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STUDY AND DESIGN OF AN EJECTION SYSTEM FOR VTOL AIRCRAFT. PART I. VOLUME 3. COMPUTER PROGRAM USER'S MANUAL FOR VTOL ESCAPE SYSTEM SIMULATION

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LTV Aerospace Corporation

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13. ABSTRACT

A digital computer program is described which has been used to design an ejection seat system for escape from aircraft in both VTOL and high speed flight regimes. The program generates and plots time histories of the dynamics of a variety of escape seat system designs responding to a typical fighter/close support VTOL aircraft reacting to a selected spectrum of deterministic failure modes. The six degree-of-freedom non-linear equations are integrated numerically and system coefficients are computed by table-look-up and curve-fitting options. Trajectory dynamics are computed for the seat as it is catapulted along a set of flexible rails constrained to translate with the aircraft. The impetus of seat-rail separation is simulated, and the airplane and seat trajectories are portrayed as the seat responds to a sequence of forces from rockets and parachutes. Acceleration loads on the man are computed throughout the time history, demonstrating the effects of parachute projection, snatch forces, and opening shocks as well as catapult and sustainer rocket forces. The program is written in Fortran in an easily understood format to facilitate modifications or replacement of any subroutine, thus allowing analysis of any conceivable airplane or escape system concept.

FORFWORD

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This report covers work conducted during the period April 1969 to February 1970. It was submitted by the authors in February 1970.

The documentation of this project necessitates publication in several parts. The total documentation includes:

Part I

Volume 1 - VTOL Aircraft Equations and Failure Mode Analysis
Volume 2 - Escape System Parameters Analysis
Volume 3 - Computer Program User's Manual for VTOL Escape System Simulation

Part II

Volume 1 - Escape Seat Systems Concept Analysis
Volume 2 - Escape Seat Subsystems and Detail Drawings

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Mrs. Eleanor Roch, who was primarily responsible for programming and maintenance of the computer program, and who wrote part of Section V of this volume; Jim Lacy, who assisted in de-bugging the parachute routines, researched and reduced aerodynamic data for program inclusion and wrote part of Section VI of this volume; Eddie Smart, who assisted in the development and de-bugging of the bridle and rail subroutines and who wrote part of Section VI of this volume.

ABSTRACT

A digital computer program is described which has been used to design an ejection seat system for escape from aircraft in both VTOL and high speed flight regimes. The program generates and plots time histories of the dynamics of a variety of escape seat system designs responding to a typical/fighter close support VTOL aircraft reacting to a selected spectrum of deterministic failure modes. The six degree-of-freedom non-linear equations are integrated numerically and system coefficients are computed by table-look-up and curve-fitting options. Trajectory dynamics are computed for the seat as it is catapulted along a set of flexible rails constrained to translate with the aircraft. The impetus of seat-rail separation is simulated, and the airplane and seat trajectories are portrayed as the seat responds to a sequence of forces from rockets and parachutes. Acceleration loads on the man are computed throughout the time history, demonstrating the effects of parachute projection, snatch forces, and opening shocks as well as catapult and sustainer rocket forces. The program is written in Fortran in an easily understood format to facilitate modifications or replacement of any subroutine, thus allowing analysis of any conceivable airplane or escape system concept.

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SECTION I

INTRODUCTION

The basic objective of this study is to design a complete ejection seat escape system that has the capability of providing safe crew escape from fighter/close support VTOL aircraft during emergencies in the VTOL and the low altitude, high speed flight regimes. The established ground rule is that the design must be achieved through a totally analytical effort employing a computer simulation which will account for all system interactions from aircraft failure occurrence to crew recovery.

To fulfill the ultimate objective, a logical sequence of intermediate objectives was planned. In Part I, Volume 1, of this five volume report the first series of objectives were attained. These objectives were:

- Select a hypothetical aircraft as a basis for escape system preliminary design.
- Establish the failure modes which influence the escape system concept.
- Provide a post-failure aircraft dynamic simulation for use in preliminary design of the escape system.

In Part I, Volume 2, another set of interim objectives was reported. These objectives were:

- To conduct an analytical study program to arrive at approximations of the performance of drag chute stabilizers while operating behind an ejection seat in flight.
- To conduct an analysis that will constitute a detailed study of the separation dynamics of the ejection seat escape system as it travels along and separates from the guide rails.
- To evaluate ejection propulsion techniques through a comparative analysis of rocket/catapult designs, determining the consequences of the different design approaches on performance and trajectory.

The final objective, the analytical design of a complete escape seat system, is reported in Part II, Volume 1 - Escape Seat Systems Concepts Analysis.

The purpose in presenting this volume (Part I, Volume 3) is to explain the mechanization of the computer program used in the escape system design by demonstrating to the user how to input data to the program, how to select output from the program and how to modify the simulation to analyze escape system concepts different from those already programmed. The sixteen options available from the program are described in Section V and are further clarified by specific program examples given in Section VI. All the equations coded in this volume, listed in Section VIII, are derived in Volumes 1 and 2 of Part I. The variables defined in those volumes are repeated in Section IV which lists the core location allocated to each variable. The complexity of the problem and the limited time allotted for final system selection engendered a program philosophy, explained in Section II, which emphasized ease of understanding. Overly clever programming was avoided and greatly increased computing speed was achieved with some sacrifice of core through increased calling argument table space and use of scratch core. In Section VII, suggestions are made for changing the program to reduce the core requirements for computers having limited core.

SECTION II

PROGRAMMING PHILOSOPHY

The initiation of this study coincided with LTV's conversion to an IBM S/360 Triplex computing system with approximately 2 million bits of available core, presenting the principal author with the opportunity to write a program from an engineering viewpoint, without the necessity to tailor the simulation to fit restrictive computing capacity. Consequently, it was not necessary to fragment the equations through dangerous assumptions about negligibility of interaction effects and the time history simulation was written for continuous computation from aircraft failure to crew recovery.

From an engineering viewpoint, a developing computer program must be written for ease of understanding so that it can be readily expanded to include new engineering ideas immediately upon conception so that interim answers are always provided. In engineering practice the development of the computer program and the design of the engineering system are simultaneous events and highly responsive programming is required. The mechanization of this type of easily modified program is facilitated by programming techniques which allow additions to the program to be made without affecting the existing program statements. Data should also be stored in logical groups for ease of program control - a storage location for turbojet thrust constants should not be located in the same region as the constants for the human spine equations of motion, for example. In addition, the computer coded symbols should resemble the actual equation symbols as much as possible so that the programming engineer is always certain that the changes he is making are really what he wants. Emphasizing these considerations resulted in a computer program with some compromise in efficient core utilization. The changes necessary to overcome the shortcomings are discussed in Section VII and should be considered for production status computing. However, the final changes in the computer program coincided with the completion of the study contract, as expected, and no attempt was made to incorporate the suggested improvements.

Relating computer coding to equation symbols is straightforward when Fortran coding is used. For example, consider the mathematical expression for the angular momentum component about the roll axis:

$$H_x = I_{xx}p - I_{xy}q - I_{xz}r.$$

In Fortran coding the equation has the same form:

```
HX = IXX *P - IXY * Q - IXZ * R.
```

All the basic equations are written in this way and enclosed in subroutines with recognizable calling arguments. The use of an argument list, however, requires table space for the calling program - as explained in Section VII where suggestions are made for reducing the argument list to the detriment of program understanding and computing time. However, unlike a research program, the details of a production program need not be understood by the user, who is usually concerned only with input - output specifications.

Subroutine segmentation was used extensively to provide a "tool box" in which specific tools could be found to perform a specific task. General purpose subroutines were avoided because of the reduction of computing speed. For example, repetitive simultaneous equation solutions are required by the program but the equations are all of degree three and non-singular; consequently, a simultaneous equation subroutine was mechanized which obviated the set-up time, indexing and pivotal element search written into all good general purpose simultaneous equation or matrix inversion subroutines.

A secondary motive for the subroutine segmentation was to build a library of useful subroutines, independent of the escape system program, for future use. For example, the parachute equations of motion (Appendix II, Section III of Part I, Volume 2) are coded as a single subroutine, called CHUTES (Section VIII, page 248), and may be used wherever a dynamic parachute simulation is needed. Acceleration components - to be numerically integrated - are returned from CHUTES and the input arguments are carefully defined by comments within the subroutine; consequently, use of the subroutine for parachute analysis is not dependent upon a complete understanding of the mathematics required to develop the equations. Note the similarity of the equation symbols to the Fortran variables passed through the argument list.

Except for the very simplest programs the engineer cannot predict the amount and location of data he will need to store. The escape system program is not a simple program and many of the escape concepts were not expected to materialize until the programming was well underway. To forestall the fragmentation of data storage that inevitably occurs under these conditions, the idea of using a subscripted - subscripted variable was conceived. For instance, the use of roll-yaw-pitch rockets for bang-bang stabilization was programmed in the last month of the 11 month program and the rocket data were stored in a core region initially set aside for rockets and catapults rather than in some illogical location belatedly assigned at the end of the array. Referring to Table I, page 25, it can be seen that the rocket input data were planned to be stored in the subscripted array, R, from R(NR13) to R(NR13 + 77) before the roll-yaw-pitch motor control was considered. To save core the next NR number, NR14, was assigned a value one greater than NR13 + 77; i.e., NR14 = NR13 + 78. In this way, the first value of the drag chute input data, starting in R(NR14), followed immediately after the last rocket data point and no core was wasted. The addition of 69 input variables from programming the bang-bang system was done by setting NR14 = NR13 + 147, moving all data following NR13 + 77 forward 69 locations. (The user does not calculate the NR subscripts, but inputs data for the subscript addends of each NR number. The program then computes the NR array from this information. Before the bang-bang system was programmed, for example, the NR13 addend was entered as 77. Afterward, the NR13 addend was set to 146.)

From the beginning of the escape system study the principal author has proceeded on the premise that the computer program will be run by an engineer and that the computational flow will be controlled by engineering judgement. To this end, all input-output statements and option controls were programmed to be accessible from a control program which branches to selected statement numbers that perform specific tasks and return for further instructions from the user. The 16 options under the engineer's control, described in Section V, are shown in the Fortran listing of the control program, (SUBROUTINE MAINPR) Section VIII, page 197. Note that at statement 98 a series of options is read in and, after completion, each option branches to statement 100 for the next instruction. With this programming concept, flow charting the program is an exercise in futility. The main program flow chart would consist basically of a triangle, numbered 100, with 16 arrows leaving it and 16 arrows returning to it. Reading the main program source listing is much more informative and only a redimentary knowledge of Fortran is needed. The author knows few engineers who are not familiar with Fortran. The program examples of Section VI show how to control the computing flow to perform a desired analysis sequence.

Time history outputs from the program are presented in plotted, printed, punched and saved formats and any combination of the four options may be chosen or suppressed. The most used output will be the plot option. In the basic program configuration the time histories are stored in core if the intent to plot is indicated at program initiation. As the plot option is called, specified time histories are retrieved from core and plotted. The use of core storage rather than a scratch external device results in a phenomenal increase in computing speed at the cost of 7000 words for core storage. An alternate version using a scratch tape or disk was mechanized and may be used by removing the C from column 1 of the appropriate statements in the main program, as explained in Section VII. The plot option provides multiple plotting of several variables from different time histories on the same plot, showing instantly the effects of escape system parameter variations; however, this will be expensive computing if scratch devices are used - although the time saved in engineering man-hours should compensate for the input-output costs.

SECTION III

NUMERICAL SOLUTION TECHNIQUES

The single goal, numerically speaking, of this computer program is to compute a series of differential equations in the sequential order necessary for numerical integration by digital computer. Each derivative to be integrated must be expressed in terms of lower derivatives so that all variables are defined before the derivative expression is evaluated. The resulting system of differential equations is non-linear and discontinuous, with the force-moment summations being computed through table-look-up and polynomial functions of the system variables.

1. Differential Equation Integration

Using known initial conditions for the airplane variables, initial conditions for all the subsystems are computed automatically before time history initiation. For example, the seat is positioned in the airplane by transformations through the airplane-to-rail-to-seat direction cosines and reference positions which do not change for a given configuration. The final seat orientation will be correctly positioned with respect to the earth and airplane even though the automatic airplane trim option is not used; i.e., the airplane is not required to begin in straight, level, unaccelerated flight.

The system differential equations are computed by one subroutine, named DEQU, which calls all necessary subsidiary routines. The first four time points are integrated by a fourth order Runge-Kutta subroutine mechanized from equations of the form:

$$X_i = X_{0_i} + 1/6\,(C_{1_i} + 2C_{2_i} + 2C_{3_i} + C_{4_i}),\quad i = 1, n$$

$$C_{1_i} = [\,\dot{X}_i\,(t_0, X_{0_1}, X_{0_2}, X_{0_3}, \text{---}\, X_{0_n})\,]\,\Delta t$$

$$C_{2_i} = [\,\dot{X}_i\,(t_0+\Delta t/2, X_{0_1}+C_{1_1}/2, X_{0_2}+C_{1_2}/2, \text{---}, X_{0_n}+C_{1_n}/2)\,]\,\Delta t$$

$$C_{3_i} = [\,\dot{X}_i\,(t_0+\Delta t/2, X_{0_1}+C_{2_1}/2, X_{0_2}+C_{2_2}/2, \text{---}, X_{0_n}+C_{2_n}/2)\,]\,\Delta t$$

$$C_{4_i} = [\,\dot{X}_i\,(t_0+\Delta t, X_{0_1}+C_{3_1}/2, X_{0_2}+C_{3_2}/2, \text{---}, X_{0_n}+C_{3_n}/2)\,]\,\Delta t$$

where,

n is the number of differential equations

i is the i^{th} variable

X_i is the present variable

X_{0_i} is the last computed value

$[\dot{X}_i(\ A\ )\ ]$ means $\dot{X}_i$ is a function of A

Δt is the integration mesh

The equations are not programmed in exactly this way, single subscripted variables being used instead of double subscripted variables.

After the solution is begun by the Runge-Kutta method, an alternate predictor-modifier-corrector method by Hamming is used to continue the solution. The Hamming equations are of the form:

Predictor- $X_{4_i} = X_{0_i} + (4\Delta t/3)\,(2\dot{X}_{3_i} - \dot{X}_{2_i} + 2\dot{X}_{1_i})$

Modifier- $Xm_{4_i} = X_{4_i} + (112/121)\,(X_{3_i} - Xm_{3_i})$

$\dot{X}m_{4_i} = \dot{X}m_i\,(t,\ Xm_{4_i})$

Corrector- $X_{4_i} = (1/8)\,(9X_{3_i} - X_{1_i}) + (3\Delta t/8)\,(\dot{X}m_{4_i} + 2\dot{X}_{3_i} - \dot{X}_{2_i})\ ,\ i = 1,\ n$

The error between prediction and correction is compared to a specified upper bound, and the time increment halved if the error exceeds the upper bound. The time increment is doubled as the error becomes less than a specified lower bound.

The abrupt imposition and cessation of forces and moments - such as rockets and catapults firing, seat separations and parachutes hitting line stretch - is very demanding of any integration algorithm and the Runge-Kutta technique repeatedly demonstrated superior performance during this study. This is disappointing because of the necessity for computing the derivatives four times for each integrated point in the Runge-Kutta method while Hamming's method (and Milne's, which was also tried) requires only two evaluations; however, the integration mesh for Hamming's algorithm has consistently been required to be less than half that needed for the Runge-Kutta routine, with a resulting increase in computing time to achieve the same accuracy. This is probably because of the extreme non-analyticity of the differential equations which must be integrated by formulae based on analytic interpolating functions. The Runge-Kutta method, although analytic, is an averaging technique which seems to represent the discontinuities and non-linearities better than the analytic predictor-corrector methods.

After the final parachute has hit line stretch and the oscillations have subsided, the predictor-corrector subroutine begins repeated doubling of the integration increment with a resultant rapid increase in computing speed; consequently, the increased computing cost from using Hamming's method during the initial part of the time history is recovered many fold for time histories run to crew recovery conditions.

2. Curve-Fitting Methods

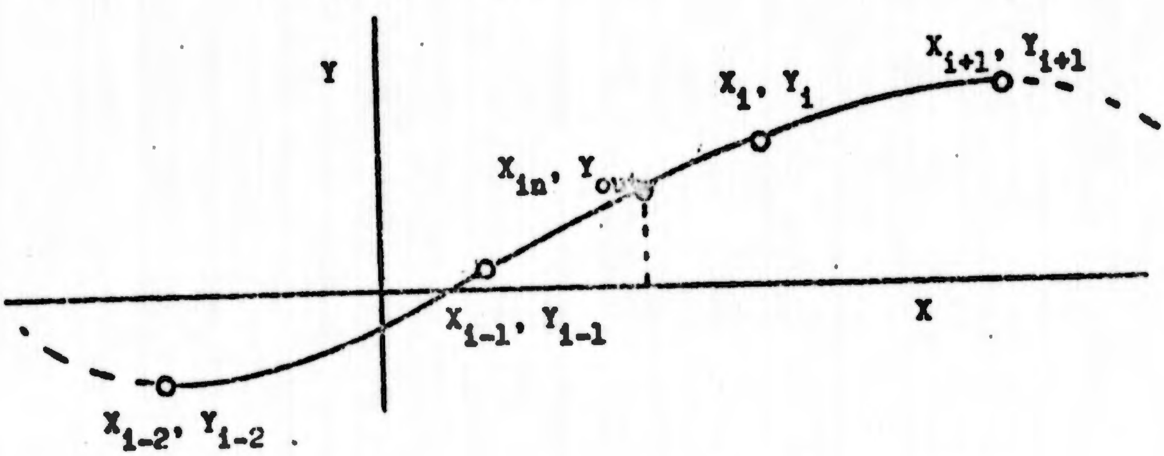
Many of the system coefficients are represented by polynomial functions and standard linear regression methods are employed to compute the polynomial coefficients from dependent-independent variable tables. In Section V.9 the use of the curve-fitting option is explained in detail. In general, the curve-fitting option allows the least squares coefficients to be stored in the necessary core location for immediate use by the simulation for time history computation. In this way, no time is lost by having to run a separate program for the coefficients which would have to be keypunched for input to the escape system simulation. The curve-fit option also provides punched cards, if desired, of the coefficients in a format compatible with the escape system program so that curve-fitting is not required on the subsequent run.

3. Table-Look-Up Mechanization

When the data are non-analytic, polynomial curve-fits are inadequate and a table-look-up method is used. A four point Lagrange interpolation formula is used with bi-quadratic weighting to approximate the non-analyticity.

Interpolating functions are nearly always analytic, while empirical data quite often has discontinuous derivatives. The non-analyticity, however, can be approximated by weighting the interpolating function in a non-linear fashion such that the tabular value nearest the interpolated point is more influential than any other point. For Lagrange interpolation, the weighting can be done by fitting two quadratics through four points, the quadratics overlapping the center two points, and then weighting the two quadratics appropriately.

In the following figure, for example, we wish to interpolate for the value of Y, Y_{out}, when X_{in} is given.



A Lagrange quadratic passing exactly through X_{i-2}, X_{i-1} and X_i is

$$Q_2 = B_1 Y_{i-2} + B_2 Y_{i-1} + B_3 Y_i$$

where

$$B_1 = [(X_{in}-X_{i-1})(X_{in}-X_i)]/[(X_{i-2}-X_{i-1})(X_{i-2}-X_i)]$$

$$B_2 = [(X_{in}-X_{i-2})(X_{in}-X_i)]/[(X_{i-1}-X_{i-2})(X_{i-1}-X_i)]$$

$$B_3 = [(X_{in}-X_{i-2})(X_{in}-X_{i-1})]/[(X_i-X_{i-2})(X_i-X_{i-1})]$$

Similarly, a Lagrange quadratic passing exactly through X_{i-1}, X_i and X_{i+1} is

$$Q_3 = C_1Y_{i-1} + C_2Y_i + C_3Y_{i+1}$$

where

$$C_1 = [(X_{in}-X_i)(X_{in}-X_{i+1})]/[(X_{i-1}-X_i)(X_{i-1}-X_{i+1})]$$

$$C_2 = [(X_{in}-X_{i-1})(X_{in}-X_{i+1})]/[(X_i-X_{i-1})(X_i-X_{i+1})]$$

$$C_3 = [(X_{in}-X_{i-1})(X_{in}-X_i)]/[(X_{i+1}-X_{i-1})(X_{i+1}-X_i)]$$

The interpolating formula sums these two quadratics, properly weighted, and the result is

$$Y_{out} = [(X_{in}-X_i)/(X_{i-1}-X_i)]Q_2 + [(X_{in}-X_{i-1})/(X_i-X_{i-1})]Q_3$$

When this equation is expanded, four interpolating coefficients independent of Y can be computed and the interpolating function becomes

$$Y_{out} = A_1Y_{i-2} + A_2Y_{i-1} + A_3Y_i + A_4Y_{i+1}$$

This last form is most efficient because a family of X-dependent functions can be interpolated with the same coefficients, which are

$$A_1 = (X_{in}-X_i)B_1/(X_{i-1}-X_i)$$

$$A_2 = (X_{in}-X_i)B_2/(X_{i-1}-X_i) + (X_{in}-X_{i-1})C_1/(X_i-X_{i-1})$$

$$A_3 = (X_{in}-X_i)B_3/(X_{i-1}-X_i) + (X_{in}-X_{i-1})C_2/(X_i-X_{i-1})$$

$$A_4 = (X_{in}-X_{i-1})C_3/(X_i-X_{i-1})$$

4. Trim Computations

Two options are provided for trimming the airplane in level unaccelerated flight. Both options are mechanized with a successive approximation technique which is more efficient than iteration methods. The equations are given in Part I, Volume 1, Section X where it is shown how the airplane is trimmed in either VTOL flight or conventional flight. The use of both trim options is explained in Section V of this volume.

SECTION IV
COMPUTER MEMORY ORGANIZATION

All the input and output data that are accessible to the user are stored in one single subscripted array, R, with variable subscripts. The user identifies the array variable of interest by specifying the subscript, which may be changed at will to rearrange variables in core in any desired order. This capability is necessary to enable the use of tables of varying lengths. Because of this flexibility an important advantage accrues to the program user who wishes to program additional equations, for he can move all the data to other core locations simply by assigning new values to the variable subscripts. In the vacated core he can program the additional computations without affecting the original program in any way.

The R-array, listed in Table I, consists of 9000 memory locations, each being identified by a subscript of the form, I = NR(IT) + JT. By specifying IT and JT, R(I) can be identified for input or output. For example, (refer to Table I, page 23) to input "Ignition Time of Catapult", t_{o_c}, one would input values for IT of 13 and JT of 23 with the desired value of t_{o_c}.

Note that the R-subscript, I, is composed of a subscripted integer, NR, resulting in a subscripted-subscripted variable array, R. The integer array, NR, will be read in at program initiation and this relocatable feature is the key concept which makes the program flexible and easily modified. The program examples of Section VI will help to clarify this concept.

TABLE I

R-ARRAY STORAGE OF VARIABLES

JT	JT	I	R(I)	UNITS	DEFINITION
0	1	1	$\dot{u}$	ft/sec^2	Axial acceleration, seat and/or man
0	2	2	$\dot{v}$	ft/sec^2	Side acceleration, seat and/or man
0	3	3	$\dot{w}$	ft/sec^2	Normal acceleration, seat and/or man
0	4	4	$\dot{p}$	rad/sec^2	Roll acceleration, seat and/or man
0	5	5	$\dot{q}$	rad/sec^2	Pitch acceleration, seat and/or man
0	6	6	$\dot{r}$	rad/sec^2	Yaw acceleration, seat and/or man
0	7	7	$\dot{x}_e$	ft/sec	Downrange earth axis rate, seat/man
0	8	8	$\dot{y}_e$	ft/sec	Lateral earth axis rate, seat/man
0	9	9	$\dot{z}_e$	ft/sec	Sink rate, seat/man
0	10	10	$\dot{a}_{11}$	sec^{-1}	A direction cosine rate, seat/man.
0	11	11	$\dot{a}_{12}$	sec^{-1}	A direction cosine rate, seat/man
0	12	12	$\dot{a}_{13}$	sec^{-1}	A direction cosine rate, seat/man
0	13	13	$\dot{a}_{21}$	sec^{-1}	A direction cosine rate, seat/man
0	14	14	$\dot{a}_{22}$	sec^{-1}	A direction cosine rate, seat/man
0	15	15	$\dot{a}_{23}$	sec^{-1}	A direction cosine rate, seat/man
0	16	16	$d\dot{\delta}/dt$	ft/sec^2	Spinal compression acceleration
0	17	17	$\dot{\delta}$	ft/sec	Spinal compression rate
0	18	18	$d\dot{x}/dt_{dc}$	ft/sec^2	Downrange accel, drag chute
0	19	19	$d\dot{y}/dt_{dc}$	ft/sec^2	Earth axis side accel, drag chute
0	20	20	$d\dot{z}/dt_{dc}$	ft/sec^2	Sink acceleration, drag chute
0	21	21	$\dot{x}_{dc}$	ft/sec	Downrange rate, drag chute
0	22	22	$\dot{y}_{dc}$	ft/sec	Earth axis lateral rate, drag chute

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
0	23	23	$\dot{z}_{dc}$	ft/sec	Earth axis sink rate, drag chute
0	24	24	$d\dot{x}/dt_{rc}$	ft/sec^2	Downrange accel, recovery chute
0	25	25	$d\dot{y}/dt_{rc}$	ft/sec^2	Lateral accel, recovery chute
0	26	26	$d\dot{z}/dt_{rc}$	ft/sec^2	Sink acceleration, recovery chute
0	27	27	$\dot{x}_{rc}$	ft/sec	Downrange rate, recovery chute
0	28	28	$\dot{y}_{rc}$	ft/sec	Lateral earth axis rate, recovery chute
0	29	29	$\dot{z}_{rc}$	ft/sec	Sink rate, recovery chute.
0	30	30	$\dot{u}_{ap}$	ft/sec^2	Axial acceleration, airplane
0	31	31	$\dot{v}_{ap}$	ft/sec^2	Side acceleration, airplane
0	32	32	$\dot{w}_{ap}$	ft/sec^2	Normal acceleration, airplane
0	33	33	$\dot{p}_{ap}$	rad/sec^2	Roll acceleration, airplane
0	34	34	$\dot{q}_{ap}$	rad/sec^2	Pitch acceleration, airplane
0	35	35	$\dot{r}_{ap}$	rad/sec^2	Yaw acceleration, airplane
0	36	36	$\dot{x}_{e_{ap}}$	ft/sec	Downrange earth axis rate, airplane
0	37	37	$\dot{y}_{e_{ap}}$	ft/sec	Lateral earth axis rate, airplane
0	38	38	$\dot{z}_{e_{ap}}$	ft/sec	Sink rate, airplane
0	39	39	$\dot{a}_{11_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	40	40	$\dot{a}_{12_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	41	41	$\dot{a}_{13_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	42	42	$\dot{a}_{21_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	43	43	$\dot{a}_{22_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	44	44	$\dot{a}_{23_{ap}}$	sec^{-1}	A direction cosine rate-airplane
0	45	45	$\dot{L}_j$	in/sec	propellant web burn rate

TABLE I (CONT)

Enter airplane initial conditions only - except for direction cosines

IT	JT	I	R(I)	UNITS	DEFINITION
1	1	N+1	u	ft/sec	$\int \dot{u} dt$
1	2	N+2	v	ft/sec	$\int \dot{v} dt$
1	3	N+3	w	ft/sec	$\int \dot{w} dt$
1	4	N+4	p	rad/sec	$\int \dot{p} dt$
1	5	N+5	q	rad/sec	$\int \dot{q} dt$
1	6	N+6	r	rad/sec	$\int \dot{r} dt$ NOTE, N = NR1
1	7	N+7	x_e	ft	$\int \dot{x}_e dt$
1	8	N+8	y_e	ft	$\int \dot{y}_e dt$
1	9	N+9	z_e	ft	$\int \dot{z}_e dt$
1	10	N+10	a_{11}	1/sec	$\int \dot{a}_{11} dt$
1	11	N+11	a_{12}	1/sec	$\int \dot{a}_{12} dt$
1	12	N+12	a_{13}	1/sec	$\int \dot{a}_{13} dt$
1	13	N+13	a_{21}	1/sec	$\int \dot{a}_{21} dt$
1	14	N+14	a_{22}	1/sec	$\int \dot{a}_{22} dt$
1	15	N+15	a_{23}	1/sec	$\int \dot{a}_{23} dt$
1	16	N+16	$\dot{\delta}$	ft/sec	$\int d\dot{\delta}/dt\ dt$
1	17	N+17	δ	ft	$\int \dot{\delta} dt$
1	18	N+18	$\dot{x}_{dc}$	ft/sec	$\int d\dot{x}/dt_{dc}\ dt$
1	19	N+19	$\dot{y}_{dc}$	ft/sec	$\int d\dot{y}/dt_{dc}\ dt$
1	20	N+20	$\dot{z}_{dc}$	ft/sec	$\int d\dot{z}/dt_{dc}\ dt$
1	21	N+21	x_{dc}	ft	$\int \dot{x}_{dc} dt$
1	22	N+22	y_{dc}	ft	$\int \dot{y}_{dc} dt$
1	23	N+23	z_{dc}	ft	$\int \dot{z}_{dc} dt$

JT	JT	I	R(I)	UNITS	DEFINITION
1	24	N+24	$\dot{x}_{rc}$	ft/sec	$\int d\dot{x}/dt_{rc}\ dt$
1	25	N+25	$\dot{y}_{rc}$	ft/sec	$\int d\dot{y}/dt_{rc}\ dt$
1	26	N+26	$\dot{z}_{rc}$	ft/sec	$\int d\dot{z}/dt_{rc}\ dt$
1	27	N+27	x_{rc}	ft	$\int \dot{x}_{rc} dt$
1	28	N+28	y_{rc}	ft	$\int \dot{y}_{rc} dt$
1	29	N+29	z_{rc}	ft	$\int \dot{z}_{rc} dt$
1	30	N+30	u_{ap}	ft/sec	$\int \dot{u}_{ap} dt$
1	31	N+31	v_{ap}	ft/sec	$\int \dot{v}_{ap} dt$
1	32	N+32	w_{ap}	ft/sec	$\int \dot{w}_{ap} dt$
1	33	N+33	p_{ap}	rad/sec	$\int \dot{p}_{ap} dt$ INITIAL CONDITIONS
1	34	N+34	q_{ap}	rad/sec	$\int \dot{q}_{ap} dt$
1	35	N+35	r_{ap}	rad/sec	$\int \dot{r}_{ap} dt$
1	36	N+36	$x_{e_{ap}}$	ft	$\int \dot{x}_{e_{ap}} dt$
1	37	N+37	$y_{e_{ap}}$	ft	$\int \dot{y}_{e_{ap}} dt$
1	38	N+38	$z_{e_{ap}}$	ft	$\int \dot{z}_{e_{ap}} dt$
1	39	N+39	$a_{11_{ap}}$	non-dim	$\int \dot{a}_{11_{ap}} dt$
1	40	N+40	$a_{12_{ap}}$	non-dim	$\int \dot{a}_{12_{ap}} dt$
1	41	N+41	$a_{13_{ap}}$	non-dim	$\int \dot{a}_{13_{ap}} dt$
1	42	N+42	$a_{21_{ap}}$	non-dim	$\int \dot{a}_{21_{ap}} dt$
1	43	N+43	$a_{22_{ap}}$	non-dim	$\int \dot{a}_{22_{ap}} dt$
1	44	N+44	$a_{23_{ap}}$	non-dim	$\int \dot{a}_{23_{ap}} dt$
1	45	N+45	L_j	in	$\int \dot{L}_j dt$

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
2	1	2N+1	u	ft/sec	$\int \dot{u} dt$ NOTE, 2N = NR2
2	2	2N+2	v	ft/sec	$\int \dot{v} dt$
.	.	.	.		Reserved for numerical integration
2	45	2N+45	.		
3	1	3N+1	u	ft/sec	$\int \dot{u} dt$ NOTE, 3N = NR3
3	2	3N+2	v	ft/sec	$\int \dot{v} dt$
.	.	.	.		Reserved for numerical integration
3	45	3N+45	.		
4	1	4N+1			
4	2	4N+2	t	sec	Time NOTE, 4N = NR4
4	3	4N+3	Δt	sec	Basic time history integration increment
4	4	4N+4	t_{max}	sec	Maximum time of time history
4	5	4N+5	Δt_{out}	sec	Output time increment
4	6	4N+6	ψ	rad	Euler yaw angle, seat/man
4	7	4N+7	θ	rad	Euler pitch angle, seat/man
4	8	4N+8	ϕ	rad	Euler bank angle, seat/man
4	9	4N+9	a_{31}	non-dim	Gravity vector direction cosines
4	10	4N+10	a_{32}	non-dim	Gravity vector direction cosines
4	11	4N+11	a_{33}	non-dim	Gravity vector direction cosines
4	12	4N+12	U_a	ft/sec	Airspeed of the seat and/or man
4	13	4N+13	q_a	lb/ft^2	Dynamic pressure of seat and/or man
4	14	4N+14	±1		Flag for catapult force on seat
4	15	4N+15	Mach	non-dim	Seat/man Mach number
4	16	4N+16	α	rad	Angle of attack of the seat and/or man

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
4	17	4N+17	β	rad	Sideslip angle of the seat and/or man
4	18	4N+18	$n_{x_{cg}}$	non-dim	Seat/man axial load factor
4	19	4N+19	$n_{y_{cg}}$	non-dim	Seat/man side load factor
4	20	4N+20	$n_{z_{cg}}$	non-dim	Seat/man normal load factor
4	21	4N+21	$n_{x_{pilot}}$	non-dim	Load factors at a
4	22	4N+22	$n_{y_{pilot}}$	non-dim	specified point on
4	23	4N+23	$n_{z_{pilot}}$	non-dim	the pilot's body
4	24	4N+24	λ	non-dim	Pressure ratio at seat/man altitude
4	25	4N+25	V_s	ft/sec	Speed of sound at seat/man altitude
4	26	4N+26	ρ	slug/ft^3	Air density at seat/man altitude
4	27	4N+27	H_x	ft-lb-sec	Seat and/or man
4	28	4N+28	H_y	ft-lb-sec	angular momentum
4	29	4N+29	H_z	ft-lb-sec	components
4	30	4N+30	F_{x_e}	lb	
4	31	4N+31	F_{y_e}	lb	Seat/man non-aerodynamic forces
4	32	4N+32	F_{z_e}	lb	
4	33	4N+33	τ_{x_e}	ft-lb	
4	34	4N+34	τ_{y_e}	ft-lb	Seat/man non-aerodynamic moments
4	35	4N+35	τ_{z_e}	ft-lb	
4	36	4N+36	F_{x_o}	lb	
4	37	4N+37	F_{y_o}	lb	Summation of all seat/man forces
4	38	4N+38	F_{z_o}	lb	
4	39	4N+39	τ_{x_o}	ft-lb	
4	40	4N+40	τ_{y_o}	ft-lb.	Summation of seat/man moments
4	41	4N+41	τ_{z_o}	ft-lb	
4	42	4N+42	± 1		Flag for printing staging comments
4	43	4N+43	± 1		Flag for seat tip-of, +1 for tip-off
4	44	4N+44	± 1		Flag for recovery chute ejection rocket or gun
4	45	4N+45	± 1		Flag for recovery chute line stretch
4	46	4N+46	± 1		Flag for drag chute ejection rocket or gun
4	47	4N+47	± 1		Flag for drag chute line stretch

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
4	48	4N+48	$D_{11_{as}}$	non-dim	.
4	49	4N+49	$D_{12_{as}}$	non-dim	.
4	50	4N+50	$D_{13_{as}}$	non-dim	.
4	51	4N+51	$D_{21_{as}}$	non-dim	. Direction cosines relating
4	52	4N+52	$D_{22_{as}}$	non-dim	. airplane to seat through rails
4	53	4N+53	$D_{23_{as}}$	non-dim	. $D_{as} = D_{ac}D_{cs}$
4	54	4N+54	$D_{31_{as}}$	non-dim	.
4	55	4N+55	$D_{32_{as}}$	non-dim	.
4	56	4N+56	$D_{33_{as}}$	non-dim	.
4	57	4N+57	$n_{x_{ap}}$	non-dim	Load factors at a specified
4	58	4N+58	$n_{y_{ap}}$	non-dim	point on the airplane, such as
4	59	4N+59	$n_{z_{ap}}$	non-dim	the seat pre-ejection location
4	60	4N+60	$a_{31_{ap}}$	non-dim	Airplane direction cosines
4	61	4N+61	$a_{32_{ap}}$	non-dim	of the gravity vector
4	62	4N+62	$a_{33_{ap}}$	non-dim	
4	63	4N+63	$U_{a_{ap}}$	ft/sec	Airplane airspeed
4	64	4N+64	$q_{a_{ap}}$	lb/ft^2	Airplane dynamic pressure
4	65	4N+65	α_{ap}	rad	Airplane angle of attack
4	66	4N+66	β_{ap}	rad	Airplane sideslip angle
4	67	4N+67	$n_{x_{cgap}}$	non-dim	Airplane axial load factor
4	68	4N+68	$n_{y_{cgap}}$	non-dim	Airplane side load factor
4	69	4N+69	$n_{z_{cgap}}$	non-dim	Airplane normal load factor
4	70	4N+70	$H_{x_{ap}}$	ft-lb-sec	
4	71	4N+71	$H_{y_{ap}}$	ft-lb-sec	Airplane angular momentums
4	72	4N+72	$H_{z_{ap}}$	ft-lb-sec	
4	73	4N+73	$F_{x_{eap}}$	lb	Airplane non-aerodynamic force
4	74	4N+74	$F_{y_{eap}}$	lb	component summations, excluding
4	75	4N+75	$F_{z_{eap}}$	lb	turbojet thrust
4	76	4N+76	$r_{x_{eap}}$	ft-lb	Airplane non-aerodynamic
4	77	4N+77	$r_{y_{eap}}$	ft-lb	moment component summations
4	78	4N+78	$r_{z_{eap}}$	ft-lb	excluding turbojet thrust
4	79	4N+79	$F_{x_{oap}}$	lb	
4	80	4N+80	$F_{y_{oap}}$	lb	Airplane force summations
4	81	4N+81	$F_{z_{oap}}$	lb	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
4	82	4N+82	$r_{x_{oap}}$	ft-lb	Airplane moment summations
4	83	4N+83	$r_{y_{oap}}$	ft-lb	
4	84	4N+84	$r_{z_{oap}}$	ft-lb	
4	85	4N+85	$x_{e_{ap}}$	ft	Earth axis co-ordinates of a specified point on the airplane, such as the tip of the vertical tail
4	86	4N+86	$y_{e_{ap}}$	ft	
4	87	4N+87	$z_{e_{ap}}$	ft	
4	88	4N+88	Δx_{sa}	ft	Earth axis co-ordinates of distance between a point on the airplane and the seat/man center of gravity (cg)
4	89	4N+89	Δy_{sa}	ft	
4	90	4N+90	Δz_{sa}	ft	
4	91	4N+91	R_{sa}	ft	Distance from the seat/man cg to a point on the airplane, such as the vertical tail
4	92	4N+92	ψ_{ap}	rad	Airplane Euler angles, initial condition input
4	93	4N+93	θ_{ap}	rad	
4	94	4N+94	ϕ_{ap}	rad	
4	95	4N+95	F_{x_a}	lb	Airplane aerodynamic force components and turbojet thrust components
4	96	4N+96	F_{y_a}	lb	
4	97	4N+97	F_{z_a}	lb	
4	98	4N+98	r_{x_a}	ft-lb	Airplane aerodynamic moments and moments from turbojet thrust
4	99	4N+99	r_{y_a}	ft-lb	
4	100	4N+100	r_{z_a}	ft-lb	
4	101	4N+101	$r_{y_{\dot{\psi}}}$	lb/sec^2	
4	102	4N+102	$r_{y_{\delta}}$	$ft-lb/rad/sec^2$	
4	103	4N+103	$r_{x_{\gamma}}$	lb/sec^2	
4	104	4N+104	$r_{z_{\gamma}}$	lb/sec^2	
4	105	4N+105	$r_{x_{\rho}}$	$ft-lb/rad/sec^2$	
4	106	4N+106	$r_{x_{\zeta}}$	$ft-lb/rad/sec^2$	
4	107	4N+107	$r_{z_{\rho}}$	lb/sec^2	
4	108	4N+108	r_{z_r}	lb/sec^2	
4	109	4N+109	$F_{z_{\dot{\psi}}}$	$lb/ft/sec^2$	Accel. dependent forces from structural deformations and aerodynamic lags
4	110	4N+110	F_{y_v}	$lb/ft/sec^2$	
4	111	4N+111	u_{cp}	ft/sec	Linear velocity components of a point on the airplane in airplane body axis system - such as the cockpit
4	112	4N+112	v_{cp}	ft/sec	
4	113	4N+113	w_{cp}	ft/sec	
4	114	4N+114	$\dot{x}_{cp}$	ft/sec	Earth axis velocity components of a point in the airplane, such as the cockpit
4	115	4N+115	$\dot{y}_{cp}$	ft/sec	
4	116	4N+116	$\dot{z}_{cp}$	ft/sec	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
4	117	4N+117	x_{cp}	ft	Earth axis position components of a point in the airplane, such as the cockpit
4	118	4N+118	y_{cp}	ft	
4	119	4N+119	z_{cp}	ft	
4	120	4N+120	λ_{ap}	non-dim	Pressure ratio at airplane altitude
4	121	4N+121	V_{s_a}	ft/sec	Speed of sound at airplane altitude
4	122	4N+122	ρ_a	slug/ft^3	Air density at airplane altitude
4	123	4N+123	$\dot{x}_{wind}$	ft/sec	Earth axis wind components, steady winds plus turbulence
4	124	4N+124	$\dot{y}_{wind}$	ft/sec	
4	125	4N+125	$\dot{z}_{wind}$	ft/sec	
4	126	4N+126	$t_{rail\ switch}$	sec	Time at trip switch contact

Seat and man aerodynamic tables

IT	JT	I	R(I)	UNITS	DEFINITION
5	0	NR5	α_1	rad	
5	1	NR5+1	α_2	rad	
5	2	NR5+2	α_3	rad	
.	.	.	.	.	Seat angle of attack tables, N_α entries
.	.	.	.	.	
.	.	.	.	.	
5	N_α-1	NR5+N_α-1	$\alpha_{N\alpha}$	rad	
6	0	NR6	β_1	rad	
6	1	NR6+1	β_2	rad	
6	2	NR6+2	β_3	rad	
.	.	.	.	.	Table of seat sideslip angles, N_β entries
.	.	.	.	.	
.	.	.	.	.	
6	N_β-1	NR6+N_β-1	$\beta_{N\beta}$	rad	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
7	0	NR7	C_{L_1}	non-dim	
7	1	NR7+1	C_{L_2}	non-dim	
.	.	.	.	.	Seat lift coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
7	$N_\alpha N_\beta$-1	NR8+$N_\alpha N_\beta$-1	$C_{L_{N\alpha N\beta}}$	non-dim	
8	0	NR8	C_{D_1}	non-dim	
8	1	NR8+1	C_{D_2}	non-dim	
.	.	.	.	.	Seat drag coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
8	$N_\alpha N_\beta$-1	NR8+$N_\alpha N_\beta$-1	$C_{D_{N\alpha N\beta}}$	non-dim	
9	0	NR9	C_{m_1}	non-dim	
9	1	NR9+1	C_{m_2}	non-dim	
.	.	.	.	.	Seat pitching moment coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
9	$N_\alpha N_\beta$-1	NR9+$N_\alpha N_\beta$-1	$C_{m_{N\alpha N\beta}}$	non-dim	
10	0	NR10	C_{n_1}	non-dim	
.	.	.	.	.	Seat yawing moment coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
10	$N_\alpha N_\beta$-1	NR10+$N_\alpha N_\beta$-1	$C_{n_{N\alpha N\beta}}$	non-dim	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
11	0	NR11	C_{l_1}	non-dim	
.	.	.	.	.	Seat rolling moment coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
11	$N_\alpha N_\beta$-1	NR11+$N_\alpha N_\beta$-1	$C_{l_{N\alpha N\beta}}$	non-dim	
12	0	NR12	C_{y_1}	non-dim	
.	.	.	.	.	Seat side force coefficient tables,
.	.	.	.	.	with $N_\alpha N_\beta$ entries
.	.	.	.	.	
12	$N_\alpha N_\beta$-1	NR12+$N_\alpha N_\beta$-1	$C_{y_{N\alpha N\beta}}$	non-dim	

Rocket and catapult input data

IT	JT	I	R(I)	UNITS	DEFINITION
13	0	NR13			
13	1	NR13+ 1			
13	2	NR13+ 2	Δt_r	SECONDS	Burn time of sustainer
13	3	NR13+ 3	t_{0_r}	SECONDS	Sustainer ignition time
13	4	NR13+ 4	$C\alpha_r$	NON-DIM	Direction cosines of sustainer
13	5	NR13+ 5	$C\beta_r$	NON-DIM	thrust vector with respect
13	6	NR13+ 6	$C\gamma_r$	NON-DIM	to the seat axis system
13	7	NR13+ 7	Δx_{cg_r}	FEET	Moment arm components of
13	8	NR13+ 8	Δy_{cg_r}	FEET	sustainer thrust vector in
13	9	NR13+ 9	Δz_{cg_r}	FEET	seat axis system form seat cg
13	10	NR13+ 10	F_{DB}	POUNDS	Deployment bag strip out force
13	11	NR13+ 11	0. or 1.	NON-DIM	0. for rocket, 1. for gun
13	12	NR13+ 12	Δt_{pd}	SEC	Burn time drag chute deploy. impulse
13	13	NR13+ 13	$t_{0_{pd}}$	SEC	Ignition drag chute deploy. impulse

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
13	14	NR13+ 14	$C\alpha_{pd}$	NON-DIM	Direction cosines of drag chute
13	15	NR13+ 15	$C\beta_{pd}$	NON-DIM	deployment impulse with
13	16	NR13+ 16	$C\gamma_{pd}$	NON-DIM	respect to the seat axis system
13	17	NR13+ 17	$\Delta x_{cg_{pd}}$	FEET	Moment arm components of drag
13	18	NR13+ 18	$\Delta y_{cg_{pd}}$	FEET	chute deployment impulse
13	19	NR13+ 19	$\Delta z_{cg_{pd}}$	FEET	in seat axis system
13	20	NR13+ 20	A	IN^2	Piston area
13	21	NR13+ 21	k_1	$LB/LB/IN^2$	Friction proportionality constant
13	22	NR13+ 22	k_3	NON-DIM	Heat loss constant
13	23	NR13+ 23	t_{0_c}	SEC	Ignition time of catapult
13	24	NR13+ 24			
13	25	NR13+ 25			
13	26	NR13+ 26			
13	27	NR13+ 27	Δx_{cg_c}	FT	Moment arm components of catapult
13	28	NR13+ 28	Δy_{cg_c}	FEET	thrust vector in seat axis
13	29	NR13+ 29	Δz_{cg_c}	FEET	system from seat cg
13	30	NR13+ 30	$\Delta t_{pilot\ release}$	sec	Time from trip switch contact to pilot release from seat
13	31	NR13+ 31	0. or 1.	NON-DIM	0. for rocket, 1. for gun
13	32	NR13+ 32	Δt_{rc}	SEC	Burn time recovery chute impulse
13	33	NR13+ 33	$t_{0_{rc}}$	SEC	Ignition recovery chute impulse
13	34	NR13+ 34	$C\alpha_{rc}$	NON-DIM	Direction cosines of recovery
13	35	NR13+ 35	$C\beta_{rc}$	NON-DIM	chute impulse with respect
13	36	NR13+ 36	$C\gamma_{rc}$	NON-DIM	to seat axis system
13	37	NR13+ 37	$\Delta x_{cg_{rc}}$	FEET	Moment arm components of
13	38	NR13+ 38	$\Delta y_{cg_{rc}}$	FEET	recovery chute impulse
13	39	NR13+ 39	$\Delta z_{cg_{rc}}$	FEET	in the seat axis system
13	40	NR13+ 40	$\dot{\phi}_r$	RAD/SEC	Rotation rate of tractor thrust
13	41	NR13+ 41	ϕ_{0_r}	RADIANS	Initial angle wrt earth z axis of tractor thrust vector
13	42	NR13+ 42	±1.	NON-DIM	+1. tractor used, -1. no tractor

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
13	43	NR13+ 43	$\Delta x_{cg_{ts}}$	FEET	Seat axis coordinates of tractor system line attach point
13	44	NR13+ 44	$\Delta y_{cg_{ts}}$	FEET	
13	45	NR13+ 45	$\Delta z_{cg_{ts}}$	FEET	
13	46	NR13+ 46	F_{r_1}	LB	Sustainer force schedule
13	47	NR13+ 47	t_1	SEC	
13	48	NR13+ 48	F_{r_2}	LB	
13	49	NR13+ 49	t_2	SEC	
13	50	NR13+ 50	F_{r_3}	LB	
13	51	NR13+ 51	t_3	SEC	
13	52	NR13+ 52	F_{r_4}	LB	
13	53	NR13+ 53	t_4	SEC	
13	54	NR13+ 54	F_{r_5}	LB	
13	55	NR13+ 55	t_5	SEC	
13	56	NR13+ 56	F_{r_6}	LB	
13	57	NR13+ 57	t_6	SEC	
13	58	NR13+ 58	T_v	°Kelvin	Constant volume flame temperature
13	59	NR13+ 59	c_v	IN-LB/SLUG°K	Constant volume specific heat
13	60	NR13+ 60	b	IN/SEC/(LB/IN²)ⁿ	Burn rate proportionality constant
13	61	NR13+ 61	n	NON-DIM	Burn rate exponent of burn rate power law
13	62	NR13+ 62	c	SLUGS	Mass of total propellant
13	63	NR13+ 63	a_1	1/IN	Coefficients of the propellant grain cubic form function
13	64	NR13+ 64	a_2	1/IN²	
13	65	NR13+ 65	a_3	1/IN³	
13	66	NR13+ 66	R/M	IN-LB/SLUG°K	Universal gas constant based on mass vaits
13	67	NR13+ 67	V_0	IN³	Initial free volume available to the propellant gases
13	68	NR13+ 68	c_0	SLUGS	Booster propellant mass
13	69	NR13+ 69	$p_{(tang)}$	LB/IN²	pressure actuating the tang which allows the piston to move
13	70	NR13+ 70	t_1	SEC	Recovery chute ejection mortar (or rocket) force schedule
13	71	NR13+ 71	F_{r_1}	LB	
13	72	NR13+ 72	t_2	SEC	
13	73	NR13+ 73	F_{r_2}	LB	

JT	JT	I	R(I)	UNITS	DEFINITION
13	74	NR13+ 74	t_1	SEC	
13	75	NR13+ 75	F_{r_1}	LB	Drag chute ejection mortar
13	76	NR13+ 76	t_2	SEC	(or rocket) force schedule
13	77	NR13+ 77	F_{r_2}	LB	
13	78	NR13+ 78	Δt_{rm}	SEC	Burn time roll motor
13	79	NR13+ 79	$t_{0_{rm}}$	SEC	Ignition time roll motor
13	80	NR13+ 80	t_1	SEC	
13	81	NR13+ 81	F_{r_1}	LB	
13	82	NR13+ 82	t_2	SEC	
13	83	NR13+ 83	F_{r_2}	LB	Roll motor force schedule
13	84	NR13+ 84	t_3	SEC	
13	85	NR13+ 85	F_{r_3}	LB	
13	86	NR13+ 86	t_4	SEC	
13	87	NR13+ 87	F_{r_4}	LB	
13	88	NR13+ 88			
13	89	NR13+ 89	$\Delta x_{cg_{rm}}$	FEET	Moment arm components of
13	90	NR13+ 90	$\Delta y_{cg_{rm}}$	FEET	roll motor thrust vector
13	91	NR13+ 91	$\Delta z_{cg_{rm}}$	FEET	in seat axis system
13	92	NR13+ 92	$C\alpha_{rm}$	NON-DIM	Direction cosines of roll
13	93	NR13+ 93	$C\beta_{rm}$	NON-DIM	motor thrust vector in
13	94	NR13+ 94	$C\gamma_{rm}$	NON-DIM	seat axis system
13	95	NR13+ 95	Δt	SEC	Burn time pitch motor no. 1
13	96	NR13+ 96	t_0	SEC	Ignition time pitch motor no. 1
13	97	NR13+ 97	t_1	SEC	
13	98	NR13+ 98	F_{p_1}	LB	
13	99	NR13+ 99	t_2	SEC	
13	100	NR13+100	F_{p_2}	LB	Pitch motor no. 1 force schedule
13	101	NR13+101	t_3	SEC	(opposes pitch up rates of seat)
13	102	NR13+102	F_{p_3}	LB	
13	103	NR13+103	t_4	SEC	
13	104	NR13+104	F_{p_4}	LB	
13	105	NR13+105	$\Delta x_{cg_{pm}}$	FEET	Moment arm components of
13	106	NR13+106	$\Delta y_{cg_{pm}}$	FEET	Pitch motor no 1 thrust
13	107	NR13+107	$\Delta z_{cg_{pm}}$	FEET	vector in seat axis system
13	108	NR13+108	$C\alpha_{pm}$	NON-DIM	Direction cosines of pitch motor
13	109	NR13+109	$C\beta_{pm}$	NON-DIM	No. 1 thrust vector in
13	110	NR13+110	$C\gamma_{pm}$	NON-DIM	seat axis system

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
13	111	NR13+111	Δt	SEC	Pitch motor no. 2 burn time
13	112	NR13+112	t_0	SEC	Ignition time pitch motor no. 2
13	113	NR13+113	t_1	SEC .	
13	114	NR13+114	F_{p_1}	LB .	
13	115	NR13+115	t_2	SEC .	
13	116	NR13+116	F_{p_2}	LB .	Pitch motor no. 2 force schedule
13	117	NR13+117	t_3	SEC .	(opposes pitch down rates of seat)
13	118	NR13+118	F_{p_3}	LB .	
13	119	NR13+119	t_4	SEC .	
13	120	NR13+120	F_{p_4}	LB .	
13	121	NR13+121	$\Delta x_{cg_{pm}}$	FEET	Moment arm components of
13	122	NR13+122	$\Delta y_{cg_{pm}}$	FEET	Pitch motor no. 2
13	123	NR13+123	$\Delta z_{cg_{pm}}$	FEET	thrust vector in seat axis
13	124	NR13+124	$C\alpha_{pm}$	NON-DIM	Direction cosines of pitch motor
13	125	NR13+125	$C\beta_{pm}$	NON-DIM	No. 2 thrust vector in
13	126	NR13+126	$C\gamma_{pm}$	NON-DIM	seat axis system
13	127	NR13+127	Δt	SEC	Burn time yaw motor
13	128	NR13+128	t_0	SEC	Ignition time yaw motor
13	129	NR13+129	t_1	SEC .	
13	130	NR13+130	F_{y_1}	LB .	
13	131	NR13+131	t_2	SEC .	
13	132	NR13+132	F_{y_2}	LB .	Yaw motor force schedule
13	133	NR13+133	t_3	SEC .	
13	134	NR13+134	F_{y_3}	LB .	
13	135	NR13+135	t_4	SEC .	
13	136	NR13+136	F_{y_4}	LB .	
13	137	NR13+137	$\Delta x_{cg_{ym}}$	FEET	Moment arm components of
13	138	NR13+138	$\Delta y_{cg_{ym}}$	FEET	yaw motor thrust vector
13	139	NR13+139	$\Delta z_{cg_{ym}}$	FEET	in seat axis system
13	140	NR13+140	$C\alpha_{ym}$	NON-DIM	Direction cosines of yaw motor
13	141	NR13+141	$C\beta_{ym}$	NON-DIM	thrust vector in the seat
13	142	NR13+142	$C\gamma_{ym}$	NON-DIM	axis system
13	143	NR13+143		RAD/SEC	Seat pitch up rate for pitch motor initiation
13	144	NR13+144		RAD/SEC	Seat pitch down rate for motor initiation
13	145	NR13+145	$\pm 1.$	NON-DIM	-1. No. 1 motor burned, +1. not
13	146	NR13+146	$\pm 1.$	NON-DIM	-1. No. 2 motor burned, +1. not

TABLE I (CONT)

Drag chute inputs

IT	JT	I	R(I)	UNITS	DEFINITION
14	0	NR14	W_p	LB	Weight of parachute
14	1	NR14+ 1	Δx_a	FEET	Seat axis coordinate of bridle apex
14	2	NR14+ 2	Δy_a	FEET	
14	3	NR14+ 3	Δz_a	FEET	
14	4	NR14+ 4	R_{lines}	FEET	Unloaded line length
14	5	NR14+ 5	R_{sc}	FEET	Length of skirt + 1/4 canopy cir.
14	6	NR14+ 6	R_{in}	FEET	Parachute inlet radius
14	7	NR14+ 7	R_{L_0}	FEET	Distance from parachute attach point to parachute cg at full inflation
14	8	NR14+ 8	K	LB/FT	Line elastic modulus
14	9	NR14+ 9	B_1	FEET	Coefficients in the equation for SC_D of a reefed parachute
14	10	NR14+ 10	B_2	NON-DIM	
14	11	NR14+ 11	B_3	$FEET^{-1}$	
14	12	NR14+ 12	C_1	FT-SEC	Coefficient in equation for SC_D
14	13	NR14+ 13	C_2	SEC^2	Coefficient in equation for SC_D
14	14	NR14+ 14	SC_{T_i}	FT^2	Product of reference area and tangent force coef. at full inflation
14	15	NR14+ 15	K_1	NON-DIM	Coefficients in equation for mass acquisition time
14	16	NR14+ 16	K_2	NON-DIM	
14	17	NR14+ 17	K_3	NON-DIM	
14	18	NR14+ 18	C	NON-DIM	Effective porosity
14	19	NR14+ 19	Δt_{gun}	SEC	Decrease in spreading time due to spreading gun
14	20	NR14+ 20	B_0	FT^2	Constant in equation for SC_D of reefed parachute
14	21	NR14+ 21	F_D	NON-DIM	Wake to free stream ratio, aero. coef.

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
14	22	NR14+ 22	Δx_1	FEET.	
14	23	NR14+ 23	Δy_1	feet.	
14	24	NR14+ 24	Δz_1	feet.	
14	25	NR14+ 25	Δx_2	feet.	
14	26	NR14+ 26	Δy_2	feet.	
14	27	NR14+ 27	Δz_2	feet.	Seat axis coordinates of bridle attach points
14	28	NR14+ 28	Δx_3	feet.	
14	29	NR14+ 29	Δy_3	feet.	
14	30	NR14+ 30	Δz_3	feet.	
14	31	NR14+ 31	Δx_4	feet.	
14	32	NR14+ 32	Δy_4	feet.	
14	33	NR14+ 33	Δz_4	feet.	
14	34	NR14+ 34	ERRDC	NON-DIM	Allowable error in force direction cosines on bridle
14	35	NR14+ 35	N_{lines}	NON-DIM	Number of bridle lines
14	36	NR14+ 36	SC_{T_α}	NONDIM	Curve fit coefficients for SC_T as $f(\alpha)$
14	37	NR14+ 37	$SC_{T_{\alpha^2}}$	NONDIM	
14	38	NR14+ 38	$SC_{T_{\alpha^3}}$	NONDIM	
14	39	NR14+ 39	SC_{N_α}	NONDIM	Curve fit coefficients for SC_N as $f(\alpha)$
14	40	NR14+ 40	$SC_{N_{\alpha^2}}$	NONDIM	
14	41	NR14+ 41	$SC_{N_{\alpha^3}}$	NONDIM	

Recovery chute inputs

IT	JT	I	R(I)	UNITS	DEFINITIONS
15	0	NR15	W_p	LB	Weight of parachute
15	1	NR15+ 1	Δx_a	FEET	Seat axis coordinate of bridle apex
15	2	NR15+ 2	Δy_a	FEET	
15	3	NR15+ 3	Δz_a	FEET	
15	4	NR15+ 4	R_{lines}	FEET	Unloaded line length
15	5	NR15+ 5	R_{sc}	FEET	Length of skirt + 1/4 canopy cir.
15	6	NR15+ 6	R_{in}	FEET	Parachute inlet radius
15	7	NR15+ 7	R_{L_0}	FEET	Distance from parachute attach point to parachute cg at full inflation
15	8	NR15+ 8	K	LB/FT	Line elastic modulus

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
15	9	NR15+ 9	B_1	FEET	Coefficients in the equation for SC_D of a reefed parachute
15	10	NR15+ 10	B_2	NON-DIM	
15	11	NR15+ 11	B_3	$FEET^{-1}$	
15	12	NR15+ 12	C_1	FT-SEC	Coefficient in equation for SC_D
15	13	NR15+ 13	C_2	SEC^2	Coefficient in equation for SC_D
15	14	NR15+ 14	SC_{T_i}	FT^2	Product of reference area and tangent force coef. at full inflation
15	15	NR15+ 15	K_1	NON-DIM	Coefficients in equation for mass acquisition time
15	16	NR15+ 16	K_2	NON-DIM	
15	17	NR15+ 17	K_3	NON-DIM	
15	18	NR15+ 18	C	NON-DIM	Effective porosity
15	19	NR15+ 19	Δt_{gun}	SEC	Decrease in spreading time due to spreading gun
15	20	NR15+ 20	B_0	FT^2	Constant in equation for SC_D of reefed parachute
15	21	NR15+ 21	F_D	NON-DIM	Wake to free stream ratio, aero. coef.
15	22	NR15+ 22	SC_{T_α}	NONDIM	Curve fit coefficients for SC_T as $f(\alpha)$
15	23	NR15+ 23	$SC_{T_{\alpha^2}}$	NONDIM	
15	24	NR15+ 24	$SC_{T_{\alpha^3}}$	NONDIM	
15	25	NR15+ 25	SC_{N_α}	NONDIM	Curve fit coefficients for SC_N as $f(\alpha)$
15	26	NR15+ 26	$SC_{N_{\alpha^2}}$	NONDIM	
15	27	NR15+ 27	$SC_{N_{\alpha^3}}$	NONDIM	

Seat + man inputs

IT	JT	I	R(I)	UNITS	DEFINITIONS
16	0	NR16	W	LB	Weight
16	1	NR16+ 1	I_{xx}	SLUG-FT^2	Moments and products of inertia
16	2	NR16+ 2	I_{yy}	SLUG-FT^2	
16	3	NR16+ 3	I_{zz}	SLUG-FT^2	
16	4	NR16+ 4	I_{xz}	SLUG-FT^2	
16	5	NR16+ 5	I_{yz}	SLUG-FT^2	
16	6	NR16+ 6	I_{xy}	SLUG-FT^2	

IT	JT	I	R(I)	UNITS	DEFINITION
16	7	NR16+ 7	Δx_{cg}	FEET	c. g. shift from basic c. g.
16	8	NR16+ 8	Δy_{cg}	FEET	
16	9	NR16+ 9	Δz_{cg}	FEET	
16	10	NR16+ 10	C_{m_q}	RAD^{-1}	Damping derivatives
16	11	NR16+ 11	C_{l_p}	RAD^{-1}	
16	12	NR16+ 12	C_{n_r}	RAD^{-1}	
16	13	NR16+ 13	S	FT^2	Reference area
16	14	NR16+ 14	c	FEET	Longitudinal reference length
16	15	NR16+ 15	b	FEET	Lateral reference length
16	16	NR16+ 16	0. or 1.	NONDIM	Body or stability axes tables

Seat alone inputs

IT	JT	I	R(I)	UNITS	DEFINITIONS
16	17	NR16+ 17	W	LB	Weight
16	18	NR16+ 18	I_{xx}	SLUG-FT^2	Moments and products of inertia
16	19	NR16+ 19	I_{yy}	SLUG-FT^2	
16	20	NR16+ 20	I_{zz}	SLUG-FT^2	
16	21	NR16+ 21	I_{xz}	SLUG-FT^2	
16	22	NR16+ 22	I_{yz}	SLUG-FT^2	
16	23	NR16+ 23	I_{xy}	SLUG-FT^2	
16	24	NR16+ 24	Δx_{cg}	FEET	c. g. shift from basic c. g.
16	25	NR16+ 25	Δy_{cg}	FEET	
16	26	NR16+ 26	Δz_{cg}	FEET	
16	27	NR16+ 27	C_{m_q}	RAD^{-1}	Damping derivatives
16	28	NR16+ 28	C_{l_p}	RAD^{-1}	
16	29	NR16+ 29	C_{n_r}	RAD^{-1}	
16	30	NR16+ 30	S	FT^2	Reference area
16	31	NR16+ 31	c	FEET	Longitudinal reference length
16	32	NR16+ 32	b	FEET	Lateral reference length
16	33	NR16+ 33	0. or 1.	NONDIM	Body or stability axes tables

TABLE I (CONT)

Man alone inputs

IT	JT	I	R(I)	UNITS	DEFINITIONS
16	34	NR16+ 34	W	LB	Weight
16	35	NR16+ 35	I_{xx}	SLUG-FT^2	.
16	36	NR16+ 36	I_{yy}	SLUG-FT^2	.
16	37	NR16+ 37	I_{zz}	SLUG-FT^2	Moments and products
16	38	NR16+ 38	I_{xz}	SLUG-FT^2	of inertia
16	39	NR16+ 39	I_{yz}	SLUG-FT^2	.
16	40	NR16+ 40	I_{xy}	SLUG-FT^2	.
16	41	NR16+ 41	Δx_{cg}	FEET	c. g. shift from basic c. g.
16	42	NR16+ 42	Δy_{cg}	FEET	
16	43	NR16+ 43	Δz_{cg}	FEET	
16	44	NR16+ 44	C_{m_q}	RAD^{-1}	Damping derivatives
16	45	NR16+ 45	C_{l_p}	RAD^{-1}	
16	46	NR16+ 46	C_{n_r}	RAD^{-1}	
16	47	NR16+ 47	S	FT^2	Reference area
16	48	NR16+ 48	c	FEET	Longitudinal reference length
16	49	NR16+ 49	b	FEET	Lateral reference length
16	50	NR16+ 50	0. or 1.	NONDIM	Body or stability axes tables
16	51	NR16+ 51	$2\zeta\omega_n$	RAD/SEC	Constant in spine eq. of motion
16	52	NR16+ 52	ω_n^2	RAD^2/SEC^2	Constant in spine eq.
16	53	NR16+ 53	Δx_{cp}	FEET	Aerodynamic center of pressure
16	54	NR16+ 54	Δy_{cp}	FEET	
16	55	NR16+ 55	Δz_{cp}	FEET	
16	56	NR16+ 56	1. or 2.	NON-DIM	Control to follow man or seat
16	57	NR16+ 57			
16	58	NR16+ 58	C_{f_m}	NON-DIM	Man skin friction coefficient
16	59	NR16+ 59			
16	60	NR16+ 60	Δx_{cg}	FEET	Distance from man c. g. to a point on the man for load factor calculations
16	61	NR16+ 61	Δy_{cg}	FEET	
16	62	NR16+ 62	Δz_{cg}	FEET	

Note These output data are for the seat+man, the man alone, or the seat. Before seat-man separation it is for the seat + man. After seat-man separation it is for either the seat or the man depending on which is chosen.

IT	JT	I	R(I)	UNITS	DEFINITIONS
17	0	NR17	ΣC_m	NON-DIM	Total pitching moment coefficient
17	1	NR17+ 1	ΣC_Y	NON-DIM	Total side force coefficient
17	2	NR17+ 2	ΣC_N	NON-DIM	Total normal force coefficient
17	3	NR17+ 3	ΣC_A	NON-DIM	Total axial force coefficient
17	4	NR17+ 4	ΣC_n	NON-DIM	Total yawing moment coefficient
17	5	NR17+ 5	ΣC_l	NON-DIM	Total rolling moment coefficient

Rocket and catapult outputs

IT	JT	I	R(I)	UNITS	DEFINITION
18	0	NR18	F_{x_r}	LB	Seat-man sustainer forces
18	1	NR18+ 1	F_{y_r}		
18	2	NR18+ 2	F_{z_r}		
18	3	NR18+ 3	Γ_{x_r}	FT-LB	Seat-man sustainer moments
18	4	NR18+ 4	Γ_{y_r}		
18	5	NR18+ 5	Γ_{z_r}		
18	6	NR18+ 6	F_r	LB	Seat-man sustainer force magnitude
18	7	NR18+ 7	$F_{x_{pd}}$	LB	Seat-man drag parachute deployment reaction forces
18	8	NR18+ 8	$F_{y_{pd}}$		
18	9	NR18+ 9	$F_{z_{pd}}$		
18	10	NR18+10	$\Gamma_{x_{pd}}$	FT-LB	Seat-man drag parachute deployment reaction moments
18	11	NR18+11	$\Gamma_{y_{pd}}$		
18	12	NR18+12	$\Gamma_{z_{pd}}$		
18	13	NR18+13	$F_{l_{pd}}$	LB	Seat-man drag parachute deployment reaction force magnitude
18	14	NR18+14	F_{x_c}	LB	Seat-man catapult forces
18	15	NR18+15	F_{y_c}		
18	16	NR18+16	F_{z_c}		

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
18	17	NR18+17	τ_{x_c}	FT-LB	Seat-man catapult moments
18	18	NR18+18	τ_{z_c}		
18	19	NR18+19	τ_{z_c}		
18	20	NR18+20	F_{l_c}	LB	Seat-man catapult force magnitude
18	21	NR18+21	$F_{x_{rc}}$	LB	Seat-man recovery parachute reaction forces
18	22	NR18+22	$F_{y_{rc}}$		
18	23	NR18+23	$F_{z_{rc}}$		
18	24	NR18+24	$\tau_{x_{rc}}$	FT-LB	Seat-man recovery parachute reaction moments
18	25	NR18+25	$\tau_{y_{rc}}$		
18	26	NR18+26	$\tau_{z_{rc}}$		
18	27	NR18+27	F_{rc}	LB	Seat-man recovery parachute reaction force magnitude
18	28	NR18+28	$C\alpha_r$	NON-DIM	Seat axis direction cosines for tractor thrust vector
18	29	NR18+29	$C\beta_r$		
18	30	NR18+30	$C\gamma_r$		
18	31	NR18+31	$C\beta_e$	NON-DIM	Earth axis direction cosines for tractor thrust vector
18	32	NR18+32	$C\gamma_e$		
18	33	NR18+33	ϕ	RAD	Earth axis angle of tractor thrust
18	34	NR18+34	$F_{x_{rm}}$	LB	Seat-man roll motor forces
18	35	NR18+35	$F_{y_{rm}}$		
18	36	NR18+36	$F_{z_{rm}}$		
18	37	NR18+37	F_{rm}	LB	Seat-man roll motor force magnitude
18	38	NR18+38	$\tau_{x_{rm}}$	FT-LB	Seat-man roll motor moments
18	39	NR18+39	$\tau_{y_{rm}}$		
18	40	NR18+40	$\tau_{z_{rm}}$		
18	41	NR18+41	$F_{x_{pm}}$	LB	Seat-man No. 1 pitch motor forces opposing pitch-up rates
18	42	NR18+42	$F_{y_{pm}}$		
18	43	NR18+43	$F_{z_{pm}}$		
18	44	NR18+44	F_{pm}	LB	Seat-man No. 1 pitch motor force magnitude
18	45	NR18+45	$\tau_{x_{pm}}$	FT-LB	Seat-man No. 1 pitch motor moments opposing pitch-up rates
18	46	NR18+46	$\tau_{y_{pm}}$		
18	47	NR18+47	$\tau_{z_{pm}}$		
18	48	NR18+48	F_{x_c}	LB	Catapult reaction forces on airplane
18	49	NR18+49	F_{y_c}		
18	50	NR18+50	F_{z_c}		

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
18	51	NR18+51	τ_{x_c}	FT-LB	Catapult reaction moments on airplane
18	52	NR18+52	τ_{y_c}		
18	53	NR18+53	τ_{z_c}		
18	54	NR18+54	$F_{x_{ym}}$	LB	Seat-man yaw motor forces
18	55	NR18+55	$F_{y_{ym}}$		
18	56	NR18+56	$F_{z_{ym}}$		
18	57	NR18+57	F_{ym}	LB	Seat-man yaw motor force magnitude
18	58	NR18+58	$\tau_{x_{ym}}$	FT-LB	Seat-man yaw motor moments
18	59	NR18+59	$\tau_{y_{ym}}$		
18	60	NR18+60	$\tau_{z_{ym}}$		
18	61	NR18+61	$F_{x_{pm}}$	LB	Seat-man No. 2 pitch motor forces opposing pitch-down rates
18	62	NR18+62	$F_{y_{pm}}$		
18	63	NR18+63	$F_{z_{pm}}$		
18	64	NR18+64	F_{pm}	LB	Seat-man No. 2 pitch motor force magnitude
18	65	NR18+65	$\tau_{x_{pm}}$	FT-LB	Seat man No. 2 pitch motor forces opposing pitch-down rates
18	66	NR18+66	$\tau_{y_{pm}}$		
18	67	NR18+67	$\tau_{z_{pm}}$		
18	68	NR18+68	p_j	LB/IN^2	Pressure on piston base
18	69	NR18+69	c_j	SLUGS	Mass of propellant burned at time$_j$
18	70	NR18+70	T_j	°Kelvin	Space average gas temperature at time$_j$

Drag chute outputs

IT	JT	I	R(I)	UNITS	DEFINITION
19	0	NR19	$F_{x_{ps}}$	lb	Seat/man force components from chute through the bridle
19	1	NR19+1	$F_{y_{ps}}$	lb	
19	2	NR19+2	$F_{z_{ps}}$	lb	
19	3	NR19+3	$\tau_{x_{ps}}$	ft-lb	Seat/man moment components from chute through the bridle
19	4	NR19+4	$\tau_{y_{ps}}$	ft-lb	
19	5	NR19+5	$\tau_{z_{ps}}$	ft-lb	
19	6	NR19+6	$F_{x_{sp}}$	lb	Forces on the parachute from bridle reaction on the seat/man
19	7	NR19+7	$F_{y_{sp}}$	lb	
19	8	NR19+8	$F_{z_{sp}}$	lb	

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
19	9	NR19+9	F_{x_m}	lb	Forces on the parachute from air mass acquisition during chute filling
19	10	NR19+10	F_{y_m}	lb	
19	11	NR19+11	F_{z_m}	lb	
19	12	NR19+12	SC_D	ft^2	Parachute drag area
19	13	NR19+13	$SC_{D_{LS}}$	ft^2	Chute drag area at line stretch
19	14	NR19+14	V_p	ft/sec	Parachute airspeed
19	15	NR19+15	R_{x_L}	ft	Earth axis distance components from bridle apex to chute center of gravity (cg)
19	16	NR19+16	R_{y_L}	ft	
19	17	NR19+17	R_{z_L}	ft	
19	18	NR19+18	R_L	ft	Distance from bridle apex to chute cg
19	19	NR19+19	R_m	ft	Chute radius for air mass volume computation
19	20	NR19+20	α	rad	Parachute angle of attack
19	21	NR19+21	SC_L	ft^2	Parachute lift area
19	22	NR19+22			
19	23	NR19+23	t_{LS}	sec	Time at line stretch
19	24	NR19+24	Δt_i	sec	Parachute filling time
19	25	NR19+25	ρ_s	$slug/ft^3$	Stagnation air density in chute
19	26	NR19+26	Vol	ft^3	Parachute volume for mass acquisition term
19	27	NR19+27	$\dot{m}_a$	slug/sec	Chute mass acquisition rate
19	28	NR19+28	F_{x_i}	lb	Force components on chute from parachute ejection rockets or gun
19	29	NR19+29	F_{y_i}	lb	
19	30	NR19+30	F_{z_i}	lb	
19	31	NR19+31	$F_{x_{pso}}$	lb	Penultimate force components on the seat/man through the bridle apex for bridle error criterion
19	32	NR19+32	$F_{y_{pso}}$	lb	
19	33	NR19+33	$F_{z_{pso}}$	lb	

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
19	34	NR19+34	$F_{p_{so}}$	lb	Penultimate bridle force on seat/man
19	35	NR19+35	F_{p_s}	lb	Bridle force on the seat and/or man
19	36	NR19+36	Δx_F	FT	Seat axis co-ordinates of the force application point on the seat/man from the chute as the bridle apex moves
19	37	NR19+37	Δy_F	FT	
19	38	NR19+38	Δz_F	FT	
19	39	NR19+39	A	FT^2	Coefficients of the bridle attach point plane
19	40	NR19+40	B	FT^2	
19	41	NR19+41	C	FT^2	
19	42	NR19+42	D	FT^3	
19	43	NR19+43	F_{x_D}	LB	Force components on the chute from drag, in the earth axis system
19	44	NR19+44	F_{y_D}	LB	
19	45	NR19+45	F_{z_D}	LB	
19	46	NR19+46	F_{x_L}	LB	Force components on the chute from lift, in the earth axis system
19	47	NR19+47	F_{y_L}	LB	
19	48	NR19+48	F_{z_L}	LB	
19	49	NR19+49	$R_{x_{ps}}$	ft	Seat axis distance components from the bridle apex to the chute cg
19	50	NR19+50	$R_{y_{ps}}$	ft	
19	51	NR19+51	$R_{z_{pc}}$	ft	
19	52	NR19+52	θ_{bp}	rad	Line-of-sight elevation angle from the bridle apex to the parachute cg
19	53	NR19+53	ψ_{bp}	rad	Line-of-sight azimuth angle from the bridle apex to the parachute cg

Recovery chute outputs

IT	JT	I	R(I)	UNITS	DEFINITION
20	0	NR20	$F_{x_{ps}}$	lb	Seat/man force components from chute through the bridle
20	1	NR20+1	$F_{y_{ps}}$	lb	
20	2	NR20+2	$F_{z_{ps}}$	lb	
20	3	NR20+3	$\tau_{x_{ps}}$	ft-lb	Seat/man moment components from chute through the bridle
20	4	NR20+4	$\tau_{y_{ps}}$	ft-lb	
20	5	NR20+5	$\tau_{z_{ps}}$	ft-lb	
20	6	NR20+6	$F_{x_{sp}}$	lb	Forces on the parachute from bridle reaction on the seat/man
20	7	NR20+7	$F_{y_{sp}}$	lb	
20	8	NR20+8	$F_{z_{sp}}$	lb	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
20	9	NR20+9	F_{x_m}	lb	Forces on the parachute from air mass acquisition during chute filling
20	10	NR20+10	F_{y_m}	lb	
20	11	NR20+11	F_{z_m}	lb	
20	12	NR20+12	SC_D	ft^2	Parachute drag area
20	13	NR20+13	$SC_{D_{LS}}$	ft^2	Chute drag area at line stretch
20	14	NR20+14	V_p	ft/sec	Parachute airspeed
20	15	NR20+15	R_{x_L}	ft	Earth axis distance components from bridle apex to chute center of gravity (cg)
20	16	NR20+16	R_{y_L}	ft	
20	17	NR20+17	R_{z_L}	ft	
20	18	NR20+18	R_L	ft	Distance from bridle apex to chute cg
20	19	NR20+19	R_m	ft	Chute radius for air mass volume computation
20	20	NR20+20	α	rad	Parachute angle of attack
20	21	NR20+21	SC_L	ft^2	Parachute lift area
20	22	NR20+22	-		
20	23	NR20+23	t_{LS}	sec	Time at line stretch
20	24	NR20+24	Δt_i	sec	Parachute filling time
20	25	NR20+25	ρ_s	$slug/ft^3$	Stagnation air density in chute
20	26	NR20+26	Vol	ft^3	Parachute volume for mass acquisition term
20	27	NR20+27	$\dot{m}_a$	slug/sec	Chute mass acquisition rate
20	28	NR20+28	F_{x_i}	lb	Force components on chute from parachute ejection rockets or gun
20	29	NR20+29	F_{y_i}	lb	
20	30	NR20+30	F_{z_i}	lb	
20	31	NR20+31	F_{x_D}	LB	Force components on the chute from drag, in the earth axis system
20	32	NR20+32	F_{y_D}	LB	
20	33	NR20+33	F_{z_D}	LB	
20	34	NR20+34	F_{x_L}	LB	Force components on the chute from lift, in the earth axis system
20	35	NR20+35	F_{y_L}	LB	
20	36	NR20+36	F_{z_L}	LB	

Airplane-seat-rail input/output

IT	JT	I	R(I)	UNITS	DEFINITION
21	0	NR21	Δx	FT	Distance from A/P CG to some point on A/P in body axis system (Input)
21	1	NR21+ 1	Δy		
21	2	NR21+ 2	Δz		
21	3	NR21+ 3	$D_{11_{ac}}$	NON-DIM	Direction cosines relating airplane to catapult (Output)
21	4	NR21+ 4	$D_{12_{ac}}$		
21	5	NR21+ 5	$D_{13_{ac}}$		
21	6	NR21+ 6	$D_{21_{ac}}$		
21	7	NR21+ 7	$D_{22_{ac}}$		
21	8	NR21+ 8	$D_{23_{ac}}$		
21	9	NR21+ 9	$D_{31_{ac}}$		
21	10	NR21+10	$D_{32_{ac}}$		
21	11	NR21+11	$D_{33_{ac}}$		
21	12	NR21+12	$D_{11_{cs}}$	NON-DIM	Direction cosines relating catapult to seat (Output)
21	13	NR21+13	$D_{12_{cs}}$		
21	14	NR21+14	$D_{13_{cs}}$		
21	15	NR21+15	$D_{21_{cs}}$		
21	16	NR21+16	$D_{22_{cs}}$		
21	17	NR21+17	$D_{23_{cs}}$		
21	18	NR21+18	$D_{31_{cs}}$		
21	19	NR21+19	$D_{32_{cs}}$		
21	20	NR21+20	$D_{33_{cs}}$		
21	21	NR21+21	ψ_{ac}	RAD	Orientation of catapult with respect to airplane (Input)
21	22	NR21+22	θ_{ac}		
21	23	NR21+23	ϕ_{ac}		
21	24	NR21+24	ψ_{cs}	RAD	Orientation of seat with respect to catapult (Input)
21	25	NR21+25	θ_{cs}		
21	26	NR21+26	ϕ_{cs}		
21	27	NR21+27	Δx_{as}	FT	Initial distance from A/P CG to seat CG in A/P axis system (Output)
21	28	NR21+28	Δy_{as}		
21	29	NR21+29	Δz_{as}		

TABLE I (CONT)

Slider block-rail inputs

IT	JT	I	R(I)	UNITS	DEFINITION
21	30	NR21+30	$z_{sb_{r03}}$	FT	Z coordinate-top block at rest
21	31	NR21+31	$z_{sb_{r02}}$	FT	Z coordinate-middle block at rest
21	32	NR21+32	$z_{sb_{r01}}$	FT	Z coordinate-bottom block at rest
21	33	NR21+33	Δx_{sb_1}		
21	34	NR21+34	Δy_{sb_1}	FT	Seat axis coordinates of right lower
21	35	NR21+35	Δz_{sb_1}		block on seat
21	36	NR21+36	Δx_{sb_2}		
21	37	NR21+37	Δy_{sb_2}	FT	Seat axis coordinates of right
21	38	NR21+38	Δz_{sb_2}		middle block on seat
21	39	NR21+39	Δx_{sb_3}		
21	40	NR21+40	Δy_{sb_3}	FT	Seat axis coordinates of right
21	41	NR21+41	Δz_{sb_3}		upper block on seat
21	42	NR21+42	Δx_{sb_4}		
21	43	NR21+43	Δy_{sb_4}	FT	Seat axis coordinates of left
21	44	NR21+44	Δz_{sb_4}		lower block on seat
21	45	NR21+45	Δx_{sb_5}		
21	46	NR21+46	Δy_{sb_5}	FT	Seat axis coordinates of left
21	47	NR21+47	Δz_{sb_5}		middle block on seat
21	48	NR21+48	Δx_{sb_6}		
21	49	NR21+49	Δy_{sb_6}	FT	Seat axis coordinates of left
21	50	NR21+50	Δz_{sb_6}		upper block on seat
21	51	NR21+51	G_x	FT-LB/RAD	Roll element of rigidity matrix
21	52	NR21+52	G_y	FT-LB/RAD	Pitch element of rigidity matrix
21	53	NR21+53	UP	±1	Pos for upward ejection, neg for downward
21	54	NR21+54	STROKE	FT	Catapult stroke
21	55	NR21+55	R_L	FT	Rail length
21	56	NR21+56	B_F	NON-DIM	Slider block coefficient of friction
21	57	NR21+57	G_z	FT-LB/RAD	Yaw element of rigidity matrix
21	58	NR21+58	S_x	LB/FT	Axial rail stiffness
21	59	NR21+59	S_y	LB/FT	Lateral rail stiffness
21	60	NR21+60	S_z	LB/FT	Vertical rail stiffness

IT	JT	I	R(I)	UNITS	DEFINITION
21	61	NR21+61	$x_{ar_{01}}$		
21	62	NR21+62	$y_{ar_{01}}$	FT	A/P axis coordinates of bottom of right rail
21	63	NR21+63	$z_{ar_{01}}$		
21	64	NR21+64	$x_{ar_{02}}$		
21	65	NR21+65	$y_{ar_{02}}$	FT	A/P axis coordinates of bottom of left rail
21	66	NR21+66	$z_{ar_{02}}$		
21	67	NR21+67	B_x		
21	68	NR21+68	B_y	$\frac{\text{FT-LB}}{\text{RAD/SEC}}$	Rail structural damping
21	69	NR21+69	B_z		
21	70	NR21+70	$(\Delta z_{sb})_{sm}$	FT	Lower slider block position at rail trip switch contact

Airplane curve fit coefficients for single wing fan

IT	JT	I	R(I)	UNITS	DEFINITION
22	0	NR22	$X_{0_{10}}$		
22	1	NR22+ 1	$X_{0_{11}}$	NON-DIM	Polynomial curve fit coefficients for C_{x_0}
22	2	NR22+ 2	$X_{0_{12}}$		
22	3	NR22+ 3	$X_{0_{13}}$		
22	4	NR22+ 4			
22	5	NR22+ 5	$V_{x_{10}}$		
22	6	NR22+ 6	$V_{x_{11}}$	RAD^{-1}	Polynomial curve fit coefficients for V_{x_1}
22	7	NR22+ 7	$V_{x_{12}}$		
22	8	NR22+ 8	$V_{x_{13}}$		
22	9	NR22+ 9			
22	10	NR22+10	$V_{x_{20}}$		
22	11	NR22+11	$V_{x_{21}}$	RAD^{-2}	Polynomial curve fit coefficients for V_{x_2}
22	12	NR22+12	$V_{x_{22}}$		
22	13	NR22+13	$V_{x_{23}}$		
22	14	NR22+14			
22	15	NR22+15	$S_{x_{10}}$		
22	16	NR22+16	$S_{x_{11}}$	RAD^{-1}	Polynomial curve fit coefficients for S_{x_1}
22	17	NR22+17	$S_{x_{12}}$		
22	18	NR22+18	$S_{x_{13}}$		

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
22	19	NR22+19			
22	20	NR22+20	$S_{x_{20}}$		
22	21	NR22+21	$S_{x_{21}}$	RAD^{-2}	Polynomial curve fit coefficients for S_{x_2}
22	22	NR22+22	$S_{x_{22}}$		
22	23	NR22+23	$S_{x_{23}}$		
22	24	NR22+24			
22	25	NR22+25	$X_{A_{20}}$	NON-DIM	
22	26	NR22+26	$X_{A_{21}}$	RAD^{-1}	Polynomial curve fit coefficients for X_{A_2}
22	27	NR22+27	$X_{A_{22}}$	RAD^{-2}	
22	28	NR22+28	$X_{A_{23}}$	RAD^{-3}	
22	29	NR22+29			
22	30	NR22+30	DCX/DA_0		
22	31	NR22+31	DCX/DA_1	RAD^{-1}	Polynomial curve fit coefficients for $\partial C_x{}^s/\partial\alpha$
22	32	NR22+32	DCX/DA_2		
22	33	NR22+33	DCX/DA_3		
22	34	NR22+34			
22	35	NR22+35			
22	36	NR22+36	CXAPB1		
22	37	NR22+37	CXAPB2	RAD^{-2}	Polynomial curve fit coefficients for $\partial/\partial\beta v\ (\partial C_x{}^s/\partial\alpha)$
22	38	NR22+38	CXAPB3		
22	39	NR22+39			
22	40	NR22+40	$V_{N_{10}}$		
22	41	NR22+41	$V_{N_{11}}$	PAD^{-1}	Polynomial curve fit coefficients for V_{N_1}
22	42	NR22+42	$V_{N_{12}}$		
22	43	NR22+43	$V_{N_{13}}$		
22	44	NR22+44			
22	45	NR22+45	$V_{N_{20}}$		
22	46	NR22+46	$V_{N_{21}}$	RAD^{-2}	Polynomial curve fit coefficients for V_{N_2}
22	47	NR22+47	$V_{N_{22}}$		
22	48	NR22+48	$V_{N_{23}}$		
22	49	NR22+49			

JT	JT	I	R(I)	UNITS	DEFINITION
22	50	NR22+50	$S_{N_{10}}$		
22	51	NR22+51	$S_{N_{11}}$	RAD^{-1}	Polynomial curve fit coefficients for S_{N_1}
22	52	NR22+52	$S_{N_{12}}$		
22	53	NR22+53	$S_{N_{13}}$		
22	54	NR22+54			
22	55	NR22+55	$S_{N_{20}}$		
22	56	NR22+56	$S_{N_{21}}$	RAD^{-1}	Polynomial curve fit coefficients for S_{N_2}
22	57	NR22+57	$S_{N_{22}}$		
22	58	NR22+58	$S_{N_{23}}$		
22	59	NR22+59			
22	60	NR22+60	$A_{N_{\alpha 10}}$		
22	61	NR22+61	$A_{N_{\alpha 11}}$	NON-DIM	Polynomial curve fit coefficients for $A_{N_{\alpha 1}}$
22	62	NR22+62	$A_{N_{\alpha 12}}$		
22	63	NR22+63	$A_{N_{\alpha 13}}$		
22	64	NR22+64			
22	65	NR22+65	$A_{m_{0_{10}}}$		
22	66	NR22+66	$A_{m_{0_{11}}}$	NON-DIM	Polynomial curve fit coefficients for C_{m_0}
22	67	NR22+67	$A_{m_{0_{12}}}$		
22	68	NR22+68	$A_{m_{0_{13}}}$		
22	69	NR22+69			
22	70	NR22+70	$V_{m_{10}}$		
22	71	NR22+71	$V_{m_{11}}$	RAD^{-1}	Polynomial curve fit coefficients for V_{m_1}
22	72	NR22+72	$V_{m_{12}}$		
22	73	NR22+73	$V_{m_{13}}$		
22	74	NR22+74			
22	75	NR22+75	$V_{m_{20}}$		
22	76	NR22+76	$V_{m_{21}}$	RAD^{-2}	Polynomial curve fit coefficients for V_{m_2}
22	77	NR22+77	$V_{m_{22}}$		
22	78	NR22+78	$V_{m_{23}}$		
22	79	NR22+79			
22	80	NR22+80	$S_{m_{10}}$		
22	81	NR22+81	$S_{m_{11}}$	RAD^{-1}	Polynomial curve fit coefficients for S_{m_1}
22	82	NR22+82	$S_{m_{12}}$		
22	83	NR22+83	$S_{m_{13}}$		
22	84	NR22+84			

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
22	85	NR22+85	S_{m20}		
22	86	NR22+86	S_{m21}	RAD^{-2}	Polynomial curve fit coefficients for S_{m_2}
22	87	NR22+87	S_{m22}		
22	88	NR22+88	S_{m23}		
22	89	NR22+89			
22	90	NR22+90	$C_{p\beta v00}$		
22	91	NR22+91	$C_{p\beta v01}$	NON-DIM	Polynomial curve fit coefficients for $C_{p\beta v_0}$
22	92	NR22+92	$C_{p\beta v02}$		
22	93	NR22+93	$C_{p\beta v03}$		
22	94	NR22+94			
22	95	NR22+95	V_{p10}		
22	96	NR22+96	V_{p11}	RAD^{-1}	Polynomial curve fit coefficients for V_{p_1}
22	97	NR22+97	V_{p12}		
22	98	NR22+98	V_{p13}		
22	99	NR22+99			
22	100	NR22+100	V_{p20}		
22	101	NR22+101	V_{p21}	RAD^{-2}	Polynomial curve fit coefficients for V_{ν_2}
22	102	NR22+102	V_{p22}		
22	103	NR22+103	V_{p23}		
22	104	NR22+104			
22	105	NR22+105	β_{v_0}	RAD	Origin about which X_{A_1} is computed
22	106	NR22+106	$A_{N_{01}}$		
22	107	NR22+107	$A_{N_{02}}$	NON-DIM	Polynomial curve fit coefficients for C_{N_0}, also see NR22+117
22	108	NR22+108	$A_{N_{03}}$		
22	109	NR22+109	$A_{N_{\alpha 2}}$	RAD^{-2}	Polynomial curve fit coefficients for $C_{N(\alpha)}$, also see NR22+60 thru NR22+63 for $A_{N_{\alpha 1}}$
22	110	NR22+110	$A_{N_{\alpha 3}}$		
22	111	NR22+111	$A_{m_{\alpha 2}}$	RAD^{-1}	Polynomial curve fit coefficients for $C_{m(\alpha)}$, also see NR22+115 and NR22+116
22	112	NR22+112	$A_{m_{\alpha 3}}$		
22	113	NR22+113	S_{p_1}	RAD^{-1}	Polynomial curve fit coefficients for $C_{p_{\beta v}}$
22	114	NR22+114	S_{p_2}	RAD^{-2}	

IT	JT	I	R(I)	UNITS	DEFINITION
22	115	NR22+115	$A_{m_{\alpha 0}}$	RAD^{-1}	Polynomial curve fit coefficients for $C_{m(\alpha)}$, also see NR22+111 and NR22+112
22	116	NR22+116	$A_{m_{\alpha 1}}$		
22	117	NR22+117	$A_{N_{00}}$	NON-DIM	See NR22+106 thru NR22+108

Airplane input curve fit coefficients for both wing fans

IT	JT	I	R(I)	UNITS	DEFINITION
23	0	NR23	$C_{N_{ONF_0}}$	NON-DIM	Polynomial curve fit coefficients for $C_{N_{ONF}}$
23	1	NR23+ 1	$C_{N_{ONF_1}}$		
23	2	NR23+ 2	$C_{N_{ONF_2}}$		
23	3	NR23+ 3			
23	4	NR23+ 4			
23	5	NR23+ 5	$C_{x_{ONF_0}}$	NON-DIM	Polynomial curve fit coefficients for $C_{x_{ONF}}$
23	6	NR23+ 6	$C_{x_{ONF_1}}$		
23	7	NR23+ 7	$C_{x_{ONF_2}}$		
23	8	NR23+ 8			
23	9	NR23+ 9			
23	10	NR23+10	$K_{\ell}\eta_{\ell_0}$	NON-DIM	Polynomial curve fit coefficients for $K_{\ell}\eta_{\ell}$
23	11	NR23+11	$K_{\ell}\eta_{\ell_1}$	RAD^{-1}	
23	12	NR23+12	$K_{\ell}\eta_{\ell_2}$	RAD^{-2}	
23	13	NR23+13			
23	14	NR23+14			
23	15	NR23+15	$C_{y_{\beta 0}}$	RAD^{-1}	Polynomial curve fit coefficients for $C_{y_{\beta}}$
23	16	NR23+16	$C_{y_{\beta 1}}$		
23	17	NR23+17	$C_{y_{\beta 2}}$		
23	18	NR23+18			
23	19	NR23+19			
23	20	NR23+20	$C_{l_{\beta A00}}$	RAD^{-1}	Polynomial curve fit coefficients for $C_{l_{\beta_{A0}}}$
23	21	NR23+21	$C_{l_{\beta A01}}$		
23	22	NR23+22	$C_{l_{\beta A02}}$		
23	23	NR23+23	$C_{l_{\beta A03}}$		
23	24	NR23+24			

JT	JT	I	R(I)	UNITS	DEFINITION
23	25	NR23+25	C_{lBA10}	RAD^{-2}	Polynomial curve fit coefficients for $C_{l_{\beta_{a1}}}$
23	26	NR23+26	C_{lBA11}		
23	27	NR23+27	C_{lBA12}		
23	28	NR23+28	C_{lBA13}		
23	29	NR23+29			
23	30	NR23+30	C_{lBA20}	RAD^{-3}	Polynomial curve fit coefficients for $C_{l_{\beta_{a2}}}$
23	31	NR23+31	C_{lBA21}		
23	32	NR23+32	C_{lBA22}		
23	33	NR23+33	C_{lBA23}		
23	34	NR23+34			
23	35	NR23+35	$C_{n\beta 0}$	RAD^{-1}	Polynomial curve fit coefficientsfor C_{n_β}
23	36	NR23+36	$C_{n\beta 1}$		
23	37	NR23+37	$C_{n\beta 2}$		
23	38	NR23+38	$C_{n\beta 3}$		
23	39	NR23+39			
23	40	NR23+40	ϵ_{00}	RAD	Polynomial curve fit coefficients for ϵ_0
23	41	NR23+41	ϵ_{01}		
23	42	NR23+42	ϵ_{02}		
23	43	NR23+43			
23	44	NR23+44			
23	45	NR23+45			
23	46	NR23+46	ϵ_1	NON-DIM	Polynomial curve fit coefficients for ϵ, also see NR23+40 thru NR23+42
23	47	NR23+47	ϵ_2	RAD^{-1}	
23	48	NR23+48			
23	49	NR23+49			
23	50	NR23+50	DCN_{SA0}	NON-DIM	Polynomial curve fit coefficients for $\Delta C_{N(\sin\alpha)}$
23	51	NR23+51	DCN_{SA1}		
23	52	NR23+52	DCN_{SA2}		
23	53	NR23+53	DCN_{SA3}		

TABLE I (CONT)

J	JT	I	R(I)	UNITS	DEFINITION
23	54	NR23+54			
23	55	NR23+55	DCM_{A50}		
23	56	NR23+56	DCM_{A51}	NON-DIM	Polynomial curve fit coefficients for $\Delta C_{m(\sin(\alpha-\alpha_0))}$
23	57	NR23+57	DCM_{A52}		
23	58	NR23+58	DCM_{A53}		
23	59	NR23+59			
23	60	NR23+60	DCM_{SA0}		
23	61	NR23+61	DCM_{SA1}	NON-DIM	Polynomial curve fit coefficients for $\Delta C_{m(\sin\alpha)}$
23	62	NR23+62	DCM_{SA2}		
23	63	NR23+63	DCM_{SA3}		
23	64	NR23+64			
23	65	NR23+65	α_0	RAD	Origin about which $\Delta C_{m(\sin(\alpha-\alpha_0))}$ is computed
23	66	NR23+66	α_{max}	RAD	Angle of attack limit, used to limit aerodynamic coefficients
23	67	NR23+67	$\frac{\partial C_N}{\partial \sin\alpha_{NF}}$	NON-DIM	Variation of normal force coefficient with α_{NF}
23	68	NR23+68	$C_{n_{\delta a_0}}$	RAD^{-1}	Aileron yawing moment coefficient
23	69	NR23+69	$\frac{\partial C_{N_{\delta a}}}{\partial T_c^s}$	RAD^{-1}	Variation of aileron yawing c effectiveness with T_c^s
23	70	NR23+70	β_{max}	RAD	Sideslip angle limit
23	71	NR23+71	$P_{F_{100}}$		
23	72	NR23+72	$P_{F_{NG}}$	FT/SEC	Curve fit coefficients for P_F (wing fan power)
23	73	NR23+73	$P_{F_{NG2}}$		
23	74	NR23+74			
23	75	NR23+75			
23	76	NR23+76	NG	NON-DIM	Percent of engine RPM
23	77	NR23+77	E_{TEST}	LB/FT^2	Tolerance for T_{oooNF} iteration if $E_{TEST} < 0$, do not iterate

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
23	78	NR23+78	K_{*NF_1}	RAD^{-1}	
23	79	NR23+79	K_{*NF_2}	RAD^{-2}	Polynomial curve fit coefficients for K_{*NF}
23	80	NR23+80	K_{*NF_3}	RAD^{-3}	
23	81	NR23+81			
23	82	NR23+82	$K_{N_{NF_1}}$	RAD^{-1}	
23	83	NR23+83	$K_{N_{NF_2}}$	RAD^{-2}	Polynomial curve fit coefficients for $K_{N_{NF}}$
23	84	NR23+84	$K_{N_{NF_3}}$	RAD^{-3}	
23	85	NR23+85	E_{β_v}	RAD	Allowable error in β_v iteration for trim
23	86	NR23+86	E_{β_s}	RAD	Allowable error in β_s iteration for trim
23	87	NR23+87	E_{δ_B}	RAD	Allowable error in δ_B iteration for trim
23	88	NR23+88	E_α	RAD	Allowable error in α iteration for trim
23	89	NR23+89	E_i	RAD	Allowable error in horizontal tail incidence iteration for trim
23	90	NR23+90	E_T	LB	Allowable error in thrust iteration for trim

Airplane aerodynamic coefficient outputs

IT	JT	I	R(I)	UNITS	DEFINITION
24	0	NR24	Cx_{0R}	NON-DIM	Right wing basic axial force coefficient
24	1	NR24+ 1	$Cx_{\beta v_R}$	NON-DIM	Axial force coefficient due to louver vectoring for right wing
24	2	NR24+ 2	$Cx_{\beta s_R}$	NON-DIM	Axial force coefficient due to louver staggering for right wing
24	3	NR24+ 3	$Cx_{(\alpha)_R}$	NON-DIM	Axial force coefficient due to angle of attack of right wing
24	4	NR24+ 4	$C_{N_{0R}}$	NON-DIM	Right wing basic normal force coefficient
24	5	NR24+ 5	$C_{N\beta v_R}$	NON-DIM	Normal force coefficient due to louver vectoring for right wing
24	6	NR24+ 6	$C_{N\beta s_R}$	NON-DIM	Normal force coefficient due to louver staggering for right wing
24	7	NR24+ 7	$C_{N(\alpha)_R}$	NON-DIM	Normal force coefficient due to angle of attack of right wing

TABLE I (CONT)

JT	JT	I	R(I)	UNITS	DEFINITION
24	8	NR24+ 8	Cm_{0_R}	NON-DIM	Right wing basic pitching moment coefficient
24	9	NR24+ 9	$Cm_{\beta v_R}$	NON-DIM	Pitching moment coefficient due to louver vectoring for right wing
24	10	NR24+10	$Cm_{\beta s_R}$	NON-DIM	Pitching moment coefficient due to louver staggering for right wing
24	11	NR24+11	$Cm_{(\alpha)_R}$	NON-DIM	Pitching moment coefficient due to angle of attack of right wing
24	12	NR24+12	$Cp_{\beta v_R}$	NON-DIM	Fan power coefficient due to louver vectoring for right fan
24	13	NR24+13	$Cp_{\beta s_R}$	NON-DIM	Fan power coefficient due to louver staggering for right fan
24	14	NR24+14	Cx_{0_L}	NON-DIM	Left wing basic axial force coefficient
24	15	NR24+15	$Cx_{\beta v_L}$	NON-DIM	Axial force coefficient due to louver vectoring for left wing
24	16	NR24+16	$Cx_{\beta s_L}$	NON-DIM	Axial force coefficient due to louver staggering for left wing
24	17	NR24+17	$Cx_{(\alpha)_L}$	NON-DIM	Axial force coefficient due to angle of attack of left wing
24	18	NR24+18	C_{N0_L}	NON-DIM	Left wing basic normal force coefficient
24	19	NR24+19	$C_{N\beta v_L}$	NON-DIM	Normal force coefficient due to louver vectoring for left wing
24	20	NR24+20	$C_{N\beta s_L}$	NON-DIM	Normal force coefficient due to louver staggering for left wing
24	21	NR24+21	$C_{N(\alpha)_L}$	NON-DIM	Normal force coefficient due to angle of attack of left wing
24	22	NR24+22	Cm_{0_L}	NON-DIM	Left wing basic pitching moment coefficient
24	23	NR24+23	$Cm_{\beta v_L}$	NON-DIM	Pitching moment coefficient due to louver vectoring for left wing
24	24	NR24+24	$Cm_{\beta s_L}$	NON-DIM	Pitching moment coefficient due to louver staggering for left wing
24	25	NR24+25	$Cm_{(\alpha)_L}$	NON-DIM	Pitching moment coefficient due to angle of attack of left wing

IT	JT	I	R(I)	UNITS	DEFINITION
24	26	NR24+26	$C_{P\beta_{v_L}}$	NON-DIM	Fan power coefficient due to louver vectoring for left fan
24	27	NR24+27	$C_{P\beta_{s_L}}$	NON-DIM	Fan power coefficient due to louver staggering for left fan
24	28	NR24+28	$C_{No_{NF}}$	NON-DIM	Normal force coefficient of nose fan
24	29	NR24+29	$C_{x\,o_{NF}}$	NON-DIM	Axial force coefficient of nose fan
24	30	NR24+30	$K_t \eta_t$	NON-DIM	Horizontal tail efficiency factor
24	31	NR24+31	C_{y_β}	RAD^{-1}	Side force stability derivative
24	32	NR24+32	C_{l_β}	RAD^{-1}	Effective dihedral
24	33	NR24+33	C_{n_β}	RAD^{-1}	Directional stability
24	34	NR24+34	ϵ	RAD	Downwash
24	35	NR24+35			
24	36	NR24+36	$\Delta C_{N(\sin\alpha)}$	NON-DIM	Normal force coefficient variation with $\sin\alpha$
24	37	NR24+37	$\Delta C_{m(\sin\alpha-\alpha_0)}$	NON-DIM	Pitching moment variation with $\sin(\alpha-\alpha_0)$
24	38	NR24+38	$\Delta C_{m(\sin\alpha)}$	NON-DIM	Pitching moment coefficient variation with $\sin\alpha$
Airplane Aerodynamic Coefficient Inputs					
24	39	NR24+39	$C_{L_{\alpha_t}}$	RAD^{-1}	H. Tail lift curve slope referenced to H. Tail area
24	40	NR24+40	$C_{L_{\delta_e}}$	RAD^{-1}	Elevator lift effectiveness referenced to H. Tail area
24	41	NR24+41	$C_{D_{o_T}}$	NON-DIM	H. Tail drag coefficient at H. Tail zero lift(parasite drag) , based on H. Tail area
24	42	NR24+42	$C_D/C_{L_t}^{\,2}$	NON-DIM	H. Tail induced drag, referenced to H. Tail area

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
24	43	NR24+43	$K_{x_{NF}}$	NON-DIM	Nose fan axial force variation with thrust reverser door position
24	44	NR24+44	T_j	LB	Turbojet thrust
24	45	NR24+45	$C_{y_{\delta a}}$	RAD^{-1}	Aileron side force coefficient based on wing area, for 1 aileron
24	46	NR24+46	$C_{y_{\delta r}}$	RAD^{-1}	Rudder side force coefficient based on wing area
24	47	NR24+47	$\partial F_y/\partial v$	LB/FT/SEC	Variation of side force with side velocity
24	48	NR24+48	$-C_D S_w$	FT^2	Drag area
24	49	NR24+49	$\partial F_y/\partial r_{NF}$	LB/RAD/SEC	Nose fan side force variation with yaw rate
24	50	NR24+50	C_{y_r}	RAD^{-1}	Side force coefficient variation with non-dimensional yaw rate
24	51	NR24+51	C_{L_q}	RAD^{-1}	Lift coefficient variation with non-dimensional pitch rate
24	52	NR24+52	$K_{N_{NF}}$	NON-DIM	Nose fan normal force variation with thrust reverser door position
24	53	NR24+53	$\partial N/\partial u$	LB/FT/SEC	Variation of normal force with axial velocity
24	54	NR24+54	$\partial N/\partial v$	LB/FT/SEC	Variation of normal force with side velocity
24	55	NR24+55	C_{l_p}	RAD^{-1}	Roll damping
24	56	NR24+56	C_{l_r}	RAD^{-1}	Rotary coupling derivative relating variation of rolling moment coefficient with non-dimensional yaw rate
24	57	NR24+57	$C_{l_{\delta a}}$	RAD^{-1}	Aileron rolling effectiveness, referenced to wing area and wing span, for one aileron
24	58	NR24+58	$C_{l_{\delta r}}$	RAD^{-1}	Rudder rolling effectiveness based on wing area and wing span

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
24	59	NR24+59	$\partial l/\partial v$	FT-LB/FT/SEC	Variation of rolling moment with side velocity
24	60	NR24+60	$\partial l/\partial p_{mf}$	FT-LB/RAD/SEC	Variation of main fan rolling moment roll rate
24	61	NR24+61	$C_{m_{\dot\beta}}$	RAD^{-1}	Pitch-sideslip coupling
24	62	NR24+62	C_{m_q}	RAD^{-1}	Pitch damping
24	63	NR24+63	$\partial m/\partial u$	FT-LB/FT/SEC	Variation of pitching moment with axial velocity
24	64	NR24+64	$\partial C_m/\partial q^s$	$1/LB/FT^2$	Variation of pitching moment coefficient with slipstream q
24	65	NR24+65	$C_{n_{\delta r}}$	RAD^{-1}	Rudder yawing effectiveness based on wing area and wing span
24	66	NR24+66	C_{n_r}	RAD^{-1}	Yaw damping
24	67	NR24+67	C_{n_p}	RAD^{-1}	Rotary coupling derivative, variation of yawing moment coefficient with helix angle
24	68	NR24+68	$\partial n/\partial v$	FT-LB/FT/SEC	Variation of yawing moment with side velocity
24	69	NR24+69	C_DSX	FT^3	Drag area arm
24	70	NR24+70	$\partial n/\partial r_{mf}$	FT-LB/RAD/SEC	Variation of main fan yawing moment with yaw rate
24	71	NR24+71	$\partial n/\partial(X_{NF}{}^2 r)$	FT-LB	Nose fan momentum yaw damping term
24	72	NR24+72	$C_{m_{\dot q}}$	RAD^{-1}	In phase stability derivatives
24	73	NR24+73	C_{m_q}		
24	74	NR24+74	$C_{l_{\dot\beta}}$		
24	75	NR24+75	$C_{n_{\dot\beta}}$		
24	76	NR24+76	$C_{l_{\dot p}}$		
24	77	NR24+77	$C_{l_{\dot r}}$		
24	78	NR24+78	$C_{n_{\dot p}}$		
24	79	NR24+79	$C_{n_{\dot r}}$		
24	80	NR24+80	C_{L_q}		
24	81	NR24+81	$C_{y_{\dot\beta}}$		

TABLE I (CONT)

Airplane Aerodynamic Coefficient Outputs

JT	JT	I	R(I)	UNITS	DEFINITION
24	82	NR24+82	$C_{N(\alpha_{NF})}$	NON-DIM	Normal force coefficient due to nose fan
24	83	NR24+83	$C_{n_{\delta a}}$	RAD^{-1}	Yawing moment slope due to aileron deflection
24	84	NR24+84	C_{L_T}	NON-DIM	Lift coefficient of tail
24	85	NR24+85	C_{D_T}	NON DIM	Drag coefficient of tail
24	86	NR24+86	$C_x{}^s{}_R$	NON-DIM	Axial force coefficient of right wing
24	87	NR24+87	$C_x{}^s{}_L$	NON-DIM	Axial force coefficient of left wing
24	88	NR24+88	C_{x_T}	NON-DIM	Axial force coefficient of tail
24	89	NR24+89	$C_N{}^s{}_R$	NON-DIM	Normal force coefficient of right wing
24	90	NR24+90	$C_N{}^s{}_L$	NON-DIM	Normal force coefficient of left wing
24	91	NR24+91	C_{N_T}	NON-DIM	Normal force coefficient of tail
24	92	NR24+92	$C_m{}^s{}_R$	NON-DIM	Pitching moment coefficient of right wing
24	93	NR24+93	$C_m{}^s{}_L$	NON-DIM	Pitching moment coefficient of left wing
24	94	NR24+94	POF1	NON-DIM	Phase out functions
24	95	NR24+95	POF2		
24	96	NR24+96	K_{ts}	NON-DIM	Thrust spoiler effectiveness

Airplane output thrust and control deflections

IT	JT	I	R(I)	UNITS	DEFINITION
25	0	NR25	$q^s{}_R$	LB/FT^2	Slipstream dynamic pressure of right wing
25	1	NR25+ 1	$q^s{}_L$	LB/FT^2	Slipstream dynamic pressure of left wing
25	2	NR25+ 2	$q^s{}_{AV}$	LB/FT^2	Average slipstream dynamic pressure

JT	JT	I	R(I)	UNITS	DEFINITION
25	3	NR25+ 3	Rq_R	NON-DIM	Ratio of freestream q to slipstream q for right wing
25	4	NR25+ 4	Rq_L	NON-DIM	Ratio of freestream q to slipstream q for left wing
25	5	NR25+ 5	Rq_{AV}	NON-DIM	Average dynamic pressure ratio
25	6	NR25+ 6	Rq_{NF}	NON-DIM	Ratio of freestream q to slipstream q for nose fan
25	7	NR25+ 7	$Tc^s{}_R$	NON-DIM	Slipstream thrust coefficient of right wing
25	8	NR25+ 8	$Tc^s{}_L$	NON-DIM	Slipstream thrust coefficient of left wing
25	9	NR25+ 9	Tc^s	NON-DIM	Average slipstream thrust coefficient
25	10	NR25+10	$T000_R$	LB	Static thrust from right fan at zero speed, zero vector, and zero stagger
25	11	NR25+11	$T000_L$	LB	Static thrust from left fan at zero speed, zero vector, and zero stagger
25	12	NR25+12	$T000_{NF}$	LB	Nose fan static thrust at zero speed
25	13	NR25+13	α_R	RAD	Right wing angle of attack
25	14	NR25+14	α_L	RAD	Left wing angle of attack
25	15	NR25+15	α_{NF}	RAD	Nose fan angle of attack
25	16	NR25+16	βv_R	RAD	Right fan louver vector angle
25	17	NR25+17	βv_L	RAD	Left fan louver vector angle
25	18	NR25+18	βs_R	RAD	Right fan louver stagger angle
25	19	NR25+19	βs_L	RAD	Left fan louver stagger angle
25	20	NR25+20	δ_{aR}	RAD	Right aileron deflection, positive for trailing edge down

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
25	21	NR25+21	δ_{a_L}	RAD	Left aileron deflection, positive for trailing edge down
25	22	NR25+22	δ_r	RAD	Rudder deflection, positive for trailing edge left, relative to plane of symmetry
25	23	NR25+23	δ_T	RAD	H. Tail incidence, positive for trailing edge down, relative to fuselage center line
25	24	NR25+24	δ_e	RAD	Elevator deflection, positive for trailing edge down, relative to H. Tail root chord
25	25	NR25+25	q_{NF}	LB/FT^2	Dynamic pressure of nose fan
25	26	NR25+26	${T_c}^s{}_{NF}$	NON-DIM	Nose fan thrust coefficient
25	27	NR25+27	P_F	$FT\text{-}LB/SEC^2$	Wing fan power
25	28	NR25+28	E_F	LB/FT^2	Error function, Tooo iteration
25	29	NR25+29	δ_B	RAD	Nose fan thrust reverser bucket position

Airplane reference geometry, weight, inertia, and control transfer function coefficients and commanded controls - all inputs

IT	JT	I	R(I)	UNITS	DEFINITION
26	0	NR26	S_w	FT^2	Wing reference area
26	1	NR26+ 1	b	FT	Wing reference span
26	2	NR26+ 2	c	FT	Wing mean aerodynamic chord (M.A.C.)
26	3	NR26+ 3	S_t	FT^2	H. Tail reference area
26	4	NR26+ 4	l_t/c	NON-DIM	H. Tail arm, from the CG to the h. tail M.A.C., positive for tail aft of the CG
26	5	NR26+ 5	z_t/c	NON-DIM	Vertical, non-dimensional distance in the plane of symmetry, from the CG to the h. tail M.A.C., positive for h. tail M.A.C. above CG

IT	JT	I	R(I)	UNITS	DEFINITION
26	6	NR26+ 6	A_F	FT^2	Reference area of two fans
26	7	NR26+ 7	D_F	FT	Reference diameter of one wing fan
26	8	NR26+ 8	Y_F	FT	Spanwise distance from the plane of symmetry to the wing fan hub, > 0
26	9	NR26+ 9	A_{NF}	FT^2	Reference area of nose fan
26	10	NR26+10	X_{NF}	FT	Longitudinal body axis distance, in the plane of symmetry, from the CG to the nose fan hub, > 0
26	11	NR26+11	l_i	FT	Engine thrust horizontal moment arm - distance from the CG to the point of thrust application, positive for thrust point forward of the CG
26	12	NR26+12	z_i	FT	Engine thrust vertical moment arm - distance from the CG to the point of thrust application, positive for thrust point below the CG
26	13	NR26+13	i_e	RAD	Engine thrust vector incidence angle, positive for an upward rotation of the thrust above the body X-axis
26	14	NR26+14	I_{xx}	$SLUG\text{-}FT^2$	Body axis rolling moment of inertia
26	15	NR26+15	I_{yy}	$SLUG\text{-}FT^2$	Body axis pitching moment of inertia
26	16	NR26+16	I_{zz}	$SLUG\text{-}FT^2$	Body axis yawing moment of inertia
26	17	NR26+17	I_{xz}	$SLUG\text{-}FT^2$	Body axis product of inertia
26	18	NR26+18	ω_{x_e}	RAD/SEC	Engine rotation rate
26	19	NR26+19	I_{x_e}	$SLUG\text{-}FT^2$	Engine rolling moment of inertia

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
26	20	NR26+20	I_{z_e}	SLUG-FT²	Engine yawing moment of inertia
26	21	NR26+21	Sin i_e	NON-DIM	Sine of engine incidence
26	22	NR26+22	Cos i_e	NON-DIM	Cosine of engine incidence
26	23	NR26+23	$I_{x_{ep}}$	NON-DIM	Rolling moment of inertia of engine rotating parts
26	24	NR26+24	$I_{z_{ep}}$	NON-DIM	Yawing moment of inertia of engine rotating parts
26	25	NR26+25	$I_{xz_{ep}}$	SLUG-FT²	Product of inertia of engine rotating parts
26	26	NR26+26	Sin i_{ep}	NON-DIM	Sin of incidence of engine rotating parts
26	27	NR26+27	Cos i_{ep}	NON-DIM	Cosine of incidence of engine rotating parts
26	28	NR26+28	I_{xx_a}	SLUG-FT²	A/P rolling moment of inertia excluding variable incidence components
26	29	NR26+29	I_{xz_a}	SLUG-FT²	A/P product of inertia excluding variable incidence components
26	30	NR26+30	I_{zz_a}	SLUG-FT²	A/P yawing moment of inertia excluding variable incidence components
26	31	NR26+31	GW	LB	A/P gross weight
26	32	NR26+32	Δx_{CG}		
26	33	NR26+33	Δy_{CG}	FT	CG shift from base CG
26	34	NR26+34	Δz_{CG}		
26	35	NR26+35	m_e	SLUGS	Mass of engine rotating parts
26	36	NR26+36			Code to short A/P dynamics, +1/-1 (-1, no dynamics)

IT	JT	I	R(I)	UNITS	DEFINITION
26	37	NR26+37			Code to short A/P direction cosine rates, +1/-1, (-1, no rates)
26	38	NR26+38			Code to short A/P earth axis rates, +1/-1, (-1, no rates)
26	39	NR26+39			Maneuver control, subroutine CNTRL
26	40	NR26+40	$\delta_{H_{trim}}$	RAD	
26	41	NR26+41	$\delta_{H_{com}}$	RAD	UHT response to commanded position
26	42	NR26+42	$1/T_H$	SEC	
26	43	NR26+43	t_{delay}	SEC	
26	44	NR26+44	$\delta_{A_{com}}$	RAD	
26	45	NR26+45	$1/T_A$	SEC	Aileron response to a commanded position
26	46	NR26+46	t_{delay}	SEC	
26	47	NR26+47	$T000_{trim}$	LB	
26	48	NR26+48	$T000_{NF-trim}$	LB	
26	49	NR26+49	$T000_{com}$	LB	
26	50	NR26+50	$T000_{NF-com}$	LB	Wing fan and nose fan thrust response to a commanded level
26	51	NR26+51	$1/T_F$	SEC	
26	52	NR26+52	$t_{delay_{WF}}$	SEC	
26	53	NR26+53	$1/T_{NF}$	SEC	
26	54	NR26+54	$t_{delay_{NF}}$	SEC	
26	55	NR26+55	$\beta v_{L_{com}}$	RAD	
26	56	NR26+56	βv_{trim}	RAD	
26	57	NR26+57	$\beta v_{R_{com}}$	RAD	Beta vector response to commanded position
26	58	NR26+58	$1/T_{BV}$	SEC	
26	59	NR26+59	t_{delay}	SEC	

TABLE I (CONT)

IT	JT	I	R(I)	UNITS	DEFINITION
26	60	NR26+60	βs_{trim}	RAD	
26	61	NR26+61	$\beta s_{R_{com}}$	RAD	
26	62	NR26+62	$1/T_{BS}$	SEC	Beta stagger response to commanded position
26	63	NR26+63	t_{delay}	SEC	
26	64	NR26+64	$\beta s_{L_{com}}$	RAD	
26	65	NR26+65	δB_{trim}	RAD	
26	66	NR26+66	δB_{com}	RAD	
26	67	NR26+67	$1/T_{B}$	SEC	Pitch fan bucket response to commanded position
26	68	NR26+68	t_{delay}	SEC	

Rail system outputs

IT	JT	I	R(I)	UNITS	DEFINITION
27	0	NR27	$\Delta \dot{x}_{sb_{rl}}$	FT/SEC	Rail axis velocity components of right lower block relative to the rail
27	1	NR27+ 1	$\Delta \dot{y}_{sb_{rl}}$		
27	2	NR27+ 2	$\Delta \dot{z}_{sb_{rl}}$		
27	3	NR27+ 3	$\Delta \Phi_{cs}$	RAD	Rail angular deformations
27	4	NR27+ 4	$\Delta \theta_{cs}$		
27	5	NR27+ 5	$\Delta \psi_{cs}$		
27	6	NR27+ 6	$\Delta F_{x_{sc}}$	LB	Force components on the seal due to rail friction and rail linear deformation
27	7	NR27+ 7	$\Delta F_{y_{sc}}$		
27	8	NR27+ 8	$\Delta F_{z_{sc}}$		
27	9	NR27+ 9	$\Delta \tau_{x_{sc}}$	FT-LB	Moment components on the seal due to rail friction and rail linear deformation
27	10	NR27+10	$\Delta \tau_{y_{sc}}$		
27	11	NR27+11	$\Delta \tau_{z_{sc}}$		
27	12	NR27+12	$\Delta F_{x_{ac}}$	LB	Force components on the airplane due to rail friction and rail linear deformation
27	13	NR27+13	$\Delta F_{y_{ac}}$		
27	14	NR27+14	$\Delta F_{z_{ac}}$		
27	15	NR27+15	$\Delta \tau_{x_{ac}}$	FT-LB	Moment components on the airplane due to rail friction and rail linear deformation
27	16	NR27+16	$\Delta \tau_{y_{ac}}$		
27	17	NR27+17	$\Delta \tau_{z_{ac}}$		

IT	JT	I	R(I)	UNITS	DEFINITION
27	18	NR27+18	$\Delta x_{sb_{r1}}$	FT	Rail axis components of right lower block
27	19	NR27+19	$\Delta y_{sb_{r1}}$		
27	20	NR27+20	$\Delta z_{sb_{r1}}$		
27	21	NR27+21	$\Delta x_{sb_{r2}}$	FT	Rail axis components of right middle block
27	22	NR27+22	$\Delta y_{sb_{r2}}$		
27	23	NR27+23	$\Delta z_{sb_{r2}}$		
27	24	NR27+24	$\Delta x_{sb_{r3}}$	FT	Rail axis components of right upper blocks
27	25	NR27+25	$\Delta y_{sb_{r3}}$		
27	26	NR27+26	$\Delta z_{sb_{r3}}$		
27	27	NR27+27	$\Delta x_{sb_{r4}}$	FT	Rail axis components of left lower block
27	28	NR27+28	$\Delta y_{sb_{r4}}$		
27	29	NR27+29	$\Delta z_{sb_{r4}}$		
27	30	NR27+30	$\Delta x_{sb_{r5}}$	FT	Rail axis components of left middle block
27	31	NR27+31	$\Delta y_{sb_{r5}}$		
27	32	NR27+32	$\Delta z_{sb_{r5}}$		
27	33	NR27+33	$\Delta x_{sb_{r6}}$	FT	Rail axis components of left upper block
27	34	NR27+34	$\Delta y_{sb_{r6}}$		
27	35	NR27+35	$\Delta z_{sb_{r6}}$		

Upper and lower error bounds for Hamming s method

IT	JT	I	R(I)	DEFINITION
28	0	NR28	u	Upper error bound (absolute value) on each integrated variable for Hamming's method. Refer to tables starting in R(N+1) , page for variable names and units.
28	1	NR28+ 1	v	
.	.	.	.	
.	.	.	.	
28	N-1	NR28+N-1	L_j	
29	0	NR29	u	Lower error bound (absolute value) on each integrated variable for Hamming's method. Refer to tables starting in R(N+1) , page for variable names and units.
29	1	NR29+ 1	v	
.		.	.	
.		.	.	
29	N-1	NR29+N-1	L_j	

IT	JT	I	R(I)	UNITS	DEFINITION
27	18	NR27+18	$\Delta x_{sb_{r1}}$	FT	Rail axis components of right lower block
27	19	NR27+19	$\Delta y_{sb_{r1}}$		
27	20	NR27+20	$\Delta z_{sb_{r1}}$		
27	21	NR27+21	$\Delta x_{sb_{r2}}$	FT	Rail axis components of right middle block
27	22	NR27+22	$\Delta y_{sb_{r2}}$		
27	23	NR27+23	$\Delta z_{sb_{r2}}$		
27	24	NR27+24	$\Delta x_{sb_{r3}}$	FT	Rail axis components of right upper blocks
27	25	NR27+25	$\Delta y_{sb_{r3}}$		
27	26	NR27+26	$\Delta z_{sb_{r3}}$		
27	27	NR27+27	$\Delta x_{sb_{r4}}$	FT	Rail axis components of left lower block
27	28	NR27+28	$\Delta y_{sb_{r4}}$		
27	29	NR27+29	$\Delta z_{sb_{r4}}$		
27	30	NR27+30	$\Delta x_{sb_{r5}}$	FT	Rail axis components of left middle block
27	31	NR27+31	$\Delta y_{sb_{r5}}$		
27	32	NR27+32	$\Delta z_{sb_{r5}}$		
27	33	NR27+33	$\Delta x_{sb_{r6}}$	FT	Rail axis components of left upper block
27	34	NR27+34	$\Delta y_{sb_{r6}}$		
27	35	NR27+35	$\Delta z_{sb_{r6}}$		

Upper and lower error bounds for Hamming s method

IT	JT	I	R(I)	DEFINITION
28	0	NR28	u	Upper error bound (absolute value) on each integrated variable for Hamming's method. Refer to tables starting in R(N+1) , page for variable names and units.
28	1	NR28+ 1	v	
.	.	.	.	
.	.	.	.	
28	N-1	NR28+N-1	L_j	
29	0	NR29	u	Lower error bound (absolute value) on each integrated variable for Hamming's method. Refer to tables starting in R(N+1) , page for variable names and units.
29	1	NR29+ 1	v	
.		.	.	
.		.	.	
29	N-1	NR29+N-1	L_j	

TABLE I (CONT)

IT	JT	I	R(I)	DEFINITION
29	N	NR29+N		Predictor-corrector errors of hamming method
.	.	.		
29	2N-1	NR29+2N-1		
29	2N	NR29+2N		Integrated variables at first saved time point
.	.	.		
29	3N-1	NR29+3N-1		
29	3N	NR29+3N		Integrated variables at second saved time point
.	.	.		
29	4N-1	NR29+4N-1		
29	4N	NR29+4N		Integrated variables at third saved time point
.	.	.		
29	5N-1	NR29+5N-1		
29	5N	NR29+5N		Integrated variables at fourth saved time point
.	.	.		
29	6N-1	NR29+6N-1		
29	6N	NR29+6N		Derivatives at second saved time point
.	.	.		
29	7N-1	NR29+7N-1		
29	7N	NR29+7N		Derivatives at third saved time point
.	.	.		
29	8N-1	NR29+8N-1		

SECTION V
PROGRAM OPTIONS

The computing flow of the escape system program is controlled by selecting a sequence of operations from 16 options which are chosen by inputting descriptive option names to the computer. The alphanumeric word, PLØT, for example, is an instruction to the computer to transfer to a statement number which retrieves specified variables from previously computed time histories and generates SC4020 plots with titles and labels previously read in by the option called ØUTPUT.

Each option name consists of eight characters (some of the characters are blank) left adjusted for input. From one to ten options may be read in on one card using a 20A4 format, each option name requiring two computer words. A function subroutine, named INTERP, interprets the name and returns a value to an integer variable used in a Computed Go To statement that causes a branch to a statement number corresponding to the option name. After completing a specific algorithm, such as trimming the airplane and computing time history initial conditions, a return to option control is effected. The next input variable on the same card is inspected for an option name and the sequence is continued until blanks are encountered on the option card. This is a signal to read in another option card. The program is terminated by one of the options called STØP which dumps the SC4020 buffers and calls the system Exit routine.

The 16 option names are READbNbb, READbRbb, READbRbC, ØUTPUTbb, TIMEbHbb, PLØTbbbb, WRITEbbb, WRITEbRC, CRVFITbb, CØMMENT, DUMPbRbb, TRIMbVTØ, TRIMbCØN, RESTØREb, HELPbbbb, and STØPbbbb. (b means blank)

The use of each option is explained by the following text and examples are given in Section VI. The main program listing in Section VIII is always used by the author for format requirements in setting up computer runs and is superior to any other explanatory text.

1. . Input of Variable Subscripts

The option READ N reads and prints input to the NR-Array, the array which defines the position in the R-matrix where each NR section begins. (See Table I, Section IV) The first card required by the option contains N, the number of differential equations; NR5, the starting point of the R-matrix elements of the NR5 section (NR5 = 4 * N + NAD4 where NAD4 is the number of elements in the NR4 section.); and NTEMP, the total number of NR-subscript addends (the number of NR sections). The format for these three inputs is 18I4.

The input NR-subscript addends (the last element number in each NR section or the number of elements in the section minus 1) are then read by the same format, continuing or additional cards until the list is complete. NR1, NR2, NR3, and NR4 are computed as N, 2N, 3N and 4N, respectively. The remaining NR-subscripts beginning with NR6 are computed in terms of the addends and the previously computed NR-subscript:

NR (I + 1) = NR(I) + NADD(I) + 1
where NADD(I) is the addend for NR(I).

2. Input of Single Element into the Array

The option READ R is invoked to input single elements into the R-matrix, one element per card. The format is:

1	2	3 - 6	7 ——— 18	19 ——— 66
IT		JT	R [NR (IT) + JT]	NALPHA

where

IT and JT — are the NR numbers defining an element of the R-matrix as shown in Table I, Section IV. The format is I2, I4.

R [NR (IT) + JT] — is the floating point value to be stored in the R-matrix element, read in on an E12.5 format.

NALPHA — is element descriptive information to be pointed out with the element in the listing of the input.

This option is terminated by a card with -1 in columns 1 and 2.

3. Input of Multiple Elements into the Array

The READ R C option allows for input of consecutive R-matrix elements, 7 values per card. The first card required by this option contains four fixed point elements (IT1, JT1, IT2, JT2) telling the starting point and ending point for consecutive reading of R elements.

IT1 and JT1 are NR numbers (as defined in Table 1, Section IV) which define the point in the R-matrix to start storing data. JT2 and JT2 are NR numbers which define the last point into which data is to be stored. Also appearing on this card is an array, NALPHA, to be printed out in the listing of the input. NALPHA contains information describing the input data defined by IT1, JT1, IT2, and JT2. The format for this card is (4I4, 12A4).

Following the control card are the card(s) containing the data to be stored in the R-matrix. The format for this data is (7E10.0).

The option is terminated by a blank card. Example:

1 - 4	5 - 8	9 - 12	13 - 16	17 ——— 64	
25	10	25	12	TCOOR, TOCOL, TCOONG	(1)

1 - 10	11 - 20	21 - 30	
5567.	5567.	1577.	(2)

The value 5567. is stored into R(NR25+10), 5567. into R(NR25+11), and 1577. into R(NR25+12).

4. Time History and Plotting Output Initializing

The ØUTPUT option is invoked to tell the program which variables of the time history to output and information about these variables such as their labels for plotting, whether or not to punch the time history or to write a scratch tape or disk and whether or not multiple plots are desired.

Following is an example of the first input card required by this option. The format for the 10 fixed point input variables in 10I4.

1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40
IFPLT	IFPRNT	IFPNCH	NPLTFM	IFINT	IFTITL	NTAPE	LPLØT	IFMULT	NHISTO

NAME	VALUE	DESCRIPTION
IFPLT	1 or -1	Intent to plot; +1, plot -1, do not plot. If plots are to be made, the time histories are stored in core, thereby limiting the length of the time histories run and, in the case of multiple plots, the number of time histories run. If plots are not made, no time history is stored in core.
IFPRNT	1 or -1	Intent to print output; +1, print time history output -1, do not print time history output.
IFPNCH	1 or -1	Intent to punch output time history on cards or store it on an external device (See NTAPE) +1, do punch cards or write on external device -1, do not punch cards or write on external device.
NPLTFM	1,2,3,or 4	Number of plots per frame for SC4020 plot output
IFINT	-1,0,+1	Intent to interpolate between points before plotting; Also used for style of plots. -1, do not interpolate; put only symbols on plots, do not draw lines (Symbols can be used only for multiple plots) 0, do not interpolate; connect points with lines +1, do interpolate and connect interpolated points with lines. Interpolation points are picked every $\frac{XPLØT(LAST)-XPLØT(FIRST)}{20}$ points between XPLØT(LAST) and XPLØT(FIRST) where XPLØT(LAST) is the last independent variable and XPLØT(FIRST) is the first independent variable.

IFTITL	0 or +1	0, read in one title to appear on all plots +1, read in a title for each plot (SEE LPLØT).
NTAPE	Variable	Unit on which time history is punched or written if IFPNCH = 1; NTAPE is assigned the value 7 if input as 0.
LPLØT	Variable ≤ 38	Number of plots to be made; LPLØT controls the number of titles to be read in for the plots; input as 0 if IFTITL = 0
IFMULT	0 or 1	Intent to make multiple plots of time histories (more than one time history plotted on one graph) 0, no multiple plots; each successive time history is stored in core on top of the previous one. 1, multiple plots; each successive time history is stored in core following the previous one (When plots are not made the time histories are not stored in core).
NHISTO	Variable	Restart of time history numbering, used for multiple plots only. As an example, assume 5 time histories are to be run with multiple plots of 1, 2 and 3 and of 1, 4 and 5. Assume, also, that all of these time histories will not fit in the approximately 7000 locations available in core. Time histories 1, 2 and 3 can be run and plotted, the output option can be recalled with NHISTO = 2, and time histories 4 and 5 will be stored on top of 2 and 3. These time histories will now be plotted as 1, 2 and 3.

The second input required by option ØUTPUT is the plot title or titles. If IFTITL = 0, one two-card title is required input in an 8A4 format. If IFTITL = 1, LPLØT (the number of plots) must be read in and LPLØT two-card TITLET's must be read in on an 8A4 format. (LPLØT ≤ 38) These TITLET's must be in an order to correspond with the order of plots described later in the PLØT option.

The next set of inputs required by the output option is the list of NR numbers of the variables to be output by the time history, the scale values for each variable and the label associated with each variable. First, a control, NØUTT, must be read in telling the number of output variables (NØUTT ≤ 38); the format is I4. If NØUTT is positive, the output variables, their scales and labels are read in. If NØUTT is negative, the program assumes that the output variable information remains the same as that in the previous case. No output variables are read in and the program proceeds to the next option. The following example shows the format for inputting the variables, their scales and labels.

1 - 4	
NØUTT	①

1 - 2	3 - 6	7 - 18	19 - 66	
IT	JT	SCALE	NALPHA	②

1 - 20	
LABEL	③

Card #2 - IT, JT - Identifying NR numbers for the variable. See Section IV, Table I. The format is I2, I4.

SCALE - Scaling factor for the output variable. For example, if an angle (in radians in the program) is a desired output, the scale factor might be 57.3 so that the output angle would be in degrees. If no scale factor is desired, SCALE, should be input as 1. The format is E12.5.

NALPHA - Descriptive information for the variable, such as the output variable number. This information does not appear on the plots. The format is 12A4.

Card #3 LABEL - This array contains the variable identification to be used when the variable is plotted. LABEL will appear as either the x or y axis label depending on whether the variable to which it corresponds is the independent or dependent variable. The format is 5A4.

Cards 2 and 3 must be repeated for each of the NØUTT variables. The order of output variables established in this ØUTPUT option is maintained throughout the program. The time history variables will be printed out in this order and variables to be plotted will be selected depending on this order.

5. Time History Computation

After all initial inputs are read in (options READ N, ØUTPUT, READ R, and READ R C) the TIME H option may be called to do the computation. No additional inputs are required by this option. The output for each time history point is controlled by the data read in option ØUTPUT.

If five overflow or divide check errors occur during time history execution the time history is terminated and the DUMPER subroutine is called automatically to print out the entire R-array. (See DUMP R option). The program returns for the next option and computation continues.

6. Plot Output Variable Selection

The PLØT option may be invoked to obtain SC4020 hard copy plots of the time history. Options for single and multiple plots per grid are available but care must be taken to have the data to be plotted stored in the proper form for the desired option. (See ØUTPUT option).

a. Single Plot per Grid Option

This option allows the plotting of one time history, one plot per grid. In the ØUTPUT option the following variables must have been set:

IFPLT	=	1
NPLTFM	=	1, 2, 3, or 4
IFINT	=	0 or 1
IFTITL	=	0 or 1
LPLØT	=	0 or number-of-plots
IFMULT	=	0 or 1

The variables to be plotted are identified by number according to the order in which they were input in the ØUTPUT option. The data are read in on a 36I2 format in the form IX1, IY1, IX2, IY2 ...IX18, IY18 where IX1 and IY1 are the numbers corresponding to the first independent and dependent variables, respectively; IX2 and IY2 are the numbers corresponding to the second independent and dependent variables, etc. If fewer than 18 plots are desired, the remainder of the card is left blank. If more than 18 plots are desired, the option can be continued on a second, third, etc., card. Any blank in an IX position terminates the option.

The following example demonstrates use of the plot option for single plots.

1 - 8
PLØT

1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	11 - 12	13 - 14	15 - 16
1	2	1	3	1	4	1	5

Grid 1 Variable 2 versus Variable 1

Grid 2 Variable 3 versus Variable 1

Grid 3 Variable 4 versus Variable 1

Grid 4 Variable 5 versus Variable 1

b. Multiple Plots per Grid Option

This option allows plotting of multiple time histories on one grid. The following variables must have been set in the ØUTPUT option:

IFPLT	=	1
NPLTFM	=	1, 2, 3, or 4
IFINT	=	-1, 0, +1
LPLØT	=	0 or number of plots
IFTITL	=	0 or 1
IFMULT	=	1

The variables to be plotted are identified by number according to the order in which they were input in the ØUTPUT option and by the number of the stored time history in which they can be found.

One card describes the data for one grid. (This will hereafter be called a grid description card). The data are input on a 40I2 format in the form:

	Col 74	Col 76	Col 78
IX, NHIST1, IY1, NHIST2, IY2...	NGRPLT	IFLAB	IQUAD

where

- **IX** is the number of the independent variable. The value of the independent variable will be taken from the same time history as the corresponding value of the dependent variable.
- **NHIST1** is the number of the time history from which the first dependent variable will be taken.
- **IY1** is the number of the dependent variable in time history NHIST1
- **NHIST2** is the number of the time history from which the second dependent variable will be taken.
- **IY2** is the number of the dependent variable in time history NHIST2.

(NHISTx and IYx are continued until the list is complete. It is usually not practical to plot more than 3 or 4 time histories on one grid).

- **NGRPLT** is the number of time histories to be plotted on one grid.
- **IFLAB** is a control (o or 1) used to determine whether or not symbols and labels for each curve on a grid will be read in.

  IFLAB = 0 DO NOT read symbols and labels.

  IFLAB = 1 READ symbols and labels

- **IQUAD** is the quadrant in which symbol and label definitions will be placed on the grid where:

1	2
3	4

are the quadrants

If IQUAD = 0, the program determines the quadrant most sparsely populated with points and places the symbol and label definitions there.

After plotting one grid, the program returns for another grid description card.

The option is terminated with a blank card.

A second set of inputs is required by this option if IFLAB = 1. These are the symbol and label for each curve on the grid. The symbol will be placed on each point on the curve (with a minimum density restriction of 30 rasters) and the symbol and label corresponding to it will appear in one corner of the grid depending on IQUAD. One card with the symbol and label must be read in for each curve (NGRPLT cards) on an (A4, 2X, 12A4) format. All BCD keypunch symbols plus SQUA (a square) are available for plotting symbols. The label is alphanumeric and can be 20 columns long. The symbols (except for SQUA) must be in column 1.

After plotting one grid with these labels, the program looks for a card describing the next grid. If IFLAB remains zero on these remaining grid description cards, the same labels and symbols will be used and are not read in again. If new symbols and labels are desired, IFLAB can be set equal to 1 and the new labels read in.

The following example will demonstrate the use of this option.

1 - 8
PLØT

1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	73 - 74	75 - 76	77 - 78
1	1	2	2	2	2	1	1

1 - 6	7 - 54
*	AIRPLANE
SQUA	SEAT

1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	73 - 74	75 - 76	77 - 78
1	1	3	2	3	2	0	1
1	1	4	2	4	2	0	1

Grid 1 and Variable 2, time hist 1 versus Variable 1, time hist 1
Variable 2, time hist 2 versus Variable 1, time hist 2

Grid 2 and Variable 3, time hist 1 versus Variable 1, time hist 1
Variable 3, time hist 2 versus Variable 1, time hist 2

Grid 3 and Variable 4, time hist 1 versus Variable 1, time hist 1
Variable 4, time hist 2 versus Variable 1, time hist 2

The symbol (*) will appear on the first curve on each grid and the symbol (□) on the second curve on each grid. The symbol and labels are the same for each grid and will appear in quadrant 1 on each grid.

7. Output of Single Element from the Array

The option WRITE is available for writing or writing and punching elements of the R-matrix. Each element to be printed or punched is defined by one card. The elements are printed out one at a time, but are punched with up to seven per card.

The first input required by this option is a control, IFPNC, intent to punch (format, I4). If IFPNC > 0 cards are punched in addition to the print-out of the elements. Output cards will be punched in (1P7E10.3) format. If IFPNC ≤ 0, cards are not punched.

Following the control, IFPNC, element description cards are stacked, each card describing the element to be printed or punched. The format is: (I2, I4, E12.5, 12A4)

1 - 2	3 - 6	7 - 18	19 - 66
IT	JT	SCALE	NALPHA

Where:

IT and JT — are NR numbers defining the element location within the R-matrix. See Table I, Section IV

SCALE — is the value to be multiplied by the variable before it is printed or punched - a scale factor

NALPHA — identifying information to be printed out with the variable IT, JT, the actual position of the variable within the R-matrix, the scaled value of the variable, and NALPHA will appear in the print out. Only the scaled value will be punched.

This option is terminated by a card with -1 in columns 1 and 2.

8. Output of Multiple Elements from the Array

In order to print or print and punch consecutive elements of the R-matrix, the WRITE R C option should be called.

The first input required by this option is the intent to punch, IFPNC, in an I4 format. If IFPNC > 0, the consecutive data will be printed and then punched in the format required by the consecutive input option READ R C. If INPNC ≤ 0, the consecutive data will be printed but not punched.

Following the control card, IFPNC, element description cards are stacked. Each card describes a set of consecutive elements to be printed or punched. The format is :

(4I4, 12A4)

1 - 4	5 - 8	9 - 12	13 - 16	17 - 64
IT1	JT1	IT2	JT2	NALPHA

where

IT1 and JT1 are NR numbers defining the first element of the R-matrix to be printed or punched (See Table I, Section IV).

IT2 and JT2 are NR numbers defining the last element of the R-matrix to be printed or punched.

All R-matrix elements between and including R(NR (IT1) + JT1) and R (NR (IT2) + JT2) are printed or printed and punched. On the print out IT1, JT1, IT2, JT2, and NALPHA will appear preceding the list of the actual position of the elements within the R-matrix and the value of these elements. On the punch cards a card containing IT1, JT1, IT2, JT2 and NALPHA will precede the cards containing the values of the elements.

This option is terminated by a blank card.

Following the control, IFPNC, element description cards are stacked, each card describing the element to be printed or punched. The format is: (I2, I4, E12.5, 12A4)

1 - 2	3 - 6	7 - 18	19 - 66
IT	JT	SCALE	NALPHA

Where:

IT and JT — are NR numbers defining the element location within the R-matrix. See Table I, Section IV

SCALE — is the value to be multiplied by the variable before it is printed or punched - a scale factor

NALPHA — identifying information to be printed out with the variable IT, JT, the actual position of the variable within the R-matrix, the scaled value of the variable, and NALPHA will appear in the print out. Only the scaled value will be punched.

This option is terminated by a card with -1 in columns 1 and 2.

8. Output of Multiple Elements from the Array

In order to print or print and punch consecutive elements of the R-matrix, the WRITE R C option should be called.

The first input required by this option is the intent to punch, IFPNC, in an I4 format. If IFPNC > 0, the consecutive data will be printed and then punched in the format required by the consecutive input option READ R C. If INPNC ≤ 0, the consecutive data will be printed but not punched.

Following the control card, IFPNC, element description cards are stacked. Each card describes a set of consecutive elements to be printed or punched. The format is :

(4I4, 12A4)

1 - 4	5 - 8	9 - 12	13 - 16	17 - 64
IT1	JT1	IT2	JT2	NALPHA

where

IT1 and JT1 are NR numbers defining the first element of the R-matrix to be printed or punched (See Table I, Section IV).

IT2 and JT2 are NR numbers defining the last element of the R-matrix to be printed or punched.

All R-matrix elements between and including R(NR (IT1) + JT1) and R (NR (IT2) + JT2) are printed or printed and punched. On the print out IT1, JT1, IT2, JT2, and NALPHA will appear preceding the list of the actual position of the elements within the R-matrix and the value of these elements. On the punch cards a card containing IT1, JT1, IT2, JT2 and NALPHA will precede the cards containing the values of the elements.

This option is terminated by a blank card.

9. Least Squares Curve Fit Option

Much of the data in the escape seat simulation was orderly enough to be represented by polynomial functions and the least squares option was programmed to compute these coefficients from dependent-independent variable tables. Because the least squares coefficients vary with configurational changes the curve-fit option, called CRVFIT, was programmed as an integral part of the simulation to allow a time history to be run immediately after determination of the coefficients. The dependent-independent variable tables may be resident in core or may be read in on cards. The resulting curve-fit coefficients may be stored in core for subsequent time history use and may be punched on cards in a format compatible with the input requirements of option READ R.

The first card read in by this option (on a 4I4, 12A4 format) contains the following integers and alphanumeric data:

1-4	5-8	9-12	13-16	17 - 64
IFSTRC	IFPNC	MP	NP	IDENTIFYING COMMENT, NOT RETAINED

IFSTRC controls the core storage of the resulting curve-fit coefficients. For IFSTRC < 0, not stored; for IFSTRC ≥ 0, stored.

IFPNC controls the punching of the coefficients. If IFPNC < 0, not punched; If IFPNC ≥ 0, each coefficient and its associated R-array subscript is punched on a single card with the identifying comment. The cards may be used as input to the READ R option the next time the program is run.

MP is an integer defining the number of points to be used in the curve fitting and NP is the degree of the polynomial ($NP \leq 3$) to which the MP points are to be fitted. If MP is entered as 0 (blank card) this option is terminated.

If core storage is desired, the next card read in contains the integers defining the R-array subscript for storing each coefficient - the core storage need not be consecutive.

1-4	5-8	9-12	13-16	---
IT1	JT1	IT2	JT2	---

The first coefficient will be stored in R(NR(IT1) + JT1), the second coefficient in R(NR(IT2) + JT2), etc. This card is not read in for IFSTRC < 0.

The next card contains, on an I2, I4, E12.5, 12A4 format,

1-2	3-6	7-18	19 - 66
ITX	JTX	XSCALE	IDENTIFYING CODE, NOT RETAINED

If the independent variable is in core, the MP data points are assumed to be consecutively stored starting in R (NR(ITX) + JTX). If the independent variable points are to be read in from cards, enter ITX = 0. XSCALE scales the independent variable unless entered as zero. If XSCALE is entered as zero the independent variable points will not be read in because the least squares matrix will have been generated by a previous computation using the same array of independent variables and a different set of dependent variables;

therefore, the most efficient way to use this option is to fit all functions having identical independent variable arrays, to eliminate the computation of the variance-covariance matrix and matrix inversion.

If the independent variable is read in by cards the next cards contain all of them on a 7E10.0 format.

The next card is for the dependent variable, using an I2, I4, E12.5, 12A4 format (identical to the format for the independent variable) containing: ITY, JTY, YSCALE and identifying information for print-out which is not retained. If ITY > 0, the dependent variable is assumed to be consecutively stored in core starting at R [NR(ITY) + JTY]. The program will retrieve and scale, by multiplying each point by YSCALE, and generate a least squares column vector. If ITY = 0 the next card is presumed to be the dependent variable on a 7E10.0 format.

The curve-fitting is next completed and the coefficients are printed out and processed according to the dictates of IFSTRC and IFPNC from the first card. The program remains in this option, continuously returning to read in the first card described until a blank card is encountered. The reading of a blank card is a signal to terminate the CRVFIT option.

10. Printing Explanatory Comments

The COMMENT option is available for printing comments throughout a run. This option is particularly useful for printing a descriptive paragraph before each time history print out.

The inputs to the option are alphanumeric data in a 20A4 format. Each time the option is called, the program begins writing the comments at the top of a new page.

If the intent to plot, IFPLT = 1, is input previously in the OUTPUT option, these comments will also be written on the plot tape to appear with the plots. Using this procedure, a thorough explanation of the time history can accompany the plots. Each time the COMMENT option is called the comments begin at the top of a new frame.

This option is terminated by a card with blanks in the first eight columns.

11. Dumping the Complete Array

An extremely useful option for debugging problem cases is the DUMP R option which calls the DUMPR subroutine. This subroutine prints the entire R-matrix in decimal format. The output is divided into sections according to NR number and includes with the element its position within the R-matrix. No input is needed to this option except for the initial option request, DUMP R.

12. Trimming the Airplane for VTOL Flight

The option TRIM VTØ calls a subroutine, called TRIMV, that computes airplane VTOL control deflections required for wings level unaccelerated hovering or transition flight. The solution of the non-linear equations is by successive approximations and convergence to the built-in error criteria usually requires about five cycles. Unlike conventional flight controls the VTOL controls have the power to trim at a desired pitch attitude, within reason; consequently, the desired pitch attitude is read in, along with other flight conditions, before this option is called. Because forward speed can be maintained by wing fan vectoring alone, the level of turbojet thrust must be read in and the chosen value will affect the wing fan vector angle. Any altitude and airspeed combinations may be chosen - read in beforehand. In addition, wing fan static thrust (right wing only - the programs assumes left wing and right wing fan static thrust to be equal) and initial guesses must be read in for right vector, right stagger and nose fan bucket angles. The guesses need not be good but fewer computational cycles are required for more accurate guesses. The preliminary inputs are stored in R(NR4 + 93), R(NR4 + 63), R(NR1 + 38), R(NR25 + 16), R(NR25 + 18), R(NR25 + 29), R(NR25 + 10) and R(NR25 + 12). The conventional aerodynamic controls may be set to any desired values and the VTOL trimmed control deflections will reflect the interaction effects. (A common mistake in using this option is to fail to input turbojet thrust, particularly after running a conventional flight time history with a high value of thrust required).

After completion of this option a time history may be run with no further R-array inputs because the outputs from TRIMV are stored as initial conditions for the time history option, TIME H.

13. Trimming the Airplane for Conventional Flight

The option, TRIM CØN, calls a subroutine named TRIMC which computes the required values of angle of attack, horizontal tail incidence and turbojet thrust to trim the airplane for level unaccelerated conventional flight. When this option is called all VTOL controls are set to zero by TRIMC on the assumption that a mixed combination of VTOL/conventional controls will be at a flight condition where VTOL controls dominate; therefore, the 12th option, TRIM VTØ, would have been used.

Before calling TRIM CØN the desired airspeed and altitude will have been stored in R(NR4 + 63) and R(NR1 + 38).

After completion of this option a time history may be run with no further R-array inputs because the outputs from TRIMC are stored as initial conditions for the time history option, TIME H.

14. Transferring Data Within Core

The RESTØRE option is available for storing consecutive R-matrix elements into other consecutive R-matrix positions. The input card required to perform this operation is:

1-4	5-8	9-12	13-16	17-20
N	IT	JT	ITX	JTX

where

N consecutive elements from the R-array starting in R(NR(IT) + JT) will be stored into other R-matrix locations starting in R(NR(ITX) + JTX). See Table I, Section IV for values of IT, JT, ITX, JTX.

Care must be taken when using the RESTØRE option to ensure that values are not stored into portions of the R-matrix used by the program. The user will know which portions of the R-matrix are available for temporary storage.

The RESTØRE option is often used to save the trimmed airplane initial conditions (following NR4, for instance, provided the input for NR5 has left some unused locations after NR4). For the next time history, those values can be restored as initial conditions without having to call the trim option again.

This option is terminated with a blank card.

15. Use of the "Helper" Option

No engineer can foresee all the subsidiary computational requirements that may arise after a computer program becomes operational and the author has found it advisable always to plan for unexpected developments by providing access to a subroutine which is designed to be re-compiled when needed. A call to the option called HELP results in a call to subroutine HELPER (Section VIII source listing) which the user will re-program for his special computing needs. This option is terminated by the return from HELPER. At present, two algorithms are programmed in HELPER; one to check the orthogonality of the direction cosines at the end of a time history and another to punch cards in a DATA statement format allowing basic data to be compiled into the main program, eliminating the necessity to read so much data at each program initiation.

16. Stopping the Program

The STØP option is invoked to terminate execution of the program. If this option is not used, the program will be terminated by the end of file card, but an error message will be issued and, when the intent to plot has been indicated through option ØUTPUT, the plotter buffers will not be dumped and the required end of file mark will not be written on the plot tape.

 (Page 74 is blank.)

SECTION VI
PROGRAM EXAMPLES

It is the intent of this section to lead the inexperienced user of this computer program through a step by step procedure of selecting the appropriate program options, setting up the required input data requested by the options, and displaying the resulting output data in the desired manner for three representative escape system analyses. The first analysis consists of the comparison of two drag parachute types and their resulting performance as a deceleration-stabilization device for an escape seat. The second analysis presents the effects of seat slider block arrangements on escape seat behavior at tip-off. The final analysis describes the recovery from a hard-over roll control failure in which the independent elements of the program - the airplane dynamic simulation, the ejection seat simulation, and the parachute simulation - are incorporated to produce the desired time history.

Before discussing the actual data set up for the first example a brief description of two methods of reading in the program options will be pointed out. A maximum of ten (10) options may be read in on one card, each requiring eight (8) columns, left adjusted. If the options are read in this manner all the required data inputs for these options are read in next with the appropriate termination card at the end of each option's data input requirement. However, it may be desirable to read in only one option on a card. In this procedure the option card, the data input required, and the termination card become a complete unit and can be easily removed from or added to the data deck. Both are acceptable ways of calling the program options; however, the latter procedure may be somewhat easier to follow while learning how to set up data decks. With this in mind the first two examples will use the latter procedure while the last example will incorporate the first procedure.

1. Drag Parachute Comparisons

In the first example two solid cloth parachutes, the flat circular, and ribless guide surface are projected from the back of an ejection seat which has been ejected up a set of flexible rails from an aircraft in straight and level flight at Mach .9 at sea level. It is desired to compute the time history of the ejection seat-drag parachute system through one second. Table II is a listing of the input data required for this example. All input data and computational results are printed out as Table III. Sequence numbers have been added to the extreme right of the input data listing to aid in the following discussion. It should be emphasized that the sequence numbers are merely for reference and are not part of the input data.

The first data input card required (card 1) is a program title card which appears only once for a given run. It can be used to identify the user and the date, or any other pertinent information with up to eighty (80) columns (20A4 format) available for this information.

Following the program title card is the first option card required (card 2) which is the option READ N. This option should always be called first since its function is to define the variable subscripts NR6 through NR30. Cards 3 through 5 are the inputs required by this option. Refer to the definition of option READ N in Section V to obtain the required formats for these data inputs and a complete definition of the values required. Referring to card 3 it shows that there were 45 differential equations, the value of the NR5 subscript was 350, and there were 29 addends to be supplied to this option. Cards 4 and 5 supply the values of the 29 addends as requested. This option is terminated automatically and needs no termination card.

Card 6 is the option ØUTPUT which determines the time history output variables and scale factors desired. It also specifies the manner in which the output variables will be presented. The first input requested by option ØUTPUT (Card 7) are the control integers which specify printing, punching, storing on tape, or plotting and if plotting the required information for the plotting format. Refer to the discussion of the ØUTPUT option in Section V to obtain the required formats for reading in the data required by this option and an extensive definition of the integer controls. For this example it is desired to print and plot the two time histories (one time history for each parachute analyzed). It is also desired to display four (4) plots per frame, with two (2) time histories on each plot, and a two line title at the bottom of each plot. Finally, for clarity and ease of reading the plots it is desired to put symbols on the curves; an asterisk (*) for the flat circular and an Ø for the ribless guide surface. Therefore, the integers read in on card 7 starting with the first are: 1 (plots are desired), 1 (printing is desired), -1 (do not punch), 4 (four plots per frame), 0 (do not interpolate between points), 1 (read in a two line title for each plot), 0 (output is punched on tape 7), 24 (number of plots to be made), 1 (multiple plots on one graph; in this case, 2), 0 (do not restart time history numbering). Referring to the discussion of the ØUTPUT option in Section V if IFTITL = 1 then title's must be read in for each plot desired. The number of plots is determined by the user. In this example 24 plots were desired with each plot having its own title. Therefore IFTITL is read in as 1 and LPLØT (the number of plots) is read in as 24 as shown on card 7. Therefore, the output option requires 24 two-card titles as the second input to this option. These titles appear immediately after card 7 and are represented as cards 8 through 55. The next input required by this option, card 56, designates the number of output variables requested in the time history; for this example 27 output variables (cards 57 through 110). The NR location and scale factor of each output variable appear followed by the label associated with it. These labels will appear along the abscissa or ordinate of the plots specified in the PLØT option. Notice that the output variables are numbered consecutively from 1 to NØUT (number of output variables) in the space allotted for descriptive information. These numbers will be used to identify a given output variable in the PLØT option. This option is terminated automatically and needs no termination card. For clarification of any phase of this option see the discussion of the ØUTPUT option in Section V.

The next option selected is the READ RC option (card 111) which allows for input of consecutive R-MATRIX ELEMENTS. This Read option is best suited for reading in the basic data elements which usually maintain the same value between time histories. Also, the formats used for reading and writing the data by this option provide for a condensed and compact data deck and data listing. The format required by this input option is defined in the discussion of the READ RC option in Section V. As is shown in this example the angle of attack tables, cards 112 through 115 are read in followed by the angle of sideslip tables, cards 116 and 117. Each coefficient must be read in by first holding beta constant and reading in the value of the coefficient for each angle of attack specified in the angle of attack tables. The next value of beta is selected from the beta tables and the procedure is repeated for the same alpha table. In this example there were four values of beta read in; therefore, there are four sets of tables for each aerodynamic coefficient. This option is terminated with a -1 (card 457).

To complete the required input for the first time history the READ R option is selected (card 458) which reads data into the program one element at a time. The R-matrix subscript and value of a given input are supplied on each card along with any descriptive information desired. The format required for this input option is defined in the discussion of the READ R option in Section V. This option is useful in reading in data elements which frequently change value, since the required change can be made rapidly and with minimum chance of input error. Contained in the data input of this READ R are all the initial conditions required to start the time history. For example, starting with card 459 and continuing through card 463 the inputs are: airplane altitude, time history integration interval, time history maximum time, print out interval, and airplane airspeed. The first and last input just mentioned have to be read in at the start of every time history. The integration interval, print out interval and time history maximum time are stored by the program and will remain the same from one time history to the next unless changed by the user. The remaining data input by this READ R option is the parachute data for the flat circular cloth drag parachute. The inputs include parachute geometry, weight, permeability, curve fit coefficients for the chute's aerodynamic coefficients, filling time equation coefficients, a set of attach points for a four line bridle, and various other inputs required all of which are defined in Table I. It is desirable to have the initial conditions and, in this example, the parachute data immediately preceding the time history print out for quick reference since the main purpose of the time history is to analyze the parachute's performance. It is for these reasons that the READ R option was used although the data could have been read in using the READ RC option. This final READ R option is also terminated with a -1 (card 511).

The final step remaining before initiation of the time history is trimming the airplane. This is accomplished by selecting the TRIM CØN option with card 512. This option trims up the airplane in straight and level unaccelerated flight at the altitude and airspeed specified. The altitude and airspeed are the only inputs required by this option and have already been supplied (cards 459 through 463) in the last READ R option. The TRIM CØN option computes all the initial conditions of the airplane required to initiate the time history. No other initial condition inputs are required because the program automatically initializes all other initial conditions in terms of the airplane initial conditions and the system relative geometry. For a complete explanation of the TRIM CØN option see Section V part 13. This option is terminated internally by the program and requires no termination card.

The time history is now computed by calling the TIME H option with card 513. All data input requirements have been satisfied by the read options or the trim option. The variables controlling the time history length, print out interval, and integration interval have already been supplied by the last READ R option. The output variables will be printed out in the order they were specified in the output option and will also be stored in core for subsequent plotting. This option is also terminated by the program at time = t_{max} and requires no termination card.

It is now desired to compute the time history of the escape seat employing the ribless guide surface parachute and using the same initial conditions and system variables as in the previous time history. Therefore, it is necessary only to read in the parachute data for the ribless guide surface and the initial conditions required for the trim option and control of the time history. To do this the READ R option is called again with card 514 and is identical to the last READ R option called except for the drag parachute data. As before, this option is terminated by a -1 (card 561).

The procedure for computing the second time history is the same as the first. First the TRIM CØN option is called (card 562) followed by the TIME H option (card 563). It should be pointed out here that the initial conditions computed by the TRIM CØN option for the first time history could have been saved and used for the second time history; since both time histories are to have the same initial flight conditions. This could have been accomplished using the RESTØRE option. This procedure is more efficient but for clarity and ease in understanding the data set up it was not used here. This procedure will be demonstrated in detail in the second example.

The time history output from both time histories is now stored in core and is available for plotting. Therefore, the next option to be called is the PLØT option (card 564) with the necessary control cards required by this option (card 565 through 591). Each card describes the data for one grid and defines which output variables will appear on it. The output variables are numbered according to the order they appear in the output option. Cards 566 and 567 define the symbol and label for each curve on the grid. These two cards need appear only once if the symbols and labels remain the same for all the plots requested. The first symbol (*) and the label associated with it go with the first time history; the second symbol (Ø) and label with the second time history, and so on. Figures 1 through 24 are the plots generated by this option. There were 28 grids requested by this option; therefore, there are 28 cards defining the data that are to appear on each grid plus one set of symbol and label definitions. For a complete understanding of the plot option and the format's required for the data to this option, it is imperative that the user study the discussion of the plot option in Section V, part 6. This option is terminated by a blank card (card 591).

2. Seat Tip-Off Effects

With the capability built into the program for requesting each of the options as they are needed, it is possible in the same computer run to make seat tip-off studies. With the completion of the parachute time histories and plots, the program is ready to read another option.

Since the output variables for the parachute histories are different from those of the seat tip off time histories, the ØUTPUT option must be called again (card 592). The next card is the control card for this option and has the same values as the first time the ØUTPUT option was used with the exception of two values. IFINT for this case is +1 to provide better curves and LPLØT is 31 since there will be that many plots for this study. Cards 594 through 655 are the titles which will appear on the plots, with the 32 output variables chosen in cards 657 through 720. When the last card of the output variables is read this option is terminated.

The majority of the data used in the parachute study will be the same for the seat tip-off. Therefore, it is only necessary to update this data with another READ R (card 721). The time history is initiated from a trimmed hover so it is necessary to read a jet thrust of zero and the wing and nose fan thrusts which are appropriate. Initial guesses at the V/STOL control variables are read followed by a zero total airspeed. Then a card with -1 in columns 1 and 2 is read to terminate this option.

The VTOL option, TRIM VTØ, is then called with card number 733. The program calculates the trimmed initial conditions of the airplane and stores them in their appropriate locations in the R array.

Since the seat reacts on the airplane through the rails, the weight and inertias of the seat are subtracted from that of the airplane. This is done after the airplane is trimmed with another READ R option. The airplane gross weight and inertias are read as well as the c.g. shift which results. This option is then terminated with a -1.

Two time histories are run and the trimmed initial conditions are required for both histories. To save the calculations of the trim option for the second time history, the RESTØRE option is used. This option is called with card numbered 744. This option restores blocks of consecutive data. For more information see Section V. The next card (no. 745) is for the first block of data restored. The 9 in the first field indicates nine values to be restored. The 1 and the 30 in the next two fields indicates that the starting location of the data to be restored is R(NR1 + 30) and the next two fields dictate R(NR4 + 125) as the first location in which the data will be restored. It follows that the second card of this option specifies that 3 values starting in R(NR4 + 92) are restored starting in R(NR4 + 135).

This option is terminated with a blank card (749). All of the initial conditions are then stored at the end of NR4 as well as their proper location.

With all the necessary data available, the next step is to run the time history. This is accomplished with card (750) which calls the time history option of the program, TIME H. The .15 second time history is then generated with values calculated at every .002 seconds and printed every .01 seconds.

To compare the effects of the slider blocks on tip-off, a second time history is run, this time with no middle slider blocks. In order to simulate no middle blocks, it is necessary to change the data so that the READ R option is used (card 751.). The rail axis rest position of the middle blocks and the seat axis coordinates of the middle blocks which change are read (cards 752-756). The option is again terminated with a -1 (card 757).

The intial conditions for this time history are the same as for the previous one and are saved in R(NR4 + 125) and successive locations. The values are restored back in their original locations with a second use of the RESTORE option. Cards numbered 758 through 763 show the procedure. This option again ends with a blank card (763).

Next the time history is generated by use of the TIME H option (card 764). It also is printed at every .01 seconds for .15 seconds. Since multiple plots are being made this time history is stored behind the first in core.

After the time histories are both completed, they can be plotted on the same graph. To achieve this the PLOT option is called (card 765). All of the output variables are plotted vs time for both time histories. The first plot is of the second variable in each time history vs time (card 766). The symbols used on the first plot are read next (cards 767 and 768). Since these symbols will be used on all the following plots, NFLAB is input as zero on the card for the second plot. It remains zero for all subsequent plots. This PLOT option is terminated with a blank card (798). The resulting plots are shown in Figures 25 through 54.

3. Recovery from Hard-Over Roll Control Failures

In this example a hypothetical VTOL aircraft employing lifting fans for hover and transition has experienced loss of the right wing fan while in transition flight at 46 knots and an altitude of 50 feet. The aircraft begins rolling rapidly to the right due to the resulting asymmetric thrust. The escape seat is ejected at a predetermined bank angle and roll rate combination which well exceeds the limits of the operational envelope. It is desired to compute the time history of the escape seat-pilot combination from occurrence of the failure through full inflation of the recovery chute. The time history output variables will represent the escape seat-pilot combination till the pilot separates from the seat at line stretch of the recovery chute. The output variables will then represent the pilot and recovery chute system for the remainder of the time history.

The options required to perform this time history are presented on card 799 of the input data listing in Table XI. It was mentioned previously that the last example would incorporate the procedure of reading in all the options required on one card. The data required by those options follow card 799 and continue through card 1143. The data input required by each option is terminated either internally or by the proper termination card.

The first option required is the ØUTPUT option. The output variables and associated labels are supplied along with the titles that will appear at the bottom of each plot. The first READ R option is used to update the basic data furnished in example 1. The second READ R furnishes all the inputs required by the TRIM VTØ option which trims the aircraft in transition flight at the desired airspeed, pitch attitude, and altitude. These inputs, cards 1123 through 1130, could have been supplied in the first READ R but for clarity and quick reference to the trim conditions they were supplied by a second READ R. After the airplane has been trimmed by calling the TRIM VTØ option a third READ R option is required. It supplies the necessary fan inputs which simulate the loss of the right wing fan; the maximum time for the time history; the initiation time of the catapult, sustainer rocket, various roll-yaw-pitch stabilization rockets; and projection time of the recovery chute. After this input data has been supplied the TIME H option can be called.

The final step remaining is to incorporate the plot option. Since only one time history was generated it is necessary to supply only the two output variables per grid for each plot desired. The data input is set up exactly as shown in the discussion of the single plot per grid option in Section V, part 6a. The plots are portrayed in Figures 55 through 63.

The program is terminated by requesting the STØP option (card 1144). This option causes the plotter buffers to be dumped, and an end of file to be placed on the plot tape. This option should always be used to terminate the program.

TABLE II

EXAMPLE INPUTS

(Pages 82 - 101)

```
IVAN CLINKENBEARD 19 FEB 70 L1
READ N
  45 350  29
  18   3  75  75  75  75  75  75 146  41  27  62   5  70  53  36  70 117
  90  96  29  68  35  44  44
OUTPUT
   1   1  -1   4   0   1   0  24   1   0
FIG      SOLID CLOTH PARACHUTES
VERT. TAIL VERT. CLEARANCE
FIG      SOLID CLOTH PARACHUTES
VERT. TAIL LONG. CLEARANCE
FIG      SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE
FIG      SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE
FIG  .   SOLID CLOTH PARACHUTES
SEAT AXIAL LOAD FACTOR
FIG      SOLID CLOTH PARACHUTES
SEAT SIDE LOAD FACTOR
FIG      SOLID CLOTH PARACHUTES
SEAT NORMAL LOAD FACTOR
FIG      SOLID CLOTH PARACHUTES
MAN DYNAMIC RESPONSE INDEX
FIG      SOLID CLOTH PARACHUTES
SEAT AIRSPEED
FIG      SOLID CLOTH PARACHUTES
DIST. FROM BRIDLE TO CHUTE CG
FIG      SOLID CLOTH PARACHUTES
SEAT-PARACHUTE AZIMUTH ANGLE
FIG      SOLID CLOTH PARACHUTES
SEAT-PARACHUTE ELEVATION ANGLE
FIG      SOLID CLOTH PARACHUTES
SEAT CLIMB RATE
FIG      SOLID CLOTH PARACHUTES
SEAT EARTH AXIS YAW ANGLE
FIG      SOLID CLOTH PARACHUTES
SEAT EARTH AXIS PITCH ANGLE
FIG      SOLID CLOTH PARACHUTES
SEAT EARTH AXIS BANK ANGLE
FIG      SOLID CLOTH PARACHUTES
  SEAT ALTITUDE
FIG      SOLID CLOTH PARACHUTES
SEAT DOWNRANGE DISTANCE
FIG      SOLID CLOTH PARACHUTES
   SEAT TRAJECTORY
FIG      SOLID CLOTH PARACHUTES
   SEAT TRAJECTORY
FIG      SOLID CLOTH PARACHUTES
SEAT ANGLE OF ATTACK
FIG      SOLID CLOTH PARACHUTES
   SEAT SIDESLIP ANGLE
FIG      SOLID CLOTH PARACHUTES
PARACHUTE ANGLE OF ATTACK
FIG      SOLID CLOTH PARACHUTES
PARACHUTE AREA DRAG COEFF
  27
 4   2 1.          TIME         1
TIME.SEC
 1   7 1.          XESM         2
DOWNRANGE DIST.FT.
```

```
 1   8 1.          YESM         3
LATERAL DIST.FT.
 1   9-1.          ALT SM       4
ALTITUDE.FT.
 4   6 57.3        PSI.SM       5
PSI SM.DEG
 4   7 57.3        THETA.SM     6
THETA SM.DEG
 4   8 57.3        PHI.SM       7
PHI SM.DEG
 0   9 -1.         HDOT SM      8
HDOT SM.FT/SEC
 4  12 1.          UA SM        9
UA SM.FT/SEC
 4  18 1.          NX.CG SM    10
NXCG SM.G
 4  19 1.          NY.CG SM    11
NYCG SM.G
 4  20 1.          NZ.CG SM    12
NZCG SM.G
 4  16 57.3        ALPHA SM    13
ALPHA SM.DEG
 4  17 57.3        BETA SM     14
BETA SM.DEG
19  18 1.0         RL.D        15
RLD.FT
19  20 57.3        ALPHA.DC    16
ALPHA.DC , DEG
19  53 57.3        PSI P.S     17
PSI LOS PS.DEG
19  52 57.3        THETA P.S   18
THETA LOS PS.DEG
19  36 1.0         DXF DC      19
DXF.FT
19  37 1.0         DYF DC      20
DYF.FT
19  38 1.0         DZF DC      21
DZF.FT
19  12 1.0         SCD.DC      22
SCD.DC , SQ.FT.
 1  17 86.85       DRI         23
DRI
 4  88 1.0         DXSA        24
DXSA.FT
 4  89 1.0         DYSA        25
DYSA.FT
 4  90 -1.0        DHSA        26
DHSA.FT
 4  91 1.0         RSA         27
RSA.FT
READ R C
   5   0    5  18 ALPHA TABLES
  -3.1416    -2.785    -2.445     -2.095     -1.746    -1.396    -1.048     ALFA 1-7
  -.700      -.349     .0         .349       .700      1.048     1.396      ALFA8-14
  1.746      2.095     2.445      2.785      3.1416                         ALF15-19
   6   0    6   3 BETA TABLES
  .0         .262      .785       3.1416
   7   0    7  18   CN TABLES
  .0         .04       -.12       -.29       -.34      -.49      -.58       CN1.1 TO
  -.58       - .52     -.26       .04        .40       .62       .66        CN1.19
  .64        .71       .67        .36        .07                            BETA = 0
   7  19    7  37   CN TABLES
```

```
.0          .04         -.12        -.29        -.34        -.49        -.58        CN2,1 TO
-.58        -.52        -.26        .04         .40         .62         .66         CN2,19
.64         .71         .67         .36         .07                                 BETA =15
 7  38   7  56   CN TABLES
.0          .04         -.12        -.29        -.34        -.49        -.58        CN3,1 TO
-.58        -.52        -.26        .04         .40         .62         .66         CN3,19
.64         .71         .67         .36         .07                                 BETA =45
 7  57   7  75   CN TABLES
.0          .04         -.12        -.29        -.34        -.49        -.58        CN4,1 TO
-.58        - .52       -.26        .04         .40         .62         .66         CN4,19
.64         .71         .67         .36         .07                                 BETA=180
 8   0   8  18   CA TABLES
-.90        -.78        -.72        -.45        -.04        .46         .94         CA1,1 TO
1.10        1.18        1.16        .82         .38         .23         .01         CA1,19
-.24        -.71        -1.06       -1.12       -.95                                BETA = 0
 8  19   8  37   CA TABLES
-.90        -.78        -.72        -.45        -.04        .46         .94         CA2,1 TO
1.10        1.18        1.16        .82         .38         .23         .01         CA2,19
-.24        -.71        -1.06       -1.12       -.95                                BETA =15
 8  38   8  56   CA TABLES
-.636       -.551       -.509       -.318       -.028       .325        .665        CA3,1 TO
.778        .835        .820        .580        .268        .162        .007        CA3,19
-.17        -.50        -.75        -.792       -.671                               BETA =45
 8  57   8  75   CA TABLES
-1.16       -.82        -.38        -.23        -.01        .24         .71         CA4,1 TO
1.06        1.12        .90         .78         .72         .45         .04         CA4,19
-.46        -.94        -1.10       -1.18       -1.16                               BETA=180
 9   0   9  18   CM TABLES
-.075       -.188       -.253       -.11        .028        .157        .180        CM1,1 TO
.085        -.024       -.120       -.125       -.08        -.03        .07         CM1,19
.098        .095        .08         .011        -.065                               BETA = 0
 9  19   9  37   CM TABLES
-.075       -.188       -.253       -.11        .028        .157        .180        CM2,1 TO
.085        -.024       -.120       -.125       -.08        -.03        .07         CM2,19
.098        .095        .08         .011        -.065                               BETA =15
 9  38   9  56   CM TABLES
-.075       -.148       -.193       -.10        .028        .107        .130        CM3,1 TO
.075        -.014       -.07        -.075       -.08        -.03        .05         CM3,19
.055        .055        .035        .001        -.065                               BETA =45
 9  57   9  75   CM TABLES
.12         .125        .08         .03         -.07        -.098       -.095       CM4,1 TO
-.08        -.011       .075        .188        .253        .110        -.028       CM4,19
-.157       -.18        -.085       .024        .12                                 BETA=180
10   0  10  18   C YAW TABLES
.0          .0          .0          .0          .0          .0          .0          CN1,1 TO
.0          .0          .0          .0          .0          .0          .0          CN1,19
.0          .0          .0          .0          .0                                  BETA = 0
10  19  10  37   C YAW TABLES
-.1         -.115       -.12        -.10        -.037       -.037       -.1         CN2,1 TO
-.12        -.115       -.10        -.075       -.065       -.07        -.112       CN2,19
-.112       -.07        -.065       -.076       -.10                                BETA =15
10  38  10  56   C YAW TABLES
-.085       -.120       -.143       -.120       .008        .008        -.120       CN3,1 TO
-.143       -.120       -.085       -.05        -.028       -.041       -.130       CN3,19
-.130       -.041       -.028       -.05        -.085                               BETA =45
10  57  10  75   C YAW TABLES
.0          .0          .0          .0          .0          .0          .0          CN4,1 TO
.0          .0          .0          .0          .0          .0          .0          CN4,19
.0          .0          .0          .0          .0                                  BETA=180
11   0  11  18   C ROLL TABLES
.0          .0          .0          .0          .0          .0          .0          CR1,1 TO
.0          .0          .0          .0          .0          .0          .0          CR1,19
```

```
                                                                      BETA = 0
.0         .0         .0         .0         .0
11  19  11  37   C ROLL TABLES
.04        .0         -.06       -.156      -.180      -.180      -.156      CR2.1 TO
.06        .0         .04        .02        -.025      -.095      -.150      CR2.19
.150       -.095      -.025      .02        .04                              BETA =15
11  38  11  56   C ROLL TABLES
.22        .16        .05        -.11       -.355      -.355      -.11       CR3.1 TO
.05        .16        .22        .192       .10        -.055      -.372      CR3.19
-.372      -.055      .10        .192       .22                              BETA =45
11  57  11  75   C ROLL TABLES
.0         .0         .0         .0         .0         .0         .0         CR4.1 TO
.0         .0         .0         .0         .0         .0         .0         CR4.19
.0         .0         .0         .0         .0                               BETA=180
12   0  12  18   CY TABLES
.0         .0         .0         .0         .0         .0         .0         CY1.1 TO
.0         .0         .0         .0         .0         .0         .0         CY1.19
.0         .0         .0         .0         .0                               BETA = 0
12  19  12  37   CY TABLES
-.448      - .48      -.51       -.59       -.32       -.28       -.66       CY2.1 T6
-.780      -.580      -.448      -.480      -.510      -.582      -.321      CY2.19
-.28       -.66       -.78       -.57       -.448                            BETA =15
12  38  12  56   CY TABLES
-1.56      -1.42      -1.16      -1.20      -.61       -.61       -1.43      CY3.1 T6
-1.82      -1.72      -1.56      -1.41      -1.16      -1.23      -.61       CY3. 9
-.61       -1.43      -1.81      -1.72      -1.56                            BETA =45
12  57  12  75   CY TABLES
.0         .0         .0         .0         .0         .0         .0         CY4.1 TO
.0         .0         .0         .0         .0         .0         .0         CY4.19
.0         .0         .0         .0         .0                               BETA=180
13   2  13   9 SUST-DTR.TOR.CAR.CBR.CGR.DXCGR.DYCGR.DZCGR
2.500E-01 1.000E 03 5.740E-01 0.0       -8.200E-01-4.800E-01 0.0
1.110F 00
13  10  13  10 FDB. DEPLOYMENT BAG STRIP OUT FORCE
1.000F 01
13  11  13  16 D.CHUTE IMP.-ROCGUN.DTPD.TOPD.CAPD.CBPD.CGPD
          2.000E-01 1.000E 03-1.000E 00 0.0         0.0
13  17  13  19 D.CHUTE IMPULSE-DXCGPD.DYCGPD.DZPDCG
-1.290F 00 3.200F-01-1.980E 00
13  20  13  23 CATAPULT-A.K1.K3.TOC
5.900E 00 9.000E-02 3.000E-01 1.000E 03
13  27  13  29 CATAPULT-DXCGC.DYCGC.DZCGC
-1.040E 00 0.0       -7.500E-01
13  30  13  30 TIME FROM TRIP SWITCH TO PILOT RELEASE
50.0
13  31  13  36 R.CHUTE IMP.-ROCGUN.DTRC.TORC.CARC.CBRC.CGRC
0.0       3.000E-01 1.000E 03 9.400F-01-3.420E-01 0.0
13  37  13  39 R.CHUTE IMPULSE-DXCGRC.DYCGRC.DZCGRC
-1.270E 00-1.000E-02-2.230E 00
13  40  13  45 TRACTOR-PHIDOTR.PHIOR.IFTRAC.DXCGT.DYCGT.DZCGT
0.0       0.0       -1.000E 00 0.0       0.0       0.0
13  46  13  57 SUST-FR1.T1.FR2.T2.FR3.T3.FR4.T4.FR5.T5.FR6.T6
5.000E 03 2.500E-02 5.000E 03 2.500E-01 0.0       0.0       0.0
0.0       0.0       0.0       0.0       2.740E-01
13  58  13  69 CATAPULT-TV.CV.B.N.C.A1.A2.A3.R/M.VO.CO.PTANG
2.653E 03 2.312E 05 3.160E-02 4.400E-01 7.000E-03 2.800E-01 1.200E 02
1.000E 03 4.162E 04 5.900F 00 5.000E-06 0.0
13  70  13  73 R.CHUTE DEPLOYMENT IMPULSE-T1.FR1.T2.FR2
0.0       3.000E 02 2.500F-01 3.000F 02
13  74  13  77 D.CHUTE DEPLOYMENT IMPULSE-T1.FR1.T2.FR2
0.0       2.000E 02 2.000E-01 2.000F 02
13  78  13  87 ROLL MOTOR-DTRM.TORM.T1.F1.T2.F2.T3.F3.T4.F4
3.200E-01 1.000E 03 0.0       5.000E 02 1.400E-01 5.000F 02 0.0
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-5.000E 02 3.300E-01-5.000E 02
 13  89  13  94 ROLL MOTOR-DXCG,DYCG,DZCG,CARM,CBRM,CGRM
-7.400E-01-7.300E-01-1.010E 00 0.0        -1.000E 00 0.0
 13  95  13 104 PITCH MOTOR 1-DT,T0,T1,FP1,T2,FP2,T3,FP3,T4,FP4
 1.800E-01 5.000E 01 0.0         1.000E 03 1.800E-01 1.000E 03 0.0
 0.0       0.0       0.0
 13 105  13 110 PITCH MOTOR 1-DXCG,DYCG,DZCG,CAPM,CBPM,CGPM
-4.200E-01 0.0         1.320E 00-7.300E-01 0.0        -6.819E-01
 13 111  13 120 PITCH MOTOR 2-DT,T0,T1,FP1,T2,FP2,T3,FP3,T4,FP4
 1.800E-01 5.000E 01 0.0         2.000E 02 1.800E-01 2.000E 02 0.0
 0.0       0.0       0.0
 13 121  13 126 PITCH MOTOR 2-DXCG,DYCG,DZCG,CAPM,CBBP,CGPM
-6.000E-02 0.0         1.470E 00 1.000E 00 0.0         0.0
 13 127  13 136 YAW MOTOR-DT,T0,T1,FY1,T2,FY2,T3,FY3,T4,FY4
 1.800E-01 1.000E 03 0.0         2.000E 02 1.800E-01 2.000E 02 0.0
 0.0       0.0       0.0
 13 137  13 142 YAW MOTOR-DXCG,DYCG,DZCG,CAYM,CBYM,CGYM
-7.700E-01-3.800E-01 5.600E-01 8.012E-01 0.0        -5.983E-01
 13 143  13 144 PITCH MOTORS INITIATION RATES-PITCH UP,DOWN
 2.000E 00-1.000E 00
 14   0  14   3 D.CHUTE-WEIGHT,DXAPEX,DYAPEX,DZAPEX
 1.404E 01-2.920E 00 0.0         0.0
 14   4  14   8 D.CHUTE-RLINES,RSC,RIN,RLO,K
 1.332E 01 3.330E 00 1.405E 00 1.500E 01 6.000E 03
 14   9  14  17 D.CHUTE-B1,B2,B3,C1,C2,SCTI,K1,K2,K3
 8.493E-02-1.533E-01 8.215E-02-6.113E-01 1.741E-01 1.500E 01 1.090E-01
 2.640E-01 1.000E 00
 14  18  14  21 D.CHUTE-POROSITY,DTGUN,B0,FD
 2.200E-01 0.0         8.070E-03 9.100E-01
 14  22  14  27 D.CHUTE BRIDLE-DX1,DY1,DZ1,DX2,DY2,DZ2
-1.210E 00 6.660E-01-8.340E-01-1.210E 00-6.660E-01-8.340E-01
 14  28  14  33 D.CHUTE BRIDLE-DX3,DY3,DZ3,DX4,DY4,DZ4
-5.000E-01-6.660E-01 1.415E 00-5.000E-01 6.660E-01 1.415E 00
 14  34  14  35 D.CHUTE-ALLOWABLE FORCE DIR COS ERR, NO. LINES
 5.000E-02 4.000E 00
 14  36  14  41 D.CHUTE-SCTA,SCTA2,SCTA3,SCNA,SCNA2,SCNA3
-7.750E-01-3.460E 01 2.085E 01 4.430E 01-4.410E 00-2.800E 00
 15   0  15   3 R.CHUTE-WEIGHT,DXAPEX,DYAPEX,DZAPEX
 1.790E 01 0.0         0.0        -2.590E 00
 15   4  15   8 R.CHUTE-RLINES,RSC,RIN,RLO,K
 2.283E 01 1.400E 01 4.870E 00 2.300E 01 2.000E 04
 15   9  15  17 R.CHUTE-B1,B2,B3,C1,C2,SCTI,K1,K2,K3
 8.493E-02-1.533E-01 8.215E-02-1.413E 00 6.031E-01 4.610E 02 0.0
 1.210E-01 1.000E 00
 15  18  15  21 R.CHUTE-POROSITY,DTGUN,B0,FD
 1.000E-01 8.000E-01 8.070E-03 1.000E 00
 15  22  15  27 R.CHUTE-SCTA,SCTA2,SCTA3,SCNA,SCNA2,SCNA3
 1.341E 01 8.910E 01-1.715E 02-3.820E 01 3.700E 01 3.970E 01
 16   0  16   6 SEAT/MAN-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
 3.544E 02 1.199E 01 2.262E 01 1.062E 01 3.020E 00 0.0         0.0
 16   7  16  15 SEAT/MAN-DXCG,DYCG,DZCG,CMQ,CLP,CNR,S,C,B
 0.0       0.0       0.0        -6.000E-01-2.600E-02-3.000E-02 5.050E 00
 3.820E 00 3.820E 00
 16  16  16  16 SEAT/MAN-0. IF BODY AXIS AERO,1. IF STABILITY
 0.0
 16  17  16  23 SEAT-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
 2.044E 02 3.830E 00 6.130E 00 2.300E 00-1.880E 00 0.0         0.0
 16  24  16  32 SEAT-DXCG,DYCG,DZCG,CMQ,CLP,CNR,S,C,B
 0.0       0.0       0.0        -6.000E-01-2.600E-02-3.000E-02 5.050E 00
 3.820E 00 3.820E 00
 16  33  16  33 SEAT-0. IF BODY AXIS AERO,1. IF STABILITY
 0.0
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 16  34  16  40 MAN-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
1.500E 02 1.300E 01 1.500E 01 6.000E 00 0.0        0.0        0.0
 16  41  16  49 MAN-DXCG,DYCG,DZCG,CMQ,CLP,CNR,S,C,B
0.0        0.0        0.0       -6.000E-01-2.600E-02-3.000E-02 6.000E 00
0000F-01 1.375F 00
 16  50  16  50 MAN-0. IF BODY AXIS AERO,1. IF STABILITY
0.0
 16  51  16  52 MAN-SPINAL CONSTANTS 2*ZETA*OMEGA,OMEGA**2
2.370E 01 2.795E 03
 16  53  16  55 MAN AERO CP-DXCP,DYCP,DZCP
7.450E-02 0.0        9.000E-02
 16  56  16  56 1. FOLLOWS MAN AFTER SEAT/MAN SEPARATION,2.SEAT
1.000E 00
 16  58  16  58 MAN SKIN FRICTION COEFFICIENT
0.0
 16  60  16  62 MAN-LOAD FACTOR POINT ON MAN DX,DY,DZ
0.0        0.0       -1.665F 00
 21   0  21   2 DX,DY,DZ CO-ORDINATES OF A/P POINT,VERT. TAIL--
-1.650E 01 0.0       -9.000E 00
 21  21  21  26 PSIAC,THETAAC,PHIAC,PSICS,THETACS,PHICS
0.0        2.965E-01 0.0        0.0       -2.965E-01 0.0
 21  30  21  32 RAIL AXIS Z COORDINATE-TOP,MIDDLE,BOTTOM BLOCKS
-2.796E 00-1.252E 00-5.853E-01
 21  33  21  35 DXSB1,DYSB1,DZSB1 IS RT LOWER BLOCK SEAT POS.
-5.596E-01 8.600E-01 1.361E 00
 21  36  21  38 DXSB2,DYSB2,DZSB2 IS RT MIDDLE BLOCK SEAT POS.
-7.545E-01 8.600E-01 7.234F-01
 21  39  21  41 DXSB3,DYSB3,DZSB3 IS RT UPPER BLOCK SEAT POS.
-1.206E 00 8.600E-01-7.533F-01
 21  42  21  44 DXSB4,DYSB4,DZSB4 IS LEFT LOWER BLOCK SEAT POS.
-5.596E-01-8.600E-01 1.361E 00
 21  45  21  47 DXSB5,DYSB5,DZSB5 IS LEFT MID. BLOCK SEAT POS.
-7.545E-01-8.600E-01 7.256E-01
 21  48  21  50 DXSB6,DYSB6,DZSB6 IS LEFT UPPER BLOCK SEAT POS.
-1.206E 00-8.600E-01-7.533E-01
 21  51  21  60 GX,GY,UP,STROKE,RAIL LNGTH,BF,GZ,SX,SY,SZ
1.000E 06 1.000E 06 1.000E 00 2.833E 00 3.990E 00 2.000E-02 1.000E 06
5.000F 03 5.000E 03 5.000F 03
 21  61  21  63 XAR01,YAR01,ZAR01 IS A/P POS. BOTTOM RT RAIL
1.005E 01 1.990E 00 7.200F-01
 21  64  21  66 XAR02,YAR02,ZAR02 IS A/P POS. BOTTOM LEFT RAIL
1.005E 01 2.700E-01 7.200F-01
 21  67  21  70 BX,BY,BZ,POS.LOWER BLOCK AT TRIP SWITCH CONTACT
5.530E 03 7.600E 03 5.120F 03-3.000E 00
 22   0  22 117 AIRPLANE CURVE FIT COEF. FOR SINGLE WING FAN
-2.635E-03-4.117E 00 7.467E 00-3.560E 00 0.0        1.234E 00-5.045E 00
8.035E 00-4.226E 00 0.0       -6.629E-01 4.859E 00-9.550E 00 5.354E 00
0.0       -4.815E-02-1.462F 00 7.014E 00-5.504E 00 0.0       -6.784E-02
-1.644E 00 6.601E 00-4.890F 00 0.0        2.800E-03-1.691E 00 9.764E 00
1.544E 01 0.0       -3.323E-02 3.759E 00-1.921E 00-1.067E 00 0.0
3.621E-02-1.198E 01 5.208E 01-4.013E 01 0.0       -1.869E-01-1.481E 00
5.779E 00-4.112E 00 0.0       -6.277E-01 3.014E 00-4.664E 00 2.278E 00
0.0       -1.217E-01 5.251E-01-6.896E-01 2.857E-01 0.0       -5.490E-01
1.453E-02 3.854E 00-3.320E 00 0.0        4.424E-01 1.673E 01-6.805E 00
1.228E 01 0.0       -4.883E-02 1.344E 00-4.817E 00 3.296E 00 0.0
4.433E-01-3.154E 00 6.214E 00-3.502E 00 0.0       -2.534E-01-6.191E-02
2.092E-01 1.050E-01 0.0        1.315E-01-1.720E 00 3.642E 00-2.053E 00
0.0       -9.432E-02-4.698E-01 1.317E 00-7.543E-01 0.0        9.980E-01
-1.533E 00 3.805E-01 1.535F-01 0.0        1.114E-01 4.119E 00-4.164E 01
1.066E 02 0.0       -4.758F-01-2.128E 00 2.844E 01-6.172E 01 0.0
8.725E-01 3.473E 00-4.529E 00 1.090E-01-1.379E-01 5.515E 00-1.908E 01
1.481E 01-1.554E-02-2.237E-01 9.506E-03 9.084E 00 9.368E-01
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 23   0  23  70 AIRPLANE CURVE FIT COEF. FOR BOTH WING FANS
 1.000E 00-1.000E 00 0.0         0.0         0.0         0.0        -2.840E 00
 2.840E 00 0.0         0.0         9.140E-01-1.609E-01-1.346E 00 0.0
 0.0         0.0        -3.116E 00 7.467E 00 0.0         0.0        -1.661E-03
-1.215E-01 1.128E-01-7.169E-02 0.0         2.619E-02-2.222E 00 1.254E 01
-1.101E 01 0.0        -8.868E-02 5.618E 00-3.901E 01 3.411E 01 0.0
 2.997E-03 1.300E-01 4.558E-02-1.802E-02 0.0         1.800E-01-4.590E-01
 3.685E-01 0.0         0.0         0.0         2.367E-01 8.812E-01 0.0
 0.0         1.150E-02 2.818E-01-6.620E-02-1.327E-01 0.0        -4.360E-02
-7.200E-02-1.336E-01-1.081E-01 0.0        -0.0         1.216E-01 0.0
-1.307E-01 0.0         8.725E-01 3.491E-01 6.250E 00-5.730E-03-1.780E-02
 3.491E-01
 23  71  23  73 PF100,PFNG,PFNG2 ARE FAN POWER CURVEFIT COEF.
 0.0         0.0         0.0
 23  76  23  77 ENGINE RPM AND THRUST ITERATION TOLERANCE
 1.000E 02-1.000E 00
 23  78  23  80 KXNF1,KXNF2,KXNF3 ARE NOSE FAN AXIAL FORCE COEF
 2.990E 00-2.719E 00 6.991E-01
 23  82  23  84 KNNF1,KNNF2,KNNF3 ARE NOSE FAN NORM. FORCE COEF
-1.154E 00 1.467E 00-3.206E-01
 23  85  23  90 EBV,EBS,EDB,EA,EI,ET ARE TRIM TOLERANCES
 1.000E-02 1.000E-02 1.000E-02 1.745E-03 1.745E-03 5.000E 01
 24  39  24  45 CLAT,CLDE,CDOT,CDCL2T,AKXNF,TJ,CYDA
3.037       1.318       .015        0.1         1.0         0.0         -.0344
 24  46  24  52 CYDR,PFYPV,CDSW,PFYRNF,CYR,CLQ,AKNNF
.1117       -31.8       317.        -61.328     .625        3.44        .425
 24  53  24  59 PNPU,PNPV,CLP,CLR,CLDA,CLDR,PLPV
3.0         10.         -.31        .15         .0504       .0143       -134.
 24  60  24  66 PLPPMF,CMB,CMQ,PMPU,PCMSOS,CNDR,CNRYAW
-645.7      -.356       -6.9        134.        35.5        -.0699      -.4
 24  67  24  73 CNP,PYAWV,CDSX,FYWRMF,PYAWXN,CMADOT,CMQDOT
-.02        47.         560.        -645.7      -4.38       -2.296      0.
 24  74  24  80 CLBDOT,CNBDOT,CLPDOT,CLRDOT,CNPDOT,CNRDOT,CLADOT
0.          0.          0.          0.          0.          0.          1.148
 24  81  24  81 CYBDOT
0.
 24  96  24  96 AKTS
1.0
 25  10  25  12 TOOOR,TOOOL,TOOONF
5567.       5567.       1577.
 25  16  25  24 BVR,BVL,BSR,BSL,DAR,DAL,DR,DELTAH,DELTAE
-.0375      -.0375      .6238       .6238       0.          0.          0.
.349        0.
 25  29  25  29 NOSE FAN BUCKET POSITION
1.0
 26   0  26  35 AIRPLANE GEOM.,WEIGHT,INERTIA
 2.600E 02 2.983E 01 9.400E 00 5.286E 01 2.192E 00 8.319E-01 4.260E 01
 5.200E 00 5.070E 00 7.070E 00 1.560E 01 1.402E 01 1.531E 00 1.040E-01
 4.252E 03 1.514E 04 1.742E 04 9.190E 02 0.0         3.020E 01 1.500E 01
 1.000E 00 0.0         0.0         0.0         0.0         0.0         1.000E 00
 0.0         0.0         0.0         9.200E 03 0.0         0.0         0.0
 1.500E 01
 26  36  26  38 SHORT OF A/P DYN.,A/P DIR.COS.,A/P EARTH RATES
 1.000E 00 1.000E 00 1.000E 00
 26  39  26  39 A/P MANEUVER CONTROL
 1.000E 00
 26  40  26  43 H.TAIL-DHTRIM,DHCOMMAND,1/TH,TDELAY
 0.0         0.0         20.0        0.0
 26  44  26  46 AILERON-DACOMMAND,1/TA,TDELAY
 0.0         25.         0.0
 26  47  26  50 WING,NOSE FAN-TOOO,TOOONF,TOOOCOM,TOOONCOM
 0.0         0.0         0.0         0.0
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 26   51   26   54 WING,NOSE FAN-1/TF,TDELF,1/TNF,TDELNF
.815       .2          1.66        .2
 26   55   26   59 BVLCOM,BVTRIM,BVRCOM,1/TBV,TDELAYBV
[illegible]        0.0         0.0         22.         0.0
[illegible]   60   26   64 BSTRIM,BSRCOM,1/TBS,TDELAYBS,BSLCOM
0.0        0.0         22.         0.0         0.0
 26   65   26   68 DBTRIM,DBCOM,1/TB,TDELAYB
0.0        0.0         10.0        0.0
 28    0   28   44 UPPER PREDICTOR-CORRECTOR ERROR BOUNDS
4.000E-02 1.000E-01 4.000E-02 5.000E-02 5.000E-02 5.000E-02 1.000E 01
1.000E 01 1.000E 01 2.000E-02 2.000E-02 2.000E-02 2.000E-02 2.000E-02
2.000E-02 1.000E-02 1.000E-02 1.000E-01 1.000E-01 1.000E-01 1.000E 01
1.000E 01 1.000E 01 1.000E-01 1.000E-01 1.000E-01 1.000E 01 1.000E 01
1.000E 01 4.000E-02 1.000E-01 4.000E-02 3.000E-02 3.000E-02 3.000E-02
1.000E 01 1.000E 01 1.000E 01 2.000E-02 2.000E-02 2.000E-02 2.000E-02
2.000E-02 2.000E-02 4.000E-02
 29    0   29   44 LOWER PREDICTOR-CORRECTOR ERROR BOUNDS
3.000E-03 3.000E-03 3.000E-03 3.000E-03 3.000E-03 3.000E-03 5.000E 00
5.000E 00 5.000E 00 1.000E-03 1.000E-03 1.000E-03 1.000E-03 1.000E-03
1.000E-03 1.000E-03 1.000E-03 1.000E-02 1.000E-02 1.000E-02 5.000E 00
5.000E 00 5.000E 00 1.000E-02 1.000E-02 1.000E-02 5.000E 00 5.000E 00
5.000E 00 1.000E-03 1.000E-03 1.000E-03 4.000E-03 3.000E-02 3.500E-03
5.000E 00 5.000E 00 5.000E 00 1.000E-03 1.000E-03 1.000E-03 1.000E-03
1.000E-03 1.000E-03 1.000E-02
-1
READ R
  1   38 0.           ZE A/P
  4    3 .002         DT
  4    4 1.0          TMAX
  4    5 .01          DT,PRINT
  4   63 1020.0       AIRSPEED A/P
 13    3 .125         TOR
 13   13 .075         TO,DP
 13   23 0.           TOC
[illegible]    0 1.80         WEIGHT,FLAT CIRC. CLOTH DP=2.22
[illegible]    1 -2.92        X APEX OF BRIDLE
 14    2 0.           Y APEX OF BRIDLE
 14    3 0.           Z APEX OF BRIDLE
 14    4 3.18         RLINES-FLAT CIRCULAR CLOTH DC
 14    5 1.59         RSC-FLAT CIRCULAR CLOTH DC
 14    6 1.03         RIN-FLAT CIRCULAR CLOTH DC
 14    7 10.0         RLO,RUNS 1,2
 14    8 7000.0       K
 14    9 .084928      B1
 14   10 -.15327      B2
 14   11  .082146     B3
 14   12 -1.4129      C1 ,FLAT CIRCULAR CLOTH
 14   13 .6031        C2 ,FLAT CIRCULAR CLOTH
 14   14 7.00         SCDI
 14   15 .339         K1,CLOTH PARACHUTE
 14   16 .121         K2,CLOTH PARACHUTE
 14   17 1.0          K3,CLOTH PARACHUTE
 14   18 .01          CC,CLOTH PARACHUTE, ALT=SL
 14   19 0.           DTGUN
 14   20 .00807       B0
 14   21 .71          FD,RUNS 1,2
 14   22 -1.21        DX1
 14   23 -.666        DY1
 14   24 -.834        DZ1
 14   25 -.50         DX2
 14   26 -.666        DY2
 14   27 1.415        DZ2
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14  28 -.50        DX3
14  29 .666        DY3
14  30 1.415       DZ3
14  31 -1.21       DX4
14  32 .666        DY4
14  33 -.834       DZ4
14  34 .05         ERRDC
14  35 4.0         NLINES
14  36 .690        SCTA,FLAT CIRC. CLOTH,ALT.=SL
14  37 4.58        SCTA2,FLAT CIRC. CLOTH,ALT.=SL
14  38 -8.82       SCTA3,FLAT CIRC. CLOTH,ALT.=SL
14  39 -1.962      SCNA-FLAT CIRCULAR CLOTH,SCTI=7
14  40 1.902       SCNA2-FLAT CIRCULAR CLOTH,SCTI=7
14  41 2.04        SCNA3-FLAT CIRCULAR CLOTH,SCTI=7
13  75 168.0       FDC1
13  77 168.0       FDC2
-1
TRIM CON
TIME H
READ P
 1  38 0.          ZE A/P
 4  63 1020.0      AIRSPEED A/P
14   0 6.00        WEIGHT,RIBLESS GUIDE SURF. DP=2.95
14   1 -2.92       X APEX OF BRIDLE
14   2 0.          Y APEX OF BRIDLE
14   3 0.          Z APEX OF BRIDLE
14   4 3.92        RLINES-RIBLESS GUIDE SURFACE DC
14   5 2.225       RSC-RIBLESS GUIDE SURFACE DC
14   6 1.03        RIN-RIBLESS GUIDE SURFACE DC
14   7 10.0        RLO,RUNS 1,2
14   8 7000.0      K
14   9 .084928     B1
14  10 -.15327     B2
14  11  .082146    B3
14  12 -1.0078     C1 ,RIBLESS GUIDE SURFACE
14  13 .2268       C2 ,RIBLESS GUIDE SURFACE
14  14 7.00        SCDI
14  15 .339        K1,CLOTH PARACHUTE
14  16 .121        K2,CLOTH PARACHUTE
14  17 1.0         K3,CLOTH PARACHUTE
14  18 .01         CC,CLOTH PARACHUTE. ALT=SL
14  19 0.          DTGUN
14  20 .00807      B0
14  21 .71         FD,RUNS 1,2
14  22 -1.21       DX1
14  23 -.666       DY1
14  24 -.834       DZ1
14  25 -.50        DX2
14  26 -.666       DY2
14  27 1.415       DZ2
14  28 -.50        DX3
14  29 .666        DY3
14  30 1.415       DZ3
14  31 -1.21       DX4
14  32 .666        DY4
14  33 -.834       DZ4
14  34 .05         ERRDC
14  35 4.0         NLINES
14  36 1.495       SCTA-RIBLESS GUIDE SURFACE DC
14  37 6.12        SCTA2-RIBLESS GUIDE SURFACE DC
14  38 -12.80      SCTA3-RIBLESS GUIDE SURFACE DC
14  39 2.86        SCNA-RIBLESS GUIDE SURFACE DC
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14  40 -.054      SCNA2-RIBLESS GUIDE SURFACE DC
14  41 -.524      SCNA3-RIBLESS GUIDE SURFACE DC
13  75 550.0      FDC1
13  77 550.0      FDC2
-1
TRIM CON
TIME H
PLOT
 1 126 226                                                          2 1 0
*      FLAT CIRC. CLOTH
0      RIBLESS GUIDE SURF.
 1 124 224                                                          2
24 126 226                                                          2
25 126 226                                                          2
 1 110 210                                                          2
 1 111 211                                                          2
 1 112 212                                                          2
 1 123 223                                                          2
 1 1 9 2 9                                                          2
 1 115 215                                                          2
 1 117 217                                                          2
 1 118 218                                                          2
 1 1 8 2 8                                                          2
 1 1 5 2 5                                                          2
 1 1 6 2 6                                                          2
 1 1 7 2 7                                                          2
 1 1 4 2 4                                                          2
 1 1 2 2 2                                                          2
 2 1 4 2 4                                                          2
 3 1 4 2 4                                                          2
 1 113 213                                                          2
 1 114 214                                                          2
 1 116 216                                                          2
 1 122 222                                                          2

  UT
   1    1  -1   4   1   1   7  31   1   1
FIG     RAIL POSITION LOWER BLK
SEAT SLIDER BLOCK POSITIONING
FIG     YAW ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING
FIG     PITCH ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING
FIG     BANK ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING
FIG     YAW ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING
FIG     PITCH ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING
FIG     BANK ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT AXIAL LOAD FACTOR
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT SIDE LOAD FACTOR
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT NORMAL LOAD FACTOR
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SEAT SLIDER BLOCK POSITIONING
FIG     SEAT ROLL RATE
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT PITCH RATE
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT YAW RATE
SEAT SLIDER BLOCK POSITIONING
FIG     AIRPLANE ROLL RATE
SEAT SLIDER BLOCK POSITIONING
FIG     AIRPLANE PITCH RATE
SEAT SLIDER BLOCK POSITIONING
FIG     AIRPLANE YAW RATE
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING
FIG     EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING
FIG     SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING
FIG     A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING
FIG     A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING
FIG     A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING
  32
 4   2 1.          TIME        1
TIME, SEC
27  20 1.          DZSBR1      2
SM RAIL VER POS.FT
 4   6 57.3        PSI SEAT    3
YAW ANGLE SEAT.DEG
 4   7 57.3        THETA SEAT  4
PITCH ANG SEAT.DEG
 4   8 57.3        PHI SEAT    5
BANK ANG SEAT.DEG
 4  92 57.3        PSI A/P     6
YAW ANGLE A/P.DEG
 4  93 57.3        THETA A/P   7
PITCH ANG A/P.DEG
 4  94 57.3        PHI A/P     8
BANK ANGLE A/P.DEG
27   5 57.3        D PSI CS    9
RAIL YAW DEFL.DEG
27   4 57.3        D THETA CS10
RAIL PITCH DEF.DEG
27   3 57.3        D PHI CS   11
RAIL ROLL DEF.DEG
 4  18 1.          NX SEAT    12
SM AX LOAD FAC.GS
```

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 4  19 1.          NY SEAT    13
SM LAT LOAD FAC,GS
 4  20 1.          NZ SEAT    14
SM NOR LOAD FAC,GS
 1   4 1.          P SEAT     15
ROLL VEL S,RAD/SEC
 1   5 1.          Q SEAT     16
PIT VEL SM,RAD/SEC
 1   6 1.          R SEAT     17
YAW VEL SM,RAD/SEC
 1  33 1.          P A/P      18
ROLL VEL A,RAD/SEC
 1  34 1.          Q A/P      19
PIT VEL AP,RAD/SEC
 1  35 1.          R A/P      20
YAW VEL AP,RAD/SEC
 0   7 1.          XEDOT SEAT21
DWNRNGE VEL,FT/SEC
 0   8 1.          YEDOT SEAT22
LATERAL VEL,FT/SEC
 0   9 -1.         HDOT SEAT 23
CLIMB RATE,FT/SEC
 0  36 1.          XEDOT A/P 24
DWNRNGE VEL,FT/SEC
 0  37 1.          YEDOT A/P 25
LATERAL VEL,FT/SEC
 0  38 -1.         HDOT A/P   26
CLIMB RATE,FT/SEC
 1   1 1.          U SEAT     27
LONG VEL SM,FT/SEC
 1   2 1.          V SEAT     28
LAT VEL SM,FT/SEC
 1   3 1.          W SEAT     29
VERT VEL SM,FT/SEC
 1  30 1.          U A/P      30
LONG VEL AP,FT/SEC
 1  31 1.          V A/P      31
LAT VEL A/P,FT/SEC
 1  32 1.          W A/P      32
VERT VEL AP,FT/SEC
READ R
 4   4 0.15        TMAX
13  13 1000.0      TOPD
24  44 0.          TJ
25  10  5567.      TOOOR
25  12  1577.      TOOONF
25  16 -.0375      BVR
25  18  .6238      BSR
25  29 1.392       DB
 4  63  0.         UA
21  54  2.9        STROKE
-1
TRIM VTO
READ R
26  31 8800.        GROSS WT OF A/P - RIGHT SEAT
26  14 4207.        IXX A/P - RIGHT SEAT
26  15 14973.       IYY A/P - RIGHT SEAT
26  16 17267.       IZZ A/P - RIGHT SEAT
26  17 1052.        IXZ A/P - RIGHT SEAT
26  32 -.477        DXCG A/P - RIGHT SEAT
26  33 -.0514       DYCG A/P - RIGHT SEAT
26  34 .0455        DZCG A/P - RIGHT SEAT
```

```
-1
RESTORF
   9   1   30    4 130
   3   4   92    4 140
   3   4   67    4 143
   3   0   33    4 146

TIME H
READ R
21   31 -2.5861      ZSBR02 NO MIDDLE BLOCKS
21   36 -1.2         DXSR2 NO MIDDLE BLOCK
21   38 -.755        DXSB2 NO MIDDLE BLOCK
21   45 -1.2         DXSR5 NO MIDDLE BLOCK
21   47 -.755        DZSB5 NO MIDDLE BLOCK
-1
RESTORF
   9   4 130   1  30
   3   4 140   4  92
   3   4 143   4  67
   3   4 146   0  33

TIME H
PLOT
 1 1 2 2 2                                                        2 1
*      BASIC CONFIG
O      NO MID BLOCK
 1 1 3 2 3                                                        2 0
 1 1 4 2 4                                                        2 0
 1 1 5 2 5                                                        2 0
 1 1 6 2 6                                                        2 0
 1 1 7 2 7                                                        2 0
 1 1 8 2 8                                                        2 0
 1 1 9 2 9                                                        2 0
 1 110 210                                                        2 0
 1 111 211                                                        2 0
 1 112 212                                                        2 0
 1 113 213                                                        2 0
 1 114 214                                                        2 0
 1 115 215                                                        2 0
 1 116 216                                                        2 0
 1 117 217                                                        2 0
 1 118 218                                                        2 0
 1 119 219                                                        2 0
 1 120 220                                                        2 0
 1 121 221                                                        2 0
 1 122 222                                                        2 0
 1 123 223                                                        2 0
 1 124 224                                                        2 0
 1 125 225                                                        2 0
 1 126 226                                                        2 0
 1 127 227                                                        2 0
 1 128 228                                                        2 0
 1 129 229                                                        2 0
 1 130 230                                                        2 0
 1 131 231

OUTPUT  RFAD R  READ R  TRIM VTOREAD R  TIME H  PLOT
   1   1 -1   2   0   1   0   9   0   0
FIG      LAT. CONTROL FAILURF
SEAT AND/OR MAN DOWNRANGF DIST
FIG      LAT. CONTROL FAILURE
SEAT AND/OR MAN LATERAL DIST.
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FIG     LAT. CONTROL FAILURF
SEAT AND/OR MAN ALTITUDE
FIG     LAT. CONTROL FAILURF
SEAT AND/OR MAN CLIMB RATF
FIG     LAT. CONTROL FAILURF
PARACHUTE DOWNRANGE DISTANCE
FIG     LAT. CONTROL FAILURF
PARACHUTE LATFRAL DISTANCF
FIG     LAT. CONTROL FAILURE
PARACHUTE ALTITUDE
FIG     LAT. CONTROL FAILURE
PARACHUTE TOTAL AIRSPEED
FIG     LAT. CONTROL FAILURF
SEAT AND/OR MAN TOTAL AIRSPEFD
  10
 4   2 1.           TIMF         1
TIMF.SEC
 1   7 1.           XESM         2
DOWNRANGF DIST.FT.
 1   8 1.           YESM         3
LATERAL DIST.FT.
 1   9-1.           ALT SM       4
ALTITUDE.FT.
 0   9 -1.          HDOT SM      5
HDOT SM.FT/SEC
 1  27 1.0          XERC         6
XERC.FT
 1  28 1.0          YFRC         7
YERC.FT
 1  29 -1.0         ALT.RC       8
ALTITUDF RC.FT
20  14 1.           UA RC        9
UA RC.FT/SEC
 4  12 1.           UA SM       10
UA SM.FT/SEC
13   2 .25          DELTA TR
13   4 .574         CAR
13   5 .0           CBR
13   6 -.820        CGR
13   7 -.48         DELTA XCGR
13   8 .0           DELTA YCGR
13   9 1.11         DELTA ZCGR
13  11 0.           ROC/GUN.DRAG CHUTE
13  12 .20          DELTA PD
13  13 50.0         TOPD
13  14 -1.00        CAPD
13  15 .0           CBPD
13  16 .0           CGPD
13  17 -1.29        DELTA XCGPD
13  18 .32          DELTA YCGPD
13  19 -1.98        DELTA ZCGPD
13  27 -1.04        DELTA XCGC
13  28 .0           DELTA YCGC
13  29 -.75         DELTA ZCGC
13  31 0.           ROC/GUN.RECOV CHUTE
13  32 .30          DT.RC
13  34  .94         CA.RC
13  35 -.342        CB.RC
13  36 0.           CG.RC
13  37 -1.27        DX.CGC
13  38 -.01         DY.CGC
13  39 -2.23        DZ.CGC
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13  46 5000.0     FR1                867
13  47 .025       T1                 868
13  48 5000.0     FR2                869
13  49 .250       T2                 870
13  50 0.         FR3                871
13  51 0.         T3                 872
13  52 0.         FR4                873
13  53 0.         T4                 874
13  54 0.         FR5                875
13  55 0.         T5                 876
13  56 0.         FR6                877
13  57 .274       T6                 878
13  70 0.         T1                 879
13  71 300.0      FRC1               880
13  72 .25        T2                 881
13  73 300.0      FRC2               882
13  74 0.         T1                 883
13  75 200.0      FDC1               884
13  76 .20        T2                 885
13  77 200.0      FDC1               886
13  78 .32        DT R-MOTOR         887
13  80 0.         T1                 888
13  81 500.0      FR1,ROLL MOTOR     889
13  82 .14        T2                 890
13  83 500.0      FR2,ROLL MOTOR     891
13  84 0.         T3                 892
13  85 -500.0     FR3,ROLL MOTOR     893
13  86 .33        T4                 894
13  87 -500.0     FR4,ROLL MOTOR     895
13  89 -.74       DXCG-RM            896
13  90 -.73       DYCG-RM            897
13  91 -1.01      DZCG-RM            898
13  92 0.         CALPHA-RM          899
13  93 -1.0       CBETA-RM           900
13  94 0.         CGAMMA-RM          901
13  95 .18        DT-PITCH M         902
13  97 0.         T1                 903
13  98 1000.0     F1,PITCH MOTOR     904
13  99 .18        T2                 905
13 100 1000.0     F2,PITCH MOTOR     906
13 101 0.         T3                 907
13 102 0.         F3,PITCH MOTOR     908
13 103 0.         T4                 909
13 104 0.         F4,PITCH MOTOR     910
13 105 -.42       DXCG-PM            911
13 106 0.         DYCG-PM            912
13 107 1.32       DZCG-PM            913
13 108 -.73       CALPHA-PM          914
13 109 0.         CBETA-PM           915
13 110 -.6819     CGAMMA-PM          916
13 111 .18        DT,PITCH M 2       917
13 113 0.          T1                918
13 114 200.       FPM2               919
13 115 .18        T2                 920
13 116 200.       FPM2               921
13 117 0.          T3                922
13 118 0.          FPM2              923
13 119 0.         T4                 924
13 120 0.         FPM2               925
13 121 -.06        DXCG-PM2          926
13 122 0.         DYCG-PM2           927
13 123 1.47       DZCG-PM2           928
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13	124	1.00	CAPM2	929
13	125	0.	CBPM2	930
13	126	0.	CGPM2	931
13	127	.18	DT-YAW MOTOR	932
13	129	0.	T1-YAW MOTOR	933
13	130	200.0	FY1-YAW MOTOR	934
13	131	.18	T2-YAW MOTOR	935
13	132	200.0	FY2-YAW MOTOR	936
13	133	0.	T3-YAW MOTOR	937
13	134	0.	FY3-YAW MOTOR	938
13	135	0.	T4-YAW MOTOR	939
13	136	0.	FY4-YAW MOTOR	940
13	137	-.77	DXCG-YAW MOTOR	941
13	138	-.38	DYCG-YAW MOTOR	942
13	139	.56	DZCG-YAW MOTOR	943
13	140	.5983	CAYM	944
13	141	0.	CBYM	945
13	142	-.8012	CGYM	946
13	143	2.0	POS. PITCH RATE INITIATION VALU	947
13	144	-1.0	NEG. PITCH RATE INITIATION VALU	948
14	0	14.04	WT. DRAG CHUTE	949
14	1	-2.97	X APEX OF BRIDLE	950
14	2	0.	Y APEX OF BRIDLE	951
14	3	0.	Z APEX OF BRIDLE	952
14	4	13.32	RLINES	953
14	5	3.33	RSC	954
14	6	2.16	RIN	955
14	7	15.0	RLO	956
14	8	7000.0	K,DC	957
14	9	.084928	B1	958
14	10	-.15327	B2	959
14	11	.082146	B3	960
14	12	-.6113	C1 ,HEMISFLO	961
14	13	.1741	C2 ,HEMISFLO	962
14	14	15.0	SCDI	963
14	15	.189	K1	964
14	16	.264	K2	965
14	17	1.0	K3	966
14	18	.22	C	967
14	19	0.	DTGUN	968
14	20	.00807	B0	969
14	21	.91	FD	970
14	22	-1.21	DX1	971
14	23	.666	DY1	972
14	24	-.834	DZ1	973
14	25	-1.21	DX2	974
14	26	-.666	DY2	975
14	27	-.834	DZ2	976
14	28	-.50	DX3	977
14	29	-.666	DY3	978
14	30	1.415	DZ3	979
14	31	-.50	DX4	980
14	32	.666	DY4	981
14	33	1.415	DZ4	982
14	34	.05	ERRDC	983
14	35	4.0	NLINES	984
14	36	-.775	SCTA,HEMISFLO,SCTI=15	985
14	37	-20.4	SCTA2,HEMISFLO,SCTI=15	986
14	38	-18.93	SCTA3,HEMISFLO,SCTI=15	987
14	39	.951	SCNA,HEMISFLO,SCTI=15	988
14	40	60.2	SCNA2,HEMISFLO,SCTI=15	989
14	41	81.0	SCNA3,HEMISFLO,SCTI=15	990

15	0	17.9	WT. REC. CHUTE	991
15	1	0.	X APEX OF BRIDLE	992
15	2	0.	Y APEX OF BRIDLE	993
15	3	-2.59	Z APEX OF BRIDLE	994
15	4	22.833	RLINES	995
15	5	14.0	RSC	996
15	6	7.5	RIN	997
15	7	23.0	RLO	998
15	8	30000.0	K	999
15	9	.084928	B1	1000
15	10	-.15327	B2	1001
15	11	.082146	B3	1002
15	12	-1.4129	C1 .FLAT CIRCULAR CLOTH	1003
15	13	.6031	C2 .FLAT CIRCULAR CLOTH	1004
15	14	461.0	SCDI	1005
15	15	0.	K1	1006
15	16	.121	K2	1007
15	17	1.0	K3	1008
15	18	.10	C	1009
15	19	.8	DTGUN	1010
15	20	.00807	BO	1011
15	21	1.0	FD	1012
15	22	13.41	SCTA	1013
15	23	89.1	SCTA2	1014
15	24	-171.5	SCTA3	1015
15	25	-38.2	SCNA	1016
15	26	37.0	SCNA2	1017
15	27	39.7	SCNA3	1018
16	0	354.43	WT.SEAT+MAN	1019
16	1	11.99	IXX	1020
16	2	22.62	IYY	1021
16	3	10.62	IZ	1022
16	4	3.02	IXZ	1023
16	5	0.	IYZ	1024
16	6	0.	IXY	1025
16	7	.0	DELTA XCG	1026
16	8	.0	DELTA YCG	1027
16	9	.0	DELTA ZCG	1028
16	10	-.6	CMQ	1029
16	11	-.026	CLP	1030
16	12	-.03	CNR	1031
16	13	5.05	S	1032
16	14	3.82	C=LM	1033
16	15	3.82	B=LM	1034
16	16	0.	0.-BD.1.-SB	1035
16	17	204.43	W.S	1036
16	18	3.83	IXX	1037
16	19	6.13	IYY	1038
15	20	2.30	IZZ	1039
16	21	-1.88	IXZ	1040
16	22	0.	IYZ	1041
16	23	0.	IXY	1042
16	24		DELTA XCG	1043
16	25		DELTA YCG	1044
16	26		DELTA ZCG	1045
16	27	-.6	CMQ	1046
16	28	-.026	CLP	1047
16	29	-.03	CNR	1048
16	30	5.05	S	1049
16	31	3.82	C=LM	1050
16	32	3.82	B=LM	1051
16	33	0.	0.-BD.1.-ST	1052

16	34	150.0	W.M	1053
16	35	13.0	IXX	1054
16	36	15.0	IYY	1055
16	37	6.0	IZZ	1056
16	38		IXZ	1057
16	39		IYZ	1058
16	40		IXY	1059
16	41		DELTA XCG	1060
16	42		DELTA YCG	1061
16	43		DELTA ZCG	1062
16	44	-.6	CMQ	1063
16	45	-.026	CLP	1064
16	46	-.03	CNR	1065
16	47	6.0	S=L	1066
16	48	.9	C.BAR=T	1067
16	49	1.375	B=D	1068
16	50	0.	0.-BD.1.-ST	1069
16	51	23.7	B SPINF	1070
16	52	2795.	K SPINF	1071
16	53	.0745	DXCP	1072
16	54	0.	DYCP	1073
16	55	.09	DZCP	1074
16	56	1.	FOL.	1075
16	58	0.	CFM	1076
16	60	0.	DXCG.HD	1077
16	61	0.	DXCG.HD	1078
16	62	-1.665	DZCG.HD	1079
21	0	-16.5	DXCGP	1080
21	1	0.	DYCGP	1081
21	2	-9.0	DZCGP	1082
21	21	0.	PSI A/C	1083
21	22	.2965	THETA A/C	1084
21	23	0.	PHI A/C	1085
21	24	0.	PSI C/S	1086
21	25	-.2965	THETA C/S	1087
21	26	0.	PHI C/S	1088
21	27	10.5	DXAS-CG	1089
21	28	-1.13	DYAS-CG	1090
21	29	-1.00	DZAS-CG	1091
21	30	-2.7961	ZSBR03	1092
21	31	-1.2521	ZSBR02	1093
21	32	-.5853	ZSBR01	1094
21	33	-.55965	DXSB1	1095
21	34	.86	DYSB1	1096
21	35	1.36107	DZSB1	1097
21	36	-.75447	DXSB2	1098
21	37	.86	DYSB2	1099
21	38	.723367	DZSB2	1100
21	39	-1.20558	DXSB3	1101
21	40	.86	DYSB3	1102
21	41	-.75327	DZSB3	1103
21	42	-.55965	DXSB4	1104
21	43	-.86	DYSB4	1105
21	44	1.36107	DZSB4	1106
21	45	-.75447	DXSB5	1107
21	46	-.86	DYSB5	1108
21	47	.725567	DZSB5	1109
21	48	-1.20558	DXSB6	1110
21	49	-.86	DYSB6	1111
21	50	-.75327	DZSB6	1112
21	54	2.83	STROKE	1113
21	55	3.99	RL	1114

16	34	150.0	W.M
16	35	13.0	IXX
16	36	15.0	IYY
16	37	6.0	IZZ
16	38		IXZ
16	39		IYZ
16	40		IXY
16	41		DELTA XCG
16	42		DELTA YCG
16	43		DELTA ZCG
16	44	-.6	CMQ
16	45	-.026	CLP
16	46	-.03	CNR
16	47	6.0	S=L
16	48	.9	C.BAR=T
16	49	1.375	B=D
16	50	0.	0.-BD.1.-ST
16	51	23.7	B SPINF
16	52	2795.	K SPINF
16	53	.0745	DXCP
16	54	0.	DYCP
16	55	.09	DZCP
16	56	1.	FOL.
16	58	0.	CFM
16	60	0.	DXCG.HD
16	61	0.	DXCG.HD
16	62	-1.665	DZCG.HD
21	0	-16.5	DXCGP
21	1	0.	DYCGP
21	2	-9.0	DZCGP
21	21	0.	PSI A/C
21	22	.2965	THETA A/C
21	23	0.	PHI A/C
21	24	0.	PSI C/S
21	25	-.2965	THETA C/S
21	26	0.	PHI C/S
21	27	10.5	DXAS-CG
21	28	-1.13	DYAS-CG
21	29	-1.00	DZAS-CG
21	30	-2.7961	ZSBR03
21	31	-1.2521	ZSBR02
21	32	-.5853	ZSBR01
21	33	-.55965	DXSB1
21	34	.86	DYSB1
21	35	1.36107	DZSB1
21	36	-.75447	DXSB2
21	37	.86	DYSB2
21	38	.723367	DZSB2
21	39	-1.20558	DXSB3
21	40	.86	DYSB3
21	41	-.75327	DZSB3
21	42	-.55965	DXSB4
21	43	-.86	DYSB4
21	44	1.36107	DZSB4
21	45	-.75447	DXSB5
21	46	-.86	DYSB5
21	47	.725567	DZSB5
21	48	-1.20558	DXSB6
21	49	-.86	DYSB6
21	50	-.75327	DZSB6
21	54	2.83	STROKE
21	55	3.99	RL

```
21   56  .02         BF
21   61 10.05        XAR01
21   62 1.99         YAR01
21   63 .72          ZAR01
21   64 10.05        XAR02
21   65 .27          YAR02
21   66 .72          ZAR02
-1
 1   38 -50.0        ZE
 4   93 0.           THETA
 4   63 77.          AIRSPEED
25   16 .2235        BVR
25   18 .24760       BSR
25   29 1.1          DB
25   10 5567.         TOOOR
25   12 1577.        TOOONF
-1
 4    4 5.0          TMAX
25   16 0.           BVR
25   18 0.           BSR
25   10 0.           TOOOR
13   30 .3           TIME FROM SWITCH TO PILOT REL.
13    3 .557         TO.SUST
13   23 .430         TO.CAT
13   33 .582         TO.RC
13   79 .532         TO.RM
13  128 .532         TO.YAW
-1
 1 2 1 3 1 4 1 5 1 6 1 7 1 8 1 9 110
STOP
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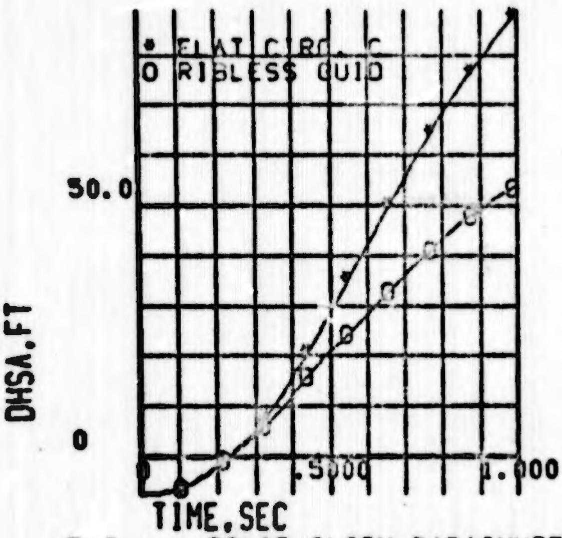

FIG 1 SOLID CLOTH PARACHUTES
VERT. TAIL VERT. CLEARANCE

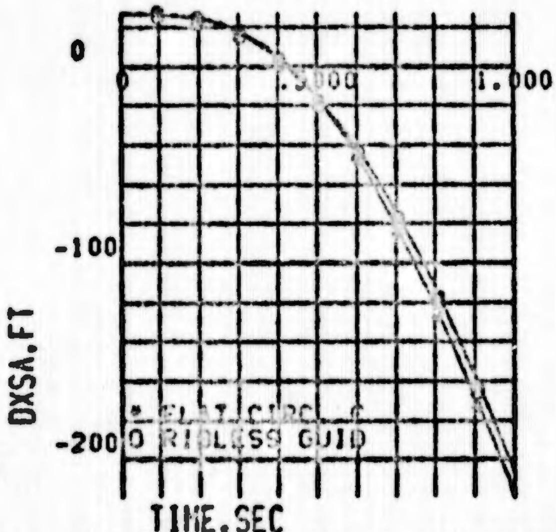

FIG 2 SOLID CLOTH PARACHUTES
VERT. TAIL LONG. CLEARANCE

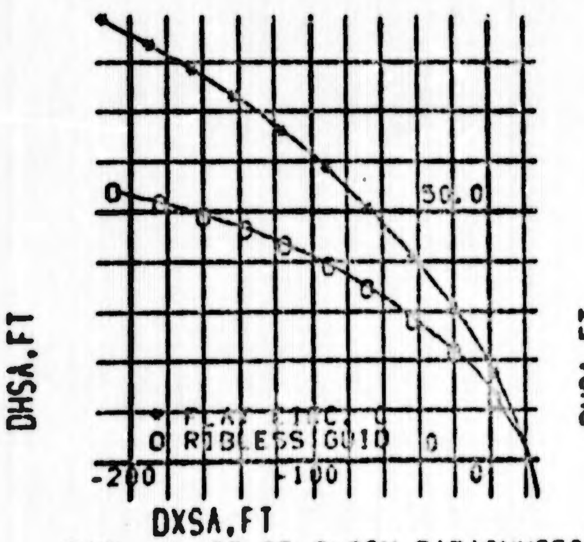

FIG 3 SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE

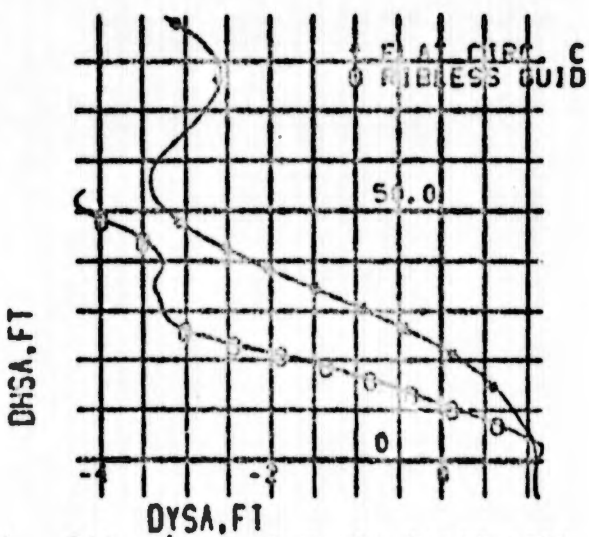

FIG 4 SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE

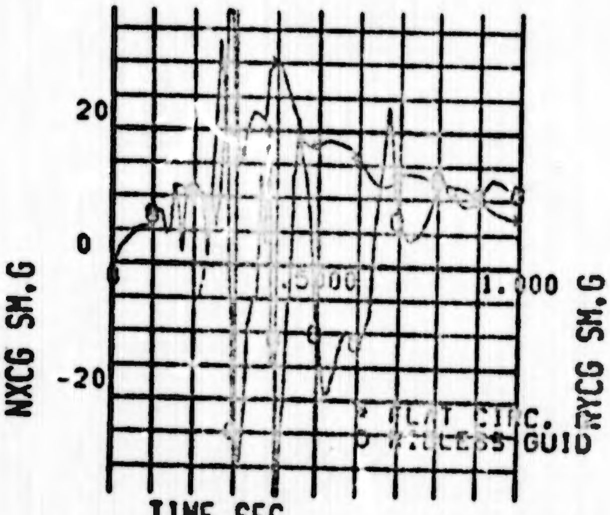

FIG 5 SOLID CLOTH PARACHUTES
SEAT AXIAL LOAD FACTOR

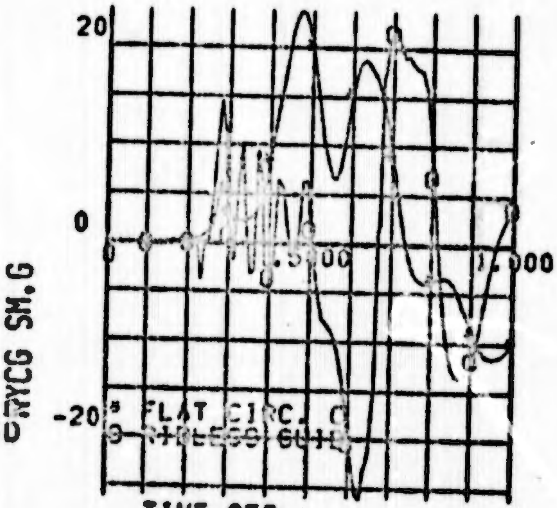

FIG 6 SOLID CLOTH PARACHUTES
SEAT SIDE LOAD FACTOR

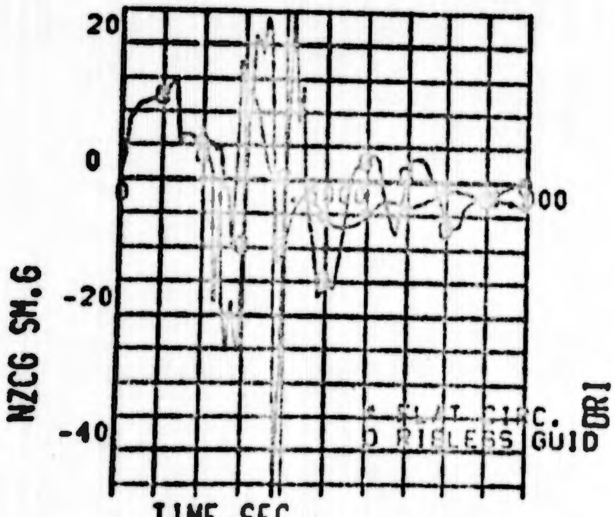

FIG 7 SOLID CLOTH PARACHUTES
SEAT NORMAL LOAD FACTOR

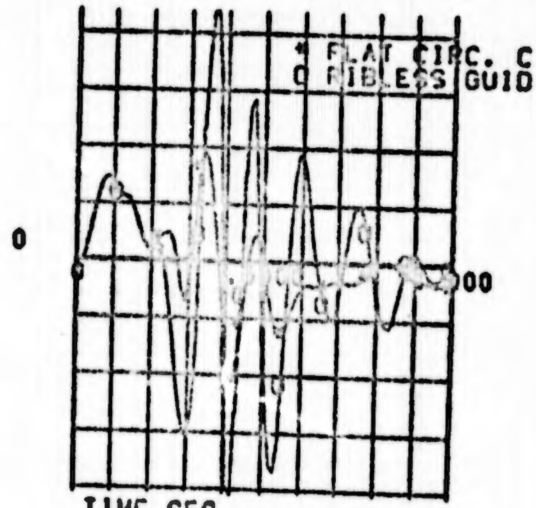

FIG 8 SOLID CLOTH PARACHUTES
MAN DYNAMIC RESPONSE INDEX

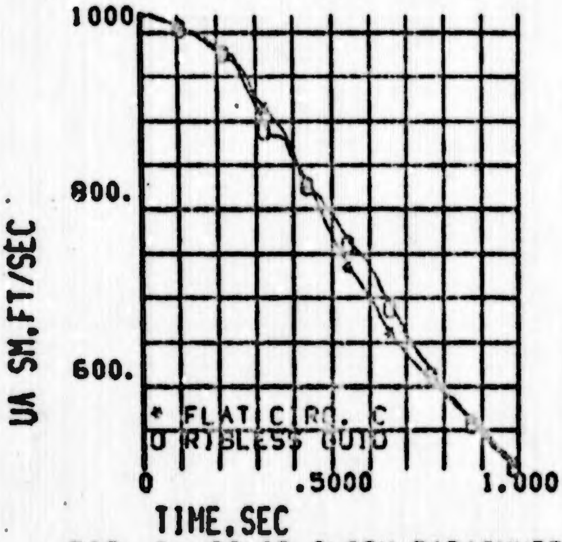

FIG 9 SOLID CLOTH PARACHUTES
SEAT AIRSPEED

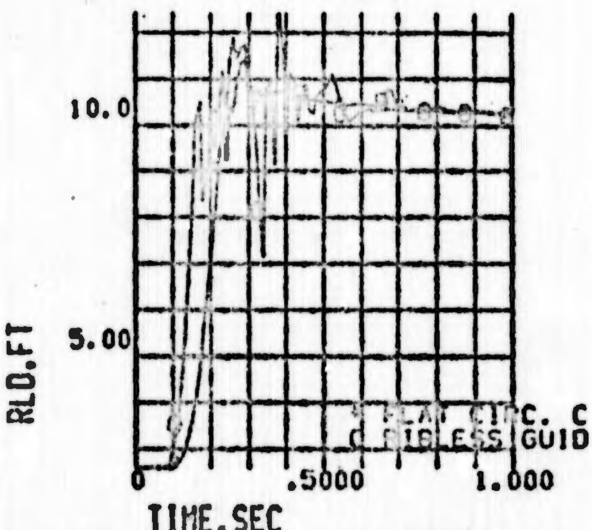

FIG 10 SOLID CLOTH PARACHUTES
DIST. FROM BRIDLE TO CHUTE CG

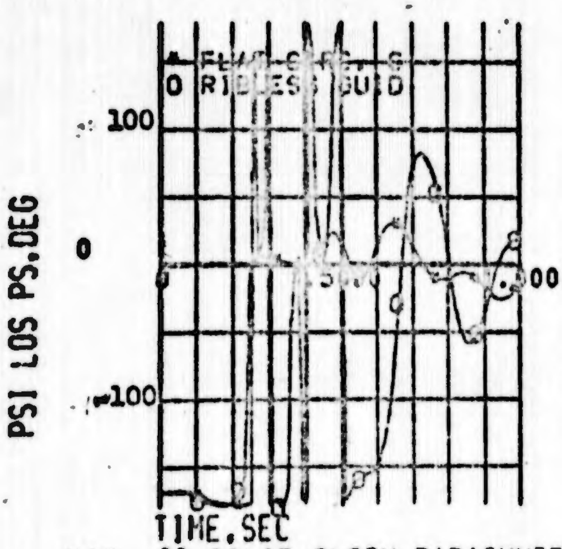

FIG 11 SOLID CLOTH PARACHUTES
SEAT-PARACHUTE AZIMUTH ANGLE

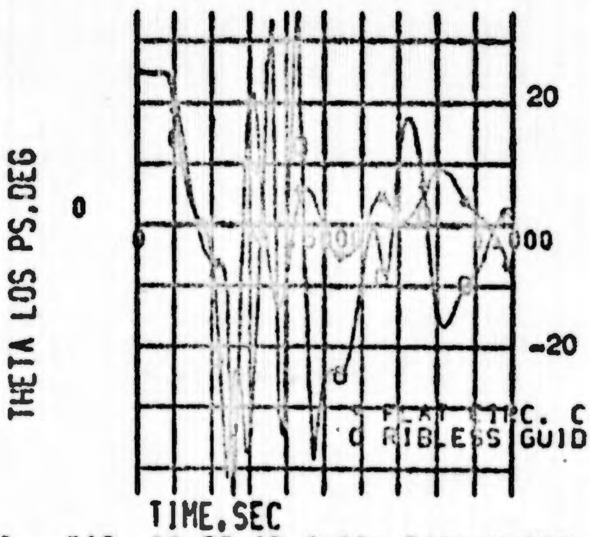

FIG 12 SOLID CLOTH PARACHUTES
SEAT-PARACHUTE ELEVATION ANGLE

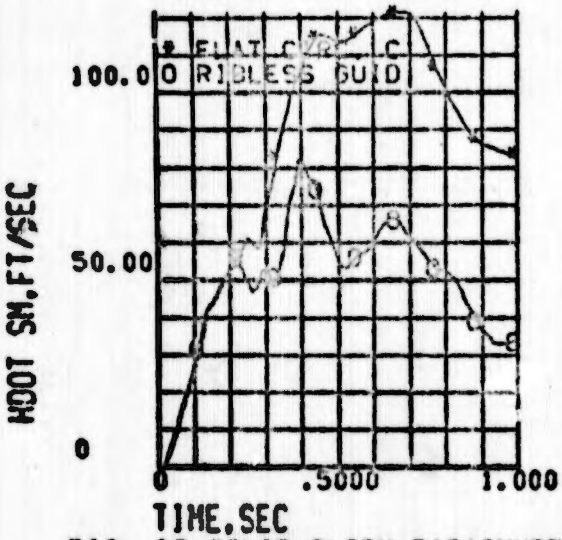

FIG 13 SOLID CLOTH PARACHUTES
SEAT CLIMB RATE

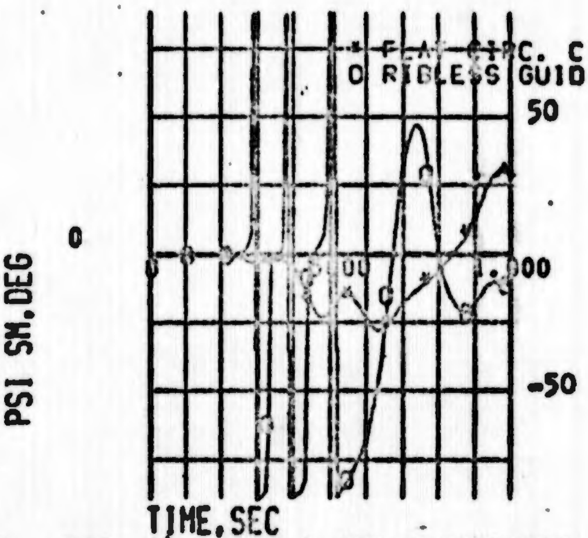

FIG 14 SOLID CLOTH PARACHUTES
SEAT EARTH AXIS YAW ANGLE

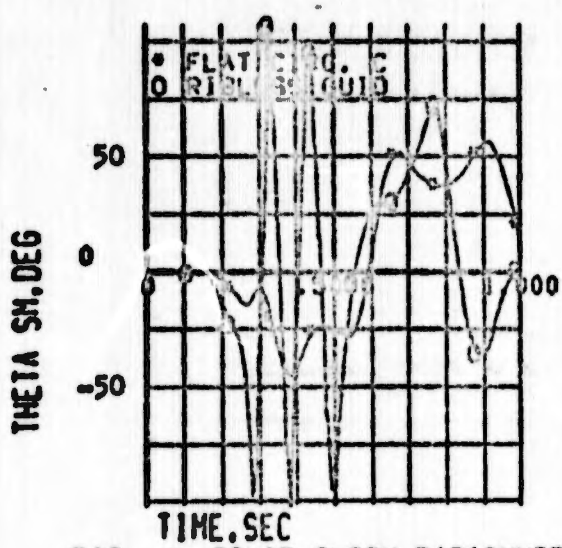

FIG 15 SOLID CLOTH PARACHUTES
SEAT EARTH AXIS PITCH ANGLE

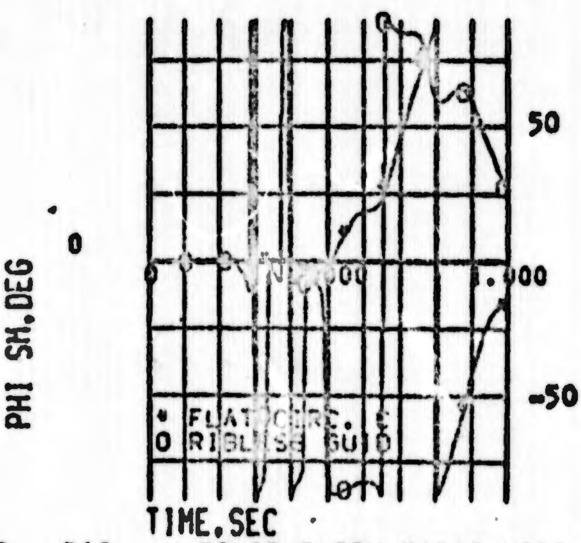

FIG 16 SOLID CLOTH PARACHUTES
SEAT EARTH AXIS BANK ANGLE

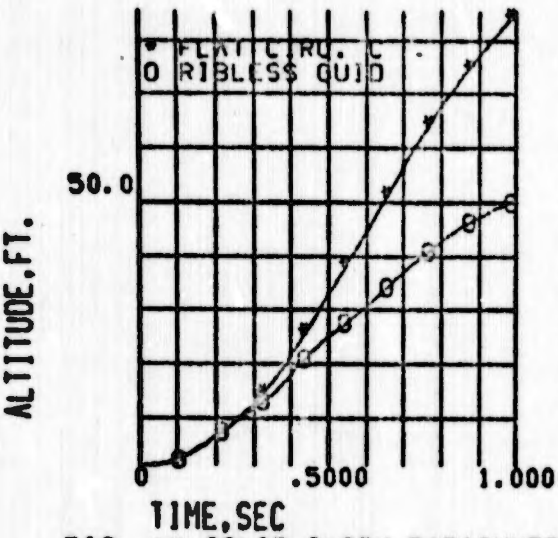

FIG 17 SOLID CLOTH PARACHUTES
SEAT ALTITUDE

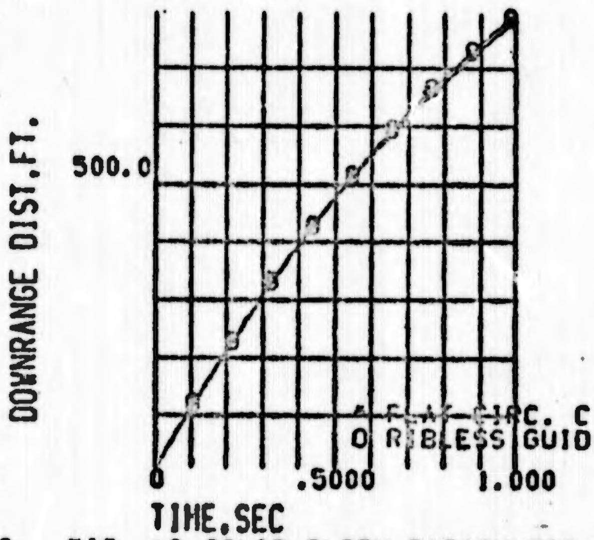

FIG 18 SOLID CLOTH PARACHUTES
SEAT DOWNRANGE DISTANCE

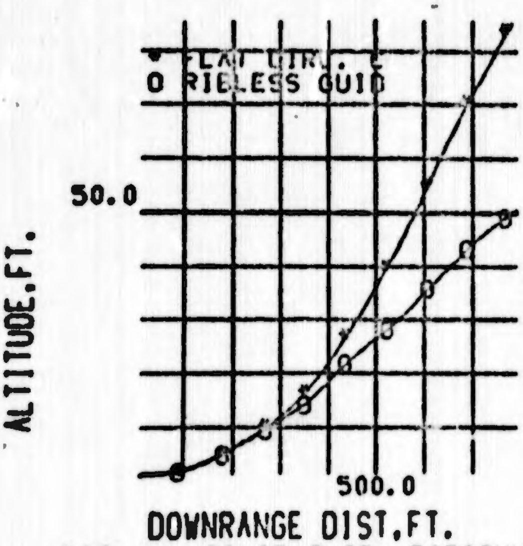

FIG 19 SOLID CLOTH PARACHUTES
SEAT TRAJECTORY

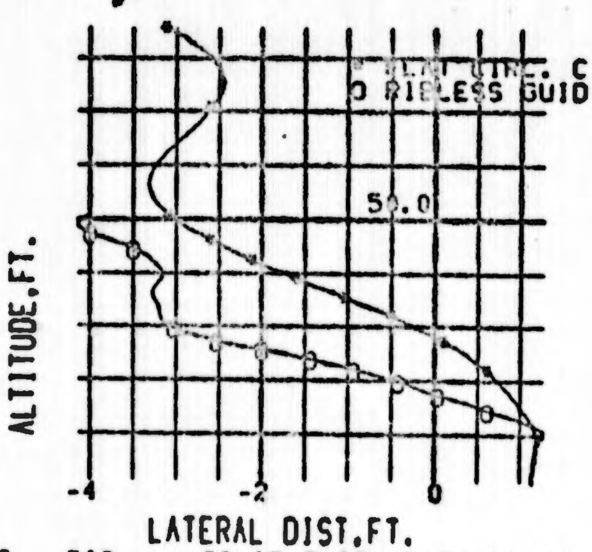

FIG 20 SOLID CLOTH PARACHUTES
SEAT TRAJECTORY

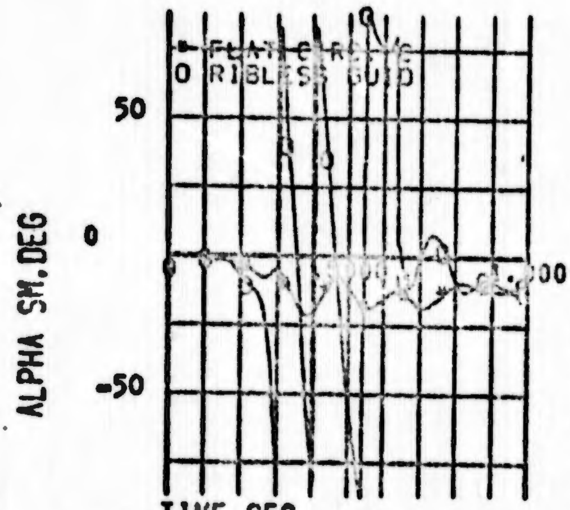

FIG 21 SOLID CLOTH PARACHUTES
SEAT ANGLE OF ATTACK

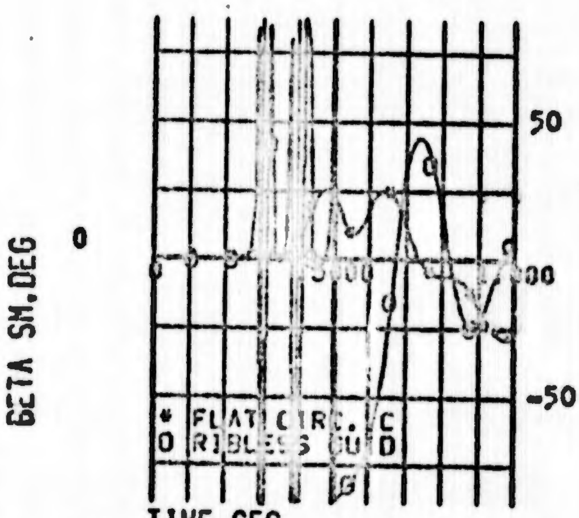

FIG 22 SOLID CLOTH PARACHUTES
SEAT SIDESLIP ANGLE

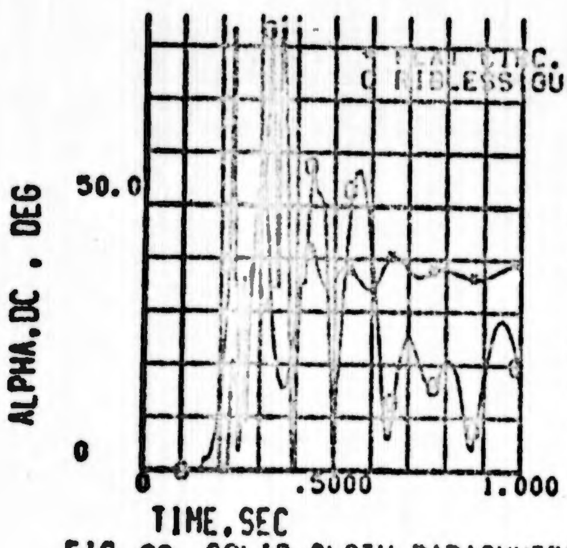

FIG 23 SOLID CLOTH PARACHUTES
PARACHUTE ANGLE OF ATTACK

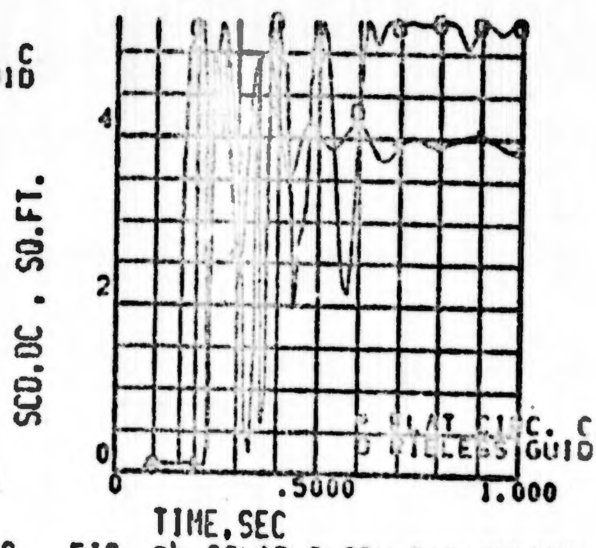

FIG 24 SOLID CLOTH PARACHUTES
PARACHUTE AREA DRAG COEFF

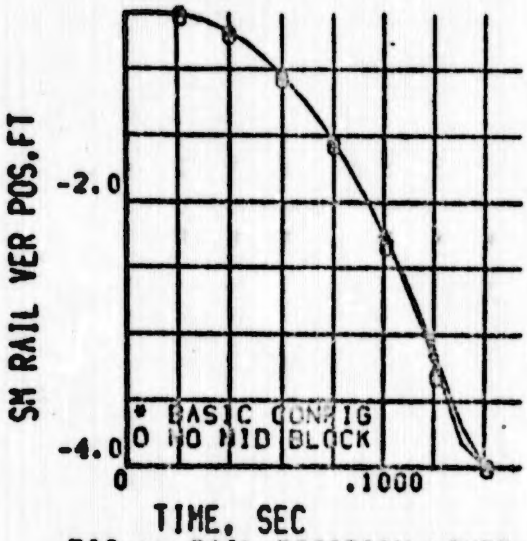

FIG 25 RAIL POSITION LOWER BLK
SEAT SLIDER BLOCK POSITIONING

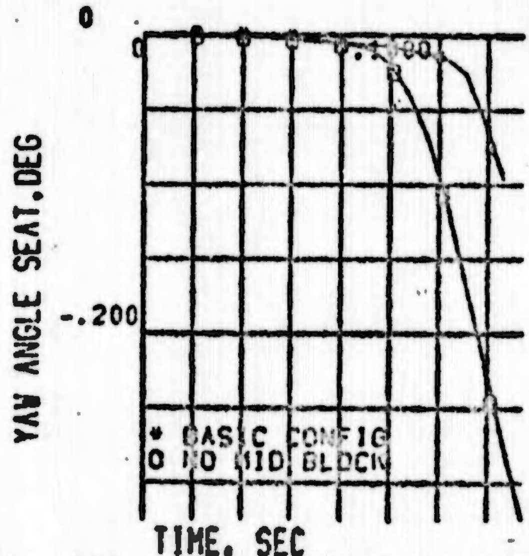

FIG 26 YAW ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING

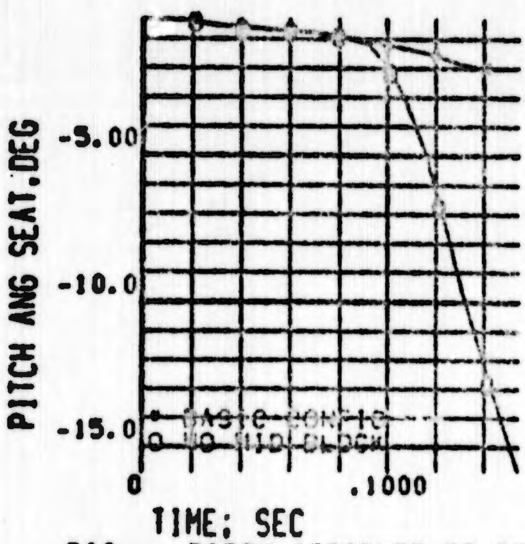

FIG 27 PITCH ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING

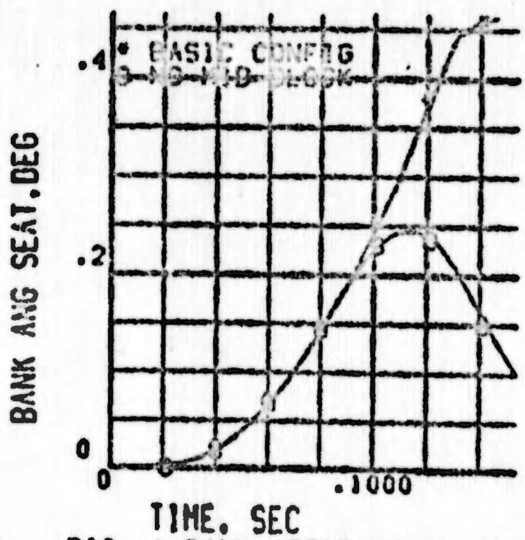

FIG 28 BANK ATTITUDE OF SEAT
SEAT SLIDER BLOCK POSITIONING

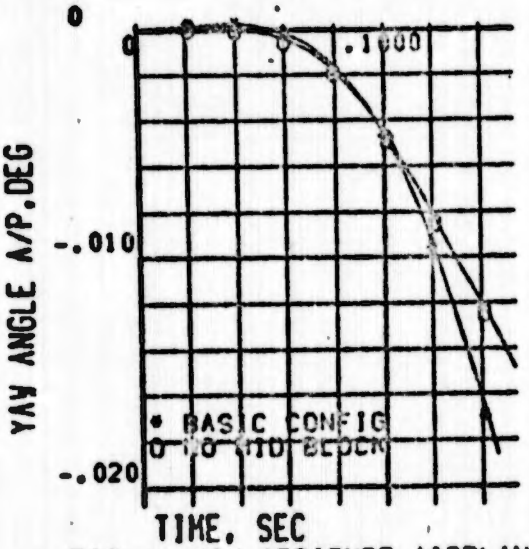

FIG 29 YAW ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING

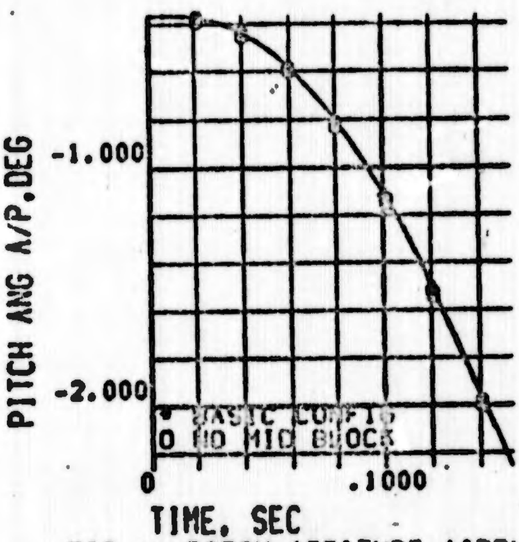

FIG 30 PITCH ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING

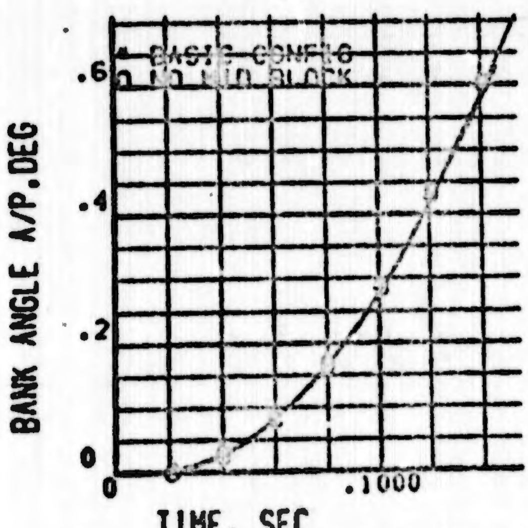

FIG 31 BANK ATTITUDE AIRPLANE
SEAT SLIDER BLOCK POSITIONING

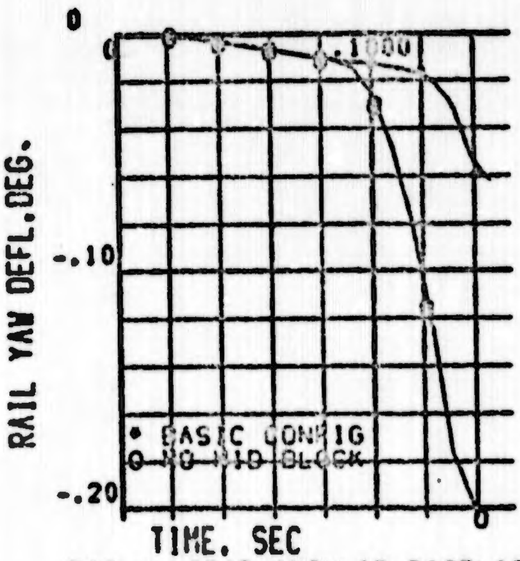

FIG 32 SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING

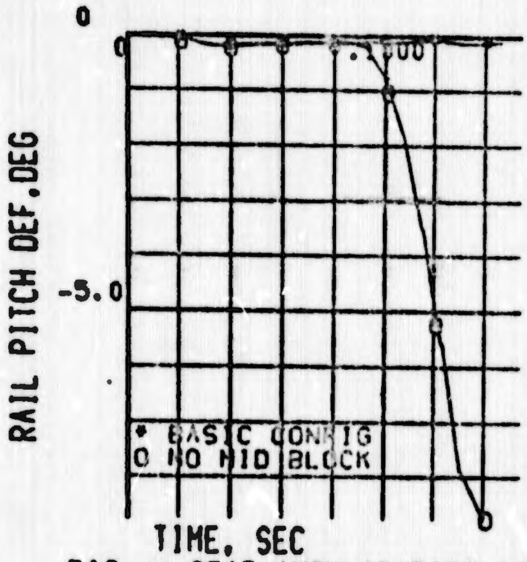

FIG 33 SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING

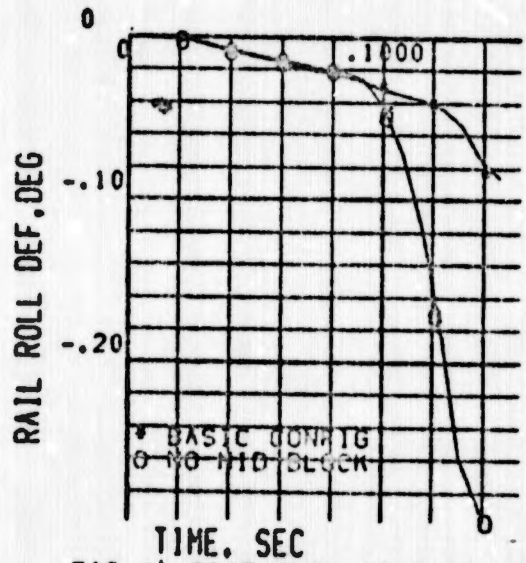

FIG 34 SEAT ANGULAR DISPLACE.
SEAT SLIDER BLOCK POSITIONING

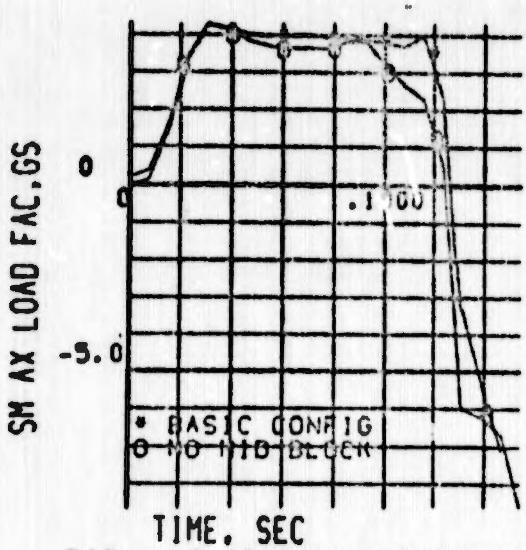

FIG 35 SEAT AXIAL LOAD FACTOR
SEAT SLIDER BLOCK POSITIONING

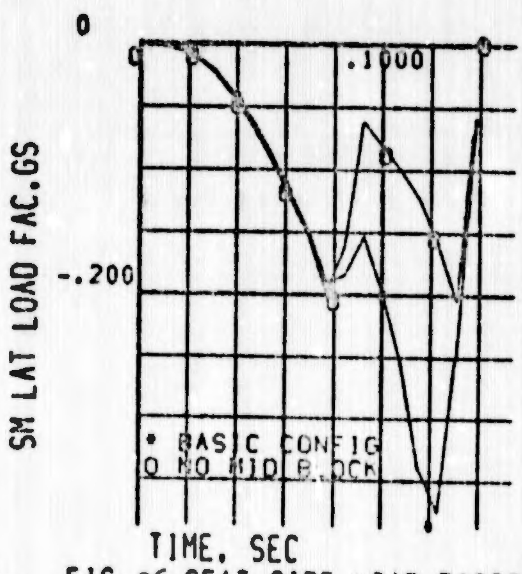

FIG 36 SEAT SIDE LOAD FACTOR
SEAT SLIDER BLOCK POSITIONING

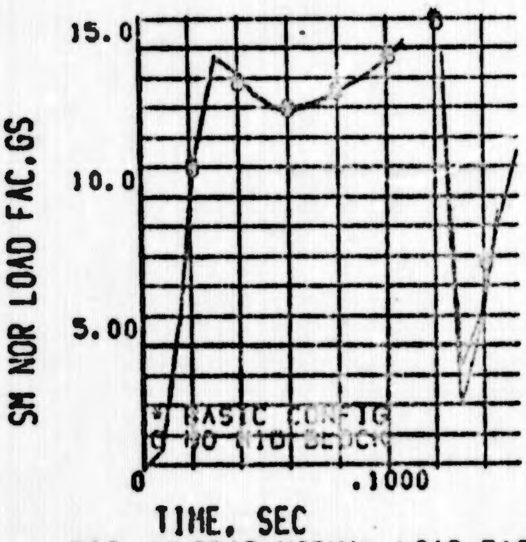

FIG 37 SEAT NORMAL LOAD FACTOR
SEAT SLIDER BLOCK POSITIONING

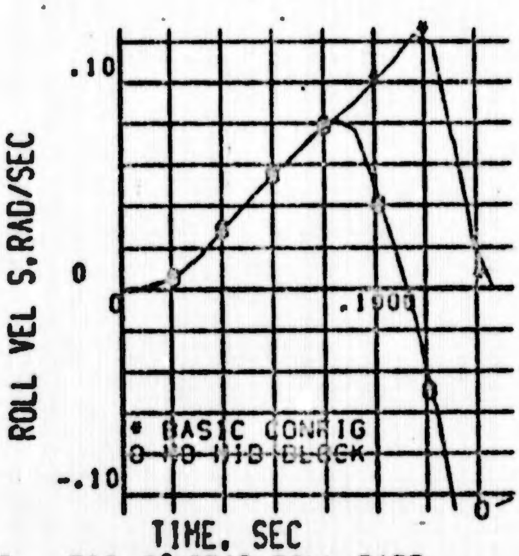

FIG 38 SEAT ROLL RATE
SEAT SLIDER BLOCK POSITIONING

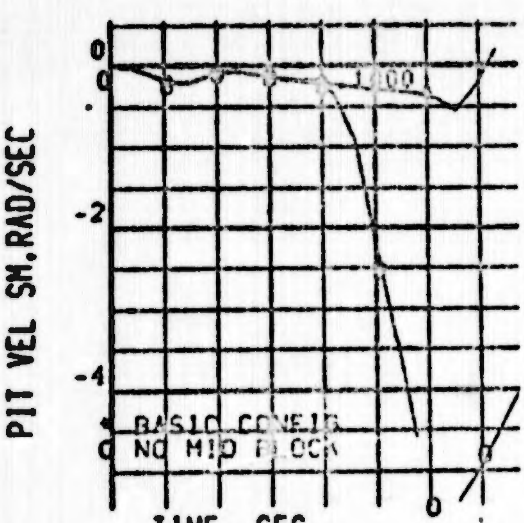

FIG 39 SEAT PITCH RATE
SEAT SLIDER BLOCK POSITIONING

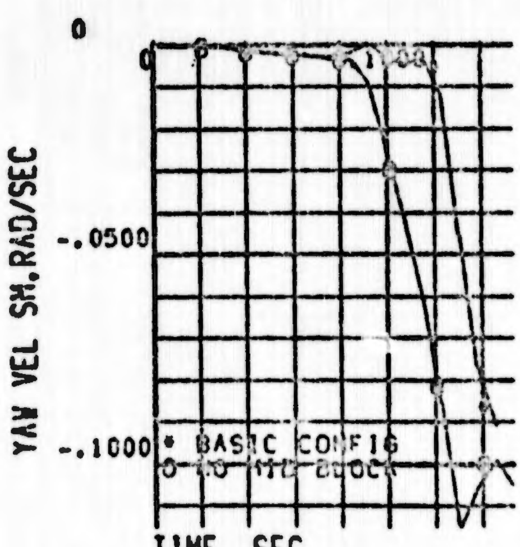

FIG 40 SEAT YAW RATE
SEAT SLIDER BLOCK POSITIONING

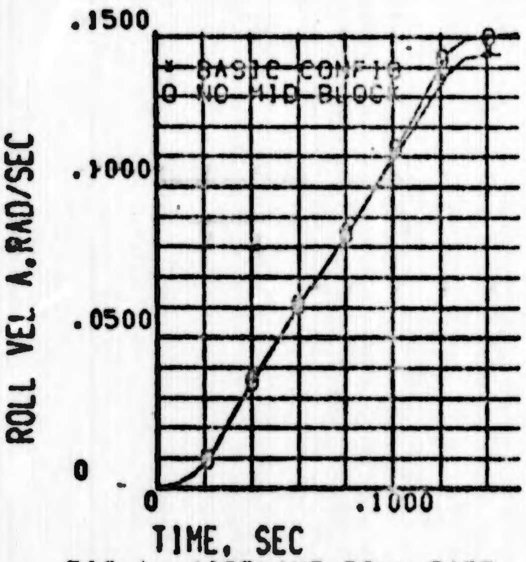

FIG 41 AIRPLANE ROLL RATE
SEAT SLIDER BLOCK POSITIONING

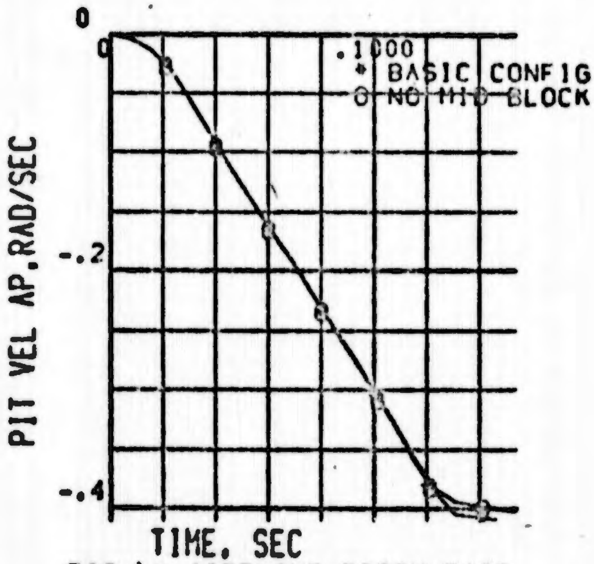

FIG 42 AIRPLANE PITCH RATE
SEAT SLIDER BLOCK POSITIONING

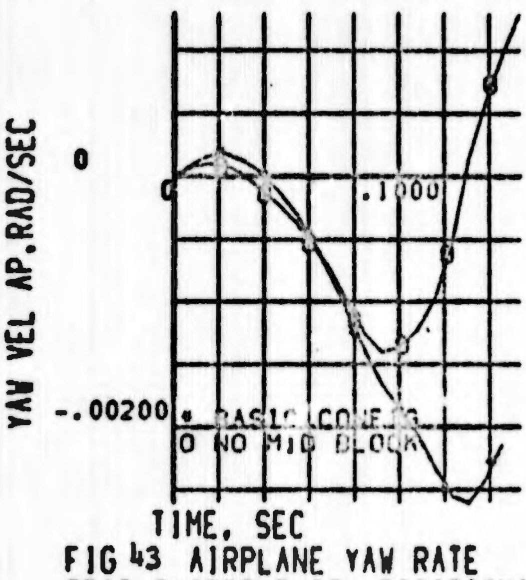

FIG 43 AIRPLANE YAW RATE
SEAT SLIDER BLOCK POSITIONING

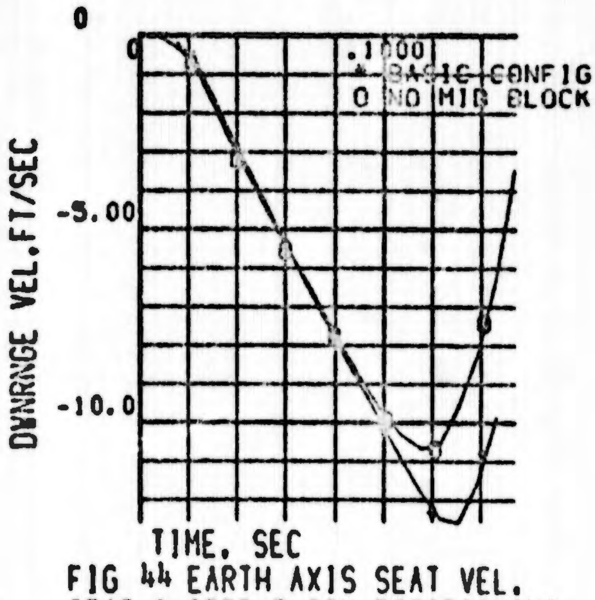

FIG 44 EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

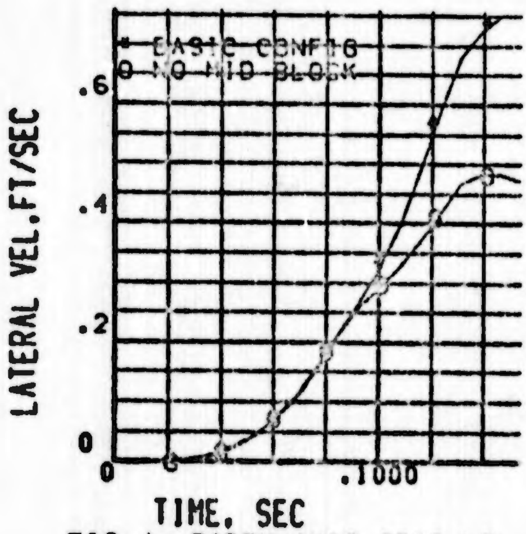

FIG 45 EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

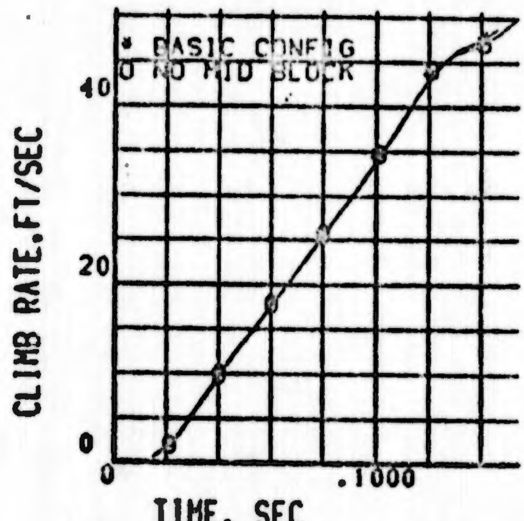

FIG 46 EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

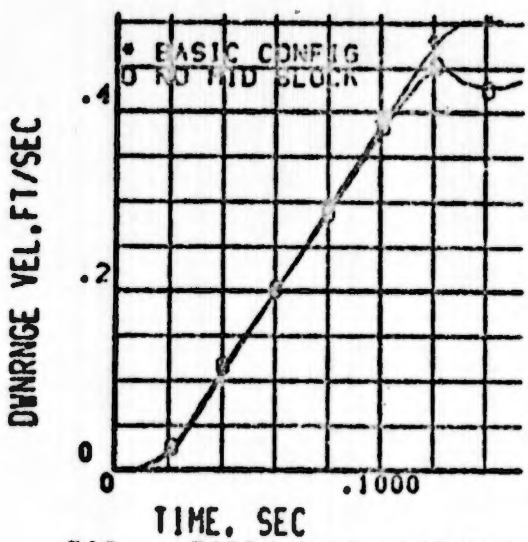

FIG 47 EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

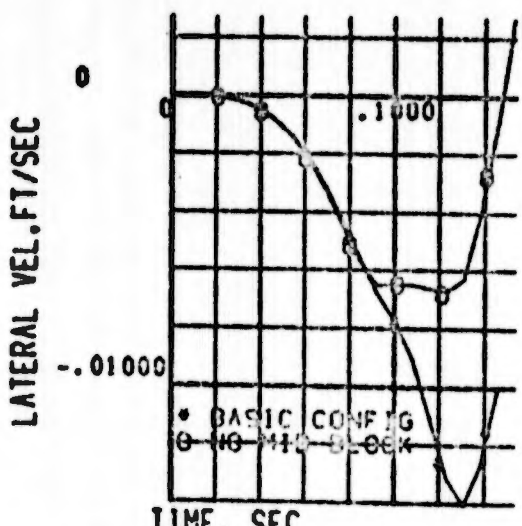

FIG 48 EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

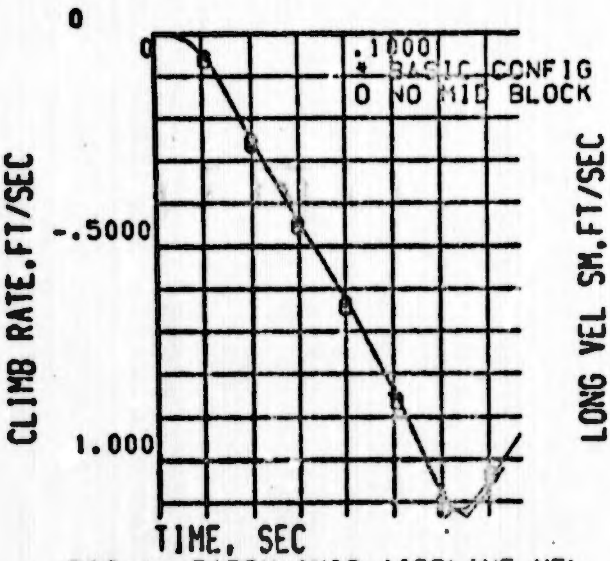

FIG 49 EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

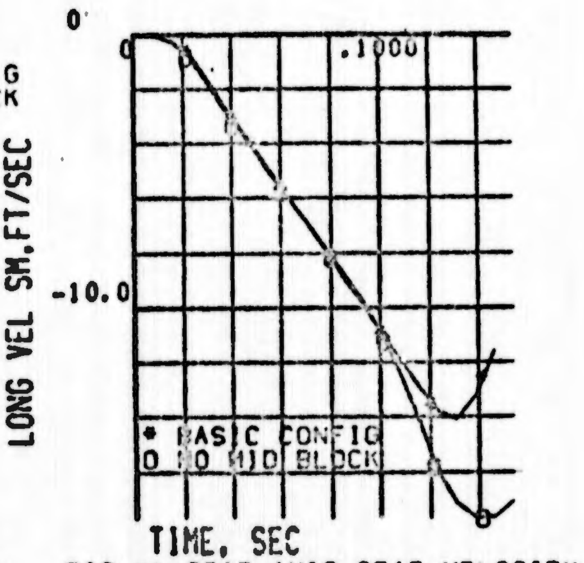

FIG 50 SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

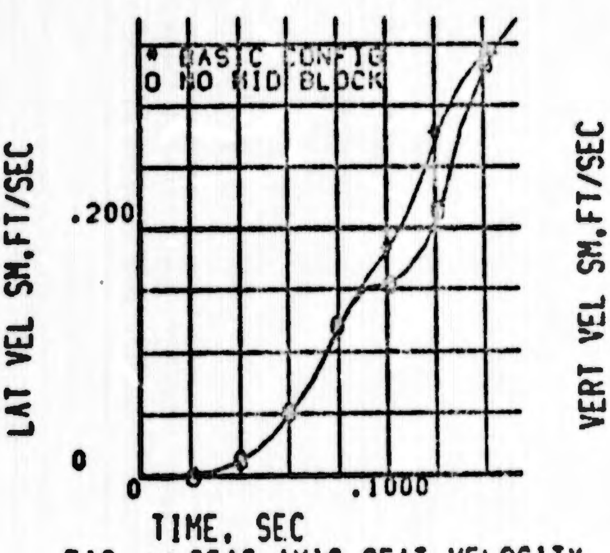

FIG 51 SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

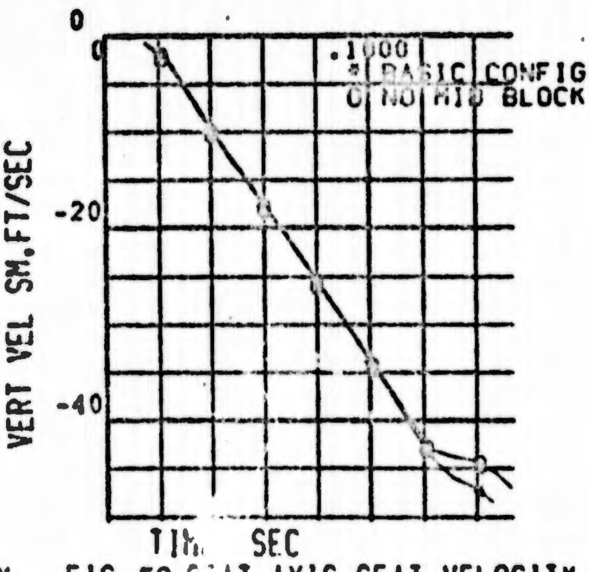

FIG 52 SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

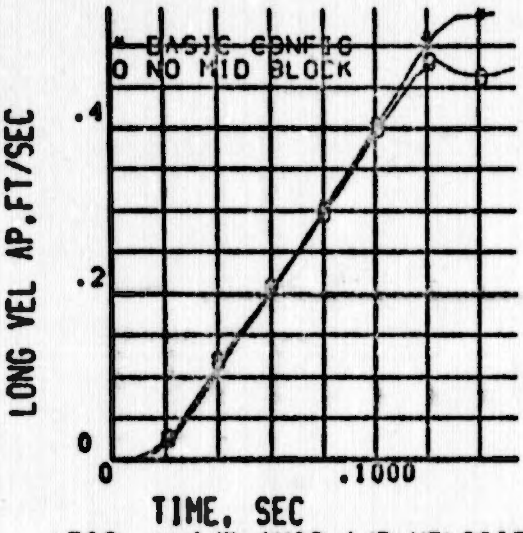

FIG 53 A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING

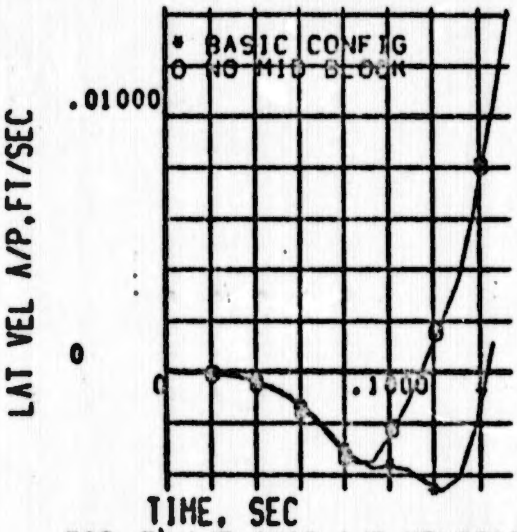

FIG 54 A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING

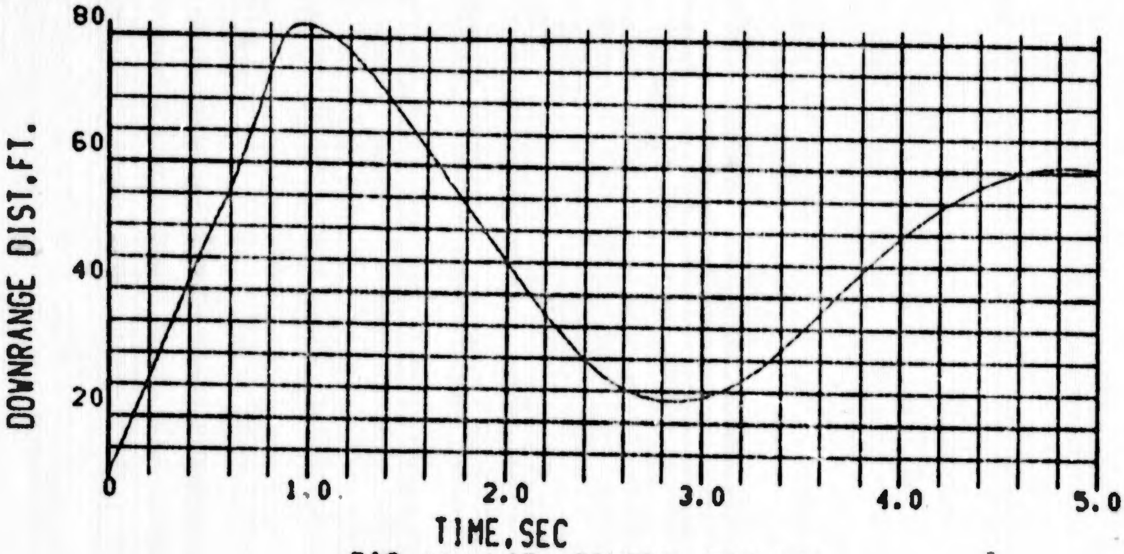

FIG 55 LAT. CONTROL FAILURE
SEAT AND/OR MAN DOWNRANGE DIST

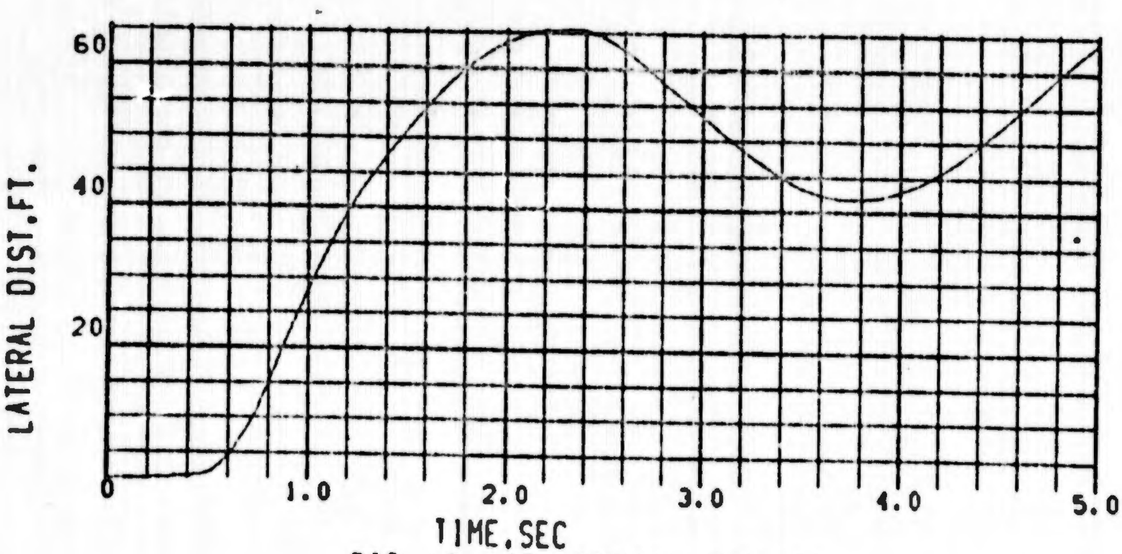

FIG 56 LAT. CONTROL FAILURE
SEAT AND/OR MAN LATERAL DIST.

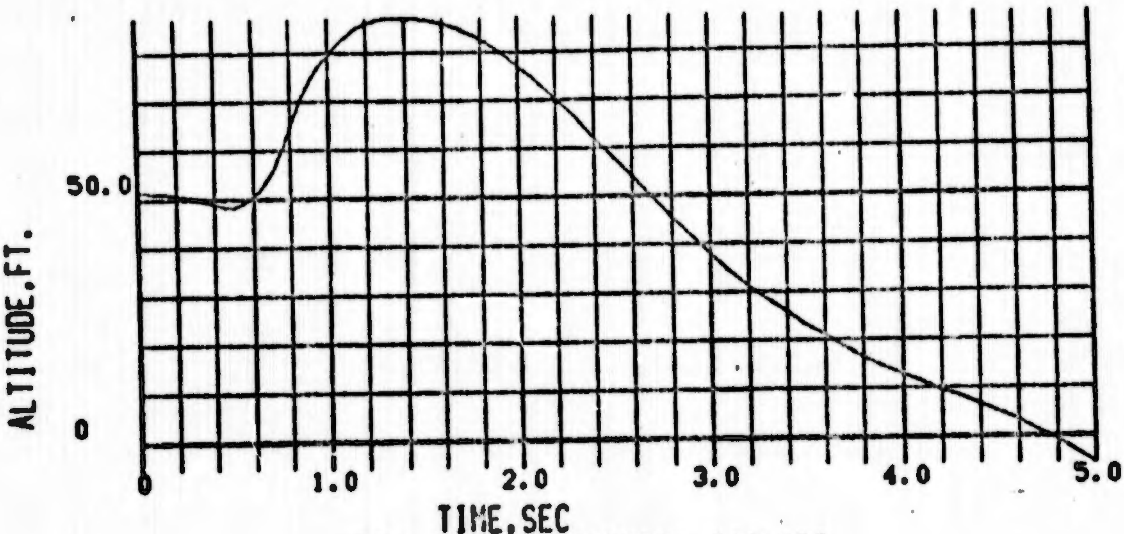

FIG 57 LAT. CONTROL FAILURE
SEAT AND/OR MAN ALTITUDE

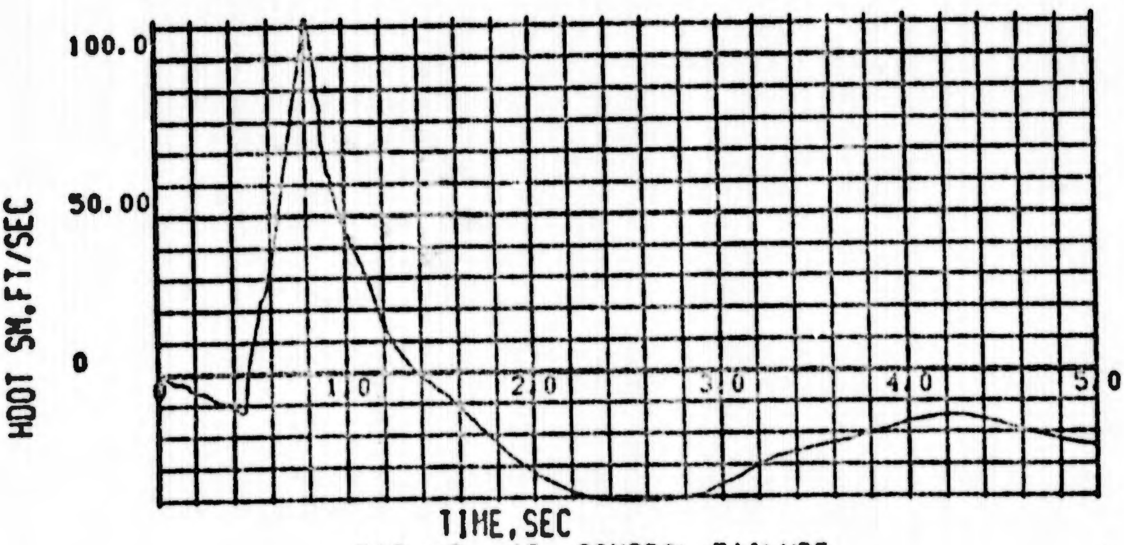

FIG 58 LAT. CONTROL FAILURE
SEAT AND/OR MAN CLIMB RATE

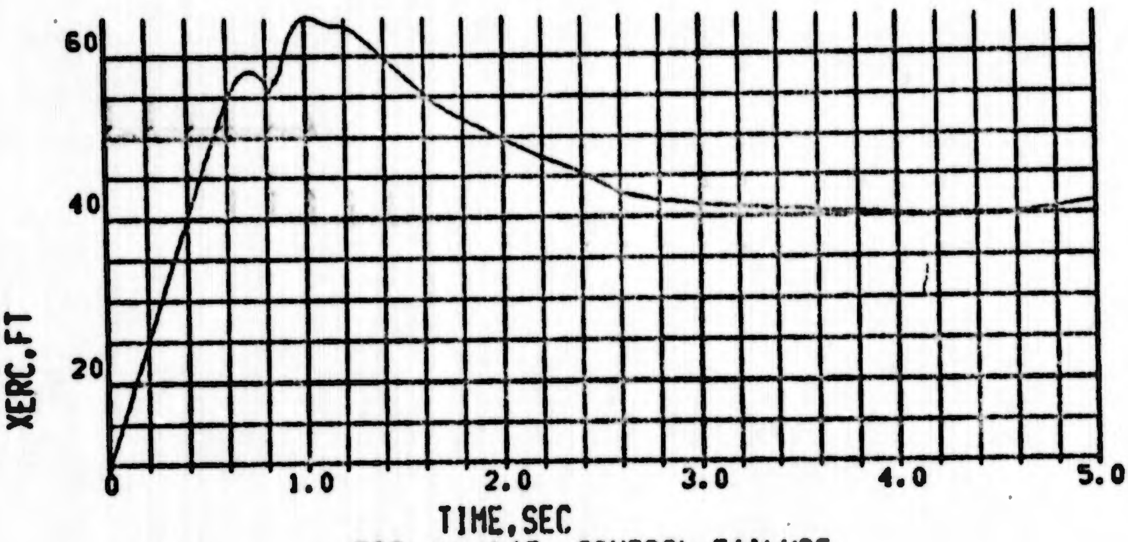

FIG 59 LAT. CONTROL FAILURE
PARACHUTE DOWNRANGE DISTANCE

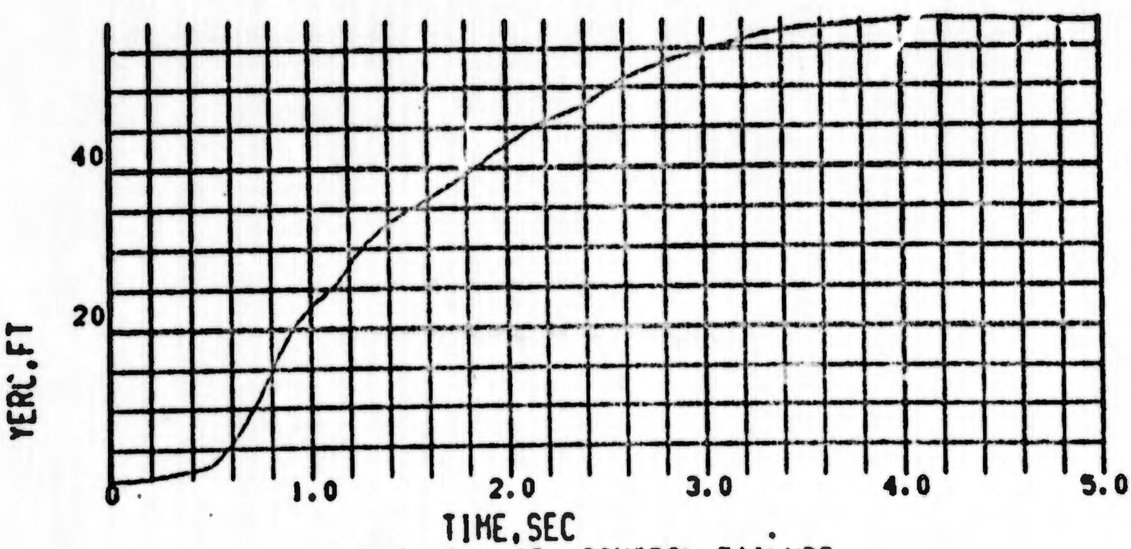

FIG 60 LAT. CONTROL FAILURE
PARACHUTE LATERAL DISTANCE

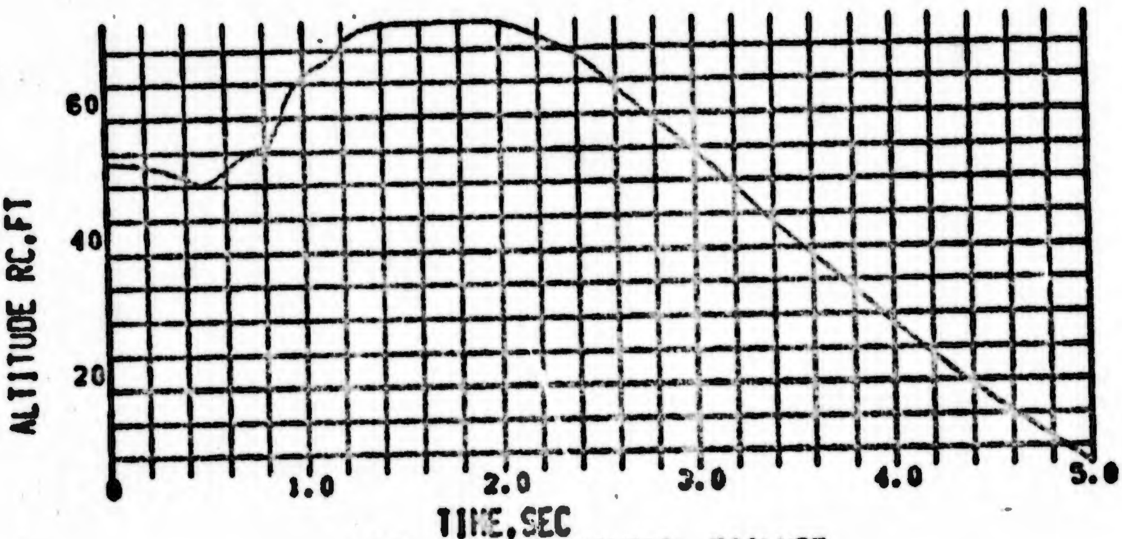

FIG 61 LAT. CONTROL FAILURE
PARACHUTE ALTITUDE

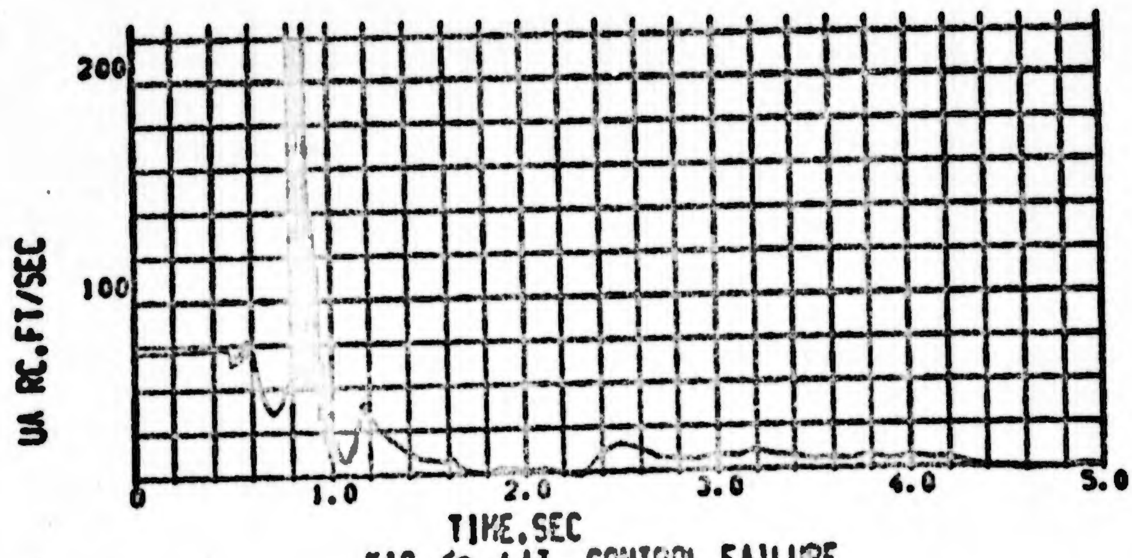

FIG 62 LAT. CONTROL FAILURE
PARACHUTE TOTAL AIRSPEED

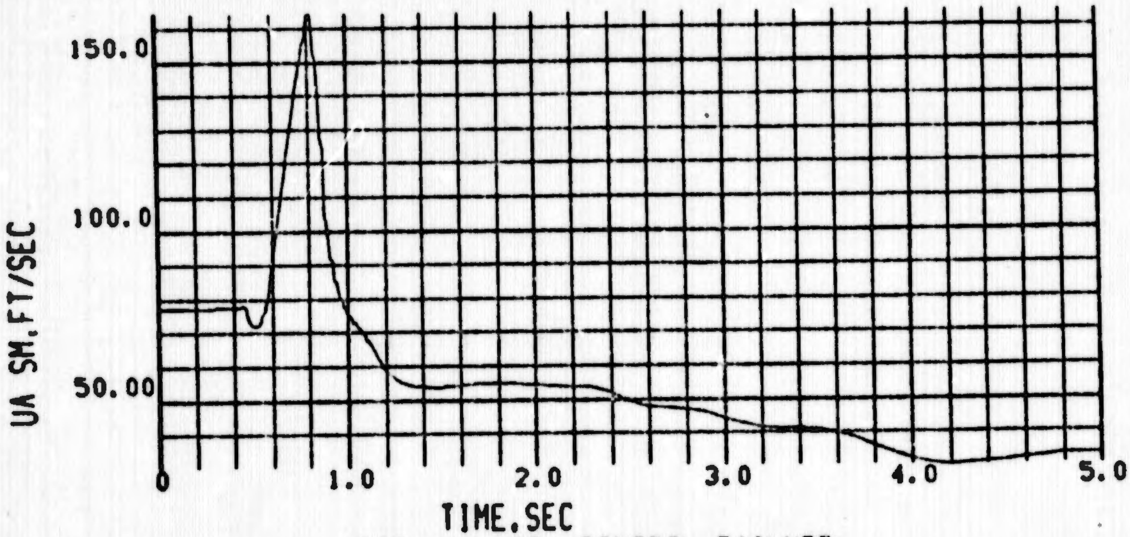

FIG 63 LAT. CONTROL FAILURE
SEAT AND/OR MAN TOTAL AIRSPEED

TABLE III

EXAMPLE OUTPUT

IVAN CLINKENBEARD 19 FEB 70 L1
READ N

(Pages 121 - 189)

NR-MATRIX INPUT

```
I NR%I¤ I NR%I¤ I NR%I¤ I NR%I¤ I NR%I¤ I NR%I¤ I NR%I¤ I NR6I¤ I NR%I¤

 1   45  2   90  3  135  4  180  5  350  6  369  7  373  8  449  9  525
10  601 11  677 12  753 13  829 14  976 15 1018 16 1046 17 1109 18 1115
19 1186 20 1240 21 1277 22 1349 23 1466 24 1557 25 1654 26 1684 27 1753
28 1789 29 1834 30 2194
```

OUTPUT

TIME HISTORY OUTPUT SUBSCRIPTS AND SCALE FACTORS

```
 1   1  -1   4 .0   1   7  24   1   0
```

FIG SOLID CLOTH PARACHUTES
VERT. TAIL VERT. CLEARANCE

FIG SOLID CLOTH PARACHUTES
VERT. TAIL LONG. CLEARANCE

FIG SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE

FIG SOLID CLOTH PARACHUTES
VERTICAL TAIL CLEARANCE

FIG SOLID CLOTH PARACHUTES
SEAT AXIAL LOAD FACTOR

FIG SOLID CLOTH PARACHUTES
SEAT SIDE LOAD FACTOR

FIG SOLID CLOTH PARACHUTES
SEAT NORMAL LOAD FACTJR

FIG SOLID CLOTH PARACHUTES
MAX DYNAMIC RESPONSE INDEX

FIG SOLID CLOTH PARACHUTES
SEAT AIRSPEED

FIG SOLID CLOTH PARACHUTES
DIST. FROM BRIDLE TO CHUTE CG

FIG SOLID CLOTH PARACHUTES
SEAT-PARACHUTE AZIMUTH ANGLE

FIG SOLID CLOTH PARACHUTES
SEAT-PARACHUTE ELEVATION ANGLE

FIG SOLID CLOTH PARACHUTES
SEAT CLIMB RATF

FIG SOLID CLOTH PARACHUTES
SEAT EARTH AXIS YAW ANGLE

FIG SOLID CLOTH PARACHUTES
SEAT EARTH AXIS PITCH ANGLE

FIG SOLID CLOTH PARACHUTES
SEAT EARTH AXIS BANK ANGLE

```
FIG      SOLID CLOTH PARACHUTES
  SEAT ALTITUDE

FIG      SOLID CLOTH PARACHUTES
SEAT DOWNRANGE DISTANCE

FIG      SOLID CLOTH PARACHUTES
   SEAT TRAJECTORY

FIG      SOLID CLOTH PARACHUTES
   SEAT TRAJECTORY

FIG      SOLID CLOTH PARACHUTES
SEAT ANGLE OF ATTACK

FIG      SOLID CLOTH PARACHUTES
   SEAT SIDESLIP ANGLE

FIG      SOLID CLOTH PARACHUTES
PARACHUTE ANGLE OF ATTACK

FIG      SOLID CLOTH PARACHUTES
PARACHUTE AREA DRAG COEFF
 4    2   182       1.000000  TIME          1
TIME.SEC
 1    7    52       1.000000  XESM          2
DOWNRANGE DIST.FT.
 1    8    53       1.000000  YESM          3
LATERAL DIST.FT.
 1    9    54      -1.000000  ALT SM        4
ALTITUDE.FT.
 4    6   186      57.299988  PSI.SM        5
PSI SM.DEG
 4    7   187      57.299988  THETA.SM      6
THETA SM.DEG
 4    8   188      57.299988  PHI.SM        7
PHI SM.DEG
 0    9     9      -1.000000  HDOT SM       8
HDOT SM.FT/SEC
 4   12   192       1.000000  UA SM         9
UA SM.FT/SEC
 4   18   198       1.000000  NX.CG SM     10
NXCG SM.G
 4   19   199       1.000000  NY.CG SM     11
NYCG SM.G
 4   20   200       1.000000  NZ.CG SM     12
NZCG SM.G
 4   16   196      57.299988  ALPHA SM     13
ALPHA SM.DEG
 4   17   197      57.299988  BETA SM      14
BETA SM.DEG
19   18  1204       1.000000  RL.D         15
RLD.FT
19   20  1206      57.299988  ALPHA.DC     16
ALPHA.DC , DEG
19   53  1239      57.299988  PSI P.S      17
PSI LOS PS.DEG
19   52  1238      57.299988  THETA P.S    18
THETA LOS PS.DEG
19   36  1222       1.000000  DXF DC       19
DXF.FT
19   37  1223       1.000000  DYF DC       20
DYF.FT
19   38  1224       1.000000  DZF DC       21
DZF.FT
```

```
19    12  1198        1.000000  SCD.DC     22
SCD.DC , SQ.FT.
 1    17    62       86.849991  DRI        23
DRI
 4    88   268        1.000000  DXSA       24
DXSA,FT
 4    89   269        1.000000  DYSA       25
DYSA,FT
 4    90   270       -1.000000  DHSA       26
DHSA,FT
 4    91   271        1.000000  RSA        27
RSA,FT
READ R C
```

INPUT TO THE R-MATRIX

5	0	5	18 ALPHA TABLES				
350	-3.141600	351	-2.785000	352	-2.445000	353	-2.094999
354	-1.745999	355	-1.396000	356	-1.047999	357	-0.700000
358	-0.349000	359	0.0	360	0.349000	361	0.700000
362	1.047999	363	1.396000	364	1.745999	365	2.094999
366	2.445000	367	2.785000	368	3.141600		
6	0	6	3 BETA TABLES				
369	0.0	370	0.262000	371	0.785000	372	3.141600
7	0	7	18 CN TABLES				
373	0.0	374	0.040000	375	-0.120000	376	-0.290000
377	-0.340000	378	-0.490000	379	-0.580000	380	-0.580000
381	-0.520000	382	-0.260000	383	0.040000	384	0.400000
385	0.620000	386	0.660000	387	0.640000	388	0.710000
389	0.670000	390	0.360000	391	0.070000		
7	19	7	37 CN TABLES				
392	0.0	393	0.040000	394	-0.120000	395	-0.290000
396	-0.340000	397	-0.490000	398	-0.580000	399	-0.580000
400	-0.520000	401	-0.260000	402	0.040000	403	0.400000
404	0.620000	405	0.660000	406	0.640000	407	0.710000
409	0.670000	409	0.360000	410	0.070000		
7	38	7	56 CN TABLES				
411	0.0	412	0.040000	413	-0.120000	414	-0.290000
415	-0.340000	416	-0.490000	417	-0.580000	418	-0.580000
419	-0.520000	420	-0.260000	421	0.040000	422	0.400000
423	0.620000	424	0.660000	425	0.640000	426	0.710000
427	0.670000	428	0.360000	429	0.070000		
7	57	7	75 CN TABLES				
430	0.0	431	0.040000	432	-0.120000	433	-0.290000
434	-0.340000	435	-0.490000	436	-0.580000	437	-0.580000
439	-0.520000	439	-0.260000	440	0.040000	441	0.400000
442	0.620000	443	0.660000	444	0.640000	445	0.710000
446	0.670000	447	0.360000	448	0.070000		
8	0	8	18 CA TABLES				
449	-0.900000	450	-0.780000	451	-0.720000	452	-0.450000
453	-0.040000	454	0.460000	455	0.940000	456	1.099999
457	1.179999	458	1.160000	459	0.820000	460	0.380000
461	0.230000	462	0.010000	463	-0.240000	464	-0.710000
465	-1.059999	466	-1.120000	467	-0.950000		
8	19	8	37 CA TABLES				
468	-0.900000	469	-0.780000	470	-0.720000	471	-0.450000
472	-0.040000	473	0.460000	474	0.940000	475	1.099999
476	1.179999	477	1.160000	478	0.820000	479	0.380000
480	0.230000	481	0.010000	482	-0.240000	483	-0.710000
484	-1.059999	485	-1.120000	486	-0.950000		
8	38	8	56 CA TABLES				
487	-0.636000	488	-0.551000	489	-0.509000	490	-0.318000
491	-0.028000	492	0.325000	493	0.665000	494	0.778000
495	0.835000	496	0.820000	497	0.560000	498	0.268000
499	0.162000	500	0.007000	501	-0.170000	502	-0.500000
503	-0.750000	504	-0.792000	505	-0.671000		
8	57	8	75 CA TABLES				
506	-1.160000	507	-0.820000	508	-0.380000	509	-0.230000
510	-0.010000	511	0.240000	512	0.710000	513	1.059999
514	1.120000	515	0.900000	516	0.780000	517	0.720000
518	0.450000	519	0.040000	520	-0.400000	521	-0.940000
522	-1.099999	523	-1.179999	524	-1.160000		
9	0	9	16 CM TABLES				
525	-0.075000	526	-0.188000	527	-0.253000	528	-0.110000
529	0.028000	530	0.157000	531	0.180000	532	0.085000
533	-0.024000	534	-0.120000	535	-0.125000	536	-0.080000

537	-0.030000	538	0.070000	539	0.098000	540	0.095000
541	0.080000	542	0.011000	543	-0.065000		
9	19	9	37	CM TABLES			
544	-0.075000	545	-0.188000	546	-0.253000	547	-0.110000
548	0.028000	549	0.157000	550	0.180000	551	0.085000
552	-0.024000	553	-0.120000	554	-0.125000	555	-0.080000
556	-0.030000	557	0.070000	558	0.098000	559	0.095000
560	0.080000	561	0.011000	562	-0.065000		
9	38	9	56	CM TABLES			
563	-0.075000	564	-0.148000	565	-0.193000	566	-0.100000
567	0.028000	568	0.107000	569	0.130000	570	0.075000
571	-0.014000	572	-0.070000	573	-0.075000	574	-0.080000
575	-0.030000	576	0.050000	577	0.055000	578	0.055000
579	0.035000	580	0.001000	581	-0.065000		
9	57	9	75	CM TABLES			
582	0.120000	583	0.125000	584	0.080000	585	0.030000
586	-0.070000	587	-0.098000	588	-0.095000	589	-0.080000
590	-0.011000	591	0.075000	592	0.188000	593	0.253000
594	0.110000	595	-0.028000	596	-0.157000	597	-0.180000
598	-0.085000	599	0.024000	600	0.120000		
10	0	10	18	C YAW TABLES			
601	0.0	602	0.0	603	0.0	604	0.0
605	0.0	606	0.0	607	0.0	608	0.0
609	0.0	610	0.0	611	0.0	612	0.0
613	0.0	614	0.0	615	0.0	616	0.0
617	0.0	618	0.0	619	0.0		
10	19	10	37	C YAW TABLES			
620	-0.100000	621	-0.115000	622	-0.120000	623	-0.100000
624	-0.037000	625	-0.037000	626	-0.100000	627	-0.120000
628	-0.115000	629	-0.100000	630	-0.075000	631	-0.065000
632	-0.070000	633	-0.112000	634	-0.112000	635	-0.070000
636	-0.065000	637	-0.076000	638	-0.100000		
10	38	10	56	C YAW TABLES			
639	-0.085000	640	-0.120000	641	-0.143000	642	-0.120000
643	0.008000	644	0.008000	645	-0.120000	646	-0.143000
647	-0.120000	648	-0.085000	649	-0.050000	650	-0.028000
651	-0.041000	652	-0.130000	653	-0.130000	654	-0.041000
655	-0.028000	656	-0.050000	657	-0.085000		
10	57	10	75	C YAW TABLES			
658	0.0	659	0.0	660	0.0	661	0.0
662	0.0	663	0.0	664	0.0	665	0.0
666	0.0	667	0.0	668	0.0	669	0.0
670	0.0	671	0.0	672	0.0	673	0.0
674	0.0	675	0.0	676	0.0		
11	0	11	18	C ROLL TABLES			
677	0.0	678	0.0	679	0.0	680	0.0
681	0.0	682	0.0	683	0.0	684	0.0
685	0.0	686	0.0	687	0.0	688	0.0
689	0.0	690	0.0	691	0.0	692	0.0
693	0.0	694	0.0	695	0.0		
11	19	11	37	C ROLL TABLES			
696	0.040000	697	0.0	698	-0.060000	699	-0.156000
700	-0.180000	701	-0.180000	702	-0.156000	703	-0.060000
704	0.0	705	0.040000	706	0.020000	707	-0.025000
708	-0.095000	709	-0.150000	710	-0.150000	711	-0.095000
712	-0.025000	713	0.020000	714	0.040000		
11	38	11	56	C ROLL TABLES			
715	0.220000	716	0.160000	717	0.050000	718	-0.110000
719	-0.355000	720	-0.355000	721	-0.110000	722	0.050000
723	0.160000	724	0.220000	725	0.192000	726	0.100000
727	-0.055000	728	-0.372000	729	-0.372000	730	-0.055000
731	0.100000	732	0.192000	733	0.220000		
11	57	11	75	C ROLL TABLES			
734	0.0	735	0.0	736	0.0	737	0.0
738	0.0	739	0.0	740	0.0	741	0.0
742	0.0	743	0.0	744	0.0	745	0.0

```
 746      0.0         747       0.0         748       0.0         749        0.0
 750      0.0         751       0.0         752       0.0
  12    0    12       18   CY TABLES
 753      0.0         754       0.0         755       0.0         756        0.0
 757      0.0         758       0.0         759       0.0         760        0.0
 761      0.0         762       0.0         763       0.0         764        0.0
 765      0.0         766       0.0         767       0.0         768        0.0
 769      0.0         770       0.0         771       0.0
  12   19    12       37   CY TABLES
 772    -0.448000     773     -0.480000     774    -0.510000      775    -0.590000
 776    -0.320000     777     -0.280000     778    -0.660000      779    -0.780000
 780    -0.580000     781     -0.448000     782    -0.480000      783    -0.510000
 784    -0.582000     785     -0.321000     786    -0.280000      787    -0.660000
 788    -0.780000     789     -0.570000     790    -0.448000
  12   38    12       56   CY TABLES
 791    -1.559999     792     -1.419999     793    -1.160000      794    -1.200000
 795    -0.610000     796     -0.610000     797    -1.429999      798    -1.820000
 799    -1.719999     800     -1.559999     801    -1.410000      802    -1.160000
 803    -1.230000     804     -0.610000     805    -0.610000      806    -1.429999
 807    -1.809999     808     -1.719999     809    -1.559999
  12   57    12       75   CY TABLES
 810      0.0         811       0.0         812       0.0         813        0.0
 814      0.0         815       0.0         816       0.0         817        0.0
 818      0.0         819       0.0         820       0.0         821        0.0
 822      0.0         823       0.0         824       0.0         825        0.0
 826      0.0         827       0.0         828       0.0
  13    2    13        9 SUST-DTR,TOR,CAR,CBR,CGR,DXCGR,DYCGR,DZCGR
 831      0.250000    832   1000.000000     833      0.574000     834        0.0
 835     -0.820000    835     -0.480000     837      0.0          838        1.110000
  13   10    13       10 FDB, DEPLOYMENT BAG STRIP OUT FORCE
 839     10.000000
  13   11    13       16 D.CHUTE IMP.-ROCGUN,DTPD,TOPD,CAPD,CBPD,CGPD
 840      0.0         841      0.200000     842   1000.000000     843       -1.000000
 844      0.0         845      0.0
  13   17    13       19 D.CHUTE IMPULSE-DXCGPD,DYCGPD,DZPDCG
 846     -1.290000    847      0.320000     848     -1.980000
  13   20    13       23 CATAPULT-A,K1,K3,TOC
 849      5.900000    850      0.090000     851      0.300000     852     1000.000000
  13   27    13       29 CATAPULT-DXCGC,DYCGC,DZCGC
 856     -1.040000    857      0.0          858     -0.750000
  13   30    13       30 TIME FROM TRIP SWITCH TO PILOT RELEASE
 859     50.000000
  13   31    13       36 R.CHUTE IMP.-ROCGUN,DTRC,TORC,CARC,CBRC,CGRC
 860      0.0         861      0.300000     862   1000.000000     863        0.940000
 864     -0.342000    865      0.0
  13   37    13       39 R.CHUTE IMPULSE-DXCGRC,DYCGRC,DZCGRC
 866     -1.270000    867     -0.010000     868     -2.230000
  13   40    13       45 TRACTOR-PHIDOTR,PHIOR,IFTRAC,DXCGT,DYCGT,DZCGT
 869      0.0         870      0.0          871     -1.000000     872        0.0
 873      0.0         874      0.0
  13   46    13       57 SUST-FR1,T1,FR2,T2,FR3,T3,FR4,T4,FR5,T5,FR6,T6
 875   5000.000000    876      0.025000     877   5000.000000     878        0.250000
 879      0.0         880      0.0          881      0.0          882        0.0
 883      0.0         884      0.0          885      0.0          886        0.274000
  13   58    13       69 CATAPULT-TV,CV,D,N,C,A1,A2,A3,R/M,VO,CO,PTANG
 887   2653.000000    888 231200.000000     889      0.031600     890        0.440000
 891      0.007000    892      0.280000     893    120.000000     894     1000.000000
 895  41620.000000    896      5.900000     897      0.000005     898        0.0
  13   70    13       73 R.CHUTE DEPLOYMENT IMPULSE-T1,FR1,T2,FR2
 899      0.0         900    300.000000     901      0.250000     902      300.000000
  13   74    13       77 D.CHUTE DEPLOYMENT IMPULSE-T1,FR1,T2,FR2
 903      0.0         904    200.000000     905      0.200000     906      200.000000
  13   78    13       87 ROLL MOTOR-DTRM,TORM,T1,F1,T2,F2,T3,F3,T4,F4
 907      0.320000    908   1000.000000     909      0.0          910      500.000000
 911      0.140000    912    500.000000     913      0.0          914     -500.000000
 915      0.330000    916   -500.000000
```

```
  13     89    13     94 ROLL MOTOR-DXCG,DYCG,DZCG,CARM,CBRM,CGRM
 918      -0.740000   919     -0.730000    920      -1.009999   921        0.0
 922      -1.000000   923      0.0
  13     95    13    104 PITCH MOTOR 1-DT,T0,T1,FP1,T2,FP2,T3,FP3,T4,FP4
 924       0.180000   925     50.000000    926       0.0        927    1000.000000
 928       0.180000   929   1000.000000    930       0.0        931        0.0
 932       0.0        933      0.0
  13    105    13    110 PITCH MOTOR 1-DXCG,DYCG,DZCG,CAPM,CBPM,CGPM
 934      -0.420000   935      0.0         936       1.320000   937       -0.730000
 938       0.0        939     -0.681900
  13    111    13    120 PITCH MOTOR 2-DT,T0,T1,FP1,T2,FP2,T3,FP3,T4,FP4
 940       0.180000   941     50.000000    942       0.0        943      200.000000
 944       0.180000   945    200.000000    946       0.0        947        0.0
 948       0.0        949      0.0
  13    121    13    126 PITCH MOTOR 2-DXCG,DYCG,DZCG,CAPM,CBBP,CGPM
 950      -0.060000   951      0.0         952       1.469999   953        1.000000
 954       0.0        955      0.0
  13    127    13    136 YAW MOTOR-DT,T0,T1,FY1,T2,FY2,T3,FY3,T4,FY4
 956       0.180000   957   1000.000000    958       0.0        959      200.000000
 960       0.180000   961    200.000000    962       0.0        963        0.0
 964       0.0        965      0.0
  13    137    13    142 YAW MOTOR-DXCG,DYCG,DZCG,CAYM,CBYM,CGYM
 966      -0.770000   967     -0.380000    968       0.560000   969        0.801200
 970       0.0        971     -0.598300
  13    143    13    144 PITCH MOTORS INITIATION RATES-PITCH UP,DOWN
 972       2.000000   973     -1.000000
  14      0    14      3 D.CHUTE-WEIGHT,DXAPEX,DYAPEX,DZAPEX
 976      14.040000   977     -2.919999    978       0.0        979        0.0
  14      4    14      8 D.CHUTE-RLINES,RSC,RIN,RLO,K
 980      13.320000   981      3.330000    982       1.405000   983       15.000000
 984    6000.000000
  14      9    14     17 D.CHUTE-B1,B2,B3,C1,C2,SCTI,K1,K2,K3
 985       0.084930   986     -0.153300    987       0.082150   988       -0.611300
 989       0.174100   990     15.000000    991       0.169000   992        0.264000
 993       1.000000
  14     18    14     21 D.CHUTE-POROSITY,DTGUN,B0,FD
 994       0.220000   995      0.0         996       0.008070   997        0.910000
  14     22    14     27 D.CHUTE BRIDLE-DX1,DY1,DZ1,DX2,DY2,DZ2
 998      -1.209999   999      0.666000   1000      -0.834000  1001       -1.209999
1002      -0.666000  1003     -0.834000
  14     28    14     33 D.CHUTE BRIDLE-DX3,DY3,DZ3,DX4,DY4,DZ4
1004      -0.500000  1005     -0.666000   1006       1.415000  1007       -0.500000
1008       0.666000  1009      1.415000
  14     34    14     35 D.CHUTE-ALLOWABLE FORCE DIR COS ERR, NO. LINES
1010       0.050000  1011      4.000000
  14     36    14     41 D.CHUTE-SCTA,SCTA2,SCTA3,SCNA,SCNA2,SCNA3
1012      -0.775000  1013    -34.599991   1014      20.849991  1015       44.299988
1016      -4.410000  1017     -2.799999
  15      0    15      3 R.CHUTE-WEIGHT,DXAPEX,DYAPEX,DZAPEX
1018      17.899994  1019      0.0        1020       0.0       1021       -2.589999
  15      4    15      8 R.CHUTE-RLINES,RSC,RIN,RLO,K
1022      22.829987  1023     14.000000   1024       4.870000  1025       23.000000
1026   20000.000000
  15      9    15     17 R.CHUTE-B1,B2,B3,C1,C2,SCTI,K1,K2,K3
1027       0.084930  1028     -0.153300   1029       0.082150  1030       -1.412999
1031       0.603100  1032    461.000000   1033       0.0       1034        0.121000
1035       1.000000
  15     18    15     21 R.CHUTE-POROSITY,DTGUN,B0,FD
1036       0.100000  1037      0.800000   1038       0.008070  1039        1.000000
  15     22    15     27 R.CHUTE-SCTA,SCTA2,SCTA3,SCNA,SCNA2,SCNA3
1040      13.410000  1041     69.099991   1042    -171.500000  1043      -38.199997
1044      37.000000  1045     39.699997
  16      0    16      6 SEAT/MAN-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
1046     354.399902  1047     11.990000   1048      22.619995  1049       10.620000
1050       3.020000  1051      0.0        1052       0.0
  16      7    16     15 SEAT/MAN-DXCG,DYCG,DZCG,CMQ,CLP,CNR,S,C,B
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1053       0.0        1054       0.0       1055       0.0       1056     -0.600000
1057      -0.026000   1058      -0.030000  1059       5.049999  1060      3.820000
1061       3.820000
  16     16     16    16 SEAT/MAN-0. IF BODY AXIS AERO,1. IF STABILITY
1062       0.0
  16     17     16    23 SEAT-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
1063     204.399994   1064       3.830000  1065       6.129999  1066      2.299999
1067      -1.879999   1068       0.0       1069       0.0
  16     24     16    32 SEAT-DXCG,DYCG,DZCG,CMO,CLP,CNR,S,C,B
1070       0.0        1071       0.0       1072       0.0       1073     -0.600000
1074      -0.026000   1075      -0.030000  1076       5.049999  1077      3.820000
1078       3.820000
  16     33     16    33 SEAT-0. IF BODY AXIS AERO,1. IF STABILITY
1079       0.0
  16     34     16    40 MAN-WEIGHT,IXX,IYY,IZZ,IXZ,IYZ,IXY
1080     150.000000   1081      13.000000  1082      15.000000  1083      6.000000
1084       0.0        1085       0.0       1086       0.0
  16     41     16    49 MAN-DXCG,DYCG,DZCG,CMO,CLP,CNR,S,C,B
1087       0.0        1088       0.0       1089       0.0       1090     -0.600000
1091      -0.026000   1092      -0.030000  1093       6.000000  1094      0.900000
1095       1.375000
  16     50     16    50 MAN-0. IF BODY AXIS AERO,1. IF STABILITY
1096       0.0
  16     51     16    52 MAN-SPINAL CONSTANTS 2*ZETA*OMEGA,OMEGA**2
1097      23.699997   1098    2795.000000
  16     53     16    55 MAN AERO CP-DXCP,DYCP,DZCP
1099       0.074500   1100       0.0       1101       0.090000
  16     56     16    56 1. FOLLOWS MAN AFTER SEAT/MAN SEPARATION,2. SEAT
1102       1.000000
  16     58     16    58 MAN SKIN FRICTION COEFFICIENT
1104       0.0
  16     60     16    62 MAN-LOAD FACTOR POINT ON MAN DX,DY,DZ
1106       0.0        1107       0.0       1108      -1.665000
  21      0     21     2 DX,DY,DZ CO-ORDINATES OF A/P POINT,VERT. TAIL--
1277     -16.500000   1278       0.0       1279      -9.000000
  21     21     21    26 PSIAC,THETAAC,PHIAC,PSICS,THETACS,PHICS
1298       0.0        1299       0.296500  1300       0.0       1301      0.0
1302      -0.296500   1303       0.0
  21     30     21    32 RAIL AXIS Z COORDINATE-TOP,MIDDLE,BOTTOM BLOCKS
1307      -2.796000   1308      -1.252000  1309      -0.585300
  21     33     21    35 DXSB1,DYSB1,DZSB1 IS RT LOWER BLOCK SEAT POS.
1310      -0.559600   1311       0.860000  1312       1.360999
  21     36     21    38 DXSB2,DYSB2,DZSB2 IS RT MIDDLE BLOCK SEAT POS.
1313      -0.754500   1314       0.860000  1315       0.723400
  21     39     21    41 DXSB3,DYSB3,DZSB3 IS RT UPPER BLOCK SEAT POS.
1316      -1.205999   1317       0.860000  1318      -0.753300
  21     42     21    44 DXSB4,DYSB4,DZSB4 IS LEFT LOWER BLOCK SEAT POS.
1319      -0.559600   1320      -0.860000  1321       1.360999
  21     45     21    47 DXSB5,DYSB5,DZSB5 IS LEFT MID. BLOCK SEAT POS.
1322      -0.754500   1323      -0.860000  1324       0.725600
  21     48     21    50 DXSB6,DYSB6,DZSB6 IS LEFT UPPER BLOCK SEAT POS.
1325      -1.205999   1326      -0.860000  1327      -0.753300
  21     51     21    60 GX,GY,UP,STROKE,RAIL LNGTH,BF,GZ,SX,SY,SZ
13281000000.000000   13291000000.000000  1330       1.000000  1331      2.832999
1332       3.990000   1333       0.020000  13341000000.000000  1335   5000.000000
1336    5000.000000   1337    5000.000000
  21     61     21    63 XAR01,YAR01,ZAR01 IS A/P POS. BOTTOM RT RAIL
1338      10.049999   1339       1.990000  1340       0.720000
  21     64     21    66 XAR02,YAR02,ZAR02 IS A/P POS. BOTTOM LEFT RAIL
1341      10.049999   1342       0.270000  1343       0.720000
  21     67     21    70 BX,BY,BZ,POS.LOWER BLOCK AT TRIP SWITCH CONTACT
1344    5530.000000   1345    7600.000000  1346    5120.000000  1347     -3.000000
  22      0     22   117 AIRPLANE CURVE FIT COEF. FOR SINGLE WING FAN
1348      -0.002635   1349      -4.117000  1350       7.466999  1351     -3.559999
1352       0.0        1353       1.233999  1354      -5.044999  1355      8.035000
1356      -4.226000   1357       0.0       1358      -0.662900  1359      4.858999
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1360   -9.549999  1361     5.353999  1362     0.0       1363   -0.049150
1364   -1.462000  1365     7.014000  1366    -5.504000  1367    0.0
1368   -0.067840  1369    -1.643999  1370     6.601000  1371   -4.889999
1372    0.0       1373     0.002800  1374    -1.691000  1375    9.764000
1376   15.440000  1377     0.0       1378    -0.033230  1379    3.759000
1380   -1.921000  1381    -1.066999  1382     0.0       1383    0.036210
1384  -11.980000  1385    52.079987  1386   -40.129990  1387    0.0
1388   -0.186900  1389    -1.481000  1390     5.778999  1391   -4.112000
1392    0.0       1393    -0.627700  1394     3.014000  1395   -4.564000
1396    2.278000  1397     0.0       1398    -0.121700  1399    0.525100
1400   -0.689600  1401     0.285700  1402     0.0       1403   -0.549000
1404    0.014530  1405     3.853999  1406    -3.320000  1407    0.0
1408    0.442400  1409    16.729996  1410    -6.804999  1411   12.280000
1412    0.0       1413    -0.048830  1414     1.344000  1415   -4.816999
1416    3.296000  1417     0.0       1418     0.443300  1419   -3.153999
1420    6.214000  1421    -3.502000  1422     0.0       1423   -0.253400
1424   -0.061910  1425     0.209200  1426     0.105000  1427    0.0
1428    0.131900  1429    -1.719999  1430     3.641999  1431   -2.052999
1432    0.0       1433    -0.094320  1434    -0.469800  1435    1.316999
1436   -0.754300  1437     0.0       1438     0.990000  1439   -1.533000
1440    0.380500  1441     0.153500  1442     0.0       1443    0.111400
1444    4.118999  1445   -41.639999  1446   106.599991  1447    0.0
1448   -0.475800  1449    -2.127999  1450    28.439987  1451  -61.719986
1452    0.0       1453     0.872500  1454     3.473000  1455   -4.528999
1456    0.109000  1457    -0.137900  1458     5.514999  1459  -19.079987
1460   14.809999  1461    -0.015540  1462    -0.223700  1463    0.009506
1464    9.084000  1465     0.936800
  23    0    23   70 AIRPLANE CURVE FIT COEF. FOR BOTH WING FANS
1466    1.000000  1467    -1.000000  1468     0.0       1469    0.0
1470    0.0       1471     0.0       1472    -2.839999  1473    2.839999
1474    0.0       1475     0.0       1476     0.914000  1477   -0.160900
1478   -1.346000  1479     0.0       1480     0.0       1481    0.0
1482   -3.115999  1483     7.460999  1484     0.0       1485    0.0
1486   -0.001661  1487    -0.121500  1488     0.112800  1489   -0.071690
1490    0.0       1491     0.026190  1492    -2.221999  1493   12.540000
1494  -11.009999  1495     0.0       1496    -0.088680  1497    5.617999
1498  -39.009995  1499    34.109985  1500     0.0       1501    0.002997
1502    0.130000  1503     0.045580  1504    -0.018020  1505    0.0
1506    0.180000  1507    -0.459000  1508     0.368500  1509    0.0
1510    0.0       1511     0.0       1512     0.236700  1513    0.881200
1514    0.0       1515     0.0       1516     0.011500  1517    0.281800
1518   -0.066200  1519    -0.132700  1520     0.0       1521   -0.043600
1522   -0.072000  1523    -0.133600  1524    -0.108100  1525    0.0
1526   -0.0       1527     0.121600  1528     0.0       1529   -0.130700
1530    0.0       1531     0.872500  1532     0.349100  1533    6.250000
1534   -0.005730  1535    -0.017800  1536     0.349100
  23   71    23   73 PF100.PFNG.PFNG2 ARE FAN POWER CURVEFIT COEF.
1537    0.0       1538     0.0       1539     0.0
  23   76    23   77 ENGINE RPM AND THRUST ITERATION TOLERANCE
1542  100.000000  1543    -1.000000
  23   78    23   80 KXNF1.KXNF2.KXNF3 ARE NOSE FAN AXIAL FORCE COEF
1544    2.990000  1545    -2.719000  1546     0.699100
  23   82    23   84 KNNF1.KNNF2.KNNF3 ARE NOSE FAN NORM. FORCE COEF
1548   -1.153999  1549     1.466999  1550    -0.320600
  23   85    23   90 EBV.EBS.EDB.EA.EI.ET ARE TRIM TOLERANCES
1551    0.010000  1552     0.010000  1553     0.010000  1554    0.001745
1555    0.001745  1556    50.000000
  24   39    24   45 CLAT.CLDE.CDOT.CDCL2T.AKXNF.TJ.CYDA
1596    3.037000  1597     1.318000  1598     0.015000  1599    0.100000
1600    1.000000  1601     0.0       1602    -0.034400
  24   46    24   52 CYDR.PFYPV.CDSW.PFYRNF.CYR.CLQ.AKNNF
1603    0.111700  1604   -31.799988  1605   317.000000  1606  -61.327988
1607    0.625000  1608     3.440000  1609     0.425000
  24   53    24   59 PNPU.PNPV.CLP.CLR.CLDA.CLDR.PLPV
1610    3.000000  1611    10.000000  1612    -0.310000  1613    0.150000
1614    0.050400  1615     0.014300  1616  -134.000000
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  24      60     24     66 PLPPMF,CMB,CMQ,PMPU,PCMSOS,CNDR,CNRYAW
1617  -645.699951   1618     -0.356000  1619       -6.900000  1620       134.000000
1621    35.500000   1622     -0.069900  1623       -0.400000
  24      67     24     73 CNP,PYAWV,CDSX,PYWRMF,PYAWXN,CMADOT,CMQDOT
1624    -0.020000   1625     47.000000  1626      560.000000  1627      -645.699951
1628    -4.379999   1629     -2.296000  1630        0.0
  24      74     24     80 CLBDOT,CNBDOT,CLPDOT,CLRDOT,CNPDOT,CNRDOT,CLADO
1631      0.0       1632      0.0       1633        0.0       1634         0.0
1635      0.0       1636      0.0       1637        1.148000
  24      81     24     81 CYBDOT
1638      0.0
  24      96     24     96 AKTS
1653      1.000000
  25      10     25     12 TOOOR,TOOOL,TOOONF
1664  5567.000000   1665   5567.000000  1666     1577.000000
  25      16     25     24 BVR,BVL,BSR,BSL,DAR,DAL,DR,DELTAH,DELTAE
1670    -0.037500   1671     -0.037500  1672        0.623800  1673         0.623800
1674      0.0       1675      0.0       1676        0.0       1677         0.349000
1678      0.0
  25      29     25     29 NOSE FAN BUCKET POSITION
1683      1.000000
  26       0     26     35 AIRPLANE GEOM.,WEIGHT,INERTIA
1684   260.000000   1685     29.829987  1686        9.400000  1687        52.859985
1688     2.131999   1689      0.831900  1690       42.599991  1691         5.200000
1692     5.070000   1693      7.070000  1694       15.599999  1695        14.020000
1696     1.530999   1697      0.104000  1698     4252.000000  1699     15140.000000
1700 17420.000000   1701    919.000000  1702        0.0       1703        30.199997
1704    15.000000   1705      1.000000  1706        0.0       1707         0.0
1708      0.0       1709      0.0       1710        0.0       1711         1.000000
1712      0.0       1713      0.0       1714        0.0       1715      9200.000000
1716      0.0       1717      0.0       1718        0.0       1719        15.000000
  26      36     26     38 SHORT OF A/P DYN.,A/P DIR.COS.,A/P EARTH RATES
1720      1.000000  1721      1.000000  1722        1.000000
  26      39     26     39 A/P MANEUVER CONTROL
1723      1.000000
  26      40     26     43 H.TAIL-DHTRIM,DHCOMMAND,1/TH,TDELAY
1724      0.0       1725      0.0       1726       20.000000  1727         0.0
  26      44     26     46 AILERON-DACOMMAND,1/TA,TDELAY
1728      0.0       1729     25.000000  1730        0.0
  26      47     26     50 WING,NOSE FAN-TOOC,TOOONF,TOOOCOM,TOOONCOM
1731      0.0       1732      0.0       1733        0.0       1734         0.0
  26      51     26     54 WING,NOSE FAN-1/TF,TDELF,1/TNF,TDELNF
1735      0.815000  1736      0.200000  1737        1.600000  1738         0.200000
  26      55     26     59 BVLCOM,BVTRIM,BVRCOM,1/TBV,TDELAYBV
1739      0.0       1740      0.0       1741        0.0       1742        22.000000
1743      0.0
  26      60     26     64 BSTRIM,BSRCOM,1/TBS,TDELAYBS,BSLCOM
1744      0.0       1745      0.0       1746       22.000000  1747         0.0
1748      0.0
  26      65     26     68 DBTRIM,DBCOM,1/TB,TDELAYB
1749      0.0       1750      0.0       1751       10.000000  1752         0.0
  28       0     28     44 UPPER PREDICTOR-CORRECTOR ERROR BOUNDS
1789      0.040000  1790      0.100000  1791        0.040000  1792         0.050000
1793      0.050000  1794      0.050000  1795       10.000000  1796        10.000000
1797     10.000000  1798      0.020000  1799        0.020000  1800         0.020000
1801      0.020000  1802      0.020000  1803        0.020000  1804         0.010000
1805      0.010000  1806      0.100000  1807        0.100000  1808         0.100000
1809     10.000000  1810     10.000000  1811       10.000000  1812         0.100000
1813      0.100000  1814      0.100000  1815       10.000000  1816        10.000000
1817     10.000000  1818      0.040000  1819        0.100000  1820         0.040000
1821      0.030000  1822      0.030000  1823        0.030000  1824        10.000000
1825     10.000000  1826     10.000000  1827        0.020000  1828         0.020000
1829      0.020000  1830      0.020000  1831        0.020000  1832         0.020000
1833      0.040000
  29       0     29     44 LOWER PREDICTOR-CORRECTOR ERROR BOUNDS
1834      0.003000  1835      0.003000  1836        0.003000  1837         0.003000
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1838	0.003000	1839	0.003000	1840	5.000000	1841	5.000000
1842	5.000000	1843	0.001000	1844	0.001000	1845	0.001000
1846	0.001000	1847	0.001000	1848	0.001000	1849	0.001000
1850	0.001000	1851	0.010000	1852	0.010000	1853	0.010000
1854	5.000000	1855	5.000000	1856	5.000000	1857	0.010000
1858	0.010000	1859	0.010000	1860	5.000000	1861	5.000000
1862	5.000000	1863	0.001000	1864	0.001000	1865	0.001000
1866	0.004000	1867	0.030000	1868	0.003500	1869	5.000000
1870	5.000000	1871	5.000000	1872	0.001000	1873	0.001000
1874	0.001000	1875	0.001000	1876	0.001000	1877	0.001000
1878	0.010000						

READ R

INPUT TO THE R-MATRIX

1	38	83	0.0	ZE A/P
4	3	183	0.002000	DT
4	4	184	1.000000	TMAX
4	5	185	0.010000	DT.PRINT
4	63	243	1020.000000	AIRSPEED A/P
13	3	832	0.125000	TOR
13	13	842	0.075000	TO.DP
13	23	852	0.0	TOC
14	0	976	1.799999	WEIGHT.FLAT CIRC. CLOTH DP#2.22
14	1	977	-2.919999	X APEX OF BRIDLE
14	2	978	0.0	Y APEX OF BRIDLE
14	3	979	0.0	Z APEX OF BRIDLE
14	4	980	3.179999	RLINES-FLAT CIRCULAR CLOTH DC
14	5	981	1.589999	RSC-FLAT CIRCULAR CLOTH DC
14	6	982	1.030000	RIN-FLAT CIRCULAR CLOTH DC
14	7	983	10.000000	RLO.RUNS 1.2
14	8	984	7000.000000	K
14	9	985	0.084928	B1
14	10	986	-0.153270	B2
14	11	987	0.082146	B3
14	12	988	-1.412900	C1 .FLAT CIRCULAR CLOTH
14	13	989	0.603100	C2 .FLAT CIRCULAR CLOTH
14	14	990	7.000000	SCDI
14	15	991	0.339000	K1.CLOTH PARACHUTE
14	16	992	0.121000	K2.CLOTH PARACHUTE
14	17	993	1.000000	K3.CLOTH PARACHUTE
14	18	994	0.010000	CC.CLOTH PARACHUTE. ALT#SL
14	19	995	0.0	DTGUN
14	20	996	0.009070	B0
14	21	997	0.710000	FD.RUNS 1.2
14	22	998	-1.209999	DX1
14	23	999	-0.666000	DY1
14	24	1000	-0.834000	DZ1
14	25	1001	-0.500000	DX2
14	26	1002	-0.666000	DY2
14	27	1003	1.415000	DZ2
14	28	1004	-0.500000	DX3
14	29	1005	0.666000	DY3
14	30	1006	1.415000	DZ3
14	31	1007	-1.209999	DX4
14	32	1008	0.666000	DY4
14	33	1009	-0.834000	DZ4
14	34	1010	0.050000	ERRDC
14	35	1011	4.000000	NLINES
14	36	1012	0.690000	SCTA.FLAT CIRC. CLOTH.ALT.#SL
14	37	1013	4.580000	SCTA2.FLAT CIRC. CLOTH.ALT.#SL
14	38	1014	-8.820000	SCTA3.FLAT CIRC. CLOTH.ALT.#SL
14	39	1015	-1.962000	SCNA-FLAT CIRCULAR CLOTH.SCTI#7
14	40	1016	1.901999	SCNA2-FLAT CIRCULAR CLOTH.SCTI#7
14	41	1017	2.040000	SCNA3-FLAT CIRCULAR CLOTH.SCTI#7
13	75	904	163.000000	FDC1
13	77	906	163.000000	FDC2

TRIM CON

CONVERGENCE AFTER 4 CYCLES

TIME H

TIME HISTORY

BEGINNING OF COMBINED SEAT-MAN TRAJECTORY.

0.0					
10.4275	1.1300	1.2814	0.0	0.5078	0.0
-0.0000	1019.9993	-0.0557	-0.0001	0.9316	0.5078
0.0	2.5545	0.0	-168.9052	50.0088	0.0
0.0	0.0	0.0	0.0	27.0066	1.1300
-7.5720	28.0708				

0.0120					
22.6672	1.1300	1.2822	0.0001	0.4869	0.0002
0.2783	1019.9185	0.6086	-0.0012	3.1006	0.4712
-0.0001	2.5939	0.0	-168.9058	49.9949	0.0
0.0	0.0	0.0	0.0702	27.0062	1.1299
-7.5714	28.0702				

0.0220					
32.8644	1.1300	1.2910	0.0001	0.4319	0.0013
1.7792	1019.4502	2.3568	-0.0043	8.7338	0.3318
-0.0001	2.5829	0.0	-168.9072	49.9701	0.0
0.0	0.0	0.0	0.7232	27.0025	1.1296
-7.5638	28.0646				

0.0310					
42.0355	1.1300	1.3177	0.0000	0.3604	0.0045
4.2061	1018.6602	2.9084	-0.0102	9.7636	0.1238
0.0002	2.5836	0.0	-168.9148	49.9530	0.0
0.0	0.0	0.0	2.5085	26.9915	1.1288
-7.5396	28.0475				

0.0410					
52.2163	1.1300	1.3743	-0.0004	0.3144	0.0117
7.1787	1017.5962	3.6579	-0.0202	10.7316	-0.0899
0.0008	2.5821	0.0	-168.9073	49.9568	0.0
0.0	0.0	0.0	5.5454	26.9680	1.1273
-7.4878	28.0109				

0.0510					
62.3850	1.1302	1.4620	-0.0010	0.2678	0.0227
10.3957	1016.3062	4.3484	-0.0314	11.1791	-0.3178
0.0019	2.5840	0.0	-168.9172	49.9503	0.0
0.0	0.0	0.0	8.9473	26.9303	1.1253
-7.4069	27.9530				

0.0610					
72.5395	1.1304	1.5824	-0.0020	0.2128	0.0372
13.6976	1014.8223	4.9522	-0.0433	11.4458	-0.5606
0.0034	2.5819	0.0	-168.9108	49.9379	0.0
0.0	0.0	0.0	11.9284	26.8763	1.1227
-7.2947	27.8713				

0.0710					
82.6779	1.1308	1.7362	-0.0032	0.1478	0.0549
17.0930	1013.1877	5.3724	-0.0564	11.7040	-0.8189
0.0052	2.5840	0.0	-168.9160	49.9548	0.0

0.0	0.0	0.0	13.9196	26.8040	1.1198
-7.1498	27.7638				
0.0810					
92.7988	1.1314	1.9245	-0.0047	0.0722	0.0756
20.5845	1011.4780	5.5252	-0.0763	12.0299	-1.0940
0.0075	2.5815	0.0	-168.9975	49.6124	0.0008
0.0	-2.3015	0.1053	14.7112	26.7124	1.1165
-6.9705	27.6294				
0.0910					
102.9019	1.1323	2.1483	-0.0064	-0.0133	0.0987
24.1888	1009.7708	5.4765	-0.0982	12.4033	-1.3861
0.0101	2.5854	0.0	-169.5736	47.4210	0.0008
0.0	-2.3015	0.1054	14.4422	26.6014	1.1132
-6.7550	27.4682				
0.1010					
112.9867	1.1335	2.4085	-0.0077	-0.0965	0.1240
27.8621	1007.8425	7.4443	-0.0788	12.5210	-1.6809
0.0122	2.6061	0.0	-170.5541	43.2576	0.0008
0.0	-2.3015	0.1056	13.4801	26.4707	1.1098
-6.5015	27.2799				
0.1110					
123.0483	1.1351	2.7063	-0.0086	-0.1673	0.1511
31.7436	1005.4897	7.8017	-0.1121	13.4726	-1.9767
0.0139	2.6647	0.0	-171.7542	37.2655	0.0008
0.0	-2.3015	0.1062	12.2751	26.3154	1.1064
-6.2080	27.0603				
0.1210					
133.0851	1.1372	3.0441	-0.0101	-0.2562	0.1809
35.8687	1003.1326	7.7024	-0.1611	14.1363	-2.3056
0.0165	2.7836	0.0	-172.9893	29.8521	0.0008
0.0	-2.3015	0.1074	11.3688	26.1340	1.1031
-5.9713	26.8081				
0.1310					
143.0975	1.1400	3.4247	-0.0112	-0.3390	0.2131
40.3229	1001.1282	4.5721	-0.2262	14.6379	-2.6476
0.0195	2.9846	0.0	-174.1398	21.6759	0.0008
0.0	-2.3015	0.1091	11.1162	25.9276	1.1007
-5.4874	26.5248				
0.1410					
153.0904	1.1435	3.8433	-0.0174	-0.3447	0.2400
42.6389	999.3088	5.1077	-0.1371	5.0215	-2.7905
0.0274	3.2802	0.0	-175.1406	13.5933	0.0008
0.0	-2.3015	0.1110	11.0349	25.7025	1.0981
-5.0591	26.2186				
0.1510					
163.0622	1.1474	4.2773	-0.0450	-0.0848	0.2369
44.2035	996.5212	11.7170	0.0751	6.5644	-2.6277
0.0573	3.6764	0.0	-175.9766	6.4379	0.0008
0.0	-2.3015	0.1126	9.4402	25.4590	1.0972
-4.6056	25.8955				
0.1610					
172.9981	1.1514	4.7283	-0.0828	-0.0876	0.2296
45.9993	992.8547	11.5842	0.0430	6.5700	-2.7438
0.0951	4.1729	0.0	-176.6709	0.4314	0.0008
0.0	-2.3015	0.1133	7.1682	25.1816	1.0971
-4.1250	25.5408				

0.1710					
182.8965	1.1554	5.1972	-0.1329	-0.4248	0.2219
47.7954	989.2349	11.4836	0.0661	6.4947	-3.1950
0.1439	4.7650	0.0	-177.2408	-4.3451	0.0008
0.0	-2.3015	0.1124	4.9847	24.6688	1.0976
-3.6162	25.1543				
0.1810					
192.7587	1.1594	5.6841	-0.2008	-1.0626	0.2137
49.5849	985.7820	10.8448	0.0972	6.3465	-3.9470
0.2093	5.4477	0.0	-177.7003	-7.9512	0.0008
0.0	-2.3015	0.1100	3.3834	24.5215	1.0985
-3.0793	24.7384				
0.1910					
202.5860	1.1633	6.1888	-0.2941	-1.9234	0.2053
51.3624	982.4443	10.7792	0.1408	6.1457	-4.9217
0.2992	6.2179	0.0	-178.0587	-10.5342	0.0008
0.0	-2.3015	0.1062	2.5949	24.1410	1.0998
-2.5143	24.2965				
0.2010					
212.3793	1.1669	6.7112	-0.4232	-2.9738	0.1969
53.1245	979.1636	10.7101	0.2027	5.9024	-6.0859
0.4246	7.0761	0.0	-178.3206	-12.2377	0.0008
0.0	-2.3015	0.1020	2.5907	23.7280	1.1012
-1.9216	23.8311				
0.2110					
222.1389	1.1702	7.2512	-0.6032	-4.1797	0.1893
54.8680	975.9465	10.6307	0.2922	5.6273	-7.4050
0.6010	8.0235	0.0	-178.4840	-13.2005	0.0008
0.0	-2.3015	0.0993	3.1474	23.2829	1.1026
-1.3017	23.3453				
0.2210					
231.8656	1.1730	7.8085	-0.8557	-5.5017	0.1839
56.5909	972.7971	10.5374	0.4224	5.3331	-8.8396
0.8503	9.0588	0.0	-178.5391	-13.5606	0.0008
0.0	-2.3015	0.1009	3.9448	22.6059	1.1037
-0.6550	22.8420				
0.2310					
241.5603	1.1749	8.3829	-1.2113	-6.6996	0.1828
58.2654	969.7896	7.7376	0.5402	4.3845	-10.3472
1.2041	10.1419	20.8866	-178.4660	-13.5151	0.0008
0.0	-2.3015	0.6010	4.6666	22.2983	1.1043
0.0176	22.3256				
0.2410					
251.2273	1.1756	8.9727	-1.7112	-8.5832	0.2044
59.7919	967.1697	10.3552	0.8952	4.6910	-12.1310
1.7021	9.2364	14.8610	-178.1517	-22.3462	0.0008
0.0	-2.3015	4.9695	5.0045	21.7641	1.1039
0.7142	21.8037				
0.2510					
260.8630	1.1743	9.5786	-2.4216	-10.2700	0.2437
61.1837	964.3835	5.8158	1.1370	-1.1382	-13.9098
2.4139	10.3577	24.1904	-177.7685	-51.2606	1.4981
0.0	3.3312	4.7235	4.9214	21.1998	1.1015
1.4349	21.2768				
0.2610					
270.4731	1.1701	10.1836	-3.4257	-11.3387	0.2377
59.9563	961.8726	10.0373	1.9437	-1.1274	-14.9079

3.4374	10.2708	36.2504	155.6539	-88.5842	-1.1748
0.0	1.0682	4.0443	3.2218	20.6132	1.0966
2.1621	20.7552				
0.2710					
280.0488	1.1616	10.7803	-4.7844	-11.4048	0.2272
58.8958	956.9404	21.1693	3.4418	-10.0077	-14.9143
4.8110	10.9236	9.2058	6.1727	-51.9322	-2.3788
0.0	0.6672	5.0116	-0.0331	19.9934	1.0873
2.8878	20.2301				
0.2810					
289.5519	1.1469	11.3646	-6.0160	-9.4613	0.2780
58.6504	947.2031	37.8582	6.0677	0.3351	-12.9905
5.9866	11.3596	37.7692	6.4784	-13.6667	-2.9200
0.0	0.0	3.9343	-4.5558	19.3010	1.0721
3.6075	19.6645				
0.2910					
298.9375	1.1257	11.9694	-6.1600	-6.5852	0.3973
63.1727	934.6853	37.5548	5.6495	17.4489	-10.4671
6.0249	11.4299	49.3933	5.9712	20.8357	-2.9200
0.0	0.0	3.0263	-6.8270	18.4919	1.0504
4.3534	19.0265				
0.3010					
308.2119	1.0989	12.6340	-5.3548	-6.1416	0.6934
69.4515	926.7607	19.3340	3.0834	14.8359	-10.4780
5.1200	10.5635	55.8199	4.5479	41.2033	-2.9200
0.0	0.0	2.5869	-3.4472	17.5723	1.0233
5.1642	16.3439				
0.3110					
317.4248	1.0680	13.3506	-4.5904	-7.9744	0.9982
73.7156	922.3584	15.5827	2.3450	11.6105	-12.6123
4.2581	10.3327	54.8004	3.2812	42.7822	-2.9200
0.0	0.0	2.6479	3.4285	16.5913	0.9922
6.0317	17.6815				
0.3210					
326.5916	1.0339	14.1095	-4.1023	-11.2882	1.2291
78.1850	917.8333	19.0957	2.2741	12.0522	-16.2326
3.6682	10.5167	42.4222	2.5487	32.3801	-2.9200
0.0	0.0	3.5767	10.6799	15.5640	0.9578
6.9456	17.0703				
0.3310					
335.7056	0.9970	14.9146	-3.8103	-16.0665	1.3760
82.8219	912.7280	21.3406	2.2375	9.5943	-21.3276
3.2792	10.5950	31.1722	2.0245	17.7255	-2.9200
0.0	0.0	4.3766	16.4216	14.4822	0.9208
7.9093	16.5269				
0.3410					
344.7620	0.9574	15.7653	-3.6675	-21.7159	1.4317
87.2690	907.2019	22.7415	2.3239	6.3403	-27.2836
3.0779	10.6603	22.6556	1.5814	2.8173	-2.9200
0.0	0.0	4.7738	19.0274	13.3428	0.8811
8.9215	16.0748				
0.3510					
353.7578	0.9148	16.6587	-3.6767	-27.3307	1.4000
91.3894	901.5859	22.9323	2.5097	3.2390	-33.1855
3.1170	10.6868	17.7685	1.1861	-10.1244	-2.9200
0.0	0.0	4.9186	17.7616	12.1431	0.8384
9.9792	15.7398				

0.3610					
362.6934	0.8681	17.5918	-3.9074	-34.0036	1.3066
95.2397	846.0254	22.1596	2.8444	0.9943	-38.1269
3.5153	10.6968	15.4959	0.9216	-19.7409	-2.9200
0.0	0.0	4.9603	13.0211	10.8831	0.7917
11.0787	15.5501				
0.3710					
371.5693	0.8163	18.5624	-4.5005	-35.0912	1.1957
98.8816	890.6553	21.2653	3.4566	-0.2231	-41.4609
4.4417	10.6990	16.0413	0.4583	-25.2930	-2.9200
0.0	0.0	4.9515	6.1637	9.5632	0.7399
12.2174	15.5328				
0.3810					
380.3816	0.7583	19.5666	-5.6600	-36.2553	1.0952
101.6301	883.0054	29.0267	4.5150	-11.9717	-42.8040
6.1133	10.7050	19.4872	0.0902	-26.3908	-2.9200
0.0	0.0	4.8778	-1.4463	8.1797	0.6819
13.3910	15.7064				
0.3910					
389.0989	0.6944	20.5935	-7.6309	-35.6387	0.9720
103.8235	873.4180	29.4029	6.1446	-11.2240	-42.2759
8.7702	10.7228	25.5511	-0.1804	-23.1682	-2.9200
0.0	0.0	4.6668	-9.9185	6.7009	0.6181
14.5885	16.0657				
0.4010					
397.7170	0.6234	21.6433	-10.6382	-33.4680	0.6901
106.2109	863.7576	30.0568	8.3913	-9.4909	-40.0509
12.5926	10.7387	32.6433	-0.0841	-16.2762	-2.9200
0.0	0.0	4.2866	-17.0907	5.1230	0.5470
15.8096	16.6279				
0.4110					
406.2351	0.5434	22.7179	-14.9191	-30.2348	0.0187
108.7493	854.1069	29.6674	11.0604	-6.5955	-36.4607
17.6497	10.7112	38.6210	0.7577	-7.4071	-2.9200
0.0	0.0	3.8709	-21.0766	3.4448	0.4671
17.0558	17.4065				
0.4210					
414.6533	0.4531	23.8175	-20.1274	-26.6678	-1.2522
111.1572	844.6853	27.5944	13.7728	-4.7374	-31.9922
23.7868	10.6372	42.0998	2.7383	1.0186	-2.9200
0.0	0.0	3.6021	-21.0008	1.6665	0.3768
18.3273	18.4067				
0.4310					
422.9756	0.3514	24.9391	-26.2321	-23.4812	-3.1090
113.0990	835.5310	25.0151	16.4494	-3.2792	-27.1790
30.5199	10.5691	42.8182	6.1274	7.1649	-2.9200
0.0	0.0	3.5453	-17.2123	-0.2083	0.2751
19.6206	19.6236				
0.4410					
431.2024	0.2378	26.0772	-32.5414	-21.1427	-5.2266
114.4777	826.4038	22.9550	19.1232	-2.3488	-22.5804
37.1618	10.5366	41.2933	10.7951	10.5915	-2.9200
0.0	0.0	3.6656	-11.0631	-2.1705	0.1616
20.9302	21.0439				
0.4510					
439.3340	0.1130	27.2267	-38.3165	-19.8183	-7.0857

115.3819	817.0488	21.5862	21.5089	-1.7127	-18.8079
43.0250	10.5302	38.6662	15.9852	11.7128	-2.9200
0.0	0.0	3.8675	-4.3201	-4.2424	0.0367
22.2507	22.6516				
0.4610					
447.3687	-0.0223	28.3812	-42.8534	-19.3391	-8.1665
115.3567	807.6038	18.6168	23.0839	-3.3460	-16.3289
47.4980	10.5286	36.2308	20.5320	11.1016	-2.9200
0.0	0.0	4.0457	1.2613	-6.4004	-0.0987
23.5757	24.4292				
0.4710					
455.3096	-0.1672	29.5324	-45.6292	-19.2921	-8.2223
114.9414	798.0425	18.0085	23.7769	-3.4477	-15.4241
50.1258	10.5266	34.6870	23.3198	9.2558	-2.9200
0.0	0.0	4.1528	4.3241	-8.6521	-0.2436
24.8967	26.3583				
0.4810					
463.1501	-0.3197	30.6789	-46.3396	-19.4917	-7.0850
114.4419	788.4939	17.6506	23.5139	-3.9703	-16.2707
50.6368	10.5184	34.3978	23.5497	6.3269	-2.9200
0.0	0.0	4.1723	4.6139	-11.0046	-0.3962
26.2121	28.4312				
0.4910					
470.8960	-0.4790	31.8206	-45.0035	-19.8567	-4.8192
113.9847	779.1252	17.6893	22.3359	-4.7802	-18.7469
48.9493	10.5129	34.9651	20.9558	2.5647	-2.9200
0.0	0.0	4.1339	2.5193	-13.4521	-0.5557
27.5219	30.6385				
0.5010					
478.5498	-0.6451	32.9583	-41.9709	-20.3893	-1.5801
113.6815	770.1218	17.8713	20.1976	-5.6578	-22.4449
45.1835	10.5020	36.1228	15.7398	-1.5307	-2.9200
0.0	0.0	4.0533	-1.1408	-15.9919	-0.7220
28.8267	32.9734				
0.5110					
486.1147	-0.8184	34.0941	-37.9243	-21.0919	2.4239
113.6326	761.6387	18.2371	17.3167	-6.3083	-26.7176
39.7131	10.4935	37.3006	8.6429	-5.2776	-2.9200
0.0	0.0	3.9687	-5.3542	-18.6182	-0.8955
30.1286	35.4284				
0.5210					
493.5967	-0.9985	35.2310	-33.7997	-21.8611	6.9717
113.8818	753.7627	18.5191	13.9603	-6.7857	-30.8021
33.2432	10.4779	38.2175	0.9202	-8.0666	-2.9200
0.0	0.0	3.9011	-9.1473	-21.3301	-1.0758
31.4307	38.0002				
0.5310					
501.0010	-1.1935	36.3717	-30.6003	-22.4225	11.8645
114.3894	746.4707	18.6366	10.7242	-6.9364	-34.0454
26.8491	10.4619	38.6069	-5.8348	-9.6825	-2.9200
0.0	0.0	3.8720	-11.7848	-24.1201	-1.2612
32.7355	40.6815				
0.5410					
508.3328	-1.3704	37.5182	-29.0699	-22.3563	16.9418
115.0417	739.6650	18.4606	8.1751	-6.9032	-36.1283
21.7185	10.4447	38.4776	-10.3363	-10.3481	-2.9200
0.0	0.0	3.8817	-12.9023	-26.9827	-1.4485

34.0451	43.4653				
0.5510					
515.5974	-1.5559	38.6716	-29.4762	-21.2069	22.0296
115.7212	733.1953	18.2015	6.7548	-6.7894	-37.0714
18.7553	10.4328	37.8366	-11.9081	-10.4290	-2.9200
0.0	0.0	3.9293	-12.5377	-29.9126	-1.6343
35.3605	46.3444				
0.5610					
522.7966	-1.7370	39.6317	-31.6355	-18.5975	26.8556
116.3740	726.8967	17.9905	6.6889	-6.6343	-37.0516
18.3773	10.4268	36.8894	-10.4691	-10.1273	-2.9200
0.0	0.0	3.9985	-11.0604	-32.9084	-1.8160
36.6813	49.3134				
0.5710					
529.9285	-1.9125	40.9981	-35.0942	-14.3186	31.0373
117.0132	720.6125	17.7983	7.9020	-6.4317	-36.2373
20.5630	10.4262	35.8561	-6.3304	-9.4101	-2.9200
0.0	0.0	4.0721	-9.0214	-35.9717	-1.9920
38.0094	52.3595				
0.5810					
536.9954	-2.0320	42.1710	-39.3166	-8.4045	34.1989
117.6740	714.2058	17.4665	10.0582	-6.1523	-34.7419
24.9228	10.4307	34.8930	-0.0632	-8.1159	-2.9200
0.0	0.0	4.1388	-6.9817	-39.0996	-2.1621
39.3404	55.5079				
0.5910					
543.9961	-2.2457	43.3507	-43.7937	-1.1854	36.1635
118.3659	707.5959	16.8201	12.6680	-5.7476	-32.6848
30.7124	10.4365	34.3340	7.4231	-6.0593	-2.9200
0.0	0.0	4.1766	-5.3648	-42.2942	-2.3265
40.6785	58.7278				
0.6010					
550.9268	-2.4036	44.5374	-48.0715	6.7504	37.0976
119.0612	700.7429	15.9265	15.2052	-5.2029	-30.2989
36.9409	10.4412	34.3641	15.0008	-3.2389	-2.9200
0.0	0.0	4.1746	-4.3725	-45.5588	-2.4852
42.0227	62.0298				
0.6110					
557.7861	-2.5551	45.7308	-51.7390	14.7181	37.5119
119.7000	693.6602	14.8861	17.1710	-4.5594	-27.9632
42.6303	10.4368	35.0744	21.6022	0.0661	-2.9200
0.0	0.0	4.1264	-3.9780	-48.8948	-2.6375
43.3729	65.4130				
0.6210					
564.5710	-2.6983	46.9300	-54.4273	22.1340	38.1234
120.2159	686.4429	13.9680	18.3436	-3.9259	-26.1036
47.0701	10.4273	36.3278	26.5403	3.3917	-2.9200
0.0	0.0	4.0388	-3.9907	-52.3054	-2.7816
44.7282	68.8781				
0.6310					
571.2817	-2.8312	48.1335	-55.8208	28.6040	39.6834
120.5792	679.2214	13.1113	18.7395	-3.4214	-25.0603
49.8676	10.4089	37.7879	29.5956	6.2410	-2.9200
0.0	0.0	3.9329	-4.1610	-55.7903	-2.9155
46.0871	72.4229				
0.6410					

577.9204	-2.9516	49.3402	-55.6996	33.8877	42.8328
120.8217	672.1414	12.4600	18.5525	-3.1125	-25.0186
50.8647	10.3884	39.1013	30.9708	8.2143	-2.9200
0.0	0.0	3.8347	-4.2808	-59.3472	-3.0369
47.4485	76.0439				
0.6510					
584.4961	-3.0578	50.5489	-54.0164	37.8342	47.9578
121.0054	665.3069	11.9840	17.8927	-3.0165	-25.9920
50.0419	10.3650	40.0284	30.5085	9.0730	-2.9200
0.0	0.0	3.7638	-4.2420	-62.9773	-3.1442
48.8115	79.7407				
0.6610					
590.9839	-3.1482	51.7594	-50.9854	40.3546	55.0699
121.1839	658.7942	11.7760	16.8948	-3.0744	-27.8279
47.4561	10.3462	40.3769	29.0516	6.7778	-2.9200
0.0	0.0	3.7369	-4.0441	-66.6753	-3.2358
50.1757	83.5084				
0.6710					
597.4177	-3.2213	52.9717	-47.0848	41.4400	63.7982
121.3722	652.6575	11.8120	15.5316	-3.2275	-30.2296
43.1907	10.3319	40.2136	26.3508	7.5096	-2.9200
0.0	0.0	3.7496	-3.7596	-70.4373	-3.3102
51.5413	87.3434				
0.6810					
603.7937	-3.2754	54.1857	-42.9404	41.2233	73.5101
121.4965	646.9185	12.1911	13.7452	-3.4146	-32.7814
37.3873	10.3244	39.5920	22.6213	5.6321	-2.9200
0.0	0.0	3.7973	-3.4865	-74.2568	-3.3656
52.9082	91.2396				
0.6910					
610.1099	-3.3087	55.3999	-39.1025	40.0291	83.5174
121.4070	641.5598	12.8256	11.5102	-3.5881	-34.9906
30.3707	10.3214	38.8134	18.0340	3.6821	-2.9200
0.0	0.0	3.8564	-3.3050	-78.1365	-3.4003
54.2750	95.1979				
0.7010					
616.3748	-3.3199	56.6116	-35.8346	38.3191	93.2986
120.9301	636.5439	13.4353	8.9093	-3.7067	-36.4124
22.7361	10.3194	37.9443	12.9474	2.1577	-2.9200
0.0	0.0	3.9214	-3.2502	-82.0674	-3.4131
55.6390	99.2089				
0.7110					
622.5911	-3.3091	57.8161	-33.0842	36.5271	102.6155
119.9642	631.7925	13.8190	6.0914	-3.7294	-36.8066
15.2330	10.3206	37.2657	7.8011	1.4375	-2.9200
0.0	0.0	3.9712	-3.3044	-86.0471	-3.4038
56.9956	103.2675				
0.7210					
628.7629	-3.2781	59.0083	-30.6480	34.9018	111.4835
118.4878	627.2561	13.8918	3.3036	-3.6444	-36.1942
8.4630	10.3213	36.8497	2.9739	1.6586	-2.9200
0.0	0.0	4.0014	-3.4046	-90.0710	-3.3745
58.3397	107.3671				
0.7310					
634.8918	-3.2304	60.1835	-28.3483	33.5118	120.0380
116.5586	622.8618	13.7749	0.8135	-3.4570	-34.7618
2.7203	10.3199	36.7504	-1.2992	2.7847	-2.9200

0.0	0.0	4.0085	-3.4655	-94.1379	-3.3285
59.6666	111.5039				
0.7410					
640.9814	-3.1704	61.3374	-26.0890	32.3471	128.4151
114.2916	618.5317	13.6676	-1.1838	-3.1840	-32.7469
-1.9350	10.3189	36.8704	-4.8764	4.6556	-2.9200
0.0	0.0	3.9999	-3.4065	-98.2441	-3.2703
60.9722	115.6729				
0.7510					
647.0327	-3.1026	62.4675	-23.8380	31.3866	136.7111
111.8284	614.1946	13.5679	-2.5592	-2.6522	-30.3841
-5.5729	10.3165	37.1603	-7.6819	7.0373	-2.9200
0.0	0.0	3.9789	-3.1751	-102.3687	-3.2043
62.2539	119.8718				
0.7610					
653.0435	-3.0306	63.5728	-21.5711	30.6425	144.9723
109.3214	609.8494	13.3593	-3.3936	-2.4954	-27.8898
-8.2804	10.3114	37.5311	-9.6619	9.6700	-2.9200
0.0	0.0	3.9518	-2.7606	-106.5735	-3.1349
63.5107	124.1021				
0.7710					
659.0137	-2.9575	64.6532	-19.2540	30.1404	153.2189
106.8762	605.5220	13.1290	-3.8183	-2.1377	-25.4646
-10.1550	10.3066	37.8620	-10.7970	12.2828	-2.9200
0.0	0.0	3.9275	-2.1959	-110.7993	-3.0632
64.7426	128.3546				
0.7810					
664.9458	-2.8855	65.7096	-16.8504	29.6985	161.4651
104.5469	601.2378	12.8776	-3.9493	-1.8172	-23.2862
-11.3223	10.3007	38.0781	-11.1251	14.5932	-2.9200
0.0	0.0	3.9114	-1.5478	-115.0630	-2.9932
65.9505	132.6571				
0.7910					
670.8374	-2.8161	66.7435	-14.3348	29.9190	169.7296
102.3559	597.0154	12.6426	-3.8975	-1.5553	-21.4964
-11.9439	10.2950	38.1768	-10.7615	16.4086	-2.9200
0.0	0.0	3.9041	-0.9020	-119.3669	-2.9259
67.1360	136.9827				
0.8010					
676.6924	-2.7504	67.7561	-11.6972	30.1941	178.0388
100.2964	592.8555	12.4605	-3.7554	-1.3660	-20.1950
-12.2113	10.2910	38.0871	-9.8823	17.5602	-2.9200
0.0	0.0	3.9108	-0.3444	-123.7075	-2.8624
68.3002	141.3388				
0.8110					
682.5078	-2.6892	68.7488	-8.9409	30.7145	-173.5989
98.3581	588.7563	12.2929	-3.5883	-1.2722	-19.4347
-12.3373	10.2867	37.9260	-8.7169	17.9887	-2.9200
0.0	0.0	3.9227	0.0551	-128.0876	-2.8034
69.4446	145.7287				
0.8210					
688.2844	-2.6332	69.7226	-6.0763	31.4764	-165.0915
96.5226	584.7073	12.1612	-3.4695	-1.2679	-19.2207
-12.5465	10.2835	37.6371	-7.5214	17.6852	-2.9200
0.0	0.0	3.9440	0.2530	-132.5068	-2.7496
70.5703	150.1525				

0.8310					
694.0232	-2.5830	70.6786	-3.1086	32.4860	-156.4214
94.7808	580.6938	12.0401	-3.4638	-1.3470	-19.5104
-13.0640	10.2806	37.3525	-6.5501	16.7302	-2.9200
0.0	0.0	3.9649	0.2373	-136.9636	-2.7017
71.6781	154.6094				
0.8410					
699.7253	-2.5392	71.6176	-0.0243	33.7579	-147.5417
93.1277	576.6990	11.9284	-3.6326	-1.4891	-20.2157
-14.1028	10.2785	37.0418	-6.0359	15.2295	-2.9200
0.0	0.0	3.9875	0.0257	-141.4570	-2.6603
72.7691	159.0990				
0.8510					
705.3882	-2.5027	72.5407	3.2239	35.3085	-138.3994
91.5766	572.7102	11.8289	-4.0312	-1.6647	-21.2053
-15.8480	10.2783	36.8082	-6.1619	13.3513	-2.9200
0.0	0.0	4.0044	-0.3407	-145.9897	-2.6261
73.8443	163.6242				
0.8610					
711.0137	-2.4745	73.4487	6.7339	37.1380	-128.9308
90.1497	568.7073	11.6426	-4.6968	-1.8646	-22.3147
-18.4321	10.2768	36.6051	-7.0519	11.2699	-2.9200
0.0	0.0	4.0190	-0.8058	-150.5598	-2.6004
74.9045	168.1835				
0.8710					
716.6025	-2.4557	74.3433	10.6664	39.1996	-119.0611
88.8884	564.6724	11.3924	-5.6359	-2.0522	-23.3627
-21.9983	10.2772	36.4346	-8.7430	9.1673	-2.9200
0.0	0.0	4.0312	-1.3098	-155.1663	-2.5840
75.9514	172.7769				
0.8810					
722.1514	-2.4473	75.2262	15.2333	41.3570	-108.7186
87.8343	560.5869	10.9758	-6.7708	-2.2213	-24.1848
-26.1619	10.2750	36.3910	-11.1461	7.2271	-2.9200
0.0	0.0	4.0343	-1.7980	-159.8130	-2.5781
76.9868	177.4086				
0.8910					
727.6575	-2.4500	76.0998	20.6299	43.2571	-97.8834
87.0107	556.4329	10.4939	-7.9963	-2.3475	-24.6754
-30.9997	10.2747	36.4200	-14.0448	5.5673	-2.9200
0.0	0.0	4.0322	-2.2280	-164.5024	-2.5833
78.0129	182.0817				
0.9010					
733.1223	-2.4541	76.9662	26.9095	44.8412	-86.6790
86.3981	552.1838	9.9064	-9.1482	-2.4421	-24.8252
-36.0795	10.2710	36.5150	-17.1355	4.1948	-2.9200
0.0	0.0	4.0254	-2.5727	-169.2329	-2.5999
79.0320	186.7956				
0.9110					
738.5466	-2.4891	77.8275	33.8364	45.4333	-75.4729
85.9434	547.8342	9.4045	-10.1384	-2.5050	-24.7219
-41.0415	10.2698	36.7069	-20.0750	3.0311	-2.9200
0.0	0.0	4.0117	-2.8229	-174.0042	-2.6274
80.0459	191.5508				
0.9210					
743.9268	-2.5244	78.6645	40.8643	44.8633	-64.8707
85.5710	543.3870	8.8919	-10.9366	-2.5618	-24.5163

-45.5753	10.2625	37.0262	-22.5458	1.9346	-2.9200
0.0	0.0	3.9886	-2.9862	-178.6193	-2.6652
81.0559	196.3504				
0.9310					
749.2603	-2.5690	79.5380	47.3299	43.0703	-55.5146
85.2201	538.9687	8.5217	-11.3133	-2.6230	-24.3666
-49.4765	10.2581	37.3751	-24.3374	0.7304	-2.9200
0.0	0.0	3.9632	-3.0855	-183.6812	-2.7124
82.0023	201.1973				
0.9410					
754.5489	-2.6224	80.3880	52.7150	40.1743	-47.8461
84.8553	534.3169	8.1613	-11.5511	-2.7072	-24.4075
-52.6216	10.2505	37.7827	-25.3333	-0.7362	-2.9200
0.0	0.0	3.9333	-3.1526	-188.5879	-2.7687
83.0553	206.0395				
0.9510					
759.7915	-2.6339	81.2344	56.7870	36.3997	-41.9911
84.5056	529.7593	7.8737	-11.6083	-2.8212	-24.7334
-54.9556	10.2432	38.1059	-25.4972	-2.5686	-2.9200
0.0	0.0	3.9049	-3.2229	-193.5405	-2.8323
84.0549	211.0281				
0.9610					
764.9878	-2.7530	82.0772	59.5507	31.9911	-37.8122
84.1554	525.2505	7.6349	-11.5093	-2.9653	-25.3931
-56.4721	10.2357	38.5064	-24.8500	-4.6075	-2.9200
0.0	0.0	3.8795	-3.3271	-198.5396	-2.9039
85.0609	216.0133				
0.9710					
770.1411	-2.8292	82.9166	61.1525	27.1702	-35.0255
83.8363	520.8162	7.4604	-11.2955	-3.1355	-26.3903
-57.2035	10.2295	38.7440	-23.4587	-7.4257	-2.9200
0.0	0.0	3.8617	-3.4853	-203.5815	-2.9826
86.0536	221.0420				
0.9810					
775.2498	-2.9119	83.7531	61.7842	22.1232	-33.3031
83.5597	516.4524	7.2925	-10.9706	-3.3144	-27.6906
-57.2097	10.2224	38.9142	-21.4064	-10.3314	-2.9200
0.0	0.0	3.8488	-3.7027	-208.6682	-3.0678
87.0434	226.1158				
0.9910					
780.3147	-3.0005	84.5873	61.6380	17.0109	-32.3307
83.3093	512.2141	7.1705	-10.5745	-3.4973	-29.2293
-56.5703	10.2177	38.9580	-18.8019	-13.3910	-2.9200
0.0	0.0	3.8455	-3.9685	-213.7988	-3.1589
88.0310	231.2345				
1.0010					
785.3376	-3.0942	85.4198	60.8820	11.5766	-31.8390
83.2401	508.0379	7.0341	-10.1043	-3.6597	-30.9206
-55.3808	10.2112	38.9266	-15.7740	-16.4441	-2.9200
0.0	0.0	3.8479	-4.2600	-218.9712	-3.2551
89.0170	236.3959				

READ R

INPUT TO THE R-MATRIX

1	38	83	0.0	ZE A/P
4	63	243	1020.000000	AIRSPEED A/P
14	0	976	5.000000	WEIGHT,RIBLESS GUIDE SURF. DP#2.95
14	1	977	-2.919999	X APEX OF BRIDLE
14	2	978	0.0	Y APEX OF BRIDLE
14	3	979	0.0	Z APEX OF BRIDLE
14	4	980	3.915999	RLINES-RIBLESS GUIDE SURFACE DC
14	5	981	2.224999	RSC-RIBLESS GUIDE SURFACE DC
14	6	982	1.030000	RIN-RIBLESS GUIDE SURFACE DC
14	7	983	10.000000	RLO,RUNS 1,2
14	8	984	7000.000000	K
14	9	985	0.084928	B1
14	10	986	-0.153270	B2
14	11	987	0.032146	B3
14	12	988	-1.307799	C1 ,RIBLESS GUIDE SURFACE
14	13	989	0.226800	C2 ,RIBLESS GUIDE SURFACE
14	14	990	7.000000	SCDI
14	15	991	0.339000	K1,CLOTH PARACHUTE
14	16	992	0.121000	K2,CLOTH PARACHUTE
14	17	993	1.000000	K3,CLOTH PARACHUTE
14	18	994	0.010000	CC,CLOTH PARACHUTE, ALT#SL
14	19	995	0.0	DTGUN
14	20	996	0.008070	BO
14	21	997	0.710000	FD,RUNS 1,2
14	22	998	-1.209999	DX1
14	23	999	-0.666000	DY1
14	24	1000	-0.834000	DZ1
14	25	1001	-0.500000	DX2
14	26	1002	-0.666000	DY2
14	27	1003	1.415000	DZ2
14	28	1004	-0.500000	DX3
14	29	1005	0.666000	DY3
14	30	1006	1.415000	DZ3
14	31	1007	-1.209999	DX4
14	32	1008	0.656000	DY4
14	33	1009	-0.834000	DZ4
14	34	1010	0.050000	ERRDC
14	35	1011	4.000000	NLINES
14	36	1012	1.495000	SCTA-RIBLESS GUIDE SURFACE DC
14	37	1013	6.120000	SCTA2-RIBLESS GUIDE SURFACE DC
14	38	1014	-12.799999	SCTA3-RIBLESS GUIDE SURFACE DC
14	39	1015	2.860000	SCNA-RIBLESS GUIDE SURFACE DC
14	40	1016	-0.054000	SCNA2-RIBLESS GUIDE SURFACE DC
14	41	1017	-0.524000	SCNA3-RIBLESS GUIDE SURFACE DC
13	75	904	550.000000	FDC1
13	77	906	550.000000	FDC2

TRIM CON

CONVERGENCE AFTER 4 CYCLES

TIME H

TIME HISTORY

BEGINNING OF COMBINED SEAT-MAN TRAJECTORY.

0.0					
10.4275	1.1300	1.2914	0.0	0.5076	0.0
-0.0000	1019.9993	-0.0557	-0.0001	0.4316	0.5078
0.0	2.5845	0.0	-168.9052	50.0086	-2.9200
0.0	0.0	0.0	0.0	27.0066	1.1300
-7.5720	28.0708				
0.0120					
22.6672	1.1300	1.2822	0.0001	0.4869	0.0002
0.2783	1019.9185	0.6066	-0.0012	3.1006	0.4712
-0.0001	2.5825	0.0	-168.9038	49.9778	-2.9200
0.0	0.0	0.0	0.0702	27.0062	1.1299
-7.5714	28.0702				
0.0270					
32.8644	1.1300	1.2910	0.0001	0.4319	0.0013
1.7792	1019.4302	2.3569	-0.0043	8.7338	0.3318
-0.0001	2.5798	0.0	-168.9130	49.8917	-2.9200
0.0	0.0	0.0	0.7232	27.0025	1.1296
-7.5638	28.0646				
0.0310					
42.0355	1.1300	1.3177	0.0000	0.3604	0.0045
4.2061	1018.6502	2.9085	-0.0102	9.7636	0.1238
0.0002	2.5784	0.0	-168.9320	49.7864	-2.9200
0.0	0.0	0.0	2.5085	26.9915	1.1288
-7.5396	28.0475				
0.0410					
52.2163	1.1300	1.3743	-0.0004	0.3144	0.0117
7.1788	1017.5962	3.6580	-0.0202	10.7318	-0.0899
0.0008	2.5810	0.0	-168.9346	49.6254	-2.9200
0.0	0.0	0.0	5.5454	26.9680	1.1273
-7.4378	28.0109				
0.0510					
62.3950	1.1302	1.4620	-0.0010	0.2677	0.0227
10.3358	1016.3067	4.3485	-0.0314	11.1794	-0.3178
0.0019	2.5795	0.0	-168.9180	49.6666	-2.9200
0.0	0.0	0.0	8.9473	26.9303	1.1253
-7.4069	27.9530				
0.0610					
72.5395	1.1304	1.5824	-0.0020	0.2128	0.0372
13.6977	1014.8223	4.9523	-0.0433	11.4442	-0.5606
0.0034	2.5778	0.0	-168.9366	49.7563	-2.9200
0.0	0.0	0.0	11.9284	26.8703	1.1227
-7.2947	27.8713				
0.0710					
82.6779	1.1308	1.7362	-0.0032	0.1478	0.0549
17.0931	1013.1477	5.3725	-0.0564	11.7044	-0.8189
0.1052	2.5309	0.0	-168.9493	49.7619	-2.9200

0.0	0.0	0.0	13.9197	26.6040	1.1199
-7.1498	27.7638				
0.0910					
92.7989	1.1314	1.9245	-0.0047	0.0722	0.0756
20.5846	1011.4785	5.5250	-0.0762	12.0297	-1.0940
0.0075	2.5396	0.0	-169.1683	49.1712	0.0043
0.0	-2.2987	0.1055	14.7113	26.7124	1.1165
-6.9705	27.6294				
0.0910					
102.9019	1.1323	2.1483	-0.0064	-0.0133	0.0987
24.1997	1009.7708	5.4755	-0.0981	12.4024	-1.3861
0.0101	2.7338	0.0	-170.5659	44.7348	0.0043
0.0	-2.2987	0.1065	14.4422	26.6014	1.1132
-6.7550	27.4592				
0.1010					
112.9863	1.1335	2.4085	-0.0077	-0.0906	0.1240
27.8616	1007.8433	7.4440	-0.0784	12.5188	-1.6809
0.0122	3.0373	0.0	-172.4834	37.2444	0.0043
0.0	-2.2987	0.1095	13.4799	26.4707	1.1098
-6.5015	27.2300				
0.1110					
123.0483	1.1351	2.7063	-0.0086	-0.1675	0.1511
31.7421	1005.4397	7.7991	-0.1113	13.4691	-1.9767
0.0139	3.5559	0.0	-174.2510	26.0524	0.0043
0.0	-2.2987	0.1123	12.2741	26.3154	1.1064
-6.2080	27.0603				
0.1210					
133.0851	1.1372	3.0441	-0.0101	-0.2563	0.1809
35.8661	1003.1355	7.7020	-0.1605	14.1346	-2.3056
0.0165	4.3527	0.0	-175.6358	20.6909	0.0043
0.0	-2.2987	0.1132	11.3666	26.1341	1.1031
-5.8713	26.8082				
0.1310					
143.0975	1.1399	3.4246	-0.0112	-0.3391	0.2131
40.3196	1001.1326	4.5760	-0.2260	14.8358	-2.6476
0.0195	5.4064	0.0	-176.6589	14.1492	0.0043
0.0	-2.2987	0.1102	11.1130	25.9277	1.1002
-5.4875	26.5249				
0.1410					
153.0905	1.1434	3.8432	-0.0175	-0.3450	0.2397
42.6347	999.3123	5.1097	-0.1366	5.0186	-2.7906
0.0274	6.7204	0.0	-177.4000	9.0931	0.0043
0.0	-2.2987	0.1037	11.0313	25.7026	1.0980
-5.0592	26.2188				
0.1510					
163.0623	1.1474	4.2772	-0.0454	-0.0657	0.2360
44.1989	996.5249	11.7171	0.0262	6.5637	-2.6283
0.0576	8.2920	0.0	-177.9245	5.2548	0.0043
0.0	-2.2987	0.0991	9.4365	25.4591	1.0977
-4.6057	25.8956				
0.1610					
172.9942	1.1514	4.7281	-0.0836	-0.0691	0.2275
45.9960	992.8360	9.2052	-0.0270	6.6772	-2.7450
0.0960	10.1221	2.4427	-178.3004	2.5659	0.0043
0.0	-2.2987	0.1098	7.1651	25.2817	1.0970
-4.1252	25.5409				

0.1710					
182.9149	1.1559	5.1975	-0.1201	-1.5542	0.2843
47.8611	993.3010	1.9998	-0.1867	6.4292	-4.3171
0.1279	10.4558	1.7918	-178.4671	1.5561	0.0043
0.0	-2.2987	3.7573	5.0243	24.8872	1.0980
-3.6160	25.1724				
0.1810					
192.8213	1.1610	5.6848	-0.1539	-4.6222	0.4310
49.5954	990.2419	11.2055	0.0639	5.3883	-7.6947
0.1268	8.3307	3.8286	-178.1774	0.5540	0.0043
0.0	-2.2987	5.0554	3.4145	24.5840	1.1001
-3.0786	24.8004				
0.1910					
202.6934	1.1661	6.1891	-0.2043	-8.2003	0.5804
51.2784	986.9424	11.0711	0.0663	4.6167	-11.1811
0.1239	8.9073	7.0035	-177.1851	-3.3158	0.0043
0.0	-2.2987	5.1398	2.3788	24.2483	1.1026
-2.5140	24.4032				
0.2010					
212.5324	1.1713	6.7101	-0.2714	-11.5644	0.7330
52.9155	983.7371	10.8583	0.0686	3.9306	-14.6513
0.1200	9.9189	13.6063	-175.5689	-9.9107	0.0043
0.0	-2.2987	5.3071	1.8631	23.8811	1.1055
-1.9228	23.9839				
0.2110					
222.3395	1.1765	7.2473	-0.3546	-14.8056	0.8899
54.5247	980.7744	10.6293	0.0705	3.3843	-17.9975
0.1160	9.5410	24.1757	-172.7565	-22.7000	0.0043
0.0	-2.2987	5.3623	1.7204	23.4834	1.1089
-1.3056	23.5458				
0.2210					
232.1163	1.1820	7.8005	-0.4525	-17.8213	1.0515
56.0929	977.9224	8.2560	-0.4166	0.6963	-21.1162
0.1132	10.1555	39.3666	-167.3288	-43.4491	1.5894
0.0	3.2840	4.5103	1.7775	23.0565	1.1127
-0.6630	23.0929				
0.2310					
241.8696	1.1906	8.3510	-0.3819	-20.1839	0.6086
52.8040	975.9556	1.4005	-3.6836	-18.1743	-23.2904
0.2397	11.1707	83.2827	-156.6140	-65.2393	1.5894
0.0	3.2840	0.2864	0.5972	22.6076	1.1199
-0.0142	22.6353				
0.2410					
251.5985	1.2078	8.8618	0.1565	-22.3864	-1.5518
50.5940	972.6831	10.2140	0.1144	-0.4821	-25.3615
0.6848	10.1634	34.6117	-72.2720	-83.0972	1.5894
0.0	3.2840	4.9167	-3.9034	22.1353	1.1360
0.6034	22.1726				
0.2510					
261.2900	1.2265	9.3678	0.7912	-25.2607	-4.2935
49.9767	967.6428	21.2280	0.3084	-19.2195	-28.1869
1.5365	11.2505	3.8835	-4.1932	-62.3468	1.5894
0.0	3.2840	5.0568	-7.9044	21.6268	1.1537
1.2241	21.6921				
0.2610					
270.8931	1.2462	9.8508	1.9185	-33.6917	-7.7197
47.0720	955.2998	33.1855	4.3469	-25.2698	-36.6152

3.5033	11.8789	14.8129	3.2447	-48.6435	1.5894
0.0	3.2840	5.3310	-13.6989	21.0331	1.1726
1.8293	21.1451				
0.2710					
280.3696	1.2578	10.3226	4.4794	-52.1113	-11.8823
47.8801	943.6975	25.8037	9.7937	-18.0106	-54.6406
9.1510	11.4327	29.0042	8.4370	-47.0416	1.5894
0.0	3.2840	5.2297	-20.9747	20.3140	1.1835
2.4301	20.4930				
0.2810					
289.7454	1.2432	10.8150	14.3855	-77.9193	-22.2702
50.6472	934.6248	14.6672	14.4120	-23.4110	-78.6115
41.0636	11.6881	38.2840	16.8090	-55.9013	1.5894
0.0	3.2840	4.6141	-26.4460	19.4946	1.1684
3.0579	19.7675				
0.2910					
299.0310	1.1914	11.3311	175.6320	-67.7289	178.2720
52.4448	926.1526	-4.7131	11.4974	-25.2377	-116.1377
167.3985	11.7009	40.7865	44.5869	-74.4450	1.5894
0.0	3.2840	4.3644	-29.9394	18.5854	1.1162
3.7151	18.9359				
0.3010					
308.2332	1.1130	11.8590	-178.9892	-28.7905	-179.6414
52.6372	916.1794	-24.5144	0.7419	-9.3659	-154.5296
-178.1221	11.1150	45.7675	162.7246	-73.4599	1.5894
0.0	3.2840	3.7705	-30.9604	17.5935	1.0373
4.3892	18.1624				
0.3110					
317.3494	1.0291	12.3770	-176.6445	10.4041	-171.3013
51.0011	908.6091	-29.3643	-1.7041	10.1410	165.9652
-178.1642	10.3461	55.5965	-175.9621	-48.7562	1.5894
0.0	3.2840	2.3264	-26.2764	16.5159	0.9532
5.0581	17.2993				
0.3210					
326.3679	0.9480	12.8782	-173.6279	48.8502	-163.4781
49.5410	898.6472	-21.1637	6.0218	21.3556	128.3322
170.0249	9.4462	68.0432	-175.3970	-24.7865	1.5894
0.0	3.2840	0.5387	-13.5439	15.3403	0.8719
5.7143	16.3932				
0.3310					
335.2917	0.8574	13.3794	-123.9097	85.6158	-113.9333
51.0529	890.2944	-8.5957	10.0079	20.4318	80.4918
83.7526	8.1880	83.0945	-179.1455	-1.6209	1.5894
0.0	3.2840	0.2646	4.9248	14.0684	0.7812
6.3740	15.4647				
0.3410					
344.1440	0.7481	13.9055	-4.4979	54.8739	-2.1115
54.5564	884.7534	-4.8521	1.8755	18.7796	51.3589
3.3495	7.1436	61.4208	-178.6475	20.3552	1.5894
0.0	3.2840	1.4259	23.2593	12.7249	0.6717
7.0618	14.5685				
0.3510					
352.9553	0.6313	14.4721	-1.2159	18.3793	-8.4694
58.9716	882.3965	-5.2961	-3.0899	23.9988	14.4610
-1.7308	10.9277	34.6373	-165.9026	53.0717	-0.0894
0.0	-2.3715	4.9149	36.3480	11.3406	0.5549
7.7926	13.7730				

0.3610					
361.7534	0.5129	15.1145	1.2374	-20.2822	-13.5034
69.6594	882.5774	13.2829	-2.9734	22.1655	-24.5851
4.0216	10.9846	85.5684	-41.5983	66.5044	-1.3663
0.0	-1.2511	0.6179	43.7727	9.9431	0.4365
8.6014	13.1545				
0.3710					
370.5408	0.3334	15.8278	4.4345	-60.2582	-14.8078
72.0945	881.8538	3.2086	9.3971	4.0616	-63.6491
18.4426	9.1544	64.5503	-5.8481	0.5096	-2.2156
0.0	-0.8020	0.9772	43.7214	8.5347	0.3070
9.4828	12.7616				
0.3810					
379.3152	0.2268	16.5566	174.5393	-61.4558	179.5176
75.3972	877.3420	20.6658	6.2676	-46.6981	-104.2960
159.9705	12.4077	24.5452	5.0450	-63.2430	-2.0637
0.0	0.8663	5.3563	32.9245	7.1133	0.1504
10.3311	12.5853				
0.3910					
387.9712	0.0612	17.3495	-177.9679	-49.1425	178.5032
82.1111	862.6594	-15.1926	-2.2868	-30.9306	-136.3193
-177.1380	11.5733	0.4777	-174.2710	-68.9336	-1.2100
0.6660	-0.8340	4.9791	6.8351	5.5732	-0.0152
11.3446	12.6397				
0.4010					
396.5237	-0.0988	18.1704	-176.4873	-20.3626	-174.8400
81.4246	857.8687	-10.8114	-3.4463	0.6273	-165.6458
-173.9617	9.7367	20.4367	-174.1429	-21.9079	1.6151
0.0	3.2549	5.3888	-22.4110	3.9297	-0.1751
12.3368	12.9487				
0.4110					
405.0332	-0.2506	18.9780	-175.4597	7.8897	-168.4697
80.0438	851.1724	-34.3303	-1.5380	10.9558	165.8979
-177.1369	11.0985	35.3375	179.0461	20.7482	-2.9200
0.0	0.0	4.8631	-39.9474	2.2429	-0.3270
13.3160	13.5075				
0.4210					
413.4392	-0.4003	19.7645	-173.5308	37.8692	-163.9160
77.1738	838.4968	-21.4520	6.3582	25.0241	136.5176
175.0426	10.9859	35.2369	159.9042	59.2931	-0.2832
0.0	-2.4956	4.8707	-40.8959	0.4524	-0.4766
14.2743	14.2394				
0.4310					
421.7451	-0.5588	20.5290	-165.6836	69.9627	-157.9065
76.2555	832.0442	-4.8017	5.5328	8.8700	105.3244
156.5978	10.0645	48.8659	35.7137	69.4662	-1.7633
0.0	-2.6543	3.3453	-26.3310	-1.4387	-0.6351
15.2106	15.2317				
0.4410					
430.0068	-0.7331	21.2863	-16.4112	76.2536	-15.3799
74.6199	827.8926	13.5967	1.9345	13.7537	71.6060
1.6404	10.7007	57.7712	6.0367	26.3060	-2.9200
0.0	0.0	1.9860	-5.5436	-3.3740	-0.8094
16.1394	16.5081				
0.4510					
438.2183	-0.9122	22.0095	-2.1045	43.6599	-9.8513

69.8201	822.0422	20.9981	-1.4119	-0.8494	38.4983
-6.8029	10.8683	52.6962	4.8298	-17.4693	-2.9200
0.0	0.0	2.7764	14.8867	-5.3582	-0.9886
17.0337	17.8839				
0.4610					
446.3806	-1.0850	22.6833	2.3371	11.7685	-13.8294
65.2682	817.2561	15.7962	-0.6341	-6.9947	6.1117
-5.1590	10.3124	51.7432	16.6496	-54.7056	-2.6373
0.0	0.4240	2.9214	27.2079	-7.3884	-1.1614
17.8779	19.3793				
0.4710					
454.4971	-1.2522	23.3220	6.5154	-19.7239	-17.8625
62.7260	812.1375	13.3312	0.9724	-10.6988	-25.3124
-0.1473	10.2460	49.8073	75.0365	-77.1037	-1.6933
0.0	1.0061	3.2093	28.3800	-9.4646	-1.3287
18.6864	20.9887				
0.4810					
462.5593	-1.4189	23.9384	13.1067	-50.0002	-22.4292
60.5632	806.3560	7.5144	6.1828	-17.1562	-55.3864
7.3715	10.5813	37.9808	150.4333	-68.5920	-1.6933
0.0	1.0061	4.6420	19.4716	-11.5955	-1.4955
19.4718	22.7122				
0.4910					
470.5623	-1.5951	24.5323	36.3551	-76.3707	-42.0338
58.1823	800.5769	-3.5690	6.4089	-16.7174	-82.1923
32.3074	10.6950	19.5964	169.6429	-57.3416	-1.6933
0.0	1.0061	5.3869	3.5528	-13.7859	-1.6718
20.2338	24.5408				
0.5010					
478.5125	-1.7835	25.0996	158.1781	-75.0948	-160.1696
55.4306	795.3337	-9.9456	1.4231	-14.5055	-107.9749
174.9355	10.7202	1.9689	178.4245	-51.2398	-1.6933
0.0	1.0061	5.0107	-13.9041	-16.0293	-1.8604
20.9682	26.4587				
0.5110					
486.4075	-1.9737	25.6436	176.6300	-54.3646	-174.0701
53.5911	789.0952	-14.8117	-2.4305	-15.8299	-129.6197
-175.9734	10.9145	17.6510	-175.0335	-48.6030	-1.6933
0.0	1.0061	5.3727	-27.8447	-18.3254	-2.0508
21.6783	28.4601				
0.5210					
494.2334	-2.1577	26.1759	-177.5748	-36.4117	-174.5596
53.1699	781.4314	-19.1169	-5.5245	-16.0290	-148.1673
-172.1581	11.0665	30.4696	-169.4228	-47.6917	-1.6933
0.0	1.0061	5.1651	-35.7714	-20.6934	-2.2351
22.3758	30.5596				
0.5310					
501.9805	-2.3324	26.7107	-173.2884	-22.4163	-173.2500
53.9860	777.5308	-18.8847	-7.6373	-12.1846	-162.9291
-169.5042	10.8631	39.8181	-164.7188	-46.0112	-1.6933
0.0	1.0061	4.4651	-36.9253	-23.1406	-2.4102
23.0747	32.7680				
0.5410					
509.4536	-2.4960	27.2570	-168.9638	-11.6948	-171.8047
55.3235	767.0308	-15.6250	-8.3435	-7.5193	-174.3398
-165.7829	10.5282	47.7074	-160.9987	-46.7373	-1.6933
0.0	1.0061	3.5086	-31.5589	-25.6619	-2.5742

23.7841	35.0833				
0.5510					
517.2659	-2.6475	27.8165	-164.3061	-3.7649	-170.4416
56.5212	761.8179	-12.8503	-8.9969	-3.0281	176.6240
-163.5854	10.2819	53.2868	-158.5406	-48.4030	-1.6933
0.0	1.0061	2.6857	-21.2451	-28.2441	-2.7261
24.5057	37.4925				
0.5610					
524.8298	-2.7844	28.3848	-159.2774	2.8841	-169.1490
57.0903	757.3501	-10.5990	-9.9992	0.3579	169.1030
-159.7988	10.1254	56.1853	-157.2384	-46.0026	-1.6933
0.0	1.0061	2.2342	-8.4682	-30.6752	-2.8635
25.2351	39.9786				
0.5710					
532.3501	-2.9036	28.9568	-153.8490	8.6610	-167.9078
57.3697	753.0583	-9.6219	-11.5963	1.9289	162.5902
-155.3112	10.0842	56.6090	-156.4293	-41.1901	-1.6933
0.0	1.0061	2.1678	3.9711	-33.5500	-2.9833
25.9672	42.5300				
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539.8259	-3.0024	29.5324	-147.8709	13.7615	-166.7568
57.9042	748.4160	-10.0378	-13.9908	2.1504	156.9891
-149.8106	10.1493	54.0658	-155.2032	-34.2162	-1.6933
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26.7020	45.1436				
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547.2512	-3.0791	30.1159	-141.0076	18.0185	-165.8048
58.9660	743.0574	-10.8277	-16.9654	2.4354	152.6575
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27.4439	47.8247				
0.6010					
554.6179	-3.1331	30.7123	-132.7831	21.1824	-165.1858
60.4531	736.7905	-11.1396	-20.2153	3.0784	150.1997
-133.5247	10.2999	41.1648	-148.0310	-16.9816	-1.6933
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28.1978	50.5802				
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561.9150	-3.1655	31.3249	-122.6525	23.1030	-165.0687
62.1565	729.5349	-10.6151	-23.3593	3.7066	150.3216
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28.9672	53.4194				
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569.1350	-3.1915	31.9547	-110.0751	23.7982	-165.7173
63.8726	721.4087	-9.1803	-25.6219	3.7696	153.7303
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65.4173	712.9543	-7.1091	-26.0188	2.9443	160.8638
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583.3235	-3.2021	33.2594	-76.1978	22.9333	-170.7032
66.2395	705.5884	4.6706	-22.9965	-1.3841	8.6234
-74.9795	10.2910	6.4751	-89.6383	-2.3322	-1.6933
0.0	1.0061	5.1253	-0.2425	-53.9441	-3.2877
31.3679	62.4377				
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590.3013	-3.2105	33.9235	-54.6290	22.9182	-175.2978
66.6230	698.0691	9.4614	-21.5760	-3.7824	-4.0126
-55.2100	10.3632	6.1804	-62.4991	-9.3057	-1.6933
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32.1863	65.6836				
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597.2024	-3.2287	34.5888	-29.8989	24.4715	179.6119
66.4159	690.5708	17.2798	-14.4839	-6.6969	-15.9126
-30.7099	10.5435	13.0886	-28.9089	-16.3316	-2.8118
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33.0053	68.9592				
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65.3132	682.7839	23.5079	1.7785	-7.9747	-21.6929
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33.8175	72.3084				
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610.7778	-3.2760	35.8924	23.9584	29.3616	174.1312
63.7090	674.5928	19.0944	17.3411	-4.6444	-18.6685
27.7244	10.7181	22.3322	39.5130	-2.9378	-2.8498
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617.4446	-3.2741	36.5222	46.6552	31.4850	172.2621
62.4724	666.0511	10.4878	21.1552	-1.2296	-10.2470
49.9722	10.4617	24.6626	60.0715	11.6708	-2.8498
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35.3975	79.2287				
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624.0398	-3.2526	37.1418	64.8666	33.9716	170.8293
61.5777	659.5901	6.9477	21.6739	1.0668	-0.8853
66.0444	10.3877	25.6353	72.8813	23.6662	-2.8498
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36.1695	82.7957				
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630.5610	-3.2222	37.7520	78.7823	36.9078	170.2016
60.5168	652.1755	5.2029	22.0519	3.2067	6.9987
77.5240	10.4224	24.0594	80.0940	31.5098	-2.8498
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59.3420	645.1155	4.1563	20.0440	3.3262	12.4044
84.7941	10.3427	21.7266	82.3010	35.0760	-2.8498
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643.3928	-3.1697	38.9379	93.1711	44.0772	170.5270
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88.4747	10.3156	19.7368	80.9392	34.7563	-2.8498

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649.7134	-3.1595	39.5126	93.9438	46.1785	170.4988
56.8706	632.4275	4.2833	19.1909	3.2005	15.8573
98.7051	10.3319	17.6670	77.1442	31.0462	-2.8498
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39.1476	97.7527				
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655.9724	-3.1626	40.0744	89.1519	52.4493	168.4962
55.5919	626.2086	4.7430	18.3590	1.9101	13.9768
85.3655	10.2804	16.2444	71.2539	24.3235	-2.8498
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39.8610	101.6477				
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662.1721	-3.1786	40.6243	77.7650	56.2417	162.7537
54.5188	620.2998	5.6441	17.9592	0.5830	9.8257
79.9764	10.2533	15.8814	63.6124	15.1112	-2.8498
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40.5624	105.6010				
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668.3132	-3.2050	41.1646	59.0004	58.1004	151.8526
53.6404	614.2112	7.2991	17.6772	-0.9241	3.6594
69.9089	10.2910	16.2813	53.8588	4.0515	-2.8498
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41.2542	109.6133				
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674.3921	-3.2383	41.6972	35.2881	55.6633	137.7007
53.0471	608.1306	9.0466	15.9106	-2.6223	-3.9610
58.1572	10.3343	17.5599	41.0305	8.0070	-2.8498
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41.9383	113.6875				
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680.4126	-3.2750	42.2255	13.2431	48.6010	126.2677
52.7525	602.3240	11.1458	12.6487	-4.9371	-11.9187
43.8384	10.3474	19.3588	24.3978	-19.4932	-2.8498
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42.6182	117.8219				
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686.3755	-3.3138	42.7511	-3.5875	37.7041	120.3889
52.4090	596.8396	13.2990	6.9768	-6.7663	-18.6948
27.4650	10.3967	20.5711	4.3197	-28.1702	-2.8498
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43.2955	122.0156				
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692.2866	-3.3567	43.2714	-15.6428	25.5827	118.7275
51.6593	591.7710	13.0396	0.8315	-7.1951	-22.9985
10.6189	10.3756	20.7286	-16.1402	-32.5361	-2.8498
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43.9675	126.2523				
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698.1499	-3.4061	43.7824	-24.3551	13.9646	119.3445
50.5596	587.2686	11.3264	-4.1357	-6.6768	-24.6937
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44.6303	130.5571				

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703.9714	-3.4640	44.2803	-30.9555	3.3290	121.2114
49.0456	582.8306	10.2860	-8.2008	-6.4170	-24.3820
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45.2800	134.8926				
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709.7478	-3.5320	44.7613	-35.9787	-6.1032	123.6979
47.2149	578.2466	10.9062	-11.0794	-4.0653	-22.6778
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45.9130	139.2709				
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715.4785	-3.6063	45.2221	-39.6465	-14.0074	126.1007
45.0615	573.2258	9.6942	-12.5128	-3.3819	-20.4951
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46.5259	143.6914				
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721.1580	-3.6823	45.6621	-42.0379	-20.2767	127.7646
43.0350	568.1218	9.1778	-13.3626	-2.9439	-18.5019
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47.1181	148.1591				
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726.7869	-3.7583	46.0826	-42.9577	-24.9109	128.0913
41.1895	562.8728	9.1483	-13.6541	-2.6255	-17.1084
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47.6909	152.6738				
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732.3547	-3.8323	46.4855	-42.2455	-27.9011	126.6325
39.5369	557.6069	9.3516	-13.3763	-2.3504	-16.5236
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48.2462	157.2369				
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737.8906	-3.9026	46.8727	-39.9772	-29.2254	123.2262
38.0393	552.3633	9.9650	-12.8637	-2.2416	-16.7815
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48.7959	161.8498				
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743.3662	-3.9672	47.2455	-36.4646	-28.7929	117.9998
36.6664	547.1716	10.7516	-11.8142	-2.1510	-17.7643
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49.3115	166.5111				
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748.7303	-4.0244	47.6054	-32.3231	-26.6197	111.4138
35.4250	542.1621	11.5044	-10.0976	-1.9835	-19.2029
-39.4606	10.2394	21.3513	-26.1415	-13.7074	-2.8498
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49.4241	171.2228				
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754.1667	-4.0722	47.9536	-28.3013	-22.9981	104.1133
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2  1   0
*     FLAT CIRC. CLOTH
0     RIBLESS GUIDE SURF.
1  1  24   2  24   0   0   0   0   0   0   0   0   0   0   0   0   0
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  52.2695    195.4523

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 780.4129     -4.1244     49.6163    -20.5187     -2.6902     69.1728
  33.2385    517.2947     11.7753      1.5003     -0.1952    -21.6456
   1.5266     10.2299     26.1440     15.6609      3.6580     -2.8498
  -0.1796     -0.0222      5.3226     -2.1378   -193.3098     -4.2781
  52.7534    200.4243

   0.9810
 785.5483     -4.0982     49.9498    -21.1165     -0.4977     62.7750
  33.5772    513.7239     11.5772      2.4205     -0.1040    -20.9965
   6.2576     10.2232     23.5120     17.4481      4.2621     -2.8498
  -0.1796     -0.0222      5.3715     -1.2396   -198.3696     -4.2544
  53.2403    205.4340

   0.9910
 790.6472     -4.0622     50.2872    -22.1857      0.9844     56.4449
  34.0013    510.1294     11.4732      3.1952     -0.0988    -20.3763
  10.4454     10.2231     20.0079     18.6316      3.6386     -2.8498
  -0.1796     -0.0222      5.3882     -0.3678   -203.4663     -4.2208
  53.7311    210.4837

   1.0010
 795.7102     -4.0177     50.6291    -23.6287      1.7846     50.1772
  34.4673    506.5007     11.2638      3.8320     -0.1672    -19.8284
  14.2272     10.2189     15.8415     19.6351      1.6527     -2.8498
  -0.1796     -0.0222      5.3486      0.2487   -208.5986     -4.1788
  54.7264    215.5721
 PLOT
1  1  26  2  26  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
2  1  0
*     FLAT CIRC. CLOTH
0     RIBLESS GUIDE SURF.
1  1  24  2  24  0  0  0  0  0  0  0  0  0  0  0  0  0
```

```
   -32.6942      10.2948      24.5781     -15.4915     -11.1327      -2.8498
    -0.1796      -0.0222       5.3557      -0.1034    -168.5793      -4.2133
    50.3251     175.9311

     0.9310
   759.4983      -4.1087      48.2929     -24.9640     -16.4764      96.6525
    33.6273     532.3713      12.9624      -5.4492      -1.4342     -21.9032
   -25.0310      10.2715      26.8393      -6.2170      -7.9248      -2.8498
    -0.1796      -0.0222       5.3040      -1.4561    -173.4431      -4.2523
    50.8174     180.7844

     0.9410
   764.7856      -4.1322      48.6262     -22.5708     -13.7372      89.3725
    33.1759     528.6348      12.8865      -3.1167      -1.0239     -22.5307
   -17.3859      10.2707      28.1866       2.0164      -4.3505      -2.8498
    -0.1796      -0.0222       5.2606      -2.4885    -178.3511      -4.2784
    51.3037     185.6326

     0.9510
   770.0332      -4.1425      48.9563     -21.1200      -9.3535      82.3934
    32.9959     524.6326      12.5443      -1.2063      -0.6622     -22.5867
   -10.2340      10.2535      28.5903       8.3434      -0.9179      -2.8498
    -0.1796      -0.0222       5.2459      -2.9493    -183.2988      -4.2911
    51.7870     190.5223

     0.9610
   775.2427      -4.1396      49.2857     -20.4832      -5.6355      75.6855
    33.0221     520.9241      12.2109       0.3363      -0.3789     -22.2273
    -3.9214      10.2442      27.8830      12.7837       1.6674      -2.8498
    -0.1796      -0.0222       5.2713      -2.7890    -188.2847      -4.2907
    52.2695     195.4523

     0.9710
   780.4129      -4.1244      49.6163     -20.5187      -2.6902      69.1728
    33.2385     517.2947      11.7753       1.5003      -0.1952     -21.6456
     1.5266      10.2299      26.1440      15.6609       3.6580      -2.8498
    -0.1796      -0.0222       5.3226      -2.1378    -193.3096      -4.2781
    52.7534     200.4243

     0.9810
   785.5483      -4.0982      49.9498     -21.1165      -0.4977      62.7750
    33.5772     513.7239      11.5772       2.4205      -0.1040     -20.9965
     6.2576      10.2232      23.5120      17.4481       4.2621      -2.8498
    -0.1796      -0.0222       5.3715      -1.2396    -198.3696      -4.2544
    53.2403     205.4340

     0.9910
   790.6472      -4.0622      50.2872     -22.1857       0.9844      56.4449
    34.0013     510.1294      11.4732       3.1952      -0.0988     -20.3763
    10.4454      10.2231      20.0079      18.6316       3.6386      -2.8498
    -0.1796      -0.0222       5.3882      -0.3678    -203.4663      -4.2208
    53.7311     210.4337

     1.0010
   795.7102      -4.0177      50.6291     -23.6287       1.7846      50.1772
    34.4673     506.5007      11.2638      3.8320      -0.1872     -19.8284
    14.2272      10.2189      15.8415      19.6351       1.6527      -2.8498
    -0.1796      -0.0222       5.3486       0.2487    -208.5986      -4.1788
    54.2264     215.5721
  PLOT
1  1 26  2 26  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
2  1  0
*     FLAT CIRC. CLOTH
0     RIBLESS GUIDE SURF.
1  1 24  2 24  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
2	0	0															
24	1	26	2	26	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
2	0	0															
25	1	26	2	26	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
2	0	0															
1	1	10	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	11	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	12	2	12	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
2	0	0															
1	1	23	2	23	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
2	0	0															
1	1	9	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	15	2	15	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
2	0	0															
1	1	17	2	17	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
2	0	0															
1	1	18	2	18	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
2	0	0															
1	1	8	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	5	2	5	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
2	0	0															
1	1	6	2	6	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
2	0	0															
1	1	7	2	7	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	4	2	4	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
2	0	0															
1	1	2	2	2	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
2	0	0															
2	1	4	2	4	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
2	0	0															
3	1	4	2	4	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
2	0	0															
1	1	13	2	13	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
2	0	0															
1	1	14	2	14	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
2	0	0															
1	1	16	2	16	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
2	0	0															
1	1	22	2	22	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
2	0	0															
24	1	26	2	26	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
2	0	0															
25	1	26	2	26	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
2	0	0															
1	1	10	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	11	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	12	2	12	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
2	0	0															
1	1	23	2	23	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
2	0	0															
1	1	9	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	15	2	15	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
2	0	0															
1	1	17	2	17	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
2	0	0															
1	1	18	2	18	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
2	0	0															
1	1	8	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	5	2	5	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
2	0	0															
1	1	6	2	6	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
2	0	0															
1	1	7	2	7	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0															
1	1	4	2	4	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
2	0	0															
1	1	2	2	2	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
2	0	0															
2	1	4	2	4	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
2	0	0															
3	1	4	2	4	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
2	0	0															
1	1	13	2	13	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
2	0	0															
1	1	14	2	14	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
2	0	0															
1	1	16	2	16	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
2	0	0															
1	1	22	2	22	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
2  C  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0
 OUTPUT
     TIME HISTORY OUTPUT SUBSCRIPTS AND SCALE FACTORS

1  1  -1  4  1  1  7  31  1  1
    FIG     RAIL POSITION LOWER BLK
    SEAT SLIDER BLOCK POSITIONING

    FIG     YAW ATTITUDE OF SEAT
    SEAT SLIDER BLOCK POSITIONING

    FIG     PITCH ATTITUDE OF SEAT
    SEAT SLIDER BLOCK POSITIONING

    FIG     BANK ATTITUDE OF SEAT
    SEAT SLIDER BLOCK POSITIONING

    FIG     YAW ATTITUDE AIRPLANE
    SEAT SLIDER BLOCK POSITIONING

    FIG     PITCH ATTITUDE AIRPLANE
    SEAT SLIDER BLOCK POSITIONING

    FIG     BANK ATTITUDE AIRPLANE
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT ANGULAR DISPLACE.
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT ANGULAR DISPLACE.
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT ANGULAR DISPLACE.
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT AXIAL LOAD FACTOR
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT SIDE LOAD FACTOR
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT NORMAL LOAD FACTOR
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT ROLL RATE
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT PITCH RATE
    SEAT SLIDER BLOCK POSITIONING

    FIG     SEAT YAW RATE
    SEAT SLIDER BLOCK POSITIONING

    FIG     AIRPLANE ROLL RATE
    SEAT SLIDER BLOCK POSITIONING

    FIG     AIRPLANE PITCH RATE
    SEAT SLIDER BLOCK POSITIONING

    FIG     AIRPLANE YAW RATE
```

```
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS SEAT VEL.
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

FIG    EARTH AXIS AIRPLANE VEL
SEAT SLIDER BLOCK POSITIONING

FIG    SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

FIG    SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

FIG    SEAT AXIS SEAT VELOCITY
SEAT SLIDER BLOCK POSITIONING

FIG    A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING

FIG    A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING

FIG    A/P AXIS A/P VELOCITY
SEAT SLIDER BLOCK POSITIONING
 4    2   182       1.000000  TIME         1
TIME. SEC
27   20  1773       1.000000  DZSBR1       2
SM RAIL VER POS.FT
 4    6   186      57.299988  PSI SEAT     3
YAW ANGLE SEAT.DEG
 4    7   187      57.299988  THETA SEAT 4
PITCH ANG SEAT.DEG
 4    8   188      57.299988  PHI SEAT     5
BANK ANG SEAT.DEG
 4   92   272      57.299988  PSI A/P      6
YAW ANGLE A/P.DEG
 4   93   273      57.299988  THETA A/P    7
PITCH ANG A/P.DEG
 4   94   274      57.299988  PHI A/P      8
BANK ANGLE A/P.DEG
27    5  1758      57.299988  D PSI CS     9
RAIL YAW DEFL.DEG
27    4  1757      57.299988  D THETA CS10
RAIL PITCH DEF.DEG
27    3  1756      57.299988  D PHI CS    11
RAIL ROLL DEF.DEG
 4   18   198       1.000000  NX SEAT     12
SM AX LOAD FAC.GS
 4   19   199       1.000000  NY SEAT     13
SM LAT LOAD FAC.GS
 4   20   200       1.000000  NZ SEAT     14
SM NOR LOAD FAC.GS
 1    4    49       1.000000  P SEAT      15
```

```
ROLL VEL S.RAD/SEC
 1     5     50         1.000000  Q SEAT     16
PIT VEL SM.RAD/SEC
 1     6     51         1.000000  R SEAT     17
YAW VEL SM.RAD/SEC
 1    33     78         1.000000  P A/P      18
ROLL VEL A.RAD/SEC
 1    34     79         1.000000  Q A/P      19
PIT VEL AP.RAD/SEC
 1    35     80         1.000000  R A/P      20
YAW VEL AP.RAD/SEC
 0     7      7         1.000000  XEDOT SEAT21
DWNRNGF VEL.FT/SEC
 0     8      8         1.000000  YEDOT SEAT22
LATERAL VEL.FT/SEC
 0     9      9        -1.000000  HDOT SEAT 23
CLIMB RATE.FT/SEC
 0    36     36         1.000000  XEDOT A/P 24
DWNRNGF VEL.FT/SEC
 0    37     37         1.000000  YEDOT A/P 25
LATERAL VEL.FT/SEC
 0    38     38        -1.000000  HDOT A/P  26
CLIMB RATE.FT/SEC
 1     1     46         1.000000  U SEAT     27
LONG VEL SM.FT/SEC
 1     2     47         1.000000  V SEAT     28
LAT VEL SM.FT/SEC
 1     3     48         1.000000  W SEAT     29
VERT VEL SM.FT/SEC
 1    30     75         1.000000  U A/P      30
LONG VEL AP.FT/SEC
 1    31     76         1.000000  V A/P      31
LAT VEL A/P.FT/SEC
 1    32     77         1.000000  W A/P      32
VERT VEL AP.FT/SEC
READ R
```

INPUT TO THE R-MATRIX

4	4	184	0.150000	THAX
13	13	847	1000.000000	TOPD
24	44	1601	0.0	TJ
25	10	1664	5567.000000	TOOOR
25	12	1666	1577.000000	TOOONF
25	16	1670	-0.037500	BVR
25	18	1672	0.623800	BSR
25	29	1683	1.391999	DB
4	63	243	0.0	UA
21	54	1331	2.900000	STROKE

TRIM VTO

CONVERGENCE AFTER 6 CYCLES

READ R

INPUT TO THE R-MATRIX

26	31	1715	8800.000000	GROSS WT OF A/P - RIGHT SEAT
26	14	1698	4207.000000	IXX A/P - RIGHT SEAT
26	15	1699	14973.000000	IYY A/P - RIGHT SEAT
26	16	1700	17267.000000	IZZ A/P - RIGHT SEAT
26	17	1701	1052.000000	IXZ A/P - RIGHT SEAT
26	32	1716	-0.477000	DXCG A/P - RIGHT SEAT
26	33	1717	-0.051400	DYCG A/P - RIGHT SEAT
26	34	1718	0.045500	DZCG A/P - RIGHT SEAT

```
    RESTORE
  9   1  30    4 130
STORING FROM R% 75¤ TO R% 310¤
  3   4  92    4 140
STORING FROM R% 272¤ TO R% 320¤
  3   4  67    4 143
STORING FROM R% 247¤ TO R% 323¤
  3   0  33    4 146
STORING FROM R% 33¤ TO R% 326¤
    TIME H
```

TIME HISTORY

BEGINNING OF COMBINED SEAT-MAN TRAJECTORY.

0.0					
-0.5740	0.0	-0.3620	0.0	0.0	-0.3620
0.0	0.0	0.0000	0.0	-0.0394	-0.0001
0.9267	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0					
0.0120					
-0.5757	0.0002	-0.3835	0.0004	0.0000	-0.3644
0.0010	-0.0001	-0.0191	-0.0006	0.6704	-0.0024
3.2316	0.0017	-0.0608	-0.0001	0.0033	-0.0082
0.0001	-0.0773	0.0003	0.2880	0.0023	-0.0000
-0.0102	-0.0792	0.0003	-0.2875	0.0024	-0.0000
0.0102					
0.0220					
-0.5888	0.0001	-0.4500	0.0024	0.0001	-0.3734
0.0046	-0.0007	-0.0774	-0.0021	3.1165	-0.0086
11.1721	0.0065	-0.2074	-0.0004	0.0105	-0.0264
0.0002	-0.6137	0.0019	2.1028	0.0217	-0.0001
-0.0587	-0.6302	0.0018	-2.0980	0.0221	-0.0001
0.0585					
0.0310					
-0.6314	0.0001	-0.5664	0.0076	0.0002	-0.3948
0.0130	-0.0017	-0.1721	-0.0051	4.2532	-0.0213
14.7573	0.0153	-0.2030	-0.0003	0.0226	-0.0579
0.0001	-1.6966	0.0062	5.7490	0.0615	-0.0002
-0.1495	-1.7534	0.0054	-5.7319	0.0625	-0.0002
0.1491					
0.0410					
-0.7253	-0.0003	-0.6409	0.0203	0.0002	-0.4389
0.0301	-0.0033	-0.2019	-0.0092	4.0951	-0.0448
13.8901	0.0295	-0.0707	-0.0012	0.0366	-0.0956
-0.0000	-3.0004	0.0173	10.0874	0.1100	-0.0005
-0.2599	-3.1130	0.0137	-10.0532	0.1120	-0.0004
0.2590					
0.0510					
-0.8669	-0.0011	-0.6770	0.0411	0.0001	-0.5039
0.0548	-0.0051	-0.1731	-0.0128	3.9665	-0.0766
13.0639	0.0430	-0.0751	-0.0017	0.0495	-0.1311
-0.0002	-4.2431	0.0385	14.0960	0.1563	-0.0011
-0.3570	-4.4094	0.0283	-14.0450	0.1595	-0.0009
0.3556					
0.0610					
-1.0543	-0.0022	-0.7361	0.0691	-0.0002	-0.5888
0.0866	-0.0069	-0.1473	-0.0162	3.9700	-0.1144
12.8756	0.0554	-0.1322	-0.0021	0.0616	-0.1650
-0.0005	-5.4684	0.0723	17.9477	0.2024	-0.0020

-0.4478	-5.6985	0.0505	-17.8762	0.2070	-0.0014
0.4458					
0.0710					
-1.2868	-0.0036	-0.8257	0.1041	-0.0008	-0.6930
0.1254	-0.0086	-0.1328	-0.0196	3.9807	-0.1559
13.0808	0.0674	-0.1799	-0.0026	0.0735	-0.1988
-0.0009	-6.6939	0.1209	21.8094	0.2491	-0.0033
-0.5391	-7.0075	0.0811	-21.7110	0.2556	-0.0021
0.5361					
0.0910					
-1.5651	-0.0053	-0.9398	0.1459	-0.0017	-0.8167
0.1709	-0.0105	-0.1232	-0.0230	3.9298	-0.2004
13.5135	0.0793	-0.2190	-0.0031	0.0854	-0.2332
-0.0013	-7.9058	0.1860	25.7786	0.2960	-0.0050
-0.6347	-8.3276	0.1200	-25.6462	0.3051	-0.0031
0.6305					
0.0910					
-1.8903	-0.0068	-1.0752	0.1941	-0.0030	-0.9603
0.2233	-0.0118	-0.1151	-0.0269	3.8892	-0.1512
14.0602	0.0884	-0.2540	0.0007	0.0976	-0.2684
-0.0016	-9.0846	0.2590	29.9110	0.3425	-0.0066
-0.7369	-9.6444	0.1572	-29.7365	0.3548	-0.0037
0.7311					
0.1010					
-2.2643	-0.0078	-1.2298	0.2481	-0.0047	-1.1245
0.2828	-0.0126	-0.1055	-0.0325	3.6097	-0.2025
14.6865	0.1020	-0.2880	-0.0033	0.1101	-0.3047
-0.0019	-10.2340	0.3318	34.2338	0.3889	-0.0079
-0.8467	-10.9666	0.1831	-34.0081	0.4055	-0.0037
0.8389					
0.1110					
-2.6991	-0.0110	-1.4045	0.3099	-0.0069	-1.3097
0.3496	-0.0149	-0.0951	-0.0370	3.6847	-0.2814
15.3714	0.1143	-0.3245	-0.0049	0.1227	-0.3422
-0.0027	-11.3336	0.4307	38.7701	0.4345	-0.0098
-0.9650	-12.2808	0.2204	-38.4834	0.4565	-0.0039
0.9549					
0.1210					
-3.1669	-0.0150	-1.6005	0.3784	-0.0096	-1.5168
0.4236	-0.0178	-0.0840	-0.0419	3.5247	-0.3877
16.0979	0.1260	-0.3620	-0.0057	0.1354	-0.3808
-0.0025	-12.3670	0.5657	43.5352	0.4788	-0.0127
-1.0926	-13.5785	0.2773	-43.1769	0.5075	-0.0046
1.0797					
0.1310					
-3.6940	-0.0268	-1.8759	0.4440	-0.0130	-1.7437
0.5042	-0.0298	-0.1391	-0.0542	-3.3779	-0.2467
3.0119	0.0713	-0.5466	-0.0454	0.1431	-0.4036
-0.0026	-12.5305	0.6794	46.3512	0.5010	-0.0140
-1.1319	-14.0916	0.3177	-45.9198	0.5352	-0.0041
1.1162					
0.1420					
-4.0163	-0.0774	-2.0595	0.4585	-0.0170	-1.9991
0.5948	-0.0597	-0.1212	-0.0837	-0.0734	0.0012
7.8531	0.0063	-0.0425	-0.0867	0.1440	-0.4070
-0.0023	-10.8417	0.7367	47.8609	0.5008	-0.0116
-1.0498	-12.5559	0.3424	-47.4463	0.5371	-0.0008
1.0318					

```
        0.1520
       -4.0163      -0.1256      -1.9222       0.4643      -0.0208      -2.2332
        0.6777      -0.0597      -0.1212      -0.0837      -8.6636       0.0014
       11.5539       0.0053       0.5565      -0.0868       0.1450      -0.4101
       -0.0019      -8.2698       0.7579      50.6984       0.5080      -0.0072
       -0.9739      -9.9676       0.3314     -50.3986       0.5455       0.0043
        0.9534
    READ R
```

INPUT TO THE R-MATRIX

```
    21     31   1308        -2.586100   ZSBR02 NO MIDDLE BLOCKS
    21     36   1313        -1.200000   DXSB2 NO MIDDLE BLOCK
    21     38   1315        -0.755000   DXSB2 NO MIDDLE BLOCK
    21     45   1322        -1.200000   DXSB5 NO MIDDLE BLOCK
    21     47   1324        -0.755000   DZSB5 NO MIDDLE BLOCK
    RESTORE
  9    4 130     1   30
STORING FROM R% 310□ TO R%  75□
  3    4 140     4   92
STORING FROM R% 320□ TO R% 272□
  3    4 143     4   67
STORING FROM R% 323□ TO R% 247□
  3    4 146     0   33
STORING FROM R% 326□ TO R%   0□
    TIME H
```

BEGINNING OF COMBINED SEAT-MAN TRAJECTORY.

0.0					
-0.5751	0.0	-0.3620	0.0	0.0	-0.3620
0.0	0.0	0.0000	0.0	0.2067	0.0021
0.8639	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0					

0.0120					
-0.5769	0.0000	-0.3830	0.0002	0.0000	-0.3644
0.0008	-0.0001	-0.0187	-0.0005	0.8975	-0.0008
3.2320	0.0013	-0.0611	-0.0001	0.0028	-0.0082
0.0001	-0.1701	-0.0004	0.2723	0.0060	0.0000
-0.0096	-0.1719	-0.0004	-0.2712	0.0061	0.0000
0.0095					

0.0220					
-0.5903	-0.0000	-0.4508	0.0020	0.0001	-0.3734
0.0041	-0.0007	-0.0783	-0.0019	3.2296	-0.0080
11.0259	0.0060	-0.2089	-0.0005	0.0101	-0.0266
0.0001	-0.7749	0.0007	2.1095	0.0281	-0.0000
-0.0571	-0.7914	0.0006	-2.1033	0.0285	-0.0000
0.0569					

0.0310					
-0.6332	-0.0002	-0.5644	0.0071	0.0001	-0.3948
0.0122	-0.0018	-0.1702	-0.0048	4.3008	-0.0224
14.6229	0.0150	-0.1970	-0.0005	0.0220	-0.0577
0.0000	-1.8803	0.0050	5.7069	0.0688	-0.0001
-0.1470	-1.9364	0.0043	-5.6881	0.0698	-0.0001
0.1465					

0.0410					
-0.7270	-0.0008	-0.6379	0.0196	0.0000	-0.4387
0.0289	-0.0034	-0.1990	-0.0086	4.0316	-0.0480
13.9033	0.0293	-0.0720	-0.0015	0.0360	-0.0954
-0.0001	-3.1850	0.0166	10.0273	0.1173	-0.0005
-0.2566	-3.2965	0.0131	-9.9913	0.1193	-0.0004
0.2557					

0.0510					
-0.8685	-0.0017	-0.6749	0.0403	-0.0001	-0.5036
0.0532	-0.0052	-0.1713	-0.0120	3.7427	-0.0807
13.1562	0.0[illegible]29	-0.0764	-0.0020	0.0489	-0.1309
-0.0003	-4.3319	0.0386	14.0536	0.1619	-0.0011
-0.3544	-4.5472	0.0286	-14.0011	0.1650	-0.0009
0.3530					

0.0610					
-1.0559	-0.0030	-0.7344	0.0683	-0.0005	-0.5884
0.0848	-0.0070	-0.1460	-0.0151	3.6442	-0.1185
13.0023	0.0355	-0.1327	-0.0023	0.0611	-0.1650
-0.0005	-5.5169	0.0734	17.9402	0.2043	-0.0021

-0.4467	-5.7465	0.0518	-17.8682	0.2089	-0.0014
0.4446					
0.0710					
-1.2885	-0.0045	-0.8244	0.1034	-0.0010	-0.6927
0.1233	-0.0088	-0.1317	-0.0181	3.6505	-0.1595
13.2055	0.0576	-0.1806	-0.0027	0.0732	-0.1990
-0.0008	-6.6347	0.1228	21.8414	0.2466	-0.0034
-0.5396	-6.9483	0.0831	-21.7442	0.2532	-0.0023
0.5366					
0.0810					
-1.5669	-0.0063	-0.9392	0.1455	-0.0019	-0.8165
0.1686	-0.0106	-0.1228	-0.0210	3.6909	-0.2041
13.6072	0.0797	-0.2209	-0.0032	0.0852	-0.2334
-0.0011	-7.7535	0.1886	25.8447	0.2898	-0.0051
-0.6365	-8.1762	0.1225	-25.7149	0.2989	-0.0032
0.6324					
0.0910					
-1.8930	-0.0090	-1.1245	0.1935	-0.0031	-0.9603
0.2210	-0.0132	-0.1453	-0.0248	3.9267	-0.0671
14.0649	0.0794	-0.7634	-0.0070	0.0978	-0.2683
-0.0014	-8.8954	0.2531	29.9942	0.3348	-0.0064
-0.7394	-9.4825	0.1511	-29.8151	0.3472	-0.0036
0.7337					
0.1020					
-2.3218	-0.0243	-2.1537	0.2324	-0.0048	-1.1415
0.2375	-0.0301	-1.0127	-0.0486	3.0429	-0.0869
14.8013	0.0414	-2.5056	-0.0296	0.1134	-0.3071
-0.0013	-9.9159	0.2990	34.7728	0.3852	-0.0065
-0.8609	-11.2159	0.1554	-34.3773	0.4023	-0.0021
0.8531					
0.1120					
-2.7804	-0.0558	-4.0299	0.2464	-0.0066	-1.3279
0.3568	-0.0541	-2.7024	-0.0960	2.3560	-0.1124
15.6344	0.0006	-4.0293	-0.0528	0.1282	-0.3437
-0.0011	-10.5328	0.3501	39.3847	0.4245	-0.0065
-0.9812	-13.2750	0.1741	-38.5492	0.4471	-0.0004
0.9711					
0.1220					
-3.3073	-0.1057	-6.7508	0.2376	-0.0085	-1.5355
0.4347	-0.1154	-5.2160	-0.1705	1.2692	-0.1527
15.9366	-0.0492	-5.4433	-0.0810	0.1436	-0.3813
-0.0006	-10.6533	0.4118	44.2735	0.4532	-0.0068
-1.1112	-15.7946	0.2151	-42.7154	0.4828	0.0017
1.0987					
0.1310					
-3.8270	-0.1579	-9.6484	0.2065	-0.0103	-1.7373
0.5109	-0.1783	-7.9113	-0.2623	-6.0322	-0.2037
4.3127	-0.1084	-5.3816	-0.1152	0.1493	-0.3945
0.0001	-9.5833	0.4677	45.9951	0.4351	-0.0069
-1.1136	-17.1580	0.2819	-43.7409	0.4686	0.0036
1.0999					
0.1420					
-4.0004	-0.2453	-12.8275	0.1510	-0.0124	-1.9869
0.6055	-0.2040	-8.7486	-0.2978	-6.0763	0.0011
7.8541	-0.1067	-4.7911	-0.0999	0.1505	-0.3978
0.0007	-7.3800	0.4837	47.2638	0.4274	-0.0027
-1.0333	-17.6912	0.3349	-44.4480	0.4630	0.0081
1.0179					

```
                0.1540
               -4.0004         -0.3252      -15.8818        0.0993      -0.0149      -2.2617
                0.7094         -0.2040       -8.7486       -0.2978      -0.6677       0.0013
               11.5554         -0.1016       -4.0555       -0.1055       0.1515      -0.4016
                0.0013         -3.4661        0.4721       49.9809       0.4361       0.0027
               -0.9424        -17.0138        0.3707      -47.1263       0.4729       0.0143
                0.9244
        PLOT
    1   1   2   2   2   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
    2   1   0
 *      BASIC CONFIG
 0      NC MID BLOCK
    1   1   3   2   3   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
    2   0   0
    1   1   4   2   4   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
    2   0   0
    1   1   5   2   5   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
    2   0   0
    1   1   6   2   6   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
    2   0   0
    1   1   7   2   7   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    2   0   0
    1   1   8   2   8   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    2   0   0
    1   1   9   2   9   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    2   0   0
    1   1  10   2  10   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    2   0   0
    1   1  11   2  11   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    2   0   0
    1   1  12   2  12   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
    2   0   0
    1   1  13   2  13   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
    2   0   0
    1   1  14   2  14   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
    2   0   0
    1   1  15   2  15   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
    2   0   0
    1   1  16   2  16   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
    2   0   0
    1   1  17   2  17   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
    2   0   0
    1   1  18   2  18   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
    2   0   0
    1   1  19   2  19   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
    2   0   0
    1   1  20   2  20   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
2  0  0
1  1 21  2 21  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
2  0  0
1  1 22  2 22  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
2  0  0
1  1 23  2 23  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
2  0  0
1  1 24  2 24  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
2  0  0
1  1 25  2 25  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
2  0  0
1  1 26  2 26  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
2  0  0
1  1 27  2 27  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
2  0  0
1  1 28  2 28  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
2  0  0
1  1 29  2 29  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
2  0  0
1  1 30  2 30  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
2  0  0
1  1 31  2 31  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
2  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0
  OUTPUT  READ R  READ R  TRIM VTOREAD R  TIME H  PLOT
     TIME HISTORY OUTPUT SUBSCRIPTS AND SCALE FACTORS

1  1 -1  2  0  1  7  9  0  0

     FIG     LAT. CONTROL FAILURE
     SEAT AND/OR MAN DOWNRANGE DIST

     FIG     LAT. CONTROL FAILURE
     SEAT AND/OR MAN LATERAL DIST.

     FIG     LAT. CONTROL FAILURE
     SEAT AND/OR MAN ALTITUDE

     FIG     LAT. CONTROL FAILURE
     SEAT AND/OR MAN CLIMB RATE

     FIG     LAT. CONTROL FAILURE
     PARACHUTE DOWNRANGE DISTANCE

     FIG     LAT. CONTROL FAILURE
     PARACHUTE LATERAL DISTANCE

     FIG     LAT. CONTROL FAILURE
     PARACHUTE ALTITUDE

     FIG     LAT. CONTROL FAILURE
```

```
PARACHUTE TOTAL AIRSPEED

FIG      LAT. CONTROL FAILURE
SEAT AND/OR MAN TOTAL AIRSPEED
 4    2  182      1.000000  TIME        1
TIME.SEC
 1    7   52      1.000000  XESM        2
DOWNRANGE DIST.FT.
 1    8   53      1.000000  YESM        3
LATERAL DIST.FT.
 1    9   54     -1.000000  ALT SM      4
ALTITUDE.FT.
 0    9    9     -1.000000  HDOT SM     5
HDOT SM.FT/SEC
 1   27   72      1.000000  XERC        6
XERC.FT
 1   28   73      1.000000  YERC        7
YERC.FT
 1   29   74     -1.000000  ALT.RC      8
ALTITUDE RC.FT
20   14 1254      1.000000  UA RC       9
UA RC.FT/SEC
 4   12  192      1.000000  UA SM      10
UA SM.FT/SEC
```

INPUT TO THE R-MATRIX

13	2	831	0.250000	DELTA TR
13	4	833	0.574000	CAR
13	5	834	0.0	CBR
13	6	835	-0.820000	CGR
13	7	836	-0.480000	DELTA XCGR
13	8	837	0.0	DELTA YCGR
13	9	838	1.110000	DELTA ZCGR
13	11	840	0.0	ROC/GUN,DRAG CHUTE
13	12	841	0.200000	DELTA PD
13	13	842	50.000000	TOPD
13	14	843	-1.000000	CAPD
13	15	844	0.0	CBPD
13	16	845	0.0	CGPD
13	17	846	-1.290000	DELTA XCGPD
13	18	847	0.320000	DELTA YCGPD
13	19	848	-1.930000	DELTA ZCGPD
13	27	856	-1.040000	DELTA XCGC
13	28	857	0.0	DELTA YCGC
13	29	858	-0.750000	DELTA ZCGC
13	31	860	0.0	ROC/GUN,RECOV CHUTE
13	32	861	0.300000	DT,RC
13	34	863	0.940000	CA,RC
13	35	864	-0.342000	CB,RC
13	36	865	0.0	CG,RC
13	37	866	-1.270000	DX,CGC
13	38	867	-0.010000	DY,CGC
13	39	868	-2.230000	DZ,CGC
13	46	875	5000.000000	FR1
13	47	876	0.025000	T1
13	48	877	5000.000000	FR2
13	49	878	0.250000	T2
13	50	879	0.0	FR3
13	51	880	0.0	T3
13	52	881	0.0	FR4
13	53	882	0.0	T4
13	54	883	0.0	FR5
13	55	884	0.0	T5
13	56	885	0.0	FR6
13	57	886	0.274000	T6
13	70	899	0.0	T1
13	71	900	300.000000	FRC1
13	72	901	0.250000	T2
13	73	902	300.000000	FRC2
13	74	903	0.0	T1
13	75	904	200.000000	FDC1
13	76	905	0.200000	T2
13	77	906	200.000000	FDC1
13	78	907	0.320000	DT R-MOTOR
13	80	909	0.0	T1
13	81	910	500.000000	FR1,ROLL MOTOR
13	82	911	0.140000	T2
13	83	912	500.000000	FR2,ROLL MOTOR
13	84	913	0.0	T3
13	85	914	-500.000000	FR3,ROLL MOTOR
13	86	915	0.330000	T4
13	87	916	-500.000000	FR4,ROLL MOTOR
13	89	918	-0.740000	DXCG-RM
13	90	919	-0.730000	DYCG-RM
13	91	920	-1.109999	DZCG-RM
13	92	921	0.0	CALPHA-RM

13	93	922	-1.000000	CBETA-RM
13	94	923	0.0	CGAMMA-RM
13	95	924	0.180000	DT-PITCH M
13	97	926	0.0	T1
13	98	927	1000.000000	F1,PITCH MOTOR
13	99	928	0.180000	T2
13	100	929	1000.000000	F2,PITCH MOTOR
13	101	930	0.0	T3
13	102	931	0.0	F3,PITCH MOTOR
13	103	932	0.0	T4
13	104	933	0.0	F4,PITCH MOTOR
13	105	934	-0.420000	DXCG-PM
13	106	935	0.0	DYCG-PM
13	107	936	1.320000	DZCG-PM
13	108	937	-0.730000	CALPHA-PM
13	109	938	0.0	CBETA-PM
13	110	939	-0.681900	CGAMMA-PM
13	111	940	0.180000	DT,PITCH M 2
13	113	942	0.0	T1
13	114	943	200.000000	FPM2
13	115	944	0.130000	T2
13	116	945	200.000000	FPM2
13	117	946	0.0	T3
13	118	947	0.0	FPM2
13	119	948	0.0	T4
13	120	949	0.0	FPM2
13	121	950	-0.060000	DXCG-PM2
13	122	951	0.0	DYCG-PM2
13	123	952	1.469999	DZCG-PM2
13	124	953	1.000000	CAPM2
13	125	954	0.0	CBPM2
13	126	955	0.0	CGPM2
13	127	956	0.180000	DT-YAW MOTOR
13	129	958	0.0	T1-YAW MOTOR
13	130	959	200.000000	FY1-YAW MOTOR
13	131	960	0.180000	T2-YAW MOTOR
13	132	961	200.000000	FY2-YAW MOTOR
13	133	962	0.0	T3-YAW MOTOR
13	134	963	0.0	FY3-YAW MOTOR
13	135	964	0.0	T4-YAW MOTOR
13	136	965	0.0	FY4-YAW MOTOR
13	137	966	-0.770000	DXCG-YAW MOTOR
13	138	967	-0.390000	DYCG-YAW MOTOR
13	139	968	0.560000	DZCG-YAW MOTOR
13	140	969	0.598300	CAYM
13	141	970	0.0	CBYM
13	142	971	-0.801200	CGYM
13	143	972	2.000000	POS. PITCH RATE INITIATION VALU
13	144	973	-1.000000	NEG. PITCH RATE INITIATION VALU
14	0	976	14.040000	WT. DRAG CHUTE
14	1	977	-2.919999	X APEX OF BRIDLE
14	2	978	0.0	Y APEX OF BRIDLE
14	3	979	0.0	Z APEX OF BRIDLE
14	4	980	13.320000	RLINES
14	5	981	3.330000	RSC
14	6	982	2.160000	RIN
14	7	983	15.000000	RLO
14	8	984	7000.000000	K,DC
14	9	985	0.034928	B1
14	10	986	-0.153270	B2
14	11	987	0.032146	B3
14	12	988	-0.611300	C1 ,HEMISFLO
14	13	989	0.174100	C2 ,HEMISFLO
14	14	990	13.000000	SCDI
14	15	991	0.189000	K1
14	16	992	0.264000	K2

14	17	993	1.000000	K3
14	18	994	0.220000	C
14	19	995	0.0	DTGUN
14	20	996	0.008070	BO
14	21	997	0.910000	FD
14	22	998	-1.209999	DX1
14	23	999	0.666000	DY1
14	24	1000	-0.834000	DZ1
14	25	1001	-1.209999	DX2
14	26	1002	-0.666000	DY2
14	27	1003	-0.834000	DZ2
14	28	1004	-0.500000	DX3
14	29	1005	-0.666000	DY3
14	30	1006	1.415000	DZ3
14	31	1007	-0.500000	DX4
14	32	1008	0.666000	DY4
14	33	1009	1.415000	DZ4
14	34	1010	0.050000	ERRDC
14	35	1011	4.000000	NLINES
14	36	1012	-0.775000	SCTA,HEMISFLO,SCTI#15
14	37	1013	-20.399994	SCTA2,HEMISFLO,SCTI#15
14	38	1014	-18.929993	SCTA3,HEMISFLO,SCTI#15
14	39	1015	0.951000	SCNA,HEMISFLO,SCTI#15
14	40	1016	60.199997	SCNA2,HEMISFLO,SCTI#15
14	41	1017	81.000000	SCNA3,HEMISFLO,SCTI#15
15	0	1018	17.899994	WT. REC. CHUTE
15	1	1019	0.0	X APEX OF BRIDLE
15	2	1020	0.0	Y APEX OF BRIDLE
15	3	1021	-2.589999	Z APEX OF BRIDLE
15	4	1022	22.832993	RLINES
15	5	1023	14.000000	RSC
15	6	1024	7.500000	RIN
15	7	1025	23.000000	RLO
15	8	1026	30000.000000	K
15	9	1027	0.084928	B1
15	10	1028	-0.153270	B2
15	11	1029	0.082146	B3
15	12	1030	-1.412900	C1 ,FLAT CIRCULAR CLOTH
15	13	1031	0.603100	C2 ,FLAT CIRCULAR CLOTH
15	14	1032	461.000000	SCDI
15	15	1033	0.0	K1
15	16	1034	0.121000	K2
15	17	1035	1.000000	K3
15	18	1036	0.100000	C
15	19	1037	0.800000	DTGUN
15	20	1038	0.008070	BO
15	21	1039	1.000000	FD
15	22	1040	13.410000	SCTA
15	23	1041	89.099991	SCTA2
15	24	1042	-171.500000	SCTA3
15	25	1043	-34.199997	SCNA
15	26	1044	37.000000	SCNA2
15	27	1045	37.699997	SCNA3
16	0	1046	354.429932	WT.SLATEMAN
16	1	1047	11.990000	IXX
16	2	1048	22.619995	IYY
16	3	1049	10.620000	IZ
16	4	1050	3.020000	IXZ
16	5	1051	0.0	IYZ
16	6	1052	0.0	IXY
16	7	1053	0.0	DELTA XCG
16	8	1054	0.0	DELTA YCG
16	9	1055	0.0	DELTA ZCG
16	10	1056	-0.600000	CMO
16	11	1057	-0.026000	CLP
16	12	1058	-0.030000	CNR

16	13	1059	5.049999	S
16	14	1060	3.820000	C#LM
16	15	1061	3.820000	B#LM
16	16	1062	0.0	O.-BD,1.-SB
16	17	1063	204.429993	W.S
16	18	1064	3.830000	IXX
16	19	1065	6.129999	IYY
16	20	1066	2.299999	IZZ
16	21	1067	-1.879999	IXZ
16	22	1068	0.0	IYZ
16	23	1069	0.0	IXY
16	24	1070	0.0	DELTA XCG
16	25	1071	0.0	DELTA YCG
16	26	1072	0.0	DELTA ZCG
16	27	1073	-0.600000	CMQ
16	28	1074	-0.025000	CLP
16	29	1075	-0.030000	CNR
16	30	1076	5.049999	S
16	31	1077	3.820000	C#LM
16	32	1078	3.820000	B#LM
16	33	1079	0.0	O.-BD,1.-ST
16	34	1080	150.000000	W.M
16	35	1081	13.000000	IXX
16	36	1082	13.000000	IYY
16	37	1083	5.000000	IZZ
16	38	1084	0.0	IXZ
16	39	1085	0.0	IYZ
16	40	1086	0.0	IXY
16	41	1087	0.0	DELTA XCG
16	42	1088	0.0	DELTA YCG
16	43	1089	0.0	DELTA ZCG
16	44	1090	-0.600000	CMQ
16	45	1091	-0.026000	CLP
16	46	1092	-0.030000	CNR
16	47	1093	6.000000	S#L
16	48	1094	0.900000	C.BAR#1
16	49	1095	1.375000	B#D
16	50	1096	0.0	O.-BD,1.-ST
16	51	1097	23.699997	B SPINE
16	52	1098	2795.000000	K SPINE
16	53	1099	0.074500	DXCP
16	54	1100	0.0	DYCP
16	55	1101	0.090000	DZCP
16	56	1102	1.000000	FOL.
16	58	1104	0.0	CFM
16	60	1106	0.0	DXCG.HD
16	61	1107	0.0	DXCG.HD
16	62	1108	-1.665000	DZCG.HD
21	0	1277	-10.500000	DXCGP
21	1	1278	0.0	DYCGP
21	2	1279	-[illegible].000000	DZCGP
21	21	1298	0.0	PSI A/C
21	22	1299	0.296500	THETA A/C
21	23	1300	0.0	PHI A/C
21	24	1301	0.0	PSI C/S
21	25	1302	-0.296500	THETA C/S
21	26	1303	0.0	PHI C/S
21	27	1304	10.500000	DXAS-CG
21	28	1305	-1.129999	DYAS-CG
21	29	1306	-1.000000	DZAS-CG
21	30	1307	-2.796100	ZSBR03
21	31	1308	-1.252100	ZSBR02
21	32	1309	-0.535300	ZSBR01
21	33	1310	-0.559650	DXSB1
21	34	1311	0.860000	DYSB1
21	35	1312	1.361070	DZSB1

21	36	1313	-0.754470	DXSB2
21	37	1314	0.860000	DYSB2
21	38	1315	0.723367	DZSB2
21	39	1316	-1.205560	DXSB3
21	40	1317	0.860000	DYSB3
21	41	1318	-0.753270	DZSB3
21	42	1319	-0.559650	DXSB4
21	43	1320	-0.860000	DYSB4
21	44	1321	1.361070	DZSB4
21	45	1322	-0.754470	DXSB5
21	46	1323	-0.860000	DYSB5
21	47	1324	0.725567	DZSB5
21	48	1325	-1.205560	DXSB6
21	49	1326	-0.860000	DYSB6
21	50	1327	-0.753270	DZSB6
21	54	1331	2.830000	STROKE
21	55	1332	3.990000	RL
21	56	1333	0.020000	BF
21	61	1338	10.049999	XAR01
21	62	1339	1.990000	YAR01
21	63	1340	0.720000	ZAR01
21	64	1341	10.049999	XAR02
21	65	1342	0.270000	YAR02
21	66	1343	0.720000	ZAR02

INPUT TO THE R-MATRIX

1	39	83	-50.000000	ZE
4	93	273	0.0	THETA
4	63	243	77.000000	AIRSPEED
25	16	1670	0.223560	BVR
25	18	1672	0.247600	BSR
25	29	1683	1.039999	DB
25	10	1664	5567.000000	TOOOR
25	12	1666	1577.000000	TOOONF

CONVERGENCE AFTER 5 CYCLES

INPUT TO THE R-MATRIX

4	4	184	5.000000	IMAX
25	16	1670	0.0	BVR
25	18	1672	0.0	BSR
25	10	1664	0.0	TOOOR
13	30	859	0.300000	TIME FROM SWITCH TO PILOT REL.
13	3	832	0.557000	TO,SUST
13	23	852	0.430000	TO,CAT
13	33	862	0.582000	TO,RC
13	79	908	0.532000	TO,RM
13	128	957	0.532000	TO,YAW

TIME HISTORY

BEGINNING OF COMBINED SEAT-MAN TRAJECTORY.

0.0					
10.4385	1.1299	51.1901	0.0	9.1685	1.1199
53.4201	77.0000	77.0000			
0.0120					
11.3625	1.1299	51.1896	-0.0474	10.0929	1.1200
53.4189	77.0959	77.0059			
0.0220					
12.1326	1.1302	51.1883	-0.1770	10.8636	1.1216
53.4188	76.9901	77.0102			
0.0310					
12.8256	1.1308	51.1854	-0.4002	11.5560	1.1249
53.4160	76.9537	77.0110			
0.0410					
13.5957	1.1325	51.1790	-0.7757	12.3264	1.1298
53.4090	77.1133	77.0092			
0.0510					
14.3657	1.1357	51.1685	-1.2552	13.0970	1.1379
53.4001	76.9947	77.0069			
0.0610					
15.1355	1.1405	51.1529	-1.7787	13.8666	1.1490
53.3839	77.0569	77.0071			
0.0710					
15.9053	1.1470	51.1322	-2.2729	14.6376	1.1620
53.3633	77.1672	77.0110			
0.0810					
16.6748	1.1551	51.1068	-2.6706	15.4080	1.1785
53.3392	77.0239	77.0199			
0.0910					
17.4443	1.1541	51.0781	-2.9341	16.1779	1.1966
53.3093	77.1539	77.0347			
0.1010					
18.2138	1.1737	51.0475	-3.0668	16.9494	1.2158
53.2797	77.2236	77.0536			
0.1110					
18.9836	1.1333	51.0162	-3.1100	17.7199	1.2370
53.2490	77.1418	77.0729			
0.1210					
19.7536	1.1927	50.9844	-3.1282	18.4910	1.2579
53.2166	77.3115	77.0885			
0.1310					

20.5236 53.1862	1.2018 77.2057	50.9524 77.0994	-3.1927	19.2628	1.2798
0.1410 21.2936 53.1527	1.2110 77.2252	50.9192 77.1049	-3.3630	20.0334	1.3031
0.1510 22.0636 53.1173	1.2207 77.3364	50.8838 77.1076	-3.6694	20.8051	1.3266
0.1610 22.8335 53.0795	1.2312 77.2381	50.8445 77.1095	-4.0963	21.5765	1.3528
0.1710 23.6031 53.0341	1.2431 77.3502	50.8008 77.1138	-4.5985	22.3472	1.3810
0.1810 24.3724 52.9859	1.2564 77.3317	50.7517 77.1240	-5.1079	23.1188	1.4108
0.1910 25.1416 52.9318	1.2711 77.3469	50.6980 77.1409	-5.5473	23.8895	1.4438
0.2010 25.9106 52.8725	1.2867 77.5045	50.6404 77.1617	-5.8699	24.6606	1.4778
0.2110 26.6797 52.8131	1.3029 77.4646	50.5802 77.1842	-6.0588	25.4323	1.5130
0.2210 27.4489 52.7498	1.3190 77.4835	50.5186 77.2037	-6.1355	26.2033	1.5497
0.2310 29.2182 52.6865	1.3348 77.5763	50.4566 77.2212	-6.1522	26.9751	1.5855
.2410 9875 46 29 52.	1.3501 77.4678	50.3946 77.2385	-6.1818	27.7470	1.6222
0.2 30.52 52.493	1.3651 77.5181	50.3319 77.2549	-6.2941	28.5180	1.6593
0.2710 31.2755 52.4245	3800 24	50.2673 77.2724	-6.5305	29.2900	1.6962
0.2810 32.0645 52.3499	1 77.	50.1998 77.2924	-6.8978	30.0618	1.7357
0.2910 32.8333 52.2714	1.4291281 77.7665 61		-7.3678	30.8328	1.7751
			-7.8754	31.6047	1.8165

0.3010					
33.6019	1.4483	49.9697	-8.3507	32.3759	1.8607
52.1859	77.7622	77.3762			
0.3110					
34.3704	1.4681	49.8638	-8.7310	33.1470	1.9054
52.0967	77.8625	77.4068			
0.3210					
35.1396	1.4886	49.7946	-8.9825	33.9188	1.9516
52.0044	77.9272	77.4339			
0.3310					
35.9070	1.5091	49.7036	-9.1088	34.6897	1.9989
51.9080	77.8710	77.4575			
0.3410					
36.6754	1.5293	49.6118	-9.1517	35.4615	2.0451
51.8124	78.0061	77.4729			
0.3510					
37.4440	1.5489	49.5197	-9.1755	36.2334	2.0922
51.7158	77.9454	77.4835			
0.3610					
38.2127	1.5680	49.4273	-9.2499	37.0047	2.1388
51.6171	77.9705	77.4904			
0.3710					
38.9812	1.5368	49.3335	-9.4304	37.7769	2.1848
51.5196	78.0323	77.4953			
0.3910					
39.7496	1.6057	49.2373	-9.7371	38.5479	2.2324
51.4161	77.9559	77.5147			
0.3910					
40.5177	1.6252	49.1374	-10.1577	39.3190	2.2801
51.3097	78.1029	77.5355			
0.4010					
41.2853	1.6456	49.0329	-10.6437	40.0905	2.3292
51.1994	78.0769	77.5641			
0.4110					
42.0526	1.6673	48.9235	-11.1307	40.8603	2.3804
51.0805	78.1519	77.6003			
0.4210					
42.9196	1.6900	48.8096	-11.5536	41.6313	2.4320
50.9595	78.2953	77.6411			
0.4310					
43.5863	1.7135	46.6920	-11.8708	42.4015	2.4855
50.9334	78.2296	77.6812			
0.4410					
44.3530	1.7370	48.5711	-12.1722	43.1709	2.5390
50.7024	78.3684	77.7644			
0.4510					
45.1205	1.7559	48.4476	-12.4348	43.9423	2.5910
50.5706	78.5534	77.8681			
0.4610					

45.8881	1.7823	48.3235	-11.8734	44.7138	2.6440
50.4339	78.5497	77.6368			
0.4710					
46.6469	1.8179	48.2313	-5.2587	45.4876	2.7029
50.3149	78.3772	75.2062			
0.4810					
47.3843	1.8863	48.2136	1.1845	46.2481	2.8074
50.3001	74.5126	73.4874			
0.4910					
48.1077	1.4799	48.2465	5.2584	46.9521	2.9408
50.3376	70.7516	72.6696			
0.5010					
48.8182	2.0958	48.3151	8.4795	47.6709	3.0731
50.3629	75.7299	72.1820			
0.5110					
49.5174	2.2364	48.4136	11.2844	48.3905	3.2579
50.4769	73.0549	71.9912			
0.5210					
50.2057	2.4051	48.5392	13.9307	49.0647	3.4583
50.5849	71.6535	72.1583			
0.5310					
50.8845	2.6024	48.6919	16.7276	49.7682	3.6782
50.7045	77.1987	72.6762			
0.5410					
51.5551	2.8288	48.8739	19.7833	50.4472	3.9506
50.9068	73.6107	73.7203			
0.5510					
52.2196	3.0358	49.0864	22.8277	51.1055	4.2307
51.0815	76.2299	75.2391			
0.5610					
52.8805	3.3722	49.3245	24.0767	51.7984	4.5533
51.3109	81.8359	76.3940			
0.5710					
53.5501	3.6693	49.5670	24.8325	52.4587	4.8779
51.5806	74.6086	78.2557			
0.5820					
54.3099	4.0070	49.8522	27.3283	53.2132	5.1646
51.8267	81.9308	81.9855			
0.5920					
55.0314	4.3295	50.1399	30.2680	53.9142	5.4732
52.1025	79.2293	86.3102			
0.6040					
55.9385	4.7377	50.5244	33.8496	54.6824	5.8616
52.4211	73.8348	91.4853			
0.6120					
56.5677	5.0225	50.8049	36.3736	55.1503	6.1310
52.6250	70.4933	94.8927			
0.6220					
57.3767	5.3946	51.1869	40.0622	55.6859	6.4794
52.8707	66.5240	98.9697			

0.6320 58.2082 53.1063	5.7850 62.8506	51.6061 103.0308	43.8176	56.1674	6.8406
0.6440 59.2341 53.3760	6.2770 58.8813	52.1592 107.8762	48.4176	56.8742	7.2906
0.6520 59.9342 53.5480	6.6189 56.5339	52.5590 111.0864	51.5402	56.9694	7.6005
0.6640 61.0076 53.7944	7.1518 53.5204	53.2058 115.6674	56.3066	57.3488	8.0801
0.6720 61.7365 53.9509	7.5200 51.8846	53.6690 119.0297	59.5378	57.5596	8.4093
0.6820 62.6632 54.1381	7.9953 50.2976	54.2842 122.9653	63.5152	57.7764	8.8315
0.6940 63.7946 54.3502	8.5903 49.1069	55.0750 127.6362	68.3359	57.9683	9.3533
0.7020 64.5595 54.4843	9.0015 48.7597	55.6347 130.7126	71.6027	58.0555	9.7102
0.7140 65.7209 54.6741	9.6391 48.9055	56.5235 135.2406	76.5341	58.1254	10.2588
0.7220 66.5025 54.7933	10.0791 49.4308	57.1481 138.0922	79.6745	58.1319	10.6331
0.7320 67.4853 54.9341	10.6467 50.5359	57.9646 141.5975	83.6484	58.0954	11.1107
0.7440 68.6706 55.0912	11.3525 52.4543	58.9971 145.6068	88.4495	57.9870	11.6974
0.7520 69.4620 55.1887	11.8371 54.0478	59.7174 148.1532	91.6568	57.8759	12.0967
0.7620 70.4507 55.3026	12.4381 56.3426	60.6539 151.2668	95.6788	57.6940	12.6047
0.7740 71.6339 55.4278	13.2249 59.4674	61.8309 154.8947	100.5065	57.4133	13.2273
0.7820 72.4188 55.5043	13.7490 61.7331	62.6477 157.2452	103.7157	57.1888	13.6500
0.7920					

73.3947 55.5922	14.4165 64.7234	63.7045 160.2487	107.5837	56.8667	14.1868
0.8020 74.3679 55.6715	15.1065 67.8388	64.7984 163.4023	111.2298	56.4992	14.7325
0.8140 75.5318 55.7556	15.9530 71.6373	66.1478 164.4646	112.4674	55.9995	15.3986
0.8220 76.3038 55.8176	16.5216 64.2984	67.0468 162.9012	111.2697	55.6532	15.8460
0.8320 77.1981 56.7668	17.2315 216.7290	68.1150 151.7449	103.6295	56.4810	16.4201
0.8420 78.0488 57.5431	17.9428 68.2208	69.1487 151.3987	103.0112	57.0748	16.9305

BEGINNING OF MAN-ALONE TRAJECTURY.

0.8520 78.8708 57.6176	18.6543 95.4254	70.1565 138.6997	94.5680	56.6916	17.3409
[illegible] 79.[illegible] 58.6134	19.3504 125.6335	71.0460 127.7308	87.2579	57.7289	17.8436
0.8720 80.1395 59.0974	20.0429 60.4374	71.9147 124.7869	85.2941	57.9261	18.2352
0.8820 80.6064 60.0218	20.7169 226.0688	72.6984 104.1956	72.3714	59.0214	18.7102
0.8920 80.9524 61.0331	21.3763 95.2316	73.4165 103.3604	71.6685	60.3045	19.1932
0.9020 81.2722 61.6757	22.0324 139.4996	74.1191 96.3895	66.7936	60.8797	19.5828
0.9120 81.4703 62.5838	22.6746 122.7325	74.7605 92.1080	63.4501	62.0643	20.0257
0.9220 81.6558 63.0994	23.3152 61.0588	75.3930 91.2053	62.5998	62.4753	20.3718
0.9320 81.7767 63.7064	23.9480 114.8658	75.9896 85.4553	57.4051	63.0979	20.7317
0.9420 81.9555	24.5756	76.5616	57.0402	63.5941	21.0668

73.3947	14.4185	63.7045	107.5837	56.6667	14.1868
55.5922	64.7234	160.2487			
0.8020					
74.3679	15.1065	64.7984	111.2298	56.4992	14.7325
55.6715	67.8388	163.4023			
0.8140					
75.5318	15.9530	66.1478	112.4674	55.9995	15.3986
55.7556	71.6373	164.4646			
0.8220					
76.3038	16.5216	67.0468	111.2697	55.6532	15.8460
55.8176	64.2984	162.9012			
0.8320					
77.1981	17.2315	68.1150	103.6295	56.4810	16.4201
56.7668	216.7290	151.7449			
0.8420					
78.0488	17.9428	69.1487	103.0112	57.0748	16.9305
57.5431	68.2208	151.3987			

BEGINNING OF MAN-ALONE TRAJECTORY.

0.8520					
78.8708	18.6543	70.1565	94.5680	56.6916	17.3409
57.6176	95.425[illegible]	138.6997			
0.8620					
79.5187	19.3504	71.0460	87.2579	57.7289	17.8436
58.6134	125.6335	127.7308			
0.8720					
80.1395	20.0429	71.9147	85.2941	57.9261	18.2352
59.0974	60.4374	124.7869			
0.8820					
80.6064	20.7169	72.6984	72.3714	59.0214	18.7102
60.0218	226.0688	104.1956			
0.9920					
80.9524	21.3763	73.4165	71.6685	60.3045	19.1932
61.0331	95.2316	103.3604			
0.9020					
81.2722	22.0324	74.1191	66.7936	60.8797	19.5828
61.6757	139.4996	96.3895			
0.9120					
81.4703	22.6746	74.7605	63.4501	62.0643	20.0257
62.5838	122.7325	92.1080			
0.9220					
81.6558	23.3152	75.3930	62.5998	62.4753	20.3718
63.0994	61.0588	91.2053			
0.9320					
81.7767	23.9480	75.9896	57.4051	63.0979	20.7317
63.7064	114.8658	85.4553			
0.9420					
81.8555	24.5756	76.5616	57.0402	63.5941	21.0668

64.2317	45.3333	85.1763			
0.9520					
81.9186	25.2009	77.1216	53.8466	63.7733	21.3548
64.5805	70.9433	82.2011			
0.9620					
81.9249	25.8181	77.6465	52.0780	64.2336	21.6738
65.0781	56.4453	80.7201			
0.9720					
81.9255	26.4343	78.1647	51.2251	64.3012	21.9308
65.3416	34.7761	80.0508			
0.9820					
81.8896	27.0444	78.6571	47.8616	64.5216	22.2076
65.6973	59.6515	77.4975			
0.9920					
81.8342	27.6511	79.1341	47.5418	64.6543	22.4659
65.9940	28.8357	77.2812			
1.0020					
81.7682	28.2556	79.6005	45.0818	64.6432	22.6961
66.1981	41.3623	75.5975			
1.0120					
81.6719	28.8540	80.0430	43.9595	64.7761	22.9520
66.5017	32.2892	74.8819			
1.0220					
81.5725	29.4516	80.4799	43.1444	64.6837	23.1596
66.6464	26.8482	74.3678			
1.0320					
81.4514	30.0442	80.8972	40.8519	64.6953	23.3891
66.8719	35.2138	72.9859			
1.0420					
81.3207	30.6344	81.3037	40.5128	64.6252	23.598[illegible]
67.0366	26.5506	72.7900			
1.0520					
81.1820	31.2224	81.7003	38.4010	64.4972	23.7918
67.1589	29.7253	71.5679			
1.0620					
81.0263	31.8055	82.0790	37.6785	64.4413	24.0057
67.3454	26.2595	71.1662			
1.0720					
80.9686	32.3880	82.4525	36.6280	64.2603	24.1810
67.4263	26.2497	70.5661			
1.0820					
80.6945	32.9544	82.8069	34.8394	64.1737	24.3893
67.5982	29.1832	69.5694			
1.0920					
80.5155	33.5390	83.1532	34.4164	64.0325	24.5793
67.7233	26.5997	69.3343			
1.1020					
80.3263	34.1091	83.4858	32.0159	63.9169	24.7836
67.8904	33.0019	67.9660			

1.1120					
80.1250	34.6729	83.8012	31.3418	63.6489	25.0155
68.0955	30.1350	67.5948			
1.1220					
79.9183	35.2336	84.1073	29.4276	63.7572	25.2444
68.2958	36.9148	66.4780			
1.1320					
79.6939	35.7836	84.3895	27.4855	63.7424	25.5290
68.5955	41.9156	65.3724			
1.1420					
79.4514	36.3282	84.6590	26.1299	63.7061	25.8137
68.8833	42.2929	64.5952			
1.1520					
79.2137	36.8613	84.9064	23.5372	63.7069	26.1405
69.2304	51.3553	63.1113			
1.1620					
78.9532	37.3840	85.1346	22.1903	63.7041	26.4826
69.5876	47.7003	62.3745			
1.1720					
78.6819	37.8971	85.3457	19.9740	63.6874	26.8326
69.9413	52.5826	61.1485			
1.1820					
78.3970	38.3976	85.5367	18.4239	63.6700	27.2020
70.3070	49.8055	60.3378			
1.1920					
78.1035	38.8396	85.7136	16.8519	63.6153	27.5555
70.6367	49.1201	59.5321			
1.2020					
77.7989	39.3699	85.8731	15.2669	63.5521	27.9198
70.9647	48.2362	58.7555			
1.2140					
77.4235	39.9357	86.0481	13.8112	63.4315	28.3326
71.3111	45.2428	58.0893			
1.2220					
77.1664	40.3053	86.1538	12.6664	63.3388	28.6068
71.5300	45.1944	57.5777			
1.2320					
76.8387	40.7600	86.2751	11.6797	63.2015	28.9379
71.7794	42.1600	57.1779			
1.2420					
76.5047	41.2074	86.3857	10.4625	63.0426	29.2551
72.0023	41.9304	56.6872			
1.2520					
76.1639	41.6467	86.4850	9.4970	62.8727	29.5683
72.2101	40.2009	56.3351			
1.2620					
75.8181	42.0799	86.5752	8.5094	62.6838	29.8649
72.3917	39.3746	55.9895			
1.2720					
75.4603	42.5058	86.6551	7.5370	62.4896	30.1591

72.5618	38.6508	55.6702			
1.2820					
75.1099	42.9256	86.7263	6.7282	62.2820	30.4391
72.7108	37.4343	55.4313			
1.2940					
74.6753	43.4210	86.8000	5.6415	62.0280	30.7683
72.8739	36.8320	55.1228			
1.3020					
74.3821	43.7468	86.8427	5.0596	61.8537	30.9804
72.9711	35.9570	54.9796			
1.3120					
74.0120	44.1493	86.8992	4.2466	61.6314	31.2369
73.0802	35.4627	54.7846			
1.3220					
73.6374	44.5460	86.9276	3.5278	61.4091	31.4893
73.1809	34.6519	54.6330			
1.3320					
73.2596	44.9383	86.9593	2.8298	61.1821	31.7303
73.2681	33.9375	54.4995			
1.3420					
72.8780	45.3256	86.9839	2.1332	60.9567	31.9671
73.3484	33.3326	54.3792			
1.3520					
72.4932	45.7087	87.0019	1.5202	60.7288	32.1947
73.4181	32.5547	54.2877			
1.3640					
72.0276	46.1631	87.0154	0.7522	60.4566	32.4584
73.4923	31.8575	54.1844			
1.3760					
71.5582	46.6123	87.0203	0.0680	60.1840	32.7114
73.5554	31.0516	54.1075			
1.3840					
71.2434	46.9089	87.0190	-0.3889	60.0030	32.8746
73.5923	30.5813	54.0617			
1.3920					
70.9272	47.2039	87.0143	-0.7726	59.8201	33.0306
73.6232	29.9939	54.0233			
1.4020					
70.5296	47.5690	87.0032	-1.3443	59.5979	33.2258
73.6617	29.5385	53.9762			
1.4120					
70.1305	47.9317	86.9872	-1.8275	59.3706	33.4078
73.6900	28.9566	53.9444			
1.4220					
69.7293	48.2915	86.9660	-2.3567	59.1482	33.5873
73.7165	28.4194	53.9135			
1.4320					
69.3269	48.6491	86.9402	-2.7587	58.9242	33.7578
73.7367	27.9585	53.8943			

1.4420					
68.9231	49.0046	86.9099	-3.2596	58.7021	33.9231
73.7537	27.5281	53.8763			
1.4520					
68.5180	49.3581	86.8750	-3.6542	58.4814	34.0840
73.7679	27.1943	53.8667			
1.4620					
68.1122	49.7100	86.8361	-4.1307	58.2587	34.2375
73.7771	26.9368	53.8611			
1.4720					
67.7046	50.0594	86.7924	-4.5620	58.0385	34.3904
73.7862	26.7308	53.8624			
1.4820					
67.2962	50.4073	86.7446	-4.9887	57.8137	34.5344
73.7888	26.6392	53.8694			
1.4920					
66.8861	50.7527	86.6920	-5.4911	57.5912	34.6791
73.7924	26.4746	53.8833			
1.5020					
66.4749	51.0963	86.6350	-5.8759	57.3655	34.8176
73.7916	26.4727	53.9021			
1.5140					
65.9794	51.5056	86.5605	-6.5196	57.0952	34.9821
73.7899	26.2714	53.9343			
1.5219					
65.6479	51.7768	86.5070	-6.8250	56.9154	35.0908
73.7884	26.2798	53.9585			
1.5319					
65.2326	52.1141	86.4361	-7.3561	56.6877	35.2212
73.7826	26.1493	53.9945			
1.5439					
64.7316	52.5150	86.3439	-7.8961	56.4214	35.3852
73.7825	26.0247	54.0430			
1.5519					
64.3971	52.7812	86.2792	-8.2857	56.2410	35.4889
73.7785	25.9568	54.0776			
1.5619					
63.9769	53.1109	86.1931	-8.9734	56.0224	35.6277
73.7313	25.8567	54.1262			
1.5734					
63.4711	53.5041	86.0836	-9.3914	55.7601	35.7916
73.7936	25.7009	54.1848			
1.5819					
63.1328	53.7540	86.0063	-9.9042	55.5883	35.9052
73.7891	25.8540	54.2269			
1.5919					
62.7080	54.0857	85.9043	-10.4284	55.3746	36.0525
73.7997	26.0323	54.2811			
1.6019					
62.2817	54.4046	85.7968	-11.0481	55.1583	36.1991

73.8095	26.3240	54.3360			
1.6119 61.8534 73.8249	54.7194 26.6961	85.6830 54.3435	-11.6787	54.4432	36.3539
1.6219 61.3372 73.8424	55.0123 26.8006	85.5383 54.4628	-12.4443	54.6803	36.5395
1.6319 60.9914 73.8585	55.3374 25.0544	85.4365 54.5103	-12.9409	54.5145	36.6671
1.6419 60.5581 73.8757	55.6413 24.2040	85.3044 54.5700	-13.4596	54.3186	36.8194
1.6519 60.1236 73.8902	55.9416 23.6103	85.1664 54.6226	-14.1265	54.1371	36.9733
1.6619 59.6004 73.9221	56.2470 22.4578	84.9926 54.6889	-14.7784	53.9330	37.1579
1.6719 59.2504 73.9389	56.5313 22.2884	84.8724 54.7246	-15.2949	53.8033	37.2801
1.6819 58.9127 73.9628	56.8200 21.8171	84.7161 54.7704	-15.8878	53.6488	37.4369
1.6919 58.3740 73.9911	57.1356 21.3536	84.5542 54.8132	-16.4527	53.4988	37.5897
1.7019 57.8462 74.0096	57.4428 21.1489	84.3521 54.8545	-17.1718	53.3266	37.7779
1.7119 57.4941 74.0247	57.6049 20.7375	84.2130 54.8845	-17.6017	53.2147	37.9012
1.7219 57.0934 74.0432	57.9389 20.8940	84.0337 54.9065	-18.2098	53.0780	38.0567
1.7319 56.6122 74.0605	58.2089 20.3519	83.8487 54.9367	-18.7386	52.9446	38.2131
1.7419 56.1707 74.0751	58.4751 20.4551	83.6582 54.9552	-19.3179	52.8135	38.3679
1.7519 55.7291 74.0896	58.7370 20.2446	83.4622 54.9767	-19.8634	52.6851	38.5260
1.7619 55.2871 74.1011	58.9951 20.2458	83.2607 54.9914	-20.4171	52.5583	38.6826

1.7719 54.8453 74.1125	59.2484 20.3918	83.0535 54.9995	-20.9829	52.4336	38.8432
1.7919 54.4033 74.1216	59.4975 20.3137	82.8408 55.0128	-21.5203	52.3100	39.0039
1.7939 53.8731 74.1319	59.7903 20.7059	82.5783 55.0112	-22.2028	52.1635	39.2017
1.8019 53.5199 74.1376	59.9817 20.1903	82.3990 55.0302	-22.6028	52.0666	39.3356
1.8179 52.8135 74.1483	60.3542 20.7410	82.0293 55.0022	-23.5240	51.8737	39.6128
1.8219 52.6371 74.1463	60.4461 21.2990	81.9351 54.9923	-23.7613	51.8259	39.6747
1.8319 52.1961 74.1511	60.6688 21.5337	81.6940 54.9472	-24.3688	51.7056	39.8552
1.8419 51.7556 74.1503	60.8965 21.0554	81.4477 54.9570	-24.8693	51.5857	40.0292
1.8519 51.3157 74.1481	61.0987 22.0349	81.1959 54.9132	-25.4428	51.4657	40.2080
1.8619 50.8766 74.1446	61.3051 21.6315	80.9386 54.9131	-25.9364	51.3452	40.3912
1.8739 50.3507 74.1359	61.5463 22.2324	80.6236 54.8701	-26.5679	51.2008	40.6090
1.8819 50.0009 74.1281	61.7022 22.2183	80.4093 54.8493	-26.9671	51.1039	40.7587
1.8919 49.5644 74.1144	61.8928 21.8918	80.1372 54.8360	-27.4351	50.9833	40.9414
1.9019 49.1290 74.0983	62.0775 22.3736	79.6602 54.7876	-27.9329	50.6618	41.1264
1.9119 48.6946 74.0782	62.2370 21.8344	79.5764 54.7763	-28.3757	50.7404	41.3100
1.9239 48.1751 74.0488	62.4656 22.1236	79.2345 54.7270	-28.9278	50.5951	41.5277
1.9319 47.4298	62.6002	79.0016	-29.2705	50.4979	41.6731

74.0265	21.8213	54.7119			
1.9419					
47.3992	62.7643	78.7067	-29.6933	50.3773	41.8500
73.9942	21.6562	54.6884			
1.9519					
46.9700	62.9228	78.4074	-30.1179	50.2562	42.0274
73.9583	21.7531	54.6491			
1.9619					
46.5422	63.0765	78.1040	-30.5164	50.1358	42.2013
73.9183	21.3711	54.6365			
1.9739					
46.0309	63.2545	77.7348	-31.0015	49.9916	42.4079
73.8657	21.5516	54.5908			
1.9819					
45.6911	63.3690	77.4854	-31.3095	49.8955	42.5447
73.8267	21.3023	54.5783			
1.9919					
45.2679	63.5079	77.1704	-31.6937	49.7760	42.7177
73.7750	21.3121	54.5492			
2.0039					
44.7672	63.6677	76.7872	-32.1467	49.6322	42.9145
73.7081	21.3231	54.5105			
2.0119					
44.4263	63.7704	76.5287	-32.4402	49.5370	43.0466
73.6604	21.2369	54.4916			
2.0219					
44.0080	63.8941	76.2023	-32.8059	49.4174	43.2119
73.5973	21.4388	54.4474			
2.0319					
43.5916	64.0128	75.8722	-33.1601	49.2979	43.3763
73.5305	21.3420	54.4176			
2.0419					
43.1772	64.1266	75.5388	-33.5089	49.1787	43.5393
73.4602	21.4825	54.3733			
2.0579					
42.5184	64.2982	74.9982	-34.0486	48.9877	43.7997
73.3400	21.4423	54.3096			
2.0659					
42.1910	64.3793	74.7247	-34.3110	48.8924	43.9287
73.2767	21.5947	54.2652			
2.0739					
41.8651	64.4569	74.4492	-34.5669	48.7967	44.0583
73.2101	21.4354	54.2352			
2.0819					
41.5405	64.5314	74.1715	-34.8179	48.7011	44.1868
73.1416	21.4072	54.1864			
2.0919					
41.1366	64.6199	73.8217	-35.1221	48.5828	44.3439
73.0525	21.8500	54.1093			

2.1919					
37.7267	65.2482	70.1695	-37.7913	47.4539	45.7797
71.9700	20.1408	53.7385			
2.2919					
33.5279	65.5206	60.2702	-40.1005	46.5788	46.7320
70.5361	17.9761	53.9309			
2.3939					
30.0154	65.4209	62.1063	-41.1446	45.6133	47.7960
68.9013	28.8042	52.3592			
2.4919					
27.2991	64.5460	58.0796	-41.0321	44.2207	49.4790
66.6304	33.0337	49.4909			
2.5939					
25.2404	62.8187	53.9072	-40.7323	42.9859	51.0583
63.9969	30.5747	47.8061			
2.6919					
24.0796	60.7167	49.9164	-40.8174	42.4236	52.1552
61.5816	25.8593	47.5094			
2.7919					
23.4970	58.3751	45.8502	-40.2587	42.0349	53.0712
59.1924	25.4865	46.9732			
2.8919					
23.4452	55.9517	41.8645	-39.2411	41.7689	53.8701
56.8502	24.9312	46.2349			
2.9918					
23.9750	53.5307	38.0713	-36.3372	41.4717	54.5972
54.2991	27.5834	44.2883			
3.0918					
25.0203	51.1610	34.5688	-33.7184	41.3386	55.3085
51.7489	26.2254	42.9839			
3.1918					
26.5896	48.8819	31.3757	-29.9522	41.1628	55.9530
49.0140	29.3448	41.6645			
3.2918					
28.7321	46.7353	28.5143	-27.5352	41.0444	56.5597
46.2984	26.5188	41.4219			
3.3918					
31.3220	44.9767	25.6586	-25.6012	40.9170	57.0307
43.6375	26.2326	41.1693			
3.4918					
34.2335	43.5448	23.3519	-24.6210	40.6041	57.4339
41.2217	24.0706	40.8830			
3.5918					
37.3197	42.5292	20.9515	-23.2940	40.6771	57.6644
38.7745	25.0000	39.8634			
3.6918					
40.4637	41.9708	18.6778	-22.1483	40.5511	57.8372
36.3398	24.2534	38.5279			
3.7918					
43.5387	41.8774	16.5611	-20.0333	40.4017	57.8880

33.7951	26.1527	36.1566			
3.8918					
46.4526	42.2368	14.6397	-18.5533	40.3282	58.0397
31.3090	23.8820	34.2741			
3.9918					
49.1716	42.9067	12.8707	-16.6197	40.1864	58.2319
28.8577	25.7097	32.2873			
4.0918					
51.6910	44.0974	11.2983	-15.1170	40.0633	58.3937
26.3443	24.1572	31.0160			
4.1918					
53.8857	45.5906	9.8176	-14.4009	39.9653	58.5314
23.9446	24.5347	30.4996			
4.2917					
55.8085	47.4370	8.3909	-14.4887	39.9422	58.5037
21.5401	22.7660	30.5461			
4.3917					
57.4286	49.5913	6.8870	-15.6356	39.9951	58.5016
19.3786	20.9910	31.0450			
4.4917					
58.7303	51.9163	5.2556	-17.0755	40.1264	58.4201
17.3152	20.0698	31.6149			
4.5917					
59.7279	54.3568	3.4582	-18.8668	40.2449	58.3479
15.3322	19.0695	32.3151			
4.6917					
60.4051	56.8557	1.4899	-20.4826	40.5006	58.2596
13.4602	19.6245	32.8422			
4.7917					
60.7482	59.3381	-0.6404	-22.0885	40.7698	58.1788
11.5414	19.4125	33.3371			
4.8917					
60.7373	61.8010	-2.9059	-23.1070	41.1518	58.1380
9.5403	21.3404	33.3466			
4.9917					
60.3404	64.1215	-5.2572	-23.9284	41.5220	58.1011
7.4610	20.7512	33.3585			
5.0017					
60.2820	64.3455	-5.4968	-24.0012	41.5486	58.0944
7.2553	20.7531	33.3613			

```
1  2  1  3  1  4  1  5  1  6  1  7  1  8  1  9  1  10
0  0  C  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0
STCP
```

TOTAL COMPUTING TIME FOR THIS PROGRAM WAS 7.7149E 00 MINUTES.

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SECTION VII
SUGGESTIONS FOR REDUCING CORE REQUIREMENTS AND COMPUTING TIME

Because the escape system routine may be run on computers lacking the capacity of the IBM S/360 Triplex system it may be necessary to modify the program for reduced core utilization. Unfortunately, most modifications that result in the reduction of core usage will usually cause the program to run longer. The capacity of the user's computer and the core/computing time cost ratio will determine the desirability of such program changes. The existing program is written to emphasize computing speed primarily through the use of scratch core.

Two of the easiest methods to reduce core requirements are:

- Use of a scratch tape or disk for time history storage
- Use of overlay links to force sharing of core among those computing segments which perform independent functions.

The logic for storing the time histories on an external scratch device has been built into the program, then eliminated by punching a C in column 1 of the main program source deck. (Refer to the source listing, Section VIII.) Between comment cards having two asterisks are the statements peculiar to the System 360. Between comment cards containing four asterisks are statements to be used on computers similar to the IBM 7090 or 7094. By using the 7090/7094 statements, scratch storage is mechanized with the saving of 7,000 words (28,000 bytes) of core. Computing speed is highly compromised.

In overlaying to save core, caution must be exercised to ensure that links are not exchanged during a time history. The following overlay tree, Figure 64, demonstrates how to avoid this computing catastrophe by proper assignment of five independent computing segments to the same link. The time history, plotting, curve-fitting and two trim options are not related except for use of some of the time history subroutines in the trim computations. By inserting the commonly used subroutines in the main link, successful core reduction by overlaying is achieved. Computing time will not be appreciably increased for most runs because the least squares option is infrequently used, the plot option can be rolled in only after completion of several time histories and the trimmed initial conditions can all be computed at one time and transferred when needed by the RESTØRE option. Figure 65 is a listing of the S/360 deck set-up required to overlay the program, compile and link edit with object decks and a load module stored on a disk with the data set name CT130.SCITEST.

By eliminating the variable subscript, the EQUIVALENCE statement may be used to relate subroutine dummy variables to R-array addresses which do not vary with each call to the subroutine. Unlike simpler computer programs, however, most of the calling argument addresses in the escape system program are different for each call to the subroutine. The subroutine called MØMENT, for example, is used to compute moments from such disparate sources as sustainer rockets, catapults, parachute lines, control rockets, etc., all with different input addresses for forces and moment arms and different output addresses for moments from each source.

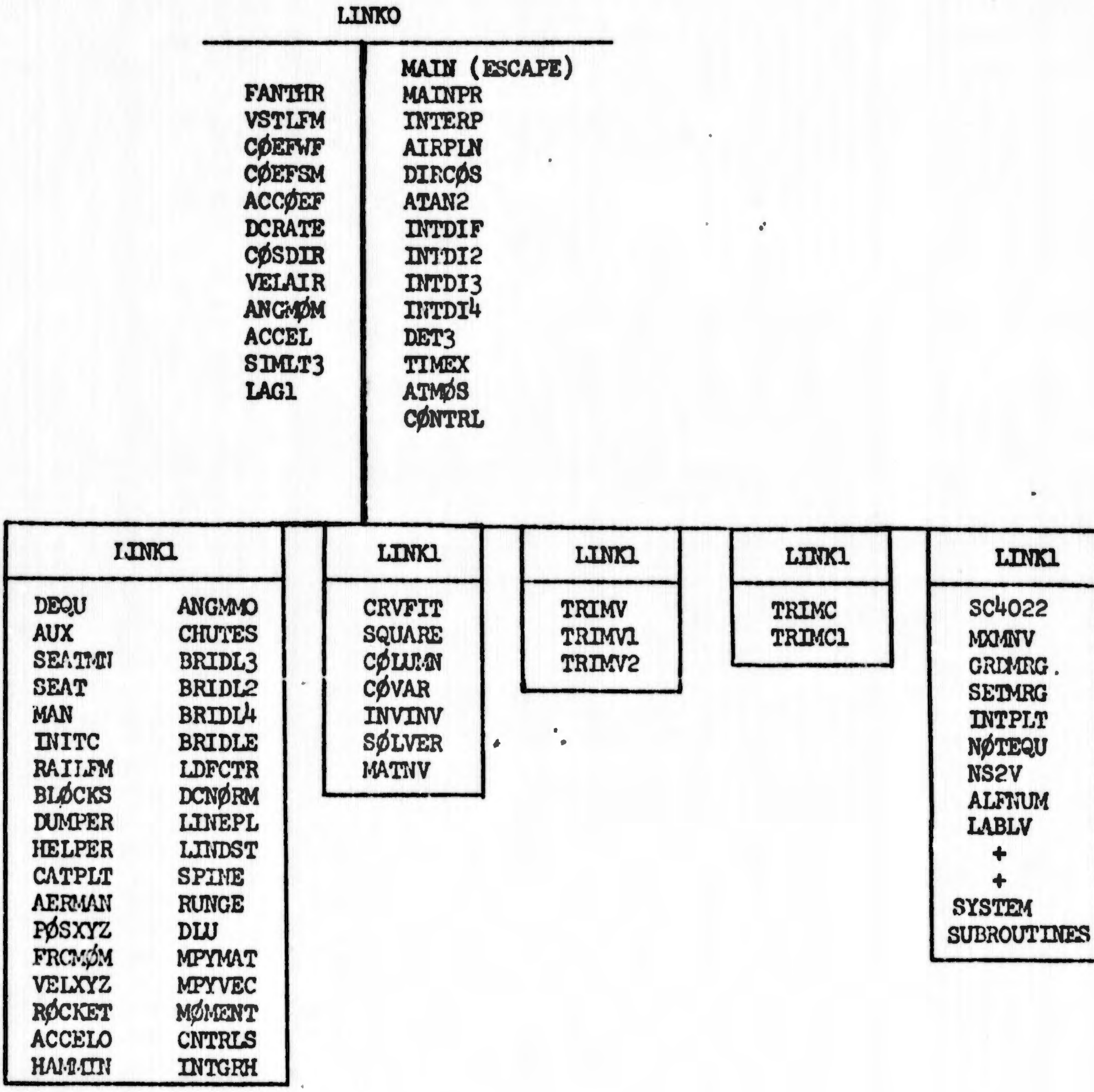

FIGURE 64 ESCAPE SYSTEM PROGRAM OVERLAY TREE

```
//ESC119C3 JOB (S03,253310,ESCAPE,0020,2693AA--1250),                X
//             'CLINKENBEARD',MSGLEVEL=1,CLASS=C,REGION=220K
/*SETUP DCNAME=FETCH,DEVICE=FETCH,ID=PAPER
/*SETUP DDNAME=FT10F001,UNIT=TAPE7,ID=(006827,,,NL)
/*FORMAT PR,DDNAME=FT06F001,FORMS=1410,DEST=VADEPR1
/*DATASET DDNAME=TMSDISPO
FT10F001 SCIK.LS071301      PLOT   PLT01
/*ENDDATASET
//STEP1     EXEC FORTGCLG,PARM.FORT='BCD,ID,NAME=ESCAPE,DECK',            X
//               PARM.LKED=(LIST,XREF,OVLY)
//FORT.SYSIN DD *
********FORTRAN SOURCE DECKS***********
/*
//LKED.DD1 DD DSN=CTI30.SCITEST,DISP=(SHR,PASS)
//LKED.SYSIN DD *
********OBJECT DECKS********
      INCLUDE DD1(ESCAPE)
      ENTRY ESCAPE
      OVERLAY LINK1
      INSERT DEQU,AUX,SEATMN,SEAT,MAN,INITC,RAILFM,BLOCKS,DUMPER
      INSERT HELPER,CATPLT,AERMAN,POSXYZ,FRCHOM,VELXYZ,ROCKET,ACCELO
      INSERT ANGMMO,CHUTES,BRIDL3,BRIDL2,BRIDL4,BRIDLE,LDFCTR,DCNORM
      INSERT LINEPL,LINDST,SPINE,RUNGE,DLU,MPYMAT,MPYVEC,MOMENT
      INSERT CNTRLS,CAD,INTGRH,HAMMIN
      OVERLAY LINK1
      INSERT CRVFIT,SQUARE,COLUMN,COVAR,INVINV,SOLVER,MATNV
      OVERLAY LINK1
      INSERT TRIMV,TRIMV1,TRIMV2
      OVERLAY LINK1
      INSERT TRIMC,TRIMC1
      OVERLAY LINK1
      INSERT SC4022,MXMNV,GRDMRG,SETMRG,INTPLT,NOTEQU,NS2V,ALFNUM
        INSERT CHSIZV#,FRAMEV#,RITE2V#,RITSTV,FLAGSV#,TABL1V
        INSERT DXDYV#,GRID1V#,LINEV#,NXYV#,SETMIV#,TABL2V#
        INSERT VCHAR,CTL4V#,INTBCD#,ANDV#,BRITEV#,SHFT1V,SHFT2V
        INSERT TABL3V,VCHARV#,CNTIBH#,HOLDIV#,LINRV#,SETCIV#
        INSERT NONLNV#,SERSAV#,XSCALV#,ERRLNV#,ERRNLV#
        INSERT LINE2V#,VECTRV#,XMODV#,BNBCDV#,ERRRKV#,XAXISV#
        INSERT LABLV#,HOLLV#,HOLL
/*
//GO.FT10F001 DD DSNAME=SCIK.LS071301,UNIT=(TAPE7,,DEFER),               X
//               LABEL=(,NL,RETPD=0007),                                  X
//               DCB=(DEN=1,TRTCH=C,RECFM=U,BLKSIZE=400),                 X
//               DISP=(NEW,KEEP)
//GO.SYSIN DD *
********DATA********
/*
```

FIGURE 65

S/360 Job Control Setup

Some of the DIMENSION specifications may be unnecessarily large for some applications and could be reduced, although for this escape system study every bit of specified core was used. The user should investigate this possibility in light of his own computing requirements and may elect, for example, to re-read plot titles and labels for each grid rather than reading all at once.

Precise control of the size of the R-array is implemented by making a subroutine of the main program and writing a small control program which calls the former main program. The small control program is designed to be compiled each time a run is made with a changed DIMENSIØN and, because of its simplicity, is inexpensive to compile. Assuming the real main program to be converted to a subroutine called MAINPR with no changes other than replacing STØP with RETURN the small control program will consist of the following listing:

```
C      T4SA00
C  THIS SMALL PROGRAM IS INTENDED TO BE COMPILED EVERY TIME THE
C  PROGRAM IS RUN WITH A CHANGED DIMENSION TO USE THE SMALLEST DIMENSION
C  POSSIBLE ON THE R-ARRAY.
C  FOR NHIST TIME HISTORIES WITH NPT TIME POINTS, EACH HAVING NOUT
C  VARIABLES, ALL STORED IN CORE AT THE SAME TIME, THE MINIMUM
C  DIMENSION ON THE R-ARRAY IS -
C     NDIM = NR30 + NHIST*NPT*NOUT.
      DIMENSION R(9000)
     1 ,ZERO(2194)
      EQUIVALENCE (R(1),ZERO(1))
      DATA ZERO/2194*0./
      CALL MAINPR(R,9000)
      STOP
      END
```

The comment cards explain the control program usage. For example, assuming three time histories with 31 output variables and 16 time points all stored in core for multiple plotting and with NR30 = 2194 for the basic program:

NDIM = 2194 + (3) (31) (16) = 3682.

Two statements in the control program will be rewritten, in the following example, to use only the core needed for this run, saving 9000 - 3682 = 5318 words of 21,272 bytes of core storage.

```
      DIMENSION R(3682)
      CALL MAINPR(R,3682)
```

Because of the use of calling arguments the new dimension for the R-array will be carried through to all subroutines without the necessity of recompiling any of the subprograms. This case of DIMENSIØN conversion would not exist, of course, if the R-array were placed in CØMMØN.

Almost all sections of the program appearing in the time history computational flow were optimized for computing speed before contract expiration, except for subroutine VSTLFM. VSTLFM should be modified to eliminate excessive multiplications and trigonometric computations. Repeated trigonometric terms, such as SIN (EPSLØN) should be computed once only and recurring expressions, such as .5*AF*QR, should be factored out and stored in a temporary location by an initial computation.

Also, in VSTLFM, aeroelastic effects should be incorporated through use of subroutine ELASAT (Ref. 6) which is provided for this purpose. At present, aeroelasticity effects are simulated by modifying the basic aerodynamic coefficients by hand. Incorporating subroutine ELASAT for automatic elastic computations should require about 40 man-hours of programming.

Calling argument table space may be reduced by placing the R-array in common and entering the subroutine with the required R-subscripts instead of R-array elements. When many subscripts are consecutive, only the initial and final subscripts need be entered. Within the subroutine the computations are stored in the required locations by use of a DO loop within which the necessary subscript computations are performed. The result is a saving of core with an increase in computing time because of the need to re-store so many variables. The approach is verging on programming stupidity and should be used only in those computer facilities which charge an exorbitant price for core usage compared to computer time or for computers with limited capacity. (Table space within the subroutine is not used by most computers when the argument address is transmitted through the argument list. For the S/360 the argument value instead of the address is passed for non-array arguments unless the argument is enclosed in a slash. Without the slash enclosure, additional table space is reserved and computing time is lost by the storing and restoring of the value upon entering and exiting from the subroutine).

The use of variable subscripts for the R-array during the programming phase was an effective technique for maintaining an organized effort but has two disadvantages in a production program:

- EQUIVALENCE statements may not be used to express the equivalency between dummy variables and elements of the R-array, assuming the R-array to be changed to a COMMON area.

- Each reference to a variable requires computation of the variable subscript expression.

For example, passing seat airspeed, V_a, through a calling argument list to one of the basic subroutines may be done in two ways - as R(NR4 + 12) or, for 45 differential equiations, as R(192) because NR4 = 4N = (4) (45) = 180. The second expression, R(192) does not require the computation of NR4 + 12; however, an alternate version of the program may use an additional differential equation for the web burn rate instead of thrust tables for each rocket and the number of rockets will vary for each control concept. For any change of the number of differential equations new subscript constants must be computed, a new source deck punched and the program recompiled. Making the changes by re-coding and keypunching would be a formidable task, leading to many mistakes, and is not recommended. A better way is to write a small program which reads in the source deck on an 80A1 format, searches each card for an "R" and converts all expressions enclosed within following parentheses to a known integer constant. After the text of each card is converted it is punched, in BCD or EBCDIC, as a new source deck. A similar program required only two hours programming effort by the author and was used to insert slashes in the subroutine calling arguments during conversion to the S/360 from an IBM 7090.

TABLE IV

PROGRAM SOURCE LISTING

(Pages 196 - 282)

```
C        T4SA00
C   THIS SMALL PROGRAM IS INTENDED TO BE COMPILED EVERY TIME THE
C   PROGRAM IS RUN WITH A CHANGED DIMENSION TO USE THE SMALLEST DIMENSION
C   POSSIBLE ON THE R-ARRAY.
C   FOR NHIST TIME HISTORIES WITH NPT TIME POINTS. EACH HAVING NOUT
C   VARIABLES. ALL STORED IN CORE AT THE SAME TIME. THE MINIMUM
C   DIMENSION ON THE R-ARRAY IS -
C       NDIM = NR30 + NHIST*NPT*NOUT.
        DIMENSION R(9000)
       1 .ZERO(2194)
        EQUIVALENCE (R(1),ZERO(1))
        DATA ZERO/2194*0./
        CALL MAINPR(R,9000)
        STOP
        END

      SUBROUTINE MAINPR(R,NDIM)
C        T4SA01
C   IVAN CLINKENBEARD. ENGINEERING SPECIALIST
C   ELEANOR ROCH. AERODYNAMICS ENGINEER
C   JIM LACY. AERODYNAMICS ENGINEER
C   EDDIE SMART. AERODYNAMICS ENGINEER
C     DIMENSION R(2194)
      DIMENSION R(1),
     X           NR(30),IO(38),OUT(38),SCALE(38),NALPHA(12)
     1     , A(4),DADX(4),DA2DX2(4)
     2 ,XPLOT(500),YPLOT(500),XLABEL(5),YLABEL(5),TITLE(16),BLANK(20)
     3 ,OPTION(20), LABEL(5,38),ITPLOT(38),TITLET(16,38)
     4,ALS(5,5),SLS(5,5),ULS(5,5),BLS(5),CLS(5),ICOL(5)
     5 ,PAR(2), TEXT(5), NPTCRV( 6), NOUOUT( 6), NPTT( 6)
     6 ,LAB(24,6), KSYM(6), LAB1(24,6)
      INTEGER OPTION,BLANK
      REAL LABEL
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      EQUIVALENCE (NR(1),NR1) , (TITLE(1),TITLET(1,1))
      DATA BLANK/4H    /, IBLANK/4H    /,
     1 KSYM/6*48/, LAB/144*48/  , LAB1/144*48/
      EXTERNAL TABLIV
 2037 FORMAT(9(I3,I5))
C2039 FORMAT(6A2)
 2040 FORMAT(1H1/34X,12HTIME HISTORY//)
 2041 FORMAT(1H1/29X,24HOUTPUT FROM THE R-MATRIX//)
 2042 FORMAT(1H1/30X,21HINPUT TO THE R-MATRIX//)
 2043 FORMAT(15X,48HTIME HISTORY OUTPUT SUBSCRIPTS AND SCALE FACTORS//)
 2044 FORMAT(10X,I2,I6,I6,F15.6,2X12A4)
 2045 FORMAT(I2,I4,E12.5,12A4)
 2046 FORMAT(18I4)
 2047 FORMAT( /10XF12.4/(10X6F12.4))
 2048 FORMAT(10X6F14.6)
C2049 FORMAT( I2,2E10.2,3A1)
 2050 FORMAT(1P7E10.3,2I5)
 2051 FORMAT(20A4)
 2052 FORMAT(10X20A4)
 2053 FORMAT(1P7E10.3)
 2055 FORMAT(40I2)
 2056 FORMAT(20A4)
 2057 FORMAT(10X20A4)
 2058 FORMAT(4I4,12A4)
 2059 FORMAT(6X4I6,12A4)
```

```
2060 FORMAT( 6XI6,F14.6,I6,F14.6,I6,F14.6,I6,F14.0)
2061 FCRMAT(1H1//26X24HOUTPUT FROM THE R-MATRIX//11X1HI6X4HR(I)7X1HI6X
    14HR(I)7X1HI6X4HR(I)7X1HI6X4HR(I)//)
2062 FCRMAT(6X15HSTORING FROM R(,I4, 7H) TO R(,I4,1H) )
2063 FCRMAT(6X18I4)
2071 FCRMAT(8A4)
2072 FCRMAT(/10X,8A4/10X,8A4)
C3051  FORMAT(12A6)
C3052  FORMAT(10X12A6)
32001 FCRMAT(1H1//28X15HNR-MATRIX INPUT//72H I NR(I) I NR(I) I NR(I) I N
    1R(I) I NR(I) I NR(I) I NR(I) I NR(I) I NR(I)//)
32002 FCRMAT(1H1/)                                                    00320
32003 FORMAT(7E10.0)
32005 FCRMAT(1H0/79HSTORAGE OF TIME HISTORIES EXCEEDS THE ADJUSTABLE DIM
    1ENSICN SPECIFIED BY NDIM = , I4//)
32006 FORMAT(1H1/10X34HLEAST SQUARES POLYNOMIAL CURVE FIT//)
32007 FORMAT(//10X46HINDEPENDENT VARIABLE OF THE CURVE TO BE FITTED//)
32008 FCRMAT(//1CX44HDEPENDENT VARIABLE OF THE CURVE TO BE FITTED//)
32009 FCRMAT(//10X67HPCLYNOMIAL CURVE FIT COEFFICIENTS, BEGINNING WITH T
    1HE CONSTANT TERM//)
32010 FCRMAT(7F10.4)
32011  FORMAT(//2X,27HMORE THAN 5 ERRORS DETECTED)
32012 FORMAT(A4,2X,12I2)
32013 FCRMAT(10X,A4,I4,2X,12I2)
32014 FCRMAT(A4,2X,12A4)
32015 FORMAT(6X,A4,2X,12A4)
C**    IBM S/360
      CALL ERRSET(207,256,0,0,1)
      CALL ERRSET(208,0,-1,1,1)
      CALL ERRSET(209,256,0,0,1)
C**    IBM S/360
      CALL TIMEX(3,DUM,DUM,TIMES,TIMEF)                               00340
      READ(5,2051) BLAME                                              00350
C****  IBM 7090,7094
C     READ(5,3051)(BLAME(I),I=1,12)
C****  IBM 7090,7094
      WRITE(6,32002)                                                  00360
      WRITE(6,2052) BLAME                                             00370
C****  IBM 7090,7094
C     WRITE(6,3052)(BLAME(I),I=1,12)
C     NTAPEP = 1
C****  IBM 7090,7094
      NHIST = 0                                                       00440
      NPLCT = 0                                                       00450
      IFPLOT = -1                                                     00460
      NDIMCF = 5
      NPT=0
C**    IBM S/360
C**    IBM S/360
C****  IBM 7090,7094
C     NDIM = 2194
C****  IBM 7090,7094
   98 READ(5,2056) (OPTION(I),I=1,20)
      WRITE(6,2057) (OPTION(I),I=1,20)
      IOP = -1
  100 IOP = IOP + 2
      IF(IOP-20) 99,99,98
   99 NOPT = INTERP(OPTION(IOP),OPTION(IOP+1))
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,98), NOPT
C                                                                     00530
C                                                                     00540
```

```
C  READ N
C  READ AND PRINT INPUT TO THE NR-MATRIX
C  THE FIRST INTEGER READ IN IS N. NR2, NR3, AND NR4
C  ARE THEN COMPUTED. NR5 IS THEN READ. THE NUMBER OF NR-SUBSCRIPT
C  ADDENDS IS READ NEXT, FOLLOWED BY THE ADDENDS. THE NR-SUBSCRIPTS ARE
C  AUTOMATICALLY CALCULATED,IN TERMS OF THE ADDENDS AND THE PREVIOUSLY
C  COMPUTED NR-SUBSCRIPTS.
    1 WRITE(6,32001)
      READ(5,2046)  N,NR5,NTEMP
      NR1 = N
      NR2 = 2 * N
      NR3 = 3 * N
      NR4 = 4 * N
      IF(NTEMP.LE.0)GO TO 100
      READ(5,2046)  (ITPLOT(I),I=5,NTEMP)
      DO 120 I=5,NTEMP
  120 NR(I+1) = NR(I) + ITPLOT(I) + 1
      NTEMP = NTEMP +1
      NR29 = NR28 + N
      IERROR = NR29 + N
      IY0 = IERROR + N
      IY1 = IY0 + N
      IY2 = IY1 + N
      IY3 = IY2 + N
      IYD1 = IY3 + N
      IYD2 = IYD1 + N
      NR30 = IYD2 + N
      WRITE(6,2037) (I,NR(I),I=1,NTEMP)
      GO TO 100
C
C
C  READ R
    2 WRITE(6,2042)
  135 READ(5,2045)IT,JT,RIO,NALPHA
      IF(IT)100,140,150
  140 IT1=JT
      GO TO 160
  150 IT1=NR(IT)+JT
  160 R(IT1)=RIO
      WRITE(6,2044)IT,JT,IT1,RIO,NALPHA
      GO TO 135
C
C
C  READ R C
C  READ AND PRINT CONSECUTIVE INPUT TO THE R-MATRIX,STARTING AT R(NTEMP)
C  AND ENDING AT R(NTEMP1).AFTER READING THESE CONSECUTIVE DATA NEW
C  VALUES OF NTEMP AND NTEMP1 ARE REQUESTED BY THE COMPUTER UNTIL NTEMP
C  IS .LE.0. THIS TERMINATES THIS OPTION.
    3 WRITE(6,2042)
  165 READ(5,2058) (ITPLOT(I),I=1,4),(NALPHA(I),I=1,12)
      NTEMP =ITPLOT(1)
      IF(NTEMP.GT.0)NTEMP=NR(NTEMP)
      NTEMP= NTEMP+ITPLOT(2)
      IF(NTEMP.LE.0) GO TO 100
      NTEMP1=ITPLOT(3)
      IF(NTEMP1.GT.0)NTEMP1=NR(NTEMP1)
      NTEMP1=NTEMP1+ITPLOT(4)
      READ(5,32003)      (R(I),I=NTEMP,NTEMP1)
      WRITE(6,2059) (ITPLOT(I),I=1,4),(NALPHA(I),I=1,12)
      WRITE(6,2060)      (I,R(I),I=NTEMP,NTEMP1)
      GO TO 165
```

```
C
C
C  OUTPUT
    4 WRITE(6,2043)
C  READ INTENT TO PLOT, PRINT OR WRITE ON NTAPE, NUMBER OF PLOTS/FRAME,
C  OPTION FOR INTERPOLATION,INTENT TO READ INDIVIDUAL TITLES,
C  SCRATCH OUTPUT TAPE, NUMBER OF PLOTS EXPECTED FOR EACH TIME HISTORY
C  ,INTENT TO STORE MULTIPLE TIME HISTORIES IN CORE,
C  RESTART OF TIME HISTORY NUMBERING
C  IFMULT = 1 FOR MULTIPLE PLOTS
      READ(5,2046) IFPLT,IFPRNT,IFPNCH,NPLTFM,IFINT,IFTITL,NTAPE,LPLOT
     1 ,IFMULT, NHISTO
      FRCT = IFINT
      FRCT = FRCT/20.
      IF(NHISTO.GT. 0) NHIST = NHISTO - 1
      IF(NTAPE .LE. 0) NTAPE=7
      IF(NTAPE .LT. 5) REWIND NTAPE
      IF(NDIM.LE.NR30)IFPLT = -1
      WRITE(6,2046) IFPLT, IFPRNT, IFPNCH, NPLTFM, IFINT
     1 ,IFTITL,NTAPE,LPLOT
     2 ,IFMULT, NHISTO
C  READ TITLE THAT WILL APPEAR AT THE BOTTOM OF EACH PLOT
C**     IBM S/360
      IF(IFTITL .LE. 0) GO TO 193
      DO 192 I=1,LPLOT
      READ(5,2071) (TITLET(J,I),J=1,16)
  192 WRITE(6,2072) (TITLET(J,I),J=1,16)
      GO TO 194
  193 READ(5,2071) TITLE
      WRITE(6,2072) TITLE
C**     IBM S/360
C****   IBM 7090,7094
C 168 READ(5,3051) TITLE
C     WRITE(6,3052) TITLE
C****   IBM 7090,7094
  194 READ(5,2046)NOUTT
      IF(NOUTT) 100, 100, 173
  173 NOUT = NOUTT
      DO 200 I=1,NOUT
      READ(5,2045)IT,JT,SCALE(I),NALPHA
      IF(IT)100, 170,180
  170 IO(I)=JT
      GO TO 190
  180 IO(I)=NR(IT)+JT
  190 WRITE(6,2044)IT,JT,IO(I),SCALE(I),NALPHA
C  READ LABEL ASSOCIATED WITH EACH OUTPUT VARIABLE
C**     IBM S/360
  191 READ(5,2051)(LABEL(J,I),J=1,5)
      WRITE(6,2052)(LABEL(J,I),J=1,5)
C**     IBM S/360
C****   IBM 7090,7094
C 191 READ(5,3051)(LABEL(J,I),J=1,3)
C     WRITE(6,3052)(LABEL(J,I),J=1,3)
C****   IBM 7090,7094
  200 CONTINUE
      GO TO 100
C
C
C  TIME H
    5 WRITE(6,2040)
C****   IBM 7090,7094
```

```
C      IF(IFPLOT .GT. 0) REWIND NTAPEP
C**** IBM 7090,7094
       NTIME = 0
       NHIST = NHIST + 1
       IST = 0
       IF(NHIST .EQ. 1) GO TO 705
       IST = NPTT(NHIST-1)
   705 ASTCR = NR30 + IFMULT*IST
       IC=0
       R(NR4+2)=0.
       TPUNCH=R(NR4+2)
       TMAX=R(NR4+4)
       CT=R(NR4+3)
       NPT = 0
       CALL INITC(R)
       CALL INTGRH(R,R(IYO),R(IY1),R(IY2),R(IY3),R(IYD1),R(IYD2),R(NR28),
      1 R(NR29),R(IERROR))
       NERR=C
       CALL CVCHK(IDVCK)
       IF(IDVCK.EQ.1) NERR=NERR+1
       CALL OVERFL(IOVFL)
       IF(IOVFL.EQ.1) NERR=NERR+1
       IF(NERR-5) 1300,1300,701
   701 WRITE(6,32011)
       CALL DUMPER(R)
       GO TO 1375
  1100 CONTINUE
       CALL INTGRH(R,R(IYO),R(IY1),R(IY2),R(IY3),R(IYD1),R(IYD2),R(NR28),
      1 R(NR29),R(IERROR))
       CALL CVCHK(IDVCK)
       IF(IDVCK.EQ.1) NERR=NERR+1
       CALL OVERFL(IOVFL)
       IF(IOVFL.EQ.1) NERR=NERR+1
       IF(NERR-5) 1150,1150,701
  1150 IF(R(NR4+2).GE.R(NR4+4)) GO TO 1300
       IF(TPUNCH-R(NR4+2)) 1300,1300,1100
  1300 CALL AUX(R)
       NPT = NPT + 1
       DO 1350 I=1,NOUT
       IT= IC(I)
  1350 OUT(I)=R(IT)*SCALE(I)
       IF(IFPLT . LT. 0) GO TO 1360
C   STORE THE OUTPUT VARIABLES FOR SUBSEQUENT PLOTTING.
C****  IBM 7090,7094
C      WRITE(NTAPEP) (OUT(I), I = 1,NOUT)
C****  IBM 7090,7094
C**    IBM S/360
       DO 1355 I = 1, NOUT
       IT1 = NSTOR + (NPT-1)*NOUT + I - 1
       IF(IT1-NDIM)1355,1355,1356
  1355 R(IT1) = OUT(I)
       GO TO 1360
  1356 NPT = NPT-1
       WRITE(6,32005)NDIM
C**    IBM S/360
  1360 IF(IFPRNT.GE.0)
      1 WRITE(6,2047) (OUT(I), I = 1,NOUT)
       IF(IFPNCH.LT.0) GO TO 1362
C   PUNCH TIME HISTORY ON CARDS OR WRITE ON TAPE
       NTIME = NTIME + 1
       DO 1361 I = 1,NOUT,5
```

```
      IT1 = I + 4
      WRITE(NTAPE,2050) (OUT(J),J = I,IT1),NTIME,NHIST
 1361 CONTINUE
 1362 CONTINUE
      TPUNCH=TPUNCH+R(NR4+5)
      IF(R(NR4+2)-R(NR4+4)) 1100,1375,1375
 1375 R(NR4+4)=TMAX
      R(NR4+3)=DT
      IF(IFMULT.EQ.0) GO TO 100
      IF(NHIST .GT.  6) GO TO 100
      NPTCRV(NHIST) = NPT
      NOOUT(NHIST) = NOUT
      IF(NHIST .GT. 1) GO TO 1376
      NPTT(1) = NPT*NOUT
      GC TO 100
 1376 NPTT(NHIST) = NPTT(NHIST-1) + NPT*NOUT
      GO TO 100
C
C
C  PLOT
    6 CONTINUE
C  PLOT THE X-Y ARRAY WHERE X-ARRAY IS STORED IN THE R-ARRAY STARTING
C  AT R(NR30),WHERE IT IS THE IT-TH VARIABLE STORED BY
C  THE TIME HISTORY OPTION.
C  JT DEFINES THE Y-ARRAY IN A SIMILAR MANNER.
  166 IFPLCT = IFPLOT + 1
      IF(IFPLOT) 168,167,168
  167 CALL CAMRAV(9)
C**    IBM S/360
      CALL ID40V(BLANE)
C**    IBM S/360
  168 CONTINUE
      JPLOT=0
      KPLCT = 0
 1397 READ(5,2055) (ITPLOT(I),I=1,36),NGRPLT,IFLAB,IQUAD
      WRITE(6,2063) (ITPLOT(I),I=1,36),NGRPLT,IFLAB,IQUAD
      IF(NGRPLT .GT. 1) GO TO 1302
      KSYM(1)=48
      IST=0
      IF(IFMULT .EQ. 0 .OR. NHIST .EQ.1) GO TO 1341
      IST = NPTT(NHIST-1)
 1341 DO 1410 J = 1,35,2
      JPLCT=JPLOT+1
      IT = ITPLCT(J)
      IF(IT) 100,100,1398
 1398 JT = ITPLCT(J+1)
C**** IBM 7090,7094
C     REWIND NTAPEP
C**** IBM 7090,7094
      IFTL = 0
      IF(IFTITL .GT. 0) IFTL = 1
      JPLT = (JPLCT-1)*IFTL + 1
      NFLCT = NPLOT + 1
      IF(NPLOT - 100*NPLTFM) 1396,1396,1395
 1395 NPLCT = 1
      KPLOT=0
      CALL PLTNC(1)
 1396 CCNTINUE
      DC 1400 I = 1,NPT
C**** IBM 7090,7094
C     READ(NTAPEP)(OUT(K),K=1,NOUT)
```

```
C     XPLOT(I)=CUT(IT)
C     YPLOT(I)=CUT(JT)
C**** IBM 7090,7094
C**   IBM S/360
      IX = NR30 + (I-1)*NOUT + IT-1 + IFMULT*IST
      IY = NR30 + (I-1)*NOUT + JT-1 + IFMULT*IST
      XPLOT(I) = R(IX)
      YPLOT(I) = R(IY)
C**   IBM S/360
 1400 CONTINUE
 1410 CALL SC4022(XPLOT,YPLOT,NPT,1,NPLTFM,KPLOT,TITLET(1,JPLT),
     1 LABEL(1,IT),LABEL(1,JT),KSYM,0,FRCT,LAB1,0,
     2 XMIN,YMIN,XMAX,YMAX,0,1)
      GO TO 1397
C  DATA IS IN FORM--IX NHIST1 IY1 NHIST2 IY2 NHIST3 IY3 ----
 1302 JPLOT = JPLOT + 1
      IFTL = 0
      IF(IFTITL .GT. 0) IFTL = 1
      JPLT = (JPLOT-1)*IFTL + 1
      IT = ITPLOT(1)
      JT = ITPLOT(3)
      NPLOT = NPLOT + 1
      IF(NPLOT .LE. 100*NPLTFM) GO TO 1310
      NPLOT = 1
      KPLOT = 0
      CALL PLTND(1)
 1310 CONTINUE
      IF(IFLAB .LE. 0) GO TO 1303
      DO 1301 J = 1,NGRPLT
      READ(5,32014) SYM, (TEXT(K),K=1,5)
      WRITE(6,32015)SYM, (TEXT(K),K=1,5)
      CALL ALFNUM(KSYM(J),LAB(1,J),SYM,TEXT)
 1301 CONTINUE
 1303 CONTINUE
      K=0
      DO 1311 J = 1, NGRPLT
      II = ITPLOT(2*J)
      NPT = NPTCRV(II)
      ICOL(J) = NPT
      IST = 0
      IF(II .EQ. 1) GO TO 1314
      IST = NPTT(II-1)
 1314 DO 1312 I = 1,NPT
      K=K+1
      IX = NR30 + IST + (I-1)*NODOUT(II) + ITPLOT(1) - 1
      IY = NR30 + IST + (I-1)*NODOUT(II) + ITPLOT(2*J+1) - 1
      XPLOT(K) = R(IX)
 1312 YPLOT(K) = R(IY)
 1311 CONTINUE
      CALL SC4022(XPLOT,YPLOT,ICOL,NGRPLT,NPLTFM,KPLOT,TITLET(1,JPLT),
     1 LABEL(1,IT),LABEL(1,JT),KSYM,1,FRCT,LAB,0,
     2 XMIN,YMIN,XMAX,YMAX,0,IQUAD)
      GO TO 1397
C
C
C  WRITE
    7 WRITE(6,2041)
      READ(5,2046) IFPNC
      WRITE(6,2063) IFPNC
 1460 NVAR = 0
      DO 1500 I=1,5
```

```
      READ(5,2045) IT,JT,SCALED,NALPHA
      IF(IT) 1510,1470,1480
 1470 IT1 =JT
      GC TO 1490
 1480 IT1 = NR(IT) + JT
 1490 OUT(I) = R(IT1)* SCALED
      NVAR = NVAR + 1
      WRITE(6,2044)IT,JT,IT1,OUT(I),NALPHA
 1500 CONTINUE
      IF(IFPNC.GT.0) WRITE(7,2053) (OUT(K),K = 1,NVAR)
      GC TO 1460
 1510 IF(NVAR) 1C0,100,1520
 1520 IF(IFPNC.GT.0) WRITE(7,2053) (OUT(K),K = 1,NVAR)
      GC TO 100
C
C
C  WRITE RC
C  PRINTS OUT THE R-MATRIX FROM R(NTEMP) TO R(NTEMP1). AFTER PRINTING,
C  NEW VALUES OF NTEMP AND NTEMP1 ARE REQUESTED.  WHEN NTEMP=0 (BLANK
C  CARD) THIS CPTICN IS TERMINATEC.
    8 WRITE(6,2061)
C  IF IFPNC IS GT 0, THE OUTPUT WILL BE PUNCHED IN THE FORMAT REQUIRED
C  FOR THE CCNSECUTIVE INPUT OPTION, READ RC.
      READ(5,2046) IFPNC
      WRITE(6,2063) IFPNC
  800 READ(5,2058)(ITPLOT(I),I=1,4),(NALPHA(I),I=1,12)
      IF(ITPLCT(1)) 801,8C1,802
  801 NTEMP = ITPLOT(2)
      GC TO 803
  802 NTEMP=ITPLCT(1)
      NTEMP=NR(NTEMP)+ITPLOT(2)
  803 IF(NTEMP)1C0,100,804
  804 IF(ITPLOT(3)) 805,805,810
  805 NTEMP1=ITPLOT(4)
      GC TO 813
  810 NTEMP1=ITPLOT(3)
      NTEMP1=NR(NTEMP1)+ITPLOT(4)
  813 WRITE(6,2059)(ITPLOT(I),I=1,4),(NALPHA(I),I=1,12)
      WRITE(6,2060) (I,R(I),I=NTEMP,NTEMP1)
      IF(IFPNC)8C0,800,814
  814 WRITE(7,2058)(ITPLOT(I),I=1,4),(NALPHA(I),I=1,12)
      WRITE(7,2053)(R(I),I=NTEMP,NTEMP1)
      GC TO 800
C
C
C  CRVFIT
    9 CONTINUE
C  LEAST SQUARES PCLYNCMIAL CURVE FIT
      WRITE(6,22006)
C  READ STORAGE CONTROL (IFSTRC), PUNCH CONTROL(IFPNC), THE
C  NUMBER OF PCINTS TO BE CURVE-FITTED (MP), THE DEGREE OF THE
C  POLYNOMIAL (NP) AND IDENTIFYING INFORMATION (NALPHA).
C  TERMINATE THIS OPTION WITH A BLANK CARD.
 1549 READ(5,2058)IFSTRC,IFPNC,MP,NP,NALPHA
      IF(MP)1C0,100,1550
 1550 NP1 = NP+1
      WRITE(6,2059)IFSTRC,IFPNC,MP,NP,NALPHA
      NP2 = 2*NP1
C  NP1 COEFFICIENTS WILL BE COMPUTED, STORED AND PUNCHED OUT IN THE
C  FORMAT REQUIREC BY THE SINGLE INPUT OPTION, READ R  .
C  REAC THE NR SUBSCRIPTS (NONE ZERO) DEFINING THE LOCATIONS IN THE
C  R-ARRAY FOR STORAGE OF THE CURVE-FIT COEFFICIENTS.
      IF(ISTRC .GE. 0)
```

```
      READ(5,2046)(ITPLOT(I),I=1,NP2)
C  READ NR SUBSCRIPTS IDENTIFYING THE STARTING LOCATION IN THE R-ARRAY
C  FROM WHICH THE INDEPENDENT VARIABLE WILL BE TAKEN (ITX,JTX), THE
C  SCALE FACTOR (XSCALE) AND IDENTIFYING INFORMATION (XLABEL). SET
C  XSCALE TO ZERO IF THE LEAST SQUARES MATRIX HAS BEEN PREVIOUSLY
C  COMPUTED.
      READ(5,2045)ITX,JTX,XSCALE,XLABEL
      IF(XSCALE)1553,1560,1553
 1553 IF(ITX)1556,1556,1554
C  RETRIEVE THE INDEPENDENT VARIABLE FROM THE R-ARRAY.
 1554 NTEMP1 = JTX + MP - 1
      WRITE(6,32007)
      WRITE(6,2059)ITX,JTX,ITX,NTEMP1,XLABEL
      J = NR(ITX)+JTX-1
      DO 1555 I = 1,MP
      J = J + 1
 1555 XPLOT(I) = R(J)*XSCALE
      WRITE(6,2048)(XPLOT(I),I=1,MP)
      GO TO 1560
C  READ IN THE INDEPENDENT VARIABLE AND SCALE.
 1556 READ(5,32003)(XPLOT(I),I=1,MP)
      DO 1557 I = 1,MP
 1557 XPLOT(I) = XPLOT(I) * XSCALE
      WRITE(6,32007)
      WRITE(6,2048)(XPLOT(I),I=1,MP)
C  READ THE DEPENDENT VARIABLE STARTING SUBSCRIPT (ITY,JTY), SCALE
C  FACTOR (YSCALE) AND IDENTIFYING INFORMATION (YLABEL).
 1560 READ(5,2045)ITY,JTY,YSCALE,YLABEL
      IF(ITY)1566,1566,1564
C  RETRIEVE DEPENDENT VARIABLE FROM THE R-ARRAY.
 1564 NTEMP1 = JTY + MP - 1
      WRITE(6,32008)
      WRITE(6,2059)ITY,JTY,ITY,NTEMP1,YLABEL
      J = NR(ITY)+JTY-1
      DO 1565 I = 1,MP
      J = J +1
 1565 YPLOT(I) = R(J)*YSCALE
      WRITE(6,2048)(YPLOT(I),I=1,MP)
      GO TO 1570
C  READ THE DEPENDENT VARIABLE AND SCALE.
 1566 WRITE(6,32008)
      READ(5,32003)(YPLOT(I),I = 1,MP)
      DO 1567 I = 1,MP
 1567 YPLOT(I) = YPLOT(I)*YSCALE
      WRITE(6,2048)(YPLOT(I),I=1,MP)
C  COMPUTE THE CURVE FIT COEFFICIENTS, STORE, PUNCH AND PRINT
 1570 INVERT = 1
      IF(XSCALE.EQ.0.) INVERT = -1
      CALL CRVFIT(BLS,ALS,CLS,XPLOT,YPLOT,MP,NP,NDIMCF,ICOL  ,INVERT,
     1 SLS,ULS)
C  PRINT
      WRITE(6,32009)
      WRITE(6,2048)(BLS(I),I=1,NP1)
      IF(IFSTRC)1552,1551,1551
C  STORE
 1551 J =-1
      DO 1571 I = 1,NP1
      J = J + 2
      IT = ITPLOT(J)
      JT = ITPLOT(J+1)
      NTEMP2= NR(IT)+JT
      R(NTEMP2)=BLS(I)
 1571 CONTINUE
 1552 IF(IFPNC)1549,1572,1572
```

```
C  PUNCH
 1572 J=-1
      DO 1573 I = 1,NP1
      J = J + 2
      IT = ITPLOT(J)
      JT = ITPLOT(J+1)
 1573 WRITE(7,2045) IT,JT,BLS(I),NALPHA
      GO TO 1549
C
C
C  COMMENT
   10 CONTINUE
      IF(IFPLT .LT. 0) GO TO 1706
      IF(IFPLOT .GE. 0) GO TO 1708
      CALL CAMRAV(9)
      CALL ID40V(BLAME)
      IFPLOT = IFPLOT + 1
 1708 CALL FRAMEV(3)
      CALL CHSIZV(2,3)
      IXC = 24
      IYC = 1024
      CALL RITSTV(13,26,TABL1V)
 1706 WRITE(6,32002)
 1705 READ(5,2056) (XPLOT(I),I=1,20)
      IF(XPLOT(1).EQ.BLANK .AND. XPLOT(2).EQ.BLANK) GO TO 100
      WRITE(6,2057) (XPLOT(I),I=1,20)
      IF(IFPLT .LT. 0) GO TO 1705
      IYC = IYC - 26
      IF(IYC .GT. 24) GO TO 1707
      CALL FRAMEV(3)
      IYC = 998
 1707 CALL RITE2V(IXC,IYC,1020,90,1,80,1,XPLOT,NLAST)
      GO TO 1705
C
C
C
C
C  DUMP R
   11 CALL DUMPER(R)
      GO TO 100
C
C
C  TRIM VTO
   12 CALL TRIMV(R)
      GO TO 100
C
C
C  TRIM CON
   13 CALL TRIMC(R)
      GO TO 100
C
C
C  RESTORE
C  RESTORING NTEMP CONSECUTIVE VARIABLES FROM THE R-ARRAY STARTING
C  IN NR(IT)+ JT TO OTHER R-ARRAY LOCATIONS STARTING IN NR(ITX)+JTX.
C  TERMINATE WITH A BLANK CARD.
   14 CONTINUE
 1800 READ(5,2046) NTEMP,IT,JT,ITX,JTX
      IF(NTEMP)100,100,1801
 1801 WRITE(6,2063) NTEMP,IT,JT,ITX,JTX
      IF(IT)100,1802,1803
```

```
 1802 ITY = JT
      GO TO 1804
 1803 ITY = NR(IT)+JT
 1804 IF(ITX)100,1805,1806
 1805 JTY = ITX
      GO TO 1807
 1806 JTY = NR(ITX)+JTX
 1807 WRITE(6,2062) ITY,JTY
      ITY = ITY-1
      JTY = JTY-1
      DO 1808 I = 1, NTEMP
      ITY = ITY + 1
      JTY = JTY + 1
 1808 R(JTY) = R(ITY)
      GO TO 1800
C
C
C  HELP
   15 CALL HELPER(R)
      GO TO 100
C  STOP
   16 CONTINUE
      IF(IFPLOT.GE.0) CALL PLTND(1)
      IF(IFPNCH ) 1636,1636,1634
 1634 NHIST = NHIST + 1
      DO 1635 I = 1,NOUT,5
      IT1 = I + 4
      WRITE(NTAPE,2050) (OUT(J),J=I,IT1),NTIME,NHIST
 1635 CONTINUE
 1636 CALL TIMEX(4,DUM,DUM,TIMES,TIMEF)
      RETURN
      END


      FUNCTION INTERP(KOPT1,KOPT2)
C       T4SA02
C  CHANGED 15 AUG 69
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANOR ROCH, AERODYNAMICS ENGINEER
      DIMENSION LABELS(32)
32000 FORMAT(1H0/1X,17HTHE OPTION CALLED,1X,2A4,1X,
     1 17HCAN NOT BE FOUND./1X,19HPROGRAM TERMINATED.)
      DATA LABELS/4HREAD,4H N  ,4HREAD,4H R  ,4HREAD,4H R C,4HOUTP,4HUT
     1 ,4HTIME,4H H  ,4HPLOT,4H    ,4HWRIT,4HE   ,4HWRIT,4HE RC,4HCRVF,4
     2HIT  ,4HCOMM,4HENT ,4HDUMP,4H R  ,4HTRIM,4H VTO,4HTRIM,4H CON,
     3 4HREST,4HORE ,4HHELP,4H    ,
     4 4HSTOP,4H    /, KBLANK/4H    /
      IF(KOPT1 .EQ. KBLANK) GO TO 300
      INTERP = 0
      DO 100 I=1,32,2
      INTERP = INTERP + 1
      IF(KOPT1.EQ.LABELS(I).AND.KOPT2.EQ.LABELS(I+1)) GO TO 200
  100 CONTINUE
      WRITE(6,32000) KOPT1,KOPT2
      INTERP=16
  200 RETURN
  300 INTERP=17
      RETURN
      END
```

```
      SUBROUTINE CEQU(R)
C         T4SAC3
C   CHANGED 3 SEPT 69
C   SIX DEGREE OF FREEDOM EQUATIONS FOR AN ESCAPE SEAT
C
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
C   JIM LACY, AERODYNAMICS ENGINEER
C   EDDIE SMART, AERODYNAMICS ENGINEER
C
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      INTEGER W,X,Y
     1 ,Z,V
      EQUIVALENCE (NR3,I),(NR4,J),(NR13,K),(NR14,M),(NR15,L),(NR16,W),
     1 (NR19,X),(NR20,Y)
     2             ,(NR27,Z), (NR21,V)
32000 FORMAT(1H0/10X34HBEGINNING OF MAN-ALONE TRAJECTORY.//)
32001 FORMAT(1H0/10X35HBEGINNING OF SEAT-ALONE TRAJECTORY.//)
C
      CALL RAILFM(R(V+67),R(V+68),R(V+69),R(Z+3),R(Z+4),R(Z+5),R(Z+6),
     1 R(Z+7),R(Z+8),R(Z+9),R(Z+10),R(Z+11),R(Z+12),R(Z+13),R(Z+14),
     2 R(Z+15),R(Z+16),R(Z+17),R(I+10),R(I+11),R(I+12),R(I+13),
     3 R(I+14),R(I+15),R(J+9),R(J+10),R(J+11),R(V+12),R(V+13),R(V+14),
     4 R(V+15),R(V+16),R(V+17),R(V+18),R(V+19),R(V+20),R(I+39),R(I+40),
     5 R(I+41),R(I+42),R(I+43),R(I+44),R(J+60),R(J+61),R(J+62),R(V+3),
     6 R(V+4),R(V+5),R(V+6),R(V+7),R(V+8),R(V+9),R(V+10),R(V+11),
     7 R(I+7),R(I+8),R(I+9),R(I+36),R(I+37),R(I+38),R(V+30),R(V+31),
     8 R(V+32),R(V+33),R(V+34),R(V+35),R(V+36),R(V+37),R(V+38),R(V+39),
     9 R(V+40),R(V+41),R(V+42),R(V+43),R(V+44),R(V+45),R(V+46),R(V+47),
     1 R(V+48),R(V+49),R(V+50),R(V+51),R(V+52),R(V+53),R(V+54),R(V+55),
     2 R(V+56),R(V+57),R(V+58),R(V+59),R(V+60),R(V+61),R(V+62),R(V+63),
     3 R(J+43), R(NR21+64),R(NR21+65),R(NR21+66), R(NR13+23), R(NR4+2),
     4 R(Z+18), R(Z+19), R(Z+20), R(Z+21), R(Z+22), R(Z+23), R(Z+24),
     5 R(Z+25), R(Z+26), R(Z+27), R(Z+28), R(Z+29), R(Z+30), R(Z+31),
     6 R(Z+32), R(Z+33), R(Z+34), R(Z+35) ,R(I+4),R(I+5),R(I+6) )
       CALL CATPLT(R)
       CALL AIRPLN(R)
       R(NR4+15) = R(NR4+12)/R(NR4+25)
       IF(R(NR4+126)-999.)40,30,30
   30 IF((R(NR27+20)+R(NR27+29))/2.0.LE.R(NR21+70)) R(NR4+126)=R(NR4+2)
   40 IF(R(NR4+2)-R(NR4+126)-R(NR13+30))10,20,20
C
C   THIS SECTION IS FOR THE COMBINED ESCAPE SEAT-PILOT CONFIGURATION,
C   OUTSIDE THE AIRCRAFT INFLUENCE.
   10 CALL SEATMN(R)
       RETURN
   20 ITT = IFIX(R(NR16+56))
       GO TO (1,2), ITT
C   MAN ALONE EQUATIONS
    1 IF(R(NR4+42) - .98 ) 3,4,4
    3 WRITE(6,32000)
       R(NR4+42) = 1.
    4 CONTINUE
       CALL MAN(R)
       RETURN
    2 CALL SEAT(R)
       RETURN
       END
```

```
      SUBROUTINE AUX(R)
C       T4SAC4
C   IVAN  CLINKENBEARD, ENGINEERING SPECIALIST
C   JIM LACY, AERODYNAMICS ENGINEER
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
C   CALCULATION OF LOAD FACTORS AT A GIVEN POINT ON THE PILOTS BODY.
      CALL LDFCTR(R(NR4+21),R(NR4+22),R(NR4+23),R(NR4+18),
     1 R(NR4+19),R(NR4+20),R(NR16+60),R(NR16+61),R(NR16+62),
     2 R(4),R(5),R(6),R(NR3+4),R(NR3+5),R(NR3+6))
C   CALCULATION OF DISTANCE BETWEEN A POINT ON THE AIRPLANE AND
C   THE SEAT C.G.
      CALL PCSXYZ(R(NR4+85),R(NR4+86),R(NR4+87),R(NR3+36),
     1 R(NR3+37),R(NR3+38),R(NR21),R(NR21+1),R(NR21+2),
     2 R(NR3+39),R(NR3+40),R(NR3+41),R(NR3+42),R(NR3+43),
     3 R(NR3+44),R(NR4+60),R(NR4+61),R(NR4+62))
      R(NR4+88) = R(NR3+7) - R(NR4+85)
      R(NR4+89) = R(NR3+8) - R(NR4+86)
      R(NR4+90) = R(NR3+9) - R(NR4+87)
      RSA2 = R(NR4+88)**2 + R(NR4+89)**2 + R(NR4+90)**2
      R(NR4+91) = SQRT(RSA2)
C   CALCULATION OF LOAD FACTORS AT COCKPIT.
      CALL LDFCTR(R(NR4+57),R(NR4+58),R(NR4+59),R(NR4+67),R(NR4+68),
     1 R(NR4+69),R(NR21+27),R(NR21+28),R(NR21+29),R(33),R(34),R(35),
     2 R(NR3+33),R(NR3+34),R(NR3+35))
C   CALCULATION OF EARTH AXIS VELOCITIES AND POSITIONS OF COCKPIT.
      CALL VELXYZ(R(NR4+111),R(NR4+112),R(NR4+113),R(NR3+30),R(NR3+31),
     1 R(NR3+32),R(NR21+27),R(NR21+28),R(NR21+29),R(NR3+33),R(NR3+34),
     2 R(NR3+35))
      CALL PCSXYZ(R(NR4+114),R(NR4+115),R(NR4+116),0.,0.,0.,R(NR4+111),
     1 R(NR4+112),R(NR4+113),R(NR3+39),R(NR3+40),R(NR3+41),R(NR3+42),
     2 R(NR3+43),R(NR3+44),R(NR4+60),R(NR4+61),R(NR4+62))
      CALL PCSXYZ(R(NR4+117),R(NR4+118),R(NR4+119),R(NR3+36),R(NR3+37),
     1 R(NR3+38),R(NR21+27),R(NR21+28),R(NR21+29),R(NR3+39),R(NR3+40),
     2 R(NR3+41),R(NR3+42),R(NR3+43),R(NR3+44),R(NR4+60),R(NR4+61),
     3 R(NR4+62))
C   CALCULATION OF PSI AND THETA OF THE PARACHUTE C.G. W/R TO
C   BRIDLE APEX IN SEAT AXIS SYSTEM.
      CALL MPYVEC(R(NR19+49),R(NR19+50),R(NR19+51),R(NR19+15),
     1 R(NR19+16),R(NR19+17),R(NR3+10),R(NR3+13),R(NR4+9),
     2 R(NR3+11),R(NR3+14),R(NR4+10),R(NR3+12),R(NR3+15),R(NR4+11))
      R(NR19+52) = ARSIN(-R(NR19+51)/R(NR19+18))
      R(NR19+53) = -ATAN2(R(NR19+50),-R(NR19+49))
      IF(R(NR4+1).GE.R(NR13+33)+1.5) R(NR4+5) = .1
C   DRAG PARACHUTE RELEASED AT DEPLOYMENT OF RECOVERY CHUTE.
    2 IF(R(NR4+1)-R(NR13+33)+.05)100,100,80
   80 R(NR13+13) = 1000.0
  100 RETURN
      END


      SUBROUTINE SEATMN(R)
C       T4SAC5
C
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   JIM LACY, AERODYNAMICS ENGINEER
C   EDDIE SMART, AERODYNAMICS ENGINEER
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
```

```
C
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      INTEGER W,X,Y
     1 ,Z,V
      EQUIVALENCE (NR3,I),(NR4,J),(NR13,K),(NR14,M),(NR15,L),(NR18,W),
     1 (NR19,X),(NR20,Y)
     2              ,(NR27,Z), (NR21,V)
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+9))
      CALL CCRATE(R(10),R(11),R(12),R(13),R(14),R(15),R(NR3+4),R(NR3+5),
     1 R(NR3+6),R(NR4+6),R(NR4+7),R(NR4+8),R(NR3+10),R(NR3+11),R(NR3+12)
     2 ,R(NR3+13),R(NR3+14),R(NR3+15),R(NR4+9),R(NR4+10),R(NR4+11))
      CALL VELAIR(R(7),R(8),R(9),R(NR4+16),R(NR4+17),R(NR4+12),R(NR4+13)
     1 ,R(NR3+10),R(NR3+11),R(NR3+12),R(NR3+13),R(NR3+14),R(NR3+15)
     2 ,R(NR4+9),R(NR4+10),R(NR4+11),R(NR3+1),R(NR3+2),R(NR3+3),
     3  R(NR4+26))
      CALL CLU(R(NR4+16),ABS(R(NR4+17)),R(NR17+2) ,R(NR17+3) ,
     1 R(NR17)    ,R(NR17+1) ,R(NR17+4) ,R(NR17+5) ,NR5, NR6-1, NR6,
     2 NR7-1, NR7,NR8,NR9,NR12,NR10,NR11,R)
      R(NR17+1)  = R(NR17+1) *SIGN(1.,R(NR4+17))
      R(NR17+4)  = R(NR17+4) *SIGN(1.,R(NR4+17))
      R(NR17+5)  = R(NR17+5) *SIGN(1.,R(NR4+17))
C  ADD DAMPING TERMS FOR AIRSPEED GREATER THAN .1 FT/SEC.
      IF(R(NR4+12) - .1)2,2,1
C  ADD PITCH DAMPING
    1 R(NR17)     = R(NR17)    + R(NR16+10)*(.5*R(NR3+5)*R(NR16+14)/
     1 R(NR4+12))
C  ADD YAW DAMPING
      R(NR17+4)   = R(NR17+4)  + R(NR16+12)*(.5*R(NR3+6)*R(NR16+15)/
     1 R(NR4+12))
C  ADD ROLL DAMPING
      R(NR17+5)   = R(NR17+5)  + R(NR16+11)*(.5*R(NR3+4)*R(NR16+15)/
     1 R(NR4+12))
    2 IF(R(NR4+43)) 4,3,3
    4 IF(R(NR13+23)-R(NR4+1))6,5,5
    5 R(NR17+1)  = 0.
      R(NR17) = 0.
      R(NR17+2)  = 0.
      R(NR17+3)  = 0.
      R(NR17+4)  = 0.
      R(NR17+5)  = 0.
      GO TO 3
    6 BS = (R(NR21+32)-R(NR27+20))/(R(NR21+55)+ R(NR21+32))
      IF(ABS(BS) .GT. 1. ) BS=1.
      IF(BS .LT. 0. ) BS=0.
      R(NR17) = R(NR17) * BS
      R(NR17+1)  = BS*R(NR17+1)
      R(NR17+2)  = BS*R(NR17+2)
      R(NR17+3)  = BS*R(NR17+3)
      R(NR17+4) = R(NR17+4) * BS
      R(NR17+5) = R(NR17+5) * BS
    3 CONTINUE
C  RECOVERY CHUTE IMPULSE, ABSORBED BY SEAT
      CALL ROCKET (R(NR18+21),R(NR18+22),R(NR18+23),R(NR18+24),          RECOV
     1 R(NR18+25), R(NR18+26),R(NR18+27),              R(NR4 + 1),       CHUTE
     2 R(NR13+34), R(NR13+35),R(NR13+36),R(NR13+37),R(NR13+38),
     3 R(NR13+39), R(NR13+33),R(NR13+70),R(NR13+71),R(NR13+72),
     4 R(NR13+73), R(NR13+72),R(NR13+73),R(NR13+72),R(NR13+73),
     5 R(NR13+72), R(NR13+73),               R(NR13+32),R(NR13+73))
```

```
C  SUSTAINER RCCKET FORCES AND MOMENTS
C  TRACTOR SYSTEM
      IF(R(NR13+42))20,20,10
   10 IF(R(NR4+1)-R(NR16+59))12,14,14
   12 R(NR18+28) = R(NR13+24)
      R(NR18+29) = R(NR13+25)
      R(NR18+30) = R(NR13+26)
      GC TC 18
   14 R(NR18+33) = R(NR13+41) + R(NR13+40)*R(NR4+1)
      IF(R(NR18+33).GT.3.14)R(NR18+33) = 3.1416
      R(NR18+31) = SIN(R(NR18+33))
      R(NR18+32) = COS(R(NR18+33))
      R(NR18+28) = R(NR3+13)*R(NR18+31) + R(NR4+9)*R(NR18+32)
      R(NR18+29) = R(NR3+14)*R(NR18+31) + R(NR4+10)*R(NR18+32)
      R(NR18+30) = R(NR3+15)*R(NR18+31) + R(NR4+11)*R(NR18+32)
   18 CALL ROCKET (R(NR18  ),R(NR18+ 1),R(NR18+ 2),R(NR18+ 3),          TRACTOR
     1 R(NR18+ 4), R(NR18+ 5),R(NR18+ 6),            R(NR4 + 1),
     2 R(NR18+28), R(NR18+29),R(NR18+30),R(NR13+43),R(NR13+44),
     3 R(NR13+45), R(NR13+ 3),R(NR13+47),R(NR13+46),R(NR13+49),
     4 R(NR13+48), R(NR13+51),R(NR13+50),R(NR13+53),R(NR13+52),
     5 R(NR13+55), R(NR13+54),R(NR13+57),R(NR13+56))
      GC TC 22
   20 CALL ROCKET (R(NR18  ),R(NR18+ 1),R(NR18+ 2),R(NR18+ 3),          SUSTAINR
     1 R(NR18+ 4), R(NR18+ 5),R(NR18+ 6),            R(NR4 + 1),
     2 R(NR13+ 4), R(NR13+ 5),R(NR13+ 6),R(NR13+ 7),R(NR13+ 8),
     3 R(NR13+ 9), R(NR13+ 3),R(NR13+47),R(NR13+46),R(NR13+49),
     4 R(NR13+48), R(NR13+51),R(NR13+50),R(NR13+53),R(NR13+52),
     5 R(NR13+55), R(NR13+54),R(NR13+57),R(NR13+56))
C  DRAG CHUTE DEPLOYMENT IMPULSE
   22 CALL ROCKET (R(NR18+ 7),R(NR18+ 8),R(NR18+ 9),R(NR18+10),         DRAG
     1 R(NR18+11), R(NR18+12),R(NR18+13),            R(NR4 + 1),         PARACHT
     2 R(NR13+14), R(NR13+15),R(NR13+16),R(NR13+17),R(NR13+18),         DPLYMNT
     3 R(NR13+19), R(NR13+13),R(NR13+74),R(NR13+75),R(NR13+76),
     4 R(NR13+77), R(NR13+76),R(NR13+77),R(NR13+76),R(NR13+77),
     5 R(NR13+76), R(NR13+77),            R(NR13+12),R(NR13+77))
C  ROLL MCTCR,PITCH MOTOR,AND YAW MOTOR FORCES AND MOMENTS.
      CALL CNTRLS(R)
C  COMPUTE RECOV CHUTE FORCES AND MOMENTS
      CALL CHUTES(R(24),R(25),R(26),R(Y+23),R(Y+24),R(Y+25),R(Y+26),     RECOV
     1 R(Y+14),R(Y+27),R(Y+12),R(Y+13),R(Y+6),R(Y+7),R(Y+8),R(Y),       CHUTE
     2 R(Y+1),R(Y+2),FPS,R(Y+9),R(Y+10),R(Y+11),R(Y+3),R(Y+4),R(Y+5),
     3 R(Y+19),R(Y+15),R(Y+16),R(Y+17),R(Y+18),R(Y+28),R(Y+29),
     4 R(Y+30),R(Y+20),R(Y+31),R(Y+32),R(Y+33),R(Y+34),R(Y+35),R(Y+36),
     5 R(Y+21),
     6 R(I+24),R(I+25),R(I+26),R(I+27),R(I+28),R(I+29),R(J+1),R(K+33),
     7 R(J+44),R(J+45),R(L)/32.17,R(J+26),FXPSO,FYPSO,FZPSO,FPSO,
     8 R(L+1),R(L+2),R(L+3),A,B,C,D,R(J+15),R(K+37),R(K+38),R(K+39),
     9 R(K+34),R(K+35),R(K+36),R(W+21),R(W+22),R(W+23),
     1 R(J+12),R(I+1),R(I+2),R(I+3),R(I+7),R(I+8),R(I+9),R(I+4),R(I+5),
     2 R(I+6),                 R(L+4),R(L+5),R(L+6),R(I+10),R(I+11),
     3 R(I+12),R(I+13),R(I+14),R(I+15),R(J+9),R(J+10),R(J+11),R(L+7),
     4 R(L+8),R(L+20),R(L+9),R(L+10),R(L+11),R(L+21),R(L+12),R(L+13),
     5 R(L+14),R(L+15),R(L+16),R(L+17),R(L+18),R(L+19),R(K+10),DX1,
     6 DY1,DZ1,DX2,DY2,DZ2,DX3,DY3,DZ3,DX4,DY4,DZ4,R(L+1),R(L+2),
     7 R(L+3),ERRDC,1,R(L+22),R(L+23),R(L+24),R(L+25),R(L+26),R(L+27))
      R(27) = R(NR3+24)
      R(28) = R(NR3+25)
      R(29) = R(NR3+26)
C  COMPUTE CRAG CHUTE FORCES AND MOMENTS
      CALL CHUTES(R(18),R(19),R(20),R(X+23),R(X+24),R(X+25),R(X+26),     DRAG
     1 R(X+14),R(X+27),R(X+12),R(X+13),R(X+6),R(X+7),R(X+8),R(X),       CHUTE
```

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      2 R(X+1),R(X+2),R(X+35),R(X+9),R(X+10),R(X+11),R(X+3),R(X+4),
      3 R(X+5),R(X+19),R(X+15),R(X+16),R(X+17),R(X+18),R(X+28),R(X+29),
      4 R(X+30),R(X+20),R(X+43),R(X+44),R(X+45),R(X+46),R(X+47),R(X+48),
      5 R(X+21),
      6 R(I+18),R(I+19),R(I+20),R(I+21),R(I+22),R(I+23),R(J+1),R(K+13),
      7 R(J+46),R(J+47),R(M)/32.17 ,R(J+26),R(X+31),R(X+32),R(X+33),
      8 R(X+34),R(X+36),R(X+37),R(X+38),R(X+39),R(X+40),R(X+41),R(X+42),
      9 R(J+15),R(K+17),R(K+18),R(K+19),R(K+14),R(K+15),R(K+16),R(W+7),
      1 R(W+8),R(W+9),                R(J+12),R(I+1),R(I+2),R(I+3),R(I+7),
      2 R(I+8),R(I+9),R(I+4),R(I+5),R(I+6),                    R(M+4),R(M+5),
      3 R(M+6),R(I+10),R(I+11),R(I+12),R(I+13),R(I+14),R(I+15),R(J+9),
      4 R(J+10),R(J+11),R(M+7),R(M+8),R(M+20),R(M+9),R(M+10),R(M+11),
      5 R(M+21),R(M+12),R(M+13),R(M+14),R(M+15),R(M+16),R(M+17),R(M+18),
      6 R(M+19),R(K+10),R(M+22),R(M+23),R(M+24),R(M+25),R(M+26),R(M+27),
      7 R(M+28),R(M+29),R(M+30),R(M+31),R(M+32),R(M+33),R(M+1),
      8 R(M+2),R(M+3),R(M+34),IFIX(R(M+35)+.001),R(M+36),R(M+37),R(M+38),
      9 R(M+39),R(M+40),R(M+41))
       R(21) = R(NR3+18)
       R(22) = R(NR3+19)
       R(23) = R(NR3+20)
C   SUMMATION OF NON-AERODYNAMIC FORCES AND MOMENTS
       A=R(NR13+11)
       B=R(NR13+31)
       R(NR4+30) = R(NR18) + R(NR18+7)*A+R(NR18+14)
      1 + R(NR18+21)*B + R(NR18+34) + R(NR18+41) + R(NR27+6)
      2 + R(NR19) + R(NR20)+R(NR18+54) + R(NR18+61)
       R(NR4+31) = R(NR18+1)+A*R(NR18+8)+R(NR18+15)
      1 + R(NR18+22)*B + R(NR18+35) + R(NR18+42) + R(NR27+7)
      2 + R(NR19+1) + R(NR20+1)+ R(NR18+55) + R(NR18+62)
       R(NR4+32) = R(NR18+2)+A*R(NR18+9)+R(NR18+16)
      1 + R(NR18+23)*B + R(NR18+36) + R(NR18+43) + R(NR27+8)
      2 + R(NR19+2) + R(NR20+2)+ R(NR18+56) + R(NR18+63)
       R(NR4+33) = R(NR18+3)+A*R(NR18+10)+R(NR18+17)
      1 + R(NR18+24)*B + R(NR18+38) + R(NR18+45) + R(NR27+9)
      2 + R(NR19+3) + R(NR20+3)+ R(NR18+58) + R(NR18+65)
       R(NR4+34) = R(NR18+4)+A*R(NR18+11)+R(NR18+18)
      1 + R(NR18+25)*B + R(NR18+39) + R(NR18+46) + R(NR27+10)
      2 + R(NR19+4) + R(NR20+4)+ R(NR18+59) + R(NR18+66)
       R(NR4+35) = R(NR18+5)+A*R(NR18+12)+R(NR18+19)
      1 + R(NR18+26)*B + R(NR18+40) + R(NR18+47) + R(NR27+11)
      2 + R(NR19+5) + R(NR20+5)+ R(NR18+60) + R(NR18+67)
       CALL ANGMHO(R(NR4+27),R(NR4+28),R(NR4+29),R(NR16+1),R(NR16+2),
      1 R(NR16+3),R(NR16+4),R(NR16+5),R(NR16+6),R(NR3+4),R(NR3+5),
      2 R(NR3+6))
       CALL FRCMOM(R(NR4+36),R(NR4+37),R(NR4+38),R(NR4+39),R(NR4+40),
      1 R(NR4+41), R(NR17+3) ,R(NR17+1) ,R(NR17+2) ,R(NR17+5) ,R(NR17)
      2 ,R(NR17+4) , R(NR4+13), R(NR16+13),R(NR16+14),R(NR16+15),
      3 R(NR4+30),R(NR4+31), R(NR4+32), R(NR4+33), R(NR4+34),R(NR4+35) )
       CALL ACCELO(R(1),R(2),R(3),R(4),R(5),R(6),R(NR4+18),R(NR4+19),
      1 R(NR4+20),R(NR3+4),R(NR3+5),R(NR3+6),R(NR3+1),R(NR3+2),R(NR3+3),
      2 R(NR4+9),R(NR4+10),R(NR4+11), R(NR4+36),R(NR4+37), R(NR4+38),
      3 R(NR16), R(NR4+39), R(NR4+40), R(NR4+41), R(NR16+1), R(NR16+2),
      4 R(NR16+3),R(NR16+4),R(NR16+5), R(NR16+6), R(NR4+27),R(NR4+28),
      5 R(NR4+29), R(NR16+7), R(NR16+8), R(NR16+9), 0.        , 0.       ,
      6  0.     , 0.      , 0.        )
       CALL SPINE(R(16),R(NR3+16),R(NR3+17),R(NR4+11),
      1 R(NR4+20),R(NR16+51),R(NR16+52))
       R(17) = R(NR3+16)
       RETURN
       END
```

```
      SUBROUTINE CONTRL(R)
C       T4SAC6
C     IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C     JIM LACY, AERODYNAMICS ENGINEER
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      NGO = IFIX(R(NR26+39) + .001)
      GO TO(1,2,3,4,5,6,7,8,9),NGO
C     CALCULATION OF TOOOR FOR SETTING OR TO ZERO TO SIMULATE LOSS
C     OF RIGHT WING.
    2 R(NR25+10) = -R(NR4+64)*R(NR26+6)/2.0
      RETURN
C     UHT RESPONSE TO A COMMANDED POSITION.
    3 R(NR25+23) = LAG1(R(NR26+41),R(NR26+40),R(NR26+42),
     1 R(NR4+1),R(NR26+43))
      RETURN
C     RIGHT AND LEFT AILERON RESPONSE TO A COMMANDED POSITION.
    4 R(NR25+20) = LAG1(R(NR26+44),0.,R(NR26+45),R(NR4+1),R(NR26+46))
      R(NR25+21) = -R(NR25+20)
      RETURN
C     WING AND NOSE FAN THRUST RESPONSE TO ENGINE FAILURE.
    5 R(NR25+10) = LAG1(R(NR26+49),R(NR26+47),R(NR26+51),
     1 R(NR4+1),R(NR26+52))
      R(NR25+11) = R(NR25+10)
      R(NR25+12) = LAG1(R(NR26+50),R(NR26+48),R(NR26+53),
     1 R(NR4+1),R(NR26+54))
      R(NR25+16) = LAG1(R(NR26+57),R(NR26+56),R(NR26+58),
     1 R(NR4+1),R(NR26+59))
      R(NR25+17) = LAG1(R(NR26+55),R(NR26+56),R(NR26+58),
     1 R(NR4+1),R(NR26+59))
      R(NR25+18) = LAG1(R(NR26+61),R(NR26+60),R(NR26+62),
     1 R(NR4+1),R(NR26+63))
      R(NR25+19) = LAG1(R(NR26+64),R(NR26+60),R(NR26+62),
     1 R(NR4+1),R(NR26+63))
      RETURN
C     BETA VECTOR, BETA STAGGER, AND WING FAN THRUST RESPONSE TO FAN
C     STRUCTURAL FAILURE(RIGHT FAN)
    6 R(NR25+10) = LAG1(R(NR26+49),R(NR26+47),R(NR26+51),
     1 R(NR4+1),R(NR26+52))
      R(NR25+16) = LAG1(R(NR26+57),R(NR26+56),R(NR26+58),
     1 R(NR4+1),R(NR26+59))
      R(NR25+18) = LAG1(R(NR26+61),R(NR26+60),R(NR26+62),
     1 R(NR4+1),R(NR26+63))
      RETURN
C     PITCH FAN BUCKET RESPONSE TO A COMMANDED POSITION.
    7 R(NR25+29) = LAG1(R(NR26+66),R(NR26+65),R(NR26+67),
     1 R(NR4+1),R(NR26+68))
      RETURN
C     BETA VECTOR RESPONSE TO VECTOR ACTUATER FAILURE.
    8 R(NR25+16) = LAG1(R(NR26+57),R(NR26+56),R(NR26+58),
     1 R(NR4+1),R(NR26+59))
      R(NR25+17) = LAG1(R(NR26+55),R(NR26+56),R(NR26+58),
     1 R(NR4+1),R(NR26+59))
      RETURN
C     BETA STAGGER RESPONSE TO VECTOR ACTUATER FAILURE.
    9 R(NR25+18) = LAG1(R(NR26+61),R(NR26+60),R(NR26+62),
     1 R(NR4+1),R(NR26+63))
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      R(NR25+19) = LAG1(R(NR26+64),R(NR26+60),R(NR26+62),
     1 R(NR4+1),R(NR26+63))
    1 RETURN
      END
```

```
      SUBROUTINE INITC(R)
C     T45A07
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
32004 FORMAT(1H0//10X42HBEGINNING OF COMBINED SEAT-MAN TRAJECTORY.//)
C  SUBROUTINE FOR COMPUTING AIRPLANE,SEAT,AND PARACHUTE INITIAL
C  CONDITIONS.
C
      WRITE(6,32004)
C  SET UP FLAG FOR STAGING INFORMATION.
      R(NR4+42) = 0.
C  SET UP FLAG FOR PARACHUTE EJECTION AND LINE STRETCH.
      R(NR4+44) = -1.0
      R(NR4+45) = -1.0
      R(NR4+46) = -1.0
      R(NR4+47) = -1.0
C  FLAGS FOR PITCH MOTORS.
      R(NR13+145) = -1.0
      R(NR13+146) = -1.0
C  FLAG FOR CATAPULT FIRING AND STROKE.
      R(NR4+14) = -1.0
C  ZERO INITIAL SPINAL COMPRESSION RATE AND DEFLECTION
      R(N+16) = 0.
      R(N+17) = 0.
C  ZERO INITIAL PROPELLANT WFB BURNED FOR CATAPULT
      R(N+45) = 0.
C  SUPPRESS THE PITCH MOTORS, WHICH WILL BE INITIATED
C  AUTOMATICALLY BY SPECIFIED PITCH RATES.
C
C  MOTOR OPPOSING PITCH-UP.
      R(NR13+96) = 1000.
C
C  MOTOR OPPOSING PITCH-DOWN.
      R(NR13+112) = 1000.
C
C  INITIALIZE RAIL TRIP SWITCH ACTUATION TIME TO PREVENT SEAT-MAN
C  SEPARATION INITIATION UNTIL SET AUTOMATICALLY BY SEAT CONTACT
      R(NR4+126) = 1000.
C  AIRPLANE DIRECTION COSINES WITH RESPECT TO THE EARTH.
      CALL DIRCOS(R(N+39),R(N+40),R(N+41),R(N+42),R(N+43),
     1 R(N+44),R(NR4+60),R(NR4+61),R(NR4+62),R(NR4+92),
     2 R(NR4+93),R(NR4+94),SINPSI,COSPSI,SINTHE,COSTHE,
     3 SINPHI,COSPHI)
C  CATAPULT DIRECTION COSINES WITH RESPECT TO THE AIRPLANE.
      CALL DIRCOS(R(NR21+3),R(NR21+4),R(NR21+5),R(NR21+6),R(NR21+7),
     1 R(NR21+8),R(NR21+9),R(NR21+10),R(NR21+11),R(NR21+21),R(NR21+22),
     2 R(NR21+23),SINPSI,COSPSI,SINTHE,COSTHE,SINPHI,COSPHI)
C  SEAT DIRECTION COSINES WITH RESPECT TO THE CATAPULT.
      CALL DIRCOS(R(NR21+12),R(NR21+13),R(NR21+14),R(NR21+15),R(NR21+16)
     1,R(NR21+17),R(NR21+18),R(NR21+19),R(NR21+20),R(NR21+24),R(NR21+25)
     2 ,R(NR21+26),SINPSI,COSPSI,SINTHE,COSTHE,SINPHI,COSPHI)
C  SEAT DIRECTION COSINES WITH RESPECT  TO THE AIRPLANE.
      CALL MPYMAT(R(NR4+48),R(NR4+49),R(NR4+50),R(NR4+51),R(NR4+52),
     1 R(NR4+53),R(NR4+54),R(NR4+55),R(NR4+56),
     2 R(NR21+3),R(NR21+4),R(NR21+5),R(NR21+6),R(NR21+7),R(NR21+8),
     3 R(NR21+9),R(NR21+10),R(NR21+11),
     4 R(NR21+12),R(NR21+13),R(NR21+14),R(NR21+15),R(NR21+16),R(NR21+17)
     5,R(NR21+18),R(NR21+19),R(NR21+20) )
C  SEAT DIRECTION COSINES WITH RESPECT TO THE EARTH.
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      CALL MPYMAT(R(N+10),R(N+11),R(N+12),R(N+13),R(N+14),R(N+15),
     1 R(NR4+9),R(NR4+10),R(NR4+11),
     2 R(N+39),R(N+40),R(N+41),R(N+42),R(N+43),R(N+44),
     3 R(NR4+60),R(NR4+61),R(NR4+62),
     4 R(NR4+48),R(NR4+49),R(NR4+50),R(NR4+51),R(NR4+52),R(NR4+53),
     5 R(NR4+54),R(NR4+55),R(NR4+56))
C  SEAT EULER ANGLES WITH RESPECT TO THE EARTH.
      CALL COSDIR(R(NR4+6),R(NR4+7),R(NR4+8),
     1 R(N+10),R(N+11),R(N+12),R(N+13),R(N+14),R(N+15),
     2 R(NR4+9),R(NR4+10),R(NR4+11) )
C  SEAT POSITION, EARTH AXIS SYSTEM.
      CALL MPYMAT (AEC11, AEC12, AEC13, AEC21, AEC22, AEC23, AEC31,
     1 AEC32, AEC33, R(NR1+39), R(NR1+40), R(NR1+41), R(NR1+42),
     2 R(NR1+43), R(NR1+44), R(NR4+60), R(NR4+61), R(NR4+62), R(NR21+3),
     3 R(NR21+4), R(NR21+5), R(NR21+6), R(NR21+7), R(NR21+8), R(NR21+9),
     4 R(NR21+10), R(NR21+11) )
C  INITIAL RAIL POSITION OF SEAT IF RAILS SHORTED OUT
      R(NR27+18) = 0.
      R(NR27+19) = 0.
      R(NR27+20) = R(NR21+32)
C  FLAG FOR SEAT TIPOFF IF RAILS SHORTED OUT
      R(NR4+43) = 1.
C  CHECK FOR RAILS SHORTED
      IF(R(NR21+58))20,20,10
   10 CONTINUE
C  INITIAL SEAT POSITION IN A/P AXIS SYSTEM FOR ZERO LOAD FACTOR.
C  GEOMETRIC CONSIDERATIONS ONLY.
      CALL MPYVEC(R(NR21+27),R(NR21+28),R(NR21+29),-R(NR21+33),
     1 -R(NR21+34),-R(NR21+35), R(NR4+48),R(NR4+49),R(NR4+50),R(NR4+51),
     2 R(NR4+52),R(NR4+53),R(NR4+54),R(NR4+55),R(NR4+56))
      R(NR21+27) = R(NR21+27)+R(NR21+61)+ R(NR4+50)* R(NR21+32)
      R(NR21+28) = R(NR21+28)+R(NR21+62)+ R(NR4+53)* R(NR21+32)
      R(NR21+29) = R(NR21+29)+R(NR21+63)+ R(NR4+56)* R(NR21+32)
C  CALCULATION OF LOAD FACTORS AT COCKPIT.
      CALL LDFCTR(R(NR4+57),R(NR4+58),R(NR4+59),R(NR4+67),R(NR4+68),
     1 R(NR4+69),R(NR21+27),R(NR21+28),R(NR21+29),R(33),R(34),R(35),
     2 R(NR3+33),R(NR3+34),R(NR3+35))
C  DCS * NXYZ
      CALL MPYVEC( XTMP, YTMP,ZTMP, R(NR4+57), R(NR4+58), R(NR4+59),
     1 R(NR21+12), R(NR21+13), R(NR21+14), R(NR21+15), R(NR21+16),
     2 R(NR21+17), R(NR21+18), R(NR21+19), R(NR21+20) )
C RAIL DEFLECTION OF BOTTOM RIGHT BLOCK FOR COMPUTED LOAD FACTORS
      R(NR27+18) = XTMP / R(NR21+58) * R(NR16) / 6.
      R(NR27+19) = YTMP / R(NR21+59) * R(NR16) / 6.
      R(NR27+20) = ZTMP / R(NR21+60) * R(NR16) / 6. + R(NR21+32)
C  FLAG FOR SEAT TIPOFF IF RAILS NOT SHORTED
      R(NR4+43) = -1.0
   20 CONTINUE
C  EARTH AXIS COORDINATES OF SEAT WITH RAILS DEFLECTED TO
C  GIVE COMPUTED LOAD FACTORS
      CALL POSXYZ (XS,YS,ZS,R(NR1+36),R(NR1+37),R(NR1+38),R(NR27+18),
     1 R(NR27+19),R(NR27+20),AEC11, AEC12, AEC13, AEC21, AEC22, AEC23,
     2 AEC31, AEC32, AEC33 )
      CALL POSXYZ (XTMP, YTMP, ZTMP, XS, YS, ZS, -R(NR21+33),
     1 -R(NR21+34), -R(NR21+35), R(NR1+10), R(NR1+11), R(NR1+12),
     2 R(NR1+13), R(NR1+14), R(NR1+15), R(NR4+9), R(NR4+10), R(NR4+11) )
      CALL POSXYZ (R(NR1+7), R(NR1+8), R(NR1+9), XTMP, YTMP, ZTMP,
     1 R(NR21+61), R(NR21+62), R(NR21+63), R(NR1+39), R(NR1+40),
     2 R(NR1+41), R(NR1+42), R(NR1+43), R(NR1+44), R(NR4+60), R(NR4+61),
     3 R(NR4+62) )
C  INITIAL DISTANCE FROM AIRPLANE CG TO SEAT CG IN AIRPLANE AXIS SYSTEM
      CALL MPYVEC(R(NR21+27),R(NR21+28),R(NR21+29),R(N+7)-R(N+36),
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     1 R(N+8)-R(N+37),R(N+9)-R(N+38),R(N+39),R(N+42),R(NR4+60),R(N+40),
     2 R(N+43),R(NR4+61),R(N+41),R(N+44),R(NR4+62))
C  SEAT BODY AXIS ANGULAR RATE COMPONENTS.
      CALL POSXYZ(R(N+4),R(N+5),R(N+6),0.,0.,0.,R(N+33),R(N+34),R(N+35),
     1 R(NR4+48),R(NR4+49),R(NR4+50),R(NR4+51),R(NR4+52),R(NR4+53),
     2 R(NR4+54),R(NR4+55),R(NR4+56))
C  SEAT BODY AXIS LINEAR VELOCITY COMPONENTS.
      CALL VELXYZ(USA,VSA,WSA,R(N+30),R(N+31),R(N+32),R(NR21+27),
     1 R(NR21+28),R(NR21+29),R(N+33),R(N+34),R(N+35))
      CALL POSXYZ(R(N+1),R(N+2),R(N+3),0.,0.,0.,USA,VSA,WSA,R(NR4+48),
     1 R(NR4+49),R(NR4+50),R(NR4+51),R(NR4+52),R(NR4+53),R(NR4+54),
     2 R(NR4+55),R(NR4+56))
C  DRAG CHUTE EARTH AXIS VELOCITY COMPONENTS.
      CALL VELXYZ(UPDC,VPDC,WPDC,R(N+1),R(N+2),R(N+3),R(NR13+17),
     1 R(NR13+18),R(NR13+19),R(N+4),R(N+5),R(N+6))
      CALL POSXYZ(R(N+18),R(N+19),R(N+20),0.,0.,0.,UPDC,VPDC,WPDC,
     1 R(N+10),R(N+11),R(N+12),R(N+13),R(N+14),R(N+15),R(NR4+9),
     2 R(NR4+10),R(NR4+11))
C  DRAG CHUTE EARTH AXIS POSITION COMPONENTS.
      CALL POSXYZ(R(N+21),R(N+22),R(N+23),R(N+7),R(N+8),R(N+9),
     1 R(NR13+17),R(NR13+18),R(NR13+19),R(N+10),R(N+11),R(N+12),
     2 R(N+13),R(N+14),R(N+15),R(NR4+9),R(NR4+10),R(NR4+11))
C  RECOVERY CHUTE EARTH AXIS VELOCITY COMPONENTS.
      CALL VELXYZ(UPRC,VPRC,WPRC,R(N+1),R(N+2),R(N+3),R(NR13+37),
     1 R(NR13+38),R(NR13+39),R(N+4),R(N+5),R(N+6))
      CALL POSXYZ(R(N+24),R(N+25),R(N+26),0.,0.,0.,UPRC,VPRC,WPRC,
     1 R(N+10),R(N+11),R(N+12),R(N+13),R(N+14),R(N+15),R(NR4+9),
     2 R(NR4+10),R(NR4+11))
C  RECOVERY CHUTE EARTH AXIS POSITION COMPONENTS.
      CALL POSXYZ(R(N+27),R(N+28),R(N+29),R(N+7),R(N+8),R(N+9),
     1 R(NR13+37),R(NR13+38),R(NR13+39),R(N+10),R(N+11),R(N+12),
     2 R(N+13),R(N+14),R(N+15),R(NR4+9),R(NR4+10),R(NR4+11))
      RETURN
      END

      SUBROUTINE AIRPLN(R)
C      I4SAC8
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANOR ROCH, AERODYNAMICS ENGINEER
C  JIM LACY, AERODYNAMICS ENGINEER
C  EDDIE SMART, AERODYNAMICS ENGINEER
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      INTEGER E,F
      EQUIVALENCE (NR22,I),(NR23,J),(NR24,K),(NR25,L),(NR26,M),(NR4,F),
     1 (NR3,E)
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+38))
      CALL CCRATE(R(39),R(40),R(41),R(42),R(43),R(44),R(NR3+33),
     1 R(NR3+34),R(NR3+35),R(NR4+92),R(NR4+93),R(NR4+94),R(NR3+39),
     2 R(NR3+40),R(NR3+41),R(NR3+42),R(NR3+43),R(NR3+44),R(NR4+60),
     3 R(NR4+61),R(NR4+62))
      CALL VELAIR(R(36),R(37),R(38),R(NR4+65),R(NR4+66),
     1 R(NR4+63),R(NR4+64),R(NR3+39),R(NR3+40),R(NR3+41),
     2 R(NR3+42),R(NR3+43),R(NR3+44),R(NR4+60),R(NR4+61),
     3 R(NR4+62),R(NR3+30),R(NR3+31),R(NR3+32),R(NR4+26))
      CALL CONTRL(R)
      CALL COEFWF(R(K),R(K+1),R(K+2),R(K+3),R(K+4),R(K+5),R(K+6),R(K+7),
     1 R(K+8),R(L+27),R(K+9),R(K+10),R(K+11),R(K+12),R(K+13),R(L+3),
     2 R(L+13),R(L),R(L+7),R(L+28),
     3 R(L+16),R(L+18),R(L+10),R(F+64),R(M+6),R(M+8),R(J+66),R(E+30),
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4 R(E+32),R(E+33),R(E+35),R(I+106),R(I+107),R(I+108),R(I+109),
A R(I+110),R(J+76),R(J+77),R(I+111),R(I+112),R(I+113),R(I+114),
B R(J+71),R(J+72),R(J+73),                              R(NR4+26),
5 R(I),R(I+1),R(I+2),R(I+3),R(I+5),R(I+6),R(I+7),R(I+8),R(I+10),
6 R(I+11),R(I+12),R(I+13),R(I+15),R(I+16),R(I+17),R(I+18),R(I+20),
7 R(I+21),R(I+22),R(I+23),R(I+25),R(I+26),R(I+27),R(I+28),R(I+30),
8 R(I+31),R(I+32),R(I+33),R(I+36),R(I+37),R(I+40),R(I+41),R(I+42),
9 R(I+43),R(I+45),R(I+46),R(I+47),R(I+48),R(I+50),R(I+51),R(I+52),
1 R(I+53),R(I+55),R(I+56),R(I+57),R(I+58),R(I+60),R(I+61),R(I+62),
2 R(I+63),R(I+65),R(I+66),R(I+67),R(I+68),R(I+70),R(I+71),R(I+72),
3 R(I+73),R(I+75),R(I+76),R(I+77),R(I+78),R(I+80),R(I+81),R(I+82),
4 R(I+83),R(I+85),R(I+86),R(I+87),R(I+88),R(I+90),R(I+91),R(I+92),
5 R(I+93),R(I+95),R(I+96),R(I+97),R(I+98),R(I+100),R(I+101),
6 R(I+102),R(I+103),R(I+105),R(I+117),R(I+115),R(I+116),R(I+38))
 CALL COEFWF(R(K+14),R(K+15),R(K+16),R(K+17),R(K+18),R(K+19),
1 R(K+20),R(K+21),R(K+22),R(L+27),R(K+23),R(K+24),R(K+25),R(K+26),
2 R(K+27),R(L+4),R(L+14),R(L+1),R(L+8),R(L+28),
3 R(L+17),R(L+19),R(L+11),R(F+64),R(M+6),-R(M+8),R(J+66),R(E+30),
4 R(E+32),R(E+33),R(E+35),R(I+106),R(I+107),R(I+108),R(I+109),
5 R(I+110),R(J+76),R(J+77),R(I+111),R(I+112),R(I+113),R(I+114),
A R(J+71),R(J+72),R(J+73),                              R(NR4+26),
6 R(I),R(I+1),R(I+2),R(I+3),R(I+5),R(I+6),R(I+7),R(I+8),R(I+10),
7 R(I+11),R(I+12),R(I+13),R(I+15),R(I+16),R(I+17),R(I+18),R(I+20),
8 R(I+21),R(I+22),R(I+23),R(I+25),R(I+26),R(I+27),R(I+28),R(I+30),
9 R(I+31),R(I+32),R(I+33),R(I+36),R(I+37),R(I+40),R(I+41),R(I+42),
1 R(I+43),R(I+45),R(I+46),R(I+47),R(I+48),R(I+50),R(I+51),R(I+52),
2 R(I+53),R(I+55),R(I+56),R(I+57),R(I+58),R(I+60),R(I+61),R(I+62),
3 R(I+63),R(I+65),R(I+66),R(I+67),R(I+68),R(I+70),R(I+71),R(I+72),
4 R(I+73),R(I+75),R(I+76),R(I+77),R(I+78),R(I+80),R(I+81),R(I+82),
5 R(I+83),R(I+85),R(I+86),R(I+87),R(I+88),R(I+90),R(I+91),R(I+92),
6 R(I+93),R(I+95),R(I+96),R(I+97),R(I+98),R(I+100),R(I+101),
7 R(I+102),R(I+103),R(I+105),R(I+117),R(I+115),R(I+116),R(I+38))
 CALL            COEFSM (R(K+28),R(K+29),R(K+30),R(K+31),R(K+32),
1 R(K+33),R(K+34),R(K+36),R(K+37),R(K+38),R(L+25),R(L+2),R(L+9),
2 R(F+65),R(K+82),R(K+83),R(L+26),R(L+15),
3 R(J),R(J+1),R(J+2),R(J+5),R(J+6),R(J+7),R(J+10),
4 R(J+11),R(J+12),R(J+15),R(J+16),R(J+17),R(J+20),
5 R(J+21),R(J+22),R(J+23),R(J+25),R(J+26),R(J+27),R(J+28),R(J+30),
6 R(J+31),R(J+32),R(J+33),R(J+35),R(J+36),R(J+37),R(J+40),R(J+41),
7 R(J+42),R(J+46),R(J+47),R(J+50),R(J+51),R(J+52),R(J+53),R(J+55),
8 R(J+56),R(J+57),R(J+58),R(J+60),R(J+61),R(J+62),R(J+63),R(J+67),
9 R(J+68),R(J+69),R(L+5),R(L+6),R(J+65),R(L+12),R(M+9),R(F+64),
1 R(E+32),R(E+30),R(J+66),R(E+34),R(M+10) ,R(L)  ,R(L+1) ,
2 R(L+7), R(L+8),R(J+38))
 CALL            VSTLFM ( R(F+98),R(F+99),R(F+100),R(F+95),R(F+96),
1 R(F+97),R(F+66),R(K+84),R(K+85),R(K+86),R(K+87),R(K+88),R(K+89),
2 R(K+90),R(K+91),R(K+92),R(K+93),R(K+94),R(K+95),
3 R(M+6),R(F+64),R(L+12),R(M+9),R(J+66),R(E+32),R(E+30),R(E+33),
4 R(M+8 ),R(E+35),R(M+10),R(E+34),R(J+70),R(E+31),R(K+33),R(L+23),
5 R(K+34),R(K+40),R(L+24),R(K+41),R(K+42),R(K),R(K+1),R(K+2),R(K+3)
6,R(K+14),R(K+15),R(K+16),R(K+17),R(M+3),R(M),R(K+4),R(K+5),R(K+6),
7 R(K+7),R(K+18),R(K+19),R(K+20),R(K+21),R(K+43),R(K+29),R(K+30),
8 R(K+96),R(M+13),R(K+44),R(K+31),R(K+45),R(L+21),R(L+20),R(K+46),
9 R(L+22),R(K+47),R(F+26),R(F+63),R(K+48),R(K+49),R(M+1),
1 R(K+50),R(M+2),R(K+51),R(K+52),R(K+28),R(K+53),R(K+54),R(K+36),
2 R(K+8),R(K+9),R(K+10),R(K+11),R(K+22),R(K+23),R(K+24),R(K+25),
3 R(K+32),R(K+55),R(K+56),R(K+57),R(K+58),R(K+59),R(K+60),R(M+7),
4 R(K+61),R(M+4),R(M+5),R(K+62),R(M+12),R(M+11),R(K+63),R(K+64),
5 R(K+37),R(K+38),R(K+33),R(K+65),R(K+66),R(K+67),R(K+68),R(K+69),
6 R(K+70),R(K+71),R(F+65),R(L),R(L+1),R(L+9),R(L+25),R(L+2) ,
7 R(K+82),R(K+83),R(L+29),R(J+78),R(J+79),R(J+80),R(J+82),R(J+83),
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8 R(J+84) )
  CALL              ACCOEF( R(F+101),R(F+102),R(F+103),R(F+104),
1 R(F+105),R(F+106),R(F+107),R(F+108),R(F+109),R(F+110),
2 R(K+72),R(K+73),R(K+74),R(K+75),R(K+76),R(K+77),R(K+78),R(K+79),
3 R(K+80),R(K+81),R(F+26),R(M),R(M+2),R(M+1) )
  CALL              ANGMOM( R(F+70),R(F+71),R(F+72),R(M+14),R(M+15),
1 R(M+16),R(M+17),R(E+33),R(E+34),R(E+35),R(M+18),R(M+19),R(M+20),
2 R(M+21),R(M+22),R(M+23),R(M+24),R(M+25),R(M+26),R(M+27),R(M+28),
3 R(M+29),R(M+30) )
C  NON-AERODYNAMIC FORCES AND MOMENTS
   R(NR4+73) = R(NR27+12) + R(NR18+48)
   R(NR4+74) = R(NR27+13) + R(NR18+49)
   R(NR4+75) = R(NR27+14) + R(NR18+50)
   R(NR4+76) = R(NR27+15) + R(NR18+51)
   R(NR4+77) = R(NR27+16) + R(NR18+52)
   R(NR4+78) = R(NR27+17) + R(NR18+53)
C  ALL FORCES AND MOMENTS
   R(NR4+79) = R(NR4+73) + R(NR4+95)
   R(NR4+80) = R(NR4+74) + R(NR4+96)
   R(NR4+81) = R(NR4+75) + R(NR4+97)
   R(NR4+82) = R(NR4+76) + R(NR4+98)
   R(NR4+83) = R(NR4+77) + R(NR4+99)
   R(NR4+84) = R(NR4+78) + R(NR4+100)
   CALL              ACCEL( R(30),R(31),R(32),R(33),R(34),R(35),R(F+67)
  1,R(F+68),R(F+69),R(E+33),R(E+34),R(E+35),R(E+30),R(E+31),R(E+32),
  2 R(F+60),R(F+61),R(F+62),R(F+79),R(F+80),R(F+110),R(F+81),R(F+109)
  3,R(M+31),R(F+82),R(F+105),R(F+106),R(F+103),R(F+83),R(F+102),
  4 R(F+101),R(F+84),R(F+108),R(F+107),R(F+104),R(M+14),R(M+15),
  5 R(M+16),R(M+17),R(F+70),R(F+71),R(F+72),R(M+32),R(M+33),R(M+34),
  6 R(M+35),R(M+18),R(M+21),R(M+22) )
   IF (R(NR26+36))1,2,2
 1 DO 10 KK=30,35
10 R(KK) = 0.
 2 IF(R(NR26+37)) 3,4,4
 3 DO 30 KK=39,44
30 R(KK)=0.
 4 IF(R(NR26 + 38)) 5,6,6
 5 DO 50 KK=36,38
50 R(KK) = 0.
 6 CONTINUE
   RETURN
   END


   SUBROUTINE RAILFM
  X(/BX/,/BY/,/BZ/,/DPHIC/,/DTHETC/,/DPSIC/,/DFXSC/,/DFYSC/,/DFZSC
  X/,/DTXSC/,/DTYSC/,/DTZSC/,/DFXAC/,/DFYAC/,/DFZAC/,/DTXAC
  X/,/DTYAC/,/DTZAC/,/AES11/,/AES12/,/AES13/,/AES21/,/AES22
  X/,/AES23/,/AES31/,/AES32/,/AES33/,/CS11/,/CS12/,/CS13/,/CS21
  X/,/CS22/,/CS23/,/CS31/,/CS32/,/CS33/,/AEA11/,/AEA12/,/AEA13
  X/,/AEA21/,/AEA22/,/AEA23/,/AEA31/,/AEA32/,/AEA33/,/DAC11
  X/,/DAC12/,/DAC13/,/DAC21/,/DAC22/,/DAC23/,/DAC31/,/DAC32
  X/,/DAC33/,/XS/,/YS/,/ZS/,/XA/,/YA/,/ZA/,/ZSBR03/,/ZSBR02
  X/,/ZSBR01/,/DXSB1/,/DYSB1/,/DZSB1/,/DXSB2/,/DYSB2/,/DZSB2
  X/,/DXSB3/,/DYSB3/,/DZSB3/,/DXSB4/,/DYSB4/,/DZSB4/,/DXSB5
  X/,/DYSB5/,/DZSB5/,/DXSB6/,/DYSB6/,/DZSB6/,/GX/,/GY/,/UP/,/WR
  X/,/RL/,/BF/,/GZ/,/SX/,/SY/,/SZ/,/XARO1/,/YARO1/,/ZARO1/,/FLAGC
  X/,/XARO2/,/YARO2/,/ZARO2/,/TOC/,/T/,/DXSBR1/,/DYSBR1/,/DZSBR1
  X/,/DXSBR2/,/DYSBR2/,/DZSBR2/,/DXSBR3/,/DYSBR3/,/DZSBR3/,/DXSBR4
  X/,/DYSBR4/,/DZSBR4/,/DXSBR5/,/DYSBR5/,/DZSBR5/,/DXSBR6/,/DYSBR6
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      X/,/DZSBR6/,/P/,/Q/,/R/)
C        T4SA09
C     FORCES AND MOMENTS ON THE AIRPLANE AND SEAT FROM RAIL ELASTICITY AND
C     RAIL TO SLIDER BLOCK FRICTION FORCES.
C     IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C     EDDIE SMART, AERODYNAMICS ENGINEER
C     BLOCKS NUMBERED STARTING AT BOTTOM OF RIGHT RAIL AND GOING UP 1, 2, 3
C     AND STARTING AT BOTTOM OF LEFT RAIL 4, 5, 6
C
C
      IF(FLAGC) 5,1,1
    1 CONTINUE
      RETURN
C     AEDC = AEA*DAC
    5 CALL MPYMAT(AEDC11,AEDC12,AEDC13,AEDC21,AEDC22,AEDC23,AEDC31,
     1 AEDC32,AEDC33,AEA11,AEA12,AEA13,AEA21,AEA22,AEA23,AEA31,AEA32,
     2 AEA33,DAC11,DAC12,DAC13,DAC21,DAC22,DAC23,DAC31,DAC32,DAC33 )
C     DCS = (AEA*DAC)TRANSPOSE * AES
      CALL MPYMAT(DCS11,DCS12,DCS13,DCS21,DCS22,DCS23,DCS31,DCS32,DCS33,
     1 AEDC11,AEDC21,AEDC31,AEDC12,AEDC22,AEDC32,AEDC13,AEDC23,AEDC33,
     2 AES11,AES12,AES13,AES21,AES22,AES23,AES31,AES32,AES33 )
      CALL MPYMAT ( ACC11,ACC12,ACC13,ACC21,ACC22,ACC23,ACC31,ACC32,
     1 ACC33, DCS11, DCS12, DCS13, DCS21, DCS22, DCS23, DCS31, DCS32,
     2 DCS33, CS11, CS21, CS31, CS12, CS22, CS32, CS13, CS23, CS33 )
C     RAIL ANGULAR DEFLECTION
      CALL COSDIR ( DPSIC, DTHETC, DPHIC, ACC11, ACC12, ACC13, ACC21,
     1 ACC22, ACC23, ACC31, ACC32, ACC33 )
C     CALCULATION OF RAIL MOMENTS ON SEAT AS FUNCTION OF ANGULAR DEFLECTION
      IF(DZSBR2 .LE. -RL .AND. DZSBR5 .LE. -RL )  GO TO 10
      DTXG = GX * DPHIC
      DTYG = GY * DTHETC
      DTZG = GZ * DPSIC
      DTXSCD = - BX * P
      DTYSCD = - BY * Q
      DTZSCD = - BZ * R
      GO TO 20
   10 DTXG = 0.
      DTYG = 0.
      DTZG = 0.
      DTXSCD = 0.
      DTYSCD = 0.
      DTZSCD = 0.
   20 CONTINUE
C     MOMENTS ON SEAT IN SEAT AXIS SYSTEM
      CALL MPYVEC ( DTXSG, DTYSG, DTZSG, -DTXG, -DTYG, -DTZG,
     1 DCS11, DCS21, DCS31, DCS12, DCS22, DCS32, DCS13, DCS23, DCS33 )
C     MOMENTS ON AIRPLANE IN AIRPLANE AXIS SYSTEM
      CALL MPYVEC ( DTXAG, DTYAG, DTZAG, DTXG, DTYG, DTZG,
     1 DAC11, DAC12, DAC13, DAC21, DAC22, DAC23, DAC31, DAC32, DAC33 )
C     SEAT RELATIVE TO A/P IN RAIL AXIS SYSTEM
      CALL MPYVEC(XTM,YTM,ZTM,XS-XA,YS-YA,ZS-ZA,AEDC11,AEDC21,AEDC31,
     1 AEDC12,AEDC22,AEDC32,AEDC13,AEDC23,AEDC33)
C     SLIDER BLOCK LOCATIONS AND FORCES FOR RIGHT RAIL
      CALL POSXYZ(XSR,YSR,ZSR,XTM,YTM,ZTM,-XAR01,-YAR01,-ZAR01,
     1 DAC11,DAC21,DAC31,DAC12,DAC22,DAC32,DAC13,DAC23,DAC33)
      CALL BLOCKS (DFXS1 , DFYS1 , DFZS1 , DFXA1 , DFYA1 , DFZA1 ,
     1 DTXS1 , DTYS1 , DTZS1 , DTXA1 , DTYA1 , DTZA1 , DXSBR1 , DYSBR1 ,
     2 DZSBR1 , XSR , YSR , ZSR , XAR01   , YAR01 , ZAR01 , DXSB1 ,
     3 DYSB1 , DZSB1 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBR01,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
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     6 DAC32 , DAC33 )
      CALL BLOCKS ( DFXS2 , DFYS2 , DFZS2 , DFXA2 , DFYA2 ,  DFZA2 ,
     1 DTXS2 , DTYS2 , DTZS2 , DTXA2 , DTYA2 , DTZA2 , DXSBR2 , DYSBR2 ,
     2 DZSBR2 , XSR , YSR , ZSR , XARO1 , YARO1 , ZARO1 , DXSB2 ,
     3 DYSB2 , DZSB2 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBRO2,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
     6 DAC32 , DAC33 )
      CALL BLOCKS ( DFXS3 , DFYS3 , DFZS3 , DFXA3 , DFYA3 ,  DFZA3 ,
     1 DTXS3 , DTYS3 , DTZS3 , DTXA3 , DTYA3 , DTZA3 , DXSBR3 , DYSBR3 ,
     2 DZSBR3 , XSR , YSR , ZSR , XARO1 , YARO1 , ZARO1 , DXSB3 ,
     3 DYSB3 , DZSB3 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBRO3,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
     6 DAC32 , DAC33 )
C  SLIDER BLOCK LOCATIONS AND FORCES FOR LEFT RAIL
      CALL PCSXYZ(XSR,YSR,ZSR,XTM,YTM,ZTM,-XARO2,-YARO2,-ZARO2,
     1 DAC11,DAC21,DAC31,DAC12,DAC22,DAC32,DAC13,DAC23,DAC33)
      CALL BLOCKS ( DFXS4 , DFYS4 , DFZS4 , DFXA4 , DFYA4 ,  DFZA4 ,
     1 DTXS4 , DTYS4 , DTZS4 , DTXA4 , DTYA4 , DTZA4 , DXSBR4 , DYSBR4 ,
     2 DZSBR4 , XSR , YSR , ZSR , XARO2 , YARO2 , ZARO2 , DXSB4 ,
     3 DYSB4 , DZSB4 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBRO1,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
     6 DAC32 , DAC33 )
      CALL BLOCKS ( DFXS5 , DFYS5 , DFZS5 , DFXA5 , DFYA5 ,  DFZA5 ,
     1 DTXS5 , DTYS5 , DTZS5 , DTXA5 , DTYA5 , DTZA5 , DXSBR5 , DYSBR5 ,
     2 DZSBR5 , XSR , YSR , ZSR , XARO2 , YARO2 , ZARO2 , DXSB5 ,
     3 DYSB5 , DZSB5 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBRO2,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
     6 DAC32 , DAC33 )
      CALL BLOCKS ( DFXS6 , DFYS6 , DFZS6 , DFXA6 , DFYA6 ,  DFZA6 ,
     1 DTXS6 , DTYS6 , DTZS6 , DTXA6 , DTYA6 , DTZA6 , DXSBR6 , DYSBR6 ,
     2 DZSBR6 , XSR , YSR , ZSR , XARO2 , YARO2 , ZARO2 , DXSB6 ,
     3 DYSB6 , DZSB6 , SX , SY , SZ , BF , UP , TOC , T , RL ,ZSBRO3,
     4 DCS11 , DCS12 , DCS13 , DCS21 , DCS22 , DCS23 , DCS31 , DCS32 ,
     5 DCS33 , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 , DAC31 ,
     6 DAC32 , DAC33 )
C  TOTAL FORCES AND MOMENTS ON SEAT
      DFXSC= DFXS1 + DFXS2 + DFXS3 + DFXS4 + DFXS5 + DFXS6
      DFYSC= DFYS1 + DFYS2 + DFYS3 + DFYS4 + DFYS5 + DFYS6
      DFZSC= DFZS1 + DFZS2 + DFZS3 + DFZS4 + DFZS5 + DFZS6
      DTXSC= DTXS1 + DTXS2 + DTXS3 + DTXS4 + DTXS5 + DTXS6 + DTXSG
     1 + DTXSCD
      DTYSC= DTYS1 + DTYS2 + DTYS3 + DTYS4 + DTYS5 + DTYS6 + DTYSG
     1 + DTYSCD
      DTZSC= DTZS1 + DTZS2 + DTZS3 + DTZS4 + DTZS5 + DTZS6 + DTZSG
     1 + DTZSCD
C  TOTAL FORCES AND MOMENTS ON AIRPLANE
      DFXAC= DFXA1 + DFXA2 + DFXA3 + DFXA4 + DFXA5 + DFXA6
      DFYAC= DFYA1 + DFYA2 + DFYA3 + DFYA4 + DFYA5 + DFYA6
      DFZAC= DFZA1 + DFZA2 + DFZA3 + DFZA4 + DFZA5 + DFZA6
      DTXAC= DTXA1 + DTXA2 + DTXA3 + DTXA4 + DTXA5 + DTXA6  + DTXAG
      DTYAC= DTYA1 + DTYA2 + DTYA3 + DTYA4 + DTYA5 + DTYA6 + DTYAG
      DTZAC= DTZA1 + DTZA2 + DTZA3 + DTZA4 + DTZA5 + DTZA6 + DTZAG
      IF(DZSBR1 .LE. -RL.AND.DZSBR4 .LE.-RL )FLAGC = 1.
      RETURN
      END
```

```
      SUBROUTINE DUMPER(R)
C       T4SA10
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
      DIMENSION R(1), NR(30)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      EQUIVALENCE (NR(1),NR1)
32000 FORMAT(6X,I6,6H      1,2I6,6H    NR,I2)
32001 FORMAT(1H1,26X,16HDUMP OF R-MATRIX//)
32002 FORMAT(6X16,F14.5,I6,F14.5,I6,F14.5,I6,F14.5)
32003 FORMAT(6X,I6,6H      0,2I6,6H    NR,I2)
      WRITE(6,32001)
      NTEMP1=0
      JJ2=N
      DO 100 I=1,4
      JJ1=I-1
      NTEMP=NTEMP1+1
      NTEMP1 = NTEMP+N-1
      WRITE(6,32000)JJ1,JJ1,JJ2,JJ1
  100 WRITE(6,32002) (II,R(II),II=NTEMP,NTEMP1)
      JJ1=4
      JJ2 = NR5-NR4-1
      WRITE(6,32000) JJ1,JJ1,JJ2,JJ1
      NTEMP=NR(4)+1
      NTEMP1=NR(5)-1
      WRITE(6,32002) (II,R(II),II=NTEMP,NTEMP1)
      DO 200 I=5,29
      JJ1=I
      JJ2 = NR(I+1) - NR(I) - 1
      NTEMP=NR(I)
      NTEMP1=NR(I+1)-1
      WRITE(6,32003) JJ1,JJ1,JJ2,JJ1
  200 WRITE(6,32002) (II,R(II),II=NTEMP,NTEMP1)
      RETURN
      END


      SUBROUTINE FARTHR(/T000/,/TCS/,/RQ/,/OS/,/PF/,/EF/,/CPBV
     X/,/CPBS/,/NG/,/PF100/,/PFNG/,/PFNG2/,/CPBV00/,/CPBV01/,/CPBV02
     X/,/CPBV03/,/VP10/,/VP11/,/VP12/,/VP13/,/VP20/,/VP21/,/VP22
     X/,/VP23/,/SP1/,/SP2/,/BV/,/BS/,/RHO/,/AF/,/QA/,/ETEST/)
C       T4SA11
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
      REAL NG
      OS = 2.*T000/AF+QA
      IF(ABS(OS) - 1.) 1,1,2
    1 TCS = 0.
      GO TO 3
    2 TCS = 2.*(T000/AF)/OS
    3 RQ = 1. - TCS
      PF = PF100 + (PFNG + PFNG2*(NG-100.))*(NG-100.)
C     ICOUNT = 0
  100 CPBV0 = CPBV00 + (CPBV01 + (CPBV02 + CPBV03*RQ)*RQ)*RQ
      VP1 = VP10 + (VP11 + (VP12 + VP13*RQ)*RQ)*RQ
      VP2 = VP20 + (VP21 + (VP22 + VP23*RQ)*RQ)*RQ
      CPBV= CPBV0 + (VP1 + VP2*BV)*BV
```

```
      IF(CPBV.GT.1.)CPBV=1.
      IF(CPBV.LT..65)CPBV=.65
      CPBS=  (SP1 + SP2*BS)*BS
C   REMOVE THE C FROM COLUMN 1 IF ITERATION DESIRED. ITERATION IS
C   UNRELIABLE AT PRESENT AND DOES NOT MAKE A SIGNIFICANT DIFFERENCE
C   WHEN IT DOES CONVERGE.
C   ALSO REMOVE THE C FORM COLUMN 1 OF THE STATEMENT IMMEDIATELY
C   PRECEDING STATEMENT 100.
C      IF(ETEST .LT. 0.) RETURN
C      F =-(RHO**.3333 *     (    PF/AF/(CPBV+CPBS))**.6666)
C      G = -.6666 * F / (CPBV+CPBS)
C      EF = 2.*TOOO/AF + F
C      IF (ABS(EF) .LE. ETEST) RETURN
C      ICOUNT = ICOUNT + 1
C      IF (ICOUNT .GT. 4) GO TO 200
C      DCPTC = -((3.*CPBVO3*RO + 2.*CPBVO2)*RO + CPBVO1)
C     1 -((3.*VP13*RO + 2.*VP12)*RO + VP11)*BV
C     2 -((3.*VP23*RO + 2.*VP22)*RO + VP21)*BV*BV
C      DEFTC = OS - QA*TCS + G*DCPTC
C      TCS = TCS - EF/DEFTC
C      RO = 1. - TCS
C      OS = QA*RO
C      TOOO =     AF*OS*TCS/2.
C      GO TO 100
  200 RETURN
      END



      SUBROUTINE TRIMV(R)
C
C   T4SA12
C
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
32001 FORMAT(  34H  BV,BS,DB ITERATION DID NOT CLOSE)
32002 FORMAT(  43H  DETERMINANT EQ ZERO IN BV,BS,DB ITERATION)
32003 FORMAT(//1CX17HCONVERGENCE AFTER,I3,1X,6HCYCLES//)
       INTEGER E,F
      EQUIVALENCE (NR22,I),(NR23,J),(NR24,K),(NR25,L),(NR26,M),
     1 (NR4,F),(NR3,E)
C   VTOL TRIM FOR LEVEL FLIGHT
C   BEFORE CALLING READ IN -
C      (1) DESIRED PITCH ATTITUDE IN R(NR4+93)
C      (2) DESIRED AIRSPEED IN R(NR4+63)
C      (3) DESIRED ZE(NEGATIVE ALTITUDE) IN R(N+38)
C      (4) GROSS WEIGHT,OTHER CONFIGURATION DATA FOR AIRPLANE
C      (5) INITIAL GUESSES FOR BVR=R(NR25+16),BSR=R(NR25+18),
C          DB=R(NR25+29), TOOOR=R(NR25+10), TOOONF=R(NR25+12)
C      (6) ALL OTHER CONTROLS TO DESIRED VALUES.
      EBV=R(NR23+85)
      EBS=R(NR23+86)
      EDB=R(NR23+87)
      IO = NR3+30
      IF = NR3+44
      WST=R(N+38)
      DO 50 II= IO,IF
```

```
      III=II-NR2
      R(III)=0.
   50 R(II) = 0.
      R(N+38) = WST
      R(NR3+30) = R(NR4+63)*COS(R(NR4+93))
      R(NR3+32) = R(NR4+63)*SIN(R(NR4+93))
      R(N+30) = R(NR3+30)
      R(N+32) = R(NR3+32)
      R(NR3+38) = R(N+38)
      R(NR25+17) = R(NR25+16)
      R(NR25+19) = R(NR25+18)
      R(NR25+11) = R(NR25+10)
      WST=R(NR26+31)*SIN(R(NR4+93))
      WCT=R(NR26+31)*COS(R(NR4+93))
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+38))
      CALL CIRCOS(R(NR3+39),R(NR3+40),R(NR3+41),R(NR3+42),R(NR3+43),
     1 R(NR3+44),R(NR4+60),R(NR4+61),R(NR4+62),0.
     2 R(NR4+93), 0.,
     3 SINPSI,COSPSI,SINTHE,COSTHE,SINPHI,COSPHI)
      CALL AIRPLN(R)
      ITER = 0
  100 ITER = ITER+1
      CALL TRIMV1(VX1,VX2,SX1,SX2,CXAPB,VN1,VN2,SN1,SN2,VM1,VM2,SM1,SM2,
     1 R(I+5),R(I+6),R(I+7),R(I+8),R(I+10),R(I+11),R(I+12),R(I+13),
     2 R(I+15),R(I+16),R(I+17),R(I+18),R(I+20),R(I+21),R(I+22),R(I+23),
     3 R(I+36),R(I+37),R(I+38),R(I+40),R(I+41),R(I+42),R(I+43),
     4 R(I+45),R(I+46),R(I+47),R(I+48),R(I+50),R(I+51),R(I+52),R(I+53),
     5 R(I+55),R(I+56),R(I+57),R(I+58),R(I+70),R(I+71),R(I+72),R(I+73),
     6 R(I+75),R(I+76),R(I+77),R(I+78),R(I+80),R(I+81),R(I+82),R(I+83),
     7 R(I+85),R(I+86),R(I+87),R(I+88),
     8 R(L+3))
      CALL TRIMV2(DEXDBV,DEXDBS,DEXDDB,DEZDBV,DEZDBS,DEZDDB,
     1 DEMDBV,DEMDBS,DEMDDB,VX1,VX2,SX1,SX2,CXAPB,VN1,VN2,SN1,SN2,
     2 VM1,VM2,SM1,SM2,
     3 R(NR23+78),R(NR23+79),R(NR23+80),R(NR23+82),
     4 R(NR23+83),R(NR23+84),R(NR22+109),R(NR22+110),
     5 R(NR26+6),R(NR25),R(NR26+9),R(NR25+25),R(NR25+13),R(L+3),
     6 R(NR24+29),R(NR24+28),R(NR24+82),R(L+29),R(NR26+7),R(NR26+10),
     7 R(NR25+16),R(NR25+18) )
      CALL SIMLT3(DBV,DBS,DDB,-(R(F+95)-WST),-(R(F+97)+WCT),-R(F+99),
     1 DEXDBV,DEXDBS,DEXDDB,DEZDBV,DEZDBS,DEZDDB,DEMDBV,DEMDBS,DEMDDB,
     2 DET)
      IF(DET)1,10, 1
    1 R(NR25+16)= R(NR25+16)+DBV/2.
      R(NR25+17)= R(NR25+16)
      R(NR25+18)= R(NR25+18)+DBS/2.
      R(NR25+19)= R(NR25+18)
      R(NR25+29)= R(NR25+29)+DDB
      CALL AIRPLN(R)
      IF(ABS(DBV) - EBV) 2,2,4
    2 IF(ABS(DBS) - EBS) 3,3,4
    3 IF(ABS(DDB) - EDB) 5,5,4
    4 IF(ITER .LT. 10) GO TO 100
      WRITE(6,32001)
      RETURN
    5 WRITE(6,32003)ITER
      RETURN
   10 WRITE(6,32002)
      RETURN
      END
```

```
      SUBROUTINE TRIMC(R)
C
C   T4SA13
C
C   SUBROUTINE FOR TRIMMING AN AIRPLANE, USING CURVE-FIT DIFFERENTIATION
C   AND NEWTON-RAPHSON ITERATION TO COMPUTE ANGLE OF ATTACK, HORIZONTAL
C   TAIL INCIDENCE AND THRUST REQUIRED.
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
C   INPUTS--ZE=R(NR1+38), UA=R(NR4+63)
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
32000 FORMAT(1H0/20X40HFAILURE TO CONVERGE AFTER 10 ITERATIONS.//)
32002 FORMAT(  50H  DETERMINANT EQ ZERO IN ALPHA,IT,TJ ITERATION      )
32003 FORMAT(//10X17HCONVERGENCE AFTER,I3,1X,6HCYCLES//)
C   ITERATION INITIATION
      EA=R(NR23+88)
      EI=R(NR23+89)
      ET=R(NR23+90)
      IO = NR3+30
      IF = NR3+44
      WST = R(N+38)
      DO 50 II= IO,IF
      III = II-NR2
      R(III) = 0.
   50 R(II) = 0.
      R(N+38) = WST
      R(NR25+16) = 0.
      R(NR25+17) = 0.
      R(NR25+18) = 0.
      R(NR25+19) = 0.
      R(NR25+10) = 0.
      R(NR25+11) = 0.
      R(NR25+29) = 0.
      R(NR25+12) = 0.
      R(NR24+44) = 0.
      R(NR25+23) = 0.
      R(NR4+65) = 0.
      R(NR4+92) = 0.
      R(NR4+93) = 0.
      R(NR4+94) = 0.
      R(NR3+30) = R(NR4+63)
      R(NR3+38) = R(N+38)
      WST = 0.
      WCT = R(NR26+31)
      DEXDTJ=R(NR24+96) * COS(R(NR26+13))
      DEZDTJ = -R(NR24+96) * SIN(R(NR26+13))
      DEMDTJ = R(NR26+12)*DEXDTJ - R(NR26+11)*DEZDTJ
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+38))
      CALL DIRCOS(R(NR3+39),R(NR3+40),R(NR3+41),R(NR3+42),R(NR3+43),
     1 R(NR3+44),R(NR4+60),R(NR4+61),R(NR4+62),0.
     2 R(NR4+93), 0.,
     3 SINPSI,COSPSI,SINTHE,COSTHE,SINPHI,COSPHI)
      CALL AIRPLN(R)
      R(NR24+44) = -R(NR4+79)
      ANA1 = R(NR22+60)  + R(NR22+61) + R(NR22+62) + R(NR22+63)
      XA1 = R(NR22+30) + R(NR22+31) + R(NR22+32) + R(NR22+33)
```

```
     1 - R(NR22+105) * (R(NR22+36) + R(NR22+37) + R(NR22+38) )
      CCMDA=R(NR22+115)+R(NR22+116)+R(NR22+111)+R(NR22+112)
      STSW = R(NR26+3)/R(NR26)
C  BEGIN ITERATICN                                                   00290
      ITER = 0                                                       00280
    1 ITER = ITER + 1                                                00300
      IF(ITER - 11) 100,100,5                                        00310
  100 CALL TRIMC1(DEXDA,DEXDDH,DEZDA,DEZDDH,DEMDA,DEMDDH,
     1 R(NR4+65),R(NR24+34),R(NR25+2),R(NR4+64),STSW,R(NR26+6),R(NR26),
     2 R(NR26+2),R(NR26+4),R(NR26+5),R(NR26+7),R(NR24+39),DCMDA,
     3 R(NR24+42),R(NR24+30),R(NR24+84),R(NR24+88),R(NR24+91),XA1,
     4 R(NR22+26),R(NR22+27),R(NR22+28),ANA1,R(NR23+46),R(NR23+47))
      CALL SIMLT3(DELA,DELIT,DELT, -(R(NR4+95)-WST),-(R(NR4+97)+WCT),
     1 -R(NR4+99),DEXDA,DEXDDH,DEXDTJ,DEZDA,DEZDDH,DEZDTJ,DEMDA,
     2 DEMDDH,DEMDTJ,DET)
      IF(DET)8,10,8
    8 R(NR4+65) = R(NR4+65) + DELA
      R(NR25+23) = R(NR25+23) + DELIT
      R(NR24+44) = R(NR24+44) + DELT
      R(NR4+93) = R(NR4+65)
      R(NR3+30) = R(NR4+63)*COS(R(NR4+93))
      R(NR3+32) = R(NR4+63)*SIN(R(NR4+93))
      WST=R(NR26+31)*SIN(R(NR4+93))
      WCT=R(NR26+31)*COS(R(NR4+93))
      CALL DIRCOS(R(NR3+39),R(NR3+40),R(NR3+41),R(NR3+42),R(NR3+43),
     1 R(NR3+44),R(NR4+60),R(NR4+61),R(NR4+62),0.
     2 R(NR4+93), 0.,
     3 SINPSI,COSPSI,SINTHE,COSTHE,SINPHI,COSPHI)
      CALL AIRPLN(R)
      IF(ABS(DELA) - EA) 2, 2, 1                                     00550
    2 IF(ABS(DELIT)- EI) 3, 3, 1                                     00560
    3 IF(ABS(DELT) - ET) 4, 4, 1
    4 DO 200 II=IO,IF
      III=II-NR2
  200 R(III) = R(II)
      WRITE(6,32003)ITER
      RETURN
    5 WRITE(6,32000)                                                 00590
      DO 250 II = IO,IF
      III = II - NR2
  250 R(III)=R(II)
      RETURN
   10 WRITE(6,32002)
      RETURN
      END                                                            00610


      SUBROUTINE TRIMV1(/VX1/,/VX2/,/SX1/,/SX2/,/CXAPB/,/VN1/,/VN2
     X/,/SN1/,/SN2/,/VM1/,/VM2/,/SM1/,/SM2/,/VX10/,/VX11/,/VX12
     X/,/VX13/,/VX20/,/VX21/,/VX22/,/VX23/,/SX10/,/SX11/,/SX12
     X/,/SX13/,/SX20/,/SX21/,/SX22/,/SX23/,/CXAPB1/,/CXAPB2/,/CXAPB3
     X/,/VN10/,/VN11/,/VN12/,/VN13/,/VN20/,/VN21/,/VN22/,/VN23
     X/,/SN10/,/SN11/,/SN12/,/SN13/,/SN20/,/SN21/,/SN22/,/SN23
     X/,/VM10/,/VM11/,/VM12/,/VM13/,/VM20/,/VM21/,/VM22/,/VM23
     X/,/SM10/,/SM11/,/SM12/,/SM13/,/SM20/,/SM21/,/SM22/,/SM23
     X/,/RC/)
C  T4SA14
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANOR ROCH, AERODYNAMICS ENGINEER
      VX1 = VX10 + (VX11 + (VX12 + VX13*RQ)*RQ)*RQ
```

```
      VX2 = VX20 + (VX21 + (VX22 + VX23*RQ)*RQ)*RQ
      SX1 = SX10 + (SX11 + (SX12 + SX13*RQ)*RQ)*RQ
      SX2 = SX20 + (SX21 + (SX22 + SX23*RQ)*RQ)*RQ
      CXAPB = (CXAPB1 + (CXAPB2 + CXAPB3*RQ)*RQ)*RQ
      VN1 = VN10 + (VN11 + (VN12 + VN13*RQ)*RQ)*RQ
      VN2 = VN20 + (VN21 + (VN22 + VN23*RQ)*RQ)*RQ
      SN1 = SN10 + (SN11 + (SN12 + SN13*RQ)*RQ)*RQ
      SN2 = SN20 + (SN21 + (SN22 + SN23*RQ)*RQ)*RQ
      VM1 = VM10 + (VM11 + (VM12 + VM13*RQ)*RQ)*RQ
      VM2 = VM20 + (VM21 + (VM22 + VM23*RQ)*RQ)*RQ
      SM1 = SM10 + (SM11 + (SM12 + SM13*RQ)*RQ)*RQ
      SM2 = SM20 + (SM21 + (SM22 + SM23*RQ)*RQ)*RQ
      RETURN
      END


      SUBROUTINE TRIMV2
     X (/DEXDBV/,/DEXDBS/,/DEXDDB/,/DEZDBV/,/DEZDBS/,/DEZDDB/,/DEMDBV
     X/,/DEMDBS/,/DEMDDB/,/VX1/,/VX2/,/SX1/,/SX2/,/CXAPB/,/VN1
     X/,/VN2/,/SN1/,/SN2/,/VM1/,/VM2/,/SM1/,/SM2/,/AKXNF1/,/AKXNF2
     X/,/AKXNF3/,/AKNNF1/,/AKNNF2/,/AKNNF3/,/ANA2/,/ANA3/,/AF/,/QS
     X/,/ANF/,/QNF/,/ALPHA/,/RQ/,/CXONF/,/CNONF/,/CNANF/,/DB/,/DF
     X/,/XNF/,/BV/,/BS/)
C  T4SA15
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANOR ROCH, AERODYNAMICS ENGINEER
      AFQS=AF*QS
      AQSNF=ANF*QNF
      DEXDBV = AFQS * (VX1 + 2.*VX2*BV + CXAPB*ALPHA)
      DEXDBS = AFQS * (SX1 + 2.*SX2*BS)
      DEXDDB = AQSNF* CXONF * ( AKXNF1 + (2.*AKXNF2 + 3.*AKXNF3*DB) *DB)
      DEZDBV =-AFQS * (VN1 + 2.*VN2*BV + ANA2 + ANA3*RQ*ALPHA)
      DEZDBS =-AFQS * (SN1 + 2.*SN2*BS)
      DEZDDB =-AQSNF * (CNONF + CNANF) * (AKNNF1 + (2.*AKNNF2 +
     1 3.*AKNNF3*DB) * DB )
      DEMDBV = AFQS * DF * (VM1 + 2.*VM2*BV)
      DEMDBS = AFQS * DF * (SM1 + 2.*SM2*BS)
      DEMDDB = -XNF * DEZDDB
      RETURN
      END


      SUBROUTINE TRIMC1(/DEXDA/,/DEXDDH/,/DEZDA/,/DEZDDH/,/DEMDA
     X/,/DEMDDH/,/ALPHA/,/EPSLON/,/QAV/,/QA/,/STSW/,/AF/,/SW/,/C
     X/,/ALT/,/ZT/,/DF/,/CLAT/,/DCMDA/,/CDCL2T/,/AKTNT/,/CLT/,/CXT
     X/,/CNT/,/XA1/,/XA21/,/XA22/,/XA23/,/ANA1/,/EPS1/,/EPS2/)
C  T4SA16
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANOR ROCH, AERODYNAMICS ENGINEER
       SDEDA = 1. - EPS1 - 2.*EPS2 * ALPHA
       DCLTDA = CLAT * SDEDA
       DCDTDA = 2.* CDCL2T * CLT * DCLTDA
       DCDTDH = 2.* CDCL2T * CLT * CLAT
       SINEA = SIN(EPSLON - ALPHA)
       COSEA = COS(EPSLON - ALPHA)
      DCXDA = XA1 + XA21 + (3.*XA23*ALPHA + 2.*XA22) * ALPHA
      DCXTDA = SDEDA*CNT - STSW*(DCDTDA*COSEA + DCLTDA*SINEA)
      DCXTDH = -STSW*(DCDTDH*COSEA + CLAT * SINEA)
      DCNTDA = SDEDA*CXT + STSW * (DCLTDA*COSEA - DCDTDA*SINEA)
```

```
      CCNTOF = STSW * ( CLAT * COSEA - DCDTCF * SINEA )
      CEXCA = AF*QAV*DCXDA + AKTNT*QA*SW*DCXTDA
      DEXDDH= AKTNT*QA*SW*CCXTDH
      CEZDA = -AF*QAV*ANA1 - AKTNT*QA*SW*DCNTDA
      CEZDCF = -AKTNT*QA*SW*DCNTOH
      DEMCA = AF*DF*QAV*CCMDA - AKTNT*QA*SW*C * (ALT*CCNTDA + ZT*DCXTDA)
      CEMDDF =  C * (ALT * DEZDDH - ZT * DEXDDH)
      RETURN
      END


      SUBROUTINE SEAT(R)
C     T4SA17
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANCR ROCH, AERODYNAMICS ENGINEER
C  JIM LACY, AERODYNAMICS ENGINEER
C  EDDIE SMART, AERODYNAMICS ENGINEER
C
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      INTEGER W,X,Y
     1 ,Z,V
      EQUIVALENCE (NR3,I),(NR4,J),(NR13,K),(NR14,M),(NR15,L),(NR16,W),
     1 (NR19,X),(NR20,Y)
     2            ,(NR27,Z), (NR21,V)
32001 FORMAT(1H0/10X35HBEGINNING OF SEAT-ALONE TRAJECTORY.//)
C  SEAT ALONE EQUATIONS
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+9))
      CALL CCRATE(R(10),R(11),R(12),R(13),R(14),R(15),R(NR3+4),R(NR3+5),
     1 R(NR3+6),R(NR4+6),R(NR4+7),R(NR4+8),R(NR3+10),R(NR3+11),R(NR3+12)
     2 ,R(NR3+13),R(NR3+14),R(NR3+15),R(NR4+9),R(NR4+10),R(NR4+11))
      CALL VELAIR(R(7),R(8),R(9),R(NR4+16),R(NR4+17),R(NR4+12),R(NR4+13)
     1 ,R(NR3+10),R(NR3+11),R(NR3+12),R(NR3+13),R(NR3+14),R(NR3+15)
     2 ,R(NR4+9),R(NR4+10),R(NR4+11),R(NR3+1),R(NR3+2),R(NR3+3),
     3  R(NR4+26))
    2 IF(R(NR4+42) - .98) 5,6,6
    5 WRITE(6,32001)
      R(NR4+21) = 1.
    6 CONTINUE
C  COMPUTE DRAG CHUTE FORCES AND MOMENTS
      CALL CHUTES(R(18),R(19),R(20),R(X+23),R(X+24),R(X+25),R(X+26),     DRAG
     1 R(X+14),R(X+27),R(X+12),R(X+13),R(X+6),R(X+7),R(X+8),R(X),        CHUTE
     2 R(X+1),R(X+2),R(X+35),R(X+9),R(X+10),R(X+11),R(X+3),R(X+4),
     3 R(X+5),R(X+19),R(X+15),R(X+16),R(X+17),R(X+18),R(X+28),R(X+29),
     4 R(X+30),R(X+20),R(X+43),R(X+44),R(X+45),R(X+46),R(X+47),R(X+48),
     5 R(X+21),
     6 R(I+18),R(I+19),R(I+20),R(I+21),R(I+22),R(I+23),R(J+1),R(K+13),
     7 R(J+46),R(J+47),R(M)/32.17 ,R(J+26),R(X+31),R(X+32),R(X+33),
     8 R(X+34),R(X+36),R(X+37),R(X+38),R(X+39),R(X+40),R(X+41),R(X+42),
     9 R(J+15),R(K+17),R(K+18),R(K+19),R(K+14),R(K+15),R(K+16),R(W+7),
     1 R(W+8),R(W+9),              R(J+12),R(I+1),R(I+2),R(I+3),R(I+7),
     2 R(I+8),R(I+9),R(I+4),R(I+5),R(I+6),                 R(M+4),R(M+5),
     3 R(M+6),R(I+10),R(I+11),R(I+12),R(I+13),R(I+14),R(I+15),R(J+9),
     4 R(J+10),R(J+11),R(M+7),R(M+8),R(M+20),R(M+9),R(M+10),R(M+11),
     5 R(M+21),R(M+12),R(M+13),R(M+14),R(M+15),R(M+16),R(M+17),R(M+18),
     6 R(M+19),R(K+10),R(M+22),R(M+23),R(M+24),R(M+25),R(M+26),R(M+27),
     7 R(M+28),R(M+29),R(M+30),R(M+31),R(M+32),R(M+33),R(M+1),
     8 R(M+2),R(M+3),R(M+34),IFIX(R(M+35)+.001),R(M+36),R(M+37),R(M+38),
```

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9 R(M+39),R(M+40),R(M+41))
  R(21) = R(NR3+18)
  R(22) = R(NR3+19)
  R(23) = R(NR3+20)
  CALL ANGMMO(R(NR4+27),R(NR4+28),R(NR4+29),R(NR16+18),R(NR16+19),
 1 R(NR16+20),R(NR16+21),R(NR16+22),R(NR16+23),R(NR3+4),R(NR3+5),
 2 R(NR3+6))
  CALL FRCMOM(R(NR4+36),R(NR4+37),R(NR4+38),R(NR4+39),R(NR4+40),
 1 R(NR4+41), R(NR17+3) ,R(NR17+1) ,R(NR17+2) ,R(NR17+5) ,R(NR17)
 2 ,R(NR17+4) , R(NR4+13), R(NR16+13),R(NR16+14),R(NR16+15),
 3 R(NR4+30),R(NR4+31), R(NR4+32), R(NR4+33), R(NR4+34),R(NR4+35) )
  CALL ACCELO(R(1),R(2),R(3),R(4),R(5),R(6),R(NR4+18),R(NR4+19),
 1 R(NR4+20),R(NR3+4),R(NR3+5),R(NR3+6),R(NR3+1),R(NR3+2),R(NR3+3),
 2 R(NR4+9),R(NR4+10),R(NR4+11), R(NR4+36),R(NR4+37), R(NR4+38),
 3 R(NR16+17),R(NR4+39),R(NR4+40),R(NR4+41),R(NR16+18),R(NR16+19),
 4 R(NR16+20),R(NR16+21),R(NR16+22),R(NR16+23),R(NR4+27),R(NR4+28),
 5 R(NR4+29),R(NR16+24),R(NR16+25),R(NR16+26), 0.      , 0.      ,
 6 0.      , 0.      , 0.      )
  RETURN
  END


      SUBROUTINE CATPLT(R)
C     T4SA18
C     IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      IF(R(NR4+14 )) 5,5,10
C     FORCES AND MOMENTS OF CATAPULT ON SEAT
C     USING CATAPULT THERMODYNAMICAL EQUATIONS.
    5 CONTINUE
C     SEAT-AIRPLANE RELATIVE VELOCITY COMPONENTS IN THE RAIL AXIS SYSTEM
C          SEAT
      CALL MPYVEC(R(NR27),R(NR27+1),R(NR27+2),R(NR3+1),R(NR3+2),R(NR3+3)
     1 ,R(NR21+12),R(NR21+13),R(NR21+14),R(NR21+15),R(NR21+16),
     2 R(NR21+17),R(NR21+18),R(NR21+19),R(NR21+20))
C          AIRPLANE
      CALL MPYVEC(UAC,VAC,WAC,R(NR3+30),R(NR3+31),R(NR3+32),
     1 R(NR21+3),R(NR21+6),R(NR21+9),R(NR21+4),R(NR21+7),R(NR21+10),
     2 R(NR21+5),R(NR21+8),R(NR21+11))
C          RELATIVE COMPONENTS
      R(NR27) = R(NR27) - UAC
      R(NR27+1) = R(NR27+1)-VAC
      R(NR27+2) = R(NR27+2)-WAC
      CALL CAD(R(NR18+20),R(NR18+68),R(45),R(NR3+45),R(NR18+69),
     1R(NR4+14),ABS (-R(NR27+20)+R(NR21+32))*12.,R(NR4+2),R(NR18+70),
     2 R(NR13+58),R(NR13+59),R(NR13+60),R(NR13+61),R(NR13+62),
     3 R(NR13+63),R(NR13+64),R(NR13+65),R(NR13+66),R(NR13+67),R(NR13+68)
     4 ,R(NR13+23),R(NR13+20),R(NR13+21),R(NR13+22),R(NR13+69),
     5 R(NR21+54)*12.,R(NR16)/32.17, R(NR27+2)*12.)
      FUP= R(NR21+53)*R(NR18+20)
      R(NR18+14) =-FUP*R(NR21+18)
      R(NR18+15) =-FUP*R(NR21+19)
      R(NR18+16) =-FUP*R(NR21+20)
      CALL MOMENT(R(NR18+17),R(NR18+18),R(NR18+19),R(NR18+14),R(NR18+15)
     1 ,R(NR18+16),R(NR13+27),R(NR13+28),R(NR13+29) )
C     FORCES AND MOMENTS OF CATAPULT ON AIRPLANE
      R(NR18+48) = FUP * R(NR21+5)
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      R(NR18+49) = FUP * R(NR21+8)
      R(NR18+50) = FUP * R(NR21+11)
      CALL MOMENT(R(NR18+51),R(NR18+52),R(NR18+53),R(NR18+48),
     1 R(NR18+49),R(NR18+50),R(NR21+64),(R(NR21+65)+R(NR21+62))/2. ,
     2 R(NR21+66) )
   10 RETURN
      END


      SUBROUTINE MAN(R)
C  T4SA19
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  JIM LACY, AERODYNAMICS ENGINEER
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      INTEGER W,X,Y
     1 ,Z,V
      EQUIVALENCE (NR3,I),(NR4,J),(NR13,K),(NR14,M),(NR15,L),(NR16,W),
     1 (NR19,X),(NR20,Y)
     2           ,(NR27,Z), (NR21,V)
      CALL ATMOS(R(NR4+24),R(NR4+25),R(NR4+26),-R(NR3+9))
      CALL DCRATE(R(10),R(11),R(12),R(13),R(14),R(15),R(NR3+4),R(NR3+5),
     1 R(NR3+6),R(NR4+6),R(NR4+7),R(NR4+8),R(NR3+10),R(NR3+11),R(NR3+12)
     2 ,R(NR3+13),R(NR3+14),R(NR3+15),R(NR4+9),R(NR4+10),R(NR4+11))
      CALL VELAIR(R(7),R(8),R(9),R(NR4+16),R(NR4+17),R(NR4+12),R(NR4+13)
     1 ,R(NR3+10),R(NR3+11),R(NR3+12),R(NR3+13),R(NR3+14),R(NR3+15)
     2 ,R(NR4+9),R(NR4+10),R(NR4+11),R(NR3+1),R(NR3+2),R(NR3+3),
     3  R(NR4+26))
C  COMPUTE FORCES AND MOMENTS OF RECOV CHUTE
      CALL CHUTES(R(24),R(25),R(26),R(Y+23),R(Y+24),R(Y+25),R(Y+26),     RECOV
     1 R(Y+14),R(Y+27),R(Y+12),R(Y+13),R(Y+6),R(Y+7),R(Y+8),R(Y),        CHUTE
     2 R(Y+1),R(Y+2),FPS,R(Y+9),R(Y+10),R(Y+11),R(Y+3),R(Y+4),R(Y+5),
     3 R(Y+19),R(Y+15),R(Y+16),R(Y+17),R(Y+18),R(Y+28),R(Y+29),
     4 R(Y+30),R(Y+20),R(Y+31),R(Y+32),R(Y+33),R(Y+34),R(Y+35),R(Y+36),
     5 R(Y+21),
     6 R(I+24),R(I+25),R(I+26),R(I+27),R(I+28),R(I+29),R(J+1),R(K+33),
     7 R(J+44),R(J+45),R(L)/32.17,R(J+26),FXPSO,FYPSO,FZPSO,FPSO,
     8 R(L+1),R(L+2),R(L+3),A,B,C,D,R(J+15),R(K+37),R(K+38),R(K+39),
     9 R(K+34),R(K+35),R(K+36),R(W+21),R(W+22),R(W+23),
     1 R(J+12),R(I+1),R(I+2),R(I+3),R(I+7),R(I+8),R(I+9),R(I+4),R(I+5),
     2 R(I+6),             R(L+4),R(L+5),R(L+6),R(I+10),R(I+11),
     3 R(I+12),R(I+13),R(I+14),R(I+15),R(J+9),R(J+10),R(J+11),R(L+7),
     4 R(L+8),R(L+20),R(L+9),R(L+10),R(L+11),R(L+21),R(L+12),R(L+13),
     5 R(L+14),R(L+15),R(L+16),R(L+17),R(L+18),R(L+19),R(K+10),DX1,
     6 DY1,DZ1,DX2,DY2,DZ2,DX3,DY3,DZ3,DX4,DY4,DZ4,R(L+1),R(L+2),
     7 R(L+3),ERRDC,1,R(L+22),R(L+23),R(L+24),R(L+25),R(L+26),R(L+27))
      R(27) = R(NR3+24)
      R(28) = R(NR3+25)
      R(29) = R(NR3+26)
      CALL AERMAN(R(NR17+3), R(NR17+1), R(NR17+2), R(NR17+5),
     1 R(NR17), R(NR17+4),         R(NR4+16), R(NR4+17),
     2 R(NR16+49),R(NR16+48), R(NR16+47), R(NR16+47), R(NR16+49),
     3 R(NR16+48), R(NR16+58), R(NR16+53), R(NR16+54), R(NR16+55))
      CALL ANGMMO(R(NR4+27),R(NR4+28),R(NR4+29),R(NR16+35),R(NR16+36),
     1 R(NR16+37),R(NR16+38),R(NR16+39),R(NR16+40),R(NR3+4),R(NR3+5),
     2 R(NR3+6))
C     SUM FORCES AND MOMENTS.
      R(NR4+30) = R(NR20)
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      R(NR4+31) = R(NR20+1)
      R(NR4+32) = R(NR20+2)
      R(NR4+33) = R(NR20+3)
      R(NR4+34) = R(NR20+4)
      R(NR4+35) = R(NR20+5)
C   ADD DAMPING TERMS FOR AIRSPEED GREATER THAN .1 FT/SEC.
      IF(R(NR4+12) - .1)40,40,30
C   ADD PITCH DAMPING
   30 R(NR17)     = R(NR17)    + R(NR16+44)*(.5*R(NR3+5)*R(NR16+14)/
     1 R(NR4+12))
C   ADD YAW DAMPING
      R(NR17+4)   = R(NR17+4)  + R(NR16+46)*(.5*R(NR3+6)*R(NR16+15)/
     1 R(NR4+12))
C   ADD ROLL DAMPING
      R(NR17+5)   = R(NR17+5)  + R(NR16+45)*(.5*R(NR3+4)*R(NR16+15)/
     1 R(NR4+12))
   40 CALL FRCMOM(R(NR4+36),R(NR4+37),R(NR4+38),R(NR4+39),R(NR4+40),
     1 R(NR4+41), R(NR17+3) ,R(NR17+1) ,R(NR17+2) ,R(NR17+5) ,R(NR17)
     2 ,R(NR17+4) , R(NR4+13), R(NR16+13),R(NR16+14),R(NR16+15),
     3 R(NR4+30),R(NR4+31), R(NR4+32), R(NR4+33), R(NR4+34),R(NR4+35) )
      CALL ACCELO(R(1),R(2),R(3),R(4),R(5),R(6),R(NR4+18),R(NR4+19),
     1 R(NR4+20),R(NR3+4),R(NR3+5),R(NR3+6),R(NR3+1),R(NR3+2),R(NR3+3),
     2 R(NR4+9),R(NR4+10),R(NR4+11), R(NR4+36),R(NR4+37), R(NR4+38),
     3 R(NR16+34),R(NR4+39),R(NR4+40),R(NR4+41),R(NR16+35),R(NR16+36),
     4 R(NR16+37),R(NR16+38),R(NR16+39),R(NR16+40),R(NR4+27),R(NR4+28),
     5 R(NR4+29),R(NR16+41),R(NR16+42),R(NR16+43), 0.       , 0.       ,
     6  0.     , 0.      , 0.        )
      CALL SPINE(R(16),R(NR3+16),R(NR3+17),R(NR4+11),
     1 R(NR4+20),R(NR16+51),R(NR16+52))
      R(17) = R(NR3+16)
      RETURN
      END



      SUBROUTINE BLOCKS (/DFXS/,/DFYS/,/DFZS/,/DFXA/,/DFYA/,/DFZA
     X/,/DTXS/,/DTYS/,/DTZS/,/DTXA/,/DTYA/,/DTZA/,/DXSBR/,/DYSBR
     X/,/DZSBR/,/XSR/,/YSR/,/ZSR/,/XARO/,/YARO/,/ZARO/,/DXSB/,/DYSB
     X/,/DZSB/,/SX/,/SY/,/SZ/,/BF/,/UP/,/TOC/,/T/,/RL/,/ZSBRO/,/DCS11
     X/,/DCS12/,/DCS13/,/DCS21/,/DCS22/,/DCS23/,/DCS31/,/DCS32
     X/,/DCS33/,/DAC11/,/DAC12/,/DAC13/,/DAC21/,/DAC22/,/DAC23
     X/,/DAC31/,/DAC32/,/DAC33/)
C       T4SA20
C   THIS SUBROUTINE COMPUTES THE FORCES AND MOMENTS ON THE SEAT AND
C   AIRPLANE DUE TO EACH INDIVIDUAL ROLLER
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   EDDIE SMART, AERODYNAMICS ENGINEER
C   THE FORCES ARE LINEAR FUNCTIONS OF DISPLACEMENT OF THE BLOCKS FROM TH
C   THE MOMENTS ARE THE CROSS-PRODUCT OF AN ARM AND THE FORCES.
C
C   CALCULATION OF SLIDER BLOCK LOCATION IN RAIL AXIS SYSTEM
      CALL PCSXYZ(DXSBR,DYSBR,DZSBR,XSR,YSR,ZSR,DXSB,DYSB,DZSB,
     1 DCS11,DCS12,DCS13,DCS21,DCS22,DCS23,DCS31,DCS32,DCS33)
C   CHECK FOR BLOCK ON RAILS
      IF(DZSBR+RL) 10,20,20
   10 DFXS = 0.
      DFYS = 0.
      DFZS = 0.
      DTXS = 0.
      DTYS = 0.
      DTZS = 0.
```

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      DFXA = 0.
      CFYA = 0.
      DFZA = 0.
      DTXA = 0.
      DTYA = 0.
      CTZA = 0.
      RETURN
C   FORCES REQC TC CEFLECT RAILS
   20 DFXC = SX * DXSBR
      CFYC = SY * CYSBR
      IF(TOC - T)30,30,40
   30 DFZC = -BF * SQRT(DFXC**2 + DFYC**2) * UP
      GC TO 50
   40 DFZC = SZ * (CZSBR - ZSBRO)
   50 CCNTINUE
C   FORCES ON SEAT IN SEAT AXIS SYSTEM
      CALL MPYVEC( CFXS , DFYS , DFZS , -DFXC , -DFYC , -DFZC ,
     1 CCS11 , CCS21 , DCS31  , DCS12 , DCS22  , DCS32 , DCS13 , DCS23 ,
     2 CCS33 )
C   FORCES ON AIRPLANE IN AIRPLANE AXIS SYSTEM
      CALL MPYVEC( CFXA , CFYA , DFZA , DFXC , DFYC , DFZC , DAC11 ,
     1 CAC12 , CAC13 , CAC21 , DAC22 , DAC23 , DAC31 , DAC32 , DAC33 )
C   AIRPLANE MOMENT ARM
      CALL POSXYZ( CXAB , DYAB , DZAB , XARO , YARO , ZARO , DXSBR ,
     1 CYSBR , DZSBR , DAC11 , DAC12 , DAC13 , DAC21 , DAC22 , DAC23 ,
     2 CAC31 , CAC32 , CAC33 )
C   MOMENTS ON SEAT
      CALL MOMENT( CTXS , DTYS , DTZS , DFXS , DFYS , DFZS , DXSB ,
     1 CYSB , CZSB )
C   MOMENTS CN AIRPLANE
      CALL MOMENT ( DTXA , CTYA , DTZA , DFXA , DFYA , CFZA ,
     1 DXAB , CYAB , DZAB )
      RETURN
      END


      SUBROUTINE HELPER(R)
C       T4SA21
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
      DIMENSION R(1)
      CCMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
32000 FORMAT(18I4)
      REAC(5,32000) NGO
      WRITE(6,32000) NGO
      GC TO (1,2,3,4,5,6,7,8,9,10), NGO
    1 CONTINUE
C   PUNCH OUT BASIC CATA FROM SELECTED SECTIONS OF THE R-ARRAY TO BE
C   USED AS DATA IN A DATA STATEMENT
32001 FCRMAT(5X1HX,1PE10.3,1H,,1PE10.3,1H,,1PE10.3,1H,,1PE10.3,1H,,
     1 1PE10.3,1H,,1PE10.3,1H,)
32002 FCRMAT(2I4,A4,A2)
32003 FCRMAT(6X5HDATA ,A4,A2,1H/)
32004 FORMAT(5X1HX,1PE10.3,1H/)
      READ(5,32002)IO,IF,DATNM1,DATNM2
      IF(IO)11,11,100
  100 WRITE(7,32003) DATNM1,DATNM2
      IF1 = IF-1
      WRITE(7,32C01) (R(I),I=IO,IF1)
```

```
      WRITE(7,32004) R(IF)
      GC TO 1
   11 CONTINUE
      RETURN
    2 CONTINUE
C  TEST ORTHOGONALITY OF THE DIRECTION COSINE MATRICES
32005 FORMAT(10X52HAIRPLANE DIRECTION COSINE MATRIX ORTHOGONALITY CHECK/
     1 10X30HRESULT SHOULD BE A UNIT MATRIX//(20X3F10.4))
32006 FORMAT(10X52HSEAT/MAN DIRECTION COSINE MATRIX ORTHOGONALITY CHECK/
     1 10X30HRESULT SHOULD BE A UNIT MATRIX//(20X3F10.4))
      CALL MPYMAT(R(NR29),R(NR29+1),R(NR29+2),R(NR29+3),R(NR29+4),
     1 R(NR29+5),R(NR29+6),R(NR29+7),R(NR29+8),
     2 R(N+10),R(N+11),R(N+12),R(N+13),R(N+14),R(N+15),R(NR4+9),
     3 R(NR4+10),R(NR4+11),
     4 R(N+10),R(N+13),R(NR4+9),R(N+11),R(N+14),R(NR4+10),R(N+12),
     5 R(N+15),R(NR4+11) )
      IF = NR29+8
      WRITE(6,32006) (R(I),I=NR29,IF)
      CALL MPYMAT(R(NR29),R(NR29+1),R(NR29+2),R(NR29+3),R(NR29+4),
     1 R(NR29+5),R(NR29+6),R(NR29+7),R(NR29+8),R(N+39),
     2 R(N+40),R(N+41),R(N+42),R(N+43),R(N+44)          ,R(NR4+60),
     3 R(NR4+61),R(NR4+62),
     4 R(N+39),R(N+42),R(NR4+60),R(N+40),R(N+43),R(NR4+61),R(N+41),
     5 R(N+44),R(NR4+62) )
      WRITE(6,32005) (R(I),I=NR29,IF)
      RETURN
    3 CONTINUE
      RETURN
    4 CONTINUE
      RETURN
    5 CONTINUE
      RETURN
    6 CONTINUE
      RETURN
    7 CONTINUE
      RETURN
    8 CONTINUE
      RETURN
    9 CONTINUE
      RETURN
   10 CONTINUE
      RETURN
      END


      SUBROUTINE CNTRLS(R)
C     T4SA22
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  JIM LACY, AERODYNAMICS ENGINEER
C
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
C
C     CALCULATION OF ROLL MOTOR,PITCH MOTOR,AND YAW MOTOR FORCES
C     AND MOMENTS ON AN ESCAPE SEAT.
C
C     CALCULATION OF PITCH MOTOR FORCES AND MOMENTS.
```

```
    5 IF(R(NR13+145))10,30,40
   10 IF(R(NR2+5).GE.R(NR13+143)) GO TO 20
      GO TO 30
   20 R(NR13+96) = R(NR4+1)
      R(NR13+145) = 0.
   30 CALL ROCKET (R(NR18+41),R(NR18+42),R(NR18+43),R(NR18+45),          PITCH-1
     1 R(NR18+46), R(NR18+47),R(NR18+44),              R(NR4 + 1),
     2 R(NR13+108),R(NR13+109),R(NR13+110),R(NR13+105),R(NR13+106),
     3 R(NR13+107),R(NR13+96),R(NR13+97),R(NR13+98),R(NR13+99),
     4 R(NR13+100),R(NR13+101),R(NR13+102),R(NR13+103),R(NR13+104),
     5 R(NR13+103),R(NR13+104),           R(NR13+95),R(NR13+104))
      IF(R(NR4+1).GT.R(NR13+95)+R(NR13+96)) R(NR13+145) = 1.0
   40 IF(R(NR13+146))50,70,80
   50 IF(R(NR2+5).LE.R(NR13+144))GO TO 60
      GO TO 70
   60 R(NR13+112) = R(NR4+1)
      R(NR13+146) = 0.
   70 CALL ROCKET (R(NR18+61),R(NR18+62),R(NR18+63),R(NR18+65),          PITCH 2
     1 R(NR18+66),R(NR18+67),R(NR18+64),R(NR4+1),R(NR13+124),
     2 R(NR13+125),R(NR13+126),R(NR13+121),R(NR13+122),R(NR13+123),
     3 R(NR13+112),R(NR13+113),R(NR13+114),R(NR13+115),R(NR13+116),
     4 R(NR13+117),R(NR13+118),R(NR13+119),R(NR13+120),R(NR13+119),
     5 R(NR13+120),          R(NR13+111),R(NR13+120))
      IF(R(NR4+1).GT.R(NR13+111)+R(NR13+112)) R(NR13+146) = 1.0
C  CALCULATION OF YAW MOTOR FORCES AND MOMENTS.
   80 CALL ROCKET(R(NR18+54),R(NR18+55),R(NR18+56),R(NR18+58),           YAW
     1 R(NR18+59),R(NR18+60),R(NR18+57),R(NR4+1),R(NR13+140),
     2 R(NR13+141),R(NR13+142),R(NR13+137),R(NR13+138),R(NR13+139),
     3 R(NR13+128),R(NR13+129),R(NR13+130),R(NR13+131),R(NR13+132),
     4 R(NR13+133),R(NR13+134),R(NR13+135),R(NR13+136),R(NR13+135),
     5 R(NR13+136),          R(NR13+127),R(NR13+136))
C  CALCULATION OF ROLL MOTOR FORCES AND MOMENTS.
      CALL ROCKET (R(NR18+34),R(NR18+35),R(NR18+36),R(NR18+38),          ROLL
     1 R(NR18+39), R(NR18+40),R(NR18+37),              R(NR4 + 1),
     2 R(NR13+92), R(NR13+93),R(NR13+94),R(NR13+89),R(NR13+90),
     3 R(NR13+91), R(NR13+79),R(NR13+80),R(NR13+81),R(NR13+82),
     4 R(NR13+83), R(NR13+84),R(NR13+85),R(NR13+86),R(NR13+87),
     5 R(NR13+86), R(NR13+87),           R(NR13+78),R(NR13+87))
      IF(R(NR4+2).GE.R(NR13+79)+R(NR13+82).AND.R(NR4+2).LE.R(NR13+79)+
     1 R(NR13+82) + .04) GO TO 90
      GO TO 100
   90 R(NR18+34) = 0.
      R(NR18+35) = 0.
      R(NR18+36) = 0.
      R(NR18+37) = 0.
      R(NR18+38) = 0.
      R(NR18+39) = 0.
      R(NR18+40) = 0.
  100 RETURN
      END


      SUBROUTINE AERMAN(/CA/,/CY/,/CN/,/CROLL/,/CM/,/CYAW/,/ALPHA
     X/,/BETA/,/B/,/C/,/S/,/L/,/D/,/T/,/CF/,/DXCP/,/DYCP/,/DZCP/)
C      T4AC13
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      REAL L
C  BODY AXIS FORCE COEFFICIENTS (CA,CY,CN) AND MOMENT COEFFICIENTS
C  (CROLL,CM,CYAW) FROM NEWTONIAN IMPACT AND SKIN FRICTION ON A MAN
C  L FEET TALL, T FEET THICK, D FEET WIDE WHOSE VERTICAL CG IS
```

```
C  DISPLACED DZCG FROM THE FACE FORWARD CENTROID.
      CAL=CCS(ALPHA)
      SAL=SIN(ALPHA)
      CEET=COS(BETA)
      SBET=SIN(BETA)
      CA = 1.4/S * CAL*ABS(CBET)* (.5*L*D + (L+D)*T*CF)
      CY = -1.4/S *ABS(CAL)*SBET * (.5*L*T + (L+T)*D*CF)
      CN = 1.4/S * SAL * (.5*D*T + (D+T)*L*CF)
      CROLL = -(CY*CZCP + CN*DYCP) / B
      CP = (CN*DXCP - CA*DZCP) / C
      CYAW = (CA*DYCP + CY*DXCP) / B
      RETURN
      END


      SLBROUTINE VSTLFM
     X (/RCLL/,/PITCH/,/YAW/,/FX/,/FY/,/FZ/,/BETA/,/CLT/,/CDT/,/CXR
     X/,/CXL/,/CXT/,/CNR/,/CNL/,/CNT/,/CMR/,/CML/,/POF1/,/PCF2
     X/,/AF/,/CA/,/TOOONF/,/ANF/,/ALPMAX/,/W/,/U/,/P/,/YF/,/R/,/XNF
     X/,/Q/,/BETMAX/,/V/,/CLAT/,/DELTAH/,/EPSLON/,/CLCE/,/DELTAE
     X/,/CDCT/,/CDCL2T/,/CXOR/,/CXBVR/,/CXBSR/,/CXAR/,/CXOL/,/CXBVL
     X/,/CXBSL/,/CXAL/,/ST/,/SW/,/CNOR/,/CNBVR/,/CNBSR/,/CNAR/,/CNOL
     X/,/CNBVL/,/CNBSL/,/CNAL/,/AKXNF/,/CXONF/,/AKTNT/,/AKTS/,/AIE
     X/,/TJ/,/CYB/,/CYDA/,/DAL/,/DAR/,/CYDR/,/DR/,/PFYPV/,/RHU
     X/,/VT/,/CDSW/,/PFYRNF/,/BW/,/CYR/,/C/,/CLO/,/AKNNF/,/CNONF
     X/,/PNPU/,/PNPV/,/DCNSSA/,/CMOR/,/CMBVR/,/CMBSR/,/CMAR/,/CMOL
     X/,/CMBVL/,/CMBSL/,/CMAL/,/CLB/,/CLP/,/CLR/,/CLDA/,/CLDR/,/PLPV
     X/,/PLPPMF/,/CF/,/CMB/,/ALT/,/ZT/,/CMC/,/ZJ/,/ALJ/,/PMPU/,/PCMSQS
     X/,/DCMSA5/,/DCMSA/,/CNB/,/CNDR/,/CNRYAW/,/CNP/,/PYAWV/,/CDSX
     X/,/PYWRMF/,/PYAWXN/,/ALPHA/,/QR/,/QL/,/TCS/,/QNF/,/QAV/,/CNANF
     X/,/CNDA/,/CB/,/AKXNF1/,/AKXNF2/,/AKXNF3/,/AKNNF1/,/AKNNF2
     X/,/AKNNF3/)
C
C        T4AC19
C
C
C    THIS ROUTINE COMPUTES THE V/STOL FORCES AND MOMENTS
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANCR ROCH, AERODYNAMICS ENGINEER
C   JIM LACY, AERCDYNAMICS ENGINEER
C   EDDIE SMART, AERCDYNAMICS ENGINEER
      IF(TCS - .99)9,9,10
   1C PCF1 = 1.
      PCF2 = 100.*(1.-TCS)
      GC TC 413
    9 IF(TCS-.98)7,7,8
    7 PCF1 = 0.
      PCF2 = 0.
      GO TO 413
    8 PCF1 = 1. + 100.*(TCS - .99)
      PCF2 = PCF1
C  7.2. SIDE SLIP ANGLE
  413 BETA = ATAN2(V, SQRT(U*U+W*W))
  900 IF(ABS (BETA) - BETMAX )902,902,901
  901 BETA = BETMAX *BETA/ABS (BETA)
  902 CCNTINUE
      AKNNF = (AKNNF1 + (AKNNF2 + AKNNF3*DB)*DB)*DB
      AKXNF = (AKXNF1 + (AKXNF2 + AKXNF3*DB)*DB)*DB
C  8. FORCE CCEFFICIENT BUILD-UP
C  8.1. TAIL LIFT
      CLT = CLAT * (ALPHA + DELTAH - EPSLON) + CLDE * DELTAE
C  8.2. TAIL DRAG
      CDT = CDOT + CDCL2T * CLT * CLT
```

```
C  8.3. AXIAL FORCE COEFFICIENT BUILD- UP
      CXR = CXOR + CXBVR + CXBSR + CXAR
      CXL = CXOL + CXBVL + CXBSL + CXAL
      CXT = -(CDT*COS (EPSLON) + CLT*SIN (EPSLON))*ST*COS (ALPHA)/SW
     1     +(CLT*COS (EPSLON) - CDT*SIN (EPSLON))*ST*SIN (ALPHA)/SW
C  8.4. NORMAL FORCE COEFFICIENT BUILD-UP
      CNR = CNOR + CNBVR + CNBSR + CNAR
      CNL = CNOL + CNBVL + CNBSL + CNAL
      CNT = (CLT*COS (EPSLON) - CDT*SIN (EPSLON))*ST*COS (ALPHA)/SW
     1     +(CDT*COS (EPSLON) + CLT*SIN (EPSLON))*ST*SIN (ALPHA)/SW
C  9. FORCES
C  9.1. AXIAL (FORWARD)
      FX = .5*AF*QR*CXR + .5*AF*QL*CXL +AKXNF*QNF*ANF*CXONF
     1+AKTNT * QA*SW * CXT + AKTS*COS (AIE)*TJ
C  9.2. LATERAL(SIDE)
      FY=QAV*SW*CYB*BETA+QA*SW*(CYDA*(DAL-DAR)+ CYDR*DR)
     1 +(PFYPV  *V - .5*RHO*VT*CDSW   *V + PFYRNF *R)*POF1
     2 + .25*RHO*VT*SW*BW*CYR*R
C  9.3. VERTICAL (NEGATIVE NORMAL)
      FZ = -.5*AF*QR*CNR -.5*AF*QL*CNL-.25*RHO*VT*SW*C*CLQ*Q
     1 -AKNNF* QNF *ANF *(CNONF + CNANF)-AKTNT*QA*SW*CNT
     2 -AKTS * SIN (AIE) * TJ
     3-(PNPU   *ABS (U) + PNPV   *ABS (V))*POF1
     4-QAV*AF*DCNSSA *POF2
C  10. MOMENT COEFFICIENT BUILD-UP
C  10.1. PITCHING
      CMR = CMOR + CMBVR + CMBSR + CMAR
      CML = CMOL + CMBVL + CMBSL + CMAL
C  10.2. YAWING
C  11. MOMENTS
C  11.1. ROLLING
      ROLL = QAV*SW*BW*CLB*BETA+.25*RHO*VT*SW*BW*BW*(CLP*P+CLR*R)
     1 + QA*SW*BW*(CLDA*(DAL-DAR)+CLDR*DR)
     2+.5*AF*QL*CNL*YF-.5*AF*QR*CNR*YF
     3 +(PLPV   *V + PLPPNF *P)*POF1
     4 -.5*AF*YF*POF1*(QL*CNAL - QR*CNAR)
C  11.2. PITCHING
      PITCH = .5*AF*DF*QR*CMR+.5*AF*DF*QL*CML
     1+QA*SW*C*CMB*ABS (BETA)+AKNNF*QNF*ANF*XNF*(CNONF+CNANF)
     2-AKTNT*QA*SW*C*(ALT*CNT+ZT*CXT)
     3+.25*RHO*VT*SW*C*C*CMQ*Q
     4+AKTS*TJ*(ZJ*COS (AIE)-ALJ*SIN (AIE))
     5+(PMPU   *U-QAV*PCMSCS )*POF1
     6+QAV*AF*CF*(DCMSA5  + DCMSA  )*POF2
C  11.3. YAWING
      YAW = QAV*SW*BW*CNB*BETA + QA*SW*BW*(CNDA*(DAL-DAR)+CNDR*DR)
     1 +.25*RHO*VT*SW*BW*BW*(CNRYAW*R+CNP*P)
     2+.5*AF*QL*CXL*YF-.5*AF*QR*CXR*YF
     3+(PYAWV  *V + .5*RHO*VT*CDSX   *V + PYWRNF *R)*POF1
     4 + PYAWXN *XNF*XNF*R
     5 -.5*AF*YF*POF1*(QL*CXAL - QR*CXAR)
      RETURN
      END


      SUBROUTINE COEFWF
     X(/CXO/,/CXBV/,/CXBS/,/CXA/,/CNO/,/CNBV/,/CNBS/,/CNA/,/CMO
     X/,/PF/,/CMBV/,/CMBS/,/CMA/,/CPBV/,/CPBS/,/RQ/,/ALPHA/,/US
     X/,/TCS/,/EF/,/BV/,/BS/,/TOOO/,/QA/,/AF/,/YF/,/ALPMAX/,/U
     X/,/W/,/P/,/R/,/ANO1/,/ANO2/,/ANO3/,/ANA2/,/ANA3/,/NG/,/ETEST
     X/,/AMA2/,/AMA3/,/SP1/,/SP2/,/PF100/,/PFNG/,/PFNG2/,/RHO/,/XO10
     X/,/XO11/,/XO12/,/XO13/,/VX10/,/VX11/,/VX12/,/VX13/,/VX20
     X/,/VX21/,/VX22/,/VX23/,/SX10/,/SX11/,/SX12/,/SX13/,/SX20
```

```
     X/,/SX21/,/SX22/,/SX23/,/XA20/,/XA21/,/XA22/,/XA23/,/DCXDA0
     X/,/DCXDA1/,/DCXDA2/,/DCXDA3/,/CXAPB1/,/CXAPB2/,/VN10/,/VN11
     X/,/VN12/,/VN13/,/VN20/,/VN21/,/VN22/,/VN23/,/SN10/,/SN11
     X/,/SN12/,/SN13/,/SN20/,/SN21/,/SN22/,/SN23/,/ANA10/,/ANA11
     X/,/ANA12/,/ANA13/,/AMO10/,/AMO11/,/AMO12/,/AMO13/,/VM10/,/VM11
     X/,/VM12/,/VM13/,/VM20/,/VM21/,/VM22/,/VM23/,/SM10/,/SM11
     X/,/SM12/,/SM13/,/SM20/,/SM21/,/SM22/,/SM23/,/CPBV00/,/CPBV01
     X/,/CPBV02/,/CPBV03/,/VP10/,/VP11/,/VP12/,/VP13/,/VP20/,/VP21
     X/,/VP22/,/VP23/,/BVO/,/ANO0/,/AMA0/,/AMA1/,/CXAPB3/)
C        T4AC20
C   COEFWF COMPUTES THE AERODYNAMIC COEFFICIENTS, ANGLES OF ATTACK,
C   SLIPSTREAM THRUST COEFFICIENTS AND DYNAMIC PRESSURE RATIOS FOR EITHER
C   RIGHT OR LEFT FAN--FOR INSTANCE, YF IS POSITIVE FOR THE RIGHT FAN AND
C   NEGATIVE FOR THE LEFT FAN.
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
C   JIM LACY, AERODYNAMICS ENGINEER
C   EDDIE SMART, AERODYNAMICS ENGINEER
      REAL NG
      CALL FANTHR(TOOO,TCS,RO,JS,PF,EF,CPBV,CPBS,
     1 NG,PF100,PFNG,PFNG2,CPBV00,CPBV01,CPBV02,CPBV03,VP10,VP11,VP12,
     2 VP13,VP20,VP21,VP22,VP23,SP1,SP2,BV,BS,RHO,AF,CA,ETEST)
      ALPHA = ATAN2(W+P*YF,U-R*YF)
      IF(ABS(ALPHA).GT.ALPMAX)ALPHA=ALPMAX*ALPHA/ABS(ALPHA)
      XO1 = XO10 + (XO11 + (XO12 + XO13*RO)*RO)*RO
      VX1 = VX10 + (VX11 + (VX12 + VX13*RO)*RO)*RO
      VX2 = VX20 + (VX21 + (VX22 + VX23*RO)*RO)*RO
      SX1 = SX10 + (SX11 + (SX12 + SX13*RO)*RO)*RO
      SX2 = SX20 + (SX21 + (SX22 + SX23*RO)*RO)*RO
      XA2 = XA20 + (XA21 + (XA22 + XA23*ALPHA)*ALPHA)*ALPHA
      DCXDA = DCXDA0 + (DCXDA1 + (DCXDA2 + DCXDA3*RO)*RO)*RO
      CXAPB = (CXAPB1 + (CXAPB2 + CXAPB3*RO)*RO)*RO
      XA1 = DCXDA + CXAPB*(BV - BVO)
      VN1 = VN10 + (VN11 + (VN12 + VN13*RO)*RO)*RO
      VN2 = VN20 + (VN21 + (VN22 + VN23*RO)*RO)*RO
      SN1 = SN10 + (SN11 + (SN12 + SN13*RO)*RO)*RO
      SN2 = SN20 + (SN21 + (SN22 + SN23*RO)*RO)*RO
      ANA1 = ANA10 + (ANA11 + (ANA12 + ANA13*RO)*RO)*RO
      AMO1 = AMO10 + (AMO11 + (AMO12 + AMO13*RO)*RO)*RO
      VM1 = VM10 + (VM11 + (VM12 + VM13*RO)*RO)*RO
      VM2 = VM20 + (VM21 + (VM22 + VM23*RO)*RO)*RO
      SM1 = SM10 + (SM11 + (SM12 + SM13*RO)*RO)*RO
      SM2 = SM20 + (SM21 + (SM22 + SM23*RO)*RO)*RO
      CXO = XO1
      CXBV=  (VX1 + VX2*BV)*BV
      CXBS=  (SX1 + SX2*BS)*BS
      CXA = RO*XA2 + XA1*ALPHA
      CNO=ANO0 + (ANO1 + (ANO2 + ANO3*RO) * RO) * RO
      CNBV=  (VN1 + VN2*BV)*BV
      CNBS=  (SN1 + SN2*BS)*BS
      CNA = (ANA1 + (ANA2 + ANA3*RO)*BV)*ALPHA
      CMO = AMO1
      CMBV=  (VM1 + VM2*BV)*BV
      CMBS=  (SM1 + SM2*BS)*BS
      CMA = (AMA0 + (AMA1 + (AMA2 + AMA3*RO) * RO) * RO) * ALPHA
      RETURN
      END


      SUBROUTINE COEFSM
```

```
      X (/CNONF/,/CXONF/,/AKTNT/,/CYB/,/CLB/,/CNB/,/EPSLON/,/DCNSSA
      X/,/DCMSA5/,/DCMSA/,/QNF/,/QAV/,/TCS/,/ALPHA/,/CNANF/,/CNDA
      X/,/TCSNF/,/ALPHNF/,/CNONF0/,/CNONF1/,/CNONF2/,/CXONF0/,/CXONF1
      X/,/CXONF2/,/AKTNT0/,/AKTNT1/,/AKTNT2/,/CYB0/,/CYB1/,/CYB2
      X/,/CLBA00/,/CLBA01/,/CLBA02/,/CLBA03/,/CLBA10/,/CLBA11/,/CLBA12
      X/,/CLBA13/,/CLBA20/,/CLBA21/,/CLBA22/,/CLBA23/,/CNB0/,/CNB1
      X/,/CNB2/,/EPS00/,/EPS01/,/EPS02/,/EPS1/,/EPS2/,/DCNSA0/,/DCNSA1
      X/,/DCNSA2/,/DCNSA3/,/DCMA50/,/DCMA51/,/DCMA52/,/DCMA53/,/DCMSA0
      X/,/DCMSA1/,/DCMSA2/,/DCMSA3/,/PCNSAL/,/CNDA0/,/CNDATC/,/ROAV
      X/,/RONF/,/ALPOR/,/TOOONF/,/ANF/,/QA/,/W/,/U/,/ALPMAX/,/Q
      X/,/XNF/,/QR/,/QL/,/TCSR/,/TCSL/,/CNB3/)
C        T4AC21
C   THIS SUBROUTINE CALCULATES THE SYMMETRICAL AERODYNAMIC COEFFICIENTS
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
C   JIM LACY, AERODYNAMICS ENGINEER
C   EDDIE SMART, AERODYNAMICS ENGINEER
C   6.2. SLIPSTREAM DYNAMIC PRESSURE
      QNF = TOOONF/ANF + QA
      QAV = .5*(QR + QL)
C   6.3. THRUST COEFFICIENTS AND PHASE-OUT FUNCTIONS
      TCS = (TCSR + TCSL)/2.
      IF(QNF)2,1,2
    1 TCSNF = 0.
      GO TO 3
    2 TCSNF =(TOOONF/ANF)/QNF
    3 ROAV = 1. - TCS
      RONF = 1. - TCSNF
C   7. AERODYNAMIC ANGLES
C   7.1.1. ANGLE OF ATTACK
   20 ALPHA = ATAN2(W,U)
  400 IF(ABS (ALPHA)-ALPMAX )412,412,409
  409 ALPHA = ALPMAX *ALPHA/ABS (ALPHA)
C   7.1.4. ANGLE OF ATTACK, NOSE FAN
  412 ALPHNF = ATAN2(W-XNF*Q, U)
      IF(ABS (ALPHNF) - ALPMAX )413,413,439
  439 ALPHNF = ALPMAX *ALPHNF/ABS (ALPHNF)
  413 CNANF=PCNSAL + (1.-TCSNF)*SIN (ALPHNF)
      CNDA = CNDA0 + .5*(TCSR + TCSL)*CNDATC
      CNONF = CNONF0 + (CNONF1 + CNONF2*RONF)*RONF
      CXONF = CXONF0 + (CXONF1 + CXONF2*RONF)*RONF
      AKTNT = AKTNT0 + (AKTNT1 + AKTNT2*ALPHA)*ALPHA
      CYB = CYB0 + (CYB1 + CYB2*ROAV)*ROAV
      CLBA0 = CLBA00 + (CLBA01 + (CLBA02 + CLBA03*ROAV)*ROAV)*ROAV
      CLBA1 = CLBA10 + (CLBA11 + (CLBA12 + CLBA13*ROAV)*ROAV)*ROAV
      CLBA2 = CLBA20 + (CLBA21 + (CLBA22 + CLBA23*ROAV)*ROAV)*ROAV
      CLB = CLBA0 + (CLBA1 + CLBA2*ALPHA)*ALPHA
      CNB = CNB0 + (CNB1 + (CNB2 + CNB3*ROAV) * ROAV) * ROAV
      EPS0 = EPS00 + (EPS01 + EPS02*ROAV)*ROAV
      EPSLON = EPS0 + (EPS1 + EPS2*ALPHA)*ALPHA
      SINA = SIN(ALPHA)
      DCNSSA = DCNSA0 + (DCNSA1 + (DCNSA2 + DCNSA3*SINA)*SINA)*SINA
      SINA5 = SIN(ALPHA - ALPOR)
      DCMSA5 = DCMA50 + (DCMA51 + (DCMA52 + DCMA53*SINA5)*SINA5)*SINA5
      DCMSA = DCMSA0 + (DCMSA1 + (DCMSA2 + DCMSA3*SINA)*SINA)*SINA
      RETURN
      END


      SUBROUTINE ACCOEF(/TYWDOT/,/TYUDOT/,/TXVDOT/,/TZVDOT/,/TXPDOT
```

```
     X/,/TXPDOT/,/TZPDOT/,/TZRDOT/,/FZWDOT/,/FYVDOT/,/CMADOT/,/CMQDOT
     X/,/CLBDOT/,/CNBDOT/,/CLPDOT/,/CLRDOT/,/CNPDOT/,/CNRDOT/,/CLADOT
     X/,/CYBDOT/,/RHO/,/S/,/C/,/B/)
C
C       T4AC22
C   COMPUTING ACCELERATION DEPENDENT COEFFICIENTS WHICH REPRESENT
C   STRUCTURAL DEFORMATIONS ARISING FROM ACCELERATIONS RATHER THAN
C   AIRLOADS - ALSO MAY BE USED TO ACCOUNT FOR AERODYNAMIC LAG.
C
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
      RSC = .25*RHO*S*C
      FZWDOT=-RSC*CLADOT
      RSC=RSC*C
      TYWDOT = RSC*CMADOT
      TYQDOT = .5*C*RSC*CMQDOT
      RSC = .25*RHO*S*B
      FYVDOT=RSC*CYBDOT
      RSC=RSC*B
      TXVDOT = RSC*CLBDOT
      TZVDOT = RSC*CNBDOT
      RSC = .5*B*RSC
      TXPDOT = RSC*CLPDOT
      TXRDOT = RSC*CLRDOT
      TZPDOT = RSC*CNPDOT
      TZRDOT = RSC*CNRDOT
      RETURN
      END


      SUBROUTINE ELASAT(EW,EAC,CMQWB,EH,EDH,EDE,PHIH,EDA,EBO,EBA,CLPWB,
     1 EV,EDR,PHIV,EDSP,CLPDOT, UA,
     2 QA,FCW,FCH,FCV,FCDSP,SH,CLAH,SV,CLAV, B,
     3 K1EW,K2EW,K1AC,K2AC,CMQFCW,K1CMQ,K2CMQ,K1EH,K2EH,K1DH,K2DH,
     4 DAHDLH,K1DA,K2DA,K1BO,K2BO,K1BCL,K2BCL,CLPFCW,K1P,K2P,
     5 K1V,K2V,K1R,K2R,DHVDYV,K1E,K2E,K1DSP,K2DSP,CLPDFC,K1PDOT,K2PDOT)
C       T4AE01
C   ELASTIC ATTENUATION FACTORS (LTV REPORT 2-53320/6R-5246,PAGE IV.2)
C
C   IVAN CLINKENBEARD,AERODYNAMICS SPECIALIST
C
      REAL K1EW,K2EW,K1AC,K2AC,K1CMQ,K2CMQ,K1EH,K2EH,K1DH,K2DH,
     1 K1DA,K2DA,K1BO,K2BO,K1BCL,K2BCL,K1P,K2P,K1V,K2V,K1R,K2R,
     2 K1E,K2E,K1DSP,K2DSP,K1PDOT,K2PDOT
C
      E(C0,C1,C2,X) = C0 + (C1 + C2*X)*X
      QFCW = QA*FCW
      QFCH = QA*FCH
      QFCV = QA*FCV
      EW = E(1.,K1EW,K2EW,QFCW)
      EAC= E(1.,K1AC,K2AC,QFCW)
      CMQWB= E(CMQFCW,K1CMQ,K2CMQ,QFCW)*FCW
      EH = E(1.,K1EH,K2EH,QFCH)
      PHIH = 1./ (1.+DAHDLH*QA*SH*CLAH*EH)
      EDH= E(1.,K1DH,K2DH,QFCH)
      EDE= E(1.,K1E, K2E ,QFCH)
      EDA = E(1.,K1DA,K2DA,QFCW)
      EBO = E(1.,K1BO,K2BO,QFCW)
      EBA = E(1.,K1BCL,K2BCL,QFCW)
      CLPWB = E(CLPFCW,K1P,K2P,QFCW)*FCW
```

```
      FV = E(1.,K1V,K2V,CFCV)
      PHIV= 1./(1.-DBVDYV*CA*SV*CLAV*EV)
      ECR= E(1.,K1R,K2R,QFCV)
      ECSP = E(1.,K1DSP,K2DSP,DA*FCDSP)
      CLPDOT = E(CLPDFC,K1PDOT,K2PDOT,QFCW)*FCW + 2.*LA**2/8
      RETURN
      END


      SUBROUTINE DCRATE(/ADOT11/,/ADOT12/,/ADOT13/,/ADOT21/,/ADOT22
     X/,/ADOT23/,/P/,/Q/,/R/,/PSI/,/THETA/,/PHI/,/A11/,/A12/,/A13
     X/,/A21/,/A22/,/A23/,/A31/,/A32/,/A33/)
C       T4ATC3
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C  COMPUTING SIX DIRECTION COSINE RATES,ADOT11 THROUGH ADOT23, FOR
C  NUMERICAL INTEGRATION OF THE SIX DIRECTION COSINES, A11 THROUGH A23.
C  THE REMAINING DIRECTION COSINES, A31,A32 AND A33 ARE COMPUTED BY
C  AN ORTHOGONAL RELATIONSHIP USING THE FIRST SIX. THE EULER ANGLES,
C  PSI, THETA AND PHI ARE COMPUTED FROM THE DIRECTION COSINES. INITIAL
C  CONDITIONS FOR THE DIRECTION COSINES A11 THROUGH A33 MUST BE SUPPLIED
C  TO THE SUBROUTINE---AFTERWORD, THE INTEGRATED VALUES WILL BE USED.
C
C
C  FIRST ROW RATES
C
      ADOT11 = A12*R - A13*Q
      ADOT12 =-A11*R + A13*P
      ADOT13 = A11*Q - A12*P
C
C  SECOND ROW RATES
C
      ADOT21 = A22*R - A23*Q
      ADOT22 =-A21*R + A23*P
      ADOT23 = A21*Q - A22*P
C
C  THIRD ROW DIRECTION COSINES
C
      A31 = A12*A23 - A13*A22
      A32 = A13*A21 - A11*A23
      A33 = A11*A22 - A12*A21
C
C  EULER ANGLES
      CALL COSDIR(PSI,THETA,PHI,A11,A12,A13,A21,A22,A23,A31,A32,A33)
      RETURN
      END


      SUBROUTINE DIRCOS(/A11/,/A12/,/A13/,/A21/,/A22/,/A23/,/A31
     X/,/A32/,/A33/,/PSI/,/THETA/,/PHI/,/SINPSI/,/COSPSI/,/SINTHE
     X/,/COSTHE/,/SINPHI/,/COSPHI/)
C       T4ATC5
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C  DIRECTION COSINES,A11 THROUGH A33, FOR YAW,PITCH,ROLL ORDER OF
C  EULER ANGLE TRANSFORMATION.
C
C
C  THE DIRECTION COSINES TRANSFORM BODY AXIS COMPONENTS TO FIXED (EARTH)
```

```
C   AXIS COMPONENTS
C   PSI,THETA,PHI ARE YAW,PITCH,ROLL ANGLES, RESPECTIVELY.
C
      SINPSI = SIN(PSI)
      COSPSI = COS(PSI)
      SINTHE = SIN(THETA)
      COSTHE = COS(THETA)
      SINPHI = SIN(PHI)
      COSPHI = COS(PHI)
      A11   = COSTHE * COSPSI
      A12   = COSPSI * SINTHE *SINPHI - SINPSI * COSPHI
      A13   = SINPHI * SINPSI + COSPHI * SINTHE * COSPSI
      A21   = COSTHE * SINPSI
      A22   = COSPHI * COSPSI + SINPHI * SINTHE * SINPSI
      A23   = COSPHI * SINTHE * SINPSI - SINPHI * COSPSI
      A31   = - SINTHE
      A32   = SINPHI * COSTHE
      A33   = COSPHI * COSTHE
      RETURN
      END


      SUBROUTINE COSDIR(/PSI/,/THETA/,/PHI/,/A11/,/A12/,/A13/,/A21
     X/,/A22/,/A23/,/A31/,/A32/,/A33/)
C       T4ATC6
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C   COMPUTING THE EULER ANGLES WHEN THE DIRECTION COSINES ARE GIVEN.
C
C   EULER ANGLES, YAW, PITCH,ROLL ORDER OF DEVELOPMENT.
C
C   YAW ANGLE
C
      PSI = ATAN2(A21,A11)
C
C   BANK ANGLE
C
      PHI = ATAN2(A32,A33)
C
C   PITCH ANGLE
C
      IF(ABS(A31) - 1.) 1,1,2
    1 THETA = ARSIN(-A31)
      GO TO 3
    2 THETA=SIGN(1.5708,-A31)
C
C   TEST FOR GIMBAL LOCK
    3 IF(ABS(PSI)-3.14)10,4,4
    4 IF(ABS(PHI)-3.14)10,5,5
    5 PSI=SIGN(3.14159,PSI) - PSI
      PHI=SIGN(3.14159,PHI) - PHI
      THETA = SIGN(3.14159,THETA) - THETA
   10 RETURN
      END


      SUBROUTINE POSXYZ(/XE/,/YE/,/ZE/,/XCGE/,/YCGE/,/ZCGE/,/DX
     X/,/DY/,/DZ/,/A11/,/A12/,/A13/,/A21/,/A22/,/A23/,/A31/,/A32
     X/,/A33/)
```

```
C        T4A107
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C
C   SUBROUTINE FOR COMPUTING THE EARTH AXIS CO-ORDINATES,XE,YE,ZE, OF
C   PCINT CISPLACED FROM THE C.G. A CISTANCE GIVEN BY DX,DY,DZ.
C
C
C   DX = X- XCG
C   DY = Y- YCG
C   DZ = Z- ZCG
C   WHERE X,Y,Z ARE CO-ORCINATES OF THE POINT AT WHICH POSITIONS ARE
C   DESIREC ANC XCG,YCG,ZCG ARE CO-ORDINATES OF THE C.G..
C
C   XCGE,YCGE,ZCCE ARE EARTH AXIS CO-ORDINATES OF THE C.G..
C
      XE = XCGE + A11*DX + A12*DY + A13*DZ
      YE = YCGE + A21*DX + A22*DY + A23*DZ
      ZE = ZCGE + A31*CX + A32*DY + A33*DZ
C
      RETURN
      END
      SUBROUTINE VELAIR(/XDOT/,/YDOT/,/ZDOT/,/ALPHA/,/BETA/,/UA
     X/,/QA/,/A11/,/A12/,/A13/,/A21/,/A22/,/A23/,/A31/,/A32/,/A33
     X/,/U/,/V/,/W/,/RHO/)
C        T4EMC2
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C   THE CUTPUT CF THIS SUBROUTINE IS USED AS INPUT TO SUBRCUTINE FRCMOM
C   AND ACCEL.
C   (1) TRANSFORMS THE BODY AXIS LINEAR VELOCITY COMPONENTS TO VELOCITY
C       COMPCNENTS IN THE FIXED FRAME--
C   (2) COMPUTES THE ANGLE OF ATTACK AND SIDESLIP ANGLE,
C   (3) CCMPUTES THE DYNAMIC PRESSURE AND AIRSPEED.
      XDOT = A11 * U  + A12 * V  + A13 * W
      YDOT = A21 * U  + A22 * V  + A23 * W
      ZDOT = A31 * U  + A32 * V  + A33 * W
      UA2 = (U * U + V * V + W * W)
      UA = SQRT(UA2)
      BETA = ATAN2(V,U)
      ALPHA = ATAN2(W*ABS(COS(BETA)),U)
C    DYNAMIC PRESSURE
      QA = .5 * RHO * UA2
      RETURN
      END



      SUBROUTINE FRCMOM(/FXO/,/FYO/,/FZO/,/TXO/,/TYO/,/TZO/,/CA
     X/,/CY/,/CN/,/CLROLL/,/CM/,/CNYAW/,/UA/,/S/,/C/,/B/,/FXE/,/FYE
     X/,/FZE/,/TXE/,/TYE/,/TZE/)
C        T4EMC6
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C   FORCES (FXO,FYO,FZO) AND MOMENTS(TXO,TYO,TZO) INDEPENDENT OF
C   ACCELERATIONS.
C   CA,CY,CN,CL RCLL,CM,CN YAW ARE BODY AXIS NON-DIMENSIONAL AERODYNAMIC
C   CCEFFICIENTS.
C   FXE,FYE,FZE ARE ADDITIONAL FORCE COMPONENTS, SUCH AS ENGINES, ROCKETS
C   TXE,TYE,TZE ARE ADDITIONAL MOMENTS.
      QAS = QA*S
C   AXIAL FCRCES, EXCLUCING ACCELERATION DEPENDENT FORCES.
      FXO = -QAS*CA + FXE
```

```
C  SIDE FORCES, EXCLUDING ACCELERATION DEPENDENT FORCES.
      FYO = CAS*CY + FYE
C  NEGATIVE NORMAL FORCES, EXCLUDING ACCELERATION DEPENDENT FORCES.
      FZO = -CAS*CN + FZE
C  PITCHING MOMENT, EXCLUDING ACCELERATION DEPENDENT MOMENTS.
      TYO = OAS*C*CM + TYE
C  ROLLING MOMENT, EXCLUDING ACCELERATION DEPENDENT MOMENTS.
      CAS = QAS*B
      TXO = QAS*CL ROLL + TXE
C  YAWING MOMENT, EXCLUDING ACCELERATION DEPENDENT MOMENTS.
      TZO = CAS*CN YAW + TZE
      RETURN
      END


      SUBROUTINE ANGMOM(/HX/,/HY/,/HZ/,/IXX/,/IYY/,/IZZ/,/IXZ/,/P
     X/,/C/,/R/,/OMEGXE/,/IXE/,/IZE/,/SIE/,/CIE/,/IXEP/,/IZEP/,/IXZEP
     X/,/SIEP/,/CIEP/,/IXXA/,/IXZA/,/IZZA/)
C     T4EM07
      REAL IXX,IYY,IZZ,IXZ,IXE,IZE,IXEP,IZEP,IXZEP,IXXA,IXZA,IZZA
C
C  ANGULAR MOMENTUM COMPONENTS, HX,HY,HZ.
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  IXX,IYY,IZZ,AND IXZ ARE BODY AXIS MOMENTS AND PRODUCT OF INERTIA.
C  P,C,R ARE BODY AXIS ANGULAR RATES.
C  OMEGXE IS THE ROTATION RATE OF ALL ENGINE PARTS, FANS OR PROPELLERS
C  NOT CANCELLED BY COUNTER ROTATING PARTS.
C  IXE IS ROLLING MOMENT OF INERTIA OF THE PART ROTATING AT OMEGXE
C  RAD/SEC WITH AN INCIDENCE WHOSE SIN AND COSINE ARE SIE,CIE.
C  IZE IS YAWING MOMENT OF INERTIA OF THE PART ROTATING AT OMEGXE
C  RAD/SEC WITH AN INCIDENCE WHOSE SIN AND COSINE ARE SIE,CIE.
C  IXEP,IZEP,IXZEP ARE MOMENTS AND PRODUCT OF INERTIA OF A NON-ROTATING
C  COMPONENT WHICH CHANGES INCIDENCE, IEP, WITH RESPECT TO THE BASIC
C  UNVARYING AIRFRAME. SIEP = SIN(IEP) AND CIEP = COS(IEP).
C  IXXA,IXZA,IZZA ARE BASIC UNVARYING INERTIA COMPONENTS.
      CONTINUE
C  REMOVE C IN COLUMN 1 OF THE FOLLOWING EQUATIONS IF COMPUTATION
C  DESIRED.
C
C     SIEP2 = SIEP**2
C     CIEP2 = CIEP**2
C     SIE2 = SIE**2
C     CIE2 = CIE**2
C     IXX = IXXA
C    1 +IXEP*CIEP2-2.*IXZEP*SIEP*CIEP+IZEP*SIEP2
C    2 +IXE*CIE2 + IZE*SIE2
C
C     IXZ = IXZA
C    1 +IXZEP*(CIEP2-SIEP2)+(IXEP-IZEP)*SIEP*CIEP
C    2 +(IXE-IZE)*SIE*CIE
C
C     IZZ = IZZA
C    1 +IZEP*CIEP2+2.*IXZEP*SIEP*CIEP+EXEP*SIEP2
C    2 +IZE*CIE2 + IXE*SIE2
C
      HX = IXX*P - IXZ*R
C    1 + IXE*CIE*OMEGXE
      HY = IYY*C
      HZ = -IXZ*P + IZZ*R
C    1 -IXE*SIE*OMEGXE
```

```
      RETURN
      END


      SUBROUTINE ACCEL(/UDOT/,/VDOT/,/WDOT/,/PDOT/,/QDOT/,/RDOT
     X/,/NXCG/,/NYCG/,/NZCG/,/P/,/Q/,/R/,/U/,/V/,/W/,/A31/,/A32
     X/,/A33/,/FXO/,/FYO/,/FYVDOT/,/FZO/,/FZWDOT/,/GW/,/TXO/,/TXPDOT
     X/,/TXRDOT/,/TXVDOT/,/TYO/,/TYQDOT/,/TYWDOT/,/TZO/,/TZRDOT
     X/,/TZPDOT/,/TZVDOT/,/IXX/,/IYY/,/IZZ/,/IXZ/,/HX/,/HY/,/HZ
     X/,/DXCG/,/DYCG/,/DZCG/,/ME/,/OMEGXE/,/SIE/,/CIE/)
C     T4EMC8
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
      REAL NXCG,NYCG,NZCG,IXX,IYY,IZZ,IXZ,ME,M
C
C
      M = GW/32.17
C
C  AXIAL LOAD FACTOR
      NXCG = -FXO/GW
C
C  AXIAL ACCELERATION, POSITIVE FORWARD
      UDOT = R*V-Q*W+32.17*(A31-NXCG)
C    1 -ME/ M*OMEGXE*SIE*V
C
C  SIDE ACCELERATION, POSITIVE RIGHT
      VDOT =(M*(P*W-R*U+32.17*A32)+FYO
C    1 -ME*OMEGXE*(U*SIE + W*CIE)
     2 )/(M - FYVDOT)
C
C  NORMAL ACCELERATION, POSITIVE DOWN
      WDOT = (M*(Q*U-P*V+32.17*A33)+FZO
C    1 + ME*OMEGXE*CIE*V
     2 )/(M - FZWDOT)
C
C  SIDE LOAD FACTOR
      NYCG = -(FYO + FYVDOT *VDOT)/GW
C  NORMAL LOAD FACTOR
C
      NZCG = -(FZO + FZWDOT *WDOT)/GW
C
C  PITCHING ACCELERATION, POSITIVE NOSE UP
      QDOT = (P*HZ-R*HX+TYO+TYWDOT*WDOT)/(IYY-TYQDOT)
     1 + GW*(NZCG*DXCG - NXCG*DZCG)/(IYY-TYQDOT)
C
C  ROLLING ACCELERATION, POSITIVE RIGHT WING DOWN
      TX1 = R*HY-Q*HZ+TXO + TXVDOT*VDOT
     1 + GW*(NYCG*DZCG - NZCG*DYCG)
      TZ1 = Q*HX-P*HY+TZO + TZVDOT*VDOT
     1 + GW*(NXCG*DYCG - NYCG*DXCG)
      PDOT =((IZZ-TZRDOT)*TX1+(IXZ+TXRDOT)*TZ1)/
     1 (((IXX-TXPDOT)*(IZZ-TZRDOT)-(IXZ+TXRDOT)*(IXZ+TZPDOT))
C
C  YAWING ACCELERATION, POSITIVE NOSE RIGHT
      RDOT =(TZ1 +(IXZ+TZPDOT)*PDOT)/(IZZ-TZRDOT)
C
      RETURN
      END
```

```
      SUBROUTINE VELXYZ(/U/,/V/,/W/,/UCG/,/VCG/,/WCG/,/DX/,/DY
     X/,/DZ/,/P/,/Q/,/R/)
C        T4EM10
C
C  SUBROUTINE FOR COMPUTING THE VELOCITY COMPONENTS, U,V,W, AT A POINT
C  OFF THE C.G.
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C  UCG,VCG,WCG ARE VELOCITY COMPONENTS AT THE C.G.
C
C  DX = X- XCG
C  DY = Y- YCG
C  DZ = Z- ZCG
C  WHERE X,Y,Z ARE CO-ORDINATES OF THE POINT AT WHICH VELOCITIES ARE
C  DESIRED AND XCG,YCG,ZCG ARE CO-ORDINATES OF THE C.G..
C
C  P,Q,R ARE ROTATIONAL RATES.
C
      U = UCG + Q*DZ - R*DY
      V = VCG + R*DX - P*DZ
      W = WCG + P*DY - Q*DX
      RETURN
      END


      SUBROUTINE ROCKET(/FXR/,/FYR/,/FZR/,/TXR/,/TYR/,/TZR/,/FR
     X/,/T/,/CALPHA/,/CBETA/,/CGAMMA/,/DXR/,/DYR/,/DZR/,/T0/,/T1
     X/,/FR1/,/T2/,/FR2/,/T3/,/FR3/,/T4/,/FR4/,/T5/,/FR5/,/T6/,/FR6/)
C        T4EM13
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  JIM LACY, AERODYNAMICS ENGINEER
C  EDDIE SHART, AERODYNAMICS ENGINEER
C  ELEANOR HUCH, AERODYNAMICS ENGINEER
C
      REAL I
C
C  FORCE (FXR,FYR,FZR) AND MOMENT (TXR,TYR,TZR) COMPONENTS FROM A ROCKET
C  WITH A KNOWN FORCE-TIME SCHEDULE, A KNOWN BURN TIME,DT, STARTING
C  AT TIME TO AND KNOWN DIRECTION COSINES (CALPHA,CBETA,CGAMMA).
C  CALPHA,CBETA,CGAMMA ARE DIRECTION COSINES OF THE ROCKET THRUST
C  VECTOR WITH RESPECT TO THE SEAT.
C  THE FORCE   IS APPLIED AT DISTANCE COMPONENTS (DXR,DYR,DZR) FROM THE
C  C.G.
C  IF THE ROCKET THRUST IS YAWED (PSI) AND PITCHED (THETA) WITH RESPECT
C  TO THE SEAT AXIS SYSTEM THE DIRECTION COSINES OF THE THRUST LINE WILL
C  BE COMPUTED AS INPUTS IN THE FORM,
C     CALPHA = COS(THETA)* COS(PSI)
C     CBETA  = COS(THETA)* SIN(PSI)
C     CGAMMA = -SIN(THETA)
C
C
C  FOR A PURE IMPULSE, FOUR INPUTS TO THE FORCE SCHEDULE ARE REQUIRED.
C  THEY ARE T1,FR1,T2,FR2, SET T1=0., FR1=THE FORCE, FR2=FR1, AND
C  T2=TO+DT+.01 . ALL OTHER FORCE SCHEDULE INPUTS SHOULD BE ZERO
C  EXCEPT T6 WHICH SHOULD BE CALLED WITH TO+DT.
C  TO AND DT ARE DEFINED ABOVE.
C  TO SHORT OUT SUSTAINER SET TO OF SUSTAINER GREATER THAN 40
```

```
C  IF TC OF SUSTAINER IS GREATER THAN 10 SEC AND LESS THAN 40 SEC
C  SUBROUTINE CATPLT SETS TO OF SUSTAINER TO TIME WHEN CATAPULT REACHES
C  END OF STROKE
C
      IF(T-TO)30,30,1
    1 IF(T-T6-TO) 3,30,30
    3 IF(T-T1-TO) 4,4,5
    4 FR = FR1*(T-TO)/T1
      GO TO 25
    5 IF(T-T2-TO) 6,6,7
    6 FR = FR1 + (FR2-FR1)*(T-T1-TO)/(T2-T1)
      GO TO 25
    7 IF(T-T3-TO) 8,8,9
    8 FR = FR2 + (FR3-FR2)*(T-T2-TO)/(T3-T2)
      GO TO 25
    9 IF(T-T4-TO) 10,10,11
   10 FR = FR3 + (FR4-FR3)*(T-T3-TO)/(T4-T3)
      GO TO 25
   11 IF(T-T5-TO) 12,12,13
   12 FR = FR4 + (FR5-FR4)*(T-T4-TO)/(T5-T4)
      GO TO 25
   13 IF(T-T6-TO) 14,30,30
   14 FR = FR5 +(FR6-FR5)*(T-T5-TO)/(T6-T5)
C  AXIAL FORCE COMPONENT, POSITIVE FORWARD
   25 FXR = FR*CALPHA
C  LATERAL FORCE COMPONENT, POSITIVE RIGHT
      FYR = FR*CBETA
C  NORMAL FORCE COMPONENT, POSITIVE DOWN
      FZR = FR*CGAMMA
C  ROLLING MOMENT, POSITIVE CLOCKWISE LOOKING FORWARD
      TXR = DYR*FZR - DZR*FYR
C  PITCHING MOMENT, POSITIVE NOSE UP
      TYR = DZR*FXR - DXR*FZR
C  YAWING MOMENT, POSITIVE NOSE RIGHT
      TZR = DXR*FYR - DYR*FXR
      RETURN
C
C  TIME IS OUTSIDE THE BURN TIME INTERVAL.
   30 FR = 0.
      FXR = 0.
      FYR = 0.
      FZR = 0.
      TXR = 0.
      TYR = 0.
      TZR = 0.
      RETURN
      END


      SUBROUTINE MOMENT(/TX/,/TY/,/TZ/,/FX/,/FY/,/FZ/,/DX/,/DY
     X/,/DZ/)
C       T4EM14
C  SUBROUTINE FOR COMPUTING THE MOMENT COMPONENTS,TX,TY,TZ, FROM
C  FORCE COMPONENTS,FX,FY,FZ, OPERATING ON MOMENT ARM COMPONENTS,
C  DX,DY,DZ.
C  WHERE
C  DX = X-XCG
C  DY = Y-YCG
C  DZ = Z-ZCG
C  WITH THE FORCE BEING APPLIED AT X,Y,Z AND THE MOMENT FULCRUM AT
```

```
C  XCG.YCG.ZCG.
C
C
C
C  IVAN CLINKENBEARD. ENGINEERING SPECIALIST
      TX = FZ*CY - FY*CZ
      TY = FX*DZ - FZ*DX
      TZ = FY*CX - FX*DY
      RETURN
      END



      SUBROUTINE ACCELO(/UDOT/,/VDOT/,/WDOT/,/PDOT/,/QDOT/,/RDOT
     X/,/NXCG/,/NYCG/,/NZCG/,/P/,/Q/,/R/,/U/,/V/,/W/,/A31/,/A32
     X/,/A33/,/FXO/,/FYO/,/FZO/,/GW/,/TXO/,/TYO/,/TZO/,/IXX/,/IYY
     X/,/IZZ/,/IXZ/,/IYZ/,/IXY/,/HX/,/HY/,/HZ/,/DXCG/,/DYCG/,/DZCG
     X/,/MECVM/,/OMEGXE/,/SIE/,/CIE/,/MDOTOM/)
C       T4EM18
C
C  IVAN CLINKENBEARD. ENGINEERING SPECIALIST
      REAL NXCG.NYCG.NZCG.IXX.IYY.IZZ.IXZ. IYZ.IXY.MECVM.MDOTOM
C
C  CONTINUATION STATEMENTS 1.2.3 ARE INPUTS TO THIS SUBROUTINE.
C  AXIAL LOAD FACTOR
      NXCG = -FXO/GW
C  SIDE LOAD FACTOR
      NYCG = -FYO/GW
C  NORMAL LOAD FACTOR
      NZCG = -FZO/GW
C
C  AXIAL ACCELERATION. POSITIVE FORWARD
      UDOT = R*V-Q*W+32.17*(A31-NXCG)
C    1 -MECVM*OMEGXE*SIE*V
     2- MDOTOM * U
C
C  SIDE ACCELERATION. POSITIVE RIGHT
      VDOT = P*W-R*U+32.17*(A32-NYCG)
C    1 +MECVM*OMEGXE*(U*SIE + W*CIE)
     2- MDOTOM * V
C
C  NORMAL ACCELERATION. POSITIVE DOWN
      WDOT = Q*U-P*V+32.17*(A33-NZCG)
C    1 -MECVM*OMEGXE*CIE*V
     2- MDOTOM * W
C
C  PITCHING ACCELERATION. POSITIVE NOSE UP
      TX1 = R*HY-Q*HZ + TXO
     1 + GW*(NYCG*DZCG - NZCG*DYCG)
      TY1 = P*HZ-R*HX+TYO
     1 + GW*(NZCG*DXCG-NXCG*DZCG)
      TZ1 = Q*HX-P*HY + TZO
     1 + GW*(NXCG*DYCG - NYCG*DXCG)
      DM1 = IXY*IZZ + IXZ*IYZ
      DM2 = IXX*IZZ - IXZ*IXZ
      DM3 = IXX*IYZ + IXY*IXZ
      QDOT =(TX1*DM1 + TY1*DM2 + TZ1*DM3)/(-IXY*DM1 +IYY*DM2 - IYZ*DM3)
C
C  ROLLING ACCELERATION. POSITIVE RIGHT WING DOWN
      PDOT = ( IZZ*(TX1+IXY*QDOT) + IXZ*(TZ1+IYZ*QDOT)) / ( DM2)
C
```

```
C  YAWING ACCELERATION, POSITIVE NOSE RIGHT
      RDOT = (TZ1 +IYZ*QDOT + IXZ*PDOT)/IZZ
C
      RETURN
      END


      SUBROUTINE ANGMMO(/HX/,/HY/,/HZ/,/IXX/,/IYY/,/IZZ/,/IXZ/,/IYZ
     X/,/IXY/,/P/,/Q/,/R/)
C       T4EM20
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      REAL IXX,IYY,IZZ,IXZ,IYZ,IXY
C
C  ANGULAR MOMENTUM COMPONENTS, HX, HY, HZ, ARE OUTPUTS.
C
C
C  IXX,IYY,IZZ,IXZ,IYZ,IXY ARE MOMENTS AND PRODUCTS OF INERTIA.
C
      HX = IXX*P - IXY*Q - IXZ*R
      HY =-IXY*P + IYY*Q - IYZ*R
      HZ =-IXZ*P - IYZ*Q + IZZ*R
C
      RETURN
      END


      SUBROUTINE CHUTES(/XPDD/,/YPDD/,/ZPDD/,/TLS/,/DTI/,/RHOS
     X/,/VOL/,/VP/,/MDOTA/,/SCD/,/SCDLS/,/FXSP/,/FYSP/,/FZSP/,/FXPS
     X/,/FYPS/,/FZPS/,/FPS/,/FXM/,/FYM/,/FZM/,/TXPS/,/TYPS/,/TZPS
     X/,/RM/,/RXL/,/RYL/,/RZL/,/RL/,/FXI/,/FYI/,/FZI/,/ALPHA/,/FXD
     X/,/FYD/,/FZD/,/FXL/,/FYL/,/FZL/,/SCL/,/XPD/,/YPD/,/ZPD/,/XP
     X/,/YP/,/ZP/,/T/,/TE/,/FLAGE/,/FLAGL/,/PP/,/RHO/,/FXPSO/,/FYPSO
     X/,/FZPSO/,/FPSO/,/DXF/,/DYF/,/DZF/,/A/,/B/,/C/,/D/,/MACH
     X/,/CXAP/,/DYAP/,/DZAP/,/CAE/,/CBE/,/CGE/,/FXIS/,/FYIS/,/FZIS
     X/,/VELS/,/US/,/VS/,/WS/,/XS/,/YS/,/ZS/,/P/,/Q/,/R/,/RLINES
     X/,/RSC/,/RIN/,/D11/,/D12/,/D13/,/D21/,/D22/,/D23/,/D31/,/D32
     X/,/D33/,/RLO/,/K/,/B0/,/B1/,/B2/,/B3/,/FD/,/C1/,/C2/,/SCTI
     X/,/K1/,/K2/,/K3/,/CC/,/DTGUN/,/FDB/,/DX1/,/DY1/,/DZ1/,/DX2
     X/,/DY2/,/DZ2/,/DX3/,/DY3/,/DZ3/,/DX4/,/DY4/,/DZ4/,/DXA/,/DYA
     X/,/DZA/,/ERRCC/,/NLINES/,/SCTA/,/SCTA2/,/SCTA3/,/SCNA/,/SCNA2
     X/,/SCNA3/)
C       T4EM21
C
C   SUBROUTINE FOR COMPUTING PARACHUTE FORCES AND MOMENTS.
C   INCLUDING THE MASS ACQUISITION TERMS.
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  JIM LACY, AERODYNAMICS ENGINEER
C
C    XPDD,YPDD,ZPDD/XPD,YPD,ZPD/XP,YP,ZP ARE PARACHUTE
C    ACCELERATION,VELOCITY,AND POSITION COMPONENTS IN THE
C    EARTH AXIS SYSTEM
C    FXSP,FYSP,FZSP ARE FORCE COMPONENTS FROM THE SEAT(OR MAN)
C    PULL THROUGH THE PARACHUTE RISERS AND BRIDLE.
C    FXIS,FYIS,FZIS ARE FORCE COMPONENTS DUE TO CHUTE DEPLOYMENT IMPULSE
C    IN SEAT AXIS SYSTEM.
C    FXI,FYI,FZI ARE FORCE COMPONENTS DUE TO CHUTE DEPLOYMENT
C    IMPULSE IN EARTH AXIS SYSTEM.
C    FXM,FYM,FZM ARE FORCE COMPONENTS RESULTING FROM PARACHUTE
C    AIR MASS ACQUISITION.
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C    FXPS.FYPS.FZPS.TXPS.TYPS.TZPS ARE FORCE AND MOMENT COMPONENTS
C    FROM THE PARACHUTE ACTING ON THE SEAT.
C FPS = MAGNITUDE OF PARACHUTE FORCE ON SEAT
       CONTINUE
C    US.VS.WS.XS.YS.ZS ARE SEAT
C    VELOCITY.AND POSITION COMPONENTS RESPECTIVELY IN THE SEAT
C    AXIS SYSTEM.
C    P.Q.R ARE ANGULAR VELOCITY COMPONENTS OF THE SEAT.
C    D11 TO D33 ARE DIRECTION COSINES RELATING THE SEAT UNIT
C    VECTORS TO THE EARTH UNIT VECTORS.
C    VP IS THE TOTAL VELOCITY OF THE PARACHUTE.
C    VELS IS THE TOTAL VELOCITY OF THE SEAT.
C    TE = PARACHUTE EJECTION TIME, TLS = TIME AT LINE STRETCH.
       CONTINUE
C    DTI = MASS ACQUISITION TIME.
C    DTGUN IS THE DECREASE IN THE SPREADING TIME OF THE CHUTE
C    DUE TO THE SPREADING GUN.
C    MP = MASS OF PARACHUTE .MDOTA = AIR MASS ACQUISITION RATE.
C    ALPHA IS PARACHUTE ANGLE OF ATTACK
C    VOL = VOLUME OF AIR ACQUIRED BY PARACHUTE.
C    RHOS IS THE COMPRESSED AIR DENSITY AND RHO IS THE AMBIENT
C    AIR DENSITY.
C    DXA.DYA.DZA. ARE THE COMPONENTS OF THE DISTANCE FROM THE SEAT
C    CG TO THE PARACHUTE ATTACH POINT.
C    DXAP.DYAP.DZAP ARE THE COMPONENTS OF THE DISTANCE FROM THE SEAT
C    CG TO THE PARACHUTE PACKED LOCATION. CAE.CBE.CGE ARE DIRECTION
C    COSINES OF PARACHUTE IMPULSE IN SEAT AXIS SYSTEM.
       CONTINUE
C    RLINES IS THE LENGTH OF THE LINES FROM THE ATTACH POINT TO
C    THE CANOPY OF THE CHUTE(RISER LENGTH).
C    RL IS THE DISTANCE FROM THE PARACHUTE ATTACH POINT TO THE
C    PARACHUTE CG.
C    RXL.RYL.RZL ARE THE COMPONENTS OF RL IN THE EARTH AXIS SYSTEM.
C    RLO IS THE DISTANCE FROM THE PARACHUTE ATTACH POINT TO THE
C    PARACHUTE CG AT FULL INFLATION.
C    RSC IS THE LENGTH OF THE SKIRT AND CANOPY QUARTER CIRCUMFERENCE.
C    RIN IS THE INLET RADIUS OF THE CHUTE.
C    RM IS THE CANOPY CIRCUMFERENCE.
C    K IS THE LINE ELASTIC MODULUS
C    FDB IS PARACHUTE STRIP OUT FORCE.
       CONTINUE
C    B0.B1.B2.B3 ARE CONSTANTS IN THE EQUATION FOR THE SCD OF THE REEFED
C    CHUTE.
C    C1.C2 ARE CONSTANTS IN THE EQUATION FOR THE COMPRESSIBILITY
C    FACTOR FC. FC IS THE RATIO OF AN AERODYNAMIC COEFFICIENT OF A
C    SECONDARY BODY IN THE WAKE OF A PRIMARY BODY TO THE FREE STREAM
C    COEFFICIENT OF THE SECONDARY BODY.
C    K1.K2.K3 ARE CONSTANTS IN EQUATION FOR DTI(MASS ACQUISITION TIME).
C    CC IS PARACHUTE POROSITY FACTOR.
C    SCDLS IS SCD AT LINE STRETCH. SCDI IS SCD AT FULL INFLATION.
C  DX1.DY1.DZ1....DZ4 ARE COORDINATES OF THE BRIDLE ATTACH POINTS.
C THESE ATTACH POINTS MUST BE NUMBERED CONSECUTIVELY IN A CCW DIRECTION.
C  FXPSO.FYPSO.FZPSO ARE COMPONENTS OF PARACHUTE FORCE ON THE SEAT
C  THE LAST TIME BRIDLE WAS CALLED.
C  DXF.DYF.DZF. ARE COORDINATES W.R.T. SEAT C.G. OF FORCE APPLICATION PT
C  A.B.C.D ARE COEFFICIENTS OF THE EQ. FOR THE PLANE CONTAINING THE
C  BRIDLE ATTACH POINTS.
C  ERRDC IS THE ERROR IN THE DIRECTION COSINES OF THE FORCE FROM
C  THE PREVIOUS TIME INCREMENT TO THE PRESENT TIME INCREMENT.
C  IF THE DIFFERENCE IN THE SET OF DIRECTION COSINES IS LESS THAN
C  ERRDC THE PREVIOUS FORCE APPLICATION POINT IS USED FOR MOMENT CAL.
```

```
C     FLAGE IS EJECTION TIME FLAG. FLAGL IS LINE STRETCH FLAG.
C     BEFCRE STARTING TIME HISTORY SET FLAGE = FLAGL = -1.0
C
      REAL MP,MACH,MDOTA,K,K1,K2,K3
      CALL PCSXYZ(RXL,RYL,RZL,XP-XS,YP-YS,ZP-ZS,-DXA,-DYA,-DZA,
     1 C11,D12,C13,C21,C22,D23,D31,D32,D33)
      RL = SQRT(RXL**2 + RYL**2 + RZL**2)
      VP = SQRT(XPD**2 + YPD**2 + ZPD**2)
      IF(T-TE)3,1,1
    1 IF(FLAGE)2,2,4
    2 FLAGE = 1.
      DTI = K1*2.*RSC/(VELS*(K2-K3*CC)) - DTGUN
      IF(CTI.LE.C.)CTI = DTGUN
      RM = (RLINES + RSC)/(RLINES/RIN + 1.5708)
      VCL = 4.19*RM**3
      CALL BRIDLE(0.00,0.00,0.00,1.0,FXPS0,FYPSC,FZPS0,FPS0,ERROC,
     1 TXPS,TYPS,TZPS,DXF,CYF,CZF,CX1,DY1,DZ1,DX2,DY2,DZ2,
     2 CX3,CY3,CZ3,DX4,DY4,CZ4,DXA,DYA,DZA,A,B,C,D,NLINES,1)
      CALL POSXYZ(FXI,FYI,FZI,0.,0.,0.,-FXIS,-FYIS,
     1  -FZIS,C11,D12,D13,C21,D22,C23,D31,D32,D33)
      GC TC 4
    3 CALL POSXYZ(FXSP,FYSP,FZSP,XP-XS,YP-YS,ZP-ZS,-DXAP,-DYAP,-DZAP,
     1 C11,C12,C13,C21,D22,D23,D31,D32,D33)
      FXSF = -K*FXSP
      FYSP = -K*FYSP
      FZSP = -K*FZSP
      XPDC = FXSP/MP
      YPDC = FYSP/MP
      ZPDC = FZSP/MP + 32.17
      FXPS=C.
      FYPS=C.
      FZPS=0.
      TXPS=0.
      TYPS=C.
      TZPS=0.
      FXI=0.
      FYI=0.
      FZI=0.
      ALPHA=0.
      FXD = 0.
      FYC = 0.
      FZD = 0.
      FXL = 0.
      FYL = 0.
      FZL = 0.
      SCL=0.
      SCD=0.
      RETURN
    4 IF(RL-RLO)5,1C,10
    5 IF(FLAGL)6,6,15
   15 FSP = -K*(RL-RLO)/RL
      FXSP=FSP*RXL
      FYSP=FSP*RYL
      FZSP=FSP*RZL
      FPS=0.
      FXPS=0.
      FYPS=0.
      FZPS=0.
      TXPS=0.
      TYPS=C.
      TZPS=0.
```

```
      GC TO 7
    6 FXSP = -FCB*RXL/RL
      FYSP = -FDB*RYL/RL
      FZSP = -FCB*RZL/RL
      FPS=FCB
      CALL POSXYZ(FXPS,FYPS,FZPS,0.,0.,0.,-FXSP,-FYSP,-FZSP,D11,D21,D31,
     1 C12, D22, D32, D13, D23, D33)
      CALL BRIDLE(FXPS,FYPS,FZPS,FPS,FXPSO,FYPSC,FZPSC,FPSO,ERRDC,
     1 TXPS,TYPS,TZPS,CXF,CYF,CZF,DX1,DY1,DZ1,DX2,DY2,DZ2,
     2 CX3,CY3,DZ3,CX4,CY4,DZ4,DXA,DYA,DZA,A,B,C,D,NLINES,-1)
      RR = RL/RLO
      FC = FD
      IF(MACH.GT.1.) FC =(1.0 + (C1+C2*(MACH-1.))*(MACH-1.))*FD
      SCD=(((B3*RR+B2)*RR+B1)*RR+B0)*SCTI*FC
      SCL = 0.
      ALPHA = 0.
      FXL= 0.
      FYL= 0.
      FZL= 0.
      GO TO 9
   10 IF(FLAGL)11,11,12
   11 FLAGL=1.
      TLS = T
   12 FSPR= -K*(RL-RLO)/RL
      FPS=ABS(FSPR)*RL
      FXSP = FSPR*RXL
      FYSP = FSPR*RYL
      FZSP = FSPR*RZL
      CALL POSXYZ(FXPS,FYPS,FZPS,0.,0.,0.,-FXSP,-FYSP,-FZSP,D11,D21,D31,
     1 C12, C22, D32, D13, D23, D33)
      CALL BRIDLE(FXPS,FYPS,FZPS,FPS,FXPSO,FYPSO,FZPSC,FPSO,ERRDC,
     1 TXPS,TYPS,TZPS,CXF,DYF,DZF,DX1,DY1,CZ1,DX2,DY2,DZ2,
     2 CX3,CY3,DZ3,DX4,DY4,DZ4,DXA,DYA,DZA,A,B,C,D,NLINES,-1)
    7 IF(T-TLS-CTI)14,14,8
    8 CAL=ABS((XPD*RXL + YPD*RYL + ZPD*RZL)/(RL*VP))
      IF(CAL .GT. 1.) CAL=1.0
      ALPHA=ARCOS(CAL)
      SINA = SIN(ALPHA)
      COSA = COS(ALPHA)
      FC = FD
      IF(MACH.GT.1.) FC =(1.0 + (C1+C2*(MACH-1.))*(MACH-1.))*FD
      SCT = SCTI +((SCTA3*ALPHA+SCTA2)*ALPHA+SCTA)*ALPHA
      SCN = ((SCNA3*ALPHA+SCNA2)*ALPHA + SCNA)*ALPHA
      SCD =(SCN*SINA + SCT*COSA)*FC
      SCL =(SCN*COSA - SCT*SINA)*FC
C  COMPLETE EARTH AXIS LIFT COMPONENTS.
      CALL VELXYZ(DVX,DVY,DVZ,C.,C.,0.,RXL,RYL,RZL,XPD,YPD,ZPD)
      CALL VELXYZ(DAX,DAY,DAZ,0.,0.,0.,DVX,DVY,DVZ,XPC,YPC,ZPD)
      E = .5*RHC*SCL*VP*VP/SQRT(DAX**2+DAY**2+DAZ**2)
      FXL = E*DAX
      FYL = E*DAY
      FZL = E*CAZ
      FXI=0.
      FYI=0.
      FZI=0.
    9 FXM = 0.
      FYM = 0.
      FZM = 0.
      GC TO 100
   14 RHOS = RHO/((1.+.2*MACH**2)**2.5)
      MDOTA = VOL*RHOS/DTI
```

```
      FXM = -MDOTA*XPD
      FYM = -MDOTA*YPD
      FZM = -MDOTA*ZPD
      CAL=ABS((XPD*RXL + YPD*RYL + ZPD*RZL)/(VP*RL))
      IF(CAL .GT. 1.) CAL=1.0
      ALPHA=ARCOS(CAL)
      SINA = SIN(ALPHA)
      COSA = COS(ALPHA)
      FC = FD
      IF(MACH.GT.1.) FC =(1.0 + (C1+C2*(MACH-1.))*(MACH-1.))*FD
      SCTIA = SCTI +((SCTA3*ALPHA+SCTA2)*ALPHA+SCTA)*ALPHA
      SCDLS =(B3 + B2 + B1 + B0)*SCTIA
      SCT = SCDLS +(SCTIA-SCDLS)*(T-TLS)/DTI
      SCN = ((SCNA3*ALPHA+SCNA2)*ALPHA+SCNA)*ALPHA*(T-TLS)/DTI
      SCD =(SCN*SINA + SCT*COSA)*FC
      SCL =(SCN*COSA - SCT*SINA)*FC
C  COMPUTE EARTH AXIS LIFT COMPONENTS.
      CALL VELXYZ(DVX,DVY,DVZ,0.,0.,0.,RXL,RYL,RZL,XPD,YPD,ZPD)
      CALL VELXYZ(DAX,DAY,DAZ,0.,0.,0.,DVX,DVY,DVZ,XPD,YPD,ZPD)
      E = .5*RHO*SCL*VP*VP/SQRT(DAX**2+DAY**2+DAZ**2)
      FXL = E*DAX
      FYL = E*DAY
      FZL = E*DAZ
  100 E =-.5*RHO*SCD*VP
C  COMPUTE EARTH AXIS DRAG COMPONENTS
      FXD = E*XPD
      FYD = E*YPD
      FZD = E*ZPD
      XPDD = (FXD + FXL + FXM + FXI + FXSP)/MP
      YPDD = (FYD + FYL + FYM + FYI + FYSP)/MP
      ZPDD = (FZD + FZL + FZM + FZI + FZSP)/MP + 32.17
      RETURN
      END


      SUBROUTINE BRIDL3(/CAF/,/CBF/,/CGF/,/X1/,/Y1/,/Z1/,/DXF/,/DYF
     X/,/DZF/,/DX1/,/DY1/,/DZ1/,/DX2/,/DY2/,/DZ2/,/DX3/,/DY3/,/DZ3
     X/,/CXA/,/CYA/,/CZA/)
C        T4EH22
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  EDDIE SMART, AERODYNAMICS ENGINEER
C  SUBROUTINE OF COMPUTING THE MOMENT CENTER FROM KNOWN
C  FORCES (FX,FY,FZ,F) ACTING THROUGH A BRIDLE WITH THREE FLEXIBLE
C  LINES.
C  DXF,DYF,DZF ARE CO-ORDINATES, FROM THE C.G., AT WHICH THE FORCES-
C  WILL BE ACTING. THIS IS COMPUTED AS A FUNCTION OF THE NUMBER OF
C  TAUT LINES IN THE BRIDLE.
C  DX1,DY1,DZ1---DZ3 ARE THE CO-ORDINATES, FROM THE C.G., OF THE
C  THREE POINTS ON THE SEAT TO WHICH THE BRIDLE LINES ARE ATTACHED.
C  THESE ATTACH POINTS MUST BE NUMBERED CONSECUTIVELY IN A CCW DIRECTION
C  ----------------------------------------------------------------------
C  CXA,CYA,CZA ARE THE CO-ORDINATES OF THE INTERSECTION OF THE
C  THREE LINES (INPUT) AND IS POINT AT WHICH THE FORCES WILL BE
C  ACTING WHEN ALL LINES ARE TAUT. (MEASURED FROM THE C.G.)
C  A,B,C,D ARE COEFFICIENTS OF THE PLANE IN WHICH THE THREE ATTACH
C  POINTS LIE. THEY MUST BE SUPPLIED TO THIS SUBROUTINE FOR IFPLAN.LE.0
C  FOR IFPLAN.GT.0 THE SUBROUTINE WILL COMPUTE A,B,C,D. SINCE THESE
C  ARE CONSTANT FOR ANY GIVEN CONFIGURATION THEY SHOULD BE COMPUTED
C  ONLY ONCE,OR SUPPLIED IF THE CONFIGURATION NEVER CHANGES.
C  TEST FOR COMPRESSION IN LINE 1A (FROM POINT 1 TO POINT A).
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```
C     COMPUTE INTERSECTION OF THE NORMAL FROM POINT 1 TO VECTOR 2,3.
      CALL LINDST(XN123,YN123,ZN123,R123,CA123,CB123,CG123,DX2,DY2,DZ2,
     1 DX3,DY3,DZ3,DX1,DY1,DZ1)
C     COMPUTE INTERSECTION OF THE NORMAL FROM THE FORCE-PLANE INTER-
C     SECTION TO VECTOR 2,3.
      CALL LINDST(XNI23,YNI23,ZNI23,RI23,CAI23,CBI23,CGI23,DX2,DY2,DZ2,
     1 DX3,DY3,DZ3,XI,YI,ZI)
      TEST =CA123*CAI23+CB123*CBI23+CG123*CGI23
      IF(TEST)10,10,100
   10 CONTINUE
C  LINE 1A UNDER COMPRESSION. COMPUTE THE FORCE VECTOR LYING IN PLANE
C  2A3.
      CALL BRIDL2(CAF,CBF,CGF,XI,YI,ZI,DXF,DYF,DZF,
     1 DX2,DY2,DZ2,DX3,DY3,DZ3,DXA,DYA,DZA)
      RETURN
  100 CONTINUE
C     TEST FOR COMPRESSION IN LINE 2A.
C     COMPUTE NORMAL FROM POINT 2 TO VECTOR 1,3.
      CALL LINDST(XN213,YN213,ZN213,R213,CA213,CB213,CG213,
     1 DX1,DY1,DZ1,DX3,DY3,DZ3,DX2,DY2,DZ2)
C     COMPUTE NORMAL FROM THE FORCE-PLANE INTERSECTION TO VECTOR 1,3.
      CALL LINDST(XNI13,YNI13,ZNI13,RI13,CAI13,CBI13,CGI13,
     1 DX1,DY1,DZ1,DX3,DY3,DZ3, XI, YI, ZI)
      TEST = CA213*CAI13+CB213*CBI13+CG213*CGI13
      IF(TEST) 20,20,200
   20 CONTINUE
C     LINE 2A UNDER COMPRESSION. COMPUTE THE FORCE VECTOR LYING IN
C     PLANE 1A3
      CALL BRIDL2(CAF,CBF,CGF,XI,YI,ZI,DXF,DYF,DZF,
     1 DX3,DY3,DZ3,DX1,DY1,DZ1,DXA,DYA,DZA)
      RETURN
  200 CONTINUE
C     TEST FOR COMPRESSION IN LINE 3A
C     COMPUTE NORMAL FROM POINT 3 TO VECTOR 1,2.
      CALL LINDST(XN312,YN312,ZN312,R312,CA312,CB312,CG312,
     1 DX1,DY1,DZ1,DX2,DY2,DZ2,DX3,DY3,DZ3)
C     COMPUTE NORMAL FROM FORCE-PLANE INTERSECTION TO VECTOR 1,2.
      CALL LINDST(XNI12,YNI12,ZNI12,RI12,CAI12,CBI12,CGI12,
     1 DX1,DY1,DZ1,DX2,DY2,DZ2, XI, YI, ZI)
      TEST = CA312*CAI12+CB312*CBI12+CG312*CGI12
      IF(TEST) 30,30,300
   30 CONTINUE
C     LINE 3A UNDER COMPRESSION. COMPUTE THE FORCE VECTOR IN PLANE 1A2
      CALL BRIDL2(CAF,CBF,CGF,XI,YI,ZI,DXF,DYF,DZF,
     1 DX1,DY1,DZ1,DX2,DY2,DZ2,DXA,DYA,DZA)
      RETURN
  300 CONTINUE
C     ALL THREE LINES ARE IN TENSION
      DXF = DXA
      DYF = DYA
      DZF = DZA
      RETURN
      END


      SUBROUTINE BRIDL2(/CAF/,/CBF/,/CGF/,/XI/,/YI/,/ZI/,/DXF/,/DYF
     X/,/DZF/,/X1/,/Y1/,/Z1/,/X2/,/Y2/,/Z2/,/XA/,/YA/,/ZA/)
C       T4EM23
C     THIS SUBROUTINE CALCULATES THE MOMENT CENTER
C     WHICH RESULTS FROM A FORCE APPLIED TO A TWO STRAND BRIDLE.
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C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   EDDIE SMART, AERODYNAMICS ENGINEER
C       FX,FY, FZ ARE THE COMPONENTS OF THE FORCE F. (INPUT)
C       AND DXF,DYF, AND DZF ARE COORDINATES OF THE MOMENT CENTER (OUTPUT)
C       X1,Y1,Z1,X2,Y2,Z2,XA,YA, AND ZA DEFINE THE BRIDLE ATTACH POINTS
C       AND APEX. (ALL MEASURED FROM C.G.)
        CALL DCNCRP (D12,D22,D32,R1A,R2A,XA,YA,ZA,X2,Y2,Z2,X1,Y1,Z1)
        CALL LINDST (XI,YI,ZI,RIA,D11,D21,D31,X1,Y1,Z1,X2,Y2,Z2,XA,YA,ZA)
        PHI = ATAN2(D12*CAF+D22*CBF+D32*CGF,-(D11*CAF+D21*CBF+D31*CGF))
        SINPHI = SIN(PHI)
        COSPHI = COS(PHI)
         XF = XI + RIA*(-D11*COSPHI + D12*SINPHI )
        YF = YI + RIA*(-D21*COSPHI  +D22*SINPHI  )
        ZF = ZI + RIA*(-D31*COSPHI  +D32*SINPHI)
C       CALCULATE INTERSECTION OF FORCE VECTOR AND LINE DEFINED BY TWO
C       BRIDLE ATTACH POINTS. THIS INTERSECTION CALLED XIN,YIN,ZIN.
        R12 = SQRT((X2-X1)**2 + (Y2-Y1)**2 + (Z2-Z1)**2)
        CA12 = (X2-X1)/R12
        CB12 = (Y2-Y1)/R12
        CG12 = (Z2-Z1)/R12
        NGO = 1
        CAD = ABS(CAF)
        IF(CAD -ABS(CBF)) 10,20,20
     10 NGO = 2
        CAD=ABS(CBF)
     20 IF(CAD-ABS(CGF)) 30,40,40
     30 NGO = 3
     40 GO TO (1,2,3),NGO
      1 CONTINUE
        RAT1 = CBF/CAF
        DET = RAT1*CA12-CB12
        IF(DET) 50,75,50
     50 XIN = ((Y2-YF+RAT1*XF)*CA12-CB12*X2)/DET
        YIN = YF + RAT1*(XIN-XF)
        ZIN = ZF + CGF/CAF*(XIN-XF)
        GO TO 80
      2 CONTINUE
        RAT1 = CAF/CBF
        DET = RAT1*CB12-CA12
        IF (DET) 60,75,60
     60 YIN = ((X2-XF+RAT1*YF)*CB12-CA12*Y2)/DET
        XIN = XF + RAT1*(YIN - YF)
        ZIN = ZF + CGF/CBF*(YIN-YF)
        GO TO 80
      3 CONTINUE
        RAT1 = CAF/CGF
        DET = RAT1*CG12-CA12
        IF (DET) 70,75,70
     70 ZIN = ((X2-XF+RAT1*ZF)*CG12-CA12*Z2)/DET
        XIN = XF + RAT1*(ZIN-ZF)
        YIN = YF + CBF/CGF*(ZIN-ZF)
        GO TO 80
     75 CONTINUE
C       DENOMINATOR IS ZERO
        GO TO 88
     80 CONTINUE
        TEST = (XIN-X1)*(X2-X1)+(YIN-Y1)*(Y2-Y1)+(ZIN-Z1)*(Z2-Z1)
        IF(TEST) 90,90,85
     85 R1IN = SQRT((XIN-X1)**2 +(YIN-Y1)**2 +(ZIN-Z1)**2)
        R12 = SQRT((X2-X1)**2+(Y2-Y1)**2+(Z2-Z1)**2)
        IF (R12-R1IN) 87,88,88
```

```
   87 CXF = X2
      CYF = Y2
      DZF = Z2
      RETURN
   88 CXF = XF
      CYF = YF
      DZF = ZF
      RETURN
   90 CXF = X1
      DYF = Y1
      DZF = Z1
      RETURN
      END
```

```
      SUBROUTINE BRIDL4
     1(/CAF    /,/CBF    /,/CGF   /,/XI     /,/YI    /,/ZI     /,/DXF   /,
     2 /DYF    /,/DZF    /,/DX1   /,/DY1    /,/DZ1   /,/DX2    /,/DY2   /,
     3 /DZ2    /,/DX3    /,/DY3   /,/DZ3    /,/DX4   /,/CY4    /,/DZ4   /,
     4 /CXA    /,/DYA    /,/CZA/)
C       T4EM24
C THIS    ROUTINE CETERMINES THE PROPER THREE BRIDLE ATTACH POINTS TO
C BE USEC IN BRICL3
C  IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C  ECCIE SMART, AERCDYNAMICS ENGINEER
C  THE FOUR ATTACH POINTS OF THE BRIDLE ARE CESIGNATEC AS 1,2,3,4
C  NUMBERING CCNSECUTIVELY IN A CCW DIRECTION.
C LET PCINTS 2 ANC 4 CEFINE A LINE AND CHECK TO SEE WHICH SIDE OF THE
C LINE THE FORCE-PLANE INTERSECTION LIES ON.
      CALL LINDST(XN124,YN124,ZN124,R124,CA124,CB124,CG124,DX2,DY2,DZ2,
     1 CX4,CY4,DZ4,CX1,CY1,DZ1)
      CALL LINDST(XN124,YN124,ZN124,R124,CA124,CB124,CG124,DX2,DY2,DZ2,
     1 CX4,CY4,DZ4,XI,YI,ZI)
      TEST = CA124*CA124 + CB124*CB124 + CG124*CG124
      IF (TEST) 3,4,4
    3 CALL BRICL3(CAF,CBF,CGF,XI,YI,ZI,DXF,DYF,DZF,
     1 CX2,CY2,CZ2,CX3,DY3,DZ3,DX4,DY4,DZ4,DXA,CYA,DZA)
      RETURN
    4 CALL BRIDL3(CAF,CBF,CGF,XI,YI,ZI,DXF,DYF,DZF,
     1 CX1,CY1,DZ1,CX2,DY2,DZ2,CX4,DY4,DZ4,DXA,CYA,DZA)
      RETURN
      END
```

```
      SUBRCUTINE BRIDLE(/FX/,/FY/,/FZ/,/F/,/FXO/,/FYO/,/FZO/,/FO
     X/,/ERROC/,/TX/,/TY/,/TZ/,/DXF/,/DYF/,/DZF/,/DX1/,/DY1/,/DZ1
     X/,/CX2/,/DY2/,/DZ2/,/DX3/,/DY3/,/DZ3/,/DX4/,/DY4/,/DZ4/,/DXA
     X/,/DYA/,/DZA/,/A/,/B/,/C/,/D/,/NLINES/,/IFPLAN/)
C       T4EM25
C  IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C  EDDIE SMART, AERCDYNAMICS ENGINEER
      IF(NLINES.EC.1)GO TO 1
      IF(IFPLAN) 20,10,10
   10 A=CET3(1.,CY1,DZ1,1.,DY2,DZ2,1.,DY3,DZ3)
      B=DET3(DX1,1.,DZ1,CX2,1.,DZ2,DX3,1.,DZ3)
      C=DET3(1.,CX1,DY1,1.,CX2,DY2,1.,DX3,DY3)
      D=DET3(CY1,DX1,DZ1,DY2,DX2,DZ2,DY3,DX3,DZ3)
      FXC = 0.
      FYO = 0.
```

```
      FZO = 0.
      FO = 1.0
   20 CCNTINUE
      IF(F) 25.5C.25
   25 CAF= FX/F
      CBF= FY/F
      CGF= FZ/F
      CAFO = FXO/FO
      CBFO= FYO/FO
      CGFO= FZO/FO
      IF(ABS(CAF-CAFO)-ERRDC)30.30.45
   30 IF(ABS(CBF-CBFO)-ERRDC)40.40.45
   40 IF(ABS(CGF-CGFO)-ERRDC)50.50.45
   45 CALL LINEFL(XI.YI.ZI.A.B.C.D.DXA.DYA.DZA.CAF.CBF.CGF.NGU)
      GC TC (1.2.3.4).NLINES
    1 DXF=DXA
      DYF=DYA
      DZF=DZA
      GO TO 50
    2 CALL BRICL2(CAF.CBF.CGF.XI.YI.ZI.DXF.DYF.DZF.DX1.DY1.DZ1.DX2.DY2.
     1 DZ2.DXA.DYA.DZA)
      GC TC 50
    3 CALL BRICL3(CAF.CBF.CGF.XI.YI.ZI.DXF.DYF.DZF.DX1.DY1.DZ1.DX2.DY2.
     1 DZ2.DX3.DY3.DZ3.DXA.DYA.DZA)
    4 CALL BRIDL4(CAF.CBF.CGF.XI.YI.ZI.DXF.DYF.DZF.DX1.DY1.DZ1.DX2.DY2.
     1 DZ2.DX3.DY3.DZ3.DX4.DY4.DZ4.DXA.DYA.DZA)
   5C TX=FZ*DYF - FY*DZF
      TY= FX*DZF-FZ*DXF
      TZ= FY*DXF-FX*DYF
      FXO= FX
      FYO= FY
      FZO= FZ
      FO = F
      RETURN
      END


      SUBROUTINE LDFCTR(/NX/./NY/./NZ/./NXCG/./NYCG/./NZCG/./DX
     X/./DY/./DZ/./PO/./QO/./RO/./P/./Q/./R/)
C        T4EM26
C     IVAN CLINKENBEARD. ENGINEERING SPECIALIST
C
C     SUBROUTINE FOR COMPUTING THE LOAD FACTOR COMPONENTS AT A POINT OFF
C     THE C.G.
C
C
C     NX.NY AND NZ ARE LOAD FACTOR COMPONENTS.
C
C     NXCG.NYCG.NZCG ARE LOAD FACTOR COMPONENTS AT THE C.G. (BY CALLING
C     THIS SUBROUTINE WITH NXCG=NYCG=NZCG=0.. INCREMENTAL LOAD FACTORS
C     ARE OBTAINED.)
C
C     DX = X- XCG
C     DY = Y- YCG
C     DZ = Z- ZCG
C     WHERE X.Y.Z ARE CO-ORDINATES OF THE POINT AT WHICH LOAD FACTORS ARE
C     DESIRED AND XCG.YCG.ZCG ARE CO-ORDINATES OF THE C.G..
C
C      P.Q.R ARE ROTATIONAL RATES.
C
```

```
C  PD.QC.RC ARE ROTATIONAL ACCELERATIONS.
C
      REAL NX,NY,NZ,NXCG,NYCG,NZCG
C
      P2 = P*P
      Q2 = Q*Q
      R2 = R*R
      PQ = P*Q
      PR = P*R
      QR = Q*R
      NX = NXCG+((Q2+R2)*DX +(RD-PQ)*DY -(QD+PR)*DZ)/32.17
      NY =NYCG+(-(RD+PQ)*DX +(P2+R2)*DY +(PD-QR)*DZ)/32.17
      NZ = NZCG+((QD-PR)*DX -(PD+QR)*DY +(P2+Q2)*DZ)/32.17
      RETURN
      END


      SUBROUTINE DCNORM(/CA/,/CB/,/CG/,/R12/,/R13/,/X1/,/Y1/,/Z1
     X/,/X2/,/Y2/,/Z2/,/X3/,/Y3/,/Z3/)
C       T4GGC4
C  DIRECTION COSINES OF THE NORMAL TO THE VECTORS R12 AND R13.
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DX12 = X2-X1
      DY12 = Y2-Y1
      DZ12 = Z2-Z1
      DX13 = X3-X1
      DY13 = Y3-Y1
      DZ13 = Z3-Z1
C  VECTOR MAGNITUDES.
      R12 = SQRT(DX12**2 + DY12**2 + DZ12**2)
      R13 = SQRT(DX13**2 + DY13**2 + DZ13**2)
C  DIRECTION COSINES, PROJECTIONS ON X,Y,Z AXES, RESPECTIVELY.
      CA = (DY12*DZ13 - DZ12*DY13)
      CB = (DZ12*DX13 - DZ13*DX12)
      CG = (DX12*DY13 - DY12*DX13)
      TEMP = SQRT(CA**2 + CB**2 + CG**2 )
      CA = CA / TEMP
      CB = CB / TEMP
      CG = CG / TEMP
      RETURN
      END


      SUBROUTINE LINEPL(/X/,/Y/,/Z/,/A/,/B/,/C/,/D/,/XL/,/YL/,/ZL
     X/,/CAL/,/CBL/,/CGL/,/NGO/)
C       T4GG07
C  THIS ROUTINE DETERMINES THE COORDINATES OF THE INTERSECTION OF
C  A LINE AND A PLANE
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  X,Y,Z ARE COORDINATES OF THE INTERSECTION OF A LINE AND A PLANE
C  THE PLANE IS DEFINED AS AX+BY+CZ+D=0 WHERE A,B,C,D ARE INPUTS
C  THE LINE IS DEFINED WITH THREE DIRECTION COSINES
C  CAL,CBL, AND CGL WITH RESPECT TO THE THREE ORTHOGONAL AXES X,Y,AND
C  Z RESPECTIVELY
C  THE LINE IS DEFINED AS GOING THROUGH A POINT WITH COORDINATES XL,YL,Z
      NGO=1
      CAD=ABS(CAL)
      IF(CAD-ABS(CBL)) 10,20,20
   10 NGO=2
```

```
      CAC=ABS(CBL)
   20 IF(CAC-ABS(CGL)) 30,40,40
   3C NGO=3
   40 GC TO (1,2,3),NGC
    1 T1= CBL/CAL
      T2= CGL/CAL
      X=(B*(T1*XL-YL)+C*(T2*XL-ZL)-D)/(A+B*T1+C*T2)
      Y = YL + T1*(X-XL)
      Z = ZL + T2*(X-XL)
      RETURN
    2 T1 = CAL/CBL
      T2 = CGL/CBL
      Y=(A*(T1*YL-XL)+C*(T2*YL-ZL)-D)/(A*T1+B+C*T2)
      X = XL+T1*(Y-YL)
      Z = ZL+T2*(Y-YL)
      RETURN
    3 T1 = CAL/CGL
      T2 = CBL/CGL
      Z=(A*(T1*ZL-XL)+B*(T2*ZL-YL)-D)/(A*T1+B*T2+C)
      X= XL+T1*(Z-ZL)
      Y= YL+T2*(Z-ZL)
      RETURN
      END


      SUBROUTINE LINDST(/X/,/Y/,/Z/,/D/,/CAD/,/CBD/,/CGD/,/XO/,/YO
     X/,/ZC/,/XF/,/YF/,/ZF/,/XI/,/YI/,/ZI/)
C       T4GGC8
C  IVAN CLINKENBEARC, ENGINEERING SPECIALIST
      DOF = SQRT(((XF-XO)**2) +((YF-YO)**2)+((ZF-ZO)**2))
      CAL = (XF-XO) / DOF
      CBL = (YF-YO) / DOF
      CGL = (ZF-ZO)/DOF
      ROX = (XI-XO)*CAL + (YI-YO)*CBL + (ZI-ZO)*CGL
      X = XO + ROX*CAL
       Y = YO + ROX*CBL
      Z = ZO + ROX*CGL
      D = SQRT(((X-XI)**2) + ((Y-YI)**2) + ((Z-ZI)**2))
      DMIN = .02*DOF
      IF(D-DMIN) 6,6,7
    6 CAD = 0.
      CBD = 0.
      CGD = 0.
      RETURN
    7 CAD = (X-XI)/D
      CBD = (Y-YI)/D
      CGD = (Z-ZI)/D
      RETURN
      END


      SUBROUTINE CAD(/FC/,/PJ/,/OLDTJ/,/LJ/,/CJ/,/FLAGP/,/DX/,/TIME/,
     1 /TMPJ/,/TV/,/CV/,/B/,/N/,/C/,/A1/,/A2/,/A3/,/RM/,/VO/,/CO/,
     2 /TCC/,/A/,/K1/,/K3/,/PTANG/,/DXMAX/,/MASS/,/XDOT/)
C       T4PPC1
C  FORCE FROM A CARTRIDGE ACTUATED DEVICE (CAD), SUCH AS CATAPULTS,
C  PARACHUTE EJECTION GUNS, CANOPY EJECTORS---.
C
C
C  IVAN CLINKENBEARC, ENGINEERING SPECIALIST
```

```
C
C  REFERENCE - NAVAIR REPORT NO. 7836, NAVY POWER CARTRIDGE HANDBOOK.
C
C  FC IS THE FORCE, IN POUNDS, TRANSMITTED TO THE EJECTED MASS.
C
C  PJ IS THE PRESSURE, LB/FT**2, ON THE PISTON BASE.
C
C  DLDTJ IS THE BURN RATE, FT/SEC, OF THE PROPELLANT AT TIME= TIMEJ.
C     THIS RATE IS INTEGRATED BY THE CALLING PROGRAM FOR LJ COMPUTATION.
C  LJ IS THE LENGTH, FT, OF THE PROPELLANT BURNED AT TIME= TIMEJ.
C
C  CJ IS THE WEIGHT, GRAMS, OF THE PROPELLANT BURNED AT TIME= TIMEJ.
C
C  FLAGP IS A FLAG FOR THE CAD SEQUENCE.
C     (1) SET FLAGP = -1.0 BEFORE INITIATING THE TIME HISTORY
C     (2) THIS SUBROUTINE WILL SET FLAGP =+1.0 AT END OF STROKE.
      CONTINUE
C  DX IS THE PISTON STROKE, FT.
C
C  TIME IS THE CURRENT TIME, TIMEJ.
C
C  TMPJ IS THE SPACE AVERAGE GAS TEMPERATURE, DEG-KELVIN, AT TIMEJ.
C
C  B IS THE BURN RATE PROPORTIONALITY CONSTANT, FT/SEC/PJ**N.
C
C  N IS THE BURN RATE EXPONENT OF THE BURN RATE POWER LAW, NON-DIM.
C
C  A1,A2,A3 (1/FT,1/FT**2,1/FT**3) ARE COEFFICIENTS OF THE PROPELLANT
C  GRAIN CUBIC FORM FUNCTION.
C
C  RM IS THE RATIO OF THE UNIVERSAL GAS CONSTANT TO THE MOLECULAR
C  WEIGHT OF THE PROPELLANT CHARGE.
C
C  VO IS THE INITIAL FREE VOLUME, FT**3, AVAILABLE TO THE PROPELLANT
C  GASES.
      CONTINUE
C  PO IS THE BOOSTER PRESSURE, LB/FT**2.
C
C  TOC IS THE INITIATION TIME, SEC, OF THE CAD.
C
C  A IS THE PISTON AREA, FT**2.
C
C  K1 IS THE FRICTION PROPORTIONALITY CONSTANT, LB/LB/FT**2.
C
C  PTANG IS THE PRESSURE, LB/FT**2, ACTUATING THE TANG WHICH ALLOWS
C  THE PISTON TO MOVE.
C
C  DXMAX IS THE MAXIMUM PISTON STROKE, FT. GASES WILL BE PORTED INTO
C  THE ATMOSPHERE, SETTING FC= 0.AT DXMAX.
C
C  TEST FOR FIRE INITIATION.
      REAL LJ,  N,K1,K3,MASS
      IF(TIME-TOC)20,3,3
C  TEST FOR PREVIOUS FIRE TERMINATION.
    3 IF(FLAGP)4,4,20
C  TEST FOR END OF STROKE.
    4 IF(DX-DXMAX)5,5,10
C  COMPUTE WEIGHT OF BURNED PROPELLANT.
    5 CJ = (A1 + LJ *(A2 + A3*LJ) ) * LJ * C
C  TEST FOR TOTAL PROPELLANT CONSUMPTION.
      IF(CJ-C)7,7,6
C  ALL PROPELLANT BURNED
    6 CJ = C
```

```
C  FIRING HAS BEEN INITIATEC AND IS CUNTINUING.
C  CCMPUTE INTERNAL PRESSURE AT TIME=TIMEJ.
    7 VCL = VO + A*CX
      IF(VOL) 1001,1001,1002
 1001 VCL=VC
C  SPACE AVERAGE GAS TEMPERATURE
 1C02 TMPJ=(1.-K3)*TV-.5*MASS*XDOT*XDOT/(CV*(CJ+CO))*(1.+K1)
      PJ=RM*TMPJ*(CJ+CO)/VOL
C  COMPUTE PROPELLANT BURN RATE.
      DLDTJ = 0.
      IF(CJ-C) 1003,1004,1004
 1003 DLDTJ = B*ABS(PJ)**N
C  TEST FCR PISTCN TANG RELEASE.
 1004 IF(FLAGP)15,18,1CC
   15 IF(PJ-PTANG)16,17,17
   16 FC = 0.
      RETURN
   17 FLAGP = 0.
   18 FC = A*PJ/(1.+K1)
  10C RETURN
   10 FLAGP = 1.
   20 FC = 0.
      DLDTJ = 0.
      PJ = 0.
      RETURN
      END


      SUBROUTINE ATMOS(/LAMBDA/,/VS/,/RHO/,/H/)
C      T300C1
C
C  EQUATIONS FOR STANDARD ATMUSPHERE, FROM LTV REPORT NUMBER
C  2-5331C/6R-5246.
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C  H IS ALTITUCE, FT. (INPUT)
C
C  RHO IS AIR DENSITY, SLUG/FT**3. (OUTPUT)
C
C  VS IS SPEED CF SCUNC, FT/SEC, (OUTPUT)
C
C  LAMBDA IS PRESSURE RATIO, NON-DIM, (OUTPUT)
C
      REAL LAMBDA
      IF(H-35332.)10,10,20
C
C  ALTITUCE BELCW THE TROPOPAUSE
C
C     PRESSURE RATIO
   10 TEMP = 1. -.6879E-05 * H
      LAMBDA = TEMP**5.256
C     SPEED CF SOUND
      VS = 1116.016 *SQRT(TEMP)
      GC TO 30
C
C   ALTITUDE ABOVE THE TROPOPAUSE
C
C     PRESSURE RATIO
   20 LAMBDA = 10.**((4705.-H)/48211.)
C     SPEEC OF SOUND
      VS = 97C.9579
C     AIR DENSITY
```

```
30 RHO = 2962.0 * LAMBDA/(VS*VS)
   RETURN
   END


      SUBROUTINE SPINE(/DDDT/,/DDT/,/D/,/A33/,/NZCG/,/B/,/K/)
C      190001
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C
C  SPINAL COMPRESSION OF THE HUMAN BODY FROM LOADS APPLIED PARALLEL TO
C  THE SPINE, FROM MIL S-9479A(USAF), SECTION 6.4.
C  D IS COMPRESSION LENGTH, IN FEET.
C  B = 2*RHO*OMEGAN
C  K = OMEGAN**2
C
C
      REAL NZCG,K
      DDDT = -B*DDT - K*D + 32.17*(NZCG-A33)
      RETURN
      END


      FUNCTION ATAN2(AI,AR)
C      810004
C  CHANGED 27 MAY 69
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  FOUR QUADRANT ARCTANGENT FUNCTION, AI BEING THE NUMERATOR AND AR
C  BEING THE DENOMINATOR.
      IF(ABS(AR) - .000001 * ABS(AI)) 1,1,2
    1 IF(AI) 3,7,3
    3 ATAN2 = 1.57079     * SIGN(1.,AI)
      RETURN
    2 ATAN2 = ATAN(AI/AR)
      IF(AR) 4,3,5
    4 ATAN2 = 3.14159 + ATAN2
      N = ATAN2/3.14159
      EN = N
      ATAN2 = ATAN2 - 6.28318*EN
    5 RETURN
    7 ATAN2 = 0.
      RETURN
      END


      REAL FUNCTION LAG1(LAGC,LAGO,RECTAU,T,TO)
      REAL LAGC,LAGO
C      C30006
C  RESPONSE TO A STEP OF AMPLITUDE LAGC AT TIME =TO OF A FIRST ORDER
C  LAG WITH RECIPROCAL TIME CONSTANT RECTAU.
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  THE AMPLITUDE, LAG1, APPROACHES THE COMMANDED AMPLITUDE, LAGC, AS
C  TIME,T, APPROACHES INFINITY.
C  TO MAY BE USED TO MECHANIZE A TIME DELAY, LAG1 REMAINING AT LAGO
C  UNTIL TO.
      IF(T-TO)2,2,1
    1 LAG1 = LAGO + (LAGC-LAGO)* (1. - EXP(-RECTAU*(T-TO)))
      RETURN
```

```
    2 LAG1 = LAGO
      RETURN
      END

      SUBROUTINE RUNGE(R)
C       D20001
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION R(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
      IC=IC+1
      IF(IC-1)5,5,6
    5 DO 100 I=1,N
      NI1=N+I
      NI2=NR2+I
      NI3=NR3+I
      R(NI2)=R(NI1)
  100 R(NI3)=R(NI1)
      R(NR4+1)=R(NR4+2)
      CALL DEQU(R)
      RETURN
    6 DO 200 J=1,4
      TEMP=1.
      GO TO(151,20,20,40),J
   20 TEMP=2.
   40 R(NR4+1)=R(NR4+2)+R(NR4+3)/TEMP
   50 DO 150 I=1,N
      NI1=N+I
      NI3=NR3+I
  150 R(NI3)=R(NI1)+R(I)*R(NR4+3)/TEMP
      CALL DEQU(R)
  151 DO 152 I=1,N
      NI2=NR2+I
  152 R(NI2)=R(NI2)+TEMP*R(I)*R(NR4+3)/6.
  200 CONTINUE
      R(NR4+2)=R(NR4+2)+R(NR4+3)
      DO300 I=1,N
      NI1=N+I
      NI2=NR2+I
      NI3=NR3+I
      R(NI1)=R(NI2)
  300 R(NI3)=R(NI2)
      CALL DEQU(R)
      RETURN
      END

      SUBROUTINE HAMMIN(R,YO,Y1,Y2,Y3,YD1,YD2,ERRMAX,ERRMIN,ERR)
C
C       D20002
C
C   HAMMING,S PREDICTOR-MODIFIER-CORRECTOR METHOD OF INTEGRATING N
C   FIRST ORDER DIFFERENTIAL EQUATIONS.
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   THE FIRST FOUR INTEGRATED VALUES,YO,Y1,Y2 AND R(N+I) WILL BE
C   INTEGRATED BY THE RUNGE-KUTTA METHOD. THE SECOND,THIRD AND FOUKTH
C   DERIVATIVES,YD1,YD2 AND R(I) WILL HAVE BEEN SAVED BY THE RUNGE-KUTTA
```

```
C  PROGRAM FOR USE HERE.
C
      DIMENSION R(1),Y0(1),Y1(1),Y2(1),Y3(1),YD1(1),YD2(1)
     1 ,ERRMAX(1),ERRMIN(1), ERR(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
C
      DO 100 I = 1,N
      NI1 = NR1+I
      NI2 = NR2+I
      NI3 = NR3+I
C  PREDICTOR
      Y4 = Y0(I)+1.333333*R(NR4+3)*(2.*R(I)-YD2(I)+2.*YD1(I))
C  MODIFIER
C  FIRST TIME THROUGH, Y3(I) WILL BE EQUAL TO R(NI1)
      R(NI3) = Y4 + .9256198*(R(NI1)-Y3(I))
      R(NI2)= R(NI3)
      Y0(I) = Y1(I)
      Y1(I) = Y2(I)
      Y2(I) = R(NI1)
      Y3(I) = Y4
      YD1(I)= YD2(I)
      YD2(I)= R(I)
  100 CONTINUE
      R(NR4+2) = R(NR4+2)+R(NR4+3)
      R(NR4+1) = R(NR4+2)
      CALL DEQU(R)
      IFTIMN = 0
      IFTIMX = -1
  150 DO 200 I = 1,N
      NI1 = NR1+I
      NI2 = NR2+I
      NI3 = NR3 + I
C  CORRECTOR
      R(NI3) =.125*(9.*Y2(I) - Y0(I))
     1 + .375*R(NR4+3)*(R(I)+2.*YD2(I)-YD1(I))
      R(NI1) = R(NI3)
      R(NI2) = R(NI3)
C  THE DIFFERENCE BETWEEN PREDICTOR AND CORRECTOR IS THE ERROR OF THIS
C  INTEGRATION POINT, GIVEN BY R(NI1)-Y3(I)
      ERR(I) = ABS(R(NI1)-Y3(I))
      IF(IFTIMX)155,200,200
  155 IF(ERRMAX(I)-ERR(I))160,200,170
C  ERROR TOO LARGE
  160 IFTIMX = 1
      GO TO 200
  170 IF(ERRMIN(I)- ERR(I))200,200,180
C  ERROR SMALL ENOUGH TO INCREASE DT
  180 IFTIMN = 1 + IFTIMN
  200 CONTINUE
      CALL DEQU(R)
      IF(IFTIMN-N)450,300,300
C  ALL ERRORS BELOW LOWER BOUND, DOUBLE TIME INCREMENT AND SET UP CALL
C  TO RUNGE TO GENERATE TWO ADDITIONAL TIME POINTS.
  300 R(NR4+3) = 2.*R(NR4+3)
      IC = 2
      DO 350 I = 1,N
      NI1 = NR1 + I
      Y0(I) = Y1(I)
      Y1(I) = R(NI1)
  350 YD1(I) = R(I)
  400 RETURN
```

```
  450 IF(IFTIMX)400,500,500
C  AT LEAST ONE ERROR ABOVE UPPER BOUND. HALVE TIME INCREMENT AND
C  INTERPOLATE FOR TWO ADDITIONAL POINTS.
  500 R(NR4+3) = .5*R(NR4+3)
      DO 550 I = 1,N
      NI1 = NR1+I
      Y2I = .0625*Y0(I) + .3125*(R(NI1)-Y1(I)) + .9375*Y2(I)
      Y0(I) = -.0625*(Y0(I)+R(NI1)) + .5625*(Y1(I)+Y2(I))
      Y1(I) = Y2(I)
      Y2(I) = Y2I
      YD1(I) = YD2(I)
      YD2(I) = (.1666666*Y0(I) - Y1(I) + .5*Y2(I) + .3333333*R(NI1))
     1 /R(NR4+3)
  550 CONTINUE
      RETURN
      END


      SUBROUTINE INTGRH(R,Y0,Y1,Y2,Y3,YD1,YD2,ERRMAX,ERRMIN,ERR)
C       C20003
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION R(1),Y0(1),Y1(1),Y2(1),Y3(1),YD1(1),YD2(1)
     1 ,ERRMAX(1), ERRMIN(1), ERR(1)
      COMMON IC,N,NR1,NR2,NR3,NR4,NR5,NR6,NR7,NR8,NR9,NR10,NR11,NR12,
     1 NR13,NR14,NR15,NR16,NR17,NR18,NR19,NR20,NR21,NR22,NR23,NR24,
     2 NR25,NR26,NR27,NR28,NR29,NR30
C  COMPUTING THE FIRST FOUR TIME POINTS USING A FOURTH ORDER RUNGE-KUTTA
C  INTEGRATION FOR SUBSEQUENT INTEGRATION USING HAMMING,S PREDICTOR-
C  MODIFIER-CORRECTOR METHOD.
C
C  BETTY DEICHELMANN, AERODYNAMICS ENGINEER
      IGO = IC + 1
      GO TO (1,2,3,4,5),IGO
    1 CALL RUNGE(R)
      DO 10 I = 1,N
      NI1 = NR1 + I
      Y0(I) = R(NI1)
   10 CONTINUE
      RETURN
    2 CALL RUNGE(R)
      DO 20 I = 1,N
      NI1 = NR1 + I
      Y1(I) = R(NI1)
      YD1(I) = R(I)
   20 CONTINUE
      RETURN
    3 CALL RUNGE(R)
      DO 30 I = 1,N
      NI1 = NR1 + I
      Y2(I) = R(NI1)
      YD2(I) = R(I)
   30 CONTINUE
      RETURN
    4 CALL RUNGE(R)
      DO 40 I = 1,N
      NI1 = NR1 + I
   40 Y3(I) = R(NI1)
      RETURN
    5 CALL HAMMIN(R,Y0,Y1,Y2,Y3,YD1,YD2,ERRMAX,ERRMIN,ERR)
      RETURN
      END
```

```
      SUBROUTINE INTDIF(/XIN/,/ISTRT/,/ISTOP/,/X/,/XO/,/XF/,/IO
     X/,/IF/,/XLO/,/XLF/,/NT/,/A/,/CADX/,/DA2DX2/)
C        E10001
C   CHANGED 21 JAN. 69
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   THIS SUBROUTINE GENERATES LAGRANGE INTERPOLATION AND DIFFERENTIATION
C   COEFFICIENTS, USING ONLY THE TABLE OF ABSCISSAS. THE CALLING PROGRAM
C   USES THE TABLE OF ORDINATES,AND THE COEFFICIENTS GENERATED BY THIS
C   SUBROUTINE,TO INTERPOLATE AND DIFFERENTIATE.
C   THE LAGRANGE COEFFICIENTS ARE WEIGHTED TO ACCOMPLISH BI-QUADRATIC
C   INTERPOLATION WITH NOTCHES AT THE SECOND AND THIRD POINT.
C   XIN IS THE POINT ON THE ABSCISSA AT WHICH THE ORDINATE VALUE IS TO
C   BE FOUND.
C   ISTRT IS THE SUBSCRIPT OF THE FIRST VARIABLE TO BE USED IN THE ARRAY.
C   ISTOP IS THE SUBSCRIPT OF THE LAST VARIABLE TO BE USED IN THE ARRAY.
C   X IS THE DIMENSIONED VARIABLE WHICH IS THE NAME OF THE ABSCISSA
C   ARRAY.
C   IO CONTROLS EXTRAPOLATION FOR XIN.LT.X(ISTRT)
C    (1) FOR IO =1, THE FUNCTION BECOMES ZERO AT XO.
C    (2) FOR IO =2, THE DERIVATIVE OF THE FUNCTION BECOMES ZERO AT XO.
C    (3) FOR IO =3, THE SLOPE REMAINS CONSTANT FOR XIN.LE.X(ISTRT).
C   IF CONTROLS EXTRAPOLATION FOR XIN.GT.X(ISTOP)
C    (1) FOR IF =1, THE FUNCTION BECOMES ZERO AT XF.
C    (2) FOR IF =2, THE DERIVATIVE OF THE FUNCTION BECOMES ZERO AT XF.
C    (3) FOR IF =3, THE SLOPE REMAINS CONSTANT FOR XIN.GE.X(ISTOP).
C   NT IS USED BY THE CALLING PROGRAM TO COMPLETE THE COMPUTATION. FOR
C   EXAMPLE -
        CONTINUE
C      YOUT=A(1)*Y(NT-2)+A(2)*Y(NT-1)+A(3)*Y(NT)+A(4)* Y(NT+1)
C      DYDX=DADX(1)*Y(NT-2)+DADX(2)*Y(NT-1)+DADX(3)*Y(NT)+DADX(4)*Y(NT+1)
C      DY2DX2=DA2DX2(1)*Y(NT-2)+DA2DX2(2)*Y(NT-1)+DA2DX2(3)*Y(NT)
C      +DA2DX2(4)*Y(NT+1)
C   WOULD BE EQUATIONS USED TO INTERPOLATE AND DIFFERENTIATE,AT X=XIN,
C   ON A TABLE OF X,Y COORDINATES.
C   FOR LINEAR INTERPOLATION BETWEEN XLO AND XLF SET XLO.NE.XLF.
      DIMENSION X(1    ), A(4), DADX(4),DA2DX2(4)
      NGO = 1
      XI=XIN
       SGN = 1.
      IF(X(ISTOP)-X(ISTRT))1,2,2
    1 SGN = -1.
    2 IF((XIN-X(ISTRT))*SGN)10,3,3
    3 IF((XIN-X(ISTOP))*SGN)4,4,20
    4 NGO = 2
      GO TO 50
   10 XI = X(ISTRT)
      ADD3 = 0.
      ADDX3 =.0
      ADDX23=.0
      GO TO(12,13,14),IO
   12 T = (XIN-X(ISTRT)) * (XO-XIN) / (XO-X(ISTRT))
      R = 1. -2. *(XIN-X(ISTRT)) / (XO - X(ISTRT))
      S =-2./(XO-X(ISTRT))
      ADD1 = 1.-(XIN-X(ISTRT)) *(XIN-X(ISTRT))/(XO-X(ISTRT))*
     1 (XO-X(ISTRT))
      ADDX1 =-2.*(XIN-X(ISTRT))/((XO-X(ISTRT)) *(XO-X(ISTRT)))
      ADDX21= S/(XO-X(ISTRT))
      GO TO 50
   13 T =.5*((XIN-XO)*(XIN-XO)/(X(ISTRT)-XO)-X(ISTRT)+XO)
      R = (XIN-XO)/(X(ISTRT)-XO)
      S = -1./(XO -X(ISTRT))
      ADD1 = 1.
```

```
      ADDX1 =0.
      ADDX21= 0.
      GO TO 50
   14 T = XIN - X(ISTRT)
      R = 1.
      S = 0.
      ADD1 = 1.
      ADDX1= 0.
      ADDX21=.0
      GO TO 50
   20 XI = X(ISTOP)
      ADDX1=.0
      ADDX21=.0
      GO TO(22,23,24),IF
   22 T =(XIN-X(ISTOP))* (XF-XIN) /(XF-X(ISTOP))
      R = 1. -2.*(XIN-X(ISTOP)) / (XF - X(ISTOP))
      S = -2. /(XF - X(ISTOP))
      ADD1 = 0.
      ADD3 = 1.-(XIN-X(ISTOP))*(XIN-X(ISTOP))/((XF-X(ISTOP)) *
     1 (XF -X(ISTOP)))
      ADDX3 =-2.*(XIN-X(ISTOP))/((XF-X(ISTOP))*(XF-X(ISTOP)))
      ADDX23 = S/(XF-X(ISTOP))
      GO TO 50
   23 T = (XIN-X(ISTOP)) *(.5*(XIN+X(ISTOP))-XF)/(X(ISTOP)-XF)
      R = (XIN-XF) /(X(ISTOP)- XF)
      S = -1. /(X(ISTOP) - XF)
      ADD1 = 0.
      ADD3 = 1.
      ADDX3 =.0
      ADDX23=.0
      GO TO 50
   24 T = XIN - X(ISTOP)
      R = 1.
      S = 0.
      ADD1 = 0.
      ADD3 = 1.
      ADDX3 = 0.
      ADDX23 = 0.
   50 DO 100 I = ISTRT, ISTOP
      NT= I
      IF((XIN-X(I))*SGN)200,200,100
  100 CONTINUE
  200 CONTINUE
      IF(XLO-XLF)51,60,51
   51 IF((XIN-XLO)*SGN)60,52,52
   52 IF((XIN-XLF)*SGN)53,53,60
   53 CALL INTDI2(XIN,X,NT-1,A,DADX,DA2DX2)
      NT = NT + 1
      RETURN
   60 IF(ISTOP-ISTRT -2) 70,91,90
   70 CALL INTDI2(XI,X,ISTRT,A,DADX,DA2DX2)
      NT = ISTRT + 2
      GO TO (800,900),NGO
   90 IF(ISTRT+1-NT) 92,91,91
   91 CALL INTDI3(XI,X,ISTRT,A,DADX,DA2DX2)
      NT = ISTRT + 2
      GO TO (800,900),NGO
   92 IF(ISTOP-1-NT) 93,94,94
   93 CALL INTDI3(XI,X,ISTOP-2,A,DADX,DA2DX2)
      NT = ISTOP
      GO TO (800,900),NGO
   94 CALL INTDI4(XI,X,NT,A,DADX,DA2DX2)
      GO TO (800,900),NGO
  800 DO 700 I =1,4
```

```
      A(I) = T * CADX(I)
      DA2DX2(I) =S * DADX(I)
  700 DADX(I) = R * DADX(I)
      A(1) = A(1) + ADD1
      A(3) = A(3) + ADD3
      DADX(1) = DADX(1) + ADDX1
      DADX(3)=DADX(3)+ADDX3
      DA2DX2(1) = DA2DX2(1) + ADDX21
      DA2DX2(3)=DA2DX2(3)+ADDX23
  900 RETURN
      END


      SUBROUTINE INTDI2(/XI/,/X/,/ISTRT/,/A/,/DADX/,/DA2DX2/)
C       E10002
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  SUBROUTINE FOR GENERATING LAGRANGE INTERPOLATING AND DIFFERENTIATION
C  COEFFICIENTS FOR N = 2.
      DIMENSION X(1),    A(4), DADX(4),DA2DX2(4)
      DO 100 I = 1,4
  100 DA2DX2(I) =0.
      DADX(1) = 1./(X(ISTRT) - X(ISTRT+1))
      DADX(2)= -DADX(1)
      DADX(3)= 0.
      DADX(4)= 0.
      A(1) = (XI -X(ISTRT+1)) * DADX(1)
      A(2) = (XI -X(ISTRT)) * DADX(2)
      A(3) = 0.
      A(4) = 0.
      RETURN
      END


      SUBROUTINE INTDI3(/XIN/,/X/,/ISTRT/,/A/,/DADX/,/DA2DX2/)
C       E10003
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
CHANGED 10 APR 68
C  SUBROUTINE FOR INTERPOLATING WHEN ONLY THREE POINTS AVAILABLE, USING
C  THREE POINT LAGRANGE.
      DIMENSION X(1),    A(4), DADX(4),DA2DX2(4)
      DA2DX2(1)=1./((X(ISTRT)-X(ISTRT+1))*(X(ISTRT)-X(ISTRT+2)))
      DA2DX2(2)=1./((X(ISTRT+1)-X(ISTRT))*(X(ISTRT+1)-X(ISTRT+2)))
      DA2DX2(3)=1./((X(ISTRT+2)-X(ISTRT))*(X(ISTRT+2)-X(ISTRT+1)))
      DA2DX2(4)=0.
      DADX(1)=(2.*XIN-X(ISTRT+1)-X(ISTRT+2))*DA2DX2(1)
      DADX(2)=(2.*XIN-X(ISTRT)  -X(ISTRT+2))*DA2DX2(2)
      DADX(3)=(2.*XIN-X(ISTRT)  -X(ISTRT+1))*DA2DX2(3)
      DADX(4) = 0.
      A(1)=(XIN-X(ISTRT+1))*(XIN-X(ISTRT+2))*DA2DX2(1)
      A(2)=(XIN-X(ISTRT))  *(XIN-X(ISTRT+2))*DA2DX2(2)
      A(3)=(XIN-X(ISTRT))  *(XIN-X(ISTRT+1))*DA2DX2(3)
      A(4) = 0.
      RETURN
      END


      SUBROUTINE INTDI4 (/XI/,/X/,/NT/,/A/,/DADX/,/DA2DX2/)
C       E10004
```

```
C  IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C  SUBRCUTINE FOR GENERATING LAGRANGE INTERPOLATING AND DIFFERENTIATION
C  COEFFICIENTS FOR N.GE.4
      DIMENSION X(1),A(4),DADX(4),DA2DX2(4),B(4),C(4),DBDX(4),DCDX(4)
     1 ,DB2CX2(4),CC2DX2(4)
      CALL INTDI3(XI ,X,NT-2,B,DBCX,DB2DX2)
      CALL INTDI3(XI ,X,NT-1,C,DCDX,DC2DX2)
      TEMP1  =(XI-X(NT))/(X(NT-1) - X(NT))
      TEMP2  = 1./(X(NT-1) - X(NT))
      TEMP3  =(XI-X(NT-1)) / (X(NT)-X(NT-1))
      TEMP4  = 1./(X(NT) - X(NT-1))
      TEMP5  = 2.* TEMP2
      TEMP6  = 2.* TEMP4
      DADX(1) =(TEMP1  * DBDX(1)) + (TEMP2  * B(1))
      DADX(2) =(TEMP1  * DBDX(2)) + (TEMP2  * B(2)) +(TEMP3  * DCDX(1))
     1 + (TEMP4  * C(1))
      DADX(3) =(TEMP1  * DBDX(3)) + (TEMP2  * B(3)) +(TEMP3  * DCDX(2))
     1 + (TEMP4  * C(2))
      DADX(4) =(TEMP3  * DCDX(3)) + (TEMP4  * C(3))
      DA2DX2(1) =(TEMP1  * DB2CX2(1))+(TEMP5  * DBDX(1))
      DA2DX2(2) = (TEMP1  * DB2DX2(2)) + (TEMP5  * DBDX(2)) + (TEMP3 *
     1 CC2CX2(1)) + (TEMP6  * DCDX(1))
      DA2DX2(3) = (TEMP1  * DB2DX2(3)) + (TEMP5  * DBDX(3)) + (TEMP3 *
     1 CC2DX2(2)) + (TEMP6  * CCDX(2))
      DA2DX2(4) = (TEMP3  * DC2DX2(3)) + (TEMP6  * DCDX(3))
      A(1) = TEMP1  * B(1)
      A(2) =(TEMP1  * B(2))+(TEMP3  * C(1))
      A(3) =(TEMP1  * B(3)) + (TEMP3  * C(2))
      A(4) =(TEMP3  * C(3))
      RETURN
      END


      SUBROUTINE DLU(/ALFAIN/,/BIN/,/CL/,/CD/,/CM/,/CY/,/CYAW/,/CROLL
     X/,/ISTRTA/,/ISTOPA/,/ISTRTB/,/ISTOPB/,/ISTRTL/,/ISTRTD/,/ISTRTH
     X/,/ISTRTY/,/ISTYAW/,/ISTRTR/,/R/)
C       E10008
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  ISTRTA,ISTOPA ARE STARTING, STOPPING SUBSCRIPTS OF THE ANGLE OF
C  ATTACK TABLES STCREC IN THE R-ARRAY
C  ISTRTB,ISTOPB ARE STARTING, STOPPING SUBSCRIPTS OF THE SIDESLIP
C  ANGLE TABLES STORED IN THE R-ARRAY.
C  ISTRTL IS THE START OF THE CL TABLES.
C  ISTRTD IS THE START OF THE CD TABLES.
C  ISTRTM IS THE START OF THE CM TABLES.
C  ISTRTY IS THE START OF THE SIDE FORCE COEFFICIENT TABLES, CY.
C  ISTYAW IS THE START CF THE YAWING MOMENT COEFFICIENT TABLES, CYAW.
C  ISTRTR IS THE START OF THE ROLLING MOMENT COEFFICIENT TABLES, CROLL.
      CIMENSION R(1),
     1 A(4),DACX(4),DA2CX2(4),B(4),DBDX(4),DB2DX2(4)
      CALL INTDIF(ALFAIN,ISTRTA,ISTOPA, R,-3.1416,3.1416,1,1,0.,0.,NX,
     1 A,CACX,CA2DX2)
      CALL INTCIF(BIN,ISTRTB,ISTOPB,R ,-3.1416,3.1416,1,1,0.,0.,NY,
     1B,DBCX,CB2CX2)
      CL = 0.
      CD = 0.
      CM = 0.
      CY=0.
      CYAW=0.
      CROLL=0.
```

```
      NA= ISTOPA-ISTRTA+1
      KADD = (NY-2-ISTRTB) * NA + NX - ISTRTA-NA
      KL = ISTRTL + KADD
      KM = ISTRTM + KADD
      KD = ISTRTD + KADD
      KY=ISTRTY+ KADD
      KYAW=ISTYAW+ KADD
      KR=ISTRTR+ KADD
      DO 100 I = 1, 4
      KL = KL + NA
      KM = KM + NA
      KD = KD + NA
      KY=KY+NA
      KYAW=KYAW+NA
      KR=KR+NA
      CL = CL
     1 + B(I)*(A(1)*R(KL-2)+A(2)*R(KL-1)+A(3)*R(KL)+A(4)*R(KL+1))
      CM = CM
     1 + B(I)*(A(1)*R(KM-2)+A(2)*R(KM-1)+A(3)*R(KM)+A(4)*R(KM+1))
      CD = CD
     1 + B(I)*(A(1)*R(KD-2)+A(2)*R(KD-1)+A(3)*R(KD)+A(4)*R(KD+1))
      CY=CY
     1 + B(I)*(A(1)*R(KY-2)+A(2)*R(KY-1)+A(3)*R(KY)+A(4)*R(KY+1))
      CYAW=CYAW
     1 + B(I)*(A(1)*R(KYAW-2)+A(2)*R(KYAW-1)+A(3)*R(KYAW)+
     2 A(4)*R(KYAW+1))
      CRCLL=CRCLL
     1 + B(I)*(A(1)*R(KR-2)+A(2)*R(KR-1)+A(3)*R(KR)+A(4)*R(KR+1))
  100 CONTINUE
      RETURN
      END


      SUBROUTINE CRVFIT(/B/,/A/,/C/,/X/,/Y/,/M/,/NP/,/NDIM1/,/ICOL
     X/,/INVERT/,/S/,/U/)
C        E21VC2
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION B(1),C(1),X(1),Y(1), A(NDIM1,NDIM1),ICOL(1)
     1 ,S(NDIM1,NDIM1),U(NDIM1,NDIM1)
32001 FORMAT(1H0/10X13HDETERMINANT = ,E14.5  )
32000 FORMAT(1H0/10X43HMAXIMUM ERROR ELEMENT OF MATRIX INVERSION = ,E14.
     14//)
32002 FORMAT(1H1//30X20HLEAST SQUARES MATRIX//)
32003 FORMAT(1H0//30X13HCOLUMN VECTOR//)
32010 FORMAT(10X6E12.4)
32020 FORMAT(1H0//30X26HVARIANCE-COVARIANCE MATRIX//)
C  SUBROUTINE FOR GENERATING LEAST SQUARES CURVE-FIT COEFFICIENTS,B(I),
C  FOR A POLYNOMIAL CURVE FIT.
C  INVERT CONTROLS THE MATRIX INVERSION. IF THE X,S HAVE NOT CHANGED
C  SINCE THE LAST COMPUTATION NO MATRIX INVERSION IS REQUIRED,THERFORE,
C  SET INVERT.LT.0 .
      IF(INVERT) 200,100,100
  100 CALL SQUARE(A,NP,X, M, NDIM1)
      WRITE(6,32002)
      NP1 = NP +1
      DO 110 I=1,NP1
      WRITE(6,32010) (A(I,K),K=1,NP1)
      DO 110 J=1,NP1
      U(I,J) = A(I,J)
  110 S(I,J) = A(I,J)
```

```
C  COMPUTE THE VARIANCE - COVARIANCE MATRIX.
      CALL COVAR(U,A,NP1,NDIM1)
      WRITE(6,32020)
      DO 112 I=1,NP1
      WRITE(6,32010)(U(I,J),J=1,NP1)
  112 CONTINUE
C  INVERT THE VARIANCE-COVARIANCE MATRIX.
      CALL MATNV(U,NP1,ICOL,DET,NDIM1)
C  COMPUTE THE MATRIX INVERSE FROM THE VARIANCE-COVARIANCE MATRIX
C  INVERSE.
      CALL INVINV(A,U,S,NP1,NDIM1)
      WRITE(6,32001) DET
      ERR=0.
      DO 120 I=1,NP1
      DO 120 J=1,NP1
      DET = 0.
      DO 115 K=1,NP1
  115 DET = DET + A(I,K) * S(K,J)
      U(I,J) = DET
      IF(I.EQ.J) DET = DET-1.
      IF(ABS(DET).GT.ABS(ERR)) ERR=DET
  120 CONTINUE
      WRITE(6,32000) ERR
      DO 130 I = 1,NP1
      WRITE(6,32010) (U(I,J),J = 1,NP1)
  130 CONTINUE
  200 CALL CCLUMN(C, NP, X, Y, M )
      WRITE(6,32003)
      WRITE(6,32010)(C(I),I=1,NP1)
      CALL SOLVER(B, A, C, NP+1, NDIM1 )
      RETURN
      END


      SUBROUTINE SQUARE(/A/,/NP/,/X/,/M/,/NDIM1/)
C       E2IV03
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION A(NDIM1,NDIM1), X(1)
C  SUBROUTINE FOR GENERATING THE SQUARE MATRIX USED IN THE LEAST SQUARES
C  EQUATION.
C  A(I,J) IS THE RESULTING MATRIX ELEMENT.
C  NP IS THE DEGREE OF OF CURVE-FIT POLYNOMIAL, WHICH WILL BE OF THE
C  FORM  Y = B(1)+ B(2)*X + B(3)* X**2 + B(4)* X**3 +++ B(NP+1)* X**NP
C  X(I) IS THE TABLE OF ABSCISSA VALUES.
C  M IS THE NUMBER OF X(I),S.
C  NDIM1.GE.NP+1
C  NDIM2 = 2 * NDIM1
C  ZEROS IN FIRST ROW AND LAST COLUMN.
      N = NP +1
      DO 100 I = 2, N
      A(1,I) = 0.
  100 A(I,N) = 0.
C  FIRST ROW AND LAST COLUMN COEFFICIENTS.
      A(1,1) = M
      DO 400 I =1,M
C  FIRST ROW.
      PROD = 1.
      DO 200 J = 2,N
      PROD = PROD * X(I)
  200 A(1,J) = A(1,J) +PROD
```

```
C  LAST COLUMN
      DC 300 J = 2.N
      PROD = PRCC * X(I)
  30C A(J.N) = A(J.N) + PROD
  40C CONTINUE
C  TRANSLATE TC FILL IN MATRIX.
      DC 500 I = 2. N
      CC 500 J = 1. NP
  500 A(I.J) = A(I-1.J+1)
      RETURN
      END


      SUBROUTINE COLUMN(/C/./NP/./X/./Y/./M/)
C       E2IVC4
C  IVAN CLINKENBEARD. ENGINEERING SPECIALIST
      DIMENSION C(1). X(1). Y(1)
C  SUBRCUTINE FOR GENERATING THE COLUMN VECTOR USED IN THE LEAST SQUARES
C  MATRIX.
C  ZERO THE COLUMN
      N = NP +1
      DO 10C I = 1. N
  100 C(I) = 0.
C  CCMPUTE THE COLUMN CCEFFICIENTS
      DC 200 I =1.M
      C(1) = C(1) + Y(I)
      PRCD = 1.
      DC 200 J = 2. N
      PRCC = X(I) * PROD
  200 C(J) = C(J) + PROD * Y(I)
      RETURN
      END


      SUBROUTINE COVAR(/CV/./C/./N/./NDIM/)
C       E2IVC5
C  IVAN CLINKENBEARD. ENGINEERING SPECIALIST
      DIMENSION CV(NDIM.NDIM). C(NDIM.NDIM)
      N1 = N-1
      DC 10C I = 1. N1
      CV(I.I) = 1.
      J1 = I + 1
      DC 1CC J = J1. N
      CV(I.J) = C(I.J) /SQRT(C(I.I) * C(J.J))
      CV(J.I) = CV(I.J)
  100 CCNTINUE
      CV(N.N) = 1.
      RETURN
      END


      SUBROUTINE INVINV(/AIN/./CVIN/./A/./N/./NDIM1/)
C       E2IVC6
C  IVAN CLINKENBEARD. ENGINEERING SPECIALIST
      DIMENSION AIN(NDIM1.NDIM1).CVIN(NDIM1.NDIM1).A(NDIM1.NDIM1)
      DC 10C I=1.N
      DC 10C J=1.N
      AIN(I.J) = CVIN(I.J)/SQRT(A(I.I)*A(J.J))
  10C CCNTINUE
      RETURN
```

```
      END

      SUBROUTINE SOLVER(/B/,/A/,/C/,/N/,/NDIM1/)
C       E2IV07
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION B(1),C(1), A(NDIM1,NDIM1)
C  SUBROUTINE FOR CALCULATING THE POLYNOMIAL COEFFICIENTS.
      DO 100 I = 1, N
      B(I) = A(I,1) * C(1)
      DO 100 J = 2, N
  100 B(I) = B(I) + A(I,J) * C(J)
      RETURN
      END

      SUBROUTINE MATNV (/A/,/N/,/LIST/,/DETR/,/NDIM/)
C       F1IV01
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C     DIMENSION A(16,16), LIST(1)
      DIMENSION A(NDIM,NDIM),LIST(1)
C  SUBROUTINE FOR INVERTING AN NXN MATRIX, A.
C  THE MATRIX IS DESTROYED IN THE PROCESS, BEING REPLACED BY ITS
C  INVERSE.
C     DOUBLE PRECISION A, DIV, B, DETR
      DETR = 1.0
      LIST(1) = 1
      DO 1  I = 2,N
    1 LIST(I) = LIST(I-1) + 1
      DO 8  IR = 1,N
      IRNO = IR
      IF (IR-N)  13,12,13
   13 DIV = ABS(A(IR,IR))
      J=IR+1
      DO 3  I = J,N
      IF(DIV - ABS(A(I,IR)))2,3,3
    2 DIV = ABS(A(I,IR))
      IRNO = I
    3 CONTINUE
      IF (IRNO - IR)  14,12,14
C        INTERCHANGE ROW IR AND IRNO
   14 DO 4  J = 1,N
      B = A(IRNO,J)
      A(IRNO,J) = A(IR,J)
    4 A(IR,J) = B
      ICOM = LIST(IRNO)
      LIST(IRNO) = LIST(IR)
      LIST(IR) = ICOM
   12 DIV = A(IR,IR)
       IF (DIV)  15,16,15
   15 DETR = DETR*DIV
      A(IR,IR) = 1.0
      DO 5  J = 1,N
    5 A(IR,J) = A(IR,J)/DIV
      DO 8   J = 1,N
      IF (J-IR)  6,8,6
    6 B = A(J,IR)
      A(J,IR) = 0.0
      DO 7  K = 1,N
    7 A(J,K) = A(J,K)-B*A(IR,K)
    8 CONTINUE
C       INTERCHANGE COLUMNS
```

```
      DC 11 K = 1,N
      DC 9  I = K,N
      IF (LIST(I)-K) 9,10,9
    9 CCNTINUE
   10 ICCN = LIST(K)
      LIST(K) = LIST(I)
      LIST(I) = ICCN
      CC 11  J = 1,N
      B = A(J,K)
      A(J,K) = A(J,I)
   11 A(J,I) = B
   17 RETURN
   16 CETR = 0.
      RETURN
       ENC


      SLBRCUTINE MPYMAT(/A11/,/A12/,/A13/,/A21/,/A22/,/A23/,/A31
     X/,/A32/,/A33/,/B11/,/B12/,/B13/,/B21/,/B22/,/B23/,/B31/,/B32
     X/,/B33/,/C11/,/C12/,/C13/,/C21/,/C22/,/C23/,/C31/,/C32/,/C33/)
C       F1IV19
C       A=B*C
C       THIS ROUTINE MULTIPLIES A 3*3 MATRIX B TIMES A 3*3 MATRIX C
C        TC CBTAIN THE 3*3 MATRIX A
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C
      A11=B11*C11+B12*C21+B13*C31
      A12=B11*C12+B12*C22+B13*C32
      A13=B11*C13+B12*C23+B13*C33
      A21=B21*C11+B22*C21+B23*C31
      A22=B21*C12+B22*C22+B23*C32
      A23=B21*C13+B22*C23+B23*C33
      A31=B31*C11+B32*C21+B33*C31
      A32=B31*C12+B32*C22+B33*C32
      A33=B31*C13+B32*C23+B33*C33
      RETURN
      END


      SLBROUTINE MPYVEC(/Y1/,/Y2/,/Y3/,/X1/,/X2/,/X3/,/A11/,/A12
     X/,/A13/,/A21/,/A22/,/A23/,/A31/,/A32/,/A33/)
C       F1IV20
C
C   SUBRCUTINE FOR MULTIPLYING A 3*3 MATRIX,A,BY A COLUMN VECTOR,X.
C   Y = A*X
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
C
      Y1 = A11*X1 + A12*X2 + A13*X3
      Y2 = A21*X1 + A22*X2 + A23*X3
      Y3 = A31*X1 + A32*X2 + A33*X3
C
      RETURN
      END


      SLBROUTINE SIMLT3(/X1/,/X2/,/X3/,/B1/,/B2/,/B3/,/A11/,/A12
     X/,/A13/,/A21/,/A22/,/A23/,/A31/,/A32/,/A33/,/DET/)
C       F1IV21
```

```
C  SOLVING THREE SIMULTANEOUS EQUATIONS FOR X1,X2,X3 WITH COLUMN VECTOR
C  ELEMENTS B1,B2,B3 AND DETERMINANT ELEMENTS A11,A12---A33.
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  DET IS THE VALUE OF THE DETERMINANT, WHICH SHOULD BE TESTED FOR ZERO
C  BY THE CALLING PROGRAM.
C
      DET = DET3(A11,A12,A13,A21,A22,A23,A31,A32,A33)
      IF(DET)1,2,1
    1 X1  = DET3(B1 ,A12,A13,B2 ,A22,A23,B3 ,A32,A33)/DET
      X2  = DET3(A11,B1 ,A13,A21,B2 ,A23,A31,B3 ,A33)/DET
      X3  = DET3(A11,A12,B1 ,A21,A22,B2 ,A31,A32,B3 )/DET
    2 RETURN
      END


      FUNCTION DET3(D11,D12,D13,D21,D22,D23,D31,D32,D33)
C       F30001
C  COMPUTING THE VALUE OF A 3*3 DETERMINANT.
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DET3= D11*(D22*D33-D23*D32)-D12*(D21*D33-D23*D31)
     1 + D13*(D21*D32-D22*D31)
      RETURN
      END


      SUBROUTINE GRDMRG(/MRCR/,/MRCL/,/MRCT/,/MRCB/,/IXTITL/,/IYTITL
     X/,/IXXLAB/,/IYXLAB/,/IXYLAB/,/IYYLAB/,/DR/,/DL/,/DT/,/DB/)
C       J50006
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
    3 MRCL = 140. * (DL)
      MRCR = 140. * (DR)
      MRCT = 140. * (DT)
      MRCB = 140. * (DB)
      IXXLAB=140.*(.5 * (DL-DR) -.8) + 512.
      IYXLAB=140.*(DB) - 20.
      IXYLAB=140.*(DL) - 20.
      IYYLAB = 140.*(.5*(DB-DT)-.95) + 512.
      IXTITL=140.*(.5*(DL-DR) -1.25) + 512.
      IYTITL = IYXLAB - 27
      CALL SETMIV(MRCL,MRCR,MRCB,MRCT)
      RETURN
      END


      SUBROUTINE INTPLT(/XSTART/,/XSTOP/,/DXINT/,/XPLOT/,/YPLOT
     X/,/NPT/,/SGN/,/XO/,/XF/,/IO/,/IF/,/XLO/,/XLF/,/A/,/DADX/,/DA2DX2/)
C       J50007
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION XPLOT(1),YPLOT(1),A(1),DADX(1),DA2DX2(1)
      X1 = XSTART
      X2 = X1 + DXINT
      CALL INTDIF(X1,1,NPT,XPLOT,XO,XF,IO,IF,XLO,XLF,NT,A,DADX,DA2DX2)
      Y1 = A(1)*YPLOT(NT-2)+A(2)*YPLOT(NT-1)+A(3)*YPLOT(NT)
     1 + A(4)*YPLOT(NT+1)
  300 CALL INTDIF(X2,1,NPT,XPLOT,XO,XF,IO,IF,XLO,XLF,NT,A,DADX,DA2DX2)
      Y2 = A(1)*YPLOT(NT-2)+A(2)*YPLOT(NT-1)+A(3)*YPLOT(NT)
     1 + A(4)*YPLOT(NT+1)
      IXO = NXV(X1)
```

```
      IXF = NXV(X2)
      IYC = NYV(Y1)
      IYF = NYV(Y2)
      IF(IXO*IXF*IYO*IYF)275,285,275
  275 CALL LINEV(IXO,IYO,IXF,IYF)
  285 X1 = X2
      X2 = X1 + DXINT
      Y1 = Y2
      IF((X2-XSTOP)* SGN) 300,300,600
  600 RETURN
      END


      SUBROUTINE SETMRG(/DR/,/DL/,/DT/,/DB/,/KPLOT/,/NEWGRD/,/NPLTFM/)
C     JSC018
C  COMPUTING THE MARGIN DISTANCES, IN INCHES, FOR THE SC4020 PLOTTER.
C
C  IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C  DR IS DISTANCE FROM THE RIGHT MARGIN.
C  DL IS DISTANCE FROM THE LEFT MARGIN.
C  DT IS DISTANCE FROM THE TOP.
C  DB IS DISTANCE FROM THE BOTTOM.
C  NPLTFM IS NUMBER OF PLOTS DESIRED PER FRAME, LE 4.
C  NEWGRD WILL BE 0 UNTIL THE FRAME IS FULL, WILL BE 1 FOR A NEW FRAME.
C  KPLOT IS THE CUMULATIVE NUMBER OF PLOTS FOR A SEQUENCE OF PLOTS.
C
      KPLOT = KPLOT + 1
      GO TO (1,2,3,4),NPLTFM
    1 DR = .75
      DL = .75
      DT = .75
      DB = .75
      NEWGRD = 1
      RETURN
    2 DR = .75
      DL = .75
      NEWGRD = KPLOT - 2*(KPLOT/2)
      TEMP = NEWGRD
      DT = 3.8 -3.55*TEMP
      DB = 4.3 -3.55*(1.-TEMP)
      RETURN
    3 N3 = KPLOT - 3*(KPLOT/3)
      IF(N3.EQ.0) N3 = 3
      GO TO (5,6,7),N3
    5 NEWGRD = 1
      DR= 3.825
      DL= .75
      DT= .25
      DB= 4.3
      RETURN
    6 NEWGRD = 0
      DR = .75
      DL = 3.825
      DT = .25
      DB = 4.3
      RETURN
    7 DR = .75
      DL = .75
      DT = 3.8
      DB = .75
      NEWGRD = 0
      RETURN
```

```
    4 N2 = KPLOT - 2*(KPLOT/2)
      TEMP = N2
      DR=3.825 - 3.075 * (1.-TEMP)
      DL = 3.825 - 3.075 * TEMP
      N4 = KPLOT - 4*(KPLOT/4)
      IF(N4.EQ.0) N4 = 4
      TEMP = N4 / 3
      DT = 3.8 - 3.55*(1.-TEMP)
      DB = 4.3 - 3.55*TEMP
      NEWGRD = 0
      IF(N4.EQ.1) NEWGRD = 1
      RETURN
      END



      SUBROUTINE SC4022(/XPLOT/,/YPLOT/,/NPTCRV/,/NGRPLT/,/NPLTFM
     X/,/KPLOT/,/TITLE/,/XLABEL/,/YLABEL/,/KSYM/,/IXX/,/FRCT/,/NOTES
     X/,/MAXMIN/,/XMIN/,/YMIN/,/XMAX/,/YMAX/,/IDENT/,/IQUADT/)
C   J50023
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   ELEANOR ROCH, AERODYNAMICS ENGINEER
      DIMENSION XPLOT(1),YPLOT(1),TITLE(1),XLABEL(1),YLABEL(1),KSYM(1)
     1 ,A(4),DACX(4),DA2DX2(4),NOTES(24,6),NPTCRV(1)
      EXTERNAL TABL1V
      EXTERNAL TABL2V
32000 FORMAT(1H1/10X24HIMPOSSIBLE TO DRAW GRID.)
32010 FORMAT(1H1/10X65H DIFFICULT TO DRAW GRAPH BECAUSE OF IDENTICAL ABS
     1CISSA END POINTS)
      CALL SETMRG(DR,DL,DT,DB,KPLOT,NEWFRM,NPLTFM)
      IF(NEWFRM .EQ. 1) CALL FRAMEV(3)
      CALL GRDMRG(MRCR,MRCL,MRCT,MRCB,IXTITL,IYTITL,IXXLAB,IYXLAB
     1 ,IXYLAB,IYYLAB,CR,CL,CT,CB)
C   SCALE FOR MULTIPLE PLOTS
      IF(MAXMIN.LE.0)
     1 CALL MXMNV(XMAX,XMIN,YMAX,YMIN,XPLOT,YPLOT,NPTCRV,NGRPLT,IXX)
      CALL CXDYV(1,XMIN,XMAX,DX,NLINE,ILABEL,NX, 20., IERR)
      IF(IERR)9,7,9
    9 WRITE(6,32000)
      RETURN
    7 CALL CXDYV(2,YMIN,YMAX,DY,MLINE,JLABEL,NY, 20.,IERR)
      IF(IERR)9,21,9
   21 CALL CHSIZV(2,2)
      CALL SETCIV(12,16)
      CALL GRID1V(2,XMIN,XMAX,YMIN,YMAX,DX,DY,NLINE,MLINE,ILABEL,JLABEL,
     1 NX,NY)
      IQUAD = IQUADT
      IF(IQUAD.LE.0)
     1 CALL NOTEQU(IQUAD,XPLOT,YPLOT,NPTCRV,NGRPLT,IXX,XMIN,YMIN,
     2 XMAX,YMAX)
      GO TO(1,2,3,4),IQUAD
    1 IXNOTE = MRCL +12 * (NY + 2)
      IYNOTE = 982  - MRCT
      GO TO 5
    2 IXNOTE = 870 - MRCR
      IYNOTE = 982  - MRCT
      GO TO 5
    3 IXNOTE = MRCL +12 * (NY + 2)
      IYNOTE = MRCB + (NGRPLT+1)*18 + 18
      GO TO 5
    4 IXNOTE = 870 - MRCR
      IYNOTE = MRCB + (NGRPLT+1)*18 + 18
    5 CONTINUE
      CALL CHSIZV(2,3)
```

```
      CALL RITSTV(13,26,TABL1V)
      CALL RITE2V(IXTITL,IYTITL,1050-MRCR,90,1,30,1,TITLE,NLAST)
C**** IBM 7090,7094
C     CALL RITE2V(IXTITL,IYTITL-26,1050-MRCR,90,1,30,31,TITLE,NLAST)
C**** IBM 7090,7094
C**    IBM S/360
      CALL RITE2V(IXTITL,IYTITL-26,1050-MRCR,90,1,30,33,TITLE,NLAST)
C**    IBM S/360
      CALL RITE2V(IXXLAB,IYXLAB,1023-MRCR,90,1,18,1,XLABEL,NLAST)
      CALL RITE2V(IXYLAB,IYYLAB,1023-MRCT,180,1,18,1,YLABEL,NLAST)
      CALL CHSIZV(2,2)
      NPTSUM = 0
      NPT = 0
      DO 38 II = 1, NGRPLT
      NPTSUM = NPTSUM + NPT
      NPT = NPTCRV(II)
      IYNOTE = IYNOTE - 18
C     CALL VCHARV(90,1,IXNOTE,IYNOTE,KSYM(II),TABL1V)
      CALL VCHAR (90,1,IXNOTE,IYNOTE,KSYM(II),TABL1V)
      IXN = IXNOTE + 13
      DO 36 J = 1,12
      IXN = IXN + 13
      IF(NOTES(J,II) .EQ. 48) GO TO 36
      IXID = IXN
      IF(NOTES(J,II))30,31,31
C  30 CALL VCHARV(90,1,IXN,IYNOTE,-NOTES(J,II)-1,TABL2V)
   30 CALL VCHAR (90,1,IXN,IYNOTE,-NOTES(J,II)-1,TABL2V)
      GO TO 36
C  31 CALL VCHARV(90,1,IXN,IYNOTE,NOTES(J,II),TABL1V)
   31 CALL VCHAR (90,1,IXN,IYNOTE,NOTES(J,II),TABL1V)
   36 CONTINUE
      IF(ICENT) 370,370,360
  360 CONTINUE
      IXN = IXID + 13
      DO 365 J = 13, 24
      IXN = IXN + 13
      IYN = (J/22) * 6 + IYNOTE
C     CALL VCHARV(90, 1, IXN, IYN, NOTES(J,II), TABL1V )
      CALL VCHAR (90, 1, IXN, IYN, NOTES(J,II), TABL1V )
  365 CONTINUE
  370 CONTINUE
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      IXMIN=NXV(XPLOT(IIX+1)) - 6
      DO 35 I = 1, NPT
      ITMP1 = IIX+I
      IF(XPLOT(ITMP1) .LT. XMIN .OR. XPLOT(ITMP1) .GT. XMAX) GO TO 35
      IXO = NXV(XPLOT(ITMP1))-6
      IF(IABS(IXO-IXMIN) - 30) 35,37,37
   37 ITMP2 = IIY + I
      IF(YPLOT(ITMP2) .LT. YMIN .OR. YPLOT(ITMP2) .GT. YMAX) GO TO 35
      IXMIN = IXO
      IYO = NYV(YPLOT(ITMP2))-9
C     CALL VCHARV(90,1,IXO,IYO,KSYM(II),TABL1V)
      CALL VCHAR (90,1,IXO,IYO,KSYM(II),TABL1V)
   35 CONTINUE
   38 CONTINUE
      IF(FRCT)600,40,250
   40 CONTINUE
      NPTSUM = 0
      NPT = 0
      DO 101 II = 1,NGRPLT
      NPTSUM = NPTSUM + NPT
```

```
      NPT = NPTCRV(II)
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      DO 100 I = 2,NPT
      I1 = IIX+I
      IXO = NXV(XPLOT(I1-1))
      I2=IIY+I
      IYO = NYV(YPLOT(I2-1))
      IXF = NXV(XPLOT(I1))
      IYF = NYV(YPLOT(I2))
      IF(IXO*IXF*IYO*IYF) 50,100,50
   50 CALL LINEV(IXO,IYO,IXF,IYF)
  100 CONTINUE
  101 CONTINUE
      RETURN
  250 CONTINUE
      NPTSUM = 0
      NPT = 0
      DO 270 II = 1, NGRPLT
      NPTSUM = NPTSUM + NPT
      NPT = NPTCRV(II)
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      IIX1 = IIX + 1
      IIX2 = IIX1+NPT-1
      XSTART = XPLOT(IIX1)
      XSTOP = XPLOT(IIX2)
      DXINT = FRCT * (XMAX-XMIN)
      IIY = IIY + 1
      SGN=1.
      IF(XSTOP-XSTART)240,500,260
  500 WRITE(6,32010)
  240  SGN = -1.
  260 CALL INTPLT(XSTART,XSTOP,DXINT,XPLOT(IIX1),YPLOT(IIY), NPT,SGN,
     1 XSTART,XSTOP,1,1,0.,0.,A,DADX,DA2DX2)
  270 CONTINUE
  600 RETURN
      END


      FUNCTION NS2V(NS1V)
C        J50024
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
C   COMPUTING THE TABL2V CODE NUMBER, NS2V, FROM THE TABL1V CODE
C   NUMBER, NS1V, WHICH WILL ALLOW GREEK LETTERS TO BE PRINTED IN THE
C   SAME ORDER AS THE TABL9V-TABL1V EQUIVALENCE IN WRITEV.
      DIMENSION NS2(26)
      DATA NS2/0,1,13,5,4,48,2,6,8,7,9,10,11,12,14,15,48,16,17,18,19,20,
     1 23,21,22,17/
      NS2V = 48
      NS2SUB = NS1V - 16 - 7*(NS1V/33) - 8 *(NS1V/50)
      IF(NS2SUB .LT. 1 .OR. NS2SUB .GT. 26) RETURN
      NS2V = NS2(NS2SUB)
      RETURN
      END


      SUBROUTINE NOTEQU(IQUAD,XPLOT,YPLOT,NPTCRV,NGRPLT,IXX,XMIN,YMIN,
     1 XMAX,YMAX)
C        J50026
C   COMPUTE THE MOST SPARSE QUADRANT FOR WRITING NOTES.
C   IVAN CLINKENBEARD, ENGINEERING SPECIALIST
```

```
      CIMENSICN XPLCT(1).VPLOT(1).IOU(4)
     1 .NPTCRV(1)
      DC 1 I = 1.4
    1 ICU(I) = 0
      XC =(XMIN+XMAX)/2.
      YC =(YMIN+YMAX)/2.
      NPTSUM = 0
      N = 0
      DC 88 II = 1.NGRPLT
      NPTSUM = NPTSUM + N
      N = NPTCRV(II)
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      DC 91 I =. 1.N
      IXST = IIX + I
      IYST = IIY + I
      IF(XPLOT(IXST) - XO ) 10.10.20
C   IN CUACRANT 1 OR 3
   10 CONTINUE
      IF(YPLOT(IYST) - YO )15.15.16
C   IN CUACRANT 3
   15 ICU(3) = ICU(3) + 1
      GC TO 91
C   IN OUACRANT 1
   16 ICU(1) = IOU(1) + 1
      GC TC 91
C   IN CUACRANT 2 OR 4
   2C IF(YPLOT(IYST)- YO )25.25.26
C   IN CUADRANT 4
   25 ICU(4) = ICU(4)+ 1
      GC TO 91
C   IN CUADRANT 2
   26 ICU(2) = ICU(2)+1
   91 CONTINUE
   88 CONTINUE
      ICUAD = 1
      DC 100 I = 2.4
      IF(IOU(I) .LT. ICU(IQUAD)) IQUAD = I
  10C CONTINUE
      RETURN
      END


      SUBROUTINE LABLV(/D/./IX/./IY/./NCHAR/./INT/./NDMAX/)
C      J5CC27
C   IVAN CLINKENBEARC, ENGINEERING SPECIALIST
      DIMENSION BCCWD(2) . BCOW(2)
      EXTERNAL TABL1V
C     IBM 7090
C     CALL BNBCDV(D.BCCWD   .NDS)
C     S/360
      CALL BNBCCV(C. BCCW. NDS )
      CALL SHFT2V( BCDW(1). BCOW(2). BCOWD(1). BCOWD(2). 16)
      IXN = IX-4
      IYN = IY-6
      NT=1
      ICEC = 0
      IF(D)1.9.2
    1 CALL VCHAR (90.NT.IXN-12.IYN.32.TABL1V)
    2 I = 0
```

```
      IF(NCS)10,3,3
    3 I = I+1
      IF(I + ICEC          - NCHAR) 4,4,8
    4 IF(ICEC .EQ. 1) GO TU 6
      IF(I-NDS-1)6,5,6
    5 NCAR = 27
      I = I - 1
      ICEC = 1
      GC TO 7
    6 CALL HOLL (I,BCDWD,NCAR)
    7 CALL VCHAR (9C,NT,IXN,IYN,NCAR,TABL1V)
      IXN = IXN+12
      GC TC 3
    8 RETURN
    9 CALL VCHAR (90,NT,IXN,IYN,0,TABL1V)
      RETURN
C     NUMEFR LT 1.0
   1C CALL VCHAR (90,NT,IXN,IYN,27,TABL1V)
      ICEC = 1 - NOS
      IXN = IXN + 12
      NCSL = -NCS
      CC 12 J = 1,NCSL
      CALL VCHAR (90,NT,IXN,IYN,0,TABL1V)
   12 IXN = IXN + 12
      GC TO 3
      END


      SUBROUTINE HOLL (N,BCDTXT,NS)
C     J50029
C  IVAN  CLINKENBEARD, ENGINEERING SPECIALIST
      DIMENSION BCDTXT(1),TEXT(61)
      DATA TEXT/1HO,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H ,1H=,1H',1H',
     1 1H ,1H ,1H+,1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1H ,1H.,1H),1H ,
     2 1H ,1H ,1H-,1HJ,1HK,1HL,1HM,1HN,1HO,1HP,1HQ,1HR,1H ,1H$,1H*,1H ,
     3 1H ,1H ,1H ,1H/,1HS,1HT,1HU,1HV,1HW,1HX,1HY,1HZ,1H ,1H,,1H(/
      IWORD = (N-1)/4 + 1
      ICHAR = N - 4*(IWORD-1)
      TEMP = TEXT(48)
      TEMP1 =BCDTXT(IWORD)
      IF(ICHAR .NE.4)
     1CALL SHFT1V(BCDTXT(IWORD),TEMP1, 8*(ICHAR-4) )
      CALL SHFT2V(TEMP1,TEXT(48),TEMP,TEMP3,24)
      NS = 48
      IF(TEMP.EQ.TEXT(48) ) RETURN
      DC 100 I = 1, 61
      NS = I-1
      IF(TEMP.EQ.TEXT(I)) RETURN
  100 CONTINUE
C  NOT FOUND, USE BLANK
      NS = 48
      RETURN
      END


      SUBROUTINE MXMNV(XMAX,XMIN,YMAX,YMIN,XPLOT,YPLOT,NPTCRV,
     1 NGRPLT,IXX)
C  IVAN  CLINKENBEARD, ENGINEERING SPECIALIST
C      J50030
```

```
      CIMENSION XPLCT(1),YPLUT(1)
     1 ,NPTCRV(1)
      XMAX=XPLOT(1)
      XMIN=XMAX
      YMAX=YPLCT(1)
      YMIN=YMAX
      IF(IXX .GT. 0) GO TO 5
      NPT = NPTCRV(1)
      CC 2 I = 1, NPT
      XMAX=AMAX1(XMAX,XPLOT(I))
    2 XMIN = AMIN1(XMIN,XPLCT(I))
      GC TO 6
    5 CONTINUE
      NPTSUM = 0
      NPT = 0
      DO 4 II = 1,NGRPLT
      NPTSUM = NPTSUM + NPT
      NPT = NPTCRV(II)
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      DC 3 I = 1, NPT
      ITMP = IIX + I
      XMAX= AMAX1(XMAX,XPLOT(ITMP))
    3 XMIN = AMIN1(XMIN,XPLOT(ITMP))
    4 CONTINUE
    6 CONTINUE
      NPTSUM = 0
      NPT = 0
      DC 10 II = 1,NGRPLT
      NPTSUM = NPTSUM + NPT
      NPT = NPTCRV(II)
      IIX = IXX*NPTSUM
      IIY = NPTSUM
      DC 9 I = 1,NPT
      ITMP = IIY + I
      YMAX = AMAX1(YMAX,YPLOT(ITMP))
    9 YMIN = AMIN1(YMIN,YPLCT(ITMP))
   10 CONTINUE
      IF(YMAX-YMIN) 20,15,20
   15 YMAX = YMIN + .01*ABS(YMIN)
      IF(YMIN .EQ. 0.) YMIN = -.01
   20 IF(XMAX-XMIN) 30,25,30
   25 XMAX = XMIN + .01*ABS(XMIN)
      IF(XMIN .EQ. 0.) XMIN = -.01
   30 RETURN
      END


      SUBROUTINE ALFNUM(/KSYM/,/LABEL/,/SYMBOL/,/TEXT/)
C      J50031
C  IVAN  CLINKENBEARD, ENGINEERING SPECIALIST
C  ELEANCR ROCH, AERODYNAMICS ENGINEER
      DIMENSION LABEL(1),TEXT(1)
      DATA SYMB/4HSCUA/
      CALL MOLL(1,SYMBOL,KSYM)
      IF(SYMBOL.EQ.SYMB ) KSYM = 63
      J = 0
      I = 0
    8 I = I + 1
      J = J+1
```

```
      IF(I.GT.18.OR.J.GT.12) GO TO 13
      CALL HOLL (I.TEXT.NS1V)
      IF(I .EQ. 18) GO TO 11
C ASTERISK IS CLUE. USED ONLY ONCE. FOR GREEK LETTERS FROM TABL9V.
C   CHANGED TO TABL2V BY NS2V
      IF(NS1V.NE.44)GO TO 9
      CALL HOLL (I+1.TEXT.NSBL)
      IF(NSBL .EQ. 48) GO TO 11
      I = I + 1
      LABEL(J)     = - NS2V(NSBL) - 1
      GO TO 8
C     APOSTROPHE IS THE CLUE. USED ONCE EACH TIME NEEDED. FOR SPECIAL
C  CHARACTERS FROM TABL1V.
    9 IF(NS1V.NE.12) GO TO 11
      CALL HOLL (I+1.TEXT.NSBL)
      IF(NSBL .EQ. 48) GO TO 11
      I = I+2
      CALL HOLL (I.TEXT.LABEL(J))
      LABEL(J)     = 10 * NSBL + LABEL(J)
      GO TO 8
   11 LABEL(J)     = NS1V
      GO TO 8
   13 CONTINUE
      RETURN
      END


      SUBROUTINE TIMEX(/NGO/./TIMEO/./TIME1/./TIMES/./TIMEF/)
C       C40002
C  IVAN  CLINKENBEARD. ENGINEERING SPECIALIST
32000 FORMAT(1HO/10X43HELAPSED COMPUTING TIME FOR THIS SEGMENT WAS 2X
     1 1PE12.4 . 9H MINUTES. // )
32001 FORMAT(1H1/10X41HTOTAL COMPUTING TIME FOR THIS PROGRAM WAS 2X
     1 1PE12.4 . 9H MINUTES. // )
      GO TO (1.2.3.4). NGO
    1 CALL CLOCK2(TIMEO)
      RETURN
    2 CALL CLOCK2(TIME1)
      TIME = TIME1 - TIMEO
      WRITE(6.32000) TIME
      RETURN
    3 CALL CLOCK2(TIMES)
      RETURN
    4 CALL CLOCK2(TIMEF)
      TIME = TIMEF - TIMES
      WRITE(6.32001) TIME
      RETURN
      END
```

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