHTE,YHLE,CPCWL,NPNL11,CPSWL,INT1,ZAVHT(1))  DRGD4500
      CALL PANEL(XHLE,YHLE,XHTE,NPNL11,INT1,ZAVHT(1))                   DRGD4510
      NHT1P=NHT1P+INT1-1                                                DRGD4520
   45 IPANEL=LPANEL+1                                                   DRGD4530
      IF (NCAN.NE.2) GO TO 48                                           DRGD4540
      IST=1                                                             DRGD4550
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      HALFR2=YHT2(IHT2)                                                 DRGD4560
      HT2PNL=IPANFL                                                     DRGD4570
C***********************************************************************DRGD4580
      READ (5,60) (CPCWL(I),I=1,NPNL22)                                 DRGD4590
C***********************************************************************DRGD4600
      IHT21=IHT2-1                                                      DRGD4610
      IF (NOPTON.LE.2.AND.ZAVFUS.NE.ZAVHT(2)) GO TO 52                  DRGD4620
   46 DO 47 I=IST,IHT21                                                 DRGD4630
      INT=(YHT2(I+1)-YHT2(I))/W1+0.5                                    DRGD4640
      CALL NEWCOR(XHT2LE,XHT2TE,YHT2,I,XHLE,XHTE,YHLE)                  DRGD4650
      IF (INT.EQ.0) INT=1                                               DRGD4660
      INT1=INT+1                                                        DRGD4670
      CALL GNCCWL(INT,CPSWL,1.)                                         DRGD4680
      CALL RITXYZ(KKK,XHLE,XHTE,YHLE,CPCWL,NPNL22,CPSWL,INT1,ZAVHT(2))  DRGD4690
      CALL PANEL(XHLE,YHLE,XHTE,NPNL22,INT1,ZAVHT(2))                   DRGD4700
      NHT2P=NHT2P+INT1-1                                                DRGD4710
   47 IPANFL=LPANFL+1                                                   DRGD4720
   48 CONTINUF                                                          DRGD4730
      LSTPNL=LPANEL                                                     DRGD4740
C***********************************************************************DRGD4750
      READ (5,60) CCREF                                                 DRGD4760
C***********************************************************************DRGD4770
      IF (CCRFF.NE.0.) CREF=CCREF                                       DRGD4780
      IF (RFFA.NF.0.) GO TO 50                                          DRGD4790
      IM=HT1PNL-1                                                       DRGD4800
      IF (HT1PNL.LE.0) IM=LPANEL                                        DRGD4810
      HALFSW=0.                                                         DRGD4820
      DO 49 I=WNGPNL,IM                                                 DRGD4830
   49 HALFSW=HALFSW+AREA(I)                                             DRGD4840
      REFA=2.*HALFSW                                                    DRGD4850
      WRITE (6,66) REFA,CREF                                            DRGD4860
      RETURN                                                            DRGD4870
   50 HALFSW=REFA/2.                                                    DRGD4880
      WRITE (6,66) REFA,CRFF                                            DRGD4890
      RETURN                                                            DRGD4900
```

```
51 CPSWL(1)=0.                                                          DRGD4910
   CPSWL(2)=100.                                                        DRGD4920
   CALL NEWCOR(XHT1LE,XHT1TE,YHT1,1,XHLE,XHTE,YHLE)                     DRGD4930
   CALL RITXYZ(KKK,XHLE,XHTE,YHLE,CPCWL,NPNL11,CPSWL,2,ZAVHT(1))        DRGD4940
   CALL PANEL(XHLE,YHLE,XHTE,NPNL11,2,ZAVHT(1))                         DRGD4950
   IST=2                                                                DRGD4960
   NHT1P=1                                                              DRGD4970
   GO TO 44                                                             DRGD4980
52 CPSWL(1)=0.                                                          DRGD4990
   CPSWL(2)=100.                                                        DRGD5000
   CALL NEWCOR(XHT2LE,XHT2TE,YHT2,1,XHLE,XHTE,YHLE)                     DRGD5010
   CALL RITXYZ(KKK,XHLE,XHTE,YHLE,CPCWL,NPNL22,CPSWL,2,ZAVHT(2))        DRGD5020
   CALL PANEL(XHLE,YHLE,XHTE,NPNL22,2,ZAVHT(2))                         DRGD5030
   IST=2                                                                DRGD5040
   NHT2P=1                                                              DRGD5050
   GO TO 46                                                             DRGD5060
53 WRITE (6,61)                                                         DRGD5070
   RETURN                                                               DRGD5080
54 WRITE (6,62)                                                         DRGD5090
   RETURN                                                               DRGD5100
55 WRITE (6,63)                                                         DRGD5110
   RETURN                                                               DRGD5120
56 WRITE (6,64)                                                         DRGD5130
   RETURN                                                               DRGD5140
57 FORMAT (24I3)                                                        DRGD5150
58 FORMAT (10F7.3)                                                      DRGD5160
59 FORMAT (4I2)                                                         DRGD5170
60 FORMAT (8F10.5)                                                      DRGD5180
61 FORMAT (90HTHIS TEST CASE HAS FUSELAGE AND HORIZONTAL TAIL. CHANGEDRGD5190
  1 HORIZONTAL TAIL DATA TO WING DATA.    )                             DRGD5200
62 FORMAT (89HTHIS TEST CASE HAS ONLY FUSELAGE WHICH DOES NOT MAKE ANDRGD5210
  1Y SENSE. FIRST DATA CARD IS WRONG.     )                             DRGD5220
63 FORMAT (62HTHIS TEST CASE HAS ONLY HORIZONTAL TAIL. CHANGE HORIZONDRGD5230
  1TAL TAIL DATA TO WING DATA.      )                                   DRGD5240
64 FORMAT (79HTHIS TEST CASE DOES NOT HAVE ANY AERODYNAMIC SURFACE. FDRGD5250
```

```
  1IRST DATA CARD IS WORNG.     )                                       DRGD5260
65 FORMAT (1H1,//,11X,45H********************************************DRGD5270
  1*,/,11X,32H* GEOMETRY DATA IS DIVIDED IN TO,I2,11H SECTIONS *,/,11DRGD5280
  2X,45H*********************************************,///)              DRGD5290
66 FORMAT (10X,10HREF. AREA=,E12.5,/,10X,11HREF. CHORD=,E12.5)          DRGD5300
   END                                                                  DRGD5310
```

```
      SUBROUTINE GNCCWL(NPNL,CPCWL,A)                                   GNCC0010
C                             G*N*C*C*W*L                               GNCC0020
C.......................................................................GNCC0030
C       SUBROUTINE  GNCCWL  FINDS OUT THE CONSTANT PERCENT STREAMWISE   GNCC0040
C       LINES FOR THE LIFTING SURFACE                  .                GNCC0050
C.......................................................................GNCC0060
      DIMENSION CPCWL(1)                                                GNCC0070
      CPCWLL=100./FLOAT(NPNL)                                           GNCC0080
      CPCWL(1)=0.                                                       GNCC0090
      CPCWL(2)=CPCWLL/A                                                 GNCC0100
      CPCWL(NPNL+1)=100.                                                GNCC0110
      DO 1 I=3,NPNL                                                     GNCC0120
    1 CPCWL(I)=CPCWL(I-1)+CPCWLL                                        GNCC0130
      RETURN                                                            GNCC0140
      END                                                               GNCC0150
```

```
      SUBROUTINE MAXVLU(Y,N,YMAX,KK)                                    MAXV0010
C                               M*A*X*V*L*U                             MAXV0020
C.......................................................................MAXV0030
C       SUBROUTINE MAXVLU FINDS THE VALUE OF THE LARGEST ELEMENT OF     MAXV0040
C       ARRAY Y                                                         MAXV0050
C.......................................................................MAXV0060
      DIMENSION Y(1)                                                    MAXV0070
      I=1                                                               MAXV0080
      NN=N+1                                                            MAXV0090
    1 IF (Y(I).GT.Y(I+1)) GO TO 2                                       MAXV0100
      I=I+1                                                             MAXV0110
      IF (I.EQ.NN) GO TO 2                                              MAXV0120
      GO TO 1                                                           MAXV0130
    2 YMAX=Y(I)                                                         MAXV0140
      KK=I                                                              MAXV0150
      RETURN                                                            MAXV0160
      END                                                               MAXV0170
```

```
      SUBROUTINE NEWBRK(X1,X2,Y1,Y2,C1,C2,YY,XNEW,YNEW,CNEW)              NBRK0010
C                             N*E*W*B*R*K                                  NBRK0020
C.....................................................................NBRK0030
C      SUBROUTINE NEWBRK FINDS OUT THE COORDINATES OF BREAK LINES          NBRK0040
C.....................................................................NBRK0050
      YY1=(YY-Y1)/(Y2-Y1)                                                 NBRK0060
      X21=X2-X1                                                           NBRK0070
      XNEW=X1+X21*YY1                                                     NBRK0080
      C21=C2-C1                                                           NBRK0090
      CNEW=C1+C21*YY1                                                     NBRK0100
      YNEW=YY                                                             NBRK0110
      RETURN                                                              NBRK0120
      END                                                                 NBRK0130
```

```
      SUBROUTINE NEWCOR(XWLE,XWTE,YL,I,XWLE1,XWTE1,YL1)                 NCOR0010
C                            N*E*W*C*O*R                                NCOR0020
C.......................................................................NCOR0030
C      SUBROUTINE NEWCOR OUTPUTS THE INBOARD AND OUTBOARD CHORD OF      NCOR0040
C      LIFTING SURFACE UNDER CONSIDERATION        .                     NCOR0050
C.......................................................................NCOR0060
      DIMENSION XWLE(1),XWTE(1),YL(1),XWLE1(1),XWTE1(1),YL1(1)          NCOR0070
      YL1(1)=YL(I)                                                      NCOR0080
      YL1(2)=YL(I+1)                                                    NCOR0090
      XWLF1(1)=XWLE(I)                                                  NCOR0100
      XWLF1(2)=XWLE(I+1)                                                NCOR0110
      XWTE1(1)=XWTE(I)                                                  NCOR0120
      XWTF1(2)=XWTE(I+1)                                                NCOR0130
      RETURN                                                            NCOR0140
      END                                                               NCOR0150
```

```
      SUBROUTINE NEWPNL                                                 NPNL0010
C                               N*E*W*P*N*L                             NPNL0020
C.......................................................................NPNL0030
C       SUBROUTINE NEWPNL USES THE INPUT DATA FORMAT OF THE PRESENT     NPNL0040
C       PROGRAM FOR FINDING OUT AERODYNAMIC PANELS                      NPNL0050
C                                                                       NPNL0060
C       KONT=1  FUSELAGE DATA                                           NPNL0070
C       KONT=2  WING DATA                                               NPNL0080
C       KONT=3  HORIZONTAL TAIL 1 DATA                                  NPNL0090
C       KONT=4  HORIZONTAL TAIL 2 DATA                                  NPNL0100
C                                                                       NPNL0110
C.......................................................................NPNL0120
      COMMON/CNTROL/ LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,          NPNL0130
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,         NPNL0140
     2 NHT1P,NHT2P,HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX           NPNL0150
      COMMON XCG(300),XCP(300),YCP(300),ZCP(300),AREA(300),AMASS(300),  NPNL0160
     1 XN(300,4),YN(300,4),ZN(300,4),BPRIM(300,4)                       NPNL0170
      COMMON/PNL/CPCWL(35),CPSWL(35),IPANEL                             NPNL0180
      DIMENSION XXL(2),YL(2),XXT(2)                                     NPNL0190
      INTEGER WNGPNL,HT1PNL,HT2PNL                                      NPNL0200
      KKK=0                                                             NPNL0210
      IPANEL=1                                                          NPNL0220
      NWNGP=0                                                           NPNL0230
      NHT1P=0                                                           NPNL0240
      NHT2P=0                                                           NPNL0250
C***********************************************************************NPNL0260
      READ (5,8) NCP1,NCP2,NCP3,NCP4                                    NPNL0270
      READ (5,8) NC                                                     NPNL0280
C***********************************************************************NPNL0290
      NCPFUS=NCP1-1                                                     NPNL0300
      NCPWNG=NCP2-1                                                     NPNL0310
      NCPHT1=NCP3-1                                                     NPNL0320
      NCPHT2=NCP4-1                                                     NPNL0330
      WRITE (6,9) NC                                                    NPNL0340
      KONT=0                                                            NPNL0350
```

```
      DO 6 KK=1,NC                                                      NPNL0360
C***********************************************************************NPNL0370
      READ (5,8) NCPSWL,KONTL                                           NPNL0380
      IF (KONTL.EQ.1) NCPCWL=NCP1                                       NPNL0390
      IF (KONTL.EQ.2) NCPCWL=NCP2                                       NPNL0400
      IF (KONTL.EQ.3) NCPCWL=NCP3                                       NPNL0410
      IF (KONTL.EQ.4) NCPCWL=NCP4                                       NPNL0420
      READ (5,10) (XXL(I),XXT(I),YL(I),I=1,2),Z                         NPNL0430
      IF (KONT.NE.KONTL) READ (5,10) (CPCWL(I),I=1,NCPCWL)              NPNL0440
      READ (5,10) (CPSWL(K),K=1,NCPSWL)                                 NPNL0450
C***********************************************************************NPNL0460
      IF (KONTL.EQ.2) GO TO 1                                           NPNL0470
      GO TO 2                                                           NPNL0480
    1 NWNGP=NWNGP+NCPSWL-1                                              NPNL0490
      HALFB=YL(2)                                                       NPNL0500
    2 IF (KONTL.EQ.3) NHT1P=NHT1P+NCPSWL-1                              NPNL0510
      IF (KONTL.EQ.4) NHT2P=NHT2P+NCPSWL-1                              NPNL0520
      IF (KONTL.EQ.3) HALFB1=YL(2)                                      NPNL0530
      IF (KONTL.EQ.4) HALFB2=YL(2)                                      NPNL0540
C                                                                       NPNL0550
C       SUBROUTINE RITXYZ WRITES THE GEOMETRY DATA                      NPNL0560
C                                                                       NPNL0570
      CALL RITXYZ(KKK,XXL,XXT,YL,CPCWL,NCPCWL,CPSWL,NCPSWL,Z)           NPNL0580
      IF (KONT.LT.2.AND.KONTL.EQ.2) GO TO 3                             NPNL0590
      GO TO 4                                                           NPNL0600
    3 CREF=XXT(1)-XXL(1)                                                NPNL0610
      WNGPNL=IPANEL                                                     NPNL0620
      GO TO 5                                                           NPNL0630
    4 IF (KONT.LT.3.AND.KONTL.EQ.3) HT1PNL=IPANEL                       NPNL0640
      IF (KONT.LT.4.AND.KONTL.EQ.4) HT2PNL=IPANEL                       NPNL0650
C                                                                       NPNL0660
C       SUBROUTINE PANEL DIVIDES A LIFTING SURFACE INTO AERODYNAMIC     NPNL0670
C       PANELS                                                          NPNL0680
C                                                                       NPNL0690
    5 CALL PANEL(XXL,YL,XXT,NCPCWL,NCPSWL,Z)                            NPNL0700
```

```
      IPANEL=LPANEL+1                                                   NPNL0710
      KONT=KONTL                                                        NPNL0720
    6 CONTINUE                                                          NPNL0730
      IM=HT1PNL-1                                                       NPNL0740
      IF (HT1PNL.LE.0) IM=LPANEL                                        NPNL0750
      HALFSW=0.                                                         NPNL0760
      DO 7 I=WNGPNL,IM                                                  NPNL0770
    7 HALFSW=HALFSW+AREA(I)                                             NPNL0780
      READ (5,10) SREF,CCREF                                            NPNL0790
      IF (SREF.NE.0.) HALFSW=SREF/2.                                    NPNL0800
      IF (CCREF.NE.0.) CREF=CCREF                                       NPNL0810
      LSTPNL=LPANEL                                                     NPNL0820
      SW=2.*HALFSW                                                      NPNL0830
      WRITE (6,11) SW                                                   NPNL0840
      WRITE (6,12) CREF                                                 NPNL0850
      RETURN                                                            NPNL0860
    3 FORMAT (4I2)                                                      NPNL0870
    9 FORMAT (1H1,//,11X,45H*********************************************NPNL0880
     1*,/,11X,32H* GEOMETRY DATA IS DIVIDED IN TO,I2,11H SECTIONS *,/,11NPNL0890
     2X,45H*********************************************,///)           NPNL0900
   10 FORMAT (8F10.5)                                                   NPNL0910
   11 FORMAT (10X,10HREF. AREA=,E12.5)                                  NPNL0920
   12 FORMAT (10X,11HREF. CHORD=,E12.5)                                 NPNL0930
      END                                                               NPNL0940
```

```
      SUBROUTINE ORDER(X,Y,CHORD,INTL,XWLE,XWTE,YL,II)                  ORDR0010
C                           O*R*D*E*R                                    ORDR0020
C.......................................................................ORDR0030
C       SUBROUTINE ORDER ARRANGES ALL THE BREAK LINES IN ORDER FROM     ORDR0040
C       INBOARD TO OUTBOARD                                              ORDR0050
C.......................................................................ORDR0060
      DIMENSION X(1),Y(1),CHORD(1),XWLE'1),XWTE(1),YL(1)                ORDR0070
      INT1=INTL+1                                                        ORDR0080
      DO 2 I=1,INT1                                                      ORDR0090
      JJ=1                                                               ORDR0100
      YL(I)=Y(1)                                                         ORDR0110
      XWLF(I)=X(1)                                                       ORDR0120
      XWTF(I)=CHORD(1)                                                   ORDR0130
      DO 1 J=2,INTL                                                      ORDR0140
      IF (YL(I).LE.Y(J)) GO TO 1                                         ORDR0150
      YL(I)=Y(J)                                                         ORDR0160
      XWLE(I)=X(J)                                                       ORDR0170
      XWTE(I)=CHORD(J)                                                   ORDR0180
      JJ=J                                                               ORDR0190
    1 CONTINUE                                                           ORDR0200
      Y(JJ)=1.E06                                                        ORDR0210
    2 CONTINUE                                                           ORDR0220
      I=0                                                                ORDR0230
      DO 3 J=1,INTL                                                      ORDR0240
      IF (XWLE(J).EQ.XWLE(J+1).AND.YL(J).EQ.YL(J+1).AND.XWTE(J).EQ.XWTE(ORDR0250
     1J+1)) GO TO 3                                                      ORDR0260
      I=I+1                                                              ORDR0270
      X(I)=XWLE(J)                                                       ORDR0280
      Y(I)=YL(J)                                                         ORDR0290
      CHORD(I)=XWTE(J)                                                   ORDR0300
    3 CONTINUF                                                           ORDR0310
      II=I                                                               ORDR0320
      DO 4 J=1,II                                                        ORDR0330
      XWLE(J)=X(J)                                                       ORDR0340
      YL(J)=Y(J)                                                         ORDR0350
```

```
    4 XWTE(J)=CHORD(J)                                                ORDR0360
      RETURN                                                          ORDR0370
      END                                                             ORDR0380
```

```
      SUBROUTINE PANEL(XXL,YL,XXT,NCW,NSW,Z)                            PANL0010
C                            P*A*N*E*L                                  PANL0020
C.......................................................................PANL0030
C       SUBROUTINE PANEL DIVIDES A LIFTING SURFACE INTO AERODYNAMIC     PANL0040
C       PANELS                                                          PANL0050
C.......................................................................PANL0060
      COMMON/CNTROL/ LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,          PANL0070
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,         PANL0080
     2 NHT1P,NHT2P,HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX           PANL0090
      COMMON XCG(300),YCP(300),YCP(300),ZCP(300),AREA(300),AMASS(300),  PANL0100
     1 XN(300,4),YN(300,4),ZN(300,4),BPRIM(300,4)                       PANL0110
      COMMON/PNL/CPCWL(35),CPSWL(35),IPANEL                             PANL0120
      DIMENSION XXL(2),YL(2),XXT(2)                                     PANL0130
      INTEGER WNGPNL,HT1PNL,HT2PNL                                      PANL0140
      DIMENSION C(2),X(35,35),Y(35,35),SLOPE(35),XL(2,35)               PANL0150
      NSW1=NSW-1                                                        PANL0160
      NCW1=NCW-1                                                        PANL0170
      DO 1 I=1,2                                                        PANL0180
      C(I)=XXT(I)-XXL(I)                                                PANL0190
      DO 1 J=1,NCW                                                      PANL0200
    1 XL(I,J)=XXL(I)+CPCWL(J)*C(I)/100.                                 PANL0210
      SPAN=YL(2)-YL(1)                                                  PANL0220
      DO 2 J=1,NCW                                                      PANL0230
    2 SLOPE(J)=(XL(2,J)-XL(1,J))/SPAN                                   PANL0240
      DO 3 K=1,NSW                                                      PANL0250
      YK=CPSWL(K)*SPAN/100.                                             PANL0260
      DO 3 J=1,NCW                                                      PANL0270
      Y(J,K)=YK+YL(1)                                                   PANL0280
      X(J,K)=XL(1,J)+SLOPE(J)*(Y(J,K)-YL(1))                            PANL0290
    3 CONTINUE                                                          PANL0300
      DO 6 K=1,NSW1                                                     PANL0310
      DO 6 J=1,NCW1                                                     PANL0320
      NPANEL=(K-1)*NCW1+J-1+IPANEL                                      PANL0330
      DO 5 I=1,4                                                        PANL0340
      ZN(NPANEL,I)=Z                                                    PANL0350
```

```
      KI1=K+I-1                                                         PANL0360
      KI3=K+I-3                                                         PANL0370
      IF (I.LE.2) GO TO 4                                               PANL0380
      XN(NPANEL,I)=X(J+1,KI3)                                           PANL0390
      YN(NPANEL,I)=Y(J+1,KI3)                                           PANL0400
      BPRIM(NPANEL,I)=SLOPE(J+1)                                        PANL0410
      GO TO 5                                                           PANL0420
    4 XN(NPANEL,I)=X(J,KI1)                                             PANL0430
      YN(NPANEL,I)=Y(J,KI1)                                             PANL0440
      BPRIM(NPANEL,I)=SLOPE(J)                                          PANL0450
    5 CONTINUE                                                          PANL0460
      A1=X(J+1,K)-X(J,K)                                                PANL0470
      A2=X(J+1,K+1)-X(J,K+1)                                            PANL0480
      B=Y(J,K+1)-Y(J,K)                                                 PANL0490
      YBAR=B*(A1+2.*A2)/(3.*(A1+A2))                                    PANL0500
      CBAR=A1+(A2-A1)*YBAR/B                                            PANL0510
      XBAR=X(J,K)+YBAR*(X(J,K+1)-X(J,K))/B                              PANL0520
      FE=X(J+1,K+1)-X(J+1,K)                                            PANL0530
      AE=A1+FE                                                          PANL0540
      BC=X(J,K+1)-X(J,K)                                                PANL0550
      XK=(AE*AE+2.*AE*A1-A1*FE-BC*BC)/(3.*(A1+A2))                      PANL0560
      XCG(NPANEL)=X(J,K)+XK                                             PANL0570
      XCP(NPANEL)=XBAR+0.95*CBAR                                        PANL0580
      YCP(NPANEL)=Y(J,K)+YBAR                                           PANL0590
      ZCP(NPANEL)=Z                                                     PANL0600
      AREA(NPANEL)=(A1+A2)/2.*B                                         PANL0610
    6 CONTINUE                                                          PANL0620
      LPANEL=NPANEL                                                     PANL0630
      RETURN                                                            PANL0640
      END                                                               PANL0650
```

```
      SUBROUTINE RITXYZ(KK,XXL,XXT,YL,CPCWL,NCPCWL,CPSWL,NCPSWL,Z)      RITX0010
C                               R*I*T*X*Y*Z                             RITX0020
C.......................................................................RITX0030
C       SUBROUTINE RITXYZ WRITES THE GEOMETRY DATA                      RITX0040
C.......................................................................RITX0050
      DIMENSION XXL(1),XXT(1),YL(1),CPCWL(1),CPSWL(1)                   RITX0060
      KK=KK+1                                                           RITX0070
      WRITE (6,1) KK                                                    RITX0080
      WRITE (6,2)                                                       RITX0090
      WRITE (6,3) (XXL(I),XXT(I),YL(I),Z,I=1,2)                         RITX0100
      WRITE (6,4) NCPCWL,(CPCWL(I),I=1,NCPCWL)                          RITX0110
      WRITE (6,5) NCPSWL,(CPSWL(I),I=1,NCPSWL)                          RITX0120
    1 FORMAT (1H0,10X,21HDEFINITION OF SECTION,I2,/,11X,23H*************RITX0130
     1**********)                                                       RITX0140
    2 FORMAT (1H0,10X,14HX-LEADING EDGE,5X,15HX-TRAILING EDGE,5X,14HY-LERITX0150
     1ADING EDGE,12X,1HZ)                                               RITX0160
    3 FORMAT (4(10X,F11.5))                                             RITX0170
    4 FORMAT (10X,10HTHERE ARE ,I2,36H CONSTANT PERCENT CHORDWISE LINES RITX0180
     1AT,/,10X,(12F10.3))                                               RITX0190
    5 FORMAT (10X,10HTHERE ARE ,I2,37H CONSTANT PERCENT STREAMWISE LINESRITX0200
     1 AT,/,10X,(12F10.3))                                              RITX0210
      RETURN                                                            RITX0220
      END                                                               RITX0230
```

```
      SUBROUTINE WIDTH (XFUS,YFUS,NFUSXF,XLE,XTE,FUSWTH)
C                               W*I*D*T*H
C.......................................................................
C      SUBROUTINE WIDTH FINDS OUT THE AVERAGE FUSELAGE WIDTH BETWEEN
C      THE GIVEN TWO STATIONS
C.......................................................................
      DIMENSION XFUS(1),YFUS(1)
      K=0
      SUM=0.
      DO 1 I=1,NFUSXF
      IF (XFUS(I).LT.XLE.OR.XFUS(I).GT.XTE) GO TO 1
      K=K+1
      SUM=SUM+YFUS(I)
    1 CONTINUE
      IF (SUM.EQ.0.) GO TO 2
      FUSWTH=SUM/FLOAT(K)
      RETURN
    2 FUSWTH=0.
      RETURN
      END
```

```
      PROGRAM AERELA(INPUT=201,OUTPUT=201,TAPE5=INPUT,TAPE6=OUTPUT,
     1 TAPE7=1001,TAPE20=401)
C.......................................................................
C       COMPUTER PROGRAM FOR CALCULATING ALPHA- AND Q- STABILITY
C       DERIVATIVES AND INDUCED DRAG FOR THIN ELASTIC AEROPLANES AT
C       SUBSONIC AND SUPERSONIC SPEEDS
C
C       MAIN INPUT DATA
C       N=NUMBER OF PANELS OR NUMBER OF UNIT LOADING POINTS FOR (C)
C       M=MAXIMUM NUMBER OF ELASTIC AXIS END-POINTS
C       IF NCNTL=0T (A),(C) AND ALL DERIVATIVES ARE COMPUTED
C       IF NCNTL=1, ONLY (A) AND RIGID DERIVATIVES ARE COMPUTED
C       IF NCNTL=2, ONLY (C) IS COMPUTED AND PRINTED OUT
C       IF NCNTL=3, (A) IS COMPUTED, (C) IS READ FROM TAPE  AND ALL
C                   THE DERIVATIVES ARE CALCULATED
C       IF NCNTL=4, (A),(C) AND ALL DERIVATIVES ARE COMPUTED (PRINTS (C))
C
C
C       THE SUBROUTINE FOR GENERATING STRUCTURAL INFLUENCE COEFFICIENT
C       MATRIX CANNOT HANDLE A CONFIGURATION WITH CANARD SURFACE
C
C**AERELA USES DATA PROCESSED IN AEREAD AND STORED ON TAPE20
C  TO GENERATE THE A-MATRIX.  ELASTIC AXIS DATA IS READ FROM CARDS
C  TO CREATE THE C-MATRIX.  ALTITUDE DATA IS READ FROM CARDS FOR
C  SOLUTION OF THE B-MATRIX.
C
C**IN THIS VERSION OF AEREL, ONLY ONE FULL MATRIX RESIDES IN
C  CORE AT ANY ONE TIME.  THE OTHERS RESIDE ON DISC, STORED
C  BY ROWS.
C
C
C**OPTIMIZED BY COMPUTER SCIENCES CORPORATION FOR NASA LANGLEY
C  RESEARCH CENTER.
C
C  MODIFICATIONS BY C.BOLZ AND B.PARKER JUNE 1972.
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C.........................................................................ARLA0360
      COMMON IND(1)                                                      ARLA0370
      COMMON/CNTROL/LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,            ARLA0380
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,          ARLA0390
     2 NHT1P,NHT2P, HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX           ARLA0400
      DIMENSION D(1)                                                     ARLA0410
      EQUIVALENCE (IND(1),D(1))                                          ARLA0420
      COMMON/INDMS/ IA,IB,IC                                             ARLA0430
      DIMENSION DUM1(25)                                                 ARLA0440
      EQUIVALENCE (DUM1(1),LPANEL)                                       ARLA0450
      EQUIVALENCE (NEAMAX,M)                                             ARLA0460
      INTEGER WNGPNL,HT1PNL,HT2PNL                                       ARLA0470
      CALL OPENMS(20,IND,12,0)                                           ARLA0480
      CALL READMS(20,LPANEL,25,1)                                        ARLA0490
      N=LPANEL                                                           ARLA0500
      INL=1                                                              ARLA0510
      NN=N*N                                                             ARLA0520
      IA=1                                                               ARLA0530
      IB=N+IA                                                            ARLA0540
      IC=N+IB                                                            ARLA0550
C                                                                        ARLA0560
C**PARTITION COMMON FOR PROBLEM ARRAYS.                                  ARLA0570
      IBASE=13                                                           ARLA0580
      IXP=IBASE+3*N+1                                                    ARLA0590
      IYP=IXP+N                                                          ARLA0600
      IZP=IYP+N                                                          ARLA0610
      IXG=IZP+N                                                          ARLA0620
      IAR=IXG+N                                                          ARLA0630
      IAM=IAR+N                                                          ARLA0640
      IXN=IAM+N                                                          ARLA0650
C                                                                        ARLA0660
      N4=4*N                                                             ARLA0670
      IYN=IXN+N4                                                         ARLA0680
      IZN=IYN+N4                                                         ARLA0690
      IBP=IZN+N4                                                         ARLA0700
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      ICP=IBP+N4                                                        ARLA0710
      IMM=ICP+N                                                         ARLA0720
      IWA=IMM+NN                                                        ARLA0730
      IWB=IWA+N                                                         ARLA0740
C**READ PROBLEM INPUT FROM DISC.                                        ARLA0750
     OCALL DISCRD(IND(1),D(IXP),D(IYP),D(IZP),D(IXG),D(IAR),D(IAM),     ARLA0760
     1 D(IXN),D(IYN),D(IZN),D(IBP),D(ICP),N)                            ARLA0770
C                                                                       ARLA0780
C**CHANGE DISC KEY.  RECORD NO.1 WILL NOW BE THE FIRST ROW OF MATRIX A. ARLA0790
      N3=3*N+1                                                          ARLA0800
      CALL STINDX(20,IND(IBASE),N3)                                     ARLA0810
C                                                                       ARLA0820
C**AERODYNAMIC MATRIX.  IWA AND IWB ARE FOR WORKING STORAGE.            ARLA0830
      IF (NCNTL.EQ.2) GO TO 2                                           ARLA0840
C                                                                       ARLA0850
C       LINK  LINK11  CALCULATES THE AERODYNAMIC INFLUENCE COEFFICIENT  ARLA0860
C       MATRIX, RIGID DERIVATIVES, THE RIGID INDUCED DRAG PARAMETER     ARLA0870
C       (CDI/(CL*CL)) AND THE PRESSURE COEFFICIENTS                     ARLA0880
C                                                                       ARLA0890
     OCALL LINK1L(IND(IBASE),D(IXP),D(IYP),D(IZP),D(IXG),D(IAR),D(IAM), ARLA0900
     1 D(IXN),D(IYN),D(IZN),D(IBP),D(IWA),D(IWB),D(ICP),D(IMM),N)       ARLA0910
      IF (NCNTL.EQ.1) GO TO 3                                           ARLA0920
    2 M1=M-1                                                            ARLA0930
      MM=M*M                                                            ARLA0940
      INC=1                                                             ARLA0950
      INPHUP=IMM                                                        ARLA0960
      INPHUM=INPHUP+MM                                                  ARLA0970
      INPHUT=INPHUM+MM                                                  ARLA0980
      INXEA=INPHUT+MM                                                   ARLA0990
      INYEA=INXEA+M                                                     ARLA1000
      INPHIP=INYEA+M                                                    ARLA1010
      INPHIM=INPHIP+M                                                   ARLA1020
      INPHIT=INPHIM+M                                                   ARLA1030
      INFI=INPHIT+M                                                     ARLA1040
      INGJ=INFI+M1                                                      ARLA1050
```

```
      INCA=INGJ+M1                                                      ARLA1060
      INGAMA=INCA+M1                                                    ARLA1070
      ING=INGAMA+M1                                                     ARLA1080
      INSTRP=ING+M1*M1                                                  ARLA1090
      INSTRM=INSTRP+M                                                   ARLA1100
C                                                                       ARLA1110
C      LINK  LINK22  CALCULATES THE STRUCTURAL INFLUENCE COEFFICIENT    ARLA1120
C      MATRIX                                                           ARLA1130
C                                                                       ARLA1140
C                                                                       ARLA1150
C**STRUCTURAL MATRIX                                                    ARLA1160
     0CALL LINK2L(D(IXG),D(IYP),D(INPHUP),D(INPHUM),D(INPHUT),D(INXEA), ARLA1170
     1 D(INYEA),D(INPHIP),D(INPHIM),D(INPHIT),D(INEI),D(INGJ),D(INCA),  ARLA1180
     2 D(INGAMA),D(ING),D(INSTRP),D(INSTRM),M,M1,N   ,D(IWA),D(IWB),    ARLA1190
     3 IND(IBASE),D(IMM))                                               ARLA1200
      IF(NCNTL.EQ.2) STOP                                               ARLA1210
      N1=N+1                                                            ARLA1220
      IZN1=IZN+N                                                        ARLA1230
      IZN2=IZN1+N                                                       ARLA1240
      IZN3=IZN2+N                                                       ARLA1250
C                                                                       ARLA1260
C      LINK  LINK33  CALCULATES ELASTIC DERIVATIVES, THE ELASTIC        ARLA1270
C      INDUCED DRAG PARAMETER AND THE ELASTIC PRESSURE COEFFICIENTS     ARLA1280
C                                                                       ARLA1290
      CALL LINK3L(IND(IBASE),D(IXP),D(IYP),D(IZP),D(IXG),D(IAR),D(IAM), ARLA1300
     1 D(IXN),D(IYN),D(ICP),D(IMM),D(IZN),D(IZN1),D(IZN2),D(IZN3),N,N1) ARLA1310
    3 WRITE (6,7)                                                       ARLA1320
    7 FORMAT (1H1,55X,21HTHIS CASE IS COMPLETE,/,56X,21H***************ARLA1330
     1*****)                                                            ARLA1340
C** CHANGE INDEX KEY TO SET UP DISC FOR NEXT CASE                       ARLA1350
      CALL STINDX(20,IND(1),12)                                         ARLA1360
      STOP                                                              ARLA1370
      END                                                               ARLA1380
```

```
      SUBROUTINE DISCRD(IND,XCP,YCP,ZCP,XCG,AREA,AMASS,XN,YN,ZN,BPRIM,  DISC0010
     1 DUM,N)                                                           DISC0020
C.......................................................................DISC0030
C     SUBROUTINE DISCRD READS THE DATA STORED ON TAPE20 INTO CORE       DISC0040
C.......................................................................DISC0050
      DIMENSION XCP(N),YCP(N),ZCP(N),XCG(N),AREA(N),AMASS(N),           DISC0060
     1 XN(N,4),YN(N,4),ZN(N,4),BPRIM(N,4)                               DISC0070
      DIMENSION IND(12),DUM(4,N)                                        DISC0080
      CALL READMS(20,XCP(1),N,2)                                        DISC0090
      CALL READMS(20,YCP(1),N,3)                                        DISC0100
      CALL READMS(20,ZCP(1),N,4)                                        DISC0110
      CALL READMS(20,XCG(1),N,5)                                        DISC0120
      CALL READMS(20,AREA(1),N,6)                                       DISC0130
      CALL READMS(20,AMASS(1),N,7)                                      DISC0140
      N4=4*N                                                            DISC0150
      CALL READMS(20,DUM(1,1),N4, 8)                                    DISC0160
      DO 1 I=1,N                                                        DISC0170
      DO 1 J=1,4                                                        DISC0180
    1 XN(I,J)=DUM(J,I)                                                  DISC0190
      CALL READMS(20,DUM(1,1),N4, 9)                                    DISC0200
      DO 2 I=1,N                                                        DISC0210
      DO 2 J=1,4                                                        DISC0220
    2 YN(I,J)=DUM(J,I)                                                  DISC0230
      CALL READMS(20,DUM(1,1),N4,10)                                    DISC0240
      DO 3 I=1,N                                                        DISC0250
      DO 3 J=1,4                                                        DISC0260
    3 ZN(I,J)=DUM(J,I)                                                  DISC0270
      CALL READMS(20,DUM(1,1),N4,11)                                    DISC0280
      DO 4 I=1,N                                                        DISC0290
      DO 4 J=1,4                                                        DISC0300
    4 BPRIM(I,J)=DUM(J,I)                                               DISC0310
      RETURN                                                            DISC0320
      END                                                               DISC0330
```

```
      SUBROUTINE LINK1L(IND,XCP,YCP,ZCP,XCG,AREA,AMASS,XN,YN,ZN,BPRIM,
     1 WA,WB,CP,AW,N)
C                             L*I*N*K*1*L
C.......................................................................
C       SUBROUTINE LINK1L CONTROLS THE CALCULATION OF THE AERODYNAMIC
C       INFLUENCE COEFFICIENT MATRIX, RIGID DERIVATIVES, THE RIGID
C       INDUCED DRAG PARAMETER AND THE PRESSURE COEFFICIENTS
C.......................................................................
C
      COMMON/INDMS/IA,IB,IC
      COMMON/CNTROL/LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,
     2 NHT1P,NHT2P,HALFB,ALPHA,HALF1,HALF2,NCPSWL,NCPWNG,MAX
      DIMENSION XCP(N),YCP(N),ZCP(N),XCG(N),AREA(N),AMASS(N),
     1 XN(N,4),YN(N,4),ZN(N,4),BPRIM(N,4),WA(N),WB(N),CP(N),AW(N,N)
      DIMENSION HEAD(6),IND(1)
      INTEGER WNGPNL,HT1PNL,HT2PNL
      DATA (HEAD(I),I=1,6)/5HWING ,5HHORIZ,5HONTAL,5H TAIL,5H(ONE),5H(TW
     1O)/
      MAX=N
      ALPHA=1.
C
C       SUBROUTINE  ADICMX  CALCULATES DOWNWASH MATRIX
C
      CALL ADICMX(AM,XN,YN,ZN,XCP,YCP,ZCP,LPANEL,BPRIM,AW,MAX)
C
C** MINV INVERTS A WELL-CONDITIONED MATRIX
C
      CALL MINV(AW,LPANEL)
C
C       SUBROUTINE  DELTCP  FINDS OUT PRESSURE COEFFICIENTS FOR A
C       GIVEN VALUE OF ALPHA
C
      CALL DELTCP(AW,ALPHA,LPANEL,CP)
      DO 1 J=1,LPANEL
```

```
      DO 1 I=1,LPANEL
    1 AW(I,J)=-2.*AREA(I)*AW(I,J)
C
C     AW(I,J) IS THE AERODYNAMIC INFLUENCE COEFFICIENT MATRIX A(I,R)
C
C** DERIVR FINDS STABILITY DERIVATIVES
C
      DO 2 I=1,LPANEL
    2 XCG(I)=-XCG(I)
      CALL DERIVR(HALFSW,CREF,LPANEL,AW,XCG,WA,WB,CLALPA)
C**STORE MATRIX A ON DISC
      DO 30 I=1,N
      IAA=IA+I-1
      DO 29 J=1,N
   29 WA(J)=AW(I,J)
   30 CALL WRITMS(20,WA,N,IAA)
      DO 3 I=1,LPANEL
    3 XCG(I)=-XCG(I)
      IF (CLDES.EQ.0.) GO TO 5
C
C      NEXT THREE CARDS COMPUTE THE PRESSURE COEFFICIENTS FOR
C      DESIRED VALUE OF LIFT COEFFICIENT
C
      ALPHA=CLDES/CLALPA
      DO 4 I=1,LPANEL
    4 CP(I)=CP(I)*ALPHA
      CL=CLDES
      GO TO 6
    5 CL=ALPHA*CLALPA
 6    DO 7 I=1,LPANEL
 7    WA(I)=0.0
C
C      SETDRAG SETS UP CALLS TO COMPUTE WING, TAIL AND CANARD DRAG.
C
      CALL SETDRAG(XN,YN,YCP,AREA,CP,XCG,WA,CL,AW,N)
```

```
      WRITE (6,19)                                                      LN1L0710
      WRITE(6,24)AM                                                     LN1L0720
      IF(CLDES.NE.0.)WRITE(6,26)CLDES                                   LN1L0730
      WRITE(6,25)ALPHA                                                  LN1L0740
      IF(NCNTL.NE.1)GO TO 14                                            LN1L0750
      WRITE(6,20)                                                       LN1L0760
      WRITE(6,21)(I,XCP(I),YCP(I),ZCP(I),XCG(I),AREA(I),CP(I),I=1,      LN1L0770
     1 LPANEL)                                                          LN1L0780
      WRITE(6,19)                                                       LN1L0790
      RETURN                                                            LN1L0800
   14 WRITE(6,22)                                                       LN1L0810
      WRITE (6,23) (I,XCP(I),YCP(I),ZCP(I),XCG(I),AREA(I),CP(I),AMASS(I)LN1L0820
     1,I=1,LPANEL)                                                      LN1L0830
      WRITE (6,19)                                                      LN1L0840
      RETURN                                                            LN1L0850
   19 FORMAT (1H1)                                                      LN1L0860
   20 FORMAT (7X,5HPANEL,8X,3HXCP,12X,3HYCP,10X,3HZCP,15X,3HXCG,11X,4HARLN1L0870
     1EA,10X,2HCP,/7X,6HNUMBER)                                         LN1L0880
   21 FORMAT ((7X,I3,5(5X,F10.5),5X,E12.5))                             LN1L0890
   22 FORMAT (7X,5HPANEL,8X,3HXCP,12X,3HYCP,10X,3HZCP,15X,3HXCG,11X,4HARLN1L0900
     1EA,10X,2HCP,12X,4HMASS,/,7X,6HNUMBER)                             LN1L0910
   23 FORMAT ((7X,I3,5(5X,F10.5),5X,E12.5,5X,F10.7))                    LN1L0920
   24 FORMAT (55X,12HMACH NUMBER=,F5.2,/,55X,17H*****************,///)  LN1L0930
   25 FORMAT (44X,24HCP VALUES ARE FOR ALPHA=,F10.6,8H RADIAN   ',44X,42HLN1L0940
     1******************************************,////)                  LN1L0950
   26 FORMAT (48X,25HDESIRED LIFT COEFFICIENT=,F10.5,/,48X      *********LN1L0960
     1****************,////)                                            LN1L0970
      END                                                               LN1L0980
```

```
      SUBROUTINE ADICMX(AM,XN,YN,ZN,XCP,YCP,ZCP,NPANEL,BPRIM,AW,MAX)
C                             A*D*I*C*M*X
C.......................................................................
C       SUBROUTINE  ADICMX  CALCULATES DOWNWASH MATRIX
C.......................................................................
      DIMENSION XCP(1),YCP(1),A(2),ZCP(1)
      DIMENSION XN(NPANEL,4),YN(NPANEL,4),ZN(NPANEL,4),BPRIM(NPANEL,4)
      DIMENSION AW(NPANEL,NPANEL),W(4),TWO(2),CON(2)
      DATA TWO/1.,-1./,CON/0.25,0.50/,PAI/3.14159265/,EPSLON/1.E-8/
      BETA1=1./SQRT(ABS(1.-AM*AM))
      IJ=1
      IF(AM.GE.1.0) IJ=2
      DO 1 I=1,NPANEL
      DO 1 J=1,4
    1 BPRIM(I,J)=BPRIM(I,J)*BETA1
C
C**DOWNWASH MATRIX COMPUTATION
C
      F5=0.
      DO 16 I=1,NPANEL
      DO 16 J=1,NPANEL
      DO 15 II=1,2
      DO 14 K=1,4
      BPM=BPRIM(J,K)
      XIPRIM=(XCP(I)-XN(J,K))*BETA1
      YPRIM=TWO(II)*YCP(I)-YN(J,K)
      ZPRIM=ZCP(I)-ZN(J,K)
      KK=1
      IF(BPM.GE.0.0) GO TO 4
      BPM=-BPM
      YPRIM=-YPRIM
      KK=2
C
    4 IF(BPM.LE.EPSLON) BPM=0.0
      IF(ABS(BPM-1.).LE.EPSLON)BPM=1.
```

```
      BPM2=BPM*BPM                                                      ADIC0360
      BB=ABS(1.-BPM2)                                                   ADIC0370
      IF(IJ.EQ.2)BB=SQRT(BB)                                            ADIC0380
      IF(BB.GT.EPSLON) GO TO 5                                          ADIC0390
      BPM=1.0                                                           ADIC0400
      BB=0.0                                                            ADIC0410
    5 B1=XIPRIM*XIPRIM                                                  ADIC0420
      B2=YPRIM*YPRIM+ZPRIM*ZPRIM                                        ADIC0430
      GO TO (51,120),IJ                                                 ADIC0440
C                                                                       ADIC0450
C**SUBSONIC CASE                                                        ADIC0460
C                                                                       ADIC0470
      CONTINUE                                                          ADIC0480
      A1=XIPRIM+SQRT(B1+B2)                                             ADIC0490
      A11=XIPRIM/SQRT(B2)                                               ADIC0500
      A2=BPM*XIPRIM+YPRIM                                               ADIC0510
      A3=XIPRIM-BPM*YPRIM                                               ADIC0520
      A33=(BPM2+1.)*ZPRIM*ZPRIM                                         ADIC0530
      SQA3=1./SQRT(A3*A3+A33)                                           ADIC0540
      A4=A2*SQA3                                                        ADIC0550
      IF(A11+1000.) 53,53,57                                            ADIC0560
   53 CALL F(XIPRIM,YPRIM,ZPRIM,F1)                                     ADIC0570
      GO TO 6                                                           ADIC0580
   57 F1=ALOG(A11+SQRT(A11*A11+1.0))                                    ADIC0590
C                                                                       ADIC0600
    6 IF(A4+1000.) 63,63,67                                             ADIC0610
   63 CALL F(A2,A3,A33,A6)                                              ADIC0620
      GO TO 7                                                           ADIC0630
   67 CONTINUE                                                          ADIC0640
C                                                                       ADIC0650
      A7=SQRT(A4*A4+1.)                                                 ADIC0660
      A8=A4+A7                                                          ADIC0670
      A6=ALOG(A8)                                                       ADIC0680
    7 F2=A6/SQRT(1.+BPM2)                                               ADIC0690
      F6=A1/B2                                                          ADIC0700
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```
      A5=ABS(BPM)*SQRT(B2)*SQA3                                         ADIC0710
      F5=0.                                                             ADIC0720
      IF(A5.GT.EPSLON)F5=ALOG(A5)                                       ADIC0730
      GO TO 13                                                          ADIC0740
C                                                                       ADIC0750
C**SUPERSONIC CASE                                                      ADIC0760
C                                                                       ADIC0770
  120 A1=B2                                                             ADIC0780
      A2=SQRT(A1)                                                       ADIC0790
      IF(XIPRIM.GT.A2) GO TO 127                                        ADIC0800
      F1=0.                                                             ADIC0810
      F2=0.                                                             ADIC0820
      F6=0.                                                             ADIC0830
      IF(BPM2.GE.1.0) GO TO 13                                          ADIC0840
      TEST=YPRIM-BPM*XIPRIM                                             ADIC0850
      IF(XIPRIM.EQ.A2) GO TO 122                                        ADIC0860
      IF(YPRIM.LE.0.0) GO TO 13                                         ADIC0870
C                                                                       ADIC0880
      CONTL=BPM*YPRIM+BB*ABS(ZPRIM)                                     ADIC0890
      IF(XIPRIM-CONTL) 13,123,122                                       ADIC0900
  122 IF(TEST) 13,123,124                                               ADIC0910
  123 F2=1.57079632/BB                                                  ADIC0920
      GO TO 13                                                          ADIC0930
  124 F2=PAI/BB                                                         ADIC0940
      GO TO 13                                                          ADIC0950
C                                                                       ADIC0960
  127 A3=XIPRIM/A1                                                      ADIC0970
      SQXI=SQRT(XIPRIM*XIPRIM-A1)                                       ADIC0980
      F6=SQXI/A1                                                        ADIC0990
      A11=XIPRIM/A2                                                     ADIC1000
      F1=ALOG(A11+SQRT(A11*A11-1.))                                     ADIC1010
      IF (BPM2.EQ.1.) GO TO 128                                         ADIC1020
      A4=XIPRIM-BPM*YPRIM                                               ADIC1030
      A5=(BPM2-1.)*ZPRIM*ZPRIM                                          ADIC1040
      A6=SQRT(A4*A4+A5)                                                 ADIC1050
```

```
      A7=BPM*XIPRIM-YPRIM                                              ADIC1060
      IF (BPM2.GT.1.) GO TO 129                                        ADIC1070
      F2=(1./BB)*ACOS(A7/A6)                                           ADIC1080
      GO TO 131                                                        ADIC1090
  128 F2=SQXI/(XIPRIM-YPRIM)                                           ADIC1100
      GO TO 131                                                        ADIC1110
  129 A8=A7/A6                                                         ADIC1120
      F2=(1./BB)*ALOG(A8+SQRT(A8*A8-1.))                               ADIC1130
      GO TO 131                                                        ADIC1140
  130 BPM=-BPM                                                         ADIC1150
      YPRIM=-YPRIM                                                     ADIC1160
      KK=2                                                             ADIC1170
      GO TO 120                                                        ADIC1180
  131 CONTINUE                                                         ADIC1190
   130W(K)=CON(IJ)/(BETA1*PAI)*((BPM2+TWO(IJ))*F2-BPM*(F1-F5)-YPRIM*F6)*ADIC1200
     1 TWO(KK)                                                         ADIC1210
   14 CONTINUE                                                         ADIC1220
   15 A(II)=W(1)-W(2)-W(3)+W(4)                                        ADIC1230
   16 AW(I,J)-A(1)+A(2)                                                ADIC1240
      RETURN                                                           ADIC1250
      END                                                              ADIC1260
```

```
      SUBROUTINE DERIVR(AREA,CREF,LPANEL,A,X,A1,UNIT1,CLALPA)           DRVR0010
C                                D*E*R*I*V*R                            DRVR0020
C.......................................................................DRVR0030
C       SUBROUTINE  DERIVR  FINDS RIGID STABILITY DERIVATIVES           DRVR0040
C.......................................................................DRVR0050
      DIMENSION A(LPANEL,LPANEL),X(LPANEL,1),A1(LPANEL,1),UNIT1(LPANEL,1DRVR0060
     1)                                                                 DRVR0070
      DO 1 I=1,LPANEL                                                   DRVR0080
    1 UNIT1(I,1)=1.                                                     DRVR0090
C                                                                       DRVR0100
C     CLALPA COMPUTATION                                                DRVR0110
C     (A1)=(A)*(UNIT1)                                                  DRVR0120
C                                                                       DRVR0130
C       SUBROUTINE  MATMPY  FINDS OUT PRODUCT OF TWO MATRICES           DRVR0140
C                                                                       DRVR0150
      CALL MATMPY(A,UNIT1,A1,LPANEL,LPANEL,1)                           DRVR0160
C     (A3)=(UNIT1)T*(A1)                                                DRVR0170
C                                                                       DRVR0180
C       SUBROUTINE  TRNPRD  FINDS OUT DOT PRODUCT OF TWO VECTORS        DRVR0190
C                                                                       DRVR0200
      CALL TRNPRD(UNIT1,A1,A3,LPANEL)                                   DRVR0210
      CLALPA=A3/AREA                                                    DRVR0220
      WRITE(6,2) CLALPA                                                 DRVR0230
C                                                                       DRVR0240
C     CMALPA COMPUTATION                                                DRVR0250
C     (A4)=(X)T*A1                                                      DRVR0260
C                                                                       DRVR0270
      CALL TRNPRD(X,A1,A4,LPANEL)                                       DRVR0280
      CMALPA=A4/(AREA*CREF)                                             DRVR0290
      WRITE(6,3) CMALPA                                                 DRVR0300
C                                                                       DRVR0310
C     CLQ COMPUTATION                                                   DRVR0320
C     A1=A*X(I)                                                         DRVR0330
C                                                                       DRVR0340
      CALL MATMPY(A,X,A1,LPANEL,LPANEL,1)                               DRVR0350
```

```
C     (A3)=(UNIT1)T*(A1)                                                DRVR0360
      CALL TRNPRD(UNIT1,A1,A3,LPANEL)                                   DRVR0370
      CLQ=-2.*A3/(AREA*CREF)                                            DRVR0380
      WRITE(6,4) CLQ                                                    DRVR0390
C                                                                       DRVR0400
C     CMQ COMPUTATION                                                   DRVR0410
C     (A4)=(X)T*(A1)                                                    DRVR0420
C                                                                       DRVR0430
      CALL TRNPRD(X,A1,A4,LPANEL)                                       DRVR0440
      CMQ=-2.*A4/(AREA*CREF*CREF)                                       DRVR0450
      WRITE(6,5) CMQ                                                    DRVR0460
    2 FORMAT (10X,9HCLALPR  =,E12.5)                                    DRVR0470
    3 FORMAT (10X,9HCMALPR  -,E12.5)                                    DRVR0480
    4 FORMAT (10X,9HCLQ     =,E12.5)                                    DRVR0490
    5 FORMAT (10X,9HCMQ     =,E12.5)                                    DRVR0500
      RETURN                                                            DRVR0510
      END                                                               DRVR0520
```

```
SUBROUTINE F(X2,X3,X4,FUNCT)
A6=X2/SQRT(X3*X3+X4*X4)
A7= SQRT(A6*A6+1.)
FUNCT=ALOG(A6+A7)
RETURN
END
```

```
      SUBROUTINE DELTCP(AW,ALPHA,LPANEL,CP)                             DELT0010
C                             D*E*L*T*C*P                               DELT0020
C.......................................................................DELT0030
C      SUBROUTINE  DELTCP  FINDS OUT PRESSURE COEFFICIENTS FOR A        DELT0040
C      GIVEN VALUE OF ALPHA                                             DELT0050
C.......................................................................DELT0060
      DIMENSION AW(LPANEL,LPANEL),CP(LPANEL)                            DELT0070
      DO 1 I=1,LPANEL                                                   DELT0080
      CP(I)=0.                                                          DELT0090
      DO 1 J=1,LPANEL                                                   DELT0100
    1 CP(I)=CP(I)-AW(I,J)*ALPHA*2.                                      DELT0110
      RETURN                                                            DELT0120
      END                                                               DELT0130
```

```
      SUBROUTINE LINK2L(XCG,YCG,PHUP,PHUM,PHUT,XEA,YEA,PHIUP,PHIUM,     LN2L0010
     1 PHIUT,EI,GJ,A,GAMMA,G,STORP,STORM,M1,M2,NUMPNL,IASIGN,C,IND,CC)  LN2L0020
C                            L*I*N*K*2*L                                LN2L0030
C.......................................................................LN2L0040
C      SUBROUTINE LINK2L CONTROLS CALCULATION OF THE STRUCTURAL         LN2L0050
C       INFLUENCE COEFFICIENT MATRIX                                    LN2L0060
C.......................................................................LN2L0070
C                                                                       LN2L0080
      DIMENSION C(1),PHUP(M1,M1),PHUM(M1,M1),PHUT(M1,M1),G(M2,M2)       LN2L0090
      DIMENSION XCG(1),YCG(1),IASIGN(1),XEA(1),YEA(1),PHIUP(1),PHIUM(1),LN2L0100
     1PHIUT(1),EI(1),GJ(1),A(1),GAMMA(1),STORP(1),STORM(1)              LN2L0110
      DIMENSION HEAD(12),LPNL(4)                                        LN2L0120
      DIMENSION CC(NUMPNL,NUMPNL)                                       LN2L0125
      INTEGER FPNLFF,FPNLRF,FPNLMW,FPNLHT                               LN2L0130
      DIMENSION IND(1)                                                  LN2L0140
      COMMON/INDMS/IA,IB,IC                                             LN2L0150
      INTEGER WNGPNL,HT1PNL,HT2PNL                                      LN2L0160
      COMMON /PNLNUM/ FPNLFF,LPNLFF,FPNLRF,LPNLRF,FPNLMW,LPNLMW,FPNLHT,LLN2L0170
     1PNLHT,MOVTEL                                                      LN2L0180
      COMMON/CNTROL/LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM                  LN2L0190
      DATA (HEAD(I),I=1,12)/5HFRONT,5H FUSE,5HLAGE ,5H REAR,5H FUSE,5HLALN2L0200
     1GE ,5H   MA,5HIN WI,5HNG   ,5HHORIZ,5HONTAL,5H TAIL/              LN2L0210
C                                                                       LN2L0220
C     NCONTL=1      FRONT FUSELAGE ONLY                                 LN2L0230
C     NCONTL=2      REAR FUSELAGE ONLY                                  LN2L0240
C     NCONTL=3      MAIN WING ONLY                                      LN2L0250
C     NCONTL=4      HORIZONTAL TAIL ONLY                                LN2L0260
C     N1= ELASTIC AXIS POINT ATTACHED TO HORIZONTAL TAIL                LN2L0270
C     MOVTEL=0 NON-MOVABLE TAIL                                         LN2L0280
C     MOVTEL=1 ALL MOVABLE TAIL                                         LN2L0290
C                                                                       LN2L0291
C**IF NCNTL = +3, READ MATRIX (C) FROM TAPE7 BY ROWS AND RETURN.        LN2L0292
C  IF NCNTL = -3, READ MATRIX (C) FROM TAPE7 BY COLUMNS, STORE BY       LN2L0293
C  ROWS, AND RETURN                                                     LN2L0294
C**NOTE.  AFREL EXPECTS EACH ROW (OR COLUMN) TO BE A LOGICAL RECORD.    LN2L0295
```

```
C  HOWEVER, IF AN END OF FILE IS ENCOUNTERED AFTER THE FIRST READ,
C  AN ATTEMPT WILL BE MADE TO READ THE ENTIRE MATRIX FROM TAPE7.
C
      NCP=NUMPNL
      IF(IABS(NCNTL).NE.3) GO TO 99
      REWIND 7
      DO 40 I=1,NCP
      ICC=IC+I-1
      READ(7) (C(J),J=1,NCP)
      IF(EOF,7) 50,40
   40 CALL WRITMS(20,C,NCP,ICC)
      IF(NCNTL) 80,80,90
C
C**EOF ENCOUNTERED
   50 NREC=I-1
      IF(NREC) 55,55,60
   55 WRITE(6,56)
   56 FORMAT(1H1,*NO DATA FOUND ON TAPE7.  EXECUTION TERMINATED*)
      CALL EXIT
C
   60 WRITE(6,61) NREC
   61 FORMAT(1H1,I5,* RECORDS FOUND ON TAPE7*/*     MATRIX READ OF FIRST
     1 RECORD BEING ATTEMPTED*)
      REWIND 7
      READ(7) ((CC(I,J),J=1,NCP),I=1,NCP)
C
      DO 70 I=1,NCP
      ICC=IC+I-1
      DO 65 J=1,NCP
   65 C(J)=CC(I,J)
   70 CALL WRITMS(20,C,NCP,ICC)
      IF(NCNTL) 80,80,90
C
C**MATRIX WAS READ BY COLUMNS.  STORE BY ROWS.
   80 CALL CWRITE(PHUP(1),C,NCP,IND)
```

```
   90 REWIND 7                                                          LN2L0331
      RETURN                                                            LN2L0332
C                                                                       LN2L0333
   99 CONTINUF                                                          LN2L0334
      DO 29 I=1,NCP                                                     LN2L0335
   29 C(I)=0.0                                                          LN2L0336
      DO 31 I=1,NCP                                                     LN2L0340
      ICC=IC+I-1                                                        LN2L0350
   31 CALL WRITMS(20,C,NCP,ICC)                                         LN2L0360
C***********************************************************************LN2L0370
      READ(5,12)(LPNL(I),I=1,4),N1,MOVTEL,NEIGJ                         LN2L0380
C***********************************************************************LN2L0390
      FPNLFF=1                                                          LN2L0400
      LPNLFF=LPNL(1)                                                    LN2L0410
      FPNLRF=LPNLFF+1                                                   LN2L0420
      LPNLRF=LPNLFF+LPNL(2)                                             LN2L0430
      FPNLMW=LPNLRF+1                                                   LN2L0440
      LPNLMW=LPNLRF+LPNL(3)                                             LN2L0450
      FPNLHT=LPNLMW+1                                                   LN2L0460
      LPNLHT=LPNLMW+LPNL(4)                                             LN2L0470
      IF (LPNLFF.GE.FPNLFF) WRITE (6,16) FPNLFF,LPNLFF                  LN2L0480
      IF (LPNLRF.GE.FPNLRF) WRITE (6,17) FPNLRF,LPNLRF                  LN2L0490
      IF (LPNLMW.GE.FPNLMW) WRITE (6,18) FPNLMW,LPNLMW                  LN2L0500
      IF (LPNLHT.GE.FPNLHT) WRITE (6,19) FPNLHT,LPNLHT                  LN2L0510
C***********************************************************************LN2L0520
      READ (5,9) (IASIGN(I),I=1,NCP)                                    LN2L0530
      READ (5,10) CSMW,CSHT,WDTHMW,WDTHHT,XREF                          LN2L0540
C***********************************************************************LN2L0550
      IF (CSMW.NE.0.) WRITE (6,20) CSMW                                 LN2L0560
      IF (CSHT.NE.0.) WRITE (6,21) CSHT                                 LN2L0570
      IF (WDTHMW.NE.0.) WRITE (6,22) WDTHMW                             LN2L0580
      IF (WDTHHT.NE.0.) WRITE (6,23) WDTHHT                             LN2L0590
      WRITE (6,24) XREF                                                 LN2L0600
C***********************************************************************LN2L0610
      IF (NCNTL.EQ.2) READ (5,10) (XCG(I),YCG(I),I=1,NUMPNL)            LN2L0620
```

```
C***********************************************************************LN2L0630
      WRITE (6,13) (I,XCG(I),YCG(I),IASIGN(I),I=1,NCP)                  LN2L0640
    1 CONTINUE                                                          LN2L0650
C***********************************************************************LN2L0660
      READ (5,9) NCONTL,NEA                                             LN2L0670
C***********************************************************************LN2L0680
      IF (NCONTL.GT.4) GO TO 7                                          LN2L0690
      IF (NCONTL.EQ.0) GO TO 6                                          LN2L0700
      IF (NEA.GT.M1) GO TO 8                                            LN2L0710
      NN=NEA-1                                                          LN2L0720
C***********************************************************************LN2L0730
      READ (5,10) (XEA(I),YEA(I),I=1,NEA)                               LN2L0740
      READ (5,11) (EI(I),GJ(I),I=1,NN)                                  LN2L0750
C                                                                       LN2L0760
C       SUBROUTINE  CNVERT  IS USED TO CONVERT EI AND GJ VALUES FROM    LN2L0770
C       (LB-INCH**2) UNITS TO (LB-FEET**2) UNITS                        LN2L0780
C                                                                       LN2L0790
      IF (NEIGJ.EQ.0) CALL CNVERT(EI,GJ,NN)                             LN2L0800
C***********************************************************************LN2L0810
      NCCC2=3*NCONTL                                                    LN2L0820
      NCCC1=NCCC2-2                                                     LN2L0830
      WRITE (6,27) (HEAD(I),I=NCCC1,NCCC2),NEA                          LN2L0840
      WRITE (6,14) (I,XEA(I),YEA(I),I=1,NEA)                            LN2L0850
      WRITE (6,15) (I,EI(I),GJ(I),I=1,NN)                               LN2L0860
      GO TO (2,3,4,5),NCONTL                                            LN2L0870
C                                                                       LN2L0880
C       USE OF  CTHETA  FOR FRONT FUSELAGE                              LN2L0890
C                                                                       LN2L0900
    2 NCP1=FPNLFF                                                       LN2L0910
      NCP2=LPNLFF                                                       LN2L0920
      NW1=FPNLMW                                                        LN2L0930
      NW2=LPNLMW                                                        LN2L0940
      GO TO 30                                                          LN2L0950
C                                                                       LN2L0960
C       USE OF  CTHETA  FOR REAR FUSELAGE                               LN2L0970
```

```
C                                                                       LN2L0980
    3 NCP1=FPNLRF                                                       LN2L0990
      NCP2=LPNLRF                                                       LN2L1000
      NW1=FPNLMW                                                        LN2L1010
      NW2=LPNLMW                                                        LN2L1020
      NH1=FPNLHT                                                        LN2L1030
      NH2=LPNLHT                                                        LN2L1040
      GO TO 30                                                          LN2L1050
C                                                                       LN2L1060
C       USE OF   CTHETA   FOR WING                                      LN2L1070
C                                                                       LN2L1080
    4 NCP1=FPNLMW                                                       LN2L1090
      NCP2=LPNLMW                                                       LN2L1100
      GO TO 30                                                          LN2L1110
C                                                                       LN2L1120
C       USE OF   CTHETA   FOR HORIZONTAL TAIL                           LN2L1130
C                                                                       LN2L1140
    5 NCP1=FPNLHT                                                       LN2L1150
      NCP2=LPNLHT                                                       LN2L1160
      NH1=FPNLHT                                                        LN2L1170
      NH2=LPNLHT                                                        LN2L1180
      NC1=FPNLRF                                                        LN2L1190
      NC2=LPNLRF                                                        LN2L1200
C                                                                       LN2L1210
C       SUBROUTINE  CTHETA  IS THE ACTUAL SUBROUTINE WHICH CALCULATES   LN2L1220
C       STRUCTURAL MATRIX                                               LN2L1230
C                                                                       LN2L1240
   30 CALL CTHETA(NCONTL,XEA,YEA,XCG,YCG,EI,GJ,IASIGN,CSMW,WDTHMW,CSHT,WLN2L1250
     1DTHHT,NCP1,NCP2,NW1,NW2,N1,NH1,NH2,NC1,NC2,NEA,NN,PHIUP,PHIUM,PHIULN2L1260
     2T,PHUP,PHUM,PHUT,A,STORP,STORM,GAMMA,G,C,NCP,XREF,M1,M2,IND)      LN2L1270
      GO TO 1                                                           LN2L1280
C** CWRITE STORES THE C MATRIX ON DISC BY ROWS                           LN2L1290
    6 CALL CWRITE(PHUP(1),C,NUMPNL,IND)                                 LN2L1300
C                                                                       LN2L1310
C** WRITEC PRINTS OUT THE INFLUENCE COEFFICIENT MATRIX                   LN2L1320
```

```
      IF(NCNTL.EQ.2.OR.NCNTL.EQ.4) CALL WRITEC(PHUP'1),NCP)             LN2L1330
      RETURN                                                            LN2L1340
    7 IERROR=2                                                          LN2L1350
      WRITE (6,28) IERROR                                               LN2L1360
      WRITE (6,26)                                                      LN2L1370
      RETURN                                                            LN2L1380
    8 IERROR=3                                                          LN2L1390
      WRITE (6,28) IERROR                                               LN2L1400
      WRITE (6,25) NEA,M1                                               LN2L1410
      RETURN                                                            LN2L1420
    9 FORMAT (40I2)                                                     LN2L1430
   10 FORMAT (8F10.5)                                                   LN2L1440
   11 FORMAT (4E15.8)                                                   LN2L1450
   12 FORMAT (10I3)                                                     LN2L1460
   13 FORMAT(1H1,65H COORDINATES OF UNIT LOADING POINTS AND LOADING POINLN2L1470
     1T ASSIGNMENTS,//33H    I        XCG        YCG   IASIGN//(I5,2F10.5,ILN2L1480
     28))                                                               LN2L1490
   14 FORMAT(///,37H COORDINATES OF ELASTIC AXIS SEGMENTS//25H    I     LN2L1500
     1  XEA        YEA//(I5,2F10.5))                                    LN2L1510
   15 FORMAT(///,46H ELASTIC AXIS TORSIONAL AND BENDING STIFFNESS /     LN2L1520
     14X,1HI,10X,2HEI,9X,3HKGJ//(I5,2E12.4))                            LN2L1530
   16 FORMAT (10X,38HFIRST PANEL NUMBER ON FRONT FUSELAGE =,I3,/,10X,38HLN2L1540
     1LAST PANEL NUMBER ON FRONT FUSELAGE  =,I3)                        LN2L1550
   17 FORMAT (10XT38HFIRST PANEL NUMBER ON REAR FUSELAGE  =,I3,/,10X,38HLN2L1560
     1LAST PANEL NUMBER ON REAR FUSELAGE   =,I3)                        LN2L1570
   18 FORMAT (10XT38HFIRST PANEL NUMBER ON MAIN WING      =,I3,/,10X,38HLN2L1580
     1LAST PANEL NUMBER ON MAIN WING       =,I3)                        LN2L1590
   19 FORMAT (10X,38HFIRST PANEL NUMBER ON HORIZONTAL TAIL=,I3,/,10X,38HLN2L1600
     1LAST PANEL NUMBER ON HORIZONTAL TAIL =,I3)                        LN2L1610
   20 FORMAT (10X,42H     STRUCTURAL CHORD FOR MAIN WING      =,F10.5)  LN2L1620
   21 FORMAT (10X,42H     STRUCTURAL CHORD FOR HORIZONTAL TAIL=,F10.5)  LN2L1630
   22 FORMAT (10X,64HHALF THE WIDTH OF FUSELAGE AT ROOT CHORD OF THE MAILN2L1640
     1NWING        =,F10.5)                                             LN2L1650
   23 FORMAT (10X,64HHALF THE WIDTH OF FUSELAGE AT ROOT CHORD OF THE HORLN2L1660
     1IZONTAL TAIL=,F10.5)                                              LN2L1670
```

```
24 FORMAT (10X,28HX-COORDINATE OF FIXED POINT=,F10.5)               LN2L1680
25 FORMAT (10X,45HNEA IS GREATER THAN MAXIMUM ASSUMED NEA VALUE,/,10XLN2L1690
  1,30HFIRST INPUT DATA CARD IS WRONG,/,10X,26HSECOND VARIABLE SHOULDLN2L1700
  2 BE ,I2,9H AND NOT ,I2)                                          LN2L1710
26 FORMAT (10X,31HNCONTL CANNOT BE GREATER THAN 4)                   LN2L1720
27 FORMAT (1H1,33HNUMBER OF ELASTIC AXIS POINTS ON ,3A5,1H=,I2,///)  LN2L1730
28 FORMAT (1H1,10X,7HIERROR=,I2)                                    LN2L1740
   END                                                              LN2L1750
```

```
      SUBROUTINE CTHETA(NCONTL,XEA,YEA,XCG,YCG,EI,GJ,IASIGN,CSMW,WDTHMW,CTHE0010
     1CSHT,WDTHHT,NCP1,NCP2,NW1,NW2,N1,NH1,NH2,NC1,NC2,NEA,NN,PHIUP,PHIUCTHE0020
     2M,PHIUT,PHUP,PHUM,PHUT,A,STORP,STORM,GAMMA,G,C,NCP,XREF,M1,M2,IND)CTHE0030
C                             C*T*H*E*T*A                               CTHE0040
C.......................................................................CTHE0050
C       SUBROUTINE  CTHETA  IS THE ACTUAL SUBROUTINE WHICH CALCULATES   CTHE0060
C       THE STRUCTURAL MATRIX C.   C RESIDES ON DISC. ROWS ARE ACCESSED CTHE0070
C       AS NEEDED.                                                      CTHE0080
C                                                                       CTHE0090
C     NCONTL=1      FRONT FUSELAGE ONLY                                 CTHE0100
C     NCONTL=2      REAR FUSELAGE ONLY                                  CTHE0110
C     NCONTL=3      MAIN WING ONLY                                      CTHE0120
C     NCONTL=4      HORIZONTAL TAIL ONLY                                CTHE0130
C                                                                       CTHE0140
C.......................................................................CTHE0150
      DIMENSION A(1),XEA(1),YEA(1),XCG(1),YCG(1),EI(1),GJ(1),GAMMA(1)   CTHE0160
      DIMENSION PHIUP(1),PHIUM(1),PHIUT(1)                              CTHE0170
      DIMENSION STORP(1),STORM(1),IASIGN(1)                             CTHE0180
      DIMENSION PHUP(M1,M1),PHUM(M1,M1),PHUT(M1,M1),G(M2,M2)            CTHE0190
      DIMENSION IND(1),C(1)                                             CTHE0200
      COMMON/INDMS/IA,IB,IC                                             CTHE0210
      INTEGER FPNLFF,FPNLRF,FPNLMW,FPNLHT                               CTHE0220
      COMMON /PNLNUM/ FPNLFF,LPNLFF,FPNLRF,LPNLRF,FPNLMW,LPNLMW,FPNLHT,LCTHE0230
     1PNLHT,MOVTEL                                                      CTHE0240
      N=NCP                                                             CTHE0250
      IF (NCONTL.GT.2) GO TO 24                                         CTHE0260
      DO 1 I=2,NEA                                                      CTHE0270
    1 A(I-1)=ABS(XEA(I)-XEA(I-1))                                       CTHE0280
      IF (NCONTL.EQ.1) CK=1.                                            CTHE0290
      IF (NCONTL.EQ.2) CK=-1.                                           CTHE0300
      DO 5 I=1,NN                                                       CTHE0310
      J=NEA-I                                                           CTHE0320
      JP=J+1                                                            CTHE0330
    2 JJ=J+1                                                            CTHE0340
      XM=(XEA(JJ)-XEA(JP))*CK                                           CTHE0350
```

```
      PHIUP(JJ)=(XM*A(J)/EI(J)+A(J)*A(J)/(2.*EI(J)))*CK                 CTHE0360
      PHIUM(JJ)=(A(J)/EI(J))*CK                                         CTHE0370
      J=J-1                                                             CTHE0380
      IF (JJ.GT.2) GO TO 2                                              CTHE0390
      PHUP(1,JP)=0.                                                     CTHE0400
      PHUM(1,JP)=0.                                                     CTHE0410
      DO 4 II=2,NEA                                                     CTHE0420
      IF (II.GT.JP) GO TO 3                                             CTHE0430
      PHUP(II,JP)=PHUP(II-1,JP)+PHIUP(II)                               CTHE0440
      PHUM(II,JP)=PHUM(II-1,JP)+PHIUM(II)                               CTHE0450
      GO TO 4                                                           CTHE0460
    3 PHUP(II,JP)=PHUP(JP,JP)                                           CTHE0470
      PHUM(II,JP)=PHUM(JP,JP)                                           CTHE0480
    4 CONTINUE                                                          CTHE0490
    5 CONTINUE                                                          CTHE0500
C                                                                       CTHE0510
C     EFFECT OF FRONT FUSELAGE ON FRONT FUSELAGE                        CTHE0520
C                                                                       CTHE0530
      IF (NCONTL.EQ.1) GO TO 7                                          CTHE0540
      N2=IASIGN(N1)                                                     CTHE0550
      DO 6 II=1,NFA                                                     CTHE0560
      STORP(II)=PHUP(II,N2)                                             CTHE0570
    6 STORM(II)=PHUM(II,N2)                                             CTHE0580
C                                                                       CTHE0590
C     EFFECT OF REAR FUSELAGE ON REAR FUSELAGE                          CTHE0600
C                                                                       CTHE0610
    7 DO 12 K=NCP1,NCP2                                                 CTHE0620
      ICC=IC+K-1                                                        CTHE0630
C** READ C MATRIX FROM DISC                                             CTHE0640
      CALL READMS(20,C,N,ICC)                                           CTHE0650
      I=IASIGN(K)                                                       CTHE0660
      IF (I.EQ.1) GO TO 8                                               CTHE0670
      XM=(XFA(I)-XCG(K))*CK                                             CTHE0680
      GO TO 10                                                          CTHE0690
    8 DO 9 J=NCP1,NCP2                                                  CTHE0700
```

```
      L=IASIGN(J)
    9 C(L)=0.
      GO TO 12
   10 DO 11 J=NCP1,NCP2
      L=IASIGN(J)
   11 C(J)=PHUP(L,I)+PHUM(L,I)*XM
C** REPLACE C MATRIX WITH REAR FUSELAGE ON REAR FUSELAGE EFFECTS
   12 CALL WRITIN(20,C,N,ICC)
C
C     EFFECT OF FRONT FUSELAGE ON MAIN WING
C     EFFECT OF REAR FUSELAGE ON MAIN WING
C
      NHH1=NCP1
      NHH2=NCP2
      NCP11=NCP1
      IF (NCONTL.EQ.2) NCP11=NCP1-1
      NCP22=NCP2
   13 CSMW2=CSMW/2.
      YLIMIT=WDTHMW+CSMW2
      DO 17 K=NHH1,NHH2
      ICC=IC+K-1
C** READ C MATRIX FROM DISC
      CALL READMS(20,C,N,ICC)
      DO 16 I=NW1,NW2
      IF(YCG(I).GT.YLIMIT) GO TO 165
      XCONT=(XCG(I)-XREF)*CK
      IF(XCONT.GE.0.) GO TO 16
C
      DO 14 J=NCP11,NCP22
 14   IF(XCG(I).GT.XCG(J).AND.XCG(I).LE.XCG(J+1)) GO TO 15
C
 15   Y=1.-(YCG(I)-WDTHMW)/CSMW2
      X=(XCG(J+1)-XCG(I))/(XCG(J+1)-XCG(J))
      CMAX=C(J+1)  +(C(J)  -C(J+1)  )*X
 16   C(I)  =CMAX*Y
```

```
 165   CONTINUE                                                          CTHE1060
C** REPLACE C MATRIX WITH FRONT AND REAR FUSELAGE ON MAIN WING EFFECTS   CTHE1070
 17    CALL WRITIN(20,C,N,ICC)                                           CTHE1080
   18 CONTINUE                                                           CTHE1090
      IF (NCONTL.EQ.4) GO TO 36                                          CTHE1100
      IF (NCONTL.EQ.1) RETURN                                            CTHE1110
C                                                                        CTHE1120
C     EFFECT OF REAR FUSELAGE ON HORIZONTAL TAIL                         CTHE1130
C                                                                        CTHE1140
      CSHT2=CSHT/2.                                                      CTHE1150
      YLIMIT=WDTHHT+CSHT2                                                CTHE1160
      DO 23 I=NH1,NH2                                                    CTHE1170
      IF (YCG(I).GT.YLIMIT) GO TO 21                                     CTHE1180
      DO 19 J=NCP1,NCP2                                                  CTHE1190
      IF (XCG(I).LE.XCG(J+1).AND.XCG(I).GT.XCG(J)) GO TO 20              CTHE1200
   19 CONTINUE                                                           CTHE1210
   20 Y=1.-(YCG(I)-WDTHHT)/CSHT2                                         CTHE1220
      X=(XCG(J)-XCG(I))/(XCG(J+1)-XCG(J))                                CTHE1230
      GO TO 22                                                           CTHE1240
   21 Y=0.                                                               CTHE1250
   22 DO 23 K=NCP1,NCP2                                                  CTHE1260
      ICC=IC+K-1                                                         CTHE1270
C** READ C MATRIX FROM DISC                                              CTHE1280
      CALL READMS(20,C,N,ICC)                                            CTHE1290
      CMAX=C(J)+(C(J)-C(J+1))*X                                          CTHE1300
      C(I)=C(N1)*(1.-Y)+CMAX*Y                                           CTHE1310
C** REPLACE C MATRIX WITH REAR FUSELAGE ON HORIZONTAL TAIL EFFECTS       CTHE1320
   23 CALL WRITIN(20,C,N,ICC)                                            CTHE1330
      RETURN                                                             CTHE1340
   24 CONTINUE                                                           CTHE1350
C                                                                        CTHE1360
C     EFFECT OF MAIN WING ON MAIN WING                                   CTHE1370
C     EFFECT OF HORIZONTAL TAIL ON HORIZONTAL TAIL                       CTHE1380
C     (WITHOUT REAR FUSELAGE BENDING)                                    CTHE1390
C                                                                        CTHE1400
```

```
      DO 26 I=2,NEA                                                     CTHE1410
      A(I-1)=SQRT((XEA(I)-XEA(I-1))**2+(YEA(I)-YEA(I-1))**2)            CTHE1420
      IF (YEA(I).EQ.YEA(I-1)) GO TO 25                                  CTHE1430
      GAMMA(I-1)=ATAN((XEA(I)-XEA(I-1))/(YEA(I)-YEA(I-1)))              CTHE1440
      GO TO 26                                                          CTHE1450
   25 GAMMA(I-1)=1.570796325                                            CTHE1460
   26 CONTINUE                                                          CTHE1470
      DO 27 I=1,NN                                                      CTHE1480
      DO 27 J=1,NN                                                      CTHE1490
   27 G(I,J)=GAMMA(J)-GAMMA(I)                                          CTHE1500
      DO 31 I=1,NN                                                      CTHE1510
      J=NEA-I                                                           CTHE1520
      JP=J+1                                                            CTHE1530
   28 JJ=J+1                                                            CTHE1540
      SINE=SIN(GAMMA(J))                                                CTHE1550
      COSINE=COS(GAMMA(J))                                              CTHE1560
      T=(YEA(JP)-YEA(JJ))*SINE-(XEA(JP)-XEA(JJ))*COSINE                 CTHE1570
      XM=(YEA(JP)-YEA(JJ))*COSINE+(XEA(JP)-XEA(JJ))*SINE                CTHE1580
      SINJJP=SIN(G(J,JP-1))                                             CTHE1590
      COSJJP=COS(G(J,JP-1))                                             CTHE1600
      THETP=XM*A(J)/EI(J)+A(J)*A(J)/(2.*EI(J))                          CTHE1610
      PHIP=T*A(J)/GJ(J)                                                 CTHE1620
      THETM=COSJJP*A(J)/EI(J)                                           CTHE1630
      PHIM=-SINJJP*A(J)/GJ(J)                                           CTHE1640
      THETT=SINJJP*A(J)/EI(J)                                           CTHE1650
      PHIT=COSJJP*A(J)/GJ(J)                                            CTHE1660
      PHIUP(JJ)=PHIP*COSINE-THETP*SINE                                  CTHE1670
      PHIUM(JJ)=PHIM*COSINE-THETM*SINE                                  CTHE1680
      PHIUT(JJ)=PHIT*COSINE-THETT*SINE                                  CTHE1690
      J=J-1                                                             CTHE1700
      IF (JJ.GT.2) GO TO 28                                             CTHE1710
      PHUP(1,JP)=0.                                                     CTHE1720
      PHUT(1,JP)=0.                                                     CTHE1730
      PHUM(1,JP)=0.                                                     CTHE1740
      DO 30 II=2,NEA                                                    CTHE1750
```

```
      IF (II.GT.JP) GO TO 29                                            CTHE1760
      PHUP(II,JP)=PHUP(II-1,JP)+PHIUP(II)                               CTHE1770
      PHUM(II,JP)=PHUM(II-1,JP)+PHIUM(II)                               CTHE1780
      PHUT(II,JP)=PHUT(II-1,JP)+PHIUT(II)                               CTHE1790
      GO TO 30                                                          CTHE1800
   29 PHUP(II,JP)=PHUP(JP,JP)                                           CTHE1810
      PHUT(II,JP)=PHUT(JP,JP)                                           CTHE1820
      PHUM(II,JP)=PHUM(JP,JP)                                           CTHE1830
   30 CONTINUE                                                          CTHE1840
   31 CONTINUE                                                          CTHE1850
      DO 33 K=NCP1,NCP2                                                 CTHE1860
      ICC=IC+K-1                                                        CTHE1870
C** READ C MATRIX FROM DISC                                             CTHE1880
      CALL READMS(20,C,N,ICC)                                           CTHE1890
      I=IASIGN(K)                                                       CTHE1900
      SING=SIN(GAMMA(I-1))                                              CTHE1910
      COSG=COS(GAMMA(I-1))                                              CTHE1920
      T=(YCG(K)-YEA(I))*SING-(XCG(K)-XEA(I))*COSG                       CTHE1930
      XM=(YCG(K)-YEA(I))*COSG+(XCG(K)-XEA(I))*SING                      CTHE1940
      DO 32 J=NCP1,NCP2                                                 CTHE1950
      L=IASIGN(J)                                                       CTHE1960
   32 C(J)=PHUP(L,I)+PHUM(L,I)*XM+PHUT(L,I)*T                           CTHE1970
C** REPLACE C MATRIX WITH MAIN WING ON MAIN WING EFFECTS                CTHE1980
   33 CALL WRITIN(20,C,N,ICC)                                           .THE1990
      IF (NCONTL.EQ.3) RETURN                                           CTHE2000
C                                                                       CTHE2010
C     EFFECT OF HORIZONTAL TAIL ON REAR FUSELAGE                        CTHE2020
C                                                                       CTHE2030
      DO 35 K=NCP1,NCP2                                                 CTHE2040
      ICC=IC+K-1                                                        CTHE2050
C** READ C MATRIX FROM DISC                                             CTHE2060
      CALL READMS(20,C,N,ICC)                                           CTHE2070
      XM=XCG(K)-XCG(N1)                                                 CTHE2080
      DO 34 J=NC1,NC2                                                   CTHE2090
      L=IASIGN(J)                                                       CTHE2100
```

```
   34 C(J)=STORP(L)+STORM(L)*XM                                           CTHE2110
C** REPLACE C MATRIX WITH HORIZONTAL TAIL ON REAR FUSELAGE EFFECTS        CTHE2120
   35 CALL WRITIN(20,C,N,ICC)                                             CTHE2130
C                                                                         CTHE2140
C     EFFECT OF HORIZONTAL TAIL ON MAIN WING                              CTHE2150
C                                                                         CTHE2160
      NH1=FPNLHT                                                          CTHE2170
      NH2=LPNLHT                                                          CTHE2180
      NHH1=FPNLHT                                                         CTHE2190
      NHH2=LPNLHT                                                         CTHE2200
      NW1=FPNLMW                                                          CTHE2210
      NW2=LPNLMW                                                          CTHE2220
      NCP1=FPNLRF                                                         CTHE2230
      NCP2=LPNLRF                                                         CTHE2240
      CK=-1.                                                              CTHE2250
      NCP11=LPNLFF                                                        CTHE2260
      NCP22=LPNLRF                                                        CTHE2270
      GO TO 13                                                            CTHE2280
   36 CONTINUF                                                            CTHE2290
C                                                                         CTHE2300
C     EFFECT OF HORIZONTAL TAIL ON HORIZONTAL TAIL                        CTHE2310
C     (WITH REAR FUSELAGE BENDING)                                        CTHE2320
C                                                                         CTHE2330
      IF (MOVTEL.EQ.1) GO TO 43                                           CTHE2340
      CSHT2=CSHT/2.                                                       CTHE2350
      YLIMIT=WDTHHT+CSHT2                                                 CTHE2360
      DO 42 K=NH1,NH2                                                     CTHE2370
      ICC=IC+K-1                                                          CTHE2380
C** READ C MATRIX FROM DISC                                                CTHE2390
      CALL READMS(20,C,N,ICC)                                             CTHE2400
C                                                                         CTHE2410
      DO 41 I=NH1,NH2                                                     CTHE2420
      IF(YCG(I).GT.YLIMIT) GO TO 39                                       CTHE2430
      DO 37 J=NC1,NC2                                                     CTHE2440
 37   IF(XCG(I).GT.XCG(J).AND.XCG(I).LE.XCG(J+1)) GO TO 38                CTHE2450
```

```
 38   Y=1.-(YCG(I)-WDTHHT)/CSHT2                                             CTHE2460
      X=(XCG(J)-XCG(I))/(XCG(J+1)-XCG(J))                                    CTHE2470
      GO TO 40                                                               CTHE2480
 39   Y=0.                                                                   CTHE2490
      X=0.                                                                   CTHE2500
 40   CMAX=C(J)+(C(J)-C(J+1))*X                                              CTHE2510
      C(I)=C(I)+C(N1)*(1.-Y)+CMAX*Y                                          CTHE2520
 41   CONTINUE                                                               CTHE2530
C                                                                            CTHE2540
C** REPLACE C MATRIX WITH HORIZONTAL TAIL ON HORIZONTAL TAIL EFFECTS          CTHE2550
 42   CALL WRITIN(20,C,N,ICC)                                                CTHE2560
      RETURN                                                                 CTHE2570
   43 DO 44 J=NH1,NH2                                                        CTHE2580
      ICC=IC+K-1                                                             CTHE2590
C** READ C MATRIX FROM DISC                                                  CTHE2600
      CALL READMS(20,C,N,ICC)                                                CTHE2610
      DO 44 I=NH1,NH2                                                        CTHE2620
      C(I)=C(I)+C(N1)                                                        CTHE2630
C** REPLACE C MATRIX WITH ALL-MOVABLE HORIZONTAL TAIL EFFECTS                 CTHE2640
   44 CALL WRITIN(20,C,N,ICC)                                                CTHE2650
      WRITE (6,45)                                                           CTHE2660
   45 FORMAT (///1X*THIS AIRCRAFT HAS ALL-MOVABLE HORIZONTAL TAIL*///)       CTHE2670
      RETURN                                                                 CTHE2680
      END                                                                    CTHE2690
```

```
      SUBROUTINE CWRITE(C,DUM,N,IND)                                    CWRT0010
C.......................................................................CWRT0020
C**CTHETA CREATED AND STORED MATRIX C BY COLUMNS.  CWRITE READS         CWRT0030
C  C BACK INTO CORE AND STORES ON DISC BY ROWS FOR LATER USAGE.         CWRT0040
C.......................................................................CWRT0050
C                                                                       CWRT0060
      DIMENSION C(N,N),DUM(N)                                           CWRT0070
      DIMENSION IND(1)                                                  CWRT0080
      COMMON/INDMS/IA,IB,IC                                             CWRT0090
      DO 1 I=1,N                                                        CWRT0100
      ICC=IC+I-1                                                        CWRT0110
      CALL READMS(20,DUM(1),N,ICC)                                      CWRT0120
      DO 1 J=1,N                                                        CWRT0130
    1 C(J,I)=DUM(J)                                                     CWRT0140
      DO 2 J=1,N                                                        CWRT0150
      ICC=IC+J-1                                                        CWRT0160
      DO 3 I=1,N                                                        CWRT0170
    3 DUM(I)=C(J,I)                                                     CWRT0180
    2 CALL WRITIN(20,DUM(1),N,ICC)                                      CWRT0190
      RETURN                                                            CWRT0200
      END                                                               CWRT0210
```

```
      SUBROUTINE WRITEC(C,NCP)                                          WRTC0010
C                                W*R*I*T*E*C                            WRTC0020
C.......................................................................WRTC0030
C**WRITEC WRITES THE C-MATRIX TO TAPE AND TO THE OUTPUT FILE.           WRTC0040
C.......................................................................WRTC0050
      DIMENSION C(NCP,NCP)                                              WRTC0060
    1 FORMAT(1H1,47X,36HINFLUENCE COEFFICIENT MATRIX  C(J,K)//          WRTC0070
     1          6X,88HNOTATION FOR MATRIX C(J,K). J IS THE DEFLECTED PAWRTC0080
     2NEL. K IS THE PANEL WITH THE UNIT LOAD.//4X,7HJ    K=,6X,I3,7(12X,WRTC0090
     3I3))                                                              WRTC0100
    2 FORMAT(I5,8E15.5)                                                 WRTC0110
      REWIND 7                                                          WRTC0115
      K2=0                                                              WRTC0120
      NPAGE=NCP/8+1                                                     WRTC0130
      DO 3 I=1,NPAGE                                                    WRTC0140
      K1=K2+1                                                           WRTC0150
      K2=K2+8                                                           WRTC0160
      IF(K2.GT.NCP) K2=NCP                                              WRTC0170
      WRITE (6,1) (K,K=K1,K2)                                           WRTC0180
      DO 3 J=1,NCP                                                      WRTC0190
      WRITE (6,2) J,(C(J,K),K=K1,K2)                                    WRTC0200
    3 CONTINUE                                                          WRTC0210
C                                                                       WRTC0220
      DO 4 I=1,NCP                                                      WRTC0230
 4    WRITE(7) (C(I,J),J=1,NCP)                                         WRTC0240
      RETURN                                                            WRTC0250
      END                                                               WRTC0260
```

```
      SUBROUTINE CNVERT(EI,GJ,NN)                                       CNVT0010
C                             C*N*V*E*R*T                               CNVT0020
C.......................................................................CNVT0030
C       SUBROUTINE  CNVERT  IS USED TO CONVERT EI AND GJ VALUES FROM    CNVT0040
C       (LB-INCH**2) UNITS TO (LB-FEET**2) UNITS                        CNVT0050
C.......................................................................CNVT0060
      DIMENSION EI(NN),GJ(NN)                                           CNVT0070
      C=1./144.                                                         CNVT0080
      DO 1 I=1,NN                                                       CNVT0090
      EI(I)=EI(I)*C                                                     CNVT0100
    1 GJ(I)=GJ(I)*C                                                     CNVT0110
      RETURN                                                            CNVT0120
      END                                                               CNVT0130
```

```
      SUBROUTINE LINK3L(IND,XCP,YCP,THETAE,XCG,AREA,AMASS,XN,YN,CP,P,WA,
     1 WB,WC,WI,NUMPNL,N1)
C.......................................................................
C                           L*I*N*K*3*L
C       SUBROUTINE LINK3L CONTROLS THE CALCULATION OF ALL THE ELASTIC
C       STABILITY DERIVATIVES, THE ELASTIC INDUCED DRAG PARAMETER
C       AND THE PRESSURE COEFFICIENTS
C
C       THE P-ARRAY IS USED TO HOLD THE A AND B-MATRICES AS NEEDED.
C
C.......................................................................
      COMMON/INDMS/IA,IB,IC
      DIMENSION XCG(1),AMASS(1),THETAE(1),CP(1),YCP(1),AREA(1),HEAD(6)
      DIMENSION WA(1),WB(1),WC(1),WI(1)
      DIMENSION P(NUMPNL,N1)
      DIMENSION IND(1)
      DIMENSION XCP(1)
      EQUIVALENCE (N,LPANEL)
      DIMENSION XN(NUMPNL,4),YN(NUMPNL,4)
      COMMON/CNTROL/LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AMACH,CLDES,
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,
     2 NHT1P,NHT2P, HALFB,ALPHA,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX
      INTEGER WNGPNL,HT1PNL,HT2PNL
      DATA (HEAD(I),I=1,6)/5HWING ,5HHORIZ,5HONTAL,5H TAIL,5H(ONE),5H(TW
     1O)/
      WRITE (6,25) AMACH
      AM=AMACH
C***********************************************************************
      READ (5,19) W,ALTNUM
C***********************************************************************
      NALT=ALTNUM
      DO 18 K=1,NALT
      WRITE (6,20) W
      DO 1 I=1,LPANEL
    1 XCG(I)=-XCG(I)
```

```
C***********************************************************************
      READ (5,19) RHO,SOS,ALT
      READ(5,19) Q
C***********************************************************************
      WRITE (6,21) RHO,SOS,ALT
      V=AMACH*SOS
      CLTRIM=W/(Q*2.*HALFSW)
      G=32.2
      WRITE (6,22) V
      WRITE (6,23) Q
      WRITE (6,24) CLTRIM
      NUM=NUMPNL
C
C       SUBROUTINE  DERIV  CALCULATES ALL THE ELASTIC DERIVATIVES
C
      CALL DERIV(AMASS,HALFSW,CREF,XCG,Q,G,V,CLTRIM,CLALPE,P,
     1 WA,WB,WC,WI,N,IND)
      DO 2 I=1,LPANEL
    2 XCG(I)=-XCG(I)
C
C       CALCULATION OF DEFORMED ANGLE OF PANELS (THETAE) AND THE
C       PRESSURE COEFFICIENTS (STARTS)
C
      CL=CLALPE*ALPHA
C
C       SUBROUTINE  MATMPY  FINDS THE PRODUCT OF TWO MATRICES
C
      CALL DISMPY(WC,AMASS,WA,LPANEL,LPANEL,1,20,IC,0,IND)
C** READ MATRIX A FROM DISC AND STORE IT IN P
      DO 29 I=1,LPANEL
      IAA=IA+I-1
      CALL READMS(20,WB,LPANEL,IAA)
      DO 29 J=1,LPANEL
   29 P(I,J)=WB(J)
      DO 3 I=1,LPANEL
```

```
    3 WA(I)=ALPHA-WA(I)*G                                            LN3L0710
      CALL MATMPY(P,WA,THETAE,LPANEL,LPANEL,1)                         LN3L0720
      CALL DISMPY(WB,THETAE,CP,LPANEL,LPANEL,1,20,IB,0,IND)            LN3L0730
      DO 4 I=1,LPANEL                                                  LN3L0740
    4 CP(I)=CP(I)/AREA(I)                                              LN3L0750
      ALPHAQ=ALPHA*Q                                                   LN3L0760
      DO 6 I=1,LPANEL                                                  LN3L0770
      SUMA=0.                                                          LN3L0780
      DO 5 J=1,LPANEL                                                  LN3L0790
    5 SUMA=SUMA+P(I,J)                                                 LN3L0800
    6 WA(I)=SUMA*ALPHAQ-G*AMASS(I)                                     LN3L0810
      CALL DISMPY(WC,WA,THETAE,LPANEL,LPANEL,1,20,IC,0,IND)            LN3L0820
      CALL DISMPY(WC,P,WB,LPANEL,LPANEL,LPANEL,20,IC,IB,IND)           LN3L0830
    7 CONTINUE                                                         LN3L0840
C**READ MATRIX B FROM DISC AND STORE IT IN MATRIX P                     LN3L0850
      DO 30 I=1,LPANEL                                                 LN3L0860
      IBB=IB+I-1                                                       LN3L0870
      CALL READMS(20,WB,LPANEL,IBB)                                    LN3L0880
      DO 30 J=1,LPANEL                                                 LN3L0890
   30 P(I,J)=WB(J)                                                     LN3L0900
      DO 9 I=1,LPANEL                                                  LN3L0910
      DO 9 J=1,LPANEL                                                  LN3L0920
      IF (I.EQ.J) GO TO 8                                              LN3L0930
      P(I,J)=-Q*P(I,J)                                                 LN3L0940
      GO TO 9                                                          LN3L0950
    8 P(I,J)=1.-Q*P(I,J)                                               LN3L0960
    9 CONTINUE                                                         LN3L0970
      CALL MINV(P,LPANEL)                                              LN3L0980
      CALL MATMPY(P,THETAE,WA,LPANEL,LPANEL,1)                         LN3L0990
C                                                                      LN3L1000
C       CALCULATION OF DEFORMED ANGLE OF PANELS (THETAE) AND THE       LN3L1010
C       PRESSURE COEFFICIENTS (ENDS)                                   LN3L1020
C                                                                      LN3L1030
      WRITE (6,27)                                                     LN3L1040
      WRITE (6,28) (I,WA(I),CP(I),I=1,LPANEL)                          LN3L1050
```

```
      CALL SETDRAG(XN,YN,YCP,AREA,CP,XCG,WA,CL,P,N)                    LN3L1060
   18 CONTINUE                                                         LN3L1070
      RETURN                                                           LN3L1080
   19 FORMAT (3F10.5)                                                  LN3L1090
   20 FORMAT (10X,7HWEIGHT=,F10.0)                                     LN3L1100
   21 FORMAT (10X,4HRHO=,F12.8,5X,7HS.O.S.=,F10.3,5X,9HALTITUDE=,F6.0) LN3L1110
   22 FORMAT (10X,9HVELOCITY=,E12.5)                                   LN3L1120
   23 FORMAT (10X,17HDYNAMIC PRESSURE=,E12.5)                          LN3L1130
   24 FORMAT (10X,7HCLTRIM=,F10.5)                                     LN3L1140
   25 FORMAT (1H1,9X,36HELASTIC DERIVATIVES FOR MACH NUMBER=,F5.2,///) LN3L1150
   27 FORMAT (7X,5HPANEL,8X,8HTHETA(E),11X,5HCP(E),/,7X,6HNUMBER)      LN3L1160
   28 FORMAT (7X,I3,8X,E12.5,5X,E12.5)                                 LN3L1170
      END                                                              LN3L1180
```

```
      SUBROUTINE DERIV(AMASS,AREA,CREF,X,Q,G,V,CLTRIM,CLALPE,B,            DERV0010
     1 WA,WB,WC,WI,N,IND)                                                  DERV0020
C......................................................................DERV0030
C                               D*E*R*I*V                                  DERV0040
C       SUBROUTINE  DERIV  CALCULATES ALL THE ELASTIC DERIVATIVES          DERV0050
C......................................................................DERV0060
      COMMON/INOMS/IA,IB,IC                                                DERV0070
      DIMENSION IND(1)                                                     DERV0080
      DIMENSION THETAE(1),AMASS(1),CP(1),X(1),                             DERV0090
     1 WA(1),WB(1),WC(1),WI(1)                                             DERV0100
      DIMENSION B(N,N)                                                     DERV0110
      DO 1 I=1,N                                                           DERV0120
    1 WI(I)=1.                                                             DERV0130
C                                                                          DERV0140
C     GENERATION OF (B) MATRIX                                             DERV0150
C                                                                          DERV0160
C                                                                          DERV0170
C** SUBROUTINE DISMPY FINDS THE PRODUCT OF TWO MATRICES BY USEING          DERV0180
C    RANDOM ACCESS DISC                                                    DERV0190
C                                                                          DERV0200
      DO 19 I=1,N                                                          DERV0210
      ICC=IC+I-1                                                           DERV0220
      CALL READMS(20,WB,N,ICC)                                             DERV0230
      DO 19 J=1,N                                                          DERV0240
   19 B(I,J)=WB(J)                                                         DERV0250
      CALL DISMPY(WA,B,WB,N,N,N,20,IA,IB,IND)                              DERV0260
      DO 20 I=1,N                                                          DERV0270
      IBB=IB+I-1                                                           DERV0280
      CALL READMS(20,WB,N,IBB)                                             DERV0290
      DO 20 J=1,N                                                          DERV0300
   20 B(I,J)=WB(J)                                                         DERV0310
      DO 3 I=1,N                                                           DERV0320
      DO 3 J=1,N                                                           DERV0330
      IF (I.EQ.J) GO TO 2                                                  DERV0340
      B(I,J)=-Q*B(I,J)                                                     DERV0350
```

```
      GO TO 3                                                           DERV0360
    2 B(I,J)=1.-Q*B(I,J)                                                DERV0370
    3 CONTINUE                                                          DERV0380
C                                                                       DERV0390
C** MINV INVERTS A WELL-CONDITIONED MATRIX                               DERV0400
C                                                                       DERV0410
      CALL MINV(B,N)                                                    DERV0420
      DO 21 I=1,N                                                       DERV0430
      IBB=IB+I-1                                                        DERV0440
      DO 22 J=1,N                                                       DERV0450
   22 WB(J)=B(I,J)                                                      DERV0460
   21 CALL WRITIN(20,WB,N,IBB)                                          DERV0470
C** THE B MATRIX HAS BEEN GENERATED AND THE INVERSE OF B                 DERV0480
C   HAS BEEN STORED ON DISC.                                            DERV0490
C                                                                       DERV0500
C     CLALPA COMPUTATION                                                DERV0510
C                                                                       DERV0520
      CALL DISMPY(WB,WI,WA,N,N,1,20,IA,0,IND)                           DERV0530
      CALL MATMPY(B,WA,WB,N,N,1)                                        DERV0540
C                                                                       DERV0550
C      SUBROUTINE  TRNPRD  FINDS OUT THE DOT PRODUCT OF TWO ARRAYS      DERV0560
C                                                                       DERV0570
      CALL TRNPRD(WI,WB,A3,N)                                           DERV0580
      CLALPA=A3/AREA                                                    DERV0590
      WRITE(6,5) CLALPA                                                 DERV0600
C                                                                       DERV0610
C     CMALPA COMPUTATION                                                DERV0620
C                                                                       DERV0630
      CALL TRNPRD(X,WB,A4,N)                                            DERV0640
      CMALPA=A4/(AREA*CREF)                                             DERV0650
      WRITE(6,6) CMALPA                                                 DERV0660
C                                                                       DERV0670
C     CLQEBR COMPUTATION                                                DERV0680
C                                                                       DERV0690
      CALL DISMPY(WB,X,WA,N,N,1,20,IA,0,IND)                            DERV0700
```

```
      CALL MATMPY(B,WA,WB,N,N,1)                                        DERV0710
      CALL TRNPRD(WI,WB,A3,N)                                           DERV0720
      CLQERR=-2.*A3/(AREA*CREF)                                         DERV0730
      WRITE(6,7) CLQERR                                                 DERV0740
C                                                                       DERV0750
C     CMQERR COMPUTATION                                                DERV0760
C                                                                       DERV0770
      CALL TRNPRD(X,WB,A4,N)                                            DERV0780
      CMQERR=-2.*A4/(AREA*CREF*CREF)                                    DERV0790
      WRITE(6,8) CMQERR                                                 DERV0800
C                                                                       DERV0810
C     STABILITY DERIVATIVES AT VARYING LOAD FACTOR                      DERV0820
C                                                                       DERV0830
      AC=(AREA*CREF)/(2.*V*V)                                           DERV0840
C                                                                       DERV0850
C     CLQI COMPUTATION                                                  DERV0860
C                                                                       DERV0870
      CALL DISMPY(WB,AMASS,WA,N,N,1,20,IC,0,IND)                        DERV0880
      CALL DISMPY(WC,WA,WB,N,N,1,20,IA,0,IND)                           DERV0890
      CALL MATMPY(B,WB,WC,N,N,1)                                        DERV0900
      CALL TRNPRD(WI,WC,ACLQI,N)                                        DERV0910
      CLQI=ACLQI/AC                                                     DERV0920
      WRITE(6,9) CLQI                                                   DERV0930
C                                                                       DERV0940
C     CMQI COMPUTATION                                                  DERV0950
C                                                                       DERV0960
      CALL TRNPRD(X,WC,ACMQI,N)                                         DERV0970
      CMQI=ACMQI/(AC*CREF)                                              DERV0980
      WRITE(6,10) CMQI                                                  DERV0990
C                                                                       DERV1000
      CLWDI COMPUTATION                                                 DERV1010
                                                                        DERV1020
      CLWDI=-ACLQI/AREA                                                 DERV1030
      WRITE(6,11) CLWDI                                                 DERV1040
C                                                                       DERV1050
```

```
C     CMWDI COMPUTATION
C
      CMWDI=-ACMOI/(AREA*CREF)
      WRITE(6,12) CMWDI
      DO 4 I=1,N
    4 WB(I)=AMASS(I)*X(I)
C
C     CLTDDI COMPUTATION
C
      CALL DISMPY(WC,WB,WA,N,N,1,20,IC,0,IND)
      CALL DISMPY(WC,WA,WB,N,N,1,20,IA,0,IND)
      CALL MATMPY(B,WB,WC,N,N,1)
      CALL TRNPRD(WI,WC,ALTDDI,N)
      CLTDDI=ALTDDI/AREA
      WRITE(6,13) CLTDDI
C
C     CMTDDI COMPUTATION
C
      CALL TRNPRD( X,WC,AMTDDI,N)
      CMTDDI=AMTDDI/(AREA*CREF)
      WRITE(6,14) CMTDDI
C
C     DCLDN COMPUTATION
C
      DCLDN=-32.2*CLWDI
      WRITE(6,15) DCLDN
C
C     DCMDN COMPUTATION
C
      DCMDN=-32.2*CMWDI
      WRITE(6,16) DCMDN
C
C     CLALPAE COMPUTATION
C
      CLALPE=CLALPA/(1.-DCLDN/CLTRIM)
```

```
      WRITE(6,17) CLALPE                                                DERV1410
C                                                                       DERV1420
C     CMALPAE COMPUTATION                                               DERV1430
C                                                                       DERV1440
      CMALPE=CMALPA+DCMDN*CLALPA/(CLTRIM-DCLDN)                         DERV1450
      WRITE(6,18) CMALPE                                                DERV1460
    5 FORMAT (10X,7HCLALPA=,E12.5)                                      DERV1470
    6 FORMAT (10X,7HCMALPA=,E12.5)                                      DERV1480
    7 FORMAT (10X,7HCLQERR=,E12.5)                                      DERV1490
    8 FORMAT (10X,7HCMQERR=,F12.5)                                      DERV1500
    9 FORMAT (10X,7HCLQI   =,E12.5)                                     DERV1510
   10 FORMAT (10X,7HCMQI   =,E12.5)                                     DERV1520
   11 FORMAT (10X,7HCLWDI =,E12.5)                                      DERV1530
   12 FORMAT (10X,7HCMWDI =,E12.5)                                      DERV1540
   13 FORMAT (10X,7HCLTDDI=,E12.5)                                      DERV1550
   14 FORMAT (10X,7HCMTDDI=,E12.5)                                      DERV1560
   15 FORMAT (10X,7HDCLDN =,E12.5)                                      DERV1570
   16 FORMAT (10X,7HDCMDN =,E12.5)                                      DERV1580
   17 FORMAT (10X,7HCLALPE=,E12.5)                                      DERV1590
   18 FORMAT (10X,7HCMALPE=,E12.5)                                      DERV1600
      RETURN                                                            DERV1610
      END                                                               DERV1620
```

```
      SUBROUTINE SETDRAG(XN,YN,YCP,AREA,CP,XCG,WA,CL,P,N)                 SETD0010
C.................................................................... SETD0020
C** SETDRAG COMPUTES THE LEADING EDGE THRUST COEFFICIENT                SETD0030
C   AND THE INDUCED DRAG COEFFICIENT                                    SETD0040
C.................................................................... SETD0050
      COMMON/CNTROL/ LPANEL,NEAMAX,NCNTL,HALFSW,CREF,AM,CLDES,           SETD0060
     1 NCP2,NCP3,NCP4,WNGPNL,HT1PNL,HT2PNL,NCPHT1,NCPHT2,NWNGP,          SETD0070
     2 NHT1P,NHT2P,HALFB,ALPH,HALFB1,HALFB2,NCPSWL,NCPWNG,MAX            SETD0080
      INTEGER WNGPNL,HT1PNL,HT2PNL                                       SETD0090
      DIMENSION XN(N,4),YN(N,4),YCP(1),AREA(1),CP(1),XCG(1),WA(1)        SETD0100
      DIMENSION HEAD(6),P(1)                                             SETD0110
      DATA HEAD/5HWING ,5HHORIZ,5HONTAL,5H TAIL,5H(ONE),5H(TWO)/         SETD0120
C                                                                        SETD0130
      DO 10 I=1,N                                                        SETD0140
 10   WA(I)=WA(I)+ALPH                                                   SETD0150
      LFUS=WNGPNL-1                                                      SETD0160
      CLF=0.                                                             SETD0170
      IF(LFUS.LE.0) GO TO 20                                             SETD0180
      DO  5 I=1,LFUS                                                     SETD0190
    5 CLF=CLF+CP(I)*AREA(I)                                              SETD0200
 20   CDF=CLF*ALPH                                                       SETD0210
      WRITE(6,15) HEAD(1)                                                SETD0220
      CTT=0.                                                             SETD0230
      CD=CDF                                                             SETD0240
C                                                                        SETD0250
C**SET UP FOR FIRST CALL TO DRAG.                                        SETD0260
      NA=NCP2                                                            SETD0270
      NAM=NCP2-1                                                         SETD0280
      NP=NWNGP                                                           SETD0290
      NW=WNGPNL                                                          SETD0300
      HB=HALFB                                                           SETD0310
      ASSIGN 30 TO JBACK                                                 SETD0320
      GO TO 100                                                          SETD0330
 30   IF(HT1PNL.LE.WNGPNL) GO TO 200                                     SETD0340
C**SET UP FOR SECOND CALL AND WRITE HEADING.                             SETD0350
```

```
      NA=NCP3                                                           SETD0360
      NAM=NCP3-1                                                        SETD0370
      NP=NHT1P                                                          SETD0380
      NW=HT1PNL                                                         SETD0390
      HB=HALFB1                                                         SETD0400
C                                                                       SETD0410
      IH=4                                                              SETD0420
      IF(HT2PNL.GT.HT1PNL) IH=5                                         SETD0430
      WRITE(6,15) (HEAD(I),I=2,IH)                                      SETD0440
      ASSIGN 40 TO JBACK                                                SETD0450
      GO TO 100                                                         SETD0460
C                                                                       SETD0470
C**SET UP FOR THIRD CALL                                                SETD0480
 40   IF(HT2PNL.LE.HT1PNL) GO TO 200                                    SETD0490
      NA=NCP4                                                           SETD0500
      NAM=NCP4-1                                                        SETD0510
      NW=HT2PNL                                                         SETD0520
      HB=HALFB2                                                         SETD0530
      WRITE(6,15) (HEAD(I),I=2,4),HEAD(6)                               SETD0540
      ASSIGN 200 TO JBACK                                               SETD0550
C**CALL DRAG AND INCREMENT SUMS                                         SETD0560
C                                                                       SETD0570
 100 0CALL DRAG(XN,YN,XCG,YCP,AREA,CP,WA,P(711),N,NA,NAM,NP,NW,HB,AM,CL,SETD0580
     1 CTA,CDA,P(1),P(36),P(71),P(106),P(141),P(176),P(211),P(246),     SETD0590
     2 P(281),P(316),P(351),P(386))                                     SETD0600
      CTT=CTT+CTA                                                       SETD0610
      CD=CD+CDA                                                         SETD0620
      GO TO JBACK,(30,40,200)                                           SETD0630
C                                                                       SETD0640
C**COMPLETE DRAG COMPUTATIONS AND RETURN                                SETD0650
 200  CD=CD/HALFSW                                                      SETD0660
      CTT=CTT/HALFSW                                                    SETD0670
      CDBCL=CD/(CL*CL)                                                  SETD0680
      WRITE(6,17) CTT,CD,CDBCL                                          SETD0690
      RETURN                                                            SETD0700
```

```
15    FORMAT(//,5X,23HSECTIONAL CD/CL**2 FOR ,6A5)                               SETD0710
17   OFORMAT(//,5X,38HTOTAL LEADING EDGE THRUST COEFFICIENT=,E12.5/5X,          SETD0720
     1 31HTOTAL INDUCED DRAG COEFFICIENT=,E12.5/5X, 9HCD/CL**2=,E12.5)          SETD0730
      END                                                                       SETD0740
```

```
 0SUBROUTINE DRAG(XN,YN,XCG,YCP,AREA,CP,ALPHA,A,K,NCPCWL,NN,NCPSWL,  DRAG0010
  1 IPANEL,HALFB,AM,CL,CTT,CD,DELTL,DELTY,XCGL,DELTC,ZBAR,CT,CLA,CDL,DRAG0020
  2 GAMMA,CAK,Y,AK)                                                   DRAG0030
C                              D*R*A*G                                DRAG0040
C.....................................................................DRAG0050
C** DRAG CALCULATES THE INDUCED DRAG DISTRIBUTION                     DRAG0060
C.....................................................................DRAG0070
      DIMENSION XN(K,4),YN(K,4),XCG(1),YCP(1),AREA(1),CP(1),ALPHA(1)  DRAG0080
      DIMENSION A(NN,1),DELTL(1),DELTY(1),XCGL(1),DELTC(1),ZBAR(1)    DRAG0090
      DIMENSION CT(1),CLA(1),CDL(1),GAMMA(1),CAK(1),Y(1),AK(1)        DRAG0100
      NCC=NCPCWL-1                                                    DRAG0110
      NCS=NCPSWL                                                      DRAG0120
      K2=IPANEL-1                                                     DRAG0130
      DO 1 I=1,NCS                                                    DRAG0140
      K4=K2+NCC                                                       DRAG0150
      K3=K2+1                                                         DRAG0160
      DELTL(I)=SQRT((XN(K3,2)-XN(K3,1))**2+(YN(K3,2)-YN(K3,1))**2)    DRAG0170
      DELTY(I)=YN(K3,2)-YN(K3,1)                                      DRAG0180
      XCGL(I)=XN(K3,1)+(XN(K3,2)-XN(K3,1))*(YCP(K3)-YN(K3,1))/DELTY(I) DRAG0190
      XCGT=XN(K4,3)+(XN(K4,4)-XN(K4,3))*(YCP(K3)-YN(K4,3))/DELTY(I)   DRAG0200
      DELTC(I)=XCGT-XCGL(I)                                           DRAG0210
      K2=K4                                                           DRAG0220
    1 CONTINUE                                                        DRAG0230
      N=IPANEL                                                        DRAG0240
      DO 2 I=1,NCC                                                    DRAG0250
      II=N+I-1                                                        DRAG0260
    2 ZBAR(I)=(XCG(II)-XCGL(1))/DELTC(1)                              DRAG0270
      NCC1=NCC+1                                                      DRAG0280
      KK=1                                                            DRAG0290
C                                                                     DRAG0300
C      PRESSURE DISTRIBUTION INTERPOLATION IN STREAMWISE DIRECTION    DRAG0310
C                                                                     DRAG0320
    3 CONTINUE                                                        DRAG0330
      AB=AM*AM*(DELTY(KK)*DELTY(KK)/(DELTL(KK)*DELTL(KK)))            DRAG0340
      IF (AB .GE. 1.0) GO TO 6                                        DRAG0350
```

```
      DO 5 J=1,NCC                                                      DRAG0360
      JN=J+N-1                                                          DRAG0370
      A(J,NCC1)=-CP(JN)*SQRT(ZBAR(J)/(1.-ZBAR(J)))                      DRAG0380
      DO 4 I=1,NCC                                                      DRAG0390
      A(J,I)=ZBAR(J)**(I-1)                                             DRAG0400
    4 CONTINUE                                                          DRAG0410
    5 CONTINUE                                                          DRAG0420
C                                                                       DRAG0430
C       SUBROUTINE  VMSEQN  SOLVES A SET OF SIMULTANEOUS EQUATIONS      DRAG0440
C       WITHOUT INVERTING THE MATRIX                                    DRAG0450
C                                                                       DRAG0460
      CALL VMSEQN(A,AK,CAK,NCC,NCC1)                                    DRAG0470
      AC = SQRT(1.0 - AB)                                               DRAG0480
      CTL=(3.14159265*DELTL(KK)*AC)/(8.0*DELTY(KK))                     DRAG0490
      CT(KK)=-CTL*AK(1)*AK(1)                                           DRAG0500
      GO TO 7                                                           DRAG0510
    6 CT(KK)=0.0                                                        DRAG0520
    7 N=N+NCC                                                           DRAG0530
      KK = KK+1                                                         DRAG0540
      IF (KK.GT.NCS) GO TO 8                                            DRAG0550
      GO TO 3                                                           DRAG0560
    8 CONTINUE                                                          DRAG0570
      K2=IPANEL-1                                                       DRAG0580
      CD = 0.0                                                          DRAG0590
      CTT = 0.0                                                         DRAG0600
      III=K2                                                            DRAG0610
      DO 10 I=1,NCS                                                     DRAG0620
      CLA(I) =0.0                                                       DRAG0630
      CDL(I)=0.                                                         DRAG0640
      III=(I-1)*NCC+K2                                                  DRAG0650
      DO 9 J=1,NCC                                                      DRAG0660
      II = III + J                                                      DRAG0670
      DCY=DELTC(I)*DELTY(I)                                             DRAG0680
      TT=(CP(II)*AREA(II))/DCY                                          DRAG0690
      CDL(I)=CDL(I)+TT*ALPHA(II)                                        DRAG0700
```

```
 9 CLA(I) = CLA(I) + TT                                                DRAG0710
   CDL(I)=CDL(I)+CT(I)                                                 DRAG0720
   CTT=CTT+CT(I)*DCY                                                   DRAG0730
   GAMMA(I)=CLA(I)*DFLTC(I)/(4.0*HALFB)                                DRAG0740
   CD=CD+CDL(I)*DCY                                                    DRAG0750
10 III=III+NCC                                                         DRAG0760
   N=IPANEL                                                            DRAG0770
   WRITE (6,13)                                                        DRAG0780
   J=N                                                                 DRAG0790
   DO 11 I=1,NCS                                                       DRAG0800
   CDL2=CDL(I)/(CL*CL)                                                 DRAG0810
   Y(I)=YCP(J)/HALFB                                                   DRAG0820
   J=J+NCC                                                             DRAG0830
11 WRITE (6,12) Y(I),CDL(I),CLA(I),GAMMA(I),CT(I),CDL2                 DRAG0840
12 FORMAT (6(5X,F10.5))                                                DRAG0850
13 FORMAT (11X,1HY,13X,3HCDI,12X,3HCLI,11X,5HGAMMA,11X,2HCT,10X,9HCDIDRAG0860
  1/CL**2)                                                             DRAG0870
   RETURN                                                              DRAG0880
   END                                                                 DRAG0890
```

```
      SUBROUTINE MINV(A,NN)
C.......................................................................
C**GAUSSIAN ELIMINATION ROUTINE TO INVERT A WELL-CONDITIONED,
C  DIAGONALLY DOMINANT MATRIX USING THE DIAGONAL ELEMENTS
C  FOR PIVOTING.
C.............................. .........................................
      DIMENSION A(NN,NN)
      DO 30 I=1,NN
      PIV=1./A(I,I)
      A(I,I)=1.0
      DO 31 L=1,NN
   31 A(I,L)=A(I,L)*PIV
C
      DO 30 M=1,NN
      IF(M.EQ.I) GO TO 30
      TT=A(M,I)
      A(M,I)=0.0
C
      DO 32 L=1,NN
   32 A(M,L)=A(M,L)-A(I,L)*TT
   30 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE VMSEQN(AA,A,CA,N,N1)
C                            V*M*S*E*Q*N
C.............................................................................
C       SUBROUTINE  VMSEQN  SOLVES A SET OF SIMULTANEOUS EQUATIONS
C       WITHOUT INVERTING THE MATRIX
C       RFFFRFNCF-
C       THE VECTOR METHOD OF SOLVING SIMULTANEOUS LINEAR EQUATIONS
C       BY- EVERETT W. PURCELL
C       JOURNAL OF MATH. PHY. VOL.32/1953
C.............................................................................
      DIMENSION AA(N,N1),A(1),CA(1)
      DO 1 I=1,N
    1 A(I)=-AA(1,I+1)/AA(1,1)
      K=2
      NC1=N
    2 NC1=NC1-1
      NC=K*NC1
      SUM1=0.
      K1=K-1
      JJ=1
      DO 3 J=1,K1
      SUM1=SUM1+AA(K,J)*A(JJ)
    3 JJ=JJ+NC1+1
      SUM1=SUM1+AA(K,K)
      DO 5 I=1,NC1
      SUM2=0.
      JJ=I+1
      DO 4 J=1,K1
      SUM2=SUM2+AA(K,J)*A(JJ)
    4 JJ=JJ+NC1+1
      KK=K+I
      SUM2=SUM2+AA(K,KK)
    5 CA(I)=-SUM2/SUM1
      M=1
      L=0
```

```
      KNC=(K-1)*NC1                                                     VMSQ0360
      KI=0                                                              VMSQ0370
      DO 8 I=1,NC                                                       VMSQ0380
      IF (I.GT.KNC) GO TO 7                                             VMSQ0390
      MM=(M-1)*NC1+1                                                    VMSQ0400
      IF (I.EQ.MM) GO TO 9                                              VMSQ0410
    6 KK=KK+1                                                           VMSQ0420
      IL=I+L                                                            VMSQ0430
      A(I)=CA(KK)*BASE+A(IL)                                            VMSQ0440
      GO TO 8                                                           VMSQ0450
    7 II=I-KNC                                                          VMSQ0460
      A(I)=CA(II)                                                       VMSQ0470
    8 CONTINUE                                                          VMSQ0480
      GO TO 10                                                          VMSQ0490
    9 II=MM+M-1                                                         VMSQ0500
      KI=KI+1                                                           VMSQ0510
      BASE=A(II)                                                        VMSQ0520
      KK=0                                                              VMSQ0530
      L=L+1                                                             VMSQ0540
      M=M+1                                                             VMSQ0550
      GO TO 6                                                           VMSQ0560
   10 CONTINUE                                                          VMSQ0570
      K=K+1                                                             VMSQ0580
      IF (K.LE.N) GO TO 2                                               VMSQ0590
      RETURN                                                            VMSQ0600
      END                                                               VMSQ0610
```

```
      SUBROUTINE MATMPY(A,B,C,L,M,N)                                    MATM0010
C                             M*A*T*M*P*Y                               MATM0020
C.......................................................................MATM0030
C       SUBROUTINE  MATMPY  MULTIPLIES TWO MATRICES                     MATM0040
C       C(L,N) =A(L,M) * B(M*N)                                         MATM0050
C.......................................................................MATM0060
      DIMENSION A(L,M),B(M,N),C(L,N)                                    MATM0070
      DO 1 I=1,L                                                        MATM0080
      DO 1 J=1,N                                                        MATM0090
      C(I,J)=0.                                                         MATM0100
      DO 1 K=1,M                                                        MATM0110
    1 C(I,J)=C(I,J)+A(I,K)*B(K,J)                                       MATM0120
      RETURN                                                            MATM0130
      END                                                               MATM0140
```

```
      SUBROUTINE DISMPY(A,B,C,L,M,N,LU,IA,IC,IND)                       DISM0010
      DIMENSION A(M),B(M,N),C(N),IND(1)                                 DISM0020
C                                                                       DISM0030
C**DISMPY MULTIPLIES THE L*M MATRIX A STORED BY ROWS STARTING            DISM0040
C  AT DISC INDEX IA ONTO THE M*N MATRIX B RESIDING IN CORE.  THE        DISM0050
C  N*L PRODUCT MATRIX C IS STORED BY ROWS STARTING AT DISC INDEX        DISM0060
C   IC                                                                  DISM0070
C                                                                       DISM0080
C**A AND C ARE SINGLY-SUBSCRIPTED ARRAYS USED FOR DISC I/O.             DISM0090
C  IF N IS 1, THE PRODUCT IS RETURNED IN C WITHOUT WRITING TO DISC.     DISM0100
C                                                                       DISM0110
C**IF IC IS NEGATIVE WRITIN IS USED RATHER THAN WRITMS.                 DISM0120
C**IND IS THE DISC INDEX ARRAY.  LU IS THE DISC LOGICAL UNIT NUMBER.    DISM0130
C                                                                       DISM0140
      JWRIT=1                                                           DISM0150
      IF(IC.GT.0) GO TO 10                                              DISM0160
      JWRIT=2                                                           DISM0170
      IC=-IC                                                            DISM0180
10    IF(N.EQ.1) JWRIT=3                                                DISM0190
      IAA=IA                                                            DISM0200
      ICC=IC                                                            DISM0210
C                                                                       DISM0220
      DO 100 I=1,L                                                      DISM0230
      CALL READMS(LU,A,M,IAA)                                           DISM0240
      DO 50 J=1,N                                                       DISM0250
      C(J)=0.0                                                          DISM0260
      DO 50 K=1,M                                                       DISM0270
 50   C(J)=C(J)+A(K)*B(K,J)                                             DISM0280
C                                                                       DISM0290
C**GO TO WRITMS, WRITIN OR NO DISC WRITE                                DISM0300
      GO TO (60,70,80), JWRIT                                           DISM0310
 60   CALL WRITMS(LU,C,N,ICC)                                           DISM0320
      GO TO 90                                                          DISM0330
 70   CALL WRITIN(LU,C,N,ICC)                                           DISM0340
      GO TO 90                                                          DISM0350
```

```
C
C**FOR N-1, STORE RESULT TEMPORARILY IN C(I+1)
 80    IF(I.LT.L) C(I+1)=C(1)
C**INCREMENT DISC INDICES
 90    IAA=IAA+1
       ICC=ICC+1
 100   CONTINUE
       IF(N.GT.1) RETURN
C**RESTORE C-VECTOR FOR N=1
       A(1)=C(1)
       DO 120 I=2,L
 120   C(I-1)=C(I)
       C(L)=A(1)
       RETURN
       END
```

```
      SUBROUTINE TRNPRD(X,Y,Z,LPANEL)                                   TRNP0010
C                             T*R*N*P*R*D                               TRNP0020
C.......................................................................TRNP0030
C      SUBROUTINE  TRNPRD  CALCULATES THE DOT PRODUCT OF TWO ARRAYS     TRNP0040
C.......................................................................TRNP0050
      DIMENSION X(LPANEL,1),Y(LPANEL,1)                                 TRNP0060
      Z=0.                                                              TRNP0070
      DO 1 I=1,LPANEL                                                   TRNP0080
    1 Z=Z+X(I,1)*Y(I,1)                                                 TRNP0090
      RETURN                                                            TRNP0100
      END                                                               TRNP0110
```

10. Appendix

Assumptions for Data Reduction from Reference 3

The present computer program is valid only for thin elastic aeroplanes and therefore requires the reduction of the configuration data of Reference 3 to satisfy the input data format. The following assumptions are made for data reduction.

1. The "Y" locations of the chords in Ref. 3 are assumed to be break lines for the present program.

2. The height of the wing (ZAVWNG) is calculated by taking the average value of z- coordinates of all break lines. In other words, camber is taken to be zero.

3. If the fuselage is not circular, it is modified to a circular shape by assuming a radius equal to the maximum y- coordinate at each station, the center of which is located at the corresponding z- coordinate.

4. The z- coordinate of the fuselage (ZAVFUS) is found by taking average value of centers of circular section.

5. Half of the fuselage width (FUSWTH) is calculated by taking the average radius of fuselage sections at the root chord.

6. If $|(ZAVFUS-ZAVWNG)| \leq (FUSWTH/2)$, the wing is assumed to be in the plane of the fuselage, i.e., ZAVWNG = ZAVFUS and FUSWTH is replaced by the y-coordinate of the root chord of the wing.

7. If the wing and fuselage are not in the same plane, the wing is extended to the center line of the fuselage and the number of break lines for wing is increased by one.

8. The portion of the fuselage ahead of the wing leading edge is replaced by a trapezoid having a width equal to FUSWTH and area equal to the projected area of the fuselage in the x-y plane between the nose and wing root leading edge (See Figure A1).

9. Assumption 8 is also made for the portion of fuselage behind wing root trailing edge. (See Figure A1).

10. The y- coordinates of a horizontal tail and a canard are assumed to be the y-coordinates of the break lines for the corresponding surfaces.

11. The heights of a horizontal tail (ZAVHT(1)) and a canard (ZAVHT(2)) are calculated by taking the average value of the break line z- coordinates of the corresponding surfaces.

12. The semi-width of the fuselage at the root chord of the horizontal tail (WDTH1) and the canard (WDTH2) is calculated by taking the average radius of fuselage sections between the corresponding root chords.

13. If $|(ZAVHT(1) - ZAVFUS)| \leq (WDTH\ 1/2)$, the tail is assumed to be in the plane of the fuselage i.e. ZAVHT(1) = ZAVFS.

14. If the tail is not in the plane of the fuselage, the tail is extended to the center line of the fuselage and the number of break lines of the tail are increased by one.

15. Assumptions 13 and 14 are also applicable to a canard surface.

16. A break line on the wing induces a break line at the same y- location on the horizontal tail and on the canard and vice versa.

17. Between the two break lines on any aerodynamic surface the constant percent streamwise lines are calculated such that they are at least (b/20) apart.

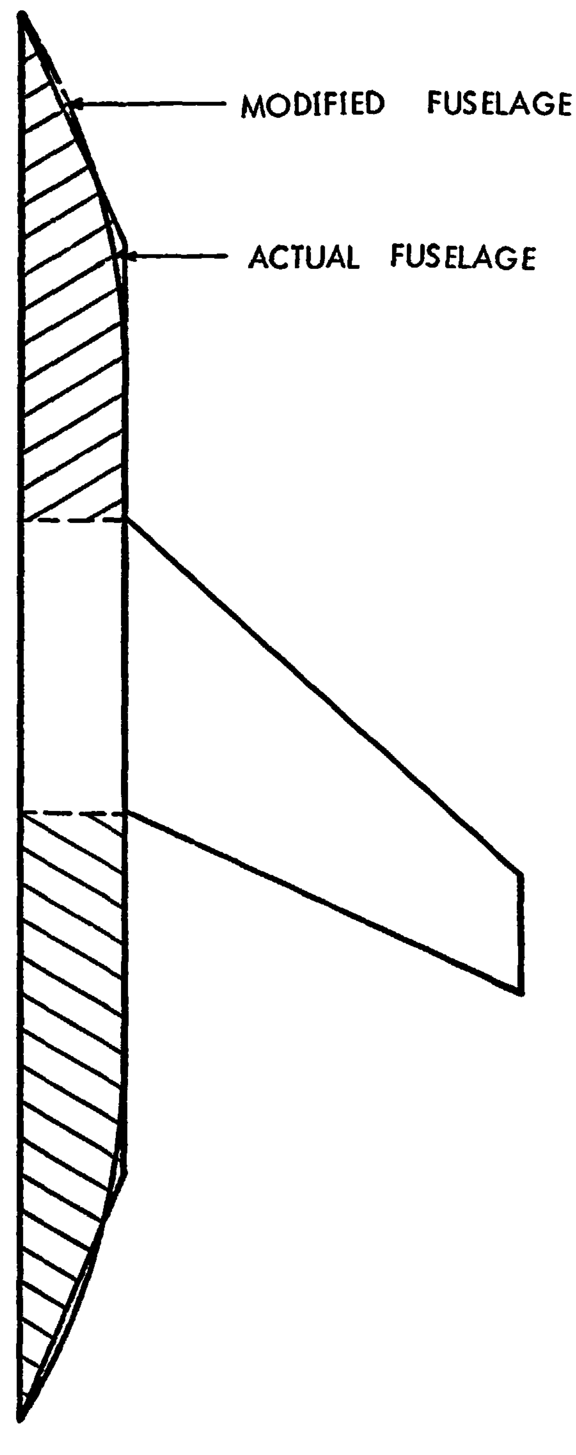

Figure A.1. Fuselage Modification

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