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NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME 1. PROGRAM DESC--ETC(U)

AUG 81 J A MCGREW, J P GIESING, T P KALMAN

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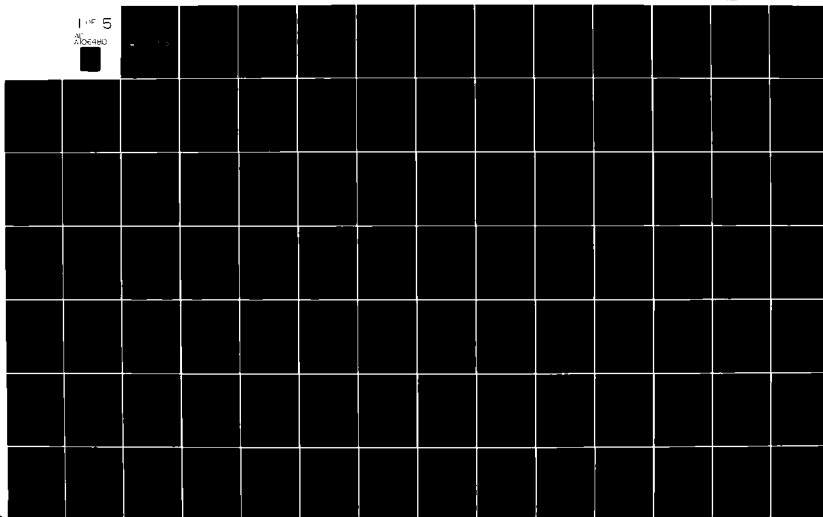
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Vol. I

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NUCLEAR BLAST RESPONSE COMPUTER PROGRAM

Volume I of III
Program Description

J. A. McGrew, et al.

Douglas Aircraft Company
3855 Lakewood Blvd.
Long Beach, CA 90846

August 1981

Final Report

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This final report was prepared by the Douglas Aircraft Company, Long Beach, California under Contracts DNA 001-75-C-0216 and DNA 001-76-C-0346, Job Order 8809C340 with the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. Mr. Alfred L. Sharp (NTYV) was the Laboratory Project Officer-in-Charge.

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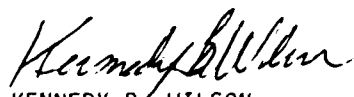
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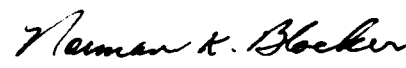
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The VIBRA-6 computer program is a digital computer program developed to determine the response of aircraft to nuclear explosions when flying at sub- sonic speeds. It is similar to the VIBRA-4 program but uses the latest Doublet-Lattice Method for obtaining subsonic aerodynamic forces for arbitrary lifting surface-body configurations. The Doublet-Lattice procedure has been extended to account for the moving blast wave by considering it as a traveling gust. The nuclear blast representation remains the same as that used in the (over)		

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18. SUPPLEMENTARY NOTES (Continued)

This report is divided into three volumes: Volume I contains the overall program descriptions and method of analysis, the input and output data descriptions, the program operation and a sample problem. Volume II details the unsteady aerodynamic procedure and Volume III contains the program listings.

20. ABSTRACT (Continued)

VIBRA-4 program but the method of solution of the equations of motion has been changed from that of numerical integration of quasi-steady equations of motion to a Fourier transform procedure to move from frequency domain solutions to time history solutions. The concept of dynamic core has been introduced to the program thus removing any restrictions on the size of the aircraft idealization which can be analyzed.

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PREFACE

This report was prepared by the Douglas Aircraft Company, Long Beach, California, under Contract DNA 001-75-C-0216 and documents the overall program descriptions and method of analysis, the input and output data descriptions, the program operation and a sample problem. This work was performed under Program Element NWE D 62704H, Project N99QAXA, Task Area E500, Work Unit 04 and was funded by the Defense Nuclear Agency under: RDT & E RMSS Code B342075464N99QAXAE50004H2590D. Funding of this effort was also supported by the Air Force Weapons Laboratory under: Program Element 62601F, Project 8809, Task 03, Work Unit 40. Inclusive dates of research and development were May 1975 through June 1976.

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Volume II of this report details the unsteady aerodynamic procedure and Volume III contains the Fortran listing of the program.

J. A. McGrew was the program technical director for this task. The technical development was performed by J. P. Giesing and T.P. Kalman with the assistance of Dr. W. P. Rodden. The programming effort was carried out by T. P. Kalman and H. H. Croxen.

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SECTION I

INTRODUCTION

The VIBRA-6 computer program is similar to earlier versions of VIBRA (Vehicle Inelastic Bending Response Aalysis) which were programs designed to calculate the structural response of aircraft exposed to a nuclear blast. Specifically, the present program is an extension of VIBRA-4 (Ref. 1) for response analysis of arbitrary wing-body configurations at subsonic speeds. Aerodynamic interference is accounted for among nonplanar lifting surfaces; e.g., wing, stabilizer, canard and fin, and among slender lifting bodies; e.g., fuselage, nacelle, and external stores. At present, VIBRA-6 has no capability for response analysis at supersonic speeds, and VIBRA-4 continues to provide for that requirement.

The primary extension is in the area of subsonic aerodynamic loads with the moving blast wave considered as a travelling gust. The aerodynamic loads for wing-body interference are based on the extensions of the Doublet-Lattice Method for nonplanar lifting surfaces to include slender body theory and the Method of Images to account for interference (Refs. 2 and 3).

-
1. Hobbs, N.P., Zartarian, G., and Walsh, J.P., *A Digital Computer Program for Calculating the Blast Response of Aircraft to Nuclear Explosions*, Air Force Weapons Laboratory, Report No. AFWL-TR-70-140, Vol. I, April 1971.
 2. Giesing, J.P., Kalman, T.P., and Rodden, W.P., *Subsonic Unsteady Aerodynamics for General Configurations; Part II-Application of the Doublet-Lattice Method and the Method of Images to Lifting-Surface/Body Interference*, Air Force Flight Dynamics Laboratory, Report No. AFFDL-TR-71-5, Part II, April 1972.
 3. Giesing, J.P., Kalman, T.P., and Rodden, W.P., "Subsonic Steady and Oscillatory Aerodynamics for Multiple Interfering Wings and Bodies," *J. Aircraft*, Vol. 9, No. 10, pp. 693-702, 1972.

Volume I of this report contains the overall technical and program description. Volume II of this report documents the modifications to Reference 2 to add the travelling gust field, improvements in the aerodynamic influence coefficients, and changes in the aerodynamic load output. Volume II also contains discussions of the aerodynamic modelling of an entire aircraft with a simple example configuration as well as the details of the aerodynamic program subroutines.

The solution method for the transient response has been changed from the method in VIBRA-4 of numerically integrating the equations to an inverse Fourier transform method. The early versions of VIBRA considered structural inelasticity and large disturbances, but VIBRA-4 restricted the structure to elastic deformations while still considering large disturbances in the rigid body response motion. Experience with VIBRA-4 has indicated that particularly for large bomber or tanker aircraft, if primary structural failure occurs, it generally occurs before substantial changes in the Eulerian angles. The further restriction to small disturbances permits VIBRA-6 to utilize linear response analysis techniques that are also consistent with the assumptions of the linearized aerodynamic analysis. The theoretical aerodynamic loads are not known for arbitrary transient motions but are only known for harmonic motions; i.e., in the frequency domain. The appropriate linear response analysis method is therefore a Fourier transform method, and Zartarian (Ref. 4) has demonstrated the feasibility of calculating transient blast loads by the Doublet-Lattice Method and Fourier trans-

4. Zartarian, G., *Application of the Doublet-Lattice Method for Determination of Blast Loads on Lifting Surfaces at Subsonic Speeds*, Air Force Weapons Laboratory, Report No. AFWL-TR-72-207, January 1973.

forms. The frequency response of the vehicle in a harmonic travelling gust field becomes the fundamental part of the solution. From the time history and orientation of the blast overpressure and its following travelling gust, the Fourier transform of the gust field may be calculated. The product of the vehicle frequency response and the transform of the gust field is the Fourier transform of the transient response of the vehicle to the blast. Its inverse transform is the desired transient response.

The assumed linearity of the system permits superposition of the blast response loads with the loads in trimmed flight. The trimmed maneuvering conditions considered are level flight or a symmetrical pull-up or pushover with the velocity vector horizontal at the time of blast wave intercept (as in VIBRA-4), and a level, climbing, or descending steady turn (VIBRA-4 considered the steady turn at constant altitude). A new trim solution is provided that is based on the aerodynamic influence coefficients from the wing-body theory. Angle of attack and elevator setting are determined for a given speed, load factor, elevator, rudder, and aileron settings are determined for a given speed, load factor, rate of climb, and altitude in the steady turning maneuvers. The final equilibrium loads on the aircraft are then the sum of the elastic aircraft trimmed flight loads and the incremental loads due to the dynamic perturbation response.

The interaction between the response caused by the blast loading and the autopilot can be a critical problem and has not been considered in previous versions of VIBRA. This interaction can cause significant stresses as the autopilot attempts to restore the disturbed vehicle to its initial trimmed flight condition. The autopilot is included in the system by adding the transfer functions of the autopilot components. These equations relate the signals sensed from the vehicle motion; e.g.,

by rate gyros or accelerometers, to the motions of control surfaces commanded by the active control system. The additional equations are written as transfer functions which are expressed as ratios of polynomials in the Laplace transform variable and become ratios of polynomials in the frequency domain which then may be used to augment the aeroelastic equations of motion.

The internal structural loads (called integrated loads) are found by integrating the resultants between the applied aerodynamic loads (from the gust and the induced motion) and the inertial reactions (called equilibrium loads). The structural loads are shears and moments (bending moments and torques) and are obtained by numerical integration of the pressure loads at the aerodynamic panel and body points and the inertial loads at the structural mass points. Internal loads can be calculated for any or all of the components of the vehicle; i.e., the wing, stabilizer, fin, fuselage, nacelles, pylons, etc., and at as many stations as desired. The internal loads may also be converted into stresses by providing a stress transformation matrix containing the necessary section property data at each load station.

An option has also been included for experimental correlation studies. The measured blast characteristics can be input and the time histories of pressures at the transducer locations can be calculated and compared with the measurements. The assumption is made that the model is rigid.

The concept of dynamic core has been utilized throughout, thus restricting the limitations of problem size only to that of computer capacity.

Volume III of this report contains the program code listings.

SECTION II

GENERAL THEORY

The VIBRA-6 computer program is a modularized extension of the VIBRA-4 program. It consists of twelve principal modules. Output data from four major modules, as explained below, may be saved on tape, at the option of the user, so that subsequent runs will not require recalculation of the same data. The twelve module interactions and the saved data are shown in Figure 1. Additional modules for further extensions of capability may be inserted with relative ease in computer programs organized in this fashion, since each module is a stand-alone subprogram with the interfacing provided by the control module.

The VIBRA-6 program has been coded using the principles for a dynamic core allocation. The program has been coded so that the computer core required for execution of any specific solution consists only of that necessary for the program (using an efficient overlay) and the core required for the data associated with the largest module to be executed in the case. This results in a cost savings since the user is charged only for the core actually used.

Although Figure 1 serves to illustrate the efficiency of the modular program under the direction of the control module, a flow chart is necessary to show the logical flow of the computational sequence. The flow chart is shown in Figure 2. The flow chart shows the necessary steps in the transient response analysis by modal and Fourier transform methods. The steps in order include calculation of:

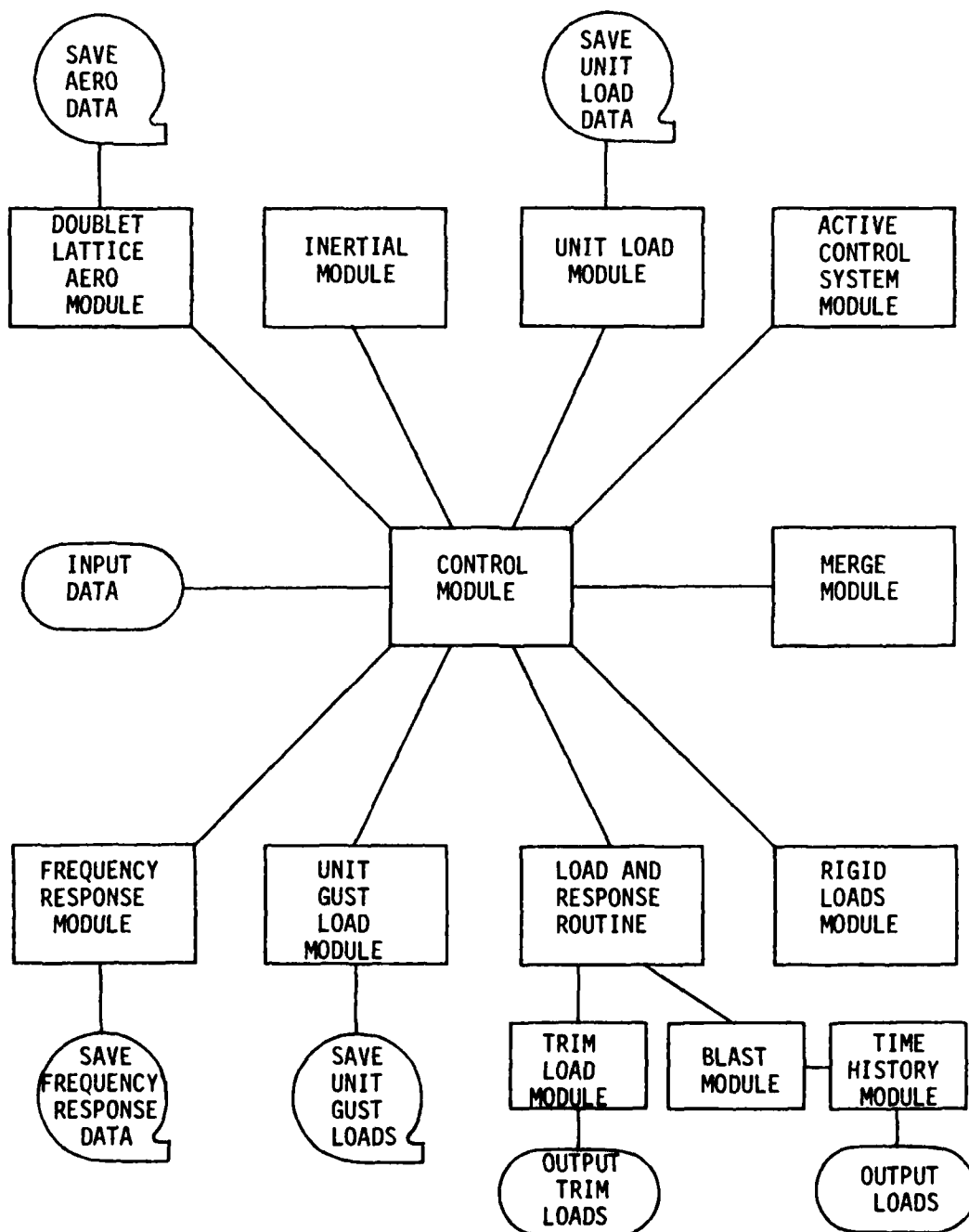


Figure 1. VIBRA-6 Modular Organization

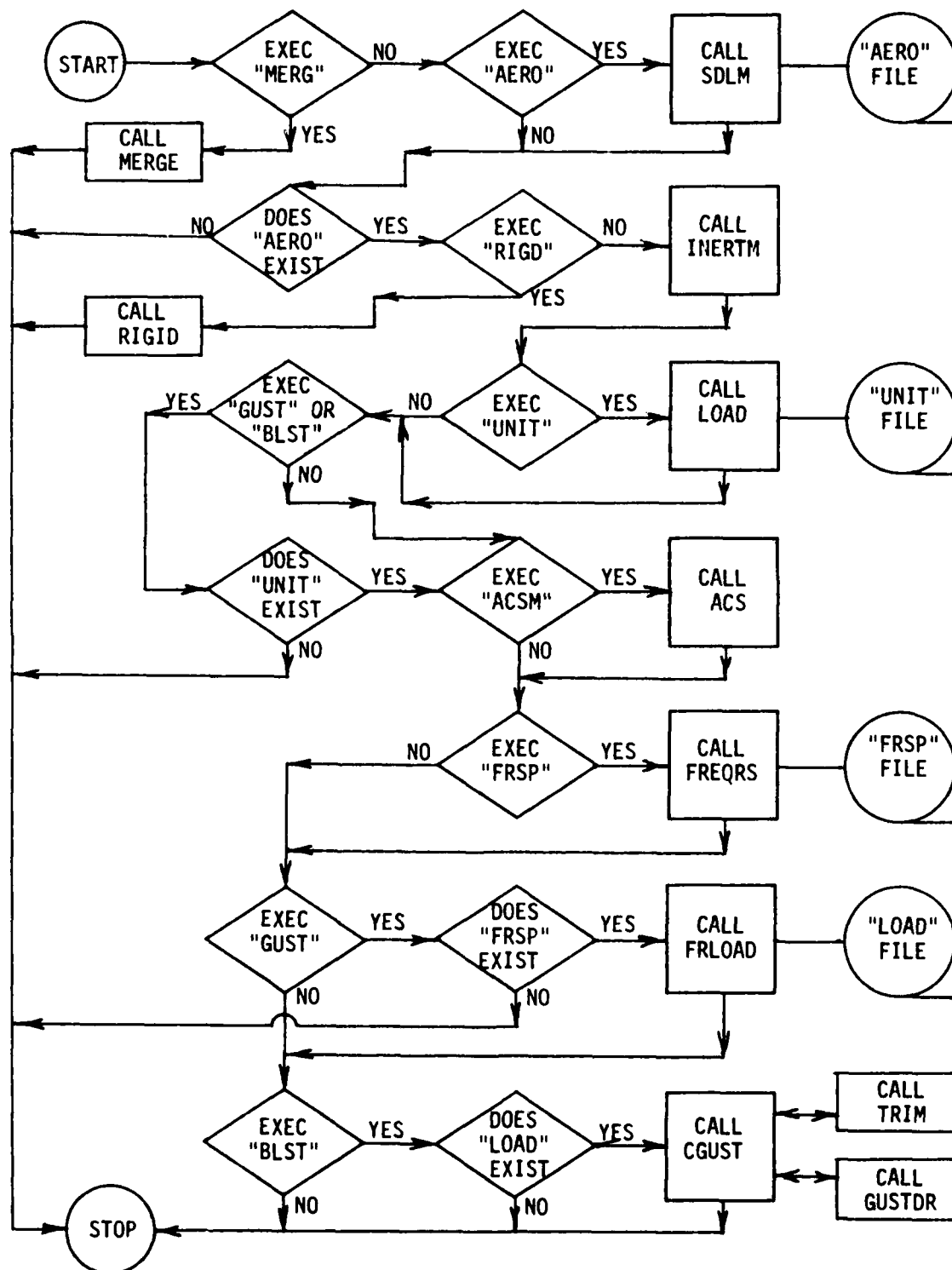


Figure 2. Program Analysis Flow Chart

1. The generalized aerodynamic forces for motion and the harmonic travelling gust field and the physical aerodynamic forces for load calculations.
2. Generalized mass, stiffness and damping forces for the structure.
3. The integrated loads (i.e., the internal shears, bending moments and torques) caused by unit aerodynamic and inertial control point loads.
4. The transfer functions and modal data necessary to obtain additional terms in the modal equations of motion arising from the active control systems.
5. The frequency response of the vehicle modes to the unit harmonic travelling gusts of varying orientations.
6. The symmetrical and antisymmetrical integrated loads for the unit gust.
7. The trim load distribution for level flight, a symmetrical pull-up, or a climbing (or descending or level) steady turn.
8. The time history of the blast induced gust field velocities.
9. The Fourier transform of the blast time history, the inverse Fourier transform of the frequency response of the vehicle to the blast to obtain the transient time history of the response, and, finally, the iteration for the critical range.

The general theory for each of the computational steps is outlined below. The detailed equations are given later with the descriptions of the various modules.

The subsonic aerodynamic forces are calculated by the Doublet-Lattice Method and the Method of Images (Refs. 2 and 3). The aerodynamic influence coefficients are determined for harmonic motion, and the load distribution is found for the harmonic travelling gust field. Then using the aerodynamic mode shapes which are read in for each rigid body and vibration mode, or determined from inertial modes, internally, if the $h-\alpha$ modal input is used, and specified at the aerodynamic control points, the generalized aerodynamic forces are obtained for motion and for the gust field. The generalized forces correspond to unit generalized coordinates and a unit gust amplitude. These aerodynamic matrices are formed for a limited number of reduced frequencies and are dependent on the Mach number but are independent of the flight velocity. These data are saved on tape.

The generalized mass and stiffness matrices are calculated from the mass, frequency and inertial mode shape data. The mass matrix and the vibration frequencies are read in along with the rigid body and vibration mode shapes as specified at the mass points. The generalized mass matrix is found from the mass matrix and the modes; and the generalized stiffness is determined by the generalized mass and the vibration frequencies.

The integrated loads consist of the internal shears, bending moments, and torques at stations and in directions specified by the user. From the geometry of the structural model and the location of the mass points and aerodynamic panel and body points, the structural reactions are determined for unit values of the inertial and thrust forces and the aerodynamic forces, and unit generalized response. These integrated inertial loads and the integrated aerodynamic loads are saved separately on tape until

the inertial and aerodynamic load distributions are found in the response analysis from which the combined integrated inertial and aerodynamic loads are calculated for use in the stress analysis. Loads due to engine thrust are included also.

The active control system transfer functions are found and the kinematic relationships between sensed and commanded motion established with input data defining the sensed and driven degrees of freedom. These data are saved in core for subsequent use in the frequency response and unit gust load analyses.

At this point, all data have been independent of flight condition, with the exception of Mach Number.

The modal frequency response of the aircraft is found from the generalized mass, aerodynamic, and stiffness matrices and the active control system for unit gusts of all available orientations at a specified flight altitude and velocity. Symmetric and antisymmetric solutions are formed. These solutions are obtained at arbitrary user specified frequencies, with spline interpolation employed to obtain the aerodynamic forces at frequencies other than those used for the basic aerodynamic matrix calculations. These data are saved on tape.

The symmetric and antisymmetric integrated loads due to the unit gust are found from the modal frequency response and the unit load solutions for all orientations and saved on tape.

The availability of aerodynamic influence coefficients permits the

estimation of all the stability derivatives, including static aeroelastic behavior, that are necessary to solve for the trim condition. For the symmetrical case, the angle of attack and a symmetric trim mode permit calculation of the longitudinal stability derivatives and, with the velocity, ambient density, and load factor specified, the trim angle of attack and horizontal stabilizer (or elevator) deflection are calculated. The load distribution on the vehicle then follows. For the case of a steady turn, additional lateral-directional derivatives are required. These require the aileron, rudder (or its equivalent), and yaw rate modes. With the addition of these lateral-directional derivatives to the longitudinal set, the angle of attack, stabilizer, aileron and rudder deflections are determined for a given speed, ambient density, load factor and rate of climb. The load distribution on the aircraft again follows.

The blast induced gust time history is obtained for specified range and yield in the same fashion as in the VIBRA-4 program.

The Fourier transform of the blast time history is found numerically from the integral definition of the transform and the assumed or specified profile of the transverse blast velocity. The numerical evaluation of the integral is straightforward.

The product of the Fourier transform of the blast profile and the frequency response of the vehicle modes to the unit harmonic travelling gust is the Fourier transform of the transient response to the specified blast wave. The inverse transform of the product is therefore the desired time history of the modal responses. The numerical evaluation of the inverse transform integral is also straightforward and is similar to that

for the forward transform integral. Superposition of the loads due to maneuvering give the final integrated load time histories and stress time histories.

Numerical checks on the time histories of the integrated loads are made against input allowable loads or stresses and an estimate is made of the allowable peak gust velocity and overpressure. Iteration then is carried out (if desired) to establish the critical range for specified orientations and flight conditions.

Two coordinate systems are used in VIBRA-6. They are the Earth Fixed Axis System (EFAS) and the Aircraft Axis System (AAS). The AAS is used for definition of the aircraft geometry and determination of its modes, mass, and aerodynamics. Figure 3 illustrates the AAS system. The EFAS is used to position the AAS in space and establish the burst to aircraft relations as a function of time. Figure 4 shows the EFAS system. The aircraft is initially positioned at the input altitude at time zero (shock intercept) and out the Y_{EFAS} axis a distance R_T where R_T is the turn radius (if the aircraft is in a turn). Time at time of burst is negative. Unlike VIBRA-4, the EFAS is fixed at sea level and the burst is located in space from the orientation direction cosines in the AAS system and the initial slant range at time of intercept. The assumption has been made that at distances from the burst, corresponding to damage thresholds for large subsonic aircraft, the shock front appears planar to the aircraft and the shock front is moving at sonic velocity.

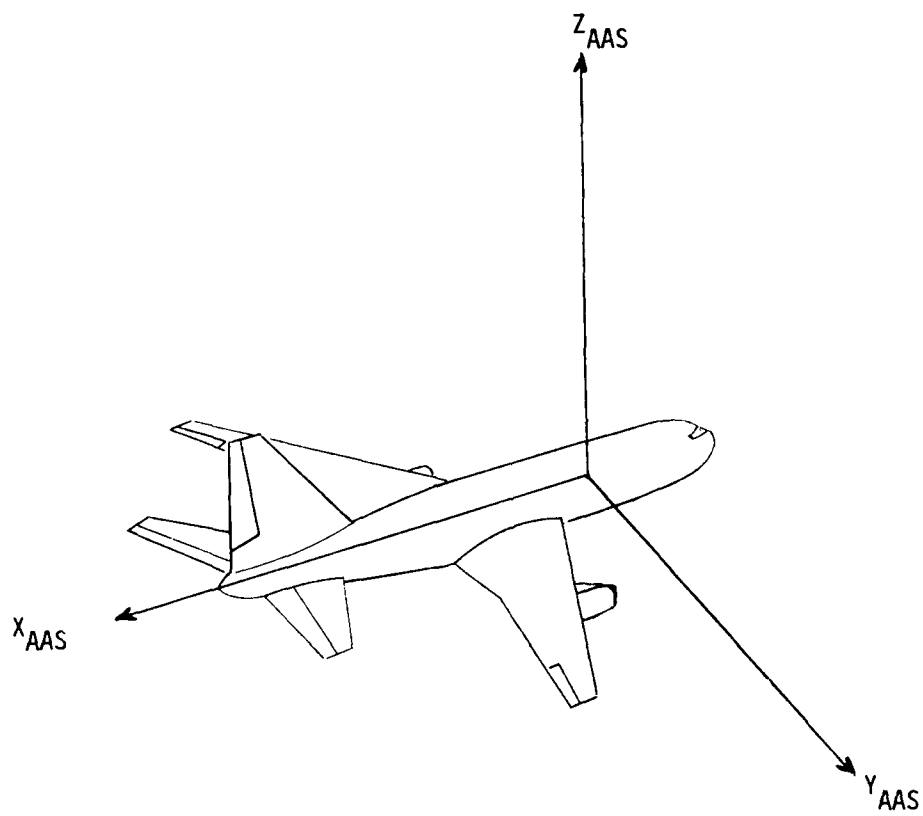


Figure 3. Aircraft Axis System (AAS)

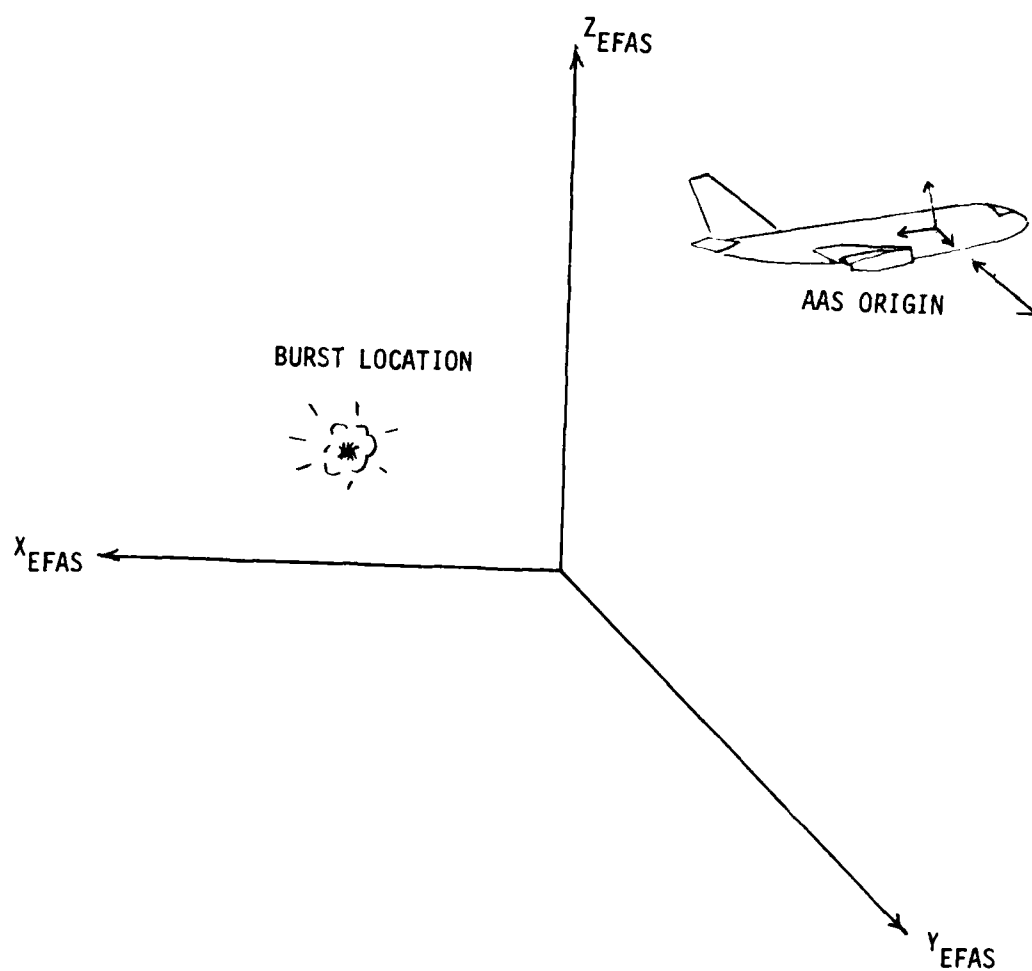


Figure 4. Earth Fixed Axis System (EFAS)

SECTION III

MODULE DESCRIPTIONS

This section describes the operation of the various modules presently in VIBRA-6. Contained within each module description are the equations for the solutions. Nomenclature is defined as used.

In some instances matrix operations are shown in the figurative sense whereas the actual coding for the most part carries out such operations in a more efficient fashion.

1. CONTROL MODULE

This module serves to control program data flow and operation. All data necessary to the modular execution and dimensioning of the modules are read into this module. Data to any module have three sources at a given point of execution: the input data file (card or disk), core stored data, or generated data files (tape or disk). The modularization of the program allows the generation of a data base of files which may be reused for a specific aircraft configuration thus avoiding the necessity of recalculation of the majority of basic data necessary for final solution.

The input data file is divided into two classes: fixed data and run data. Fixed data are data which describe the basic configuration under analysis and are expected to vary the least, while run data varies from case to case. The collection of these data is called the Fixed Data Deck and the Run Data Deck. While the Fixed Data Deck must be available to the program during execution, only the data needed for execution during any single phase is used. Header cards are used within the Fixed Data Deck to define particular groupings of data.

The following input data file data comprise the Fixed Data Deck:

- Data necessary for execution of the aerodynamic module.
- Data necessary for calculation of the generalized mass, stiffness and damping in the inertial module.
- Data necessary for calculating unit loads matrices in the unit loads module.

The following input data file data comprise the Run Data Deck:

- Flight condition data.
- Data necessary to define the active control system.
- Frequency data for the frequency response module.
- Data for defining the maneuver condition.
- Data for definition of the blast condition.

Generated data consist of stored arrays which result from execution of four of the modules. If these data are available to the program and so noted by the user, the program draws upon the files as necessary. Core data consist of data which are minimal in cost to generate and required in numerous parts of the overall program and thus are not saved as generated file data.

Figure 5 details the major routines called by the control module, each of which is the controlling routine of a module. Tables 1 and 2 illustrate the data requirements for each module and the data source. A more complete description of the data input, module by module, is contained in the module descriptions following. In these descriptions, input data file is referred to as 'card' input and generated data file is referred to as 'tape' data.

The analysis of an aircraft can be carried out with a single pass through the program. The suggested procedure for operation is to develop aerodynamics for a few Mach numbers, unit loads once, and cycle through the active system, frequency response, and unit gust load modules for as many airspeed/altitude conditions as required. Then, cycle through the trim, blast and time history modules only for maneuver and blast conditions as required.

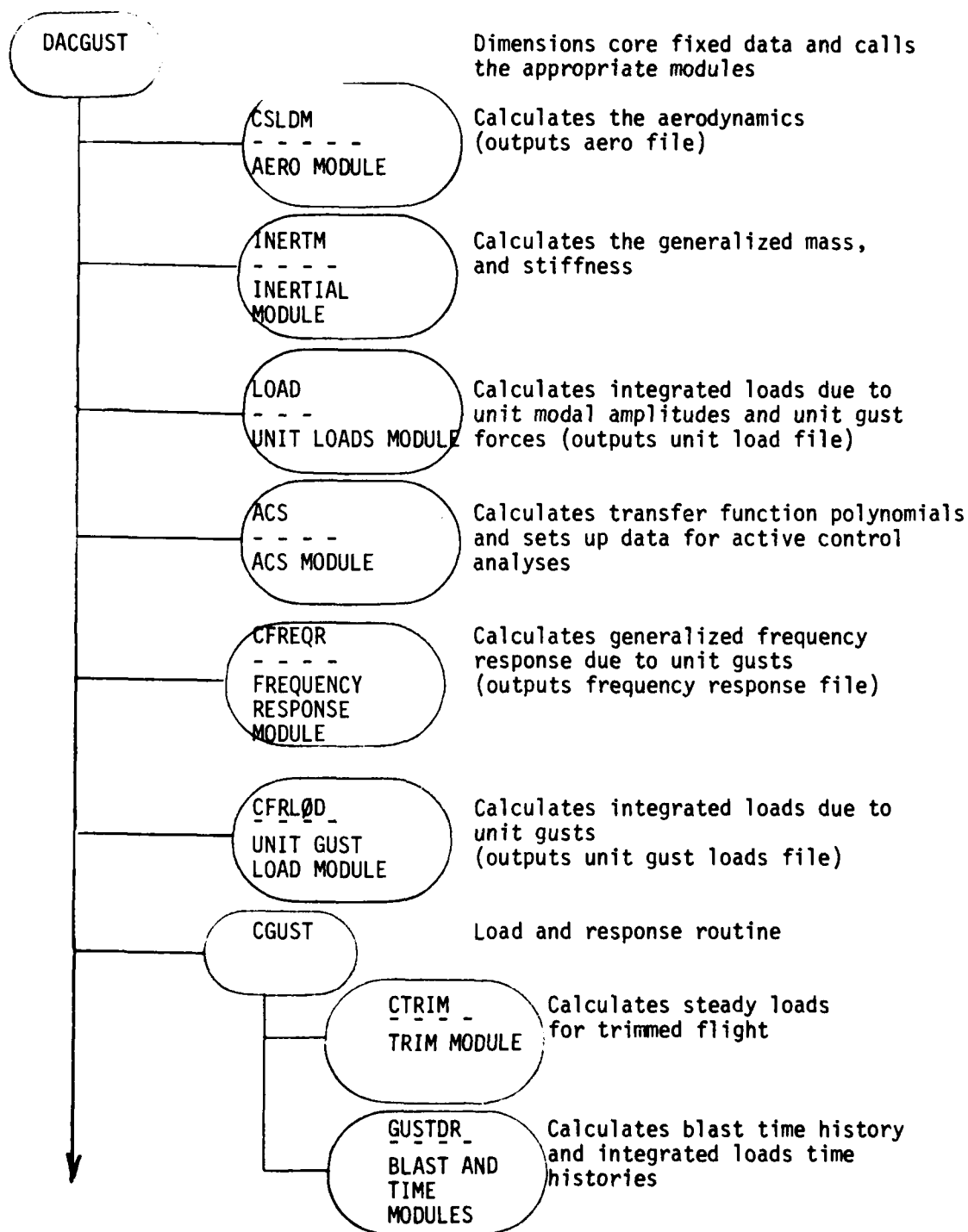


Figure 5. Control Module Routines

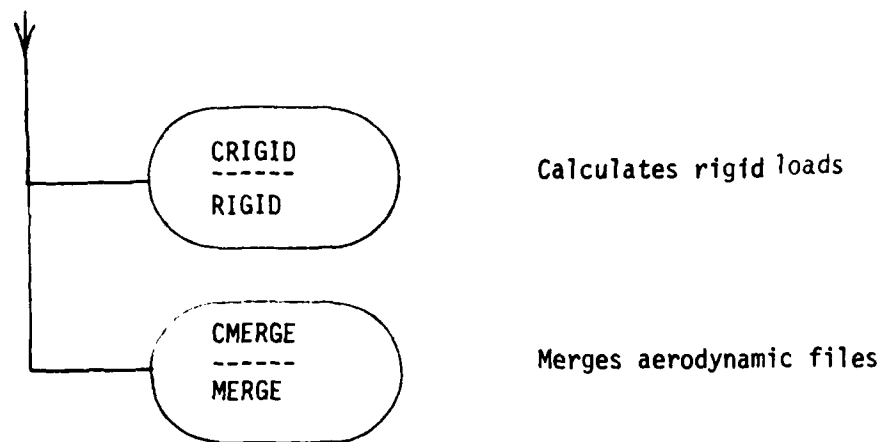


Figure 5 (cont'd). Control Module Routines

TABLE 1
MODULE EXECUTION REQUIREMENTS
FOR NEW DATA INPUT

MODULE EXECUTED FOR NEW DATA	MODULE AFFECTED						
	AERO	INERTIAL	ACTIVE CONTROL	UNIT LOAD	FREQUENCY RESPONSE	UNIT GUST LOAD	BLAST RESPONSE
AERODYNAMIC	FDD	R	R	R	R	R	R
INERTIAL		FDD	R	R	R	R	R
ACTIVE CONTROL			RDD		R	R	R
UNIT LOAD				FDD		R	R
FREQUENCY RESPONSE					RDD	R	R
UNIT GUST LOAD						RDD	R
BLAST RESPONSE							RDD

Note: Inertial module is always exercised with input of run data.

TABLE 2
BASIC DATA REQUIREMENT AND TRANSFER

		FDD = FIXED DATA DECK INPUT RUD = RUN DATA DECK		OUTPUT	
MODULE	CARD DATA	CORE DATA	GENERATED DATA FILE	CORE DATA	GENERATED DATA FILE
AERODYNAMIC	(FDD) AERO GEOM. AERO MODES ORIENTATIONS REDUCED FREQ MACH NO.				AERO GEOM. $D\phi_S, D\phi_A$ F_S, F_A $SPLHS, SPLHA$
INERTIAL	(FDD) MASS GEOM. MASS FREQUENCIES INERTIA MODES MODE DEF.			m κ g M ϕ_I MODE DEF.	
UNIT LOAD	(FDD) BEAM GEOM. INT'GD LOAD GEOM. LOAD ALLOW. STRESS DEF. MASS SPARSING MASS ORIENT. BOX SPARSING BODY SPARSING ENG. GEOM.	MASS GEOM. ϕ_I $M\phi_I$	AERO GEOM. $D\phi_S, D\phi_A$		PIQ PAQS PAQA THRGNF THRLØD PINT STRESS
ACTIVE SYSTEM	(RDD) ACS KINEMATICS BLOCK DATA	ϕ_I		ACS KINEMATICS T_S, T_A	
FREQUENCY RESPONSE	(RDD) FREQUENCIES ALTITUDE AIRSPEED	m κ g T_S, T_A ACS KINEMATICS MODE DEF.	Z_S, Z_A F_S, F_A $SPLHS, SPLHA$		q
UNIT GUST LOADS		T_S, T_A ACS KINEMATICS	q PIQ PAQS PAQA F_S, F_A PINT STRESS		P_S, P_A STRESS

TABLE 2 (cont)

BASIC DATA REQUIREMENT AND TRANSFER

MODULE	CARD DATA	CORE DATA	GENERATED DATA FILE	CORE DATA	GENERATED DATA FILE
TRIM	(RDD) MANEUVER DATA THRUST	MODE DEF. m α	D_S, D_A PIQ PAQS PAQA THRGNF THRLØD	P_{STRIM} P_{ATRIM}	
BLAST AND TIME RESPONSE	(RDD) ORIENTATIONS YIELD & RANGE MAX TIME ALLOWABLES	P_{STRIM} P_{ATRIM}	P_S, P_A STRESS	$\bar{P}$ σ	

2. AERODYNAMIC MODULE

The aerodynamic module SDLM has been modified from the computer program of Reference 2. The modifications to add a travelling gust field, improve the aerodynamic influence coefficients, and change the load output, are discussed in detail in Volume II of this report. The basic data requirements and output are summarized here for convenience. This module serves to provide the aerodynamic forces due to motion and the travelling gust and the generalized aerodynamic equations for solution of the blast response problem

The geometry required is that necessary to describe the lifting surfaces, the slender bodies, and the interference surfaces between the lifting surfaces and bodies. The lifting surfaces are idealized as plane panels with no thickness, camber, or twist, but with dihedral. Each lifting surface is subdivided into smaller trapezoidal lifting elements (boxes) arranged in strips parallel to the freestream such that box boundaries lie on surface edges, fold lines, and control surface edges. For coplanar or near-coplanar surfaces, e. g., a wing and tail, the boxes must be aligned in the streamwise direction. For non-coplanar surfaces alignment is not required if the perpendicular separation is more than one strip width. For intersecting surfaces the box edges must also be located at intersections, as in the case of a wing pylon.

The idealization of fuselages, nacelles, or external stores as slender bodies does not require geometric similarity to the actual body, but it is recommended that the best elliptical representation of the body cross-sectional area be used. The displacements of the body during motion are accounted for in the upwash and sidewash boundary conditions. All bodies, including jet engines, must be idealized as having pointed noses; however, a body need not

be closed at its downstream end and a suitable base area may be selected to approximate flow separation effects. In addition to the idealization of the body cross sections, the body length is divided into segments. Each segment is described by its length and width at each end. Smaller lengths are chosen where the body cross section is changing rapidly and in regions of maximum interference with lifting surfaces such as occur near the wing root or at a nacelle-pylon intersection.

The interference surface is a cylindrical tube with an elliptical cross section. All attached lifting surfaces are connected to this tube. Within this tube is placed a system of images of the external lifting elements, and the image system approximately negates the flow field at the body surface induced by lifting surfaces. The interference tube is segmented into elements by means of angular divisions around its circumference and streamwise divisions along its length. Since the interference elements increase the computational cost, their number should be limited, but they need only be used near lifting surface/body intersections and only upstream and downstream within a chord-length of the lifting surface. In situations in which high accuracy is not required, e.g., for small external stores, the interference elements might be eliminated altogether.

In addition to the geometry of the idealized aerodynamic configuration, the aerodynamic load calculation requires the normalwash distribution at the aerodynamic elements. The aerodynamic control points are located differently on the lifting surfaces and on the slender bodies. On the lifting surfaces, the normalwash control point is chosen at the three-quarter chord point of the centerline of each box and the lift acts at the one-quarter chord point. On the slender body elements, both the normalwash and lift (or side force)

are determined at the midpoint of the segment length. The deflections and slopes at these points are determined by a surface spline interpolation among a set of deflections of aerodynamic modes. The aerodynamic modes differ from the structural modes to the extent that they cover the lifting surfaces and slender bodies more completely, e.g., including the leading and trailing edges, whereas the structural modes give the deflections only at the mass points. The increased area covered by the aerodynamic modes improves the accuracy of interpolation for the normal washes and deflections and, hence, the accuracy of the generalized aerodynamic forces. The aerodynamic modes correspond to the vehicle rigid body and elastic modes, the control surface and trim modes, and jig modes. The jig modes are necessary to establish the basic pitching moment and basic lift distributions over the vehicle, and they describe the positions from the reference aerodynamic planes of the actual chord lines of surfaces, (camber and twist), and local body pitch and surface pitch.

The aerodynamic influence coefficients (AIC's) of Reference 2 are useful either in a direct influence coefficient solution, which avoids modal convergence problems, or in the modal solution which consider many varying modes, e.g., modes that change because of design changes in stiffness or weight distribution. Since the AIC's depend on the planform (and Mach number and reduced frequency) and not on the modes, the generalized aerodynamic forces are easily obtained from the AIC's,

$$[\mathcal{L}] = [\phi_A]^T [AIC] [\phi_A]$$

where $[\phi_A]$ is the matrix of modal deflections at the aerodynamic nodal points. The additional calculations required to obtain the AIC's are not justified for the VIBRA-6 analysis because only a few sets of modes are considered in a response analysis. The modifications to Reference 2 described in Volume II

of this report are summarized below along with a few basic relationships necessary for use of the finite element aerodynamics.

Let [SPL] be the spline interpolation matrix that yields the complex normalwash $\{\bar{w}\}$ from the deflections $\{h_A\}$ at the aerodynamic nodal points

$$\{\bar{w}\} = [\text{SPL}] \{h_A\}$$

The nodal point deflections $\{h_A\}$ may be regarded as either translations or rotations. The modal solution expresses the deflections as a series of vibration modes with generalized coordinates $\{q\}$:

$$\{h_A\} = [\phi_A] \{q\}$$

and the modal approximation to the normalwash is

$$\{\bar{w}_q\} = [\text{SPL}] [\phi_A] \{q\}$$

The Doublet-Lattice Method initially relates the downwash to the local pressure coefficients by the relationship (Ref. 5 and 6) through:

$$\{\bar{w}_q\} = [D_{\text{DLM}}] \{\Delta C_p\}$$

where $[D_{\text{DLM}}]$ is a large matrix. The downwashes, however, are given in terms of a reduced set of coordinates q as shown above. The forces on the boxes and slender bodies are given in terms of the pressure coefficients by:

$$\{F_B\} = [F_{\text{DTP}}] \{\Delta C_p\}$$

where $[F_{\text{DTP}}]$ is an integration matrix relating local force to local pressure. These forces then are obtained by the general relationship:

$$\{F_B\} = [F_{\text{DTP}}] [D_{\text{DLM}}]^{-1} [\text{SPL}] [\phi_A] \{q\}$$

5. Albano, E., Rodden, W.P., *A Doublet Lattice Method for Calculating Lift Distributions on Oscillating Surfaces in Subsonic Flows*, AIAA Journal Vol. 7, No. 2, February 1969.

6. Kalman, T.P., Rodden, W.P., Giesing, J.P., *Aerodynamic Influence Coefficients by the Doublet Lattice Method for Interfering Nonplanar Lifting Surfaces Oscillating in a Subsonic Flow*, IRAD Final Report, DAC-67977, November 1969.

where the inverse is not actually carried out, but the forces due to unit q obtained by solving for the number of right-hand sides corresponding to the number of modes required. The generalized forces are given in terms of the above forces by the relationship:

$$\{F\} = [\phi_A]^T [SPLH] \{F_B\}$$

where $[SPLH]$ is an interpolation matrix relating local force to aerodynamic nodal point forces. The stored generalized aerodynamic forces due to motion then are given symbolically by

$$[D] = [\phi_A]^T [SPLH] [F_{DTP}] [D_{DLM}]^{-1} [SPL] [\phi_A]$$

and the stored local aerodynamic forces due to motion (necessary for integrated loads) by:

$$[D\phi] = [F_{DTP}] [D_{DLM}]^{-1} [SPL] [\phi_A]$$

The gust loads are calculated for each orientation of the aircraft and the blast. The unit normalwash $\bar{w}_g$ induced by the blast at a point on the aircraft is given (in Vol.II) by

$$\bar{w}_g(x, y, z) = G_0 \exp(-i 2 k_r \ell R/\bar{c})$$

where

G_0 = the amplitude of the harmonic blast material velocity

$$Q = \vec{n} \cdot \vec{v}_g$$

$\vec{n}$ = the unit normal vector to the lifting surface or slender body

$$\vec{v}_g = i \cos\alpha + j \cos\beta + k \cos\gamma$$

α, β, γ = the blast orientation angles

$$k_r = \omega \bar{c} / 2U$$

ω = circular frequency

$\bar{c}$ = reference chord

U = aircraft velocity

$$\ell = x \cos\alpha + y \cos\beta + z \cos\gamma$$

$$R = U/(V_g + U \cos \alpha)$$

V_g = velocity of blast pressure wave

In general, an arbitrary burst location results in an asymmetric loading of the flight vehicle. Since any asymmetric condition can be found as a linear combination of a symmetric and an antisymmetric condition (assuming linear systems), both symmetric and antisymmetric aerodynamic gust analyses must be performed. If the gust normalwash on the right side is $\bar{w}_g(x, y, z, \bar{\gamma})$ and on the left side is $\bar{w}_g(x, -y, z, -\bar{\gamma})$, then the symmetrical normalwash is

$$\bar{w}_{gs} = (1/2) [\bar{w}_g(x, y, z, \bar{\gamma}) + \bar{w}_g(x, -y, z, -\bar{\gamma})]$$

and the antisymmetrical normalwash is

$$\bar{w}_{ga} = (1/2) [\bar{w}_g(x, y, z, \bar{\gamma}) - \bar{w}_g(x, -y, z, -\bar{\gamma})]$$

The symmetric and antisymmetric normalwashes can be used as outlined above to obtain sets of symmetrical and antisymmetrical local forces $\{F_g\}$ and generalized forces $\{\mathcal{F}_g\}$.

$$\{F_g\} = [F_{DTP}] [D_{DLM}]^{-1} \{\bar{w}_g\}$$

$$\{\mathcal{F}_g\} = [\phi_A]^T [SPLH] \{F_g\}$$

The aerodynamic data required for the blast response analysis consist therefore of generalized aerodynamic forces for symmetric and antisymmetric modes of vibration, and for symmetric and antisymmetric harmonic gust fields having a number of orientations. The orientations depend on the burst locations. A standard set of thirteen burst locations is shown in Figure 6. Other orientations may be chosen but must be specified separately by the user. The generalized forces are required at a sufficient number of reduced frequencies that interpolation will lead to accurate values at intermediate frequencies.

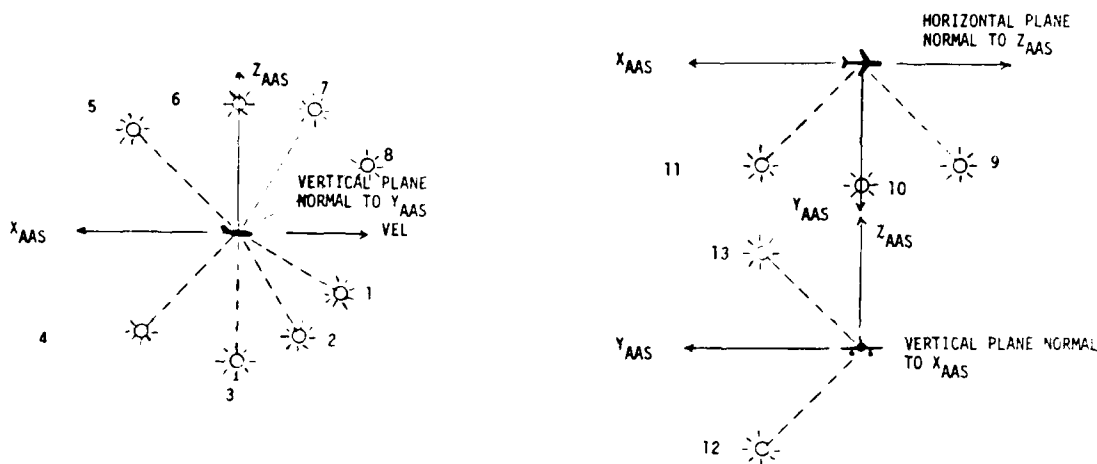


Figure 6. Blast Orientations for Aero Module

The spacing of the reduced frequencies necessary for an accurate interpolation depends on the blast orientation; an estimate is given as:

$$\Delta k_r = \pi P / u_1; P = (1 + M_\infty \cos \alpha) / M_\infty \bar{r} / c$$

where $\bar{r}$ is the slant distance from a point on the aircraft to the blast plane, as the blast plane passes through the aircraft origin. If the maximum distance $\bar{r}$ is used the estimate for Δk_r will be conservative for all points on the aircraft.

The maximum reduced frequency, $k_{r_{\max}}$, that is necessary to consider is estimated as:

$$k_{r_{\max}} = u_2 P$$

where u_2 is approximately 2.5. In many cases the $k_{r_{\max}}$ value is above the practical limit for the Doublet Lattice Method (which is 2 or 3). For such cases piston theory is used to fill the gap between the DLM $k_{r_{\max}}$ and the one required by the above formula. The application of piston theory is discussed in Vol. II, Section II-4, and is based on the following relation:

$$\Delta C_D = (4/M_\infty) \bar{W}/V$$

where $\bar{W}/V$ is the dimensionless downwash.

3. INERTIAL MODULE

The inertial module calculates the generalized mass and stiffness from the specified inertial mode shapes and point mass data. Input data which are used for core allocation consist of the number of masses for the half aircraft analysis and the number of symmetric and antisymmetric modes used (which must agree with the aerodynamic module input.) Array data input consists of:

- The point mass data for the right side of the aircraft and the point coordinates in the AAS system. Though the analyses are carried out for only half an aircraft, full centerline mass point data are loaded.
- Inertial mode shapes and associated frequencies defining the motion in three orthogonal axes at each point (identified as PHIX, PHIY, and PHIZ.)
- An array called AMODNØ which defines the type of modes by location in the modal array. The input requirement is set that all symmetric modes precede all antisymmetric modes and the order of inertial mode input within these general groupings must agree with the aerodynamic mode ordering sequence. The rigid body modes must have zero frequency input and input modes defining any jig modes must be present, but may be of zero deflection.
- The structural damping of each mode, which should be zero for all but the elastic modes.

The inertial mode shapes (as distinguished from the aerodynamic mode shapes) define the mass point motion in each mode. The motion of each point must consist of three orthogonal modal deflections but they need not necessarily

be deflections parallel to the AAS system. (Input data in the unit loads module are provided to establish the alignment of these deflections in terms of AAS system motion.) The modes need not be aircraft free-free modes, as the analysis procedure will, in effect, orthogonalize the modes in the event that constrained modes are used. A distinction is made, however, between modes used to describe the symmetric and antisymmetric motion of the aircraft.

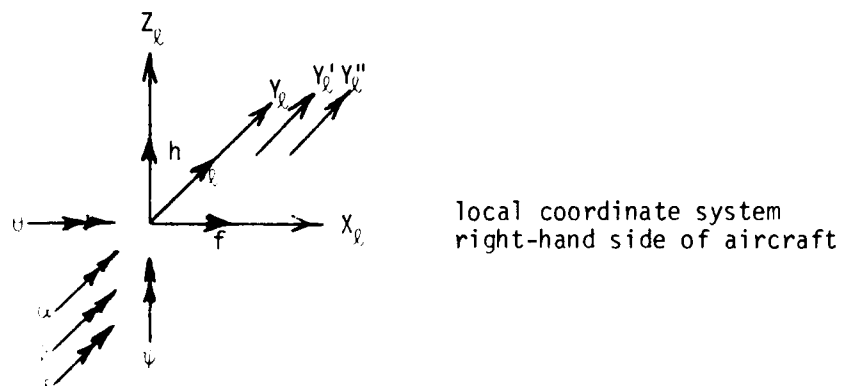
There are two formats for the mass data. The first simply consists of the concentrated masses at each mass point. The second consists of the sectional mass data for each section when the modes are specified by the user in terms of sectional translations and slopes (called the h and α input). The first format is a subset of the second although the two have been programmed separately. The sectional mass matrix is shown in Figure 7 for the maximum number of eight degrees of freedom. Figure 8 shows the local coordinate systems of the mass data and modeshapes for typical components. The mass matrix itself is not input to the program. The mass properties are input and the program forms the mass matrix internally from the mass properties.

The generalized mass matrix is given by

$$[m] = [\phi_I]^T [M] [\phi_I]$$

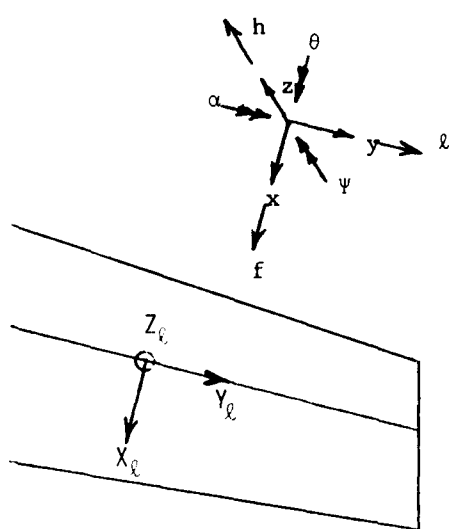
where $[\phi_I]$ is the array of all inertial shapes. The off-diagonal terms of the generalized mass matrix coupling symmetric and antisymmetric modes are zeroed since the assumption of a vertical plane of symmetry in mass, stiffness and geometry is made, and thus this coupling is identically zero for free-free modes but not arithmetically for the one half aircraft analyses.

The generalized stiffness is given by

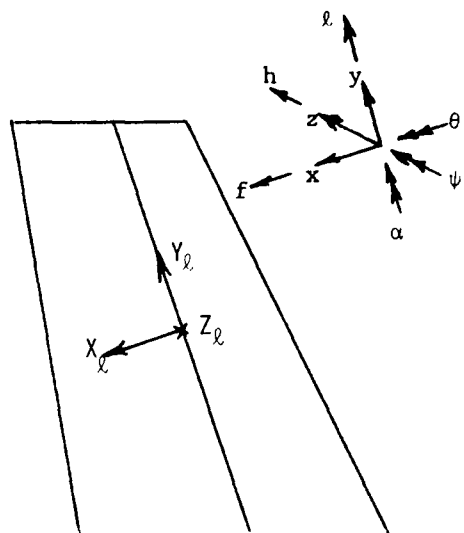


	f	ell	h	theta	alpha	psi	beta	delta
f	M	0	0	0	M ΔZ	-M ΔY	+S $_{f\beta}$	+S $_{f\delta}$
ell	0	M	0	-M ΔZ	0	M ΔX	0	0
h	0	0	M	M ΔY	-M ΔX	0	-S $_{h\beta}$	-S $_{h\delta}$
theta	0	-M ΔZ	M ΔY	I $_{xx}$	-I $_{xy}$	-I $_{zx}$	-P $_{\theta\beta}$	-P $_{\theta\delta}$
alpha	M ΔZ	0	-M ΔX	-I $_{xy}$	I $_{yy}$	-I $_{yz}$	P $_{\alpha\beta}$	P $_{\alpha\delta}$
psi	-M ΔY	M ΔX	0	-I $_{zx}$	-I $_{yz}$	I $_{zz}$	-P $_{\psi\beta}$	-P $_{\psi\delta}$
beta	-S $_{f\beta}$	0	-S $_{h\beta}$	-P $_{\theta\beta}$	P $_{\alpha\beta}$	-P $_{\psi\beta}$	I $_{\beta\beta}$	P $_{\beta\delta}$
delta	-S $_{f\delta}$	0	-S $_{h\delta}$	-P $_{\theta\delta}$	P $_{\alpha\delta}$	-P $_{\psi\delta}$	P $_{\beta\delta}$	I $_{\delta\delta}$

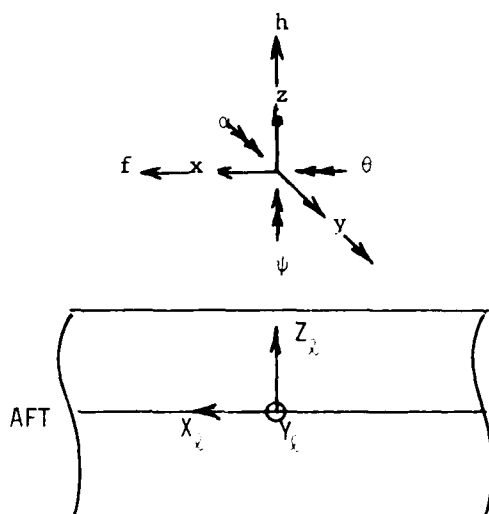
Figure 7. Sectional Mass Matrix



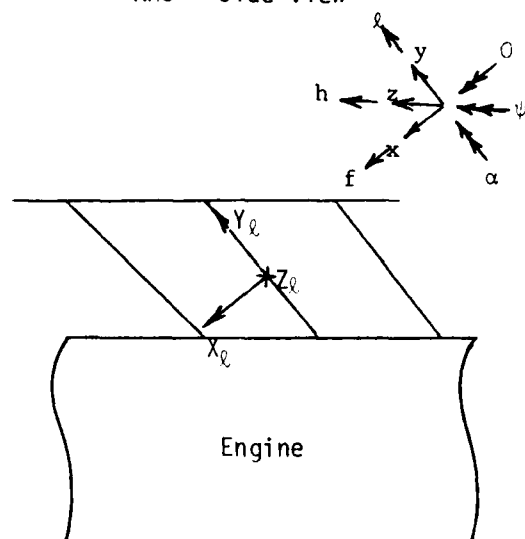
Wing or Horizontal Tail
RHS - Plan View



Vertical Tail
RHS - Side View



Fuselage or Nacelle
RHS - Side View



Pylon
RHS - Side View

Figure 8. Component Local Coordinate Systems

$$[\kappa] = [m_{ij} \omega_1^2]$$

The generalized mass and stiffness matrices are saved in core along with the input structural damping and mode definition array for subsequent use. The array EMPHI which gives the inertial forces at the mass points for unit generalized response is calculated by

$$[EMPHI] = [M] [\phi_I]$$

for use in calculation of the integrated loads due to mass point motion. Figure 9 shows the principal routines of this module.

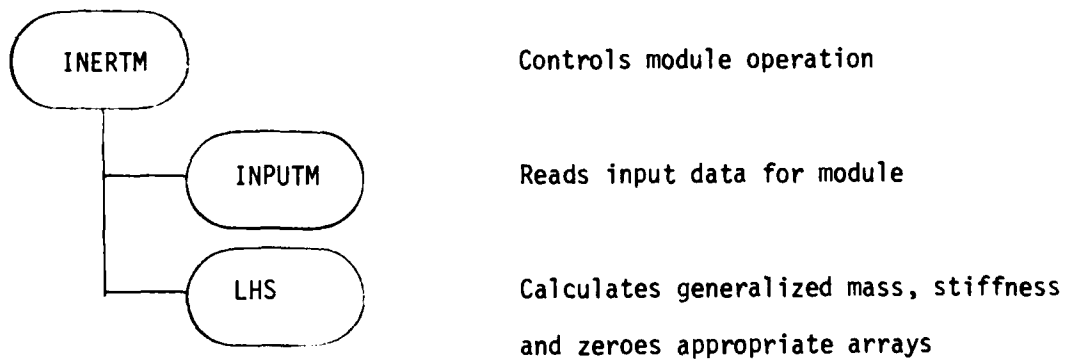


Figure 9. Inertial Module Routines

4. UNIT LOADS MODULE

The unit loads module serves to generate the matrices required to obtain integrated loads at all required locations on the vehicle. Its primary functions are to:

- Find the spatial location and orientation of each of the local beams, the network of which defines the load integrations for integrated loads and the spatial orientations of the integrated loads.
- Calculate the integrated loads due to unit inertial loads at the mass points and due to unit aerodynamic loads (motion dependent and gust) at the aerodynamic box load points and slender body load points.
- Calculate the integrated loads due to unit generalized responses in the modes for loads from mass point motion and aerodynamic box and slender body motion and thrust.

Figure 10 details the major routines of this module and a brief description of their functions. Input data required for this module consist of:

- An aero file.
- The number of local beams describing the possible load paths for internal loads, the AAS coordinates of the beam end points and their component definition numbers.
- The number of integrated loads desired, the local beam number each load is associated with, a load and component code for type and orientation, the AAS coordinate of each integrated load and the maximum allowable positive and negative load for each.

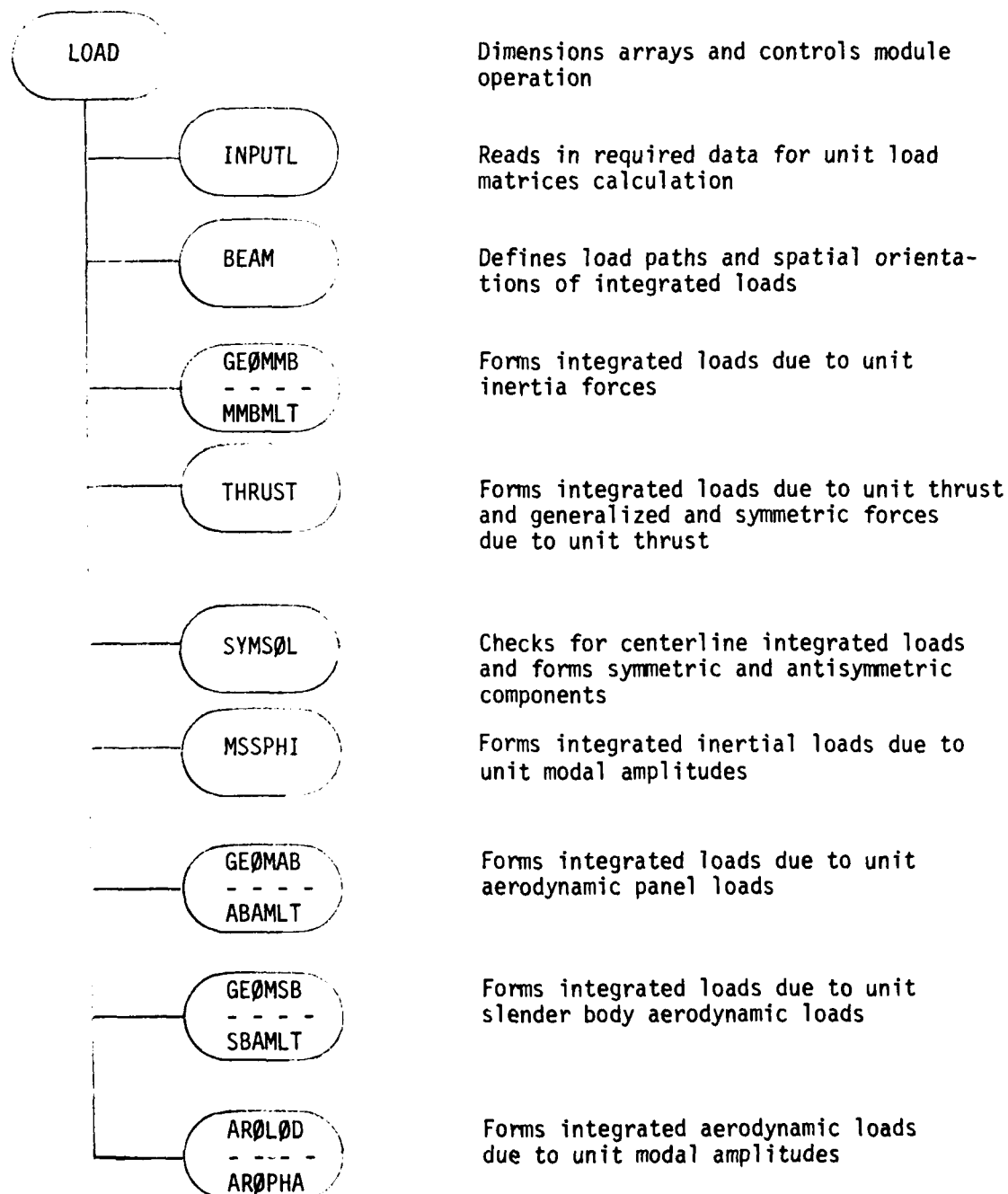


Figure 10. Unit Loads Module Routines

- the number of stresses required (if any) and the matrix relation between stresses and integrated loads.
- the number of mass point groups, the first and last mass point number and local beam number the loads from each group of mass points first enter and direction cosines (TLAMV) relating inertia motion to AAS motion.
- the number of aerodynamic box groups and the first and last box numbers and local beam number the loads from each group of aerodynamic boxes first enter.
- the number of slender body element aerodynamic groups and the first and last body element and local beam number the loads from each group of body elements first enter.
- number of engines and engine thrust location definition.

Routine LOAD dimensions and controls the operation of this module. INPUTL reads the required external input data which consist of beam network geometry, integrated load definition data, stress calculation matrix (if required), mass group definitions, aero box group definitions, and aero body group definitions. Group definitions of mass and aero points are used to form sparse matrices and to define which beam each group is associated with.

Routine BEAM defines the load paths by checking connections of the beam network and calculates the orientation in space of the beams.

A local beam coordinate system is used to define the orientation of the integrated loads. The location in space of any beam is determined from the end points of the beam defined as the inner and outer ends. Load integration

always passes from the outer ends to the inner ends of the local beams. The connection of these beam ends then defines the load path for determination of the integrated load which is the summation of all equilibrium loads 'out-board' of the integrated load station.

The spatial location and orientation of a beam segment is determined as follows:

- Let the beam segment be initially oriented parallel to the AAS system, with the beam Y axis along the AAS Y axis. The final orientation is determined by rotating through dihedral (positive about the X axis) then sweep (negative about the dihedrally rotated Z axis). The beam segment is now properly rotated and its end points are now as given by its endpoint coordinates in the AAS system.
- The direction cosine and transfer matrix relating the two coordinate systems (X_R the reference or AAS system and X_ℓ the beam local system) are given by

$$\begin{pmatrix} X_R \\ Y_R \\ Z_R \end{pmatrix} = \begin{bmatrix} \lambda_S & \mu_S & 0 \\ -\lambda_D \mu_S & \lambda_D \lambda_S & -\mu_D \\ -\mu_S \mu_D & \lambda_S \mu_D & \lambda_D \end{bmatrix} \begin{pmatrix} X_\ell \\ Y_\ell \\ Z_\ell \end{pmatrix} + \begin{pmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{pmatrix}$$

where X_{IR} are the coordinates of the inner end of the beam segment given in the AAS system and λ_S , μ_S , λ_D , μ_D are the cosines and sines of the sweep and dihedral angles respectively.

The AAS coordinates of the outer end of any beam are given by

$$\begin{pmatrix} X_{OR} \\ Y_{OR} \\ Z_{OR} \end{pmatrix} = \ell_B \begin{pmatrix} \mu_S \\ \lambda_D \lambda_S \\ \lambda_S \mu_D \end{pmatrix} + \begin{pmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{pmatrix}$$

where

$$\begin{aligned} \rho_B &= \sqrt{(X_{OR} - X_{IR})^2 + (Y_{OR} - Y_{IR})^2 + (Z_{OR} - Z_{IR})^2} \\ &= \sqrt{\Delta X_B^2 + \Delta Y_B^2 + \Delta Z_B^2} \end{aligned}$$

Let

$$\Delta L = \sqrt{\Delta Y_B^2 + \Delta Z_B^2}$$

Then the sweep and dihedral angles are

$$\begin{aligned} \mu_S &= \frac{\Delta X_B}{\rho_B} & \lambda_S &= \frac{\Delta L}{\rho_B} \\ \mu_D &= \frac{\Delta Z_B}{\Delta L} & \lambda_D &= \frac{\Delta Y_B}{\Delta L} \end{aligned}$$

In the event that ΔL is zero, the dihedral angle by definition is $+90^\circ$.

The inverse transformation from AAS to local coordinates is given by

$$\begin{aligned} \begin{Bmatrix} X_\ell \\ Y_\ell \\ Z_\ell \end{Bmatrix} &= \begin{bmatrix} \lambda_S & -\lambda_D \mu_S & -\mu_S \mu_D \\ \mu_S & \lambda_D \lambda_S & \lambda_S \mu_D \\ 0 & -\mu_D & \lambda_D \end{bmatrix} \left(\begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix} \right) \\ &= \begin{bmatrix} \text{TLAMM} \end{bmatrix} \begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \begin{bmatrix} \text{TLAMM} \end{bmatrix} \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix} \end{aligned}$$

The local Y value of any point in the AAS system is given by

$$Y_\ell = \begin{bmatrix} \mu_S & \lambda_D \lambda_S & \lambda_S \mu_D \end{bmatrix} \left(\begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix} \right)$$

$$= [TLAMY] \begin{Bmatrix} x_R \\ y_R \\ z_R \end{Bmatrix} + \begin{bmatrix} \mu_S & \lambda_D \lambda_S & \lambda_S \mu_D \end{bmatrix} \begin{Bmatrix} x_{IR} \\ y_{IR} \\ z_{IR} \end{Bmatrix}$$

which is required in the load calculations to insure that any equilibrium load which is inboard of an integrated load station is not included in the integration. The above rotation arrays are generated in BEAM.

The integrated loads are defined by specifying which local beam each is associated with, a load code which identifies it as one of the six possible shears and moments, the aircraft component it is associated with, its spatial location in the AAS system and the maximum positive and negative values. The location in space of the integrated load need not be on a beam, but its orientation will be vectorially parallel to the associated local beam system and load transfer will be made in a plane normal to the local Y axis and containing the load point.

The integrated loads due to inertial loads are found by transferring each inboard along the beam network. A sparsing procedure is employed in input data in that the local beam a group of mass point loads first enters is defined as well as the mass number range (first to last) of the mass point group.

The aerodynamic loads are similarly defined by entering first to last box numbers and first to last slender body element numbers and the beams they are first associated with. Box number sequencing and slender body sequencing definitions are found in Volume II describing the aerodynamic module details.

The process of transferring a group of equilibrium loads to an integrated

load station consists of: 1) converting the equilibrium loads in the AAS system to shears and moments at the integrated load point in the AAS system; 2) rotating the integrated loads into the local beam coordinate system; 3) rotating the resulting integrated loads properly to reflect the orientation of the equilibrium loads.

The load transfer is given by

$$\begin{Bmatrix} P_{XR} \\ P_{YR} \\ P_{ZR} \end{Bmatrix} = \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}, \quad \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix} = \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix} + [DEL] \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}$$

where F_{XR} and M_{XR} are loads and moments respectively in the AAS coordinate system and

$$[DEL] = \begin{bmatrix} 0 & -\Delta Z_B & \Delta Y_B \\ \Delta Z_B & 0 & \Delta X_B \\ -\Delta Y_B & \Delta X_B & 0 \end{bmatrix}$$

where the transfer distances in the AAS system from the loads to integrated loads stations are

$$\Delta X_B = X_{RL} - X_{RB}, \quad \Delta Y_B = Y_{RL} - Y_{RB}, \quad \Delta Z_B = Z_{RL} - Z_{RB}$$

If sectional data is not input to the program, then $M_{XR} = 0$.

The integrated load rotation from AAS to local beam system is found from:

$$\begin{Bmatrix} P_{XB} \\ P_{YB} \\ P_{ZB} \end{Bmatrix} = [TLAMM] \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}$$

$$\begin{Bmatrix} M_{XB} \\ M_{YB} \\ M_{ZB} \end{Bmatrix} + [TLAMM] [DEL] \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix} + [TLAMM] \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix}$$

Where now the P and M are shears and moments in the local beam system coordinate directions (pounds and inch pounds).

The equilibrium inertial loads come from rotating the inertial loads from the orientations of the nodal deflection vectors used to the AAS system.

Let

$$\begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix} = [TLAMV] \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix}, \quad \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix} = [TLAMM] \begin{Bmatrix} M_{XI} \\ M_{YI} \\ M_{ZI} \end{Bmatrix}$$

where F_{XI} and M_{XI} are inertia loads and moments in whatever orientation the idealization has assumed. (Note that often TLAMV will be the transpose of TLAMM for corresponding sets of mass points and beam these first enter).

Then

$$\begin{Bmatrix} P_{XB} \\ P_{YB} \\ P_{ZB} \end{Bmatrix} = [TLAMM] [TLAMV] \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix}$$

$$\begin{Bmatrix} M_{XB} \\ M_{YB} \\ M_{ZB} \end{Bmatrix} = [TLAMM] [DEL] [TLAMV] \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix} + [TLAMM] [TLAMV] \begin{Bmatrix} M_{XI} \\ M_{YI} \\ M_{ZI} \end{Bmatrix}$$

and TLAMV is input by the user for each mass group, and is seen to be the direction cosine matrix giving the components of the inertial loads in the AAS system.

The panel aerodynamic loads are defined positive (for a panel loaded in the usual fashion) up for horizontal surfaces and along the $-Y_R$ axis for vertical type surfaces. For an aerodynamic panel load F , let

$$\begin{pmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{pmatrix} = \begin{pmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{pmatrix} \cdot F$$

Panel aerodynamic loads are assumed to act at the local mid-span point of each box and on the local quarter chord, and $\gamma_x, \gamma_y, \gamma_z$ here are the direction cosines of the force in the AAS system.

Then

$$\begin{pmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{pmatrix} = \begin{pmatrix} 0 \\ -\mu_D \\ \lambda_D \end{pmatrix}$$

where

$$\mu_D = \frac{\Delta z}{\sqrt{\Delta y^2 + \Delta z^2}} \quad \lambda_D = \frac{\Delta y}{\sqrt{\Delta y^2 + \Delta z^2}}$$

and Δy and Δz are distances from inner to outer ends of the local aerodynamic box in the AAS system and are obtained from the aerodynamic module data.

Slender body aero forces are aligned in the $+Z_R$ and $+Y_R$ directions only, and act at the geometric center of each body.

The spatial orientation of an integrated load is seen to be fixed by the rotation process the local beam has undergone to arrive at its spatial

position as defined previously. Figure 11 shows the definition of the potential loads at a load station, and Figure 12 gives typical orientations for components of the vehicle. The load station itself is defined by specifying its AAS system coordinates and which local beam it is associated with.

Integrated loads on the centerline of the vehicle are checked to establish their symmetric and antisymmetric components and suitably modified for the one-half aircraft analysis.

Routine GEOMMB and MMBMLT form the matrices PINTH, PINTL, PINTS relating the equilibrium inertial loads to the integrated loads based on the preceding transformation. If sectional data is input to the program, these routines also form the matrices PINTT, PINTA, and PINTP for the sectional slope degrees of freedom. Routine MSSPHI forms the matrix PIQ relating generalized response to integrated loads.

$$\begin{bmatrix} \text{PIQ} \end{bmatrix} = \begin{bmatrix} \text{PINTH} \\ \text{PINTL} \\ \text{PINTF} \end{bmatrix} \begin{bmatrix} \text{EMPHI} \end{bmatrix} + \begin{bmatrix} \text{PINTT} \\ \text{PINTA} \\ \text{PINTS} \end{bmatrix} \begin{bmatrix} \text{EMPHI} \end{bmatrix}$$

where

$$\begin{bmatrix} \text{EMPHI} \end{bmatrix} = \begin{bmatrix} \text{M} \end{bmatrix} \begin{bmatrix} \phi_I \end{bmatrix}$$

PIQ is saved for use in the unit gust loads module.

Routines GEOMAB, ABAMLT, GEOMSB, and SBAMLT form the matrices PINTP, PINTY, and PINTZ which relate unit aerodynamic forces at all box and slender body load points to the integrated loads using the transformations discussed above. Routines AROLOD and AROPHA form the matrices PAQS and PAQA which give the integrated loads for symmetric and antisymmetric motion dependent

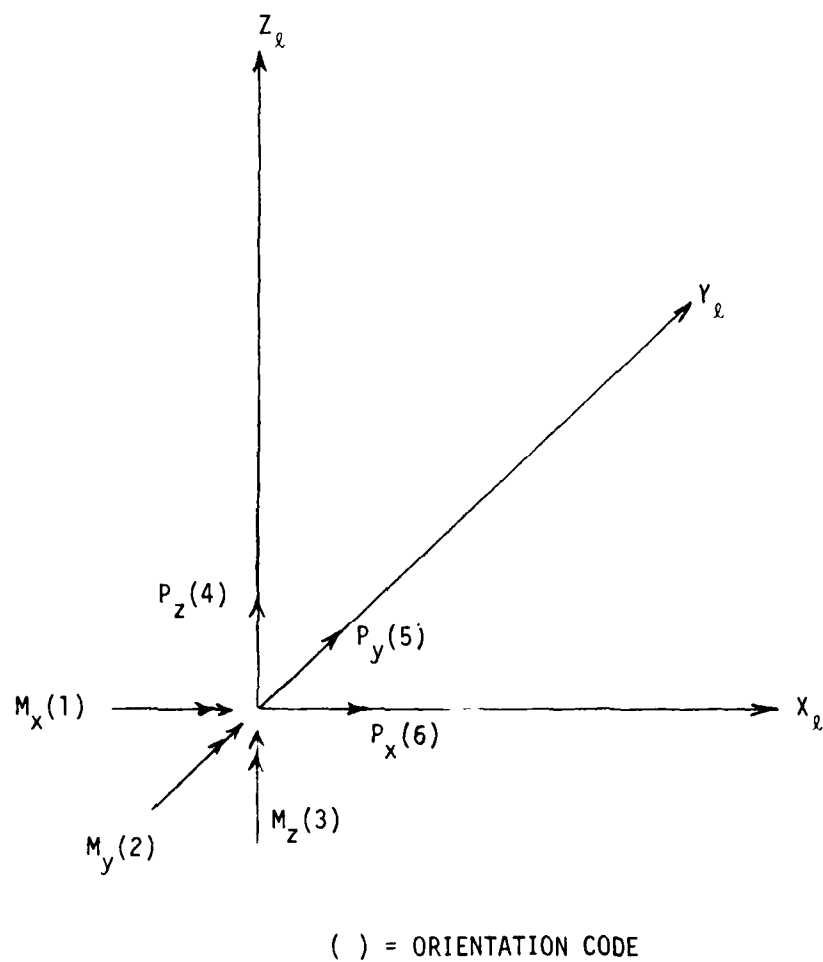


Figure 11. Integrated Loads in Local Beam System

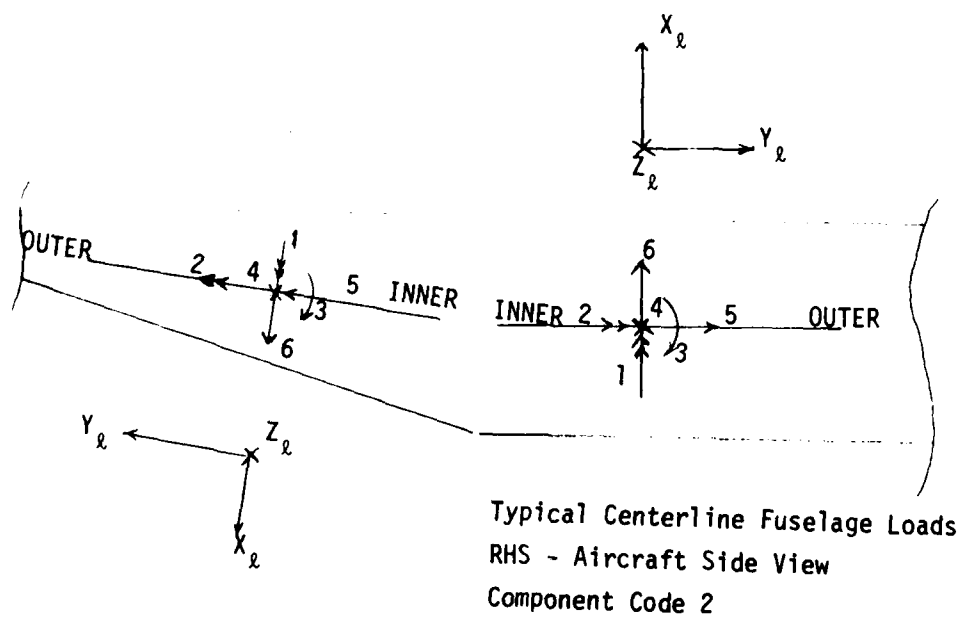
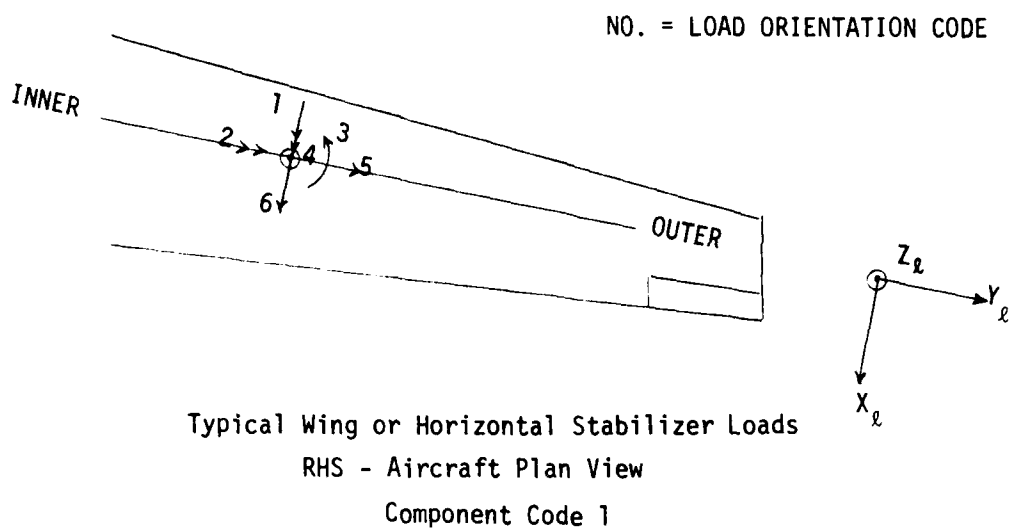
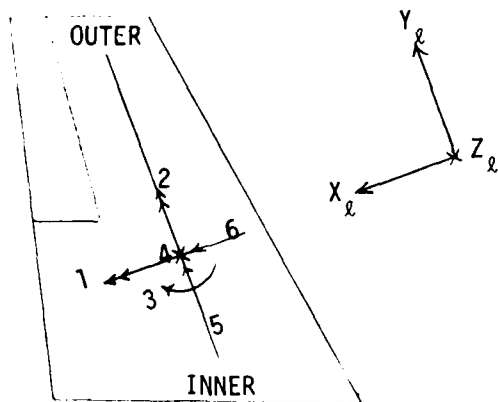
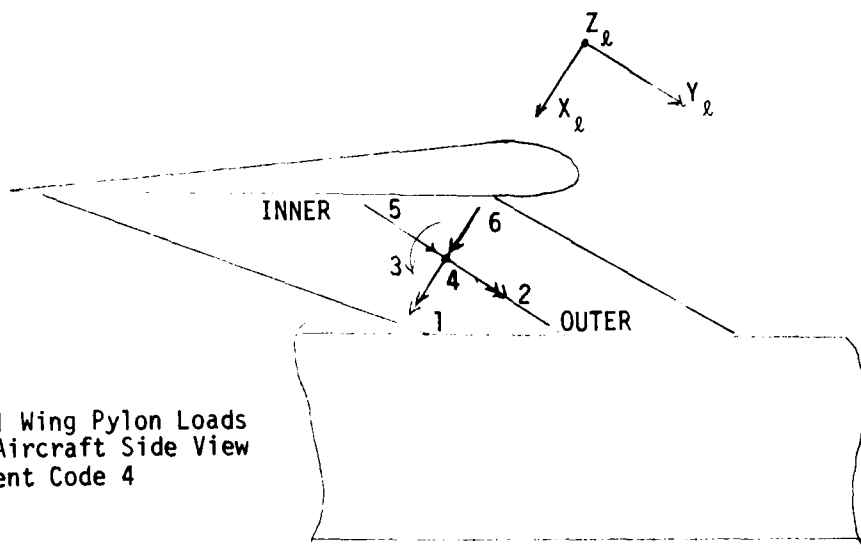


Figure 12. Sample Integrated Load Orientations

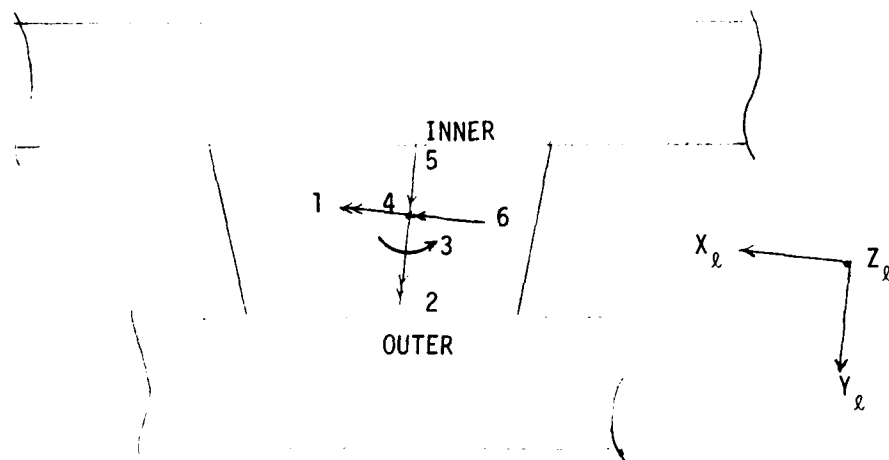


Typical Vertical Stabilizer Loads
 RHS - Aircraft Side View
 Component Code 3

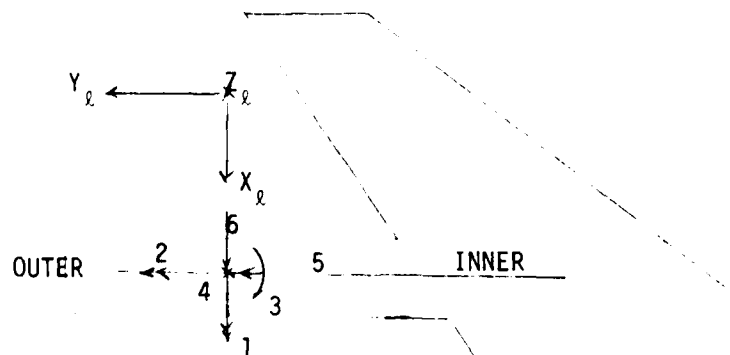


Typical Wing Pylon Loads
 RHS - Aircraft Side View
 Component Code 4

Figure 12 (cont). Sample Integrated Load Orientations



Typical Fuselage Side Pylon Pod Loads
 RHS - Aircraft Plan View
 Component Code 5



Typical Centerline Vertical Stabilizer Pylon Loads
 RHS - Aircraft Side View
 Component Code 6

Figure 12 (cont). Sample Integrated Load Orientations

aerodynamic forces, respectively, due to unit generalized amplitudes.

$$\begin{aligned} \begin{bmatrix} \text{PAQS}(\kappa) \end{bmatrix} &= \begin{bmatrix} \text{PINTP} \\ - - - \\ \text{PINTY} \\ - - - \\ \text{PINTZ} \end{bmatrix} \begin{bmatrix} D_{\phi S}(\kappa) \end{bmatrix} \\ \begin{bmatrix} \text{PAQA}(\kappa) \end{bmatrix} &= \begin{bmatrix} \text{PINTP} \\ - - - \\ \text{PINTY} \\ - - - \\ \text{PINTZ} \end{bmatrix} \begin{bmatrix} D_{\phi A}(\kappa) \end{bmatrix} \end{aligned}$$

Where $D_{\phi S}$ and $D_{\phi A}$ are respectively the motion dependent aerodynamic box and body forces due to all symmetric and antisymmetric input modes. The matrices PAQS, PAQA, PINTP, PINTY, and PINTZ are saved for use in the unit gust loads and trim modules.

A stress matrix may be defined by the user which relates local stresses to the defined integrated loads:

$$\{\sigma\} = [\text{STRESS}] \{P\}$$

Routine THRUST calculates the integrated loads and generalized forces due to unit thrust loads for all engines specified. The components of the thrust loads are found from direction cosines ($\gamma_x, \gamma_y, \gamma_z$) determined by the line of action of the thrust which is found from the two mass points per engine thrust specified in the input. If only one mass station per engine is used with the sectional input data, then a dummy station must be specified to define the line of action of the thrust. The resulting forces are taken at the first input thrust mass:

$$\begin{Bmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{Bmatrix}_i = [\text{TLAMV}]^{-1} \begin{Bmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{Bmatrix}$$

This aligns the forces with the inertial forces at the thrust mass point.

The integrated loads due to the i th unit thrust then are

$$\{\text{THRLD}_i\} = \begin{bmatrix} \text{PINTF}_i \\ - \\ \text{PINTL}_i \\ - \\ \text{PINTH}_i \end{bmatrix} \begin{pmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{pmatrix}_i$$

The generalized forces in the symmetric modes are given by premultiplying F_{XT} , F_{YT} , F_{ZT} by the symmetric modal row corresponding to the thrust mass:

$$\{\text{THRGNF}_i\} = \begin{bmatrix} \text{PHIX}_i \\ \text{PHIY}_i \\ \text{PHIZ}_i \end{bmatrix}^T \begin{pmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{pmatrix}_i$$

THRLD and THRGNF are saved for later use in the trim module.

5. ACTIVE CONTROL MODULE

The active control module forms the data and arrays necessary to augment the equations of motion for the feedback effects. Input data required for this module consist of; 1) definition of the kinematics of the control system and 2) 'block' data defining the individual transfer functions. Data for symmetric and antisymmetric control are entered separately. The kinematics are described by the definition (for each symmetric and antisymmetric transfer function) of the mass point number and orientation (x, y, z) of the sensed motion, a scalar for scaling the transfer function and, the mode number of the input modal column which provides the control force. The 'block' input data consist of the definition of numerator and denominator polynomials which, when multiplied together, give the total output/input polynomial in s, where s is the LaPlace operator. The maximum order of any single block polynomial in the entire group is input as MXØBLK, and the maximum number of blocks in the largest transfer function as MXBLK. NTFS and NTFA define the total number of symmetric and antisymmetric transfer functions. Figure 13 details the major routines in this module.

The incremental commanded motion of a set of degrees of freedom by a sensor may be related to the sensed quantity by a transfer function $T(s)$. For the frequency response solutions, s may be replaced by $i\omega$. For illustrative purposes, let the degrees of freedom be those deflections associated with the rotation of a control surface.

$$\{h_E\} = \{\phi_{\delta E}\} \delta$$

where $\phi_{\delta E}$ are the h_E deflections due to a unit rotation δ . The commanded rotation by an active system then may be

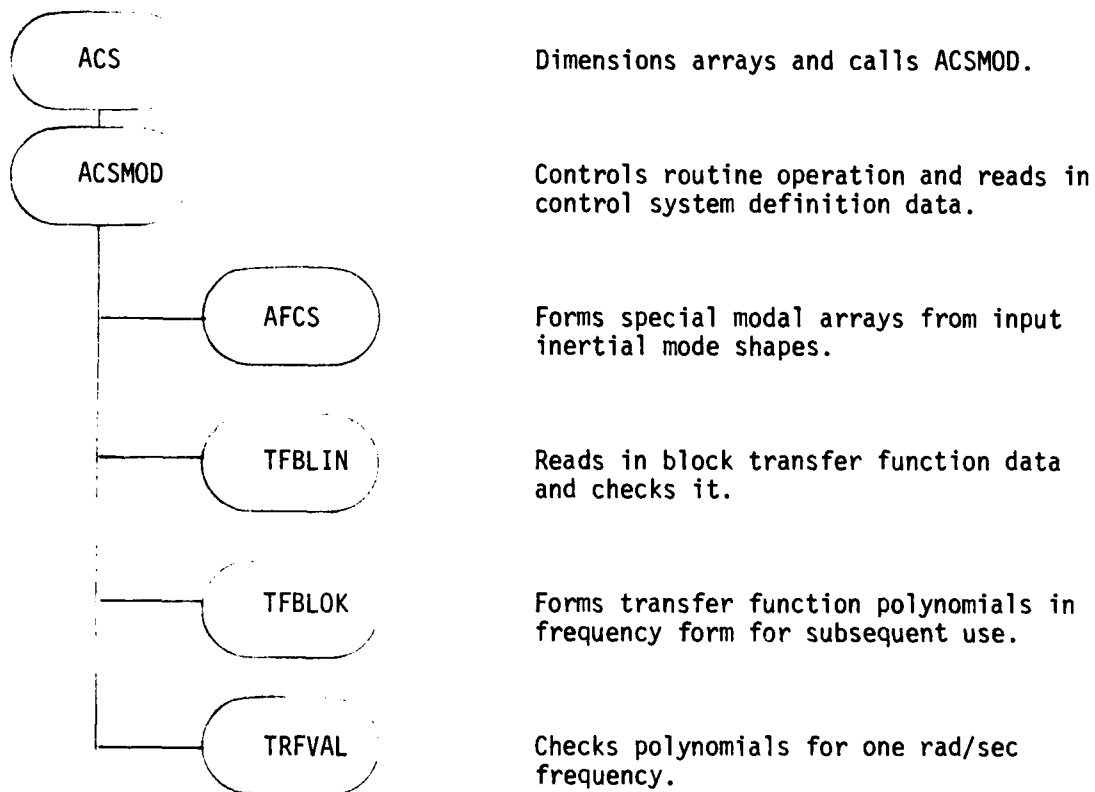


Figure 13 Active Control Module Routines

$$\delta_c = T(i\omega)h_s$$

where h_s is the amplitude of an inertial degree of freedom somewhere on the vehicle. In the modal solution, h_s is composed of motion due to aircraft rigid body perturbations plus elastic motion, and in terms of the generalized amplitudes q :

$$h_s = [\phi_s] \{q\}$$

The surface commanded deflection at any frequency ω then must be:

$$\{\Delta h_E\} = T(i\omega) \{\phi_{\delta E}\} [\phi_s] \{q\}$$

The total motion h_{ET} of the surface then is given by the sum of the elastic, rigid body and commanded motion:

$$\{h_E\} = \{\phi_{\delta E}\} \delta + T(i\omega) \{\phi_{\delta E}\} [\phi_{\delta j}] \{q\}$$

Since there may be many transfer functions and several control surfaces and many sensors, the incremental deflections may be written as

$$\{\Delta h\} = \sum_{j=1}^{NTF} T_j(i\omega) \{\phi_{E_j}\} [\phi_{\delta j}] \{q\}$$

Note that the modal amplitude commanded by the control system and the transfer function must be consistent. That is, if the transfer function representation is given in terms of degrees/unit sensed and the control surface input modal amplitude is normalized to radian, then the transfer function must be scaled down by 57.3 degrees/radian.

In the active system module the data necessary to form the augmented motion is required in terms of specification, for each transfer function, of the data input number of the mode driven, the mass number corresponding to the sensed inertial degree of freedom, a code specifying which orientation of that degree of freedom (x, y or z) and a scalar multiplier for the

transfer function. This scalar multiplier may be used as a direction cosine for sensed orientations different from that of the mass point or for interpolation or for general scaling. The transfer functions are calculated by polynomial multiplication of 'block' polynomials describing the active elements of each path. Loops which describe symmetric control surface motion and antisymmetric motion are separately entered. A transfer function then has the form:

$$T(i\omega) = \frac{\sum_{n=1}^{NN} A_n (i\omega)^{n-1}}{\sum_{n=1}^{ND} B_n (i\omega)^{n-1}}$$

The generalized mass and aerodynamic matrices are augmented by the active system with the following matrices:

$$[\Delta m] = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \{m_{\ell}\} [\phi_{Is_{\ell}}]$$

$$[\Delta \mathcal{D}(i\omega)] = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \{\mathcal{D}_{\ell}(i\omega)\} [\phi_{Is_{\ell}}]$$

The integrated load matrices are augmented in a similar fashion:

$$[\Delta PIQ] = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \{PIQ_{\ell}\} [\phi_{Is_{\ell}}]$$

$$\Delta \begin{bmatrix} PAQS(i\omega) \\ PAQA(i\omega) \end{bmatrix} = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \begin{bmatrix} PAQS_{\ell}(i\omega) \\ PAQA_{\ell}(i\omega) \end{bmatrix} [\phi_{Is_{\ell}}]$$

where m_{ℓ} , $\mathcal{D}_{\ell}$, PIQ_{ℓ} , $PAQS_{\ell}$, $PAQA_{\ell}$ are the columns of the matrices associated with the control surface mode associated with the ℓ th transfer function and

ϕ_{Is_l} is the modal row giving the sensed degree of freedom motion associated with the l th transfer function.

As an example of transfer function generation, the loop shown in Figure 14 commands a control surface deflection due to displacement and acceleration where

$$K_1 = \text{constant} = 0.75$$

$$K_2 = \frac{(s^2 + 3s + 20)}{(s^2 + 2s + 5)}$$

$$ACT = \frac{2500}{(s + 50)^2}$$

$$K_3 = \frac{1}{s + 1}$$

$$K_4 = \frac{(s+18)(s^2+21s+50)}{(s+10)(s^2+3s+25)}$$

$$K_5 = \frac{s + 12}{s + 5}$$

In terms of δ_c/h this loop may be represented by three simple transfer functions, each with five 'blocks' as shown in Figure 15 where

$$K_{4-1} = \frac{s + 18}{s + 10}$$

$$K_{4-2} = \frac{s^2+21s+50}{s^2+3s+25}$$

The transfer functions then are (shown by block input)

$$T_1(s) = (s^2) \left(\frac{1}{s+1} \right) \left(\frac{s+18}{s+10} \right) \left(\frac{s^2+21s+50}{s^2+3s+25} \right) \left(\frac{2500}{s^2+100s+2500} \right)$$

$$T_2(s) = (1.0) (1.0) \left(\frac{s+18}{s+10} \right) \left(\frac{s^2+21s+50}{s^2+3s+25} \right) \left(\frac{2500}{s^2+100s+2500} \right)$$

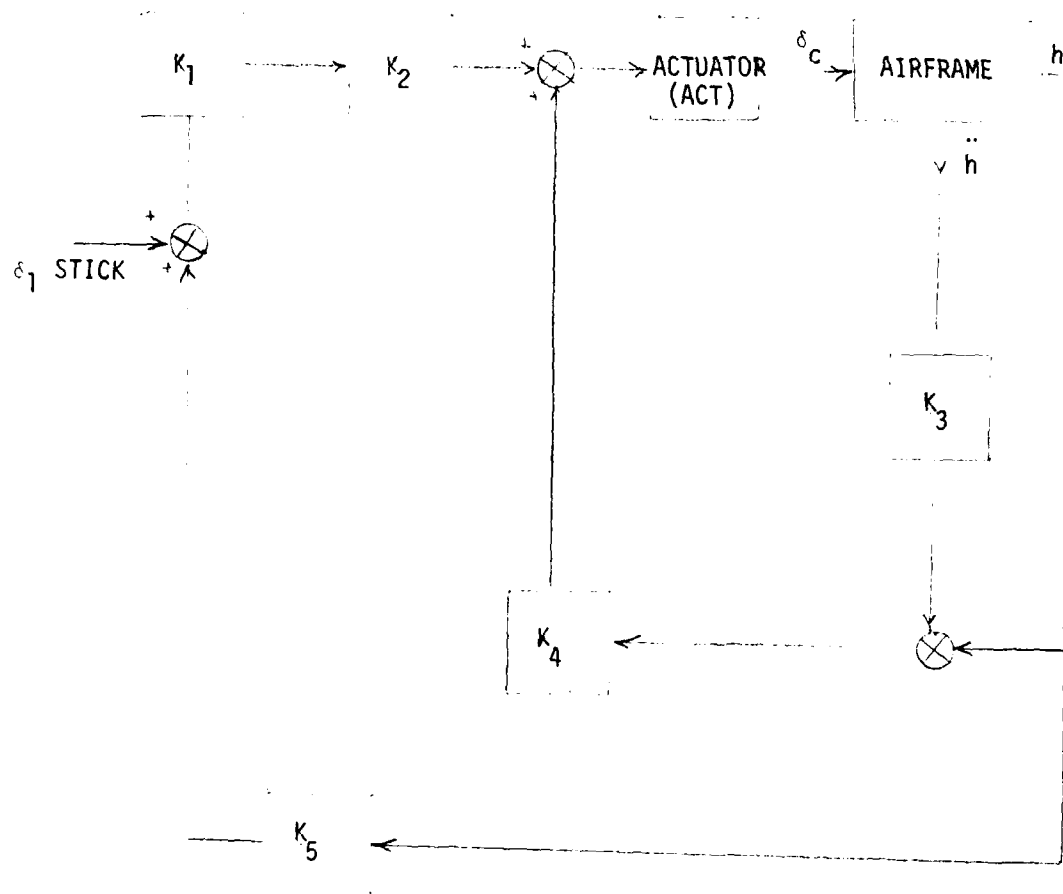
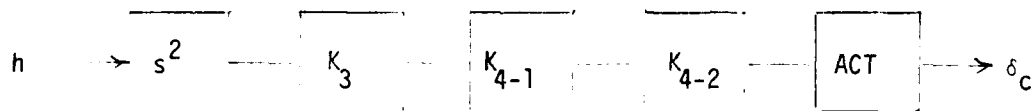
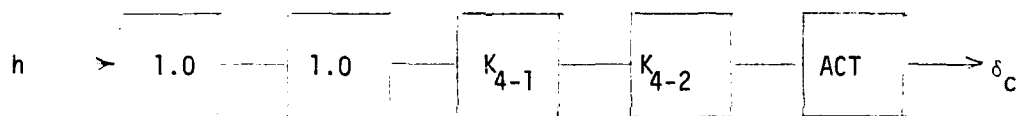


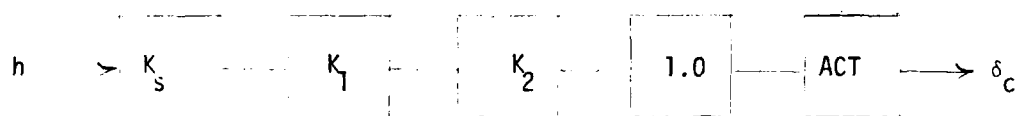
Figure 14. Sample High Gain Control Loop



TRANSFER FUNCTION NO. 1
ACCELERATION LOOP



TRANSFER FUNCTION NO. 2
DISPLACEMENT LOOP NO. 1



TRANSFER FUNCTION NO. 3
DISPLACEMENT LOOP NO. 2

Figure 15. Sample Control System Transfer Function Blocks

$$T_3(s) = (1.0) \left(\frac{s + 12}{s + 5} \right) (0.75) \left(\frac{s^2 + 3s + 20}{s^2 + 2s + 5} \right) \left(\frac{2500}{s^2 + 100s + 2500} \right)$$

Routine AFCS forms the ϕ_{Is} arrays for symmetric and antisymmetric sensors. TFBLIN reads in the 'block' transfer function data and TFBLOCK converts it to polynomials in powers of $i\omega$. TRFVAL prints out the transfer function polynomials evaluated at one rad/sec for checking.

6. FREQUENCY RESPONSE MODULE

The frequency response module solves the generalized equations of motion for the generalized response to a unit travelling gust in the frequency domain. The equations solved for each required frequency and blast orientation are

$$(-\omega^2 [m] - \bar{q} [\mathcal{D}(i\omega)] + (1 + ig) [\kappa]) \{q(i\omega)\} = \frac{\rho V}{2} \{\mathcal{X}_g(i\omega)\}$$

where:

m is the generalized mass matrix

$\mathcal{D}(i\omega)$ is the generalized aerodynamic force matrix due to motion

κ is the generalized stiffness matrix

g is the structural damping (only in the elastic modes)

$\bar{q}$ is the dynamic pressure (psi)

$q(i\omega)$ is the generalized response

$\mathcal{X}_g(i\omega)$ is the generalized gust vector for a specific orientation

ρ is the ambient density (lb-sec²/ft⁴)

V is the aircraft velocity (fps)

In the module the above equations are solved for all blast orientations available simultaneously, passing automatically through the routines twice, once for symmetric solutions and once for antisymmetric solutions.

Input data required consist of the flight altitude and velocity, the structural damping in each mode, an aerodynamic tape, and the definition of frequencies for solution. The input frequencies for solution should cover the entire range of given elastic modes of the free-free aircraft and out to the highest frequency obtainable from the available aerodynamic solutions. The major routines in this module are shown in Figure 16.

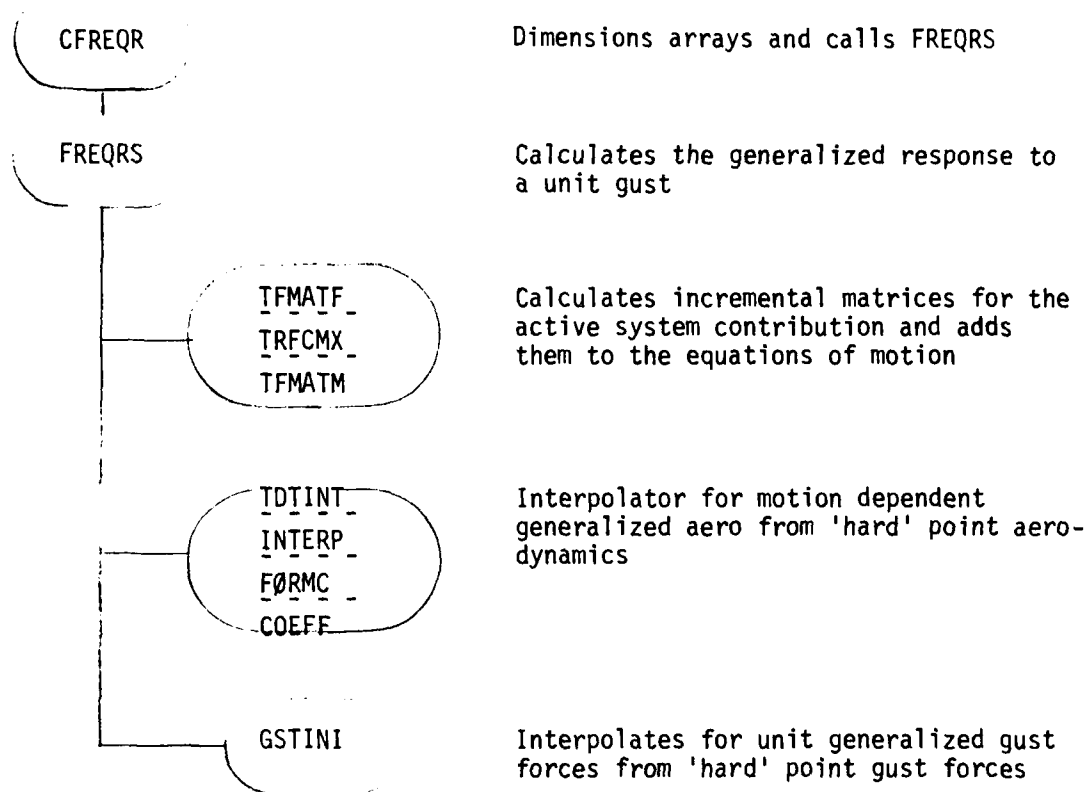


Figure 16. Frequency Response Module Routines

Routine FREQRS forms and solves the equations one frequency at a time and saves the solutions. Routines TFMATM, TFMATF and TRFCMX calculate the incremental generalized mass and generalized motion dependent aerodynamic forces due to the active system feedback, where the incremental generalized mass matrix is given by:

$$[\Delta m(i\omega)] = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \{m_j\} [\phi_{Is_{\ell}}]$$

and the incremental generalized aerodynamic matrix by

$$[\Delta \mathcal{L}(i\omega)] = \sum_{\ell=1}^{NTF} T_{\ell}(i\omega) \{\mathcal{D}_j(i\omega)\} [\phi_{Is_{\ell}}]$$

where

NTF = number of transfer functions for symmetric or antisymmetric motion

$T_{\ell}(i\omega)$ = the ℓ th transfer function evaluated at ω (in routine TRFCMX)

m_j = the j th column of the generalized mass matrix corresponding to the j th mode, the driving mode (a control surface rotation mode)

$\mathcal{D}_j(i\omega)$ = the similar column of the aerodynamic matrix

$\phi_{Is_{\ell}}$ = the modal row giving the ℓ th sensed degree of freedom motion in terms of generalized response

Routines TDTINT and INTERP form the motion dependent generalized aerodynamic forces at specific frequencies by spline interpolation from the aerodynamic matrices at the 'hard' points, where

$$[\mathcal{L}(i\omega)] = \sum_{j=1}^{NK} C_j(\omega) [\mathcal{L}_j(i\omega_j)]$$

Routine FORMC and COEFF form the coefficients $C_j(\omega)$ as function of the 'hard' point reduced frequencies and the desired frequency for solution. Routine GSTINI interpolates for the generalized gust forces, where

$$\mathcal{F}_g(i\omega) = \begin{bmatrix} \text{SPLHP} \\ - \\ - \\ \text{SPLHZ} \\ - \\ - \\ \text{SPLHY} \end{bmatrix}^T \begin{Bmatrix} F_{gP}(i\omega) \\ F_{gZ}(i\omega) \\ F_{gY}(i\omega) \end{Bmatrix}$$

and the SPLHP, SPLHZ, and SPLHY are obtained from the aero tape and are the generalized forces due to local box gust, body Z gust forces and body Y gust forces respectively. F_{gP} , F_{gZ} and F_{gY} are the aerodynamic element gust forces which are obtained from the 'hard' point aerodynamic forces by interpolation:

$$F_g = e^{i\phi_G} \sum_{j=1}^{NK} C_j(i\omega) R_G(i\omega_j)$$

$$\phi_G = \sum_{j=1}^{NK} C_j(i\omega) \phi_G(i\omega_j)$$

where R_G and ϕ_G are the moduli and phase angle of the local gust force.

The local gust forces for symmetric and antisymmetric solutions are saved for use in the unit gust load module along with the generalized response solutions and the interpolation coefficients.

7. UNIT GUST LOAD MODULE

The unit gust load module calculates the integrated loads and accelerations due to unit travelling gusts at specific orientations. Input data consist of a unit load tape, an aerodynamic tape and a frequency response tape. The routines are as shown in Figure 17.

The routine CFRLØD dimensions the necessary arrays and calls FRLØAD. FRLØAD forms the symmetric and antisymmetric oscillatory integrated loads and accelerations in the frequency domain due to a unit gust, orientation by orientation. The oscillatory loads at a specific frequency and orientation are the sum of the inertial loads and motion dependent aerodynamic and gust (blast) aerodynamic loads:

$$\begin{aligned} \begin{Bmatrix} P_S(i\omega) \\ - \\ P_A(i\omega) \end{Bmatrix} &= \omega^2 [PIQ] \begin{Bmatrix} q_S(i\omega) \\ - \\ q_A(i\omega) \end{Bmatrix} + \bar{q} \begin{bmatrix} PAQS(i\omega) \\ - \\ PAQA(i\omega) \end{bmatrix} \begin{Bmatrix} q_S(i\omega) \\ - \\ q_A(i\omega) \end{Bmatrix} \\ &+ \frac{\rho V}{2} [PINTP] \begin{Bmatrix} F_{PS}(i\omega) \\ - \\ F_{PA}(i\omega) \end{Bmatrix} + \frac{\rho V}{2} [PINTY] \begin{Bmatrix} F_{YS}(i\omega) \\ - \\ F_{YA}(i\omega) \end{Bmatrix} \\ &+ \frac{\rho V}{2} [PINTZ] \begin{Bmatrix} F_{ZS}(i\omega) \\ - \\ F_{ZA}(i\omega) \end{Bmatrix} \end{aligned}$$

The accelerations at a specific frequency are given by:

$$\begin{Bmatrix} a_S \\ - \\ a_A \end{Bmatrix} = -\omega^2 \begin{bmatrix} \phi_{IS} & 0 \\ 0 & \phi_{IA} \end{bmatrix} \begin{Bmatrix} q_S(i\omega) \\ - \\ q_A(i\omega) \end{Bmatrix}$$

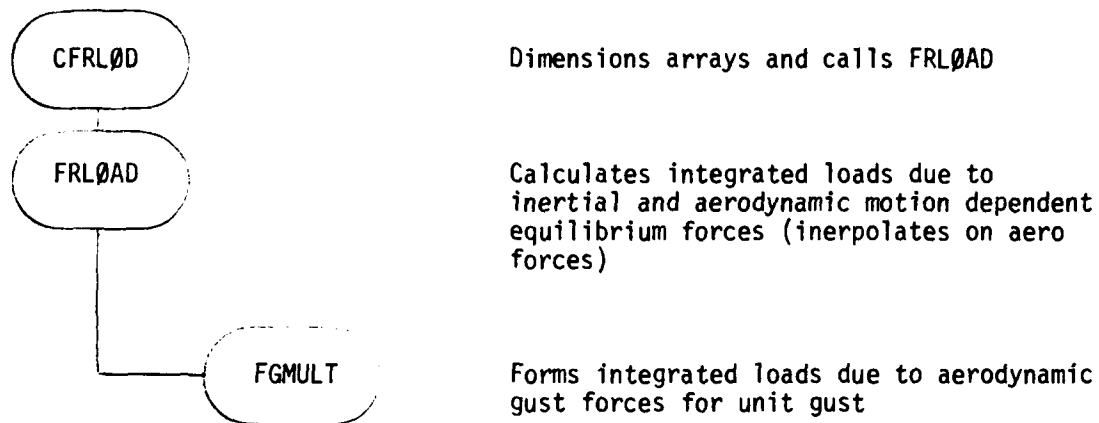


Figure 17. Unit Gust Load Module Routines

The generalized response solutions q_S and q_A are available from the frequency response module. PIQ, PINTP, PINTY, and PINTZ are frequency independent and available from the unit loads module.

PAQS and PAQA are frequency dependent and available from the unit loads module for only specific frequencies (the 'hard' points). Spline interpolation is used to obtain these arrays at all other frequencies, using the same coefficients which were generated in the frequency response module. That is

$$\begin{bmatrix} \text{PAQS}(i\omega) \\ \text{PAQA}(i\omega) \end{bmatrix} = \sum_{j=1}^{NK} C_j(\omega) \begin{bmatrix} \text{PAQS}(i\omega_j) \\ \text{PAQA}(i\omega_j) \end{bmatrix}$$

The symmetric and antisymmetric local gust forces F_{PS} , F_{PA} , F_{ZS} , F_{ZA} , F_{YS} , and F_{YA} are obtained from the frequency response module output. Routine FGMULT carries out the premultiplication by the appropriate PINT arrays.

The active system contributions to the loads are calculated by augmenting the PIQ, PAQS and PAQA arrays in the same fashion as that found in the frequency response module.

8. TRIM MODULE

The trim module trims the aircraft for a specified flight condition. A flight condition is defined as flight at specified altitude, speed (hence Mach number), maneuver and thrust. The principal routines used are CTRIM and TRIM, where CTRIM dimensions the arrays and calls the TRIM routine which carries out the trim solution. CTRIM is called from the driving routine of the blast and time response modules. Input data for this module consist of an aerodynamic tape, a unit loads tape and load factor, maneuver, rate of climb and engine thrust:

n = total load factor for flight (1.0 for trimmed level flight)

KMAN = maneuver constant (0 level flight, 1 for pullout, 2 for turns)

$\dot{z}$ = EFAS rate of climb (or descent) in a turn (ft/sec)

Flight altitude and velocity for the condition are obtained from the unit gust load tape. Figure 18 details the major routines found in this module.

The linearized force equations of motion for the solution of trimmed flight loads are:

$$\{F\} = [K_{FF}] \{h\} = \{F_I\} + \{F_A\} + \{F_T\}$$

where

K_{FF} = free-free stiffness matrix

F_I = inertial forces

F_A = aerodynamic forces

F_T = thrust forces

These solutions assume that drag equals the forward component of thrust and that the aircraft is either in a steady climbing (or descending) turn or in

CTRM

Dimensions arrays and calls TRIM

TRIM

Calculates trim parameters and trimmed
flight integrated loads

Figure 18. Trim Module Routines

level flight or a symmetric pullout.

The inertial force distribution for the above restrictions are given by

$$\{F_I\} = n g [M] \{\phi_{Ih}\}$$

where

n = load factor (ratio of lift to weight) and the local accelerations relative to rigid body oscillations are small

M is the distributed mass matrix

ϕ_{Ih} is the rigid body plunge mode for the inertial degrees of freedom

The thrust forces are given by

$$\{F_T\} = - [\lambda_{TH}] T_H$$

where: λ_{TH} is a matrix of direction cosines giving the components of the thrust vectors aligned with the appropriate inertial degrees of freedom and was generated for unit thrust loads in the unit load module

T_H is the engine thrusts for the flight condition (symmetric only)

The aerodynamic forces are given by:

$$\{F_A\} = \bar{q} [D] \{h_A\} + \bar{q} [\dot{D}] \{\dot{h}_A\}$$

where

$\bar{q}$ is the flight dynamic pressure

h_A are the aerodynamic point deflections

$\dot{h}_A$ are the aerodynamic point velocities

$D, \dot{D}$ are the aerodynamic AIC's relating aerodynamic force to point displacement and point velocity.

The aerodynamic point deflections are caused by rigid body motion,

aircraft jig shape (twist, camber and relative surface offset from the body axes, but not dihedral), control surface position, and elastic deformations. The aerodynamic point velocities are due to the constant rotational velocity of the vehicle in the prescribed maneuvers. Then:

$$\begin{aligned} \{h_A\} &= \{\phi_{AJS}\} + \{\phi_{AJA}\} + \{\phi_{A\alpha}\}\alpha_0 + \{\phi_{A\psi}\}\beta_0 + \{\phi_{A\delta_E}\}\delta_E \\ &\quad + \{\phi_{A\delta_R}\}\delta_R + \{\phi_{A\delta_A}\}\delta_A + [\phi_{AES}]\{q_{ES}\} + [\phi_{AEA}]\{q_{EA}\} \\ &= [\phi_{AS} \quad \phi_{AA}]\begin{Bmatrix} q_S \\ q_A \end{Bmatrix} \end{aligned}$$

and

$$\begin{aligned} \{\dot{h}_A\} &= \bar{P}\{\phi_{A\theta}\} + \bar{P}_{\Delta z}\{\phi_{A\delta}\} + \bar{Q}\{\phi_{A\alpha}\} + \bar{Q}_{\Delta x}\{\phi_{Ah}\} + \bar{R}\{\phi_{A\psi}\} - \bar{R}_{\Delta x}\{\phi_{Ah}\} \\ &= [\dot{\phi}_{AS} \quad \dot{\phi}_{AA}]\begin{Bmatrix} \dot{q}_S \\ \dot{q}_A \end{Bmatrix} \end{aligned}$$

where

- $\phi_{AJS,A}$ = jig modes, symmetric and antisymmetric
- $\phi_{A\alpha}$ = rigid body pitch mode
- $\phi_{A\psi}$ = rigid body yaw mode
- $\phi_{A\theta}$ = rigid body roll mode
- $\phi_{A\delta_E}$ = symmetric trim mode (elevator, horizontal stabilizer, canard)
- $\phi_{A\delta_R}$ = yaw control surface mode (usually rudder)
- $\phi_{A\delta_A}$ = roll control surface mode (usually aileron)
- ϕ_{AES}, ϕ_{AEA} = symmetric and antisymmetric aerodynamic mode shapes from the elastic modes
- $\Delta x, \Delta z$ = distances from the reference point for the rigid body modes and the c.g., and are obtained from the appropriate elements of the generalized mass matrix

$\bar{P}$ = steady roll rate about the cg

$\bar{Q}$ = steady pitch rate about the cg

$\bar{R}$ = steady yaw rate about the cg

α_0, β_0 = trim pitch and yaw angles

$\delta_E, \delta_R, \delta_A$ = trim control surface positions, elevator, rudder, aileron

q_{ES}, q_{EA} = symmetric and antisymmetric elastic modal amplitudes

and $h, \ell, \alpha, \theta, \psi$ refer to vertical and lateral deflection and pitch, roll, yaw rotation, respectively.

Integration of all pertinent forces then gives the generalized force equations of motion, where aircraft moments are taken about the reference point for the rigid body modes:

$$\begin{Bmatrix} F_z \\ M_y \\ \mathcal{F}_{\text{elastic sym.}} \end{Bmatrix} = [\phi_h \quad \phi_\alpha \quad \phi_{ES}]^T \{F\} \begin{Bmatrix} F_y \\ M_x \\ M_z \\ \mathcal{F}_{\text{elastic antisym.}} \end{Bmatrix} = [\phi_\ell \quad \phi_\theta \quad \phi_\psi \quad \phi_{EA}]^T \{F\}$$

Taking advantage of vehicle symmetry and substituting for displacements and velocities, and distinguishing between inertial and aerodynamic degrees of freedom and collecting into partitions of generalized matrices which are available from past module calculations, the equations of motion become:

Symmetric set:

$$-\ddot{q} \begin{bmatrix} \mathcal{D}_{h\alpha} & \mathcal{D}_{h\delta_E} & \mathcal{D}_{hE} \\ \mathcal{D}_{\alpha\alpha} & \mathcal{D}_{\alpha\delta_E} & \mathcal{D}_{\alpha E} \\ \mathcal{D}_{E\alpha} & \mathcal{D}_{E\delta_E} & (\mathcal{D}_{EE} - \frac{1}{\ddot{q}} \kappa_{EE}) \end{bmatrix} \begin{Bmatrix} \alpha_0 \\ \delta_E \\ q_{ES} \end{Bmatrix} = ng \begin{Bmatrix} m_{hh} \\ m_{\alpha h} \\ m_{Eh} \end{Bmatrix} - [THRGNF] \{T_H\}$$

$$+ \bar{q} \begin{Bmatrix} \mathcal{D}_{hJ} \\ \mathcal{D}_{\alpha J} \\ \mathcal{D}_{EJ} \end{Bmatrix} + \bar{q} \begin{bmatrix} \dot{\mathcal{D}}_{h\alpha} & \dot{\mathcal{D}}_{hh} \\ \dot{\mathcal{D}}_{\alpha\alpha} & \dot{\mathcal{D}}_{\alpha h} \\ \dot{\mathcal{D}}_{E\alpha} & \dot{\mathcal{D}}_{Eh} \end{bmatrix} \begin{Bmatrix} \bar{Q} \\ \bar{Q}_{\Delta x} \end{Bmatrix}$$

Antisymmetric set:

$$\bar{q} \begin{bmatrix} \mathcal{D}_{\ell\psi} & \mathcal{D}_{\ell\delta_R} & \mathcal{D}_{\ell\delta_A} & \mathcal{D}_{\ell E} \\ \mathcal{D}_{\theta\psi} & \mathcal{D}_{\theta\delta_R} & \mathcal{D}_{\theta\delta_A} & \mathcal{D}_{\theta E} \\ \mathcal{D}_{\psi\psi} & \mathcal{D}_{\psi\delta_R} & \mathcal{D}_{\psi\delta_A} & \mathcal{D}_{\psi E} \\ \mathcal{D}_{E\psi} & \mathcal{D}_{E\delta_R} & \mathcal{D}_{E\delta_A} & (\mathcal{D}_{EE} - \frac{1}{\bar{q}} \kappa_{EE}) \end{bmatrix} \begin{Bmatrix} \beta_0 \\ \delta_R \\ \delta_A \\ q_{EA} \end{Bmatrix} = \bar{q} \begin{Bmatrix} \mathcal{D}_{\ell J} \\ \mathcal{D}_{\theta J} \\ \mathcal{D}_{\psi J} \\ \mathcal{D}_{EJ} \end{Bmatrix} + \bar{q} \begin{bmatrix} \dot{\mathcal{D}}_{\ell\theta} & \dot{\mathcal{D}}_{\ell\ell} & \dot{\mathcal{D}}_{\ell\psi} \\ \dot{\mathcal{D}}_{\theta\theta} & \dot{\mathcal{D}}_{\theta\ell} & \dot{\mathcal{D}}_{\theta\psi} \\ \dot{\mathcal{D}}_{\psi\theta} & \dot{\mathcal{D}}_{\psi\ell} & \dot{\mathcal{D}}_{\psi\psi} \\ \dot{\mathcal{D}}_{E\theta} & \dot{\mathcal{D}}_{E\ell} & \dot{\mathcal{D}}_{E\psi} \end{bmatrix} \begin{Bmatrix} \bar{P} \\ \bar{P}_{\Delta z} - \bar{R}_{\Delta x} \\ \bar{R} \end{Bmatrix}$$

The elements of the above equations are obtained from the available generalized matrices by extraction.

The generalized aerodynamics for velocity are obtained from the lowest non-zero reduced frequency (k_ℓ) complex matrices:

$$\dot{\mathcal{D}} = \left(\frac{b_R}{k_\ell V} \right) \text{Imag} \left(\mathcal{D}(k_\ell) \right)$$

where b_R is the reference semichord from the aerodynamic module.

The value of n , $\bar{P}$, $\bar{Q}$ and $\bar{R}$ are obtained from input data specifying the trim condition desired. For level flight or a level pullout at specified load factor:

$$\bar{Q} = \frac{(n-1)g}{V}$$

$$\bar{P} = \bar{R} = 0$$

where the load factor n is input.

For climbing (or level or descending) turn:

$$\bar{Q} = \frac{ng}{V} \left(1 - \frac{1}{n^2}\right), \quad \phi_B = \cos^{-1}\left(\frac{1}{n}\right)$$

$$\bar{P} = -\frac{\theta_c}{V} g \tan \phi_B$$

$$\bar{R} = \frac{g}{V} \sin \phi_B$$

where ϕ_B is the bank angle calculated from the input load factor and θ_c is the climb angle. θ_c is calculated from input rate of climb ($\dot{Z}$) and R is calculated from the bank angle:

$$\theta_c = \sin^{-1} \left(\frac{\dot{Z}}{V} \right)$$

$$R = \frac{V^2}{g \tan \phi_B}$$

The symmetric and antisymmetric integrated loads for the trimmed flight solution are given by

$$\begin{aligned} \left\{ P_{STRIM} \right\} = & n g \left\{ PIQ(\phi_h) \right\} + \bar{q} [PAQS(k=0)] \left\{ q_S \right\} \\ & + \bar{q} \left(\frac{b_R}{k_\ell V} \right) \text{Imag} [PAQS(k_\ell)] \left\{ \dot{q}_S \right\} + [THRLD] \left\{ T_H \right\} \end{aligned}$$

$$\left\{ P_{ATRIM} \right\} = \bar{q} [PAQA(k=0)] \left\{ q_A \right\} + \bar{q} \left(\frac{b_R}{k_\ell V} \right) \text{Imag} [PAQA(k_\ell)] \left\{ \dot{q}_A \right\}$$

Additional aerodynamic data are output for the trim condition. These are the load distributions in varying degrees of detail. The aerodynamic

parameters and geometric data printed include the following:

1. Lifting pressures and their center locations in each box on all lifting surfaces;
2. Lift coefficient, moment coefficient (about 1/4-chord), and center of pressure on each lifting surface strip as a function of spanwise location;
3. Spanwise distribution of loading (in the form $c_{\ell}c/\bar{c}$ on each lifting surface as a function of span;
4. Vertical and lateral running loads on slender bodies (force per unit length) are output as a function of longitudinal location (body element centers) on all bodies;
5. Total force and moment coefficients for the entire aircraft and for the lifting surfaces separately.

The equations that are used in the calculation of the various aerodynamic loading coefficients are given in Section VI, Part 1 of Vol. II of this report.

9. BLAST AND TIME RESPONSE MODULES

These modules establish the blast gust time and density history at the moving AAS origin of the aircraft and the Fourier transforms of the product of velocity and the local density, and calculate the frequency response of the aircraft due to the blast from the unit gust frequency response and acceleration solutions. (The trim module is called from the driving routine CGUSTR). The program then transforms these gust and acceleration responses back to the time domain. Summation of the trim loads and the time histories of the perturbation loads gives the total loads on the vehicle as a function of time. The maximum positive and negative loads are compared to the input allowables and the solution iterated for critical range (if desired).

Input data required for this module consist of:

A unit gust load tape, a unit load tape and:

NØRMAX = the number of orientations to be analyzed

NØR = the orientation definition number for each orientation analyzed

REST = the initial slant range estimate for each orientation analyzed

EFR = burst yield (kilotons)

TIMEMX = maximum time in seconds of the response time history

KLPT = iteration control for establishing critical range:

0, for no iteration

1, for iteration

KGRD = ground reflection control:

0, for no reflection

1, for including reflection

HGRD = height above sea level of the ground (ft)

KLØAD = allowable load modification constant:

0, use maximum allowable loads from unit loads tape,
 1, input and modify allowables
 STALDS(I,J) = maximum positive (j = 7) and negative (J = 8) allowable
 loads for control range (entered only if NEWMAX = 1)
 NCRITS = control constant for determining allowable range based on
 critical stresses (is NSTRSS not zero)
 0, no critical stress
 1, input and use critical stress for range determination
 ALLOWS(I,J) = maximum positive (J = 1) and negative (J = 2) allowable
 stresses (entered if NCRITS non zero)

Gust orientations for the blast intercept and their code numbers are shown in Figure 19. A side directed burst orientation may be developed from its symmetric counterpart on the opposite side, hence the need for fewer asymmetric orientations in the aero and response modules. A tabular correspondence between the orientation numbers of the aero module and the blast module is used to take advantage of this. Table 3 gives the standard direction cosines for the standard orientations.

The substantial difference in this analysis procedure and that of the VIBRA-4 program is seen to be the use of Fourier transforms to and from the frequency domain to establish the time histories of loads rather than piecewise integration in the time domain. This procedure is necessary because the complex three dimensional unsteady aerodynamic solutions are known only for constant amplitude oscillatory motion. The Fourier transform process properly accounts for the time lags of the blast induced gust impingement across the aircraft spatially in that, in the limit, every possible phase lag across

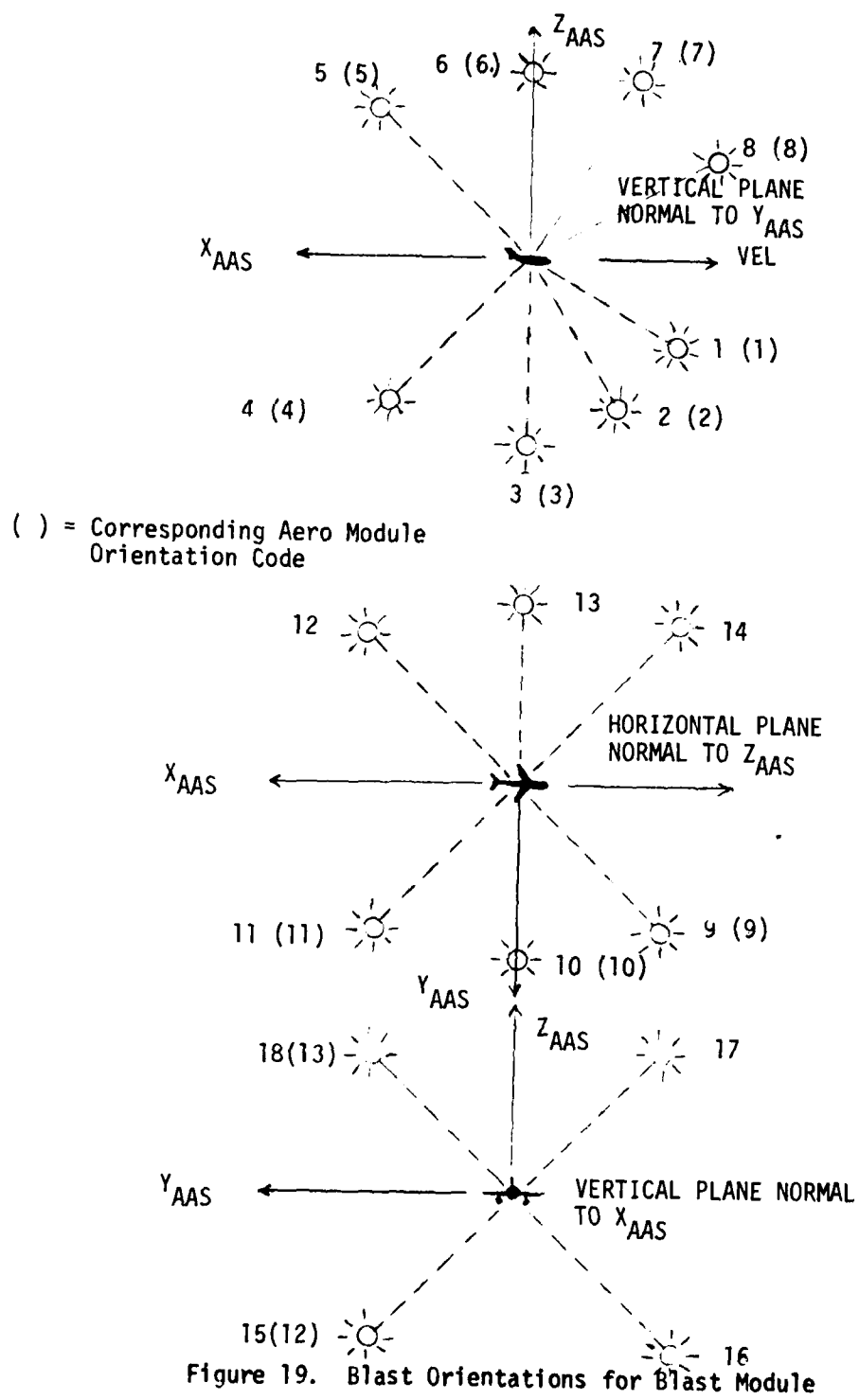


TABLE 3
DIRECTION COSINES FOR STANDARD ORIENTATIONS

<u>ORIENTATION NUMBER</u>	<u>γ_x</u>	<u>γ_y</u>	<u>γ_z</u>
1	0.8660254	0.0	0.50
2	0.50	0.0	0.8660254
3	0	0.0	1.0
4	-0.7071068	0.0	0.7071068
5	-0.7071068	0.0	-0.7071068
6	0	0.0	-1.0
7	0.50	0.0	-0.8660254
8	0.8660254	0.0	-0.50
9	0.7071068	-0.7071068	0.0
10	0	-1.0	0.0
11	-0.7071068	-0.7071068	0.0
12	-0.7071068	0.7071068	0.0
13	0	1.0	0.0
14	0.7071068	0.7071068	0.0
15	0.0	0.7071068	0.7071068
16	0.0	-0.7071068	0.7071068
17	0.0	-0.7071068	-0.7071068
18	0.0	0.7071068	-0.7071068

the surfaces is accounted for in the frequency domain by specification of all frequencies of a unit gust traveling across the vehicle of given speed and direction. The Fourier transform of the gust time history establishes the amplitudes and lags of the forces at all frequencies (in the limit) and the inverse transform results in the time history. The method assumes a linear system of equations, which is consistent with the assumption made for the aerodynamic forces and that:

1. The blast wave travels at sonic speed.
2. The material velocity (gust) at any fixed distance behind the shock front is invariant as it passes across the vehicle.
3. Peak structural loads occur before the aircraft trajectory has changed significantly and thus the material velocity distribution behind the shock front is adequately predicted by the undisturbed aircraft flight path and its distance from the shock front.
4. The incremental angle of attack due to gust locally on the vehicle is sufficiently small such that the linear aerodynamic theory is adequate.

The transform procedure follows from the definition of the traveling gust function from Volume II. The downwash at any point on the vehicle resulting from a unit amplitude sinusoidally oscillating material velocity of frequency ω and travelling at sonic speed is given by

$$w(x, \bar{t}) = \theta \cdot \text{Re} \left\{ \left[\cos \frac{\bar{k}x}{b} - i \sin \frac{\bar{k}x}{b} \right] e^{i\omega \bar{t}} \right\}$$

where $\bar{k} = \frac{kM}{b(1+\gamma_x M)}$

and

θ = velocity component of unit amplitude gust normal to surface

k = reduced frequency

M = free stream Mach number

b = reference semichord

γ_x = direction cosine of the blast wave front with respect to the

X_{AAS} axis

$\bar{t}$ = shifted time

and

$$x = \gamma_x x + \gamma_y y + \gamma_z z$$

where

$x = X_{AAS}$ coordinate of the point

$y = Y_{AAS}$ coordinate of the point

$z = Z_{AAS}$ coordinate of the point

γ_y, γ_z = direction cosines of the blast wave with respect to the

Y_{AAS} and Z_{AAS} axes, respectively.

The shifted time $\bar{t}$ is used since the gust downwash distribution over the vehicle is based on distance from the origin of the AAS system. Since t , true time must be zero at time of wave interception with the aircraft, shifted time is given by

$$\bar{t} = t + T$$

where t is true time and T is the time for the wave to move from interception point to the origin of the AAS system, and is given by

$$T = \frac{\gamma_x X_I + \gamma_y Y_I + \gamma_z Z_I}{V_{ss} (1 + \gamma_x M)}$$

where

X_I, Y_I, Z_I = AAS coordinates of the point of shock interception

V_{ss} = speed of sound.

The inverse Fourier transform of the frequency response of a stable aircraft to gust forces resulting from the above downwash distributions may be shown to be the time history of the aircraft subjected to a unit impulsive gust. The Fourier transform of the gust time history convoluted in the frequency domain with the aircraft frequency response function and subsequently inverse transformed will be the time response of the vehicle to the actual gust time history. The Fourier transformation requires that gust function, $G(t)$, be absolutely integrable; and such is the case. Examination of typical material velocity time histories shows that their Fourier transforms are effectively zero in the range of 40 to 60 Hz. This implies that the inverse Fourier procedure will predict the time history of the aircraft well if all roots of the aeroelastic system out to the maximum frequency necessary to transform the gust function are available in the aircraft frequency response function. The implication of this is that either the frequency domain aerodynamics must be known out to this frequency range or the modal set describing the aircraft vibration characteristics must be truncated at sufficiently low frequency such that no roots exist between the last known frequency response solution frequency and the frequency of zero moduli (ω_{MAX}).

The driving routine GUSTDR calls the time module for the specified maneuver, forming the symmetric and antisymmetric trimmed flight loads P_{STRIM} and P_{ATRIM} and then loops on specified orientations for the resulting load time histories. Subroutine GSTHST calculates the burst scaling factors, gets the overpressure ratio from PRESS and the gust velocity from TPEVAL and GUSHRØ as a function of time and range. Shock time of arrival is calculated in TAR. Range is updated each time step in routine FLTPOS assuming the mean flight path reasonably follows the trajectory dictated by the maneuver speci-

fication (climbing turn, pullup or level flight). Routines TPINT and INTRBL are used to include the ground reflected and incident shock waves. ROUTINES TPEVAL, GUSRHØ, TAR, PRESS, INTRPB and TPINT are taken from Reference 1. The EFAS burst coordinates at time of burst are given by

$$\begin{pmatrix} X_B \\ Y_B \\ Z_B \end{pmatrix} = -S_0 \begin{bmatrix} \cos\theta_c (\sin\phi_B \sin\theta_c) (\cos\phi_B \sin\theta_c) \\ 0 \quad \cos\phi_B \quad -\sin\phi_B \\ -\sin\theta_c (\sin\phi_B \cos\theta_c) (\cos\phi_B \cos\theta_c) \end{bmatrix} \begin{pmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{pmatrix} + \begin{pmatrix} 0 \\ R_T \\ h_0 \end{pmatrix}$$

where

S_0 is the slant range at time zero (intercept time)

θ_c is the climb angle

ϕ_B is the bank angle

$\gamma_x, \gamma_y, \gamma_z$ are direction cosines of the burst orientation with respect to the AAS system

R_T and h_0 are the turn radius and altitude at time zero.

The aircraft position in the EFAS at time t is given by

$$\begin{pmatrix} X_E \\ Y_E \\ Z_E \end{pmatrix} = \begin{pmatrix} -R_T \sin Rt \\ R_T \cos Rt \\ h_0 + (V \sin\theta_c)t \end{pmatrix} \quad \text{climbing turn}$$

where

h_0 = flight altitude

$\Omega = g \frac{\tan\phi_B}{V}$

$R_T = \frac{V}{\Omega}$

V = aircraft flight velocity (fps)

t = time (secs)

or

$$\begin{pmatrix} x_E \\ y_E \\ z_E \end{pmatrix} = \begin{pmatrix} -R_p \sin \bar{Q}_t \\ 0 \\ h_0 + R_p [1 - \cos(\bar{Q}_t)] \end{pmatrix} \quad \text{symmetric pullout}$$

where

$$\begin{aligned} \bar{Q} &= \frac{(n-1)g}{V} \\ R_p &= \frac{V^2}{(n-1)g} \\ n &= \text{load factor} \end{aligned}$$

or

$$\begin{pmatrix} x_E \\ y_E \\ z_E \end{pmatrix} = \begin{pmatrix} -Vt \\ 0 \\ h_0 \end{pmatrix} \quad \text{for level flight}$$

The slant range S at time t is given by

$$S(t) = \sqrt{(x_E - x_B)^2 + (y_E - y_B)^2 + (z_E - z_B)^2}$$

The time intervals are taken as 0.05 seconds until the gust velocity goes negative, then at 0.50 second intervals till the gust velocity is less than 2 fps (time T_{MAXS}). An extrapolation is then made to find T_{MAXS} , the time at which the gust velocity has returned to zero.

Routine TIMHST takes the output time history of the gust velocity V_g and local density ρ and with routine TRFFT Fourier transforms the product into the frequency domain:

$$G(t) = \rho(t) \cdot V_g(t) / \rho_{\text{ambient}}$$

$$\text{and } g(i\omega) = \int_{-\tau}^{T_{MAXS}} G(t) e^{-i\omega t} dt$$

It is convenient to use an analytic function for $G(t)$ for which the exact Fourier transform is known. The approximation

$$G(t) = G_0(2e^{-\alpha(t+\tau)} - e^{-\beta(t+\tau)})$$

where G_0 is the gust velocity at time $t = -\tau$, fits the G function very well for numerous time histories of gust velocity with respect to the moving airframe. This is generally the case when the vehicle is moving towards the burst. The Fourier transform of $G(t)$ then is given by:

$$g(i\omega) = G_0 \left\{ \left[\left(\frac{2\alpha}{\alpha^2 + \omega^2} - \frac{\beta}{\beta^2 + \omega^2} \right) \cos \omega\tau + \omega \left(\frac{2}{\alpha^2 + \omega^2} - \frac{1}{\beta^2 + \omega^2} \right) \sin \omega\tau \right] \right. \\ \left. + i \left[\left(\frac{2\alpha}{\alpha^2 + \omega^2} - \frac{\beta}{\beta^2 + \omega^2} \right) \sin \omega\tau - \omega \left(\frac{2}{\alpha^2 + \omega^2} - \frac{1}{\beta^2 + \omega^2} \right) \cos \omega\tau \right] \right\}$$

Routine TRFFT checks the fit of the function $G(t)$ in the region of time when the gust velocity is negative (which is the area of poorest fit) and if the fitting function predictions exceed five percent of the actual time histories the Fourier transform is taken as the sum of a series of impulses over the time history of the burst.

The gust and density function is then convoluted in the frequency domain with the symmetric (P_S) and antisymmetric (P_A) load frequency response to the unit gust:

$$P_{gS}(i\omega) = P_S(i\omega) \cdot g(i\omega)$$

$$P_{gA}(i\omega) = P_A(i\omega) \cdot g(i\omega)$$

to form the perturbation loads for the blast.

The time history of the perturbation loads are calculated in IFT:

$$\bar{P}_S(t) = -\frac{2}{\pi} \int_0^{\omega_{MAX}} \text{Imag} [P_{gS}(i\omega) \sin\omega t] d\omega$$

$$\bar{P}_A(t) = -\frac{2}{\pi} \int_0^{\omega_{MAX}} \text{Imag} [P_{gA}(i\omega) \sin\omega t] d\omega$$

A discussion of the method of Fourier transforms used herein may be found in References 7, 8 and 9.

Routine LOADCH forms the right side and left side time history loads generated from the half aircraft analysis:

$$\bar{P}_{RHS}(t) = P_{STRIM} + \bar{P}_{ATRIM} + \bar{P}_S(t) + \bar{P}_A(t)$$

$$\bar{P}_{LHS}(t) = P_{STRIM} - P_{ATRIM} + \bar{P}_S(t) - \bar{P}_A(t)$$

Maximum positive and negative loads are saved and compared to allowable positive and negative loads. If a stress matrix has been defined in the limit loads module, the stress time histories are found and, if so flagged, the maximum allowable gust velocity established on the basis of input allowable stresses. The maximum allowable gust velocity for the burst conditions are estimated from

7. Wylie, C.R. Jr., *Advanced Engineering Mathematics*, McGraw-Hill Book Co., Inc., New York, 1951.

8. Solodovnikov, V. V., *Introduction to the Statistical Dynamics of Automated Control Systems*, Dover Publications, Inc., New York, 1960.

9. Hurty, W.C. and Rubinstein, M. F., *Dynamics of Structures*, Prentice-Hall, Inc., New Jersey, 1964

$$V_{gMAX}(t = +0) = \bar{P}_{MAX}(t) \cdot \frac{V(t = +0)}{P_{Allow}}$$

and the maximum allowable overpressure from:

$$P_m = P_o \left\{ \left(\frac{21}{25} \right) \left(\frac{V_{gMAX}}{V_{ss}} \right)^2 + \sqrt{ \left(\frac{21}{25} \right)^2 \left(\frac{V_{gMAX}}{V_{ss}} \right)^4 + \left(\frac{49}{25} \right) \left(\frac{V_{gMAX}}{V_{ss}} \right)^2 } \right\}$$

where V_{ss} is the ambient speed of sound (FPS) and p_o is the ambient pressure (psi).

A revised slant range is calculated by routine RANGE, which is an inversion of routine PRESS. If iteration for range has been specified, the time history load calculation process is repeated until convergence on an allowable gust velocity. At the conclusion of a response solution, the distance from burst to intercept (in the EFAS) is displayed.

Figure 20 details the major routines in this module.

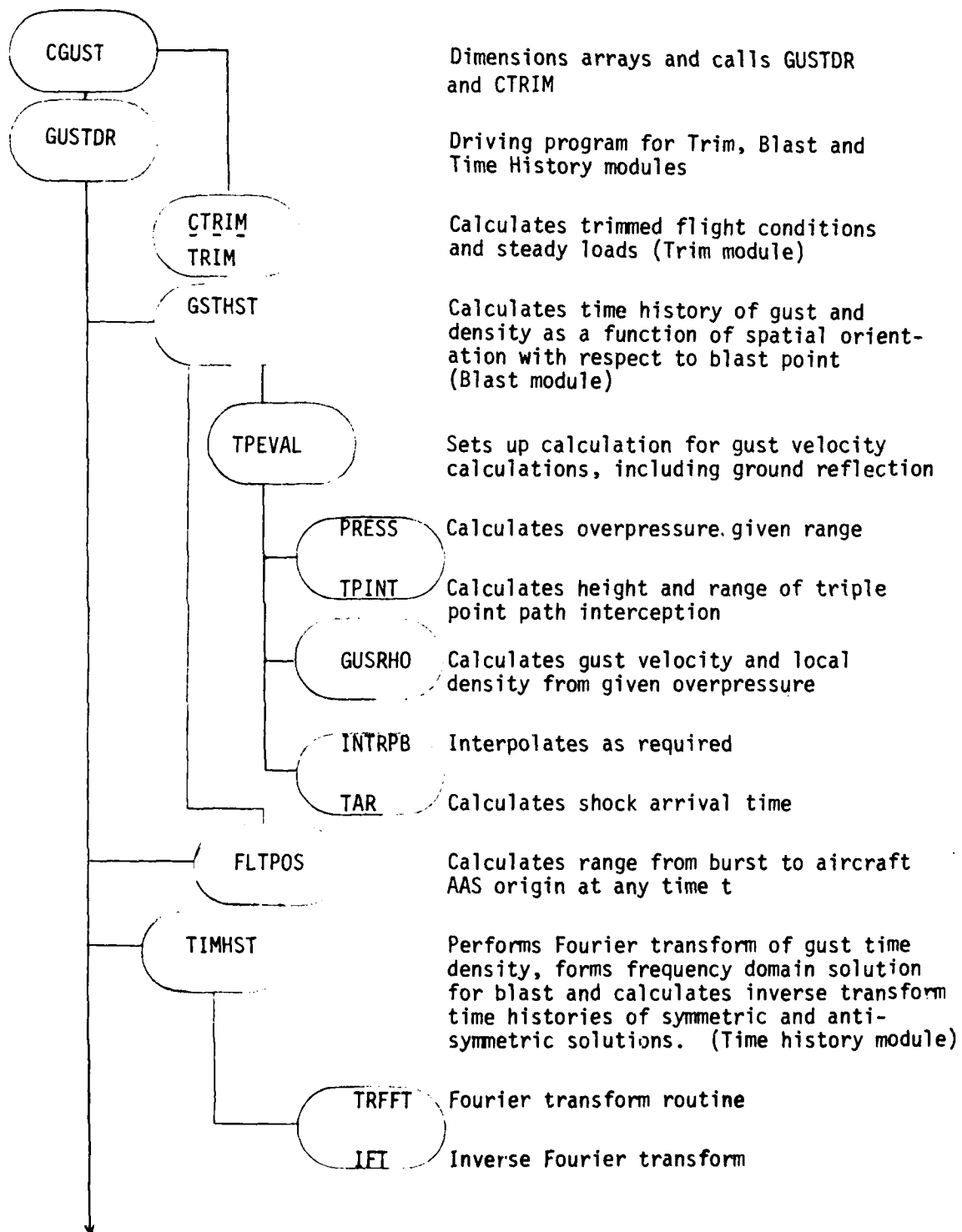


Figure 20. Blast and Time Response Module Routines

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NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME 1. PROGRAM DESC--ETC(U)

AUG 81 J A MCOREW, J P GIESING, T P KALMAN

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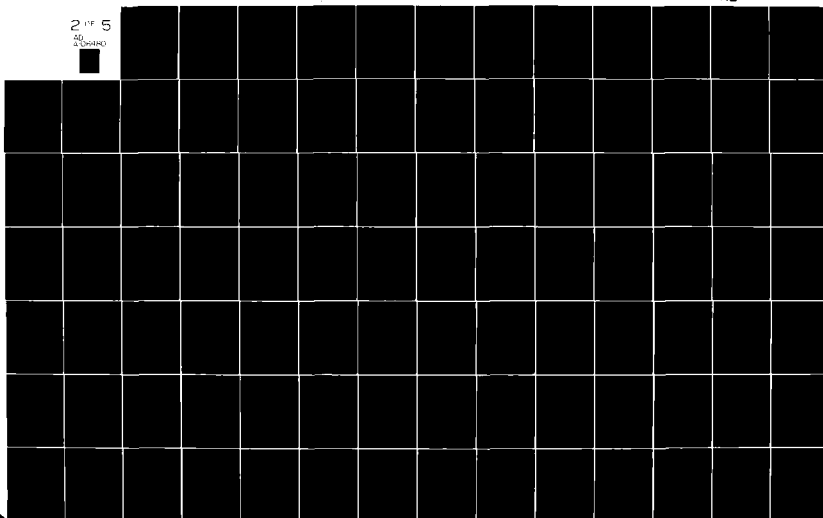
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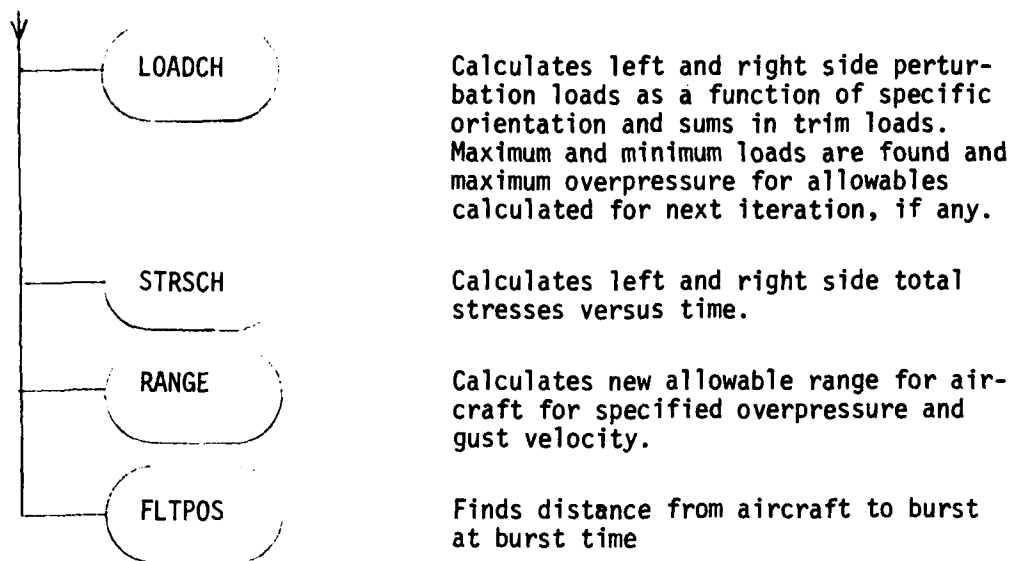


Figure 20 (contd). Blast and Time Response Module Routines

10. RIGID MODULE

The RIGID module has been added to permit correlation studies with experimental measurements of the blast loading of (effectively) rigid models. The experimental data on time histories of the moving reference point overpressure, density, and material velocity are input by the user and are utilized in place of the present internal calculations. The correlation pressure points are also specified by the user in terms of the locations of the aerodynamic boxes and slender body elements so that the pressure time histories for a steady angle of attack of the rigid vehicle can be determined.

The module first calculates the trim forces for the specified aerodynamic points by multiplying the forces from the AERO file by the dynamic pressure and the input values of generalized coordinates for any modes input to the AERO module. Next, the module performs a Fourier transform on the product of the input material velocity and density in order to put it in the frequency domain. After multiplying the result by the dynamic pressure and the gust forces from the AERO file, an inverse Fourier transform is performed to obtain the forces in the time domain. Adding these to the trim forces and dividing by box areas or body lengths leads to the desired pressures and running loads.

The output from this module is then the time histories of the pressures and running loads at the specified aerodynamic boxes and slender body elements. These may be compared to corresponding experimental results.

Figure 21 details the major routines in this module.

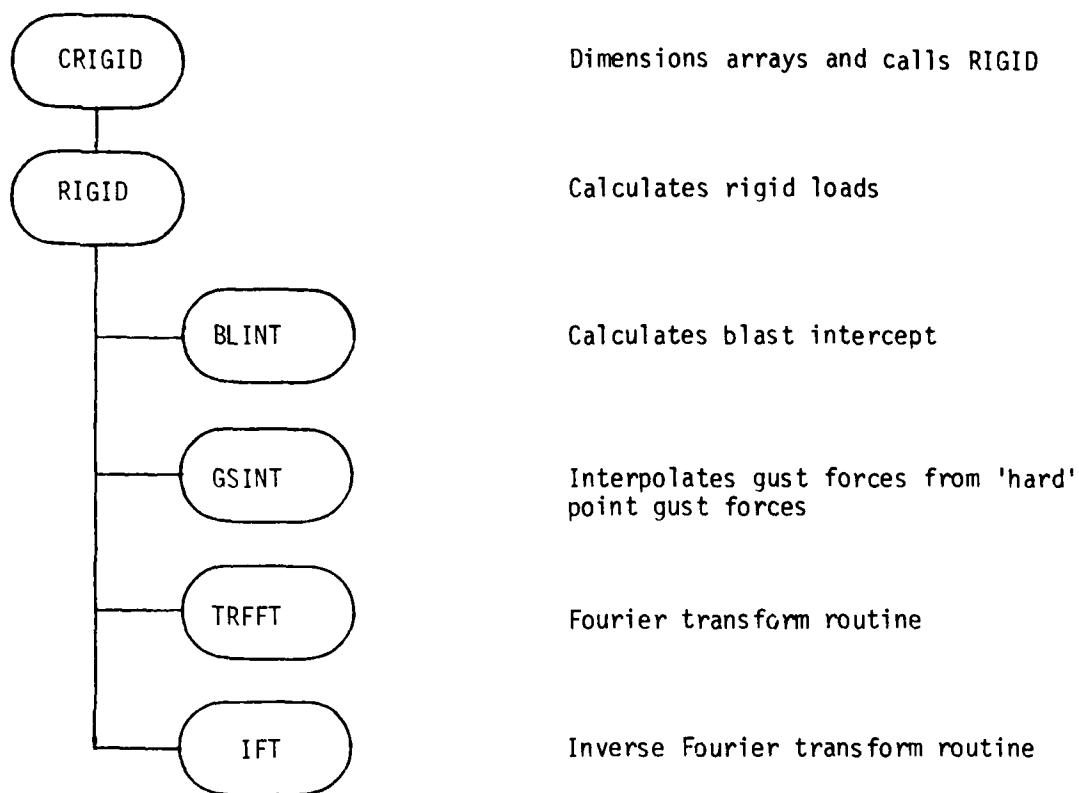


Figure 21. Rigid Module Routines

11. MERGE MODULE

The MERG module has been added to permit the merging onto one file, the aerodynamic matrices for different reduced frequencies from two separate files. This module adds a capability that will save computing time in that a set of aerodynamic matrices for a new set of reduced frequencies can be obtained without rerunning any reduced frequencies that have already been previously obtained. This feature also saves computing when an AERO job runs out of time before computing all of the reduced frequencies requested. The user simply runs the AERO module for the frequencies not completed and merges with the previous file to obtain the complete set of aerodynamic matrices.

Only two files can be input for each run, but the output file can always be input to a subsequent merge run. The filenames of the input files are TAPE 17 and TAPE 18, and the file name of the output file is TAPE 19.

SECTION IV
PROGRAM INPUT

1. GENERAL DESCRIPTION OF INPUT DATA

The program input is divided into two (2) card decks called the Fixed Data Deck and the Run Data Deck respectively. The Fixed Data Deck is divided into four (4) major groups, according to the program module which uses the data, and contains all of the information which define the aircraft geometry, mass, mode shapes, frequencies, loads, etc. The Run Data Deck contains the information necessary to define the conditions describing the specific run; for example, the blast orientations to be considered and the associated trial ranges.

Each input card consists of either all integer numbers or all real numbers input in fields of 12 columns. Integer numbers are input right justified in the field; that is, the number is punched in the card so that it ends in the right-most column of the field. Real numbers are generally left-justified, which means the number is punched in the card so that it starts in the left-most column of the field. In the input descriptions that follow, the ending card column for integer numbers or the beginning card column for real numbers are indicated above the dashed lines and the input variables are indicated below the dashed line. Each item number begins on a new card.

Units of data describing geometry must be consistent and are expected in inches, though an input parameter SIZFCT is provided in the Run Data Deck to adjust for geometric data in units other

than inches. Units for the modal deflections are expected to be inches for linear deflections and radians for angular deflections. These linear or angular deflections are given for a unit modal amplitude. Jig mode input for calculating the basic lift and moment forces on the undeformed vehicle must be in the same units used for the geometry. Modes which describe the aerodynamic and inertial deflections in terms of rotations, such as rigid body pitch or control surface rotation modes, should be for one radian of rotation. An input parameter, RBRADF, is provided in the trim module input in the event some other rotational base value has been used. All such rotation modes must have the same reference rotational value.

All other unit requirements are as described in the detailed input data section.

2. FILE CONTROL STATEMENTS

All input and/or output data files used by VIBRA-6 are sequential files and can be stored on tape or disk directly at the time of creation using standard CDC control statements. The control statements for saving a file are the REQUEST statement for saving on tape and the CATALOG statement for saving on disk. The control statements for using a previously saved file are the REQUEST statement for a file saved on tape and the ATTACH statement for a file saved on disk. Files may be copied from tape to disk or disk to tape by the use of the COPYBF control statement without affecting the operation of the program. For the proper coding of control statements, the appropriate operating system manual should be consulted.

The following correspondence must be maintained between the data files, the Fortran unit designator, and the CDC filename.

<u>Data File</u>	<u>Fortran Unit</u>	<u>CDC Filename</u>
Run Data	5	TAPE5
Fixed Data	31	TAPE31
Aerodynamics	19	TAPE19
Unit Loads	34	TAPE34
Frequency Response	35	TAPE35
Unit Gust Loads	36	TAPE36

3. FIXED DATA DECK INPUT DESCRIPTION

The four major groups in the Fixed Data Deck are the sectional input data, the aerodynamic module input, the inertial module input, and the load module input. Each group is described in more detail preceeding the specific input descriptions that follow. If a given module is not to be executed in a run, the input data for that module does not need to be removed from the Fixed Data Deck. The program can find the data necessary to run any specific module via the data designator card which is the first card in each major group. The Fixed Data Deck is input using fortran unit 31 (TAPE31).

a. Sectional Input Data (SECT)

The input data for this module consist of flags for dimensioning and module control, locations of and deflections at the inertial nodal points, and modal frequencies and structural damping. This data is optional, but if it is input, it must be the first data in the Fixed Data Deck. Either the SECT or the IMOD data must be input and the program will use the first one that appears in the Fixed Data Deck.

ITEM NO. 1 Data designator card

cc	1	2	3	4	6
1	3	5	7	9	1

SECT

Variable Description

SECT =SECT, designates that the data following are the inertial module input data

ITEM NO. 2 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

NMS NDOF NSYM NASYM NENGs KPRLDS

Variable Description

NMS number of 'right hand side' mass points, including centerline masses
 NDOF number of degrees of freedom per mass station
 NSYM number of symmetric modes
 NASYM number of antisymmetric modes
 NENGs number of engines on right hand side and centerline
 KPRLDS =1, print unit load matrices generated (if any)
 =0, do not print

ITEM NO. 3 Mass station locations. (Repeated for all mass stations, I=1,NMS)

cc	1	2	3	4	6
1	3	5	7	9	1
ELXIO	ELYIO	ELZIO			

Variable Description

ELXIO XAAS cocrdinate of mass, in.
 ELYIO YAAS cocrdinate of mass, in.
 ELZIO ZAAS cocrdinate of mass, in.

ITEM NO. 4 Inertial modal frequencies, FREQ, and mode shapes PHIX, PHIY, and PHIZ. (Repeated for all nodes, N=1,NCMOD, where NCMOD=NSYM+NASYM)

cc	1	2	3	4	6
1	3	5	7	9	1
FREQ	FREQ	FREQ	FREQ	FREQ	FREQ

Variable Description

FREQ modal frequency, Hz

ITEM NO. 5 Modeshapes (Repeated for all mass stations, I=1 to NMS and all modes, N=1 to NSYM+NASYM)

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1
F	L	H	THETA	ALPHA	PSI

Variable Description

F linear deflection in the x-direction
 L linear deflection in the y-direction
 H linear deflection in the z-direction
 THETA rotational deflection about the x-axis
 ALPHA rotational deflection about the y-axis
 PSI rotational deflection about the z-axis

SECOND CARD (Input only if NDOF=7 or 8)

cc	1	2	3	4	6
1	3	5	7	9	1
BETA	DELTA				

Variable	Description

BETA	rotational deflection about the primary control surface hinge-line
DELTA	rotational deflection about the secondary control surface hinge-line

ITEM NO. 6 Mass property table (Repeated for all mass stations, I=1,NMS). Note that this is not the mass matrix that is used by the program, but a table of mass properties that is used to form the mass matrix.

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1
M	MDELX	MDELY	MDELZ		

Variable	Description

M	mass
MDELX	mass unbalance, x-direction
MDELY	mass unbalance, y-direction
MDELZ	mass unbalance, z-direction

SECOND CARD

cc	1	2	3	4	6
1	3	5	7	9	1
IXX	IYY	IZZ	IXY	IYZ	IZX

IXX	moment of inertia about x-axis
IYY	moment of inertia about y-axis
IZZ	moment of inertia about z-axis
IXY	product of inertia about x- & y-axis
IYZ	product of inertia about y- & z-axis
IZX	product of inertia about z- & x-axis

THIRD CARD (Input only if NDOF=7 or 8)

cc	1	2	3	4	6
1	3	5	7	9	1
SHE	PAB	IBB	PTB	SFB	PPB

Variable Description

SHE mass unbalance for primary control surface
PAB product of inertia for primary control surface
IBB moment of inertia for primary control surface
PTB product of inertia relating theta and beta
SFB mass unbalance relating f and beta
PPB product of inertia relating psi and beta

FOURTH CARD (Input only if NDOF=8)

cc	1	2	3	4	6
1	3	5	7	9	1
SHD	PAD	PBD	IDD		

Variable Description

SHD mass unbalance for secondary control surface
PAD product of inertia for secondary control surface
relating alpha and delta
PBD product of inertia for secondary control surface
relating beta and delta
IDD moment of inertia for secondary control surface

FIFTH CARD (Input only if NDOF=8)

cc	1	2	3	4	6
1	3	5	7	9	1
PTL	SFD	PPD			

Variable Description

PTL product of inertia for secondary control surface
relating theta and delta
SFD mass unbalance for secondary control surface relating
f and delta
PPD product of inertia for secondary control surface
relating psi and delta

ITEM NO. 7 Modal definitions, AMODNO.

FIRST CARD

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	MODE1	MODE2	MODE3	MODE4	MODE5	

<u>Variable</u>	<u>Description</u>

MODE1	mode number of rigid body plunge mode
MODE2	mode number of rigid body pitch mode
MODE3	mode number of rigid body fore and aft mode
MODE4	mode number of first symmetric elastic mode
MODE5	mode number of last symmetric elastic mode

SECOND CARD

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	MODE6	MODE7	MODE8	MODE9		

<u>Variable</u>	<u>Description</u>

MODE6	mode number of pitch trim mode
MODE7	mode number of symmetric jig mode
MODE8	mode number of first symmetric mode to be deleted in this analysis
MODE9	mode number of last symmetric mode to be deleted in this analysis

THIRD CARD

cc	1	2	3	4	6
1	2	4	6	8	0
	MODE11	MODE12	MODE13	MODE14	MODE15

<u>Variable</u>	<u>Description</u>

MODE11	mode number of rigid body roll mode
MODE12	mode number of rigid body yaw mode
MODE13	mode number of rigid body lateral mode
MODE14	mode number of first antisymmetric elastic mode
MODE15	mode number of last antisymmetric elastic mode

FOURTH CARD

cc	1	2	3	4	6
1	2	4	6	8	0

	MODE16	MODE17	MODE18	MODE19	MODE20

<u>Variable</u>	<u>Description</u>
MODE16	mode number of roll trim mode
MODE17	mode number of yaw trim mode
MODE18	mode number of antisymmetric jig mode
MODE19	mode number of first antisymmetric mode to be deleted in this analysis
MODE20	mode number of last antisymmetric mode to be deleted in this analysis

Note: Trim modes may also be defined as elastic modes. For example, the yaw trim mode (usually rudder rotation) might also be used in the yaw damper system and hence be defined as an elastic mode, a trim mode and in the ACS definition.

ITEM NO. 8 Modal structural damping, CPXDPG.
(Repeated until the damping for all modes has been read in for N=1,NOMOD)

cc	1	2	3	4	6
1	3	5	7	9	1

CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG

<u>Variable</u>	<u>Description</u>
CPXDPG	modal structural damping

Note: The structural damping should be input zero in all modes except the elastic modes.

b. Aerodynamic Module Input Data (AERO)

The input data for this module consist of the following five groups of data: general data, panel data, body data, modal spline interpolation data, and gust data. The general data, panel data, and modal spline interpolation data must always be input, but the body data and gust data are optional as specified by flags in the general data.

The general data consist of flags for dimensioning and program control, locations of and deflections at the aerodynamic nodal points, and constants. The panel and body data consist of the input necessary to define completely each panel and body. The modal spline interpolation data consist of the data to relate the aerodynamic nodal points to the panel and body data. The gust data allow nonstandard blast orientations to be input for the gust calculations.

Units of data describing geometry must be consistent with the units for the other major groups.

GFCUP NO. 1 General Data

ITEM NO. 1 Data designator card

cc	1	2	3	4	6
1	3	5	7	9	1

AEFO

Variable Description

AEFO =AEFO, designates that the data following are the aerodynamic module input data

ITEM NO. 2 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NODES	NSYM	NASYM	MFIX1	MFIX2	

Variable Description

NODES number of aerodynamic nodal points
 NSYM number of symmetric modes
 NASYM number of antisymmetric modes
 MFIX1 mode number of first mode to monitor
 MFIX2 mode number of second mode to monitor

Note: Gusts can not be monitored.

ITEM NO. 3 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NP	MSTRIP	NSMAX	NCMAX	NBOXES	

Variable Description

NP Total number of panels on all lifting surfaces
 MSTRIP Total number of strips for all panels
 NSMAX Maximum number of strips per panel
 NCMAX Maximum number of chordwise boxes per panel
 NBOXES Total number of lifting surface boxes

ITEM NO. 4 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NB	MSBE	MBE			

Variable Description

NB Total number of bodies
 MSBE Total number of slender body elements for all bodies
 MBE Total number of interference body elements for all bodies

ITEM NO. 5 Coordinates of aerodynamic nodal points. Item numbers 5 and 6 are omitted if SECT data has been input since these data will be obtained by the program from the SECT data.
(Repeated for all aerodynamic points, I=1,NODES)

cc	1	2	3	4	6
1	3	5	7	9	1
ELXIA	ELYIA	ELZIA			

<u>Variable</u>	<u>Description</u>

ELXIA	XAAS coordinate of aerodynamic nodal point
ELYIA	YAAS coordinate of aerodynamic nodal point
ELZIA	ZAAS coordinate of aerodynamic nodal point

ITEM NO. 6 Modeshapes (Repeated first for all aerodynamic points I=1,NODES, and then for all modes J=1,NSYM+NASYM)

cc	1	2	3	4	6
1	3	5	7	9	1
PHINA	PHIZA	PHIYA			

<u>Variable</u>	<u>Description</u>

PHINA	Mode shape in normal direction at panel aerodynamic nodal point
PHIZA	Mode shape in z-direction at body aerodynamic nodal point
PHIYA	Mode shape in y-direction at body aerodynamic nodal point

ITEM NO. 7

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	IPR1	IPF2	IPF3	NGUST		

Variable Description

IPF1 Print flag for the normalwash and gust boundary conditions
 =1, print all boundary conditions
 =0, no print

IPF2 Print flag for point forces that are saved on the AEFO file
 =1, print forces
 =0, no print

IPF3 Print flag for pressures, body loadings, and downwash factors
 =1, print pressures only
 =2, print pressures and body loadings only
 =3, print pressures, body loadings, and the downwash factor matrix, DT and DTA
 =0, do not print any of the above

NGUST Gust direction cosine override flag
 =0, use standard direction cosine matrix for 13 gust conditions
 =n, override some (or all) elements of the direction cosine matrix for the gust boundary conditions.
 n=number of total gust conditions (max=20)
 See input under Group No. 5

ITEM NO. 8

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NKD	NKP	MK1	MK2		

Variable Description

NKD Number of reduced frequencies for doublet lattice calculations

NKP Number of reduced frequencies for piston theory calculations

MK1 Sequence number of first box on first panel representing a body surface, whenever this body is at zero incidence; otherwise MK1=0

MK2 Sequence number of last box on last panel representing a body surface, whenever this body is at zero incidence; otherwise MK2=0

Note: Panels on body surfaces need not be input last.
 Maximum number of reduced frequencies (NKD+NKP)=100

ITEM NO. 9

cc	1	2	3	4	6
1	3	5	7	9	1
FMACH	FEFA	FEFS	FEFC	XM	SCALER

Variable Description

FMACH Mach number, usual definition
 FEFA Reference area, usually total area of both wings
 FEFS Reference semispan
 FEFC Reference chord, usually average chord of wing
 XM Moment axis
 SCALER Nondimensional image radius

ITEM NO. 10 (Repeated until all FREQ(I) are input for I=1,NK,
 where NK = NKD+NKP)

cc	1	2	3	4	6
1	3	5	7	9	1
FREQ	FREQ	FREQ	FREQ	FREQ	FFREQ

Variable Description

FFREQ Reduced frequency

GROUP NO. 2 Panel data (Items 1 thru 5 repeated for all panels,
N=1,NP)

ITEM NO. 1

cc	1	2	3	4	6
1	3	5	7	9	1
X1	X2	X3	X4		

Variable Description

X1	inboard leading edge x-coordinate
X2	inboard trailing edge x-coordinate
X3	outboard leading edge x-coordinate
X4	outboard trailing edge x-coordinate

ITEM NO. 2

cc	1	2	3	4	6
1	3	5	7	9	1
Y1	Y2	Z1	Z2		

Variable Description

Y1	inboard edge y-coordinate
Y2	outboard edge y-coordinate
Z1	inboard edge z-coordinate
Z2	outboard edge z-coordinate

ITEM NO. 3

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NC	NS	IGRUP			

Variable Description

NC	Number of chordwise boxes for panel
NS	Number of spanwise strips for panel
IGRUP	Group number of panel. Usually, panels that are butted up trailing edge to leading edge are members of the same group, and then the monitored span loads will be calculated for the 'combined strips' of such panels. For panels in the same IGRUP, strips with the same y-coordinate (for dihedral of 45 degrees or less) or the same z-coordinate (for dihedral of greater than 45 degrees) will be added into one combined strip for the span load calculation only.

ITEM NO. 4 (Repeated until all TH(I) are input for I=1,NC+1)

cc	1	2	3	4	6
1	3	5	7	9	1
TH	TH	TH	TH	TH	TH

Variable Description

TH Fractional chordwise divisions for panel. Usually varies from 0.0 at the leading edge to 1.0 at the trailing edge

ITEM NO. 5 (Repeated until all TAU(I) are input for I=1,NS+1)

cc	1	2	3	4	6
1	3	5	7	9	1
TAU	TAU	TAU	TAU	TAU	TAU

Variable Description

TAU Fractional spanwise divisions for panel. Usually varies from 0.0 at the inboard edge to 1.0 at the outboard edge

GROUP NO. 3 Body data (Items 1 thru 7 repeated for all bodies,
N=1,NB. If NB=0, skip to Group No. 4)

ITEM NO. 1

cc	1	2	3	4	6
1	3	5	7	9	1
ZC	YC	A0	AR		

Variable	Description
ZC	z-coordinate of body axis
YC	y-coordinate of body axis
A0	average characteristic semi-width of interference body
AR	cross-sectional aspect ratio of body (height/width)

ITEM NO. 2

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NBE	NSBE	NFI	NFS	NT1	

Variable	Description
NBE	number of interference body elements
NSBE	number of slender body elements
NFI	interference 'radius' flag =1, RI array is input below =0, RI(I) = A0, for all I=1,NBE+1
NFS	slender body 'radius' flag =1, RS array is input below =0, RS(I) = A0, for all I=1,NSBE+1
NT1	number of elements in the TH1 array below (max=20)

ITEM NO. 3 (Repeated until all XII(I) are input for I=1,NBE+1)

cc	1	2	3	4	6
1	3	5	7	9	1
XII	XII	XII	XII	XII	XII

Variable	Description
XII	x-coordinates of interference body element endpoints

ITEM NO. 4 (Repeated until all RI(I) are input for I=1,NPE+1.
Omit if NRI=0)

cc	1	2	3	4	6
1	3	5	7	9	1
RI	RI	RI	RI	RI	RI

Variable Description

RI semi-widths or radii of interference body element endpoints

ITEM NO. 5 (Repeated until all TH1(I) are input for I=1,NT1)

cc	1	2	3	4	6
1	3	5	7	9	1
TH1	TH1	TH1	TH1	TH1	TH1

Variable Description

TH1 angular orientation of the points on interference body surfaces, degrees

Note: These points must not lie near any of the lifting-surface-body intersections. Also for elliptic bodies TH1 is not the angular orientation of a point on the body surface but an angular orientation parameter. The actual location of the point is:

$$Z=AR \cdot A \cdot \sin(TH1), \quad Y=A \cdot \cos(TH1)$$

ITEM NO. 6 (Repeated until all XIS(I) are input for I=1,NSBE+1)

cc	1	2	3	4	6
1	3	5	7	9	1
XIS	XIS	XIS	XIS	XIS	XIS

Variable Description

XIS x-coordinates of slender body element endpoints

ITEM NO. 7 (Repeated until all RS(I) are input for I=1,NSBE+1.
Omit if NRS=0)

cc	1	2	3	4	6
1	3	5	7	9	1
PS	RS	PS	RS	RS	RS

Variable Description

RS semi-widths or radii of slender body endpoints

GROUP NO. 4 Modal Spline Interpolation Data

ITEM NO. 1

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NSB	NSP	NMAX	KPRINT		

Variable Description

NSE Number of superbodies
NSP Number of superpanels (=0, if SECT input)
NMAX Maximum number of aerodynamic nodal points in any
 one of the superbodies/superpanels
KPRINT Print flag
 =1, print H and DHDY matrices
 =0, do not print

ITEM NO. 2 Item numbers 2 thru 4 are repeated first for all NSB
 superbodies, then for all NSP superpanels.

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	IF1	NXQ	NSUP	IXCON	NACELL	

Variable Description

IF1 Flag to select either surface spline or linear spline
 calculations (Not used with SECT input data)
 =0, surface spline (used for superpanels)
 =1, linear spline (used for superbodies)
NXQ Number of aerodynamic nodal points in the current
 superbody/superpanel
NSUP Number of bodies/panels in the current superbody/
 superpanel
IXCON Flag to indicate x or y=constant for superbody
 (not used for superpanel)
 =1, x=constant
 =0, y=constant (usual case)
NACELL flag to specify a body as a nacelle (Used only with
 SECT input data)
 =1, body is a nacelle
 =0, body is not a nacelle

ITEM NO. 3 (Repeated until all INSUP(I) are input for I=1,NSUP)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	INSUP	INSUP	INSUP	INSUP	INSUP	INSUP

Variable Description

INSUP Array of body numbers/panel numbers in the current
superbody/superpanel

ITEM NO. 4 (Repeated until all NODE(I) are input for I=1,NXQ)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NODE	NODE	NODE	NODE	NODE	NODE

Variable Description

NODE Array of aerodynamic nodal point numbers in the
current superbody/superpanel

ITEM NO. 5 Item numbers 5 thru 12 are input only if SECT data
has been input.

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NSUPTO	MAXSEC	MAXPF			

Variable Description

NSUPTO total number of superpanels
MAXSEC maximum number of sections in any one superpanel
MAXPF maximum value of IPAIR (Item 11) for any section

ITEM NO. 6 Item numbers 6 thru 13 are repeated for all NSUPTO superpanels.

cc	1	2	3	6	7
1	2	4	6	0	2
	NSEC	NODES	NEAASS	NODASS	

Variable Description

NSEC number of sections in current superpanel (see text of Volume II for definition of a section).

NODES number of nodes in current superpanel. NODES=0 for control surface without nodes on its hinge line.

NEAASS Identification number of the superpanel which contains the nodes which are associated with the current control surface superpanel.

NODASS The number of nodes lying on the associated superpanel that are to be used for the current control surface superpanel. NODASS must be less than or equal to the maximum number of nodes on the associated superpanel.

Note: NEAASS and NODASS pertain to the case where a superpanel is a control surface and does not have its own nodes. If such is not the case set them to zero.

ITEM NO. 7 Degree of freedom flags for current superpanel

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	H	A	T	B	D	

Variable Description

H =H, use the H degree of freedom for all specified nodes for current superpanel

A =A, use the ALPHA degree of freedom

T =T, use the THETA degree of freedom

B =B, use the BETA degree of freedom

D =D, use the DELTA degree of freedom

ITEM NO. 8 Elastic axis endpoint coordinates.

cc	1	2	3	4	6
1	3	5	7	9	1
XA	YA	ZA	XE	YE	ZE

Variable Description

XA	XAAS coordinate of inboard end of elastic axis
YA	YAAS coordinate of inboard end of elastic axis
ZA	ZAAS coordinate of inboard end of elastic axis
XE	XAAS coordinate of outboard end of elastic axis
YE	YAAS coordinate of outboard end of elastic axis
ZE	ZAAS coordinate of outboard end of elastic axis

Note: Endpoint coordinates must not be the same as any nodal point coordinates. The elastic axis for a control surface superpanel is the hingeline of the control surface.

ITEM NO. 9 (Repeated until all NCDE(I) are input for I=1,NODES.
Omit if NCDES=0)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NCDE	NOIE	NOIE	NOIE	NOIE	NCDE

Variable Description

NCLE	node numbers in the current superpanel

ITEM NO. 10 (Repeated until all NASS(I) are input for I=1,NODASS.
Omit if NCDASS=0)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NASS	NASS	NASS	NASS	NASS	NASS

Variable Description

NASS	Identification numbers of nodes lying on an associated superpanel that are to be used on the current control surface superpanel which has no nodes of its own. NASS must be a subset of the nodes of the associated superpanel.

ITEM NO. 11 Item numbers 11 thru 13 are repeated for all NSEC sections for the current superpanel.

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	IFP	IPAIF				

<u>Variable</u>	<u>Description</u>

IFP	=1, section is cut by parallel lines

	=0, section is cut by radial lines

IPAIF	number of pairs of box numbers to be input in item 12

Note: The aerodynamic boxes lying in a section must be identified. These boxes can be identified by the first and last box numbers of a sequence of boxes. Since there may be more than one sequence of consecutive boxes there may be several pairs of first-last box number combinations.

ITEM NO. 12

cc	1	2	3	4	6
1	3	5	7	9	1
XO	YO	ZO			

<u>Variable</u>	<u>Description</u>

XO	XAAS coordinate of reference for section

YO	YAAS coordinate of reference for section

ZO	ZAAS coordinate of reference for section

ITEM NO. 13 (Repeated for all IPAIF pairs)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	I1	I2				

<u>Variable</u>	<u>Description</u>

I1	box number of first box of group of boxes for the current section

I2	box number of last box of group of boxes for the current section

GFOUP NO. 5 Gust Data (Input only if NGUST#0)

ITEM NO. 1 (Repeated for each gust condition to be added or overridden)

cc	1	1	2	3
1	2	4	5	7
	NN	XCOS	YCOS	ZCOS

Variable Description

NN A number from 1 to NGUST indicating the gust condition to be input. If NN is less than 14, the standard gust corresponding to NN will be overridden with the following input. If NN is greater or equal to 14, the gust whose direction cosines are given below will be added to the existing 13 standard gust orientations. (the maximum number of standard plus additional gusts is 20)
NN=-1 indicates end of optional gust input.

XCOS cos(alpha), direction cosine from the x-axis to blast center

YCOS cos(beta), direction cosine from the y-axis to blast center

ZCOS cos(gamma), direction cosine from the z-axis to blast center

c. Inertial Module Input Data (IMOD)

The input data for this module consists of flags for dimensioning and module control, locations of and deflections at the inertial nodal points, and modal frequencies and structural damping.

ITEM NO. 1 Data designator card

cc	1	2	3	4	6
1	3	5	7	9	1

IMOD

Variable Description

IMOD =IMOD, designates that the data following are the inertial module input data

ITEM NO. 2 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

NMS NENGs KPRIDS

Variable Description

NMS number of 'right hand side' mass points, including centerline masses
 NENGs number of engines on right hand side and centerline
 KPRIDS =1, print unit load matrices generated (if any)
 =0, do not print

ITEM NO. 3 Mass and location data. (Repeated for all masses N=1,NMS)

cc	1	2	3	4	6
1	3	5	7	9	1

EM ELXIO ELYIO ELZIO

Variable Description

EM mass, lb. sec. sec/in
 ELXIO XAAS coördinate of mass, in.
 ELYIO YAAS coördinate of mass, in.
 ELZIO ZAAS coördinate of mass, in.

ITEM NO. 4 Inertial modal frequencies, FREQ, and mode shapes PHIX, PHIY, and PHIZ. (Repeated for all modes, N=1,NOMOD, where NOMOD=NSYM+NASYM. NSYM and NASYM are input in the AERO data)

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1

FREQ

Variable Description

FREQ modal frequency, Hz

NEXT CARD (Repeated for all mass points, I=1,NMS. Order must correspond to that of ITEM NO. 3)

cc	1	2	3	4	6
1	3	5	7	9	1

PHIX PHIY PHIZ

Variable Description

PHIX mode shape in x direction at mass station
 PHIY mode shape in y direction at mass station
 PHIZ mode shape in z direction at mass station

ITEM NO. 5 Modal definitions, AMODNO.

FIRST CARD

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

MODE1 MODE2 MODE3 MODE4 MODE5

Variable Description

MODE1 mode number of rigid body plunge mode
 MODE2 mode number of rigid body pitch mode
 MODE3 mode number of rigid body fore and aft mode
 MODE4 mode number of first symmetric elastic mode
 MODE5 mode number of last symmetric elastic mode

SECOND CARD

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	MODE6	MODE7	MODE8	MODE9		

<u>Variable</u>	<u>Description</u>

MODE6	mode number of pitch trim mode
MODE7	mode number of symmetric jig mode
MODE8	mode number of first symmetric mode to be deleted in this analysis
MODE9	mode number of last symmetric mode to be deleted in this analysis

THIRD CARD

cc	1	2	3	4	6
1	2	4	6	8	0
	MODE11	MODE12	MODE13	MODE14	MODE15

<u>Variable</u>	<u>Description</u>

MODE11	mode number of rigid body roll mode
MODE12	mode number of rigid body yaw mode
MODE13	mode number of rigid body lateral mode
MODE14	mode number of first antisymmetric elastic mode
MODE15	mode number of last antisymmetric elastic mode

FOURTH CARD

cc	1	2	3	4	6
1	2	4	6	8	0
	MODE16	MODE17	MODE18	MODE19	MODE20

<u>Variable</u>	<u>Description</u>

MODE16	mode number of roll trim mode
MODE17	mode number of yaw trim mode
MODE18	mode number of antisymmetric jig mode
MODE19	mode number of first antisymmetric mode to be deleted in this analysis
MODE20	mode number of last antisymmetric mode to be deleted in this analysis

Note: Trim modes may also be defined as elastic modes. For example, the yaw trim mode (usually rudder rotation) might also be used in the yaw damper system and hence be defined as an elastic mode, a trim mode and in the ACS definition.

ITEM NO. 6 Modal structural damping, CPXDPG.
 (Repeated until the damping for all modes has been
 read in for N=1,NOMOD)

cc	1	2	3	4	6
1	3	5	7	9	1
CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG

Variable Description

CPXDPG modal structural damping

Note: The structural damping should be input zero
 in all modes except the elastic modes.

d. Unit Load Module Input Data (LOAD)

The input data for this module consists of flags for dimensioning and module control and all the data necessary to define the desired loads.

ITEM NO. 1 Data designator card

cc	1	2	3	4	6
1	3	5	7	9	1

LOAD

Variable Description

LOAD =LOAD, designates that the data following are the unit load module input data

ITEM NO. 2 Dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

NBEAMS NINTLD NSTRSS NMGRP NABGFP NSBGRP

Variable Description

NBEAMS number of beams for integrated loads
NINTLD number of integrated loads
NSTRSS number of stresses
NMGRP number of groups of masses associated with beams
NABGFP number of groups of aerodynamic boxes associated with beams
NSBGRP number of groups of aerodynamic slender body elements associated with beams

ITEM NO. 3 Beam geometry, BEAMGM
(Repeated for all beams, N=1, NBEAMS)

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1

XI YI ZI

Variable Description

XI XAAS coordinate of inner end of beam, in.
YI YAAS coordinate of inner end of beam, in.
ZI ZAAS coordinate of inner end of beam, in.

SECOND CARD

cc	1	2	3	4	6
1	3	5	7	9	1
xo	yo	zo	CODE		

<u>Variable</u>	<u>Description</u>

xo	XAAS coordinate of outer end of beam, in.
yo	YAAS coordinate of outer end of beam, in.
zo	ZAAS coordinate of outer end of beam, in.
CODE	Code defining the component to which the beam belongs =1.0, wing or horizontal tail =2.0, fuselage =3.0, vertical stabilizer =4.0, wing pod =5.0, fuselage pod =6.0, vertical stabilizer pod

ITEM NO. 4 Required integrated loads, STALDS
 (Repeated for all loads, N=1,NINTLD)

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1
BEAMNO	CODEL	CODEC			

<u>Variable</u>	<u>Description</u>

BEAMNO	beam number of the beam with which the integrated load is associated.
CODEL	load code =1.0, integrated load is moment Mx =2.0, integrated load is moment My =3.0, integrated load is moment Mz =4.0, integrated load is shear Px =5.0, integrated load is shear Py =6.0, integrated load is shear Pz
CODEC	code defining the component to which the load belongs =1.0, wing or horizontal tail =2.0, fuselage =3.0, vertical stabilizer =4.0, wing pod =5.0, fuselage pod =6.0, vertical stabilizer pod

SECOND CARD

cc	1	2	3	4	6
1	3	5	7	9	1
XL	YL	ZL	PMAX	PMIN	

<u>Variable</u>	<u>Description</u>

XL	XAAS coordinate of location of integrated load, in.
YL	YAAS coordinate of location of integrated load, in.
ZL	ZAAS coordinate of location of integrated load, in.
PMAX	maximum allowable positive load
PMIN	maximum allowable negative load (a negative number)

ITEM NO. 5 Matrix defining local stresses in terms of the integrated loads, STRESS.
(Repeated until all of the STRESS matrix has been read in by rows. Omit if NSTRSS=0)

cc	1	2	3	4	6
1	3	5	7	9	1
STRESS	STRESS	STRESS	STRESS	STRESS	STRESS

<u>Variable</u>	<u>Description</u>

STRESS	element of STRESS matrix relating local stresses to the integrated loads

ITEM NO. 6 Definition of groups of masses associated with beams, NFNLMR. (Repeated for N=1,NMGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFM	NLM	BEAMNO			

<u>Variable</u>	<u>Description</u>

NFM	number of first mass in group
NLM	number of last mass in group
BEAMNO	beam number to which group is associated

ITEM NO. 7 Direction cosine matrix relating mass point deflection to the AAS coordinate deflections (x,y,z, ordered). (Repeated until three rows for each mass group have been read in, I=1,3, N=1,NMGFP)

cc	1	2	3	4	6
1	3	5	7	9	1
TLAMV1	TLAMV2	TLAMV3			

<u>Variable</u>	<u>Description</u>

TLAMV1	first element of the ith row of TLAMV matrix
TLAMV2	second element of the ith row of TLAMV matrix
TLAMV3	third element of the ith row of TLAMV matrix

ITEM NO. 8 Definition of groups of aero boxes associated with beams, NFNLAB. (Repeated for N=1,NABGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFAB	NLAB	FEAMNO			

<u>Variable</u>	<u>Description</u>

NFAB	number of first aero box in group
NLAB	number of last aero box in group
BEAMNO	beam number with which group is associated

ITEM NO. 9 Definition of groups of slender body elements associated with beams, NFNLSB. (Repeated for N=1,NSBGFP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFSB	NLSB	BEAMNO			

<u>Variable</u>	<u>Description</u>

NFSB	number of first slender body element in group
NLSB	number of last slender body element in group
BEAMNO	beam number with which group is associated

ITEM NO. 12 Definition of engine mass points, NENGM.
 (Repeated for N=1,NENGS. Omit if NENGS=0)

cc	1	2	3	4	6
1	3	5	7	9	1
ENGM1	ENGM2				

<u>Variable</u>	<u>Description</u>

ENGM1	number of first mass defining the engine
ENGM2	number of second mass defining the engine

Note: Force due to thrust acts at ENGM1 along a vector
 pointed from ENGM2 to ENGM1

4. FUN DATA DECK INPUT DESCRIPTION

The Fun Data Deck must always be available and is the standard fortran input unit 5 (TAPE5).

GROUP_NO. 1 Identification of configuration, print control, control of execution, and case constants

ITEM_NO. 1 Identification of configuration and print control

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	IDENT	KPRCXQ	KPRCHQ	KPRCXL	KPRCHL	

<u>Variable</u>	<u>Description</u>
IDENT	identification number of configuration
KPRCXQ	=n, print generalized response for orientation n
KPRCHQ	=n, print check matrices in frequency response module for orientation n
KPRCXL	=n, print integrated load modulii due to unit gust for orientation n
KPRCHL	=n, print matrix data for unit gust calculations for orientation n

ITEM NO. 2 Module execution control card

cc	1	1	2	2	2	3	3	4	4
1	4	9	2	7	0	5	8	3	6
OPCD	OPCD	OPCD	OPCD	OPCD	OPCD	OPCD	OPCD	OPCD	OPCD

Variable Description

OPCD defines modules to be executed
 =AERO, execute aerodynamic module
 =UNIT, execute unit loads module
 =ACSM, execute active control system module
 =FRSP, execute frequency response module
 =GUST, execute unit gust loads module
 =BLST, execute trim loads, blast, and time history
 modules
 =RIGD, execute rigid loads module
 =MEFG, execute aero file merge module

Note: The user must specify which modules are to be
 executed in any given pass through the program. If a
 module is specified to be executed and sufficient
 data is not available (from any required source) the
 program will halt with an explanatory statement. The
 active control system module need only be executed
 when running with FRSP and/or GUST specified, but the
 control system definition must be the same if these
 two modules are not run in the same pass.

ITEM NO. 3 Case constants (If MERG or AERO has been specified on
 the module control card, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
ALT	VKEAS	SIZFCT	PLQ	PLL	

Variable Description

ALT altitude, ft
 VKEAS velocity, equivalent airspeed in knots
 SIZFCT size factor defining the units of the input geometry
 data relative to inches. default=1.0
 PLQ =n, plot generalized response for nth orientation
 =0.0, do not plot
 PLL =n, plot nth load due to unit gust for all
 orientations
 =0.0, do not plot

GROUP NO. 2 Active control system. (If ACSM has not been specified on the module control card, omit this group)

Input modes must contain a mode which describes the motion of the surface driving the system as commanded by the active system. The input modal amplitude of this mode must be consistent with the commanded/sensed movement as defined by the transfer function input data. The scalar multiplier may be used for this purpose. Note that several transfer functions may be used to drive any single mode, but any single transfer function may drive only one mode. Thus if two surfaces are being used and driven by the same mathematical transfer function and two separate modes are used to define these control surface motions, the transfer function must be entered twice and defined by two different transfer function numbers.

ITEM NO. 1 Control and dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NTFS	NTFA	MXBLK	MXOBLK		

<u>Variable</u>	<u>Description</u>
NTFS	number of symmetric transfer functions
NTFA	number of antisymmetric transfer functions
MXELK	maximum number of blocks input in any single transfer function with items 3 or 5
MXOBLK	maximum order of any block polynomial in input transfer function blocks with items 3 or 5

ITEM NO. 2 Data describing kinematics of active control system for symmetric control, TMSS. (Repeated for I=1,NTFS. If NTFS=0, skip to item no. 4)

cc	1	2	3	4	6
1	3	5	7	9	1
TMSS1	TMSS2	TMSS3	TMSS4		

Variable	Description
TMSS1	mass point number of sensed mass point
TMSS2	degree of freedom number of sensed degree of freedom =1.0,PHIX; =2.0,PHIY; =3.0,PHIZ; or if SECT input: =1.0,F; =2.0,L; =3.0,H; =4.0,THETA; =5.0,ALPHA; =6.0,PSI; =7.0,BETA; =8.0,DELTA
TMSS3	scalar multiplier on sensed degree of freedom motion
TMSS4	mode number of the driving mode (should be a control surface mode).

ITEM NO. 3 Data defining elements of symmetric transfer function.

cc	1	2	3	4	6
1	3	5	7	9	1
NTF	NBLK	NOFD	AN	AD	TLAST

Variable	Description
NTF	transfer function number =-1.0, no more input data for this item
NBLK	block number of these elements
NOFD	power of Laplace operator (s), associated with these elements
AN	numerator coefficient
AD	denominator coefficient
TLAST	last transfer function associated with this data =0.0, entry is for transfer function NTF only ≠0.0, entry is for transfer function NTF thru TLAST

ITEM NO. 4 Data describing kinematics of active control system
for antisymmetric control, TMSA.
(Repeated for I=1,NTFA. If NTFA=0, skip to group 3)

cc	1	2	3	4	6
1	3	5	7	9	1
TMSA1	TMSA2	TMSA3	TMSA4		

<u>Variable</u>	<u>Description</u>

TMSA1	mass point number of sensed mass point
TMSA2	degree of freedom number of sensed degree of freedom =1.0,PHIX; =2.0,PHIY; =3.0,PHIZ; or if SECT input: =1.0,F; =2.0,L; =3.0,H; =4.0,THETA; =5.0,ALPHA; =6.0,PSI; =7.0,BETA; =8.0,DELTA
TMSA3	scalar multiplier on sensed degree of freedom motion
TMSA4	mode number of the driving mode

ITEM NO. 5 Data defining elements of antisymmetric transfer
function.

cc	1	2	3	4	6
1	3	5	7	9	1
NTF	NBLK	NOFD	AN	AD	TLAST

<u>Variable</u>	<u>Description</u>

NTF	transfer function number =-1.0, no more input data for this item
NBLK	block number of these elements
NOFD	power of LaPlace operator (s), associated with these elements
AN	numerator coefficient
AD	denominator coefficient
TLAST	last transfer function associated with these data =0.0, entry is for transfer function NTF only ≠0.0, entry is for transfer function NTF thru TLAST

Note: Inputting AN, AD and ALAST, blank fields are not the same
as 0.0; therefore 0.0's must be input explicitly.

GROUP NO. 3 Frequency response. (If FRSP has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

NFRGR

Variable Description

NFRGF number of frequency groups to be input in item no. 2

ITEM NO. 2 Frequency groups (Repeated for N=1,NFRGF)

cc	1	2	3	4	6
1	3	5	7	9	1

F1 F2 DF

Variable Description

F1 starting frequency (hz) for this group
 F2 ending frequency (hz) for this group
 DF incremental frequency for this group

Note: input frequencies must be entered in an ascending order and groups must not overlap, nor should any frequency be repeated.

GROUP NO. 4 Unit gust loads. (If GUST has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

	NACC					

Variable Description

NACC number of mass points for acceleration calculations

ITEM NO. 2 Acceleration indexes (Repeated until all mass point numbers have been input for N=1,NACC. Omit if NACC=0)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2

	MASSNO	IDOF	MASSNO	IDOF	MASSNO	IDOF

Variable Description

MASSNO mass point number for which acceleration is desired
 IDOF degree of freedom for which acceleration is desired
 =1, x-direction
 =2, y-direction
 =3, z-direction

GROUP NO. 5 Trim and blast data. (If BLST has not been specified on the module control card, omit this group)

ITEM NO. 1 Trim constants

cc	1	2	3	4	6
1	3	5	7	9	1
AN	KMAN	ZDOT	KPRTRM	RBRADF	

Variable	Description
AN	load factor
KMAN	manuever constant =0.0, no manuever =1.0, symmetric pull-up or push-over =2.0, turn
ZDOT	climb rate, fps (input only if KMAN=2.0)
KPRTRM	=1.0, print all matrices in trim solution =0.0, do not print
RBRADF	scale factor for rotation modes input at other than for one radian rotation, = 1 rad/value used in radians (default=1.0)

ITEM NO. 2 Time history constant and blast characteristics

cc	1	2	3	4	6
1	3	5	7	9	1
TIMEMX	DELT	EFF	HGRD	KPRTMH	KPLTMH

Variable	Description
TIMEMX	maximum time for time history, sec
DELT	delta time for time histories
EFF	weapon yield, KT
HGRD	height of ground above sea level, ft
KPRTMH	=1.0, print total load time histories =0.0, do not print
KPLTMH	=1.0, plot load time histories for FHS of aircraft =2.0, plot load time histories for LHS of aircraft =3.0, plot both LHS and RHS =0.0, do not plot

Note: DELT is increased by a factor of 5 after 0.25 seconds of response and again by a factor of 2 after 1.0 seconds.

ITEM NO. 3 Control flags

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NORMAX	KGRD	KLPT	KLOAD	NCFITS	KPRBLS

Variable Description

NORMAX maximum number of orientations to be considered

KGRD control constant for ground reflection
 =0, no ground reflection
 =1, include ground reflection

KLPT =1, iteration for critical range is desired
 =0, no iteration

KLOAD =1, new maximum allowable loads input in item no. 7

NCFITS =1, maximum stresses input in item no. 8

KPRBLS =1, print blast matrices for checkout
 =0, do not print

ITEM NO. 4 Thrust input data, THRUST. (Repeat until all thrust (I) have been input for I=1,NENGS. If NENGS=0, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
THRUST	THRUST	THRUST	THRUST	THRUST	THRUST

Variable Description

THRUST engine thrust, lb.

ITEM NO. 5 Orientation numbers, NOFS. (Repeat until all NORS (I) have been input for I=1, NORMAX)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NCF	NCF	NOF	NOR	NOR	NOR

Variable Description

NOF orientation number of blast for desired solution

Note: NORMAX and NOF must be consistent with the set of orientations established during execution of the FRSP module and available on the AERO file.

ITEM NO. 6 Range estimates, REST. (repeat until all REST(I)
have been input for I=1,NORMAX)

cc	1	2	3	4	6
1	3	5	7	9	1
REST	REST	FEST	REST	REST	REST

Variable Description

REST estimated range at shock arrival time, ft

ITEM NO. 7 Maximum allowable loads, STALDS. (Repeat for
N=1,NINTLD. If KLOAD=0, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
PMAX	PMIN				

Variable Description

PMAX maximum allowable positive load
PMIN maximum allowable negative load (a negative number)

ITEM NO. 8 Maximum allowable stresses. (Repeat for N=1,
NINTLD. If NCFITS=0, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
SMAX	SMIN				

Variable Description

SMAX maximum allowable positive stress
SMIN maximum allowable negative stress (a negative number)

GROUP NO. 6 Rigid loads. (If RIGD has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NTMGST	NBCX	NSBE	NOR	IPLOT	IPREQ

Variable Description

NTMGST number of input time points for gust
 NBOX number of aerodynamic boxes for which time histories of pressures are desired
 NSBE number of slender body elements for which time histories of pressures are desired
 NOR gust orientation requested
 IPLOT plot flag for Fourier transform of $\rho \cdot V G$ and pressures
 IPREQ print flag for checkout print

ITEM NO. 2 Time history constants

cc	1	2	3	4	6
1	3	5	7	9	1
	TIMEMX	DELT			

Variable Description

TIMEMX maximum time for output time history, sec
 DELT delta time for output time histories, sec

Note: DELT is increased by a factor of 5 after 0.25 seconds of response and again by a factor of 2 after 1.0 seconds.

ITEM NO. 3 Number of frequency groups

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NFFGP					

Variable Description

NFFGP number of frequency groups to be input in item no. 4

ITEM NO. 4 Frequency groups (Repeated for N=1,NFRGR)

cc	1	2	3	4	6
1	3	5	7	9	1
F1	F2	DF			

Variable Description

F1 starting frequency (hz) for this group
 F2 ending frequency (hz) for this group
 DF incremental frequency for this group

Note: input frequencies must be entered in an ascending order and groups must not overlap, nor should any frequency be repeated.

ITEM NO. 5 Aerodynamic box numbers at which pressures are desired. (Repeat until all IBOXES(I) have been input for N=1,NFOX)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	IBOX	IBOX	IBOX	IBOX	IBOX	IBOX

Variable Description

IBOX aerodynamic box number at which pressure is desired

ITEM NO. 6 Slender body element numbers at which pressures are desired. (Repeat until all ISBE(I) have been read in for N=1,NSPE)

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	ISBE	IDIF	ISBE	IDIF	ISBE	IDIF

Variable Description

ISBE slender body element number at which pressure is desired
 IDIF force direction: =1, z-direction; =2, y-direction

ITEM NO. 7 Input generalized coordinates. (Repeat until all
Q(I) have been input for N=1,NOMOD)

cc	1	2	3	4	6
1	3	5	7	9	1
Q	Q	Q	Q	Q	Q

<u>Variable</u>	<u>Description</u>
Q	input generalized coordinate

ITEM NO. 8 Input time histories of overpressure, density, and
material velocity. (Repeat until all time points
have been input for N=1,NTMGST)

cc	1	2	3	4	6
1	3	5	7	9	1
TIME	DP	RHO	VG		

<u>Variable</u>	<u>Description</u>
TIME	time, seconds
DP	overpressure, psi
RHO	density, lb-sec**2/ft**4
VG	material velocity, ft/sec

GROUP NO. 7 Merge of aerodynamic files from TAPE17 and TAPE18 onto TAPE19. (If MERG has not been specified on the module control card, omit this group)

ITEM NO. 1 Number of input reduced frequencies

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	INK1	INK2				

Variable Description

INK1 number of frequencies from TAPE17 file to be merged
 INK2 number of frequencies from TAPE18 file to be merged

ITEM NO. 2 Reduced frequencies from TAPE17 file. (Repeated until all RKIN1(I) have been input for I=1,INK1)

cc	1	2	3	4	6
1	3	5	7	9	1
RKIN1	RKIN1	RKIN1	RKIN1	RKIN1	RKIN1

Variable Description

RKIN1 value of reduced frequency from TAPE17 file for which aero is to be merged

ITEM NO. 3 Reduced frequencies from TAPE18 file. (Repeated until all RKIN2(I) have been input for I=1,INK2)

cc	1	2	3	4	6
1	3	5	7	9	1
RKIN2	RKIN2	RKIN2	RKIN2	RKIN2	RKIN2

Variable Description

RKIN2 value of reduced frequency from TAPE18 file for which aero is to be merged

5. DISCUSSION OF INPUT DATA

Fixed data deck input for the structural model is essentially the same as that given in Reference 1 with the exception of the aerodynamic model data and the unit load data. However, rigid body modes and trim must be input to both the aerodynamic module and the inertial module. Rigid body modes should consist of rigid body plunge, pitch, fore and aft, roll, yaw, and lateral translation. Trim modes describe surface motion necessary to trim the aircraft and consist of a mode each for pitch, roll, and yaw. These and the rigid body rotation modes should consist of the control point deflections for one radian of rotation. In the event that some other reference rotation is used, then a correction factor must be input to the trim module (RBRADF). Details of aerodynamic data preparation are given in Volume II of this report. The choice of reduced frequencies for the aerodynamics module must include $k=0$ and the second reduced frequency should be small (approximately 0.1). The maximum value should be high enough to extend the frequency somewhat beyond the highest natural free-free frequency of the elastic model. Reduced frequency spacing should be relatively uniform and consist of about 4 values for each 1.0 k used, though 3 will often suffice.

Unit load data required is explained in the unit load module description. Care should be taken with this data to insure that the beam segments used to define the load paths are contiguous or that all appropriate load stations (mass and aero) feed load to the appropriate beam segment.

Active system definition input data is discussed in that module.

The choice of frequencies for solution depends on the vehicle under analysis. Small increments of frequency should be used in the aircraft rigid body frequency range and near the elastic modal frequencies. Broader spacing may be used between separated modes. In the event a frequency is input which is beyond the maximum definable by the unsteady aerodynamic matrices available, the program will designate it as unusable. The maximum frequency available is given by

$$f = Vk/6.28b$$

where V is the true airspeed, k is the maximum reduced frequency available, and b is the reference semi-chord.

Run data are as described in that section, except that DELT should be small enough to give the response of the highest frequency mode, DELT greater than or equal $0.2f$. The time of solution (TIMEMX) should be at least $5S/V_{ss}$ where S is the maximum length of the vehicle (tip to tip or nose to tail) and V_{ss} is the speed of sound at flight altitude.

SECTION V

PROGRAM OUTPUT

The program output is generally self-explanatory in that all output data are preceded by headings and variable definitions which are for the most part consistent with the data definitions found in the module description and input data sections of the report.

Input data from the Fixed and Run Data Decks for any given run are printed out for the purpose of checking input data.

Generated data files, output by the several modules, are described in Section VI.

The use of a generated data file is followed by a printout of the data file header which identifies the file and gives a brief summary of the data on the file. A rewind of any file initiates a message to that effect.

During the execution of any module, messages informing the user of the number of incremental words (in decimal) required for the module are printed.

Several auxiliary print flags are available for use throughout the program. These are intended primarily for checkout purposes. The data printed consist of either input data to one module from the generated file data of a preceding module or the matrix equations formed within the module in execution. The equations are described in the module description section of the report. The user should note that the use of these print flags will result in a large amount of print.

Output from the aerodynamic module is described in detail in Volume II.

The user should check the aerodynamic output at a reduced frequency of zero to insure that the generalized forces and moments due to rigid body pitch and yaw for one radian rotations are numerically identical to the gust forces for the vertical and lateral gust orientations respectively. Lack of agreement indicates an error in modal deflection inputs for the aero node points. The error will usually be in the sign of the input for a group of points.

Output from the inertial module consists of the mass and mass point geometry, the inertial mode shapes, the modal definition table, the structural damping coefficients and the generalized mass and stiffness.

Output from the unit loads module consists of a summary of all input data for the module. In addition, the sweep and dihedral for each local beam are printed and an array defining the beams loaded (by input number) by any load first entering each defined beam. The TLAMY matrices and TLAMM for each beam are displayed. The printout following consists of the AAS location of each load point, inertial and aero, by groups as defined in the input. If the print flag KPR LDS (Fixed Data Deck) has been input non-zero, the integrated loads due to each inertial and aero load point will be printed out along with the integrated loads due to unit modal amplitude for inertial motion and aero motion.

The active system module output consists of the input definition data, a summary of the values of all block polynomials used to define the system and the transfer function polynomial in powers of $i\omega$. The final transfer functions are also printed out for a frequency of one rad/sec for check purposes. The antisymmetric data follow the symmetric data.

The frequency response module printed output consists only of the gust orientation number, direction cosines, the flight condition, and the frequencies of solution. If the print flag KPRCXQ has been input for an orientation there will be printed the generalized response solution vector q for each frequency. If the print flag KPRCHQ is input, the file input generalized motion dependent aero matrices and the gust forces on all aerodynamic elements will be printed out. The aero force integration arrays will also be printed. In addition, for each frequency of solution, the interpolated generalized gust forces, motion dependent aero forces and the equations for the generalized response will be printed. If an active system has been defined, all incremental mass and aero matrices will also be printed. The symmetric cases print first, and are followed by the antisymmetric (if an antisymmetric solution is required for the particular orientation flagged for print).

The basic print output of the unit gust loads module consists only of a message of the number of orientations analyzed. If the plot flag PLQ has been specified nonzero, the generalized response for all modes for the gust orientation specified will be plotted. If the plot flag PLL is input, the integrated load so specified will be plotted versus frequency for all orientations. If the print flag KPRCXL is nonzero, there will be displayed the complex integrated loads per unit gust for the specified orientation and their moduli for all frequencies. Setting the flag KPRCXL greater than 100 will cause a print of the integrated load moduli for all orientations. The use of the flag KPRCHL will invoke a printout of all data used to generate the loads due to unit gust for the specified orientation. These data consist of the frequencies of solution, the

interpolation coefficients, the generalized response vectors for all frequencies, the integrated loads due to unit inertial modal amplitude and unit aero modal amplitude (PIQ, PAQS, PAQA) and finally the integrated loads from summation of all forces.

The output from the Trim, Blast and Time History Modules consists of a summary of input control data for these modules and a summary of the modal control data for the symmetric trim solution and flight condition data. The generalized coordinate solutions for the symmetric part of the solution are displayed and the symmetric trim parameters for the maneuver condition follow. If the maneuver specified requires an antisymmetric trim solution, similar data for the antisymmetric solutions are printed. These data are followed by a summary of symmetric (and antisymmetric, if present) trim loads at the specified integrated load stations.

In the event that the user has flagged the trim matrix print flag (KPRTRM) there will be displayed the aerodynamic and inertial matrices used in the trim solution and the matrix equations solved for the symmetric and antisymmetric trim solutions.

The amount of blast and time history output is controlled by the three print flags, KPRTMH, KPLTMH, and KPRBLS. The minimum print, which should be the case for range iteration runs, consists of a summary of blast conditions and the delta time of intercept with respect to the AAS origin (τ) of the blast wave with the first aerodynamic load producing element of the vehicle and its AAS coordinates. These are followed by the EFAS coordinates of the AAS origin at time of intercept, the EFAS coordinates of the burst, the time required for the blast wave to reach the vehicle and the estimated highest

frequency of the gust function. The output following consists of a summary of the maximum positive and negative loads experienced at all integrated load stations and the maximum allowables. If a stress matrix has been specified, similar data are displayed for the stresses.

The next printed output is a summary of the present blast conditions and the estimated allowable blast conditions which are based on the allowables for load or stress. The next output (for the current iteration) consists of an estimate of the EFAS location of the aircraft for the estimated slant range, based on the allowables, and the relative position of the aircraft with respect to the burst at time of burst and, if a converged solution has been achieved, a notation of same.

The final output for each orientation is a summary of the integrated load definitions.

If the user has flagged the blast plot flag, KPLTMH, there will be plotted the material velocity time history and the time history of all the integrated loads.

If the print flag KPRTMH has been input, complete load time histories, will be printed for all integrated loads. If the print flag KPRBLS has been input there will result a complete printout of the gust, density and range time history, the Fourier transform of the gust material velocity times density ratio and the symmetric (and antisymmetric if necessary for the blast condition) frequency response function which consists of the product of the frequency response of the aircraft to the unit gust with the above transform function. The complete symmetric time history perturbation (and antisymmetric if required) solution for all integrated loads will also be printed.

SECTION VI

PROGRAM OPERATION

VIBRA-6 has been coded to operate on a CDC 6600. The concept of dynamic core has been utilized throughout the program, thus removing any restriction on the problem size other than the maximum core available.

Dynamic core on the CDC is achieved by using blank COMMON for all dimensioned variables. Since blank COMMON is loaded in central memory following the last subroutine, the remainder of core is available for use as dynamically allocated core. An RFL control card specifying the total central memory (program + dynamic core) must be specified before execution because blank COMMON has been dimensioned so that it has a length of 2. Dimensioning data are available from input data, the length of each array is calculated, and the starting location in COMMON of that array is referenced to the first location of COMMON as a subscripted array. The array dimensioning for each of the main program modules is shown in Tables 4 through 13. The tables show the variable length of each array and the relative location of that array with respect to the other arrays. Figure 22 shows graphically the relationship between the primary program modules and the various dimension levels. The total amount of core required to run any specific module can be calculated by using Table 14.

The various COMMON blocks used throughout the program are described in detail in Tables 15 through 19. The tables are self-explanatory except for Table 19. The COMMON block DDTBLS is essentially 10 tables

of 20 words each, where the second subscript of DDTBL is used to specify a given table. The tables are used by the data file access subroutines to read and write the appropriate data from the generated data files. The organization of the data on the files is described in Tables 20 through 24.

The Fortran listing of all subroutines is given in Volume III of this report.

The program is modularized such that each module can be executed independently, thus an efficient overlay feature is used to reduce the amount of central memory necessary for any given run. This overlay is accomplished using the CDC SEGLOAD loader. The SEGLOAD directives required are listed in Table 25.

TABLE 4

CONTROL MODULE (DACGUST) ARRAY DIMENSIONING

DIM LEVEL	FEI LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
MDL1	1	L1	20	AMODNO	MODE LOCATION DEFINER
	2	L2	NOMOI	WF	MODAL FREQUENCIES (Hz)
	3	L3	NOMOI.NOMOD	EMBAF	GENERALIZED MASS
	4	L4	NOMOL	EMWR2	GENERALIZED STIFFNESS
MDL2	5	L41	NOMOI	CPXDPG	STRUCTURAL DAMPING
	6	L9	NMS.NOMOD	PHIX	X-INERTIAL MODE SHAPES
	7	L10	NMS.NOMOD	PHIY	Y-INERTIAL MODE SHAPES
	8	L11	NMS.NOMOD	PHIZ	Z-INERTIAL MODE SHAPES
	9	L51	NTFS-4	TMSS	ACTIVE SYSTEM KINEMATICS SYMMETRIC
	10	L52	NTFA-4	TMSA	ACTIVE SYSTEM KINEMATICS ANTISYMMETRIC
	11	L53	2.NTFS-MXORD	TFCS	TRANSFER FUNCTION POLYNOMIAL SYMMETRIC
	12	L54	2.NTFA-MXORD	TFCA	TRANSFER FUNCTION POLYNOMIAL ANTISYMMETRIC
	13	L55	NTFS.NSYM	PHISS	MODAL AMPLITUDES SENSED (SYM)
	14	L56	NTFA.NASYM	PHISA	MODAL AMPLITUDES SENSED (ASM)
MDL3	15	L5	IMS.NMS	EM	MASS PROPERTY TABLE
	16	L6	NMS	ELXIO	XAAS COORDINATES OF MASSES
	17	L7	NMS	ELYIO	YAAS COORDINATES OF MASSES
	18	L8	NMS	ELZIO	ZAAS COORDINATES OF MASSES
	19*	L12	NDF.NMS.NOMOD	EMPHI	MASS TIMES MODE SHAPES
	20*	L13	2.NENG	NEMGM	ENGINE THRUST MASSES
	21**	L14	NDF.NDF.NMS	EMS	SECTIONAL MASS MATRIX
MDL4	15	L60	LENGTH1	D	SCRATCH
	15	L61	2.NTCTAP-NG	F	GUST FORCE
	16	L62	LENGTH2	WORK	SCRATCH
	16	L63	NTOTAP.NSYM	SPLS	AERO FORCE INTEGRATION MATRIX SYMMETRIC
	17	L64	NTOTAP.NASYM	SPLA	AERO FORCE INTEGRATION MATRIX ANTISYMMETRIC
	15	L70	6.NECK	GEOMBX	BOX AAS COORDINATES
	16	L71	6.NSPETO	GEOMED	BODY AAS COORDINATES

TABLE 4 (CONT'D)

CONTROL MODULE (DACGUST) ARRAY DIMENSIONING

DEFINITIONS:

NOMOD	TOTAL NUMBER OF MODES
NTFS	NUMBER OF SYMMETRIC TRANSFER FUNCTIONS
NTFA	NUMBER OF ANTISYMMETRIC TRANSFER FUNCTIONS
MXORL	(MXOBLK+1) (MXBLK)
MXOBLK	MAX. ORDER OF LARGEST TRANSFER FUNCTION BLOCK
MXPLK	NUMBER OF BLOCKS IN LARGEST TRANSFER FUNCTION
NSYM	NUMBER OF SYMMETRIC MODES
NASYM	NUMBER OF ANTISYMMETRIC MODES
IMS	NUMBER OF ITEMS IN MASS PROPERTY TABLE
NMS	NUMBER OF MASSES
NDF	NUMBER OF DEGREES OF FREEDOM PER MASS STATION
NENGs	NUMBER OF ENGINES
NBOX	NUMBER OF PANEL BOXES
NSBETO	NUMBER OF SLENDER BODY ELEMENTS
NTOTAP	NUMBER OF TOTAL AERO ELEMENTS (NBOX+2-NSBETO)
NG	NUMBER OF GUST ORIENTATIONS
LENGTH1	MAX(2-NSYM-NSYM, 2-NASYM-NASYM, NTOTAP-NSYM + NTOTAP-NASYM, 2-NTOTAP-NG)
LENGTH2	MAX(2-NBOX-NG, 2-NSBETO-NG, 2-NSYM-NSYM, 2-NASYM-NASYM)

- * Dimensioned only for unit loads calculations
- ** Dimensioned only if sectional data are input

TABLE 5

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM	REL	PROG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
ADL1	1	L1	NODES	ELXI	XAAS OF NODAL POINT
	2	L2	NODES	ELVI	YAAS CF NODAL POINT
	3	L3	NODES	ELZI	ZAAS OF NODAL POINT
	4	L4	NODES•MODES	PHINA	MODE SHAPE IN NORMAL DIR.
	5	L5	NCDES•MODES	PHIZA	MODE SHAPE IN Z-DIRECTION
	6	L6	NCDES•MODES	PHIYA	MODE SHAPE IN Y-DIRECTION
	7	L7	NF	NAS	NO. OF ASSOCIATED BODIES PER PANEL
	8	L8	NP•NE	NASB	ASSOCIATED BODY NUMBERS
	9	L9	NF	NBARAY	LAST BOX NO. OF EACH PANEL
	10	L10	NP	NCARAY	NO. OF CHORDWISE BOXES PER PANEL
	11	L11	NP	NSARAY	NO. OF SPANWISE BOXES PER PANEL
	12	L12	MSTRIP	ISSTR	SUPERSTRIP NO. OF EACH STRIP
	13	L13	MSTRIP	NSSTR	NO. OF STRIPS PER SUPERSTRIP
	14	L14	2•NB	IFLA	SEQUENCE NOS. OF IBE'S
	15	L15	2•NP	NEEA	IBE FLAGS
	16	L16	2•NB	NT12	NO. OF ANGULAR ORIENTATIONS PER BODY
	17	L17	NB	NSBEA	NO. OF SBE'S PER BODY
	18	L18	NB	YE	YAAS OF BODY CENTERLINES
	19	L19	NB	ZB	ZAAS OF BODY CENTERLINES
	20	L20	NB	AFB	BODY CROSS-SECTIONAL ASPECT RATIO
	21	L21	NB	AVF	BODY AVE. CHARACTERISTIC HALF-WIDTH
	22	L22	NB	XLE	XAAS OF LEADING EDGE OF BODY
	23	L23	NB	XTE	XAAS OF TRAILING EDGE OF BODY
	24	L24	MBE	FIA	RADII OF IBE'S
	25	L25	NB•10	TH1A	TH1 VALUES FOR ALL BODIES
	26	L27	MSPE	A0	SBE HALF-WIDTHS
	27	L28	MSEE	A0P	X-DEFIVATIVE OF THE A0 VALUES
	28	L29	MSPE	XIS1	XAAS OF LEADING EDGE OF SBE'S
	29	L30	MSEE	XIS2	XAAS OF TRAILING EDGE OF SBE'S
	30	L31	MSTRIP+NB	CG	COSINE OF DIHEDPAL OF STRIPS
	31	L32	MSTRIP+NB	CS	CHORD LENGTH OF STRIPS
	32	L33	MSTRIP+NB	EE	HALF-WIDTH OF STRIPS
	33	L34	MSTRIP+NB	SG	SINE OF DIHEDRAL OF STRIPS
	34	L35	MSTRIP+NB	YS	YAAS OF STRIP CENTERLINE AND BODY ELEMENTS
	35	L36	MSTRIP+NB	ZS	ZAAS OF STRIP CENTEFLINE AND BODY ELEMENTS

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
ADL1 CONT.	36	L37	MSTRIP+NB	XIJ	XAAS OF LEADING EDGE OF STRIP CENTERLINES
	37	L38	MSTRIP+NB	YIN	YAAS OF INBOARD EDGE OF PANEL
	38	L39	MSTRIP+NB	ZIN	ZAAS OF INBOARD EDGE OF PANEL
	39	L40	MSTRIP+NB	COORD	SPANWISE COORDINATE OF STRIPS
	40	L41	NTOTAL	X	XAAS OF 3/4 CHORD OF BOXES AND MIDPOINT OF IPE'S
	41	L42	NTOTAL	XIC	XAAS OF 1/4 CHORD OF BOXES
	42	L43	NTOTAL	DELX	AVE. CHORD-LENGTHS OF BOXES AND IBE'S
	43	L44	NTOTAL	XLAM	TANGENT OF SWEEP OF 1/4 CHORD OF BOXES
	44	L45	NTOTAL	H	A COLUMN OF h MATRIX
	45	L46	NTOTAL	DHDX	A COLUMN OF dh/dx MATRIX
	46	L47	NTOTAL	DELA	AREAS OF BOXES
	46A	L47A	4*NTOTAL	KC	X-COORDINATES OF CORNERS OF LIFTING SURFACE BOXES
	47	L48	2*NTOTAL	DT	A ROW OF THE DT MATRIX
	48	L49	2*NTOTAL	DTA	A ROW OF THE DTA MATRIX
	49	L50	2*(MCDES+NG)	RHS	TEMPORARY ARRAY
ADL2	50	L1	NCMAX	TH	PANEL CHORDWISE DIVISIONS
	51	L2	NSMAX	TAU	PANEL SPANWISE DIVISIONS
	52	L3	MBE	XII	XAAS OF IBE'S
	53	L4	MBF	PI	SEMI-WIDTHS OF IBE'S
	54	L5	MSBE	XIS	XAAS OF SBE'S
	55	L6	MSBE	RS	SEMI-WIDTHS OF SBE'S
	56	L7	NP	GMA	DIHEDRAL ANGLES OF PANELS
	57	L8	MSTRIP+NB	DYS	dy OF PANEL STRIPS
	58	L9	MSTRIP+NB	DZS	dz OF PANEL STRIPS
	59	L10	MSTRIP+NB	GMAR	DIHEDRAL ANGLE OF STRIPS
	60	L11	NTOTAL	XI1	XAAS OF INBOARD OF 1/4 CHORD LOCATION OF BOXES
	61	L12	NTOTAL	XI2	XAAS OF OUTBOARD OF 1/4 CHORD LOCATIONS OF BOXES
	62	L13	NTOTAL	ETA1	YAAS OF INBOARD OF BOXES AND CENTERLINE OF SBE'S
	63	L14	NTOTAL	ETA2	YAAS OF OUTBOARD OF BOXES AND CENTERLINE OF SBE'S
	64	L15	NTOTAL	ZETA1	ZAAS OF INBOARD OF BOXES AND CENTERLINE OF SBE'S
	65	L16	NTOTAL	ZETA2	ZAAS OF OUTBOARD OF BOXES AND CENTERLINE OF SBE'S
	66	L17	NTOTAL	ETA	YAAS OF CENTERLINE OF 3/4 CHORD LOCATION OF BOXES

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
	67	L18	NTOTAL	ZETA	ZAAS OF CENTERLINE OF 3/4 CHORD LOCATION OF BOXES
	68	L19	MSBE	ETAS	YAAS OF LEADING EDGE OF SBE'S
	69	L20	MSBE	ZETAS	ZAAS OF LEADING EDGE OF SBE'S
ADL3	50	N1	NB	NBCUM	SBE INDEXES
	51	N2	MAX(NB,NP)	INSUP	BODY/PANEL NUMBERS
	52	N3	NODES	NODE	NODE NUMBERS IN SUPERBODY/ SUPERPANEL
	53	N4	NODES	XIQ	XAAS OF NODAL POINTS IN SUPERBODY/SUPERPANEL
	54	N5	NODES	ETAQ	YAAS OF NODAL POINTS IN SUPERBODY/SUPERPANEL
	55	N6	MSTFIP+NB	CSG	COSINES OF MODIFIED DIHEDRALS OF STRIPS
	56	N8	NTOTAL	X3L	SBE ENDPOINTS PER SUPERBODY
	57	N9	NTOTAL	YL	YAAS OF ELEMENTS IN SUPERBODY
	58	N10	NTOTAL	XP	XAAS OF BOXES IN SUPERPANEL
	59	N11	NTOTAL	YP	YAAS OF BOXES IN SUPERPANEL
	60	N12	NMAX-NMAX	XKD	WORK ARRAY FOR SPLINE
	61	N13	NMAX-NMAX	FHS	WORK ARRAY FOR SPLINE
ADL4	50	L1	NIMAX	COL	COLUMN OF h OR dh/dx
	51	L2	NTMAX-MODE	WORK	WORK ARRAY USED BY ORGN
ADL5	50	L1	2-NTOTAL	DT	ROW OF DT MATRIX
	50	L1	2-NTOTAL	DPZ	ROW OF DPZ MATRIX
	51	L2	2-NTOTAL	DPY	ROW OF DPY MATRIX
	52	L3	2-NTOTAL	DTA	ROW OF DTA MATRIX
	52	L3	2-NTOTAL	DPZA	ROW OF DPZA MATRIX
	53	L4	2-NTOTAL	DPYA	ROW OF DPYA MATRIX
	54	L5	112-NCMAX	WORK	WORK ARRAY FOR GEND
ADL6	50	L1	4-NTOT-MSBE+ 6-NTOT+ 10-MSBE	WORK	WORK AREA FOR SB
ADL7	50	L1	4-LENGTH	BFS	ROW OF SYMMETRIC BFS MATRIX
	51	L2	4-LENGTH	BFA	ROW OF ANTI-SYMMETRIC BFS MATRIX
ADL8	50	L1	2-NTOTAL	W	COLUMN OF W MATRIX
	51	L2	2-NTOTAL	DW	COLUMN OF DW MATRIX
	52	L3	2-NTOTAL	COL	COLUMN FOR WORK STORAGE

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
ADL9	50	L1	2*NTCTAL	WGS	COLUMN OF SYMMETRIC GUST BOUNDARY CONDITIONS
	51	L2	2*NTCTAL	WGA	COLUMN OF ANTI-SYMMETRIC GUST BOUNDARY CONDITIONS
ADL10	50	L1	2*NTCT*NMODE	WORK	WORK AREA FOR FHSIDE
ADL11	50	L1	2*MAX(3*NPM, NTOT*NMODE)	WORK	WORK AREA FOR SOLVIT
ADL12	50	L1	2*LENGTH	DT	WORK ARRAY FOR MATMUL
	51	L2	4*LENGTH*MSBE	WORK	WORK ARRAY FOR MATMUL
ADL13	50	L1	2*NTMAX	FORCE	POINT FORCE COLUMN
	51	L2	2*NTMAX	GF	GENERALIZED FORCE COLUMN
	52	L3	2*NTMAX	WORK	WORK ARRAY
ADL14	50	L1	2*NTOTAL	DCP	NODAL POINT PRESSURES
	51	L2	2*NRMAX	FZ	BODY ELEMENT z-FORCES
	52	L3	2*NRMAX	FY	BODY ELEMENT y-FORCES
	53	L4	2*NRMAX	CN	STRIP LIFT COEFFICIENTS
	54	L5	2*NRMAX	CM	STRIP MOMENT COEFFICIENTS
	55	L6	2*NRMAX	SPLD	SPAN LOADS
	56	L7	2*NB	CZB	BODY LIFT COEFFICIENT IN z-DIRECTION
	57	L8	2*NB	CYB	BODY LIFT COEFFICIENT IN y-DIRECTION
	58	L9	2*NP	CNB	BODY YAWING MOMENT COEFF.
	59	L10	2*NB	CMB	BODY PITCHING MOMENT COEFF.
	60	L11	MSTRIP	CPR	STRIP CENTER OF PRESSURE (REAL PART)
	61	L12	MSTRIP	CPI	STRIP CENTER OF PRESSURE (IMAGINARY PART)

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DEFINITIONS:

SBE	SLENDER BODY ELEMENT
IBE	INTERFERENCE BODY ELEMENT
NODES	NUMBER OF AERODYNAMIC NODAL POINTS
MODES	NUMBER OF MODES = $NSYM + NASYM$
MODE	$MAX(NSYM, NASYM)$
NMODE	$MODE + NG$
NP	TOTAL NUMBER OF PANELS ON ALL LIFTING SURFACES
NE	TOTAL NUMBER OF BODIES
MSTRIP	TOTAL NUMBER OF STRIPS FOR ALL BODIES
MBE	TOTAL NUMBER OF IBE'S FOR ALL BODIES + 1
MSBE	TOTAL NUMBER OF SEE'S FOR ALL BODIES + 1
NTOTAL	TOTAL NUMBER OF LIFTING SURFACE BOXES + $2 \cdot MSBE$
NTOT	TOTAL NUMBER OF LIFTING SURFACE BOXES + $2 \cdot MBE$
NPM	$NTOT + NMCD$
NMAX	$NTOTAL + 3$
NCMAX	MAX. NO. OF CHORDWISE BOXES PER PANEL
NSMAX	MAX. NO. OF STRIPS PER PANEL
NTMAX	$MAX(NTOTAL, 2 \cdot MBE)$
LENGTH	$NTOTAL + 2 \cdot MBE$
NRMAX	$MAX(MSTRIP, MSBE, MODES + 2 \cdot NG)$
NG	NUMBER OF GUST ORIENTATIONS

TABLE 6

UNIT LOADS MODULE ARFAY DIMENSIONING

DIM	FEL	PROG		ARFAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
LDL1	1	L1	7-NBEAMS	BEAMGM	BEAM GEOMETRY
	2	L2	8-NINTLD	STALDS	INTEGRATED LOAD DEFINITION
	3	L3	3-NMGRF	NFNLNB	MASS SPARSING ARRAY
	4	L4	3-NAEGFP	NFNLAB	AERO BOX SPARSING AFFAY
	5	L5	3-NSGRF	NFNLSB	SLENDER BODY SPARSING AFFAY
	6	L6	NSTRES-NINTLD	STRESS	STRESS/INTEGRATED LOAD
	7	L7	3-3-NMGRP	TLAMV	INERTIAL DOF DIF. COSINES
	8	L8	NBEAMS-NBEAMS	NSEQ	BEAM LOAD PATHS
	9	L9	NBEAMS	NECON	BEAM CONNECTIONS
	10	L91	NINTLD	SYMCOD	CENTERLINE LOAD MOD. (SYM)
	11	L92	NINTLD	ASMCOD	CENTERLINE LOAD MOD. (ASYM)
	12	L10	3-3-NBEAMS	TLAMM	BEAM/LOAD DIRECTION COSINES
	13	L11	4-NBEAMS	TLAMY	LOAD BEAM PLANE DEF.
LDL2	14	L12	LENGTH	PINTF	INTG'D LOADS DUE TO X MASS
	15	L13	LENGTH	PINTL	INTG'D LOADS DUE TO Y MASS
	16	L14	LENGTH	PINTH	INTG'D LOADS DUE TO Z MASS
	17*	L141	LENGTH	PINTT	INTG'D LOADS DUE TO THETA
	18*	L142	LENGTH	PINTA	INTG'D LOADS DUE TO ALPHA
	19*	L143	LENGTH	PINTP	INTG'D LOADS DUE TO PSI
	20	L15	NINTLD-NENG	THPLOL	INTG'D LOADS DUE TO THRUST
	21	L16	NSYM-NENG	THFGNF	GEN. FORCE DUE TO THRUST
	20	L15	NINTLD-NM	PIQ	INTG'D LOADS DUE TO GEN. FESP
LDL3	14	L12	LENGTHA	PINTP	INTG'D LOAD DUE TO AERO BOXES
	15	L13	LENGTHB	PINTZ	INTG'D LOAD DUE TO Z-SBE
	16	L14	LENGTHB	PINTY	INTG'D LOAD DUE TO Y-SBE
LDL4	17	L15	NBOXES	BBXIO	XAAS COORD. OF BOX FORCE LOAD
	18	L16	NBOXES	BBYIO	YAAS COORD. OF BOX FORCE LOAD
	19	L17	NBOXES	BBZIO	ZAAS COORD. OF BOX FORCE LOAD
	20	L18	NBOX	XI1	BOX INNER XAAS
	21	L19	NBOX	ETA1	BOX INNER YAAS
	22	L20	NBOX	ZETA1	BOX INNER ZAAS
	23	L21	NBOX	XI2	BOX OUTER XAAS
	24	L22	NBOX	ETA2	BOX OUTER YAAS
	25	L23	NBOX	ZETA2	BOX OUTER ZAAS
LDL5	17	L15	NAFSE	SBXIO	XAAS COORD OF SBE FORCE
	18	L16	NAFSE	SBYIO	YAAS COORD OF SBE FORCE
	19	L17	NAFSE	SBZIO	ZAAS COORD OF SBE FORCE
	20	L18	NSBETO	XIS1	SBE INNER XAAS
	21	L19	NSPETO	ETAS1	SBE INNER YAAS
	22	L20	NSPETO	ZETAS1	SBE INNER ZAAS
	23	L21	NSPETO	XIS2	SBE OUTER XAAS

TABLE 6 (CONT'D)

UNIT LOADS MODULE ARRAY DIMENSIONING

DIM	REL	PROG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
	24	L22	NSPETO	ETAS2	SBE OUTER YAAS
	25	L23	NSBERO	ZETAS2	SBE OUTET ZAAS
LPL6	17	L15	MXFOW-MXCOL	FPH	BOX OR BODY FORCE DUE TO MODAL AMPLITUDE
	18	L16	NINTLD-MXCOL	PAQ	INTG'D LOAD DUE TO MODAL AMPLITUDE

DEFINITIONS:

SRF	SLENDER BODY ELEMENT
NBEAMS	NUMBER OF LOAD BEAMS
NINTLD	NUMBER OF INTEGRATED LOADS
NMGRP	NUMBER OF MASS GROUPS
NABGRP	NUMBER OF AERO BOX GROUPS
NSEGRP	NUMBER OF SLENDER BODY ELEMENT GROUPS
NSTRESS	NUMBER OF STRESSES
NMASS	MAX. NO. OF MASSES IN THE NMGRP MASS GROUPS
NBOXES	MAX. NO. OF AERO BOXES IN THE NABGRP BOX GROUP
NBOX	NUMBER OF AERO BOXES (TOTAL)
NAEFSE	MAX. NO. SLENDER BODY ELEMENTS IN THE NSEGRP BODY GROUP
LENGTH	NINTLD-NMGRP-NMASS
LENGTHA	NINTLD-NAEGRP-NBOXES
LENGTHB	NINTLD-NSEGRP-NAEFSE
NSPETO	NUMBER OF SLENDER BODY ELEMENTS (TOTAL)
NENGS	NUMBER OF ENGINES
NSYM	NUMBER OF SYMMETRIC MODES
NASYM	NUMBER OF ANTISYMMETRIC MODES
NM	TOTAL NUMBER OF MODES (NSYM+NASYM)
MXFOW	MAX(NBOX, NSPETO)
MXCOL	2-MAX(NSYM, NASYM)

* Dimensioned only if sectional data are input

TABLE 7
ACTIVE SYSTEM MODULE AFRAY DIMENSIONING

DIM	REL	PROG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
CDI 1	1	L1	NTFM-MXORD	ANUM	TEMPORARY ARRAYS FOR
	2	L2	NTFM-MXORD	ADEN	FORMING TRANSFER
	3	L3	2-MXCRC	ATEN	FUNCTION POLYNOMIALS
	4	L4	2-MXCRC	ATFD	TFCS AND TFCA
	5	L5	MXORD	ANUMT	
	6	L6	MXOFI	ACENT	

DEFINITIONS:

NTFM	MAX. NO. TRANSFER FUNCTIONS (NTFS OR NTFA)
MXBLK	NO. BLOCKS IN LARGEST TRANSFER FUNCTION
MXOBLK	MAX ORDER OF LARGEST FUNCTION BLOCK
MXORD	MXBLK * (MXOBLK+1)

TABLE 8

FREQUENCY RESPONSE MODULE ARFAY DIMENSIONING

DIM	FEL	PROG		ARFAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
FDL1	1	L12	2-NMMX-NMMX	D	GEN. FORCE DUE TO MOTION
	2	L13	2-NMMX	F	GEN. FORCE DUE TO GUST
	3	L14	NVEW	OMEGA	FREQUENCY (RAD/SEC)
	4	L15	2-NM	Q	GEN. RESPONSE
	5	L18	2-NMMX-NMMX	TFM	SCRATCH FOR ACTIVE SYSTEM
	6	L19	NTOTAP-NSYM	SPLS	AERO FORCE INTEGR MAT (SYM)
	7	L20	NTOTAP-NASYM	SPLA	AERO FORCE INTEGR MAT (ASM)
FDL2	8	N1S	2-NSYM2-NK	DSALL	SYM. GEN. AERO (ALL NK)
	9	N2S	2-NTOTAP-NK	FSALL	SYM. GEN. GUST (ALL NK)
	10	N3S	NTCTAP-NK	FS	SYM. MODULUS GUST (ALL NK)
	11	N4S	NTOTAP-NK	TANS	SYM. PHASE GUST (ALL NK)
	12	N5S	2-NTCTAP	FS	SYM. GUST FORCE
	13	N1A	2-NASYM2-NK	CAALL	ASYM. GEN. AERO (ALL NK)
	14	N2A	2-NTCTAP-NK	FAALL	ASYM. GEN. GUST (ALL NK)
	15	N3A	NTOTAP-NK	RA	ASYM. MODULUS GUST (ALL NK)
	16	N4A	NTOTAP-NK	TANA	ASYM. PHASE GUST (ALL NK)
	17	N5A	2-NTCTAP	FA	ASYM. GUST FORCE

DEFINITIONS:

NMMX MAX(NSYM,NASYM)
 NVEW NC. FREQUENCIES FOR SOLUTION (NFREQ)
 NM TOTAL NO. MODES (NSYM+NASYM)
 NK NO. HARD POINT AERO MATRICES
 NTOTAP TOTAL NO. AERO ELEMENTS (NBOX+2-NSBETO)
 NSYM NO. SYM MCDES
 NASYM NO. ASYM MODES
 NSYM2 NSYM-NSYM
 NASYM2 NASYM-NASYM

TABLE 9

UNIT GUST LOAD MODULE ARRAY DIMENSIONING

DIM	REL	PROG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
GDL1	1	L60	NFREQ	PLOT	PLOTTING ARRAY
	2	L61	NFREQ	PLOT	PLOTTING ARRAY
	3	L1	NINTLD·NFREQ	PS	SYMMETRIC UNIT GUST LOADS
	4	L2	NINTLD·NFREQ	PA	ANTISYMMETRIC UNIT GUST LOADS
	5	L3	NFREQ	OMEGA	FREQUENCIES (RAD/SEC)
	5A	L3A	2·NACC	INDACC	ACCELERATION INDICES
GDL2	6	L4	NK·NFREQ	COEF	INTERPOLATION COEFFICIENTS
	7	L5	2·NM·NFREQ	Q	GEN. RESPONSES
GDL3	8	L6	NINTLD·NM	PIQ	INERTIA FORCES DUE TO GEN. RESPONSE
GDL4	8	L7	2·NINTLD·NSYM	PAQS	AERO FORCES DUE TO SYM RESP.
	9	L8	2·NINTLD·NASM	PAQA	AERO FORCES DUE TO ASYM RESP.
GDL5	6	L51	NINTLD	SYMCOD	CENTERLINE LOAD MOD (SYM)
	7	L52	NINTLD	ASMCOD	CENTERLINE LOAD MOD (ASYM)
	8	L9	3·NABGRP	NFNLAB	SEE LOAD
	9	L10	3·NSBGRP	NFNLSB	SEE LOAD
	10	L11	LENGTHA	PINTP	SEE LOAD
	11	L12	LENGTHB	PINTZ	SEE LOAD
	12	L13	LENGTHC	PINTY	SEE LOAD
GDL6	13	L62	2·NTOTAP	FGPS	SYM GUST FORCES
GDL7	13	L63	2·NTOTAP	FGPA	ASYM GUST FORCES

DEFINITIONS:

NFREQ	NO. FREQUENCIES FOR SOLUTION
NINTLD	NO. INTEGRATED LOADS
NK	NO. HARD POINT AERO MATRICES
NM	NO. TOTAL MODES (NSYM+NASM)
NSYM	NO. SYMMETRIC MODES
NASM	NO. ANTISYMMETRIC MODES
NABGRP	NO. AERO BOX GROUPS
NSBGRP	NO. SLENDER BODY ELEMENT GROUPS
NBOXES	MAX NO. AERO BOXES IN ANY NABGRP BOX GROUP
NAERSE	MAX NO. SLENDER BODY ELEMENTS IN ANY NSBGRP BODY GROUP
LENGTHA	NINTLD·NABGRP·NBOXES
LENGTHB	NINTLD·NSBGRP·NAERSE
NTOTAP	TOTAL NO. AERO ELEMENTS (NBOX+2·NSBETO)

TABLE 10

TRIM MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
TDL1	1	L1	NM	Q	GEN. STATIC RESPONSE
	2	L2	NM	QDOT	GEN. STATIC RATE RESPONSE
	3	L14	NINTLD.NENGs	THRLOD	INTGD LOADS DUE TO THRUST
	4	L15	NSYM.NENGs	THFGNF	GEN. FORCE DUE TO THRUST
TDL2	5	L3	NMS.NMS	ZSYM	SYM. EQNS. STATIC TRIM
	6	L4	NMS	FSYM	RHS EQNS. STATIC TRIM
	7	L5	2.NSYM.NSYM	DSYM	GEN. SYM AEFO
TDL3	5	L6	NMA.NMA	ZASYM	ASYM. EQNS. STATIC TRIM
	6	L7	NMA	FASYM	RHS EQNS. STATIC TRIM
	7	L8	2.NASM.NASM	DASYM	GEN. ASYM AEFO
TDL4	5	L11	NINTLD.NM	PIQ	INTGD INERTIAL LOADS, INERTIAL RESPONSE
TDL5	5	L12	2.NINTLD.NSYM	PAQS	INTGD SYM LOADS, AERO GEN. RESPONSE
	6	L13	2.NINTLD.NASM	PAQA	INTGD ASM LOADS, AERO GEN. RESPONSE

DEFINITIONS:

NM	NO. TOTAL MODES (NSYM+NASM)
NSYM	NO. SYM MODES
NASM	NO. ASM MODES
NINTLD	NO. INTGD LOADS
NENGs	NO. ENGINES
NMS	2+NO. ELASTIC MODES (SYM)
NMA	3+NO. OF ELASTIC MODES (ASYM)

TABLE 11

BLAST AND TIME HISTORY MODULE ARRAY DIMENSIONING

DIM	REL	PPOG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
BDI1	1	L1	NINTID	PSTR	SYM. TRIM LOADS
	2	L2	NINTID	PATR	ASM. TRIM LOADS
	3	L21	NSTRSS-NINTLD	STRESS	STRESS/INTGD LOAD
	4	L22	NENGS	THRUST	ENGINE THRUST
	5	L23	NINTID	SYMCOD	CENTER LINE LOAD MOD. (SYM)
	6	L24	NINTID	ASMCOD	CENTER LINE LOAD MOD. (ASYM)
BDL2	7	L3	NORMAX	NOR	BLAST ORIENTATION CODES
	8	L4	NORMAX	REST	BLAST ESTIMATED RANGES
	9	L5	8-NINTLD	STALDS	INTEGRATED LOAD DEFINITION
	10	L6	NFREQ	OMEGA	FREQUENCIES (RAD/SEC)
	11	L7	LENGTH	PS	SYM. GUST LOADS (FFREQ DOMAIN)
	11	L7	NSTRSS-NTMRSP	STF	RIGHT SIDE STRESSES
	12	L8	LENGTH	PA	ASM. GUST LOADS (FFREQ DOMAIN)
	12	L8	NSTRSS-NTMRSP	STL	LEFT SIDE STRESSES
	13	L9	NTMGST	VELG	GUST VELOCITY
	14	L10	NTMGST	TIMG	GUST VELOCITY TIMES
	15	L11	NTMGST	RHO	GUST DENSITY
	16	L12	NFREQ	PLOTF	PLOT ARRAY
	17	L13	NFREQ	PLOTA	PLOT ARRAY
	18	L14	2-NFREQ	FTG	FOURIER TRANSFORM OF VELG-RHO
	19	L15	NINTLD-NTMRSP	PST	RIGHT SIDE LOADS (TIME DOMAIN)
	20	L16	NINTLD-NTMRSP	PAT	LEFT SIDE LOADS (TIME DOMAIN)
	21	L17	NTMRSP	TIME	LOAD TIMES
	22	L18	MAX1	PKL	PEAK LOADS (OR STRESSES)
	23	L19	NINTLD-2	ALLOWS	MAX. ALLOWABLE STRESSES
	11	L7	6-MBCX	GEOMBX	BOX AAS COORDINATES
	12	L8	6-NSFETO	GEOMBC	BODY AAS COORDINATES

DEFINITIONS:

NINTLD NO. INTEGRATED LOADS
 NSTRSS NO. STRESSES
 NENGS NO. ENGINES
 NORMAX NO. ORIENTATIONS TO ANALYZE
 NFREQ NO. FREQUENCY SOLUTIONS
 NTMRSP NO. SOLUTION TIME POINTS
 NTMGST NO. GUST HISTORY TIME POINTS
 NBOX NO. PANEL BOXES
 NSFETO NO. SLENDER BODY ELEMENTS
 LENGTH 2-NINTLD-NFREQ
 MAX1 MAX (NINTLD-8, NSTRSS-8)

TABLE 12
RIGID MODULE ARRAY DIMENSIONING

DIM	FEL	PFOG		ARRAY	
LEVEL	LOC	ID	LENGTH	NAME	DEFINITION
RDL1	1	L1	NFREQ	OMEGA	FREQUENCIES
	2	L2	MAX1	TIME	TIME
	3	L3	NFOFC	GEOM	FORCE GEOMETRY
	4	L4	2·NFCPC	CPT	FORCES DUE TO TFIM
	5	L5	2·NFORC·NFREQ	CP	FORCES AND PRESSURES VS FREQ
RDL2	6	L6	NBOX	IBOXES	AERO BOX NUMBERS
	6A1	L7	2·NSBE	ISBES	SLENDER BODY ELEMENTS
	6A2	L8	NSYM	Q	GENERALIZED COORDINATES
	6A3	L20	2·NFOFC·NK	FI	INPUT AERO GUST FORCES
	6A4	L21	NK	VOBWS	REDUCED VELOCITIES FROM AERO
	6A5	L22	NFOFC·NK	RS	MODULUS GUST
	6A6	L23	NFOFC·NK	TANS	PHASE GUST
	6A5	L9	MBOX·5	GEOP	PANEL GEOMETRY
	6A5	L10	MSEE·6	GEOS	BODY GEOMETRY
	6A5	L10A	3·NORMAX	CP	GUST DIRECTION COSINES
	6A5	L11	2·MBOX·MAX2	C	BOX AERODYNAMICS
	6A5	L12	2·MSEE·MAX2	LB	SLENDER BODY AERO
RDL3	6	L13	NTMGST	DP	CVEPPRESSURE
	6B1	L14	NTMGST	RHO	GUST DENSITY
	6B2	L15	NTMGST	VG	MATERIAL VELOCITY
	6B3	L16	NFREQ	PLOT	PLOT ARRAY
	6B4	L17	MAX3	PLOTA	PLOT ARRAY
	6B5	L18	2·NFREQ	FTG	FOURIER TRANSFORM OF VG·RHO
	6B6	L19	NFORC·NTMRSP	P	FORCES & PRESSURES VS TIME

DEFINITIONS:

NFREQ	NO. FREQUENCY SOLUTIONS
NTMGST	NO. GUST HISTORY TIME POINTS
NTMRSP	NO. SOLUTION TIME POINTS
NFOFC	NO. OF FORCES
NBOX	NO. OF AERO BOXES
NSBE	NO. OF SLENDER BODY POINTS
NSYM	NO. OF SYMMETRIC MODES
NK	NO. OF REDUCED FREQUENCIES ON AERO FILE
MBOX	NO. OF AERO BOXES ON AERO FILE
MSBE	NO. OF SLENDER BODY ELEMENTS ON AERO FILE
NORMAX	NO. OF ORIENTATIONS TO BE ANALYZED
NGUST	NO. OF GUST ORIENTATIONS ON AERO FILE
MAX1	MAX(NTMGST, NTMRSP)
MAX2	MAX(NSYM, NGUST)
MAX3	MAX(NFREQ, NTMRSP)

TABLE 13

MERGE MODULE ARRAY DIMENSIONING

DIM LEVEL	FEL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
XDL1	1	L1	INK1	FKIN1	FREQUENCIES TO BE MERGED FROM TAPE17 FILE
	2	L2	INK2	FKIN2	FREQUENCIES TO BE MERGED FROM TAPE18 FILE
	3	L3	INK1+INK2	PK	DESIRED FREQS ON TAPE19 FILE
	4	L4	NK1	RK1	REDUCED FREQS ON TAPE17 FILE
	5	L5	NK2	FK2	REDUCED FREQS ON TAPE18 FILE
	6	L6	LENGTH	WORK	WORK ARRAY

DEFINITIONS:

INK1 NO. OF FREQUENCIES TO BE MERGED FROM TAPE17 FILE
 INK2 NO. OF FREQUENCIES TO BE MERGED FROM TAPE18 FILE
 NK1 NO. OF FREQUENCIES ON TAPE17 FILE
 NK2 NO. OF FREQUENCIES ON TAPE18 FILE
 LENGTH $6 \cdot \text{MAX}(\text{NEOX}, \text{NSPE})$
 NBOX NO. OF AERO BOXES
 NSPE NO. OF SLENDER BODY ELEMENTS

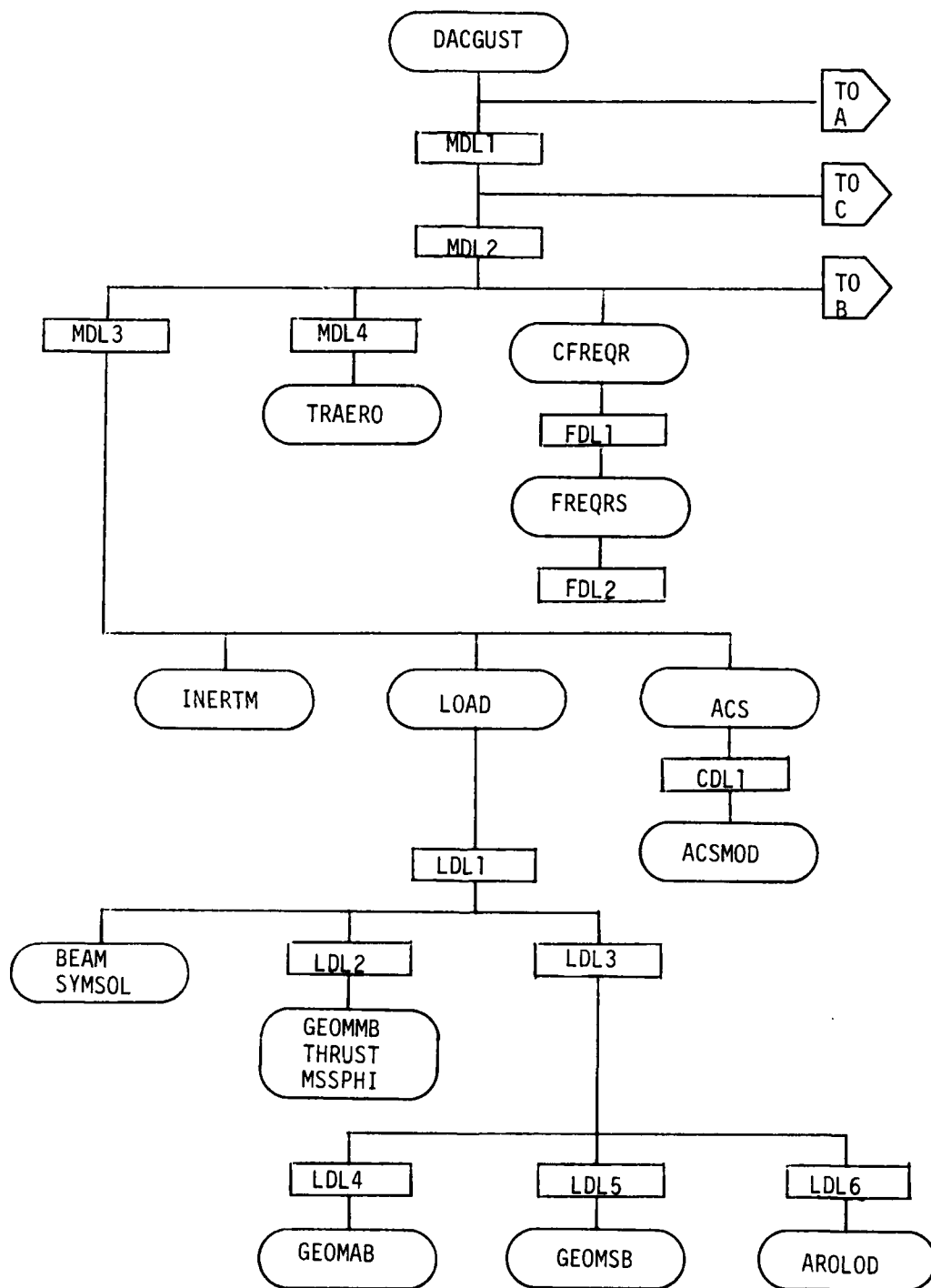


Figure 22. Dynamic Core Overlay Structure

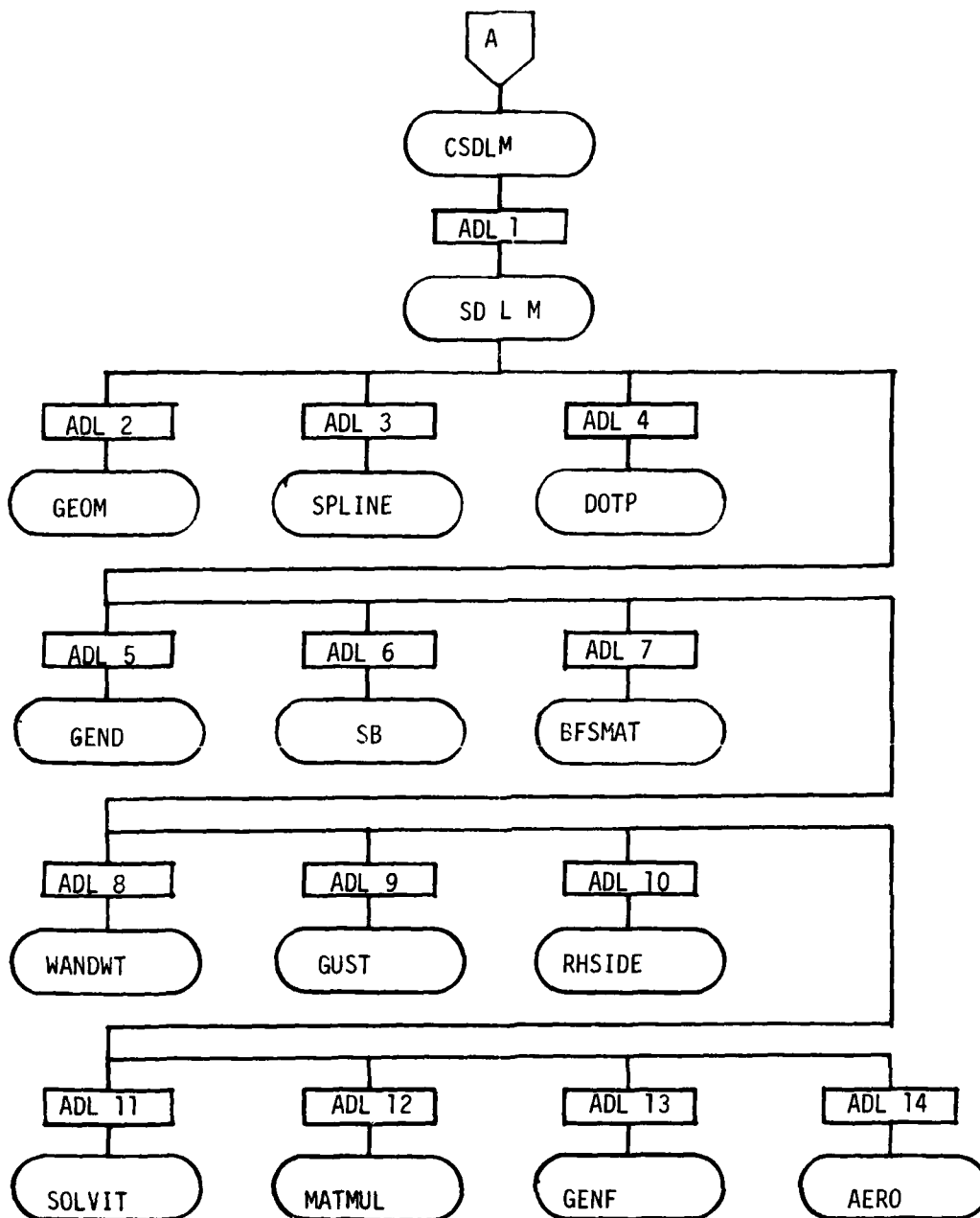


Figure 22 (cont'd). Dynamic Core Overlay Structure

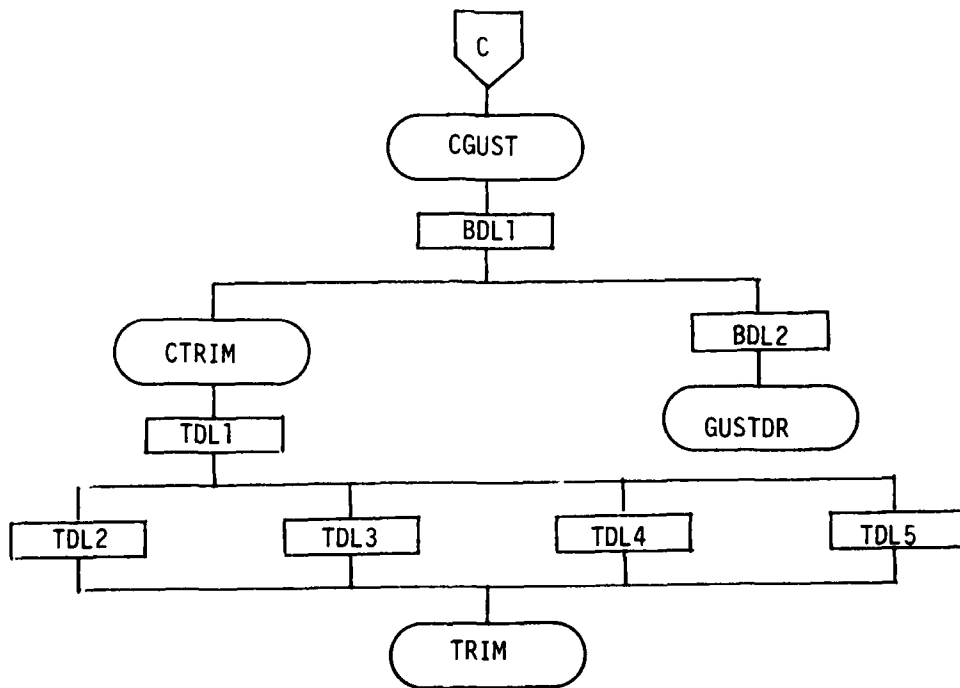
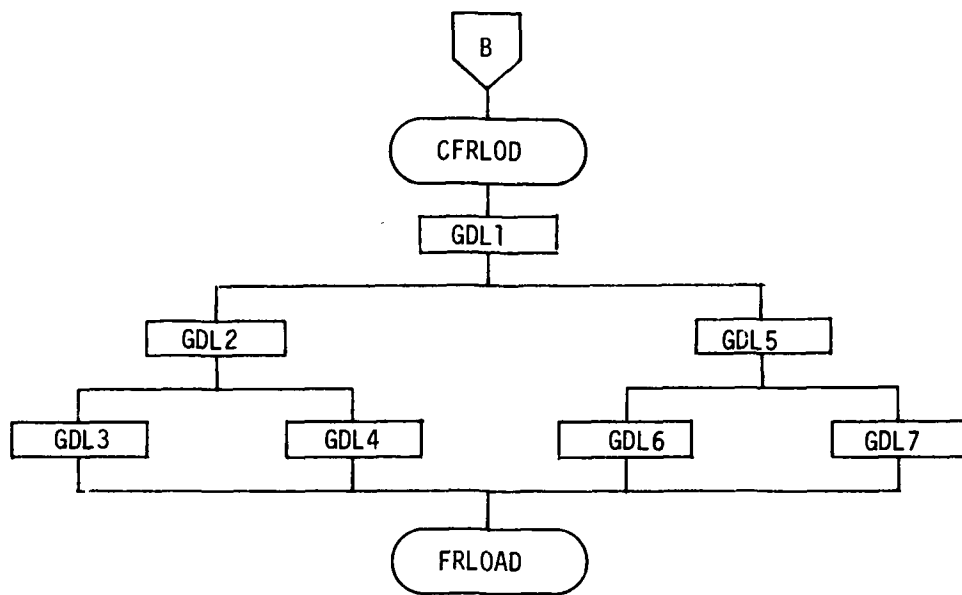


Figure 22 (Cont'd). Dynamic Core Overlay Structure

TABLE 14
CENTRAL MEMORY REQUIREMENTS

MODULE	CENTRAL MEMORY (DECIMAL WORDS)
Program	40,000
AERO	$ADL1 + \text{MAX} (ADL6, ADL 11, ADL 12)$
UNIT	$MDL1 + MDL2 + MDL3 + LDL1 + LDL3 + LDL6$
ACSM	Other modules are always longer
FRSP	$MDL1 + MDL2 + FDL1 + FDL2$
GUST	$MDL1 + MDL2 + GDL1 + GDL5 + GDL6$
BLST	$MDL1 + BDL1 + BDL2$
RIGD	$RDL1 + \text{MAX} (RDL2, RDL3)$
MERG	$XDL1$

Note: If more than one module is to be executed then the amount of central memory required is that necessary for the longest module.

TABLE 15

XTF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	AMACH	Mach number
2	GAMX	direction cosine in x-direction for current gust orientation
3	VSS	speed of sound
4	P0	atmospheric pressure at altitude
5	NMS	number of 'right hand side' mass points, including centerline masses
6	NSYM	number of symmetric modes
7	NASYM	number of antisymmetric modes
8	NOMOD	total number of modes, NSYM + NASYM
9	NFREQ	number of frequencies in frequency response
10	NENGS	number of engines on right hand side and centerline
11	IDENT	identification number of configuration
12	BZERO	reference semi-chord
13	RHO0	density at sea level
14	SIGMA	density ratio
15	EQUVAS	equivalent airspeed factor
16	IUNITS	airspeed units flag; = 2, knots
17	VKEAS	velocity, equivalent airspeed in knots
18	VTFPS	velocity, true airspeed in ft/sec
19	ALT	altitude, ft
20	KPFCHK	=nm, print all matrices in frequency response and unit gust load calculations for orientations n and m
21	KPFCXI	=nm, print generalized response (q) and integrated loads (P) due to unit gust for orientations n and m
22	KPRELS	=1, print load time history matrices
23	KPFTPM	=1, print all matrices in trim solution
24	KPRLDS	=1, print unit load matrices
25	KPFTMH	=1, print total load time history
26	IPLQ	=n, plot generalized response (q) for nth orientation
27	IPLL	=n, plot nth load due to unit gust for all orientations
28	IPL5L	=1, plot load time histories for RHS of aircraft =2, plot load time histories for LHS of aircraft =3, plot both RHS and LHS
29	NACC	number of accelerations
31	NEEAMS	number of beams for integrated loads
32	NINTLD	number of integrated loads
33	NSTRSS	number of stresses
34	NMGRP	number of groups of masses associated with beams

TABLE 15 (CONT'D)
XIF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
35	NABGFP	number of groups of aerodynamic boxes associated with beams
36	NSEGBK	number of groups of aerodynamic slender body elements associated with beams
37	NBOXES	maximum number of aerodynamic boxes per group
38	NAERSB	maximum number of aerodynamic slender body elements per group
41	NK	number of reduced frequencies
42	NG	number of gust orientations
43	NBOX	number of aerodynamic lifting surface boxes
44	NSBETO	number of aerodynamic slender body elements
45	NB	number of aerodynamic bodies
46	NTOTAP	number of total aerodynamic points
48	IDIMUL	dimension constant for unit loads
51	AN	load factor
52	ZDOT	climb rate
53	RTURN	turn radius
54	KMAN	maneuver constant =0, no maneuver =1, symmetric pull-up or push-over =2, turn
55	AB	bank angle
56	AC	climb angle
57	INDSYM	symmetry indicator
61	NORMAX	maximum number of orientations to be considered
62	TIMEMX	maximum time for time history, sec.
63	EFR	weapon yield, KT
64	KGFD	control constant for ground reflection =0, no ground reflection =1, include ground reflection
65	KLPT	=1, iteration for critical range desired =0, no iteration
66	HGRD	height of ground above sea level, ft
67	KLOAD	=1, new max allowable loads input
68	NCFITS	=1, max stresses input

TABLE 15 (CONT'D)

XTF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
70	MXORD	maximum potential order of any transfer function
71	MXOFSN	maximum order of numerator of symmetric transfer function
72	MXORSN	maximum order of denominator of symmetric transfer function
73	MXOPAN	maximum order of numerator of antisymmetric transfer function
74	MXORAD	maximum order of denominator of antisymmetric transfer function
75	NTFS	number of symmetric transfer functions
76	NTFA	number of antisymmetric transfer functions
80	ISECT	≠0, sectional input data available
81	NDOF	number of degrees of freedom per mass station
82	IMS	number of mass property items =1, for mass point data =10, for NDOF=6 =16, for NDOF=7 =23, for NDOF=8
91	FINFRQ	final estimated frequency for zero forcing function modulus
92	NFG	number of first gust
93	NLG	number of last gust
96	IPFNTM	print flag for inertial module
97	DELT	initial delta time for solutions
99	ABRADF	scale factor for rotation modes
100	SIZFCT	size factor defining units of the input geometry data relative to inches

TABLE 16

AFOCOM COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	NTI	unit designator for fixed data deck (=31)
2	MODES	number of modes
3	NP	total number of panels on all lifting surfaces
4	MSTRIP	maximum number of strips for all panels (for dimensioning)
5	NSMAX	max number of strips per panel
6	NCMAX	max number of chordwise boxes per panel
7	NTOTAL	total number of lifting surface boxes + 2MSBE
8	NB	total number of bodies
9	MSBE	maximum number of interference body elements (for dimensioning)
10	MBE	maximum number of interference body elements (for dimensioning)
11	ND	not used
12	NE	ground effect lag
13	NBY	number of y-oriented bodies
14	NBZ	number of z-oriented bodies
15	NTO	=NTP+NTY+NTZ (see below)
16	NTP	total number of lifting surface boxes
17	NTY	number of y-oriented interference body elements
18	NTZ	number of z-oriented interference body elements
19	NTYS	number of y-oriented slender body elements
20	NTZS	number of z-oriented slender body elements
21	MAXGF	number of components (groups of panels)
22	MAXSTR	number of superstrips on all panels
23	NSBETO	total number of slender body elements
24	NSTRIP	number of lifting surface strips
25	KF	reduced frequency
26	XM	moment axis
27	REFA	reference area
28	REFC	reference chord
29	REFS	reference semi-span
30	FMACH	Mach number
31	LINES	maximum number of print lines per page

TABLE 17

ZZZ COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1-30	HEDR	case header information
31-42	TITLE	matrix title information
43-48	DT	date and time
49	NIN	fortran unit designator for input data, =5
50	NOUT	fortran unit designator for output data, =6
51	KPOW	maximum number of lines per page
52	LINES	number of lines printed on current page
53	IPRNT	print flag
54	NER	error flag

TABLE 18
DISK2 COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	ND2	fortran unit number for mass storage data, =2
2-842	ITBL2	table of record numbers of start of data items
843	NFECSA	total number of records
844	NKD	number of reduced frequencies
845	NG	number of gust orientations
846	IBUMP	2(1+NG)
847	VOBWS	reduced velocities

TABLE 19

DDTPLS COMMON BLOCK DESCRIPTION

COMMON /DDTBLS/DDTEL (20,10)

Loc	Variable	Description

AERODYNAMIC FILE (TABLE 1)

1,1	NT	unit designator, =19
2,1	TYPE	file type, =4HAERO
3,1	INOUT	=1, input; =2, input and output; =3, output
4,1	STAT	current status: =1, read; =0, write
5,1	LPN	last record number processed
10,1	NK	number of reduced frequencies
11,1	NSYM	number symmetric modes
12,1	NASYM	number of antisymmetric modes
13,1	NGUST	number of gust orientations
14,1	NE	number of bodies
15,1	NPOX	number of lifting surface boxes
16,1	NSBETO	number of slender body elements
17,1	NSTRIP	number of strips
18,1	MAXSTR	number of superstrips
19,1	NP	number of panels
20,1	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

UNIT LOAD FILE (TABLE 4)

1,4	NT	unit designator, =34
2,4	TYPE	file type, =4HUNIT
3,4	INOUT	=1, input; =2, input and output; =3, output
4,4	STAT	current status: =1, read; =0, write
5,4	LRN	last record number processed
10,4	NINTLD	number of integrated loads
11,4	NSTRSS	number of stresses
12,4	NENGS	number of engines for thrust calculations
13,4	NSYM	number of symmetric modes
14,4	NASYM	number of antisymmetric modes
15,4	NK	number of reduced frequencies
16,4	NABGRP	number of aero box groups
17,4	NSBGRP	number of slender body groups
18,4	NBOXES	maximum number of boxes per aero group
19,4	NAERSB	maximum number of slender body elements per slender body group
20,4	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

TABLE 19 (CONT'D)

DITELS COMMON BLOCK DESCRIPTION

Loc	Variable	Description

FREQUENCY RESPONSE FILE (TABLE 5)		

1,5	NT	unit designator, =35
2,5	TYPE	file type, =4HFRSP
3,5	INOUT	=1, input; =2, input and output; =3, output
4,5	STAT	current status: =1, read; =0, write
5,5	LRN	last record number processed
11,5	NGUST	number of gust orientations
12,5	NFREQ	number of frequencies
13,5	NSYM	number symmetric modes
14,5	NASYM	number of antisymmetric modes
15,5	NK	number of reduced frequencies used in interpolations
16,5	NTOTAP	number of total aero points
17,5	NFG	number of first gust
20,5	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

UNIT GUST LOADS FILE (TABLE 6)		

1,6	NT	unit designator, =36
2,6	TYPE	file type, =4HLOAD
3,6	INOUT	=1, input; =2, input and output; =3, output
4,6	STAT	current status: =1, read; =0, write
5,6	LRN	last record number processed
11,6	NGUST	number of gust orientations
12,6	NFREQ	number of frequencies
13,6	NINTLD	number of integrated loads
14,6	NACC	number of accelerations
20,6	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

TABLE 20
AERODYNAMIC (AEFO) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HAERO)
	2	NK	number of reduced frequencies
	3	NSYM	number of symmetric modes
	4	NASYM	number of antisymmetric modes
	5	NGUST	number of gust orientations
	6	NB	number of bodies
	7	NPOX	number of lifting surface boxes
	8	NSBF	number of slender body elements
	9	NSTRIP	number of lifting surface strips
	10	MAXSTR	number of superstrips on all panels
	11	NP	number of panels on all lifting surfaces
	12-20	-	not used
	21	FMACH	mach number
	22	REFA	reference area
	23	REFS	reference semi-span
	24	REFC	reference chord
	25	XM	moment axis
	26-50	-	not used
2	1-N	DELA	box areas (DELA(I), I=1, NBOX)
		DELX	box chords (DELX(I), I=1, NBOX)
		XIC	XAAS of centerline of 1/4 chord of boxes (XIC(I), I=1, NBOX)
		CG	cosine of dihedral angle of strips (CG(I), I=1, NSTRIP)
		CS	chord length of strips (CS(I), I=1, NSTRIP)
		EE	half width of strips (EE(I), I=1, NSTRIP)
		SG	sine of dihedral angle of strips (SG(I), I=1, NSTRIP)
		YS	YAAS of centerline of strips (YS(I), I=1, NSTRIP)
		ZS	ZAAS of centerline of strips (ZS(I), I=1, NSTRIP)
		XIJ	XAAS of leading edge of strip centerline (XIJ(I), I=1, NSTRIP)
		ISSTR	superstrip number of each strip (ISSTR(I), I=1, NSTRIP)
		COORD	spanwise coordinate of strips (COORD(I), I=1, MAXSTR)
		NBAFAY	last box number of each panel (NBAFAY(I), I=1, N)
		NCFAY	number of chordwise boxes per panel (NCFAY(I), I=1, N)
		NSBEA	number of slender body elements per body (NSBEA(I), I=1, NB)

TABLE 20 (CONT'D)
AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
		YB	YAAS of body centerlines (YB(I), I=1, NB)
		ZB	ZAAS of body centerlines (ZB(I), I=1, NB)
3	1-N	XI1	XAAS of inboard edge of 1/4 chord of boxes (XI1(I), I=1, NBO)
		ETA1	YAAS of inboard edge of 1/4 chord of boxes (ETA1(I), I=1, NBOX)
		ZETA1	ZAAS of inboard edge of 1/4 chord of boxes (ZETA1(I), I=1, OX)
		XI2	XAAS of outboard edge of 1/4 chord of boxes (XI2(I), I=1, NBOX)
		ETA2	YAAS of outboard edge of 1/4 chord of boxes (ETA2(I), I=1, NBOX)
		ZETA2	ZAAS of outboard edge of 1/4 chord of boxes (ZETA2(I), I=1, NBOX)
4	1-N	X	XAAS of centerline of 3/4 chord of boxes (X(I), I=1, NBOX)
		ETA	YAAS of centerline of 3/4 chord of boxes (ETA(I), I=1, NBOX)
		ZETA	ZAAS of centerline of 3/4 chord of boxes (ZETA(I), I=1, NBOX)
Record type 5 is omitted if NB=0			
5	1-N	XIS1	XAAS of leading edge of slender body elements (XIS1(I), I=1, NSBE)
		ETAS1	YAAS of leading edge of slender body elements (ETAS1(I), I=1, NSBE)
		ZETAS1	ZAAS of leading edge of slender body elements (ZETAS1(I), I=1, NSBE)
		XIS2	XAAS of trailing edge of slender body elements (XIS2(I), I=1, NSBE)
		ETAS2	YAAS of trailing edge of slender body elements (ETAS2(I), I=1, NSBE)
		ZETAS2	ZAAS of trailing edge of slender body elements (ZETAS2(I), I=1, NSBE)
6	1-N	CR	direction cosines of gust orientations ((CR(I, J), I=1, 3), J=1, NGUST)
7	1-NK	RK	reduced frequencies

TABLE 20 (CONT'D)
AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
8	1-NBOX	HPS	deflection at 1/4 chord of boxes due to symmetric modes Repeated for J=1,NSYM
Record type 9 is omitted if NASYM=0			
9	1-NBOX	HPA	deflection at 1/4 chord of boxes due to antisymmetric modes Repeated for J=1,NASYM
Record types 10 thru 13 are omitted if NB=0			
10	1-NSBE	HZS	deflection in z-direction at midpoint of slender body elements due to symmetric modes Repeated for J=1,NSYM
Record type 11 is omitted if NASYM=0			
11	1-NSBE	HZA	deflection in z-direction at midpcint of slender body elements due to antisymmetric modes Repeated for J=1,NASYM
12	1-NSBE	HYS	deflection in y-direction at midpoint of slender body elements due to symmetric modes Repeated for J=1,NSYM
Record type 13 is omitted if NASYM=0			
13	1-NSBE	HYA	deflection in y-direction at midpoint of slender body elements due to antisymmetric modes Repeated for J=1,NASYM

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
Record types 14 thru 31 are repeated for K=1,NK			
Record types 14 thru 31 are all complex type arrays			
14	1-NBOX	DPOS	forces on lifting surface boxes due to symmetric modes Repeated for J=1,NSYM
15	1-NBOX	FGPS	forces on lifting surface boxes due to symmetric gusts Repeated for J=1,NGUST
Record types 16 thru 19 are omitted if NB=0			
16	1-NSBE	DZOS	forces on z-oriented slender body elements due to symmetric modes Repeated for J=1,NSYM
17	1-NSBE	FGZS	forces on z-oriented slender body elements due to symmetric gusts Repeated for J=1,NGUST
18	1-NSBE	DYOS	forces on y-oriented slender body elements due to symmetric modes Repeated for J=1,NSYM
19	1-NSBE	FGYS	forces on y-oriented slender body elements due to symmetric gusts Repeated for J=1,NGUST
Record types 20 thru 25 are omitted if NASYM=0			
20	1-NBOX	DPOA	forces on lifting surface boxes due to antisymmetric modes Repeated for J=1,NASYM
21	1-NBOX	FGPA	forces on lifting surface boxes due to antisymmetric gusts Repeated for J=1,NGUST
Record types 22 thru 25 are omitted if NB=0			
22	1-NSBE	DZOA	forces on z-oriented slender body elements due to antisymmetric modes Repeated for J=1,NASYM

TABLE 20 (CONT'D)
AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
23	1-NSBE	FGZA	forces on z-oriented slender body elements due to antisymmetric gusts Repeated for J=1,NGUST
24	1-NSBE	DYOA	forces on y-oriented slender body elements due to antisymmetric modes Repeated for J=1,NASYM
25	1-NSBE	FGYA	forces on y-oriented slender body elements due to antisymmetric gusts Repeated for J=1,NGUST
26	1-N	DPOS	generalized forces on lifting surfaces due to symmetric modes ((DPOS(I,J),I=1,NSYM),J=1,NSYM)
		FGPS	generalized forces on lifting surfaces due to symmetric gusts ((FGPS(I,J),I=1,NSYM),J=1,NGUST)
Record types 27 and 28 are omitted if NE=0			
27	1-N	DZOS	generalized forces on z-oriented slender bodies due to symmetric gusts ((DZOS(I,J),I=1,NSYM),J=1,NSYM)
		FGZS	generalized forces on z-oriented slender bodies due to symmetric gusts ((FGZS(I,J),I=1,NSYM),J=1,NGUST)
28	1-N	DYOS	generalized forces on y-oriented slender bodies due to symmetric modes ((DYOS(I,J),I=1,NSYM),J=1,NSYM)
		FGYS	generalized forces on y-oriented slender bodies due to symmetric gusts ((FGYS(I,J),I=1,NSYM),J=1,NGUST)
Record types 29 thru 31 are omitted if NASYM=0			
29	1-N	DPOA	generalized forces on lifting surfaces due to antisymmetric modes ((DPOA(I,J),I=1,NASYM),J=1,NASYM)
		FGPA	generalized forces on lifting surfaces due to antisymmetric gusts ((FGPA(I,J),I=1,NASYM),J=1,NGUST)

TABLE 20 (CONT'D)
AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
Record types 30 and 31 are omitted if NB=0			
30	1-N	DZOA	generalized forces on z-oriented slender bodies due to antisymmetric modes ((DZOA(I,J),I=1,NASYM),J=1,NASYM)
		FGZA	generalized forces on z-oriented slender bodies due to antisymmetric gusts ((FGZA(I,J),I=1,NASYM),J=1,NGUST)
31	1-N	DYOA	generalized forces on y-oriented slender bodies due to antisymmetric modes ((DYOA(I,J),I=1,NASYM),J=1,NASYM)
		FGYA	generalized forces on y-oriented slender bodies due to antisymmetric gusts ((FGYA(I,J),I=1,NASYM),J=1,NGUST)

TABLE 21

UNIT LOAD (UNIT) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HUNIT)
	2	IDENT	identification number
	3	NINTLD	number of integrated loads
	4	NSTRSS	number of stresses
	5	NENGS	number of engines for thrust calculation
	6	NSYM	number of symmetric modes
	7	NASYM	number of antisymmetric modes
	8	NK	number of reduced frequencies
	9	NABGRF	number of aero box groups
	10	NSBGRF	number of slender body groups
	11	NBOXES	maximum no. of boxes per aero box group
	12	NAERSP	maximum no. of slender body elements per slender body group
2	1-N	STALDS	Integrated load definitions ((STALDS(I,J), I=1,NINTLD), J=1,8)
3	1-N	STRESE	Stress definition matrix ((STFESE(I,J), I=1,NSTRSS), J=1,NINTLD)
4	1-N	THRLOD	Integrated loads due to thrust ((THRLOD(I,J), I=1,NINTLD), J=1,NENGS)
5	1-N	THRGNF	Generalized loads due to thrust ((THFGNF(I,J), I=1,NSYM), J=1,NENGS)
6	1-N	PIQ	Integrated inertial loads due to unit modal amplitudes ((PIQ(I,J), I=1,NINTLD), J=1,NM) where NM=NSYM+NASYM
Record types 7 and 8 are repeated for K=1,NK			
7	1-N	PAQS	Integrated aero loads due to unit modal amplitudes for symmetric modes ((PAQS(I,J), I=1,NINTLD), J=1,NSYM)
8	1-N	PAQA	Integrated aero loads due to unit modal amplitudes for antisymmetric modes ((PAQA(I,J), I=1,NINTLD), J=1,NASYM)
9	1-N	SYMCOD	Symmetric centerline load modifier (SYMCOD(I), I=1,NINTLD)

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DOUGLAS AIRCRAFT CO LONG BEACH CA

F/G 18/3

NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME 1. PROGRAM DESC--ETC(U)

AUG 81 J A MCOREW, J P GIESING, T P KALMAN

DNA001-75-C-0216

UNCLASSIFIED

AFWL-TR-81-32-VOL-1

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3 of 5

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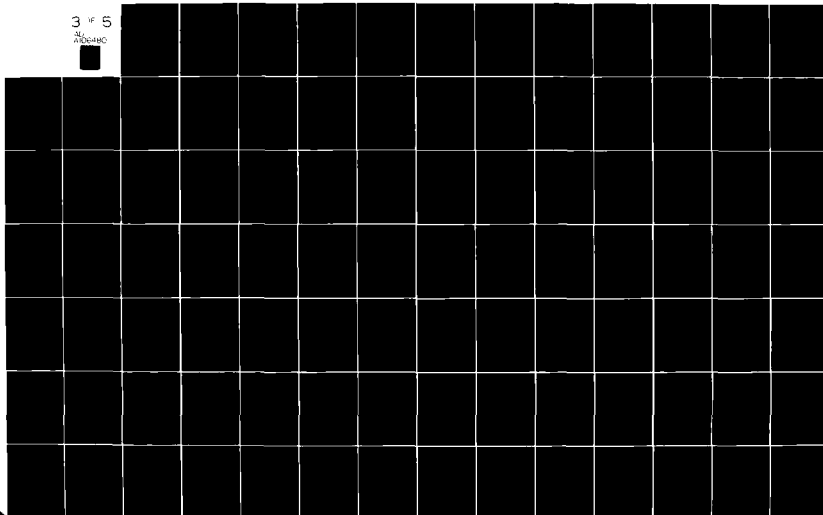


TABLE 21 (CONT'D)

UNIT LOAD (UNIT) FILE DESCRIPTION

Record type	Word	Item	Description
10	1-N	ASMCOL	Antisymmetric centerline load modifier (ASMCOD(I), I=1, NINTLD)
11	1-N	NFNLAE	Aero box group definitions ((NFNLAB(I,J), I=1, 3), J=1, NABGRP)
12	1-N	PINTP	Integrated load due to aero boxes (((PINTP(I,J,K), I=1, NINTLD), J=1, NABGRP), K=1, NBOXES)
13	1-N	NFNLSE	Slender body element group definitions ((NFNLSE(I,J), I=1, 3), J=1, NSBGRP)
14	1-N	PINTZ	Integrated loads due to slender body Z-force (((PINTZ(I,J,K), I=1, NINTLD), J=1, NSBGRP), K=1, NAERSE)
15	1-N	PINTY	Integrated loads due to slender body Y-force (((PINTY(I,J,K), I=1, NINTLD), J=1, NSBGRP), K=1, NAEFSB)

TABLE 22

FREQUENCY RESPONSE (FRSP) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type(=4HFRSP)
	2	IDENT	identification number
	3	NGUST	number of gust orientations
	4	NFREQ	number of frequencies
	5	NSYM	number of symmetric modes
	6	NASYM	number of antisymmetric modes
	7	NK	number of reduced frequencies used in the interpolations
	8	NTOTAP	number of total aero points
	9-10		not used
	11	VFL	true velocity (ft/sec)
	12	SIGMA	density ratio
2	1-N	CF	gust orientation direction cosines ((CF(I,J),I=1,3),J=1,NGUST)
3	1-N	OMEGA	frequencies (rad/sec) (OMEGA(I),I=1,NFREQ)
Record types 4 thru 9 are repeated for K=1,NFREQ and N=1,NGUST			
4	1	NOR	orientation number
	2	IFREQ	frequency number
	3	FREQ	frequency (HZ)
	4	IZFOS	orientation for zero symmetric gust loads
	5	IZROA	orientation for zero antisymmetric gust loads
5	1-N	COEF	interpolation coefficients (COEF(I),I=1,NK)
6	1-N	IVBWI	reduced frequency numbers of aero used for interpolation of this frequency (IVBWI(I),I=1,NK)
7	1-N	Q	complex generalized displacement (Q(I),I=1,NM), where NM=NSYM+NASYM
8	1-N	FGAFOS	complex symmetric aerodynamic element gust forces (F(I),I=NTOTAP)
9	1-N	FGAKOA	complex antisymmetric aerodynamic element gust forces (F(I),I=1,NTOTAP)

TABLE 23

UNIT GUST LOADS (LOAD) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HLCAD)
	2	IDENT	identification number
	3	NGUST	number of gust orientations
	4	NFREQ	number of frequencies
	5	NINTLD	number of integrated loads
	6	NACC	number of acceleration mass points
	7-10	-	not used
	11	VEL	true velocity (FPS)
	12	SIGMA	density ratio
	13-50		not used
2	1-N	STALDS	Integrated load definitions ((STALDS(I,J), I=1, NINTLD), J=1, 8)
3	1-N	CR	gust orientation direction cosines ((CR(I,J), I=1, 3), J=1, NGUST)
4	1-N	OMEGA	frequencies (rad/sec) (OMEGA(I), I=1, NFREQ)
Record type 5 is omitted if NACC=0			
5	1-N	INDACC	acceleration mass point and degree of freedom numbers ((INDACC(I,J), I=2,), J=1, NACC)
Record types 6 thru 9 are repeated for K=1, NGUST			
Record types 6 and 7 are omitted if NACC=0			
6	1-N	AS	complex symmetric accelerations ((AS(I,J), I=1, NACC), J=1, NFREQ)
7	1-N	AA	complex antisymmetric accelerations ((AA(I,J), I=1, NACC), J=1, NFREQ)
8	1-N	PS	complex symmetric integrated loads ((PS(I,J), I=1, NINTLD), J=1, NFREQ)
9	1-N	PA	complex antisymmetric integrated loads ((PA(I,J), I=1, NINTLD), J=1, NFREQ)

TABLE 24
MASS STORAGE FILE DESCRIPTION

Record type	Word	Item	Description
Record types 1 thru 4 are repeated for K=1,NK			
1	1-N	DS	complex generalized forces due to symmetric modes, ((DS(I,J),I=1,NSYM),J=1,NSYM)
2	1-N	DA	complex generalized forces due to antisymmetric modes ((DA(I,J),I=1,NASYM),J=1,NASYM)
Record types 3 and 4 are repeated for N=1,NG			
3	1-N	FS	complex gust forces due to symmetric modes (FS(I),I=1,NTOTAP), where NTOTAP=NBOX+2NSBE
4	1-N	FA	complex gust forces due to antisymmetric modes, (FA(I),I=1,NTOTAP)
5	1-N	SPLHS	aero force integration matrix for symmetric modes ((SPLHS(I,J),I=1,NTOTAP),J=1,NSYM)
6	1-N	SPLHA	aero force integration matrix for antisymmetric modes ((SPLHA(I,J),I=1,NTOTAP),J=1,NASYM)
7	1-N	GEOMBX	AAS coordinates of inboard and outboard edge of 1/4 chcrd of aero boxes ((GEOMBX(I,J),I=1,NBOX),J=1,6)
8	1-N	GEOMBD	AAS coordinates of leading and trailing edge of slender body elements ((GEOMBD(I,J),I=1,NSBE),J=1,6)

NSYM = number of symmetric modes
 NASYM = number of antisymmetric modes
 NBOX = number of lifting surface boxes
 NSBE = number of slender body elements

TABLE 25

SEGLOAD DIFECTIVE LISTING

```

A1      TREE      GEOM
A2      TREE      SPLINE
SPLINE  INCLUDE   SORT
A3      TREE      DOTP
DOTP    INCLUDE   ORGN
A4      TREE      GEND
GEND    INCLUDE   DPPS,DPZY,DYPZ,DZPY,SUBB,SUPP
A5      TREE      SP
SP      INCLUDE   DUMULT,CZYMAT,POWDYZ,MUZYC
A6      TREE      BFSMAT
BFSMAT  INCLUDE   FWMW,FZY2
A7      TREE      WANDWT
WANDWT  INCLUDE   GUST,FHSDIE,SOLVIT,MATMUL
A8      TREE      GENF
A9      TREE      AEFO
A10     TREE      NEWH
A11     TREE      PISTON
M1      TREE      CSDLM-(A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11)
CSDLM   INCLUDE   SDLM
CSDIM   GLOBAL    KDS,DIM
M2      TREE      INERTM
M3      TREE      ACS
M4      TREE      LOAD-(BEAM,GEOMMB,MSSPHI,GEOMAB,GEOMSB,AFOLOD)
LOAD    INCLUDE   TFAERC
M5      TREE      CFREQF
M6      TREE      CFRIOL
M7      TREE      CGUST-(CTRIM,GUSTDR)
GUSTDR  INCLUDE   GSTHST
M8      TREE      CFIGIC
M9      TREE      CMEFGE
MAIN    TREE      DFCGUST-(M1,M2,M3,M4,M5,M6,M7,M8,M9)
GLOBAL  DISK2,ZZZ,XTF,AEROMX,DCTBLS
END

```

SECTION VII

EXAMPLE PROBLEM

The sample problem chosen for analyses demonstration consists of a large twin engine transport. The number of degrees of freedom for the model are sufficient for demonstration of the large analyses capability of the program, though fewer aero strips, mass points, integrated loads, and elastic modes were used than necessary for a complete analyses of an aircraft of this size; 116 boxes, 19 slender body elements and 28 masses.

Figure 23 shows the aero node points and aero strips. Figure 24 shows the mass points and beam network used. Figure 25 defines the integrated loads. The modes consisted of nine rigid body modes and trim modes plus 3 symmetric and 4 antisymmetric elastic modes. The elastic modes are simple symmetric and antisymmetric surface flapping modes of the wing and horizontal and vertical tail surfaces and simple in-plane and out-of-plane fuselage hinge modes.

Details of the model data may be found in the sample data input listings and sample run data which are given in Tables 26 and 27 through 30.

Table 27 consists of the printout of a pass through the aerodynamic module for a reduced frequency of zero. Table 28 illustrates the printout of the unit load module. Table 29 is for the Frequency Response and Unit Gust Load Modules. Only selected orientation output has been included for illustrative purposes. Table 30 details the output for a single iteration pass through the trim and blast portion of the program for one orientation. The plotted data are shown for the first iteration only.

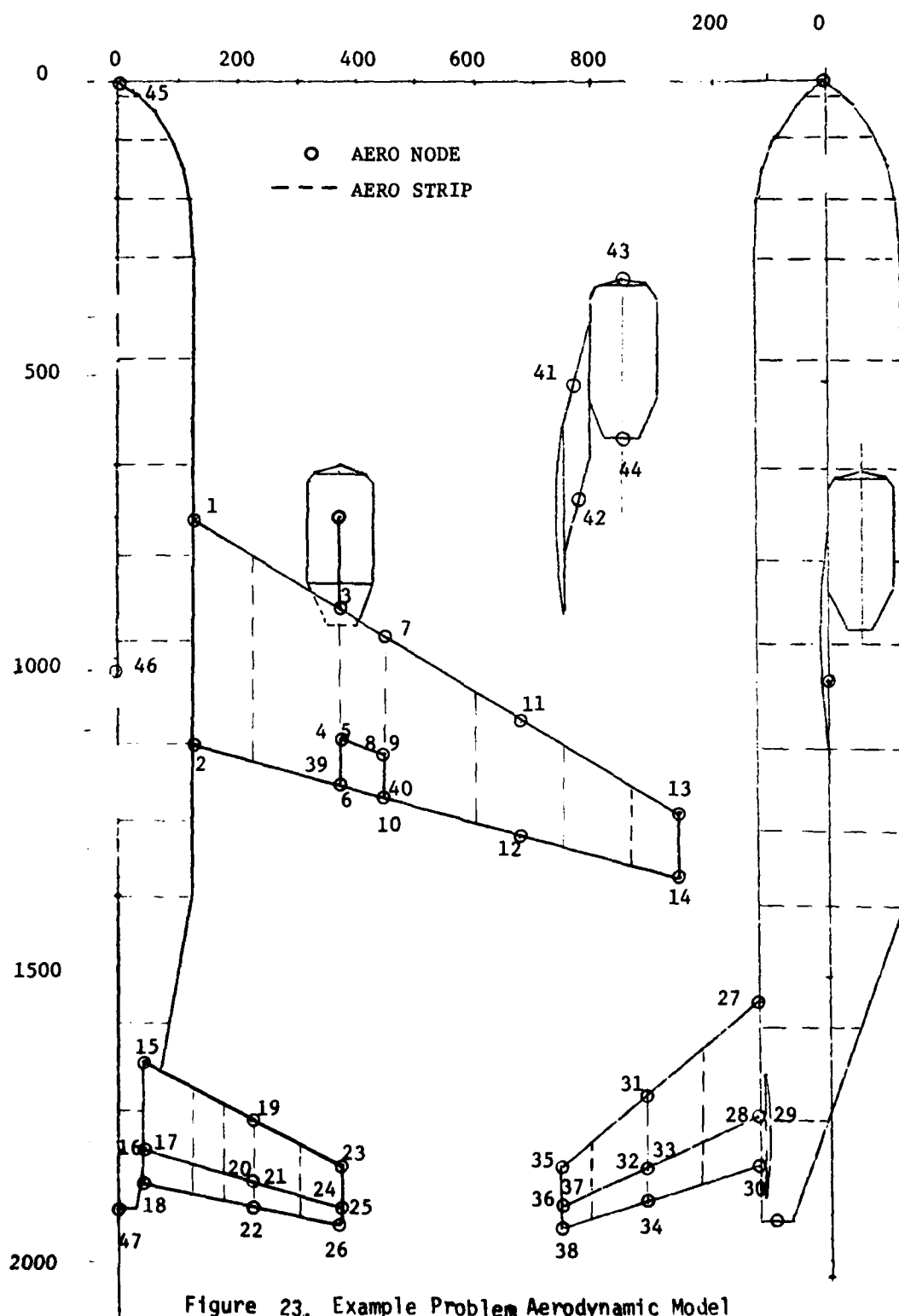


Figure 23. Example Problem Aerodynamic Model

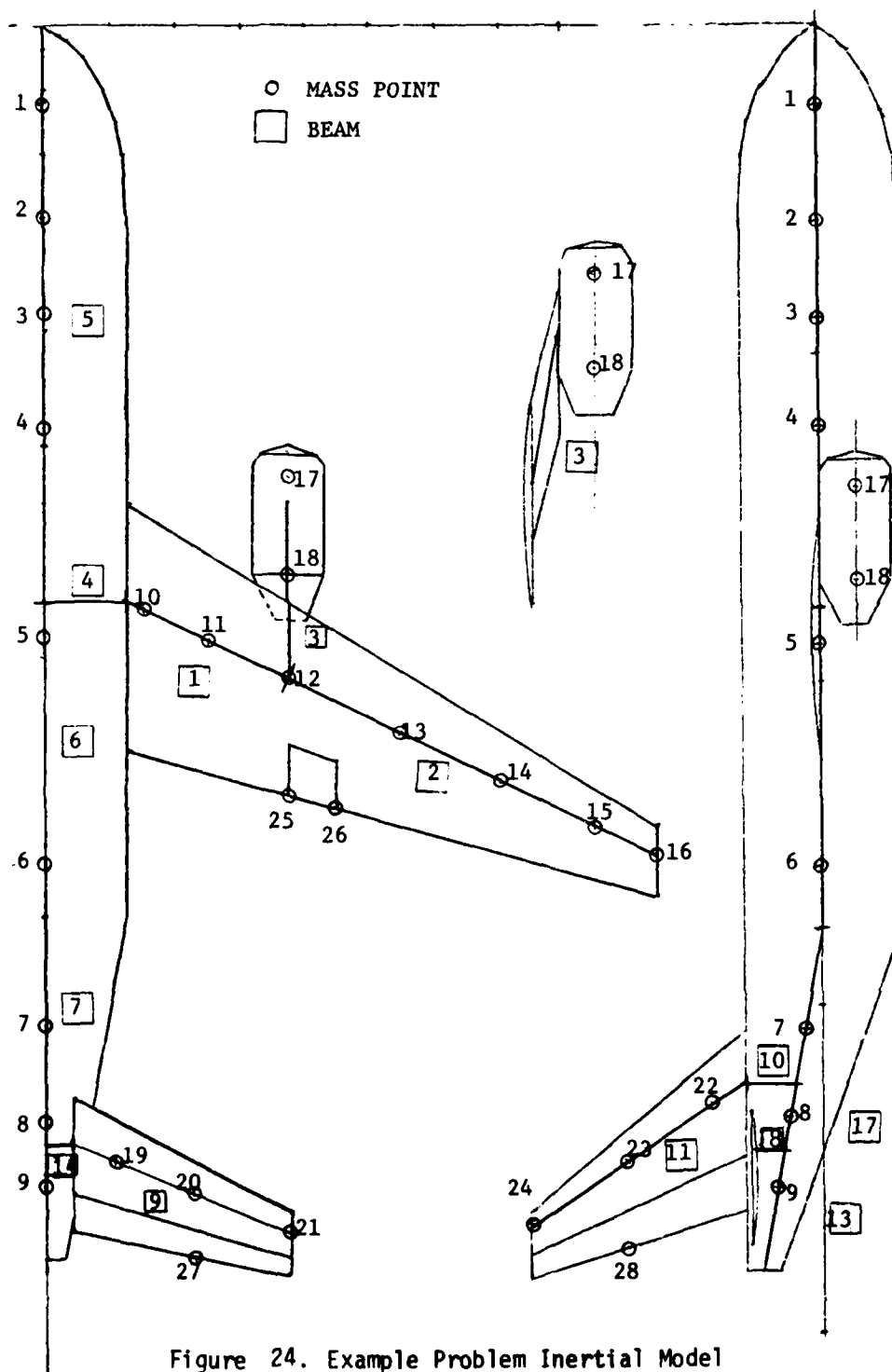


Figure 24. Example Problem Inertial Model

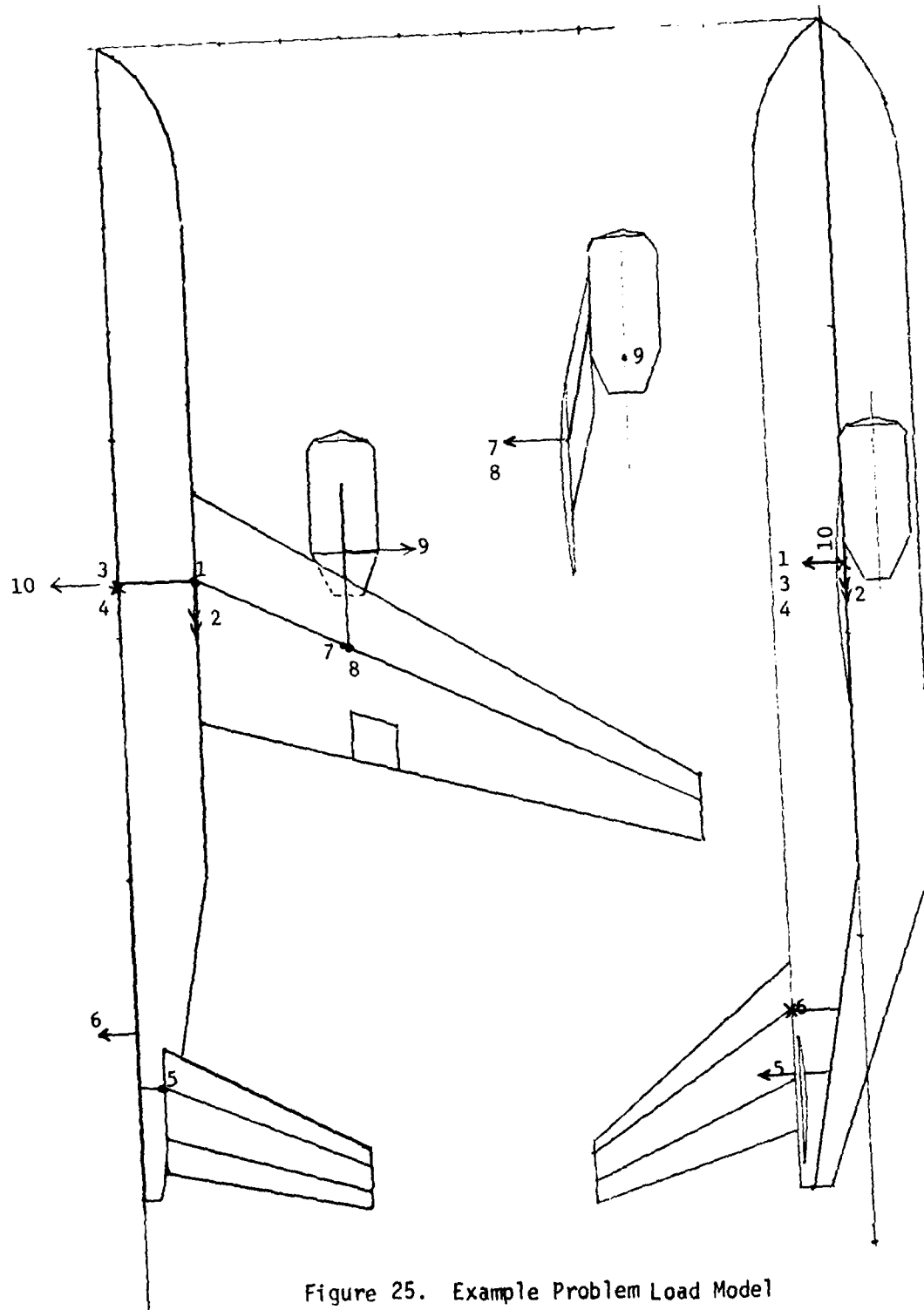


Figure 25. Example Problem Load Model
192

EXAMPLE PROBLEM INPUT DATA LISTING

193

[illegible]

ITEM 6

A 10x10 grid of circles. A vertical column of 7 circles is highlighted on the left side, and a horizontal row of 7 circles is highlighted on the top side. The intersection of these two sets is a single circle.

[illegible]

0.0
0.0
0.0

0.0
0.0
-1.0
-0.912

0.0
0.0
0.0
0.0

-0.1182
-0.1182
-0.3771
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-0.3771
-0.4533
-0.4533
-0.4533
-0.4533
-0.6817
-0.6817
-0.9610
-0.9610
-0.06023
-0.06023
-0.06023
-0.06023
-0.2481
-0.2481
-0.2481
-0.4004
-0.4004
-0.4004
-0.1200
-0.1200
-0.1200
-0.3100

ITEM 6

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-0.3100
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-0.4500
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-0.4533
-0.02248
-0.02248

-0.375
-0.375
0.0
0.0

-0.055
-0.055
0.0
0.0
0.09500

4515
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-0.01847
-0.01997
-0.03311
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-0.06078
-0.1146
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-0.1511
-0.1319
-0.1506
-0.1506
-0.1578
-0.1459

I E M 6

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 -0.8200
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 -0.8776
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 -0.03819

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 0.0
 0.0

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 0.0
 0.9120

ITEM 5

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9

1736
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1736

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1.1736
- -
1.0
- -
1.0
- -

2	7	12	0
1	3	1	0
15	45	47	
12	2	1	
3			
0	44	3	0
1	12	4	4
1	2	3	12
1	2	1	0
8	40	11	
0	4	1	
3	6	9	10
5	6	1	0
0			
5	15	19	20
0	6	1	0
6			
17	19	21	22
0	6	1	0
7			
7	28	31	32
0	6	1	0
9			
29	30	33	34
1	2	1	
9	42		

[illegible]

ITEM 4

0.07561	0.0173	-0.09269
0.1048	0.0173	-0.1628
0.1340	0.0173	-0.2329
0.1535	0.0173	-0.2797
-0.055	0.0	0.3000
-0.055	0.0	0.1500
0.01648	-0.07509	-0.7495
0.1985	-0.07513	-0.8010
0.2171	-0.07513	-0.8627
0.5161	0.0	-0.4663
0.6657	0.0	-0.4663
0.8452	0.0	-0.4663
0.05475	-0.01095	-0.1978
0.06826	-0.008619	-0.2082
0.1948	-0.09044	-0.3949
0.7412	0.0	-0.5529
0.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-0.9059	0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-0.9247	0.3806	0.0
-0.9247	-0.3806	0.0
-0.9247	-0.3806	0.0
-0.8355	0.0	-0.5494

✧

0.0752
0.0752
0.0752

[illegible][illegible]

[illegible]

1854.0	0.	450.0	3.0		
1637.0	0.	45.89			
1736.0	0.	62.57	2.0		
1736.0	0.	63.57			
1912.0	0.	95.0	2.0		
1736.0	0.	113.14			
1736.0	40.0	113.14	1.0		
*****	HERE STARTS THE REQUIRED INTEGRATED LOADS, STALDS				

4.0	4.0	1.0			ITEM 4
890.0	120.0	1.0			
4.0	1.0	1.0			ITEM 4
890.0	120.0	3.0	100000.0	-100000.0	
5.0	6.0	2.0	1.718	+10-1.446	+10
890.0	3.0	2.0	7500.	-7500.	
6.0	6.0	2.0			ITEM 4
890.0	0.0	2.0	1.5	505-1.5	F05
14.0	4.0	1.0			
1736.0	40.0	1.0	80000.0	-80000.0	
10.0	4.0	3.0	7500.	-7500.	
1637.0	3.0	1.0			
1.0	4.0	1.0	50000.0	-50000.0	
1011.05	375.0	1.0	100000.0	-100000.0	
2.0	4.0	1.0			
1011.05	375.0	4.0	1.0	506-1.	F06
3.0	4.0	4.0			
850.	375.	-55.			
6.0	4.0	2.0	1.0	F10-1.	F10
890.	0.	0.			
*****	MATRIX DEFINING LOCAL STRESSES, STRESS, OMITTED SINCE NSTRESS=0				

*****	HERE STARTS THE DEFINITIONS OF GROUPS OF MASSES, NENLMB				

1	4				ITEM 5
5	5				
7	7				

8 9
 10
 11 13
 11 17
 11 19
 22 25
 27 29
 28

8 9
 12 13
 13 18
 21 24
 25 27
 28

12 13
 13 18
 21 24
 25 27
 28

***** HERE STARTS THE ORIENTATION COSINE MATRICES, TLAMV

1.0	1.0	1.0	ITEM	7
1.0	1.0	1.0	ITEM	7
1.0	1.0	1.0	ITEM	7
1.0	1.0	1.0	ITEM	7
1.0	1.0	1.0	ITEM	7
0.9059	0.4235	1.0	ITEM	7
-0.4171	0.8921	-0.1736	ITEM	7
-0.0735	0.1573	0.9848	ITEM	7
0.9059	0.4235	-0.1736	ITEM	7
-0.4171	0.8921	0.9848	ITEM	7
-0.0735	0.1573	1.0	ITEM	7
0.9247	0.3804	1.0	ITEM	7
-0.3748	0.9107	-0.1736	ITEM	7

ITEM 7

0.9848
0.5494

0.1506
1.0

-0.0661
0.8355

ITEM 7

0.8355

0.4235

-0.5494

ITEM 7

-0.1736
0.9848

0.8921
0.1573

-0.4171
-0.0735

ITEM 7

-0.1736
0.9848
0.5494

0.3305
0.9107
0.1506

0.9247
-0.3748
-0.0661
0.8355

ITEM 8

HERE STARTS THE DEFINITION OF GROUPS OF AXES, NENLAB

15
55
85
110
116

1
17
57
97
111

HERE STARTS THE DEFINITION OF GROUPS OF SLENDER BODY ELEMENTS, NENLSP

ITEM 9

5
6
7
12
13

1
9
12
13
14
15

HERE STARTS THE DEFINITION OF ENGINE MASS POINTS, NENGM

ITEM 10

18

17

TABLE 27
 EXAMPLE PROBLEM OUTPUT LISTING
 AERODYNAMIC MODULE

DATA
 TIME

FIXED DATA DECK INPUT 60
 IDENTB
 THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN
 AERU

DATE
TIME

MODE	PLR(1)	ELV(1)	BLZ(1)
1	.74000E+03	.12000E+03	0.
2	.11200E+04	.12000E+03	0.
3	.63510E+03	.37500E+03	.449600E+02
4	.111499E+04	.37500E+03	.449600E+02
5	.111499E+04	.37500E+03	.449600E+02
6	.11966E+04	.37500E+03	.449600E+02
7	.93480E+03	.45000E+03	.581900E+02
8	.114139E+04	.45000E+03	.581900E+02
9	.114139E+04	.45000E+03	.581900E+02
10	.121145E+04	.45000E+03	.581900E+02
11	.107434E+04	.67500E+03	.976600E+02
12	.127331E+04	.67500E+03	.976600E+02
13	.12400E+04	.95000E+03	.146150E+03
14	.11500E+04	.95000E+03	.146150E+03
15	.14600E+04	.60000E+02	.113131E+03
16	.14119E+04	.40000E+02	.113131E+03
17	.14119E+04	.40000E+02	.113131E+03
18	.14700E+04	.40000E+02	.113131E+03
19	.17590E+04	.25000E+03	.145760E+03
20	.146741E+04	.25000E+03	.145760E+03
21	.146741E+04	.25000E+03	.145760E+03
22	.19766E+04	.25000E+03	.145760E+03
23	.14700E+04	.37500E+03	.172210E+03
24	.191237E+04	.37500E+03	.172210E+03
25	.191237E+04	.37500E+03	.172210E+03
26	.19400E+04	.37500E+03	.172210E+03
27	.15400E+04	0.	.12000E+03
28	.172474E+04	0.	.12000E+03
29	.172474E+04	0.	.12000E+03
30	.14200E+04	0.	.31000E+03
31	.170338E+04	0.	.31000E+03
32	.141975E+04	0.	.31000E+03
33	.141975E+04	0.	.31000E+03
34	.141751E+04	0.	.31000E+03
35	.14200E+04	0.	.45000E+03
36	.184641E+04	0.	.45000E+03
37	.144641E+04	0.	.45000E+03
38	.19200E+04	0.	.449600E+02
39	.11966E+04	.45000E+03	.581900E+02
40	.121145E+04	.37500E+03	.449600E+02
41	.61610E+03	.37500E+03	.449600E+02
42	.103814E+04	.37500E+03	.449600E+02
43	.65000E+03	.37500E+03	.55000E+02
44	.62000E+03	.37500E+03	.55000E+02
45	0.	0.	0.
46	.10000E+04	0.	0.
47	.19120E+04	0.	0.

DATE
TIME

MODE	PHI(1, 1)	PHI(1, 1)	PHI(1, 1)
1	0.00000000	0.00000000	0.00000000
2	0.00000000	0.00000000	0.00000000
3	0.00000000	0.00000000	0.00000000
4	0.00000000	0.00000000	0.00000000
5	0.00000000	0.00000000	0.00000000
6	0.00000000	0.00000000	0.00000000
7	0.00000000	0.00000000	0.00000000
8	0.00000000	0.00000000	0.00000000
9	0.00000000	0.00000000	0.00000000
10	0.00000000	0.00000000	0.00000000
11	0.00000000	0.00000000	0.00000000
12	0.00000000	0.00000000	0.00000000
13	0.00000000	0.00000000	0.00000000
14	0.00000000	0.00000000	0.00000000
15	0.00000000	0.00000000	0.00000000
16	0.00000000	0.00000000	0.00000000
17	0.00000000	0.00000000	0.00000000
18	0.00000000	0.00000000	0.00000000
19	0.00000000	0.00000000	0.00000000
20	0.00000000	0.00000000	0.00000000
21	0.00000000	0.00000000	0.00000000
22	0.00000000	0.00000000	0.00000000
23	0.00000000	0.00000000	0.00000000
24	0.00000000	0.00000000	0.00000000
25	0.00000000	0.00000000	0.00000000
26	0.00000000	0.00000000	0.00000000
27	0.00000000	0.00000000	0.00000000
28	0.00000000	0.00000000	0.00000000
29	0.00000000	0.00000000	0.00000000
30	0.00000000	0.00000000	0.00000000
31	0.00000000	0.00000000	0.00000000
32	0.00000000	0.00000000	0.00000000
33	0.00000000	0.00000000	0.00000000
34	0.00000000	0.00000000	0.00000000
35	0.00000000	0.00000000	0.00000000
36	0.00000000	0.00000000	0.00000000
37	0.00000000	0.00000000	0.00000000
38	0.00000000	0.00000000	0.00000000
39	0.00000000	0.00000000	0.00000000
40	0.00000000	0.00000000	0.00000000
41	0.00000000	0.00000000	0.00000000
42	0.00000000	0.00000000	0.00000000
43	0.00000000	0.00000000	0.00000000
44	0.00000000	0.00000000	0.00000000
45	0.00000000	0.00000000	0.00000000
46	0.00000000	0.00000000	0.00000000
47	0.00000000	0.00000000	0.00000000

DATE
TIME

NO	W1(1, 2)	W2(1, 2)	W3(1, 2)
1	.255000E+00	.00	.00
2	.118200E+00	.00	.00
3	.100800E+00	.00	.00
4	.113200E+00	.00	.00
5	.113200E+00	.00	.00
6	.147800E+00	.00	.00
7	.012700E+00	.00	.00
8	.132800E+00	.00	.00
9	.119600E+00	.00	.00
10	.255000E+00	.00	.00
11	.732100E+01	.00	.00
12	.269800E+00	.00	.00
13	.216000E+00	.00	.00
14	.334700E+00	.00	.00
15	.051700E+00	.00	.00
16	.799700E+00	.00	.00
17	.799700E+00	.00	.00
18	.518800E+00	.00	.00
19	.747500E+00	.00	.00
20	.442300E+00	.00	.00
21	.042200E+00	.00	.00
22	.094900E+00	.00	.00
23	.427200E+00	.00	.00
24	.408500E+00	.00	.00
25	.408500E+00	.00	.00
26	.428700E+00	.00	.00
27	.00	.00	.00
28	.00	.00	.00
29	.00	.00	.00
30	.00	.00	.00
31	.00	.00	.00
32	.00	.00	.00
33	.00	.00	.00
34	.00	.00	.00
35	.00	.00	.00
36	.00	.00	.00
37	.00	.00	.00
38	.00	.00	.00
39	.187800E+00	.00	.00
40	.206200E+00	.00	.00
41	.00	.00	.00
42	.00	.150000E+00	.00
43	.00	.400000E+01	.00
44	.00	.100000E+01	.00
45	.00	.00	.00
46	.00	.00	.00
47	.00	.00	.00
48	.00	.00	.00
49	.00	.00	.00
50	.00	.00	.00

DATE
TIME

NO	SWIN(I, 3)	SWIC(I, 3)	SWIV(I, 3)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	0	0	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0

DATE
TIME

MODE	PH14(I, 4)	PH12(I, 4)	PH1Y(I, 4)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	0	0	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	0	0	0
46	0	0	0
47	0	0	0

DATE
TIME

DATE	TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
11	11	11	11	11	11
12	12	12	12	12	12
13	13	13	13	13	13
14	14	14	14	14	14
15	15	15	15	15	15
16	16	16	16	16	16
17	17	17	17	17	17
18	18	18	18	18	18
19	19	19	19	19	19
20	20	20	20	20	20
21	21	21	21	21	21
22	22	22	22	22	22
23	23	23	23	23	23
24	24	24	24	24	24
25	25	25	25	25	25
26	26	26	26	26	26
27	27	27	27	27	27
28	28	28	28	28	28
29	29	29	29	29	29
30	30	30	30	30	30
31	31	31	31	31	31
32	32	32	32	32	32
33	33	33	33	33	33
34	34	34	34	34	34
35	35	35	35	35	35
36	36	36	36	36	36
37	37	37	37	37	37
38	38	38	38	38	38
39	39	39	39	39	39
40	40	40	40	40	40
41	41	41	41	41	41
42	42	42	42	42	42
43	43	43	43	43	43
44	44	44	44	44	44
45	45	45	45	45	45
46	46	46	46	46	46
47	47	47	47	47	47
48	48	48	48	48	48
49	49	49	49	49	49
50	50	50	50	50	50
51	51	51	51	51	51
52	52	52	52	52	52
53	53	53	53	53	53
54	54	54	54	54	54
55	55	55	55	55	55
56	56	56	56	56	56
57	57	57	57	57	57
58	58	58	58	58	58
59	59	59	59	59	59
60	60	60	60	60	60
61	61	61	61	61	61
62	62	62	62	62	62
63	63	63	63	63	63
64	64	64	64	64	64
65	65	65	65	65	65
66	66	66	66	66	66
67	67	67	67	67	67
68	68	68	68	68	68
69	69	69	69	69	69
70	70	70	70	70	70
71	71	71	71	71	71
72	72	72	72	72	72
73	73	73	73	73	73
74	74	74	74	74	74
75	75	75	75	75	75
76	76	76	76	76	76
77	77	77	77	77	77
78	78	78	78	78	78
79	79	79	79	79	79
80	80	80	80	80	80
81	81	81	81	81	81
82	82	82	82	82	82
83	83	83	83	83	83
84	84	84	84	84	84
85	85	85	85	85	85
86	86	86	86	86	86
87	87	87	87	87	87
88	88	88	88	88	88
89	89	89	89	89	89
90	90	90	90	90	90
91	91	91	91	91	91
92	92	92	92	92	92
93	93	93	93	93	93
94	94	94	94	94	94
95	95	95	95	95	95
96	96	96	96	96	96
97	97	97	97	97	97
98	98	98	98	98	98
99	99	99	99	99	99
100	100	100	100	100	100

DATE
TIME

MODE	PHIN(I, 6)	PHI(I, 6)	PHI(I, 6)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	0.	0.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.
46	0.	0.	0.
47	0.	0.	0.

DATE
TIME

NODE	SMIN(I, 7)	SMI(I, 7)	SMIV(I, 7)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	0.	0.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.
46	0.	0.	0.
47	0.	0.	0.

DATE
TIME

NO	PMIN(I, B)	PMAX(I, B)	PMIN(I, B)	PMAX(I, B)
1	0.118200E+00	0.0	0.0	0.0
2	0.118200E+00	0.0	0.0	0.0
3	0.118200E+00	0.0	0.0	0.0
4	0.118200E+00	0.0	0.0	0.0
5	0.118200E+00	0.0	0.0	0.0
6	0.118200E+00	0.0	0.0	0.0
7	0.118200E+00	0.0	0.0	0.0
8	0.118200E+00	0.0	0.0	0.0
9	0.118200E+00	0.0	0.0	0.0
10	0.118200E+00	0.0	0.0	0.0
11	0.118200E+00	0.0	0.0	0.0
12	0.118200E+00	0.0	0.0	0.0
13	0.118200E+00	0.0	0.0	0.0
14	0.118200E+00	0.0	0.0	0.0
15	0.118200E+00	0.0	0.0	0.0
16	0.118200E+00	0.0	0.0	0.0
17	0.118200E+00	0.0	0.0	0.0
18	0.118200E+00	0.0	0.0	0.0
19	0.118200E+00	0.0	0.0	0.0
20	0.118200E+00	0.0	0.0	0.0
21	0.118200E+00	0.0	0.0	0.0
22	0.118200E+00	0.0	0.0	0.0
23	0.118200E+00	0.0	0.0	0.0
24	0.118200E+00	0.0	0.0	0.0
25	0.118200E+00	0.0	0.0	0.0
26	0.118200E+00	0.0	0.0	0.0
27	0.118200E+00	0.0	0.0	0.0
28	0.118200E+00	0.0	0.0	0.0
29	0.118200E+00	0.0	0.0	0.0
30	0.118200E+00	0.0	0.0	0.0
31	0.118200E+00	0.0	0.0	0.0
32	0.118200E+00	0.0	0.0	0.0
33	0.118200E+00	0.0	0.0	0.0
34	0.118200E+00	0.0	0.0	0.0
35	0.118200E+00	0.0	0.0	0.0
36	0.118200E+00	0.0	0.0	0.0
37	0.118200E+00	0.0	0.0	0.0
38	0.118200E+00	0.0	0.0	0.0
39	0.118200E+00	0.0	0.0	0.0
40	0.118200E+00	0.0	0.0	0.0
41	0.118200E+00	0.0	0.0	0.0
42	0.118200E+00	0.0	0.0	0.0
43	0.118200E+00	0.0	0.0	0.0
44	0.118200E+00	0.0	0.0	0.0
45	0.118200E+00	0.0	0.0	0.0
46	0.118200E+00	0.0	0.0	0.0
47	0.118200E+00	0.0	0.0	0.0

[illegible]

DATE
TIME

CODE	P-10(1,10)	P-12(1,10)	P-13(1,10)
1	.173000E+00	.00	.00
2	.173000E+00	.00	.00
3	.173000E+00	.00	.00
4	.173000E+00	.00	.00
5	.173000E+00	.00	.00
6	.173000E+00	.00	.00
7	.173000E+00	.00	.00
8	.173000E+00	.00	.00
9	.173000E+00	.00	.00
10	.173000E+00	.00	.00
11	.173000E+00	.00	.00
12	.173000E+00	.00	.00
13	.173000E+00	.00	.00
14	.173000E+00	.00	.00
15	.173000E+00	.00	.00
16	.173000E+00	.00	.00
17	.173000E+00	.00	.00
18	.173000E+00	.00	.00
19	.173000E+00	.00	.00
20	.173000E+00	.00	.00
21	.173000E+00	.00	.00
22	.173000E+00	.00	.00
23	.173000E+00	.00	.00
24	.173000E+00	.00	.00
25	.173000E+00	.00	.00
26	.173000E+00	.00	.00
27	.173000E+00	.00	.00
28	.173000E+00	.00	.00
29	.173000E+00	.00	.00
30	.173000E+00	.00	.00
31	.173000E+00	.00	.00
32	.173000E+00	.00	.00
33	.173000E+00	.00	.00
34	.173000E+00	.00	.00
35	.173000E+00	.00	.00
36	.173000E+00	.00	.00
37	.173000E+00	.00	.00
38	.173000E+00	.00	.00
39	.173000E+00	.00	.00
40	.173000E+00	.00	.00
41	.173000E+00	.00	.00
42	.173000E+00	.00	.00
43	.173000E+00	.00	.00
44	.173000E+00	.00	.00
45	.173000E+00	.00	.00
46	.173000E+00	.00	.00
47	.173000E+00	.00	.00

DATE
TIME

MODE	PHIN(I,1)	PHI2(I,1)	PHI3(I,1)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	0.	0.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.
46	0.	0.	0.
47	0.	0.	0.

[illegible]

DATE
TIME

NODE	PMIN(I,14)	PMID(I,14)	PMAX(I,14)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	0.	0.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.
46	0.	0.	0.
47	0.	0.	0.

NUML	PRIN1(1,10)	PRIN2(1,10)	PRIN3(1,10)	PRIN4(1,10)	PRIN5(1,10)
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	0	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
35	0	0	0	0	0
36	0	0	0	0	0
37	0	0	0	0	0
38	0	0	0	0	0
39	0	0	0	0	0
40	0	0	0	0	0
41	0	0	0	0	0
42	0	0	0	0	0
43	0	0	0	0	0
44	0	0	0	0	0
45	0	0	0	0	0
46	0	0	0	0	0
47	0	0	0	0	0
48	0	0	0	0	0
49	0	0	0	0	0
50	0	0	0	0	0
51	0	0	0	0	0
52	0	0	0	0	0
53	0	0	0	0	0
54	0	0	0	0	0
55	0	0	0	0	0
56	0	0	0	0	0
57	0	0	0	0	0
58	0	0	0	0	0
59	0	0	0	0	0
60	0	0	0	0	0
61	0	0	0	0	0
62	0	0	0	0	0
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	0	0	0	0	0
67	0	0	0	0	0
68	0	0	0	0	0
69	0	0	0	0	0
70	0	0	0	0	0
71	0	0	0	0	0
72	0	0	0	0	0
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
76	0	0	0	0	0
77	0	0	0	0	0
78	0	0	0	0	0
79	0	0	0	0	0
80	0	0	0	0	0
81	0	0	0	0	0
82	0	0	0	0	0
83	0	0	0	0	0
84	0	0	0	0	0
85	0	0	0	0	0
86	0	0	0	0	0
87	0	0	0	0	0
88	0	0	0	0	0
89	0	0	0	0	0
90	0	0	0	0	0
91	0	0	0	0	0
92	0	0	0	0	0
93	0	0	0	0	0
94	0	0	0	0	0
95	0	0	0	0	0
96	0				

NUM	PHINJ,10J	PHI7J,10J	PHIYI,10J
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46
47	47	47	47
48	48	48	48
49	49	49	49
50	50	50	50
51	51	51	51
52	52	52	52
53	53	53	53
54	54	54	54
55	55	55	55
56	56	56	56
57	57	57	57
58	58	58	58
59	59	59	59
60	60	60	60
61	61	61	61
62	62	62	62
63	63	63	63
64	64	64	64
65	65	65	65
66	66	66	66
67	67	67	67
68	68	68	68
69	69	69	69
70	70	70	70
71	71	71	71
72	72	72	72
73	73	73	73
74	74	74	74
75	75	75	75
76	76	76	76
77	77	77	77
78	78	78	78
79	79	79	79
80	80	80	80
81	81	81	81
82	82	82	82
83	83	83	83
84	84	84	84
85	85	85	85
86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

```

** ARRAY OF REDUCED FREQUENCIES **
0.00000  .10000  .25000  .50000  .75000  1.00000
1.45000  1.50000  1.75000  2.00000

REFERENCE CHORD      = 300.0000
REFERENCE SEMI-SPIN  = 450.0000
REFERENCE AREA      = 406700.0000
WARM-UP TIME       = .05000
RETA               = .52678
MOMENT AXIS        = 1000.0000

NUMBER OF PANELS    = 9
NUMBER OF BORLES    = 2
TOTAL N.O.U.PERIODS = 154

1PM1 = 0
1PM2 = 0
1PM3 = 0
NO, GUST ORIENTATIONS = 13

```

*** SEGMENT 1 ***

GENERATE GEOMETRIC ARRAYS

** PANEL NO. 1 INPUT VALUES **

X1 = 1400000.000 X2 = 1120000000.000 Y1 = 120000000.000 Z1 = 0.0000000
 X3 = 075000000.000 X4 = 1190000000.000 Y2 = 375000000.000 Z2 = 44.9600000
 NL = 0 NS = 2
 GROUP NUMBER = 1

9 CHORDWISE DIVISIONS FOR PANEL 1

0. 1452021+00 142000000.000 220000000.000 375000000.000 500000000.000 622031E+00
 0. 1452021+00 142000000.000 220000000.000 375000000.000 500000000.000 622031E+00

3 SPANWISE DIVISIONS FOR PANEL 1

0. 0.11760E+00 0.100000E+01

00 PANEL NO. d INPUT VALUES 00

X1 = 893.610000 X2 = 1114.990000 Y1 = 375.000000 Z1 = 44.960000
 X3 = 938.800000 X4 = 1141.990000 Y2 = 450.000000 Z2 = 54.190000
 NC = 6 NS = 1
 GROUP NUMBER 0 1

7 CHORD-132 DIVISIONS FOR PANEL 2

0.100000E+01 .100000E+00 .333333E+00 .500000E+00 .666667E+00 .833333E+00

8 SPAN-132 DIVISIONS FOR PANEL 2

0. .100000E+01

```

.. PANEL NO. 3 INPUT VALUES ..
X1 = 1114.901000 X2 = 1190.460000 Y1 = 375.000000 Z1 = 44.960000
X3 = 1141.990000 X4 = 1211.450000 Y2 = 450.000000 Z2 = 55.190000
NC = 2 NS = 1
GROUP NUMBER = 1

3 CIRCUMFERENCE DIVISIONS FOR PANEL 3
0. 500000E+00 .100000E+01
2 SPANWISE DIVISIONS FOR PANEL 3
0. 100000E+01

```


00 PANEL NO. 4 INPUT VALUES 00

X1 = 938,00000 X2 = 1211,45000 Y1 = 450,00000 Z1 = 50,190000
 X3 = 1260,00000 X4 = 1350,00000 Y2 = 950,00000 Z2 = 100,350000
 NC = 0 NS = 4

GROUP NUMBER 6 1

0 CRUDE-OISE DIVISIONS FOR PANEL 4

0. 745262E+00 .125000E+00 .250000E+00 .175000E+00 .500000E+00 .022631E+00
 .072631E+00 .100000E+01

5 SPANWISE DIVISIONS FOR PANEL 4

0. .300000E+00 .000000E+00 .050000E+00 .100000E+01

```

X1 = 1800.000000  X2 = 1811.990000  V1 = 40.000000  Z1 = 111.137000
X3 = 1800.000000  X4 = 1912.370000  V2 = 374.000000  Z4 = 172.210000
XC = 4  X3 = 5
GROUP NUMBER = 2

```

5 CMCURRUISE DIVISIONS FOR PAVEL 5

0.	450000+00	500000+00	750000+00	1000000+00
0.	230000+00	400000+00	550000+00	770000+00

00 PANEL NO. 0 INPUT VALUES 00

X1 = 1411.920000 X2 = 1870.000000 Y1 = 40.000000 Z1 = 113.117000

X3 = 1912.370000 X4 = 1940.000000 Y2 = 375.000000 Z2 = 172.210000

NC = 2 NG = 5

GROUP NUMBER 0 2

3 CHORDWISE DIVISIONS FOR PANEL 0

0. 500000E+00 100000E+01

0 SPANWISE DIVISIONS FOR PANEL 0

0. 230010E+00 401000E+00 552240E+00 776120E+00 100000E+01

.. PANEL NO. 7 INPUT VALUES ..

X1 = 1505,000000 X2 = 1728,740000 Y1 = 0,000000 Z1 = 120,000000
 X3 = 1420,000000 X4 = 1488,810000 Y2 = 0,000000 Z2 = 450,000000
 NC = 6 NY = 4
 GROUP NUMBER = 3

5 COMPUTE DIVISIONS FOR PANEL 7

0. 25,0000E+00 .500000E+00 .750000E+00 .100000E+01
 5 SPANWISE DIVISIONS FOR PANEL 7
 0. 272730E+00 .575740E+00 .878790E+00 .100000E+01

00. PANEL NO. 4 INSET VALUES 00

X1 = 1720.740000 X2 = 1420.000000 Y1 = 0.000000 Z1 = 120.000000

X3 = 1420.000000 X4 = 1420.000000 Y2 = 0.000000 Z2 = 450.000000

NC = 2 NS = 4

GROUP NUMBER = 3

3 CHORDWISE DIVISIONS FOR PANEL 0

0. 50.0000E+00 100000E+01

5 SPANWISE DIVISIONS FOR PANEL 0

0. 272710E+00 579760E+00 878790E+00 100000E+01

00 PANEL NO. 9 INPUT VALUES 00

X1 = 740,000000 XP = 941,380000 Y1 = 375,000000 Z1 = 0,000000

X2 = 903,810000 Y2 = 1114,990000 Z2 = 375,000000

XP = 941,380000

GROUP NUMBER 0 1

7 CHURCH-18F DIVISIONS FOR PANEL 9

0, .100000E+01 .187727E+00 .335453E+00 .503178E+00 .670905E+00 .815453E+00

2 SPANWISE DIVISIONS FOR PANEL 9

0, .100000E+01

```

** SUMMARY OF PANEL DATA **
PANEL  NC  NB  NBCHRAY  DIMENSIONAL
        NC  NB  NBCHRAY  ANGLE
1      1  2  16  9.99926
2      1  1  22  10.00406
3      2  1  24  10.00406
4      6  4  56  9.99961
5      4  5  76  10.00057
6      2  5  86  10.00057
7      4  4  102  90.00001
8      2  4  110  90.00001
9      6  1  116  90.00001

```

GEOMETRY ARRAYS FROM ALL PANELS

PANEL NO.	STRIP NO.	STR NO.	1/4 CHORD X	1/4 CHORD Y	1/4 CHORD Z	CENTER	1/4 CHORD X	1/4 CHORD Y	1/4 CHORD Z	1/4 CHORD X	1/4 CHORD Y	1/4 CHORD Z
1	1	1	805.44919	751.47500	742.96655	814.04809	45.34528	45.34528	45.34528	45.34528	45.34528	45.34528
1	1	2	851.01447	792.17500	825.43143	857.20464	47.14528	47.14528	47.14528	47.14528	47.14528	47.14528
1	1	3	906.37975	866.47500	916.60111	903.51022	45.34528	45.34528	45.34528	45.34528	45.34528	45.34528
1	1	4	941.74573	896.17500	919.62439	943.74978	45.34528	45.34528	45.34528	45.34528	45.34528	45.34528
1	1	5	946.46349	941.64974	964.21273	966.77552	44.55552	44.55552	44.55552	44.55552	44.55552	44.55552
1	1	6	1.50.47111	946.46349	1003.71725	1022.13878	44.55552	44.55552	44.55552	44.55552	44.55552	44.55552
1	1	7	1.75.76614	1035.29962	1053.85165	1072.00769	46.22504	46.22504	46.22504	46.22504	46.22504	46.22504
1	1	8	1122.91322	1081.69984	1099.47470	1116.05756	46.22504	46.22504	46.22504	46.22504	46.22504	46.22504
1	2	1	978.56591	814.04809	854.47545	902.84281	40.18091	40.18091	40.18091	40.18091	40.18091	40.18091
1	2	2	914.74081	857.20464	895.65636	940.02408	40.18091	40.18091	40.18091	40.18091	40.18091	40.18091
1	2	3	954.92772	900.51422	936.81727	977.15511	40.18091	40.18091	40.18091	40.18091	40.18091	40.18091
1	2	4	994.12403	943.74978	979.01817	1014.28656	40.18091	40.18091	40.18091	40.18091	40.18091	40.18091
1	2	5	1034.71800	986.77552	1019.00670	1051.24180	39.41907	39.41907	39.41907	39.41907	39.41907	39.41907
1	2	6	1074.13740	1029.14674	1058.42410	1087.64942	39.41907	39.41907	39.41907	39.41907	39.41907	39.41907
1	2	7	1114.69446	1072.00769	1094.22425	1124.44842	40.94242	40.94242	40.94242	40.94242	40.94242	40.94242
1	2	8	1154.64188	1116.05756	1139.17667	1162.28378	40.94242	40.94242	40.94242	40.94242	40.94242	40.94242
2	1	1	422.74463	902.43417	925.03021	947.28625	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	2	478.12145	939.73063	960.43105	981.13125	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	3	524.50229	976.62749	995.81187	1014.99024	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	4	564.44319	1013.52419	1031.19273	1044.96127	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	5	604.44319	1050.42787	1068.67356	1082.72628	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	6	644.44319	1087.11744	1101.94332	1116.59120	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	7	684.44319	1124.44445	1137.56243	1150.67750	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	1	8	724.44319	1162.28375	1173.84313	1185.40250	35.34084	35.34084	35.34084	35.34084	35.34084	35.34084
2	2	1	478.12145	939.73063	960.43105	981.13125	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	2	524.50229	976.62749	995.81187	1014.99024	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	3	564.44319	1013.52419	1031.19273	1044.96127	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	4	604.44319	1050.42787	1068.67356	1082.72628	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	5	644.44319	1087.11744	1101.94332	1116.59120	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	6	684.44319	1124.44445	1137.56243	1150.67750	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	7	724.44319	1162.28375	1173.84313	1185.40250	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
2	2	8	764.44319	1200.42787	1213.84313	1226.40250	31.03156	31.03156	31.03156	31.03156	31.03156	31.03156
3	1	1	1191.94436	1015.40156	1022.76945	1064.13734	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	2	1231.94436	1055.40156	1063.40156	1092.11922	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	3	1271.94436	1095.40156	1103.40156	1120.10109	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	4	1311.94436	1135.40156	1143.40156	1147.45039	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	5	1351.94436	1175.40156	1183.40156	1175.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	6	1391.94436	1215.40156	1223.40156	1203.11967	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	7	1431.94436	1255.40156	1263.40156	1231.61046	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	1	8	1471.94436	1295.40156	1303.40156	1259.55987	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	1	1511.94436	1335.40156	1343.40156	1287.45709	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	2	1551.94436	1375.40156	1383.40156	1315.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	3	1591.94436	1415.40156	1423.40156	1343.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	4	1631.94436	1455.40156	1463.40156	1371.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	5	1671.94436	1495.40156	1503.40156	1400.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	6	1711.94436	1535.40156	1543.40156	1428.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	7	1751.94436	1575.40156	1583.40156	1456.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
3	2	8	1791.94436	1615.40156	1623.40156	1484.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	1	1831.94436	1655.40156	1663.40156	1512.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	2	1871.94436	1695.40156	1703.40156	1540.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	3	1911.94436	1735.40156	1743.40156	1568.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	4	1951.94436	1775.40156	1783.40156	1596.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	5	1991.94436	1815.40156	1823.40156	1624.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	6	2031.94436	1855.40156	1863.40156	1652.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	7	2071.94436	1895.40156	1903.40156	1680.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	1	8	2111.94436	1935.40156	1943.40156	1708.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	1	2151.94436	1975.40156	1983.40156	1736.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	2	2191.94436	2015.40156	2023.40156	1764.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	3	2231.94436	2055.40156	2063.40156	1792.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	4	2271.94436	2095.40156	2103.40156	1820.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	5	2311.94436	2135.40156	2143.40156	1848.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	6	2351.94436	2175.40156	2183.40156	1876.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	7	2391.94436	2215.40156	2223.40156	1904.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	2	8	2431.94436	2255.40156	2263.40156	1932.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	1	2471.94436	2295.40156	2303.40156	1960.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	2	2511.94436	2335.40156	2343.40156	1988.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	3	2551.94436	2375.40156	2383.40156	2016.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	4	2591.94436	2415.40156	2423.40156	2044.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	5	2631.94436	2455.40156	2463.40156	2072.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	6	2671.94436	2495.40156	2503.40156	2100.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	7	2711.94436	2535.40156	2543.40156	2128.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	3	8	2751.94436	2575.40156	2583.40156	2156.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	4	1	2791.94436	2615.40156	2623.40156	2184.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	4	2	2831.94436	2655.40156	2663.40156	2212.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	4	3	2871.94436	2695.40156	2703.40156	2240.40156	24.91219	24.91219	24.91219	24.91219	24.91219	24.91219
4	4	4	2911.94436	2735.40156	2743.40156	2268.40156	24.9121					

00 GEOMETRY ARRAYS FOR ALL PANELS 00

PANEL NO.	STRIP NO.	H/A NO.	1/4 CHORD X	1/4 CHORD INBOARD	1/4 CHORD CENTER	OUTBOARD	BOX CHORD DELTA-X	1/4 CHORD BEEP ANGLE
7	20	91	1650.41742	1629.49116	1670.45089	1710.41002	31.31126	.68151
7	20	92	1727.35054	1667.45374	1701.56185	1731.71412	31.31126	.62574
7	20	93	1753.44483	1705.41622	1717.11721	1763.41622	31.31126	.56974
7	20	94	1781.41729	1743.37562	1733.65346	1791.42231	31.31126	.49933
7	21	95	1765.52083	1710.41002	1751.16216	1791.72469	24.67493	.68151
7	21	96	1764.18174	1719.71412	1755.44424	1811.97446	24.67493	.62374
7	21	97	1812.45064	1769.41622	1770.51224	1812.26024	24.67493	.56500
7	21	98	1837.31293	1797.42231	1825.19416	1832.16601	24.67493	.49933
7	22	99	1817.14423	1791.72469	1807.95216	1824.17561	14.47414	.68151
7	22	100	1835.66136	1811.97446	1826.42649	1847.87613	14.47414	.62574
7	22	101	1852.13753	1832.22724	1844.90043	1857.59063	18.47414	.56974
7	22	102	1872.51163	1852.46501	1863.37457	1874.29313	18.47414	.49933
8	23	103	1781.51223	1741.14750	1766.71284	1781.27824	41.47404	.42466
8	23	104	1823.21444	1785.77753	1804.54352	1814.94954	41.47404	.35352
8	24	105	1827.74414	1781.27824	1804.12402	1826.97859	31.31203	.42466
8	24	106	1854.09549	1814.94954	1837.44467	1845.69119	31.31203	.35352
8	25	107	1862.34554	1826.97459	1843.42875	1872.67492	24.51157	.42466
8	25	108	1880.59911	1853.49139	1874.34232	1892.79325	24.51157	.35352
8	26	109	1890.59917	1872.67492	1881.61693	1893.99475	18.35467	.42466
8	26	110	1904.35263	1892.79425	1900.17350	1907.53175	18.35467	.35352
9	27	111	854.65353	749.28285	826.08705	902.89285	37.13140	1.28006
9	27	112	881.74479	786.41420	863.21920	943.02420	37.13116	1.24006
9	27	113	916.41597	823.54536	900.35036	977.13536	37.13116	1.28006
9	27	114	956.04715	860.67656	937.44156	1014.28656	37.13116	1.28006
9	27	115	992.65066	897.63186	974.43686	1051.24186	36.42764	1.28006
9	27	116	1029.07615	934.05944	1010.66444	1087.66944	36.42761	1.28006

STRIP	Y	Z	DELTA-Y	DELTA-Z	E	CUMUL	X-L-F.
1	172.49940	9.25516	104.99940	10.51271	93.30917	302.92229	771.62523
2	299.79940	31.71636	157.00127	26.44727	76.15743	321.44725	646.43023
3	414.50000	51.57500	75.00000	13.23000	38.07897	212.28500	916.23500
4	414.50000	51.57500	75.00000	13.23000	38.07897	12.56500	1124.49000
5	425.00000	71.41400	155.70000	26.44800	76.15800	268.24500	981.94000
6	675.00000	97.46200	155.00000	26.44800	76.15800	169.44750	1074.14000
7	812.50000	122.10400	125.00000	13.22400	61.46409	144.72875	1147.17000
8	912.50000	139.71800	75.00000	13.22400	38.07445	122.19875	1217.41000
9	107.50000	129.19061	60.00135	14.10722	40.01742	142.44297	1641.49290
10	167.50000	134.91842	55.00365	9.69920	27.92613	126.41954	1717.76290
11	204.00270	141.15145	49.99540	6.41605	25.14317	115.94190	1745.97160
12	266.50000	142.17211	74.99940	13.22526	36.07846	65.11709	1779.55240
13	317.50010	165.59737	74.99980	13.22526	36.07846	81.28260	1819.45080
14	47.00000	120.19061	80.00135	14.10722	40.01742	54.18204	1821.07587
15	147.50000	134.91842	55.00365	9.69920	27.92613	48.24091	1844.20244
16	201.00270	141.15145	49.99540	6.41605	25.14317	43.49900	1859.93350
17	264.50000	142.17211	74.99940	13.22526	36.07846	37.81221	1878.64039
18	317.50010	165.59737	74.99980	13.22526	36.07846	31.01074	1901.11342
19	47.00000	120.19061	80.00135	14.10722	40.01742	167.79444	1542.50034
20	0.00000	260.00045	0.00000	99.99990	49.99995	134.11303	1661.66734
21	0.00000	340.00075	0.00000	99.99990	49.99995	94.69973	1745.00083
22	0.00000	430.00235	0.00000	99.99990	49.99995	73.49954	1803.33393
23	0.00000	165.00045	0.00000	99.99990	49.99995	83.34126	1750.29524
24	0.00000	260.00085	0.00000	99.99990	49.99995	69.62409	1795.80041
25	0.00000	360.00075	0.00000	99.99990	49.99995	49.02714	1843.70014
26	0.00000	430.00035	0.00000	99.99990	49.99995	36.70933	1877.23017
27	375.00000	24.48000	0.00000	44.96000	22.48000	221.18000	816.00900

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** BODY NO. 1 INPUT VALUES **

CENTER OF BODY COORDINATES X = 0.000000
AVERAGE HALF-LENGTH OF BODY = 120.000000
CROSS-SECTIONAL ASPECT RATIO = 1.000000
NUMBER OF INTERFERENCE ELEMENTS ON BODY = 4
NUMBER OF BLENDER BODY ELEMENTS = 14
REV ORIENTATION FLAG = 2
MISC FLAG = 0

1 K1=1 ELEMENTS FOR BODY 1
.450000E+03 .450000E+03 .114000E+04 .125000E+04
5 K1=1 ELEMENTS FOR BODY 1
.120000E+03 .120000E+03 .120000E+03 .120000E+03
4 T=1 ELEMENTS FOR BODY 1
.450000E+02 .114000E+03 .225000E+03 .115000E+03
15 K1=8 ELEMENTS FOR BODY 1
0. .250000E+02 .100000E+03 .200000E+03 .475000E+03
.450000E+03 .200000E+03 .050000E+03 .125000E+04 .115000E+04
.140000E+04 .175000E+04 .191200E+04
15 K1=8 ELEMENTS FOR BODY 1
0. .350000E+02 .700000E+02 .900000E+02 .110000E+03
.120000E+03 .120000E+03 .120000E+03 .100000E+03
.450000E+02 .600000E+02 0. .120000E+03 .120000E+03

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** BODY NO. 2 INPUT VALUES **
CENTER OF BODY COORDINATES X = 375.000000
AVERAGE VELOCITY OF BODY = 55.000000
CROSS-SECTIONAL ASPECT RATIO = 1.000000
NUMBER OF INTERFERENCE ELEMENTS ON BODY = 4
NUMBER OF SLENDER BODY ELEMENTS = 5
Z-AXIS ORIENTATION FLAG = 2
HORIZONTAL FLAG = 1
HORIZONTAL FLAG = 1

3 X-AXIS ELEMENTS FOR BODY 2
.700000E+01 .010200E+03 .000500E+03 .001300E+03 .115000E+04
5 X-AXIS ELEMENTS FOR BODY 2
.550000E+02 .550000E+02 .550000E+02 .550000E+02 .550000E+02
4 Y-AXIS ELEMENTS FOR BODY 2
.400000E+02 .150000E+03 .220000E+03 .150000E+03
6 Y-AXIS ELEMENTS FOR BODY 2
.000000E+00 .000000E+00 .000000E+00 .000000E+00 .000000E+00
6 Z-AXIS ELEMENTS FOR BODY 2
.000000E+00 .000000E+00 .000000E+00 .000000E+00 .000000E+00
0.

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INTERFERENCE		NO. GEOMETRY ARRAYS FOR ALL BODIES **					R=1	R=2	R=3	R=4
BODY NUMBER	SEGMENT NUMBER	R=1	R=2	R=3	R=4					
1	1	725.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
1	2	875.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
1	3	1025.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
1	4	1175.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
2	5	1325.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
2	6	1475.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
2	7	1625.00000	0.00000	0.00000	0.00000	120.00000	0.00000			
2	8	1775.00000	0.00000	0.00000	0.00000	120.00000	0.00000			

BLENDER BODY NUMBER		RECHART NUMBER	RT81	RT82	40	AP-PRIME
1	1	1	0.0000	25.0000	17.5000	1.0000
1	2	2	25.0000	100.0000	52.5000	4.4667
1	3	3	100.0000	200.0000	60.0000	2.0000
1	4	4	200.0000	300.0000	95.0000	5.1000
1	5	5	300.0000	475.0000	105.0000	5.714
1	6	6	475.0000	650.0000	115.0000	5.714
1	7	7	650.0000	800.0000	120.0000	0.0000
1	8	8	800.0000	950.0000	120.0000	0.0000
1	9	9	950.0000	1120.0000	120.0000	0.0000
1	10	10	1120.0000	1250.0000	140.0000	0.0000
1	11	11	1250.0000	1380.0000	140.0000	0.0000
1	12	12	1380.0000	1600.0000	162.5000	5.1500
1	13	13	1600.0000	1750.0000	172.5000	5.1667
1	14	14	1750.0000	1912.0000	20.0000	5.3703
1	15	15	1912.0000	2050.0000	22.5000	5.5000
2	16	16	2050.0000	2200.0000	50.0000	5.5000
2	17	17	2200.0000	2400.0000	55.0000	5.5000
2	18	18	2400.0000	2600.0000	55.0000	5.5000
2	19	19	2600.0000	2800.0000	55.0000	5.5000
2	20	20	2800.0000	3000.0000	55.0000	5.5000
2	21	21	3000.0000	3200.0000	55.0000	5.5000
2	22	22	3200.0000	3400.0000	55.0000	5.5000
2	23	23	3400.0000	3600.0000	55.0000	5.5000
2	24	24	3600.0000	3800.0000	55.0000	5.5000
2	25	25	3800.0000	4000.0000	55.0000	5.5000
2	26	26	4000.0000	4200.0000	55.0000	5.5000
2	27	27	4200.0000	4400.0000	55.0000	5.5000
2	28	28	4400.0000	4600.0000	55.0000	5.5000
2	29	29	4600.0000	4800.0000	55.0000	5.5000
2	30	30	4800.0000	5000.0000	55.0000	5.5000
2	31	31	5000.0000	5200.0000	55.0000	5.5000
2	32	32	5200.0000	5400.0000	55.0000	5.5000
2	33	33	5400.0000	5600.0000	55.0000	5.5000
2	34	34	5600.0000	5800.0000	55.0000	5.5000
2	35	35	5800.0000	6000.0000	55.0000	5.5000
2	36	36	6000.0000	6200.0000	55.0000	5.5000
2	37	37	6200.0000	6400.0000	55.0000	5.5000
2	38	38	6400.0000	6600.0000	55.0000	5.5000
2	39	39	6600.0000	6800.0000	55.0000	5.5000
2	40	40	6800.0000	7000.0000	55.0000	5.5000
2	41	41	7000.0000	7200.0000	55.0000	5.5000
2	42	42	7200.0000	7400.0000	55.0000	5.5000
2	43	43	7400.0000	7600.0000	55.0000	5.5000
2	44	44	7600.0000	7800.0000	55.0000	5.5000
2	45	45	7800.0000	8000.0000	55.0000	5.5000
2	46	46	8000.0000	8200.0000	55.0000	5.5000
2	47	47	8200.0000	8400.0000	55.0000	5.5000
2	48	48	8400.0000	8600.0000	55.0000	5.5000
2	49	49	8600.0000	8800.0000	55.0000	5.5000
2	50	50	8800.0000	9000.0000	55.0000	5.5000
2	51	51	9000.0000	9200.0000	55.0000	5.5000
2	52	52	9200.0000	9400.0000	55.0000	5.5000
2	53	53	9400.0000	9600.0000	55.0000	5.5000
2	54	54	9600.0000	9800.0000	55.0000	5.5000
2	55	55	9800.0000	10000.0000	55.0000	5.5000
2	56	56	10000.0000	10200.0000	55.0000	5.5000
2	57	57	10200.0000	10400.0000	55.0000	5.5000
2	58	58	10400.0000	10600.0000	55.0000	5.5000
2	59	59	10600.0000	10800.0000	55.0000	5.5000
2	60	60	10800.0000	11000.0000	55.0000	5.5000
2	61	61	11000.0000	11200.0000	55.0000	5.5000
2	62	62	11200.0000	11400.0000	55.0000	5.5000
2	63	63	11400.0000	11600.0000	55.0000	5.5000
2	64	64	11600.0000	11800.0000	55.0000	5.5000
2	65	65	11800.0000	12000.0000	55.0000	5.5000
2	66	66	12000.0000	12200.0000	55.0000	5.5000
2	67	67	12200.0000	12400.0000	55.0000	5.5000
2	68	68	12400.0000	12600.0000	55.0000	5.5000
2	69	69	12600.0000	12800.0000	55.0000	5.5000
2	70	70	12800.0000	13000.0000	55.0000	5.5000
2	71	71	13000.0000	13200.0000	55.0000	5.5000
2	72	72	13200.0000	13400.0000	55.0000	5.5000
2	73	73	13400.0000	13600.0000	55.0000	5.5000
2	74	74	13600.0000	13800.0000	55.0000	5.5000
2	75	75	13800.0000	14000.0000	55.0000	5.5000
2	76	76	14000.0000	14200.0000	55.0000	5.5000
2	77	77	14200.0000	14400.0000	55.0000	5.5000
2	78	78	14400.0000	14600.0000	55.0000	5.5000
2	79	79	14600.0000	14800.0000	55.0000	5.5000
2	80	80	14800.0000	15000.0000	55.0000	5.5000
2	81	81	15000.0000	15200.0000	55.0000	5.5000
2	82	82	15200.0000	15400.0000	55.0000	5.5000
2	83	83	15400.0000	15600.0000	55.0000	5.5000
2	84	84	15600.0000	15800.0000	55.0000	5.5000
2	85	85	15800.0000	16000.0000	55.0000	5.5000
2	86	86	16000.0000	16200.0000	55.0000	5.5000
2	87	87	16200.0000	16400.0000	55.0000	5.5000
2	88	88	16400.0000	16600.0000	55.0000	5.5000
2	89	89	16600.0000	16800.0000	55.0000	5.5000
2	90	90	16800.0000	17000.0000	55.0000	5.5000
2	91	91	17000.0000	17200.0000	55.0000	5.5000
2	92	92	17200.0000	17400.0000	55.0000	5.5000
2	93	93	17400.0000	17600.0000	55.0000	5.5000
2	94	94	17600.0000	17800.0000	55.0000	5.5000
2	95	95	17800.0000	18000.0000	55.0000	5.5000
2	96	96	18000.0000	18200.0000	55.0000	5.5000
2	97	97	18200.0000	18400.0000	55.0000	5.5000
2	98	98	18400.0000	18600.0000	55.0000	5.5000
2	99	99	18600.0000	18800.0000	55.0000	5.5000
2	100	100	18800.0000	19000.0000	55.0000	5.5000
2	101	101	19000.0000	19200.0000	55.0000	5.5000
2	102	102	19200.0000	19400.0000	55.0000	5.5000
2	103	103	19400.0000	19600.0000	55.0000	5.5000
2	104	104	19600.0000	19800.0000	55.0000	5.5000
2	105	105	19800.0000	20000.0000	55.0000	5.5000
2	106	106	20000.0000	20200.0000	55.0000	5.5000
2	107	107	20200.0000	20400.0000	55.0000	5.5000
2	108	108	20400.0000	20600.0000	55.0000	5.5000
2	109	109	20600.0000	20800.0000	55.0000	5.5000
2	110	110	20800.0000	21000.0000	55.0000	5.5000
2	111	111	21000.0000	21200.0000	55.0000	5.5000
2	112	112	21200.0000	21400.0000	55.0000	5.5000
2	113	113	21400.0000	21600.0000	55.0000	5.5000
2	114	114	21600.0000	21800.0000	55.0000	5.5000
2	115	115	21800.0000	22000.0000	55.0000	5.5000
2	116	116	22000.0000	22200.0000	55.0000	5.5000
2	117	117	22200.0000	22400.0000	55.0000	5.5000
2	118	118	22400.0000	22600.0000	55.0000	5.5000
2	119	119	22600.0000	22800.0000	55.0000	5.5000
2	120	120	22800.0000	23000.0000	55.0000	5.5000
2	121	121	23000.0000	23200.0000	55.0000	5.5000
2	122	122	23200.0000	23400.0000	55.0000	5.5000
2	123	123	23400.0000	23600.0000	55.0000	5.5000
2	124	124	23600.0000	23800.0000	55.0000	5.5000
2	125	125	23800.0000	24000.0000	55.0000	5.5000
2	126	126	24000.0000	24200.0000	55.0000	5.5000
2	127	127	24200.0000	24400.0000	55.0000	5.5000
2	128	128	24400.0000	24600.0000	55.0000	5.5000
2	129	129	24600.0000	24800.0000	55.0000	5.5000
2	130	130	24800.0000	25000.0000	55.0000	5.5000
2	131	131	25000.0000	25200.0000	55.0000	5.5000
2	132	132	25200.0000	25400.0000	55.0000	5.5000
2	133	133	25400.0000	25600.0000	55.0000	5.5000
2	134	134	25600.0000	25800.0000	55.0000	5.5000
2	135	135	25800.0000	26000.0000	55.0000	5.5000
2	136	136	26000.0000	26200.0000	55.0000	5.5000
2	137	137	26200.0000	26400.0000	55.0000	5.5000
2	138	138	26400.0000	26600.0000	55.0000	5.5000
2	139	139	26600.0000	26800.0000	55.0000	5.5000
2	140	140	26800.0000	27000.0000	55.0000	5.5000
2	141	141	27000.0000	27200.0000	55.0000	5.5000
2	142	142	27200.0000	27400.0000	55.0000	5.5000
2	143	143	27400.0000	27600.0000	55.0000	5.5000
2	144	144	27600.0000	27800.0000	55.0000	5.5000
2	145	145	27800.0000	28000.0000	55.0000	5.5000
2	146	146	28000.0000	28200.0000	55.0000	5.5000
2	147	147	28200.0000	28400.0000	55.0000	5.5000
2	148	148	28400.0000	28600.0000	55.0000	5.5000
2	149	149	28600.0000	28800.0000	55.0000	5.5000
2	150	150	28800.0000	29000.0000	55.0000	5.5000
2	151	151	29000.0000	29200.0000	55.0000	5.5000
2	152	152	29200.0000	29400.0000	55.0000	5.5000
2	153	153	29400.0000	29600.0000	55.0000	5.5000
2	154	154	29600.0000	29800.0000	55.0000	5.5000
2	155	155	29800.0000	30000.0000	55.0000	5.5000
2	156	156	30000.0000	30200.0000	55.0000	5.5000
2	157	157	30200.0000	30400.0000	55.0000	5.5000
2	158	158	30400.0000	30600.0000		

*** SPURRING 7 ***

CALCULATE FORCES FOR MODES AND GUST, AND GENERALIZED FORCES

GENERALIZED FORCE COLUMN	1 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	2 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	3 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	4 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	5 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	6 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED FORCE COLUMN	7 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
.000000E+00	.000000E+00	.000000E+00	.000000E+00
GENERALIZED GUST FORCE COLUMN	1 OF MATRIX	DPUS	
.000000E+00	.000000E+00	.000000E+00	.000000E+00

.432662E+04	0;	.274032E+06	0;	.798908E+04	0;
.307006E+05	0;				
GENERALIZED GUST FORCE COLUMN 2 OF MATRIX PGPS					
.121119E+07	0;	.044808E+04	0;	.118808E+04	0;
.113333E+06	0;	.100108E+06	0;		
.087001E+06	0;				
GENERALIZED GUST FORCE COLUMN 3 OF MATRIX PGPS					
.120840E+07	0;	.010950E+06	0;	.159702E+05	0;
.065325E+02	0;	.509103E+06	0;		
.794191E+05	0;				
GENERALIZED GUST FORCE COLUMN 4 OF MATRIX PGPS					
.103010E+07	0;	.774317E+05	0;	.112926E+05	0;
.011077E+02	0;	.557162E+06	0;		
.061879E+05	0;				
GENERALIZED GUST FORCE COLUMN 5 OF MATRIX PGPS					
.103486E+07	0;	.774317E+05	0;	.112926E+05	0;
.011077E+02	0;	.557162E+06	0;		
.061879E+05	0;				
GENERALIZED GUST FORCE COLUMN 6 OF MATRIX PGPS					
.120840E+07	0;	.010950E+06	0;	.159702E+05	0;
.065325E+02	0;	.509103E+06	0;		
.794191E+05	0;				
GENERALIZED GUST FORCE COLUMN 7 OF MATRIX PGPS					
.127717E+07	0;	.044340E+05	0;	.138106E+05	0;
.740391E+02	0;	.437432E+06	0;		
.087791E+05	0;				
GENERALIZED GUST FORCE COLUMN 8 OF MATRIX PGPS					
.730246E+06	0;	.247525E+05	0;	.798908E+04	0;
.032662E+02	0;	.252552E+06	0;		
.307006E+05	0;				
GENERALIZED GUST FORCE COLUMN 9 OF MATRIX PGPS					
0;	0;	0;	0;	0;	0;
0;	0;	0;	0;	0;	0;
0;	0;	0;	0;	0;	0;
GENERALIZED GUST FORCE COLUMN 10 OF MATRIX PGPS					
0;	0;	0;	0;	0;	0;
0;	0;	0;	0;	0;	0;
0;	0;	0;	0;	0;	0;

S/B same as Column 2 of
DPOS x 10³ (.001 Radian Rotation
used for R.B. Pitch)

GENERALIZED FORCE COLUMN	1 UP MATRIX	UZUS	0:	0:
-0070-9E-10	-000000E-10	0:		
0:	-000000E-11	0:		
-011217E-10				
GENERALIZED FORCE COLUMN	2 UP MATRIX	UZUS	0:	0:
-001920E+00	-010700E+02	0:		
0:	-050700E+00	0:		
-000000E+02				
GENERALIZED FORCE COLUMN	3 UP MATRIX	UZUS	0:	0:
0:	0:	0:		
0:	0:	0:		
0:				
GENERALIZED FORCE COLUMN	4 UP MATRIX	DZUS	0:	0:
-000000E+01	-000000E+01	0:		
0:	-010000E-01	0:		
-000000E+01				
GENERALIZED FORCE COLUMN	5 UP MATRIX	DZUS	0:	0:
-000000E-03	-010000E-03	0:		
0:	-000000E-04	0:		
-010000E-03				
GENERALIZED FORCE COLUMN	6 UP MATRIX	DZUS	0:	0:
-000000E-04	-000000E-04	0:		
0:	-000000E-07	0:		
-000000E-04				
GENERALIZED FORCE COLUMN	7 UP MATRIX	DZUS	0:	0:
-000000E+02	-010000E+02	0:		
0:	-010000E+00	0:		
-000000E+02				
GENERALIZED FORCE COLUMN	8 UP MATRIX	FZUS	0:	0:
-000000E+00	-000000E+00	0:		
0:	-000000E+00	0:		
-000000E+00				
GENERALIZED FORCE COLUMN	9 UP MATRIX	FZUS	0:	0:
-000000E+00	-000000E+00	0:		
0:	-000000E+00	0:		
-000000E+00				

GENERALIZED GUST FORCE COLUMN 1 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 2 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 3 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 4 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 5 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 6 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 7 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 8 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 9 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 10 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:
GENERALIZED GUST FORCE COLUMN 11 OF MATRIX F0Z5	0:	0:	0:
0:	0:	0:	0:
0:	0:	0:	0:

GENERALIZED GUST FORCE COLUMN 12 OF MAINIA	PUED		
0.000000	0.0	0.0	0.0
0.000000	0.0	0.0	0.0
0.000000	0.0	0.0	0.0

GENERALIZED GUST FORCE COLUMN 13 OF MAINIA	PUED		
0.000000	0.0	0.0	0.0
0.000000	0.0	0.0	0.0
0.000000	0.0	0.0	0.0

GENERALIZED FORCE COLUMN	1 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	2 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	3 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	4 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	5 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	6 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED FORCE COLUMN	7 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED GUST FORCE COLUMN	1 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
GENERALIZED GUST FORCE COLUMN	2 OF MATRIX	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00

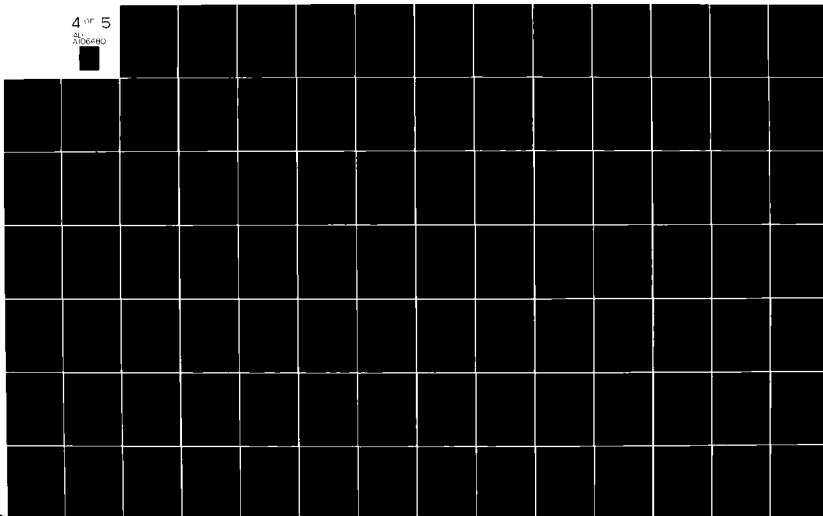
AD-A106 480

DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3
NUCLEAR BLAST RESPONSE COMPUTER PROGRAM, VOLUME 1. PROGRAM DESC--ETC(U)
AUG 81 J A MCGREW, J P GIESING, T P KALMAN DAA001-75-C-0216
AFWL-TR-81-32-VOL-1 NL

UNCLASSIFIED

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ADDA001



0.	0.				
GENERALIZED GUST FORCE COLUMN 12 OF MATRIX PGVS					
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
GENERALIZED GUST FORCE COLUMN 13 OF MATRIX PGVS					
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED FORCE COLUMN	1 OF MATRIX	UPUA	
-0.12025E+00	-0.02025E+00	0:	0:
-0.01074E+02	-0.00077E-04	0:	0:
-0.01074E+01	-0.00074E-04	0:	0:
GENERALIZED FORCE COLUMN	2 OF MATRIX	UPUA	
-0.12767E+03	-0.00031E+02	0:	0:
-0.06150E+02	-0.00031E+01	0:	0:
-0.04574E+02	-0.00031E+02	0:	0:
GENERALIZED FORCE COLUMN	3 OF MATRIX	UPUA	
-0.17701E+09	-0.00031E+09	0:	0:
-0.07620E+10	-0.00031E+10	0:	0:
-0.12601E+09	-0.00031E+09	0:	0:
GENERALIZED FORCE COLUMN	4 OF MATRIX	UPUA	
-0.07421E+02	-0.00031E+02	0:	0:
-0.12186E+01	-0.00031E+01	0:	0:
-0.53128E+02	-0.00031E+02	0:	0:
GENERALIZED FORCE COLUMN	5 OF MATRIX	UPUA	
-0.51377E+01	-0.00031E+01	0:	0:
-0.10261E+02	-0.00031E+02	0:	0:
-0.25110E+01	-0.00031E+01	0:	0:
GENERALIZED FORCE COLUMN	6 OF MATRIX	UPUA	
-0.18740E+02	-0.00031E+02	0:	0:
-0.08440E+02	-0.00031E+02	0:	0:
-0.63770E+04	-0.00031E+04	0:	0:
GENERALIZED FORCE COLUMN	7 OF MATRIX	UPUA	
-0.40781E+03	-0.00031E+03	0:	0:
-0.16792E+03	-0.00031E+03	0:	0:
-0.33049E+03	-0.00031E+03	0:	0:
GENERALIZED FORCE COLUMN	8 OF MATRIX	UPUA	
-0.38136E+10	-0.00031E+10	0:	0:
-0.23473E+13	-0.00031E+13	0:	0:
-0.26912E+10	-0.00031E+10	0:	0:
GENERALIZED FORCE COLUMN	9 OF MATRIX	UPUA	

GENERALIZED GUST FORCE COLUMN 1 OF MATRIX	0.0000E+00 0.0000E+00 -0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 2 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 3 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 4 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 5 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 6 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 7 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 8 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00
GENERALIZED GUST FORCE COLUMN 9 OF MATRIX	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00	0.0000E+00 0.0000E+00 0.0000E+00

GENERALIZED JUST FORCE COLUMN 10 OF MATRIX	FUPA	
-1127613E+03	0:	0:
-1706205E+03	0:	0:
-645215E+03	0:	0:
GENERALIZED JUST FORCE COLUMN 11 OF MATRIX	FUPA	
-192392E+03	0:	0:
-142112E+03	0:	0:
-262331E+03	0:	0:
GENERALIZED JUST FORCE COLUMN 12 OF MATRIX	FUPA	
-192392E+03	0:	0:
-142112E+03	0:	0:
-262331E+03	0:	0:
GENERALIZED JUST FORCE COLUMN 13 OF MATRIX	FUPA	
-192392E+03	0:	0:
-142112E+03	0:	0:
-262331E+03	0:	0:
GENERALIZED JUST FORCE COLUMN 14 OF MATRIX	FUPA	
-192392E+03	0:	0:
-142112E+03	0:	0:
-262331E+03	0:	0:

GENERALIZED FORCE COLUMN	1 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	2 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	3 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	4 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	5 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	6 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	7 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	8 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		
GENERALIZED FORCE COLUMN	9 UP MATRIX	UZUA		
0.000000E+00	0.000000E+00	0.000000E+00		
0.000000E+00	0.000000E+00	0.000000E+00		

285

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX	FGZA		
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
GENERALIZED GUST FORCE COLUMN 11 OF MATRIX	FGZA		
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
GENERALIZED GUST FORCE COLUMN 12 OF MATRIX	FGZA		
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
GENERALIZED GUST FORCE COLUMN 13 OF MATRIX	FGZA		
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000

0.00000000
0.00000000
0.00000000

0.00000000
0.00000000
0.00000000

0.00000000
0.00000000
0.00000000

0.00000000
0.00000000
0.00000000

287

288

- 471632E+04
 - 389178E+02
 - 707000E+04

0.00	0.00	0.00	0.00
-500000E+04	-471032E+04	-471032E+04	-471032E+04
-500000E+04	-389178E+02	-389178E+02	-389178E+02
-100000E+02	-707600E+04	-707600E+04	-707600E+04
0.00	0.00	0.00	0.00

STRIP	Y	Z	Y/Z	MODE 2		LIFT COEFFICIENT		MOMENT COEFFICIENT 1/4 CHORD OF STRIP		CENTER OF PRESSURE	
				REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
1	172.0998	9.2504	.1418	.000000	0.000000	-.000110	-.000000	.2588	0.0000	0.0000	0.0000
2	299.0998	31.7364	.3154	.000000	0.000000	-.000113	-.000000	.2327	0.0000	0.0000	0.0000
3	412.5000	51.5750	.4142	.000000	0.000000	-.000105	-.000000	.2495	0.0000	0.0000	0.0000
4	412.5000	51.5750	.4142	.000000	0.000000	-.000118	-.000000	.3175	0.0000	0.0000	0.0000
5	525.0000	71.4140	.5526	.000000	0.000000	-.000053	-.000000	.2577	0.0000	0.0000	0.0000
6	675.0000	91.6424	.7105	.000000	0.000000	-.000017	-.000000	.2523	0.0000	0.0000	0.0000
7	812.5000	122.1140	.8553	.000000	0.000000	.000073	-.000000	.2407	0.0000	0.0000	0.0000
8	912.5000	159.7340	.9605	.000000	0.000000	.000136	-.000000	.1968	0.0000	0.0000	0.0000
9	60.0000	120.1904	.0842	.000000	0.000000	-.000009	-.000000	.2516	0.0000	0.0000	0.0000
10	147.5032	152.0918	.1553	.000000	0.000000	-.000034	-.000000	.2655	0.0000	0.0000	0.0000
11	200.0027	141.3514	.2105	.000000	0.000000	-.000043	-.000000	.2670	0.0000	0.0000	0.0000
12	262.5001	152.3721	.2763	.000000	0.000000	-.000026	-.000000	.2597	0.0000	0.0000	0.0000
13	337.5001	165.5974	.3553	.000000	0.000000	-.000060	-.000000	.2275	0.0000	0.0000	0.0000
14	60.0000	120.1176	.0842	.000000	0.000000	-.000027	-.000000	.3161	0.0000	0.0000	0.0000
15	147.5032	152.0936	.1553	.000000	0.000000	-.000029	-.000000	.3065	0.0000	0.0000	0.0000
16	200.0027	141.3514	.2105	.000000	0.000000	-.000028	-.000000	.3052	0.0000	0.0000	0.0000
17	262.5003	152.3721	.2763	.000000	0.000000	-.000024	-.000000	.3001	0.0000	0.0000	0.0000
18	337.5001	165.5974	.3553	.000000	0.000000	-.000015	-.000000	.2977	0.0000	0.0000	0.0000
19	0.0000	165.0005	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
20	3.0000	260.0009	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
21	0.0000	360.0008	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
22	0.0000	430.0004	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
23	3.0000	165.0005	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
24	0.0000	260.0009	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
25	0.0000	360.0008	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
26	0.0000	430.0004	0.0000	.000000	0.000000	-.000000	-.000000	0.0000	0.0000	0.0000	0.0000
27	375.0000	22.4800	.1697	-.001751	0.000000	.000083	-.000000	.2972	0.0000	0.0000	0.0000

STATION	SPAN-188 (CM-XU)	SPAN-188 (CoCL)/[CoHAM] [HAG]
1	172.4994	.71018E+02 0.
2	299.9994	.69918E+02 0.
3	412.5006	.68818E+02 0.
4	525.0006	.67718E+02 0.
5	637.5003	.66618E+02 0.
6	750.0000	.65518E+02 0.
7	862.5000	.64418E+02 0.
8	975.0007	.63318E+02 0.
9	1087.5012	.62218E+02 0.
10	1200.0027	.61118E+02 0.
11	1312.5003	.60018E+02 0.
12	1425.0001	.58918E+02 0.
13	1537.5005	.57818E+02 0.
14	1650.0008	.56718E+02 0.
15	1762.5008	.55618E+02 0.
16	1875.0004	.54518E+02 0.
17	1987.5000	.53418E+02 0.

BODY ELM.	Y	Z	X/L	MODE 2		RUNNING LOAD (VERTICAL)		RUNNING LOAD (LATERAL)	
				REAL	IMAG.	(DP+Z/Q) / DX	IMAG.	(DP+Y/Q) / DY	IMAG.
1	0.0000	0.0000	0.0000	.254629	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.0000	0.0000	0.0000	.000771	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
4	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.0000	0.0000	0.0000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000

TOTALS ON BODY 1			
DP+Z/Q	0.000000	DP+Y/Q	0.000000
DP+Y/Q	0.000000	DP+Z/Q	0.000000

BODY ELEM.	Y	Z	X/L	RUNNING LOAD (VERTICAL) (DF=Z/Q) / DX		RUNNING LOAD (LATERAL) (DF=Y/Q) / DX	
				REAL	IMAG.	REAL	IMAG.
15	375.0000	-55.0000	.0185	.585583	0.000000	.000788	0.000000
16	375.0000	-55.0000	.0741	.290190	0.000000	.005126	0.000000
17	375.0000	-55.0000	.2685	.110982	0.000000	.030168	0.000000
18	375.0000	-55.0000	.5811	.018403	0.000000	.175721	0.000000
19	375.0000	-55.0000	.8708	-.316862	0.000000	.277610	0.000000
TOTALS ON BODY 2							
	F=Z/Q			0.000000		M=Z/Q	0.000000
	F=Y/Q			.000091	0.000000	M=Y/Q	-.000050
							0.000000

MODE 2

TOTALS ON LIFTING SURFACES

CZ	0	0.07223	0.000000	CY	0	0.000000	0.000000
CM	0	0.001796	0.000000	CM	0	0.000000	0.000000
CBL	0	0.000000	0.000000				

TOTALS ON ENGINE AIRCRAFT

CZ	0	0.00216	0.000000	CY	0	0.000000	0.000000
CM	0	0.000439	0.000000	CM	0	0.000000	0.000000
CBL	0	0.000000	0.000000				

TABLE 28
EXAMPLE PROBLEM OUTPUT LISTING
UNIT LOAD MODULE

DATE
TIME

PIPED DATA DECK INPUT 00

IDENT# 0

THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

UNIT

TAPE10 REBOUND

HEADIN DATA READ FROM TAPE10

NR 10
MSVN 7
NANVN 0

INITIAL DATA

NR: TOTAL MASSES = 20
NR: SYMMETRIC MINDS = 7
NR: ANTISYMMETRIC MINDS = 9
NR: ENGINES = 1
UNIT LOAD POINT FLAG = 0

NR: DATA DECK INPUT 00

FLIGHT DATA FOR FREQUENCY RESPONSE AND UNIT GUST LOADS

VELAS = 352.150 KIAS
ALTITUDE = 1000.000 FT.
SIZL FACTOR = 1.0000 INCHES/UNIT
VTHUE = 000.342 FTS
DYNAMIC P = 1033.336 PSF
SIGMA = .97104E+00
MACH = .8506
PLOT 2 PLU = 0
PLOT GAT FLAG = 2

3127 WORDS OF CORE ROD FOR STEP *** MAIN ***

DATE
TIME

MARS AND MASS POINT GEOMETRY

	EL(1)	EL(2)	EL(3)	EL(4)
1	0.00000000	0.00000000	0.00000000	0.00000000
2	0.00000000	0.00000000	0.00000000	0.00000000
3	0.00000000	0.00000000	0.00000000	0.00000000
4	0.00000000	0.00000000	0.00000000	0.00000000
5	0.00000000	0.00000000	0.00000000	0.00000000
6	0.00000000	0.00000000	0.00000000	0.00000000
7	0.00000000	0.00000000	0.00000000	0.00000000
8	0.00000000	0.00000000	0.00000000	0.00000000
9	0.00000000	0.00000000	0.00000000	0.00000000
10	0.00000000	0.00000000	0.00000000	0.00000000
11	0.00000000	0.00000000	0.00000000	0.00000000
12	0.00000000	0.00000000	0.00000000	0.00000000
13	0.00000000	0.00000000	0.00000000	0.00000000
14	0.00000000	0.00000000	0.00000000	0.00000000
15	0.00000000	0.00000000	0.00000000	0.00000000
16	0.00000000	0.00000000	0.00000000	0.00000000
17	0.00000000	0.00000000	0.00000000	0.00000000
18	0.00000000	0.00000000	0.00000000	0.00000000
19	0.00000000	0.00000000	0.00000000	0.00000000
20	0.00000000	0.00000000	0.00000000	0.00000000
21	0.00000000	0.00000000	0.00000000	0.00000000
22	0.00000000	0.00000000	0.00000000	0.00000000
23	0.00000000	0.00000000	0.00000000	0.00000000
24	0.00000000	0.00000000	0.00000000	0.00000000
25	0.00000000	0.00000000	0.00000000	0.00000000
26	0.00000000	0.00000000	0.00000000	0.00000000
27	0.00000000	0.00000000	0.00000000	0.00000000
28	0.00000000	0.00000000	0.00000000	0.00000000

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 2

MODE (2)	PHI(1, 2)	PHI(1, 2)	PHI(1, 2)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 3

MODE (3)	PHI(1, 3)	PHI(1, 3)	PHI(1, 3)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 4

MODE (4)	PHI(1, 4)	PHI(1, 4)	PHI(1, 4)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 4

MODE	FREQ	PHI(1, 4)	PHI(2, 4)	PHI(3, 4)
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.000000	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000	0.000000
24	0.000000	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000	0.000000

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 5

MODE	FREQ	PHI(1, 5)	PHI(2, 5)	PHI(3, 5)
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.000000	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000	0.000000

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 5

```

WR( 4) = .2000E+01
1  PH1(1, 5) PH2(1, 5)
24 0. 0.
25 -0. 0.
26 -0. 0.
27 0. 0.
28 0. 0.

```

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 6

```

WR( 6) = .4000E+01
1  PH1(1, 6) PH2(1, 6)
2 0. 0.
3 0. 0.
4 0. 0.
5 0. 0.
6 0. 0.
7 0. 0.
8 0. 0.
9 0. 0.
10 0. 0.
11 0. 0.
12 0. 0.
13 0. 0.
14 0. 0.
15 0. 0.
16 0. 0.
17 0. 0.
18 0. 0.
19 -0. 0.
20 -0. 0.
21 -0. 0.
22 0. 0.
23 0. 0.
24 0. 0.
25 0. 0.
26 0. 0.
27 -0. 0.
28 0. 0.

```

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 7

```

WR( 7) = .3000E+01
1  PH1(1, 7) PH2(1, 7)
2 0. 0.
3 0. 0.
4 0. 0.
5 0. 0.
6 0. 0.
7 -0. 0.
8 -0. 0.
9 -0. 0.
10 0. 0.
11 0. 0.

```

0418
1148

FREQUENCY AND INITIAL MODE SHAPES FOR MODE 7

NO (7)	PH1Z(1, 7)	PH1Z(1, 7)	PH1Z(1, 7)
1	.3000E+01		
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INITIAL MODE SHAPES FOR MODE 8

NO (8)	PH1Z(1, 8)	PH1Z(1, 8)	PH1Z(1, 8)
1	.3000E+01		
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INITIAL MODE SHAPES FOR MODE 9

NO (9)	PH1Z(1, 9)	PH1Z(1, 9)	PH1Z(1, 9)
1	.3000E+01		
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.

DATE
TIME

FREQUENCY AND INITIAL MODE SHAPES FOR MODE 9

MODE (n)	n	PMIX(1,9)	PMIX(2,9)
1	0	0.00000000	0.00000000
2	0	0.00000000	0.00000000
3	0	0.00000000	0.00000000
4	0	0.00000000	0.00000000
5	0	0.00000000	0.00000000
6	0	0.00000000	0.00000000
7	0	0.00000000	0.00000000
8	0	0.00000000	0.00000000
9	0	0.00000000	0.00000000
10	0	0.00000000	0.00000000
11	0	0.00000000	0.00000000
12	0	0.00000000	0.00000000
13	0	0.00000000	0.00000000
14	0	0.00000000	0.00000000
15	0	0.00000000	0.00000000
16	0	0.00000000	0.00000000
17	0	0.00000000	0.00000000
18	0	0.00000000	0.00000000
19	0	0.00000000	0.00000000
20	0	0.00000000	0.00000000
21	0	0.00000000	0.00000000
22	0	0.00000000	0.00000000
23	0	0.00000000	0.00000000
24	0	0.00000000	0.00000000
25	0	0.00000000	0.00000000
26	0	0.00000000	0.00000000
27	0	0.00000000	0.00000000
28	0	0.00000000	0.00000000

FREQUENCY AND INITIAL MODE SHAPES FOR MODE 10

MODE (n)	n	PMIX(1,10)	PMIX(2,10)
1	0	0.00000000	0.00000000
2	0	0.00000000	0.00000000
3	0	0.00000000	0.00000000
4	0	0.00000000	0.00000000
5	0	0.00000000	0.00000000
6	0	0.00000000	0.00000000
7	0	0.00000000	0.00000000
8	0	0.00000000	0.00000000
9	0	0.00000000	0.00000000
10	0	0.00000000	0.00000000
11	0	0.00000000	0.00000000
12	0	0.00000000	0.00000000
13	0	0.00000000	0.00000000
14	0	0.00000000	0.00000000
15	0	0.00000000	0.00000000
16	0	0.00000000	0.00000000
17	0	0.00000000	0.00000000
18	0	0.00000000	0.00000000
19	0	0.00000000	0.00000000
20	0	0.00000000	0.00000000

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 10

MODE	FREQ	PHI(X,1,10)	PHI(Z,1,10)
1	0.0000E+00	0.0000E+00	0.0000E+00
21	0.37000E+00	0.10700E+00	0.17300E+00
22	0.0000E+00	0.0000E+00	0.0000E+00
23	0.0000E+00	0.0000E+00	0.0000E+00
24	0.0000E+00	0.0000E+00	0.0000E+00
25	0.17100E+00	0.0000E+00	0.17300E+00
26	0.17100E+00	0.0000E+00	0.17300E+00
27	0.37000E+00	0.10700E+00	0.17300E+00
28	0.0000E+00	0.0000E+00	0.0000E+00

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 11

MODE	FREQ	PHI(X,1,11)	PHI(Z,1,11)
1	0.0000E+00	0.0000E+00	0.0000E+00
2	0.0000E+00	0.0000E+00	0.0000E+00
3	0.0000E+00	0.0000E+00	0.0000E+00
4	0.0000E+00	0.0000E+00	0.0000E+00
5	0.0000E+00	0.0000E+00	0.0000E+00
6	0.0000E+00	0.0000E+00	0.0000E+00
7	0.0000E+00	0.0000E+00	0.0000E+00
8	0.0000E+00	0.0000E+00	0.0000E+00
9	0.0000E+00	0.0000E+00	0.0000E+00
10	0.0000E+00	0.0000E+00	0.0000E+00
11	0.0000E+00	0.0000E+00	0.0000E+00
12	0.0000E+00	0.0000E+00	0.0000E+00
13	0.0000E+00	0.0000E+00	0.0000E+00
14	0.0000E+00	0.0000E+00	0.0000E+00
15	0.0000E+00	0.0000E+00	0.0000E+00
16	0.0000E+00	0.0000E+00	0.0000E+00
17	0.0000E+00	0.0000E+00	0.0000E+00
18	0.0000E+00	0.0000E+00	0.0000E+00
19	0.0000E+00	0.0000E+00	0.0000E+00
20	0.0000E+00	0.0000E+00	0.0000E+00
21	0.0000E+00	0.0000E+00	0.0000E+00
22	0.0000E+00	0.0000E+00	0.0000E+00
23	0.0000E+00	0.0000E+00	0.0000E+00
24	0.0000E+00	0.0000E+00	0.0000E+00
25	0.0000E+00	0.0000E+00	0.0000E+00
26	0.0000E+00	0.0000E+00	0.0000E+00
27	0.0000E+00	0.0000E+00	0.0000E+00
28	0.0000E+00	0.0000E+00	0.0000E+00

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 12

MODE	FREQ	PHI(X,1,12)	PHI(Z,1,12)
1	0.0000E+00	0.0000E+00	0.0000E+00
2	0.0000E+00	0.0000E+00	0.0000E+00
3	0.0000E+00	0.0000E+00	0.0000E+00
4	0.0000E+00	0.0000E+00	0.0000E+00
5	0.0000E+00	0.0000E+00	0.0000E+00
6	0.0000E+00	0.0000E+00	0.0000E+00
7	0.0000E+00	0.0000E+00	0.0000E+00
8	0.0000E+00	0.0000E+00	0.0000E+00

110

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 14

NO(12)	W(12)	PHI(1,12)	PHI(2,12)	PHI(3,12)
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
5	0.	0.	0.	0.
6	0.	0.	0.	0.
7	0.	0.	0.	0.
8	0.	0.	0.	0.
9	0.	0.	0.	0.
10	0.	0.	0.	0.
11	0.	0.	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	0.	0.	0.
15	0.	0.	0.	0.
16	0.	0.	0.	0.
17	0.	0.	0.	0.
18	0.	0.	0.	0.
19	0.	0.	0.	0.
20	0.	0.	0.	0.
21	0.	0.	0.	0.
22	0.	0.	0.	0.
23	0.	0.	0.	0.
24	0.	0.	0.	0.
25	0.	0.	0.	0.
26	0.	0.	0.	0.
27	0.	0.	0.	0.
28	0.	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 13

NO(13)	W(13)	PHI(1,13)	PHI(2,13)	PHI(3,13)
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
5	0.	0.	0.	0.
6	0.	0.	0.	0.
7	0.	0.	0.	0.
8	0.	0.	0.	0.
9	0.	0.	0.	0.
10	0.	0.	0.	0.
11	0.	0.	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	0.	0.	0.
15	0.	0.	0.	0.
16	0.	0.	0.	0.
17	0.	0.	0.	0.
18	0.	0.	0.	0.
19	0.	0.	0.	0.
20	0.	0.	0.	0.
21	0.	0.	0.	0.
22	0.	0.	0.	0.
23	0.	0.	0.	0.
24	0.	0.	0.	0.
25	0.	0.	0.	0.
26	0.	0.	0.	0.
27	0.	0.	0.	0.
28	0.	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 14

NO(14)	W(14)	PHI(1,14)	PHI(2,14)	PHI(3,14)
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
5	0.	0.	0.	0.
6	0.	0.	0.	0.
7	0.	0.	0.	0.
8	0.	0.	0.	0.
9	0.	0.	0.	0.
10	0.	0.	0.	0.
11	0.	0.	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	0.	0.	0.
15	0.	0.	0.	0.
16	0.	0.	0.	0.
17	0.	0.	0.	0.
18	0.	0.	0.	0.
19	0.	0.	0.	0.
20	0.	0.	0.	0.
21	0.	0.	0.	0.
22	0.	0.	0.	0.
23	0.	0.	0.	0.
24	0.	0.	0.	0.
25	0.	0.	0.	0.
26	0.	0.	0.	0.
27	0.	0.	0.	0.
28	0.	0.	0.	0.

DATE
TIME

FREQUENCY AND INVENTAL MODE SHAPES FOR MODE 18

```

-0.19) 0.00000001 0.00000001 0.00000001 0.00000001
1 0.00000001 0.00000001 0.00000001 0.00000001
21 0.00000001 0.00000001 0.00000001 0.00000001
22 0.00000001 0.00000001 0.00000001 0.00000001
23 0.00000001 0.00000001 0.00000001 0.00000001
24 0.00000001 0.00000001 0.00000001 0.00000001
25 0.00000001 0.00000001 0.00000001 0.00000001
26 0.00000001 0.00000001 0.00000001 0.00000001
27 0.00000001 0.00000001 0.00000001 0.00000001
28 0.00000001 0.00000001 0.00000001 0.00000001

```

FREQUENCY AND INVENTAL MODE SHAPES FOR MODE 19

```

-0.19) 0.00000001 0.00000001 0.00000001 0.00000001
1 0.00000001 0.00000001 0.00000001 0.00000001
2 0.00000001 0.00000001 0.00000001 0.00000001
3 0.00000001 0.00000001 0.00000001 0.00000001
4 0.00000001 0.00000001 0.00000001 0.00000001
5 0.00000001 0.00000001 0.00000001 0.00000001
6 0.00000001 0.00000001 0.00000001 0.00000001
7 0.00000001 0.00000001 0.00000001 0.00000001
8 0.00000001 0.00000001 0.00000001 0.00000001
9 0.00000001 0.00000001 0.00000001 0.00000001
10 0.00000001 0.00000001 0.00000001 0.00000001
11 0.00000001 0.00000001 0.00000001 0.00000001
12 0.00000001 0.00000001 0.00000001 0.00000001
13 0.00000001 0.00000001 0.00000001 0.00000001
14 0.00000001 0.00000001 0.00000001 0.00000001
15 0.00000001 0.00000001 0.00000001 0.00000001
16 0.00000001 0.00000001 0.00000001 0.00000001
17 0.00000001 0.00000001 0.00000001 0.00000001
18 0.00000001 0.00000001 0.00000001 0.00000001
19 0.00000001 0.00000001 0.00000001 0.00000001
20 0.00000001 0.00000001 0.00000001 0.00000001
21 0.00000001 0.00000001 0.00000001 0.00000001
22 0.00000001 0.00000001 0.00000001 0.00000001
23 0.00000001 0.00000001 0.00000001 0.00000001
24 0.00000001 0.00000001 0.00000001 0.00000001
25 0.00000001 0.00000001 0.00000001 0.00000001
26 0.00000001 0.00000001 0.00000001 0.00000001
27 0.00000001 0.00000001 0.00000001 0.00000001
28 0.00000001 0.00000001 0.00000001 0.00000001

```

WILLIAM L. DODD, JR., U.S. DISTRICT JUDGE

NOTICE TO THE PUBLIC

[illegible]

GENERALIZED MASS MATRIX

	9	10	11	12	13	14	15	16
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0

MIAMI 497451Z 02717003409

1

DATE
TIME

GENERALIZED STIFFNESS MATRIX

```

1
6 .10031E+03
7 .17277E+05
8 0.
9 0.
10 0.
11 .70464E+01
12 .72272E+01
13 .24321E+04
14 .10031E+03
15 .24317E+02
16 .11910E+05

```

DATE
TIME

UNIT LOAD DATA

```

NU, INTG LOAD BEAMS      14
NU, INTG LOADS DEFINED  10
NU, STIFFSSES            0
NU, MASS GROUPS        13
NU, AERU BODY GROUPS    5
NU, SLNDER BODY GROUPS  2

```

TAPE19 REMUND

```

*****
MPADEN DATA READ FROM TAPE19
NR  NSYM  NASTM  NGUST  NR  NACH  ALFA  REFS  REPC
10      7      9     13   2  .832E+00 .412E+00 .972E+03 .302E+03

```

DATE
TIME

UNIT LOAD MODULE ANALYSIS

8FANG=

1	2	3	4	5	6	7
1	.4200E+03	.1600E+03	.1311E+04	.3750E+03	.4580E+02	.1300E+01
2	.1711E+04	.1700E+03	.1240E+04	.9500E+03	.1453E+03	.1200E+01
3	.1011E+04	.3750E+03	.4700E+03	.3750E+03	0.	.1300E+01
4	.4200E+03	0.	.4200E+03	.1200E+03	0.	.1700E+01
5	.4200E+03	0.	0.	0.	0.	.2000E+01
6	.4200E+03	0.	0.	0.	0.	.2000E+01
7	.1700E+04	0.	.1580E+04	0.	.4580E+02	.2000E+01
8	.1700E+04	0.	.1617E+04	0.	.1131E+03	.1000E+01
9	.1700E+04	0.	.1617E+04	.3750E+03	.1722E+03	.1000E+01
10	.1637E+04	0.	.1637E+04	0.	.1200E+03	.3000E+01
11	.1637E+04	0.	.1637E+04	0.	.4500E+03	.3000E+01
12	.1637E+04	0.	.1637E+04	0.	.6370E+02	.2000E+01
13	.1700E+04	0.	.1700E+04	0.	.9500E+02	.2000E+01
14	.1700E+04	0.	.1700E+04	.4000E+02	.1131E+03	.1000E+01

STALOG

1	2	3	4	5	6	7
1	.4200E+03	.1600E+03	.1311E+04	.3750E+03	0.	.1300E+01
2	.1711E+04	.1700E+03	.1240E+04	.9500E+03	0.	.1710E+01
3	.1011E+04	.3750E+03	.4700E+03	.3750E+03	0.	.1500E+01
4	.4200E+03	0.	.4200E+03	.1200E+03	0.	.1500E+01
5	.4200E+03	0.	0.	0.	0.	.1500E+01
6	.4200E+03	0.	0.	0.	0.	.1500E+01
7	.1700E+04	0.	.1580E+04	0.	.4580E+02	.2000E+01
8	.1700E+04	0.	.1617E+04	0.	.1131E+03	.1000E+01
9	.1700E+04	0.	.1617E+04	.3750E+03	.1722E+03	.1000E+01
10	.1637E+04	0.	.1637E+04	0.	.1200E+03	.3000E+01
11	.1637E+04	0.	.1637E+04	0.	.4500E+03	.3000E+01
12	.1637E+04	0.	.1637E+04	0.	.6370E+02	.2000E+01
13	.1700E+04	0.	.1700E+04	0.	.9500E+02	.2000E+01
14	.1700E+04	0.	.1700E+04	.4000E+02	.1131E+03	.1000E+01

NEWLHR

1	2	3	4	5	6	7
1	.1000E+01	.5000E+01	.4000E+01	.9000E+01	.1200E+02	.1300E+02
2	.4000E+01	.6000E+01	.4000E+01	.4000E+01	.1200E+02	.1600E+02
3	.5000E+01	.6000E+01	.4000E+01	.1300E+02	.1000E+01	.2000E+01
4						
5						
6						
7						
8						
9						
10						

DATE
TIME

NAME

1 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
2 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
3 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
MASS GROUP 1

NAME

1 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
2 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
3 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
MASS GROUP 2

NAME

1 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
2 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
3 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
MASS GROUP 3

NAME

1 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
2 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
3 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
MASS GROUP 4

NAME

1 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
2 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
3 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01 1.0000E+01
MASS GROUP 5

DATE
TIME

```

LAMV
1 .10000E+01  0.  2  0.  3
2  0.  .10000E+01  0.
3  0.  0.  .10000E+01
MASS GROUP = 4
LAMV
1 .90590E+00  0.  2  0.  3
2 .41710E+00  .89210E+00  0.
3 .15500E+01  .15730E+00  .98480E+00
MASS GROUP = 7
LAMV
1 .90590E+00  0.  2  0.  3
2 .41710E+00  .89210E+00  0.
3 .15500E+01  .15730E+00  .98480E+00
MASS GROUP = 8
LAMV
1 .10000E+01  0.  2  0.  3
2  0.  .10000E+01  0.
3  0.  0.  .10000E+01
MASS GROUP = 9
LAMV
1 .92470E+00  0.  2  0.  3
2 .37100E+00  .91070E+00  0.
3 .68100E+01  .18000E+00  .98480E+00
MASS GROUP = 10

```

DATE
TIME

LAMV

	1	2	3
1	.4350E+00	=0.	.5490E+00
2	=0.	.1000E+01	=0.
3	.5490E+00	=0.	.8355E+00

MASS GROUP = 11

LAMV

	1	2	3
1	.9059E+00	.4230E+00	=0.
2	.4171E+00	.8921E+00	.1730E+00
3	.7350E+01	.1573E+00	.9848E+00

MASS GROUP = 12

LAMV

	1	2	3
1	.9247E+00	.3800E+00	=0.
2	.3746E+00	.9107E+00	.1730E+00
3	.6610E+01	.1000E+00	.9848E+00

MASS GROUP = 13

LAMV

	1	2	3
1	.4350E+00	=0.	.5490E+00
2	=0.	.1000E+01	=0.
3	.5490E+00	=0.	.8355E+00

MPNLAB

	1	2	3	4	5
1	.1000E+01	.1700E+02	.5700E+02	.8700E+02	.1110E+03
2	.1600E+02	.5800E+02	.8600E+02	.1100E+03	.1160E+03
3	.1000E+01	.2000E+01	.8000E+01	.1100E+02	.3000E+01

DATE
TIME

HPV188

1	10000E+01	2	90000E+01	3	12000E+02	4	11000E+02	5	14000E+02	6	15000E+02
2	80000E+01		11000E+02		12000E+02		13000E+02		14000E+02		19000E+02
3	90000E+01		80000E+01		70000E+01		14000E+02		13000E+02		30000E+01

ELGM

1	17000E+02	2	16000E+02								
HEADER DATA WRITTEN ON TAPE											
IDENT	NINTLO	NSINSS	NSNGS	NSVM	NSVM	NABVM	NK	NABGRP	NBGRP	NBOXES	NABRBW
6	10	0	1	7	9	9	10	5	6	40	8

MEMPHIS 6810 0009 MW3R

ON AB 030VOT MW78Q MBN19 MB803 M10N19 M16B03 MW80

1	0.00000	1.17300	0.00000	0.00000	1	0
2	0.00000	1.17301	0.00000	0.00000	2	1
3	0.00000	1.00000	0.00000	0.00000	3	1
4	1.00000	0.00000	1.00000	0.00000	4	0
5	0.00000	1.00000	0.00000	0.00000	5	0
6	0.00000	1.00000	0.00000	1.00000	6	0
7	0.00000	1.00000	1.17300	0.00000	7	0
8	0.00000	1.00000	1.00000	0.00000	8	0
9	0.00000	1.17300	0.00000	1.00000	9	0
10	0.00000	1.00000	1.00000	0.00000	10	0
11	0.00000	1.00000	0.00000	0.00000	11	0
12	0.00000	1.00000	1.17300	0.00000	12	0
13	0.00000	1.00000	1.00000	0.00000	13	0
14	1.00000	0.00000	1.00000	0.00000	14	0

714

	1	2	3	4	5	6	7	8
1	0.423591+00	0.431307+00	0.978055+00	0.100000+00	0.100000+00	0.100000+00	0.000000+00	0.000000+00
2	0.494313+00	0.822140+00	0.000000+00	0.100000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00
3	0.157501+00	0.703101+00	0.200335+00	0.000000+00	0.000000+00	0.000000+00	0.175781+00	0.100000+00
4	0.443972+03	0.769900+03	0.999231+03	0.000000+00	0.890000+03	0.000000+03	0.135851+06	0.000000+00
1	0.380591+00	0.000000+00	0.500000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00
2	0.910731+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00
3	0.000000+00	0.100000+00	0.435451+00	0.175800+00	0.000000+00	0.000000+00	0.000000+00	0.000000+00
4	0.713501+03	0.458000+02	0.999999+03	0.101982+04	0.172018+04	0.000000+00	0.000000+00	0.000000+00

WREATH 1

7: AMM

1	00500E+00	2	-41707E+00	3	-73535L+01
2	.42350E+00		.89213E+00		.15730E+00
3	0.		-1.1304E+00		.08408E+00

WHEELS 2

[illegible]

```

YLSMM
      1      2      3
      0.      -0.      .10000E+01
      .10000E+01      0.      0.
      0.      .10000E+01      0.

NREANS 7

YLSMM
      1      2      3
      .17574E+00      -0.      -.98443E+00
      .98443E+00      0.      .17574E+00
      0.      .10000E+01      0.

NREANS 8

YLSMM
      1      2      3
      .10000E+01      -0.      -0.
      0.      0.      .10000E+01
      0.      .10000E+01      0.

NREANS 9

YLSMM
      1      2      3
      .92474E+00      -0.      -.60491E-01
      .38056E+00      0.      .10000E+01
      0.      .17574E+00      .68481E+00

NREANS 10

```

DATE	TIME

7LMM	1	.10000E+01	0.	2	0.	0.	3	0.	.10000E+01	0.
	2	0.	0.							
	3	0.								
WREMS 11										
7LMM	1	.03594E+00	0.	2	0.	0.	3	0.	.13554E+00	0.
	2	.54941E+00	0.							
	3	0.								
WREMS 12										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 13										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 14										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 15										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 16										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 17										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 18										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 19										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 20										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 21										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 22										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 23										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 24										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							
	3	0.								
WREMS 25										
7LMM	1	.17500E+00	0.	2	0.	0.	3	0.	.08441E+00	0.
	2	.08441E+00	0.							

DATE
TIME

PLAN

	1	2	3
1	.100000001	.00	.00
2	.00	.100000001	.00
3	.00	.00	.100000001

SIZE = 1000 OF CORE RCD FOR STEP ***UNITLOAD ***

INERTIAL LOAD DATA

GROUPING FOR MASS GROUP 1 MASS 1 TO 4

MASS	X	Y	Z
1	.120000000	.00	.00
2	.100000000	.00	.00
3	.050000000	.00	.00
4	.025000000	.00	.00

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 2 MASS 5 TO 6
 MASS 5
 0
 X
 .000000E+00
 .130000E+04
 Y
 2
 .00
 .00

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 3 MASS 7 TO 7
 MASS 7
 0
 X
 .150000E+04
 Y
 2
 .00

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 4 MASS 0 TO 0
 MASS X .170000E+00 Y Z
 0 .170000E+00 .00

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 5 MASS 0 TO 0
 MASS X .180000E+00 Y Z
 0 .180000E+00 .00

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 6 MASS 10 TO 12

MASS	Y	Z
10	.904240E+03	.150000E+03
11	.931710E+03	.230000E+03
12	.101109E+04	.375000E+03

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 7 MASS 13 TO 16

MASS	Y	Z
13	.109412E+04	.350000E+03
14	.114533E+04	.700000E+03
15	.121651E+04	.650000E+03
16	.124400E+04	.950000E+03

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 8 MASS 17 TO 18

MASS	X	Y	Z
17	.700000E+03	.375000E+03	-.550000E+02
18	.850000E+03	.375000E+03	-.550000E+02

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 9 MASS 19 TO 21

MASS	X	Y	Z
19	.172107E+04	.100000E+03	.123720E+03
20	.181311E+04	.225000E+03	.140760E+03
21	.187600E+04	.375000E+03	.172107E+03

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 10 MASS 22 TO 24

MASS	X	Y	Z
22	.167117E+04	0.	.175000E+01
23	.175316E+04	0.	.300000E+03
24	.189400E+04	0.	.450000E+03

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 11 MASS 25 TO 26

MASS	X	Y	Z
25	.119061E+04	.375000E+03	.449600E+02
26	.121145E+04	.450000E+03	.561900E+02

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 12 MASS 27 TO 27

MASS	X	Y	Z
27	.198866E+00	.225000E+03	.145760E+03

INERTIAL LOAD DATA
 GEOMETRY FOR MASS GROUP 13 MASS 28 TO 28

MASS	X	Y	Z
28	.187758E+00	0.	.310000E+03

ENGINE THRUST MATRICES GENERATED FOR 1 ENUS
 7002 WORDS OF CORE REQ FOR STEP ***UNITLOAD ***

BUR LOAD DATA
 GEOMETRY FOR PANEL 1

NO	X	Y	Z
1	.742367E+03	.172409E+03	.024516E+01
2	.742367E+03	.172409E+03	.024516E+01
3	.742367E+03	.172409E+03	.024516E+01
4	.742367E+03	.172409E+03	.024516E+01
5	.742367E+03	.172409E+03	.024516E+01
6	.742367E+03	.172409E+03	.024516E+01
7	.742367E+03	.172409E+03	.024516E+01
8	.742367E+03	.172409E+03	.024516E+01
9	.742367E+03	.172409E+03	.024516E+01
10	.742367E+03	.172409E+03	.024516E+01
11	.742367E+03	.172409E+03	.024516E+01
12	.742367E+03	.172409E+03	.024516E+01
13	.742367E+03	.172409E+03	.024516E+01
14	.742367E+03	.172409E+03	.024516E+01
15	.742367E+03	.172409E+03	.024516E+01
16	.742367E+03	.172409E+03	.024516E+01

BOX LOAD DATA			
GEOMETRY FOR PANEL 2			
NOE	X	Y	Z
17	.025500E+03	.41250E+03	.515750E+02
18	.060451E+03	.41250E+03	.515750E+02
19	.095402E+03	.41250E+03	.515750E+02
20	.130353E+03	.41250E+03	.515750E+02
21	.165304E+03	.41250E+03	.515750E+02
22	.199955E+03	.41250E+03	.515750E+02
23	.234606E+03	.41250E+03	.515750E+02
24	.269257E+03	.41250E+03	.515750E+02
25	.303908E+03	.41250E+03	.515750E+02
26	.338559E+03	.41250E+03	.515750E+02
27	.373210E+03	.41250E+03	.515750E+02
28	.407861E+03	.41250E+03	.515750E+02
29	.442512E+03	.41250E+03	.515750E+02
30	.477163E+03	.41250E+03	.515750E+02
31	.511814E+03	.41250E+03	.515750E+02
32	.546465E+03	.41250E+03	.515750E+02
33	.581116E+03	.41250E+03	.515750E+02
34	.615767E+03	.41250E+03	.515750E+02
35	.650418E+03	.41250E+03	.515750E+02
36	.685069E+03	.41250E+03	.515750E+02
37	.719720E+03	.41250E+03	.515750E+02
38	.754371E+03	.41250E+03	.515750E+02
39	.789022E+03	.41250E+03	.515750E+02
40	.823673E+03	.41250E+03	.515750E+02
41	.858324E+03	.41250E+03	.515750E+02
42	.892975E+03	.41250E+03	.515750E+02
43	.927626E+03	.41250E+03	.515750E+02
44	.962277E+03	.41250E+03	.515750E+02
45	.996928E+03	.41250E+03	.515750E+02
46	.103148E+04	.41250E+03	.515750E+02
47	.106368E+04	.41250E+03	.515750E+02
48	.109588E+04	.41250E+03	.515750E+02
49	.112808E+04	.41250E+03	.515750E+02
50	.116028E+04	.41250E+03	.515750E+02
51	.119248E+04	.41250E+03	.515750E+02
52	.122468E+04	.41250E+03	.515750E+02
53	.125688E+04	.41250E+03	.515750E+02
54	.128908E+04	.41250E+03	.515750E+02
55	.132128E+04	.41250E+03	.515750E+02
56	.135348E+04	.41250E+03	.515750E+02

BOX LOAD DATA			
GEOMETRY FOR PANEL 5			
ROI	X	Y	Z
57	.169000E+04	.000000E+00	.120191E+03
58	.172600E+04	.000000E+00	.120191E+03
59	.176100E+04	.000000E+00	.120191E+03
60	.179700E+04	.000000E+00	.120191E+03
61	.183300E+04	.000000E+00	.120191E+03
62	.186900E+04	.000000E+00	.120191E+03
63	.190500E+04	.000000E+00	.120191E+03
64	.194100E+04	.000000E+00	.120191E+03
65	.197700E+04	.000000E+00	.120191E+03
66	.201300E+04	.000000E+00	.120191E+03
67	.204900E+04	.000000E+00	.120191E+03
68	.208500E+04	.000000E+00	.120191E+03
69	.212100E+04	.000000E+00	.120191E+03
70	.215700E+04	.000000E+00	.120191E+03
71	.219300E+04	.000000E+00	.120191E+03
72	.222900E+04	.000000E+00	.120191E+03
73	.226500E+04	.000000E+00	.120191E+03
74	.230100E+04	.000000E+00	.120191E+03
75	.233700E+04	.000000E+00	.120191E+03
76	.237300E+04	.000000E+00	.120191E+03
77	.240900E+04	.000000E+00	.120191E+03
78	.244500E+04	.000000E+00	.120191E+03
79	.248100E+04	.000000E+00	.120191E+03
80	.251700E+04	.000000E+00	.120191E+03
81	.255300E+04	.000000E+00	.120191E+03
82	.258900E+04	.000000E+00	.120191E+03
83	.262500E+04	.000000E+00	.120191E+03
84	.266100E+04	.000000E+00	.120191E+03
85	.269700E+04	.000000E+00	.120191E+03
86	.273300E+04	.000000E+00	.120191E+03

RUR LOAD DATA

GEOMETRY FOR PANEL 4

Node	X	Y	Z
87	0.00000E+00	0.00000E+00	0.00000E+00
88	0.00000E+00	0.00000E+00	0.00000E+00
89	0.00000E+00	0.00000E+00	0.00000E+00
90	0.00000E+00	0.00000E+00	0.00000E+00
91	0.00000E+00	0.00000E+00	0.00000E+00
92	0.00000E+00	0.00000E+00	0.00000E+00
93	0.00000E+00	0.00000E+00	0.00000E+00
94	0.00000E+00	0.00000E+00	0.00000E+00
95	0.00000E+00	0.00000E+00	0.00000E+00
96	0.00000E+00	0.00000E+00	0.00000E+00
97	0.00000E+00	0.00000E+00	0.00000E+00
98	0.00000E+00	0.00000E+00	0.00000E+00
99	0.00000E+00	0.00000E+00	0.00000E+00
100	0.00000E+00	0.00000E+00	0.00000E+00
101	0.00000E+00	0.00000E+00	0.00000E+00
102	0.00000E+00	0.00000E+00	0.00000E+00
103	0.00000E+00	0.00000E+00	0.00000E+00
104	0.00000E+00	0.00000E+00	0.00000E+00
105	0.00000E+00	0.00000E+00	0.00000E+00
106	0.00000E+00	0.00000E+00	0.00000E+00
107	0.00000E+00	0.00000E+00	0.00000E+00
108	0.00000E+00	0.00000E+00	0.00000E+00
109	0.00000E+00	0.00000E+00	0.00000E+00
110	0.00000E+00	0.00000E+00	0.00000E+00

UNIT 1 DATA

GEOMETRY FOR PANEL 1

NO	X	Y	Z
101	.000000E+00	.000000E+00	.000000E+00
102	.000000E+00	.000000E+00	.000000E+00
103	.000000E+00	.000000E+00	.000000E+00
104	.000000E+00	.000000E+00	.000000E+00
105	.000000E+00	.000000E+00	.000000E+00
106	.000000E+00	.000000E+00	.000000E+00
107	.000000E+00	.000000E+00	.000000E+00
108	.000000E+00	.000000E+00	.000000E+00
109	.000000E+00	.000000E+00	.000000E+00
110	.000000E+00	.000000E+00	.000000E+00

7000 WINDS UP CURVE AND FOR STEP ***UNLOAD ***

UNIT LOAD DATA

GEOMETRY FOR UNIT GROUP 1 UNITS 1 TO 8

NO	X	Y	Z
1	.000000E+00	.000000E+00	.000000E+00
2	.000000E+00	.000000E+00	.000000E+00
3	.000000E+00	.000000E+00	.000000E+00
4	.000000E+00	.000000E+00	.000000E+00
5	.000000E+00	.000000E+00	.000000E+00
6	.000000E+00	.000000E+00	.000000E+00
7	.000000E+00	.000000E+00	.000000E+00
8	.000000E+00	.000000E+00	.000000E+00

BODY LOAD DATA
 GEOMETRY FOR BODY GROUP 2 SUBS 9 TO 11

BODY	X	Y	Z
9	.103500E+04	0.	0.
10	.118500E+04	0.	0.
11	.131500E+04	0.	0.

BODY LOAD DATA
 GEOMETRY FOR BODY GROUP 3 SUBS 12 TO 12

BODY	X	Y	Z
12	.149000E+04	0.	0.

TABLE 29
EXAMPLE PROBLEM OUTPUT LISTING
FREQUENCY RESPONSE AND UNIT GUST MODULES

DATE
TIME

PIED DATA DECK INPUT 00

IDENT 0

THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

FRSP GUST

TAPE19 RECORD

HEADER DATA HEAD PROJ- TAPE19

NR	NSYM	NGLST	NR	MACH	MEFA	RPRR	REFC
10	7	15	2	.05E+00	.41E+00	.05E+03	.30E+03

INITIAL DATA

NR	TOTAL MASSES	20
NR	SYMMETRIC MODES	7
NR	ANTISYMMETRIC MODES	0
NR	ENGINES	1
NR	UNIT LOAD POINT FLAG	0

MON DATA DECK INPUT 00

FLIGHT DATA FOR FREQUENCY RESPONSE AND UNIT GUST LOADS

VRMS	552.150 KEAS
ALTITUDE	1000.000 FT.
SIZE FACTOR	1.0000 INCHES/UNIT
VTRUF	946.342 PSF
DYNAMIC P	1031.536 PSF
SIGMA	.97104E+00
MACH	.8506
PLUT W PLU	0
PLUT GUST PLG	2

1761 WORDS OF CORE RDQ PGM STEP *** MAIN ***

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D. C. 20250

WATER-LEVEL MEASUREMENT SOLUTIONS
 DATE = 15-NOV-80
 TIME = 12:00
 LAT = 52.19 N 43.5 W
 LONG = 7.14 W
 ALTITUDE = 1000.00 FT.

[illegible]

GUST JURY VATION NO. 1
 GARY 8 06603
 GARY 8 00000
 GARY 8 51000
 EMERGENCY RESPONSE SOLUTION

POJ1705 - A/A

REF ID: A5218445

0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324	330	336	342	348	354	360	366	372	378	384	390	396	402	408	414	420	426	432	438	444	450	456	462	468	474	480	486	492	498	504	510	516	522	528	534	540	546	552	558	564	570	576	582	588	594	600	606	612	618	624	630	636	642	648	654	660	666	672	678	684	690	696	702	708	714	720	726	732	738	744	750	756	762	768	774	780	786	792	798	804	810	816	822	828	834	840	846	852	858	864	870	876	882	888	894	900	906	912	918	924	930	936	942	948	954	960	966	972	978	984	990	996	1000
0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324	330	336	342	348	354	360	366	372	378	384	390	396	402	408	414	420	426	432	438	444	450	456	462	468	474	480	486	492	498	504	510	516	522	528	534	540	546	552	558	564	570	576	582	588	594	600	606	612	618	624	630	636	642	648	654	660	666	672	678	684	690	696	702	708	714	720	726	732	738	744	750	756	762	768	774	780	786	792	798	804	810	816	822	828	834	840	846	852	858	864	870	876	882	888	894	900	906	912	918	924	930	936	942	948	954	960	966	972	978	984	990	996	1000
0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324	330	336	342	348	354	360	366	372	378	384	390	396	402	408	414	420	426	432	438	444	450	456	462	468	474	480	486	492	498	504	510	516	522	528	534	540	546	552	558	564	570	576	582	588	594	600	606	612	618	624	630	636	642	648	654	660	666	672	678	684	690	696	702	708	714	720	726	732	738	744	750	756	762	768	774	780	786	792	798	804	810	816	822	828	834	840	846	852	858	864	870	876	882	888	894	900	906	912	918	924	930	936	942	948	954	960	966	972	978	984	990	996	1000
0	6	12	18	24	30	36	42	48	54	60	66																																																																																																																																																												

GUST INVESTIGATION NO. 1
GAMZ 0.0000
GAMZ 0.0000
GAMZ 0.0000
GAMZ 0.0000
WEATHER SERVICE

7,1A 0/0 0,7500000000

Q 78A 51' 255 592,15 473

UNCLASSIFIED WEB PAGE

[illegible]

QUEST ORIENTATION NO. 1
GAM1 = .5663
GAM2 = 0.0000
GAM3 = .5000
FREQUENCY RESPONSE SOLUTION

7.1A Q/V = .75843E+02

VPL # 592.15 K2A5

3646574 09217047439

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																																																																																																																															
1978	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431</

QUEST ORIENTATION NO. 13
GAMX = 0.00000
GAMY = -.70711
GAMZ = -.70711
EMERGENCY RESPONSE SLUTTI

Q/V - 75448-02

REF. # 997,15 READ

GE 42941267 46500.94

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40	1000000	1000000
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43	1000000	1000000
44	1000000	1000000
45	1000000	1000000

DATE
TIME

GUST ORIENTATION NO. 13

GAM1 = 0.00000

GAM2 = 0.70711

GAM3 = 0.70711

FREQUENCY RESPONSE SOLUTIONS

ALTITUDE = 1000.00 FT.

Q/V = .75643E+02

7.16

Q/V = .75643E+02

VFL = 552.15 REAS

GENERALIZED RESONANCE

100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	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GARY ORIENTATION NO. 15
 GARY # 0.0000
 GARY # 0.7011
 GARY # 0.7011
 FREQUENCY RESPONSE SILUT

Q/V - 2 A/D
PO-354561

CPM 61-255 - 727

Zb. .464m Q387?77-2439

[illegible]

DATE
TIME

GUST ORIENTATION NO. 13

GAMP # 0.00000

GAMP # -0.70711

GAMP # -0.70711

FREQUENCY RESPONSE SOLUTIONS

ALTITUDE = 1000.00 FT.

VPL # 552.14 HZS DVP # 7.10 U/V # .75843E+02

GENERALIZED RESPONSE

VIB #	VIB #	PRC #	PRC #
138 # 138	138 # 138	22.0000	22.0000
139 # 139	139 # 139	22.8000	22.8000
140 # 140	140 # 140	23.0000	23.0000
141 # 141	141 # 141	23.2000	23.2000
142 # 142	142 # 142	23.4000	23.4000
143 # 143	143 # 143	23.6000	23.6000
144 # 144	144 # 144	23.8000	23.8000
145 # 145	145 # 145	24.0000	24.0000

TAPESS RECORD

MEAN DATA READ FROM TAPESS

TENT	NGUST	MPREC	NGVM	NABVM	AKI	VEL	SIGMA
13	13	105	7	9	10	.95E+03	.97E+00

TAPESS RECORD

MEAN DATA READ FROM TAPESS

TENT	NGUST	MPREC	NGVM	NABVM	AKI	VEL	SIGMA
13	13	105	7	9	10	.95E+03	.97E+00

MEAN DATA WRITTEN ON TAPESS

TENT	NGUST	MPREC	NGTLO	VEL	SIGMA
13	13	105	10	986.36	.97

TAPESS RECORD

•

141. 10400 - 104000

346

DATE
TIME

INT. LOADS - MODULUS

INT. LOAD N°1

DATE	1	2	3	4	5	6	7	8
13.00	9474311E+03	4391948E+05	8674494E+03	8211941E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
14.00	9415977E+03	4339117E+05	1047254E+04	8124230E+02	8697117E+02	8697117E+02	8697117E+02	8697117E+02
15.00	1021811E+04	4291480E+05	1045120E+04	8011444E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
16.00	1106141E+04	4240777E+05	1143413E+04	7884454E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
17.00	1101333E+04	4207147E+05	1201465E+04	7744444E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
18.00	1140040E+04	4171757E+05	1259200E+04	7604444E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
19.00	1202338E+04	4161397E+05	1333992E+04	7464444E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
20.00	1204647E+04	4061174E+05	1343333E+04	7463588E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
21.00	1227855E+04	4091714E+05	1401333E+04	7224768E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
22.00	1125502E+04	4072714E+05	1447333E+04	7083588E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
23.00	1137600E+04	4055594E+05	1545294E+04	6947452E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
24.00	1142694E+04	4041714E+05	1613594E+04	6811312E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
25.00	1426633E+04	4012945E+05	1692349E+04	6674476E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
26.00	1548137E+04	4011882E+05	1721564E+04	6544694E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
27.00	1604823E+04	4004743E+05	1751164E+04	6431612E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
28.00	1673417E+04	4001477E+05	1840344E+04	6311912E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
29.00	1700372E+04	3944347E+05	1900747E+04	6237792E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
30.00	1808595E+04	3987514E+05	1960377E+04	6157750E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
31.00	1877831E+04	3984233E+05	2019005E+04	6091741E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
32.00	1947195E+04	3973772E+05	2078170E+04	6044041E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
33.00	2016410E+04	3965843E+05	2135761E+04	6021676E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
34.00	2104198E+04	3974380E+05	2211566E+04	6023080E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
35.00	2109973E+04	3913443E+05	2212683E+04	6029747E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
36.00	2211463E+04	3926545E+05	2297478E+04	6095881E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
37.00	2273094E+04	3908311E+05	2349289E+04	6174013E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
38.00	2333777E+04	3895133E+05	2400304E+04	6265595E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
39.00	2394133E+04	3974253E+05	2450924E+04	6374975E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
40.00	2454076E+04	3957521E+05	2501171E+04	6497043E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
41.00	2513482E+04	3931163E+05	2550702E+04	6630533E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
42.00	2572146E+04	3911494E+05	2599248E+04	6774471E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
43.00	2629742E+04	3792127E+05	2646244E+04	6926179E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
44.00	2685972E+04	3772824E+05	2691244E+04	7084214E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
45.00	2740133E+04	3753744E+05	2733527E+04	7244476E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
46.00	2791747E+04	3735029E+05	2774220E+04	7412446E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
47.00	2840072E+04	3716712E+05	2816220E+04	7579146E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
48.00	2884374E+04	3699444E+05	2854444E+04	7744932E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
49.00	2934444E+04	3680644E+05	2897544E+04	7926552E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
50.00	2985183E+04	3655744E+05	2945744E+04	7977892E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
51.00	2985706E+04	3633764E+05	2989244E+04	7977892E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
52.00	2970712E+04	3614404E+05	2989244E+04	8151752E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
53.00	2941107E+04	3617671E+05	2989244E+04	8310021E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
54.00	2985845E+04	3616233E+05	2781349E+04	8570230E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
55.00	2986198E+04	3604807E+05	2750942E+04	8600831E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
56.00	2986266E+04	3605584E+05	2717744E+04	8613709E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
57.00	2981133E+04	3606204E+05	2683933E+04	8340113E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
58.00	2977244E+04	3607742E+05	2649941E+04	8044449E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02
59.00	2973165E+04	3715397E+05	2616162E+04	8093446E+03	8697117E+02	8697117E+02	8697117E+02	8697117E+02

[illegible][illegible]

DATE
TIME

INT, LOADS = MODULUS
INT, LOAD NO.

10

PREC = 2	9	0
1.970	.575	.575
1.980	.580	.580
1.990	.585	.585
2.000	.590	.590
2.010	.595	.595
2.020	.600	.600
2.030	.605	.605
2.040	.610	.610
2.050	.615	.615
2.060	.620	.620
2.070	.625	.625
2.080	.630	.630
2.090	.635	.635
2.100	.640	.640
2.110	.645	.645
2.120	.650	.650
2.130	.655	.655
2.140	.660	.660
2.150	.665	.665
2.160	.670	.670
2.170	.675	.675
2.180	.680	.680
2.190	.685	.685
2.200	.690	.690
2.210	.695	.695
2.220	.700	.700
2.230	.705	.705
2.240	.710	.710
2.250	.715	.715
2.260	.720	.720
2.270	.725	.725
2.280	.730	.730
2.290	.735	.735
2.300	.740	.740
2.310	.745	.745
2.320	.750	.750
2.330	.755	.755
2.340	.760	.760
2.350	.765	.765
2.360	.770	.770
2.370	.775	.775
2.380	.780	.780
2.390	.785	.785
2.400	.790	.790
2.410	.795	.795
2.420	.800	.800
2.430	.805	.805
2.440	.810	.810
2.450	.815	.815
2.460	.820	.820
2.470	.825	.825
2.480	.830	.830
2.490	.835	.835
2.500	.840	.840
2.510	.845	.845
2.520	.850	.850
2.530	.855	.855
2.540	.860	.860
2.550	.865	.865
2.560	.870	.870
2.570	.875	.875
2.580	.880	.880
2.590	.885	.885
2.600	.890	.890
2.610	.895	.895
2.620	.900	.900
2.630	.905	.905
2.640	.910	.910
2.650	.915	.915
2.660	.920	.920
2.670	.925	.925
2.680	.930	.930
2.690	.935	.935
2.700	.940	.940
2.710	.945	.945
2.720	.950	.950
2.730	.955	.955
2.740	.960	.960
2.750	.965	.965
2.760	.970	.970
2.770	.975	.975
2.780	.980	.980
2.790	.985	.985
2.800	.990	.990
2.810	.995	.995
2.820	1.000	1.000
2.830	1.005	1.005
2.840	1.010	1.010
2.850	1.015	1.015
2.860	1.020	1.020
2.870	1.025	1.025
2.880	1.030	1.030
2.890	1.035	1.035
2.900	1.040	1.040
2.910	1.045	1.045
2.920	1.050	1.050
2.930	1.055	1.055
2.940	1.060	1.060
2.950	1.065	1.065
2.960	1.070	1.070
2.970	1.075	1.075
2.980	1.080	1.080
2.990	1.085	1.085
3.000	1.090	1.090

DATE
TIME

INT, LOADS = MODULUS

INT, LOAD NG.

10

Page 42	9	0
11.000	.1010701E+03	0.
12.000	.1002100E+03	0.
13.000	.172231E+03	0.
14.000	.1761037E+03	0.
15.000	.1908235E+03	0.
16.000	.1433443E+03	0.
17.000	.1467904E+03	0.
18.000	.1900417E+03	0.
19.000	.193125E+03	0.
20.000	.190037E+03	0.
21.000	.198753E+03	0.
22.000	.201731E+03	0.
23.000	.233570E+03	0.
24.000	.205531E+03	0.
25.000	.207405E+03	0.
26.000	.209044E+03	0.
27.000	.210421E+03	0.
28.000	.211051E+03	0.
29.000	.210943E+03	0.
30.000	.210914E+03	0.
31.000	.210019E+03	0.
32.000	.209531E+03	0.
33.000	.208444E+03	0.
34.000	.207101E+03	0.
35.000	.204805E+03	0.
36.000	.204501E+03	0.
37.000	.203003E+03	0.
38.000	.201404E+03	0.
39.000	.199784E+03	0.
40.000	.198004E+03	0.
41.000	.195562E+03	0.
42.000	.193509E+03	0.
43.000	.192001E+03	0.
44.000	.190001E+03	0.
45.000	.188001E+03	0.
46.000	.185504E+03	0.
47.000	.183117E+03	0.
48.000	.181904E+03	0.
49.000	.180127E+03	0.
50.000	.179312E+03	0.
51.000	.176407E+03	0.
52.000	.174634E+03	0.
53.000	.172704E+03	0.
54.000	.170700E+03	0.
55.000	.167605E+03	0.

DATE
TIME

INT, LOADS = MODULUS

INT, LOAD NO.

10

PREC #2	9	10
21.200	.167847E+03	0.
21.400	.164276E+03	0.
21.600	.161721E+03	0.
21.800	.159270E+03	0.
22.000	.156834E+03	0.
22.200	.154411E+03	0.
22.400	.151995E+03	0.
22.600	.149582E+03	0.
22.800	.147171E+03	0.
23.000	.144756E+03	0.
23.200	.142342E+03	0.
23.400	.139927E+03	0.
23.600	.137511E+03	0.
23.800	.135095E+03	0.
24.000	.132676E+03	0.

ASV4. UNIT GAST LOADS FOR ORIENTATION NO. 13

INT. LOADS • MODULUS

INT. LOAD NO.

DATE
TIME

PREC. #7	1	2	3	4	5	6	7
0.50	740551E+01	621677E+00	0.	0.	0.	240407E+02	637766E+01
1.00	611119E+02	634919E+05	0.	0.	0.	143155E+02	637766E+01
1.50	644717E+03	644712E+05	0.	0.	0.	297707E+02	637766E+01
2.00	117111E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
2.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
3.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
3.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
4.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
4.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
5.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
5.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
6.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
6.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
7.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
7.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
8.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
8.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
9.00	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
9.50	112113E+03	621677E+05	0.	0.	0.	170110E+02	637766E+01
1.000	201141E+03	300720E+05	0.	0.	0.	150596E+02	637766E+01
1.200	306713E+04	240220E+05	0.	0.	0.	140194E+02	637766E+01
1.400	341645E+03	330012E+05	0.	0.	0.	120110E+02	637766E+01
1.600	374455E+03	471250E+05	0.	0.	0.	100110E+02	637766E+01
1.800	412515E+03	614220E+05	0.	0.	0.	80110E+02	637766E+01
2.000	448575E+03	754240E+05	0.	0.	0.	60110E+02	637766E+01
2.200	485744E+03	894240E+05	0.	0.	0.	40110E+02	637766E+01
2.400	524144E+03	103424E+05	0.	0.	0.	20110E+02	637766E+01
2.600	559031E+03	117424E+05	0.	0.	0.	0.	637766E+01
2.800	592215E+03	131424E+05	0.	0.	0.	0.	637766E+01
3.000	624060E+03	145424E+05	0.	0.	0.	0.	637766E+01
3.200	651370E+03	159424E+05	0.	0.	0.	0.	637766E+01
3.400	674974E+03	173424E+05	0.	0.	0.	0.	637766E+01
3.600	694974E+03	187424E+05	0.	0.	0.	0.	637766E+01
3.800	714974E+03	201424E+05	0.	0.	0.	0.	637766E+01
4.000	734974E+03	215424E+05	0.	0.	0.	0.	637766E+01
4.200	754974E+03	229424E+05	0.	0.	0.	0.	637766E+01
4.400	774974E+03	243424E+05	0.	0.	0.	0.	637766E+01
4.600	794974E+03	257424E+05	0.	0.	0.	0.	637766E+01
4.800	814974E+03	271424E+05	0.	0.	0.	0.	637766E+01
5.000	834974E+03	285424E+05	0.	0.	0.	0.	637766E+01
5.200	854974E+03	299424E+05	0.	0.	0.	0.	637766E+01
5.400	874974E+03	313424E+05	0.	0.	0.	0.	637766E+01
5.600	894974E+03	327424E+05	0.	0.	0.	0.	637766E+01
5.800	914974E+03	341424E+05	0.	0.	0.	0.	637766E+01
6.000	934974E+03	355424E+05	0.	0.	0.	0.	637766E+01
6.200	954974E+03	369424E+05	0.	0.	0.	0.	637766E+01
6.400	974974E+03	383424E+05	0.	0.	0.	0.	637766E+01
6.600	994974E+03	397424E+05	0.	0.	0.	0.	637766E+01
6.800	1014974E+03	411424E+05	0.	0.	0.	0.	637766E+01
7.000	1034974E+03	425424E+05	0.	0.	0.	0.	637766E+01
7.200	1054974E+03	439424E+05	0.	0.	0.	0.	637766E+01
7.400	1074974E+03	453424E+05	0.	0.	0.	0.	637766E+01
7.600	1094974E+03	467424E+05	0.	0.	0.	0.	637766E+01
7.800	1114974E+03	481424E+05	0.	0.	0.	0.	637766E+01
8.000	1134974E+03	495424E+05	0.	0.	0.	0.	637766E+01
8.200	1154974E+03	509424E+05	0.	0.	0.	0.	637766E+01
8.400	1174974E+03	523424E+05	0.	0.	0.	0.	637766E+01
8.600	1194974E+03	537424E+05	0.	0.	0.	0.	637766E+01
8.800	1214974E+03	551424E+05	0.	0.	0.	0.	637766E+01
9.000	1234974E+03	565424E+05	0.	0.	0.	0.	637766E+01
9.200	1254974E+03	579424E+05	0.	0.	0.	0.	637766E+01
9.400	1274974E+03	593424E+05	0.	0.	0.	0.	637766E+01
9.600	1294974E+03	607424E+05	0.	0.	0.	0.	637766E+01
9.800	1314974E+03	621424E+05	0.	0.	0.	0.	637766E+01
10.000	1334974E+03	635424E+05	0.	0.	0.	0.	637766E+01

DATE
TIME

INT. LOADS - MODULUS

INT. LOAD NO.

REQ. #2	1	2	3	4	5	6	7	8
4.70	552400E+03	247444E+06	0.	0.	189264E+03	104047E+04	241224E+03	149344E+04
4.80	567330E+03	271534E+06	0.	0.	171184E+03	116715E+04	224744E+03	151444E+04
4.90	582270E+03	292732E+06	0.	0.	153170E+03	112241E+04	211744E+03	162044E+04
5.00	596910E+03	313228E+06	0.	0.	134257E+03	116165E+04	176644E+03	184534E+04
5.10	613740E+03	332428E+06	0.	0.	114451E+03	123546E+04	114210E+03	180467E+04
5.20	629450E+03	349144E+06	0.	0.	94451E+03	134546E+04	797044E+03	191460E+04
5.30	645730E+03	364122E+06	0.	0.	74451E+03	147477E+04	517444E+03	202460E+04
5.40	662450E+03	377422E+06	0.	0.	54451E+03	163144E+04	244444E+03	212460E+04
5.50	679450E+03	389422E+06	0.	0.	34451E+03	180477E+04	144444E+03	221460E+04
5.60	696450E+03	400422E+06	0.	0.	14451E+03	200477E+04	444444E+03	229460E+04
5.70	713450E+03	410422E+06	0.	0.	0.	224477E+04	144444E+03	236460E+04
5.80	730450E+03	419422E+06	0.	0.	0.	304477E+04	444444E+03	242460E+04
5.90	747450E+03	427422E+06	0.	0.	0.	384477E+04	144444E+03	247460E+04
6.00	764450E+03	434422E+06	0.	0.	0.	464477E+04	444444E+03	251460E+04
6.10	781450E+03	440422E+06	0.	0.	0.	544477E+04	144444E+03	254460E+04
6.20	798450E+03	445422E+06	0.	0.	0.	624477E+04	444444E+03	256460E+04
6.30	815450E+03	449422E+06	0.	0.	0.	704477E+04	144444E+03	257460E+04
6.40	832450E+03	452422E+06	0.	0.	0.	784477E+04	444444E+03	258460E+04
6.50	849450E+03	455422E+06	0.	0.	0.	864477E+04	144444E+03	259460E+04
6.60	866450E+03	457422E+06	0.	0.	0.	944477E+04	444444E+03	259460E+04
6.70	883450E+03	459422E+06	0.	0.	0.	1024477E+04	144444E+03	259460E+04
6.80	900450E+03	460422E+06	0.	0.	0.	1104477E+04	444444E+03	259460E+04
6.90	917450E+03	461422E+06	0.	0.	0.	1184477E+04	144444E+03	259460E+04
7.00	934450E+03	462422E+06	0.	0.	0.	1264477E+04	444444E+03	259460E+04
7.10	951450E+03	462422E+06	0.	0.	0.	1344477E+04	144444E+03	259460E+04
7.20	968450E+03	462422E+06	0.	0.	0.	1424477E+04	444444E+03	259460E+04
7.30	985450E+03	462422E+06	0.	0.	0.	1504477E+04	144444E+03	259460E+04
7.40	1002450E+03	462422E+06	0.	0.	0.	1584477E+04	444444E+03	259460E+04
7.50	1019450E+03	462422E+06	0.	0.	0.	1664477E+04	144444E+03	259460E+04
7.60	1036450E+03	462422E+06	0.	0.	0.	1744477E+04	444444E+03	259460E+04
7.70	1053450E+03	462422E+06	0.	0.	0.	1824477E+04	144444E+03	259460E+04
7.80	1070450E+03	462422E+06	0.	0.	0.	1904477E+04	444444E+03	259460E+04
7.90	1087450E+03	462422E+06	0.	0.	0.	1984477E+04	144444E+03	259460E+04
8.00	1104450E+03	462422E+06	0.	0.	0.	2064477E+04	444444E+03	259460E+04
8.10	1121450E+03	462422E+06	0.	0.	0.	2144477E+04	144444E+03	259460E+04
8.20	1138450E+03	462422E+06	0.	0.	0.	2224477E+04	444444E+03	259460E+04
8.30	1155450E+03	462422E+06	0.	0.	0.	2304477E+04	144444E+03	259460E+04
8.40	1172450E+03	462422E+06	0.	0.	0.	2384477E+04	444444E+03	259460E+04
8.50	1189450E+03	462422E+06	0.	0.	0.	2464477E+04	144444E+03	259460E+04
8.60	1206450E+03	462422E+06	0.	0.	0.	2544477E+04	444444E+03	259460E+04
8.70	1223450E+03	462422E+06	0.	0.	0.	2624477E+04	144444E+03	259460E+04
8.80	1240450E+03	462422E+06	0.	0.	0.	2704477E+04	444444E+03	259460E+04
8.90	1257450E+03	462422E+06	0.	0.	0.	2784477E+04	144444E+03	259460E+04
9.00	1274450E+03	462422E+06	0.	0.	0.	2864477E+04	444444E+03	259460E+04
9.10	1291450E+03	462422E+06	0.	0.	0.	2944477E+04	144444E+03	259460E+04
9.20	1308450E+03	462422E+06	0.	0.	0.	3024477E+04	444444E+03	259460E+04
9.30	1325450E+03	462422E+06	0.	0.	0.	3104477E+04	144444E+03	259460E+04
9.40	1342450E+03	462422E+06	0.	0.	0.	3184477E+04	444444E+03	259460E+04
9.50	1359450E+03	462422E+06	0.	0.	0.	3264477E+04	144444E+03	259460E+04
9.60	1376450E+03	462422E+06	0.	0.	0.	3344477E+04	444444E+03	259460E+04
9.70	1393450E+03	462422E+06	0.	0.	0.	3424477E+04	144444E+03	259460E+04
9.80	1410450E+03	462422E+06	0.	0.	0.	3504477E+04	444444E+03	259460E+04
9.90	1427450E+03	462422E+06	0.	0.	0.	3584477E+04	144444E+03	259460E+04
10.00	1444450E+03	462422E+06	0.	0.	0.	3664477E+04	444444E+03	259460E+04
10.10	1461450E+03	462422E+06	0.	0.	0.	3744477E+04	144444E+03	259460E+04
10.20	1478450E+03	462422E+06	0.	0.	0.	3824477E+04	444444E+03	259460E+04
10.30	1495450E+03	462422E+06	0.	0.	0.	3904477E+04	144444E+03	259460E+04
10.40	1512450E+03	462422E+06	0.	0.	0.	3984477E+04	444444E+03	259460E+04
10.50	1529450E+03	462422E+06	0.	0.	0.	4064477E+04	144444E+03	259460E+04
10.60	1546450E+03	462422E+06	0.	0.	0.	4144477E+04	444444E+03	259460E+04
10.70	1563450E+03	462422E+06	0.	0.	0.	4224477E+04	144444E+03	259460E+04
10.80	1580450E+03	462422E+06	0.	0.	0.	4304477E+04	444444E+03	259460E+04
10.90	1597450E+03	462422E+06	0.	0.	0.	4384477E+04	144444E+03	259460E+04
11.00	1614450E+03	462422E+06	0.	0.	0.	4464477E+04	444444E+03	259460E+04
11.10	1631450E+03	462422E+06	0.	0.	0.	4544477E+04	144444E+03	259460E+04
11.20	1648450E+03	462422E+06	0.	0.	0.	4624477E+04	444444E+03	259460E+04
11.30	1665450E+03	462422E+06	0.	0.	0.	4704477E+04	144444E+03	259460E+04
11.40	1682450E+03	462422E+06	0.	0.	0.	4784477E+04	444444E+03	259460E+04
11.50	1699450E+03	462422E+06	0.	0.	0.	4864477E+04	144444E+03	259460E+04
11.60	1716450E+03	462422E+06	0.	0.	0.	4944477E+04	444444E+03	259460E+04
11.70	1733450E+03	462422E+06	0.	0.	0.	5024477E+04	144444E+03	259460E+04
11.80	1750450E+03	462422E+06	0.	0.	0.	5104477E+04	444444E+03	259460E+04
11.90	1767450E+03	462422E+06	0.	0.	0.	5184477E+04	144444E+03	259460E+04
12.00	1784450E+03	462422E+06	0.	0.	0.	5264477E+04	444444E+03	259460E+04
12.10	1801450E+03	462422E+06	0.	0.	0.	5344477E+04	144444E+03	259460E+04
12.20	1818450E+03	462422E+06	0.	0.	0.	5424477E+04	444444E+03	259460E+04
12.30	1835450E+03	462422E+06	0.	0.	0.	5504477E+04	144444E+03	259460E+04
12.40	1852450E+03	462422E+06	0.	0.	0.	5584477E+04	444444E+03	259460E+04
12.50	1869450E+03	462422E+06	0.	0.	0.	5664477E+04	144444E+03	259460E+04
12.60	1886450E+03	462422E+06	0.	0.	0.	5744477E+04	444444E+03	259460E+04
12.70	1903450E+03	462422E+06	0.	0.	0.	5824477E+04	144444E+03	259460E+04
12.80	1920450E+03	462422E+06	0.	0.	0.	5904477E+04	444444E+03	259460E+04
12.90	1937450E+03	462422E+06	0.	0.	0.	5984477E+04	144444E+03	259460E+04
13.00	1954450E+03	462422E+06	0.	0.	0.	6064477E+04	444444E+03	259460E+04
13.10	1971450E+03	462422E+06	0.	0.	0.	6144477E+04	144444E+03	259460E+04
13.20	1988450E+03	462422E+06	0.	0.	0.	6224477E+04	444444E+03	259460E+04
13.30	2005450E+03	462422E+06	0.	0.	0.	6304477E+04	144444E+03	259460E+04
13.40	2022450E+03	462422E+06	0.	0.	0.	6384477E+04	444444E+03	259460E+04
13.50	2039450E+03	462422E+06	0.	0.	0.	6464477E+04	144444E+03	259460E+04
13.60	2056450E+03	462422E+06	0.	0.	0.	6544477E+04	444444E+03	259460E+04
13.70	2073450E+03	462422E+06	0.	0.	0.	6624477E+04	144444E+03	259460E+04
13.80	2090450E+03	462422E+06	0.	0.	0.	6704477E+04	444444E+03	259460E+04
13.90	2107450E+03	462422E+06	0.	0.	0.	6784477E+04	144444E+03	259460E+04
14.00	2124450E+03	462422E+06	0.	0.	0.	6864477E+04	444444E+03	259460E+04

DATE
TIME

INT, LOADS = MODULUS

INT, LOAD NO.

PREC 12	1	2	3	4	5	6	7	8
13.00	4027409E+04	4724419E+06	0	0	4627103E+03	7231304E+03	1754610E+04	
14.00	4006209E+04	4624100E+06	0	0	6594417E+03	6648406E+03	1734059E+04	
15.00	4045776E+04	4531144E+06	0	0	6495134E+03	6554751E+03	1720061E+04	
16.00	4045750E+04	4443919E+06	0	0	7177655E+03	6624105E+03	1707401E+04	
17.00	4045416E+04	4363844E+06	0	0	7442067E+03	6594736E+03	1697310E+04	
18.00	4045413E+04	4274532E+06	0	0	7680635E+03	6573241E+03	1687505E+04	
19.00	4070486E+04	4200042E+06	0	0	7945478E+03	6547320E+03	1674672E+04	
20.00	4071443E+04	4130033E+06	0	0	8094444E+03	6535560E+03	1660045E+04	
21.00	4073420E+04	4069433E+06	0	0	8155454E+03	6517044E+03	1645070E+04	
22.00	4057477E+04	4001415E+06	0	0	8544071E+03	6444799E+03	1625442E+04	
23.00	4045429E+04	3933516E+06	0	0	8729401E+03	6373942E+03	1615465E+04	
24.00	4017566E+04	3871449E+06	0	0	8894043E+03	6307344E+03	1607424E+04	
25.00	4055701E+04	3811440E+06	0	0	9054422E+03	6244744E+03	1591392E+04	
26.00	4044647E+04	3750041E+06	0	0	9199110E+03	6173067E+03	1574944E+04	
27.00	4045427E+04	3688415E+06	0	0	9332177E+03	6101517E+03	1557494E+04	
28.00	4005427E+04	3626456E+06	0	0	9454485E+03	6035448E+03	1540044E+04	
29.00	4034794E+04	3564455E+06	0	0	9565415E+03	5973515E+03	1522444E+04	
30.00	4038411E+04	3502444E+06	0	0	9667012E+03	5914444E+03	1504444E+04	
31.00	4038411E+04	3440444E+06	0	0	9757035E+03	5853335E+03	1487444E+04	
32.00	4021415E+04	3378444E+06	0	0	9841754E+03	5791754E+03	1470444E+04	
33.00	4021415E+04	3316444E+06	0	0	9910444E+03	5730444E+03	1453444E+04	
34.00	4021415E+04	3254444E+06	0	0	9972444E+03	5669444E+03	1436444E+04	
35.00	4021415E+04	3192444E+06	0	0	1001272E+04	5608444E+03	1419444E+04	
36.00	4021415E+04	3130444E+06	0	0	1005401E+04	5547444E+03	1402444E+04	
37.00	4021415E+04	3068444E+06	0	0	1009444E+04	5486444E+03	1385444E+04	
38.00	4021415E+04	3006444E+06	0	0	1013572E+04	5425444E+03	1368444E+04	
39.00	4021415E+04	2944444E+06	0	0	1017704E+04	5364444E+03	1351444E+04	
40.00	4021415E+04	2882444E+06	0	0	1021832E+04	5303444E+03	1334444E+04	
41.00	4021415E+04	2820444E+06	0	0	1025960E+04	5242444E+03	1317444E+04	
42.00	4021415E+04	2758444E+06	0	0	1030088E+04	5181444E+03	1300444E+04	
43.00	4021415E+04	2696444E+06	0	0	1034216E+04	5120444E+03	1283444E+04	
44.00	4021415E+04	2634444E+06	0	0	1038344E+04	5059444E+03	1266444E+04	
45.00	4021415E+04	2572444E+06	0	0	1042472E+04	4998444E+03	1249444E+04	
46.00	4021415E+04	2510444E+06	0	0	1046600E+04	4937444E+03	1232444E+04	
47.00	4021415E+04	2448444E+06	0	0	1050728E+04	4876444E+03	1215444E+04	
48.00	4021415E+04	2386444E+06	0	0	1054856E+04	4815444E+03	1198444E+04	
49.00	4021415E+04	2324444E+06	0	0	1058984E+04	4754444E+03	1181444E+04	
50.00	4021415E+04	2262444E+06	0	0	1063112E+04	4693444E+03	1164444E+04	
51.00	4021415E+04	2200444E+06	0	0	1067240E+04	4632444E+03	1147444E+04	
52.00	4021415E+04	2138444E+06	0	0	1071368E+04	4571444E+03	1130444E+04	
53.00	4021415E+04	2076444E+06	0	0	1075496E+04	4510444E+03	1113444E+04	
54.00	4021415E+04	2014444E+06	0	0	1079624E+04	4449444E+03	1096444E+04	
55.00	4021415E+04	1952444E+06	0	0	1083752E+04	4388444E+03	1079444E+04	
56.00	4021415E+04	1890444E+06	0	0	1087880E+04	4327444E+03	1062444E+04	
57.00	4021415E+04	1828444E+06	0	0	1092008E+04	4266444E+03	1045444E+04	
58.00	4021415E+04	1766444E+06	0	0	1096136E+04	4205444E+03	1028444E+04	
59.00	4021415E+04	1704444E+06	0	0	1100264E+04	4144444E+03	1011444E+04	
60.00	4021415E+04	1642444E+06	0	0	1104392E+04	4083444E+03	994444E+04	
61.00	4021415E+04	1580444E+06	0	0	1108520E+04	4022444E+03	977444E+04	
62.00	4021415E+04	1518444E+06	0	0	1112648E+04	3961444E+03	960444E+04	
63.00	4021415E+04	1456444E+06	0	0	1116776E+04	3900444E+03	943444E+04	
64.00	4021415E+04	1394444E+06	0	0	1120904E+04	3839444E+03	926444E+04	
65.00	4021415E+04	1332444E+06	0	0	1125032E+04	3778444E+03	909444E+04	
66.00	4021415E+04	1270444E+06	0	0	1129160E+04	3717444E+03	892444E+04	
67.00	4021415E+04	1208444E+06	0	0	1133288E+04	3656444E+03	875444E+04	
68.00	4021415E+04	1146444E+06	0	0	1137416E+04	3595444E+03	858444E+04	
69.00	4021415E+04	1084444E+06	0	0	1141544E+04	3534444E+03	841444E+04	
70.00	4021415E+04	1022444E+06	0	0	1145672E+04	3473444E+03	824444E+04	
71.00	4021415E+04	960444E+06	0	0	1149800E+04	3412444E+03	807444E+04	
72.00	4021415E+04	898444E+06	0	0	1153928E+04	3351444E+03	790444E+04	
73.00	4021415E+04	836444E+06	0	0	1158056E+04	3290444E+03	773444E+04	
74.00	4021415E+04	774444E+06	0	0	1162184E+04	3229444E+03	756444E+04	
75.00	4021415E+04	712444E+06	0	0	1166312E+04	3168444E+03	739444E+04	
76.00	4021415E+04	650444E+06	0	0	1170440E+04	3107444E+03	722444E+04	
77.00	4021415E+04	588444E+06	0	0	1174568E+04	3046444E+03	705444E+04	
78.00	4021415E+04	526444E+06	0	0	1178696E+04	2985444E+03	688444E+04	
79.00	4021415E+04	464444E+06	0	0	1182824E+04	2924444E+03	671444E+04	
80.00	4021415E+04	402444E+06	0	0	1186952E+04	2863444E+03	654444E+04	
81.00	4021415E+04	340444E+06	0	0	1191080E+04	2802444E+03	637444E+04	
82.00	4021415E+04	278444E+06	0	0	1195208E+04	2741444E+03	620444E+04	
83.00	4021415E+04	216444E+06	0	0	1199336E+04	2680444E+03	603444E+04	
84.00	4021415E+04	154444E+06	0	0	1203464E+04	2619444E+03	586444E+04	
85.00	4021415E+04	92444E+06	0	0	1207592E+04	2558444E+03	569444E+04	
86.00	4021415E+04	30444E+06	0	0	1211720E+04	2497444E+03	552444E+04	
87.00	4021415E+04	0	0	0	1215848E+04	2436444E+03	535444E+04	
88.00	4021415E+04	0	0	0	1219976E+04	2375444E+03	518444E+04	
89.00	4021415E+04	0	0	0	1224104E+04	2314444E+03	501444E+04	
90.00	4021415E+04	0	0	0	1228232E+04	2253444E+03	484444E+04	
91.00	4021415E+04	0	0	0	1232360E+04	2192444E+03	467444E+04	
92.00	4021415E+04	0	0	0	1236488E+04	2131444E+03	450444E+04	
93.00	4021415E+04	0	0	0	1240616E+04	2070444E+03	433444E+04	
94.00	4021415E+04	0	0	0	1244744E+04	2009444E+03	416444E+04	
95.00	4021415E+04	0	0	0	1248872E+04	1948444E+03	399444E+04	
96.00	4021415E+04	0	0	0	1253000E+04	1887444E+03	382444E+04	
97.00	4021415E+04	0	0	0	1257128E+04	1826444E+03	365444E+04	
98.00	4021415E+04	0	0	0	1261256E+04	1765444E+03	348444E+04	
99.00	4021415E+04	0	0	0	1265384E+04	1704444E+03	331444E+04	
100.00	4021415E+04	0	0	0	1269512E+04	1643444E+03	314444E+04	

355

DATE
TIME

INT. LOADS - MODULUS
INT. LOAD NO.

INT. LOAD NO.	INT. LOADS - MODULUS
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95	1.000
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99	1.000
100	1.000

DATE
TIME

INT, LOADS = MODULUS

INT, LOAD MD,

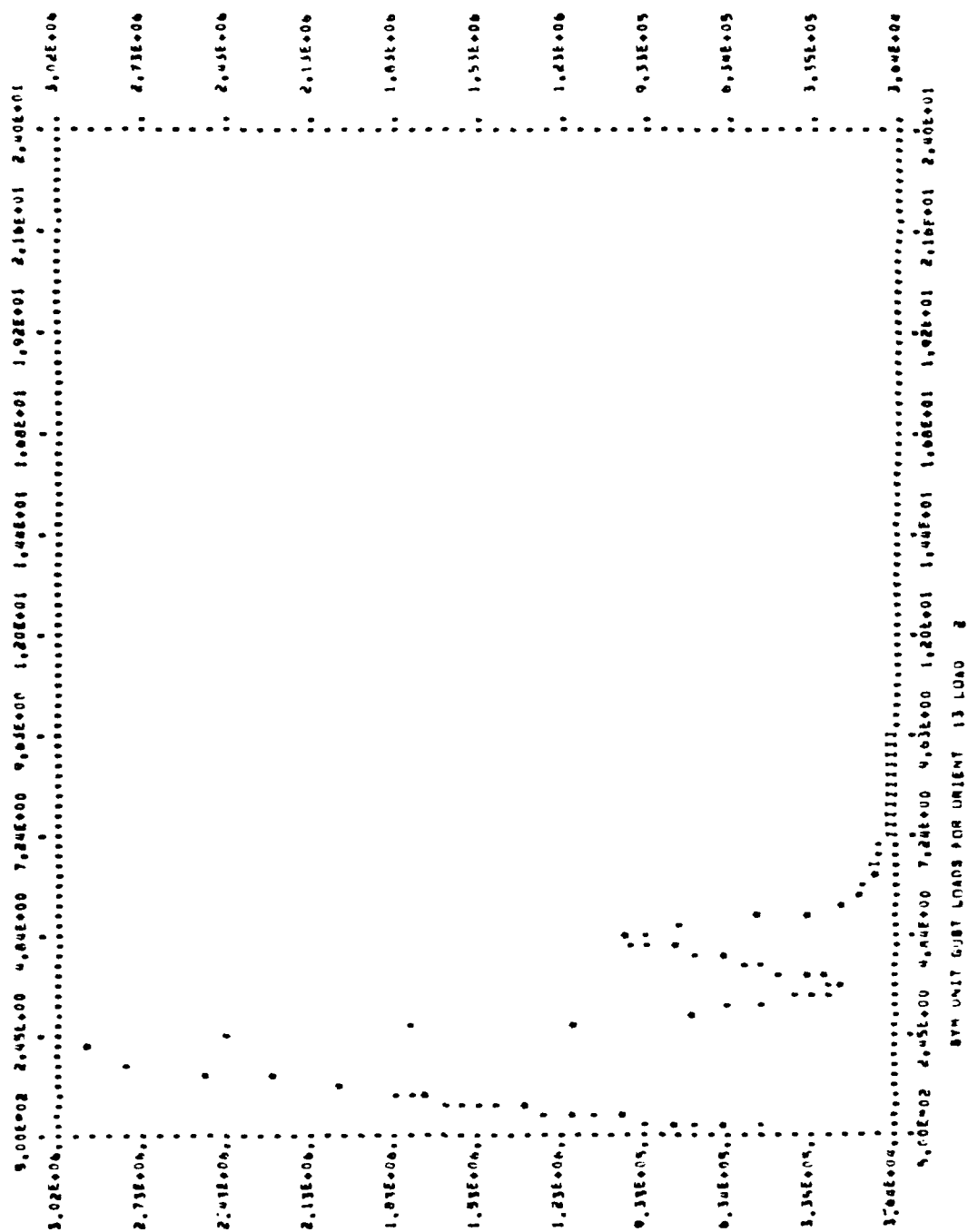
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11.840	.7337714E+03	.6635311E+03
11.860	.6060145E+03	.6343547E+03
11.880	.6665014E+03	.6662114E+03
11.900	.6174441E+03	.5623444E+03
11.920	.6161104E+03	.5610735E+03
11.940	.6710142E+03	.5954342E+03
11.960	.6624604E+03	.6627124E+03
11.980	.6567724E+03	.6666631E+03
12.000	.5945705E+03	.7371042E+03
12.020	.6745414E+03	.7394376E+03
12.040	.6103135E+03	.6188735E+03
12.060	.6763144E+03	.6751715E+03
12.080	.6665474E+03	.6363248E+03
12.100	.6852164E+03	.6667352E+03
12.120	.7225111E+03	.6166245E+03
12.140	.7123367E+03	.6164506E+03
12.160	.7431915E+03	.6166726E+03
12.180	.7405162E+03	.6162424E+03
12.200	.6194654E+03	.6162248E+03
12.220	.6627732E+03	.6160048E+03
12.240	.6607340E+03	.6164394E+03
12.260	.6973572E+03	.6167112E+03
12.280	.6247653E+03	.6161544E+03
12.300	.6927664E+03	.6161042E+03
12.320	.6816444E+03	.6166436E+03
12.340	.6697252E+03	.6164427E+03
12.360	.6164444E+03	.6163444E+03
12.380	.6164444E+03	.6164444E+03
12.400	.6164444E+03	.6164444E+03
12.420	.6164444E+03	.6164444E+03
12.440	.6164444E+03	.6164444E+03
12.460	.6164444E+03	.6164444E+03
12.480	.6164444E+03	.6164444E+03
12.500	.6164444E+03	.6164444E+03
12.520	.6164444E+03	.6164444E+03
12.540	.6164444E+03	.6164444E+03
12.560	.6164444E+03	.6164444E+03
12.580	.6164444E+03	.6164444E+03
12.600	.6164444E+03	.6164444E+03
12.620	.6164444E+03	.6164444E+03
12.640	.6164444E+03	.6164444E+03
12.660	.6164444E+03	.6164444E+03
12.680	.6164444E+03	.6164444E+03
12.700	.6164444E+03	.6164444E+03
12.720	.6164444E+03	.6164444E+03
12.740	.6164444E+03	.6164444E+03
12.760	.6164444E+03	.6164444E+03
12.780	.6164444E+03	.6164444E+03
12.800	.6164444E+03	.6164444E+03
12.820	.6164444E+03	.6164444E+03
12.840	.6164444E+03	.6164444E+03
12.860	.6164444E+03	.6164444E+03
12.880	.6164444E+03	.6164444E+03
12.900	.6164444E+03	.6164444E+03
12.920	.6164444E+03	.6164444E+03
12.940	.6164444E+03	.6164444E+03
12.960	.6164444E+03	.6164444E+03
12.980	.6164444E+03	.6164444E+03
13.000	.6164444E+03	.6164444E+03

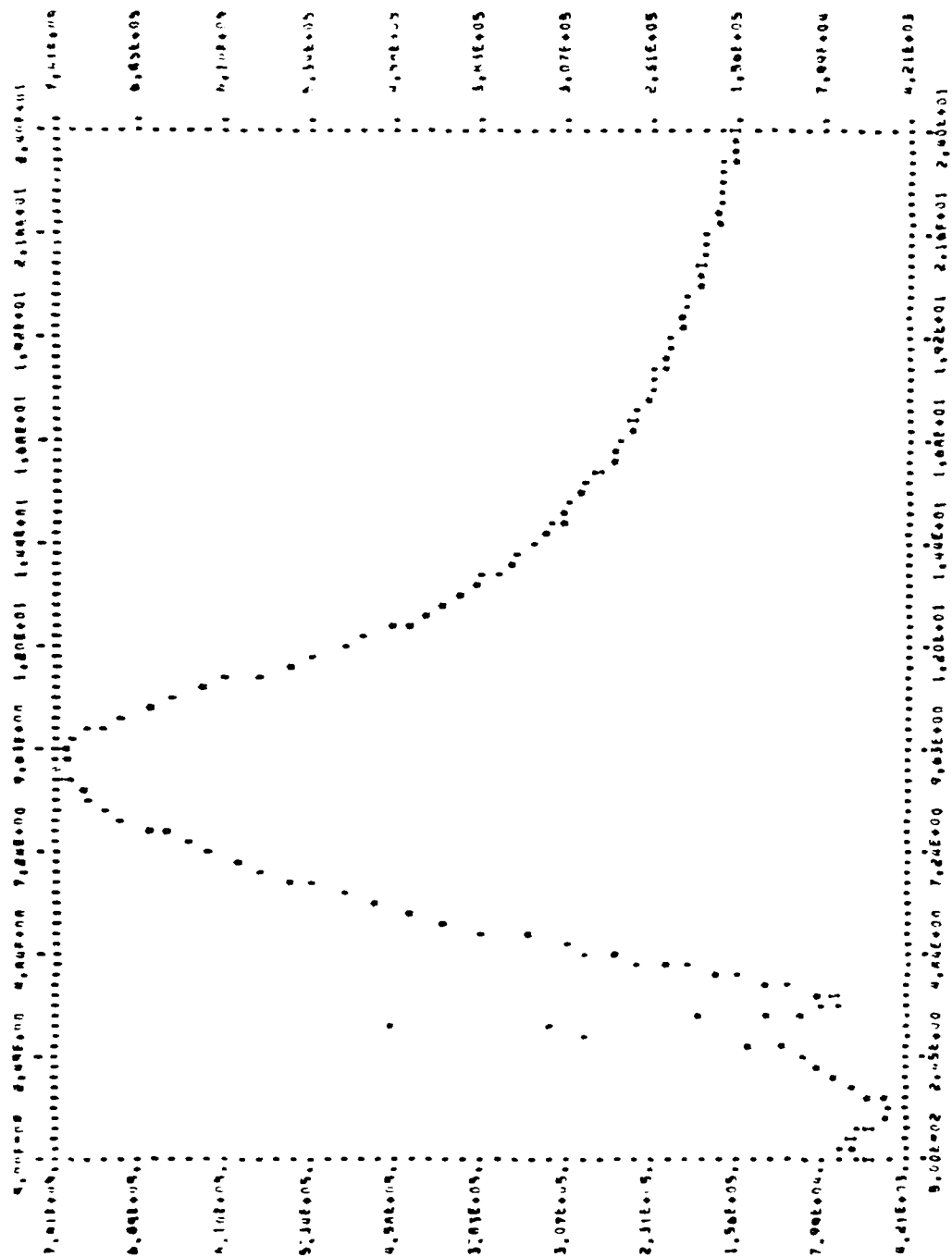
DATE
TIME

INT, LOADS = MODULUS

INT, LOAD NO.

INT, LOAD NO.	INT, LOADS = MODULUS	INT, LOAD NO.	INT, LOADS = MODULUS
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21.400	.1577465E+04	21.400	.2809316E+04
21.600	.1592148E+04	21.600	.2858443E+04
21.800	.1605172E+04	21.800	.2910647E+04
22.000	.1617492E+04	22.000	.2964766E+04
22.200	.1628841E+04	22.200	.3020274E+04
22.400	.1639122E+04	22.400	.307741E+04
22.600	.1649331E+04	22.600	.3136051E+04
22.800	.1659491E+04	22.800	.3195179E+04
23.000	.1669595E+04	23.000	.3254791E+04
23.200	.1679643E+04	23.200	.3314895E+04
23.400	.1689634E+04	23.400	.3375491E+04
23.600	.1699567E+04	23.600	.3436579E+04
23.800	.1709441E+04	23.800	.3498158E+04
24.000	.1719254E+04	24.000	.3560228E+04





DATE	TIME	DESCRIPTION	INITIALS
11/11/68	10:00	Arrived at site	JD
11/11/68	10:15	Started work	JD
11/11/68	10:30	Completed work	JD
11/11/68	10:45	Left site	JD

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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[illegible]

1741 WORDS OF CHARL RAO FOR BIZP *** MAIN ***

DATE _____ TIME _____

DATE
TIME

ROD DATA FOR TRIM

LOAD FACTOR 1.000
 RELATIVE CORR 0
 ZONE 0.000 PPS
 TRIM MTR POINT FLG 0
 24 HOUR @ T. CORR .00000004

ROD DATA FOR SLAB

MAX BR. TIME 1.000 SECS
 YIELD 10,000 KT
 GRAVITY 0.0 FT.
 LOCAL TIME MTRV POINT 0
 NO. OBSERVATIONS 4
 GRAVITY CORR 0
 INITIAL MTRV POINT 1
 MTRV POINT CORR 1
 MTRV POINT CORR 0
 LOAD MTR POINT FLG 0
 PLOT MTRV POINT FLG 3
 INITIAL CALTA Y .00200 SECS

719 -ENDS OF CORE ROD FOR STEP *** TRIM ***

ADDITIONAL INFORMATION
REF # 5219 AFAB
ALT # 1000.00 FT.

ON 708 4MGI 7A 21M44MAB 43M410A

DATE	NAME	AMOUNT	CHECK NO.	REMARKS
10/10/50	JOHN J. BROWN	100.00	100	PAYROLL
10/15/50	JOHN J. BROWN	100.00	101	PAYROLL
10/20/50	JOHN J. BROWN	100.00	102	PAYROLL
10/25/50	JOHN J. BROWN	100.00	103	PAYROLL
10/30/50	JOHN J. BROWN	100.00	104	PAYROLL
11/05/50	JOHN J. BROWN	100.00	105	PAYROLL
11/10/50	JOHN J. BROWN	100.00	106	PAYROLL
11/15/50	JOHN J. BROWN	100.00	107	PAYROLL
11/20/50	JOHN J. BROWN	100.00	108	PAYROLL
11/25/50	JOHN J. BROWN	100.00	109	PAYROLL
11/30/50	JOHN J. BROWN	100.00	110	PAYROLL
12/05/50	JOHN J. BROWN	100.00	111	PAYROLL
12/10/50	JOHN J. BROWN	100.00	112	PAYROLL
12/15/50	JOHN J. BROWN	100.00	113	PAYROLL
12/20/50	JOHN J. BROWN	100.00	114	PAYROLL
12/25/50	JOHN J. BROWN	100.00	115	PAYROLL
12/30/50	JOHN J. BROWN	100.00	116	PAYROLL
1/05/51	JOHN J. BROWN	100.00	117	PAYROLL
1/10/51	JOHN J. BROWN	100.00	118	PAYROLL
1/15/51	JOHN J. BROWN	100.00	119	PAYROLL
1/20/51	JOHN J. BROWN	100.00	120	PAYROLL
1/25/51	JOHN J. BROWN	100.00	121	PAYROLL
1/30/51	JOHN J. BROWN	100.00	122	PAYROLL
2/05/51	JOHN J. BROWN	100.00	123	PAYROLL
2/10/51	JOHN J. BROWN	100.00	124	PAYROLL
2/15/51	JOHN J. BROWN	100.00	125	PAYROLL
2/20/51	JOHN J. BROWN	100.00	126	PAYROLL
2/25/51	JOHN J. BROWN	100.00	127	PAYROLL
2/28/51	JOHN J. BROWN	100.00	128	PAYROLL
3/05/51	JOHN J. BROWN	100.00	129	PAYROLL
3/10/51	JOHN J. BROWN	100.00	130	PAYROLL
3/15/51	JOHN J. BROWN	100.00	131	PAYROLL
3/20/51	JOHN J. BROWN	100.00	132	PAYROLL
3/25/51	JOHN J. BROWN	100.00	133	PAYROLL
3/30/51	JOHN J. BROWN	100.00	134	PAYROLL
4/05/51	JOHN J. BROWN	100.00	135	PAYROLL
4/10/51	JOHN J. BROWN	100.00	136	PAYROLL
4/15/51	JOHN J. BROWN	100.00	137	PAYROLL
4/20/51	JOHN J. BROWN	100.00	138	PAYROLL
4/25/51	JOHN J. BROWN	100.00	139	PAYROLL
4/30/51	JOHN J. BROWN	100.00	140	PAYROLL
5/05/51	JOHN J. BROWN	100.00	141	PAYROLL
5/10/51	JOHN J. BROWN	100.00	142	PAYROLL
5/15/51	JOHN J. BROWN	100.00	143	PAYROLL
5/20/51	JOHN J. BROWN	100.00	144	PAYROLL
5/25/51	JOHN J. BROWN	100.00	145	PAYROLL
5/30/51	JOHN J. BROWN	100.00	146	PAYROLL
6/05/51	JOHN J. BROWN	100.00	147	PAYROLL
6/10/51	JOHN J. BROWN	100.00	148	PAYROLL
6/15/51	JOHN J. BROWN	100.00	149	PAYROLL
6/20/51	JOHN J. BROWN	100.00	150	PAYROLL
6/25/51	JOHN J. BROWN	100.00	151	PAYROLL
6/30/51	JOHN J. BROWN	100.00	152	PAYROLL
7/05/51	JOHN J. BROWN	100.00	153	PAYROLL
7/10/51	JOHN J. BROWN	100.00	154	PAYROLL
7/15/51	JOHN J. BROWN	100.00	155	PAYROLL
7/20/51	JOHN J. BROWN	100.00	156	PAYROLL
7/25/51	JOHN J. BROWN	100.00	157	PAYROLL
7/30/51	JOHN J. BROWN	100.00	158	PAYROLL
8/05/51	JOHN J. BROWN	100.00	159	PAYROLL
8/10/51	JOHN J. BROWN	100.00	160	PAYROLL
8/15/51	JOHN J. BROWN	100.00	161	PAYROLL
8/20/51	JOHN J. BROWN	100.00	162	PAYROLL
8/25/51	JOHN J. BROWN	100.00	163	PAYROLL
8/30/51	JOHN J. BROWN	100.00	164	PAYROLL
9/05/51	JOHN J. BROWN	100.00	165	PAY

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STATIONARY - 14267063-034

[illegible]

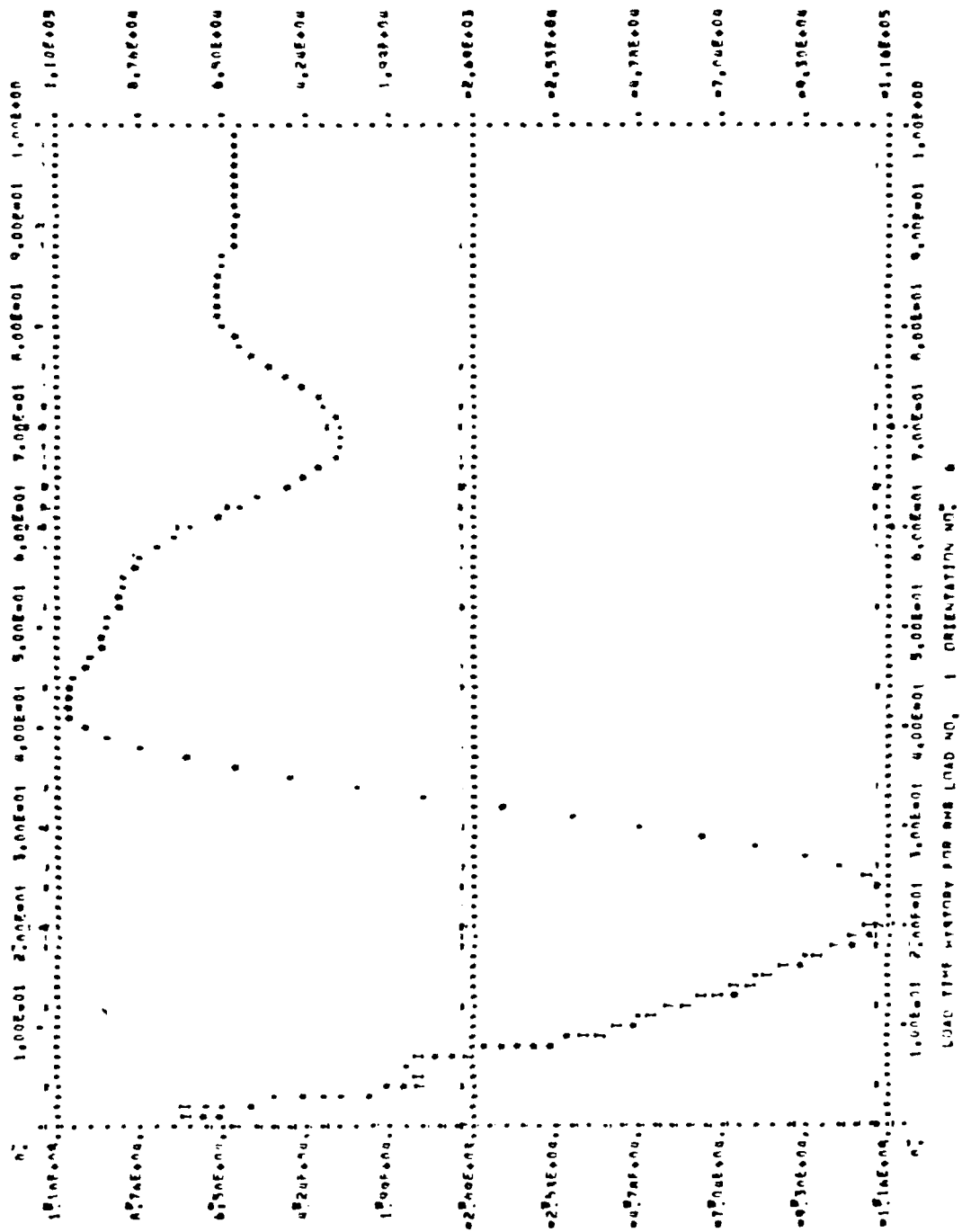
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ARIZONA	7974	•	2481	1120

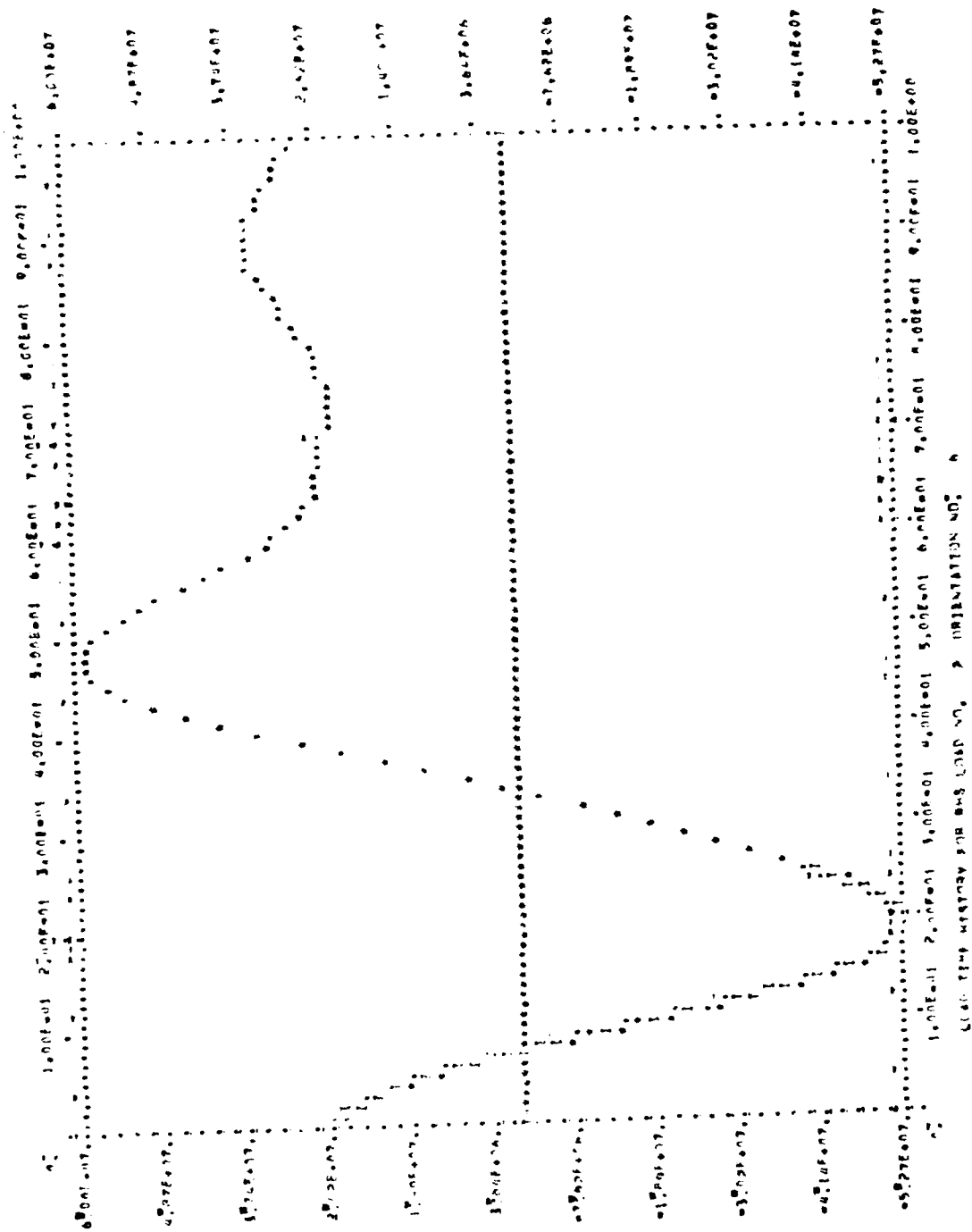
DATE
TIME

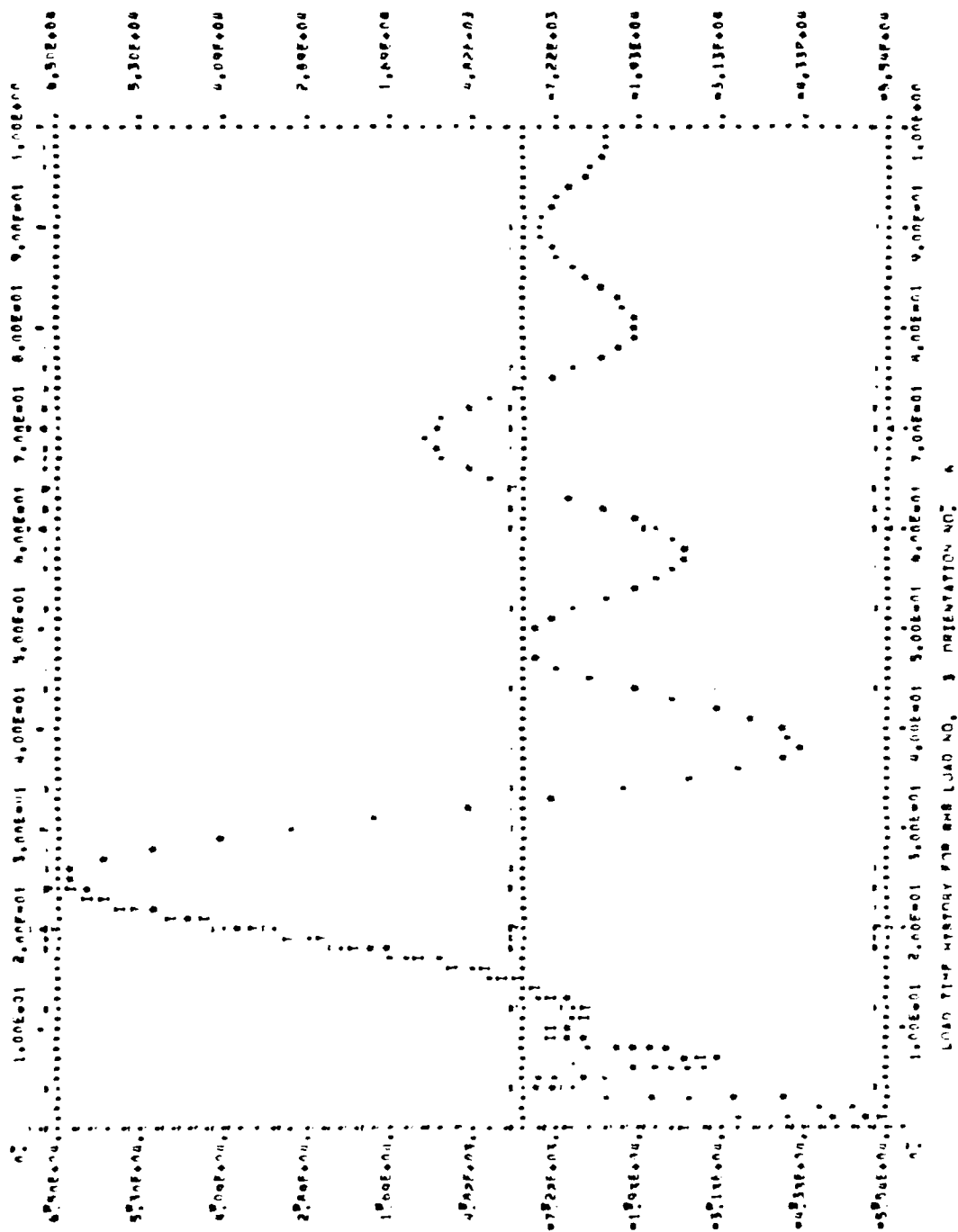
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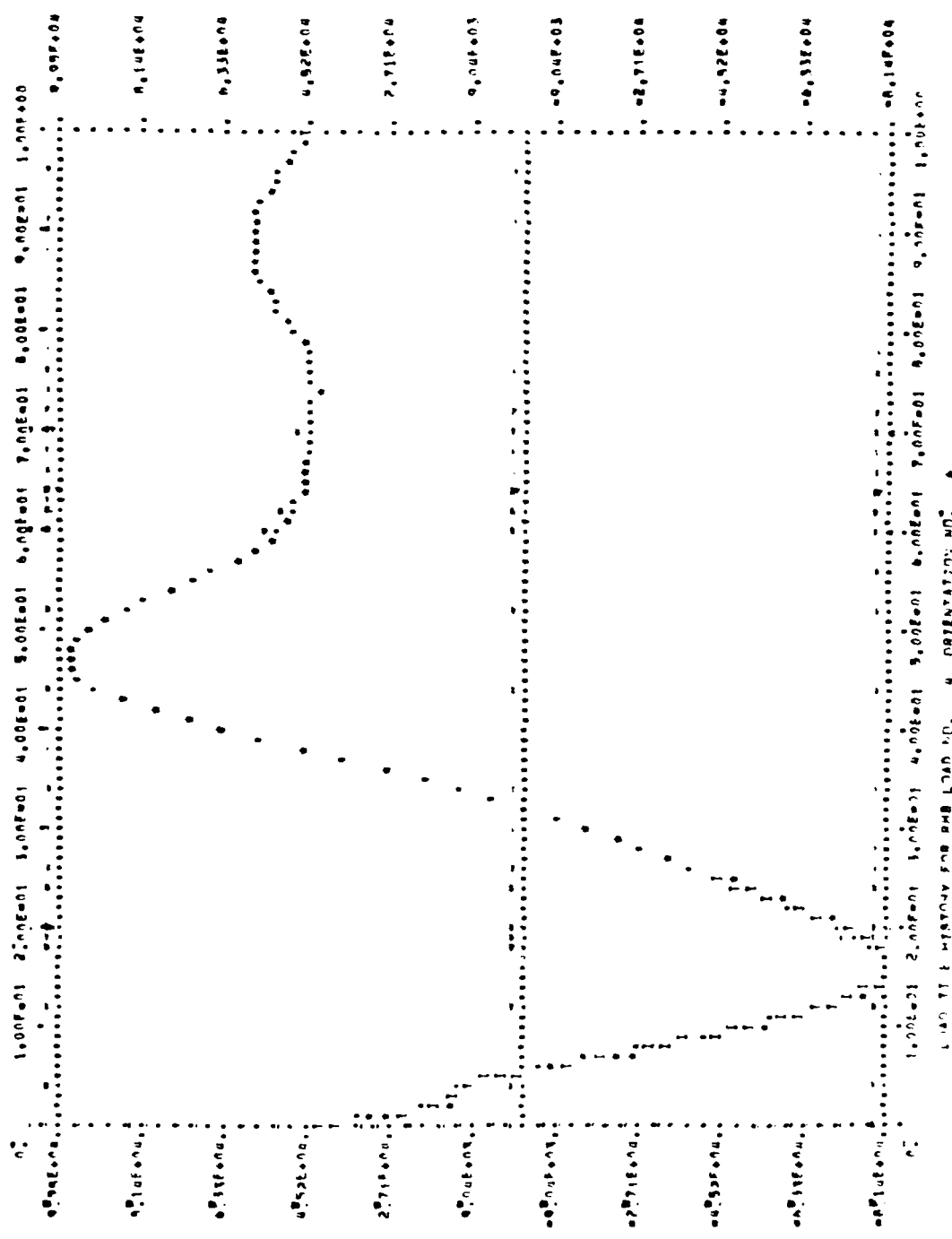
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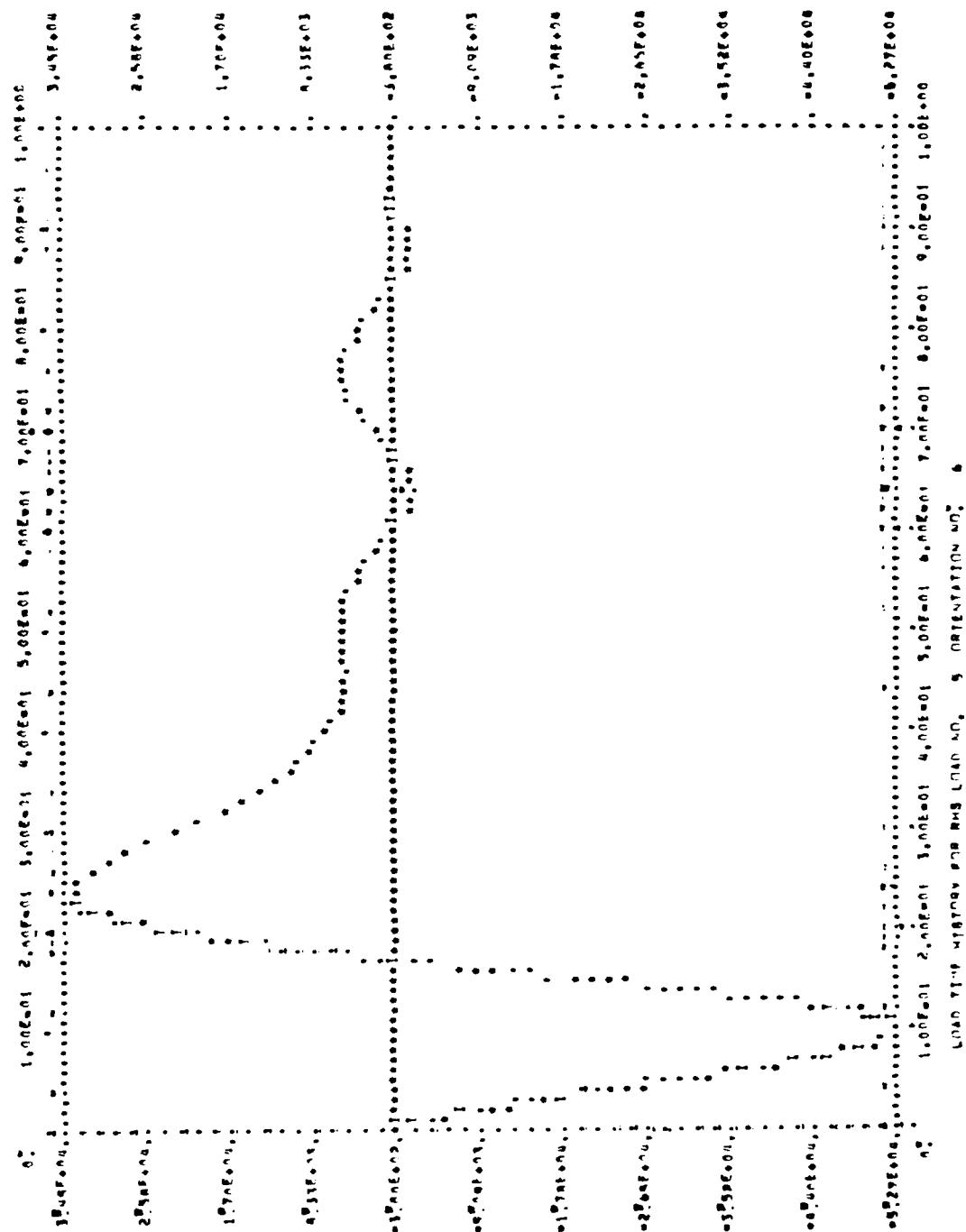
12144 WORDS OF COMP ADD FOR STEP *** READY ***

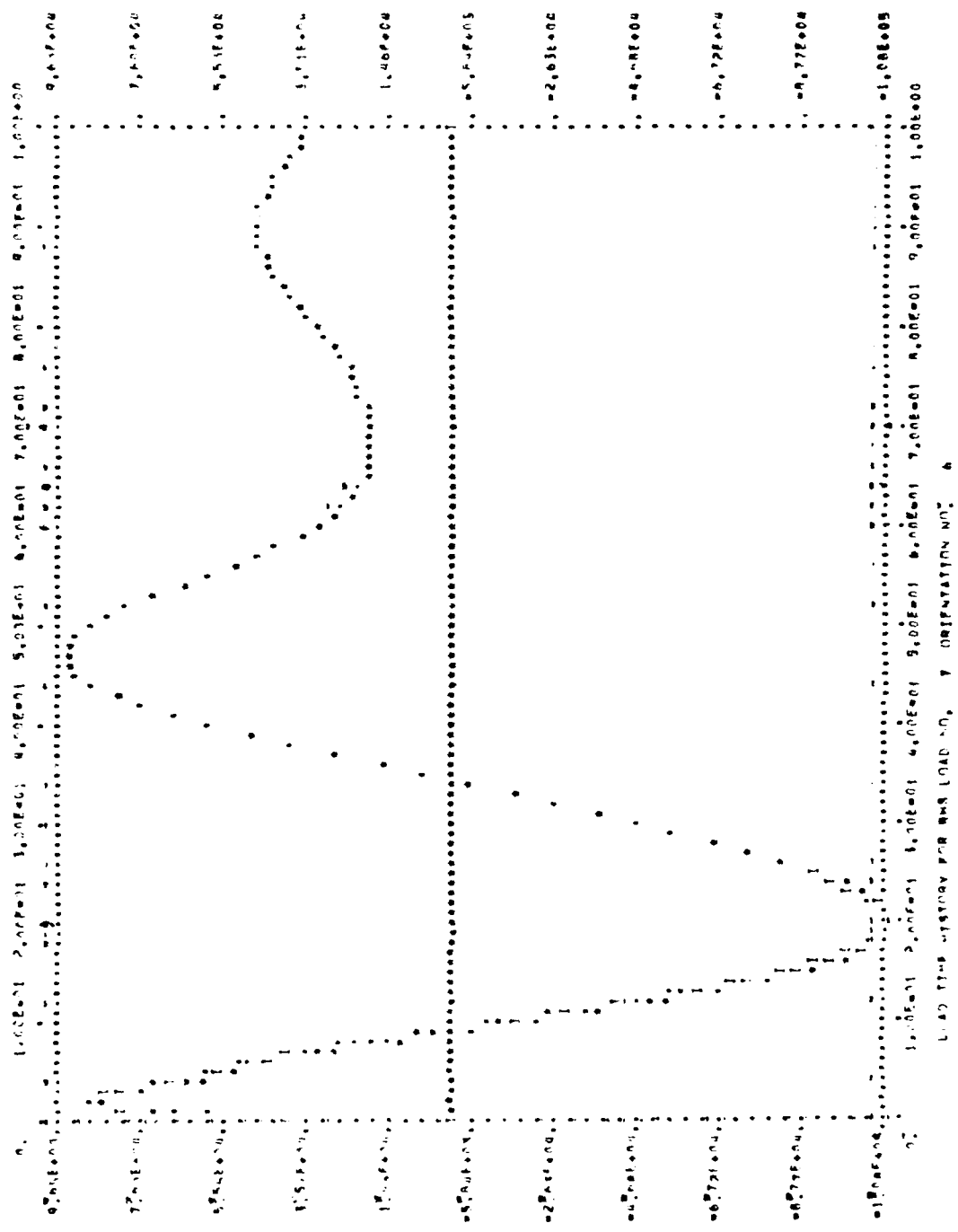


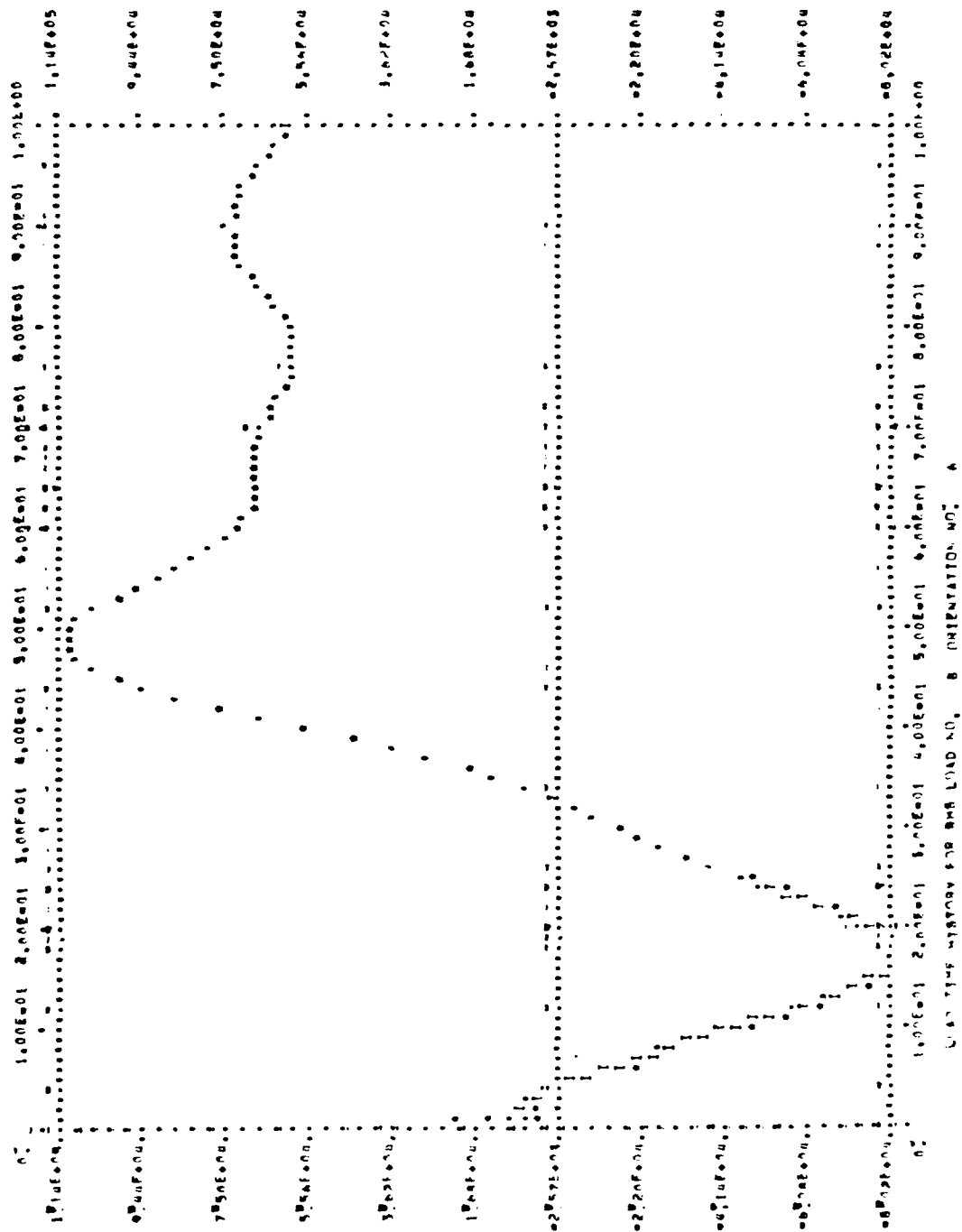


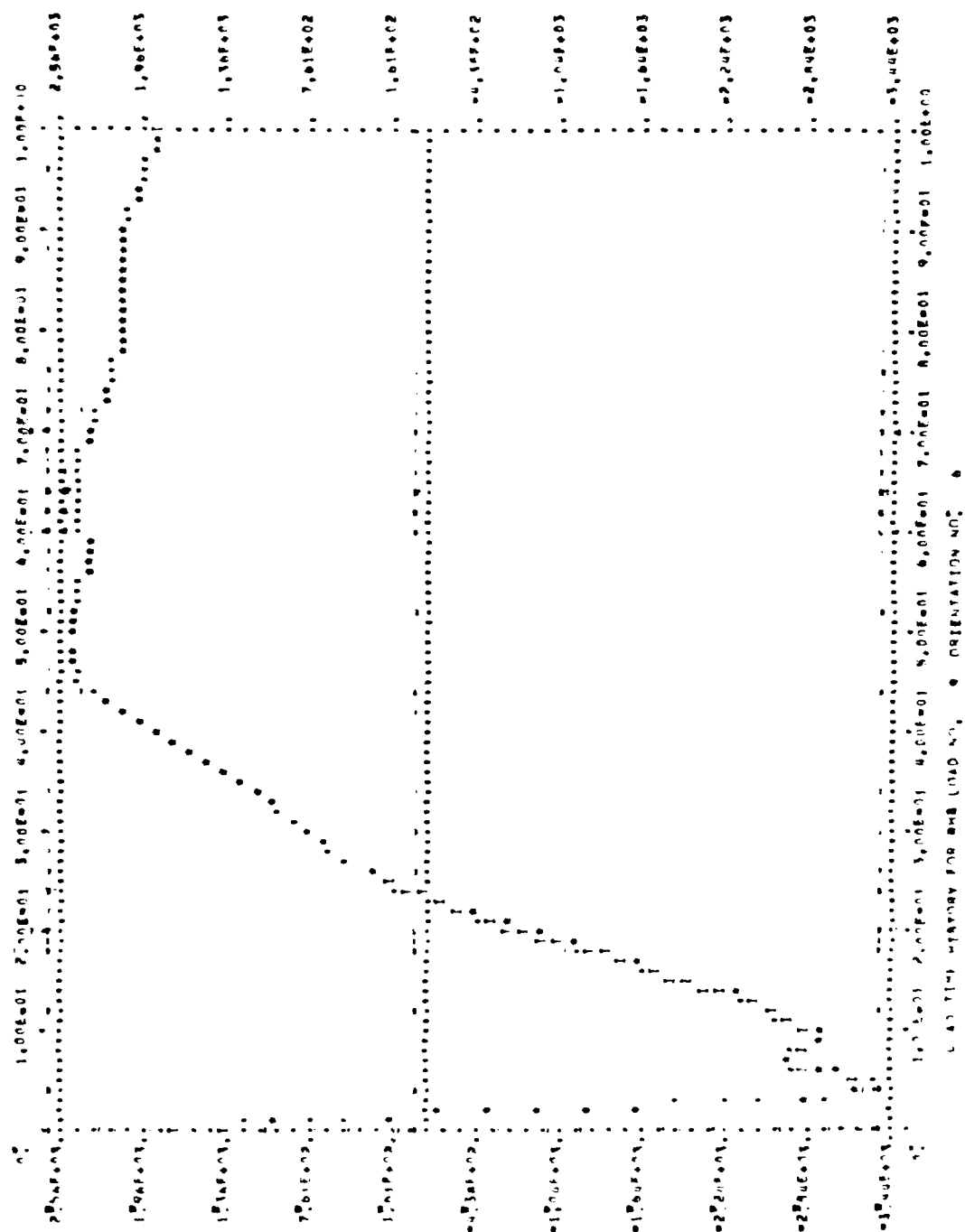












AD-A106 480

DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3
NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)
AUG 81 J A MCOREY, J P GIESING, T P KALMAN DNA001-75-C-0216
AFWL-TR-81-32-VOL-1 NL

UNCLASSIFIED

5 of 5

5010-108



END
DATE
FILMED
12-81
DTIC

DATE
TIME

MAXIMUM LOADS

STA	TIME	W. STRE	TIME	M. STRE	TIME	I. STRE	TIME	DATE
1	0100	0110000000	0100	0110000000	0100	0110000000	0100	0100
2	0200	0220000000	0200	0220000000	0200	0220000000	0200	0200
3	0300	0330000000	0300	0330000000	0300	0330000000	0300	0300
4	0400	0440000000	0400	0440000000	0400	0440000000	0400	0400
5	0500	0550000000	0500	0550000000	0500	0550000000	0500	0500
6	0600	0600000000	0600	0600000000	0600	0600000000	0600	0600
7	0700	0710000000	0700	0710000000	0700	0710000000	0700	0700
8	0800	0820000000	0800	0820000000	0800	0820000000	0800	0800
9	0900	0930000000	0900	0930000000	0900	0930000000	0900	0900
10	1000	1000000000	1000	1000000000	1000	1000000000	1000	1000

ORIENTATION NO. 6

MATERIAL VELOCITY 10,000000
 MAX ALLOWABLE VELOCITY 10,000000
 P. AIRCRAFT 10,1722 PSI
 C. AIRCRAFT 10,1722 PSI
 MAX ALLOW. OVERPRESSURE 1,116 PSI

MAXIMUM BURST AND NO. LOAD MATTER

STA	LOAD	TIME
1	0.0000	0.0000
2	0.0000	0.0000

COORDINATES OF AIRCRAFT AND BURST AT TIME 0 00,1200 SPCH

AIRCRAFT (REFS)
 X 0 0.00000000
 Y 0 0.00000000
 Z 0 0.00000000

BURST (REFS)
 X 0 0.00000000
 Y 0 0.00000000
 Z 0 0.00000000

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
 SLCTR 0 0.00000000

DISTANCE BURST TO AIRCRAFT NO. 10
 SLCTR 0 0.00000000
 BURST 0 0.00000000
 BURST 0 0.00000000
 BURST 0 0.00000000

DATE
TIME

RANGE ITERATION NO. 2
COORDINATES OF AIRCRAFT AND BURST AT TIME 0 0.0000 SECS
AIRCRAFT (FEAS)
X 0 0.
Y 0 0.
Z 0 0.0000000
BURST (FEAS)
X 0 0.
Y 0 0.
Z 0 0.0000000
DISTANCE BURST TO AIRCRAFT AT INTERCEPT
SLANT 0 0.71238E+00 FT.
DISTANCE BURST TO AIRCRAFT NOW IS
SLANT 0 0.71238E+00 FT.
X 0 0.
Y 0 0.
Z 0 0.0000000 FT.

.....
TAPED REF AND
.....

TIME BACK TO BURST 0 -5.1280 SECS

STATION	TIME	W. SING	TIME	R. SING	TIME	L. SING	TIME	M. SING	TIME	M. SING
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

CONTINUATION OF A

MATERIAL VEHICLE NO. 77777777
 MAY ALL-STAR VEHICLE 49,174,100
 P. 10,172,100
 (V. 10,172,100) 1,120,000
 MAY ALL-STAR OVERHEADS 1,000,000

MATERIAL VEHICLE AND NO. LOAD RATIO

STATION	LOAD	TIME
1	0.0000	0.0000
2	0.0000	0.0000

CUMULATIVE OF AIRCRAFT AND BURST AT TIME 0 - 0.0000 SEC

AIRCRAFT (STARS)	TIME
1	0.0000
2	0.0000

STATION (STARS)	TIME
1	0.0000
2	0.0000

DISTANCE BURST TO AIRCRAFT AT INTERCEPT

STATION	TIME
1	0.0000
2	0.0000

DATE
TIME

RANGE ITERATION NO. 3
CUMULATIVE OF AIRCRAFT AND BURST AT TIME 0 0.0000 SPES
AIRCRAFT (PFAS)
X = 0.
Y = 0.
Z = .10000E+00
BURST (EFAS)
X = 0.
Y = 0.
Z = .42000E+00
DISTANCE BURST TO AIRCRAFT AT INTERCEPT
BLN20 = .72400E+00 PT.
DISTANCE BURST TO AIRCRAFT NOW IS
BLN20 = .72400E+00 PT.
XEN20 = 0.
YEN20 = 0.
ZEN20 = .72400E+00 PT.

TAPETO REWIND

TIME BACK TO BURST 0 -5.2000 SECS

ATA	TIME	L SIZE	R SIZE	TIME	L SIZE	R SIZE	TIME	L SIZE	R SIZE	DATE	TIME
1	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
2	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
3	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
4	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
5	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
6	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
7	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
8	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
9	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000
10	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.000	0.0000000	0.0000000	0.0000000	0.0000000

ORIENTATION NO. 6

MATERIAL VELOCITY 50.3ASOPPS
 MAX ALL-SCALE VELOCITY 50.2ASOPPS
 MAX ALL-SCALE VELOCITY 14.1727 PSI
 OVERPRESSURES 1.0031 PSI
 MAX ALL-SCALE OVERPRESSURES 1.0013 PSI

MAXIMUM BURST AND NEG. LOAD RATIOS

ATA	LOAD	TIME
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000

COORDINATES OF AIRCRAFT AND BURST AT TIME 0 05.2184 SECS

AIRCRAFT (FEET)
X 0 0.0000000
Y 0 0.0000000
Z 0 0.0000000

BURST (FEET)
X 0 0.0000000
Y 0 0.0000000
Z 0 0.0000000

DISTANCE BURST TO AIRCRAFT AT INTERCEPT

SLANT	0 0.72520000 FT.
DISTANCE BURST TO AIRCRAFT NOW IS	0.72520000 FT.
SLANT	0.72520000 FT.
HEIGHT	0.00000000 FT.
VELOCITY	0.00000000 FT.
ALTITUDE	0.00000000 FT.

CONVERGED SOLUTION
 3 ITERATIONS
 CRITICAL RANGE IS 7252.02 FT.

RAIS
TIME

INTEGRATED LOAD DEFINITIONS			
LOAD BEAM CODE	PCOE CODE	YAS	ZAS
1	4.0	1.0	0.0
2	4.0	1.0	0.0
3	4.0	1.0	0.0
4	4.0	1.0	0.0
5	4.0	1.0	0.0
6	4.0	1.0	0.0
7	4.0	1.0	0.0
8	4.0	1.0	0.0
9	4.0	1.0	0.0
10	4.0	1.0	0.0

REFERENCES

1. Hobbs, N. P., Zartarian, G., and Walsh, J. P., A Digital Computer Program for Calculating the Blast Response of Aircraft to Nuclear Explosions, Air Force Weapons Laboratory, Report No. AFWL-TR-70-140, Vol. I, April 1971.
2. Giesing, J. P., Kalman, T. P., and Rodden, W. P., Subsonic Unsteady Aerodynamics for General Configurations; Part II - Application of the Doublet Lattice Method and the Method of Images to Lifting-Surface/Body Interference, Air Force Flight Dynamics Laboratory, Report No. AFFDL-TR-71-5, Part II, April 1972.
3. Giesing, J. P., Kalman, T. P., and Rodden, W. P., "Subsonic Steady and Oscillatory Aerodynamics for Multiple Interfering Wings and Bodies," J. Aircraft, Vol. 9, No. 10, pp. 693-702, 1972.
4. Zartarian, G., Application of the Doublet-Lattice Method for Determination of Blast Loads on Lifting Surfaces at Subsonic Speeds, Air Force Weapons Laboratory, Report No. AFWL-TR-72-207, January 1973.
5. Albano, E., Rodden, W. P., A Doublet Lattice Method for Calculating Lift Distributions on Oscillating Surfaces in Subsonic Flows, AIAA Journal Vol. 7, No. 2, February 1969.
6. Kalman, T. P., Rodden, W. P., Giesing, J. P., Aerodynamic Influence Coefficients by the Doublet Lattice Method for Interfering Nonplanar Lifting Surfaces Oscillating in a Subsonic Flow, IRAD Final Report, DAC-67977, November 1969.
7. Wylie, C. R. Jr., Advanced Engineering Mathematics, McGraw-Hill Book Co., Inc., New York, 1951.

8. Solodovnikov, V. V., Introduction to the Statistical Dynamics of Automated Control Systems, Dover Publications, Inc., New York, 1960.
9. Hurty, W. C. and Rubinstein, M. F., Dynamics of Structures, Prentice-Hall, Inc., New Jersey, 1964.

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