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Aerospace Nuclear Safety Program

Users Manual for Aerospace Nuclear Safety Program Six-Degree-of-Freedom Reentry Simulation (TMAGRA6C)

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USERS MANUAL FOR
AEROSPACE NUCLEAR SAFETY PROGRAM
SIX-DEGREE-OF-FREEDOM REENTRY SIMULATION
(TMAGRA6C)

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SUMMARY

This report documents the updated six-degree-of-freedom reentry simulation TMAGRA6C used in the Aerospace Nuclear Safety Program, ANSP. The simulation provides for the inclusion of the effects of ablation on the aerodynamic stability and drag of reentry bodies, specifically the General Purpose Heat Source, GPHS.

The existing six-degree-of-freedom reentry body simulations (TMAGRA6A and TMAGRA6B) used in the JHU/APL Nuclear Safety Program do not include aerodynamic effects resulting from geometric changes to the configuration due to ablation from reentry flights. A wind tunnel test was conducted in 1989 to obtain the effects of ablation on the hypersonic aerodynamics of the GPHS module. The analyzed data were used to form data sets which are included herein in tabular form. These are used as incremental aerodynamic inputs in the new TMAGRA6C six-degree-of-freedom reentry simulation.

The current document will serve as an updated users manual to TMAGRA6C.

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SYMBOLS & NOMENCLATURE¹

Group, Table	Variable	Description
	A,N,Y	Axial, normal and yaw forces, respectively (lbs)
	L	Reference length (feet). (Note: L in input is 3.826 inches.)
	M	Free stream Mach number
	p	Free stream static pressure (lbs/ft ²)
	q	Free stream dynamic pressure; $q = .7 \rho M^2$ (lbs/ft ²)
	S	Reference area (ft ²)
	X _{c.p.} (X _{c.g.})	Center of pressure (gravity) (inches)
19	ADMKUL	Adams package upper limit (sec). This is an accuracy control.
19	ALPBARO	Initial resultant angle of attack, α_R (deg) (See Fig. 2)
19	ALPHAO	Initial local angle of attack, α (deg) (See Fig. 2)
19	AZLO	Initial flight path azimuth angle, positive CW from North, relative to a rotating earth (deg)
19	BETAO	Initial sideslip angle, β (deg) (See Fig. 2)
23,1	CA	Axial force coefficient, $C_A = \frac{A \text{ (lbs)}}{qS}$
23,5	CA_FM	Axial force coefficient for free molecular flow
23,7	CASF	Skin friction axial force coefficient
23,22	CLL	Rolling moment coefficient, $C_l = \frac{\text{rolling moment (in-lb)}}{qSL}$

¹For nomenclature used in required input data groups; see Appendix A for explanation of Group and Table numbers and other nomenclature.

23,19 CLLP Roll damping coefficient, $C_{\ell_p} = \frac{\partial C_{\ell}}{\partial \left(\frac{\dot{\phi} L}{V} \right)}$ (per/rad)

23,4 CLM Pitching moment coefficient,

$$C_m = C_N \left(\frac{X_{c.g.} - X_{c.p.}}{L} \right) - C_N \left(\frac{\Delta X_{c.p.}}{L} \right)$$

where $X_{c.g.} = 1.045$ is at idealized centroid
 (1.045 inches forward of base). X is measured
 positive from leading edge.

23,15 CLM_FM Pitching moment coefficient for free molecular flow

23,11 CLN Yawing moment coefficient

$$C_n = - C_Y \left(\frac{\Delta X_{c.p.}}{L} \right)$$

23,6 CLN_FM Yawing moment coefficient for free molecular flow

23,12 CLMQ Pitch damping coefficient, $C_{m_q} = \frac{\partial C_m}{\partial \left(\frac{\dot{\theta} L}{V} \right)}$ (per/rad)

23,13 CLNR Yaw damping coefficient, $C_{n_r} = \frac{\partial C_n}{\partial \left(\frac{\dot{\psi} L}{V} \right)}$ (per/rad)

23,16 CMO Pitching moment coefficient asymmetry

23,2 CN Normal force coefficient, $C_N = \frac{N \text{ (lbs)}}{qS}$

21 CNO Yawing moment coefficient asymmetry

23,6 CN_FM Normal force coefficient for free molecular flow

23,3	CY	Side force coefficient, $C_Y = \frac{Y \text{ (lbs)}}{qS}$
23,14	CY_FM	Side force coefficient for free molecular flow
23,24	DCAA	Incremental axial force coefficient due to ablation
23,29	DCLLA	Incremental rolling moment coefficient due to ablation
23,26	DCLMA	Incremental pitching moment coefficient due to ablation
23,28	DCLNA	Incremental yawing moment coefficient due to ablation
23,25	DCNA	Incremental normal force coefficient due to ablation
23,27	DCYA	Incremental side force coefficient due to ablation
	ΔC_x	See Equation (1), page 3
7	DREF1	Vehicle reference diameter before configuration change (ft)
7	DREF2	Vehicle reference diameter after configuration change (ft)
19	DTMAX	Maximum integration step interval (sec)
21	F	Multiplying factor (multiplies all weights, moments of inertia, and centers of gravity on X axis)
7	FDSL	Fudge factor used to adjust vehicle dimensions
22	FLAMOD	REB longitude (deg) (positive east of Greenwich meridian) at TO (initial flight time, sec)
22	FLOD	REB latitude (deg) (positive north of the equator) at TO (initial flight time, sec)
19	GAMALO	Flight path angle, positive for exit phase and negative for reentry phase, relative to a rotating earth (deg)
21	HBO	Altitude for configuration change (ft)
19	HF	Trajectory cut-off altitude (ft)
19	HO	Initial altitude, above sea level (ft)
7	HTR	Transition altitude (ft) (altitude at which calculation of CASF changes from laminar to turbulent)

19	H5	Altitude at end of heat pulse
7	KCLP	Multiplying factor used in calculation of CLLP due to skin friction
7	LL	Vehicle length (in)
19	PHIV	Initial roll angle, ϕ (deg) (See Fig. 2)
7	PLTPTS	Plot control variable, varies the output time interval for data sent to the file PLTOUT, where PLTPTS = 0, do not create plot file PLTPTS = N, writes to plot file every N time steps
7	SREF1	Vehicle reference area before configuration change (ft ²)
7	SREF2	Vehicle reference area after configuration change (ft ²)
19	TF	Trajectory cut-off time (sec). This is a real time trajectory cut-off point and not a time interval.
19	TO	Initial flight time (sec)
21	VIX1	Moment of inertia about X axis (slug-ft ²)
21	VIY1	Moment of inertia about Y axis (slug-ft ²)
21	VIZ1	Moment of inertia about Z axis (slug-ft ²)
21	VIX2	Moment of inertia about X axis (slug-ft ²) after configuration change
21	VIY2	Moment of inertia about Y axis (slug-ft ²) after configuration change
21	VIZ2	Moment of inertia about Z axis (slug-ft ²) after configuration change
21	VIXY	Product of inertia (slug-ft ²)
21	VIXZ	Product of inertia (slug-ft ²)
21	VIYZ	Product of inertia (slug-ft ²)
19	VLO	Initial velocity relative to a rotating earth (ft/sec)
21	WGT1	Reentry body (REB) weight (lbs)

21	WGT2	Reentry body (REB) weight (lbs) after configuration change
20	WXMO	Initial roll rate (deg/sec)
20	WYMO	Initial pitch rate (deg/sec)
20	WZMO	Initial yaw rate (deg/sec)
21	XCG1	Center of gravity location on X axis measured from the X leading edge (inches)
21	XCG2	Center of gravity location on X axis measured from the X leading edge (inches) after configuration change
21	YCG1	Center of gravity offset on Y axis (inches)
21	YCG2	Center of gravity offset on Y axis (inches) after configuration change
21	ZCG1	Center of gravity offset on Z axis (inches)
21	ZCG2	Center of gravity offset on Z axis (inches) after configuration change
	α_R	Initial resultant angle of attack, degrees (see Fig. 2)
	α	Initial local angle of attack, degrees (see Fig. 2)
	β	Initial sideslip angle, degrees (see Fig. 2)
	ϕ	Initial roll angle, degrees (see Fig. 2)
	$\dot{\phi}, \dot{\theta}, \dot{\psi}$	time rate of change of roll, pitch, and yaw angles (per/rad)

INTRODUCTION

In the Aerospace Nuclear Safety Program six-degree-of-freedom simulations have been used to define reentry motion of bodies of interest.

The major modifications associated with the evolution of these simulations are depicted in Figure 1 and are discussed, as needed, in subsequent sections of this report. Documentation for the various components of Figure 1 are given in References 1 to 13. It is the purpose of this report to describe updates associated with the inclusion of ablation effects on aerodynamics and to serve as a users manual for the inputs needed to run the updated program, TMAGRA6C.

APPROACH

The generation herein of TMAGRA6C, see Appendix B for printout, was as follows:

1. Using test results from NASA Test 221 (Refs. 14 and 15) an aerodynamic data set ${}^1\Delta C_X = f(\alpha_R, \phi, M)$ (SIXED6) was developed for full rotation in α_R and ϕ , where: $\Delta C_X = \Delta C_A$, ΔC_N , ΔC_Y , ΔC_m , ΔC_n , and ΔC_l are the incremental axial, normal, and side force coefficients and pitching, yawing, and rolling moments coefficients, respectively. The increments are those that result from ablation. The aerodynamic resultant angle of attack is α_R and the roll angle is ϕ (see Fig. 2). The full rotation in these angles is derived using the conditional statements contained in the main routine, REB6DOF, of the TMAGRA6C program.
2. The values of ΔC_X are incorporated into a new data set by adding Tables 24 through 29 in Group 23 of TMAGRA6B. The new data set, designated SIXED6, contains the original baseline nine - component aerodynamics for both continuum and free molecular flow - SIXED5, as well as the ΔC_X tables. An example of these tables is given in Figure 3. The listing of SIXED6 is given in Appendix C.
3. Using TMAGRA6B as a basis, pertinent program members were modified to accept as inputs to the aerodynamics and equations of motion the incremental values $\Delta C_X = f(\alpha_R, \phi, M \text{ and } H)$, where H is altitude. The new program is designated TMAGRA6C.
4. In TMAGRA6C provisions were incorporated to account for ablation effects on the changes in weight, center of gravity, and moments of inertia as a function of altitude.

¹An explanation of ΔC_X can be found under Program Changes, page 3.

5. The input JCL was modified to accept the new data set and input parameters (Fig. 4).

COMPUTER PROGRAM

Before discussing the program changes, a brief description of the program is given for completeness. TMAGRA6C is written in PL/I and intended for use on the APL mainframe computer. A listing of the source code is given in Appendix B. The function of the program is to calculate the flight path and motion of a reentry body. The program consists of a main routine and ten subroutines. The JCL statements necessary to run this program are listed in Figure 4. Shown below is a diagram depicting the relationship between the main routine (REB6DOF) and the four primary subroutines of TMAGRA6C.

REB6DOF	-	Equations of motion: aerodynamic representation (pp 1-16 of Appendix B)
INPUT	-	Reads input data (pp 27-62)
ATMOS	-	Calculates atmospheric data (pp 63-64)
AERO	-	Calculates values of aerodynamic coefficients (pp 17-26)
ENTERP	-	Interpolates values from aerodynamic tables (pp 65-71)

The following 'generic' subroutines are also used by TMAGRA6C (see Appendix B, pp 72-77).

MATSMO	-	Matrix smoother
PIFREB	-	Linear interpolator (one variable)

PIFAZL - Linear interpolator (one variable)
PAR - Parabolic interpolator
SOLVE - Solves simultaneous equations
SEARCH - Finds closest value less than or equal to a given value (in a 1-D array)

Execution of TMAGRA6C produces a file for plotting. Plot capabilities are available through SPEAKEZ. Instructions for plotting the output from TMAGRA6C are given in Reference 15.

PROGRAM CHANGES

1. The program members affected are REB6DOF, AERO, ENTERP, INPUT, JCL and SIXED6.

2. SIXED6, Appendix C, is the new data set. It contains the hypersonic aerodynamic data set SIXED5, used in TMAGRA6B, and the incremental values (obtained from NASA Test 221, Ref. 14) of the static stability and axial force coefficients, ΔC_X , described in Reference 17. The option to use or not to use ΔC_X will be controlled by an altitude parameter H5 to be discussed later. Specifically, these incremental values of C_A , C_N , C_m , C_Y , C_n and C_l are obtained from:

$$\Delta C_X = C_{X_{\text{fully ablated body}}} - C_{X_{\text{baseline}}} \quad (\text{Eq. 1})$$

and used to develop:

$$\Delta C_X = f(\alpha_R, \phi, M) \quad (\text{Eq. 2})$$

for full rotation in α_R and ϕ . The ΔC_X data set will constitute added tables 24 through 29 in Group 23 for C_A , C_N , C_m , C_Y , C_n and C_l respectively.

3. Aero

The added incremental aerodynamic coefficients, ΔC_X , are named in TMAGRA6C as follows:

DCAA - increment in C_A due to full ablation
DCNA - increment in C_N due to full ablation
DCLMA - increment in C_m due to full ablation
DCYA - increment in C_Y due to full ablation

DCLNA - increment in C_n due to full ablation

DCLLA - increment in C_l due to full ablation

All of which are functions of M , ϕ , and α_R . ΔC_X varies linearly with altitude as follows:

$$\Delta C_X = (C_{X_{com}} - C_{X_{baseline}}) (ABLF) \quad (\text{Eq. 3})$$

Where $C_{X_{com}}$ is the coefficient obtained from the completely ablated model and $C_{X_{baseline}}$ is the coefficient from the baseline configuration. ABLF is an ablation factor defined as follows:

$$ABLF = 0 \text{ when } H_5 \geq H_0 \text{ (used for non-ablating bodies)} \quad (\text{Eq. 4})$$

$$ABLF = 1 \text{ when } H \leq H_5$$

otherwise,

$$ABLF = \frac{H_0 - H}{H_0 - H_5} \quad (\text{Eq. 5})$$

Here H_0 is the initial altitude, H is the local altitude, and $H_5 = f(\gamma_0)$ is the altitude at the end of heat pulse given in Figure 5 and γ_0 is the reentry angle measured negatively from the local tangent. H_0 is the initial altitude. $H_0 = f(\gamma_0)$, Figure 6, in Equation (5) is the breakup altitude for entries from gravity assist trajectories, such as the Galileo mission, as generated by JPL, Reference 18. The median values of Figure 6 as put together by Conn, Reference 19, are used in the ANSP.

4. JCL

The values H_0 , γ_0 , are input as initial conditions, and H_5 is input as a final condition in the JCL of the 6DOF program. The parameter H_5 was added to the existing Group 19.

5. REB6DOF

An account of the change in weight, center of gravity and moments of inertia resulting from ablation can be similarly related to H_5 as follows:

$$\Delta W = (W_{com} - W_{baseline}) (ABLF)$$

$$\Delta X_{c.g.} = (X_{c.g. complete} - X_{c.g. baseline}) (ABLF)$$

$$\left. \begin{matrix} I_X \\ I_Y \\ I_Z \end{matrix} \right\} = (I_{\text{complete}} - I_{\text{baseline}}) (\text{ABLF})$$

where these parameters for the completely ablated configurations will be put in to the existing vehicle configuration Group 21 as:

WGT2; XCG2; VIX2; VIY2; and VIZ2

The estimates for these parameters (Ref. 17) are given in Table 1. They were derived in Reference 13 assuming the mass distribution given in Reference 20.

6. Initial Aerodynamic Angles

The initial local aerodynamic pitch and sideslip angles, α_0 and β_0 , which are put in to Group 19 as a function of α_{R_0} and ϕ_0 are given in Table 2. These values of α_0 and β_0 and subsequent calculations of α and β are used in the calculations of magnus forces.

INPUT DATA

All the input data are list-directed (unformatted), and therefore the data must be separated by either a comma or a blank. All data must be entered (i.e., a blank is not equivalent to a zero).

The input data are divided into groups and controlled by a group number which precedes the data in that group. Some groups are required and others are optional. An explanation of each group is given in Appendix A.

OUTPUT DATA

The output data consist of two sections. The first (Figs. 7, 7a, 7b) is a listing of the input data that were read in. The second (Fig. 8) is a table of the data calculated by the program. The variables in this table are the following:

T - time (sec)
AX3 - X acceleration, number 3 (gees) (see Group 5 instructions)
AY1 - Y acceleration, number 1 (gees)
AZ2 - Z acceleration, number 2 (gees)
ALPHA- total resultant angle of attack (deg)
PDEG - P, roll rate (deg/sec)

QDEG - Q, pitch rate (deg/sec)
RDEG - R, yaw rate (deg/sec)
FMACH- M, Mach number
VCGAIR- REB speed in flight path angle direction (ft/sec)
QBAR - dynamic pressure (lb/ft²)
GAMDEG- gamma L, local flight path angle (deg)
H - geodetic altitude (ft)
DR - earth ref down range (n.m.)
DISP - earth ref lateral displacement (n.m.)

Example results obtained using the TMAGRA6C 6DOF simulation are shown in Figures 9 through 13. Plots showing altitude vs. time, angle of attack, roll rate, pitch rate, and Mach number vs. altitude are given for unablated and ablating GPHS for a shallow reentry angle using the $H5 = f(\gamma_0)$ and $H0 = f(\gamma_0)$ plots of Figures 5 and 6.

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**Table 1. Mass Properties of Fully Ablated GPHS to Use as Inputs in
Group 21 6DOF TMAGRA6C Reentry Program**

Variable	Value	Units
WGT2	3.179	Lbs.
XCG2	1.052	Inches
VIX2	0.0013423	Slug-ft ²
VIY2	0.0007054	Slug-ft ²
VIZ2	0.0008543	Slug-ft ²

α_o, β_o values in degrees

$\alpha_{R_o} \backslash \varphi_o$	-90	-45	0	45	90
-90	0	-63.4	-90	-63.4	0
	90	63.4	0	-63.4	-90
-45	0	-31.8	-45	-31.8	0
	45	31.8	0	-31.8	-45
0	0	0	0	0	0
	0	0	0	0	0
45	0	31.8	45	31.8	0
	-45	-31.8	0	31.8	45
90	0	63.4	90	63.4	0
	-90	-63.4	0	63.4	90
180	0		180		0
	-180		0		180

Table 2. Initial Aerodynamic Angles as a Function of α_{R_o} and φ_o (degrees)

**Fig. 1 Evolution Leading To The Current Six-Degree-Of-Freedom
Reentry Body Program, TMAGRA6C**

Fig. 2 Model-fixed axis system.

cc *

13

Fig. 3a

	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	'PHI = 'ALPHA ='	60	90	120	150	180
-180	-0.157	-0.238	-0.269	-0.17	-0.184	-0.157	-0.171	-0.184	-0.157	-0.171	-0.184	-0.157	-0.171	-0.184	-0.157	-0.171		-1.69	-1.688	-1.687	-1.691	-1.691
-175	-0.361	-0.408	-0.455	-0.371	-0.412	-0.371	-0.412	-0.371	-0.412	-0.371	-0.412	-0.371	-0.412	-0.371	-0.412	-0.371		-1.691	-1.687	-1.675	-1.667	-1.704
-170	-0.538	-0.588	-0.637	-0.552	-0.591	-0.552	-0.591	-0.552	-0.591	-0.552	-0.591	-0.552	-0.591	-0.552	-0.591	-0.552		-1.681	-1.677	-1.652	-1.646	-1.691
-165	-0.751	-0.796	-0.841	-0.767	-0.795	-0.767	-0.795	-0.767	-0.795	-0.767	-0.795	-0.767	-0.795	-0.767	-0.795	-0.767		-1.656	-1.652	-1.617	-1.611	-1.667
-160	-0.969	-1.024	-1.079	-0.986	-1.018	-0.986	-1.018	-0.986	-1.018	-0.986	-1.018	-0.986	-1.018	-0.986	-1.018	-0.986		-1.628	-1.624	-1.572	-1.566	-1.691
-155	-1.162	-1.217	-1.272	-1.195	-1.236	-1.195	-1.236	-1.195	-1.236	-1.195	-1.236	-1.195	-1.236	-1.195	-1.236	-1.195		-1.592	-1.588	-1.522	-1.516	-1.691
-150	-1.294	-1.349	-1.404	-1.332	-1.36	-1.332	-1.36	-1.332	-1.36	-1.332	-1.36	-1.332	-1.36	-1.332	-1.36	-1.332		-1.557	-1.553	-1.487	-1.481	-1.691
-145	-1.417	-1.472	-1.527	-1.446	-1.486	-1.446	-1.486	-1.446	-1.486	-1.446	-1.486	-1.446	-1.486	-1.446	-1.486	-1.446		-1.522	-1.518	-1.452	-1.446	-1.691
-140	-1.496	-1.551	-1.606	-1.524	-1.564	-1.524	-1.564	-1.524	-1.564	-1.524	-1.564	-1.524	-1.564	-1.524	-1.564	-1.524		-1.507	-1.503	-1.437	-1.431	-1.691
-135	-1.628	-1.683	-1.738	-1.656	-1.696	-1.656	-1.696	-1.656	-1.696	-1.656	-1.696	-1.656	-1.696	-1.656	-1.696	-1.656		-1.472	-1.468	-1.402	-1.396	-1.691
-130	-1.667	-1.722	-1.777	-1.682	-1.722	-1.682	-1.722	-1.682	-1.722	-1.682	-1.722	-1.682	-1.722	-1.682	-1.722	-1.682		-1.437	-1.433	-1.367	-1.361	-1.691
-125	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.402	-1.398	-1.332	-1.326	-1.691
-120	-1.704	-1.759	-1.814	-1.719	-1.759	-1.719	-1.759	-1.719	-1.759	-1.719	-1.759	-1.719	-1.759	-1.719	-1.759	-1.719		-1.367	-1.363	-1.297	-1.291	-1.691
-115	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.332	-1.328	-1.262	-1.256	-1.691
-110	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.297	-1.293	-1.227	-1.221	-1.691
-105	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.262	-1.258	-1.192	-1.186	-1.691
-100	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.227	-1.223	-1.157	-1.151	-1.691
-95	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.192	-1.188	-1.122	-1.116	-1.691
-90	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.157	-1.153	-1.087	-1.081	-1.691
-85	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.122	-1.118	-1.052	-1.046	-1.691
-80	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.087	-1.083	-1.017	-1.011	-1.691
-75	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.052	-1.048	-0.982	-0.976	-1.691
-70	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-1.017	-1.013	-0.947	-0.941	-1.691
-65	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.982	-0.978	-0.912	-0.906	-1.691
-60	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.947	-0.943	-0.877	-0.871	-1.691
-55	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.912	-0.908	-0.842	-0.836	-1.691
-50	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.877	-0.873	-0.807	-0.801	-1.691
-45	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.842	-0.838	-0.772	-0.766	-1.691
-40	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.807	-0.803	-0.737	-0.731	-1.691
-35	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.772	-0.768	-0.702	-0.696	-1.691
-30	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.737	-0.733	-0.667	-0.661	-1.691
-25	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.702	-0.698	-0.632	-0.626	-1.691
-20	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.667	-0.663	-0.597	-0.591	-1.691
-15	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.632	-0.628	-0.562	-0.556	-1.691
-10	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.597	-0.593	-0.527	-0.521	-1.691
-5	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.562	-0.558	-0.492	-0.486	-1.691
0	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.527	-0.523	-0.457	-0.451	-1.691
5	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.492	-0.488	-0.422	-0.416	-1.691
10	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.457	-0.453	-0.387	-0.381	-1.691
15	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.422	-0.418	-0.352	-0.346	-1.691
20	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.387	-0.383	-0.317	-0.311	-1.691
25	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.352	-0.348	-0.282	-0.276	-1.691
30	-1.691	-1.746	-1.801	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706	-1.746	-1.706		-0.317	-0.313	-0.247	-0.241	-1.691

Fig. 3b

35	1.417	1.353	1.409	1.407	1.363
40	1.314	1.223	1.31	1.309	1.244
45	1.156	1.106	1.145	1.147	1.093
50	0.964	0.931	0.944	0.958	0.935
55	0.772	0.731	0.749	0.768	0.735
60	0.588	0.54	0.567	0.594	0.53
65	0.43	0.37	0.401	0.432	0.383
70	0.296	0.253	0.273	0.292	0.26
75	0.194	0.172	0.18	0.188	0.181
80	0.127	0.108	0.115	0.121	0.113
85	0.065	0.047	0.054	0.061	0.05
90	0.006	0.002	0.003	0.005	0.002
95	-0.052	-0.031	-0.042	-0.053	-0.029
100	-0.114	-0.089	-0.102	-0.115	-0.09
105	-0.184	-0.157	-0.171	-0.184	-0.157
110	-0.3	-0.242	-0.27	-0.299	-0.238
115	-0.455	-0.371	-0.412	-0.453	-0.361
120	-0.637	-0.552	-0.591	-0.631	-0.538
125	-0.841	-0.767	-0.795	-0.823	-0.751
130	-1.018	-0.986	-0.998	-1.01	-0.969
135	-1.195	-1.18	-1.19	-1.198	-1.162
140	-1.36	-1.275	-1.346	-1.359	-1.294
145	-1.464	-1.402	-1.448	-1.466	-1.417
150	-1.526	-1.494	-1.516	-1.522	-1.496
155	-1.578	-1.565	-1.571	-1.572	-1.592
160	-1.623	-1.616	-1.619	-1.617	-1.628
165	-1.656	-1.656	-1.654	-1.652	-1.667
170	-1.681	-1.68	-1.677	-1.675	-1.691
175	-1.691	-1.693	-1.69	-1.687	-1.704
180	-1.69	-1.688	-1.687	-1.691	-1.691

Fig. 4 Listing of JCL for Running TMAGRA6C

```
//SHARB JOB (11655,C,U,O),'SHARBAUGH',USER=SHARB,
//MSGCLASS=C,NOTIFY=SHARB
//**
//**
//** DSN=BFD.SHARB.TMAGRA6C.SIXED6
//**
//**MAIN ORG=RM001
//EXEC PGM=TMAGRA6C,REGION=800K,TIME=5
//STEPLIB DD DSN=BFD.SHARB.TMAGRA6C.OBJECT,DISP=SHR
//SKFRT DD DUMMY
//**
//PLTOUT DD DSN=BFD.SHARB.TMAGRA6C.VXXAPLT,
//DISP=(NEW,CATLG),
//DCB=(RECFM=WBA,LRECL=137,BLKSIZE=9000),
//UNIT=TSOP,SPACE=(TRK,(5,5),RLSE)
//SYSPRINT DD DSN=BFD.SHARB.TMAGRA6C.SYSOUT.VXXA,
//DISP=(NEW,CATLG),
//DCB=(RECFM=WBA,LRECL=137,BLKSIZE=9000),
//UNIT=TSOP,SPACE=(TRK,(5,5),RLSE)
//** OUTLIM=50000 ***** NOT NEEDED
//SYSDN DD *
2
2
0,1.,50000.,1.
7
1,0,5000.,3.826,0.09746,0.09746,0.3188,0.3188,1,1
13
2
0,1.,50000.,1.
15
20
17
'10/ 4/89 ' VXXA'
19
0,0,348000.,46720.,0,0,-7.00,0.01,0.0,0.0,140.,,
60000.,0.001,1.5,0.01,145000.
20
250.,0,0,0,0
21
3.389,0.001508,0.000850,0.001021,1.045,0.,0.,0.,0.,0.,
3.179,0.0013423,0.0007054,0.0008543,1.052,0.,0.,0.,
22
0,0,0,0
//**
//DD DSN=BFD.SHARB.TMAGRA6C.SIXED6,DISP=SHR
```

Fig. 5 ALTITUDE H5 REPRESENTING END OF HEAT PULSE—INPUT TO 6 DOF TMAGRA6C

Fig. 6 VARIATION OF INITIAL ALTITUDE VERSUS FLIGHT PATH ANGLE FOR THE MAXIMUM AND EXPECTED INITIAL VELOCITIES FOR DISCRETE GPHS MODULE FROM GRAVITY ASSIST REENTRY TRAJECTORIES (Reproduced from Ref. 19)

Fig. 7 Listing Of Input Data

```

6DOF REENTRY PROGRAM
INPUT DATA BLOCK
CLP VS ALTITUDE      1.0000
                     0.00
500000.00           1.0000

OGROUP 7 INPUTS
1.000 = KCLP
5000.000 = HTR (FT)
3.826 = LENGTH (IN)
0.097 = SREF1 (SQFT)
0.097 = SREF2 (SQFT)
0.319 = DREF1 (FT)
0.319 = DREF2 (FT)
1.000 = PLTPTS
CMQ VARIATION VS: ALTITUDE
0.00 1.0000
500000.00 1.0000

INITIAL CONDITIONS
= TIME
= ALTITUDE
= VELOCITY
= FLIGHT PATH AZIMUTH
= FLIGHT PATH ANGLE
= ANGLE OF ATTACK
= SIDESLIP ANGLE
= ROLL ANGLE
= CUT-OFF TIME
= CUT-OFF ALTITUDE
= ADAMS PACKAGE UPPER LIMIT
= MAX TIME STEP INTERVAL
= RESULTANT ANGLE OF ATTACK
= ALTITUDE AT END OF HEAT PULSE

700.000 WXMO = INITIAL ROLL RATE (DEG/SEC)
0.000 WYMO = INITIAL PITCH RATE (DEG/SEC)
0.000 WZMO = INITIAL YAW RATE (DEG/SEC)
3.389 WGT1 = REB WEIGHT
0.002 VIX1 = REB MOMENTS OF INERTIA
0.001 VIY1 = REB MOMENTS OF INERTIA
0.001 VIZ1 = REB MOMENTS OF INERTIA
1.045 XCG1 = LOCATION OF C.G. FROM REB NOSE
0.000 YCG1 = C.G. OFFSET ON Y (IN)
0.000 ZCG1 = C.G. OFFSET ON Z (IN)
0.000 VIXY = REB PRODUCTS OF INERTIA
0.000 VIXZ = REB PRODUCTS OF INERTIA
0.000 VIYZ = REB PRODUCTS OF INERTIA
0.000000 CM0 = PITCH ASYMMETRY
0.000000 CN0 = YAW ASYMMETRY
3.179 WGT2 = BURNOFF WEIGHT
0.001 VIX2 = BURNOFF MOMENTS OF INERTIA
0.001 VIY2 = BURNOFF MOMENTS OF INERTIA
0.001 VIZ2 = BURNOFF MOMENTS OF INERTIA
1.052 XCG2 = BURNOFF C.G. LOCATION
0.000 YCG2 = BURNOFF YCG (IN)
0.000 ZCG2 = BURNOFF ZCG (IN)
0.000 HBO = BURNOFF ALTITUDE

```

Fig. 7a

```

0.00000000 FLO = REB LAT AT TO INITIAL POSITION
0.00000000 FLAMO = REB LONG AT TO
20925738.0 A = EQUATORIAL RADIUS (FT)
20855588.0 B = POLAR RADIUS (FT)
7.29211585E-05 OMEGA = EARTHS RATE (RAD/SEC) (CUFT/SECSQ)
-1.40765360E+16 ALP0 = GRAVITATIONAL CONSTANT (SQFT)
-7.10888760E+11 ALP2 = GRAVITATIONAL CONSTANT (SQFT)
2.83931250E+23 ALP4 = GRAVITATIONAL CONSTANT (FT4)
GROUP 23 INPUT DATA:
AERODYNAMIC COEFS AND RELATED ADJUSTMENT FACTORS
TABLE #7: (SPECIFIC VEL/GAMMA CONDITIONS)
SKIN FRICTION COEF (CASF_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #8: (SPECIFIC VEL/GAMMA CONDITIONS)
CHANGE OF VEHICLE WEIGHT (DWGT_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #9: (SPECIFIC VEL/GAMMA CONDITIONS)
INCREMENTAL AXIAL FORCE COEF (DCA_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #10: (SPECIFIC VEL/GAMMA CONDITIONS)
INCREMENTAL PITCH CENTER OF PRESSURE (DXCPV_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #16:
ASYMMETRIC PITCH COEF (CMO_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #17:
ASYMMETRIC ROLL COEF (CLO_T) - FUNCTION OF NORMALIZED ALTITUDE ONLY
0.00 0.0000
80.00 0.0000
TABLE #18:
INCREMENTAL PITCH CENTER OF PRESSURE (DXCP_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #20: (CONTINUUM REGIME)
MASS ADDITION PARAMETER (PMA_T) - FUNCTION OF ALTITUDE ONLY
0.00 0.0000
400000.00 0.0000
TABLE #21:
OUT OF PLANE SIDE MOMENT COEF (CMOOP) - FUNCTION OF SPIN PARAMETER
0.00 0.0000
0.00 0.0000

```

Fig. 7b

PROGRAM USES 1962 STANDARD ATMOSPHERE	
0.000	-3.56619991E-03
36089.238	518.670
65616.750	389.970
104985.875	389.970
154199.375	411.570
170603.625	487.170
200131.188	487.170
259186.313	454.770
291153.188	325.170
323002.625	325.170
354753.250	379.170
386406.125	469.170
480780.813	649.170
512045.938	1729.170
543215.188	1999.170
605268.375	2179.170
728243.750	2431.170
939894.688	2791.170
1234645.000	2.38109985E-03
1520799.000	2.01519998E-03
1798726.000	1.63550000E-03
2068776.000	4357.168
	4663.168
	4861.168
	0.00000000E+00
	2.37689982E-03
	7.06119929E-04
	1.70820000E-04
	2.56609928E-05
	2.76979972E-06
	1.47349965E-06
	4.87189993E-07
	3.88259984E-08
	6.15079898E-09
	9.65109992E-10
	1.90709989E-10
	4.72659967E-11
	3.56239951E-12
	2.24879924E-12
	1.55919982E-12
	8.43449984E-13
	3.03459948E-13
	6.95599719E-14
	1.26079973E-14
	3.05989996E-15
	9.00309837E-16
	3.04629894E-16

Fig. 8 Example of Output Data Calculated by the Computer

6-DEGREES OF FREEDOM RE-ENTRY BODY FLIGHT PROGRAM														PAGE 1	
V29A T														9/ 7/89	
TIME	AX3	AY1	AZ2	ALPHA	P	Q	R	M	VCGAR	Q BAR	GAMMA L	H	EARTH	REF	EARTH
SEC	X-ACC	Y-ACC	Z-ACC	TOT ANG	ROLL	PITCH	YAW	MACH	AIR	DYNAMIC	LOCAL	GEODETIC	REF DN	REF	DISP
	NO.3	NO.1	NO.2	ATTACK	RATE	RATE	RATE	NUMBER	FT/SEC	LB/SQ-FT	FLT PATH	ALTITUDE	RANGE	DISP	NM
	GEES	GEES	GEES	DEG	DEG/SEC	DEG/SEC	DEG/SEC				ANG-DEG	FT	NM	NM	
0.000	-0.02	0.00	0.00	0.000	700.0	0.00	0.00	45.76	46720.0	0.38	-7.000	348000	0.00	0.00	0.00
0.000	-0.02	0.00	0.00	0.000	700.0	0.00	0.00	45.76	46720.0	0.38	-7.000	347999	0.00	-0.00	-0.03
0.102	-0.02	0.00	0.00	0.000	700.0	0.00	0.00	45.84	46720.3	0.39	-6.991	347418	0.77	-0.03	-0.08
0.326	-0.02	0.00	0.00	0.000	700.0	0.00	0.00	46.03	46721.0	0.41	-6.971	346146	2.46	-0.08	-0.19
0.537	-0.02	-0.00	-0.00	0.028	699.9	-0.01	0.00	46.21	46721.7	0.44	-6.953	344950	4.06	-0.14	-0.25
0.755	-0.02	-0.00	-0.00	0.034	699.8	-0.00	-0.00	46.39	46722.3	0.47	-6.934	343721	5.70	-0.19	-0.31
0.973	-0.02	0.00	-0.00	0.034	699.7	-0.01	-0.01	46.58	46723.0	0.49	-6.914	342495	7.35	-0.25	-0.36
1.190	-0.03	0.00	-0.00	0.048	699.7	-0.01	0.00	46.76	46723.6	0.53	-6.895	341273	8.99	-0.31	-0.42
1.411	-0.03	0.00	-0.00	0.063	699.6	-0.01	0.00	46.96	46724.2	0.56	-6.876	340036	10.66	-0.36	-0.48
1.641	-0.03	-0.00	-0.00	0.069	699.5	-0.02	-0.01	47.16	46724.9	0.60	-6.856	338749	12.40	-0.42	-0.53
1.859	-0.03	0.00	0.00	0.079	699.5	-0.03	0.00	47.35	46725.5	0.64	-6.836	337537	14.05	-0.48	-0.59
2.077	-0.03	0.00	-0.00	0.086	699.4	-0.03	0.00	47.55	46726.0	0.68	-6.817	336329	15.69	-0.53	-0.64
2.288	-0.04	-0.00	0.00	0.095	699.2	-0.00	-0.01	47.74	46726.6	0.72	-6.799	335159	17.29	-0.59	-0.70
2.512	-0.04	0.00	-0.00	0.101	699.1	-0.03	-0.00	47.95	46727.1	0.77	-6.779	333921	18.98	-0.64	-0.76
2.717	-0.04	-0.00	0.00	0.107	699.1	-0.05	0.00	48.14	46727.6	0.82	-6.761	332793	20.53	-0.70	-0.82
2.947	-0.04	0.00	-0.00	0.115	699.0	-0.05	-0.01	48.35	46728.1	0.87	-6.741	331528	22.27	-0.76	-0.87
3.184	-0.05	-0.00	0.00	0.122	698.8	-0.06	0.00	48.58	46728.6	0.94	-6.720	330231	24.07	-0.82	-0.92
3.401	-0.05	0.00	-0.00	0.130	698.7	-0.07	0.01	48.78	46729.1	1.00	-6.701	329043	25.71	-0.87	-0.98
3.603	-0.05	-0.00	-0.00	0.137	698.6	-0.06	-0.01	48.97	46729.5	1.06	-6.683	327945	27.24	-0.92	-1.03
3.814	-0.06	0.00	0.00	0.145	698.4	0.01	0.00	49.09	46729.9	1.13	-6.664	326798	28.84	-0.98	-1.09
4.022	-0.06	0.00	-0.00	0.149	698.2	0.06	0.00	49.21	46730.2	1.20	-6.646	325672	30.41	-1.03	-1.15
4.246	-0.06	-0.00	0.00	0.155	698.1	-0.10	0.01	49.34	46730.6	1.28	-6.626	324462	32.10	-1.09	-1.21
4.483	-0.07	0.00	0.00	0.158	697.9	0.12	-0.02	49.48	46730.9	1.36	-6.605	323187	33.90	-1.15	-1.26
4.697	-0.07	-0.00	0.00	0.163	697.8	-0.13	0.03	49.61	46731.2	1.45	-6.586	322036	35.52	-1.21	-1.31
4.909	-0.08	0.00	0.00	0.168	697.6	-0.12	-0.01	49.74	46731.4	1.54	-6.568	320906	37.12	-1.26	-1.36
5.110	-0.08	-0.00	-0.00	0.176	697.3	-0.07	-0.01	49.86	46731.6	1.64	-6.550	319830	38.65	-1.31	-1.42
5.321	-0.09	0.00	0.00	0.179	697.1	-0.00	0.02	49.98	46731.8	1.74	-6.532	318705	40.24	-1.36	-1.48
5.536	-0.09	0.00	-0.00	0.182	696.8	0.08	-0.02	50.11	46731.9	1.85	-6.513	317567	41.87	-1.42	-1.54
5.766	-0.10	-0.00	0.00	0.182	696.6	-0.13	0.01	50.25	46732.0	1.98	-6.492	316348	43.61	-1.48	-1.59
5.990	-0.11	0.00	-0.00	0.180	696.3	-0.23	0.04	50.39	46732.1	2.11	-6.473	315166	45.31	-1.54	-1.65
6.208	-0.11	-0.00	0.00	0.177	696.1	-0.23	0.04	50.52	46732.1	2.25	-6.453	314021	46.96	-1.59	-1.70
6.425	-0.12	0.00	0.00	0.179	695.8	0.22	-0.05	50.65	46732.0	2.40	-6.434	312880	48.61	-1.65	-1.76
6.637	-0.13	-0.00	-0.00	0.179	695.6	-0.16	0.03	50.78	46731.9	2.55	-6.416	311776	50.21	-1.70	-1.81
6.848	-0.14	0.00	0.00	0.180	695.1	-0.07	0.00	50.92	46731.7	2.72	-6.397	310675	51.81	-1.76	-1.88
7.078	-0.15	-0.00	-0.00	0.176	694.6	-0.03	-0.02	51.06	46731.5	2.91	-6.377	309477	53.55	-1.81	-1.93
7.315	-0.16	0.00	0.00	0.172	694.2	0.01	0.02	51.21	46731.1	3.12	-6.356	308250	55.35	-1.86	-1.99
7.539	-0.17	0.00	0.00	0.164	693.8	0.07	-0.01	51.35	46730.7	3.33	-6.336	307093	57.04	-1.93	-2.07
7.757	-0.18	-0.00	0.00	0.155	693.3	-0.18	0.02	51.49	46730.2	3.55	-6.317	305972	58.69	-2.07	-2.15
7.961	-0.19	0.00	-0.00	0.140	693.0	0.28	-0.05	51.62	46729.7	3.78	-6.299	304921	60.25	-2.15	-2.21
8.185	-0.20	-0.00	0.00	0.127	692.5	-0.29	0.08	51.76	46729.1	4.04	-6.279	303774	61.94	-2.21	-2.27
8.397	-0.22	0.00	0.00	0.120	692.1	-0.25	-0.08	51.89	46728.4	4.30	-6.260	302696	63.55	-2.27	-2.33
8.627	-0.23	-0.00	-0.00	0.110	691.5	-0.21	0.08	52.04	46727.5	4.61	-6.240	301524	65.29	-2.33	-2.38
8.864	-0.25	0.00	0.00	0.101	690.8	0.19	-0.06	52.19	46726.4	4.95	-6.219	300324	67.09	-2.38	-2.43
9.088	-0.27	-0.00	-0.00	0.086	690.2	-0.16	0.03	52.34	46725.3	5.30	-6.199	299192	68.79	-2.43	-2.48
9.293	-0.29	0.00	0.00	0.079	689.5	0.12	0.00	52.47	46724.2	5.64	-6.181	298160	70.34	-2.48	-2.53

Fig.9 Comparison of Baseline and Completely Ablated GPHS Altitude History

Fig.10 Comparison of Baseline and Completely Ablated GPHS Angle of Attack History

Fig.11 Comparison of Baseline and Completely Ablated GPHS Roll Rate History

Fig.12 Comparison of Baseline and Completely Ablated GPHS Pitch Rate History

Fig. 13 Comparison of Baseline and Completely Ablated GPHS Mach No. History

APPENDIX A

INPUT DATA

APPENDIX A

Input Data

The input data are divided into groups and controlled by a group number which precedes the data in that group. Groups 7, 19, 20, 21, 22, 23, 24, and 26 are required. Other groups are optional. Multiple cases can be run, in which case groups 7, 19, 20, 22, 23, 24, and 26 are only required for the first case. The groups may be in any order, unless otherwise noted.

All the input data are list-directed (unformatted), and therefore the data must be separated by either a comma or a blank. All data must be entered (i.e., a blank is not equivalent to a zero). An explanation of each group is given below.

Group 0 Magnus Force Coefficient (CNPB) vs Altitude

The first item in the input file is an integer number specifying the number of altitude/CNPB combinations, followed by a value for a constant center of pressure location (XMAG).

Subsequent data items give the altitude/CNPB values separated by commas or blanks.

Group 1 Rolling Moment Coefficient Asymmetry (CLO) vs Altitude

The first data item is an integer number specifying the number of altitude/CLO combinations that are to follow.

Subsequent data items give the altitude/CLO values separated by commas or blanks.

Group 2 Multiplying Factor for Roll Damping Coefficient (CLP MF) vs Altitude

The first data item is an integer number specifying the number of altitude/CLP MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 3 Multiplying Factor for Yawing Moment Coefficient Asymmetry (CNO MF) vs Altitude

The first data item is an integer number specifying the number of altitude/CNO MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 4 Multiplying Factor for Pitching Moment Coefficient Asymmetry (CMO MF) vs Altitude

The first data item is an integer number specifying the number of altitude/CMO MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 5 Off-Axis Accelerometer Locations

Accelerometer locations are described using the body X, Y, Z coordinate system.

- 1 - accelerometer for g's in Y direction
- 2 - accelerometer for g's in Z direction
- 3 - accelerometer for g's in X direction

The off-axis distances are given in inches from the center of gravity. The order of the data is X1, Y1, Z1, X2, Y2, Z2, X3, Y3, and Z3.

Group 6 Multiplying Factor for Density vs Altitude

The first data item is an integer number specifying the number of altitude/density MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 7 Trajectory and Reentry Body Characteristics

The input file contains values in the following order:

KCLP - multiplying factor used in calculation of CLLP due to skin friction ($CLLP = -KCLP * CASF$, where CASF is the skin friction axial force coefficient.)

HTR - transition altitude (ft) (altitude at which calculation of CASF changes from laminar to turbulent)

LL - vehicle length (in)

SREF1 - vehicle ref area before configuration change (sq ft)

SREF2 - vehicle ref area after configuration change (sq ft)

DREF1 - vehicle ref diameter before configuration change (ft)

DREF2 - vehicle ref diameter after configuration change (ft)

FDSL - fudge factor used to adjust vehicle dimensions

PLTPTS - plot control variable, varies the output time interval for data sent to the file PLTOUT, where

PLTPTS = 0, do not create plotfile

PLTPTS = N, writes to plot file every N time steps

Group 8 Wind Data and Non-Standard Atmosphere Data

This group provides the user with the option to input wind data alone, atmosphere data alone, or a combination of both. If group 8 is not entered as input, standard atmosphere data will be used.

The first data items are the integer values INT1, FLAG3, and NTMS where:

INT1 - number of data points in the table

FLAG3 - flag indicating use of wind data

1 - includes wind data

0 - does not include wind data

NTMS - flag indicating use of atmosphere data

1 - includes atmosphere data

0 - does not include atmosphere data

If FLAG3 = 1 and NTMS = 0 then variables read are
(DB(I), WAXL(I), VLWS(I), I = 1 to INT1)

If FLAG3 = 0 and NTMS = 1 then variables read are
(DB(I), DMB(I), DHOB(I), I = 1 to INT1)

If FLAG3 = 1 and NTMS = 1 then variables read are
(DB(I), WAZL(I), VLWS(I), DMB(I), and DHOB(I), I = 1 to
INT1)

DB - geopotential altitude (ft)
WAZL - angle from which the wind is blowing, measured clockwise
from true north (deg)
VLWS - wind velocity (knots)
DMB - temperature (deg centigrade)
DHOB - density (g/cm**3)

The wind data will be extrapolated from the last two points
at either end of the table. Density data must extend to the
maximum trajectory altitude. Group 8 can be used twice in a
single case; first with density data only, and second with wind
data. The groups of data must be input in that order. The
altitudes defining the profiles do not have to be the same.

Group 9 Multiplying Factor for Y Coordinate CG Location (YCG MF) vs
Altitude

The first data item is an integer number specifying the
number of altitude/YCG MF combinations.

Subsequent data items give the combinations separated by
commas or blanks.

Group 10 Multiplying Factor for Z Coordinate CG Location (ZCG MF) vs
Altitude

The first data item is an integer number specifying the
number of altitude/ZCG MF combinations.

Subsequent data items give the combinations separated by
commas or blanks.

Group 11 Multiplying Factor for Axial Force Coefficient (CA MF) vs Altitude

The first data item is an integer number specifying the
number of altitude/CA MF combinations.

Subsequent data items give the combinations separated by
commas or blanks.

Group 12 Multiplying Factor for Reentry Body Weight (WGT MF) vs Altitude

The first data item is an integer number specifying the number of altitude/WGT MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 13 Multiplying Factor for Pitch Damping Derivative (CMQ MF) vs Altitude

The first data item is an integer number specifying the number of altitude/CMQ MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 14 Multiplying Factor for Normal Force Coefficient (CN MF) vs Altitude

The first data item is an integer number specifying the number of altitude/CN MF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Group 15 Output Interval

The only data item is the integer LEE, which varies the output time interval.

If LEE = +N, output will be for each Nth computed time step. If LEE = -N, output will be printed every Nth whole second. If group 15 is not used, output will be given for every whole second. The times for whole second output are not exact but are truncated from the end of the integration time step.

Group 16 Multiplying Factor for Center of Pressure Location (XCP MF) vs Altitude

The first data item is an integer number specifying the number of altitude/XCP MF combinations.

Subsequent data items give the combinations separated by commas or blanks. (XCP is measured from the nose tip.)

Group 17 Date and Case Description

Data items include both a date and case description character string which must each be enclosed in single quotes. The maximum character string length for the date is 12, and for the case or run identification, 68.

Group 18 Remarks to be Printed

The first data item is an integer specifying how many remarks are to be printed. The subsequent data items give the remarks, each enclosed in single quotes. The maximum character string length for each remark is 72.

Group 19 Initial Conditions

Initial condition variables must be in the following order:

- TO - initial flight time (sec)
- HO - initial altitude, above sea level (ft)
- VLO - initial velocity relative to a rotating earth
 (ft/sec)
- AZLO - initial flight path azimuth angle, positive CW from
 north, relative to a rotating earth (deg)
- GAMALO - flight path angle, positive for exit phase and
 negative for reentry phase, relative to a rotating
 earth (deg)
- ALPHAO - initial local angle of attack, α (deg) (See Fig. 1)
- BETAO - initial sideslip angle, β (deg) (See Fig. 1)
- PHIV - initial roll angle, ϕ (deg) (See Fig. 1)
- TF - trajectory cut-off time (sec). This is real time
 trajectory cut-off point and not a time interval.
- HF - trajectory cut-off altitude (ft)
- ADMKUL - Adams package upper limit (sec). This is an accuracy
 control.
- DTMAX - maximum integration step interval (sec)

ALPBARO - initial resultant angle of attack, α_R (deg) (See Fig. 1)

H5 - altitude at end of heat pulse (ft)

Group 20 Initial Roll, Pitch, and Yaw Rates

Initial conditions must be in the following order:

WXMO - initial roll rate (deg/sec)

WYMO - initial pitch rate (deg/sec)

WZMO - initial yaw rate (deg/sec)

Group 21 Vehicle Configuration

Configuration values must be in the following order:

WGT1 - reentry body (REB) weight (lbs)

VIX1 - moment of inertia about X axis (slug-ft**2)

VIY1 - moment of inertia about Y axis (slug-ft**2)

VIZ1 - moment of inertia about Z axis (slug-ft**2)

XCG1 - center of gravity location on X axis measured from the X leading edge (inches)

YCG1 - center of gravity offset on Y axis (inches)

ZCG1 - center of gravity offset on Z axis (inches)

VIXY - product of inertia (slug-ft**2)

VIXZ - product of inertia (slug-ft**2)

VIYZ - product of inertia (slug-ft**2)

F - multiplying factor (multiplies all weights, moments of inertia, and centers of gravity on X axis)

CMO - pitching moment coefficient asymmetry

CNO - yawing moment coefficient asymmetry

The program provides for a configuration change at a user selected altitude (HBO). Therefore, the second configuration is represented by the following variables, which are read in the given order.

WGT2 - reentry body (REB) weight (lbs)
VIX2 - moment of inertia about X axis (slug-ft**2)
VIY2 - moment of inertia about Y axis (slug-ft**2)
VIZ2 - moment of inertia about Z axis (slug-ft**2)
XCG2 - center of gravity location on X axis measured from the X leading edge (inches)
YCG2 - center of gravity offset on Y axis
ZCG2 - center of gravity offset on Z axis
HBO - altitude for configuration change (ft)

Group 22 Initial Latitude and Longitude

Data items are as follows:

FLOD - REB latitude at TO (deg) (Positive north of the equator.)
FLAMOD - REB longitude at TO (deg) (Positive east of Greenwich meridian.)

Group 23 Aerodynamic Tables and Related Variables

The aerodynamic data must appear in the following order:

Table 1 Axial force Coefficient (CA) as a function of Mach number (M), roll angle (phi), and resultant angle of attack (alpha). The first data items are four integers.

number of Mach numbers

number of phi's

number of alpha's

print option (0, won't print table in the output)
(1, will print table in the output)

The next data item is the label 'MACH# = ' followed by the first Mach number.

The next data item is the label 'PHI = ', followed by the first eight values of phi. The next data item is the label 'ALPHA = '. The next set of data items is a value of alpha followed by the eight values of the coefficient C_A corresponding to that alpha and the above listed values of phi. Repeat this set of data items until all of the alpha's have been listed, then repeat, starting with the label 'PHI = ', except follow this label with the next eight values of phi. Repeat this process until all of the phi's have been listed. (The last section does not have to contain eight values of phi. It may contain less than or equal to eight values.)

Then repeat the whole process for the next Mach number starting with the label 'MACH# = '. (See example in Figure 3.)

- Table 2 Normal Force Coefficient (C_N) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α). The form of this table is identical to that of Table 1.
- Table 3 Side Force Coefficient (C_Y) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α). The form of this table is identical to that of Table 1.
- Table 4 Pitching Moment Coefficient (C_{LM}) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α). The form of this table is identical to that of Table 1.
- Table 5 Axial Force Coefficient for Free Molecular Flow (C_{AFM}) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α) within the free molecular flow regime. The form of this table is identical to that of Table 1.
- Table 6 Normal Force Coefficient for Free Molecular Flow (C_{NFM}) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α) within the free molecular flow regime. The form of this table is identical to that of Table 1.

Table 7 Skin Friction Axial Force Coefficient (CASF) as a function of altitude.

The first data item is an integer number specifying the number of altitude/CASF combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 8 Incremental Change of Weight (DELWGT) vs Altitude

The first data item is an integer number specifying the number of altitude/DELWGT combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 9 Incremental Change of Axial Force Coefficient (DELCA) vs Altitude

The first data item is an integer number specifying the number of altitude/DELCA combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 10 Incremental Change in Center of Pressure (DELXCPL) vs Altitude

The first data item is an integer number specifying the number of altitude/DELXCPL combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 11 Yaw Moment Coefficient (CLN) as a function of Mach number (M), roll angle (phi), and angle of attack (alpha). The form of this table is identical to that of Table 1.

Table 12 Pitch Damping Coefficient (CLMQ) as a function of Mach number (M), roll angle (phi), and angle of attack (alpha). The format of this table is identical to that of Table 1.

Table 13 Yaw Damping Coefficient (CLNR) as a function of Mach number (M), roll angle (phi), and angle of attack (alpha). The form of this table is identical to that of Table 1.

Table 14 Side Force Coefficient for Free Molecular Flow (CYFM) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α) within the free molecular flow regime. The form of this table is identical to that of Table 1.

Table 15 Pitching Moment Coefficient for Free Molecular Flow (CLMFM) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α) within the free molecular flow regime. The form of this table is identical to that of Table 1.

Table 16 Pitching Moment Coefficient Asymmetry (CMO) vs Altitude

The first data item is an integer number specifying the number of altitude/CMO combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 17 Asymmetric Rolling Moment Coefficient (CLO) as a Function of Altitude/Transition Altitude (H/HTR)

The first data item is an integer number specifying the number of (H/HTR)/CLO combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 18 Change in Center of Pressure Per Unit Length (DELCP) vs Altitude

The first data item is an integer number specifying the number of altitude/DELCP combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 19 Roll Damping Coefficient (CLLP) as a function of Mach number (M), roll angle (ϕ), and angle of attack (α). The form of this table is identical to that of Table 1.

Table 20 Mass Addition Parameter (PMA) vs Altitude

The first data item is an integer number specifying the number of altitude/PMA combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 21 Out-of-Plane Pitching Moment Coefficient (CMOOP) vs the Spin Parameter (SP)

The first data item is an integer number specifying the number of SP/CMOOP combinations.

Subsequent data items give the combinations separated by commas or blanks.

Table 22 Rolling Moment Coefficient (CLL) as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 23 Yaw Moment Coefficient for Free Molecular Flow (CLNFM) as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 24 Incremental Axial Force Coefficient (DCAA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 25 Incremental Normal Force Coefficient (DCNA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 26 Incremental Pitching Moment Coefficient (DCLMA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 27 Incremental Side Force Coefficient (DCYA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 28 Incremental Yawing Moment Coefficient (DCLNA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Table 29 Incremental Rolling Moment Coefficient (DCLLA) Due to Ablation as a function of Mach number (M), roll angle (ϕ), and resultant angle of attack (α). The form of this table is identical to that of Table 1.

Group 24 Matrix Generator

Group 24 is required for the first run and for any succeeding run in which any of the following inputs are changed:

For group 19 - GAMALO, ALPHA0, BETA0, PHIV

For group 22 - FLOD, FLAMOD

Group 24 must follow groups 19 and 22. There are no input data for this group except the group identification number.

Group 25 Standard Atmosphere Data

If group 8 has been used for non-standard atmosphere data, a group 25 control card may be used to return to standard atmosphere in succeeding cases. However, if group 25 is used after group 8, group 8 will be overridden. The 1962 standard day is used. There are no input data for this group except the group identification number.

Group 26 Termination

Group 26 is necessary for all cases and must be the last card for the case. It terminates the reading of input data and returns control to the main program. There are no input data for this group except the group identification number.

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY
LAUREL MARYLAND

APPENDIX B

LISTING OF TMAGRA6C

Appendix B
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT
PAGE 001
4 OCT 1989

```

MEMBER NAME REB6DOF

REB6DOF: PROCEDURE OPTIONS (MAIN);
/* *****
-----> TMAGRA6B FEBRUARY 10, 1987 <-----
-----> TMAGRA6B APRIL 10, 1987 <-----

CHANGES MADE TO INCLUDE AERODYNAMICS FOR 360 DEG ROTATION.
      DECEMBER, 1986 JTS
      APRIL 10, 1987 JKKR
CHANGES MADE TO INCLUDE ABLATION EFFECTS
      JANUARY, 1989 RCS
*****
/* SIX DEGREES OF FREEDOM REENTRY BODY TRAJECTORY PROGRAM--CARD INPUT */

      PLTPTS=0;
      PLTCNT=0;
      DEL = 3.6361025E-4;
      ZETA1 = 1.E-7;
      RG = 1. / G0;
      DEG = 57.2957795;
      ASQ=A**2;
      BSQ=B**2;
      NCASE = 0; /* CASE BEGINS */
      #68: PUT PAGE LIST ('6DOF REENTRY PROGRAM');
      NCASE = NCASE + 1; /*
      NCOUNT = 0;
      IPRINT = 0;
      IPLOT = 0;
      NS = 1;
      KT = 2;
      NF = 1;
      PUT EDIT (#46_001,NCASE)(R(#46));
      CALL INPUT;
      YNST=0; Y:TH=0;
      ACTIND=0;
      IF VIXY = 0 & VIXZ = 0 & VIYZ = 0 THEN NVIP=0;
      ELSE NVIP=1;
      ***** ABLATION EFFECTS ON CONFIGURATION *****
      IF H5 >= H0 THEN ABLF = 0;
      ELSE IF H<= H5 THEN ABLF = 1;
      ELSE ABLF = (H0-H)/(H0-H5);
      WGTZ=WGT1+(WGT2-WGT1)*ABLF;
      VIX=VIX1+(VIX2-VIX1)*ABLF;
      VIY=VIY1+(VIY2-VIY1)*ABLF;
      VIZ=VIZ1+(VIZ2-VIZ1)*ABLF;
      XCG=XCG1+(XCG2-XCG1)*ABLF;
      *****
      DELTAY=YCG1; DELTAZ=ZCG1;
      D=DREF1; S=SREF1;
      COE(1,1) = VIX;
      COE(2,1) = - VIXY;

```

MEMBER NAME REB4DOF (CONT) LISTING OF BFD.SHARB.IMAGRA6C.SOURCE.PRNT

```

COE(3,1) = - VIXZ;
COE(1,2) = - VIXY;
COE(2,2) = VIY;
COE(3,2) = - VIYZ;
COE(1,3) = - VIXZ;
COE(2,3) = - VIYZ;
COE(3,3) = VIZ;
SAVE1 = B * SINLO;
SAVE2 = A * COSLO;
U=ATAN(SAVE1,SAVE2);
COSU = COS ( U ) ;
SINU = SIN ( U ) ;
SAVE3 = A * COSU + HO * COSLO;
XO = SAVE3 * COSLMO;
YO = SAVE3 * SINLMO;
ZO = B * SINU + HO * SINLO;
SAVE4 = VLO * CGMLO;
VXLO = SAVE4 * CAZLO;
VYLO = SAVE4 * SAZLO;
VZLO = - VLO * SGML0;
SAVE5 = Sqrt ( XO * XO + YO * YO ) ;
XDOT0 = - VXLO * SINLO * COSLMO - VYLO * SINLMO - VZLO *
COSLO * COSLMO - OMEGAE * SAVE5 * SINLMO;
YDOT0 = - VXLO * SINLO * SINLMO + VYLO * COSLMO - VZLO *
COSLO * SINLMO + OMEGAE * SAVE5 * COSLMO;
ZDOT0 = VXLO * COSLO - VZLO * SINLO;
TOP = VYLO + OMEGAE * SAVE5;
AZO=ATAN(TOP,VXLO);
SINAZO = SIN ( AZO ) ;
COSAZO = COS ( AZO ) ;
TR2K(1,1) = COSLO * COSLMO;
TR2K(1,2) = COSLO * SINLMO;
TR2K(1,3) = SINLO;
TR2K(2,1) = SINLO * COSLMO * SINAZO - SINLMO * COSAZO;
TR2K(2,2) = SINLO * SINLMO * SINAZO + COSLMO * COSAZO;
TR2K(2,3) = - COSLO * SINAZO;
TR2K(3,1) = - SINLO * COSLMO * COSAZO - SINLMO * SINAZO;
TR2K(3,2) = - SINLO * SINLMO * COSAZO + COSLMO * SINAZO;
TR2K(3,3) = COSLO * COSAZO;
TK2R(1,1) = TR2K(1,1) ;
TK2R(1,2) = TR2K(2,1) ;
TK2R(1,3) = TR2K(3,1) ;
TK2R(2,1) = TR2K(1,2) ;
TK2R(2,2) = TR2K(2,2) ;
TK2R(2,3) = TR2K(3,2) ;
TK2R(3,1) = TR2K(1,3) ;
TK2R(3,2) = TR2K(2,3) ;
TK2R(3,3)=TR2K(3,3);
KOUNT6 = LEE - 1;
KOUNT5 = 44;
NPT = T0;

```

/*
*****INITIAL SETUP FOLLOWS
*****DIFFERENTIAL EQN SPECIFICATION AND CALLING SEQ.
NUMACT = 3;
*/

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMACRA6C.SOURCE.PRNT

```

/*
*****ACCURACY TESTS ON Q R TR2M11, 2,2 AND 3,3
NACTVR(1) = 10;
NACTVR(2) = 14;
NACTVR(3) = 18;
DTMIN = .0001;
DTNMNL = .0001;
NPAGE=0;
T = TO;
YNST(4,1)=0;
YNST(5,1)=0;
YNST(6,1)=0;
YNST(7,1)=WYMO;
YNST(8,1)=WYMO;
YNST(9,1)=WZMO;
YNST(1,1)=XDOT0;
YNST(2,1)=YDOT0;
YNST(3,1)=ZDOT0;
DO J=1 TO 3;
DO I=1 TO 3;
YNST(6+I+3*J,1)=TR2MO(I,J);
END #1040;
NDEQEX=0;
/* RSTART */

```

#1040:

```

ADMKLL = 0.0;
STGATE = 1.0;
MSTIDX = 1;
DELIAT = DTNMNL;
INSDBL = 2;
ADMKLL = 0.05 * ADMKUL;
/*
XDOT=YNST(1,1);
YDOT=YNST(2,1);
ZDOT=YNST(3,1);
SXD=YNST(4,1);
SYD=YNST(5,1);
SZD=YNST(6,1);
X=SYD+X0;
Y=SYD+Y0;
Z=SZD+Z0;
WYN=YNST(7,1);
WYM=YNST(8,1);
WZN=YNST(9,1);
TR2M(1,1)=YNST(10,1);
TR2M(2,1)=YNST(11,1);
TR2M(3,1)=YNST(12,1);
TR2M(1,2)=YNST(13,1);
TR2M(2,2)=YNST(14,1);
TR2M(3,2)=YNST(15,1);
TR2M(1,3)=YNST(16,1);
TR2M(2,3)=YNST(17,1);
TR2M(3,3)=YNST(18,1);
CALL MATSMO (TR2M);
/*

```

#202:

```

/*
XDOT=YNST(1,1);
YDOT=YNST(2,1);
ZDOT=YNST(3,1);
SXD=YNST(4,1);
SYD=YNST(5,1);
SZD=YNST(6,1);
X=SYD+X0;
Y=SYD+Y0;
Z=SZD+Z0;
WYN=YNST(7,1);
WYM=YNST(8,1);
WZN=YNST(9,1);
TR2M(1,1)=YNST(10,1);
TR2M(2,1)=YNST(11,1);
TR2M(3,1)=YNST(12,1);
TR2M(1,2)=YNST(13,1);
TR2M(2,2)=YNST(14,1);
TR2M(3,2)=YNST(15,1);
TR2M(1,3)=YNST(16,1);
TR2M(2,3)=YNST(17,1);
TR2M(3,3)=YNST(18,1);
CALL MATSMO (TR2M);
/*

```

MEMBER NAME REB6DOF (CONT)
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

*/

***** ITERATION FOR DELTA

XSQ = X * X;
YSQ = Y * Y;
ZSQ = Z * Z;
RPRSQ = XSQ + YSQ + ZSQ;
RPR = SQR (RPRSQ);
COM1 = SQR (XSQ + YSQ);
THETA=ATAN(Z,COM1);

DEL=SIGN(THETA)*ABS(DEL);
DELTAN = THETA - DEL;
KOUNT1 = 0;

#98: KOUNT1 = KOUNT1 + 1;

IF 15 - KOUNT1 >= 0 THEN GO TO #107; ELSE GO TO #105;
PUT SKIP(2) LIST (' GEOCLAT DID NOT CONVERGE ');
PUT SKIP DATA (DEN,DELTA,KOUNT1,RE,FL);
GO TO #68; */

#105:

/*

#107: GO TO #300;

SAVE3 = SIN (DELTAN);
TAG1 = COS (DELTAN);
RECIP = SQR (ASQ * SAVE3 **2 + BSQ * TAG1 **2);
RE = (A * B) / RECIP;
SAVE4 = ASQ * SAVE3;
SAVE5 = BSQ * TAG1;
FL=ATAN(SAVE4,SAVE5);

DELTA = FL - (RPR / RE) * (FL - THETA);
ZETA = ABS (DELTA - DELTAN);

IF ZETA - ZETA1 <= 0 THEN GO TO #113; ELSE GO TO #109;
DEN = DELTAN;
DELTAN = DELTA;
GO TO #98;

#109:

COSDEL = COS (DELTA);
SINDEL = SIN (DELTA);
SAVE6 = ASQ * SINDEL;
SAVE7 = BSQ * COSDEL;
FL=ATAN(SAVE6,SAVE7);

#113:

IF RPR <= RE THEN H_SAVE = H;
IF -FIRSTIM THEN H_SAVE = H;
ELSE H=SQR(ABS(RPR**2+RE**2-2*RPR*RE*COS(THETA-DELTA)));
IF FIRSTIM THEN H_SAVE = H;

HSINGL = H;

H1(1) = H1(2);
H1(2) = H1(3);
H1(3) = H;
T1(1) = T1(2);
T1(2) = T1(3);
T1(3) = T;

IF H < 0 & NS = 1 THEN GO TO #84;
FLAM=ATAN(Y,X);
FLAME = FLAM - OMEGAE * (T - T0);
VE = OMEGAE * COM1;

#118:

#1030:

#1032: IF FLAG13 = 0 THEN DLTY=DELTAY;
ELSE DLTY=DELTAY*PI*FREQ(HSINGL,YCGVAR,INT13);
IF FLAG14 = 0 THEN DLTZ=DELTAZ;
ELSE DLTZ=DELTAZ*PI*FREQ(HSINGL,ZCGVAR,INT14);

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRNT

```

/* REB WEIGHT MODIFICATION, IF SELECTED */
WGTO=WTZ-PIFREB(HSINGL,DWGT_I,INT_10);
IF FLAG7 =0 THEN WGTO=WTZ*PIFREB(HSINGL,WTVAR,INT3);
RMASS = GO / WGTO;

```

```

/* *****WINDS */

```

```

IF FLAG3 = 0 THEN GO TO #124;
VLW=PIFREB(HSINGL,VLWS,INT1);
AZL=PIFAZL(HSINGL,WAZL,INT1);
WAZL1 = AZL * RAD;
COM1 = - ABS ( VLW ) ;
VXLWS = COM1 * COS ( WAZL1 ) ;
VYLWS = COM1 * SIN ( WAZL1 ) ;
VZLWS = 0.0;

```

#124:

```

SINL = SIN ( FL ) ;
COSL = COS ( FL ) ;
SINLAM = SIN ( FLAM ) ;
COSLAM = COS ( FLAM ) ;
TR2L(1,1) = - SINL * COSLAM;
TR2L(2,1) = - SINLAM;
TR2L(3,1) = - COSL * COSLAM;
TR2L(1,2) = - SINL * SINLAM;
TR2L(2,2) = COSLAM;
TR2L(3,2) = - COSL * SINLAM;
TR2L(1,3) = COSL;
TR2L(2,3) = 0.0;
TR2L(3,3) = - SINL;
TM2R(1,1) = TR2M(1,1);
TM2R(1,2) = TR2M(2,1);
TM2R(1,3) = TR2M(3,1);
TM2R(2,1) = TR2M(1,2);
TM2R(2,2) = TR2M(2,2);
TM2R(2,3) = TR2M(3,2);
TM2R(3,1) = TR2M(1,3);
TM2R(3,2) = TR2M(2,3);
TM2R(3,3) = TR2M(3,3);

```

/* COMPUTATION OF VELOCITY IN M-FRAME

```

TL2R(1,1) = TR2L(1,1);
TL2R(2,1) = TR2L(1,2);
TL2R(3,1) = TR2L(1,3);
TL2R(1,2) = TR2L(2,1);
TL2R(2,2) = TR2L(2,2);
TL2R(3,2) = TR2L(2,3);
TL2R(1,3) = TR2L(3,1);
TL2R(2,3) = TR2L(3,2);
TL2R(3,3) = TR2L(3,3);

```

```

/* *****WIND COMPONENTS TRANSFORMED FROM L-FRAME TO R-FRAME */
COM1 = VYLWS + VE;
WINDX = TL2R(1,1) * VXLWS + TL2R(1,2) * COM1 + TL2R(1,3) * VZLWS;
WINDY = TL2R(2,1) * VXLWS + TL2R(2,2) * COM1 + TL2R(2,3) * VZLWS;
WINDZ = TL2R(3,1) * VXLWS + TL2R(3,2) * COM1 + TL2R(3,3) * VZLWS;

```

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

/*
*****WIND COMPONENTS SUBTRACTED FROM R-FRAME VELOCITY COMPONENTS */
D1 = XDOT - WINDX;
D2 = YDOT - WINDY;
D3 = ZDOT - WINDZ;

/*
*****VELOCITY COMPONENTS OF MISSILE IN M - FRAME */
UPRIME=TR2M(1,1)*D1+TR2M(1,2)*D2+TR2M(1,3)*D3;
VPRIME=TR2M(2,1)*D1+TR2M(2,2)*D2+TR2M(2,3)*D3;
WPRIME=TR2M(3,1)*D1+TR2M(3,2)*D2+TR2M(3,3)*D3;
IF -FIRSTIM THEN DO;
  V_SAVE = VCGAIR;
  A_SAVE = ALPDEG;
END;
VCGAIR = SQRT ( UPRIME * UPRIME + VPRIME * VPRIME + WPRIME
* WPRIME );
VNUM = SQRT ( VPRIME * VPRIME + WPRIME * WPRIME );
/* CHANGES FOR 360 DEG ROTATION *****
ALPBAR = ACOS(UPRIME/VCGAIR) * (1 - 2*(WPRIME < 0.0));
/* ADDITIONAL CHANGES FOR 360 DEG ROTATION 4/9/87 */
IF ((VPRIME = 0.0) & (WPRIME = 0.0))
  THEN PHI = 1.5708;
ELSE PHI = ATAN(VPRIME, WPRIME);
PHIDEG = PHI * DEG; /* END 360 DEG CHANGES */
PHIDEG = ALPBAR * DEG;
ALPDEG = ALPBAR * DEG;
IF (WPRIME < 0.0) THEN DO;
  IF (PHIDEG >= 0.0) THEN
    PHIDEG = PHIDEG - 180.;
  ELSE PHIDEG = PHIDEG + 180.;
  /* END CHANGES 4/9/87 */
END;
IF FIRSTIM THEN DO;
  V_SAVE = VCGAIR;
  A_SAVE = ALPDEG;
END;
/* CHANGES FOR 360 DEG ROTATION *****
IF ((WPRIME = 0.0) & (UPRIME = 0.0))
  THEN ALFA = 0.0;
ELSE ALFA = ATAN(WPRIME, UPRIME);
IF ((VPRIME = 0.0) & (UPRIME = 0.0))
  THEN BETA = 0.0;
ELSE BETA = ATAN(VPRIME, UPRIME); /* END 360 DEG CHANGES */
CALL ATMOS (HSINGL,NATMOS,HB,TMB,GLMB,RHOB,RHO,V SOUND,
VCGAIR);

/*
DENSITY VARIATION
IF FLAG10 ^= 0 THEN RHO=RHO*PIFEB(HSINGL,RHOFCT,INT5);
#460: QBAR = 0.5 * RHO * VCGAIR * VCGAIR;
FMACH=VCGAIR/V SOUND;
/* CHANGES FOR 360 DEG ROTATION *****
CALL AERO(HSINGL,ALPDEG,FMACH,PHIDEG,CN,CA,CLN,CLMQ,
CLLP,CNZERO,CNZERO,CLZERO,CNPBETA,CMOOP,CLL,
CLNR,CY,CLM );
/*****
IF VNUM <= 0 THEN GO TO #1027 ; ELSE GO TO #1028;
#1027: FYAERO = 0.;

```

LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRNT

MEMBER NAME REB6DOF (CONT)

```

FZAERO = 0.;
GO TO #1029;
/* CHANGES FOR 360 DEG ROTATION
FZAERO = CY * QBAR * S;
FZAERO = -CN * QBAR * S; /* END OF 360 DEG CHANGES */
#1029:
FZAERO = -CA * QBAR * S;

```

/* ***** WHERE,CY,CN AND CA INCLUDE DCXA-SEE AERO SUBROUTINE***** */

```

FNMAG=QBAR*S*CNPBETA*D*WXM/VCGAIR;
FYAERO=FYAERO+FNMAG*ALFA;
FZAERO=FZAERO-FNMAG*BETA;

```

```

/* *****GRAVITY ***** */
RCU = RPRSQ * RPR;
RQU = RCU * RPR;
ZQU = ZSQ * ZSQ;
COM1 = ALP0 / RCU;
COM2 = ALP2 / RPRSQ;
COM3 = ZSQ / RPRSQ;
COM4 = ZQU / RQU;
COM5 = ALP4 / RQU;
COM6 = 5. * COM3 - 1.;
COM7 = COM5 * ( 63. * COM4 - 42. * COM3 + 3. ) ;
GXR = X * COM1 * ( 1. + COM2 * COM6 + COM7 ) ;
GYR = Y * COM1 * ( 1. + COM2 * COM6 + COM7 ) ;
GZR = Z * COM1 * ( 1. + COM2 * ( COM6 - 2. ) + COM5 *
( 63. * COM4 - 70. * COM3 + 15. ) ) ;

```

```

/* *****ACCELERATION IN R-FRAME ***** */
COM2 = FZAERO;
X2DOT = RMAS * ( FYAERO * TM2R(1,1) + FYAERO * TM2R(1,
2) + COM2 * TM2R(1,3) ) + GXR;
Y2DOT = RMAS * ( FYAERO * TM2R(2,1) + FYAERO * TM2R(2,
2) + COM2 * TM2R(2,3) ) + GYR;
Z2DOT = RMAS * ( FYAERO * TM2R(3,1) + FYAERO * TM2R(3,
2) + COM2 * TM2R(3,3) ) + GZR;
/* CHANGES FOR 360 DEG ROTATION ***** */
IF (CN = 0.0) THEN VLPFT = D;
ELSE VLPFT = (CLM / CN) * D;

```

```

ELXARO=CLZERO*QBAR*S*D;
/* CHANGES FOR 360 DEG ROTATION ***** */
ELXALP=CLL*QBAR*S*D; /* ADDED 8/18/82 FOR J. HAGAN */
/* ***** */
ELYARO = VLPFT * FNMAG * BETA + CLM * QBAR * S * D;
ELZARO = VLPFT * FNMAG * ALFA + CLN * QBAR * S * D;

```

/* WHERE CLL,CLM, AND CLN INCLUDE DCXA- SEE AERO SUBROUTINE ***** */

```

SAVE1=QBAR*S*D/VCGAIR;
VMQ = SAVE1 * CLMQ;

```


MEMBER NAME REB6DOF (CONT)
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

VNR = SAVE1 * CLNR;
ELYARD = VMQ * WYM;
ELZARD = VNR * WZM;
ELXARD = SAVE1 * CLLP * WXM; /* END OF 360 DEG CHANGES */

/* WHERE CLLP INCLUDES EFFECT OF REDUCED AREA - SEE AERO SUBROUTINE */

ELXASM = - FZAERO * DLTZ + FYAERO * DLTZ;
ELYASM=CMZERO*QBAR*S*D-FXAERO*DLTZ;
ELZASM=CNZERO*QBAR*S*D+FXAERO*DLTY;
ELMAG=FNAG*(XCG-XMAG)/FT2IN;
ELYMAG=ELMAG*BETA;
ELZMAG=ELMAG*ALFA;
EL = ELXARO + ELXARD + ELXASM + ELXALP;
EM=ELYARO+ELYARD+ELYASM+ELYMAG;
EN=ELZARO+ELZARD+ELZASM+ELZMAG;
IF VNUM .NE. 0 THEN DO;
  EM = EM + CMOOP * VPRIME/VNUM;
  EN = EN + CMOOP * WPRIME/VNUM;
END;
PQ=P*Q; RP=R*P; QR=Q*R;
CON(1)=EL+QR*(VIY-VIZ);
CON(2)=EM+RP*(VIZ-VIX);
CON(3)=EN+PQ*(VIX-VIY);

```

```

IF NVIP = 0 THEN DO; PDOT=CON(1)/VIX;
  QDOT=CON(2)/VIY;
  RDOT=CON(3)/VIZ;
  GO TO #1013;
END;

```

```

PSQ=P*P; QSQ=Q*Q; RSQ=R*R;
CON(1)=CON(1)+PQ*VIXZ+(QSQ-RSQ)*VIYZ-RP*VIXY;
CON(2)=CON(2)-PQ*VIYZ+(RSQ-PSQ)*VIXZ+QR*VIXY;
CON(3)=CON(3)-QR*VIXZ+(PSQ-QSQ)*VIYZ+RP*VIXY;
CALL SOLVE (COE,CON,PDOT,QDOT,RDOT);

```

#1013:

```

/*
*****DIRECTION COSINES TO GENERATE TR2M
TDR2M(1,1) = WZM * TR2M(2,1)
TDR2M(2,1) = WXM * TR2M(3,1)
TDR2M(3,1) = WYM * TR2M(1,1)
TDR2M(1,2) = WZM * TR2M(2,2)
TDR2M(2,2) = WXM * TR2M(3,2)
TDR2M(3,2) = WYM * TR2M(1,2)
TDR2M(1,3) = WZM * TR2M(2,3)
TDR2M(2,3) = WXM * TR2M(3,3)
TDR2M(3,3) = WYM * TR2M(1,3)
YNST(1,2)=X2DOT;
YNST(2,2)=Y2DOT;
YNST(3,2)=Z2DOT;
YNST(4,2)=XDOT;
YNST(5,2)=YDOT;
YNST(6,2)=ZDOT;
YNST(7,2)=PDOT;
*/

```

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

YNST(8,2)=QDOT;
YNST(9,2)=RDOT;
YNST(10,2)=TDR2M(1,1);
YNST(11,2)=TDR2M(2,1);
YNST(12,2)=TDR2M(3,1);
YNST(13,2)=TDR2M(1,2);
YNST(14,2)=TDR2M(2,2);
YNST(15,2)=TDR2M(3,2);
YNST(16,2)=TDR2M(1,3);
YNST(17,2)=TDR2M(2,3);
YNST(18,2)=TDR2M(3,3);
/*
  BkW
*/
#1051: DO K=3 TO 5;
      YNST(*,K)=YNST(*,K-1)-YNTH(*,K-1);
    END #1051;
      IF NDEQEX == 0 THEN GO TO #325;
      IF STGATE == 0 THEN GO TO #6;
/*
  ACT
*/
#1050: DO I=1 TO NUMACT;
      J = NACTVR(I);
      YSTAR = ABS ( YNST(J,1) );
      IF YSTAR < .000017 THEN YSTAR=.000017;
      ACTIND(I)=ABS(DELTA*YNST(J,5))/YSTAR;
    END #1050;
      HAVGTE=0;
      IF DELTA <= DTMIN THEN GO TO #11;
/*
  HAV
*/
#9: DO I=1 TO NUMACT;
      IF ACTIND(I) > ADMKUL THEN GO TO #10;
    END #9;
      HAVGTE = 0.0;
      GO TO #11;
      DELTA=DELTA/2;
      HAVGTE = 1.0;
      YNTH(*,3)=YNTH(*,3)/2.+YNTH(*,4)/8.+YNTH(*,5)/16.;
      YNTH(*,4)=YNTH(*,4)/4.+YNTH(*,5)/8.;
      YNTH(*,5)=YNTH(*,5)/8.;
      IF HAVGTE == 0 THEN GO TO #18;
      IF T < TF THEN GO TO #82;
      DTNEW=TF-T1(2);
      GO TO #86;
      IF H > HF THEN GO TO #325;
      CALL PAR (H1,T1,HF,TCRIT);
      DTNEW=TCRIT-T1(2);
      NS=2;
      NDEQEX=1; KT=2;
/*
  MODIFY
*/
      RA=DTNEW/DELTA;
      DELTA=DTNEW;
      RASQ=RA*RA; RAM=RA-1; RRAM=RA*RAM;
/*
  * CHANGES FOR 360 DEG ROTATION (ACTUALLY, CORRECTION OF AN ERROR */
      YNTH(*,3)=RA*YNTH(*,3)-RRAM*(YNTH(*,4)/2 -(RA-2)*YNTH(*,5)/6);
/*
  ***** END OF 360 DEG CHANGES */
      YNTH(*,4)=RASQ*(YNTH(*,4)-RAM*YNTH(*,5));
      YNTH(*,5)=RASQ*RA*YNTH(*,5);

```

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

```

#16:      GO TO #18;
/*      TRS
PASTT=T;
/*      YNTH=YNST;
/*      DBL
/*      IF STGATE >= 1. THEN GO TO #5;
/*      IF DELTAT >= DTMAX THEN GO TO #5;
#7:      DO I=1 TO NUMACT;
/*      IF ACTIND(I) >= ADMKLL THEN GO TO #5;
END #7;
/*      IF INSDBL >= 2 THEN GO TO #8;
/*      INSDBL=2;
/*      INSDBL=0;
/*      DELTAT=2.*DELTAT;
/*      YNTH(*,3)=2.*YNTH(*,3)- YNTH(*,4);
/*      YNTH(*,4)=4.*YNTH(*,4)-4.*YNTH(*,5);
/*      YNTH(*,5)=8.*YNTH(*,5);
/*      ADM
/*      T=PASTT+DELTAT;
/*      TEMP4=ADMCF3*YNTH(*,5);
/*      TEMP5=ADMCF2*YNTH(*,4);
/*      TEMP4=TEMP4+TEMP5;
/*      TEMP5=ADMCF1*YNTH(*,3);
/*      TEMP4=TEMP4+TEMP5+YNTH(*,2);
/*      YNST(*,1)=YNTH(*,1)+DELTAT*TEMP4;

#5:
#18:

#6:      GO TO #202;
/*      BEG
/*      PLNM_01( 1) = #1 ; PLNM_01( 2) = #2 ; PLNM_01( 3) = #3 ;
/*      PLNM_01( 4) = #4 ; GO TO PLNM_01(MSTIDX);
#1:      ADMCF1 = 0.0;
/*      ADMCF2 = 0.0;
/*      ADMCF3 = 0.0;
/*      MSTIDX = 2;
#2:      GO TO #325;
/*      ADMCF1 = 0.5;
/*      MSTIDX = 3;
#3:      GO TO #325;
/*      ADMCF2 = 0.416666667;
/*      MSTIDX = 4;
#4:      GO TO #325;
/*      ADMCF3 = 0.375;
/*      STGATE = 0;
/*
#325:      TIME = T;
/*      *****
/*      DCL FIRSTIM BIT(1) INIT('1'B);
/*      DCL ELEMENT FIXED BIN INIT(1);
/*      DCL H_TABLE (24)FLOAT(6) INIT(4.50E+05,2.40E+05,1.80E+05,1.40E+05,
/*      1.20E+05,1.00E+05,0.90E+05,0.80E+05,
/*      0.75E+05,0.70E+05,0.65E+05,0.60E+05,
/*      0.55E+05,0.50E+05,0.45E+05,0.40E+05,
/*      0.35E+05,0.30E+05,0.25E+05,0.20E+05,
/*      0.15E+05,0.10E+05,0.05E+05,0.00E+05);
/*      *****

```

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

```

0.35E+05,0.30E+05,0.25E+05,0.20E+05,
0.15E+05,0.10E+05,0.05E+05,1.00E+00);
DCL (ALPDEC,VDEC,HDEC) FIXED DEC(11,4);
DCL SKERT FILE OUTPUT;
DCL (H_PIC,V_PIC,A_PIC) PIC'999999V9999';
DCL (H_SAVE,V_SAVE,A_SAVE) FLOAT BIN(53);

IF H < H_TABLE(ELEMENT) THEN DO;
  IF (H_SAVE - H_TABLE(ELEMENT) < H_TABLE(ELEMENT) - H) THEN DO;
    ALPDEC = A_SAVE;
    VDEC = V_SAVE;
    HDEC = H_SAVE;
  END;
ELSE DO;
  ALPDEC = ALPDEC;
  VDEC = VCGAIR;
  HDEC = H;
END;
A_PIC = ALPDEC;
V_PIC = VDEC;
H_PIC = HDEC;
IF FIRSTIM THEN PUT SKIP FILE(SKERT) EDIT('24')(COL(4),A);
PUT SKIP FILE(SKERT) EDIT(A_PIC,V_PIC,H_PIC)(COL(1),A,
COL(11),A,COL(21),A);
IF ELEMENT -> 24 THEN ELEMENT = ELEMENT + 1;
END;
FIRSTIM = '0'B;
/*****
IF KT = 2 THEN GO TO #6301;
IF LEE > 0 THEN GO TO #6302;
T = TRUNC ( T );
INFT = T;
IF INFT - NPT >= 0 THEN GO TO #6301 ; ELSE GO TO #6460;
NPT = NPT - LEE;
GO TO #6304;
KOUNT6 = KOUNT6 + 1;
IF KOUNT6 - LEE >= 0 THEN GO TO #6303 ; ELSE GO TO #6460;
KOUNT6 = 0;
;
WRITE ROUTINES
KOUNT5 = KOUNT5 + 1;
IF KOUNT5 < 45 THEN GO TO #6330;
KOUNT5 = 0;
NPAGE = NPAGE + 1;
PUT EDIT (#6990_001,#6990_002, NPAGE,RUN,DATE )
(R(#6990));
PUT EDIT (#6991_001,#6991_002,#6991_003,#6991_004,
#6991_005,#6991_006,#6991_007)(R(#6991));
#6330:
;
/****COMPUTATION OF FLI PATH ANGLE AND AZIMUTH WRT LOCAL
*/
XDOTL = TR2L(1,1) * XDOT + TR2L(1,2) * YDOT + TR2L(1,3)
* ZDOT;
YDOTL = TR2L(2,1) * XDOT + TR2L(2,2) * YDOT + TR2L(2,3)
* ZDOT - VE;

```

MEMBER NAME REB6DOF (CONT)

```

ZDOTL = TR2L(3,1) * XDOT + TR2L(3,2) * YDOT + TR2L(3,3)
* ZDOT;
VL = SQRT ( XDOTL * XDOTL + YDOTL * YDOTL + ZDOTL * ZDOTL
) ;
COM2 = SQRT ( XDOTL * XDOTL + YDOTL * YDOTL ) ;
GAMMAL=ATAN(-ZDOTL/COM2);
GAMDEG = GAMMAL * DEG;

```

/* *****EARTH REFERENCED DOWN RANGE AND LATERAL DISPERSION. */

```

SINLME = SIN ( FLAME ) ;
COSLME = COS ( FLAME ) ;
TEMPO = RPR * COSL;
TEMP1 = TEMPO * COSLME;
TEMP2 = TEMPO * SINLME;
TEMP3 = RPR * SINL;
XKPR = TR2K(1,1) * TEMP1 + TR2K(1,2) * TEMP2 + TR2K(1,3)
* TEMP3;
YKPR = TR2K(2,1) * TEMP1 + TR2K(2,2) * TEMP2 + TR2K(2,3)
* TEMP3;
ZKPR = TR2K(3,1) * TEMP1 + TR2K(3,2) * TEMP2 + TR2K(3,3)
* TEMP3;

```

ETA=ATAN(ZKPR,XKPR);

RDE=RE*ETA/NM;

RLE=YKPR/NM;

PDEG = P * DEG;

QDEG = Q * DEG;

RDEG = R * DEG;

AXCG = FYAERO / WGT0;

AYCG = FYAERO / WGT0;

AZCG = FZAERO / WGT0;

PSQ=P*P; QSQ=Q*Q; RSQ=R*R;

E1 = RG * (QSQ + RSQ) ;

E2 = RG * (RDOT - PQ) ;

E3 = RG * (QDOT + RP) ;

E4 = RG * (RSQ + PSQ) ;

E5 = RG * (PDOT - QR) ;

E6 = RG * (RDOT + PQ) ;

E7 = RG * (PSQ - QSQ) ;

E8 = RG * (QDOT - RP) ;

E9 = RG * (PDOT + QR) ;

AX3 = AXCG - E1 * X3FT - E2 * Y3FT + E3 * Z3FT;

AY1 = AYCG + E6 * X1FT - E4 * Y1FT - E5 * Z1FT;

AZ2 = AZCG - E8 * X2FT + E9 * Y2FT - E7 * Z2FT;

/* CHANGES 4/9/87 */

IF (ABS(PHIDEGA) > 90.) THEN

ALPDEG = -1. * ALPDEG;

/* END CHANGES 4/9/87 */

```

PUT EDIT (T, AX3, AY1, AZ2, ALPDEG, PDEG, QDEG, RDEG,
FMACH, VCGAIR, QBAR, GAMDEG, H, RDE, RLE) (R(#6981));
IPRINT = IPRINT +1;

```

IF(PLTPTS=0) THEN GO TO NOPLOT;
PLTCNT=PLTCNT+1;

```

IF (MOD(PLICNT,PLIPTS)=0) THEN DO;
  PUT FILE(PLTOUT) EDIT (T, AX3, AY1, AZ2, ALPDEG, PDEG, QDEG,
  RDEG, FMACH, VCGAIR, QBAR, GAMDEG, H, RDE, RLE) (R(#6981));
  IPLOT = IPLOT + 1;
END;

NOPLOT:

#6460:
  KT = 1;
  T = TIME;
  NCOUNT = NCOUNT + 1;
  IF NDEQEX = 0 THEN GO TO #16;
  PUT SKIP(2) EDIT (NCOUNT, #7400_001)(F(20), A);
  PUT SKIP(2) EDIT (IPRINT, TIME STEPS PRINTED)(F(20), A);
  PUT SKIP(2) EDIT (IPLOT, TIME STEPS WRITTEN TO PLOT FILE')(F(20), A);

  FLD = FL * DEG;
  FLAMED = FLAME * DEG;
  AZLR=ATAN(YDOTL,XDOTL);
  AZLDEG=AZLR*DEG;
  PUT EDIT (#7401_001,FLD,#7401_002,#7401_003,FLAMED,
  #7401_002)(R(#7401));
  PUT EDIT (#7402_001,AZLDEG,#7402_002)(R(#7402));
  GO TO #68;
  GO TO #300;

/*
#300: STOP;
/*
DCL MOD BUILTIN;
DCL PLIPTS FIXED BIN(31) EXT;
DCL PLICNT FIXED BIN(31);
DECLARE #46_001 CHAR(10) INITIAL (' NCASE = ');
#6981: FORMAT(SKIP,F(8,3),3 F(7,2),F(8,3),F(10,1),2 F(10,2),
F(6,2),F(8,1),F(10,2),F(9,3),F(8,2),F(11,2));
DECLARE #6990_001 CHAR(51) INITIAL ( 6-DEGREES OF FREEDOM RE-ENTRY B
ODY FLIGHT PROGRAM');
DECLARE #6990_002 CHAR(5) INITIAL (' PAGE');
#6990: FORMAT (PAGE,A(51),X(69),A(5),F(3),SKIP,A(68),X(48),
A(12));
DECLARE #6991_001 CHAR(128) INITIAL (' T AX3 AY1 AZ2 A
LPHA P Q R M VCGAIR Q BAR GAMMA L
H EARTH EARTH');
DECLARE #6991_002 CHAR(128) INITIAL (' TIME X-ACC Y-ACC Z-ACC TO
T ANG ROLL PITCH
ODETIC REF DN REF LAT');
DECLARE #6991_003 CHAR(128) INITIAL (' SEC NO.3 NO.1 NO.2 AT
TACK RATE RATE RATE NUMBER SPEED PRESSURE FLT PATH AL
TITUDE RANGE DISP');
DECLARE #6991_004 CHAR(56) INITIAL ('GEES GEES GEES DEG/
SEC DEG/SEC DEG/SEC);
DECLARE #6991_005 CHAR(32) INITIAL ('FT/SEC LB/SQ-FT ANG-DEG
FT');
DECLARE #6991_006 CHAR(2) INITIAL ('NM');
DECLARE #6991_007 CHAR(2) INITIAL ('NM');

```

MEMBER NAME REB6DOF (CONT)
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```
#6991:  FORMAT(SKIP(2),A(128),SKIP,A(128),SKIP,A(128),SKIP,X(11),
        A(56),X(7),A(32),X(7),A(2),X(10),A(2));
DECLARE #7400_001 CHAR(20) INITIAL (' TIME STEPS COMPUTED');
DECLARE #7401_001 CHAR(32) INITIAL (' FINAL REB GEODETIC LATITUDE =');
);
DECLARE #7401_002 CHAR(4) INITIAL (' DEG');
DECLARE #7401_003 CHAR(21) INITIAL ('EARTH REF LONGITUDE =');
#7401:  FORMAT(SKIP(2),A(32),F(15,7),A(4),SKIP,X(11),A(21),
        F(15,7),A(4));
DECLARE #7402_001 CHAR(15) INITIAL ('AZIMUTH ANGLE =');
DECLARE #7402_002 CHAR(4) INITIAL (' DEG');
#7402:  FORMAT(SKIP,X(17),A(15),F(15,7),A(4));
DECLARE HB(200) FLOAT BINARY EXTERNAL;
DECLARE TMB(200) FLOAT BINARY EXTERNAL;
DECLARE RHOB(200) FLOAT BINARY EXTERNAL;
DECLARE GLMB(200) FLOAT BINARY EXTERNAL;
DECLARE (VLWS(400),WAZL(400)) FLOAT BINARY EXTERNAL;
DECLARE (RHOFCT(100),WTVAR(100),DWGT_I(100)) FLOAT BINARY EXTERNAL;
DCL (YCGVAR(100),ZCGVAR(100)) FLOAT BIN EXT;
DCL (FLAG3,FLAG7,FLAG10,FLAG13,FLAG14) FIXED BIN(31) EXT;
DCL NATMOS FIXED BIN(31) EXT;
DECLARE (A INITIAL (20925738.),B INITIAL (20855588.),
        ALPO INITIAL (-1.4076536E16),ALP2 INITIAL (-7.1088876E11),
        ALP4 INITIAL (2.8393125E23),RAD INITIAL (0.0174532925),
        OMEGAE INITIAL (7.29211585E-5)) FLOAT BINARY(53) EXTERNAL;
DECLARE FT2IN FLOAT BINARY INITIAL(12.) STATIC;
DECLARE G0 FLOAT BINARY INITIAL(32.1741) STATIC;
DCL (LEE,NF) FIXED BIN(31) EXT;
DECLARE X1FT FLOAT BINARY EXTERNAL;
DECLARE Y1FT FLOAT BINARY EXTERNAL;
DECLARE Z1FT FLOAT BINARY EXTERNAL;
DECLARE X2FT FLOAT BINARY EXTERNAL;
DECLARE Y2FT FLOAT BINARY EXTERNAL;
DECLARE Z2FT FLOAT BINARY EXTERNAL;
DECLARE X3FT FLOAT BINARY EXTERNAL;
DECLARE Y3FT FLOAT BINARY EXTERNAL;
DECLARE Z3FT FLOAT BINARY EXTERNAL;
DCL (TR2M0(3,3),T0,H0,VLO,SAZLO,SGMLO,CGMLO) FLOAT BIN(53) EXT;
DECLARE TF FLOAT BINARY EXTERNAL;
DECLARE HF FLOAT BINARY EXTERNAL;
DECLARE ADMKUL FLOAT BINARY EXTERNAL;
DECLARE DTMAX FLOAT BINARY EXTERNAL;
DECLARE WXM0 FLOAT BINARY EXTERNAL;
DECLARE WYMO FLOAT BINARY EXTERNAL;
DECLARE WZMO FLOAT BINARY EXTERNAL;
DECLARE WGT1 FLOAT BINARY EXTERNAL;
DECLARE VIX1 FLOAT BINARY EXTERNAL;
DECLARE VIX2 FLOAT BINARY EXTERNAL;
DECLARE VIX3 FLOAT BINARY EXTERNAL;
DCL (D,S) FLOAT BIN;
DCL (DREF1,DREF2,SREF1,SREF2) FLOAT BIN EXT;
DECLARE XCG1 FLOAT BINARY EXTERNAL;
DECLARE (YCG1,ZCG1,YCG2,ZCG2) FLOAT BINARY EXTERNAL;
DECLARE VIXY FLOAT BINARY EXTERNAL;
DECLARE VIXZ FLOAT BINARY EXTERNAL;
```

MEMBER NAME REB6DOF (CONT) LISTING OF BFD.SHARB.TMACRA6C.SOURCE.PRNT

```

DECLARE V1YZ FLOAT BINARY EXTERNAL;
DCL (DELTAY,DELTAY,DLTZ,DLTZ,CMOOP) FLOAT BIN;
DCL NVIP FIXED BIN(31) STATIC;
/*****ABLATION EFFECTS*****/
DCL (H5,ABLF) FLOAT BIN EXT;
/*****/

DECLARE HBO FLOAT BINARY EXTERNAL;
DECLARE WGT2 FLOAT BINARY EXTERNAL;
DECLARE V1X2 FLOAT BINARY EXTERNAL;
DECLARE V1Y2 FLOAT BINARY EXTERNAL;
DECLARE V1Z2 FLOAT BINARY EXTERNAL;
DECLARE XCG2 FLOAT BINARY EXTERNAL;
DECLARE (SINLO,COSLO,SINLMO,COSLMO) FLOAT BINARY(53) EXTERNAL;
DCL (INT1,INT3,INT5,INT13,INT14,INT10) FIXED BIN(31) EXT;
DCL (DATE CHAR(12),RUN CHAR(68)) VARYING EXTERNAL;
DCL (YNST(18,5),YNTH(18,5)) FLOAT BIN(53);
DCL (P,Q,R) FLOAT BIN;
DCL (WXM DEFINED P,WYM DEFINED Q,WZM DEFINED R) FLOAT BINARY;
DCL (TR2M(3,3),TR2K(3,3),TK2R(3,3)) FLOAT BIN(53);
DCL (VXLO,VYLO,VZLO,XDOT0,YDOT0,ZDOT0,TOPO,AZO,SINAZO,COSAZO,T,VE,SINL,
COSL,SINLAM,COSLAM,ETA,RDE,RLE,XKPR,YKPR,ZKPR,COM6,COM7,SINLME,
COSLME,TEMPO,TEMP1,TEMP2,TEMP3) FLOAT BIN(53);
DCL (TR2L(3,3),TL2R(3,3),TM2R(3,3),H1(3),T1(3),ACTIND(3),
COE(3,3),CON(3),ZETA1,RG,WGTZ,VIX,V1Y,V1Z,XCG,DTMIN,
DTNML,RMASS,ZETA,WGT0,
VLW,AZL,WAZL1,WINDX,WINDY,WINDZ,D1,D2,D3,UPRIME,VPRIME,
VPRIME,VCGAIR,VNUM,ALPBAR,ALPDEG,RHO,V SOUND,
FMACH,QBAR,CN,CA,/* XCP, /* /* CMQ /* GLMQ, FYAERO,
PHI, PHIDEG, CY, CLM, CLN, CLNR,
FZAERO, /* FN, /* FXAERO) FLOAT BINARY STATIC;
/***** END OF CHANGES FOR 360 DEG ROTATION *****/
/***** CHANGES MADE APRIL 8, 1987 */
/* PHIDEGA FLOAT BINARY STATIC;
/* END OF CHANGES MADE APRIL 8, 1987 */
DCL (VXLWS,VYLWS,VZLWS) FLOAT BIN INIT(0);
DCL (XDOT,YDOT,ZDOT) FLOAT BIN (53);
DCL (NDEQX,NACTVR(3),NCASE,NCOUNT,NS,KT,KOUNTG,KOUNT5,NPT,NDEQNS,
NUMACT,NPAGE,KOUNT1,MSTIDX,INSOBL,INFT) FIXED BIN(31) STATIC;
DCL (IPRINT,IPLOT) FIXED BIN(31) STATIC;
DCL (GXR,GYR,GZR,X2DOT,Y2DOT,Z2DOT,
VLCPFT,ELXARO,ELYARO,ELZARO,VMQ,VNR,ELYARD,ELZARD,
/* CLP /* CLLP,
/***** END OF CHANGES FOR 360 DEG ROTATION *****/
ELXALP,
ELXARD,ELXASM,ELYASM,ELZASM,EL,EM,EN,PSQ,QSQ,RSQ, PQ,RP,
QR,PDOT,QDOT,RDOT,STGATE,ADMKLL,
HVGTE,DTNEW,TCRIT,XDOTL,
YDOTL,ZDOTL,VL,GAMMAL,CAMDEG) FLOAT BIN;
DCL (DEL,
RPRSQ,RPR,COM1,THETA,DELTAN,DEN,DELTA,RE,TAGI,RECIP,H,SXD,
SYD,SZD) FLOAT BINARY (53) STATIC;
DCL (AZLDEG,AZLR,CMZERO,CNZERO) FLOAT BINARY STATIC;

```



```

DCL (AX3,AXCG,AY1,AYCG,AZ2,AZCG,E1,E2,E3,E4,E5,E6,E7,E8,E9,PDEG,QDEG,
RDEG) FLOAT BIN;
DECLARE CLZERO FLOAT BINARY STATIC;
/***** CHANGES FOR 360 DEG ROTATION *****/
/* DECLARE CLALF FLOAT BINARY STATIC INIT(0.0); /* 8/18/82 */
DECLARE CLL FLOAT BINARY STATIC INIT(0.0); /* 8/18/82 */
/***** END OF CHANGES FOR 360 DEG ROTATION *****/
DECLARE (FLA,FLAME,FLD,FLAMED,FL) FLOAT BINARY (53) STATIC;
DCL NM FLOAT BIN(53) INIT(6076.1033);
DECLARE (SAVE1,SAVE2,SAVE4,SAVE5,SAVE6,SAVE7) FLOAT BINARY(53) STATIC;
DECLARE DEG FLOAT BINARY (53) INITIAL (57.2957795) STATIC;
DECLARE (COSDEL,SINDEL,U,COSU,SINU) FLOAT BINARY(53) STATIC;
DECLARE (RCU,RQU,ZQU) FLOAT BINARY (53) STATIC;
DECLARE (COM2,COM3,COM4,COM5) FLOAT BINARY (53) STATIC;
DCL (ADMCF1,ADMCF2,ADMCF3) FLOAT BIN(53) EXT;
DECLARE YSTAR FLOAT BIN;
DCL (TEMP4(18),TEMP5(18)) FLOAT BIN(53);
DCL (DELTAT,PASTT,TIME) FLOAT BIN(53);
DCL HSIINGL FLOAT BIN;
DCL (I,J,K) FIXED BIN(31) STATIC;
DECLARE PLNN_01(4) LABEL;
DECLARE (RA,RASQ,RRAM,RRAM) FLOAT BINARY;
DCL CNPBETA FLOAT BIN STATIC;
DCL (FNMAG,ELMAG) FLOAT BIN STATIC;
DCL (ALFA,BETA,ELMAG,ELZMAG) FLOAT BIN STATIC;
DCL XMAG FLOAT BIN EXT;
DCL (ABS,ATAN,COS,ACOS,SIGN,SIN,SQRT,TRUNC)
BUILTIN;
DCL AERO ENTRY(
FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,
/* CHANGES MADE APRIL 9, 1987, SUBTRACT ONE ARGUMENT
FLOAT BIN */ FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,
FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN,
/***** CHANGES FOR 360 DEG ROTATION *****/
FLOAT BIN); /* NINETEENTH ARGUMENT ADDED */
/***** END OF CHANGES FOR 360 DEG ROTATION *****/
DCL ENTERP ENTRY;
DCL INPUT ENTRY;
DCL MATSMO ENTRY ( (*,*)FLOAT BIN(53) );
DCL ATMOS ENTRY(
FLOAT BIN,FIXED BIN(31),(*)FLOAT BIN,(*)FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN);
DCL PAR ENTRY(
(*)FLOAT BIN,(*)FLOAT BIN,FLOAT BIN,FLOAT BIN);
DCL SOLVE ENTRY(
(*,*)FLOAT BIN,(*)FLOAT BIN,FLOAT BIN,FLOAT BIN,FLOAT BIN);
DCL (SYSPRINT) FILE EXT;
DCL (PLTOUT) FILE EXT;
DCL PIFREB ENTRY( FLOAT BIN,(*)FLOAT BIN,FIXED BIN(31) )
RETURNS(FLOAT BIN);
DCL PIFAZL ENTRY( FLOAT BIN,(*)FLOAT BIN,FIXED BIN(31))
RETURNS(FLOAT BIN);

```

END REB6DOF;

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

MEMBER NAME AERO

AERO: PROCEDURE(H,ALFA_BAR,FMACH,PHI,CN,CA,CLN,CLMQ,CLLP,CMZERO,
CNZERO,CLZERO,CNPBETA,CMOOP,CLL,CLNR,CY,CLM);
00000020
00000030
00000040
00001080
00001110

RE = RE_LL * DREF1; /* REYNOLDS # BASED ON VEHICLE DIAM (FT) */
KN = (1.48 * FMACH)/RE;

/***** ABLATION INCREMENTAL EFFECTS 1/ 189 *****/

DCAA=NTDCAA(FMACH,PHI,ALFA_BAR,M24A,PHI24A,ALF24A,
DCA_A,INT1A,INT2A,AS12A);
/* PUT SKIP(2) EDIT(DCAA)(F(8,4)); */

DCNA=NTDCNA(FMACH,PHI,ALFA_BAR,M25A,PHI25A,ALF25A,
DCN_A,INT3A,INT4A,AS34A);
/* PUT SKIP(2) EDIT(DCNA)(F(8,4)); */

DCLMA=NTDCLMA(FMACH,PHI,ALFA_BAR,M26A,PHI26A,ALF26A,
DCLM_A,INT5A,INT6A,AS56A);
/* PUT SKIP(2) EDIT(DCLMA)(F(8,4)); */

DCYA=NTDCYA(FMACH,PHI,ALFA_BAR,M27A,PHI27A,ALF27A,
DCY_A,INT7A,INT8A,AS78A);
/* PUT SKIP(2) EDIT(DCYA)(F(8,4)); */

DCLNA=NTDCLNA(FMACH,PHI,ALFA_BAR,M28A,PHI28A,ALF28A,
DCLN_A,INT9A,INT10A,AS910A);
/* PUT SKIP(2) EDIT(DCLNA)(F(8,4)); */

DCLLA=NTDCLLA(FMACH,PHI,ALFA_BAR,M29A,PHI29A,ALF29A,
DCLL_A,INT11A,INT12A,AS1112A);
/* PUT SKIP(2) EDIT(DCLLA)(F(8,4)); */

/***** END ABLATION MODIFICATIONS *****/

CA_C=NTRPCA3(FMACH,PHI,ALFA_BAR,M_LC1,PHI_LC1,ALF_LC1,CA_LC,
INT_1,INT_2,AS12); /* MOD: 5/13/85 */
/* PUT SKIP(2) EDIT(CA_C)(F(8,4)); */

CN_C=NTRPCN3(FMACH,PHI,ALFA_BAR,M_LC2,PHI_LC2,ALF_LC2,CN_LC,
INT_3,INT_4,AS34); /* MOD: 5/13/85 */
/* PUT SKIP(2) EDIT(CN_C)(F(8,4)); */

CLN_C=NTRCLN3(FMACH,PHI,ALFA_BAR,M_LC3,PHI_LC3,ALF_LC3,CLN_LC,
INT_13,INT_14,AS1314); /* MOD: 12/16/86 */
/* PUT SKIP(2) EDIT(CLN_C)(F(8,4)); */

CLMQ_C=NTRCMQ3(FMACH,PHI,ALFA_BAR,M_LC4,PHI_LC4,ALF_LC4,CLMQ_LC,
INT_15,INT_16,AS1516); /* MOD: 5/13/85 */
/* PUT SKIP(2) EDIT(CLMQ_C)(F(8,4)); */

CLLP_C=NTRCLP3(FMACH,PHI,ALFA_BAR,M_LC5,PHI_LC5,ALF_LC5,CLLP_LC,
INT_23,INT_23A,AS23); /* MOD: 12/16/86 */
/* PUT SKIP(2) EDIT(CLLP_C)(F(8,4)); */

MEMBER NAME AERO (CONT) LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRNT PAGE 018
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```

CLNR_C=NTRCN3(FMACH,PHI,ALFA_BAR,M_LC6,PHI_LC6,ALF_LC6,CLNR_LC,00001570
INT_26,INT_27,AS2627); /* MOD: 12/16/86 */ 00001573
/* PUT SKIP(2) EDIT(CLNR_C)(F(8,4)); */ 00001576

CY_C=NTRPCY3(FMACH,PHI,ALFA_BAR,M_LC7,PHI_LC7,ALF_LC7,CY_LC,00001578
INT_28,INT_29,AS2829); /* MOD: 12/16/86 */ 00001579
/* PUT SKIP(2) EDIT(CY_C)(F(8,4)); */ 00001580

CLM_C=NTRCLM3(FMACH,PHI,ALFA_BAR,M_LC8,PHI_LC8,ALF_LC8,CLM_LC,00001581
INT_6,INT_6A,AS6); /* MOD: 12/16/86 */ 00001582
/* PUT SKIP(2) EDIT(CLM_C)(F(8,4)); */ 00001583

CLL_C=NTRCLL3(FMACH,PHI,ALFA_BAR,M_LC9,PHI_LC9,ALF_LC9,CLL_LC,00001584
INT_17,INT_18,AS1718); /* MOD: 12/16/86 */ 00001585
/* PUT SKIP(2) EDIT(CLL_C)(F(8,4)); */ 00001586

/***** ABLATION FACTOR *****/
;IF H5>=H0 THEN ABLF=0;
ELSE IF H<=H5 THEN ABLF=1;
ELSE ABLF=(H0-H)/(H0-H5);

```

```

IF KN > .01 THEN DO; /* BRIDGING EQUATIONS FOR RAREFIED FLOW */ 00001600
KNFA = ((KN-0.01)/(KN+1)); 00001610
/* MODIFICATIONS 4/8/87 */

```

```

CAFM = NTRCAFM(FMACH,PHI,ALFA_BAR,M_FM1,PHI_FM1,ALF_FM1,CA_FM,
INT_F1,INT_F2,INT_F3); /* MOD: 4/8/87 */
CLFM = NTRCNFM(FMACH,PHI,ALFA_BAR,M_FM2,PHI_FM2,ALF_FM2,CN_FM,
INT_F4,INT_F5,INT_F6); /* MOD: 4/8/87 */
CLMFM = NTRCLMFM(FMACH,PHI,ALFA_BAR,M_FM3,PHI_FM3,ALF_FM3,CLM_FM,
INT_F7,INT_F8,INT_F9); /* MOD: 4/8/87 */
CYFM = NTRCYFM(FMACH,PHI,ALFA_BAR,M_FM4,PHI_FM4,ALF_FM4,CY_FM,
INT_F10,INT_F11,INT_F12); /* MOD: 4/8/87 */
CLNFM = NTRCLNFM(FMACH,PHI,ALFA_BAR,M_FM5,PHI_FM5,ALF_FM5,CLN_FM,
INT_F13,INT_F14,INT_F15); /* MOD: 4/8/87 */

```

```

CA = CA_C + KNFA * (CAFM-CA_C) + DCAA * ABLF ;
CN = CN_C + KNFA * (CNFM-CN_C) + DCNA * ABLF ;
CLM = CLM_C + KNFA * (CLMFM-CLM_C) + DCLMA * ABLF ;
CY = CY_C + KNFA * (CYFM-CY_C) + DCYA * ABLF ;
CLN = CLN_C + KNFA * (CLNFM-CLN_C) + DCLNA * ABLF ;

/* END MODIFICATIONS 4/8/87 */

```

GO TO #6;

```

END;

/* SET THIS BLOCK OF DATA TO CONTINUUM VALUES MOD: 12/16/86 */
#5:  CA = CA_C + DCAA * ABLF ;
      CN = CN_C + DCNA * ABLF ;
      CLN = CLN_C + DCLNA * ABLF ;
      CLM = CLM_C + DCLMA * ABLF ;
      CY = CY_C + DCYA * ABLF ;
      CLMQ = CLMQ_C;

#6:

/***** CORRECTION FOR CHANGE IN SIDE AREA *****/
      CLNR = CLNR_C;
      CLL = CLL_C + DCLLA * ABLF + .0001 ;
      CLLP = -CLLP_C * ABS(DCLLA/CLL)*ABLF ;

      CASF = PIFREB(H,CASF_T,INT_9); /* SKIN FRICTION COMPONENT */
      DCA = PIFREB(H,DCA_T,INT_11); /* DELTA CA ADJUSTMENT */
      CA = CA + DCA + CASF; /* TOTAL AXIAL FORCE COEF VALUE */
      CLLPSF = -KCLP*CASF; /* ROLL DAMPING DUE TO SKIN FRICTION */
      CLLP = CLLP + CLLPSF; /* TOTAL ROLL DAMPING COEF VALUE */

      IF FLAG6 .NE. 0 THEN CA=CA*PIFREB(H,CAVAR,INT2);
      IF FLAG9 .NE. 0 THEN CN=CN*PIFREB(H,CNVAR,INT7);
      IF FLAG8 .NE. 0 THEN CLMQ=CLMQ*PIFREB(H,CMQVAR,INT4);
      IF FLAG2 .NE. 0 THEN CLLP=CLLP*PIFREB(H,CLPTBL,INT10);

      SP = (SIND(ALFA_BAR)/SIN_CONE_A)*KN * PIFREB(H,PMA_T,INT_24);
      CMOOP = PIFREB(SP,CMOOP_T,INT_25);

      H_HTR = H/HTR;
      CLZERO = PIFREB(H,HTR,CLO_T,INT_21);
      IF FLAG1 .NE. 0 THEN CLZERO=CLZERO + PIFREB(H,CLOTBL,INT11);

      CMZERO = CM0 + PIFREB(H,CMO_T,INT_20);
      IF FLAG5 .NE. 0 THEN CMZERO=CMZERO*PIFREB(H,CMOVAR,INT8);

      IF FLAG4 = 0 THEN CNZERO=CM0;
      ELSE CNZERO=CM0*PIFREB(H,CNOVAR,INT9);

      IF FLAG16 = 0 THEN CNPBETA=0.;
      ELSE CNPBETA=PIFREB(H,CNPBTBL,INT16);

      PLOT = LEE/PLTPTS;
      PLOTcnt=PLOTcnt+1;
      IF (MOD(PLOTcnt,PLOT)=0) THEN DO;
        PUT FILE(PLTOUT) EDIT (FMACH,PHI,ALFA_BAR,KN,KNFA,CAFM,CA,CNFM,CN,
          CYFM,CY,CLMFM,CLM,CLNFM,CLN)(R(#100));
        #100: FORMAT(SKIP,15 F(8,3));
      END;
      */

EXIT: RETURN;

```

00001070
00001070
00001090

(CONT)

SOURCE.PRNT

00001120

```

DEclare ALFA_BAR      FLOAT BINARY;
DEclare DCA           FLOAT BINARY;
DEclare DREF1         FLOAT BIN EXT;
DEclare FMACH         FLOAT BINARY;
DEclare H             FLOAT BINARY;
DEclare H_HTR        FLOAT BINARY EXT;
DEclare HTR           FLOAT BINARY EXT;
DEclare KN            FLOAT BINARY;
DEclare KNFA          FLOAT BINARY;
DEclare RE            FLOAT BINARY;
DEclare RE_LL         FLOAT BIN EXT;
DEclare SIN_CONE_A    FLOAT BIN STATIC INIT(.1219);
/*****ABLATION EFFECTS MOD: 1/ /89 *****/
DEclare ABLF          FLOAT BINARY EXT; /* ABLATION FACTOR*/
DEclare H5            FLOAT BINARY EXT; /*ALT AT END OF HEAT PULSE*/
/* MODIFICATION 5/13/85 */

DEclare PHI          FLOAT BIN;

/* END OF MODIFICATION 5/13/85 */

/* MODIFICATION 12/16/86 */
/***** MACH NO., ROLL ANGLE, ANGLE OF ATTACK AND ABLATION COEFF. ****/
DCL (M24A(*),PHI24A(*),ALF24A(*),DCA_A(*,*), /* AXIAL FORCE */
M25A(*),PHI25A(*),ALF25A(*),DCN_A(*,*), /* NORMAL FORCE */
M26A(*),PHI26A(*),ALF26A(*),DCLM_A(*,*), /* PITCHING MOMENT */
M27A(*),PHI27A(*),ALF27A(*),DCY_A(*,*), /* SIDE FORCE */
M28A(*),PHI28A(*),ALF28A(*),DCLN_A(*,*), /* YAWING MOMENT */
M29A(*),PHI29A(*),ALF29A(*),DCLL_A(*,*)) /* ROLLING MOMENT */
FLOAT BIN CTL EXT;

/* MACH NUMBER, ROLL ANGLE, ANGLE OF ATTACK AND COEFFICIENT */
DCL (M_LC1(*),PHI_LC1(*),ALF_LC1(*),CA_LC(*,*), /* AXIAL FORCE */
M_LC2(*),PHI_LC2(*),ALF_LC2(*),CN_LC(*,*), /* NORMAL FORCE */
M_LC3(*),PHI_LC3(*),ALF_LC3(*),CLN_LC(*,*), /* YAW MOMENT */
M_LC4(*),PHI_LC4(*),ALF_LC4(*),CLM_LC(*,*), /* PITCH DAMP. */
M_LC5(*),PHI_LC5(*),ALF_LC5(*),CLP_LC(*,*), /* ROLL DAMPING */
M_LC6(*),PHI_LC6(*),ALF_LC6(*),CLNR_LC(*,*), /* YAW DAMPING */
M_LC7(*),PHI_LC7(*),ALF_LC7(*),CY_LC(*,*), /* SIDE FORCE */
M_LC8(*),PHI_LC8(*),ALF_LC8(*),CLM_LC(*,*), /* PITCH MOMENT */
M_LC9(*),PHI_LC9(*),ALF_LC9(*),CLL_LC(*,*)) /* ROLL MOMENT */
FLOAT BIN CTL EXT;

/* END OF MODIFICATION 12/16/86 */

/* MODIFICATIONS 4/8/87 */

/***** FREE MOLECULAR FLOW VARIABLES */
DCL (M_FM1(*),PHI_FM1(*),ALF_FM1(*),CA_FM(*,*), /* AXIAL FORCE */
M_FM2(*),PHI_FM2(*),ALF_FM2(*),CN_FM(*,*), /* NORMAL FORCE */
M_FM3(*),PHI_FM3(*),ALF_FM3(*),CLM_FM(*,*), /* PITCH MOMENT */
M_FM4(*),PHI_FM4(*),ALF_FM4(*),CLN_FM(*,*), /* YAW MOMENT */
M_FM5(*),PHI_FM5(*),ALF_FM5(*),CLP_FM(*,*), /* ROLL DAMPING */
M_FM6(*),PHI_FM6(*),ALF_FM6(*),CLNR_FM(*,*), /* YAW DAMPING */
M_FM7(*),PHI_FM7(*),ALF_FM7(*),CY_FM(*,*), /* SIDE FORCE */
M_FM8(*),PHI_FM8(*),ALF_FM8(*),CLM_FM(*,*), /* PITCH MOMENT */
M_FM9(*),PHI_FM9(*),ALF_FM9(*),CLL_FM(*,*)) /* ROLL MOMENT */
FLOAT BIN CTL EXT;

/* END OF MODIFICATION 4/8/87 */

```

MEMBER NAME AERO (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

M_FM4(*),PHI_FM4(*),ALF_FM4(*),CY_FM(*,*,*), /* SIDE FORCE */000000170
M_FM5(*),PHI_FM5(*),ALF_FM5(*),CLN_FM(*,*,*) /* YAW MOMENT */000000180
FLOAT BIN CTL EXT;

***** DECLARATION OF INCREMENTAL VARIABLES DUE TO ABLATION *****/

DCL (DCAA,DCNA,DCLMA,DCYA,DCLNA,DCLLA)
FLOAT BINARY;

***** DECLARATION OF DATA ENTRY INDICES FOR ABLATION INCREMENTS **/

DCL (AS12A,AS34A,AS56A,AS78A,AS910A,AS1112A,
INT1A,INT2A,INT3A,INT4A,INT5A,INT6A,INT7A,
INT8A,INT9A,INT10A,INT11A,INT12A)
FIXED BIN(31) EXT;

/** DECLARATION OF PRINT OPTION FOR OUTPUT DUE TO ABLATION *****/

DCL (POPT24,POPT25,POPT26,POPT27,POPT28,POPT29)
FIXED BIN(31) EXT;

DECLARE INT_F1	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F2	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F3	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F4	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F5	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F6	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F7	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F8	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F9	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F10	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F11	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F12	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F13	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F14	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060
DECLARE INT_F15	FIXED BIN(31) EXT;	/* DATA ENTRY INDICES	*/00000060

DECLARE PLTPTS	FIXED BIN(31) EXT;	/* PLOT OUTPUT COUNTER	*/00000060
DECLARE LEE	FIXED BIN(31) EXT;	/* PLOT OUTPUT COUNTER	*/00000060
DECLARE PLOT	FLOAT BINARY;	/* PLOT OUTPUT COUNTER	*/
DECLARE PLOTNT	FLOAT BIN STATIC INIT(0);		

DECLARE CYFM	FLOAT BINARY;	/* FREE MOLECULAR FLOW	*/
DECLARE CLNFM	FLOAT BINARY;	/* FREE MOLECULAR FLOW	*/

/* END OF MODIFICATION 4/8/87 */

DECLARE CA	FLOAT BINARY;	/* CONTINUUM VARIABLES	*/00000060
DECLARE CN	FLOAT BINARY;	/*	*/00000060
DECLARE CLN	FLOAT BINARY;	/*	*/00000060
DECLARE CLMQ	FLOAT BINARY;	/*	*/00000060
DECLARE CLLP	FLOAT BINARY;	/* CONTINUUM VARIABLES	*/00000060
DECLARE CLNR	FLOAT BINARY;	/*	*/00000060
DECLARE CY	FLOAT BINARY;	/*	*/00000060

LISTING OF BFD.SHARB.IMAGRA6C.SOURCE.PRINT
(CONT)

MEMBER NAME AERO

```

DECLARE CLM          /*      "      */
DECLARE CLL          /*      "      */

DECLARE CA_C         /* CONTINUUM VARIABLES */
DECLARE CN_C         /*      "      */
DECLARE CLN_C        /* CONTINUUM VARIABLES */
DECLARE CLMQ_C       /*      "      */
DECLARE CLLP_C       /*      "      */
DECLARE CLNR_C       /*      "      */
DECLARE CY_C         /* CONTINUUM VARIABLES */
DECLARE CLM_C        /*      "      */
DECLARE CLL_C        /*      "      */

DECLARE CAFM         /* FREE MOLECULAR FLOW VAR */
DECLARE CNFM         /*      "      */
DECLARE CLMFM        /*      "      */

DECLARE CMO          /* FREE MOLECULAR FLOW VAR */
DECLARE CNO          /*      "      */
DECLARE CMZERO       /*      "      */
DECLARE CNZERO       /*      "      */
DECLARE CLZERO       /*      "      */
DECLARE CASF         /* CA SKIN FRICTION */
DECLARE CLLP_SF      /* CLLP SKIN FRICTION */
DECLARE CMOOP        /*      "      */
DECLARE CNPBETA      /* SKIN FRICTION M.F. */
DECLARE KCLP         /*      "      */
DECLARE SP           /*      "      */

DECLARE CLO_T (100) /* NOMINAL ROLL TORQUE COEF */
DECLARE CMOOP_T (100) /* HIGH ALPHA OUT-OF-PLANE */
DECLARE CMO_T (100) /* SIDE MOMENTS */
DECLARE CASF_T (100) /* FREE MOLECULAR FLOW */
DECLARE CLO_T (100) /* SKIN FRICTION */

DECLARE DCA_T (1000) /* DELTA CA VALUES */

DECLARE PMA_T (100) /* MASS ADDITION PARAM */
DECLARE CAVAR (100) /* PRESS FOR VEL/GAMMA */
DECLARE CMQVAR (100) /*      "      */
DECLARE CNVAR (100) /*      "      */
DECLARE CMOVAR (100) /*      "      */
DECLARE CLPTBL (100) /*      "      */
DECLARE CLOTBL (100) /*      "      */
DECLARE CNPBTBL (100) /*      "      */

DECLARE COS          /* BUILTIN; */
DECLARE SIN          /* BUILTIN; */
DECLARE SQRT         /* BUILTIN; */
DECLARE SIND         /* BUILTIN; */

```

DECLARE FLAG1	FIXED BIN(31) EXT;	00000060
DECLARE FLAG2	FIXED BIN(31) EXT;	00000060
DECLARE FLAG4	FIXED BIN(31) EXT;	00000060
DECLARE FLAG5	FIXED BIN(31) EXT;	00000060
DECLARE FLAG6	FIXED BIN(31) EXT;	00000060
DECLARE FLAG8	FIXED BIN(31) EXT;	00000060
DECLARE FLAG9	FIXED BIN(31) EXT;	00000060
DECLARE FLAG16	FIXED BIN(31) EXT;	00000060
		00001620
DECLARE INT2	FIXED BIN(31) EXT;	*/00000060
DECLARE INT4	FIXED BIN(31) EXT;	*/00000060
DECLARE INT7	FIXED BIN(31) EXT;	*/00000060
DECLARE INT8	FIXED BIN(31) EXT;	*/00000060
DECLARE INT9	FIXED BIN(31) EXT;	*/00000060
DECLARE INT10	FIXED BIN(31) EXT;	*/00000060
DECLARE INT11	FIXED BIN(31) EXT;	*/00000060
DECLARE INT16	FIXED BIN(31) EXT;	*/00000060
DECLARE INT17	FIXED BIN(31) EXT;	*/00000060
DECLARE INT18	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_1	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_2	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_3	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_4	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_6	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_6A	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_7	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_8	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_9	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_11	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_13	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_14	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_15	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_16	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_19	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_12	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_20	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_21	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_23	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_23A	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_24	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_25	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_26	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_27	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_28	FIXED BIN(31) EXT;	*/00000060
DECLARE INT_29	FIXED BIN(31) EXT;	*/00000060
DECLARE AS1718	FIXED BIN(31) EXT;	*/00000060
DECLARE AS23	FIXED BIN(31) EXT;	*/00000060
DECLARE AS2627	FIXED BIN(31) EXT;	*/00000060
DECLARE AS2829	FIXED BIN(31) EXT;	*/00000060
/* MODIFICATION 5/13/85 */		
DECLARE AS6	FIXED BIN(31) EXT;	00000992
DECLARE AS12	FIXED BIN(31) EXT;	00000993
DECLARE AS1314	FIXED BIN(31) EXT;	*/00000060
		*/00000060

MEMBER NAME AERO (CONT) LISTING OF BFD.SHARB.IMAGRA6C.SOURCE.PRNT PAGE 024 4 OCT 1989

DECLARE AS1516 FIXED BIN(31) EXT; /* DATA ENTRY INDICES */000000060
DECLARE AS34 FIXED BIN(31) EXT; /* DATA ENTRY INDICES */000000060
/* END OF MODIFICATION 5/13/85 */
00001005
00001006

***** NTR DECLARATIONS FOR ABLATION INCREMENTS 1/ /89 *****/

DCL NTDCAA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

DCL NTDCNA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

DCL NTDGLMA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

DCL NTDCYA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

DCL NTDCLNA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

DCL NTDCLLA ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(*)FLOAT BIN,
(*,*)FLOAT BIN,FIXED BIN(31),FIXED BIN(31),
FIXED BIN(31))
RETURNS (FLOAT BIN) ;

***** END NTR DECLARATIONS FOR ABLATION INCREMENTS *****/

DCL NTRPCA3 ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,(*)FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(* ,*)FLOAT BIN,
FIXED BIN(31),FIXED BIN(31),FIXED BIN(31))
RETURNS (FLOAT BIN); /* MOD: 5/13/85 */

DCL NTRPCN3 ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,(*)FLOAT BIN,
(*)FLOAT BIN,(*)FLOAT BIN,(* ,*)FLOAT BIN,
FIXED BIN(31),FIXED BIN(31),FIXED BIN(31))
RETURNS (FLOAT BIN); /* MOD: 5/13/85 */

00000150
00000160
00000170
00000180
00000185
00000220
00000230
00000240
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00000255

MEMBER NAME AERO (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

DCL NTCLNFM ENTRY(FLOAT BIN,FLOAT BIN,FLOAT BIN,(*,*)FLOAT BIN,
(*,*)FLOAT BIN,(*,*)FLOAT BIN,(*,*)FLOAT BIN,
FIXED BIN(31),FIXED BIN(31),FIXED BIN(31))
RETURNS (FLOAT BIN); /* MOD: 4/8/87 */
00000413
00000414
00000415
00000416

DCL PIFREB ENTRY(FLOAT BIN,(*,*)FLOAT BIN,FIXED BIN(31))
RETURNS (FLOAT BIN);
00000418
00000419
00000420
00000515

DECLARE PLTOUT FILE EXT;
DECLARE SYSIN FILE EXT;
DECLARE SYSPRINT FILE EXT;
END AERO;
00013420
00013420
00002130

```


FLOAT BIN CTL EXT ;

```

/* MACH NUMBER, ROLL ANGLE, ANGLE OF ATTACK AND COEFFICIENT */
DCL (M_LLC1(*), PHI_LC1(*), ALF_LC1(*), CA_LC(*, *, *), /* AXIAL FORCE */000000140
M_LC2(*), PHI_LC2(*), ALF_LC2(*), CN_LC(*, *, *), /* NORMAL FORCE */00000150
M_LC3(*), PHI_LC3(*), ALF_LC3(*), CLN_LC(*, *, *), /* YAW MOMENT */00000160
M_LC4(*), PHI_LC4(*), ALF_LC4(*), CLM_LC(*, *, *), /* PITCH DAMP. */00000170
M_LC5(*), PHI_LC5(*), ALF_LC5(*), CLP_LC(*, *, *), /* ROLL DAMPING */00000180
M_LC6(*), PHI_LC6(*), ALF_LC6(*), CLNR_LC(*, *, *), /* YAW DAMPING */00000210
M_LC7(*), PHI_LC7(*), ALF_LC7(*), CY_LC(*, *, *), /* SIDE FORCE */00000215
M_LC8(*), PHI_LC8(*), ALF_LC8(*), CLM_LC(*, *, *), /* PITCH MOMENT */00000217
M_LC9(*), PHI_LC9(*), ALF_LC9(*), CLN_LC(*, *, *), /* ROLL MOMENT */00000217
/* FREE MOLECULAR FLOW COEFFICIENTS */
M_FM1(*), PHI_FM1(*), ALF_FM1(*), CA_FM(*, *, *), /* AXIAL FORCE */00000140
M_FM2(*), PHI_FM2(*), ALF_FM2(*), CN_FM(*, *, *), /* NORMAL FORCE */00000150
M_FM3(*), PHI_FM3(*), ALF_FM3(*), CLN_FM(*, *, *), /* YAW MOMENT */00000160
M_FM4(*), PHI_FM4(*), ALF_FM4(*), CLM_FM(*, *, *), /* PITCH MOMENT */00000170
M_FM5(*), PHI_FM5(*), ALF_FM5(*), CY_FM(*, *, *), /* SIDE FORCE */00000180
FLOAT BIN CTL EXT;

```

```

/* END OF DECLARATIONS - MOD: 5/13/85
AND MOD: 12/15/86
AND MOD: 4/8/87 */

```

```

/* ON ENDFILE(SYSIN) BEGIN;
PUT SKIP LIST('EOF REACHED ON INPUTS. PROGRAM WILL TERMINATE');
STOP;
END;
*/

```

PUT SKIP(2) EDIT('INPUT DATA BLOCK') (COL(5),A);

```

#900: GET LIST (INP1);
IF INP1 < 0 | INP1 > 26 THEN DO; PUT SKIP LIST
('ERROR IN DATA DECK');
STOP;
END;

```

```

LAB( 0)=#899;
LAB( 1)=#901; LAB( 2)=#902; LAB( 3)=#903; LAB( 4)=#904;
LAB( 5)=#905; LAB( 6)=#906; LAB( 7)=#907; LAB( 8)=#908;
LAB( 9)=#909; LAB(10)=#910; LAB(11)=#911; LAB(12)=#912;
LAB(13)=#913; LAB(14)=#914; LAB(15)=#915; LAB(16)=#916;
LAB(17)=#917; LAB(18)=#918; LAB(19)=#919; LAB(20)=#920;
LAB(21)=#921; LAB(22)=#922; LAB(23)=#923; LAB(24)=#924;
LAB(25)=#925; LAB(26)=#926;

```

GO TO LAB(INP1);

```

/* OPTION CONTROLS:
FLAG = 0 / OPTION NOT SELECTED
= 1 / OPTION SELECTED

```

```

FLAG1 CLO=F(H) MULT. FACTOR
FLAG2 CLP=F(H) MULT. FACTOR

```

```

INPUT IN GROUP 1
INPUT IN GROUP 2

```

```

00000267
00000270
00000270

00000280
00000290
00000300
00000310
00000311
00000330
00000340
00000350
00000360
00000370
00000380
00000383
00000386
00000390
00000400
00000410
00000420
00000430
00000440
00000450
00000460
00000470
00000480
00000490
00000500
00000510
00000520
00000525
00000530
00000540

```

```

FLAG3 USE WIND PROFILE FROM INPUT IN GROUP 8 00000550
FLAG4 CNO=F(H) MULT. FACTOR INPUT IN GROUP 3 00000560
FLAG5 CMO=F(H) MULT. FACTOR INPUT IN GROUP 4 00000570
FLAG6 CA=F(H) MULT. FACTOR INPUT IN GROUP 11 00000580
FLAG7 WEIGHT=F(H) MULT. FACTOR INPUT IN GROUP 12 00000590
FLAG8 CMQ=F(H) MULT. FACTOR INPUT IN GROUP 13 00000600
FLAG9 CN=F(H) MULT. FACTOR INPUT IN GROUP 14 00000610
FLAG10 MULTIPLY DENSITY BY FACTOR=F(H) INPUT IN GROUP 6 00000620
FLAG11 XCP=F(H) MULT. FACTOR INPUT IN GROUP 16 00000630
FLAG12 NO LONGER USED 00000640
FLAG13 YCG=F(H) MULT. FACTOR INPUT IN GROUP 9 00000650
FLAG14 ZCG=F(H) MULT. FACTOR INPUT IN GROUP 10 00000660
FLAG16 CNPBETA=F(H) INPUT IN GROUP 0 00000670
NTMS USE DENSITY, TEMPERATURE PROFILES INPUT IN GROUP 8 */ 00000690
00000700
00000710

```

```

/*****
/***** GROUP 0 *****/
/***** MAGNUS FORCE COEFFICIENT (CNPBETA) VS ALTITUDE *****/
/*****

```

```

#899: GET LIST(INT16,XMAG);
GET LIST ((CNPBTBL(1),CNPBTBL(1+50) DO I = 1 TO INT16));
FLAG16=1.;
PUT SKIP(2) EDIT('GROUP 0 INPUT DATA:',
    (MAGNUS FORCE COEF (CNPBETA) - FUNCTION OF ALTITUDE')
    (COL(5),A,SKIP,COL(5),A);
PUT EDIT((CNPBTBL(1),CNPBTBL(1+50) DO I = 1 TO INT16))(R(#825));
PUT SKIP(2) EDIT('XMAG = ',XMAG,' INCHES')(A,F(8,3),A);
GO TO #900;

```

```

/*****
/***** GROUP 1 *****/
/***** ROLLING MOMENT COEFFICIENT (CLO) VS ALTITUDE *****/
/*****

```

```

#901: GET LIST (INT11);
GET LIST ((CLOTBL(1),CLOTBL(1+50) DO I=1 TO INT11));
FLAG1=1.;
PUT SKIP(2) EDIT('GROUP 1 INPUT DATA:',
    ('ROLLING MOMENT COEF (CLO) - FUNCTION OF ALTITUDE')
    (COL(5),A,SKIP,COL(5),A);
PUT EDIT ((CLOTBL(1),
    CLOTBL(1+50) DO I = 1 TO INT11))(R(#825));
GO TO #900;

```

```

/*****
/***** GROUP 2 *****/
/***** ROLL DAMPING COEFFICIENT (CLLP) VS ALTITUDE (MULT. FACTOR) *****/
/*****

```

```

#902: GET LIST (INT10);
GET LIST ((CLPTBL(1),CLPTBL(1+50) DO I=1 TO INT10));
FLAG2 = 1.;

```

```
PUT EDIT (#826_001)(SKIP(2),A(19))((CLPTBL(1),
CLPTBL(1+50) DO I=1 TO INT10))(R(#825));
GO TO #900;
```

```
***** GROUP 3 *****
***** YAWING MOMENT COEFFICIENT (CNO) VS ALTITUDE (MULT. FACTOR) *****
*****/00001010
```

```
#903: GET LIST (INT9);
GET LIST ((CNOVAR(1),CNOVAR(1+50) DO I=1 TO INT9));
FLAG4 = 1.;
PUT EDIT (#825_001)(SKIP(2),A(27))((CNOVAR(1),
CNOVAR(1+50) DO I=1 TO INT9))(R(#825));
GO TO #900;
```

```
***** GROUP 4 *****
***** PITCHING MOMENT COEFFICIENT (CNO) VS ALTITUDE (MULT. FACTOR) *****
*****/00001010
```

```
#904: GET LIST (INT8);
GET LIST ((CNOVAR(1),CNOVAR(1+50) DO I=1 TO INT8));
FLAG5 = 1.;
PUT EDIT (#824_001)(SKIP(2),A(27))((CNOVAR(1),
CNOVAR(1+50) DO I=1 TO INT8))(R(#825));
GO TO #900;
```

```
***** GROUP 5 *****
***** OFF-AXIS ACCELEROMETER LOCATIONS *****/00001150
```

```
#905: GET LIST (X1,Y1,Z1,X2,Y2,Z2,X3,Y3,Z3);
PUT SKIP(2) LIST (' OFF AXIS ACCELEROMETERS');
PUT SKIP DATA (X1,Y1,Z1);
PUT SKIP DATA (X2,Y2,Z2);
PUT SKIP DATA (X3,Y3,Z3);
X1FT=X1/FT2IN; Y1FT=Y1/FT2IN; Z1FT=Z1/FT2IN;
X2FT=X2/FT2IN; Y2FT=Y2/FT2IN; Z2FT=Z2/FT2IN;
X3FT=X3/FT2IN; Y3FT=Y3/FT2IN; Z3FT=Z3/FT2IN;
GO TO #900;
```

```
***** GROUP 6 *****
***** DENSITY VS ALTITUDE (MULT. FACTOR) *****/00001150
```

```
#906: GET LIST (INT5);
GET LIST ((RHOFACT(1),RHOFACT(1+50) DO I=1 TO INT5));
FLAG10 = 1.;
PUT EDIT (#411_001)(SKIP(2),A(32))((RHOFACT(1),
RHOFACT(1+50) DO I=1 TO INT5))(R(#825));
GO TO #900;
```

```
00001280
00001290
00001300
00001310
00001320
00001330
```


***** REENTRY BODY WEIGHT VS. ALTITUDE (MULT. FACTOR) *****/00001150

#912: GET LIST (INT3);
 GET LIST ((WTVAR(1),WTVAR(1+50) DO I=1 TO INT3));
 FLAG7 = 1.;
 PUT EDIT (#817_001)(SKIP(2),A(36))((WTVAR(1),
 WTVAR(1+50) DO I=1 TO INT3))(R(#825));
 GO TO #900;

***** GROUP 13 *****/00001150
 ***** PITCH DAMPING DERIVATIVE VS. ALTITUDE (MULT. FACTOR) *****

#913: GET LIST (INT4);
 GET LIST((CMQVAR(1),CMQVAR(1+50) DO I=1 TO INT4));
 FLAG8 = 1.;
 PUT EDIT (#818_001)(SKIP(2),A(28))((CMQVAR(1),
 CMQVAR(1+50) DO I=1 TO INT4))(R(#825));
 GO TO #900;

***** GROUP 14 *****/00001150
 ***** NORMAL FORCE COEF. (CN) VS. ALTITUDE (MULT. FACTOR) *****

#914: GET LIST (INT7);
 GET LIST ((CNVAR(1),CNVAR(1+50) DO I=1 TO INT7));
 FLAG9 = 1.;
 PUT EDIT (#819_001)(SKIP(2),A(27))((CNVAR(1),
 CNVAR(1+50) DO I=1 TO INT7))(R(#825));
 GO TO #900;

***** GROUP 15 *****/00001150
 ***** OUTPUT INTERVAL *****
 ***** READ IN INTERGER TO VARY THE OUTPUT INTERVAL. *****
 ***** LEE = N',OUTPUT EACH NTH COMPUTED TIME STEP *****
 ***** LEE = -N',OUTPUT EACH NTH EVEN SECOND *****

#915: GET LIST (LEE);
 IF LEE = 0 THEN LEE=-1;
 GO TO #900;

***** GROUP 16 *****/00001150
 ***** CENTER OF PRESSURE (XCP) VS. ALTITUDE (MULT. FACTOR) *****

#916: GET LIST (INT6);
 GET LIST ((XCPVAR(1),XCPVAR(1+50) DO I=1 TO INT6));
 FLAG11=1.;

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMACRA6C.SOURCE.PRNT PAGE 034 4 OCT 1989

PUT EDIT (#820_001)(SKIP(2),A(28))((XCPVAR(1),
XCPVAR(1+50) DO I=1 TO INT6))(R(#825));
GO TO #900;

00002510
00002520
00002530

***** GROUP 17 *****
***** DATE, RUN IDENTIFICATION *****

00001150

#917: GET LIST (DATE,RUN);
GO TO #900;

00002550
00002560

***** GROUP 18 *****
***** REMARKS TO BE PRINTED *****

00001150

#918: GET LIST (INP2);
PUT SKIP;
DO J=1 TO INP2;
GET LIST (REMARK);
PUT SKIP LIST (REMARK);
END #32A;
GO TO #900;

00002580
00002590
00002600
00002610
00002620
00002630
00002640

***** GROUP 19 *****
***** INITIAL CONDITIONS *****
***** TIME, VELOCITY, AND VEHICLE SETTING *****

***** ADDITION OF H5 TO GET LIST (H5=ALTITUDE AT END OF HEAT PULSE) *****

00001150

#919: GET LIST (TO,H0,VLO,AZLO,GAMALO,ALPHA0,BETA0,PHIV,
TF,HF,ADMKUL,DTMAX,ALPBARO,H5);
IF TF < TO THEN TF=TF+TG;
PUT EDIT (#48_001,TO,#48_002)(PAGE,X(39),A(18) SKIP,F(20,3),
A(16))(H0,#48_003)(SKIP,F(20,3),A(20))(VLO,#48_004)
(SKIP,F(20,3),A(20))(AZLO,#48_005)(SKIP,F(20,3),A(31))
(GAMALO,#48_006)(SKIP,F(20,3),A(29))(ALPHA0,#48_007)
(SKIP,F(20,3),A(27))(BETA0,#48_008)(SKIP,F(20,3),A(26))
(PHIV,#48_009)(SKIP,F(20,3),A(22))(TF,#48_010)(SKIP,
F(20,3),A(24))(HF,#48_011)(SKIP,F(20,3),A(28))(ADMKUL,
#48_012)(SKIP,F(20,4),A(37))(DTMAX,#48_013)(SKIP,
F(20,3),A(34))(ALPBARO,#48_014)(SKIP,F(20,3),A(37))
(H5,#48_015)(SKIP,F(20,3),A(34));
BETA0 = BETA0 * RAD;
PHIV = PHIV * RAD;
ALPHA0 = ALPHA0 * RAD;
GAMALO = GAMALO * RAD;
AZLO=AZLO*RAD;
ALPBARO = ALPBARO * RAD;
GO TO #900;

00002670
00002680
00002690
00002700
00002710
00002720
00002730
00002740
00002750
00002760
00002770
00002780
00002790
00002800
00002810
00002820
00002830
00002835
00002840

```

      PUT EDIT (#151_001)(SKIP,X(40),A)(FLOD,#151_002,FLAMOD,
        #151_003)(SKIP,F(20,7),A);
/*
      PUT EDIT (A,#158_001,B,#158_002)(SKIP,F(20,1),A)
        (OMEGAE,#158_003,ALPO,#158_004,ALP2,#158_005,ALP4,
        #158_006)(SKIP,E(20,8),A);
      GO TO #900;

/*****
/***** GROUP 23 *****/
/***** AERODYNAMIC COEFFICIENTS AND RELATED FACTORS *****/
/*****
#923: PUT PAGE EDIT('GROUP 23 INPUT DATA:',
  'AERODYNAMIC COEFS AND RELATED ADJUSTMENT FACTORS')
  (COL(5),A,SKIP,COL(5),A);

/*****
/***** GROUP 23-TABLE 1 *****/
/***** AXIAL FORCE COEFFICIENT (CA) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
#1A: GET LIST(INT_1,INT_2,AS12,POPT1);
      ALLOCATE M_LC1(INT_1),PHI_LC1(INT_2),ALF_LC1(AS12),
        CA_LC(INT_1,INT_2,AS12);
#1B: DO I = 1 TO INT_1;
      GET LIST (LABEL1);
      GET LIST (M_LC1(I));

#1C: DO L = 1 TO 1+INT_2/8 WHILE (8*L-7<=INT_2);
      GET LIST (LABEL2);
      GET LIST((PHI_LC1(I) DO I=8*L-7 TO 8*L
        WHILE (I<=INT_2)));
      GET LIST (LABEL3);
#1D: DO K = 1 TO AS12;
      GET LIST (ALF_LC1(K),(CA_LC(I,J,K) DO J=8*L-7 TO 8*L
        WHILE (J<=INT_2)));
      END #1D;
      END #1C;
      END #1B;

      IF POPT1 = 0 THEN GO TO #2A;

      PUT SKIP(2) EDIT('TABLE #1: (CONTINUUM REGIME)',
        'AXIAL FORCE COEF (CA_LC) - FUNCTION OF MACH#,PHI & ALPHA')
        (COL(4),A,SKIP,COL(4),A);
#1E: DO I=1 TO INT_1;
      PUT SKIP(2) EDIT('MACH#=',M_LC1(I))
        (COL(4),A,COL(11),F(4,1));
#1F: DO L = 1 TO 1+INT_2/15 WHILE (15*L-14 <= INT_2);
      PUT SKIP EDIT('PHI=',) (COL(4),A);
      PUT SKIP EDIT((PHI_LC1(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_2)))
        (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=',) (COL(2),A);

```

00003680
00003690
00003700
00003710
00003720
00003730
00003740
00003750

00003760
00003770
00003780
00003790

LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRINT

MEMBER NAME INPUT (CONT)

```

#1G: DO I1=1 TO AS12;
      PUT SKIP EDIT(ALF_LC1(I1),(CA_LC(I,J,I1) DO J=15*L-14 TO 15*L00003880
      WHILE (J<=INT_2)))(F(6,1),COL(9),(15)F(8,4));
      END #1G;
      END #1F;
      END #1E;

/***** GROUP 23-TABLE 2 *****/
/***** NORMAL FORCE COEFFICIENT (CN) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
/*****

#2A: GET LIST(INT_3,INT_4,AS34,POPT2);
      ALLOCATE M_LC2(INT_3),PHI_LC2(INT_4),ALF_LC2(AS34),
      CN_LC(INT_3,INT_4,AS34);

#2B: DO I = 1 TO INT_3;
      GET LIST (LABEL1);
      GET LIST (M_LC2(I));

#2C: DO L = 1 TO 1+INT_4/8 WHILE (8*L-7<=INT_4);
      GET LIST (LABEL2);
      GET LIST((PHI_LC2(I1) DO I1=8*L-7 TO 8*L
      WHILE (I1<=INT_4)));
      GET LIST (LABEL3);

#2D: DO K = 1 TO AS34;
      GET LIST (ALF_LC2(K),(CN_LC(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_4)));
      END #2D;
      END #2C;
      END #2B;

IF POPT2 = 0 THEN GO TO #3A;

      PUT SKIP(2) EDIT('TABLE #2: (CONTINUUM REGIME)',
      'NORMAL FORCE COEF (CN_LC) - FUNCTION OF MACH#, PHI & ALPHA')
      (COL(4),A,SKIP,COL(4),A);

#2E: DO I=1 TO INT_3; PUT SKIP(2) EDIT('MACH#='M_LC2(I1)
      (COL(4),A,COL(11),F(4,1));

#2F: DO L = 1 TO 1+INT_4/15 WHILE (15*L-14 <= INT_4);
      PUT SKIP EDIT('PHI=' (COL(4),A);
      PUT EDIT((PHI_LC2(K) DO K=15*L-14 TO 15*L
      WHILE (K<=INT_4)))
      (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=' (COL(2),A);

#2G: DO I1=1 TO AS34;
      PUT SKIP EDIT(ALF_LC2(I1),(CN_LC(I,J,I1) DO J=15*L-14 TO 15*L00003890
      WHILE (J<=INT_4)))(F(6,1),COL(9),(15)F(8,4));
      END #2G;
      END #2F;
      END #2E;

```

```

/***** GROUP 23-TABLE 3 *****/
/***** SIDE FORCE COEFFICIENT (CY) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
00001150
00004500
00009180
00009200
00009210
00009240
00009410

#3A: GET LIST(INT_28,INT_29,AS2829,POPT3);
      ALLOCATE M_LC7(INT_28),ALF_LC7(AS2829),PHI_LC7(INT_29),
      CY_LC7(INT_28,INT_29,AS2829);
#3B: DO I = 1 TO INT_28;
      GET LIST (LABEL1);
      GET LIST (M_LC7(I));

#3C: DO L = 1 TO 1+INT_29/8 WHILE (8*L-7<=INT_29);
      GET LIST (LABEL2);
      GET LIST((PHI_LC7(I) DO I=8*L-7 TO 8*L
      WHILE (I<=INT_29)));
      GET LIST (LABEL3);
      DO K = 1 TO AS2829;
      GET LIST (ALF_LC7(K),(CY_LC7(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_29)));
      END #3D;
      END #3C;
      END #3B;

IF POPT3 = 0 THEN GO TO #4A;

PUT SKIP(2) EDIT('TABLE #3: (CONTINUUM REGIME)',
'SIDE FORCE COEF (CY_LC) - FUNCTION OF MACH#,PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

#3E: DO I=1 TO INT_28; PUT SKIP(2) EDIT('MACH#=',M_LC7(I))
(COL(4),A,COL(11),F(4,1));
#3F: DO L = 1 TO 1+INT_29/15 WHILE (15*L-14 <= INT_29);
      PUT SKIP EDIT('PHI=',) (COL(4),A);
      PUT EDIT((PHI_LC7(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_29)))
      (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=',) (COL(2),A);
      DO J=1 TO AS2829;
      PUT SKIP EDIT(ALF_LC7(I),(CY_LC7(I,J,I) DO J=15*L-14 TO 15*L
      WHILE (J <=INT_29)))(F(6,1),COL(9),(15)F(8,4));
      END #3G;
      END #3F;
      END #3E;

/***** GROUP 23-TABLE 4 *****/
/***** PITCHING MOMENT COEFFICIENT (CLM) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
00001150
00004640
00009180
00009200
00009210

#4A: GET LIST(INT_6,INT_6A,AS6,POPT4);
      ALLOCATE M_LC8(INT_6),ALF_LC8(AS6),PHI_LC8(INT_6A),
      CLM_LC8(INT_6,INT_6A,AS6);
#4B: DO I = 1 TO INT_6;
      GET LIST (LABEL1);
      GET LIST (M_LC8(I));

```

```
#4C: DO L = 1 TO 1+INT_6A/8 WHILE (8*L-7<=INT_6A);
      GET LIST (LABEL2);
      GET LIST((PHI_LC8(11) DO I=8*L-7 TO 8*L
                WHILE (11<=INT_6A)));
      GET LIST (LABEL3);
      DO K = 1 TO AS6;
      GET LIST (ALF_LC8(K),(CLM_LC(1,J,K) DO J=8*L-7 TO 8*L
                WHILE (J<=INT_6A)));
```

00003620
00003630
00003640
00003650

```
END #4D;
END #4C;
END #4B;
```

IF POPT4 = 0 THEN GO TO #5A;

```
PUT SKIP(2) EDIT('TABLE #4: (CONTINUUM REGIME)',
'PITCHING MOMENT COEF (CLM_LC) - FUNCTION OF MACH#, PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);
```

00009480
00009490
00009500
00009510
00003720
00003740
00003750

```
#4E: DO I=1 TO INT_6; PUT SKIP(2) EDIT('MACH#='M_LC8(1)
(COL(4),A,COL(11),F(4,1));
#4F: DO L = 1 TO 1+INT_6A/15 WHILE (15*L-14 <= INT_6A);
      PUT SKIP EDIT('PHI=') (COL(4),A);
      PUT EDIT((PHI_LC8(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_6A)))
(COL(9),(15) F(8,1));
```

00003760
00003770
00003780
00003790
00003880
00003890

```
#4G: DO I=1 TO AS6;
      PUT SKIP EDIT(ALF_LC8(11),(CLM_LC(1,J,11) DO J=15*L-14
                TO 15*L WHILE (J<=INT_6A)))
(F(6,1),COL(9),(15)F(8,4));
```

```
END #4G;
END #4F;
END #4E;
```

00003920
00003920
00003930

```
/***** GROUP 23-TABLE 5 *****/
/***** AXIAL FORCE COEFFICIENT (CA_FM) FOR FREE MOLECULAR FLOW *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
```

```
#5A: GET LIST(INT_F1,INT_F2,INT_F3,POPT10);
      ALLOCATE M_FM1(INT_F1),ALF_FM1(INT_F3),PHI_FM1(INT_F2),
              CA_FM(INT_F1,INT_F2,INT_F3);
```

00009180
00009200
00009210

```
#5B: DO I = 1 TO INT_F1;
      GET LIST (LABEL1);
      GET LIST (M_FM1(I));
```

00003470
00003490
00003620
00003630

```
#5C: DO L = 1 TO 1+INT_F2/8 WHILE (8*L-7<=INT_F2);
      GET LIST (LABEL2);
      GET LIST((PHI_FM1(11) DO I=8*L-7 TO 8*L
                WHILE (11<=INT_F2)));
```

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00003650

```
#5D: DO K = 1 TO INT_F3;
      GET LIST (ALF_FM1(K),(CA_FM(1,J,K) DO J=8*L-7 TO 8*L
                WHILE (J<=INT_F2)));
```


END #5D;
END #5C;
END #5B;

IF POPT10 = 0 THEN GO TO #6A;

PUT SKIP(2) EDIT('TABLE #5: (FREE MOLECULAR FLOW REGIME)',
'AXIAL FORCE COEF (CN_FM) - FUNCTION OF MACH#, PHI & ALPHA')
(COL(4), A, SKIP, COL(4), A);

#5E: DO I=1 TO INT_F1;

PUT SKIP(2) EDIT('MACH#=' M_FM1(I))
(COL(4), A, COL(11), F(4, 1));
DO L = 1 TO 1+INT_F2/15 WHILE (15*L-14 <= INT_F2);

PUT SKIP EDIT('PHI=') (COL(4), A);

PUT EDIT((PHI_FM1(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_F2)))
(COL(9), (15) F(8, 1));

PUT SKIP EDIT('ALPHA=') (COL(2), A);

#5G: DO I1=1 TO INT_F3;
PUT SKIP EDIT(ALF_FM1(I1), (CA_FM(1, J, I1) DO J=15*L-14
TO 15*L WHILE (J <= INT_F2)))
(F(6, 1), COL(9), (15) F(8, 4));

END #5G;
END #5F;
END #5E;

/***** GROUP 23-TABLE 6 *****/
/***** NORMAL FORCE COEFFICIENT (CN_FM) FOR FREE MOLECULAR FLOW *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/

#6A: GET LIST(INT_F4, INT_F5, INT_F6, POPT11);

ALLOCATE M_FM2(INT_F4), ALF_FM2(INT_F6), PHI_FM2(INT_F5),
CN_FM(INT_F4, INT_F5, INT_F6);

#6B: DO I = 1 TO INT_F4;
GET LIST (LABEL1);
GET LIST (M_FM2(I));

#6C: DO L = 1 TO 1+INT_F5/8 WHILE (8*L-7<=INT_F5);

GET LIST (LABEL2);
GET LIST((PHI_FM2(I1) DO I1=8*L-7 TO 8*L
WHILE (I1<=INT_F5)));

GET LIST (LABEL3);

#6D: DO K = 1 TO INT_F6;
GET LIST (ALF_FM2(K), (CN_FM(1, J, K) DO J=8*L-7 TO 8*L
WHILE (J<=INT_F5)));

END #6D;
END #6C;
END #6B;

IF POPT11 = 0 THEN GO TO #7A;

PUT SKIP(2) EDIT('TABLE #6: (FREE MOLECULAR FLOW REGIME)',
'NORMAL FORCE COEF (CN_FM) - FUNCTION OF MACH#, PHI & ALPHA')
(COL(4), A, SKIP, COL(4), A);

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00003920
00003920
00003930
00009180
00009200
00009210
00003470
00003490
00003620
00003630
00003640
00003650
00009480
00009490
00009500

MEMBER NAME INPUT (CONT)
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

```
#6E: DO I=1 TO INT_F4; PUT SKIP(2) EDIT('MACH#=' M_FM2(11)
(COL(4),A,COL(11),F(4,1));
#6F: DO L = 1 TO 1+INT_F5/15 WHILE (15*L-14 <= INT_F5);
PUT SKIP EDIT('PHI=') (COL(4),A);
PUT EDIT((PHI_FM2(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_F5))
(COL(9),(15) F(8,1));
PUT SKIP EDIT('ALPHA=') (COL(2),A);
#6G: DO I1=1 TO INT_F6;
PUT SKIP EDIT(ALL_FM2(11),(CN_FM(1,J,I1) DO J=15*L-14
TO 15*L WHILE (J <=INT_F5))
(F(6,1),COL(9),(15)F(8,4));
END #6G;
END #6F;
END #6E;

/***** GROUP 23-TABLE 7 *****/
/***** SKIN FRICTION AXIAL FORCE COEFFICIENT (CASF) VS ALTITUDE *****/
#7A: GET LIST(INT_9);
GET LIST((CASF_T(1),CASF_T(1+50) DO I=1 TO INT_9 ));
PUT SKIP(2) EDIT('TABLE #7: (SPECIFIC VEL/GAMMA CONDITIONS)',
'SKIN FRICTION COEF (CASF_T) - FUNCTION OF ALTITUDE ONLY',
(COL(4),A,SKIP,COL(4),A); PUT SKIP;
PUT EDIT((CASF_T(1),CASF_T(1+50) DO I=1 TO INT_9 ))(R(#826));
/***** GROUP 23-TABLE 8 *****/
/***** INCREMENTAL CHANGE OF WEIGHT (DELWGT) VS ALTITUDE *****/
GET LIST(INT_10);
GET LIST((DWGT_T(1),DWGT_T(1+50) DO I=1 TO INT_10 ));
PUT SKIP(2) EDIT('TABLE #8: (SPECIFIC VEL/GAMMA CONDITIONS)',
'CHANGE OF VEHICLE WEIGHT (DWGT_T) - FUNCTION OF ALTITUDE ONLY',
(COL(4),A,SKIP,COL(4),A); PUT SKIP;
PUT EDIT((DWGT_T(1),DWGT_T(1+50) DO I=1 TO INT_10 ))(R(#826));
/***** GROUP 23-TABLE 9 *****/
/***** DELTA CA VS ALTITUDE *****/
GET LIST(INT_11);
GET LIST((DCA_T(1),DCA_T(1+50) DO I=1 TO INT_11 ));
PUT SKIP(2) EDIT('TABLE #9: (SPECIFIC VEL/GAMMA CONDITIONS)',
'INCREMENTAL AXIAL FORCE COEF (DCA_T) - FUNCTION OF ALTITUDE ONLY',
(COL(4),A,SKIP,COL(4),A); PUT SKIP;
PUT EDIT((DCA_T(1),DCA_T(1+50) DO I=1 TO INT_11 ))(R(#826));
/***** GROUP 23-TABLE 10 *****/
/***** DELTA CP VS ALTITUDE *****/
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```

GET LIST(INT_12);
GET LIST((DXCPV_I(1),DXCPV_I(1+50) DO I=1 TO INT_12));

PUT SKIP(2) EDIT('TABLE #10: (SPECIFIC VEL/GAMMA CONDITIONS)',
'INCREMENTAL PITCH CENTER OF PRESSURE (DXCPV_I) - FUNCTION OF ALTITUDE
ONLY') (COL(4),A,SKIP,COL(4),A); PUT SKIP;

PUT EDIT((DXCPV_I(1),DXCPV_I(1+50) DO I=1 TO INT_12))(R(#826));

/***** ***** GROUP 23-TABLE 11 *****/
/***** YAW MOMENT COEFFICIENT (CLN) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/

#11A: GET LIST(INT_13,INT_14,AS1314,POPT5);
      ALLOCATE M_LC3(INT_13),PHI_LC3(INT_14),ALF_LC3(AS1314),
      CLN_LC3(INT_13,INT_14,AS1314);

#11B: DO I = 1 TO INT_13;
      GET LIST (LABEL1);
      GET LIST (M_LC3(I));

#11C: DO L = 1 TO 1+INT_14/8 WHILE (8*L-7<=INT_14);
      GET LIST (LABEL2);
      GET LIST((PHI_LC3(I) DO I=8*L-7 TO 8*L
      WHILE (I<=INT_14)));
      GET LIST (LABEL3);
      DO K = 1 TO AS1314;
      GET LIST (ALF_LC3(K),(CLN_LC3(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_14)));
      END #11D;
      END #11C;
      END #11B;

IF POPT5 = 0 THEN GO TO #12A;

PUT SKIP(2) EDIT('TABLE #11: (CONTINUUM REGIME)',
'YAW MOMENT COEF (CLN_LC) - FUNCTION OF MACH#,PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

#11E: DO I=1 TO INT_13; PUT SKIP(2) EDIT('MACH#=',M_LC3(I))
      (COL(4),A,COL(11),F(4,1));
#11F: DO L = 1 TO 1+INT_14/15 WHILE (15*L-14 <= INT_14);
      PUT SKIP EDIT('PHI=') (COL(4),A);
      PUT EDIT((PHI_LC3(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_14)))
      (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=') (COL(2),A);
#11G: DO I=1 TO AS1314;
      PUT SKIP EDIT(ALF_LC3(11),(CLN_LC3(I,J,11) DO J=15*L-14
      TO 15*L WHILE (J <=INT_14)))
      (F(6,1),COL(9),(15)F(8,4));

END #11G;
END #11F;
END #11E;

```

MEMBER NAME INPUT (CONT)
LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

/***** GROUP 23-TABLE 12 *****/
/***** PITCH DAMPING COEFFICIENT (CLMQ) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
/00001150
/00001150
/00005980
/00005990
/00006010
/00006010

#12A: GET LIST(INT_15,INT_16,AS1516,POPT6);
      ALLOCATE M_LC4(INT_15),PHI_LC4(INT_16),ALF_LC4(AS1516),
      CLMQ_LC4(INT_15,INT_16,AS1516);

#12B: DO I = 1 TO INT_15;
      GET LIST (LABEL1);
      GET LIST (M_LC4(I));

#12C: DO L = 1 TO 1+INT_16/8 WHILE (8*L-7<=INT_16);
      GET LIST (LABEL2);
      GET LIST((PHI_LC4(I)) DO I=8*L-7 TO 8*L
      WHILE (I<=INT_16));
      GET LIST (LABEL3);

#12D: DO K = 1 TO AS1516;
      GET LIST (ALF_LC4(K),(CLMQ_LC4(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_16));
      END #12D;
      END #12C;
      END #12B;

      00003470
      00003490
      00003620
      00003630
      00003640
      00003650

      00006020
      00006260

      00006270
      00006280
      00006290
      00006300
      00003720
      00003740
      00003750
      00003760
      00003770
      00003780
      00003790
      00003880
      00003890

      00003920
      00003920
      00003930
      00006510

/***** GROUP 23-TABLE 13 *****/
/***** YAW DAMPING COEFFICIENT (CLNR) FOR CONTINUUM DENSITY *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
/00001150
/00001150
/00008570
/00008580
/00008600
/00008610

#13A: GET LIST(INT_26,INT_27,AS2627,POPT7);
      ALLOCATE M_LC6(INT_26),ALF_LC6(AS2627),PHI_LC6(INT_27),
      CLNR_LC6(INT_26,INT_27,AS2627);

#13B: DO I = 1 TO INT_26;

```

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

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GET LIST (LABEL1);
GET LIST (M_LC6(1));

#13C: DO L = 1 TO 1+INT_27/8 WHILE (8*L-7<=INT_27);
      GET LIST (LABEL2);
      GET LIST((PHI_LC6(11) DO I=8*L-7 TO 8*L
                WHILE (I<=INT_27)));
      GET LIST (LABEL3);
      DO I = 1 TO AS2627;
      GET LIST (ALF_LC6(K),(CLNR_LC(1,J,K) DO J=8*L-7 TO 8*L
                WHILE (J<=INT_27)));
      END #13D;
      END #13C;
      END #13B;

IF POPT7 = 0 THEN GO TO #14A;

PUT SKIP(2) EDIT('TABLE #13: (CONTINUUM REGIME)',
'YAW DAMPING COEF (CLNR_LC) - FUNCTION OF MACH#,PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

#13E: DO I=1 TO INT_26; PUT SKIP(2) EDIT('MACH#=',M_LC6(1))
      (COL(4),A,COL(11),F(4,1));
#13F: DO L = 1 TO 1+INT_27/15 WHILE (15*L-14 <= INT_27);
      PUT SKIP EDIT('PHI=',COL(4),A);
      PUT EDIT((PHI_LC6(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_27))
              (COL(9),(15) F(8,1)));
      PUT SKIP EDIT('ALPHA=',COL(2),A);
#13G: DO I=1 TO AS2627;
      PUT SKIP EDIT(ALF_LC6(11),(CLNR_LC(1,J,I) DO J=15*L-14
                    TO 15*L WHILE (J<=INT_27)))
                    (F(6,1),COL(9),(15)F(8,4));
      END #13G;
      END #13F;
      END #13E;

/*****GROUP 23-TABLE 14 *****/
/*****SIDE FORCE COEFFICIENT (CY_FM) FOR FREE MOLECULAR FLOW *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/

#14A: GET LIST(INT_F10,INT_F11,INT_F12,POPT13);
      ALLOCATE M_FM4(INT_F10),ALF_FM4(INT_F12),PHI_FM4(INT_F11),
              CY_FM(INT_F10,INT_F11,INT_F12);
#14B: DO I = 1 TO INT_F10;
      GET LIST (LABEL1);
      GET LIST (M_FM4(I));

#14C: DO L = 1 TO 1+INT_F11/8 WHILE (8*L-7<=INT_F11);
      GET LIST (LABEL2);
      GET LIST((PHI_FM4(11) DO I=8*L-7 TO 8*L
                WHILE (I<=INT_F11)));

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00008890
00008900
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00003720
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00003760
00003770
00003780
00003790
00003880
00003890
00003920
00003920
00003930
00006660
00006800
00001150
00001150
00009180
00009200
00009210
00003470
00003490
00003620
00003630
00003640

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

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GET LIST (LABEL3);
#14D: DO K = 1 TO INT_F12;
      GET LIST (ALF_FM4(K), (CY_FM(1,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_F11)));
END #14D;
END #14C;
END #14B;

```

IF POPT13 = 0 THEN GO TO #15A;

```

PUT SKIP(2) EDIT('TABLE #14: (FREE MOLECULAR FLOW REGIME)',
'SIDE FORCE COEF (CY_FM) - FUNCTION OF MACH#, PHI & ALPHA',
(COL(4), A, SKIP, COL(4), A);

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#14E: DO I=1 TO INT_F10;
      PUT SKIP(2) EDIT('MACH#=' M_FM4(I))
      (COL(4), A, COL(11), F(4,1));

```

```

#14F: DO L = 1 TO 1+INT_F11/15 WHILE (15*L-14 <= INT_F11);
      PUT SKIP EDIT('PHI=' (COL(4), A);
      PUT EDIT((PHI_FM4(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_F11)))
      (COL(9), (15) F(8,1));

```

```

#14G: DO I=1 TO INT_F12;
      PUT SKIP EDIT('ALPHA=' (COL(2), A);
      PUT SKIP EDIT(ALF_FM4(I), (CY_FM(1,J,I) DO J=15*L-14
      TO 15*L WHILE (J<=INT_F11)))
      (F(6,1), COL(9), (15) F(8,4));
END #14G;
END #14F;
END #14E;

```

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00003920
00003930

```

/***** GROUP 23-TABLE 15 *****/
/**** PITCHING MOMENT COEFFICIENT (CLM_FM) FOR FREE MOLECULAR FLOW *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/

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```

#15A: GET LIST(INT_F7, INT_F8, INT_F9, POPT12);
      ALLOCATE M_FM3(INT_F7), ALF_FM3(INT_F9), PHI_FM3(INT_F8),
      CLM_FM(INT_F7, INT_F8, INT_F9);

```

```

#15B: DO I = 1 TO INT_F7;
      GET LIST (LABEL1);
      GET LIST (M_FM3(I));

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00009200
00009210

#15C: DO L = 1 TO 1+INT_F8/8 WHILE (8*L-7<=INT_F8);

```

      GET LIST (LABEL2);
      GET LIST((PHI_FM3(I) DO I=8*L-7 TO 8*L
      WHILE (I<=INT_F8)));

```

GET LIST (LABEL3);

```

#15D: DO K = 1 TO INT_F9;
      GET LIST (ALF_FM3(K), (CLM_FM(1,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_F8)));

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00003620
00003630
00003640
00003650

```

END #15D;
END #15C;
END #15B;

```

IF POPT12 = 0 THEN GO TO #16A;

```

PUT SKIP(2) EDIT('TABLE #15: (FREE MOLECULAR FLOW REGIME)',
'PITCHING MOMENT COEF (CLM_FM) - FUNCTION OF MACH#, PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

#15E: DO I=1 TO INT_F7;
      PUT SKIP(2) EDIT('MACH#=',M_FM3(1))
      (COL(4),A,COL(11),F(4,1));
#15F: DO L = 1 TO 1+INT_F8/15 WHILE (15*L-14 <= INT_F8);
      PUT SKIP EDIT('PHI=',) (COL(4),A);
      PUT EDIT((PHI_FM3(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_F8)))
      (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=',) (COL(2),A);
#15G: DO I=1 TO INT_F9;
      PUT SKIP EDIT(ALF_FM3(11),(CLM_FM(1,J,1)) DO J=15*L-14
      TO 15*L WHILE (J <=INT_F8))
      (F(6,1),COL(9),(15)F(8,4));
      END #15G;
      END #15F;
      END #15E;

/***** PITCHING MOMENT COEFFICIENT (CMO) VS ALTITUDE *****/
/***** GROUP 23-TABLE 16 *****/
#16A: GET LIST(INT_20);
GET LIST((CMO_T(1),CMO_T(1+50) DO I=1 TO INT_20 ));
PUT SKIP(2) EDIT('TABLE #16:',
'ASYMMETRIC PITCH COEF (CMO_T) - FUNCTION OF ALTITUDE ONLY')
(COL(4),A,SKIP,COL(4),A); PUT SKIP;
PUT EDIT((CMO_T(1),CMO_T(1+50) DO I=1 TO INT_20))(R(#826));
/***** ASYMMETRIC ROLLING MOMENT COEF. (CLO) VS ALT./TRANSITION ALT. *****/
GET LIST(INT_21);
GET LIST((CLO_T(1),CLO_T(1+50) DO I=1 TO INT_21 ));
PUT SKIP(2) EDIT('TABLE #17:',
'ASYMMETRIC ROLL COEF (CLO_T) - FUNCTION OF NORMALIZED ALTITUDE ONLY')
(COL(4),A,SKIP,COL(4),A); PUT SKIP;
PUT EDIT((CLO_T(1),CLO_T(1+50) DO I=1 TO INT_21 ))(R(#826));
/***** CHANGE IN CENTER OF PRESSURE/UNIT LENGTH (DELCP/L) VS ALT. *****/
GET LIST(INT_22);
GET LIST((DXCP_T(1),DXCP_T(1+50) DO I=1 TO INT_22 ));
PUT SKIP(2) EDIT('TABLE #18:',
'INCREMENTAL PITCH CENTER OF PRESSURE (DXCP_T) - FUNCTION OF ALTITUDE
ONLY') (COL(4),A,SKIP,COL(4),A); PUT SKIP;

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```

PUT EDIT((DXCP_T(1),DXCP_T(1+50) DO I=1 TO INT_22 ))(R(#826));
/***** ***** GROUP 23-TABLE 19 ***** */
/***** ROLL DAMPING COEFFICIENT (CLLP) CONTINUUM DENSITY ***** */
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK ***** */
#19A: GET LIST(INT_23,INT_23A,AS23,POPT8);
      ALLOCATE M_LC5(INT_23), PHI_LC5(INT_23A), ALF_LC5(AS23),
      CLLP_LC(INT_23,INT_23A,AS23);
#19B: DO I = 1 TO INT_23;
      GET LIST (LABEL1);
      GET LIST (M_LC5(I));

#19C: DO L = 1 TO 1+INT_23A/8 WHILE (8*L-7<=INT_23A);
      GET LIST (LABEL2);
      GET LIST((PHI_LC5(I) DO I=8*L-7 TO 8*L
      WHILE (I<=INT_23A)));
      GET LIST (LABEL3);
      GET LIST (DO K = 1 TO AS23;
      GET LIST (ALF_LC5(K),(CLLP_LC(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT_23A)));
      END #19D;
      END #19C;
      END #19B;

IF POPT8 = 0 THEN GO TO #20A;

PUT SKIP(2) EDIT('TABLE #19: (CONTINUUM REGIME)',
'ROLL DAMPING COEF (CLLP_LC) - FUNCTION OF MACH#,PHI & ALPHA'
(COL(4),A,SKIP,COL(4),A);

#19E: DO I=1 TO INT_23;
      PUT SKIP(2) EDIT('MACH#=',M_LC5(I))
      (COL(4),A,COL(11),F(4,1));
#19F: DO L = 1 TO 1+INT_23A/15 WHILE (15*L-14 <= INT_23A);
      PUT SKIP EDIT('PHI=',) (COL(4),A);
      PUT EDIT((PHI_LC5(K) DO K=15*L-14 TO 15*L WHILE(K<=INT_23A))
      (COL(9),(15) F(8,1));
      PUT SKIP EDIT('ALPHA=',) (COL(2),A);
#19G: DO I=1 TO AS23;
      PUT SKIP EDIT(ALF_LC5(I),(CLLP_LC(I,J,I) DO J=15*L-14
      TO 15*L WHILE (J <=INT_23A))
      (F(6,1),COL(9),(15)F(8,4));
      END #19G;
      END #19F;
      END #19E;

/***** ***** GROUP 23-TABLE 20 ***** */
/***** MASS ADDITION PARAMETER (PMA) VS ALTITUDE ***** */
#20A: GET LIST(INT_24);
      GET LIST((PMA_T(I),PMA_T(1+50) DO I=1 TO INT_24 ));

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00007250
00007260

00001150
00001150
00007280
00007290
00007310
00007320

00003470
00003490
00003620
00003630
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00003650

00007340
00007440
00007510

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00007530
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00003720
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00003750
00003770
00003780
00003790
00003880
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00003930
00007760

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00007790
00007800


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PUT SKIP(2) EDIT('TABLE #20: (CONTINUUM REGIME)',
'MASS ADDITION PARAMETER (PMA_T) - FUNCTION OF ALTITUDE ONLY')
(COL(4),A,SKIP,COL(4),A); PUT SKIP;

PUT EDIT((PMA_T(1),PMA_T(1+50) DO I=1 TO INT_24 ))(R(#826));

/***** OUT OF PLANE PITCHING MOMENT COEF (CMOOP) VS SPIN PARM (SP) *****/
GET LIST(INT_25);
GET LIST((CMOOP_I(1),CMOOP_I(1+50) DO I=1 TO INT_25 ));

PUT SKIP(2) EDIT('TABLE #21:',
'OUT OF PLANE SIDE MOMENT COEF (CMOOP) - FUNCTION OF SPIN PARAMETER')
(COL(4),A,SKIP,COL(4),A); PUT SKIP;

PUT EDIT((CMOOP_I(1),CMOOP_I(1+50) DO I=1 TO INT_25 ))(R(#826));

/***** ROLL MOMENT COEF. (CLL) CONTINUUM DENSITY FORMERLY GROUP -1 *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/
#22A: GET LIST(INT17,INT18,AS1718,POPT9);
      ALLOCATE PHI_LC9(INT18),CLL_LC(INT17,INT18,AS1718),
      M_LC9(INT17),ALF_LC9(AS1718);
#22B: DO I = 1 TO INT17;
      GET LIST (LABEL1);
      GET LIST (M_LC9(I));

#22C: DO L = 1 TO 1+INT18/8 WHILE (8*L-7<=INT18);
      GET LIST (LABEL2);
      GET LIST((PHI_LC9(I) DO I1=8*L-7 TO 8*L
      WHILE (I1<=INT18)));
      GET LIST (LABEL3);
#22D: DO K = 1 TO AS1718;
      GET LIST (ALF_LC9(K),(CLL_LC(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT18)));
      END #22D;
      END #22C;
      END #22B;

IF POPT9 = 0 THEN GO TO #23A;

PUT SKIP(2) EDIT('TABLE #22: (CONTINUUM REGIME)',
'ROLL MOMENT COEF (CLL_LC) - FUNCTION OF MACH#,PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

#22E: DO I=1 TO INT17; PUT SKIP(2) EDIT('MACH#=',M_LC9(I))
(COL(4),A,SKIP,COL(4),A);

#22F: DO L = 1 TO 1+INT18/15 WHILE (15*L-14 <= INT18);
      PUT SKIP EDIT('PHI=') (COL(4),A);

```

00007810
00007820
00007830
00007840
00007850
00007860
00007870

00001150
00007890
00007900
00007910
00007920
00007930
00007940
00007950
00007960
00007970
00007980

00001150
00001150
00008000
00008010
00008030

00003470
00003490
00003620
00003630
00003640
00003650

00008300

00008310
00008320
00008330
00008340
00008370
00008370
00008370
00003760

```

PUT EDIT((PHI_LC9(K) DO K=15*L-14 TO 15*L WHILE(K<=INT18)))
(COL(9),(15) F(8,1));
PUT SKIP EDIT('ALPHA=') (COL(2),A);
#22G: DO I=1 TO AS1718;
PUT SKIP EDIT(ALF_LC9(I),(CLN_LC(I,J,I) DO J=15*L-14
TO 15*L WHILE (J <=INT18)))
(F(6,1),COL(9),(15)F(8,4));

```

```

END #22G;
END #22F;
END #22E;

```

```

/***** GROUP 23-TABLE 23 *****/
/***** YAW MOMENT COEFFICIENT (CLN_FM) FOR FREE MOLECULAR FLOW *****/
/***** FUNCTION OF MACH NUMBER, ROLL ANGLE, AND ANGLE OF ATTACK *****/

```

```

#23A: GET LIST(INT_F13, INT_F14, INT_F15, POPT14);
ALLOCATE M_FM5(INT_F13), ALF_FM5(INT_F15), PHI_FM5(INT_14),
CLN_FM(INT_F13, INT_F14, INT_F15);

```

```

#23B: DO I = 1 TO INT_F13;
GET LIST (LABEL1);
GET LIST (M_FM5(I));

```

```

#23C: DO L = 1 TO 1+INT_F14/8 WHILE (8*L-7<=INT_F14);
GET LIST (LABEL2);
GET LIST((PHI_FM5(I) DO I=8*L-7 TO 8*L
WHILE (I<=INT_F14)));

```

```

#23D: DO K = 1 TO INT_F15;
GET LIST (ALF_FM5(K), (CLN_FM(I,J,K) DO J=8*L-7 TO 8*L
WHILE (J<=INT_F14)));
END #23D;
END #23C;
END #23B;

```

```

IF POPT14 = 0 THEN GO TO #24A;
PUT SKIP(2) EDIT('TABLE #23: (FREE MOLECULAR FLOW REGIME)',
'YAWING MOMENT COEF (CLN_FM) - FUNCTION OF MACH#, PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);

```

```

#23E: DO I=1 TO INT_F13;
PUT SKIP(2) EDIT('MACH#=',M_FM5(I))
(COL(4),A,COL(11),F(4,1));
#23F: DO L = 1 TO 1+INT_F14/15 WHILE (15*L-14 <= INT_F14);
PUT SKIP EDIT('PHI=') (COL(4),A);
PUT EDIT((PHI_FM5(K) DO K=15*L-14 TO 15*L WHILE (K<=INT_F14)))
(COL(9),(15) F(8,1));

```

```

#23G: DO I=1 TO INT_F15;
PUT SKIP EDIT('ALPHA=') (COL(2),A);
PUT SKIP EDIT(ALF_FM5(I),(CLN_FM(I,J,I) DO J=15*L-14
TO 15*L WHILE (J <=INT_F14)))
(F(6,1),COL(9),(15)F(8,4));

```

```

END #23G;
END #23F;

```

```

00003770
00003780
00003790
00003880
00003890

```

```

00003920
00003920
00003930
00010300

```

```

00009180
00009200
00009210

```

```

00003470
00003490
00003620
00003630

```

```

00003640
00003650

```

```

00009480
00009490
00009500
00009510
00003720
00003740
00003750

```

```

00003760
00003770
00003780
00003790
00003880
00003890

```

```

00003920
00003920

```

```

END #23E;
/***** GROUP 23 - TABLE 24 *****/
/***** DELTA AXIAL FORCE COEFFICIENT (DCAA) DUE TO ABLATION *****/
/***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****/
/***** *****/
/***** *****/

#24A: GET LIST(INT1A,INT2A,AS12A,PORT24);
      ALLOCATE M24A(INT1A),PHI24A(INT2A),ALF24A(AS12A),
             DCA_A(INT1A,INT2A,AS12A);

#24B: DO I=1 TO INT1A;
      GET LIST (LABEL1);
      GET LIST (M24A(I));
#24C: DO L=1 TO 1+INT2A/8 WHILE (8*L-7<=INT2A);
      GET LIST (LABEL2);
      GET LIST ((PHI24A(I)) DO I=8*L-7 TO 8*L
             WHILE (I<=INT2A));
      GET LIST (LABEL3);
#24D: DO K=1 TO AS12A;
      GET LIST (ALF24A(K),(DCA_A(I,J,K) DO J=8*L-7 TO 8*L
             WHILE (J<=INT2A)));
      END #24D;
      END #24C;
      END #24B;

IF PORT24=0 THEN GO TO #25A;
PUT SKIP(2) EDIT ('TABLE #24: (ABLATION REGIME)',
'DELTA AXIAL FORCE COEFF (DCAA) - FUNCTION OF MACH#,PHI & ALPHA')
(COL(4),A,SKIP,COL(4),A);
#24E: DO I=1 TO INT1A;
      PUT SKIP(2) EDIT ('MACH#=',M24A(I))
             (COL(4),A,COL(11),F(4,1));
#24F: DO L=1 TO 1+ INT2A/15 WHILE (15*L-14 <= INT2A);
      PUT SKIP EDIT ('PHI=',)(COL(4),A);
      PUT EDIT ((PHI24A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT2A)))
             (COL(9),(15) F(8,1));
#24G: PUT SKIP EDIT ('ALPHA=',)(COL(2),A);
      DO I=1 TO AS12A;
      PUT SKIP EDIT (ALF24A(I),(DCA_A(I,J,I) DO J=15*L-14 TO 15*L
             WHILE (J <=INT2A)))(F(6,1),COL(9),(15)F(8,4));
      END #24G;
      END #24F;
      END #24E;

/***** GROUP 25 - TABLE 25 *****/
/***** DELTA NORMAL FORCE COEFFICIENT (DCNA) DUE TO ABLATION *****/
/***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****/
/***** *****/
/***** *****/

#25A: GET LIST(INT3A,INT4A,AS34A,PORT25);
      ALLOCATE M25A(INT3A),PHI25A(INT4A),ALF25A(AS34A),
             DCN_A(INT3A,INT4A,AS34A);
#25B: DO I=1 TO INT3A;
      GET LIST (LABEL1);

```

00003930

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

MEMBER NAME INPUT (CONT)

```

#25C: GET LIST (M25A(1));
      DO L=1 TO 1+INT4A/8 WHILE (8*L-7<=INT4A) ;
      GET LIST (LABEL2) ;
      GET LIST ((PHI25A(1)) DO I=8*L-7 TO 8*L
        WHILE (I<=INT4A)) ;
      GET LIST (LABEL3) ;
      DO K=1 TO AS34A ;
      GET LIST (ALF25A(K),(DCN_A(1,J,K) DO J=8*L-7 TO 8*L
        WHILE (J<=INT4A))) ;
      END #25D;
      END #25C;
      END #25B;

      IF POPT24=0 THEN GO TO #26A;
      PUT SKIP(2) EDIT ('TABLE #25: (ABLATION REGIME)',
        'DELTA NORMAL FORCE COEFF (DCNA) - FUNCTION OF MACH#,PHI
        & ALPHA')
      (COL(4),A,SKIP,COL(4),A);
#25E: DO I=1 TO INT3A;
      PUT SKIP(2) EDIT('MACH#=',M25A(1))
        (COL(4),A,COL(11),F(4,1));
#25F: DO L=1 TO 1+ INT4A/15 WHILE (15*L-14 <= INT4A);
      PUT SKIP EDIT ('PHI=',)(COL(4),A);
      PUT EDIT ((PHI25A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT4A)))
        (COL(9),(15) F(8,1));
      PUT SKIP EDIT ('ALPHA=')(COL(2),A);
#25G: DO I=1 TO AS34A;
      PUT SKIP EDIT (ALF25A(11),(DCN_A(1,J,11) DO J=15*L-14 TO 15*L
        WHILE (J <=INT4A))(F(6,1),COL(9),(15)F(8,4));
      END #25G;
      END #25F;
      END #25E;

/***** ***** GROUP 23 - TABLE 26 ***** */
/***** DELTA PITCHING MOMENT COEFFICIENT (DCLMA) DUE TO ABLATION *****/
/***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****/
/***** ***** */

#26A: GET LIST(INT5A,INT6A,AS56A,POPT26);
      ALLOCATE M26A(INT5A),PHI26A(INT6A),ALF26A(AS56A),
        DCLM_A(INT5A,INT6A,AS56A);
#26B: DO I=1 TO INT5A;
      GET LIST (LABEL1) ;
      GET LIST (M26A(1)) ;
#26C: DO L=1 TO 1+INT6A/8 WHILE (8*L-7<=INT6A) ;
      GET LIST (LABEL2) ;
      GET LIST ((PHI26A(1)) DO I=8*L-7 TO 8*L
        WHILE (I<=INT6A)) ;
      GET LIST (LABEL3) ;
      DO K=1 TO AS56A ;
      GET LIST (ALF26A(K),(DCLM_A(1,J,K) DO J=8*L-7 TO 8*L
        WHILE (J<=INT6A))) ;
      END #26D;
      END #26C;

```

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

END #26B;

```
IF POPT26=0 THEN GO TO #27A;
PUT SKIP(2) EDIT ('TABLE #26: (ABLATION REGIME)',
'DELTA PITCHING MOMENT COEFF (DCLMA) - FUNCTION OF MACH#,PHI
& ALPHA')
(COL(4),A,SKIP,COL(4),A);
```

```
#26E: DO I=1 TO INT5A;
      PUT SKIP(2) EDIT('MACH#=',M26A(1))
      (COL(4),A,COL(11),F(4,1));
```

```
#26F: DO L=1 TO 1+ INT6A/15 WHILE (15*L-14 <= INT6A);
      PUT SKIP EDIT ('PHI=',)(COL(4),A);
      PUT EDIT ((PHI26A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT6A)))
      (COL(9),(15) F(8,1));
```

```
#26G: PUT SKIP EDIT ('ALPHA=',)(COL(2),A);
      DO I=1 TO AS56A;
      PUT SKIP EDIT (ALF26A(11),(DCLM_A(1,J,11) DO J=15*L-14 TO 15*L
      WHILE (J <= INT6A)))(F(6,1),COL(9),(15)F(8,4));
```

END #26G;

END #26F;

END #26E;

```
***** GROUP 23 - TABLE 27 *****
***** DELTA SIDE FORCE COEFFICIENT (DCYA) DUE TO ABLATION *****
***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****
*****
```

```
#27A: GET LIST(INT7A,INT8A,AS78A,POPT27);
      ALLOCATE M27A(INT7A),PHI27A(INT8A),ALF27A(AS78A),
      DCY_A(INT7A,INT8A,AS78A);
```

```
#27B: DO I=1 TO INT7A;
      GET LIST (LABEL1);
      GET LIST (M27A(1));
```

```
#27C: DO L=1 TO 1+INT8A/8 WHILE (8*L-7<=INT8A);
      GET LIST (LABEL2);
      GET LIST ((PHI27A(11) DO I=8*L-7 TO 8*L
      WHILE (I<=INT8A)));
```

```
#27D: GET LIST (LABEL3);
      DO K=1 TO AS78A;
```

```
#27E: GET LIST (ALF27A(K),(DCY_A(I,J,K) DO J=8*L-7 TO 8*L
      WHILE (J<=INT8A)));
```

END #27D;

END #27C;

END #27B;

```
IF POPT27=0 THEN GO TO #28A;
PUT SKIP(2) EDIT ('TABLE #27: (ABLATION REGIME)',
'DELTA SIDE FORCE COEFF (DCYA) - FUNCTION OF MACH#,PHI
& ALPHA')
(COL(4),A,SKIP,COL(4),A);
```

```
#27E: DO I=1 TO INT7A;
      PUT SKIP(2) EDIT('MACH#=',M27A(1))
      (COL(4),A,COL(11),F(4,1));
```

```
#27F: DO L=1 TO 1+ INT8A/15 WHILE (15*L-14 <= INT8A);
      PUT SKIP(2) EDIT('MACH#=',M27A(1))
      (COL(4),A,COL(11),F(4,1));
```

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT 4

MEMBER NAME INPUT (CONT)

```

PUT SKIP EDIT ('PHI=')(COL(4),A);
PUT EDIT ((PHI27A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT8A)))
(COL(9),(15) F(8,1));
PUT SKIP EDIT ('ALPHA=') (COL(2),A);
DO I=1 TO AS78A;
PUT SKIP EDIT (ALF27A(I),(DCY_A(I,J,I) DO J=15*L-14 TO 15*L
WHILE (J <=INT8A))(F(6,1),COL(9),(15)F(8,4));
END #27G;
END #27F;
END #27E;

```

```

/***** GROUP 23 - TABLE 28 *****/
/***** DELTA YAWING MOMENT COEFFICIENT (DCLNA) DUE TO ABLATION *****/
/***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****/
/***** *****/

```

```

#28A: GET LIST(INT9A,INT10A,AS910A,POPT28);
ALLOCATE M28A(INT9A),PHI28A(INT10A),ALF28A(AS910A),
DCLN_A(INT9A,INT10A,AS910A);

```

```

#28B: DO I=1 TO INT9A;
GET LIST (LABEL1);
GET LIST (M28A(I));

```

```

#28C: DO L=1 TO 1+INT10A/8 WHILE (8*L-7<=INT10A);
GET LIST (LABEL2);
GET LIST ((PHI28A(I) DO I=8*L-7 TO 8*L
WHILE (I<=INT10A)));

```

```

#28D: GET LIST (LABEL3);
DO K=1 TO AS910A;
GET LIST (ALF28A(K),(DCLN_A(I,J,K) DO J=8*L-7 TO 8*L
WHILE (J<=INT10A)));

```

```

END #28D;
END #28C;
END #28B;

```

```

IF POPT28=0 THEN GO TO #29A;
PUT SKIP(2) EDIT ('TABLE #28: (ABLATION REGIME)',
'DELTA YAWING MOMENT COEFF (DCLNA) - FUNCTION OF MACH#,PHI
& ALPHA',
(COL(4),A,SKIP,COL(4),A);
#28E: DO I=1 TO INT9A;

```

```

PUT SKIP(2) EDIT('MACH#=' ,M28A(I))
(COL(4),A,COL(11),F(4,1));
#28F: DO L=1 TO 1+INT10A/15 WHILE (15*L-14 <= INT10A);
PUT SKIP EDIT ('PHI=')(COL(4),A);
PUT EDIT ((PHI28A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT10A)))
(COL(9),(15) F(8,1));

```

```

#28G: PUT SKIP EDIT ('ALPHA=') (COL(2),A);
DO I=1 TO AS910A;
PUT SKIP EDIT (ALF28A(I),(DCLN_A(I,J,I) DO J=15*L-14 TO 15*L
WHILE (J <=INT10A))(F(6,1),COL(9),(15)F(8,4));

```

```

END #28G;
END #28F;
END #28E;

```

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRNT

```

/***** GROUP 23 - TABLE 29 *****/
/***** DELTA ROLLING MOMENT COEFFICIENT (DCLLA) DUE TO ABLATION *****/
/***** FUNCTION OF MACH NO., ROLL ANGLE, AND ANGLE OF ATTACK *****/
/***** *****/

```

```

#29A: GET LIST(INT11A,INT12A,AS1112A,PORT29);
      ALLOCATE M29A(INT11A),PHI29A(INT12A),ALF29A(AS910A),
            DCLL_A(INT11A,INT12A,AS1112A);

```

```

#29B: DO I=1 TO INT11A;
      GET LIST (LABEL1);

```

```

#29C: GET LIST (M29A(I));
      DO L=1 TO 1+INT12A/8 WHILE (8*L-7<=INT12A);
      GET LIST (LABEL2);
      GET LIST ((PHI29A(I)) DO I=8*L-7 TO 8*L
            WHILE (I<=INT12A));

```

```

#29D: GET LIST (LABEL3);
      DO K=1 TO AS1112A;
      GET LIST (ALF29A(K),(DCLL_A(I,J,K) DO J=8*L-7 TO 8*L
            WHILE (J<=INT12A)));

```

```

      END #29D;
      END #29C;
      END #29B;

```

```

IF PORT29=0 THEN GO TO #23H;
PUT SKIP(2) EDIT ('TABLE #29: (ABLATION REGIME)',
'DELTA ROLLING MOMENT COEFF (DCLLA) - FUNCTION OF MACH#,PHI
& ALPHA')
(COL(4),A,SKIP,COL(4),A);

```

```

#29E: DO I=1 TO INT11A;
      PUT SKIP(2) EDIT('MACH#=',M29A(I))
            (COL(4),A,COL(11),F(4,1));

```

```

#29F: DO L=1 TO 1+ INT12A/15 WHILE (15*L-14 <= INT12A);
      PUT SKIP EDIT ('PHI=',)(COL(4),A);
      PUT EDIT ((PHI29A(K) DO K=15*L-14 TO 15*L WHILE (K<= INT12A)))
            (COL(9),(15) F(8,1));

```

```

#29G: PUT SKIP EDIT ('ALPHA=',) (COL(2),A);
      DO I=1 TO AS1112A;
      PUT SKIP EDIT (ALF29A(I),(DCLL_A(I,J,I) DO J=15*L-14 TO 15*L
            WHILE (J <=INT12A)))(F(6,1),COL(9),(15)F(8,4));

```

```

      END #29G;
      END #29F;
      END #29E;

```

```

#23H: GO TO #900;

```

```

/***** GROUP 24 *****/
/***** GENERATION OF TR2M MATRIX *****/
/***** *****/

```

```

#924: SAZLO=SIN(AZLO);
      CAZLO=COS(AZLO);
#233: SINLO = SIN ( FLO );
      COSLO = COS ( FLO );

```

```

00010320
00010330
00010340
00010350

```

MEMBER NAME INPUT (CONT)
LISTING OF BED.SHARB.TMAGRA6C.SOURCE.PRNT

```

COSLMO = COS ( FLAMO ) ;
SINLMO = SIN ( FLAMO ) ;
CGML0 = COS ( GAMALO ) ;
SGML0 = SIN ( GAMALO ) ;
TR2L0(1,1) = - SINL0 * COSLMO;
TR2L0(2,1) = - SINLMO;
TR2L0(3,1) = - COSL0 * COSLMO;
TR2L0(1,2) = - SINL0 * SINLMO;
TR2L0(2,2) = COSLMO;
TR2L0(3,2) = - COSL0 * SINLMO;
TR2L0(1,3) = COSL0;
TR2L0(2,3) = 0.0;
TR2L0(3,3) = - SINL0;
TL2V(1,1) = CGML0 * CAZL0;
TL2V(2,1) = - SAZL0;
TL2V(3,1) = SGML0 * CAZL0;
TL2V(1,2) = CGML0 * SAZL0;
TL2V(2,2) = CAZL0;
TL2V(3,2) = SGML0 * SAZL0;
TL2V(1,3) = - SGML0;
TL2V(2,3) = 0.;
TL2V(3,3) = CGML0;
SINB0 = SIN ( BETAO ) ;
COSB0 = COS ( BETAO ) ;
SINA = SIN ( ALPHAO ) ;
COSA = COS ( ALPHAO ) ;
ARG1 = SINA * COSB0;
ALPRO=ATAN(ARG1,COSA);
SINPHV = SIN ( PHIV ) ;
COSPHV = COS ( PHIV ) ;
SINA0 = SIN ( ALPRO ) ;
COSA0 = COS ( ALPRO ) ;
TV2M(1,1) = COSB0 * COSA0;
TV2M(2,1) = SINB0 * COSA0;
TV2M(3,1) = SINA0;
TV2M(1,2) = - SINB0 * COSPHV - SINPHV * SINA0 * COSB0;
TV2M(2,2) = COSB0 * COSPHV - SINPHV * SINA0 * SINB0;
TV2M(3,2) = SINPHV * COSA0;
TV2M(1,3) = SINPHV * SINB0 - COSPHV * SINA0 * COSB0;
TV2M(2,3) = - SINPHV * COSB0 - COSPHV * SINA0 * SINB0;
TV2M(3,3) = COSA0 * COSPHV;
DO K=1 TO 3;
DO I=1 TO 3;
TR2V(I,K)=SUM(TL2V(I,*)*TR2L0(*,K));
END;
END #60A;
DO N=1 TO 3;
DO M=1 TO 3;
TR2M0(M,N)=SUM(TV2M(M,*)*TR2V(*,N));
END;
END #61A;
CALL MATSMO ( TR2M0 ) ;
GO TO #900;

```

*****/

LISTING OF BFD, SHARR, TMAGRA6C, SOURCE. PRNT

```

//***** GROUP 25 *****//
//***** CONTROL CARD TO RETURN TO STANDARD ATMOSPHERE DATA *****//0000150

```

#925: NATMOS=0;
GO TO #900;
/*
00010890
00010900
*/ 00010910

```

/***** GROUP 26 *****/
/***** TERMINATES READING OF INPUT DATA *****/00001150

```

#926: RETURN;
*/ 00010930
*/ 00010940

00010970
00010960
00010920

00010300
00010300
00010990
00010990
00011000

DATA LIMIT COUNTERS	
INT_1, INT_2, INT_3, INT_4, INT_5,	*/00011010
INT_6, INT_9, INT_10,	*/00011020
INT_11, INT_12, INT_13, INT_14, INT_15,	*/00011030
INT_16, INT_20,	*/00011C40
INT_21, INT_22, INT_23, INT_24, INT_25)	*/00011050

FIXED BIN(31) EXT;	/*	*/000011060
DDCL (SREF1,SREF2,DREF1,DREF2,HTR,LL)	/*	*/000011070
VEHICLE CHARACTERISTICS	/*	*/000011080

```

DCFL FDSL FLOAT BIN ;
  FLOAI BIN EXT;
    /*
    **/00011080
    /* FUDGE FACTOR FOR
    **/00011090
    /* VEHICLE CHARACTERISTICS
    **/

```

```

DCL PLTPTS FIXED BIN(31) EXT;
      / * VEHICLE CHARACTERISTICS */
      / * PLOT EVERY PLTPTS POINT */
      / *

```

```

DCCL KCLP FLOAT BIN EXT;
/* SKIN FRICTION M.F.          */00011120
/* USED TO CALCULATE CLLP      */

```

```

DCLE CASF_T (100) FLOAT BIN EXT ; /* SKIN FRICTION */
/* /00011370 */

```

```

DUE DCA_I (1000)FLOAI BIN EXI ;
/* DELTA CA VALUES
*/00011390
*/00011400
/* DIMENSIONED TO 1000
*/00011400
/* BECAUSE USES CARD
*/00011410
*/00011410

```

```

DCL DWGT T (100) FLOAT BIN EXT :
/* DELTA WEIGHT VALUES      */
/* OUTPUT FROM AUTO3D        */
/******                      */
/00011420
/00011420
/00011420

```

	/*	/*	/*
DDCL CMO_I (100) FLOAT BIN EXT ;	NOMINAL EXT	TRIM	*/000011500

```

DOCL CLO_T (100) FLOAT BIN EXT ;
/* MOMENT COEF
*/00011510
/* NOMINAL ROLL TORQUE
*/00011520
/* COEF
*/00011530

```

DCCL DXCP_T (100) FLOAT BIN EXT	:	/* COEF	/* CHANGE IN CENTER OF
	:	*/00011533	*/00011540
	:	*/00011533	*/00011550
	:	*/00011550	*/00011550
	:	/* PRESSURE	

```
DCCL PMA_T (100) FLOAT BIN EXT ; /* MASS ADDITION PARAM
```

```
DCCL CMOOP_T (100) FLOAT BIN EXT ; /* HIGH ALT. OUT-OF-PLANE  
/* SIDE MOMENTS
```

```

DCL DXCPV_T (100) FLOAT BIN EXT ;
/* CHANGE IN CENTER OF
/* PRESS FOR VEL/GAMMA
*/00011610
*/00011620

```

```

/* COMBINATIONS
/*****
*
* END CHANGES IN DECLARE STATEMENTS
*
*****
/

DECLARE #30_001 CHAR(38) INITIAL (' WXMO = INITIAL ROLL RATE (DEG/S00011790
EC)');
DECLARE #30_002 CHAR(39) INITIAL (' WYMO = INITIAL PITCH RATE (DEG/00011800
SEC)');
DECLARE #30_003 CHAR(37) INITIAL (' WZMO = INITIAL YAW RATE (DEG/SEG0011820
C)');
DECLARE #42_001 CHAR(16) INITIAL (' CLO VS ALTITUDE');
DECLARE #48_001 CHAR(18) INITIAL (' INITIAL CONDITIONS);
DECLARE #48_002 CHAR(16) INITIAL (' TO = TIME);
DECLARE #48_003 CHAR(20) INITIAL (' HO = ALTITUDE);
DECLARE #48_004 CHAR(20) INITIAL (' VLO = VELOCITY);
DECLARE #48_005 CHAR(31) INITIAL (' AZLO = FLIGHT PATH AZIMUTH);
DECLARE #48_006 CHAR(29) INITIAL (' GAMALO = FLIGHT PATH ANGLE);
DECLARE #48_007 CHAR(27) INITIAL (' ALPHAO = ANGLE OF ATTACK);
DECLARE #48_008 CHAR(26) INITIAL (' BETAO = SIDESLIP ANGLE);
DECLARE #48_009 CHAR(22) INITIAL (' PHIV = ROLL ANGLE);
DECLARE #48_010 CHAR(24) INITIAL (' TF = CUT-OFF TIME);
DECLARE #48_011 CHAR(28) INITIAL (' HF = CUT-OFF ALTITUDE);
DECLARE #48_012 CHAR(37) INITIAL (' ADMKUL = ADAMS PACKAGE UPPER LIM00011970
IT);
DECLARE #48_013 CHAR(34) INITIAL (' DTMAX = MAX TIME STEP INTERVAL'00011980
);
DECLARE #48_014 CHAR(37) INITIAL (' ALPBARO = RESULTANT ANGLE OF ATTA00011990
CK);
DECLARE #48_015 CHAR(33) INITIAL (' H5=ALTITUDE AT END OF HEAT PULSE');
DECLARE #63_001 CHAR(24) INITIAL (' HB');
DECLARE #63_002 CHAR(2) INITIAL (' HB');
DECLARE #63_003 CHAR(3) INITIAL (' TMB');
DECLARE #63_004 CHAR(3) INITIAL (' LMB');
DECLARE #63_005 CHAR(4) INITIAL (' RHOB');
DECLARE #63_006 CHAR(4) INITIAL (' FT');
DECLARE #63_007 CHAR(7) INITIAL (' (DEG-R)');
DECLARE #63_008 CHAR(10) INITIAL (' (DEG-R/FT)');
DECLARE #63_009 CHAR(11) INITIAL (' (SLUG/CUFT)');
#63:
FORMAT (PAGE,X(28),A(24),SKIP(2),X(13),A(2),X(18),A(3),
X(17),A(3),X(17),A(4),SKIP,X(12),A(4),X(15),A(7),
X(12),A(10),X(11),A(11));
#65:
FORMAT (SKIP,F(18),F(20,2),X(2),E(20,8));
DECLARE #151_001 CHAR(18) INITIAL (' INITIAL POSITION);
DECLARE #151_002 CHAR(24) INITIAL (' FLO = REB LAT AT TO);
DECLARE #151_003 CHAR(25) INITIAL (' FLAMO = REB LONG AT TO);
DECLARE #158_001 CHAR(33) INITIAL (' A = EQUATORIAL RADIUS (FT)'00012160
);
DECLARE #158_002 CHAR(28) INITIAL (' B = POLAR RADIUS (FT)');
DECLARE #158_003 CHAR(32) INITIAL (' OMEGA = EARTHS RATE (RAD/SEC)');
DECLARE #158_004 CHAR(46) INITIAL (' ALPO = GRAVITATIONAL CONSTANT 00012190
(CUFT/SECSQ)');
DECLARE #158_005 CHAR(40) INITIAL (' ALP2 = GRAVITATIONAL CONSTANT 00012220
(SQFT)');
00011630
00011640
00011650
00011660
00011670
00011680
00011690
00011700
00011710
00011720
00011730
00011740
00011750
00011760
00011770
00011780
00011790
00011800
00011810
00011820
00011830
00011840
00011850
00011860
00011870
00011880
00011890
00011900
00011910
00011920
00011930
00011940
00011950
00011960
00011970
00011980
00011990
00012000
00012010
00012020
00012030
00012040
00012050
00012060
00012070
00012080
00012090
00012100
00012110
00012120
00012130
00012140
00012150
00012160
00012170
00012180
00012190
00012200
00012210
00012220
00012230

```

[illegible]

MEMBER NAME INPUT (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

DECLARE CNPBTBL(100)  FLOAT BINARY EXTERNAL;
DECLARE YCGVAR(100)   FLOAT BINARY EXTERNAL;
DECLARE ZCGVAR(100)   FLOAT BINARY EXTERNAL;
DECLARE XMAG          FLOAT BINARY EXTERNAL;
DECLARE HB(300)       FLOAT BINARY EXTERNAL;
DECLARE TMB(300)      FLOAT BINARY EXTERNAL;
DECLARE RHOB(300)     FLOAT BINARY EXTERNAL;
DECLARE GLMB(300)     FLOAT BINARY EXTERNAL;
DECLARE WXM0          FLOAT BINARY EXTERNAL;
DECLARE WYM0          FLOAT BINARY EXTERNAL;
DECLARE WZM0          FLOAT BINARY EXTERNAL;
DECLARE WGT1          FLOAT BINARY EXTERNAL;
DECLARE VIX1          FLOAT BINARY EXTERNAL;
DECLARE VIZ1          FLOAT BINARY EXTERNAL;
DECLARE XCG1          FLOAT BINARY EXTERNAL;
DECLARE VIXY          FLOAT BINARY EXTERNAL;
DECLARE VIXZ          FLOAT BINARY EXTERNAL;
DECLARE VIYZ          FLOAT BINARY EXTERNAL;
DECLARE HBO           FLOAT BINARY EXTERNAL;
DECLARE WGT2          FLOAT BINARY EXTERNAL;
DECLARE VIX2          FLOAT BINARY EXTERNAL;
DECLARE VIY2          FLOAT BINARY EXTERNAL;
DECLARE VIZ2          FLOAT BINARY EXTERNAL;
DECLARE XCG2          FLOAT BINARY EXTERNAL;
DECLARE YCG1          FLOAT BINARY EXTERNAL;
DECLARE YCG2          FLOAT BINARY EXTERNAL;
DECLARE ZCG1          FLOAT BINARY EXTERNAL;
DECLARE ZCG2          FLOAT BINARY EXTERNAL;
DECLARE CM0           FLOAT BINARY EXTERNAL;
DECLARE CN0           FLOAT BINARY EXTERNAL;
DECLARE TF            FLOAT BINARY EXTERNAL;
DECLARE ADMKUL        FLOAT BINARY EXTERNAL;
DECLARE DTMAX         FLOAT BINARY EXTERNAL;
DECLARE CLOTBL(100)   FLOAT BINARY EXTERNAL;
DECLARE TR2M0(3,3)    FLOAT BINARY (53) EXTERNAL;

```

```

/***** ABLATION EFFECTS *****/
DECLARE H5            FLOAT BINARY EXTERNAL;
DECLARE ABLF          FLOAT BINARY EXTERNAL;
/*****

```

```

DECLARE T0           FLOAT BINARY (53) EXTERNAL;
DECLARE H0           FLOAT BINARY (53) EXTERNAL;
DECLARE HF           FLOAT BINARY (53) EXTERNAL;
DECLARE VLO          FLOAT BINARY (53) EXTERNAL;
DECLARE SAZLO        FLOAT BINARY (53) EXTERNAL;
DECLARE CAZLO        FLOAT BINARY (53) EXTERNAL;
DECLARE SGML0        FLOAT BINARY (53) EXTERNAL;
DECLARE CGML0        FLOAT BINARY (53) EXTERNAL;
DECLARE RAD          FLOAT BINARY (53) EXTERNAL;
DECLARE SINLO        FLOAT BINARY (53) EXTERNAL;
DECLARE COSLO        FLOAT BINARY (53) EXTERNAL;
DECLARE SINLMO       FLOAT BINARY (53) EXTERNAL;
DECLARE COSLMO       FLOAT BINARY (53) EXTERNAL;

```

LISTING OF BED.SHAR.B.TMAGRA6C.SOURCE.PRINT
(CONT)

MEMBER NAME INPUT

DECLARE TR2L0(3,3)	FLOAT BINARY (53)	EXTERNAL;
DECLARE TL2V(3,3)	FLOAT BINARY (53)	EXTERNAL;
DECLARE TR2V(3,3)	FLOAT BINARY (53)	EXTERNAL;
DECLARE TV2M(3,3)	FLOAT BINARY (53)	EXTERNAL;
DECLARE SINB0	FLOAT BINARY (53)	EXTERNAL;
DECLARE COSB0	FLOAT BINARY (53)	EXTERNAL;
DECLARE SINA	FLOAT BINARY (53)	EXTERNAL;
DECLARE COSA	FLOAT BINARY (53)	EXTERNAL;
DECLARE ARG1	FLOAT BINARY (53)	EXTERNAL;
DECLARE ALPRO	FLOAT BINARY (53)	EXTERNAL;
DECLARE SINPHV	FLOAT BINARY (53)	EXTERNAL;
DECLARE COSPHV	FLOAT BINARY (53)	EXTERNAL;
DECLARE SINAO	FLOAT BINARY (53)	EXTERNAL;
DECLARE COSAO	FLOAT BINARY (53)	EXTERNAL;
DECLARE SALPB0	FLOAT BINARY (53)	EXTERNAL;
DECLARE CALPB0	FLOAT BINARY (53)	EXTERNAL;
DECLARE FLO	FLOAT BINARY (53)	STATIC;
DECLARE FLOD	FLOAT BINARY (53)	STATIC;
DECLARE FLAM0	FLOAT BINARY (53)	STATIC;
DECLARE FLAM0D	FLOAT BINARY (53)	STATIC;
DECLARE AZLO	FLOAT BINARY (53)	STATIC;
DECLARE ALPHAO	FLOAT BINARY (53)	STATIC;
DECLARE BETAO	FLOAT BINARY (53)	STATIC;
DECLARE PHIV	FLOAT BINARY (53)	STATIC;
DECLARE GAMALO	FLOAT BINARY (53)	STATIC;
DECLARE INT1	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT2	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT3	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT4	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT5	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT6	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT7	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT8	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT9	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT10	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT11	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT13	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT14	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT16	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT17	FLOAT BINARY (31)	EXTERNAL;
DECLARE INT18	FLOAT BINARY (31)	EXTERNAL;
DECLARE INP1	FLOAT BINARY (31)	STATIC;
DECLARE I	FLOAT BINARY (31)	STATIC;
DECLARE INP2	FLOAT BINARY (31)	STATIC;
DECLARE NTMS	FLOAT BINARY (31)	STATIC;
DECLARE J	FLOAT BINARY (31)	STATIC;
DECLARE I1	FLOAT BINARY (31)	STATIC;
DECLARE K	FLOAT BINARY (31)	STATIC;
DECLARE N	FLOAT BINARY (31)	STATIC;
DECLARE M	FLOAT BINARY (31)	STATIC;
DECLARE L	FLOAT BINARY (31)	STATIC;
DECLARE DHOB(300)	FLOAT BINARY;	
DECLARE DB(300)	FLOAT BINARY;	
DECLARE DMB(300)	FLOAT BINARY;	
DECLARE X1	FLOAT BINARY;	

00012970

00012970

00012970

00012970

00012970

LISTING OF BFD.SHARB.TMAGRAGC.SOURCE.PRNT

MEMBER NAME INPUT (CONT)

```

DECLARE Y1          FLOAT BINARY;
DECLARE Z1          00012970
DECLARE X2          FLOAT BINARY;
DECLARE Y2          00012970
DECLARE Z2          FLOAT BINARY;
DECLARE X3          00012970
DECLARE Y3          FLOAT BINARY;
DECLARE Z3          FLOAT BINARY;
DECLARE F           /*****
DECLARE ATAN        BUILTIN;
DECLARE COS         BUILTIN;
DECLARE SUM         BUILTIN;
DECLARE SIN         BUILTIN;
DECLARE MAX         BUILTIN;
DECLARE MATSMO ENTRY((*,*) FLOAT BIN(53));
DECLARE SYSIN       FILE EXT;
DECLARE SYSPRINT    FILE EXT;
END INPUT ;
//L.SYSPRINT DD SYSOUT=C

```

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

MEMBER NAME ATMOS

```

ATMOS:  PROCEDURE(Z,N,HB,TMB,GLMB,RHOB,RHO,V,VCGAIR);
/* PROCEDURE REVISED 12/30/70 TO MAKE TAMBNT(=T) EXTERNAL
IF N .NE. 0 THEN GO TO #21;
N=NSTD;
DO I = 1 TO N;
HB(I)=HBSTD(I);
TMB(I)=TMBSTD(I);
GLMB(I)=GLMBSTD(I);
RHOB(I)=RHOBSTD(I);
END;
PUT PAGE LIST(' PROGRAM USES 1962 STANDARD ATMOSPHERE');
PUT EDIT ((HB(I),TMB(I),GLMB(I),RHOB(I) DO I=1 TO N))(R(#50));
#50:  FORMAT (SKIP,2 F(15,3),2 E(20,8));
#21:  H=Z*RE/(Z+RE);
DO I = 2 TO N;
IF H < HB(I) THEN GO TO #2D;
END;
#2D:  IF GLMB(I-1) .NE. 0 THEN GO TO #3E;
      RHO=RHOB(I-1)*EXP(-(H-HB(I-1))*GO/(R*TMB(I-1)));
      T=TMB(I-1);
      GO TO #6C;
#3E:  T=TMB(I-1)+GLMB(I-1)*(H-HB(I-1));
      RHO=RHOB(I-1)*(T/TMB(I-1))*(-(1.+GO/(R*GLMB(I-1))));
#6C:  V=SQRT(1.4*R*T);
      TAMBNT=T;

/* CALCULATE REYNOLDS NUMBER/TOTAL LENGTH WHERE *
/* VISCOSITY IS FOUND BY USING SUTHERLAND'S EQUATION */
MUE = MUE_REF * (SQRT(T/T_REF)) * ((1+198.7/T_REF)/(1+198.7/T));
RE_LL = RHO * VCGAIR/MUE;

RETURN;

DCL (N,I) FIXED BIN(31);
DECLARE (HB(*),TMB(*),GLMB(*),RHOB(*),H,T,RHO,P,V) FLOAT BINARY;
DCL Z FLOAT BIN;
DCL GO FLOAT BIN STATIC INIT(32.1741);
DCL R FLOAT BIN STATIC INIT(1716.5631);
DCL RE FLOAT BIN(53) STATIC INIT(20855531.);
DCL TAMBNT FLOAT BIN EXT;
DCL RE_LL FLOAT BIN EXT;
DCL MUE_REF FLOAT BIN STATIC
  INIT(3.719E-07);
DCL T_REF FLOAT BIN STATIC
  INIT(519.0);
DCL MUE FLOAT BIN;
DCL VCGAIR FLOAT BIN;

/* REYNOLDS #/VEHICLE LENGTH*/
/* REFERENCE VISCOSITY */
/* REFERENCE TEMPERATURE */
/* DEGREE RANKINE */
/* VISCOSITY */
/* FREE STREAM VELOCITY */

```


MEMBER NAME ATMOS (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

/* 1962 STANDARD ATMOSPHERE
DCL NSTD FIXED BIN(31) STATIC INIT(22);
DCL HBSTD(22) FLOAT BIN STATIC INIT
    ( 0., 36089.24, 65616.8, 104985.88, 154199.4,
    170603.68, 200131.24, 259186.36, 291153.22, 323002.64, 354753.29,
    386406.18, 480780.86, 512045.95, 543215.24, 605268.39, 728243.79,
    939894.72, 1234645.7, 1520799.3, 1798726.4, 2068776.3);
DCL TMBSTD(22) FLOAT BIN STATIC INIT
    ( 518.67, (2)389.97, 411.57, (2)487.17,
    454.77, (2)325.17, 379.17, 469.17, 649.17, 1729.17, 1999.17, 2179.17,
    2431.17, 2791.17, 3295.17, 3889.17, 4357.17, 4663.17, 4861.17);
DCL GLMBST(22) FLOAT BIN STATIC INIT
    ( -3.5662E-3, 0., 5.4864E-4, 1.5362E-3, 0.,
    -1.0973E-3, -2.1946E-3, 0., 1.6953E-3, 2.8343E-3, 5.6867E-3, 1.1444E-2,
    8.635E-3, 5.7744E-3, 4.061E-3, 2.927E-3, 2.3811E-3, 2.0152E-3, 1.6355E-3,
    1.1011E-3, 7.3298E-4, 0.);
DCL RHOBST(22) FLOAT BIN STATIC INIT
    ( 2.3769E-3, 7.0612E-4, 1.7082E-4, 2.5661E-5,
    2.7698E-6, 1.4735E-6, 4.8719E-7, 3.8826E-8, 6.1508E-9, 9.6511E-10,
    1.9071E-10, 4.7266E-11, 3.5624E-12, 2.2488E-12, 1.5592E-13, 8.4345E-13,
    3.0346E-13, 6.956E-14, 1.2608E-14, 3.0599E-15, 9.0031E-16, 3.0463E-16);
DCL (EXP SORT) BUILTIN;
DCL (SYSPRINT) FILE EXT;
END ATMOS ;

```

```

*/00000820
00000830
00000840
00000850
00000860
00000870
00000880
00000890
00000900
00000910
00000920
00000930
00000940
00000950
00000960
00000970
00000980
00000990
00010000
00010100
00010200
00010300
00010400
00010500

```

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

MEMBER NAME ENTERP

ENTERP: PROCEDURE;

/* THIS PROC CONTAINS THE ENTRY POINTS FOR THE INTERPOLATION
OF EACH AERO TABLE. EACH ENTRY POINT STORES THE INDEX(ES)
OF THE LAST USED TABLE CELL AND STARTS THE TABLE SEARCH
FROM THAT POINT. DEPENDENT VARIABLES MUST HAVE THEIR
SUBSCRIPTS IN THE SAME ORDER AS THE INDEPENDENT VARIABLES
ARE READ IN. INTERNAL SUBROUTINE INTERP2 DOES
THE INTERPOLATION. */

DECLARE INT_#1 FIXED BIN(31);
DECLARE INT_#2 FIXED BIN(31);

DECLARE ICA STATIC FIXED BIN(31) INIT(1);
DECLARE ICN STATIC FIXED BIN(31) INIT(1);
DECLARE IXCP STATIC FIXED BIN(31) INIT(1);
DECLARE ICMQ STATIC FIXED BIN(31) INIT(1);
DECLARE JCA STATIC FIXED BIN(31) INIT(1);
DECLARE JCN STATIC FIXED BIN(31) INIT(1);
DECLARE JXCP STATIC FIXED BIN(31) INIT(1);
DECLARE JCMQ STATIC FIXED BIN(31) INIT(1);

DECLARE SX FLOAT BINARY;
DECLARE SY FLOAT BINARY;
DECLARE X(*) FLOAT BINARY;
DECLARE Y(*) FLOAT BINARY;

DECLARE SEARCH ENTRY (FIXED BIN(31),FLOAT BIN,*) FLOAT BIN,
FIXED BIN(31));

/****** DECLARATION OF VARIABLES DUE TO ABLATION 1/ /89 *****/

DCL (IDCAA,JDCAA,KDCAA,IDCNA,JDCNA,KDCNA,
IDCLMA,JDCLMA,KDCLMA,
IDCYA,JDCYA,KDCYA,IDCLNA,JDCLNA,KDCLNA,
IDCLLA,JDCLLA,KDCLLA)
STATIC FIXED BIN(31) INIT(1) ;

/* DECLARATION OF VARIABLES - MOD: 5/13/85 */

DECLARE ICLP STATIC FIXED BIN(31) INIT(1);
DECLARE JCLP STATIC FIXED BIN(31) INIT(1);
DECLARE KCLP STATIC FIXED BIN(31) INIT(1);
DECLARE ICNR STATIC FIXED BIN(31) INIT(1);
DECLARE JCNR STATIC FIXED BIN(31) INIT(1);
DECLARE KCNR STATIC FIXED BIN(31) INIT(1);
DECLARE ICS STATIC FIXED BIN(31) INIT(1);
DECLARE JCS STATIC FIXED BIN(31) INIT(1);
DECLARE KCS STATIC FIXED BIN(31) INIT(1);
DECLARE ICLL STATIC FIXED BIN(31) INIT(1);
DECLARE JCLL STATIC FIXED BIN(31) INIT(1);
DECLARE KCLL STATIC FIXED BIN(31) INIT(1);
DECLARE KCA STATIC FIXED BIN(31) INIT(1);
DECLARE KCN STATIC FIXED BIN(31) INIT(1);
DECLARE KXCP STATIC FIXED BIN(31) INIT(1);

00000020
00000030
00000040
00000050
00000060
00000070
00000080
00000090
00000100
00000110
00000120
00000120

00000150

00000170
00000190
00000200

00000210
00000220

MEMBER NAME ENTERP (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

```

DECLARE KCMQ          STATIC FIXED BIN(31) INIT(1);
DECLARE INT_#3        FIXED BIN(31);

DECLARE SW            FLOAT BIN;
DECLARE W(*)           FLOAT BIN;
DECLARE Z3(*,*,*)     FLOAT BIN;
DECLARE ZZZ           FLOAT BIN;

```

00000260
00000270
00000280
00000290
00000290
00000290
00000290
00000300
00000320
00000330
00000340
00000341
00000342

/* END OF DECLARATIONS - MOD: 5/13/85 */

/* MODIFICATIONS 12/17/86 */

```

DECLARE ICLN          STATIC FIXED BIN(31) INIT(1);
DECLARE JCLN          STATIC FIXED BIN(31) INIT(1);
DECLARE KCLN          STATIC FIXED BIN(31) INIT(1);
DECLARE JCY           STATIC FIXED BIN(31) INIT(1);
DECLARE JCY           STATIC FIXED BIN(31) INIT(1);
DECLARE JCY           STATIC FIXED BIN(31) INIT(1);
DECLARE JCLM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCLM          STATIC FIXED BIN(31) INIT(1);
DECLARE KCLM          STATIC FIXED BIN(31) INIT(1);

```

```

DECLARE SYSIN         FILE EXT;
DECLARE SYSPRINT       FILE EXT;

```

00000345
00013420
00013420

/* END MODIFICATIONS 12/17/86 */

/* MODIFICATIONS 4/8/87 */

```

DECLARE ICAFM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCAFM          STATIC FIXED BIN(31) INIT(1);
DECLARE ICNFM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCNFM          STATIC FIXED BIN(31) INIT(1);
DECLARE ICNFM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCNFM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCYFM          STATIC FIXED BIN(31) INIT(1);
DECLARE JCYFM          STATIC FIXED BIN(31) INIT(1);
DECLARE KCYFM          STATIC FIXED BIN(31) INIT(1);
DECLARE ICLNFM         STATIC FIXED BIN(31) INIT(1);
DECLARE JCLNFM         STATIC FIXED BIN(31) INIT(1);
DECLARE KCLNFM         STATIC FIXED BIN(31) INIT(1);
DECLARE ICLMFM         STATIC FIXED BIN(31) INIT(1);
DECLARE JCLMFM         STATIC FIXED BIN(31) INIT(1);
DECLARE KCLMFM         STATIC FIXED BIN(31) INIT(1);

```

00000346
00000347
00000341
00000342

/* END MODIFICATIONS 4/8/87 */

```

NTDCAA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCAA,SX,X,INT_#1);
CALL SEARCH(JDCYA,SY,Y,INT_#2);
CALL SEARCH(KDCYA,SW,W,INT_#3);

```

00000346
00001280

MEMBER NAME ENTERP (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```

ZZZ=INTERP3 (IDCYA,JDCYA,KDCYA) ;
RETURN(ZZZ) ;

```

```

NTDCNA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCNA,SX,X,INT_#1) ;
CALL SEARCH(JDCNA,SY,Y,INT_#2) ;
CALL SEARCH(KDCNA,SW,W,INT_#3) ;
ZZZ=INTERP3 (IDCNA,JDCNA,KDCNA) ;
RETURN(ZZZ) ;

```

```

NTDCLMA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCLMA,SX,X,INT_#1) ;
CALL SEARCH(JDCLMA,SY,Y,INT_#2) ;
CALL SEARCH(KDCLMA,SW,W,INT_#3) ;
ZZZ=INTERP3 (IDCLMA,JDCLMA,KDCLMA) ;
RETURN(ZZZ) ;

```

```

NTDCYA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCYA,SX,X,INT_#1) ;
CALL SEARCH(JDCYA,SY,Y,INT_#2) ;
CALL SEARCH(KDCYA,SW,W,INT_#3) ;
ZZZ=INTERP3 (IDCYA,JDCYA,KDCYA) ;
RETURN(ZZZ) ;

```

```

NTDCLNA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCLNA,SX,X,INT_#1) ;
CALL SEARCH(JDCLNA,SY,Y,INT_#2) ;
CALL SEARCH(KDCLNA,SW,W,INT_#3) ;
ZZZ=INTERP3 (IDCLNA,JDCLNA,KDCLNA) ;
RETURN(ZZZ) ;

```

```

NTDCLLA: /* MOD: 1/ /89 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(IDCLLA,SX,X,INT_#1) ;
CALL SEARCH(JDCLLA,SY,Y,INT_#2) ;
CALL SEARCH(KDCLLA,SW,W,INT_#3) ;
ZZZ=INTERP3 (IDCLLA,JDCLLA,KDCLLA) ;
RETURN(ZZZ) ;

```

```

NTRPCA3: /* MOD: 5/13/85 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICA,$X,$X,INT_#1);
CALL SEARCH(JCA,$Y,$Y,INT_#2);
CALL SEARCH(KCA,$W,$W,INT_#3);
ZZZ=INTERP3(ICA,JCA,KCA);
RETURN(ZZZ);

NTRPCN3: /* MOD: 5/13/85 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICN,$X,$X,INT_#1);
CALL SEARCH(JCN,$Y,$Y,INT_#2);
CALL SEARCH(KCN,$W,$W,INT_#3);
ZZZ=INTERP3(ICN,JCN,KCN);
RETURN(ZZZ);

NTRCMQ3: /* MOD: 5/13/85 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICMQ,$X,$X,INT_#1);
CALL SEARCH(JCMQ,$Y,$Y,INT_#2);
CALL SEARCH(KCMQ,$W,$W,INT_#3);
ZZZ=INTERP3(ICMQ,JCMQ,KCMQ);
RETURN(ZZZ);

NTRCLN3: /* MOD: 12/17/86 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICLN,$X,$X,INT_#1);
CALL SEARCH(JCLN,$Y,$Y,INT_#2);
CALL SEARCH(KCLN,$W,$W,INT_#3);
ZZZ=INTERP3(ICLN,JCLN,KCLN);
RETURN(ZZZ);

NTRCLP3: /* MOD: 5/13/85 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICLP,$X,$X,INT_#1);
CALL SEARCH(JCLP,$Y,$Y,INT_#2);
CALL SEARCH(KCLP,$W,$W,INT_#3);
ZZZ=INTERP3(ICLP,JCLP,KCLP);
RETURN(ZZZ);

NTRCLL3: /* MOD: 5/13/85 */
ENTRY ($X,$Y,$W,$X,$Y,$W,$Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);

```

00001290
00001300
00001310
00001390
00001400
00001410
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00001430
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00001470
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00001490
00001500
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00001620
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00001702
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00001800
00001810
00001820
00001830

MEMBER NAME ENTERP (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

```
CALL SEARCH(ICLL,SX,X,INT_#1);
CALL SEARCH(JCLL,SY,Y,INT_#2);
CALL SEARCH(KCLL,SW,W,INT_#3);
ZZZ=INTERP3(ICLL,JCLL,KCLL);
RETURN(ZZZ);
```

```
NTRCN3: /* MOD: 5/13/85 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICNR,SX,X,INT_#1);
CALL SEARCH(JCNR,SY,Y,INT_#2);
CALL SEARCH(KCNR,SW,W,INT_#3);
ZZZ=INTERP3(ICNR,JCNR,KCNR);
RETURN(ZZZ);
```

```
NTRPCY3: /* MOD: 12/17/86 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICY,SX,X,INT_#1);
CALL SEARCH(JCY,SY,Y,INT_#2);
CALL SEARCH(KCY,SW,W,INT_#3);
ZZZ=INTERP3(ICY,JCY,KCY);
RETURN(ZZZ);
```

```
NTRCLM3: /* MOD: 12/17/86 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICLM,SX,X,INT_#1);
CALL SEARCH(JCLM,SY,Y,INT_#2);
CALL SEARCH(KCLM,SW,W,INT_#3);
ZZZ=INTERP3(ICLM,JCLM,KCLM);
RETURN(ZZZ);
```

/* ENTIRE PROCEDURE - MOD: 5/13/85 AND 1/5/87 */
/* MODIFICATIONS 4/8/87 */

```
NTRCAF3: /* MOD: 4/8/87 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICAFM,SX,X,INT_#1);
CALL SEARCH(JCAFM,SY,Y,INT_#2);
CALL SEARCH(KCAFM,SW,W,INT_#3);
ZZZ=INTERP3(ICAFM,JCAFM,KCAFM);
RETURN(ZZZ);
```

```
NTRCNFM: /* MOD: 4/8/87 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICNFM,SX,X,INT_#1);
CALL SEARCH(JCNFM,SY,Y,INT_#2);
CALL SEARCH(KCNFM,SW,W,INT_#3);
ZZZ=INTERP3(ICNFM,JCNFM,KCNFM);
RETURN(ZZZ);
```

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00001880
00001890
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00001910
00001920
00001930
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00001950
00001960
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00002100
00002110
00002120
00002130
00002140
00002150
00002160
00002170
00002180

00001990
00002000
00002010
00002020
00002030
00002040
00002050
00002060

00001990
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00002030
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00002050
00002060

MEMBER NAME ENTERP (CONT) LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

```
NTCLNFM: /* MOD: 4/8/87 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICLNFM,SX,X,INT_#1);
CALL SEARCH(JCLNFM,SY,Y,INT_#2);
CALL SEARCH(KCLNFM,SW,W,INT_#3);
ZZZ=INTERP3(ICLNFM,JCLNFM,KCLNFM);
RETURN(ZZZ);
```

```
NTCLNFM: /* MOD: 4/8/87 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICLNFM,SX,X,INT_#1);
CALL SEARCH(JCLNFM,SY,Y,INT_#2);
CALL SEARCH(KCLNFM,SW,W,INT_#3);
ZZZ=INTERP3(ICLNFM,JCLNFM,KCLNFM);
RETURN(ZZZ);
```

```
NTRCYFM: /* MOD: 4/8/87 */
ENTRY (SX,SY,SW,X,Y,W,Z3,INT_#1,INT_#2,INT_#3)
  RETURNS(FLOAT BIN);
CALL SEARCH(ICYFM,SX,X,INT_#1);
CALL SEARCH(JCYFM,SY,Y,INT_#2);
CALL SEARCH(KCYFM,SW,W,INT_#3);
ZZZ=INTERP3(ICYFM,JCYFM,KCYFM);
RETURN(ZZZ);
```

/* END OF MODIFICATIONS 4/8/87 */

```
INTERP3: PROCEDURE(I,J,K) RETURNS(FLOAT BIN);
DECLARE I FIXED BIN(31);
DECLARE J FIXED BIN(31);
DECLARE K FIXED BIN(31);
DECLARE J1 FIXED BIN(31);
DECLARE J2 FIXED BIN(31);
DECLARE J3 FIXED BIN(31);
```

```
DECLARE ZI3(6) FLOAT BINARY;
DECLARE ZJ3 FLOAT BINARY;
```

```
LOOP1: DO J1=1 TO 6;
  IF (J1=1) ((J1=4) THEN J2=J;
    IF J1<4 THEN J3=K; ELSE J2=J+1;
    ELSE J3=K+1;
  IF J1=3 THEN GO TO #3;
  IF J1=6 THEN GO TO #6;
```

```
/* ZI3(J1)=INTERP3(SX,X(I),X(I+1),Z3(I,J2,J3),Z3(I+1,J2,J3));
PUT EDIT (SX,X(I),X(I+1),Z3(I,J2,J3),Z3(I+1,J2,J3))
  ((5)F(8,4));
```

```
GO TO ENDLOOP;
#3: ZI3(3)=INTERP3(SY,Y(J),Y(J+1),ZI3(1),ZI3(2));
/* PUT EDIT (SY,Y(J),Y(J+1),ZI3(1),ZI3(2))
  ((5)F(8,4));
```

00002320
00002330

LISTING OF BFD. SHARB. TMAGRA6C. SOURCE. PRNT

```

MEMBER NAME ENTERP (CONT)

#6:      GO TO ENDLOOP;
        ZI3(6)=INTOP3(SY,Y(J),Y(J+1),ZI3(4),ZI3(5));
        PUT EDIT (SY,Y(J),Y(J+1),ZI3(4),ZI3(5))
            ((5)F(8,4)); */
ENDLOOP: END LOOP1;

/*      ZJ3=INTOP3(SW,W(K),W(K+1),ZI3(3),ZI3(6));
        PUT EDIT (SW,W(K),W(K+1),ZI3(3),ZI3(6))
            ((5)F(8,4)); */

        RETURN(ZJ3);
        END INTERP3;

/* ENTIRE PROCEDURE - MOD: 5/13/85 */

INTOP3: PROCEDURE(P,Q,R,S,T) RETURNS(FLOAT BIN);

DECLARE P      FLOAT BIN;
DECLARE Q      FLOAT BIN;
DECLARE R      FLOAT BIN;
DECLARE S      FLOAT BIN;
DECLARE T      FLOAT BIN;
DECLARE DUMMY FLOAT BIN;
        DUMMY=((Q-P)*(S-T))/(R-Q)+S;

        RETURN(DUMMY);
        END INTOP3;

        END ENTERP;

```

00002340
00002350

00002360
00002370
00002380

00002390
00002400
00002410
00002420
00002430
00002440
00002450
00002460
00002470
00002470
00002470
00002470
00002470
00002470
00002480
00002490

00002500
00002510
00002520
00002530

LISTING OF BFD.SHARB.TMAGR6C.SOURCE.PRNT

MEMBER NAME MATSMO

```

/* MATRIX SMOOTHER-GSK
   A=1ST ROW, 1ST COLUMN MATRIX ELEMENT
   BEFORE SMOOTHING AND AFTER SMOOTHING
   GIVEN A(1,1) TO A(3,3) BEFORE SMOOTHING
   COMPUTE A(1,1) TO A(3,3) AFTER SMOOTHING

#7:
#8A: DO K = 1, 1+1 TO 2;
#5B: DO I = 1, 1+1 TO 3;
#6C: DO J = 1, 1+1 TO 3;
      IF ABS(A(I,J)) > 8.E-8 THEN GO TO #6C;
      A(I,J) = 0;
#6C: END #5B;
#5B: END #6C;
      D(1,1) = (.5) * ( A(2,2) * A(3,3) - A(2,3) * A(3,2) )
      D(1,2) = (.5) * ( - A(2,1) * A(3,3) + A(2,3) * A(3,1) )
      D(1,3) = (.5) * ( A(2,1) * A(3,2) - A(2,2) * A(3,1) )
      D(2,1) = (.5) * ( + A(3,2) * A(1,3) - A(3,3) * A(1,2) )
      D(2,2) = (.5) * ( - A(3,1) * A(1,3) + A(3,3) * A(1,1) )
      D(2,3) = (.5) * ( + A(3,1) * A(1,2) - A(3,2) * A(1,1) )
      D(3,1) = (.5) * ( A(1,2) * A(2,3) - A(1,3) * A(2,2) )
      D(3,2) = (.5) * ( - A(1,1) * A(2,3) + A(1,3) * A(2,1) )
      D(3,3) = (.5) * ( A(1,1) * A(2,2) - A(1,2) * A(2,1) )
      ROW1 = SQRT ( D(1,1) )
      ROW2 = SQRT ( D(2,1) )
      ROW3 = SQRT ( D(3,1) )
      D(1,*) = D(1,*)/ROW1;
      D(2,*) = D(2,*)/ROW2;
      D(3,*) = D(3,*)/ROW3;
      A=D;
#8A: END #8A;
RETURN;
DECLARE (K,I,J) FIXED BINARY(31);
DCL (A(3,3),D(3,3),ROW1,ROW2,ROW3) FLOAT BIN(53);
DCL (ABS,SQRT) BUILTIN;
END MATSMO;

```

MATS 40
MATS 50
MATS 60
MATS 70
MATS 80
MATS 90
MATS 100
MATS 110
MATS 120
MATS 130
MATS 140
MATS 160
MATS 170
MATS 180
MATS 190
MATS 200
MATS 210
MATS 220
MATS 230
MATS 240
MATS 250
MATS 260
MATS 270
MATS 280
MATS 290
MATS 300
MATS 310
MATS 320
MATS 330
MATS 340
MATS 350
MATS 360
MATS 370
MATS 380
MATS 390
MATS 410
MATS 420
MATS 430
MATS 470
MATS 500
MATS 510
MATS 520
MATS 530
MATS 540

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

MEMBER NAME PAR

```

/*
  PAR : PROCEDURE ( X, Y, XSTAR, YSTAR ) ;
  X = ARRAY OF INDEP. VAR.
  Y = ARRAY OF DEP. VAR.
  XSTAR = VALUE OF INDEP. VAR.
  YSTAR = F(XSTAR), PARABOLIC INTERPOLATION
  IF ANY X,S ARE = , YSTAR = MIDPOINT OF (Y(1),Y(2)) */
  X12 = X(1) - X(2) ;
  X13 = X(1) - X(3) ;
  X23 = X(2) - X(3) ;
  IF X12 = 0 THEN GO TO #25 ; ELSE GO TO #10;
  IF X13 = 0 THEN GO TO #25 ; ELSE GO TO #11;
  IF X23 = 0 THEN GO TO #25 ; ELSE GO TO #12;
  X1 = XSTAR - X(1) ;
  X2 = XSTAR - X(2) ;
  X3 = XSTAR - X(3) ;
  YSTAR = Y(1) * X2 * X3 / ( X12 * X13 ) - Y(2) * X1 *
  X3 / ( X12 * X23 ) + Y(3) * X1 * X2 / ( X13 * X23 ) ;
  RETURN;
  YSTAR = .5 * ( Y(2) + Y(1) ) ;
  GO TO #20;
  #10:
  #11:
  #12:
  #20:
  #25:
  DECLARE (X(3),Y(3),XSTAR,YSTAR,X12,X13,X23,X1,X2,X3) FLOAT BINARY;
  END PAR ;
  PAR 40
  PAR 50
  PAR 60
  PAR 70
  PAR 80
  PAR 90
  PAR 100
  PAR 110
  PAR 120
  PAR 130
  PAR 140
  PAR 150
  PAR 160
  PAR 170
  PAR 180
  PAR 190
  PAR 200
  PAR 210
  PAR 220
  PAR 230
  PAR 240
  PAR 260

```

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRINT

MEMBER NAME PIFAZL

PIFAZL: PROCEDURE(X,XLIST,N) RETURNS(FLOAT BIN);

K=HBOUND(XLIST,1)/2;

DO I=2 TO N-1;

IF X < XLIST(I) THEN GO TO #7;

END #1;

I = I - 1;

A=XLIST(I+K);

B=XLIST(I+K+1);

IF ABS(A-B) > PI THEN IF A < B THEN A=A+TWOPI;

ELSE B=B+TWOPI;

PIF1\$=A + (A-B)*(XLIST(I)-X)/(XLIST(I+1)-XLIST(I));

PIF1\$=MOD(PIF1\$,TWOPI);

RETURN (PIF1\$);

DECLARE (PI,INITIAL (180.)),TWOPI INITIAL (360.)) FLOAT BINARY STATIC;

DECLARE (A,B) FLOAT BINARY;

DCL(N,I,K) FIXED BIN(31);

DECLARE (XLIST(*),X) FLOAT BINARY;

DECLARE PIF1\$ FLOAT BINARY;

DCL (ABS,HBOUND,MOD) BUILTIN;

END PIFAZL;

PIFAZL

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

MEMBER NAME PIFREB

PIFREB: PROCEDURE(X,XLIST,N) RETURNS(FLOAT BIN);

K=HBOUND(XLIST,1)/2;

#1: DO I=2 TO N-1;

IF X < XLIST(I) THEN GO TO #7;

END #1;

I = I - 1;

#9: PIF1\$=XLIST(I+K)+(XLIST(I)-X)*(XLIST(I+K)-XLIST(I+K+1))/

(XLIST(I+1)-XLIST(I));

#10: RETURN (PIF1\$);

DCL(N,I,K) FIXED BIN(31);

DECLARE (XLIST(*),X) FLOAT BINARY;

DECLARE PIF1\$ FLOAT BINARY;

DCL (HBOUND) BUILTIN;

END PIFREB;

PIFR 50
PIFR 100
PIFR 110
PIFR 120
PIFR 200
PIFR 210
PIFR 220
PIFR 230
PIFR 240
PIFR 250
PIF1 251
PIFR

MEMBER NAME SEARCH LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

MEMBER NAME SEARCH

```

SEARCH: PROCEDURE(I,SX,X,IDATA);
/*
  PROC SEARCH SEARCHES A ONE DIMENSIONAL ARRAY, X, STARTING
  FROM ENEMENT I, AND RETURNS A NEW VALUE I, SUCH THAT:
  X(I)<=SX<X(I+1)
*/
  DCL IDATA FIXED BIN(31);
  DCL I FIXED BIN(31);
  DCL (SX,X(*)) FLOAT BIN;
  IF I>IDATA THEN I=IDATA;
  IF SX>X(I) THEN
    UP: DO WHILE(X(I+1)<=SX&I+1<IDATA);
        I=I+1;
      END UP;
    ELSE
      DOWN: DO;
      DLOOP: DO WHILE(X(I-1)>SX&I>2);
        I=I-1;
      END DLOOP;
        I=I-1;
      END DOWN;
      RETURN;
    END SEARCH;

```

00000070
00000080
00000090
00000100
00000110
00000120
00000125
00000130
00000140
00000170
00000180
00000190
00000200
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00000240
00000250
00000260
00000270
00000280
00000290
00000300

LISTING OF BFD.SHARB.TMAGRA6C.SOURCE.PRNT

MEMBER NAME *SOLVE

```

DETM: PROCEDURE (E, RESULT);
      SOLVE : PROCEDURE ( COE, CON, X, Y, Z ) ;
      RESULT=E(1,1)*(E(3,2)*E(2,3)-E(2,2)*E(3,3)) -E(2,1)*(E(3,2)
      *E(1,3)-E(1,2)*E(3,3)) +E(3,1)*(E(2,2)*E(1,3)-E(1,2)*E(2,3));
      RETURN;
DECLARE (E(3,3),RESULT) FLOAT BINARY;
END DETM;
      CALL DETM(COE,DELTA);
      E=COE;
      E(*,1)=CON;
      CALL DETM(E,XDELTA);
      X=XDELTA/DELTA;
      E=COE;
      E(*,2)=CON;
      CALL DETM(E,YDELTA);
      Y=YDELTA/DELTA;
      E=COE;
      E(*,3)=CON;
      CALL DETM(E,ZDELTA);
      Z=ZDELTA/DELTA;
      RETURN;
DECLARE (COE(3,3),E(3,3),CON(3),X,Y,Z,DELTA,XDELTA,YDELTA,ZDELTA)
      FLOAT BINARY ;
      END SOLVE ;

```

SOLV 40
SOLV 41
SOLV 42
SOLV 43
SOLV 44
SOLV 45
SOLV 46
SOLV 50
SOLV 60
SOLV 70
SOLV 80
SOLV 90
SOLV 100
SOLV 110
SOLV 120
SOLV 130
SOLV 140
SOLV 150
SOLV 160
SOLV 170
SOLV 180
SOLV 290
SOLV 300
SOLV 310

LISTSRC TERMINATING NORMALLY

APPENDIX C

LISTING OF SIXED6 DATA SET

Appendix

23 2 'MACH# =' 'PHI =' 'ALPHA ='	13 0 'PHI =' 'ALPHA ='	73 0 'PHI =' 'ALPHA ='	150 0 'PHI =' 'ALPHA ='	180 0 'PHI =' 'ALPHA ='	120 0 'PHI =' 'ALPHA ='	90 0 'PHI =' 'ALPHA ='	60 0 'PHI =' 'ALPHA ='	30 0 'PHI =' 'ALPHA ='	0 0 'PHI =' 'ALPHA ='	Axial Force Coefficient (CA)
-180	-1.691	-1.69	-1.69	-1.69	-1.69	-1.688	-1.687	-1.691	-1.691	-1.69
-175	-1.704	-1.695	-1.695	-1.695	-1.695	-1.693	-1.69	-1.687	-1.691	-1.695
-170	-1.682	-1.682	-1.682	-1.682	-1.681	-1.68	-1.677	-1.675	-1.674	-1.682
-165	-1.667	-1.659	-1.659	-1.659	-1.656	-1.656	-1.654	-1.652	-1.667	-1.659
-160	-1.628	-1.624	-1.624	-1.624	-1.623	-1.616	-1.619	-1.617	-1.617	-1.624
-155	-1.577	-1.577	-1.577	-1.577	-1.578	-1.565	-1.571	-1.572	-1.592	-1.577
-150	-1.496	-1.524	-1.524	-1.524	-1.526	-1.494	-1.516	-1.522	-1.496	-1.524
-145	-1.417	-1.46	-1.46	-1.46	-1.464	-1.402	-1.448	-1.466	-1.417	-1.46
-140	-1.294	-1.352	-1.352	-1.352	-1.36	-1.275	-1.346	-1.359	-1.294	-1.352
-135	-1.162	-1.204	-1.204	-1.204	-1.195	-1.18	-1.19	-1.198	-1.162	-1.204
-130	-0.969	-0.994	-0.994	-0.994	-1.018	-0.986	-0.998	-1.01	-0.969	-0.994
-125	-0.751	-0.796	-0.796	-0.796	-0.841	-0.767	-0.795	-0.823	-0.751	-0.796
-120	-0.538	-0.588	-0.588	-0.588	-0.637	-0.552	-0.591	-0.631	-0.538	-0.588
-115	-0.361	-0.408	-0.408	-0.408	-0.455	-0.371	-0.412	-0.453	-0.361	-0.408
-110	-0.238	-0.269	-0.269	-0.269	-0.3	-0.242	-0.27	-0.299	-0.238	-0.269
-105	-0.157	-0.17	-0.17	-0.17	-0.184	-0.157	-0.171	-0.184	-0.157	-0.17
-100	-0.09	-0.102	-0.102	-0.102	-0.114	-0.089	-0.102	-0.115	-0.09	-0.102
-95	-0.029	-0.04	-0.04	-0.04	-0.052	-0.031	-0.042	-0.053	-0.029	-0.04
-90	0.002	0.004	0.004	0.004	0.006	0.002	0.003	0.005	0.002	0.004
-85	0.05	0.058	0.058	0.058	0.065	0.047	0.054	0.061	0.05	0.058
-80	0.113	0.12	0.12	0.12	0.127	0.108	0.115	0.121	0.113	0.12
-75	0.181	0.188	0.188	0.188	0.194	0.172	0.173	0.188	0.181	0.188
-70	0.26	0.278	0.278	0.278	0.296	0.253	0.273	0.292	0.26	0.278
-65	0.383	0.406	0.406	0.406	0.43	0.37	0.401	0.432	0.383	0.406
-60	0.53	0.559	0.559	0.559	0.588	0.54	0.567	0.594	0.53	0.559
-55	0.736	0.772	0.772	0.772	0.772	0.731	0.749	0.768	0.736	0.754
-50	0.935	0.949	0.949	0.949	0.964	0.931	0.944	0.958	0.935	0.949
-45	1.093	1.155	1.155	1.155	1.156	1.106	1.145	1.147	1.093	1.155
-40	1.244	1.325	1.325	1.325	1.314	1.223	1.31	1.309	1.244	1.325
-35	1.363	1.423	1.423	1.423	1.417	1.353	1.409	1.407	1.363	1.423
-30	1.45	1.482	1.482	1.482	1.477	1.444	1.472	1.472	1.45	1.482
-25	1.518	1.531	1.531	1.531	1.529	1.516	1.526	1.528	1.518	1.531
-20	1.572	1.575	1.575	1.575	1.576	1.57	1.575	1.576	1.572	1.575
-15	1.612	1.615	1.615	1.615	1.617	1.611	1.612	1.614	1.612	1.615
-10	1.643	1.637	1.637	1.637	1.642	1.641	1.641	1.641	1.643	1.637
-5	1.658	1.652	1.652	1.652	1.656	1.658	1.654	1.658	1.658	1.652
0	1.658	1.653	1.653	1.653	1.654	1.658	1.656	1.658	1.658	1.653
5	1.643	1.637	1.637	1.637	1.656	1.658	1.654	1.658	1.658	1.653
10	1.612	1.615	1.615	1.615	1.642	1.641	1.641	1.641	1.643	1.637
15	1.572	1.575	1.575	1.575	1.617	1.611	1.612	1.614	1.612	1.615
20	1.518	1.531	1.531	1.531	1.576	1.57	1.575	1.576	1.572	1.575
25	1.45	1.482	1.482	1.482	1.529	1.516	1.526	1.528	1.518	1.531
30	1.363	1.423	1.423	1.423	1.477	1.444	1.472	1.472	1.45	1.482
35	1.244	1.325	1.325	1.325	1.417	1.353	1.409	1.407	1.363	1.423
40	1.093	1.155	1.155	1.155	1.314	1.223	1.31	1.309	1.244	1.325
45	0.935	0.949	0.949	0.949	1.156	1.106	1.145	1.147	0.935	0.949
50	0.736	0.754	0.754	0.754	0.964	0.931	0.944	0.958	0.736	0.754
55	0.53	0.559	0.559	0.559	0.772	0.731	0.749	0.768	0.53	0.559
60	0.383	0.406	0.406	0.406	0.588	0.54	0.567	0.594	0.383	0.406
65	0.26	0.278	0.278	0.278	0.43	0.37	0.401	0.432	0.26	0.278
70	0.181	0.188	0.188	0.188	0.296	0.253	0.273	0.292	0.181	0.188
75	0.113	0.12	0.12	0.12	0.194	0.172	0.18	0.188	0.113	0.12
80	0.05	0.058	0.058	0.058	0.127	0.108	0.115	0.121	0.05	0.058
85	0.002	0.004	0.004	0.004	0.065	0.047	0.054	0.061	0.002	0.004
90	-0.029	-0.04	-0.04	-0.04	0.006	0.002	0.003	0.005	-0.029	-0.04
95	-0.09	-0.102	-0.102	-0.102	-0.052	-0.031	-0.042	-0.053	-0.09	-0.102
100					-0.114	-0.089	-0.102	-0.115		

	pH = 60				pH = 90				pH = 120				pH = 150				pH = 180			
	ALPHA = 1				ALPHA = 1				ALPHA = 1				ALPHA = 1				ALPHA = 1			
105	-0.157	-0.17	-0.184	-0.157	-0.157	-0.17	-0.184	-0.157	-0.157	-0.17	-0.184	-0.157	-0.157	-0.17	-0.184	-0.157	-0.157			
110	-0.238	-0.269	-0.3	-0.242	-0.238	-0.269	-0.455	-0.242	-0.238	-0.269	-0.455	-0.242	-0.238	-0.269	-0.455	-0.242	-0.238			
115	-0.361	-0.408	-0.455	-0.371	-0.361	-0.408	-0.637	-0.371	-0.361	-0.408	-0.637	-0.371	-0.361	-0.408	-0.637	-0.371	-0.361			
120	-0.538	-0.588	-0.637	-0.552	-0.538	-0.588	-0.841	-0.552	-0.538	-0.588	-0.841	-0.552	-0.538	-0.588	-0.841	-0.552	-0.538			
125	-0.751	-0.796	-0.841	-0.767	-0.751	-0.796	-1.018	-0.767	-0.751	-0.796	-1.018	-0.767	-0.751	-0.796	-1.018	-0.767	-0.751			
130	-0.969	-0.994	-1.018	-0.986	-0.969	-0.994	-1.195	-0.986	-0.969	-0.994	-1.195	-0.986	-0.969	-0.994	-1.195	-0.986	-0.969			
135	-1.162	-1.204	-1.195	-1.18	-1.162	-1.204	-1.36	-1.18	-1.162	-1.204	-1.36	-1.18	-1.162	-1.204	-1.36	-1.18	-1.162			
140	-1.294	-1.352	-1.36	-1.275	-1.294	-1.352	-1.464	-1.275	-1.294	-1.352	-1.464	-1.275	-1.294	-1.352	-1.464	-1.275	-1.294			
145	-1.417	-1.46	-1.464	-1.402	-1.417	-1.46	-1.526	-1.402	-1.417	-1.46	-1.526	-1.402	-1.417	-1.46	-1.526	-1.402	-1.417			
150	-1.496	-1.524	-1.526	-1.494	-1.496	-1.524	-1.578	-1.494	-1.496	-1.524	-1.578	-1.494	-1.496	-1.524	-1.578	-1.494	-1.496			
155	-1.592	-1.577	-1.578	-1.565	-1.592	-1.577	-1.623	-1.565	-1.592	-1.577	-1.623	-1.565	-1.592	-1.577	-1.623	-1.565	-1.592			
160	-1.628	-1.624	-1.623	-1.616	-1.628	-1.624	-1.656	-1.616	-1.628	-1.624	-1.656	-1.616	-1.628	-1.624	-1.656	-1.616	-1.628			
165	-1.667	-1.659	-1.656	-1.641	-1.667	-1.659	-1.681	-1.641	-1.667	-1.659	-1.681	-1.641	-1.667	-1.659	-1.681	-1.641	-1.667			
170	-1.691	-1.682	-1.681	-1.668	-1.691	-1.682	-1.691	-1.668	-1.691	-1.682	-1.691	-1.668	-1.691	-1.682	-1.691	-1.668	-1.691			
175	-1.704	-1.695	-1.691	-1.688	-1.704	-1.695	-1.691	-1.688	-1.704	-1.695	-1.691	-1.688	-1.704	-1.695	-1.691	-1.688	-1.704			
180	-1.691	-1.69	-1.69	-1.688	-1.691	-1.69	-1.69	-1.688	-1.691	-1.69	-1.69	-1.688	-1.691	-1.69	-1.69	-1.688	-1.691			
180	-1.691	-1.688	-1.687	-1.691	-1.691	-1.688	-1.687	-1.691	-1.691	-1.688	-1.687	-1.691	-1.691	-1.688	-1.687	-1.691	-1.691			
175	-1.691	-1.693	-1.69	-1.687	-1.691	-1.693	-1.69	-1.687	-1.691	-1.693	-1.69	-1.687	-1.691	-1.693	-1.69	-1.687	-1.691			
170	-1.681	-1.68	-1.654	-1.677	-1.681	-1.68	-1.654	-1.677	-1.681	-1.68	-1.654	-1.677	-1.681	-1.68	-1.654	-1.677	-1.681			
165	-1.656	-1.656	-1.619	-1.652	-1.656	-1.656	-1.619	-1.652	-1.656	-1.656	-1.619	-1.652	-1.656	-1.656	-1.619	-1.652	-1.656			
160	-1.623	-1.616	-1.619	-1.617	-1.623	-1.616	-1.619	-1.617	-1.623	-1.616	-1.619	-1.617	-1.623	-1.616	-1.619	-1.617	-1.623			
155	-1.578	-1.565	-1.571	-1.572	-1.578	-1.565	-1.516	-1.572	-1.578	-1.565	-1.516	-1.572	-1.578	-1.565	-1.516	-1.572	-1.578			
150	-1.526	-1.494	-1.516	-1.522	-1.526	-1.494	-1.448	-1.522	-1.526	-1.494	-1.448	-1.522	-1.526	-1.494	-1.448	-1.522	-1.526			
145	-1.464	-1.402	-1.448	-1.466	-1.464	-1.402	-1.346	-1.466	-1.464	-1.402	-1.346	-1.466	-1.464	-1.402	-1.346	-1.466	-1.464			
140	-1.36	-1.275	-1.346	-1.359	-1.36	-1.275	-1.19	-1.359	-1.36	-1.275	-1.19	-1.359	-1.36	-1.275	-1.19	-1.359	-1.36			
135	-1.195	-1.18	-1.19	-1.198	-1.195	-1.18	-0.998	-1.198	-1.195	-1.18	-0.998	-1.198	-1.195	-1.18	-0.998	-1.198	-1.195			
130	-1.018	-0.986	-0.998	-1.01	-1.018	-0.986	-0.795	-1.01	-1.018	-0.986	-0.795	-1.01	-1.018	-0.986	-0.795	-1.01	-1.018			
125	-0.841	-0.767	-0.795	-0.823	-0.841	-0.767	-0.591	-0.823	-0.841	-0.767	-0.591	-0.823	-0.841	-0.767	-0.591	-0.823	-0.841			
120	-0.637	-0.552	-0.591	-0.631	-0.637	-0.552	-0.412	-0.631	-0.637	-0.552	-0.412	-0.631	-0.637	-0.552	-0.412	-0.631	-0.637			
115	-0.455	-0.371	-0.412	-0.453	-0.455	-0.371	-0.27	-0.453	-0.455	-0.371	-0.27	-0.453	-0.455	-0.371	-0.27	-0.453	-0.455			
110	-0.3	-0.242	-0.27	-0.299	-0.3	-0.242	-0.171	-0.299	-0.3	-0.242	-0.171	-0.299	-0.3	-0.242	-0.171	-0.299	-0.3			
105	-0.184	-0.157	-0.171	-0.184	-0.184	-0.157	-0.102	-0.184	-0.184	-0.157	-0.102	-0.184	-0.184	-0.157	-0.102	-0.184	-0.184			
100	-0.114	-0.089	-0.102	-0.115	-0.114	-0.089	-0.053	-0.115	-0.114	-0.089	-0.053	-0.115	-0.114	-0.089	-0.053	-0.115	-0.114			
95	-0.052	-0.031	-0.042	-0.054	-0.052	-0.031	0.003	-0.054	-0.052	-0.031	0.003	-0.054	-0.052	-0.031	0.003	-0.054	-0.052			
90	0.006	0.002	0.003	0.005	0.006	0.002	0.003	0.005	0.006	0.002	0.003	0.005	0.006	0.002	0.003	0.005	0.006			
85	0.065	0.047	0.054	0.061	0.065	0.047	0.054	0.061	0.065	0.047	0.054	0.061	0.065	0.047	0.054	0.061	0.065			
80	0.127	0.108	0.115	0.121	0.127	0.108	0.115	0.121	0.127	0.108	0.115	0.121	0.127	0.108	0.115	0.121	0.127			
75	0.194	0.172	0.18	0.188	0.194	0.172	0.18	0.188	0.194	0.172	0.18	0.188	0.194	0.172	0.18	0.188	0.194			
70	0.296	0.253	0.273	0.292	0.296	0.253	0.273	0.292	0.296	0.253	0.273	0.292	0.296	0.253	0.273	0.292	0.296			
65	0.43	0.37	0.401	0.432	0.43	0.37	0.401	0.432	0.43	0.37	0.401	0.432	0.43	0.37	0.401	0.432	0.43			
60	0.588	0.54	0.567	0.594	0.588	0.54	0.567	0.594	0.588	0.54	0.567	0.594	0.588	0.54	0.567	0.594	0.588			
55	0.772	0.731	0.749	0.768	0.772	0.731	0.749	0.768	0.772	0.731	0.749	0.768	0.772	0.731	0.749	0.768	0.772			
50	0.964	0.931	0.944	0.958	0.964	0.931	0.944	0.958	0.964	0.931	0.944	0.958	0.964	0.931	0.944	0.958	0.964			
45	1.156	1.106	1.145	1.147	1.156	1.106	1.145	1.147	1.156	1.106	1.145	1.147	1.156	1.106	1.145	1.147	1.156			
40	1.314	1.223	1.31	1.309	1.314	1.223	1.409	1.309	1.314	1.223	1.409	1.309	1.314	1.223	1.409	1.309	1.314			
35	1.417	1.353	1.409	1.407	1.417	1.353	1.409	1.407	1.417	1.353	1.409	1.407	1.417	1.353	1.409	1.407	1.417			
30	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477			
25	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529			
20	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576			
15	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617			
10	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642			
5	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656			
0	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654			
5	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656	1.658	1.654	1.658	1.656			
10	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642	1.641	1.641	1.641	1.642			
15	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617	1.611	1.612	1.614	1.617			
20	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576	1.57	1.575	1.576	1.576			
25	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529	1.516	1.526	1.528	1.529			
30	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477	1.444	1.472	1.472	1.477			

MACH# =	PHI =	ALPHA =	CA									
			100	-180	-150	-120	-90	-60	-30	0	30	
35	1.417	1.353	1.409	1.407	1.363							
40	1.314	1.223	1.31	1.309	1.244							
45	1.156	1.106	1.145	1.147	1.093							
50	0.964	0.931	0.944	0.958	0.935							
55	0.772	0.731	0.749	0.768	0.736							
60	0.568	0.54	0.567	0.594	0.53							
65	0.43	0.37	0.401	0.432	0.383							
70	0.296	0.253	0.273	0.292	0.26							
75	0.194	0.172	0.18	0.188	0.181							
80	0.127	0.108	0.115	0.121	0.113							
85	0.065	0.047	0.054	0.061	0.05							
90	0.006	0.002	0.003	0.005	0.002							
95	-0.052	-0.031	-0.042	-0.053	-0.029							
100	-0.114	-0.089	-0.102	-0.115	-0.09							
105	-0.184	-0.157	-0.171	-0.184	-0.157							
110	-0.3	-0.371	-0.412	-0.453	-0.361							
115	-0.455	-0.431	-0.491	-0.631	-0.538							
120	-0.637	-0.552	-0.591	-0.823	-0.751							
125	-0.841	-0.767	-0.795	-1.01	-0.969							
130	-1.018	-0.986	-0.998	-1.19	-1.162							
135	-1.195	-1.18	-1.19	-1.198	-1.162							
140	-1.36	-1.275	-1.346	-1.359	-1.294							
145	-1.464	-1.402	-1.448	-1.466	-1.417							
150	-1.526	-1.494	-1.516	-1.522	-1.496							
155	-1.578	-1.565	-1.571	-1.572	-1.592							
160	-1.623	-1.616	-1.619	-1.617	-1.628							
165	-1.656	-1.656	-1.654	-1.652	-1.667							
170	-1.681	-1.68	-1.677	-1.675	-1.691							
175	-1.691	-1.693	-1.69	-1.687	-1.704							
180	-1.69	-1.688	-1.687	-1.691	-1.691							
-180	-1.691	-1.69	-1.69	-1.688	-1.687							
-175	-1.704	-1.695	-1.691	-1.693	-1.69							
-170	-1.691	-1.682	-1.681	-1.68	-1.677							
-165	-1.667	-1.659	-1.656	-1.656	-1.654							
-160	-1.628	-1.624	-1.623	-1.616	-1.619							
-155	-1.592	-1.577	-1.578	-1.565	-1.571							
-150	-1.496	-1.524	-1.526	-1.494	-1.516							
-145	-1.417	-1.46	-1.464	-1.402	-1.448							
-140	-1.294	-1.352	-1.36	-1.275	-1.346							
-135	-1.162	-1.204	-1.195	-1.18	-1.19							
-130	-0.969	-0.994	-1.018	-0.986	-0.998							
-125	-0.751	-0.796	-0.841	-0.767	-0.795							
-120	-0.538	-0.588	-0.637	-0.552	-0.591							
-115	-0.361	-0.408	-0.455	-0.371	-0.412							
-110	-0.238	-0.269	-0.3	-0.242	-0.27							
-105	-0.157	-0.17	-0.184	-0.157	-0.171							
-100	-0.09	-0.102	-0.114	-0.089	-0.102							
-95	-0.029	-0.04	-0.052	-0.031	-0.042							
-90	0.002	0.004	0.006	0.002	0.003							
-85	0.05	0.058	0.065	0.047	0.054							
-80	0.113	0.12	0.127	0.108	0.115							
-75	0.181	0.188	0.194	0.172	0.18							
-70	0.26	0.278	0.296	0.253	0.273							
-65	0.383	0.406	0.43	0.37	0.401							
-60	0.53	0.559	0.588	0.54	0.567							
-55	0.736	0.754	0.772	0.731	0.749							
-50	0.935	0.949	0.964	0.931	0.944							
-45	1.093	1.155	1.156	1.106	1.145							

'PHI ='	60	90	120	150	180
-40	1.244	1.325	1.314	1.223	1.31
-35	1.363	1.423	1.417	1.353	1.409
-30	1.45	1.482	1.477	1.444	1.472
-25	1.518	1.531	1.529	1.516	1.526
-20	1.572	1.575	1.576	1.57	1.575
-15	1.612	1.615	1.617	1.611	1.612
-10	1.643	1.637	1.642	1.641	1.641
-5	1.658	1.652	1.656	1.658	1.654
0	1.658	1.653	1.654	1.658	1.656
5	1.658	1.652	1.656	1.658	1.654
10	1.643	1.637	1.642	1.641	1.641
15	1.612	1.615	1.617	1.611	1.612
20	1.572	1.575	1.576	1.57	1.575
25	1.518	1.531	1.529	1.516	1.526
30	1.45	1.482	1.477	1.444	1.472
35	1.363	1.423	1.417	1.353	1.409
40	1.244	1.325	1.314	1.223	1.31
45	1.093	1.155	1.156	1.106	1.145
50	0.935	0.949	0.964	0.931	0.944
55	0.736	0.754	0.772	0.731	0.749
60	0.53	0.559	0.588	0.54	0.567
65	0.383	0.406	0.43	0.37	0.401
70	0.26	0.278	0.296	0.253	0.273
75	0.181	0.188	0.194	0.172	0.18
80	0.113	0.12	0.127	0.108	0.115
85	0.05	0.058	0.065	0.047	0.054
90	0.002	0.004	0.006	0.002	0.003
95	-0.029	-0.04	-0.052	-0.031	-0.042
100	-0.09	-0.102	-0.114	-0.089	-0.102
105	-0.157	-0.17	-0.184	-0.157	-0.171
110	-0.238	-0.269	-0.3	-0.242	-0.27
115	-0.361	-0.408	-0.455	-0.371	-0.412
120	-0.538	-0.588	-0.637	-0.552	-0.591
125	-0.751	-0.796	-0.841	-0.767	-0.795
130	-0.969	-0.994	-1.018	-0.986	-0.998
135	-1.162	-1.204	-1.195	-1.18	-1.19
140	-1.294	-1.352	-1.36	-1.275	-1.346
145	-1.417	-1.46	-1.464	-1.402	-1.448
150	-1.496	-1.524	-1.526	-1.494	-1.516
155	-1.592	-1.577	-1.578	-1.565	-1.571
160	-1.628	-1.624	-1.623	-1.616	-1.619
165	-1.667	-1.659	-1.656	-1.656	-1.654
170	-1.691	-1.682	-1.681	-1.68	-1.677
175	-1.704	-1.695	-1.691	-1.693	-1.69
180	-1.691	-1.69	-1.69	-1.688	-1.687
'PHI ='	60	90	120	150	180
'ALPHA ='	-180	-169	-1687	-1.691	-1.691
-180	-1.691	-1.693	-1.69	-1.687	-1.704
-175	-1.681	-1.68	-1.677	-1.675	-1.691
-170	-1.656	-1.656	-1.654	-1.652	-1.667
-165	-1.623	-1.616	-1.619	-1.617	-1.628
-160	-1.578	-1.565	-1.571	-1.572	-1.592
-155	-1.526	-1.494	-1.516	-1.522	-1.496
-150	-1.464	-1.402	-1.448	-1.466	-1.417
-145	-1.36	-1.275	-1.346	-1.359	-1.294
-140	-1.195	-1.19	-1.19	-1.198	-1.162
-135	-1.018	-0.986	-1.01	-0.998	-1.004
-130	-0.841	-0.795	-0.823	-0.823	-0.751
-125	-0.637	-0.552	-0.591	-0.591	-0.538
-120	-0.455	-0.371	-0.412	-0.453	-0.361
-115					

-110	-0.184	-0.242	-0.27	-0.299	-0.238
-105	-0.114	-0.157	-0.171	-0.184	-0.157
-100	-0.089	-0.102	-0.102	-0.115	-0.09
-95	-0.031	-0.042	-0.042	-0.053	-0.029
-90	0.006	0.002	0.003	0.005	0.002
-85	0.065	0.047	0.054	0.061	0.05
-80	0.127	0.108	0.115	0.121	0.113
-75	0.194	0.172	0.18	0.188	0.181
-70	0.296	0.253	0.273	0.292	0.26
-65	0.43	0.37	0.401	0.432	0.383
-60	0.588	0.54	0.567	0.594	0.53
-55	0.772	0.731	0.749	0.768	0.736
-50	0.964	0.931	0.944	0.958	0.935
-45	1.156	1.106	1.145	1.147	1.093
-40	1.314	1.223	1.31	1.309	1.244
-35	1.417	1.353	1.409	1.407	1.363
-30	1.477	1.444	1.472	1.472	1.45
-25	1.529	1.516	1.526	1.528	1.518
-20	1.576	1.57	1.575	1.576	1.572
-15	1.617	1.611	1.612	1.614	1.612
-10	1.642	1.641	1.641	1.641	1.643
-5	1.656	1.658	1.654	1.658	1.658
0	1.654	1.658	1.656	1.658	1.658
5	1.656	1.658	1.654	1.658	1.658
10	1.642	1.641	1.641	1.641	1.643
15	1.617	1.611	1.612	1.614	1.612
20	1.576	1.57	1.575	1.576	1.572
25	1.529	1.516	1.526	1.528	1.518
30	1.477	1.444	1.472	1.472	1.45
35	1.417	1.353	1.409	1.407	1.363
40	1.314	1.223	1.31	1.309	1.244
45	1.156	1.106	1.145	1.147	1.093
50	0.964	0.931	0.944	0.958	0.935
55	0.772	0.731	0.749	0.768	0.736
60	0.588	0.54	0.567	0.594	0.53
65	0.43	0.37	0.401	0.432	0.383
70	0.296	0.253	0.273	0.292	0.26
75	0.194	0.172	0.18	0.188	0.181
80	0.127	0.108	0.115	0.121	0.113
85	0.065	0.047	0.054	0.061	0.05
90	0.006	0.002	0.003	0.005	0.002
95	-0.052	-0.031	-0.042	-0.053	-0.029
100	-0.114	-0.089	-0.102	-0.115	-0.09
105	-0.184	-0.157	-0.171	-0.184	-0.157
110	-0.3	-0.242	-0.27	-0.299	-0.238
115	-0.455	-0.371	-0.412	-0.453	-0.361
120	-0.637	-0.552	-0.591	-0.631	-0.538
125	-0.841	-0.767	-0.795	-0.823	-0.751
130	-1.018	-0.986	-0.998	-1.01	-0.969
135	-1.195	-1.18	-1.19	-1.198	-1.162
140	-1.36	-1.275	-1.346	-1.359	-1.294
145	-1.464	-1.402	-1.448	-1.466	-1.417
150	-1.526	-1.494	-1.516	-1.522	-1.496
155	-1.578	-1.565	-1.571	-1.572	-1.592
160	-1.623	-1.616	-1.619	-1.617	-1.628
165	-1.656	-1.656	-1.654	-1.652	-1.667
170	-1.681	-1.68	-1.677	-1.675	-1.691
175	-1.691	-1.693	-1.69	-1.687	-1.704
180	-1.69	-1.688	-1.687	-1.691	-1.691

Normal Force Coefficient (CN)

'MACH# ='	'PHI ='	'ALPHA ='	0	-180	-150	-120	-90	-60	-30	0	30
-180	0	0	0	0	0	0	0	0	0	0	0
-175	0.027	0.022	0.01	-0.003	-0.014	-0.021	-0.027	-0.027	-0.027	-0.027	-0.022
-170	0.07	0.058	0.032	-0.002	-0.035	-0.059	-0.07	-0.07	-0.07	-0.058	-0.058
-165	0.119	0.095	0.053	-0.006	-0.057	-0.1	-0.119	-0.119	-0.119	-0.095	-0.095
-160	0.172	0.14	0.075	-0.0001	-0.077	-0.144	-0.237	-0.237	-0.237	-0.14	-0.14
-155	0.237	0.19	0.093	-0.0003	-0.097	-0.196	-0.326	-0.326	-0.326	-0.19	-0.19
-150	0.326	0.251	0.108	-0.0001	-0.115	-0.262	-0.442	-0.442	-0.442	-0.251	-0.251
-145	0.442	0.334	0.127	-0.0005	-0.136	-0.346	-0.551	-0.551	-0.551	-0.334	-0.334
-140	0.573	0.43	0.151	-0.001	-0.167	-0.446	-0.707	-0.707	-0.707	-0.43	-0.43
-135	0.707	0.532	0.176	0.017	-0.203	-0.551	-0.89	-0.89	-0.89	-0.532	-0.532
-130	0.79	0.543	0.218	0.013	-0.275	-0.76	-0.916	-0.916	-0.916	-0.543	-0.543
-125	0.85	0.555	0.26	0.009	-0.346	-0.76	-0.916	-0.916	-0.916	-0.555	-0.555
-120	0.89	0.585	0.279	0.006	-0.377	-0.76	-0.916	-0.916	-0.916	-0.585	-0.585
-115	0.916	0.606	0.296	0.002	-0.396	-0.76	-0.916	-0.916	-0.916	-0.606	-0.606
-110	0.938	0.625	0.311	0.002	-0.407	-0.816	-0.938	-0.938	-0.938	-0.625	-0.625
-105	0.952	0.633	0.314	0.001	-0.411	-0.823	-0.952	-0.952	-0.952	-0.633	-0.633
-100	0.962	0.628	0.294	-0.0005	-0.413	-0.826	-0.962	-0.962	-0.962	-0.628	-0.628
-95	0.967	0.626	0.286	-0.0003	-0.412	-0.823	-0.967	-0.967	-0.967	-0.626	-0.626
-90	0.951	0.621	0.292	-0.007	-0.41	-0.812	-0.951	-0.951	-0.951	-0.621	-0.621
-85	0.967	0.626	0.286	-0.0003	-0.412	-0.823	-0.967	-0.967	-0.967	-0.626	-0.626
-80	0.962	0.628	0.294	-0.0005	-0.413	-0.826	-0.962	-0.962	-0.962	-0.628	-0.628
-75	0.952	0.633	0.314	0.001	-0.411	-0.823	-0.952	-0.952	-0.952	-0.633	-0.633
-70	0.938	0.625	0.311	0.002	-0.407	-0.816	-0.938	-0.938	-0.938	-0.625	-0.625
-65	0.916	0.606	0.296	0.002	-0.396	-0.794	-0.916	-0.916	-0.916	-0.606	-0.606
-60	0.89	0.585	0.279	0.006	-0.377	-0.76	-0.89	-0.89	-0.89	-0.585	-0.585
-55	0.85	0.555	0.26	0.009	-0.346	-0.76	-0.85	-0.85	-0.85	-0.555	-0.555
-50	0.79	0.543	0.218	0.013	-0.275	-0.76	-0.79	-0.79	-0.79	-0.543	-0.543
-45	0.707	0.532	0.176	0.017	-0.203	-0.551	-0.707	-0.707	-0.707	-0.532	-0.532
-40	0.573	0.43	0.151	-0.001	-0.167	-0.446	-0.573	-0.573	-0.573	-0.43	-0.43
-35	0.442	0.334	0.127	-0.0005	-0.136	-0.346	-0.442	-0.442	-0.442	-0.334	-0.334
-30	0.326	0.251	0.108	-0.0001	-0.115	-0.262	-0.326	-0.326	-0.326	-0.251	-0.251
-25	0.237	0.19	0.093	-0.0003	-0.097	-0.196	-0.237	-0.237	-0.237	-0.19	-0.19
-20	0.172	0.14	0.075	-0.0001	-0.077	-0.144	-0.172	-0.172	-0.172	-0.14	-0.14
-15	0.119	0.095	0.053	-0.006	-0.057	-0.1	-0.119	-0.119	-0.119	-0.095	-0.095
-10	0.07	0.058	0.032	-0.002	-0.035	-0.059	-0.07	-0.07	-0.07	-0.058	-0.058
-5	0.027	0.022	0.01	-0.003	-0.014	-0.021	-0.027	-0.027	-0.027	-0.022	-0.022
0	0	0	0	0	0	0	0	0	0	0	0
5	-0.027	-0.022	-0.01	0.003	0.014	0.021	0.027	0.027	0.027	0.022	0.022
10	-0.07	-0.058	-0.032	0.002	0.035	0.059	0.07	0.07	0.07	0.058	0.058
15	-0.119	-0.095	-0.053	0.006	0.057	0.1	0.119	0.119	0.119	0.095	0.095
20	-0.172	-0.14	-0.075	0.0001	0.077	0.144	0.172	0.172	0.172	0.14	0.14
25	-0.237	-0.19	-0.093	0.0003	0.097	0.196	0.237	0.237	0.237	0.19	0.19
30	-0.326	-0.251	-0.108	0.0001	0.115	0.262	0.326	0.326	0.326	0.251	0.251
35	-0.442	-0.334	-0.127	0.0005	0.136	0.346	0.442	0.442	0.442	0.334	0.334
40	-0.573	-0.43	-0.151	0.001	0.167	0.446	0.573	0.573	0.573	0.43	0.43
45	-0.707	-0.532	-0.176	-0.017	0.203	0.551	0.707	0.707	0.707	0.532	0.532
50	-0.79	-0.543	-0.218	-0.013	0.275	0.76	0.89	0.89	0.89	0.543	0.543
55	-0.85	-0.555	-0.26	-0.009	0.346	0.76	0.85	0.85	0.85	0.555	0.555
60	-0.89	-0.585	-0.279	-0.006	0.377	0.76	0.89	0.89	0.89	0.585	0.585
65	-0.916	-0.606	-0.296	-0.002	0.396	0.794	0.916	0.916	0.916	0.606	0.606
70	-0.938	-0.625	-0.311	-0.002	0.407	0.816	0.938	0.938	0.938	0.625	0.625
75	-0.952	-0.633	-0.314	-0.001	0.411	0.823	0.952	0.952	0.952	0.633	0.633
80	-0.962	-0.628	-0.294	0.0005	0.413	0.826	0.962	0.962	0.962	0.628	0.628
85	-0.967	-0.626	-0.286	0.0003	0.412	0.823	0.967	0.967	0.967	0.626	0.626
90	-0.951	-0.621	-0.292	0.007	0.41	0.812	0.951	0.951	0.951	0.621	0.621
95	-0.967	-0.626	-0.286	0.0003	0.412	0.823	0.967	0.967	0.967	0.626	0.626
100	-0.962	-0.628	-0.294	0.0005	0.413	0.826	0.962	0.962	0.962	0.628	0.628
105	-0.952	-0.633	-0.314	-0.001	0.411	0.823	0.952	0.952	0.952	0.633	0.633
110	-0.938	-0.625	-0.311	-0.002	0.407	0.816	0.938	0.938	0.938	0.625	0.625

'PHI ='	60	90	120	150	180	
115	-0.916	-0.606	-0.296	-0.002	0.396	0.794
120	-0.89	-0.585	-0.279	-0.006	0.377	0.76
125	-0.85	-0.555	-0.26	-0.009	0.346	0.702
130	-0.79	-0.543	-0.218	-0.013	0.275	0.626
135	-0.707	-0.532	-0.176	-0.017	0.203	0.551
140	-0.573	-0.43	-0.151	0.001	0.167	0.446
145	-0.442	-0.334	-0.127	0.0005	0.136	0.346
150	-0.326	-0.251	-0.108	0.0001	0.115	0.262
155	-0.237	-0.19	-0.093	0.0003	0.097	0.196
160	-0.172	-0.14	-0.075	0.0001	0.077	0.144
165	-0.119	-0.095	-0.053	0.006	0.057	0.1
170	-0.07	-0.058	-0.032	0.002	0.035	0.059
175	-0.027	-0.022	-0.01	0.003	0.014	0.021
180	0	0	0	0	0	0
'ALPHA ='	60	90	120	150	180	
-180	0	0	0	0	0	0
-175	-0.01	0.003	0.014	0.021	0.027	0.027
-170	-0.032	0.002	0.035	0.059	0.07	0.07
-165	-0.053	0.006	0.057	0.1	0.119	0.119
-160	-0.075	0.0001	0.077	0.144	0.172	0.172
-155	-0.093	0.0003	0.097	0.196	0.237	0.237
-150	-0.108	0.0001	0.115	0.262	0.326	0.326
-145	-0.127	0.0005	0.136	0.346	0.442	0.442
-140	-0.151	0.001	0.167	0.446	0.573	0.573
-135	-0.176	-0.017	0.203	0.551	0.707	0.707
-130	-0.218	-0.013	0.275	0.626	0.79	0.79
-125	-0.26	-0.009	0.346	0.702	0.85	0.85
-120	-0.279	-0.006	0.377	0.76	0.89	0.89
-115	-0.296	-0.002	0.396	0.794	0.916	0.916
-110	-0.311	-0.002	0.407	0.816	0.938	0.938
-105	-0.314	-0.001	0.411	0.823	0.952	0.952
-100	-0.294	0.0005	0.413	0.826	0.962	0.962
-95	-0.286	0.0003	0.412	0.823	0.967	0.967
-90	-0.292	0.007	0.41	0.812	0.951	0.951
-85	-0.286	0.0003	0.412	0.823	0.967	0.967
-80	-0.294	0.0005	0.413	0.826	0.962	0.962
-75	-0.314	-0.001	0.411	0.823	0.952	0.952
-70	-0.311	-0.002	0.407	0.816	0.938	0.938
-65	-0.296	-0.002	0.396	0.794	0.916	0.916
-60	-0.279	-0.006	0.377	0.76	0.89	0.89
-55	-0.26	-0.009	0.346	0.702	0.85	0.85
-50	-0.218	-0.013	0.275	0.626	0.79	0.79
-45	-0.176	-0.017	0.203	0.551	0.707	0.707
-40	-0.151	0.001	0.167	0.446	0.573	0.573
-35	-0.127	0.0005	0.136	0.346	0.442	0.442
-30	-0.108	0.0001	0.115	0.262	0.326	0.326
-25	-0.093	0.0003	0.097	0.196	0.237	0.237
-20	-0.075	0.0001	0.077	0.144	0.172	0.172
-15	-0.053	0.006	0.057	0.1	0.119	0.119
-10	-0.032	0.002	0.035	0.059	0.07	0.07
-5	-0.01	0.003	0.014	0.021	0.027	0.027
0	0	0	0	0	0	0
5	0.01	-0.003	-0.014	-0.021	-0.027	-0.027
10	0.032	-0.002	-0.035	-0.059	-0.07	-0.07
15	0.053	-0.006	-0.057	-0.1	-0.119	-0.119
20	0.075	-0.0001	-0.077	-0.144	-0.172	-0.172
25	0.093	-0.0003	-0.097	-0.196	-0.237	-0.237
30	0.108	-0.0001	-0.115	-0.262	-0.326	-0.326
35	0.127	-0.0005	-0.136	-0.346	-0.442	-0.442
40	0.151	-0.001	-0.167	-0.446	-0.573	-0.573

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'PHI ='	60	90	120	150	180
'ALPHA ='					
-180	0	0	0	0	0
-175	-0.01	0.003	0.014	0.021	0.027
-170	-0.032	0.002	0.035	0.059	0.07
-165	-0.053	0.006	0.057	0.1	0.119
-160	-0.075	0.001	0.077	0.144	0.172
-155	-0.093	0.0003	0.093	0.196	0.237
-150	-0.108	0.0001	0.108	0.262	0.326
-145	-0.127	0.0005	0.127	0.346	0.442
-140	-0.151	0.001	0.151	0.446	0.573
-135	-0.176	0.002	0.176	0.551	0.707
-130	-0.218	0.003	0.218	0.626	0.79
-125	-0.26	0.006	0.26	0.702	0.85
-120	-0.279	0.009	0.279	0.76	0.89
-115	-0.296	0.013	0.296	0.794	0.916
-110	-0.311	0.017	0.311	0.816	0.938
-105	-0.326	0.021	0.326	0.823	0.952
-100	-0.334	0.025	0.334	0.826	0.962
-95	-0.342	0.028	0.342	0.823	0.967
-90	-0.351	0.031	0.351	0.812	0.951
-85	-0.355	0.033	0.355	0.794	0.926
-80	-0.358	0.035	0.358	0.76	0.89
-75	-0.362	0.037	0.362	0.702	0.85
-70	-0.366	0.039	0.366	0.626	0.79
-65	-0.369	0.041	0.369	0.551	0.707
-60	-0.372	0.043	0.372	0.446	0.573
-55	-0.375	0.045	0.375	0.346	0.442
-50	-0.378	0.047	0.378	0.262	0.326
-45	-0.381	0.049	0.381	0.196	0.237
-40	-0.384	0.051	0.384	0.144	0.172
-35	-0.387	0.053	0.387	0.095	0.119
-30	-0.39	0.055	0.39	0.059	0.07
-25	-0.393	0.057	0.393	0.027	0.022
-20	-0.396	0.059	0.396	0	0
-15	-0.399	0.061	0.399	0	0
-10	-0.402	0.063	0.402	0	0
-5	-0.405	0.065	0.405	0	0
0	-0.408	0.067	0.408	0	0
5	-0.411	0.069	0.411	0.014	0.021
10	-0.414	0.071	0.414	0.035	0.059
15	-0.417	0.073	0.417	0.077	0.144
20	-0.42	0.075	0.42	0.136	0.262
25	-0.423	0.077	0.423	0.167	0.346
30	-0.426	0.079	0.426	0.196	0.442
35	-0.429	0.081	0.429	0.237	0.573
40	-0.432	0.083	0.432	0.279	0.707
45	-0.435	0.085	0.435	0.326	0.826
50	-0.438	0.087	0.438	0.377	0.916
55	-0.441	0.089	0.441	0.423	0.962
60	-0.444	0.091	0.444	0.466	0.995
65	-0.447	0.093	0.447	0.509	1.027
70	-0.45	0.095	0.45	0.551	1.059
75	-0.453	0.097	0.453	0.594	1.092
80	-0.456	0.099	0.456	0.637	1.125
85	-0.459	0.101	0.459	0.68	1.158
90	-0.462	0.103	0.462	0.723	1.191
95	-0.465	0.105	0.465	0.766	1.224
100	-0.468	0.107	0.468	0.809	1.257
105	-0.471	0.109	0.471	0.852	1.29
110	-0.474	0.111	0.474	0.895	1.323
115	-0.477	0.113	0.477	0.938	1.356
120	-0.48	0.115	0.48	0.981	1.389
125	-0.483	0.117	0.483	1.024	1.422
130	-0.486	0.119	0.486	1.067	1.455
135	-0.489	0.121	0.489	1.11	1.488
140	-0.492	0.123	0.492	1.153	1.521
145	-0.495	0.125	0.495	1.196	1.554
150	-0.498	0.127	0.498	1.239	1.587
155	-0.501	0.129	0.501	1.282	1.62
160	-0.504	0.131	0.504	1.325	1.653
165	-0.507	0.133	0.507	1.368	1.686
170	-0.51	0.135	0.51	1.411	1.719
175	-0.513	0.137	0.513	1.454	1.752
180	-0.516	0.139	0.516	1.497	1.785

-100	-0.294	0.0005	0.413	0.826	0.962
-95	-0.286	0.0003	0.412	0.823	0.967
-90	-0.292	0.007	0.41	0.812	0.951
-85	-0.286	0.0003	0.412	0.823	0.967
-80	-0.294	0.0005	0.413	0.826	0.962
-75	-0.314	-0.001	0.411	0.823	0.952
-70	-0.311	-0.002	0.407	0.816	0.938
-65	-0.296	-0.002	0.396	0.794	0.916
-60	-0.279	-0.006	0.377	0.76	0.89
-55	-0.26	-0.009	0.346	0.702	0.85
-50	-0.218	-0.013	0.275	0.626	0.79
-45	-0.176	-0.017	0.203	0.551	0.707
-40	-0.151	0.001	0.167	0.446	0.573
-35	-0.127	0.0005	0.136	0.346	0.442
-30	-0.108	0.0001	0.115	0.262	0.326
-25	-0.093	0.0003	0.097	0.196	0.237
-20	-0.075	0.0001	0.077	0.144	0.172
-15	-0.053	0.006	0.057	0.1	0.119
-10	-0.032	0.002	0.035	0.059	0.07
-5	-0.01	0.003	0.014	0.021	0.027
0	0	0	0	0	0
5	0.01	-0.003	-0.014	-0.021	-0.027
10	0.032	-0.002	-0.035	-0.059	-0.07
15	0.053	-0.006	-0.057	-0.1	-0.119
20	0.075	-0.0001	-0.077	-0.144	-0.172
25	0.093	-0.0003	-0.097	-0.196	-0.237
30	0.108	-0.0001	-0.115	-0.262	-0.326
35	0.127	-0.0005	-0.136	-0.346	-0.442
40	0.151	-0.001	-0.167	-0.446	-0.573
45	0.176	0.017	-0.203	-0.551	-0.707
50	0.218	0.013	-0.275	-0.626	-0.79
55	0.26	0.009	-0.346	-0.702	-0.85
60	0.279	0.006	-0.377	-0.76	-0.89
65	0.296	0.002	-0.396	-0.794	-0.916
70	0.311	0.002	-0.407	-0.816	-0.938
75	0.314	0.001	-0.411	-0.823	-0.952
80	0.294	-0.0005	-0.413	-0.826	-0.962
85	0.286	-0.0003	-0.412	-0.823	-0.967
90	0.292	-0.007	-0.41	-0.812	-0.951
95	0.286	-0.0003	-0.412	-0.823	-0.967
100	0.294	-0.0005	-0.413	-0.826	-0.962
105	0.314	0.001	-0.411	-0.823	-0.952
110	0.311	0.002	-0.407	-0.816	-0.938
115	0.296	0.002	-0.396	-0.794	-0.916
120	0.279	0.006	-0.377	-0.76	-0.89
125	0.26	0.009	-0.346	-0.702	-0.85
130	0.218	0.013	-0.275	-0.626	-0.79
135	0.176	0.017	-0.203	-0.551	-0.707
140	0.151	-0.001	-0.167	-0.446	-0.573
145	0.127	-0.0005	-0.136	-0.346	-0.442
150	0.108	-0.0001	-0.115	-0.262	-0.326
155	0.093	-0.0003	-0.097	-0.196	-0.237
160	0.075	-0.0001	-0.077	-0.144	-0.172
165	0.053	-0.006	-0.057	-0.1	-0.119
170	0.032	-0.002	-0.035	-0.059	-0.07
175	0.01	-0.003	-0.014	-0.021	-0.027
180	0	0	0	0	0

Side Force Coefficient (CY)

0 30

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-120

-150

-180

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'MACH# ='
'PHI ='

'PHI = '	60	90	120	150	180
-180	0	0	0	0	0
-175	0.017	0.023	0.022	0.014	0.003
-170	0.046	0.058	0.051	0.032	0.004
-165	0.078	0.096	0.084	0.049	0.005
-160	0.113	0.139	0.12	0.068	-0.005
-155	0.155	0.197	0.167	0.084	0.005
-150	0.214	0.287	0.235	0.1	0.005
-145	0.295	0.399	0.32	0.118	0.005
-140	0.388	0.52	0.414	0.148	0.004
-135	0.481	0.703	0.507	0.179	-0.009
-130	0.593	0.789	0.492	0.195	-0.009
-125	0.705	0.841	0.526	0.211	-0.007
-120	0.747	0.873	0.554	0.235	-0.005
-115	0.766	0.889	0.572	0.254	-0.003
-110	0.772	0.905	0.587	0.268	-0.002
-105	0.771	0.914	0.594	0.275	-0.001
-100	0.779	0.918	0.591	0.265	-0.001
-95	0.783	0.92	0.593	0.266	-0.001
-90	0.779	0.906	0.593	0.28	-0.01
-85	0.792	0.924	0.598	0.272	-0.002
-80	0.797	0.918	0.598	0.278	-0.001
-75	0.797	0.91	0.603	0.296	0
-70	0.788	0.873	0.595	0.295	0.001
-65	0.768	0.875	0.581	0.287	0.003
-60	0.733	0.848	0.56	0.273	0.005
-55	0.67	0.811	0.532	0.253	0.007
-50	0.6	0.75	0.521	0.211	0.007
-45	0.532	0.649	0.51	0.169	-0.011
-40	0.439	0.56	0.413	0.138	-0.011
-35	0.34	0.43	0.318	0.112	-0.01
-30	0.256	0.317	0.241	0.094	-0.011
-25	0.194	0.229	0.179	0.079	-0.011
-20	0.144	0.165	0.129	0.061	-0.011
-15	0.098	0.111	0.089	0.043	-0.01
-10	0.059	0.067	0.049	0.025	-0.008
-5	0.023	0.026	0.016	0.007	-0.005
0	0	0	0	0	0
5	-0.023	-0.026	-0.016	-0.007	0.005
10	-0.059	-0.067	-0.049	-0.025	0.008
15	-0.098	-0.111	-0.089	-0.043	0.01
20	-0.144	-0.165	-0.129	-0.061	0.011
25	-0.194	-0.229	-0.179	-0.079	0.011
30	-0.256	-0.317	-0.241	-0.094	0.011
35	-0.34	-0.43	-0.318	-0.112	0.01
40	-0.439	-0.56	-0.413	-0.138	0.011
45	-0.532	-0.649	-0.51	-0.169	0.011
50	-0.6	-0.75	-0.521	-0.211	-0.007

		CY															
		-180		-150		-120		-90		-60		-30		0		30	
		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
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		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
		0		0		0		0		0		0		0		0	
		0		0													

'PHI ='	60	90	120	150	180
-15	-0.01	-0.06	-0.098	-0.111	-0.089
-10	-0.008	-0.04	-0.059	-0.067	-0.049
-5	-0.005	-0.016	-0.023	-0.026	-0.016
0	0	0	0	0	0
5	0.005	0.016	0.023	0.026	0.016
10	0.008	0.04	0.059	0.067	0.049
15	0.01	0.06	0.098	0.111	0.089
20	0.011	0.082	0.144	0.165	0.129
25	0.011	0.101	0.194	0.229	0.179
30	0.011	0.119	0.256	0.317	0.241
35	0.01	0.141	0.34	0.43	0.318
40	0.011	0.166	0.439	0.56	0.413
45	0.011	0.193	0.532	0.649	0.51
50	-0.007	0.26	0.6	0.75	0.521
55	-0.007	0.331	0.67	0.811	0.532
60	-0.005	0.364	0.733	0.848	0.56
65	-0.003	0.382	0.768	0.875	0.581
70	-0.001	0.394	0.788	0.895	0.595
75	0	0.398	0.797	0.91	0.603
80	0.001	0.399	0.797	0.918	0.598
85	0.002	0.397	0.792	0.924	0.598
90	0.01	0.395	0.779	0.906	0.593
95	0.001	0.392	0.783	0.92	0.593
100	0.001	0.39	0.779	0.918	0.591
105	0.001	0.386	0.771	0.914	0.594
110	0.002	0.387	0.772	0.905	0.587
115	0.003	0.384	0.766	0.889	0.572
120	0.005	0.376	0.747	0.873	0.554
125	0.007	0.356	0.705	0.841	0.526
130	0.009	0.301	0.593	0.789	0.492
135	0.009	0.151	0.481	0.703	0.507
140	-0.004	0.124	0.388	0.52	0.414
145	-0.005	0.101	0.295	0.399	0.32
150	-0.005	0.086	0.214	0.287	0.235
155	-0.005	0.072	0.155	0.197	0.167
160	0.005	0.057	0.113	0.139	0.12
165	-0.005	0.039	0.078	0.096	0.084
170	-0.004	0.023	0.046	0.058	0.051
175	-0.003	0.006	0.017	0.023	0.022
180	0	0	0	0	0

'ALPHA ='	60	90	120	150	180
-180	0	0	0	0	0
-175	0.017	0.023	0.022	0.014	0.003
-170	0.046	0.058	0.051	0.032	0.004
-165	0.078	0.096	0.084	0.049	0.005
-160	0.113	0.139	0.12	0.068	-0.005
-155	0.155	0.197	0.167	0.084	0.005
-150	0.214	0.287	0.235	0.1	0.005
-145	0.295	0.399	0.32	0.118	0.005
-140	0.388	0.52	0.414	0.148	0.004
-135	0.481	0.703	0.507	0.179	-0.009
-130	0.593	0.789	0.492	0.195	-0.009
-125	0.705	0.841	0.526	0.211	-0.007
-120	0.747	0.873	0.554	0.235	-0.005
-115	0.766	0.889	0.572	0.254	-0.003
-110	0.772	0.905	0.587	0.268	-0.002
-105	0.771	0.914	0.594	0.275	-0.001
-100	0.779	0.918	0.591	0.266	-0.001
-95	0.783	0.92	0.593	0.266	-0.001
-90	0.779	0.906	0.593	0.28	-0.01

MACH# = PHI = ALPHA =	2	13	73	0	-150	-120	-90	-60	-30	0	30	Pitching Moment Coefficient (CLM)
-85	0.792	0.924	0.598	0.272	-0.002							
-80	0.797	0.918	0.598	0.278	-0.001							
-75	0.797	0.91	0.603	0.296	0							
-70	0.788	0.895	0.595	0.295	0.001							
-65	0.768	0.875	0.581	0.287	0.003							
-60	0.733	0.848	0.56	0.273	0.005							
-55	0.67	0.811	0.532	0.253	0.007							
-50	0.6	0.75	0.521	0.211	0.007							
-45	0.532	0.649	0.51	0.169	-0.011							
-40	0.439	0.56	0.413	0.138	-0.011							
-35	0.34	0.43	0.318	0.112	-0.01							
-30	0.256	0.317	0.241	0.094	-0.011							
-25	0.194	0.229	0.179	0.079	-0.011							
-20	0.144	0.165	0.129	0.061	-0.011							
-15	0.098	0.111	0.089	0.043	-0.01							
-10	0.059	0.067	0.049	0.025	-0.008							
-5	0.023	0.026	0.016	0.007	-0.005							
0	0	0	0	0	0							
5	-0.023	-0.026	-0.016	-0.007	0.005							
10	-0.059	-0.067	-0.049	-0.025	0.008							
15	-0.098	-0.111	-0.089	-0.043	0.01							
20	-0.144	-0.165	-0.129	-0.061	0.011							
25	-0.194	-0.229	-0.179	-0.079	0.011							
30	-0.256	-0.317	-0.241	-0.094	0.011							
35	-0.34	-0.43	-0.318	-0.112	0.01							
40	-0.439	-0.56	-0.413	-0.138	0.011							
45	-0.532	-0.649	-0.51	-0.169	0.011							
50	-0.6	-0.75	-0.521	-0.211	-0.007							
55	-0.67	-0.811	-0.532	-0.253	-0.007							
60	-0.733	-0.848	-0.56	-0.273	-0.005							
65	-0.768	-0.875	-0.581	-0.287	-0.003							
70	-0.788	-0.895	-0.595	-0.295	-0.001							
75	-0.797	-0.91	-0.603	-0.296	0							
80	-0.797	-0.918	-0.598	-0.278	0.001							
85	-0.792	-0.924	-0.598	-0.272	0.002							
90	-0.779	-0.906	-0.593	-0.28	0.01							
95	-0.783	-0.92	-0.593	-0.266	0.001							
100	-0.779	-0.918	-0.591	-0.265	0.001							
105	-0.771	-0.914	-0.594	-0.275	0.001							
110	-0.772	-0.905	-0.587	-0.268	0.002							
115	-0.766	-0.889	-0.572	-0.254	0.003							
120	-0.747	-0.873	-0.554	-0.235	0.005							
125	-0.705	-0.841	-0.526	-0.211	0.007							
130	-0.593	-0.789	-0.492	-0.195	0.009							
135	-0.481	-0.703	-0.507	-0.179	0.009							
140	-0.388	-0.52	-0.414	-0.148	-0.004							
145	-0.295	-0.399	-0.32	-0.118	-0.005							
150	-0.214	-0.287	-0.235	-0.1	-0.005							
155	-0.155	-0.197	-0.167	-0.084	-0.005							
160	-0.113	-0.139	-0.12	-0.068	0.005							
165	-0.078	-0.096	-0.084	-0.049	-0.005							
170	-0.046	-0.058	-0.051	-0.032	-0.004							
175	-0.017	-0.023	-0.022	-0.014	-0.003							
180	0	0	0	0	0							

-165	0.03168	0.02731	0.01748	0.00273	-0.0142	-0.0262	-0.0316	-0.0273
-160	0.0366	0.03332	0.0213	0.00218	-0.0174	-0.0305	-0.0366	-0.0333
-155	0.03933	0.03496	0.02185	0.00218	-0.0185	-0.0327	-0.0393	-0.0349
-150	0.04151	0.03496	0.02075	0.00218	-0.0174	-0.0327	-0.0415	-0.0349
-145	0.04042	0.02895	0.01638	0.00163	-0.0152	-0.0278	-0.0404	-0.0289
-140	0.03496	0.01857	0.00819	0.00109	-0.0087	-0.0163	-0.0349	-0.0185
-135	0.02676	0.01201	0.00054	-0.001	-0.001	-0.0103	-0.0267	-0.0102
-130	-0.0005	-0.001	-0.0016	-0.0016	-0.0032	-0.0049	0.00054	0.00109
-125	-0.0114	-0.0081	-0.0043	-0.0016	-0.0005	0.00054	0.01147	0.00819
-120	-0.0174	-0.0103	-0.0027	-0.0016	0.00273	0.0071	0.01748	0.01037
-115	-0.0152	-0.0081	-0.0016	-0.001	0.00491	0.01092	0.01529	0.00819
-110	-0.0098	-0.0054	-0.0016	-0.001	0.00546	0.01201	0.00983	0.00546
-105	-0.0098	-0.0065	-0.0027	-0.001	0.00491	0.01092	0.00983	0.00655
-100	-0.0109	-0.0071	-0.0032	-0.001	0.00382	0.00928	0.01092	0.0071
-95	-0.0114	-0.0071	-0.0032	-0.001	0.00327	0.00764	0.01147	0.0071
-90	-0.0114	-0.0076	-0.0038	-0.001	0.00273	0.0071	0.01147	0.00764
-85	-0.012	-0.0081	-0.0038	-0.0016	0.00218	0.006	0.01201	0.00819
-80	-0.0125	-0.0081	-0.0043	-0.0021	0.00437	0.01256	0.00819	0.00928
-75	-0.0125	-0.0092	-0.0054	-0.0027	0	0.00273	0.01256	0.00928
-70	-0.012	-0.0098	-0.0076	-0.0027	-0.001	0.00109	0.01201	0.00983
-65	-0.0098	-0.0092	-0.0092	-0.0021	0	0.00218	0.00983	0.00928
-60	-0.006	-0.0076	-0.0087	-0.001	0.00163	0.00491	0.006	0.00764
-55	-0.0081	-0.0081	-0.0081	-0.0021	0.00382	0.00928	0.00819	0.00819
-50	-0.018	-0.0136	-0.0092	-0.0027	0.00546	0.0142	0.01802	0.01365
-45	-0.0322	-0.0229	-0.0103	-0.0032	0.00928	0.01912	0.03223	0.02294
-40	-0.0447	-0.0295	-0.0185	-0.0032	0.01529	0.02458	0.04479	0.0295
-35	-0.048	-0.0376	-0.0262	-0.0032	0.02075	0.03332	0.04807	0.03769
-30	-0.0469	-0.0415	-0.0273	-0.0027	0.02185	0.03769	0.04698	0.04151
-25	-0.0437	-0.0409	-0.0267	-0.0027	0.02185	0.03769	0.0437	0.04097
-20	-0.0409	-0.0371	-0.024	-0.0021	0.02021	0.03441	0.04097	0.03714
-15	-0.0349	-0.0305	-0.0191	-0.0016	0.01693	0.02895	0.03496	0.03059
-10	-0.0245	-0.0218	-0.0125	-0.0005	0.01201	0.02021	0.02458	0.02185
-5	-0.0103	-0.0092	-0.0038	0.00109	0.006	0.00983	0.01037	0.00928
0	0	0	0	0	0	0	0	0
5	0.01037	0.00928	0.00382	-0.001	-0.006	-0.0098	-0.0103	-0.0092
10	0.02458	0.02185	0.01256	0.00054	-0.012	-0.0202	-0.0245	-0.0218
15	0.03496	0.03059	0.01912	0.00163	-0.0169	-0.0289	-0.0349	-0.0305
20	0.04097	0.03714	0.02403	0.00218	-0.0202	-0.0344	-0.0409	-0.0371
25	0.0437	0.04097	0.02676	0.00273	-0.0218	-0.0376	-0.0437	-0.0409
30	0.04698	0.04151	0.02731	0.00273	-0.0218	-0.0376	-0.0469	-0.0415
35	0.04807	0.03769	0.02622	0.00327	-0.0207	-0.0333	-0.04807	-0.0376
40	0.04479	0.0295	0.01857	0.00327	-0.0152	-0.0245	-0.0447	-0.0295
45	0.03223	0.02294	0.01037	0.00327	-0.0092	-0.0191	-0.0322	-0.0229
50	0.01802	0.01365	0.00928	0.00273	-0.0054	-0.0142	-0.018	-0.0136
55	0.00819	0.00819	0.00819	0.00218	-0.0038	-0.0092	-0.0081	-0.0081
60	0.006	0.00764	0.00874	0.00109	-0.0016	-0.0049	-0.006	-0.0076
65	0.00983	0.00928	0.00928	0.00218	0	-0.0021	-0.0098	-0.0092
70	0.01201	0.00983	0.00764	0.00273	0.00109	-0.001	-0.012	-0.0098
75	0.01256	0.00928	0.00546	0.00273	0	-0.0027	-0.0125	-0.0092
80	0.01256	0.00819	0.00437	0.00218	-0.001	-0.0043	-0.0125	-0.0081
85	0.01201	0.00819	0.00382	0.00163	-0.0021	-0.006	-0.012	-0.0081
90	0.01147	0.00764	0.00382	0.00109	-0.0032	-0.0076	-0.0114	-0.0076
95	0.01147	0.0071	0.00327	0.00109	-0.0032	-0.0076	-0.0114	-0.0071
100	0.01092	0.0071	0.00327	0.00109	-0.0038	-0.0092	-0.0109	-0.0071
105	0.00983	0.00655	0.00273	0.00109	-0.0038	-0.0092	-0.0098	-0.0065
110	0.00983	0.00546	0.00163	0.00109	-0.0054	-0.012	-0.0098	-0.0054
115	0.01529	0.00819	0.00163	0.00109	-0.0049	-0.0109	-0.0152	-0.0081
120	0.01748	0.01037	0.00273	0.00163	-0.0027	-0.0071	-0.0174	-0.0103
125	0.01147	0.00819	0.00437	0.00163	0.00054	-0.0005	-0.0114	-0.0081
130	0.00054	0.00109	0.00163	0.00163	0.00327	0.00491	-0.0005	-0.001
135	-0.0267	-0.012	-0.0005	0.00109	0.00109	0.01037	0.02676	0.01201
140	-0.0349	-0.0185	-0.0081	-0.001	0.00874	0.01638	0.03496	0.01857

-70	0.00764	0.00273	0.00109	-0.001	-0.012
-65	0.00928	0.00218	0	-0.0021	-0.0098
-60	0.00874	0.00109	-0.0016	-0.0049	-0.006
-55	0.00819	0.00218	-0.0038	-0.0092	-0.0081
-50	0.00928	0.00273	-0.0054	-0.0142	-0.018
-45	0.01037	0.00327	-0.0092	-0.0191	-0.0322
-40	0.01857	0.00327	-0.0152	-0.0245	-0.0447
-35	0.02622	0.00327	-0.0207	-0.0333	-0.0448
-30	0.02731	0.00273	-0.0218	-0.0376	-0.0469
-25	0.02676	0.00273	-0.0218	-0.0376	-0.0437
-20	0.02403	0.00218	-0.0202	-0.0344	-0.0409
-15	0.01912	0.00163	-0.0169	-0.0289	-0.0349
-10	0.01256	0.00054	-0.012	-0.0202	-0.0245
-5	0.00382	-0.001	-0.006	-0.0098	-0.0103
0	0	0	0	0	0
5	-0.0038	0.00109	0.006	0.00983	0.01037
10	-0.0125	-0.0005	0.01201	0.02021	0.02458
15	-0.0191	-0.0016	0.01693	0.02895	0.03496
20	-0.024	-0.0021	0.02021	0.03441	0.04097
25	-0.0267	-0.0027	0.02185	0.03769	0.0437
30	-0.0273	-0.0027	0.02185	0.03769	0.04698
35	-0.0262	-0.0032	0.02075	0.03332	0.04807
40	-0.0185	-0.0032	0.01529	0.02458	0.04479
45	-0.0103	-0.0032	0.00928	0.01912	0.03223
50	-0.0092	-0.0027	0.00546	0.0142	0.01802
55	-0.0081	-0.0021	0.00382	0.00928	0.00819
60	-0.0087	-0.001	0.00163	0.00491	0.006
65	-0.0092	-0.0021	0	0.00218	0.00983
70	-0.0076	-0.0027	-0.001	0.00109	0.01201
75	-0.0054	-0.0027	0	0.00273	0.01256
80	-0.0043	-0.0021	0.00109	0.00437	0.01256
85	-0.0038	-0.0016	0.00218	0.006	0.01201
90	-0.0038	-0.001	0.00273	0.0071	0.01147
95	-0.0032	-0.001	0.00327	0.00764	0.01147
100	-0.0032	-0.001	0.00382	0.00928	0.01092
105	-0.0027	-0.001	0.00491	0.01092	0.00983
110	-0.0016	-0.001	0.00546	0.01201	0.00983
115	-0.0016	-0.001	0.00491	0.01092	0.01529
120	-0.0027	-0.0016	0.00273	0.0071	0.01748
125	-0.0043	-0.0016	-0.0005	0.00054	0.01147
130	-0.0016	-0.0016	-0.0032	-0.0049	0.00054
135	0.00054	-0.001	-0.001	-0.0103	-0.0267
140	0.00819	0.00109	-0.0087	-0.0163	-0.0349
145	0.01638	0.00163	-0.0152	-0.0278	-0.0404
150	0.02075	0.00218	-0.0174	-0.0327	-0.0415
155	0.02185	0.00218	-0.0185	-0.0327	-0.0393
160	0.0213	0.00218	-0.0174	-0.0305	-0.0366
165	0.01748	0.00273	-0.0142	-0.0262	-0.0316
170	0.01256	0.00273	-0.0098	-0.0185	-0.0213
175	0.006	0.00218	-0.0032	-0.0081	-0.0087
180	0	0	0	0	0

'MACH#=' 2 3 38 0
 'PHI=' -180 0 180
 'ALPHA='
 -180 -1.64 -1.64 -1.64
 -170 -1.615 -1.615 -1.615
 -160 -1.57 -1.57 -1.57
 -150 -1.45 -1.45 -1.45
 -140 -1.25 -1.25 -1.25

Axial Force Coefficient for Free Molecular Flow (CAFM)

-130	-0.91	-0.91	-0.91
-120	-0.54	-0.54	-0.54
-110	-0.29	-0.29	-0.29
-100	-0.125	-0.125	-0.125
-90	0	0	0
-80	0.125	0.125	0.125
-70	0.29	0.29	0.29
-60	0.54	0.54	0.54
-50	0.91	0.91	0.91
-40	1.25	1.25	1.25
-30	1.45	1.45	1.45
-20	1.57	1.57	1.57
-10	1.615	1.615	1.615
0	1.64	1.64	1.64
5	1.63	1.63	1.63
10	1.615	1.615	1.615
20	1.57	1.57	1.57
30	1.45	1.45	1.45
40	1.25	1.25	1.25
50	0.91	0.91	0.91
60	0.54	0.54	0.54
70	0.29	0.29	0.29
80	0.125	0.125	0.125
90	0	0	0
100	-0.125	-0.125	-0.125
110	-0.29	-0.29	-0.29
120	-0.54	-0.54	-0.54
130	-0.91	-0.91	-0.91
140	-1.25	-1.25	-1.25
150	-1.45	-1.45	-1.45
160	-1.57	-1.57	-1.57
170	-1.615	-1.615	-1.615
180	-1.64	-1.64	-1.64

CAEM

'MACH# ='	100	180
'PHI ='	-180	0
'ALPHA ='	0	180
-180	-1.64	-1.64
-170	-1.615	-1.615
-160	-1.57	-1.57
-150	-1.45	-1.45
-140	-1.25	-1.25
-130	-0.91	-0.91
-120	-0.54	-0.54
-110	-0.29	-0.29
-100	-0.125	-0.125
-90	0	0
-80	0.125	0.125
-70	0.29	0.29
-60	0.54	0.54
-50	0.91	0.91
-40	1.25	1.25
-30	1.45	1.45
-20	1.57	1.57
-10	1.615	1.615
0	1.64	1.64
5	1.63	1.63
10	1.615	1.615
20	1.57	1.57
30	1.45	1.45
40	1.25	1.25
50	0.91	0.91

60	0.54	0.54	0.54
70	0.29	0.29	0.29
80	0.125	0.125	0.125
90	0	0	0
100	-0.125	-0.125	-0.125
110	-0.29	-0.29	-0.29
120	-0.54	-0.54	-0.54
130	-0.91	-0.91	-0.91
140	-1.25	-1.25	-1.25
150	-1.45	-1.45	-1.45
160	-1.57	-1.57	-1.57
170	-1.615	-1.615	-1.615
180	-1.64	-1.64	-1.64

Normal Force Coefficient for Free Molecular Flow (CNFM)

'MACH# ='	2	3	38	0
'PHI ='	-180	-180	0	180
'ALPHA ='	-180	0	0	0
-180	0	0	0	0
-170	0.08	-0.08	-0.08	0.08
-160	0.19	-0.19	-0.19	0.19
-150	0.35	-0.35	-0.35	0.35
-140	0.6	-0.6	-0.6	0.6
-130	0.82	-0.82	-0.82	0.82
-120	0.91	-0.91	-0.91	0.91
-110	0.96	-0.96	-0.96	0.96
-100	0.97	-0.97	-0.97	0.97
-90	0.97	-0.97	-0.97	0.97
-80	0.97	-0.97	-0.97	0.97
-70	0.96	-0.96	-0.96	0.96
-60	0.91	-0.91	-0.91	0.91
-50	0.82	-0.82	-0.82	0.82
-40	0.6	-0.6	-0.6	0.6
-30	0.35	-0.35	-0.35	0.35
-20	0.19	-0.19	-0.19	0.19
-10	0.08	-0.08	-0.08	0.08
0	0	0	0	0
5	-0.04	0.04	0.04	-0.04
10	-0.08	0.08	0.08	-0.08
20	-0.19	0.19	0.19	-0.19
30	-0.35	0.35	0.35	-0.35
40	-0.6	0.6	0.6	-0.6
50	-0.82	0.82	0.82	-0.82
60	-0.91	0.91	0.91	-0.91
70	-0.96	0.96	0.96	-0.96
80	-0.97	0.97	0.97	-0.97
90	-0.97	0.97	0.97	-0.97
100	-0.97	0.97	0.97	-0.97
110	-0.96	0.96	0.96	-0.96
120	-0.91	0.91	0.91	-0.91
130	-0.82	0.82	0.82	-0.82
140	-0.6	0.6	0.6	-0.6
150	-0.35	0.35	0.35	-0.35
160	-0.19	0.19	0.19	-0.19
170	-0.08	0.08	0.08	-0.08
180	0	0	0	0

CNFM

'MACH# ='	100	0	0	0
'PHI ='	-180	0	0	180
'ALPHA ='	-180	0	0	0
-180	0	0	0	0

-170	0.08	-0.08	0.08
-160	0.19	0.19	0.19
-150	0.35	0.35	0.35
-140	0.6	-0.6	0.6
-130	0.82	-0.82	0.82
-120	0.91	-0.91	0.91
-110	0.96	-0.96	0.96
-100	0.97	-0.97	0.97
-90	0.97	-0.97	0.97
-80	0.97	-0.97	0.97
-70	0.96	-0.96	0.96
-60	0.91	-0.91	0.91
-50	0.82	-0.82	0.82
-40	0.6	-0.6	0.6
-30	0.35	-0.35	0.35
-20	0.19	-0.19	0.19
-10	0.08	-0.08	0.08
0	0	0	0
5	-0.04	0.04	-0.04
10	-0.08	0.08	-0.08
20	-0.19	0.19	-0.19
30	-0.35	0.35	-0.35
40	-0.6	0.6	-0.6
50	-0.82	0.82	-0.82
60	-0.91	0.91	-0.91
70	-0.96	0.96	-0.96
80	-0.97	0.97	-0.97
90	-0.97	0.97	-0.97
100	-0.97	0.97	-0.97
110	-0.96	0.96	-0.96
120	-0.91	0.91	-0.91
130	-0.82	0.82	-0.82
140	-0.6	0.6	-0.6
150	-0.35	0.35	-0.35
160	-0.19	0.19	-0.19
170	-0.08	0.08	-0.08
180	0	0	0

	2	0	400000	0	Skin Friction Axial Force Coefficient (CASF)
	2	0	400000	0	Incremental Change of Weight (DELMGT)
	2	0	400000	0	Incremental Change of Axial Force Coefficient (DELCA)
	2	0	400000	0	Incremental Change in Center of Pressure (DELXCPL)

	2	13	73	0	-180	-150	-120	-90	-60	-30	0	30	Yaw Moment Coefficient (CLN)
'HACH# ='	2	13	73	0	-180	-150	-120	-90	-60	-30	0	30	
'PHI ='	2	13	73	0	-180	-150	-120	-90	-60	-30	0	30	
'ALPHA ='	2	13	73	0	-180	-150	-120	-90	-60	-30	0	30	
	-175	0.00273	-0.0027	0	-0.00273	-0.0027	-0.0071	-0.0098	-0.0098	-0.006	-0.0027	0.00273	0
	-170	0.00273	-0.0098	-0.0185	-0.0223	-0.0202	-0.0125	-0.0027	-0.0125	-0.0027	0.00983	0.00983	0
	-165	0.00273	-0.0142	-0.0262	-0.0322	-0.0284	-0.0174	-0.0027	-0.0174	-0.0027	0.0142	0.0142	0
	-160	0.00327	-0.0174	-0.0316	-0.0382	-0.0344	-0.0218	-0.0032	-0.0218	-0.0032	0.01748	0.01748	0
	-155	0.00273	-0.0185	-0.0338	-0.0404	-0.0366	-0.0223	-0.0027	-0.0223	-0.0027	0.01857	0.01857	0
	-150	0.00273	-0.0174	-0.0333	-0.0426	-0.0355	-0.0213	-0.0027	-0.0213	-0.0027	0.01748	0.01748	0
	-145	0.00218	-0.0147	-0.0273	-0.0409	-0.0295	-0.0174	-0.0021	-0.0174	-0.0021	0.01475	0.01475	0
	-140	0.00109	-0.0076	-0.0163	-0.0371	-0.0196	-0.0081	-0.0001	-0.0081	-0.0001	0.00764	0.00764	0

-135	0.00054	-0.0027	-0.0071	-0.0103	-0.03	-0.012	-0.0005	-0.0005	0
-130	0.00054	-0.0027	-0.0071	-0.0054	-0.0032	-0.001	0.00163	-0.0005	0.00273
-125	0.00054	0	-0.001	-0.00874	0.006	0.006	0.00382	-0.0005	0
-120	0.00054	0.00327	0.00655	0.01475	0.00819	0.00655	0.00218	-0.0005	-0.0032
-115	0.00054	0.00346	0.01037	0.01201	0.00655	0.00655	0.00054	-0.0005	-0.0054
-110	0.00109	0.006	0.01147	0.0071	0.00382	0.00054	-0.001	-0.0005	-0.006
-105	0.00109	0.00546	0.00983	0.00655	0.00382	0.00163	-0.001	-0.0054	-0.0054
-100	0.00109	0.00491	0.00874	0.00764	0.00491	0.00163	-0.001	-0.0049	-0.0049
-95	0.00054	0.00437	0.00819	0.00819	0.00491	0.00218	-0.0005	-0.0043	-0.0043
-90	0.00109	0.00437	0.00764	0.00928	0.00546	0.00218	-0.001	-0.0043	-0.0043
-85	0.00054	0.00437	0.00764	0.01147	0.00655	0.00218	-0.0005	-0.0043	-0.0043
-80	0.00163	0.00491	0.00819	0.01256	0.0071	0.00218	-0.0016	-0.0049	-0.0049
-75	0.00218	0.00546	0.00819	0.01365	0.00764	0.00218	-0.0021	-0.0054	-0.0054
-70	0.00273	0.00546	0.00819	0.01365	0.00874	0.00327	-0.0027	-0.0054	-0.0054
-65	0.00109	0.00546	0.00983	0.01147	0.00764	0.00437	-0.001	-0.0054	-0.0054
-60	0.00054	0.00655	0.01256	0.00764	0.006	0.00437	-0.0005	-0.0065	-0.0065
-55	0.00109	0.00928	0.01693	0.01037	0.00764	0.00491	-0.001	-0.0092	-0.0092
-50	0.00218	0.01201	0.0213	0.0213	0.01365	0.006	-0.0021	-0.012	-0.012
-45	0.00327	0.01037	0.02512	0.04097	0.01748	0.00764	-0.0032	-0.0103	-0.0103
-40	0.00491	0.01966	0.03277	0.04534	0.02239	0.01365	-0.0049	-0.0196	-0.0196
-35	0.006	0.0295	0.04097	0.04807	0.03059	0.01802	-0.006	-0.0295	-0.0295
-30	0.00655	0.03168	0.04534	0.04752	0.0355	0.01857	-0.0065	-0.0316	-0.0316
-25	0.0071	0.03168	0.04534	0.04479	0.03456	0.01748	-0.0071	-0.0316	-0.0316
-20	0.00655	0.0295	0.04151	0.04151	0.03223	0.01584	-0.0065	-0.0295	-0.0295
-15	0.006	0.02403	0.03387	0.03496	0.02731	0.01256	-0.006	-0.024	-0.024
-10	0.00491	0.01693	0.02403	0.02458	0.01802	0.00319	-0.0049	-0.0169	-0.0169
-5	0.00273	0.0071	0.01037	0.00983	0.00655	0.00163	-0.0027	-0.0071	-0.0071
0	0	0	0	0	0	0	0	0	0
5	-0.0027	-0.0071	-0.0103	-0.0098	-0.0098	-0.0065	-0.0016	0.00273	0.0071
10	-0.0049	-0.0169	-0.024	-0.0245	-0.0245	-0.018	-0.0081	0.00491	0.01693
15	-0.006	-0.0273	-0.0338	-0.0349	-0.0349	-0.0273	-0.0125	0.006	0.02403
20	-0.0065	-0.0295	-0.0415	-0.0415	-0.0415	-0.0322	-0.0158	0.00655	0.0295
25	-0.0071	-0.0316	-0.0453	-0.0447	-0.0447	-0.0349	-0.0174	0.0071	0.03168
30	-0.0065	-0.0316	-0.0453	-0.0475	-0.0475	-0.0355	-0.0185	0.00655	0.03168
35	-0.006	-0.0295	-0.0409	-0.048	-0.048	-0.0305	-0.018	0.006	0.0295
40	-0.0049	-0.0196	-0.0327	-0.0453	-0.0453	-0.0223	-0.0136	0.00491	0.01966
45	-0.0032	-0.0103	-0.0251	-0.0409	-0.0409	-0.0174	-0.0076	0.00327	0.01037
50	-0.0021	-0.012	-0.0213	-0.0213	-0.0213	-0.0136	-0.006	0.00218	0.01201
55	-0.001	-0.0092	-0.0169	-0.0103	-0.0103	-0.0076	-0.0049	0.00109	0.00928
60	-0.0005	-0.0065	-0.0125	-0.0076	-0.0076	-0.006	-0.0043	0.00054	0.00655
65	-0.001	-0.0054	-0.0098	-0.0114	-0.0114	-0.0076	-0.0043	0.00109	0.00546
70	-0.0027	-0.0054	-0.0081	-0.0136	-0.0136	-0.0087	-0.0032	0.00273	0.00546
75	-0.0021	-0.0054	-0.0081	-0.0136	-0.0136	-0.0076	-0.0021	0.00218	0.00546
80	-0.0016	-0.0049	-0.0081	-0.0125	-0.0125	-0.0071	-0.0021	0.00163	0.00491
85	-0.0005	-0.0043	-0.0076	-0.0114	-0.0114	-0.0065	-0.0021	0.00054	0.00437
90	-0.001	-0.0043	-0.0076	-0.0092	-0.0092	-0.0054	-0.0021	0.00109	0.00437
95	-0.0005	-0.0043	-0.0081	-0.0081	-0.0081	-0.0049	-0.0021	0.00054	0.00437
100	-0.001	-0.0049	-0.0087	-0.0076	-0.0076	-0.0049	-0.0016	0.00109	0.00491
105	-0.001	-0.0054	-0.0098	-0.0065	-0.0065	-0.0038	-0.0016	0.00109	0.00546
110	-0.001	-0.006	-0.0114	-0.0071	-0.0071	-0.0038	-0.0005	0.00109	0.00546
115	-0.0005	-0.0054	-0.0103	-0.012	-0.012	-0.0065	-0.0005	0.00054	0.00546
120	-0.0005	-0.0032	-0.0065	-0.0147	-0.0147	-0.0081	-0.0021	0.00054	0.00327
125	-0.0005	0	0.00109	-0.0087	-0.0087	-0.006	-0.0038	0.00054	0
130	-0.0005	0.00273	0.00546	0.00327	0.00327	0.00109	-0.0016	0.00054	-0.0027
135	-0.0005	0	0.01037	0.03004	0.01201	0.00054	0.00054	0	0
140	-0.001	0.00764	0.01638	0.03714	0.01966	0.00819	0.00109	-0.0076	-0.0076
145	-0.0021	0.01475	0.02731	0.04097	0.0295	0.01748	0.00218	-0.0147	-0.0147
150	-0.0027	0.01748	0.03332	0.04261	0.0355	0.0213	0.00273	-0.0174	-0.0174
155	-0.0027	0.01857	0.03387	0.04042	0.0366	0.02239	0.00273	-0.0185	-0.0185
160	-0.0032	0.01748	0.03168	0.03824	0.03441	0.02185	0.00327	-0.0174	-0.0174
165	-0.0027	0.0142	0.02622	0.03223	0.0284	0.01748	0.00273	-0.0142	-0.0142
170	-0.0027	0.00983	0.01857	0.02239	0.02021	0.01256	0.00273	-0.0098	-0.0098

	175	-0.0027	0.00273	0.00273	0.0071	0.00983	0.00983	0.00983	0.006	0.00273	-0.0027	0
180	0	0	0	0	0	0	0	0	0	0	0	0
'PHI ='												
'ALPHA ='												
-180	0	0	0	0	0	0	0	0	0	0	0	0
-175	0.0071	0.00983	0.00983	0.00983	0.00983	0.006	0.00273	0	0	0	0	0
-170	0.01857	0.02239	0.02021	0.01256	0.00273	0.01256	0.00273	0	0	0	0	0
-165	0.02622	0.03223	0.0284	0.01748	0.00273	0.01748	0.00273	0	0	0	0	0
-160	0.03168	0.03824	0.03441	0.02185	0.00327	0.02185	0.00327	0	0	0	0	0
-155	0.03387	0.04042	0.0366	0.02239	0.00273	0.02239	0.00273	0	0	0	0	0
-150	0.03332	0.04261	0.0355	0.0213	0.00273	0.0213	0.00273	0	0	0	0	0
-145	0.02731	0.04097	0.0295	0.01748	0.00218	0.01748	0.00218	0	0	0	0	0
-140	0.01638	0.03714	0.01966	0.00819	0.00109	0.00819	0.00109	0	0	0	0	0
-135	0.01037	0.03004	0.01201	0.00054	0.00054	0.00054	0.00054	0	0	0	0	0
-130	0.00546	0.00327	0.00109	0.00016	0.00054	0.00016	0.00054	0	0	0	0	0
-125	0.00109	-0.0087	-0.006	-0.0038	0.00054	-0.0038	0.00054	0	0	0	0	0
-120	-0.0065	-0.0147	-0.0081	-0.0021	0.00054	-0.0021	0.00054	0	0	0	0	0
-115	-0.0103	-0.012	-0.0065	-0.0005	0.00054	-0.0005	0.00054	0	0	0	0	0
-110	-0.0114	-0.0071	-0.0038	-0.0005	0.00109	-0.0005	0.00109	0	0	0	0	0
-105	-0.0098	-0.0065	-0.0038	-0.0016	0.00109	-0.0016	0.00109	0	0	0	0	0
-100	-0.0087	-0.0076	-0.0049	-0.0016	0.00109	-0.0016	0.00109	0	0	0	0	0
-95	-0.0081	-0.0081	-0.0049	-0.0021	0.00054	-0.0021	0.00054	0	0	0	0	0
-90	-0.0076	-0.0092	-0.0054	-0.0021	0.00109	-0.0021	0.00109	0	0	0	0	0
-85	-0.0076	-0.0114	-0.0065	-0.0021	0.00054	-0.0021	0.00054	0	0	0	0	0
-80	-0.0081	-0.0125	-0.0071	-0.0021	0.00163	-0.0021	0.00163	0	0	0	0	0
-75	-0.0081	-0.0136	-0.0076	-0.0021	0.00218	-0.0021	0.00218	0	0	0	0	0
-70	-0.0081	-0.0136	-0.0087	-0.0032	0.00273	-0.0032	0.00273	0	0	0	0	0
-65	-0.0098	-0.0114	-0.0076	-0.0043	0.00109	-0.0043	0.00109	0	0	0	0	0
-60	-0.0125	-0.0076	-0.006	-0.0043	0.00054	-0.0043	0.00054	0	0	0	0	0
-55	-0.0169	-0.0103	-0.0076	-0.0049	0.00109	-0.0049	0.00109	0	0	0	0	0
-50	-0.0213	-0.0213	-0.0136	-0.006	0.00218	-0.006	0.00218	0	0	0	0	0
-45	-0.0251	-0.0409	-0.0223	-0.0174	0.00327	-0.0174	0.00327	0	0	0	0	0
-40	-0.0327	-0.0453	-0.0223	-0.0136	0.00491	-0.0136	0.00491	0	0	0	0	0
-35	-0.0409	-0.048	-0.0305	-0.018	0.006	-0.018	0.006	0	0	0	0	0
-30	-0.0453	-0.0475	-0.0355	-0.0185	0.00655	-0.0185	0.00655	0	0	0	0	0
-25	-0.0453	-0.0447	-0.0349	-0.0174	0.0071	-0.0174	0.0071	0	0	0	0	0
-20	-0.0415	-0.0415	-0.0322	-0.0158	0.00655	-0.0158	0.00655	0	0	0	0	0
-15	-0.0338	-0.0349	-0.0273	-0.0125	0.006	-0.0125	0.006	0	0	0	0	0
-10	-0.024	-0.0245	-0.018	-0.0081	0.00491	-0.0081	0.00491	0	0	0	0	0
-5	-0.0103	-0.0098	-0.0065	-0.0016	0.00273	-0.0016	0.00273	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
5	0.01037	0.00983	0.00655	0.00163	-0.0027	0.00163	-0.0027	0	0	0	0	0
10	0.02403	0.02458	0.01802	0.00819	-0.0049	0.00819	-0.0049	0	0	0	0	0
15	0.03387	0.03496	0.02731	0.01256	-0.006	0.01256	-0.006	0	0	0	0	0
20	0.04151	0.04151	0.03223	0.01584	-0.0065	0.01584	-0.0065	0	0	0	0	0
25	0.04534	0.04479	0.03496	0.01748	-0.0071	0.01748	-0.0071	0	0	0	0	0
30	0.04534	0.04752	0.0355	0.01857	-0.0065	0.01857	-0.0065	0	0	0	0	0
35	0.04097	0.04807	0.03059	0.01802	-0.006	0.01802	-0.006	0	0	0	0	0
40	0.03277	0.04534	0.02239	0.01365	-0.0049	0.01365	-0.0049	0	0	0	0	0
45	0.02512	0.04097	0.01748	0.00764	-0.0032	0.00764	-0.0032	0	0	0	0	0
50	0.0213	0.0213	0.01365	0.006	-0.0021	0.01365	-0.0021	0	0	0	0	0
55	0.01693	0.01037	0.00764	0.00491	-0.001	0.00764	-0.001	0	0	0	0	0
60	0.01256	0.00764	0.006	0.00437	-0.0005	0.00764	-0.0005	0	0	0	0	0
65	0.00983	0.01147	0.00764	0.00437	-0.001	0.00764	-0.001	0	0	0	0	0
70	0.00819	0.01365	0.00874	0.00327	-0.0027	0.00874	-0.0027	0	0	0	0	0
75	0.00819	0.01365	0.00764	0.00218	-0.0021	0.00764	-0.0021	0	0	0	0	0
80	0.00819	0.01256	0.0071	0.00218	-0.0016	0.0071	-0.0016	0	0	0	0	0
85	0.00764	0.01147	0.00655	0.00218	-0.0005	0.00655	-0.0005	0	0	0	0	0
90	0.00764	0.00928	0.00546	0.00218	-0.001	0.00546	-0.001	0	0	0	0	0
95	0.00819	0.00819	0.00491	0.00218	-0.0005	0.00491	-0.0005	0	0	0	0	0
100	0.00874	0.00764	0.00491	0.00163	-0.001	0.00764	-0.001	0	0	0	0	0

30	-0.0065	-0.0316	-0.0453	-0.0475	-0.0355	-0.0185	0.00655	0.03168
35	-0.0006	-0.0295	-0.0409	-0.048	-0.0305	-0.018	0.006	0.0295
40	-0.0049	-0.0327	-0.0453	-0.0453	-0.0223	-0.0136	0.00491	0.01966
45	-0.0032	-0.0103	-0.0251	-0.0409	-0.0174	-0.0076	0.00327	0.01037
50	-0.0021	-0.012	-0.0213	-0.0213	-0.0136	-0.006	0.00218	0.01201
55	-0.001	-0.0092	-0.0169	-0.0103	-0.0076	-0.0049	0.00109	0.00928
60	-0.0005	-0.0065	-0.0125	-0.0076	-0.006	-0.0043	0.00054	0.00655
65	-0.001	-0.0054	-0.0098	-0.0114	-0.0076	-0.0043	0.00109	0.00546
70	-0.0027	-0.0054	-0.0081	-0.0136	-0.0076	-0.0032	0.00273	0.00546
75	-0.0021	-0.0054	-0.0081	-0.0136	-0.0076	-0.0021	0.00218	0.00546
80	-0.0016	-0.0049	-0.0081	-0.0125	-0.0071	-0.0021	0.00163	0.00491
85	-0.0005	-0.0043	-0.0076	-0.0114	-0.0065	-0.0021	0.00054	0.00437
90	-0.001	-0.0043	-0.0076	-0.0092	-0.0054	-0.0021	0.00109	0.00437
95	-0.0005	-0.0043	-0.0081	-0.0081	-0.0049	-0.0021	0.00054	0.00437
100	-0.001	-0.0049	-0.0087	-0.0076	-0.0049	-0.0016	0.00109	0.00491
105	-0.001	-0.0054	-0.0098	-0.0065	-0.0038	-0.0016	0.00109	0.00546
110	-0.001	-0.006	-0.0114	-0.0071	-0.0038	-0.0005	0.00109	0.006
115	-0.0005	-0.0054	-0.0103	-0.012	-0.0065	-0.0005	0.00054	0.00546
120	-0.0005	-0.0032	-0.0065	-0.0147	-0.0081	-0.0021	0.00054	0.00327
125	-0.0005	0.00273	0.00546	-0.0087	-0.006	-0.0038	0.00054	0
130	-0.0005	0.00764	0.01037	0.00327	0.00109	-0.0016	0.00054	-0.0027
135	-0.0005	0	0.01037	0.03004	0.01201	0.00054	0.00054	0
140	-0.001	0.00764	0.01638	0.03714	0.01966	0.00819	0.00109	-0.0076
145	-0.0021	0.01475	0.02731	0.04097	0.0295	0.01748	0.00218	-0.0147
150	-0.0027	0.01748	0.03332	0.04261	0.0355	0.0213	0.00273	-0.0174
155	-0.0027	0.01857	0.0387	0.04042	0.0366	0.02239	0.00273	-0.0185
160	-0.0032	0.01748	0.03168	0.03824	0.03441	0.02185	0.00327	-0.0174
165	-0.0027	0.0142	0.02622	0.03223	0.0284	0.01748	0.00273	-0.0142
170	-0.0027	0.00983	0.01857	0.02239	0.02021	0.01256	0.00273	-0.0098
175	-0.0027	0.00273	0.0071	0.00983	0.00983	0.006	0.00273	-0.0027
180	0	0	0	0	0	0	0	0

'PHI ='
'ALPHA ='

-180	0	0	0	0	0	0	0	0
-175	0.0071	0.00983	0.00983	0.006	0.006	0.00273	0.00273	0.00273
-170	0.01857	0.02239	0.02021	0.01256	0.01256	0.00273	0.00273	0.00273
-165	0.02622	0.03223	0.0284	0.01748	0.01748	0.00273	0.00273	0.00273
-160	0.03168	0.03824	0.03441	0.02185	0.02185	0.00327	0.00327	0.00327
-155	0.03387	0.04042	0.0366	0.02239	0.02239	0.00273	0.00273	0.00273
-150	0.03332	0.04261	0.0355	0.0213	0.0213	0.00273	0.00273	0.00273
-145	0.02731	0.04097	0.0295	0.01748	0.01748	0.00218	0.00218	0.00218
-140	0.01638	0.03714	0.01966	0.00819	0.00819	0.00109	0.00109	0.00109
-135	0.01037	0.03004	0.01201	0.00054	0.00054	0.00054	0.00054	0.00054
-130	0.00546	0.00327	0.00109	-0.0016	0.0016	0.00054	0.00054	0.00054
-125	0.00109	-0.0087	-0.006	-0.0038	0.0038	0.00054	0.00054	0.00054
-120	-0.0065	-0.0147	-0.0081	-0.0021	0.0021	0.00054	0.00054	0.00054
-115	-0.0103	-0.012	-0.0065	-0.0005	0.0005	0.00054	0.00054	0.00054
-110	-0.0114	-0.0071	-0.0038	-0.0005	0.0005	0.00109	0.00109	0.00109
-105	-0.0098	-0.0065	-0.0038	-0.0016	0.0016	0.00109	0.00109	0.00109
-100	-0.0087	-0.0076	-0.0049	-0.0021	0.0021	0.00109	0.00109	0.00109
-95	-0.0081	-0.0081	-0.0049	-0.0021	0.0021	0.00109	0.00109	0.00109
-90	-0.0076	-0.0092	-0.0054	-0.0021	0.0021	0.00109	0.00109	0.00109
-85	-0.0076	-0.0114	-0.0065	-0.0021	0.0021	0.00054	0.00054	0.00054
-80	-0.0081	-0.0125	-0.0071	-0.0021	0.0021	0.00163	0.00163	0.00163
-75	-0.0081	-0.0136	-0.0076	-0.0021	0.0021	0.00218	0.00218	0.00218
-70	-0.0081	-0.0136	-0.0087	-0.0032	0.0032	0.00273	0.00273	0.00273
-65	-0.0098	-0.0114	-0.0076	-0.0043	0.0043	0.00109	0.00109	0.00109
-60	-0.0125	-0.0076	-0.006	-0.0043	0.0043	0.00054	0.00054	0.00054
-55	-0.0169	-0.0103	-0.0076	-0.0049	0.0049	0.00109	0.00109	0.00109
-50	-0.0213	-0.0213	-0.0136	-0.006	0.006	0.00273	0.00273	0.00273
-45	-0.0251	-0.0409	-0.0174	-0.0076	0.0076	0.00327	0.00327	0.00327

-40	-0.0327	-0.0453	-0.0223	-0.0136	0.00491
-35	-0.0409	-0.048	-0.0305	-0.012	0.006
-30	-0.0453	-0.0475	-0.0355	-0.0185	0.00655
-25	-0.0453	-0.0447	-0.0349	-0.0174	0.00771
-20	-0.0415	-0.0415	-0.0322	-0.0158	0.00655
-15	-0.0338	-0.0349	-0.0273	-0.0125	0.006
-10	-0.024	-0.0245	-0.018	-0.0081	0.00491
-5	-0.0103	-0.0098	-0.0065	-0.0016	0.00273
0	0	0	0	0	0
5	0.01037	0.00983	0.00655	0.00163	-0.0027
10	0.02403	0.02458	0.01802	0.00819	-0.0049
15	0.03387	0.03496	0.02731	0.01256	-0.006
20	0.04151	0.04151	0.03223	0.01584	-0.0065
25	0.04534	0.04479	0.03496	0.01748	-0.0071
30	0.04534	0.04752	0.0355	0.01857	-0.0065
35	0.04097	0.04807	0.03059	0.01802	-0.006
40	0.03277	0.04534	0.02239	0.01365	-0.0049
45	0.02512	0.04097	0.01748	0.00764	-0.0032
50	0.0213	0.0213	0.01365	0.006	-0.0021
55	0.01693	0.01037	0.00764	0.00491	-0.001
60	0.01256	0.00764	0.006	0.00437	-0.0005
65	0.00983	0.01147	0.00764	0.00437	-0.001
70	0.00819	0.01365	0.00874	0.00327	-0.0027
75	0.00819	0.01365	0.00764	0.00218	-0.0021
80	0.00819	0.01256	0.0071	0.00218	-0.0016
85	0.00764	0.01147	0.00655	0.00218	-0.0005
90	0.00764	0.00928	0.00546	0.00218	-0.001
95	0.00819	0.00819	0.00491	0.00218	-0.0005
100	0.00874	0.00764	0.00491	0.00163	-0.001
105	0.00983	0.00655	0.00382	0.00163	-0.001
110	0.01147	0.0071	0.00382	0.00054	-0.001
115	0.01037	0.01201	0.00655	0.00054	-0.0005
120	0.00655	0.01475	0.00819	0.00218	-0.0005
125	-0.001	0.00874	0.006	0.00382	-0.0005
130	-0.0054	-0.0032	-0.001	0.00163	-0.0005
135	-0.0103	-0.03	-0.012	-0.0005	-0.0005
140	-0.0163	-0.0371	-0.0196	-0.0081	-0.001
145	-0.0273	-0.0409	-0.0295	-0.0174	-0.0021
150	-0.0333	-0.0426	-0.0355	-0.0213	-0.0027
155	-0.0338	-0.0404	-0.0366	-0.0223	-0.0027
160	-0.0316	-0.0382	-0.0344	-0.0218	-0.0032
165	-0.0262	-0.0322	-0.0284	-0.0174	-0.0027
170	-0.0185	-0.0223	-0.0202	-0.0125	-0.0027
175	-0.0071	-0.0098	-0.0098	-0.006	-0.0027
180	0	0	0	0	0

Pitch Damping Coefficient (CLM0)

2	3	11	0
"MACH# = "	-180	0	180
"PHI = "	-180	0	180
"ALPHA = "	-180	0	180
-180	-0.3	-0.3	-0.3
-135	-0.173	-0.173	-0.173
-90	-0.045	-0.045	-0.045
-45	-0.173	-0.173	-0.173
-20	-0.243	-0.243	-0.243
0	-0.3	-0.3	-0.3
20	-0.243	-0.243	-0.243
45	-0.173	-0.173	-0.173
90	-0.045	-0.045	-0.045
135	-0.173	-0.173	-0.173
180	-0.3	-0.3	-0.3

CLMQ

'MACH# ='	100	0	180
'PHI ='	-180	0	180
'ALPHA ='	-180	-0.3	-0.3
	-135	-0.173	-0.173
	-90	-0.045	-0.045
	-45	-0.173	-0.173
	-20	-0.243	-0.243
	0	-0.3	-0.3
	20	-0.243	-0.243
	45	-0.173	-0.173
	90	-0.045	-0.045
	135	-0.173	-0.173
	180	-0.3	-0.3

Yaw Damping Coefficient (CLNR)

'MACH# ='	2	3	11	0
'PHI ='	-180	0	0	180
'ALPHA ='	-180	-0.326	-0.326	-0.326
	-135	-0.188	-0.188	-0.188
	-90	-0.049	-0.049	-0.049
	-45	-0.188	-0.188	-0.188
	-20	-0.264	-0.264	-0.264
	0	-0.326	-0.326	-0.326
	20	-0.264	-0.264	-0.264
	45	-0.188	-0.188	-0.188
	90	-0.049	-0.049	-0.049
	135	-0.188	-0.188	-0.188
	180	-0.326	-0.326	-0.326

CLNR

'MACH# ='	100	0	180
'PHI ='	-180	0	180
'ALPHA ='	-180	-0.326	-0.326
	-135	-0.188	-0.188
	-90	-0.049	-0.049
	-45	-0.188	-0.188
	-20	-0.264	-0.264
	0	-0.326	-0.326
	20	-0.264	-0.264
	45	-0.188	-0.188
	90	-0.049	-0.049
	135	-0.188	-0.188
	180	-0.326	-0.326

Side Force Coefficient for Free Molecular Flow (CYFA)

'MACH# ='	2	5	38	0	90	180
'PHI ='	-180	0	-90	0	0	0
'ALPHA ='	-180	-0.08	-0.08	0	0.08	0
	-170	0	-0.19	0	0.19	0
	-160	0	-0.35	0	0.35	0
	-150	0	-0.6	0	0.6	0
	-140	0	-0.82	0	0.82	0
	-130	0	-0.91	0	0.91	0
	-120	0	-0.96	0	0.96	0
	-110	0	-0.97	0	0.97	0
	-100	0	-0.97	0	0.97	0
	-90	0	-0.97	0	0.97	0

MACH# = 'PHI =' 'ALPHA ='	CYEM			
	100 -180	-90	0	90 180
-80	0	-0.97	0	0.97
-70	0	-0.96	0	0.96
-60	0	-0.91	0	0.91
-50	0	-0.82	0	0.82
-40	0	-0.6	0	0.6
-30	0	-0.35	0	0.35
-20	0	-0.19	0	0.19
-10	0	-0.08	0	0.08
0	0	0	0	0
5	0	0.04	0	-0.04
10	0	0.08	0	-0.08
20	0	0.19	0	-0.19
30	0	0.35	0	-0.35
40	0	0.6	0	-0.6
50	0	0.82	0	-0.82
60	0	0.91	0	-0.91
70	0	0.96	0	-0.96
80	0	0.97	0	-0.97
90	0	0.97	0	-0.97
100	0	0.97	0	-0.97
110	0	0.96	0	-0.96
120	0	0.91	0	-0.91
130	0	0.82	0	-0.82
140	0	0.6	0	-0.6
150	0	0.35	0	-0.35
160	0	0.19	0	-0.19
170	0	0.08	0	-0.08
180	0	0	0	0
-180	0	0	0	0
-170	0	-0.08	0	0.08
-160	0	-0.19	0	0.19
-150	0	-0.35	0	0.35
-140	0	-0.6	0	0.6
-130	0	-0.82	0	0.82
-120	0	-0.91	0	0.91
-110	0	-0.96	0	0.96
-100	0	-0.97	0	0.97
-90	0	-0.97	0	0.97
-80	0	-0.97	0	0.97
-70	0	-0.96	0	0.96
-60	0	-0.91	0	0.91
-50	0	-0.82	0	0.82
-40	0	-0.6	0	0.6
-30	0	-0.35	0	0.35
-20	0	-0.19	0	0.19
-10	0	-0.08	0	0.08
0	0	0	0	0
5	0	0.04	0	-0.04
10	0	0.08	0	-0.08
20	0	0.19	0	-0.19
30	0	0.35	0	-0.35
40	0	0.6	0	-0.6
50	0	0.82	0	-0.82
60	0	0.91	0	-0.91
70	0	0.96	0	-0.96
80	0	0.97	0	-0.97
90	0	0.97	0	-0.97
100	0	0.97	0	-0.97

110	0	0.96	0	-0.96	0
120	0	0.91	0	-0.91	0
130	0	0.82	0	-0.82	0
140	0	0.6	0	-0.6	0
150	0	0.35	0	-0.35	0
160	0	0.19	0	-0.19	0
170	0	0.08	0	-0.08	0
180	0	0	0	0	0

Pitching Moment Coefficient for Free Molecular Flow (CLMFM)

MACH# =	2	3	37	0	180
PHI =	-180	-180	0	180	
ALPHA =					
-180	0	-0.041	0	0	0
-170	0.041	-0.066	0.041	0.041	0.066
-160	0.066	-0.085	0.066	0.066	0.085
-150	0.085	-0.079	0.085	0.079	0.085
-140	0.079	-0.006	0.079	0.006	0.006
-130	0.006	-0.021	0.021	-0.021	-0.021
-120	-0.021	0.022	0.022	0.022	-0.022
-110	-0.022	0.022	0.022	0.022	-0.022
-100	-0.022	0.022	0.022	0.022	-0.022
-90	-0.021	0.021	0.021	0.021	-0.021
-80	-0.021	0.02	0.02	0.02	-0.02
-70	-0.011	0.011	0.011	0.011	-0.011
-60	-0.011	0.032	0.032	0.032	-0.032
-50	-0.032	0.086	0.086	0.086	-0.086
-40	-0.086	0.088	0.088	0.088	-0.088
-30	-0.088	0.073	0.073	0.073	-0.073
-20	-0.073	0.046	0.046	0.046	-0.046
-10	-0.046	0	0	0	0
0	0	0.046	0.046	0.046	0.046
10	0.046	-0.073	-0.073	-0.073	0.073
20	0.073	-0.088	-0.088	-0.088	0.088
30	0.088	-0.086	-0.086	-0.086	0.086
40	0.086	-0.032	-0.032	-0.032	0.032
50	0.032	-0.011	-0.011	-0.011	0.011
60	0.011	-0.02	-0.02	-0.02	0.02
70	0.02	-0.021	-0.021	-0.021	0.021
80	0.021	-0.022	-0.022	-0.022	0.022
90	0.022	-0.022	-0.022	-0.022	0.022
100	0.022	-0.022	-0.022	-0.022	0.022
110	0.022	-0.021	-0.021	-0.021	0.021
120	0.021	-0.006	-0.006	-0.006	0.006
130	-0.006	0.079	0.079	0.079	-0.079
140	-0.079	0.085	0.085	0.085	-0.085
150	-0.085	0.066	0.066	0.066	-0.066
160	-0.066	0.041	0.041	0.041	-0.041
170	-0.041	0	0	0	0
180	0	0	0	0	0

CLMFM

MACH# =	2	3	37	0	180
PHI =	-180	-180	0	180	
ALPHA =					
-180	0	-0.041	0	0	0
-170	0.041	-0.066	0.041	0.041	0.066
-160	0.066	-0.085	0.066	0.066	0.085
-150	0.085	-0.079	0.085	0.079	0.085
-140	0.079	-0.006	0.079	0.006	0.006
-130	0.006	-0.021	0.021	-0.021	-0.021
-120	-0.021	0.022	0.022	0.022	-0.022
-110	-0.022	0.022	0.022	0.022	-0.022
-100	-0.022	0.022	0.022	0.022	-0.022
-90	-0.021	0.021	0.021	0.021	-0.021
-80	-0.021	0.02	0.02	0.02	-0.02
-70	-0.011	0.011	0.011	0.011	-0.011
-60	-0.011	0.032	0.032	0.032	-0.032
-50	-0.032	0.086	0.086	0.086	-0.086
-40	-0.086	0.088	0.088	0.088	-0.088
-30	-0.088	0.073	0.073	0.073	-0.073
-20	-0.073	0.046	0.046	0.046	-0.046
-10	-0.046	0	0	0	0
0	0	0.046	0.046	0.046	0.046
10	0.046	-0.073	-0.073	-0.073	0.073
20	0.073	-0.088	-0.088	-0.088	0.088
30	0.088	-0.086	-0.086	-0.086	0.086
40	0.086	-0.032	-0.032	-0.032	0.032
50	0.032	-0.011	-0.011	-0.011	0.011
60	0.011	-0.02	-0.02	-0.02	0.02
70	0.02	-0.021	-0.021	-0.021	0.021
80	0.021	-0.022	-0.022	-0.022	0.022
90	0.022	-0.022	-0.022	-0.022	0.022
100	0.022	-0.022	-0.022	-0.022	0.022
110	0.022	-0.021	-0.021	-0.021	0.021
120	0.021	-0.006	-0.006	-0.006	0.006
130	-0.006	0.079	0.079	0.079	-0.079
140	-0.079	0.085	0.085	0.085	-0.085
150	-0.085	0.066	0.066	0.066	-0.066
160	-0.066	0.041	0.041	0.041	-0.041
170	-0.041	0	0	0	0
180	0	0	0	0	0

CLMFM

-120	-0.021	-0.021	-0.021
-110	-0.022	0.022	-0.022
-100	-0.022	0.022	-0.022
-90	-0.022	0.022	-0.022
-80	-0.021	0.021	-0.021
-70	-0.02	0.02	-0.02
-60	-0.011	0.011	-0.011
-50	-0.032	0.032	-0.032
-40	-0.086	0.086	-0.086
-30	-0.088	0.088	-0.088
-20	-0.073	0.073	-0.073
-10	-0.046	0.046	-0.046
0	0	0	0
10	0.046	-0.046	0.046
20	0.073	-0.073	0.073
30	0.088	-0.088	0.088
40	0.086	-0.086	0.086
50	0.032	-0.032	0.032
60	0.011	-0.011	0.011
70	0.02	-0.02	0.02
80	0.021	-0.021	0.021
90	0.022	-0.022	0.022
100	0.022	-0.022	0.022
110	0.022	-0.022	0.022
120	0.021	-0.021	0.021
130	-0.006	0.006	-0.006
140	-0.079	0.079	-0.079
150	-0.085	0.085	-0.085
160	-0.066	0.066	-0.066
170	-0.041	0.041	-0.041
180	0	0	0

2 0 0 400000 0 Pitching Moment Coefficient Assymetry (CM0)

2 0 0 80 0 Assymetric Roll Moment Coefficient (CLO)

2 0 0 400000 0 Change in Center of Pressure per unit length (DELCP)

Roll Damping Coefficient (CLLP)

'MACH# ='	2	3	9	0	0
'PHI ='	-180	0	0	180	
'ALPHA ='	-180	0	0	180	
-135	-0.082	0	-0.082	-0.082	0
-90	-0.164	-0.164	-0.164	-0.164	-0.082
-45	-0.082	-0.082	-0.082	-0.082	0
0	0	0	0	0	0
45	-0.082	-0.082	-0.082	-0.082	-0.082
90	-0.164	-0.164	-0.164	-0.164	-0.082
135	-0.082	-0.082	-0.082	-0.082	0
180	0	0	0	0	0

CLLP

'MACH# ='	2	100	0	180	
'PHI ='	-180	0	180		
'ALPHA ='	-180	0	180		
-135	-0.082	-0.082	-0.082	-0.082	0

'PHI ='	60	90	120	150	180
-180	0	0.00054	0.00054	0	0.00054
-175	0	0	0.00054	0.00054	0.00054
-170	0	0	0.00054	0	0.00054
-165	-0.0005	0	0.00109	-0.0005	0.00054
-160	-0.0005	0	0.00109	-0.0005	0.00054
-155	0	0	0	0.00054	0.00054
-150	0.00218	0	-0.0027	0.00327	0.00109
-145	0.00109	-0.0005	-0.0021	0.00273	0.00218
-140	-0.0016	-0.001	0.00109	0	0.00218
-135	-0.0038	-0.0016	0.00327	-0.0027	0.00273
-130	-0.0043	-0.0027	0.00382	-0.0021	0.00382
-125	-0.0021	-0.0032	0.00273	0.00218	0.00437
-120	0.00273	-0.0038	-0.0065	0.00764	0.00437
-115	0.006	-0.0043	-0.012	0.0142	0.00437
-110	0.01037	-0.0043	-0.0125	0.01748	0.00382
-105	0.00983	-0.0038	-0.0125	0.01802	0.00382
-100	0.00928	-0.0032	-0.012	0.01746	0.00437
-95	0.00928	-0.0032	-0.012	0.01746	0.00437
-90	0.00983	-0.0038	-0.0109	0.01748	0.00218
-85	0.00983	-0.0043	-0.0125	0.01693	0.00218
-80	0.01037	-0.0043	-0.0131	0.01693	0.00218
-75	0.01092	-0.0032	-0.0125	0.01638	0.00218
-70	0.01092	-0.0032	-0.0125	0.01584	0.00163
-65	0.00874	-0.0038	-0.0098	0.01365	0.00109
-60	0.00218	-0.0038	-0.006	0.01092	0.00109
-55	-0.0032	-0.0038	-0.0032	0.00382	0.00163
-50	-0.0054	-0.0038	-0.0021	0.00109	0.00163
-45	-0.0049	-0.0038	-0.0021	0.00163	0.00163
-40	-0.0016	-0.0038	-0.0038	0.00327	0.00163
35	0.00109	-0.0021	0.00218	-0.0027	-0.0054
40	0.00163	0.00163	-0.0016	-0.0038	-0.0038
45	0.00163	0.00491	-0.0049	-0.0038	-0.0021
50	0.00163	0.00546	-0.0054	-0.0038	-0.0021
55	0.00163	0.00327	-0.0032	-0.0038	-0.0032
60	0.00109	-0.0021	0.00218	-0.0038	-0.006
65	0.00109	-0.0087	0.00874	-0.0038	-0.0098
70	0.00163	-0.0109	0.01092	-0.0032	-0.0125
75	0.00218	-0.0109	0.01092	-0.0032	-0.0125
80	0.00218	-0.0103	0.01037	-0.0043	-0.0131
85	0.00218	-0.0098	0.00983	-0.0043	-0.0125
90	0.00218	-0.0098	0.00983	-0.0038	-0.0109
95	0.00437	-0.0092	0.00928	-0.0032	-0.012
100	0.00437	-0.0092	0.00928	-0.0032	-0.012
105	0.00382	-0.0098	0.00983	-0.0038	-0.0125
110	0.00382	-0.0103	0.01037	-0.0043	-0.0125
115	0.00437	-0.006	0.006	-0.0043	-0.012
120	0.00437	-0.0027	0.00273	-0.0038	-0.0065
125	0.00437	0.00218	-0.0021	-0.0032	0.00273
130	0.00382	0.00437	-0.0043	-0.0027	0.00382
135	0.00273	0.00382	-0.0038	-0.0016	0.00327
140	0.00218	0.00163	-0.0016	-0.001	0.00109
145	0.00218	-0.001	0.00109	-0.0005	-0.0021
150	0.00109	-0.0021	0.00218	0	0.00327
155	0.00054	0	0	0	0.00054
160	0.00054	0.00054	-0.0005	0	0.00109
165	0.00054	0.00054	-0.0005	0	0.00109
170	0.00054	0	0	0	0.00054
175	0.00054	0	0	0	0.00054
180	0.00054	0	0	0.00054	0.00054

		CLL									
		MACH# = 1									
		PHI = 1									
		ALPHA = 1									
		100	-180	-150	-120	-90	-60	-30	0	30	
-35	0.00218	-0.0027	-0.0054	0.00546	0.00109						
-30	0.00218	-0.0021	-0.0043	0.00382	0.00109						
-25	-0.0005	-0.0016	-0.001	0	0						
-20	-0.0021	-0.0016	-0.0005	-0.001	0						
-15	-0.0021	-0.0016	-0.0005	-0.0005	0.00054						
-10	-0.0016	-0.001	-0.001	-0.001	0.00054						
-5	-0.001	-0.001	-0.001	-0.001	0.0005						
0	-0.001	-0.001	-0.001	-0.001	0.0005						
5	-0.001	-0.001	-0.001	-0.001	0.0005						
10	-0.0016	-0.0016	-0.001	-0.001	0.00054						
15	-0.0021	-0.0016	-0.0005	-0.0005	0.00054						
20	-0.0021	-0.0016	0	-0.001	0						
25	-0.0005	-0.0016	-0.001	-0.001	0						
30	0.00218	-0.0021	-0.0043	0.00382	0.00109						
35	0.00218	-0.0027	-0.0054	0.00546	0.00109						
40	-0.0016	-0.0038	-0.0038	0.00327	0.00163						
45	-0.0016	-0.0038	-0.0021	0.00163	0.00163						
50	-0.0054	-0.0038	-0.0021	0.00109	0.00163						
55	-0.0032	-0.0038	-0.0032	0.0038	0.00163						
60	0.00218	-0.0038	-0.006	0.0109	0.00109						
65	0.00874	-0.0038	-0.0098	0.0136	0.00109						
70	0.01092	-0.0032	-0.0125	0.01584	0.00163						
75	0.01092	-0.0032	-0.0125	0.01638	0.00218						
80	0.01037	-0.0043	-0.0131	0.01693	0.00218						
85	0.00983	-0.0043	-0.0125	0.01693	0.00218						
90	0.00983	-0.0038	-0.0109	0.01748	0.00218						
95	0.00928	-0.0032	-0.012	0.01748	0.00437						
100	0.00928	-0.0032	-0.012	0.01748	0.00437						
105	0.00983	-0.0038	-0.0125	0.01802	0.00382						
110	0.01037	-0.0043	-0.0125	0.01748	0.00382						
115	0.006	-0.0043	-0.012	0.0142	0.00437						
120	0.00273	-0.0038	-0.0065	0.00764	0.00437						
125	-0.0021	-0.0032	-0.00273	0.00218	0.00437						
130	-0.0043	-0.0027	0.00382	-0.0021	0.00382						
135	-0.0038	-0.0016	0.00327	-0.0027	0.00273						
140	-0.0016	-0.001	0.00109	0	0.00218						
145	0.00109	-0.0005	-0.0021	0.00273	0.00218						
150	0.00218	0	-0.0027	0.00327	0.00109						
155	0	0	0	0.00054	0.00054						
160	-0.0005	0	0.00109	-0.0005	0.00054						
165	-0.0005	0	0.00109	0	0.00054						
170	0	0	0.00054	0	0.00054						
175	0	0	0.00054	0.00054	0.00054						
180	0	0.00054	0.00054	0	0.00054						
		MACH# = 1									
		PHI = 1									
		ALPHA = 1									
		100									
		-180									
-180	0.00054	0	0	0.00054	0.00054	0.00054	0.00054	0.00054	0.00054	0	
-175	0.00054	0	0	0	0.00054	0.00054	0.00054	0.00054	0.00054	0	
-170	0.00054	0	0	0	0.00054	0.00054	0.00054	0.00054	0.00054	0	
-165	0.00054	0.00054	-0.0005	-0.0005	0.00109	0.00109	0.00109	0.00109	0.00054	0.00054	
-160	0.00054	0.00054	-0.0005	-0.0005	0.00109	0.00109	0.00109	0.00109	0.00054	0.00054	
-155	0.00054	0	0	0	0	0	0	0.00054	0.00054	0	
-150	0.00109	-0.0021	0.00218	0	-0.0027	0.0027	0.0027	0.0027	0.0027	-0.0027	
-145	0.00218	-0.001	0.00109	-0.0005	-0.0021	0.0021	0.0021	0.0021	0.0021	-0.0021	
-140	0.00218	0.00163	-0.00163	-0.0016	0.00109	0.00109	0.00109	0.00109	0.00163	0.00163	
-135	0.00273	0.00382	-0.00382	-0.0038	-0.0016	0.00382	0.00382	0.00382	0.00382	0.00382	
-130	0.00382	0.00437	-0.00437	-0.0043	-0.0027	0.00437	0.00437	0.00437	0.00437	0.00437	
-125	0.00437	0.00218	-0.00218	-0.0021	-0.0032	0.00218	0.00218	0.00218	0.00218	0.00218	
-120	0.00437	-0.00273	-0.00273	-0.0027	-0.0038	-0.0027	-0.0038	-0.0038	-0.0038	-0.0038	
-115	0.00437	-0.006	0.006	-0.006	-0.0043	-0.006	-0.0043	-0.006	-0.0043	-0.006	

110	0.00382	-0.0103	0.01037	-0.0043	-0.0125	0.01748	0.00382	-0.0103
105	0.00382	-0.0098	0.00983	-0.0038	-0.0125	0.01802	0.00382	-0.0098
100	0.00437	-0.0092	0.00928	-0.0032	-0.012	0.01748	0.00437	-0.0092
95	0.00437	-0.0092	0.00928	-0.0032	-0.012	0.01748	0.00437	-0.0092
90	0.00218	-0.0098	0.00983	-0.0038	-0.0109	0.01748	0.00218	-0.0098
85	0.00218	-0.0098	0.00983	-0.0043	-0.0125	0.01693	0.00218	-0.0098
80	0.00218	-0.0103	0.01037	-0.0043	-0.0131	0.01693	0.00218	-0.0103
75	0.00218	-0.0109	0.01092	-0.0032	-0.0125	0.01638	0.00218	-0.0109
70	0.00163	-0.0109	0.01092	-0.0032	-0.0125	0.01584	0.00163	-0.0109
65	0.00109	-0.0087	0.00874	-0.0038	-0.0098	0.01365	0.00109	-0.0087
60	0.00109	-0.0021	0.00218	-0.0038	-0.006	0.01092	0.00109	-0.0021
55	0.00163	0.00327	-0.0032	-0.0038	-0.0032	0.00382	0.00163	0.00327
50	0.00163	0.00546	-0.0054	-0.0038	-0.0021	0.00109	0.00163	0.00546
45	0.00163	0.00491	-0.0049	-0.0038	-0.0021	0.00163	0.00163	0.00491
40	0.00163	0.00163	-0.0016	-0.0038	-0.0038	0.00327	0.00163	0.00163
35	0.00109	-0.0021	0.00218	-0.0027	-0.0054	0.00546	0.00109	-0.0021
30	0.00109	-0.0021	0.00218	-0.0021	-0.0043	0.00382	0.00109	-0.0021
25	0	0.00054	-0.0005	-0.0016	-0.001	0	0.00054	0
20	0	0.00218	-0.0021	-0.0016	-0.001	-0.001	0	0.00218
15	0.00054	0.00218	-0.0021	-0.0016	-0.0005	-0.0005	0.00054	0.00218
10	0.00054	0.00163	-0.0016	-0.0016	-0.001	-0.0005	0.00054	0.00163
5	-0.0005	0.00109	-0.001	-0.001	-0.001	-0.0005	0.00109	-0.0005
0	-0.0005	0.00109	-0.001	-0.001	-0.001	-0.001	0.00109	-0.0005
5	-0.0005	0.00109	-0.001	-0.001	-0.001	-0.0005	0.00109	-0.0005
10	0.00054	0.00163	-0.0016	-0.0016	-0.001	-0.0005	0.00054	0.00163
15	0.00054	0.00218	-0.0021	-0.0016	-0.0005	-0.0005	0.00054	0.00218
20	0	0.00218	-0.0021	-0.0016	0	-0.001	0	0.00218
25	0	0.00054	-0.0005	-0.0016	-0.001	0	0	0.00054
30	0.00109	-0.0021	0.00218	-0.0021	-0.0043	0.00382	0.00109	-0.0021
35	0.00109	-0.0021	0.00218	-0.0027	-0.0054	0.00546	0.00109	-0.0021
40	0.00163	0.00163	-0.0016	-0.0038	-0.0038	0.00327	0.00163	0.00163
45	0.00163	0.00491	-0.0049	-0.0038	-0.0021	0.00163	0.00163	0.00491
50	0.00163	0.00546	-0.0054	-0.0038	-0.0021	0.00109	0.00163	0.00546
55	0.00163	0.00327	-0.0032	-0.0038	-0.0032	0.00382	0.00163	0.00327
60	0.00109	-0.0021	0.00218	-0.0038	-0.006	0.01092	0.00109	-0.0021
65	0.00109	-0.0087	0.00874	-0.0038	-0.0098	0.01365	0.00109	-0.0087
70	0.00163	-0.0109	0.01092	-0.0032	-0.0125	0.01584	0.00163	-0.0109
75	0.00218	-0.0109	0.01092	-0.0032	-0.0125	0.01638	0.00218	-0.0109
80	0.00218	-0.0103	0.01037	-0.0043	-0.0131	0.01693	0.00218	-0.0103
85	0.00218	-0.0098	0.00983	-0.0043	-0.0125	0.01693	0.00218	-0.0098
90	0.00218	-0.0098	0.00983	-0.0038	-0.0109	0.01748	0.00218	-0.0098
95	0.00437	-0.0092	0.00928	-0.0032	-0.012	0.01748	0.00437	-0.0092
100	0.00382	-0.0098	0.00983	-0.0038	-0.0125	0.01802	0.00382	-0.0098
105	0.00382	-0.0103	0.01037	-0.0043	-0.0125	0.01748	0.00382	-0.0103
110	0.00382	-0.0103	0.01037	-0.0043	-0.0125	0.01748	0.00382	-0.0103
115	0.00437	-0.006	0.006	-0.0043	-0.012	0.0142	0.00437	-0.006
120	0.00437	-0.0027	0.00273	-0.0038	-0.0065	0.00764	0.00437	-0.0027
125	0.00437	0.00218	-0.0021	-0.0032	0.00273	0.00218	0.00437	0.00218
130	0.00382	0.00437	-0.0043	-0.0027	0.00382	-0.0021	0.00382	0.00437
135	0.00273	0.00382	-0.0038	-0.0016	0.00327	-0.0027	0.00273	0.00382
140	0.00218	0.00163	-0.0016	-0.001	0.00109	0	0.00218	0.00163
145	0.00218	-0.001	0.00109	-0.0005	-0.0021	0.00273	0.00218	-0.001
150	0.00109	-0.0021	0.00218	0	-0.0027	0.00327	0.00109	-0.0021
155	0.00054	0	0	0	0	0.00054	0.00054	0
160	0.00054	0.00054	-0.0005	0	0.00109	-0.0005	0.00054	0.00054
165	0.00054	0.00054	-0.0005	0	0.00109	0	0.00054	0.00054
170	0.00054	0	0	0	0.00054	0	0.00054	0
175	0.00054	0	0	0	0.00054	0.00054	0.00054	0
180	0.00054	0	0	0.00054	0.00054	0	0.00054	0

'PHI =' 60 90 120 150 180
'ALPHA ='

-180	0	0.00054	0.00054	0	0.00054	0	0.00054
-175	0	0.00054	0.00054	0.00054	0.00054	0.00054	0.00054
-170	0	0.00054	0.00054	0	0.00054	0	0.00054
-165	-0.0005	0	0.00109	-0.0005	0.00054	0	0.00054
-160	-0.0005	0	0.00109	0	0.00054	0.00054	0.00054
-155	0	0	0	0	0.00054	0.00054	0.00054
-150	0.00218	0	-0.0027	0.00327	0.00109	0.00054	0.00054
-145	0.00109	-0.0005	-0.0021	0.00273	0.00218	0.00054	0.00054
-140	-0.0016	-0.001	0.00109	0.00327	0	0.00218	0.00218
-135	-0.0038	-0.0016	0.00327	-0.0027	0.00273	0.00218	0.00218
-130	-0.0043	-0.0027	0.00382	-0.0021	0.00382	0.00218	0.00382
-125	-0.0021	-0.0032	0.00273	0.00218	0.00437	0.00437	0.00437
-120	0.00273	-0.0038	-0.0065	0.00764	0.00437	0.00437	0.00437
-115	0.006	-0.0043	-0.012	0.0142	0.00437	0.00437	0.00437
-110	0.01037	-0.0043	-0.0125	0.01748	0.00382	0.00382	0.00382
-105	0.00983	-0.0038	-0.0125	0.01802	0.00382	0.00382	0.00382
-100	0.00928	-0.0032	-0.012	0.01748	0.00437	0.00437	0.00437
-95	0.00928	-0.0032	-0.012	0.01748	0.00437	0.00437	0.00437
-90	0.00983	-0.0038	-0.0109	0.01748	0.00218	0.00218	0.00218
-85	0.00983	-0.0043	-0.0125	0.01693	0.00218	0.00218	0.00218
-80	0.01037	-0.0043	-0.0131	0.01693	0.00218	0.00218	0.00218
-75	0.01092	-0.0032	-0.0125	0.01638	0.00218	0.00218	0.00218
-70	0.01092	-0.0032	-0.0125	0.01584	0.00163	0.00163	0.00163
-65	0.00874	-0.0038	-0.0098	0.01365	0.00109	0.00109	0.00109
-60	0.00218	-0.0038	-0.006	0.01092	0.00109	0.00109	0.00109
-55	-0.0032	-0.0038	-0.0032	0.00382	0.00163	0.00163	0.00163
-50	-0.0054	-0.0038	-0.0021	0.00109	0.00163	0.00163	0.00163
-45	-0.0049	-0.0038	-0.0021	0.00163	0.00163	0.00163	0.00163
-40	-0.0016	-0.0038	-0.0038	0.00327	0.00163	0.00163	0.00163
-35	0.00218	-0.0027	-0.0054	0.00546	0.00109	0.00109	0.00109
-30	0.00218	-0.0021	-0.0043	0.00382	0.00109	0.00109	0.00109
-25	-0.0005	-0.0016	-0.001	0	0	0	0
-20	-0.0021	-0.0016	0	-0.001	0	0	0
-15	-0.0021	-0.0016	-0.0005	-0.0005	0.00054	0.00054	0.00054
-10	-0.0016	-0.0016	-0.001	-0.0005	0.00054	0.00054	0.00054
-5	-0.001	-0.001	-0.001	-0.0005	-0.0005	-0.0005	-0.0005
0	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
5	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
10	-0.0016	-0.0016	-0.001	-0.0005	0.00054	0.00054	0.00054
15	-0.0021	-0.0016	-0.0016	-0.0005	0.00054	0.00054	0.00054
20	-0.0021	-0.0016	0	-0.001	0	0	0
25	-0.0005	-0.0016	-0.001	0	0	0	0
30	0.00218	-0.0021	-0.0043	0.00382	0.00109	0.00109	0.00109
35	0.00218	-0.0027	-0.0054	0.00546	0.00109	0.00109	0.00109
40	-0.0016	-0.0038	-0.0038	0.00327	0.00163	0.00163	0.00163
45	-0.0049	-0.0038	-0.0021	0.00163	0.00163	0.00163	0.00163
50	-0.0054	-0.0038	-0.0021	0.00109	0.00163	0.00163	0.00163
55	-0.0032	-0.0038	-0.0032	0.00382	0.00163	0.00163	0.00163
60	0.00218	-0.0038	-0.006	0.01092	0.00109	0.00109	0.00109
65	0.00874	-0.0038	-0.0098	0.01365	0.00109	0.00109	0.00109
70	0.01092	-0.0032	-0.0125	0.01584	0.00163	0.00163	0.00163
75	0.01092	-0.0032	-0.0125	0.01638	0.00218	0.00218	0.00218
80	0.01037	-0.0043	-0.0131	0.01693	0.00218	0.00218	0.00218
85	0.00983	-0.0043	-0.0125	0.01693	0.00218	0.00218	0.00218
90	0.00983	-0.0038	-0.0109	0.01748	0.00218	0.00218	0.00218
95	0.00928	-0.0032	-0.012	0.01748	0.00437	0.00437	0.00437
100	0.00928	-0.0032	-0.012	0.01748	0.00437	0.00437	0.00437
105	0.00983	-0.0038	-0.0125	0.01802	0.00382	0.00382	0.00382
110	0.01037	-0.0043	-0.0125	0.01748	0.00382	0.00382	0.00382
115	0.006	-0.0043	-0.012	0.0142	0.00437	0.00437	0.00437
120	0.00273	-0.0038	-0.0065	0.00764	0.00437	0.00437	0.00437
125	-0.0021	-0.0032	0.00273	0.00218	0.00437	0.00437	0.00437

	130	135	140	145	150	155	160	165	170	175	180
130	-0.0043	-0.0027	0.00382	-0.0021	0.00382	-0.0021	0.00382	-0.0021	0.00382	-0.0021	0.00382
135	-0.0038	-0.0016	0.00327	-0.0027	0.00273	-0.0027	0.00273	-0.0027	0.00273	-0.0027	0.00273
140	-0.0016	-0.0001	0.00109	0	0.00218	0	0.00218	0	0.00218	0	0.00218
145	0.00109	-0.0005	-0.0021	0.00273	0.00109	0	0.00109	0	0.00109	0	0.00109
150	0.00218	0	-0.0027	0.00327	0.00054	0	0.00054	0	0.00054	0	0.00054
155	0	0	0	0.00054	0.00054	0	0.00054	0	0.00054	0	0.00054
160	-0.0005	0	0.00109	-0.0005	0.00054	0	0.00054	0	0.00054	0	0.00054
165	-0.0005	0	0.00109	0	0.00054	0	0.00054	0	0.00054	0	0.00054
170	0	0	0.00054	0	0.00054	0	0.00054	0	0.00054	0	0.00054
175	0	0	0.00054	0.00054	0.00054	0	0.00054	0	0.00054	0	0.00054
180	0	0.00054	0.00054	0	0.00054	0	0.00054	0	0.00054	0	0.00054

2 5 37 0
 'MACH# = ' 100
 'PHI = ' -180
 'ALPHA = ' 0
 YAW Moment Coefficient for Free Molecular Flow (CLNFM)

	-180	-170	-160	-150	-140	-130	-120	-110	-100	-90	0	90	180
-180	0	-0.041	0	0	0	0	0	0	0	0	0	0	0
-170	0	-0.066	0	0	0	0	0	0	0	0	0	0.041	0
-160	0	-0.066	0	0	0	0	0	0	0	0	0	0.066	0
-150	0	-0.085	0	0	0	0	0	0	0	0	0	0.085	0
-140	0	-0.079	0	0	0	0	0	0	0	0	0	0.079	0
-130	0	-0.006	0	0	0	0	0	0	0	0	0	0.006	0
-120	0	0.021	0	0	0	0	0	0	0	0	0	-0.021	0
-110	0	0.022	0	0	0	0	0	0	0	0	0	-0.022	0
-100	0	0.022	0	0	0	0	0	0	0	0	0	-0.022	0
-90	0	0.021	0	0	0	0	0	0	0	0	0	-0.021	0
-80	0	0.02	0	0	0	0	0	0	0	0	0	-0.02	0
-70	0	0.011	0	0	0	0	0	0	0	0	0	-0.011	0
-60	0	0.032	0	0	0	0	0	0	0	0	0	-0.032	0
-50	0	0.086	0	0	0	0	0	0	0	0	0	-0.086	0
-40	0	0.088	0	0	0	0	0	0	0	0	0	-0.088	0
-30	0	0.073	0	0	0	0	0	0	0	0	0	-0.073	0
-20	0	0.046	0	0	0	0	0	0	0	0	0	-0.046	0
-10	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	-0.046	0	0	0	0	0	0	0	0	0	0.046	0
10	0	-0.073	0	0	0	0	0	0	0	0	0	0.073	0
20	0	-0.088	0	0	0	0	0	0	0	0	0	0.088	0
30	0	-0.086	0	0	0	0	0	0	0	0	0	0.086	0
40	0	-0.032	0	0	0	0	0	0	0	0	0	0.032	0
50	0	-0.011	0	0	0	0	0	0	0	0	0	0.011	0
60	0	-0.02	0	0	0	0	0	0	0	0	0	0.02	0
70	0	-0.021	0	0	0	0	0	0	0	0	0	0.021	0
80	0	-0.022	0	0	0	0	0	0	0	0	0	0.022	0
90	0	-0.022	0	0	0	0	0	0	0	0	0	0.022	0
100	0	-0.021	0	0	0	0	0	0	0	0	0	0.021	0
110	0	-0.006	0	0	0	0	0	0	0	0	0	-0.006	0
120	0	0.079	0	0	0	0	0	0	0	0	0	-0.079	0
130	0	0.085	0	0	0	0	0	0	0	0	0	-0.085	0
140	0	0.066	0	0	0	0	0	0	0	0	0	-0.066	0
150	0	0.041	0	0	0	0	0	0	0	0	0	-0.041	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0

100
 'MACH# = ' 100
 'PHI = ' -180
 'ALPHA = ' 0
 CLNFM

-130	0	-0.006	0	0.006	0
-120	0	0.022	0	-0.021	0
-110	0	0.022	0	-0.022	0
-100	0	0.022	0	-0.022	0
-90	0	0.022	0	-0.022	0
-80	0	0.021	0	-0.021	0
-70	0	0.02	0	-0.02	0
-60	0	0.011	0	-0.011	0
-50	0	0.032	0	-0.032	0
-40	0	0.086	0	-0.086	0
-30	0	0.088	0	-0.088	0
-20	0	0.073	0	-0.073	0
-10	0	0.046	0	-0.046	0
0	0	0	0	0	0
10	0	-0.046	0	0.046	0
20	0	-0.073	0	0.073	0
30	0	-0.088	0	0.088	0
40	0	-0.086	0	0.086	0
50	0	-0.032	0	0.032	0
60	0	-0.011	0	0.011	0
70	0	-0.02	0	0.02	0
80	0	-0.021	0	0.021	0
90	0	-0.022	0	0.022	0
100	0	-0.022	0	0.022	0
110	0	-0.022	0	0.022	0
120	0	-0.021	0	0.021	0
130	0	0.006	0	-0.006	0
140	0	0.079	0	-0.079	0
150	0	0.085	0	-0.085	0
160	0	0.066	0	-0.066	0
170	0	0.041	0	-0.041	0
180	0	0	0	0	0

MACH# =		PHI =		ALPHA =		Incremental Axial Force Coefficient (DCAA)		
2	5	0	-180	-90	73	0	90	180
-180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-175	0.0110	0.0060	0.0110	0.0060	0.0110	0.0060	0.0110	0.0110
-170	0.0185	0.0120	0.0185	0.0120	0.0185	0.0120	0.0185	0.0185
-165	0.0225	0.0170	0.0225	0.0170	0.0225	0.0170	0.0225	0.0225
-160	0.0255	0.0210	0.0255	0.0210	0.0255	0.0210	0.0255	0.0255
-155	0.0270	0.0230	0.0270	0.0230	0.0270	0.0230	0.0270	0.0270
-150	0.0275	0.0250	0.0275	0.0250	0.0275	0.0250	0.0275	0.0275
-145	0.0270	0.0260	0.0270	0.0260	0.0270	0.0260	0.0270	0.0270
-140	0.0260	0.0270	0.0260	0.0270	0.0260	0.0270	0.0260	0.0260
-135	0.0240	0.0260	0.0240	0.0260	0.0240	0.0260	0.0240	0.0240
-130	0.0200	0.0230	0.0200	0.0230	0.0200	0.0230	0.0200	0.0200
-125	0.0150	0.0180	0.0150	0.0180	0.0150	0.0180	0.0150	0.0150
-120	0.0085	0.0140	0.0085	0.0140	0.0085	0.0140	0.0085	0.0085
-115	0.0065	0.0120	0.0065	0.0120	0.0065	0.0120	0.0065	0.0065
-110	0.0060	0.0100	0.0060	0.0100	0.0060	0.0100	0.0060	0.0060
-105	0.0055	0.0090	0.0055	0.0090	0.0055	0.0090	0.0055	0.0055
-100	0.0040	0.0080	0.0040	0.0080	0.0040	0.0080	0.0040	0.0040
-95	0.0030	0.0070	0.0030	0.0070	0.0030	0.0070	0.0030	0.0030
-90	0.0010	0.0070	0.0010	0.0070	0.0010	0.0070	0.0010	0.0010
-85	-0.0010	0.0060	-0.0010	0.0060	-0.0010	0.0060	-0.0010	-0.0010
-80	-0.0040	0.0060	-0.0040	0.0060	-0.0040	0.0060	-0.0040	-0.0040
-75	-0.0070	0.0050	-0.0070	0.0050	-0.0070	0.0050	-0.0070	-0.0070
-70	-0.0110	0.0040	-0.0110	0.0040	-0.0110	0.0040	-0.0110	-0.0110
-65	-0.0150	0.0020	-0.0150	0.0020	-0.0150	0.0020	-0.0150	-0.0150
-60	-0.0200	-0.0030	-0.0200	-0.0030	-0.0200	-0.0030	-0.0200	-0.0200

	DCAA			
	100	90	0	180
'MACH# ='	100	90	0	180
'PHI ='	-180	-90	0	180
'ALPHA ='	-180	-90	0	180
-180	0.0000	0.0000	0.0000	0.0000
-175	0.0110	0.0060	0.0110	0.0110
-170	0.0185	0.0120	0.0185	0.0185
-165	0.0225	0.0170	0.0225	0.0225
-160	0.0255	0.0210	0.0255	0.0255
-155	0.0270	0.0230	0.0270	0.0270
-150	0.0275	0.0250	0.0275	0.0275
-145	0.0270	0.0260	0.0270	0.0270
-140	0.0260	0.0270	0.0260	0.0260
-135	0.0240	0.0260	0.0240	0.0240
-130	0.0200	0.0230	0.0200	0.0200
-125	0.0150	0.0180	0.0150	0.0150
-120	0.0085	0.0140	0.0085	0.0085
-115	0.0065	0.0120	0.0065	0.0065
-110	0.0060	0.0100	0.0060	0.0060
-105	0.0055	0.0090	0.0055	0.0055
-100	0.0040	0.0080	0.0040	0.0040
-95	0.0030	0.0070	0.0030	0.0030
-90	0.0010	0.0070	0.0010	0.0010
-85	0.0010	0.0060	0.0010	0.0010
-80	0.0040	0.0060	0.0040	0.0040
-75	0.0070	0.0050	0.0070	0.0070
-70	0.0110	0.0040	0.0110	0.0110
-65	0.0150	0.0020	0.0150	0.0150
-60	0.0200	0.0030	0.0200	0.0200
-55	0.0240	0.0060	0.0240	0.0240
-50	0.0290	0.0140	0.0290	0.0290
-45	0.0350	0.0220	0.0350	0.0350
-40	0.0435	0.0430	0.0435	0.0435
-35	0.0540	0.0650	0.0540	0.0540
-30	0.0690	0.0810	0.0690	0.0690
-25	0.0840	0.0900	0.0840	0.0840
-20	0.0970	0.0950	0.0970	0.0970
-15	0.1030	0.0960	0.1030	0.1030
-10	0.1065	0.0970	0.1065	0.1065
-5	0.1080	0.0990	0.1080	0.1080
0	0.1090	0.1000	0.1090	0.1090
5	0.1080	0.0990	0.1080	0.1080
10	0.1065	0.0970	0.1065	0.1065
15	0.1030	0.0960	0.1030	0.1030
20	0.0970	0.0950	0.0970	0.0970
25	0.0840	0.0900	0.0840	0.0840
30	0.0690	0.0810	0.0690	0.0690
35	0.0540	0.0650	0.0540	0.0540
40	0.0435	0.0430	0.0435	0.0435
45	0.0350	0.0220	0.0350	0.0350
50	0.0290	0.0140	0.0290	0.0290
55	0.0240	0.0060	0.0240	0.0240
60	0.0200	0.0030	0.0200	0.0200
65	0.0150	0.0020	0.0150	0.0150
70	0.0110	0.0040	0.0110	0.0110
75	0.0070	0.0050	0.0070	0.0070
80	0.0040	0.0060	0.0040	0.0040
85	0.0010	0.0060	0.0010	0.0010
90	0.0010	0.0070	0.0010	0.0010
95	0.0030	0.0070	0.0030	0.0030
100	0.0040	0.0080	0.0040	0.0040
105	0.0055	0.0090	0.0055	0.0055
110	0.0060	0.0100	0.0060	0.0060
115	0.0065	0.0120	0.0065	0.0065
120	0.0085	0.0140	0.0085	0.0085
125	0.0150	0.0180	0.0150	0.0150
130	0.0200	0.0230	0.0200	0.0200
135	0.0240	0.0240	0.0240	0.0240
140	0.0260	0.0270	0.0260	0.0260
145	0.0270	0.0260	0.0270	0.0270
150	0.0275	0.0250	0.0275	0.0275
155	0.0270	0.0230	0.0270	0.0270
160	0.0255	0.0210	0.0255	0.0255
165	0.0225	0.0170	0.0225	0.0225
170	0.0185	0.0120	0.0185	0.0185
175	0.0110	0.0060	0.0110	0.0110
180	0.0000	0.0000	0.0000	0.0000

-130	0.0200	0.0230	0.0200	0.0230	0.0200
-125	0.0150	0.0180	0.0150	0.0180	0.0150
-120	0.0085	0.0140	0.0085	0.0140	0.0085
-115	0.0065	0.0120	0.0065	0.0120	0.0065
-110	0.0060	0.0100	0.0060	0.0100	0.0060
-105	0.0055	0.0090	0.0055	0.0090	0.0055
-100	0.0040	0.0080	0.0040	0.0080	0.0040
-95	0.0030	0.0070	0.0030	0.0070	0.0030
-90	0.0010	0.0070	0.0010	0.0070	0.0010
-85	-0.0010	0.0060	-0.0010	0.0060	-0.0010
-80	-0.0040	0.0060	-0.0040	0.0060	-0.0040
-75	-0.0070	0.0050	-0.0070	0.0050	-0.0070
-70	-0.0110	0.0040	-0.0110	0.0040	-0.0110
-65	-0.0150	0.0020	-0.0150	0.0020	-0.0150
-60	-0.0200	-0.0030	-0.0200	-0.0030	-0.0200
-55	-0.0240	-0.0060	-0.0240	-0.0060	-0.0240
-50	-0.0290	-0.0140	-0.0290	-0.0140	-0.0290
-45	-0.0350	-0.0220	-0.0350	-0.0220	-0.0350
-40	-0.0435	-0.0430	-0.0435	-0.0430	-0.0435
-35	-0.0540	-0.0650	-0.0540	-0.0650	-0.0540
-30	-0.0690	-0.0810	-0.0690	-0.0810	-0.0690
-25	-0.0840	-0.0900	-0.0840	-0.0900	-0.0840
-20	-0.0970	-0.0950	-0.0970	-0.0950	-0.0970
-15	-0.1030	-0.0960	-0.1030	-0.0960	-0.1030
-10	-0.1065	-0.0970	-0.1065	-0.0970	-0.1065
-5	-0.1080	-0.0990	-0.1080	-0.0990	-0.1080
0	-0.1090	-0.1000	-0.1090	-0.1000	-0.1090
5	-0.1080	-0.0990	-0.1080	-0.0990	-0.1080
10	-0.1065	-0.0970	-0.1065	-0.0970	-0.1065
15	-0.1030	-0.0960	-0.1030	-0.0960	-0.1030
20	-0.0970	-0.0950	-0.0970	-0.0950	-0.0970
25	-0.0840	-0.0810	-0.0840	-0.0810	-0.0840
30	-0.0690	-0.0650	-0.0690	-0.0650	-0.0690
35	-0.0540	-0.0430	-0.0540	-0.0430	-0.0540
40	-0.0435	-0.0350	-0.0435	-0.0350	-0.0435
45	-0.0350	-0.0220	-0.0350	-0.0220	-0.0350
50	-0.0290	-0.0140	-0.0290	-0.0140	-0.0290
55	-0.0240	-0.0060	-0.0240	-0.0060	-0.0240
60	-0.0200	-0.0030	-0.0200	-0.0030	-0.0200
65	-0.0150	-0.0020	-0.0150	-0.0020	-0.0150
70	-0.0110	-0.0040	-0.0110	-0.0040	-0.0110
75	-0.0070	-0.0050	-0.0070	-0.0050	-0.0070
80	-0.0040	-0.0060	-0.0040	-0.0060	-0.0040
85	-0.0010	-0.0060	-0.0010	-0.0060	-0.0010
90	0.0010	0.0070	0.0010	0.0070	0.0010
95	0.0030	0.0070	0.0030	0.0070	0.0030
100	0.0040	0.0080	0.0040	0.0080	0.0040
105	0.0055	0.0090	0.0055	0.0090	0.0055
110	0.0060	0.0100	0.0060	0.0100	0.0060
115	0.0065	0.0120	0.0065	0.0120	0.0065
120	0.0085	0.0140	0.0085	0.0140	0.0085
125	0.0150	0.0180	0.0150	0.0180	0.0150
130	0.0200	0.0230	0.0200	0.0230	0.0200
135	0.0240	0.0260	0.0240	0.0260	0.0240
140	0.0260	0.0270	0.0260	0.0270	0.0260
145	0.0270	0.0260	0.0270	0.0260	0.0270
150	0.0275	0.0250	0.0275	0.0250	0.0275
155	0.0270	0.0230	0.0270	0.0230	0.0270
160	0.0255	0.0210	0.0255	0.0210	0.0255
165	0.0225	0.0170	0.0225	0.0170	0.0225
170	0.0185	0.0120	0.0185	0.0120	0.0185
175	0.0110	0.0060	0.0110	0.0060	0.0110

		Incremental Normal Force Coefficient (D ₀ N _A)				
		180	0.0000	0.0000	0.0000	0.0000
		2	5	0	73	0
		'MACH# ='	'PHI ='	'ALPHA ='		
		-180	0.0000	0.0000	0.0000	0.0000
		-180	0.0000	0.0000	0.0000	0.0000
		-175	-0.0060	-0.0010	0.0060	-0.0060
		-170	-0.0130	-0.0021	0.0130	-0.0130
		-165	-0.0200	-0.0030	0.0200	-0.0200
		-160	-0.0320	-0.0035	0.0320	-0.0320
		-155	-0.0500	-0.0035	0.0500	-0.0500
		-150	-0.0725	-0.0035	0.0725	-0.0725
		-145	-0.0940	-0.0025	0.0940	-0.0940
		-140	-0.1150	-0.0020	0.1150	-0.1150
		-135	-0.1310	-0.0015	0.1310	-0.1310
		-130	-0.1425	-0.0010	0.1425	-0.1425
		-125	-0.1490	-0.0005	0.1490	-0.1490
		-120	-0.1550	-0.0005	0.1550	-0.1550
		-115	-0.1600	-0.0001	0.1600	-0.1600
		-110	-0.1630	0.0015	0.1630	-0.1630
		-105	-0.1660	0.0018	0.1660	-0.1660
		-100	-0.1675	0.0018	0.1675	-0.1675
		-95	-0.1690	0.0020	0.1690	-0.1690
		-90	-0.1695	0.0022	0.1695	-0.1695
		-85	-0.1685	0.0025	0.1685	-0.1685
		-80	-0.1665	0.0028	0.1665	-0.1665
		-75	-0.1635	0.0027	0.1635	-0.1635
		-70	-0.1590	0.0025	0.1590	-0.1590
		-65	-0.1505	0.0025	0.1505	-0.1505
		-60	-0.1395	0.0022	0.1395	-0.1395
		-55	-0.1240	0.0021	0.1240	-0.1240
		-50	-0.1090	0.0020	0.1090	-0.1090
		-45	-0.0910	0.0015	0.0910	-0.0910
		-40	-0.0695	0.0010	0.0695	-0.0695
		-35	-0.0530	0.0005	0.0530	-0.0530
		-30	-0.0385	0.0000	0.0385	-0.0385
		-25	-0.0295	-0.0005	0.0295	-0.0295
		-20	-0.0230	-0.0010	0.0230	-0.0230
		-15	-0.0180	-0.0015	0.0180	-0.0180
		-10	-0.0120	-0.0015	0.0120	-0.0120
		-5	-0.0070	-0.0011	0.0070	-0.0070
		0	0.0000	0.0000	0.0000	0.0000
		5	0.0070	0.0011	-0.0070	0.0070
		10	0.0120	0.0015	-0.0120	0.0120
		15	0.0180	0.0015	-0.0180	0.0180
		20	0.0230	0.0010	-0.0230	0.0230
		25	0.0295	0.0005	-0.0295	0.0295
		30	0.0385	0.0000	-0.0385	0.0385
		35	0.0530	-0.0005	0.0530	-0.0530
		40	0.0695	-0.0010	0.0695	-0.0695
		45	0.0910	-0.0015	0.0910	-0.0910
		50	0.1090	-0.0020	0.1090	-0.1090
		55	0.1240	-0.0021	0.1240	-0.1240
		60	0.1395	-0.0022	0.1395	-0.1395
		65	0.1505	-0.0025	0.1505	-0.1505
		70	0.1590	-0.0025	0.1590	-0.1590
		75	0.1635	-0.0027	0.1635	-0.1635
		80	0.1665	-0.0028	0.1665	-0.1665
		85	0.1685	-0.0025	0.1685	-0.1685
		90	0.1695	-0.0022	0.1695	-0.1695
		95	0.1690	-0.0020	0.1690	-0.1690

DCNA

MACH# =	100	-180	-90	0	90	180
PHI =						
ALPHA =						
180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
175	-0.0060	-0.0010	0.0060	0.0060	0.0010	-0.0060
170	-0.0130	-0.0021	0.0130	0.0130	0.0021	-0.0130
165	-0.0200	-0.0030	0.0200	0.0200	0.0030	-0.0200
160	-0.0320	-0.0035	0.0320	0.0320	0.0035	-0.0320
155	-0.0500	-0.0035	0.0500	0.0500	0.0035	-0.0500
150	-0.0725	-0.0035	0.0725	0.0725	0.0035	-0.0725
145	-0.0940	-0.0025	0.0940	0.0940	0.0025	-0.0940
140	-0.1150	-0.0020	0.1150	0.1150	0.0020	-0.1150
135	-0.1310	-0.0015	0.1310	0.1310	0.0015	-0.1310
130	-0.1425	-0.0010	0.1425	0.1425	0.0010	-0.1425
125	-0.1550	-0.0005	0.1550	0.1550	0.0005	-0.1550
120	-0.1600	-0.0010	0.1600	0.1600	0.0010	-0.1600
115	-0.1630	-0.0015	0.1630	0.1630	0.0015	-0.1630
110	-0.1660	-0.0018	0.1660	0.1660	0.0018	-0.1660
105	-0.1675	-0.0018	0.1675	0.1675	0.0018	-0.1675
100	-0.1690	-0.0020	0.1690	0.1690	0.0020	-0.1690
95	-0.1695	-0.0022	0.1695	0.1695	0.0022	-0.1695
90	-0.1685	-0.0025	0.1685	0.1685	0.0025	-0.1685
85	-0.1665	-0.0028	0.1665	0.1665	0.0028	-0.1665
80	-0.1635	-0.0027	0.1635	0.1635	0.0027	-0.1635
75	-0.1590	-0.0025	0.1590	0.1590	0.0025	-0.1590
70	-0.1505	-0.0025	0.1505	0.1505	0.0025	-0.1505
65	-0.1395	-0.0022	0.1395	0.1395	0.0022	-0.1395
60	-0.1240	-0.0021	0.1240	0.1240	0.0021	-0.1240
55	-0.1090	-0.0020	0.1090	0.1090	0.0020	-0.1090
50	-0.0910	-0.0015	0.0910	0.0910	0.0015	-0.0910
45	-0.0695	-0.0010	0.0695	0.0695	0.0010	-0.0695
40	-0.0530	-0.0005	0.0530	0.0530	0.0005	-0.0530
35	-0.0385	-0.0000	0.0385	0.0385	0.0000	-0.0385
30	-0.0295	-0.0005	0.0295	0.0295	0.0005	-0.0295
25	-0.0230	-0.0010	0.0230	0.0230	0.0010	-0.0230
20	-0.0180	-0.0015	0.0180	0.0180	0.0015	-0.0180
15	-0.0120	-0.0015	0.0120	0.0120	0.0015	-0.0120
10	-0.0070	-0.0011	0.0070	0.0070	0.0011	-0.0070
5	-0.0000	-0.0000	0.0000	0.0000	0.0000	-0.0000
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0070	0.0011	0.0070	0.0070	0.0011	0.0070
10	0.0120	0.0015	0.0120	0.0120	0.0015	0.0120
15	0.0180	0.0015	0.0180	0.0180	0.0015	0.0180
20	0.0230	0.0010	0.0230	0.0230	0.0010	0.0230

[illegible]

		MACH# =				100			
		'PHI =				-180			
		'ALPHA =				-90			
		0				90			
		180				0.0000			
		-180				0.0000			
		-175				-0.0030			
		-170				-0.0066			
		-165				-0.0100			
		-160				-0.0136			
		-155				-0.0175			
		-150				-0.0210			
		-145				-0.0240			
		-140				-0.0259			
		-135				-0.0270			
		-130				-0.0274			
		-125				-0.0270			
		-120				-0.0274			
		-115				-0.0284			
		-110				-0.0287			
		-105				-0.0292			
		-100				-0.0303			
		-95				-0.0312			
		-90				-0.0324			
		-85				-0.0336			
		-80				-0.0350			
		-75				-0.0362			
		-70				-0.0364			
		-65				-0.0345			
		-60				-0.0310			
		-55				-0.0260			
		-50				-0.0180			
		-45				-0.0075			
		-40				-0.0000			
		-35				0.0005			
		-30				0.0015			
		-25				0.0016			
		-20				0.0020			
		-15				0.0019			
		-10				0.0015			
		-5				0.0009			
		0				0.0000			
		5				-0.0009			
		10				-0.0015			
		15				-0.0019			
		20				-0.0020			
		25				-0.0015			
		30				-0.0010			
		35				-0.0005			
		40				-0.0001			
		45				0.0005			
		50				0.0009			
		55				0.0015			
		60				0.0016			
		65				0.0015			
		70				0.0008			
		75				0.0100			
		80				0.0095			
		85				0.0081			
		90				-0.0061			
		95				-0.0042			
		100				-0.0028			
		105				-0.0015			
		110				-0.0005			
		115				0.0000			
		120				0.0000			
		125				0.0000			
		130				0.0000			
		135				0.0000			
		140				0.0000			
		145				0.0000			
		150				0.0000			
		155				0.0000			
		160				0.0000			
		165				0.0000			
		170				0.0000			
		175				0.0000			
		180				0.0000			

-130	-0.0270	0.0000	0.0270	0.0000	-0.0270
-125	-0.0270	0.0000	0.0270	0.0000	-0.0270
-120	-0.0274	0.0000	0.0274	0.0000	-0.0274
-115	-0.0277	0.0005	0.0277	0.0005	-0.0277
-110	-0.0284	0.0015	0.0284	0.0015	-0.0284
-105	-0.0292	0.0028	0.0292	0.0028	-0.0292
-100	-0.0303	0.0042	0.0303	0.0042	-0.0303
-95	-0.0312	0.0061	0.0312	0.0061	-0.0312
-90	-0.0324	0.0081	0.0324	0.0081	-0.0324
-85	-0.0336	0.0095	0.0336	0.0095	-0.0336
-80	-0.0350	0.0100	0.0350	0.0100	-0.0350
-75	-0.0362	0.0100	0.0362	0.0100	-0.0362
-70	-0.0364	0.0098	0.0364	0.0098	-0.0364
-65	-0.0345	0.0085	0.0345	0.0085	-0.0345
-60	-0.0310	0.0075	0.0310	0.0075	-0.0310
-55	-0.0260	0.0060	0.0260	0.0060	-0.0260
-50	-0.0180	0.0042	0.0180	0.0042	-0.0180
-45	-0.0075	0.0025	0.0075	0.0025	-0.0075
-40	-0.0071	0.0010	0.0071	0.0010	-0.0071
-35	-0.0155	0.0005	0.0155	0.0005	-0.0155
-30	-0.0167	0.0010	0.0167	0.0010	-0.0167
-25	-0.0160	0.0015	0.0160	0.0015	-0.0160
-20	-0.0134	0.0020	0.0134	0.0020	-0.0134
-15	-0.0105	0.0019	0.0105	0.0019	-0.0105
-10	-0.0067	0.0015	0.0067	0.0015	-0.0067
-5	-0.0035	0.0009	0.0035	0.0009	-0.0035
0	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0035	0.0009	0.0035	0.0009	0.0035
10	0.0067	0.0015	0.0067	0.0015	0.0067
15	0.0105	0.0019	0.0105	0.0019	0.0105
20	0.0134	0.0020	0.0134	0.0020	0.0134
25	0.0160	0.0015	0.0160	0.0015	0.0160
30	0.0167	0.0010	0.0167	0.0010	0.0167
35	0.0155	0.0005	0.0155	0.0005	0.0155
40	0.0071	0.0010	0.0071	0.0010	0.0071
45	0.0075	0.0025	0.0075	0.0025	0.0075
50	0.0180	0.0042	0.0180	0.0042	0.0180
55	0.0260	0.0060	0.0260	0.0060	0.0260
60	0.0310	0.0075	0.0310	0.0075	0.0310
65	0.0345	0.0085	0.0345	0.0085	0.0345
70	0.0364	0.0098	0.0364	0.0098	0.0364
75	0.0362	0.0100	0.0362	0.0100	0.0362
80	0.0350	0.0100	0.0350	0.0100	0.0350
85	0.0336	0.0095	0.0336	0.0095	0.0336
90	0.0324	0.0081	0.0324	0.0081	0.0324
95	0.0312	0.0061	0.0312	0.0061	0.0312
100	0.0303	0.0042	0.0303	0.0042	0.0303
105	0.0292	0.0028	0.0292	0.0028	0.0292
110	0.0284	0.0015	0.0284	0.0015	0.0284
115	0.0277	0.0005	0.0277	0.0005	0.0277
120	0.0274	0.0000	0.0274	0.0000	0.0274
125	0.0270	0.0000	0.0270	0.0000	0.0270
130	0.0270	0.0000	0.0270	0.0000	0.0270
135	0.0270	0.0000	0.0270	0.0000	0.0270
140	0.0259	0.0000	0.0259	0.0000	0.0259
145	0.0240	0.0000	0.0240	0.0000	0.0240
150	0.0210	0.0000	0.0210	0.0000	0.0210
155	0.0175	0.0000	0.0175	0.0000	0.0175
160	0.0136	0.0000	0.0136	0.0000	0.0136
165	0.0100	0.0000	0.0100	0.0000	0.0100
170	0.0066	0.0000	0.0066	0.0000	0.0066
175	0.0030	0.0000	0.0030	0.0000	0.0030

		Incremental Side Force Coefficient (DCYA)									
		180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		2	5	73	0	0	0	90	180		
		'MACH#'	'PHI'	'ALPHA'							
-180	0.0073	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0073	0.0073	0.0073
-175	0.0073	0.0070	0.0070	0.0073	0.0073	0.0073	0.0073	0.0070	0.0070	0.0073	0.0073
-170	0.0074	0.0145	0.0145	0.0074	0.0074	0.0074	0.0074	0.0145	0.0145	0.0074	0.0074
-165	0.0074	0.0215	0.0215	0.0074	0.0074	0.0074	0.0074	0.0215	0.0215	0.0074	0.0074
-160	0.0074	0.0300	0.0300	0.0074	0.0074	0.0074	0.0074	0.0300	0.0300	0.0074	0.0074
-155	0.0074	0.0420	0.0420	0.0074	0.0074	0.0074	0.0074	0.0420	0.0420	0.0074	0.0074
-150	0.0073	0.0600	0.0600	0.0073	0.0073	0.0073	0.0073	0.0600	0.0600	0.0073	0.0073
-145	0.0070	0.0830	0.0830	0.0070	0.0070	0.0070	0.0070	0.0830	0.0830	0.0070	0.0070
-140	0.0061	0.1080	0.1080	0.0061	0.0061	0.0061	0.0061	0.1080	0.1080	0.0061	0.0061
-135	0.0052	0.1280	0.1280	0.0052	0.0052	0.0052	0.0052	0.1280	0.1280	0.0052	0.0052
-130	0.0041	0.1390	0.1390	0.0041	0.0041	0.0041	0.0041	0.1390	0.1390	0.0041	0.0041
-125	0.0028	0.1460	0.1460	0.0028	0.0028	0.0028	0.0028	0.1460	0.1460	0.0028	0.0028
-120	0.0013	0.1525	0.1525	0.0013	0.0013	0.0013	0.0013	0.1525	0.1525	0.0013	0.0013
-115	0.0004	0.1570	0.1570	0.0004	0.0004	0.0004	0.0004	0.1570	0.1570	0.0004	0.0004
-110	0.0015	0.1610	0.1610	0.0015	0.0015	0.0015	0.0015	0.1610	0.1610	0.0015	0.0015
-105	0.0020	0.1640	0.1640	0.0020	0.0020	0.0020	0.0020	0.1640	0.1640	0.0020	0.0020
-100	0.0025	0.1665	0.1665	0.0025	0.0025	0.0025	0.0025	0.1665	0.1665	0.0025	0.0025
-95	0.0028	0.1685	0.1685	0.0028	0.0028	0.0028	0.0028	0.1685	0.1685	0.0028	0.0028
-90	0.0031	0.1700	0.1700	0.0031	0.0031	0.0031	0.0031	0.1700	0.1700	0.0031	0.0031
-85	0.0033	0.1700	0.1700	0.0033	0.0033	0.0033	0.0033	0.1700	0.1700	0.0033	0.0033
-80	0.0035	0.1695	0.1695	0.0035	0.0035	0.0035	0.0035	0.1695	0.1695	0.0035	0.0035
-75	0.0037	0.1665	0.1665	0.0037	0.0037	0.0037	0.0037	0.1665	0.1665	0.0037	0.0037
-70	0.0038	0.1635	0.1635	0.0038	0.0038	0.0038	0.0038	0.1635	0.1635	0.0038	0.0038
-65	0.0039	0.1560	0.1560	0.0039	0.0039	0.0039	0.0039	0.1560	0.1560	0.0039	0.0039
-60	0.0039	0.1460	0.1460	0.0039	0.0039	0.0039	0.0039	0.1460	0.1460	0.0039	0.0039
-55	0.0039	0.1340	0.1340	0.0039	0.0039	0.0039	0.0039	0.1340	0.1340	0.0039	0.0039
-50	0.0036	0.1200	0.1200	0.0036	0.0036	0.0036	0.0036	0.1200	0.1200	0.0036	0.0036
-45	0.0022	0.1010	0.1010	0.0022	0.1010	0.1010	0.1010	0.0022	0.1010	0.0022	0.0022
-40	0.0000	0.0780	0.0780	0.0000	0.0000	0.0000	0.0000	0.0780	0.0780	0.0000	0.0000
-35	0.0000	0.0580	0.0580	0.0000	0.0000	0.0000	0.0000	0.0580	0.0580	0.0000	0.0000
-30	0.0000	0.0440	0.0440	0.0000	0.0000	0.0000	0.0000	0.0440	0.0440	0.0000	0.0000
-25	0.0000	0.0350	0.0350	0.0000	0.0000	0.0000	0.0000	0.0350	0.0350	0.0000	0.0000
-20	0.0000	0.0275	0.0275	0.0000	0.0000	0.0000	0.0000	0.0275	0.0275	0.0000	0.0000
-15	0.0000	0.0210	0.0210	0.0000	0.0000	0.0000	0.0000	0.0210	0.0210	0.0000	0.0000
-10	0.0000	0.0140	0.0140	0.0000	0.0000	0.0000	0.0000	0.0140	0.0140	0.0000	0.0000
-5	0.0000	0.0070	0.0070	0.0000	0.0000	0.0000	0.0000	0.0070	0.0070	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0007	0.0000	0.0000	0.0007	0.0007	0.0007	0.0007	0.0000	0.0000	0.0007	0.0007
10	0.0012	0.0140	0.0140	0.0012	0.0012	0.0012	0.0012	0.0140	0.0140	0.0012	0.0012
15	0.0014	0.0210	0.0210	0.0014	0.0014	0.0014	0.0014	0.0210	0.0210	0.0014	0.0014
20	0.0015	0.0275	0.0275	0.0015	0.0015	0.0015	0.0015	0.0275	0.0275	0.0015	0.0015
25	0.0015	0.0350	0.0350	0.0015	0.0015	0.0015	0.0015	0.0350	0.0350	0.0015	0.0015
30	0.0014	0.0440	0.0440	0.0014	0.0014	0.0014	0.0014	0.0440	0.0440	0.0014	0.0014
35	0.0011	0.0580	0.0580	0.0011	0.0011	0.0011	0.0011	0.0580	0.0580	0.0011	0.0011
40	0.0000	0.0780	0.0780	0.0000	0.0000	0.0000	0.0000	0.0780	0.0780	0.0000	0.0000
45	0.0022	0.1010	0.1010	0.0022	0.1010	0.1010	0.1010	0.0022	0.1010	0.0022	0.0022
50	0.0036	0.1200	0.1200	0.0036	0.1200	0.1200	0.1200	0.0036	0.1200	0.0036	0.0036
55	0.0039	0.1340	0.1340	0.0039	0.1340	0.1340	0.1340	0.0039	0.1340	0.0039	0.0039
60	0.0039	0.1460	0.1460	0.0039	0.1460	0.1460	0.1460	0.0039	0.1460	0.0039	0.0039
65	0.0039	0.1560	0.1560	0.0039	0.1560	0.1560	0.1560	0.0039	0.1560	0.0039	0.0039
70	0.0038	0.1635	0.1635	0.0038	0.1635	0.1635	0.1635	0.0038	0.1635	0.0038	0.0038
75	0.0037	0.1665	0.1665	0.0037	0.1665	0.1665	0.1665	0.0037	0.1665	0.0037	0.0037
80	0.0035	0.1695	0.1695	0.0035	0.1695	0.1695	0.1695	0.0035	0.1695	0.0035	0.0035
85	0.0033	0.1700	0.1700	0.0033	0.1700	0.1700	0.1700	0.0033	0.1700	0.0033	0.0033
90	0.0031	0.1700	0.1700	0.0031	0.1700	0.1700	0.1700	0.0031	0.1700	0.0031	0.0031
95	0.0028	0.1685	0.1685	0.0028	0.1685	0.1685	0.1685	0.0028	0.1685	0.0028	0.0028

100	0.0025	-0.1665	-0.0025	0.1665	0.0025
105	0.0020	-0.1640	-0.0020	0.1640	0.0020
110	0.0015	-0.1610	-0.0015	0.1610	0.0015
115	0.0004	-0.1570	0.0004	0.1570	-0.0004
120	-0.0013	-0.1525	0.0013	0.1525	-0.0013
125	-0.0028	-0.1460	0.0028	0.1460	-0.0028
130	-0.0041	-0.1390	0.0041	0.1390	-0.0041
135	-0.0052	-0.1280	0.0052	0.1280	-0.0052
140	-0.0061	-0.1080	0.0061	0.1080	-0.0061
145	-0.0070	-0.0830	0.0070	0.0830	-0.0070
150	-0.0073	-0.0600	0.0073	0.0600	-0.0073
155	-0.0074	-0.0420	0.0074	0.0420	-0.0074
160	-0.0074	-0.0300	0.0074	0.0300	-0.0074
165	-0.0074	-0.0215	0.0074	0.0215	-0.0074
170	-0.0074	-0.0145	0.0074	0.0145	-0.0074
175	-0.0073	-0.0070	0.0073	0.0070	-0.0073
180	-0.0073	0.0000	0.0073	0.0000	-0.0073

DCYA

MACH =	100	-90	0	90	180
PHI =	-180	-90	0	90	180
ALPHA =	-180	-90	0	90	180
-180	0.0073	0.0000	-0.0073	0.0000	0.0073
-175	0.0073	0.0070	-0.0073	-0.0070	0.0073
-170	0.0074	0.0145	-0.0074	-0.0145	0.0074
-165	0.0074	0.0215	-0.0074	-0.0215	0.0074
-160	0.0074	0.0300	-0.0074	-0.0300	0.0074
-155	0.0074	0.0420	-0.0074	-0.0420	0.0074
-150	0.0073	0.0600	-0.0073	-0.0600	0.0073
-145	0.0070	0.0830	-0.0070	-0.0830	0.0070
-140	0.0061	0.1080	-0.0061	-0.1080	0.0061
-135	0.0052	0.1280	-0.0052	-0.1280	0.0052
-130	0.0041	0.1390	-0.0041	-0.1390	0.0041
-125	0.0028	0.1460	-0.0028	-0.1460	0.0028
-120	0.0013	0.1525	-0.0013	-0.1525	0.0013
-115	0.0004	0.1570	-0.0004	-0.1570	0.0004
-110	-0.0015	0.1610	-0.0015	-0.1610	-0.0015
-105	-0.0020	0.1640	-0.0020	-0.1640	-0.0020
-100	-0.0025	0.1665	-0.0025	-0.1665	-0.0025
-95	-0.0028	0.1685	-0.0028	-0.1685	-0.0028
-90	-0.0031	0.1700	-0.0031	-0.1700	-0.0031
-85	-0.0033	0.1700	-0.0033	-0.1700	-0.0033
-80	-0.0035	0.1695	-0.0035	-0.1695	-0.0035
-75	-0.0037	0.1665	-0.0037	-0.1665	-0.0037
-70	-0.0038	0.1635	-0.0038	-0.1635	-0.0038
-65	-0.0039	0.1560	-0.0039	-0.1560	-0.0039
-60	-0.0039	0.1460	-0.0039	-0.1460	-0.0039
-55	-0.0039	0.1340	-0.0039	-0.1340	-0.0039
-50	-0.0036	0.1200	-0.0036	-0.1200	-0.0036
-45	-0.0022	0.1010	-0.0022	-0.1010	-0.0022
-40	0.0000	0.0780	0.0000	0.0780	0.0000
-35	0.0011	0.0580	-0.0011	-0.0580	0.0011
-30	0.0014	0.0440	-0.0014	-0.0440	0.0014
-25	0.0015	0.0350	-0.0015	-0.0350	0.0015
-20	0.0015	0.0275	-0.0015	-0.0275	0.0015
-15	0.0014	0.0210	-0.0014	-0.0210	0.0014
-10	0.0012	0.0140	-0.0012	-0.0140	0.0012
-5	0.0000	0.0070	-0.0000	-0.0070	0.0000
0	0.0000	0.0000	0.0000	0.0000	0.0000
5	-0.0007	-0.0070	0.0007	0.0070	-0.0007
10	-0.0012	-0.0140	0.0012	0.0140	-0.0012
15	-0.0014	-0.0210	0.0014	0.0210	-0.0014
20	-0.0015	-0.0275	0.0015	0.0275	-0.0015

25	-0.0015	-0.0350	0.0015	0.0350	-0.0015
30	-0.0014	-0.0440	0.0014	0.0440	-0.0014
35	-0.0011	-0.0580	0.0011	0.0580	-0.0011
40	0.0000	-0.0780	0.0000	0.0780	0.0000
45	0.0022	-0.1010	-0.0022	0.1010	0.0022
50	0.0036	-0.1200	-0.0036	0.1200	0.0036
55	0.0039	-0.1340	-0.0039	0.1340	0.0039
60	0.0039	-0.1460	-0.0039	0.1460	0.0039
65	0.0039	-0.1560	-0.0039	0.1560	0.0039
70	0.0038	-0.1635	-0.0038	0.1635	0.0038
75	0.0037	-0.1665	-0.0037	0.1665	0.0037
80	0.0035	-0.1695	-0.0035	0.1695	0.0035
85	0.0033	-0.1700	-0.0033	0.1700	0.0033
90	0.0031	-0.1700	-0.0031	0.1700	0.0031
95	0.0028	-0.1685	-0.0028	0.1685	0.0028
100	0.0025	-0.1665	-0.0025	0.1665	0.0025
105	0.0020	-0.1640	-0.0020	0.1640	0.0020
110	0.0015	-0.1610	-0.0015	0.1610	0.0015
115	0.0004	-0.1570	-0.0004	0.1570	0.0004
120	-0.0013	-0.1525	0.0013	0.1525	-0.0013
125	-0.0028	-0.1460	0.0028	0.1460	-0.0028
130	-0.0041	-0.1390	0.0041	0.1390	-0.0041
135	-0.0052	-0.1280	0.0052	0.1280	-0.0052
140	-0.0061	-0.1080	0.0061	0.1080	-0.0061
145	-0.0070	-0.0830	0.0070	0.0830	-0.0070
150	-0.0073	-0.0600	0.0073	0.0600	-0.0073
155	-0.0074	-0.0420	0.0074	0.0420	-0.0074
160	-0.0074	-0.0300	0.0074	0.0300	-0.0074
165	-0.0074	-0.0215	0.0074	0.0215	-0.0074
170	-0.0074	-0.0145	0.0074	0.0145	-0.0074
175	-0.0073	-0.0070	0.0073	0.0070	-0.0073
180	-0.0073	0.0000	0.0073	0.0000	-0.0073

2 5 0 73 0
 'MACH' = 1
 'PHI' = 1
 'ALPHA' = 1

Incremental Yawing Moment Coefficient (DCLNA)

-180	-0.0018	0.0000	0.0018	0.0000	-0.0018
-175	-0.0018	0.0021	0.0018	-0.0021	-0.0018
-170	-0.0018	0.0052	0.0018	-0.0052	-0.0018
-165	-0.0018	0.0080	0.0018	-0.0080	-0.0018
-160	-0.0018	0.0105	0.0018	-0.0105	-0.0018
-155	-0.0018	0.0130	0.0018	-0.0130	-0.0018
-150	-0.0018	0.0155	0.0018	-0.0155	-0.0018
-145	-0.0016	0.0175	0.0016	-0.0175	-0.0016
-140	-0.0014	0.0200	0.0014	-0.0200	-0.0014
-135	-0.0012	0.0220	0.0012	-0.0220	-0.0012
-130	-0.0010	0.0238	0.0010	-0.0238	-0.0010
-125	-0.0008	0.0255	0.0008	-0.0255	-0.0008
-120	-0.0005	0.0272	0.0005	-0.0272	-0.0005
-115	-0.0003	0.0285	0.0003	-0.0285	-0.0003
-110	-0.0001	0.0295	0.0001	-0.0295	-0.0001
-105	0.0002	0.0311	-0.0002	0.0311	0.0002
-100	0.0004	0.0321	-0.0004	0.0321	0.0004
-95	0.0005	0.0331	-0.0005	0.0331	0.0005
-90	0.0006	0.0342	-0.0006	0.0342	0.0006
-85	0.0006	0.0350	-0.0006	0.0350	0.0006
-80	0.0006	0.0355	-0.0006	0.0355	0.0006
-75	0.0008	0.0360	-0.0008	0.0360	0.0008
-70	0.0011	0.0360	-0.0011	0.0360	0.0011
-65	0.0020	0.0360	-0.0020	0.0360	0.0020
-60	0.0031	0.0359	-0.0031	0.0359	0.0031

-55	0.0025	0.0350	-0.0025	-0.0350	0.0025
-50	0.0014	0.0338	-0.0014	-0.0338	0.0014
-45	0.0002	0.0320	-0.0002	-0.0320	0.0002
-40	-0.0009	0.0295	0.0009	-0.0295	-0.0009
-35	-0.0017	0.0265	0.0017	-0.0265	-0.0017
-30	-0.0024	0.0225	0.0024	-0.0225	-0.0024
-25	-0.0029	0.0180	0.0029	-0.0180	-0.0029
-20	-0.0030	0.0122	0.0030	-0.0122	-0.0030
-15	-0.0025	0.0075	0.0025	-0.0075	-0.0025
-10	-0.0018	0.0045	0.0018	-0.0045	-0.0018
-5	-0.0010	0.0020	0.0010	-0.0020	-0.0010
0	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0010	-0.0020	-0.0010	0.0020	0.0010
10	0.0018	-0.0045	-0.0018	0.0045	0.0018
15	0.0025	-0.0075	-0.0025	0.0075	0.0025
20	0.0030	-0.0122	-0.0030	0.0122	0.0030
25	0.0029	-0.0180	-0.0029	0.0180	0.0029
30	0.0024	-0.0225	-0.0024	0.0225	0.0024
35	0.0017	-0.0265	-0.0017	0.0265	0.0017
40	0.0009	-0.0295	-0.0009	0.0295	0.0009
45	-0.0002	-0.0320	0.0002	-0.0320	-0.0002
50	-0.0014	-0.0338	0.0014	-0.0338	-0.0014
55	-0.0025	-0.0350	0.0025	-0.0350	-0.0025
60	-0.0031	-0.0359	0.0031	-0.0359	-0.0031
65	-0.0020	-0.0360	0.0020	-0.0360	-0.0020
70	-0.0011	-0.0360	0.0011	-0.0360	-0.0011
75	-0.0008	-0.0360	0.0008	-0.0360	-0.0008
80	-0.0006	-0.0355	0.0006	-0.0355	-0.0006
85	-0.0006	-0.0350	0.0006	-0.0350	-0.0006
90	-0.0006	-0.0342	0.0006	-0.0342	-0.0006
95	-0.0005	-0.0331	0.0005	-0.0331	-0.0005
100	-0.0004	-0.0321	0.0004	-0.0321	-0.0004
105	-0.0002	-0.0311	0.0002	-0.0311	-0.0002
110	0.0001	-0.0295	-0.0001	0.0295	0.0001
115	0.0003	-0.0285	-0.0003	0.0285	0.0003
120	0.0005	-0.0272	-0.0005	0.0272	0.0005
125	0.0008	-0.0255	-0.0008	0.0255	0.0008
130	0.0010	-0.0238	-0.0010	0.0238	0.0010
135	0.0012	-0.0220	-0.0012	0.0220	0.0012
140	0.0014	-0.0200	-0.0014	0.0200	0.0014
145	0.0016	-0.0175	-0.0016	0.0175	0.0016
150	0.0018	-0.0155	-0.0018	0.0155	0.0018
155	0.0018	-0.0130	-0.0018	0.0130	0.0018
160	0.0018	-0.0105	-0.0018	0.0105	0.0018
165	0.0018	-0.0080	-0.0018	0.0080	0.0018
170	0.0018	-0.0052	-0.0018	0.0052	0.0018
175	0.0018	-0.0021	-0.0018	0.0021	0.0018
180	0.0018	0.0000	-0.0018	0.0000	0.0018

MACH# = ' 100		DCLNA	
PHI = ' -180			
ALPHA = ' -90			
-130	-0.0018	0.0000	0.0018
-175	-0.0018	0.0021	-0.0018
-170	-0.0018	0.0052	-0.0018
-165	-0.0018	0.0080	-0.0018
-160	-0.0018	0.0105	-0.0018
-155	-0.0018	0.0130	-0.0018
-150	-0.0018	0.0155	-0.0018
-145	-0.0016	0.0175	-0.0016
-140	-0.0014	0.0200	-0.0014
-135	-0.0012	0.0220	-0.0012

-130	-0.0010	0.0238	0.0010	-0.0238	-0.0010
-125	-0.0008	0.0255	0.0008	-0.0255	-0.0008
-120	-0.0005	0.0272	0.0005	-0.0272	-0.0005
-115	-0.0003	0.0285	0.0003	-0.0285	-0.0003
-110	-0.0001	0.0295	0.0001	-0.0295	-0.0001
-105	-0.0002	0.0311	-0.0002	-0.0311	0.0002
-100	0.0004	0.0321	-0.0004	-0.0321	0.0004
-95	0.0005	0.0331	-0.0005	-0.0331	0.0005
-90	0.0006	0.0342	-0.0006	-0.0342	0.0006
-85	0.0006	0.0350	-0.0006	-0.0350	0.0006
-80	0.0006	0.0355	-0.0006	-0.0355	0.0006
-75	0.0008	0.0360	-0.0008	-0.0360	0.0008
-70	0.0011	0.0360	-0.0011	-0.0360	0.0011
-65	0.0020	0.0360	-0.0020	-0.0360	0.0020
-60	0.0031	0.0359	-0.0031	-0.0359	0.0031
-55	0.0025	0.0350	-0.0025	-0.0350	0.0025
-50	0.0014	0.0338	-0.0014	-0.0338	0.0014
-45	0.0002	0.0320	-0.0002	-0.0320	0.0002
-40	-0.0009	0.0295	0.0009	-0.0295	-0.0009
-35	-0.0017	0.0265	0.0017	-0.0265	-0.0017
-30	-0.0024	0.0225	0.0024	-0.0225	-0.0024
-25	-0.0029	0.0180	0.0029	-0.0180	-0.0029
-20	-0.0030	0.0122	0.0030	-0.0122	-0.0030
-15	-0.0025	0.0075	0.0025	-0.0075	-0.0025
-10	-0.0018	0.0045	0.0018	-0.0045	-0.0018
-5	-0.0010	0.0020	0.0010	-0.0020	-0.0010
0	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0010	-0.0020	-0.0010	0.0020	0.0010
10	0.0018	-0.0045	-0.0018	0.0045	0.0018
15	0.0025	-0.0075	-0.0025	0.0075	0.0025
20	0.0030	-0.0122	-0.0030	0.0122	0.0030
25	0.0029	-0.0180	-0.0029	0.0180	0.0029
30	0.0024	-0.0225	-0.0024	0.0225	0.0024
35	0.0017	-0.0265	-0.0017	0.0265	0.0017
40	0.0009	-0.0295	-0.0009	0.0295	0.0009
45	-0.0002	-0.0320	0.0002	-0.0320	-0.0002
50	-0.0014	-0.0338	0.0014	-0.0338	-0.0014
55	-0.0025	-0.0350	0.0025	-0.0350	-0.0025
60	-0.0031	-0.0359	0.0031	-0.0359	-0.0031
65	-0.0020	-0.0360	0.0020	-0.0360	-0.0020
70	-0.0011	-0.0360	0.0011	-0.0360	-0.0011
75	-0.0008	-0.0360	0.0008	-0.0360	-0.0008
80	-0.0006	-0.0355	0.0006	-0.0355	-0.0006
85	-0.0006	-0.0350	0.0006	-0.0350	-0.0006
90	-0.0006	-0.0342	0.0006	-0.0342	-0.0006
95	-0.0005	-0.0331	0.0005	-0.0331	-0.0005
100	-0.0004	-0.0321	0.0004	-0.0321	-0.0004
105	-0.0002	-0.0311	0.0002	-0.0311	-0.0002
110	0.0001	-0.0295	-0.0001	0.0295	0.0001
115	0.0003	-0.0285	-0.0003	0.0285	0.0003
120	0.0005	-0.0272	-0.0005	0.0272	0.0005
125	0.0008	-0.0255	-0.0008	0.0255	0.0008
130	0.0010	-0.0238	-0.0010	0.0238	0.0010
135	0.0012	-0.0220	-0.0012	0.0220	0.0012
140	0.0014	-0.0200	-0.0014	0.0200	0.0014
145	0.0016	-0.0175	-0.0016	0.0175	0.0016
150	0.0018	-0.0155	-0.0018	0.0155	0.0018
155	0.0018	-0.0130	-0.0018	0.0130	0.0018
160	0.0018	-0.0105	-0.0018	0.0105	0.0018
165	0.0018	-0.0080	-0.0018	0.0080	0.0018
170	0.0018	-0.0052	-0.0018	0.0052	0.0018
175	0.0018	-0.0021	-0.0018	0.0021	0.0018

		2		5		73		0		90		180	
		-180		0		-90		0		0.0000		0.0018	

100	-0.0036	-0.0043	-0.0036	-0.0043	-0.0036	-0.0043	-0.0036
105	-0.0034	-0.0041	-0.0034	-0.0041	-0.0034	-0.0041	-0.0034
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120	-0.0027	-0.0040	-0.0027	-0.0040	-0.0027	-0.0040	-0.0027
125	-0.0022	-0.0040	-0.0022	-0.0040	-0.0022	-0.0040	-0.0022
130	-0.0016	-0.0040	-0.0016	-0.0040	-0.0016	-0.0040	-0.0016
135	-0.0011	-0.0038	-0.0011	-0.0038	-0.0011	-0.0038	-0.0011
140	-0.0009	-0.0034	-0.0009	-0.0034	-0.0009	-0.0034	-0.0009
145	-0.0006	-0.0028	-0.0006	-0.0028	-0.0006	-0.0028	-0.0006
150	-0.0005	-0.0021	-0.0005	-0.0021	-0.0005	-0.0021	-0.0005
155	-0.0004	-0.0016	-0.0004	-0.0016	-0.0004	-0.0016	-0.0004
160	-0.0003	-0.0011	-0.0003	-0.0011	-0.0003	-0.0011	-0.0003
165	-0.0002	-0.0008	-0.0002	-0.0008	-0.0002	-0.0008	-0.0002
170	-0.0002	-0.0005	-0.0002	-0.0005	-0.0002	-0.0005	-0.0002
175	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001
180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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'PHI = ' -180
'ALPHA = ' -180

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-175	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001
-170	-0.0002	-0.0005	-0.0002	-0.0005	-0.0002	-0.0005	-0.0002
-165	-0.0002	-0.0008	-0.0002	-0.0008	-0.0002	-0.0008	-0.0002
-160	-0.0003	-0.0010	-0.0003	-0.0010	-0.0003	-0.0010	-0.0003
-155	-0.0004	-0.0016	-0.0004	-0.0016	-0.0004	-0.0016	-0.0004
-150	-0.0005	-0.0021	-0.0005	-0.0021	-0.0005	-0.0021	-0.0005
-145	-0.0006	-0.0028	-0.0006	-0.0028	-0.0006	-0.0028	-0.0006
-140	-0.0009	-0.0034	-0.0009	-0.0034	-0.0009	-0.0034	-0.0009
-135	-0.0011	-0.0038	-0.0011	-0.0038	-0.0011	-0.0038	-0.0011
-130	-0.0016	-0.0040	-0.0016	-0.0040	-0.0016	-0.0040	-0.0016
-125	-0.0027	-0.0040	-0.0027	-0.0040	-0.0027	-0.0040	-0.0027
-120	-0.0030	-0.0040	-0.0030	-0.0040	-0.0030	-0.0040	-0.0030
-115	-0.0032	-0.0040	-0.0032	-0.0040	-0.0032	-0.0040	-0.0032
-110	-0.0034	-0.0041	-0.0034	-0.0041	-0.0034	-0.0041	-0.0034
-105	-0.0036	-0.0043	-0.0036	-0.0043	-0.0036	-0.0043	-0.0036
-100	-0.0036	-0.0047	-0.0036	-0.0047	-0.0036	-0.0047	-0.0036
-95	-0.0033	-0.0053	-0.0033	-0.0053	-0.0033	-0.0053	-0.0033
-90	-0.0031	-0.0059	-0.0031	-0.0059	-0.0031	-0.0059	-0.0031
-85	-0.0028	-0.0062	-0.0028	-0.0062	-0.0028	-0.0062	-0.0028
-80	-0.0025	-0.0063	-0.0025	-0.0063	-0.0025	-0.0063	-0.0025
-75	-0.0021	-0.0063	-0.0021	-0.0063	-0.0021	-0.0063	-0.0021
-70	-0.0018	-0.0061	-0.0018	-0.0061	-0.0018	-0.0061	-0.0018
-65	-0.0014	-0.0059	-0.0014	-0.0059	-0.0014	-0.0059	-0.0014
-60	-0.0012	-0.0056	-0.0012	-0.0056	-0.0012	-0.0056	-0.0012
-55	-0.0012	-0.0052	-0.0012	-0.0052	-0.0012	-0.0052	-0.0012
-50	-0.0013	-0.0046	-0.0013	-0.0046	-0.0013	-0.0046	-0.0013
-45	-0.0015	-0.0038	-0.0015	-0.0038	-0.0015	-0.0038	-0.0015
-40	-0.0019	-0.0024	-0.0019	-0.0024	-0.0019	-0.0024	-0.0019
-35	-0.0020	-0.0009	-0.0020	-0.0009	-0.0020	-0.0009	-0.0020
-30	-0.0016	-0.0003	-0.0016	-0.0003	-0.0016	-0.0003	-0.0016
-25	-0.0006	0.0002	-0.0006	0.0002	-0.0006	0.0002	-0.0006
-20	-0.0001	0.0005	-0.0001	0.0005	-0.0001	0.0005	-0.0001
-15	0.0000	0.0008	0.0000	0.0008	0.0000	0.0008	0.0000
-10	0.0005	0.0008	0.0005	0.0008	0.0005	0.0008	0.0005
-5	0.0009	0.0008	0.0009	0.0008	0.0009	0.0008	0.0009
0	0.0010	0.0008	0.0010	0.0008	0.0010	0.0008	0.0010
5	0.0009	0.0008	0.0009	0.0008	0.0009	0.0008	0.0009
10	0.0005	0.0007	0.0005	0.0007	0.0005	0.0007	0.0005
15	-0.0001	0.0005	-0.0001	0.0005	-0.0001	0.0005	-0.0001
20	-0.0006	0.0002	-0.0006	0.0002	-0.0006	0.0002	-0.0006

25	-0.0016	-0.0003	-0.0016	-0.0003	-0.0016
30	-0.0020	-0.0009	-0.0020	-0.0009	-0.0020
35	-0.0019	-0.0024	-0.0019	-0.0024	-0.0019
40	-0.0015	-0.0038	-0.0015	-0.0038	-0.0015
45	-0.0013	-0.0046	-0.0013	-0.0046	-0.0013
50	-0.0012	-0.0052	-0.0012	-0.0052	-0.0012
55	-0.0012	-0.0056	-0.0012	-0.0056	-0.0012
60	-0.0014	-0.0059	-0.0014	-0.0059	-0.0014
65	-0.0018	-0.0061	-0.0018	-0.0061	-0.0018
70	-0.0021	-0.0063	-0.0021	-0.0063	-0.0021
75	-0.0025	-0.0063	-0.0025	-0.0063	-0.0025
80	-0.0028	-0.0062	-0.0028	-0.0062	-0.0028
85	-0.0031	-0.0058	-0.0031	-0.0058	-0.0031
90	-0.0033	-0.0053	-0.0033	-0.0053	-0.0033
95	-0.0036	-0.0047	-0.0036	-0.0047	-0.0036
100	-0.0036	-0.0043	-0.0036	-0.0043	-0.0036
105	-0.0034	-0.0041	-0.0034	-0.0041	-0.0034
110	-0.0032	-0.0040	-0.0032	-0.0040	-0.0032
115	-0.0030	-0.0040	-0.0030	-0.0040	-0.0030
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125	-0.0022	-0.0040	-0.0022	-0.0040	-0.0022
130	-0.0016	-0.0040	-0.0016	-0.0040	-0.0016
135	-0.0011	-0.0038	-0.0011	-0.0038	-0.0011
140	-0.0009	-0.0034	-0.0009	-0.0034	-0.0009
145	-0.0006	-0.0028	-0.0006	-0.0028	-0.0006
150	-0.0005	-0.0021	-0.0005	-0.0021	-0.0005
155	-0.0004	-0.0016	-0.0004	-0.0016	-0.0004
160	-0.0003	-0.0011	-0.0003	-0.0011	-0.0003
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175	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001
180	0.0000	0.0000	0.0000	0.0000	0.0000

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