NASA CONTRACTOR REPORT 166471

Flight Dynamics Analysis and Simulation of Heavy Lift Airships

Volume V: Programmer's Manual

(NASA-CR-166471-Vol-5) FLIGHT DYNAMICS ANALYSIS AND SIMULATION OF HEAVY LIFT AIRSHIPS. VOLUME 5: PROGRAMMER'S MANUAL Final Report, Sep. 1979 - Dec. 1982 (Systems Technology, Inc.) 152 p HC A08/MF A01 G3/08

N83-22211

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CONTRACT NAS2-10330
December 1982

NASA

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Volume V: Programmer's Manual

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under Contract NAS2-10330

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FOREWORD

This document is the fifth in a five volume report which describes a comprehensive digital computer simulation of the dynamics of heavy lift airships and generically similar vehicles.

The work was performed by Systems Technology, Inc., Hawthorne, California for the Aeronautical Systems Branch in the Helicopter and Powered Lift Division of the National Aeronautics and Space Administration, Ames Research Center, Moffett Field, California. The simulation development was carried on between September 1979 and January 1982 and is currently installed on the Ames Research Center CDC 7600 computer. The contract technical monitors for NASA were Dr. Mark Ardema, Mr. Alan Faye, and Mr. Peter Talbot. STI's Program Manager was Mr. Irving Ashkenas.

The authors wish to acknowledge the technical contributions of Mr. Robert Heffley, Mr. Thomas Myers, and Mr. Samuel Craig and the further contributions of Mr. Allyn Hall, Ms. Natalie Hokama and Ms. Leslie Hokama in simulation software development. Special thanks are due to Ms. Kay Wade, Ms. Linda Huffman, Mr. Charles Reaber, and STI's production department for the preparation of the five volumes of this report.

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SECTION I

INTRODUCTION

This Programmer's Manual describes the software design of the heavy-lift-airship simulation programs and associated post-processors and was written to assist in software alterations. In addition to this manual there are two others, a User's Manual and a Technical Manual. Since the programmer should have access to all three manuals, it is suggested that the User's Manual be read very carefully before attempting to use this Programmer's Manual. The Technical Manual discusses the engineering design which, in most cases, has determined the structure of the software.

The User's Manual is designed to provide the user with the basic information necessary to run the program as it has been designed. This manual does not discuss any of the internal workings of the code or the technical details of the equations and their derivations. This manual describes the various data files necessary for the program and explains the output from the program and the various options available to the user when executing the program. The discussion of the data files is limited to:

1) The type of data contained in each file.

2) The inputs necessary to create special configurations.

3) Inputs whose nature is specialized or not obvious.

4) Additional data file information is contained in:

   Appendix A - tabulates all input variables. It indicates which values are valid for the various variables and other special considerations which the variables may have.

   Appendices B and C - contain sample sets of input files and the output resulting from those input files.

The Programmer's Manual is designed for the maintenance programmer who will be supporting this program. It explains the logic of the various program modules, and in some cases gives a detailed explanation of the reasons for various implementations. The topics discussed in the User's Manual will not be repeated in the Programmer's Manual. Consequently, the maintenance programmer will have to consult both of these manuals when working with the program. The Programmer's Manual contains several appendices, including a dictionary of program variables, a list of all subroutines and their purposes, a subroutine/common block/cross reference listing, and a calling/called subroutine cross reference listing.

The Technical Manual contains a detailed discussion of all simulation models, including derivations of all the equations, and methodology for calculating the required program input data. The user will have to consult this manual for all technical information he requires in generating the input data files or in understanding the output.

The program code is well documented, and the programmer is referred to the code documentation for the implementation details. Throughout this Programmer's Manual, relevant subroutine names are enclosed in parentheses to provide the programmer with starting points from which to work.

The appendices included in this manual are as follows: Appendix A is an alphabetical list of subroutines and their purposes; Appendice B is an alphabetical list of the common blocks with definitions of each; Appendix C is a common block/subroutine cross reference; Appendix D is a cabling/called subroutine cross reference; and Appendix E provides an alphabetical listing of the subroutine input and output variables. These appendices will continue to be useful only if they are updated to reflect all changes made to the programs.

A. BASIC PROGRAM STRUCTURE

The simulation of the heavy-lift airship consists of three programs which use a large amount of shared code. The three programs are:

1. **HLASIM** — Powered vehicle in flight without a payload.

2. **HLAMOR** — Unpowered vehicle constrained to a mast at a mooring point.

3. **HLAPAY** — Powered vehicle in flight carrying a payload.

The flow diagram used by the three programs is shown in Fig. 1.

The following discussion of the program development process provides an understanding of the present program and some guidelines for future work. HLASIM was developed by progressively adding modules. After the basic force calculation (FORCE) was implemented, the aerodynamic module (AERO), gust module (GUST), and the interference modules were added. This process could have been continued until all aspects (payload and mooring) were incorporated into one program; this was not done because the program complexity would have been unmanageable.

A completely new program to model the payload was written and structured to be compatible with the program HLASIM. After all of the payload modules were implemented and tested on the "payload only" program, calls to the payload modules were inserted in the program HLASIM. The result was the program HLAPAY. A special stability derivative module had to be written for this program, but all other modules were compatible.

Program HLAMOR was created by adapting some of the HLASIM subroutines. Though the basic program structure was maintained (Fig. 1), some parts were excluded (i.e., the control system) while others were radically altered (i.e., the rotor and propeller aerodynamics). The result was a large number of subroutines having similar names and serving similar functions, yet implemented differently. Wherever possible, however, existing code was shared with the other programs.

Program modules were built around engineering concepts (e.g., aerodynamics and control systems). This modularity should allow alternative modules to be developed and used in place of the existing ones. This

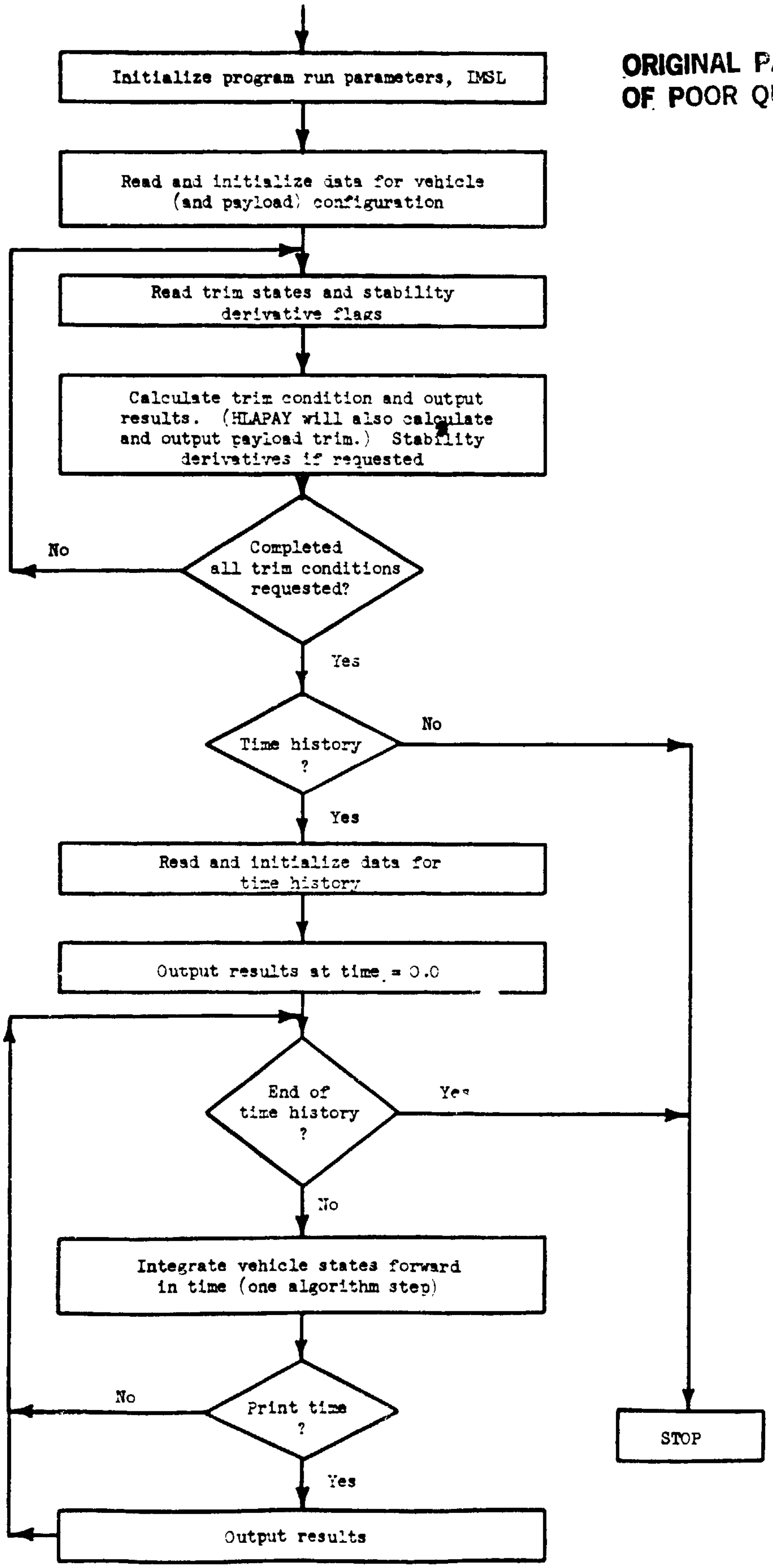

Figure 1. Heavy-Lift Airship Simulation Top-Level Flow Diagram

approach to code alteration is preferable to changing parts of individual subroutines. The program size and complexity is such that errors introduced while altering "bits and pieces here and there" may never be noticed. In addition it is difficult to maintain documentation for many small alterations. Since the program's long term usefulness depends upon the quality of the documentation, a system for recording alterations will be needed. It is also likely that parts of the programs may eventually have several alternative modules; therefore a system for storing this code will also be needed.

B. PROGRAM IMPLEMENTATION

The three programs discussed above (HLASIM, HLAMOR, and HLAPAY) have been installed on the NASA Ames Research Center CDC 7600/SCOPE system. The International Mathematics and Statistics Library (IMSL) is required to execute all of the simulation programs. The source code is stored under the UPDATE facility with a separate DECK name for each subroutine, and a LIBRARY which contains the compiled object code for all subroutines. To execute one of the programs, the LOADER is called with that program. The LOADER will then obtain all necessary subroutines from the LIBRARY. This implementation procedure ensures that only one source and one compiled object file exists for each subroutine. Therefore, the implication of all code changes on each of the three programs must be examined. Global changes to all three programs are quite simple to make with the LIBRARY organization.

The programmer may have to make parallel changes in order to maintain the similarity of the three programs. For various reasons it was necessary to write new code for some of the modules of each program (e.g., the rotor and propeller aerodynamics and the stability derivatives). If further alterations are made to such a module, the programmer will have to decide whether parallel changes are also necessary in the other modules.

SECTION II

INITIALIZATION

Initialization is performed by three routines: PINTIL for HLAPAY; MINTIL for HLAMOR; and INTIAL for variables that are common to all three of the programs. As a general rule, all program initialization is conducted in these routines. In a few cases, where a variable is used in only one place, initialization is done locally. Future program alternations must reflect consideration of the affect of overlays on initialized variables since overlays usually require the use of initialization routines.

Variables are initialized by either data statements or by assignment. The different methods, combined with the initialization routine calling order, achieve very different results. The initialization routines are called at the beginning of the program run; and, if there is more than one trim state to be calculated, the initialization routines will be called prior to each additional trim calculation. Some basic forms of initialization are as follows:

1. Many matrices (e.g., the mass matrix) are initialized to zero. The input routines will load values into some locations of the matrix while leaving the others zero. Initialization is by data statements since assignment would incorrectly zero the matrix before a second trim.

2. Variables used and changed by the trim or stability derivative calculations (e.g., the state vector) must be reinitialized (or reinput) by assignment before each trim state calculation. Failure to do this will cause the subsequent trim to use the values left over from the previous trim.

3. Some input or calculated time history data (e.g., the gust velocities) are initialized to zero because they are used (and must be defined) during the trim but are not input or calculated until the time history begins.

4. The cable forces on the hull are set to zero in INTIAL, and their values are never changed in the program HLASIM. In the program HLAPAY, the payload module generates nonzero hull cable force values for the active cables. The same vehicle force module (FORCE) serves both of the programs and does not need to know which program has called it.

If future developments require initialization, the methodology discussed above should be used. Program aintainability will be improved when these patterns are followed wherever possible.

SECTION III

INPUT/OUTPUT

This section provides a general discussion of the input/output subroutines of the three programs (HLASIM, HLAMOR, and HLAPAY) discussed previously. Table 1 is a list of all data files, their equivalent unit numbers, and the subroutines and programs which access them. Since the data files that are created and used by these programs are discussed in the <u>User's Manual</u>, the programmer is referred there for a detailed discussion of the contents of each data file as well as for sample output listings and input data files. There are <u>no computer-generated</u> default input values. If a particular constant is uncertain, the <u>user</u> can eliminate the related physical effect by assigning to that variable the value listed in the column entitled "Default Input Values" of Appendix A of Volume III, the Simulation User's Guide Appendices. Leaving out an input variable for computer default will cause automatic <u>termination</u> of the run.

The following is an overview of the subroutines which read or write data.

A. VEHICLE AND FLIGHT CONDITION INPUTS

The vehicle and flight condition inputs are contained in data files whose names end with "DTA" (e.g., PAYDTA, GMDTA) and are read by subroutines whose names begin with "IN" (e.g., INMASS, INPGEO). These data are then immediately written to the output listing by subroutines whose names begin with "OI". Each input routine has a corresponding output subroutine (e.g., INMASS/OIMASS, INGEO/OIPGEO). All "IN" subroutines are called from the three main programs (HLASIM, HLAMOR, or HLAPAY) and read data in the NAMELIST format.

B. TIME FRAME DATA OUTPUT

The program writes a user-selected block of variables to the output listing after each trim calculation as well as at user-selected print

TABLE 1

SUBROUTINES AND PROGRAMS ACCESSED BY DATA FILES

Data File	Subroutines	Programs
INPUT=TAPE5	QUESTN, TQUEST, OUTOIN	HLASIM, HLAMOR, HLAPAY
OUTPUT=TAPE6	OUTOIN, TQUEST, QUESTN, TRIM, PTRIM, MTRIM, PTRMLM, PMTRLM, WRTSTB, WRTMSB, WRTTSB, WRTIVD, WRTVOI, WRTINC, WMSDI, WRTPSB, MSSAG, STORE, PSTORE, And all OI routines (OIGEOM, etc.)	HLASIM, HLAMOR, HLAPAY
PYOUTL=TAPE9 (input)	TQUEST	HLAPAY
PAYDTA=TAPE10 (input)	INPGEO, INPMAS, INCABL, INPARO, INPYST	HLAPAY
ERMSSG=TAPE15 (input)	MSSAG	HLASIM, HLAMOR, HLAPAY
OUTLST=TAPE19 (input)	QUESTN, TQUEST	HLASIM, HLAMOR, HLAPAY
GMDTA=TAPE20 (input)	HGEOM, LPGEOM, INGEAR, INMOOR, INEXST	HLASIM, HLAMOR, HLAPAY
ARODTA-TAPE21 (input)	INHARO, INLARO	HLASIM, HLAMOR, HLAPAY
IFCDTA=TAPE25 (input)	INRIFC, INPIFC INFIFC, INHIFC, INTIFC	HLASIM, HLAMOR,HLAPAY
PLMDTA=TAPE23 (input)	INPROP, INMCLC	HLASIM, HLAPAY
TRMDTA=TAPE24 (input)	INSTAT, INATMOS, INSTAB	HLASIM, HLAMOR, HLAPAY
MORDTA-TAPE30 (input)	INMTRA, INMRST	HLAMOR
HISDTA=TAPE22 (input)	INFCSC, INPROF, INGUST, INSTEP	HLASIM, HLAMOR, HLAPAY
RG1-RG6 TAPE41-TAPE46 (input)	GETSRG	HLASIM, HLAMOR, HLAPAY
PLOT=TAPE50 (output)	STORE, PSTORE, IPLOFT	HLASIM, HLAMOR, HLAPAY

intervals during time histories. (See the sample output listing in Appendix B of the User's Manual.) The variables and the order in which they appear are controlled by the user via the input files OUTLST and PYOUTL. (See the User's Manual for a discussion of these files.) The variables to be written are loaded into output arrays (e.g., ZHLDTA for vehicle; ZLPDTA for LPUs; ZPYDTA for payload; and ZCBDTA for cables) which are contained in the commons OUTDTA and PYOPUT.

The subroutines STORE (for the vehicle) and PSTORE (for the payload) write the data that are contained in these arrays. By using the code numbers from the input files OUTLST and PYOUTL as array subscripts, the variable names and values are written in the same order as given in the user-created input file. This technique has proven itself useful for program debugging and output variable list enlargement.

The method for adding variables is as follows:

1. Insert the appropriate common into the subroutine which calculates the variable. Load the variable into the next unused location in the appropriate array. (There are many unused locations. See Appendix D in the User's Manual for a list of the locations that are presently being used.)

2. The variable name should be inserted in the corresponding variable name heading array location in subroutine STORE or subroutine PSTORE. (The variable name heading arrays are: HLHEAD for hull, LPHEAD for LPUs, PYHEAD for payload, and CBHEAD for cables.)

3. The user must then include the subscript number of the location determined above as a code number in the appropriate input file (OUTLST or PYOUTL).

4. Additions of variables should be carefully documented so that two variables are not written to the same location.

C. STABILITY DERIVATIVE OUTPUT

The stability derivative outputs are written by subroutines which begin with "WRT." As with stability derivatives in general, each main program has an exclusive set of output subroutines which are related to its stability derivatives. This was necessary because of the matrix dimension differences.

D. ERROR MESSAGES

The programmer should consult the error processing section of this guide for a complete description of the error message routine and its error messages.

E. PLOTTING FILE

An unformatted file (PLOT) contains a program descriptor, variable names, and all output variables from trim and every time history algorithm step. A complete description of this file is given in Section III-B of the User's Manual. The file is written by the routines IPLOTF, STORE, and PSTORE. IPLOTF is called from QUESTN, TQUEST writes the initial run parameters, and STORE and PSTORE write the variables and their names. If new variables are added to the output variable list (see B above), they and their names will become part of this file automatically.

All output data is written to this file with the intention that a post processor selects data from this file and plots it. The NASA Ames Research Center implementation has such a program, PPLOTF. PPLOTF is discussed in detail in Section IV of this Programmer's Manual and in the User's Manual.

SECTION IV

SYSTEM INTEGRATOR

The time history simulation of the vehicle motion is accomplished by t e following integration scheme:

1. Start with a given vehicle state vector (calculated by the trim module), flight control svstem integrators (initialized to zero), and, if applicable, the payload state vector (calculated in the payload trim module). The time is initialized to zero.

2. Increase the time by a small increment.

3. Calculate the derivatives of the vehicle state vector, flight control system integrators, and payload state vector.

4. Update the vehicle state vector, flight control system integrators, and payload state vector using the derivatives calculated in Step 3.

5. Repeat Steps 2 through 4 until reaching the specified time.

The IMSL Runge-Kutta routine, DVERK, is used to perform the numerical integration. Implementation of DVERK requires that all integrator state variables be in one vector, but the program structures require those variables to be used in different locations. In order not to compromise the programs' modularity, two interfacing routines were written (one above and the other below DVERK, see Table 2). These subroutines load and unload the integrator state variables into and out of the complete state vector, SV. This vector is then passed into DVERK and integrated numerically.

TABLE 2

SYSTEM INTEGRATOR INTERFACING SUBROUTINES

Program	Subroutine Calling DVERK	Subroutine Called by DVERK
HLASIM	INTGTR	CLCSVD
HLAMOR	MINTGR	CLMSVD
HLAPAY	TINTGR	CLTSVD

The subroutine preceeding (i.e., which calls) DVERK forms the vector SV, initializes other DVERK arguments, and calls DVERK. DVERK's arguments have been set to monitor the integration time step. If DVERK attempts to use a time step smaller than that which is allowed (MINSTP), this subroutine will force acceptance of the latest calculation. This provides some user control over the program execution cost.

The subroutine which follows (i.e., which is called by) DVERK unloads the integrator state variables from SV into their respective commons. The derivatives of each of the state variables (elements of SV) are calculated and placed into SVDOT, which is then returned to DVERK. Throughout the remainder of the program, the vehicle state vector (common SVECTR), flight control integrator states (common FCSINT), and payload state vector (common PSVCTR) are completely separate. This allows the payload only and vehicle only state derivative calculations to be merged in the program HLAPAY without altering either state derivative calculation module (CALSCD or CLCPSD).

The flight control system integrator limits are enforced in the routine called by DVERK. If a flight control system integrator is set by DVERK to a value larger than the user-specified limit, the integrator value used in the flight control system model is set back to that limit. Changing values in SV is not allowed by DVERK (see the IMSL-DVERK documentation).

Before deciding to use DVERK, we implemented both IMSL routines DGEAR and DVERK. Our reasons for choosing DVERK are as follows:

1. DVERK is relatively easy to implement.

2. DGEAR did not show a noticeable cost improvement.

3. DGEAR moves the time step backward and forward in a much more arbitrary manner than DVERK, thereby causing problems with the gust string inputs. (See subroutines RGUST, RANDOM, and PRNDOM).

NOTE: DGEAR can be used, but there is some risk of program failure because of Point 3.

It is expected that future developments will add integrator states; therefore, a means to accomplish this has been built into the system. In addition to the present integrator state variables, there are two empty arrays. The array BLKINT (spare states) is loaded into the bottom of SV, and BKDINT (time derivatives of spare states) is loaded into the corresponding bottom locations of SVDOT. These vectors are initialized to zero in subroutine INTIAL. Additional integrator states can be placed in these arrays, and they will automatically become part of the SV and SVDOT vectors. The method for doing this is as follows:

1. Common SPRINT with variables BLKSIZ and BLKINT is placed in the routine where the new integrator state is first calculated or input. That new state value is then loaded into the next unused position of BLKINT.

2. Integrator loop limits should be enforced in the subroutines CLCSVD and CLTSVD as is presently done for the flight control system limits.

3. Common SPDINT with variables BKDSIZ and BKDINT are placed in the subroutine where the derivative of that new integrator state is calculated. That derivative value is then loaded into the corresponding position of BKDINT.

Subroutines INTGTR, MINTGR, or TINTGR and CLCSVD, CLMSVD, or CLTSVD will pass these values via SV and SVDOT into DVERK.

NOTE: The user should develop a good accounting procedure in order to keep track of which elements of BLKINT and BKDINT are being used. Otherwise, one value could be erased by another.

The array size for BLKINT and BKDINT has been set at 18. If more than 18 new integrator states are needed, it will be necessary to do one of the following:

1. Enlarge the size of BLKINT and BKDINT everywhere they occur,

or

2. Create a new common for the additional states, and load it into the SV vector. (This is identical to the method for BLKINT.)

The method chosen will probably depend upon how many more states will be added and how often they will be changed. The second method is probably preferred. In either case, SV and SVDOT must be lengthened and corresponding changes must be made to DVERK's arguments.

DVERK sometimes reduces the simulation time. This point must always be remembered when altering or adding routines to the system below DVERK. In particular:

1. It should never be assumed that the last values assigned to a variable are for the previous time step.

2. Time dependent data must not be unrecoverably discarded until there is no possibility that DVERK may back up to that point. (See Section VI, Subsection D.2, "Gust String Input" for an example of how this last restriction is handled.)

SECTION V

TRIM

The basic trim algorithm for each of the three programs (HLASIM, HLAMOR, and HLAPAY) is the same, but it is implemented differently in each case. This algorithm is a generalized secant method similar to NASA's single-rotor helicopter simulation[1]. A detailed mathematical description based on the paper by Burows and McDaniel[2] is presented in the Technical Manual. The present discussion will focus on the software implementation for the three programs, emphasizing basic control logic with frequent references to subroutines. For implementation details, the programmer should consult the relevant subroutines.

The purpose of the trimmer is to find values for a set of "controls" which maintain the body in a nonaccelerating condition[3]. For the vehicle in flight (TRIM), the "controls" are the six lin! d flight-control-system controls (one for each degree of freedom). The vehicle trim orientation and velocity are defined by user inputs.

The "controls" used by the payload trimmer (PTRIM) are the three position coordinates of the payload c.g. relative to the vehicle c.g. and the three Euler angles. The trimmer searches for a steady state orientation consistent with the user input vehicle trim states. (This orientation is not necessarily a zero velocity relative to the hull

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[1]Houck, Jacob A., Lucille H. Gibson, and George G. Steinmetz, A Real Time Digital Computer Program for the Simulation of a Single Rotor Helicopter, NASA TM X-2872, June 1974.

[2]Burows and McDaniel, A Method of Introductory Analysis with Multimission Capability and Guidance Application, AIAA Paper No. 68-844, August 1968.

[3]Nonaccelerating condition refers to a constant velocity magnitude equilibrium. Trimming in a steady turn is allowed and causes a non-zero centrifugal acceleration.

because, when the hull is turning, the payload swings out and must move faster.)

The "controls" for the moored vehicle (MTRIM) are the three vehicle Euler angles. Since the vehicle is constrained to the mast by a perfect gimbal, no linear motion is possible; and the problem is reduced to three degrees of freedom. The vehicle is unpowered, so the trimmer searches for vehicle Euler angles which result in zero accelerations acting upon the vehicle.

In the mooring simulation, the inertial (steady) wind determines the yaw angle of the converged trim solution. If there was no wind velocity in the x-y inertial plane, the solution would be indeterminate. To avoid this problem, the user must specify a yaw angle with input PSIO. The program generates a large yawing moment about the mast which is scaled to the difference between the vehicle Euler yaw angle and PSIO. The yawing moment is generated only in a windless condition (MFORCE, CLMTRM) and is zero on exiting the trim since the Euler yaw angle will be equal to PSIO. The <u>User's Manual</u> has a more detailed discussion of PSIO.

<u>The payload and vehicle are trimmed as two separate systems in the program HLAPAY</u>. The payload trim is called first and trims the payload in a steady state orientation relative to the hull. The cable forces are loaded into common HCBLFO. These forces will be added into the forces acting upon the vehicle (FORCE, HCABLE) during the vehicle trim. Since the common has been initialized to zero, the program HLASIM will add zeros; but program HALPAY will have nonzero values for the active cables.

Time is not normally considered to be a trim calculation parameter. In this implementation it is a flag indicating trim or time history calculations are currently being completed. Trims are indicated by negative times while time histories have zero or positive times. This allows the same subroutine (CALCSD, CLCPSD, or CLCMSD) to be called for the state derivative calculation during trims and time histories.

Figure 2 contains a flow chart of the trim algorithm. The relevant subroutines for each step are indicated in parenthesis on the figure. As in the program, a "P" in the name generally indicates payload and "M" indicates a mooring subroutine. Each block of the flow chart is marked with a circled number. The implementation of each of these blocks will be discussed in the following paragraphs.

1. Initial Guess

    a. Vehicle. The six controls are set to balance the forces but not the moments acting upon the vehicle.

    b. Moored Vehicle. The Euler roll angle is zero. The Euler pitch angle is such that all active landing gears have some compression (in ground contact); but no other vehicle components (belly, tail, or landing gear frames) are in ground contact.

    c. Payload. The payload position is hanging directly below the hull in such a way that all active cables are stretched.

2. The initial guess is used to generate six more valid guesses (three in MTRIM). Those seven (four in MTRIM) guesses are then loaded into the control perturbation matrix, which is the "working set" of the algorithm.

3. The state derivatives associated with each of these guesses are calculated and loaded in corresponding positions of the functional matrix.

4. The (modified) Euclidean norm of each derivative vector (calculated in Step 3) is used to measure the quality of the corresponding guess.

5. The weighted average used to find a new guess is controlled by the trim constant "K" (K in TRIM, MK in MTRIM, and PK in PTRIM); see Steps 10 and 11 below.

6. The model error flag can be set in a number of places; and it indicates that the new guess (Step 5) is not a valid vehicle trim condition (e.g., the belly or tail is touching the ground, there is a slack active cable, or a vehicle control limit has been exceeded). This test ensures that an invalid (illegal) guess is never loaded into the trim control matrix.

Main Routines:

TRIM, PTRIM, MTRIM

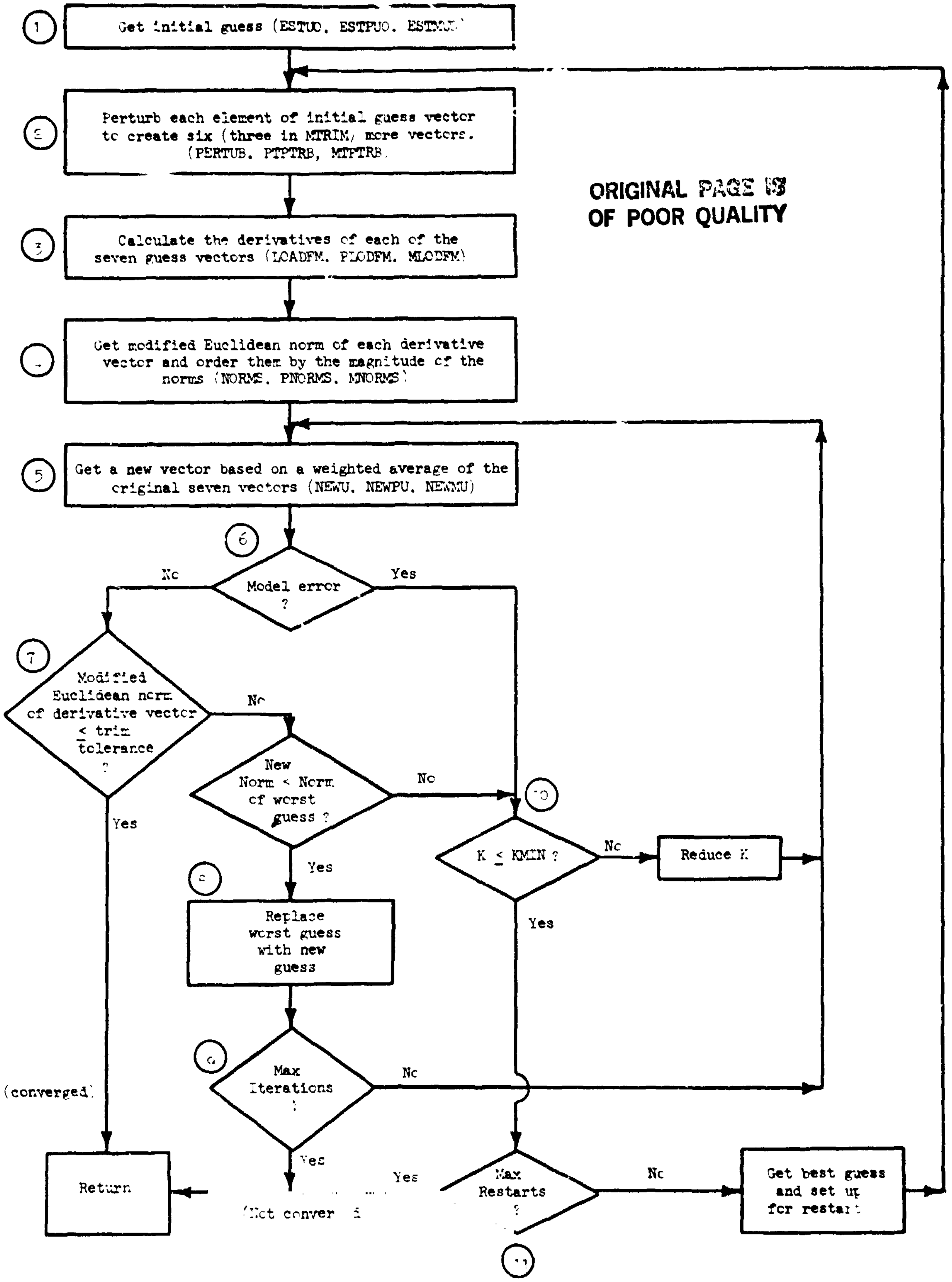

Figure 2. Trim Algorithm

7. Assuming that there were no model errors, the modified Euclidean norm of the new guess is compared with the trim tolerance. If the new guess is less than the trim tolerance, the guess has converged, and the trim subroutine returns this control vector to the main program.

8. If the test in Step 7 fails, the new guess is compared with the worst guess in the trim control matrix; and the new guess replaces the worst guess if the new guess is better. This step completes an iteration.

9. Assuming that the trimmer has not reached the maximum iterations (200 set in initialization subroutines, control is returned to Step 5 to begin a new iteration. When the maximum iterations have been made, the trimmer returns the best guess to the main program as an unconverged solution.

10. If the new guess had a model error or if it was not better than the worst guess, another new guess must be found. To insure that the next new guess is different from the one that just failed and that the program will not enter an infinite loop, the trim constant K is reduced. (Remember that K is initialized in the initialization subroutines.) If K is not smaller than the minimum allowed, it is reduced. Then the trimmer returns to Step 5 for a new guess based on the new K.

11. A trim restart is necessary when K goes below the minimum allowed. Assuming that the number of restarts has not reached the maximum allowed, the best guess is taken from the trim control matrix and used as the initial guess by Step 2. In a mathematical sense, a restart is triggered when the trimmer encounters a local minimum which does not satisfy the trim tolerance. The trimmer returns the best guess to the main program as an unconverged solution when the maximum number of allowed restarts is exceeded.

SECTION VI

TIME HISTORY

There are three groups of time dependent user inputs which can be used to control or (disturb) the vehicle in flight. They are:

1. 1-minus-cosine internally generated gusts and/or a string of gust velocities read in from data files during the time history calculations. The later inputs are referred to as "random gust strings" in the program.

2. Flight control system commands controlling any of the linear and/or angular velocities.

3. Commands which will move a particular control effector (e.g., pitch on rotors or propellers). These are referred to as "test commands" in the program.

NOTE: The mooring simulation only allows gust inputs since here the vehicle is unpowered.

The subroutines PROFIL, MPRFIL, and ?PRFIL (in HLASIM, HLAMOR, and HLAPAY, respectively) are the main controlling subroutines for calling the three modules listed above. If time is negative, indicating that the program is presently in the trim calculation, no calls are made to these modules. If time is positive or zero, the three modules are called. The calling order is:

1. Gusts (GUST and PGUST)

2. Control system commands (CONTRL)

3. Test commands (TSTCOM)

It is important that the gust module be called first so that the control system feedbacks will sense the updated gust values. The control system and test command modules are calculated separately from each other and are added together to form the total vehicle control command. The control system and test command modules can be called in either order.

A. FLIGHT CONTROL SYSTEM

The control system constants are input by the subroutine INFCSC, and the commands are input by the subroutine INPROF. Some initialization is done by SETFCS and SETCMD. The main control routine, CONTRL, is called from PROFIL. Subroutine COMGEN uses the subroutines POSHLD, GETTIZ, and INTERP to generate appropriate commands based on the simulation and hover control times.

Values for the feedback variables are calculated by FDBACK. The subroutines GUST and WINDS are called by FDBACK to obtain only the velocity and accelerations at the velocity sensor and the accelerometer locations. (GUST and WINDS are later called by AERO to calculate the wind variables which will be used in the main force and moment calculations). Two calls are necessary to ensure updated values and are used in both cases. The results are the same.

The feedback values and flight control commands are passed into SGLFLW which calculates the actual command signals (linked controls). SUMCON determines the individual controls (effectors) from the linked controls, and then CONTRL returns to PROFIL. Any desired changes in the control mixing logic can be made by simply adjusting the appropriate lines of SUMCON. These changes will be reflected in the trim, stability derivatives, and time history calculations.

B. FLIGHT CONTROL SYSTEM COMMANDS

The user specifies (on input) up to 20 flight control velocity commands in each of the vehicle's six (three linear and three angular) degrees of freedom. Each command input is a time-velocity pair. The flight control system will interpolate between user-provided pairs so that the command at any simulation time will be somewhere between the last and the next command. (See the discussion of the data files in the User's Manual.) After the time interpolation has returned a command for the present simulation time, that value, along with the result of the feedback loop, is used to calculate commands to the various effectors (i.e., rotors and propellers, and tails).

The set of input commands, which may vary in number, takes advantage of the NAMELIST format facility and the column major storage of arrays. NAMELIST does not require that all of its variables be listed in the data file nor does it require all elements of an array to be listed. When there are missing elements, the values are left unchanged. By initializing the array with large negative numbers, the software can sense which locations were filled with user inputs, i.e.,

```
UCMD   = 2.0, 25.0,
         5.0, 35.0,
HDTCMD = 0.0, 2.0,
```

will be loaded in the following manner

UCMD	1	2	3	4	...
Row 1	2.0	5.0	-100000.	-100000	...
Row 2	25.0	35.0			

HDTCMD	1	2	3	4	...
Row 1	0.0	-1000000.	-100000.	...	
Row 2	2.0				

The numbers are read into the array as they are encountered. Entries 2.0 and 25.0 would go into the first column, and entries 3.0 and 35.0 would go into the second. This follows the column major storage which frees the user from having to specify matrix positions in the data file.

If the user does not want to input commands in one axes, he merely leaves that array name out of the data file. The NAMELIST name and the END flag must be in the data file, but no entries have to go between them. (The programmer should consult the User's Manual for a complete discussion of the flight control command inputs.)

Two subroutines (SETFCS and SETCMD) are called from the main program to initialize the flight control variables. The arrays of flight commands are reorganized here. First, if the user did not input a command at time 0.0, the program moves all commands back one space and inserts the trim value with a time of 0.0. This provides a starting point for the command interpolation. Second, after the last user input command, the program duplicates the last user command with a very large number for the time. This causes the program to maintain the last user command through the end of the simulation.

The effector test commands are added to the flight control system effector commands. If test commands are input with their related loops closed, the control system will tend to negate the test command effect, which can simulate control system disturbances.

C. SUBROUTINE SUMCON

Subroutine SUMCON mixes and distributes the control commands to the various control effectors. This subroutine is used by all parts of the program (trim, stability derivatives, and time histories). The mixing laws are "hard coded" into this subroutine. Though this is contrary to the generic nature of the remainder of the program, it was felt to be necessary. The number of likely desired mixing schemes is so large that it is impossible to anticipate them all. A generalized mixing scheme would require an excessive set of inputs, which possibly would introduce errors. It was decided, therefore, to put all control system mixing and distribution into one subroutine and allow the user to write the code to produce the results he desires. The current mixing logic is discussed in detail in the Technical Manual (Volume II), Section IV, Subsection B.

D. GUSTS

The gust model is structured as follows:

GUST (Vehicle gusts)

- GUSGEN (1-minus-cosine vehicle gusts)
- RANDOM (vehicle gust strings)

PGUST (Payload gusts)

- PGSTGM (1-minus-cosine payload gusts)
- PRNDOM (payload gust strings)

1. One-Minus-Cosine Gust (GUSGEN, PGSTGN)

The user inputs a starting and ending time and maximum values for the gust velocities. A separate set of these values are input for each of the four elements of the vehicle: hull and tail (velocities and gradients), LPUs and payload (velocities only). The program will generate the time-dependent values for the gust in order to form the 1-cosine curve which is defined by the user input starting and ending times and maximum values.

These gust velocities act at the aerodynamic reference center for each element and are isolated inputs, not interpolated to other elements. Gust gradient effects are calculated based on the 1-minus-cosine gradient commands not on the velocity interpolation (as in the case of random gusts). The program internally determines the 1-minus-cosine gust velocity derivatives (D1MCOS) for force and moment calculations.

2. Vehicle Gust Input Strings (RANDOM)

The random gusts on the vehicle are considered to exist at four (RG1-RG4) user-defined gust input sources oriented about the hull (INGUST). The program interpolates between the preceding and succeeding gust inputs to determine a velocity vector for the present simulation time at each source (GETSRG). The gust source velocities (GINTRP, RGUSTS) are then spatially interpolated to obtain linear and angular velocity vectors at each element (hull, LPUs, and tail) and at the gust gradients of the hull and tail.

Finally, the gust time derivatives are calculated for the hull and tail using backward difference equations. Gust velocities (angular and linear), gradients, and derivatives are then returned to the subroutine PROFIL where they are added to the corresponding 1-minus-cosine gust values.

Subroutine RANDOM reads the time and the associated gust linear velocity vector from six data files. However, the program does not generate random gusts; the programmer should refer to the section on input files RG1-RG4 in the User's Manual.

If a zero gust is input for time zero (this is not required, however) the program initializes the gust to zero (INTIAL, PINTIL). If a nonzero gust is input at time zero, it will replace the initialized value. In addition it is not necessary to have gusts continue until the end of the time history because the program tests for the end-of-file condition and extends indefinitely the last gust velocity input at its constant value. If the user wants the gusts to be turned off after a particular point, he must input a zero velocity vector at that time. The reasoning behind the maintenance of the last user input gust is twofold: (a) to be consistent with the flight control system commands, and (b) to avoid having the program internally change gust values after the end of the input file has been reached.

3. Payload Gust Input Strings (PRNDOM)

The payload gust velocity inputs, unlike the vehicle version, act at a single input source. Angular velocities are also read in explicitly; they are <u>not</u> obtained from spatial interpolation. The payload gust inputs are totally independent of those of the vehicle.

The payload random gust subroutine (PRNDOM) is called from the subroutine PPRFIL. It uses routine GETSRG to read in and maintain the array of times and gust vectors in the same manner as that for the vehicle (see the data structure discussion below). The payload model uses two data files, each with the same format as the vehicle. The first data file (RG5=TAPE45) has times and linear velocity vectors; the second (RG6=TAPE46), has times and angular velocity vectors. The payload gust velocities are interpolated for the current simulation time, and the resulting values are returned and added to the 1-minus-cosine gust velocities. The use of the payload gust inputs (RG5-RG6) is explained in the <u>User's Manual</u> (Volume III) in Section VII, Subsection B, Article 4.

4. Storage Structure and Integrator Interface

This section presents the motivation for and details of the gust input data structure. Each gust input array is initialized with zero time and zero gust velocities. If the user inputs a gust at time zero, that value will supersede the initialized zero values. Otherwise, the zero values will provide the starting points for the time interpolations.

During the time history calculations, the gust input string data are stored in a buffer (GETSRG). This buffer holds five sets of data from each of the six input files (RG1-RG6). As the data currently residing in the buffer is exhausted, new data is loaded; and the oldest data is discarded. This buffer system is necessary in order to allow the integrator, DVERK, to iterate and adjust its time increments. DVERK was selected because it never "backs-up" (increments a negative time) to <u>before</u> the current simulation time. Therefore the oldest buffer data, which is continually discarded as the new data is entered, is never retrieved. This system is preferable to an alternate IMSL integrator, DGEAR, which can back-up to simulation times before the current one and allow access to data which may have already been discarded from the buffer.

SECTION VII

ERROR PROCESSING

Error processing in the three programs (HLASIM, HLAMOR, and HLAPAY) is handled by a single subroutine, MSSAG, and the data file ERMSSG (see the User's Manual). MSSAG will write a message to the output listing (OUTPUT=TAPE6) and will terminate the program if so requested. The messages which may be printed are contained in the data file ERMSSG along with the code numbers. The code number is passed into and used by the subroutine MSSAG to find the appropriate message. The calling routine name and up to three variable names and values are also passed in and printed.

There is no recovery or other "smarts" in this system. If an error situation (e.g., division by zero) arises, a message is printed; and the program is terminated. MSSAG is also used to write informative messages, in which cases program execution continues.

The reasons for this implementation are:

1. Documentation. All messages are in ERMSSG and cannot be "lost" in the code, only to reappear (undocumented) in the future.

2. Flexibility. Messages can be inserted for debugging purposes, for programmer/engineer information, for defensive programming, or to signal errors. New messages can be added by inserting calls to MSSAG and adding the messages to ERMSSG.

The program frequently tests for a valid range of values, but the generic nature of the program puts some restrictions on the extent of this checking. All input values which are restricted by the nature of the calculations in which they are used are tested on input. In order to maintain the generic nature of the program, the "reasonableness" of input values is not tested. Consequently, if the program results seem to be incorrect, the input data files should be checked carefully. Future additions and alterations should be designed in a similar manner.

There are several informative messages which indicate numerical problems, especially in the iterative solution to the rotor and propeller thrust. (See routines PRPARO, ROTARO, and CALCCT.) The program is not terminated in this case since these are only informative messages concerning the solution algorithm. It is possible that a large number (more than 100) messages could be printed before the solution is found, although that situation rarely arose during development. If it does becomes a problem during the use of the program, a counter could be inserted to suppress the message or terminate the program, whichever is appropriate. It is recommended, however, that the counter be inserted in the calling routine, not MSSAG

SECTION VIII

PROGRAM LOADING AND EXECUTION

The basic job control sequences necessary to load and execute the programs (HLASIM, HLAMOR, and HLAPAY) are discussed in Section XI of the User's Manual. The segmentation directives are the only aspects of the execution sequence which will be discussed here; familiarity with the CDC 7600/SCOPE segmentation facility will be assumed. The CDC Loader Reference Manual contains a complete discussion of the facility and should be consulted before attempting to alter the present structure.

The International Mathematics and Statistics Library (IMSL) is a indispensable part of this program system. The IMSL object code must be available to the loader for the program to be functional.

Figures 3, 4, and 5 contain the tree segmentation directive files used with the present program. Their similarity reflects the design similarities of the three programs. In spite of this similarity, alterations will require each file to be restructured separately. As in the program code, long-term maintainability will be enhanced if, wherever possible, the parallel design structure is maintained.

These segmentation schemes are not cost optimal; the intention is to provide a structure (within the machine restrictions of 160,000 octal words) which will accommodate the likely code alterations and additions. If additions to the code exceed the maximum allowed, it may prove easier to try other "squeezing" methods before restructuring the segmentation schemes. These alternative methods include:

1. Reduce the input/output buffer size.

2. Use a large-core-memory.

3. Use a higher compiler optimization.

Reducing the input/output buffers is probably the simplest but the most limited method, for there are only a few buffers; and some have already been reduced. Large-core-memory i very useful if the code contains large data structures. However, the third suggestion may prove to

```
INPUT1 TREE   QUESTN-INGEOM-INMOOR-INGEAR-INMASS-INEXST-INLARO-MCGDST-C
,CDIST-INHARO
INPUT2 TREE   INRIFC-INPIFC-INFIFC-INHIFC-INTIFC-INPROP-INMCLC-INSTAT-I
,NATMOS-INSTAB-AEFFCT-MATRIX
TRMSTO TREE   TRIM-STORE-INTGTR
TMHIST TREE   INFCSC-INPROF-INGUST-INSTEP
HLA    TREE   HLASIM-(INPUT1,INPUT2,TRMSTO,LINEAR,TMHIST)
   LEVEL
CNTL   TREE   SETFCS-PROFIL-TRNFRM-MAXVEC-AUXVEC-BODRAT-EULRAT
FOR1   TREE   GRAVTY-HCABLE-LGEAR
SHDOW  TREE   SHADOW-NDMLOC
INFHUL TREE   RPHIFC-GHV FC-RPTIFC-GTIFC-HULARO-ROTEFC
FOR2   TREE   AERO-(SHDOW,LPUARO,INFHUL)
FORC   TREE   FORCE-(FOR1,FOR2)
GRP1   TREE   WINDS-(CNTL,FORC)
GRP2   TREE   LOADT-LOADCA-LOADUA-CALCFC-GETSD-HGEEZ-IACLOD
GRP3   TREE   EIGEN-WRTSTB
       GLOBAL ATACHP
       GLOBAL ATACH
       GLOBAL ATAHG
       GLOBAL ATMOS
       GLOBAL AUXGST
       GLOBAL AUXVTR
       GLOBAL BTRANS
       GLOBAL CLOSLP
       GLOBAL COMAND
       GLOBAL DELTAX
       GLOBAL EMASMX
       GLOBAL ERATES
       GLOBAL FCDINT
       GLOBAL FCSGNS
       GLOBAL FCSINT
       GLOBAL FCSLIM
       GLOBAL FDBKFL
       GLOBAL FORMOM
       GLOBAL FSAROM
       GLOBAL GBACL
       GLOBAL GCMPRS
       GLOBAL GEARC
       GLOBAL GEARK
       GLOBAL GEARLC
       GLOBAL GEFP
       GLOBAL GEFR
       GLOBAL GERILC
       GLOBAL GFRAMK
       GLOBAL GSTRNG
       GLOBAL GUSTS
       GLOBAL HCBLFO
       GLOBAL HGCOM
```

```
FILE CONTINUED
GLOBAL HLAROM
GLOBAL HLCNTC
GLOBAL HULL
GLOBAL INVALD
GLOBAL KGHCM
GLOBAL KGP
GLOBAL KGR
GLOBAL KGT
GLOBAL KHP
GLOBAL KHR
GLOBAL KPF
GLOBAL KPH
GLOBAL KPT
GLOBAL KRF
GLOBAL KRH
GLOBAL KRP
GLOBAL KRT
GLOBAL LANDGL
GLOBAL LCOMND
GLOBAL LGCNTC
GLOBAL LNKCOM
GLOBAL LPATCH
GLOBAL LPGCOM
GLOBAL LPUAC
GLOBAL LPU
GLOBAL LTRANS
GLOBAL MASS
GLOBAL MAST
GLOBAL MCLMFL
GLOBAL MECLIM
GLOBAL MODLFL
GLOBAL MUKG
GLOBAL NDHTHT
GLOBAL NDPHT
GLOBAL NDRHT
GLOBAL OPWANT
GLOBAL OUTDTA
GLOBAL OUTHD
GLOBAL PAROCN
GLOBAL PFETHR
GLOBAL PGEOM
GLOBAL POSHCS
GLOBAL PROP
GLOBAL PRPRIG
GLOBAL PSTATE
GLOBAL RAROCN
GLOBAL RELVEL
GLOBAL RGEOM
GLOBAL RHRLOC
GLOBAL RMASCN
```

```
FILE CONTINUED
GLOBAL RMASCN
GLOBAL ROTOR
GLOBAL RSRCLC
GLOBAL RSTATE
GLOBAL RSWASH
GLOBAL SDOTCP
GLOBAL SENSOR
GLOBAL SHDFCN
GLOBAL SHDPCN
GLOBAL SHDRCN
GLOBAL SPDINT
GLOBAL SPRINT
GLOBAL STABDV
GLOBAL STALLS
GLOBAL SVECTR
GLOBAL TAIL
GLOBAL TAUTS
GLOBAL TDEFLC
GLOBAL TDRVS
GLOBAL TGCOM
GLOBAL TLAROM
GLOBAL TPARAM
GLOBAL TRIMFL
GLOBAL TRMCNT
GLOBAL TRMQT
GLOBAL TSDEFL
GLOBAL UCCFWC
GLOBAL UCTLCS
GLOBAL UNILST
GLOBAL VRINGP
GLOBAL VRINGR
GLOBAL PRINTC
GLOBAL SGUSTS
GLOBAL DGUSTS
GLOBAL GBUFF
GLOBAL POSHD
GLOBAL JETHST
   END HLASIM
```

Figure 3. Segmented Load Directive File (SLDIR) for Program HLASIM

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```
INPUT1 TREE    QUESTN-INGEOM-INMOOR-INGEAR-INMASS-INLARO-MCGDST-CGDIST-I
,NHARO
INPUT2 TREE    INRIFC-INPIFC-INFIFC-INHIFC-INTIFC-INMTRA-INATMOS-INSTAB-
,AEFFCT-MATRIX
TRMSTO TREE    MTRIM-STORE-MINTGR
TMHIST TREE    INGUST-INMRST-INSTEP-MCTSTP
HLA    TREE    HLAMOR-(INPUT1,INPUT2,TRMSTO,MLINAR,TMHIST)
   LEVEL
CNTL   TREE    MPRFIL-TRNFRM-MAXVEC-AUXVEC-BODRAT-EULRAT
FOR1   TREE    GRAVTY-HCABLE-LGEAR
SHDOW  TREE    SHADOW-NDMLOC
INFHUL TREE    GHVIFC-GTIFC-HULARO-ROTEFC
FOR2   TREE    MAERO-(SHDOW,MLPARO,INFHUL)
FORC   TREE    MFORCE-(FOR1,FOR2)
GRP1   TREE    WINDS-(CNTL,FORC)
GRP2   TREE    LOADMT-LODMCA-LODMUA-CLCMFC-GETMSD-HGEEZ-IACLOD
GRP3   TREE    MEIGEN-WRTMSB
       GLOBAL  ATACHP
       GLOBAL  ATACH
       GLOBAL  ATAHG
       GLOBAL  ATMOS
       GLOBAL  AUXGST
       GLOBAL  AUXVTR
       GLOBAL  BTRANS
       GLOBAL  CALMHD
       GLOBAL  COMAND
       GLOBAL  DELTAX
       GLOBAL  DGUSTS
       GLOBAL  EMASMX
       GLOBAL  ERATES
       GLOBAL  FCDINT
       GLOBAL  FCSINT
       GLOBAL  FORMOM
       GLOBAL  FSAROM
       GLOBAL  GBACL
       GLOBAL  GBUFF
       GLOBAL  GCMPRS
       GLOBAL  GEARC
       GLOBAL  GEARK
       GLOBAL  GEARLC
       GLOBAL  GERILC
       GLOBAL  GFRAMK
       GLOBAL  GSTRING
       GLOBAL  GUSTS
       GLOBAL  HCBLFO
       GLOBAL  HGCOM
       GLOBAL  HLAROM
       GLOBAL  HLCNTC
       GLOBAL  HULL
       GLOBAL  IMRLOD
```

FILE CONTINUED

```
GLOBAL INVALD
GLOBAL KGHCN
GLOBAL KGP
GLOBAL KGR
GLOBAL KGT
GLOBAL KHP
GLOBAL KHR
GLOBAL KPF
GLOBAL KPH
GLOBAL KPT
GLOBAL KRF
GLOBAL KRH
GLOBAL KRP
GLOBAL KRT
GLOBAL LANDGL
GLOBAL LGCNTC
GLOBAL LPATCH
GLOBAL LPGCOM
GLOBAL LPUAC
GLOBAL LPU
GLOBAL LTRANS
GLOBAL MASS
GLOBAL MAST
GLOBAL MCLMFL
GLOBAL MDELTX
GLOBAL MODLFL
GLOBAL MTRMCN
GLOBAL MTRMFL
GLOBAL MTRMPC
GLOBAL MUKG
GLOBAL NDHTHT
GLOBAL NDPHT
GLOBAL NDRHT
GLOBAL OPWANT
GLOBAL OUTDTA
GLOBAL OUTHD
GLOBAL PAROCN
GLOBAL PFETHR
GLOBAL PGEOM
GLOBAL POSHCS
GLOBAL POSHD
GLOBAL PRINTC
GLOBAL PROP
GLOBAL PRPRIG
GLOBAL PSTATE
GLOBAL RAROCN
GLOBAL RELVEL
GLOBAL RGEOM
GLOBAL RHRLOC
GLOBAL RMASCN
```

FILE CONTINUED

```
GLOBAL ROTOR
GLOBAL RSRCLC
GLOBAL RSTATE
GLOBAL RSWASH
GLOBAL SENSOR
GLOBAL SGUSTS
GLOBAL SHDFCN
GLOBAL SHDPCN
GLOBAL SHDRCN
GLOBAL SPDINT
GLOBAL SPRINT
GLOBAL STABDV
GLOBAL STALLS
GLOBAL SVECTR
GLOBAL TAIL
GLOBAL TAUTS
GLOBAL TDRVS
GLOBAL TGCOM
GLOBAL TLAROM
GLOBAL TPARAM
GLOBAL TRIMFL
GLOBAL TRMCNT
GLOBAL TRMQT
GLOBAL TSDEFL
GLOBAL UCCFWC
GLOBAL UCTLCS
GLOBAL UNILST
GLOBAL VRINGP
GLOBAL VRINGR
  END  HLAMOR
```

Figure 4. Segmented Load Directive File (SLDIRM) for Program HLAMOR

```
INPUT1 TREE   TQUEST-INPGEO-INGEOM-INMOOR-INGEAR-INPMAS-INCABL-INMASS-I
,NEXST-INPARO-INLARO-PCGDST-MCGDST-CGDIST-INHARO
INPUT2 TREE   INRIFC-INPIFC-INFIFC-INHIFC-INTIFC-INPROP-INMCLC-INSTAT-I
,NATMOS-AEFFCT-PMATRX-MATRIX-INSTAB
TRMSTO TREE   PTRIM-PSTORE-TRIM-STORE-PTRMRT-TINTGR
TMHIST TREE   INPYST-INFCSC-INPROF-INPCST-INGUST-INSTEP-CKTSTP
HLAP   TREE   HLAPAY-(INPUT1,INPUT2,TRMSTO,TLINAR,TMHIST)
   LEVEL
CNTL   TREE   SETFCS-PROFIL-TRNFRM-BODRAT-MAXVEC-AUXVEC-EULRAT
FOR1   TREE   GRAVITY-HCABLE-LGEAR
SHDOW  TREE   SHADOW-NDMLOC
PRPA   TREE   RPIFC-PRPARO
FUSA   TREE   FUSARO-DSKLOD-CALCHP-RPFIFC
LPARO  TREE   LPUARO-(ROTARO,PRPA,FUSA)
INFHUL TREE   RPHIFC-GHVIFC-RPTIFC-GTIFC-HULARO-ROTEFC
FOR2   TREE   AERO-(SHDOW,LPARO,INFHUL)
FORC   TREE   FORCE-(FOR1,FOR2)
GRP1   TREE   WINDS-(CNTL,FORC)
GRP2   TREE   LOADT-LOADCA-LOADUA-CALCFC-GETSD-HGEEZ-IACLOD-CICPSD
       TREE   TEIGEN
       TREE   WRTTSB
       GLOBAL ATACHP
       GLOBAL ATACH
       GLOBAL ATAHG
       GLOBAL ATMOS
       GLOBAL AUXGST
       GLOBAL AUXVTR
       GLOBAL BTRANS
       GLOBAL CLOSLP
       GLOBAL COMAND
       GLOBAL DELTAX
       GLOBAL EMASMX
       GLOBAL ERATES
       GLOBAL FCDINT
       GLOBAL FCSGNS
       GLOBAL FCSINT
       GLOBAL FCSLIM
       GLOBAL FDBKFL
       GLOBAL FORMOM
       GLOBAL FSAROM
       GLOBAL GBACL
       GLOBAL GCMPRS
       GLOBAL GEARC
       GLOBAL GEARK
       GLOBAL GEARLC
       GLOBAL GEFP
       GLOBAL GEFR
       GLOBAL GERILC
       GLOBAL GFRAMK
       GLOBAL GSTRNG
```

FILE CONTINUED

```
GLOBAL GUSTS
GLOBAL HCBLPO
GLOBAL HGCOM
GLOBAL HLAROM
GLOBAL HLCNTC
GLOBAL HULL
GLOBAL INVALD
GLOBAL KGHCN
GLOBAL KGP
GLOBAL KGR
GLOBAL KGT
GLOBAL KHP
GLOBAL KHR
GLOBAL KPF
GLOBAL KPH
GLOBAL KPT
GLOBAL KRF
GLOBAL KRH
GLOBAL KRP
GLOBAL KRT
GLOBAL LANDGL
GLOBAL LCOMND
GLOBAL LGCNTC
GLOBAL LNKCOM
GLOBAL LPATCH
GLOBAL LPGCOM
GLOBAL LPUAC
GLOBAL LPU
GLOBAL LTRANS
GLOBAL MASS
GLOBAL MAST
GLOBAL MCLMFL
GLOBAL MECLIM
GLOBAL MODLFL
GLOBAL MUKG
GLOBAL NDHTHT
GLOBAL NDPHT
GLOBAL NDRHT
GLOBAL OPWANT
GLOBAL OUTDTA
GLOBAL OUTHD
GLOBAL PAROCN
GLOBAL PFETHR
GLOBAL PGEOM
GLOBAL POSHCS
GLOBAL PROP
GLOBAL PRPRIG
GLOBAL PSTATE
GLOBAL RAROCN
GLOBAL RELVEL
```

FILE CONTINUED

```
GLOBAL RGEOM
GLOBAL RHRLOC
GLOBAL RMASCN
GLOBAL ROTOR
GLOBAL RSRCLC
GLOBAL RSTATE
GLOBAL RSWASH
GLOBAL SDOTCP
GLOBAL SENSOR
GLOBAL SHDFCN
GLOBAL SHDPCN
GLOBAL SHDRCN
GLOBAL SPDINT
GLOBAL SPRINT
GLOBAL STABDV
GLOBAL STALLS
GLOBAL SVECTR
GLOBAL TAIL
GLOBAL TAUTS
GLOBAL TDEFLC
GLOBAL TDRVS
GLOBAL TGCOM
GLOBAL TLAROM
GLOBAL TPARAM
GLOBAL TRIMFL
GLOBAL TRMCNT
GLOBAL TRMQT
GLOBAL TSDEFL
GLOBAL UCCFWC
GLOBAL UCTLCS
GLOBAL UNILST
GLOBAL VRINGP
GLOBAL VRINGR
GLOBAL POPWNT
GLOBAL PAYLOD
GLOBAL USCLTH
GLOBAL PMASS
GLOBAL CABLK
GLOBAL CABLC
GLOBAL PYAROM
GLOBAL PATCH
GLOBAL PSVCTR
GLOBAL PTRMCN
GLOBAL PTRMFL
GLOBAL PYOPUT
GLOBAL PERATS
GLOBAL PBTRNS
GLOBAL PYGCOM
GLOBAL PGSTRN
GLOBAL PDLTAX
```

FILE CONTINUED

```
GLOBAL PGUSTS
GLOBAL CBLTEN
GLOBAL PLTRNS
GLOBAL PAXVTR
GLOBAL CABLE
GLOBAL PTRMPC
GLOBAL PMDLFL
GLOBAL PPRNTC
GLOBAL PRINTC
GLOBAL SGUSTS
GLOBAL DGUSTS
GLOBAL GBUFF
GLOBAL POSHD
GLOBAL JETHST
GLOBAL PGBUFF
  END  HLAPAY
```

Figure 5. Segmented Load Directive File (SLDIRP) for Program HLAPAY

be the most useful because the present segmentation design uses code compiled under OPT=1 — a 20 to 30 percent code size reduction may result under OPT=2.

There are two situations which would require that the segmentation structure be altered:

1. If additions and/or alterations to the code have enlarged the program beyond the machine size, and the other "squeezing" techniques have not reduced it sufficiently.

2. If cost considerations demand an optimal structure.

The first situation will require restructuring based on the code changes. The second situation implies removing or combining some of the segments. Complete rebuilding of the segmentation structure is also possible (but not recommended). The following discussion will outline an approach to removing/combining segments.

Figures 6, 7, and 8 contain segmentation tree diagrams. The programmer will need to have a complete program segmentation load map for use in conjunction with these figures. All subroutines which are not explicitly listed in the segmentation directives (Figs. 3 through 5) are placed by the loader, as described in detail in the Loader Reference Manual. After determining each segment block size from the load map, Figs. 6, 7, and 8 can then be used to decide which blocks should be merged or split. Minimizing run cost, however, will be achieved by minimizing segment swapping.

The state vector derivative calculation (CALCSD, CLCTSD, or CLCMSD) is the most expensive part of the program. It may be called several times for each trim iteration; it is called four times for every stability derivative matrix column; and it is called between five and 100 times for each time history algorithm step. In addition, all segment blocks in Level II are entered during each state vector derivative calculation. Combining segment blocks in GRP1, then, is clearly a starting point to the reduction of swapping. The determining factor in the present structure is that the subroutine WINDS is called from both the control system (CONTRL) and from the aerodynamic calculations (AERO).

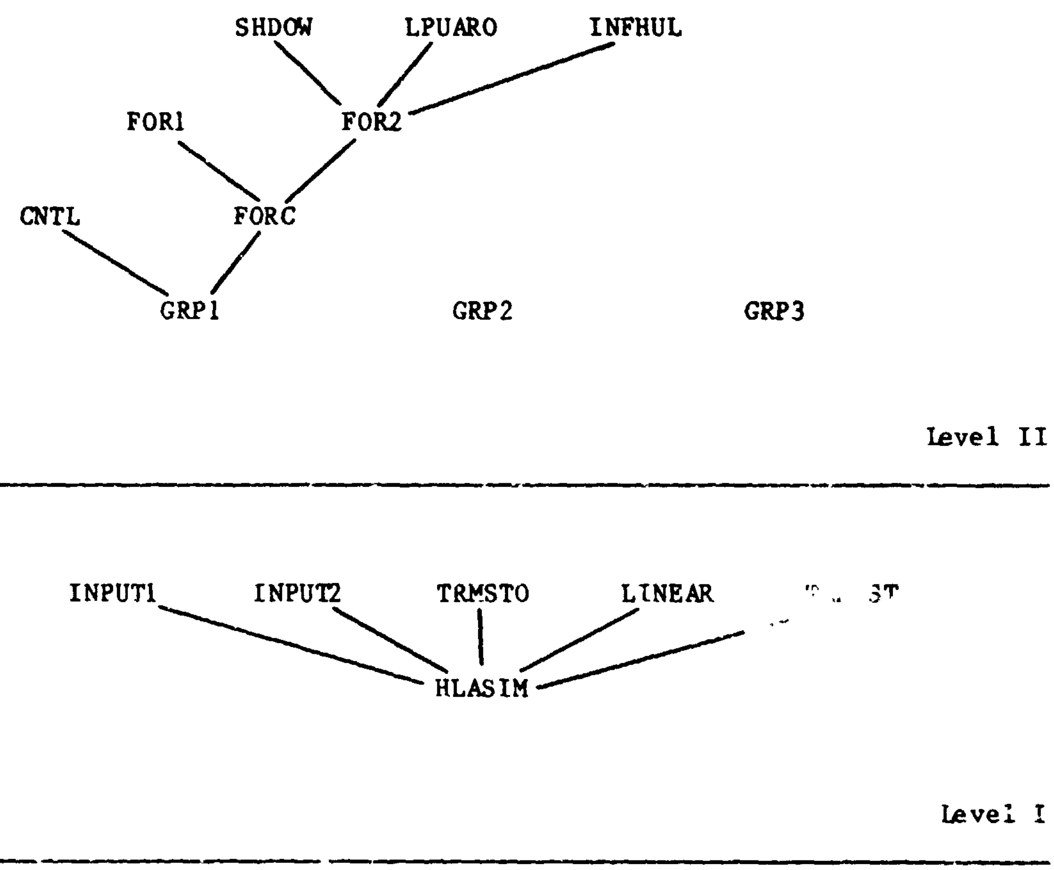

Figure 6. Segmentation Tree Diagram for the Program HLASIM

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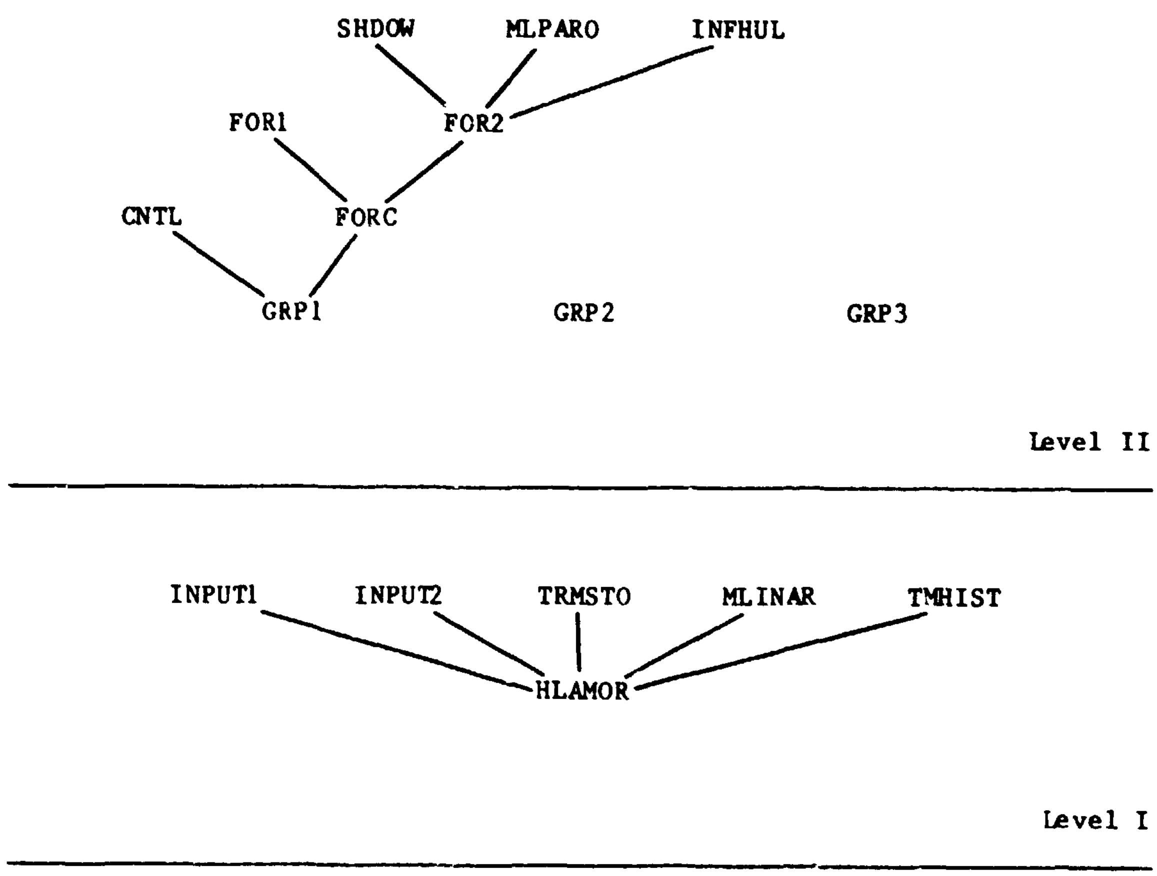

Figure 7. Segmentation Tree Diagram for the Program HLAMOR

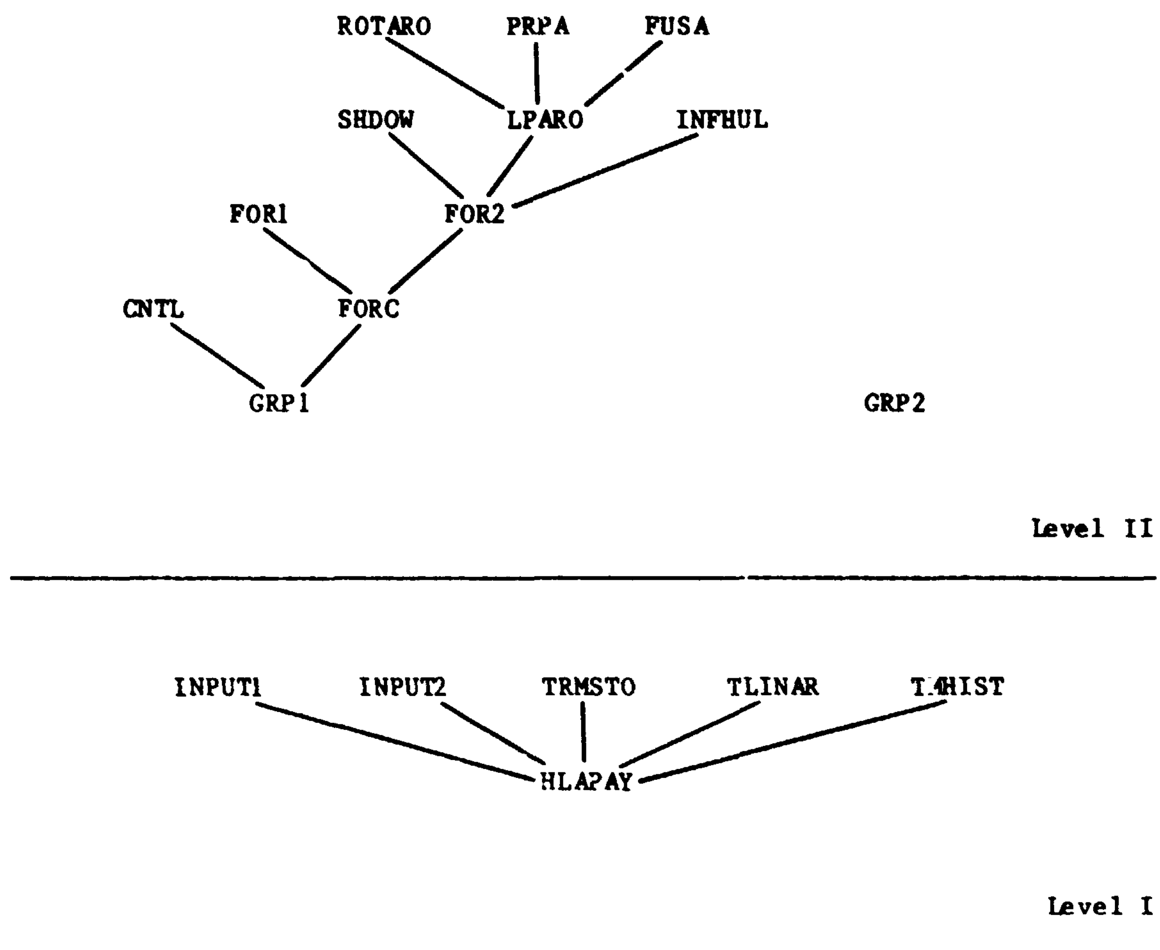

Figure 8. Segmentation Tree Diagram for the Program HLAPAY

SECTION

POST PROCESSORS

A. PROGRAM PPLOTF (PROCESS PLOTTING FILE)

The program PPLOTF reads the unformatted binary file PLOT (see Section III.B in the User's Manual for the format) which is produced by the main heavy-lift airship simulation programs and writes the time history data to the file THPLOT. The format of THPLOT, shown in Fig. 9, is compatible with the NASA Ames Research Center flight data plotting software which will be used for plotting the heavy-lift airship simulation output. In order to keep the main simulation as general as possible, file PLOT includes all output variable names and variables (see Appendix D in the User's Manual) for each trim and algorithm step of the time history. This insures that all possible data is available. An obvious future enhancement would be to write the trim data to a file. In this way, trim maps (i.e., multiple trim calculations) could be plotted from a series of flight conditions.

To execute the program PPLOTF, the input file PLOT and output files THPLOT and OUTPUT must be defined. No other libraries or data files are necessary. The program will write to the file OUTPUT a title, the date, and the simulation times as they are encountered from the file PLOT. This procedure provides the user with a record of the data processed.

The format of the variable names is changed in two ways by PPLOTF:

1. There are four values for each LPU or cable variable name (see the data frame on the output listing.) PPLOTF makes four sets of LPU and cable variables by inserting the numbers 1 to 4 in the blank sixth position. This provides a distinct name for each variable.

2. All leading or embedded blanks are squeezed out of all names using the subroutine SQUEEZ. This simplifies the user's task when he specifies which variables are to be plotted.

Record 1	TIMSTP, NVARP1, DATE
Record 2	One data block
Record 3	One data block
Record 4	One data block
Continued to end of time history	

TIMSTP — Main simulation algorithm time step (input data file HISDTA)

NVARP1 — Number of variables in each data block (time is the first variable in the block)

DATA — Julian data of the main program simulation

Variable names — A block of NVARP1 variable names (ETIME is the first name); listed in Appendix D of User's Manual Appendices (Volume IV)

Data block — A block of NVARP1 values corresponding to the variable names

Figure 9. File THPLOT Format

If new variables are added to the main program output, no changes are necessary to PPLOTF. PPLOTF can process an indefinite number of variables as long as NVARHL, NVARLP, NVARPY, and NVARCB are entered correctly.

B. PROGRAM GSRCSB (GUST SOURCE STABILITY DERIVATIVES)

Program GSRCSB generates a stability derivative matrix which defines the relationship between the gust velocities at the four vehicle input sources and the gust values at each of the vehicle elements (e.g., hull, tail, and LPUs). The main simulation program data files GMDTA, ARODTA, TRMDTA, HISDTA, and ERMSSG are used. The program algorithm is the same as that used in the main simulation program stability derivatives.

The data files mentioned above, as well as the main simulation subroutine library, must be loaded with the GSRCSB program. The main simulation input subroutines are called to read the data files; and subroutines INTIAL, CGDIST, STDTRN, LPUTRN initialize variables. All of these subroutines will be accessed via the main program subroutine library.

The output will be written to the file OUTPUT. It will reflect the vehicle and gust source geometry as well as the trim vehicle Euler angles.

APPENDIX A

ALPHABETICAL LIST OF SUBROUTINES AND PURPOSE STATEMENTS

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ALPHABETICAL LIST OF SUBROUTINES

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AEFFCT (ATMOSPHERIC AFFECTS)

PURPOSE: THIS SUBROUTINE IS A STUB WHICH IS IN THE PROGRAM TO INDICATE WHERE A SUBROUTINE SHOULD BE INSERTED TO CREATE ATMOSPHERIC AFFECTS OF TEMPERATURE CHANGES AND AIR PRESSURE CHANGES.

AERO (AERODYNAMIC MODEL MASTER SUBROUTINE)

PURPOSE: TO CALL THE AERODYNAMIC MODEL SUBROUTINES WHICH GENERATE THE AERODYNAMIC LOADS ON THE HULL, TAIL AND LPU'S.

AMASMA (LOAD APPARENT MASS MATRICES)

PURPOSE: TO LOAD THE HULL AND TAIL APPARENT MASS MATRICES FOR LATER INCORPORATION INTO THE TOTAL MASS MATRIX, AND LATER USE IN THE CALCULATION OF GUST ACCELERATION FORCES AND MOMENTS.

APPMAS (LOAD APPARENT MASS MATRIX INTO TOTAL EFFECTIVE MASS MATRIX)

PURPOSE: TO LOAD THE TOTAL HULL-TAIL ASSEMBLY APPARENT MASS MATRIX INTO THE TOTAL EFFECTIVE VEHICLE MASS MATRIX.

AROTRN (AERODYNAMIC TRANSFORMATIONS)

PURPOSE: TO CALCULATE THE TRANSFORMATIONS FROM THE LPU CG REFERENCE AXES, TO THE CONTROL WIND REFERENCE REFERENCE AXES.

AUXVEC (CALCULATION OF AUXILLARY STATE VECTOR)

PURPOSE: TO CALCULATE THE LPU LINEAR VELOCITIES IN INERTIAL POSITIONS BASED ON LPU ATTACH POINT CONSTRAINTS

AVLIFT (AVERAGE BLADE (ROTOR OR PROPELLER) LIFT COEFFICIENT)

PURPOSE: TO CALCULATE THE AVERAGE BLADE LIFT COEFFICIENT AND ANGLE OF ATTACK FOR EITHER THE ROTOR OR PROPELLER DISK.

BODRAT (CALCULATION OF HULL AND LPU BODY RATES)

PURPOSE: GIVEN THE HULL EULER RATES AND THE LPU GIMBAL RATES CALCULATE THE ABSOLUTE HULL AND LPU ANGULAR BODY RATES

BOYGRD (LOAD HULL BUOYANCY GRADIENT MATRIX)

PURPOSE: TO LOAD THE HULL BUOYANCY GRADIENT PRIME-MATRIX, FOR CALCULATION IN SUBROUTINE BOYUNC.

BOYUNC (HULL BUOYANCY LOAD CALCULATIONS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS ON THE HULL ARISING FROM AERO-STATIC, AND AERO-DYNAMIC BUOYANCY EFFECTS.

CABLEV (CABLE VELOCITY)

PURPOSE: TO CALCULATE THE RELATIVE VELOCITY BETWEEN RESPECTIVE ATTACH POINTS ON THE PAYLOAD, AND THE HULL

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CALCCT (CALCULATE THRUST COEFFICIENT)

PURPOSE: TO CALCULATE THE THRUST COEFFICIENT BASED ON FLIGHT CONDITION AND COLLECTIVE PITCH ANGLE.

CALCDL (CALCULATE DELTA)

PURPOSE: TO CALCULATE THE DISC (ROTOR OR PROPELLER) BLADE PROFILE DRAG COEFFICIENT BASED ON A QUADRATIC FUNCTION OF BLADE ANGLE OF ATTACK.

CALCFC (CALCULATE CONSTRAINT FORCE VECTOR)

PURPOSE: TO CALCULATE THE CONSTRAINT FORCE VECTOR - F

CALCHP (CALCULATED POWER FOR ROTORS AND PROPELLERS)

PURPOSE: TO CALCULATE THE POWER ON THE ROTORS AND PROPELLERS, FOR USE AS AN OUTPUT VALUE. IF THE SI SYSTEM IS BEING USED, THE POWER WILL BE IN KILOWATTS, AND FOR THE ENGLISH SYSTEM HORSEPOWER WILL BE CALCULATED

CALCSD (CALCULATE STATE DERIVATIVES)

PURPOSE: TO CALCULATE THE TIME DERIVATIVES OF THE STATE VECTOR

CALCTA (CALCULATE TAIL ANGLES)

PURPOSE: TO CALCULATE THE TRANSFORMED TAIL ANGLES IN THE FIRST AND FOURTH QUADRANTS FOR USE IN THE TAIL AERODYNAMIC MODEL CALCULATIONS

CBLFOR (CABLE FORCES)

PURPOSE: TO CALCULATE THE CABLE FORCES AT EACH ATTACH POINT ON THE PAYLOAD AND HULL IN COORDINATES OF THE RESPECTIVE COMPONENT REFERENCE AXIS

CBLTEN (CABLE TENSION)

PURPOSE: TO CALCULATE THE TENSION IN ONE CABLE

CDERV (TO CALCULATE THE STABILITY DERIVATIVE)

PURPOSE: THIS SUBROUTINE WILL TAKE THE RESULTS OF THE NEGATIVE AND POSITIVE PERTUBATIONS AS WELL AS THE ORIGINAL VALUE AND CALCULATE A SINGLE VALUE IN A STABILITY DERIVATIVE MATRIX.

CFLOWC (HULL CROSSFLOW COEFFICIENT DIRECTION)

PURPOSE: TO CORRECT THE HULL CROSSFLOW DRAG COEFFICIENT PARAMETER TO ACCOUNT FOR ROTOR AND PROPELLER INTERFERENCE EFFECTS

CGDIST (CENTER OF GRAVITY REFERENCED POSITION VECTORS)

PURPOSE: TO CALCULATE ALL POSITION VECTORS REFERENCED TO THE COMPONENT CG AXES BASED ON THE INPUT POSITION VECTORS

CHTSTP (CHECK STEP)

PURPOSE: TO ESTIMATE THE NOMINAL HIGH FREQUENCY MODE OF THE PAYLOAD CABLES AND COMPARE THIS WITH THE USER INPUT MINIMUM ALGORITHM STEP

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CLCMFC (CALCULATE MOORING CONSTRAINT FORCE VECTOR)

PURPOSE: TO CALCULATE THE MOORING CONSTRAINT VECTOR-MF

CLCMSD (CALCULATE MOORING STATE DERIVATIVES)

PURPOSE: TO CALCULATE THE TIME DERIVATIVES AT THE MOORING STATE VECTOR

CLCPSD (CALCULATE PAYLOAD STATE DERIVATIVES)

PURPOSE: TO CALCULATE THE TIME DERIVATIVES OF THE PAYLOAD STATE VECTOR

CLCSVD (CALCULATE THE INTEGRATOR STATE VECTOR DERIVATIVES)

PURPOSE: THIS SUBROUTINE BREAKS THE SV VECTOR INTO THE STATE VECTOR (S), AND THE FLIGHT CONTROL INTEGRATOR VALUES AND CALLS CALCSD TO OBTAIN THE DERIVATIVE VALUES WHICH ARE THEN LOADED INTO SVDOT AND RETURNED TO THE SYSTEM INTEGRATOR

CLMSVD (CALCULATE THE INTEGRATOR MOORING STATE VECTOR DERIVATIVE)

PURPOSE: THIS SUBROUTINE LOADS THE MSV VECTOR INTO STATE VECTOR (S), AND CALLS CLCMSD TO OBTAIN THE DERIVATIVE VALUES WHICH ARE THEN LOADED INTO MSDOT AND RETURNED TO THE SYSTEM INTEGRATOR

CLMTRM (CALM TRIM MOMENT)

PURPOSE: TO GENERATE AN ARTIFICIAL YAW STIFFNESS FOR MOORED TRIMING WITH NO INERTIAL WIND, IN ORDER TO CAUSE THE VEHICLE TO TRIM AT THE USER INPUT HEADING ANGLE (PSIO)

CLTSTP (CALCULATE RECOMMENDED TIME STEP)

PURPOSE: TO CALCULATE THE RECOMMENDED TIME STEP BASED ON THE PAYLOAD CABLE STIFFNESS AND PAYLOAD MASS (PAYLOAD SIMULATION) OR LANDING GEAR STIFFNESS AND VEHICLE MASS (MOORING VEHICLE SIMULATION)

CLTSVD (CALCULATE THE INTEGRATOR STATE VECTOR DERIVATIVE FOR THE TOTAL HULL PAYLOAD VEHICLE)

PURPOSE: THIS SUBROUTINE BREAKS THE SV VECTOR INTO THE STATE VECTOR (S), PAYLOAD STATE VECTOR (PS), AND THE FLIGHT CONTROL INTEGRATOR VALUES, AND CALLS CALCSD AND CLCPSD TO OBTAIN THE DERIVATIVE VALUES WHICH ARE THEN LOADED INTO SVDOT, AND RETURNED TO THE SYSTEM INTEGRATOR

CMAXAI (CALCULATE MAXIMUM ANGULAR INCREMENTS)

PURPOSE: THIS ROUTINE, USING THE LANDING GEAR AND MOORING POINT GEOMETRY FINDS THE ROOING AND PITCHING ANGLES AT THE MOORING POINT SUBTENDED BY THE COMPRESSION DISTANCE OF THE LANDING GEAR

CMPINC (CHECK MOORING PERTUBATION INCREMENTS)

PURPOSE: THIS ROUTINE CHECKS THE PERTUBATION INCREMENTS USED IN THE MOORING STABILITY DERIVATIVES TO SEE THAT NONE OF THEM WILL CAUSE AN ACTIVE LANDING GEAR TO BE LIFTED OFF THE GROUND

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COFVEC (COEFFICIENT TO VECTOR CONVERSIONS)

PURPOSE: TO CALCULATE THE DISK FORCE AND MOMENT SCALAR QUANTITIES AND LOAD THEM INTO FORCE AND MOMENT VECTORS.

COMGEN (COMMAND GENERATION)

PURPOSE: TO OBTAIN THE FLIGHT CONTROL SYSTEM COMMAND DESIRED AT THE CURRENT SIMULATION TIME

CONTRL (CONTROL)

PURPOSE: TO GENERATE THE FLIGHT CONTROL SYSTEM INPUTS BASED ON THE INPUT COMMANDS

CPINC (CALCULATE THE PERTUBATION INCREMENTS)

PURPOSE: DURING THE STABILITY DERIVATIVE CALCULATION FOR PROGRAM PYLOAD, AND PROGRAM HLAPAY THERE IS A POSSIBILITY THAT THE PERTUBATION INCREMENT THE USER HAS INPUT WILL CAUSE A CABLE TO GO SLACK. CONSEQUENTLY, THIS SUBROUTINE TESTS THOSE PERTUBATION INCREMENTS AGAINST A VALUE IT CALCULATES BASED ON THE GEOMETRY OF THE CABLE ATTACH POINTS, AS THE MAXIMUM ALLOWABLE INCREMENT WHICH WILL KEEP THE CABLES STRETCHED. IF THE SUBROUTINE FINDS A CABLE IS LIKELY TO GO SLACK, A MESSAGE IS PRINTED. THE INCREMENT VALUE IS REDUCED TO THE VALUE THIS SUBROUTINE HAS CALCULATED, AND THE PROGRAM CONTINUES EXECUTION WITH THE NEW VALUES.

CROSOP (CROSS PRODUCT OPERATOR)

PURPOSE: TO CALCULATE THE THREE BY THREE CROSS OPERATOR SKEW MATRIX

CROSS (VECTOR CROSS PRODUCT)

PURPOSE: TO CALCULATE THE RESULT OF THE CROSS PRODUCT OF TWO THREE BY ONE VECTORS

CUNITY (CABLE UNIT VECTORS)

PURPOSE: TO CALCULATE THE LENGTH AND A UNIT VECTOR FOR EACH CABLE

C1MCOS (CALCULATE 1 MINUS COSINE CURVE)

PURPOSE: TO CALCULATE THE GUST VALUES AS A 1 MINUS COSINE VALUE BETWEEN THE STARTING AND ENDING TIMES, AND THE MAXIMUM GUST VALUE.

DCFLWC (DISC CROSSFLOW CORRECTION)

PURPOSE: TO OBTAIN THE HULL CROSSFLOW COEFFICIENT CORRECTION FOR ROTOR OR PROPELLER INTERFERENCE EFFECTS

DEFCT (WAKE DEFECT)

PURPOSE: TO CALCULATE THE WAKE DEFECT RATIO FOR A PARTICULAR ROTOR, PROPELLER, OR FUSELAGE

DHTIVL (DISC ON HULL OR TAIL INTERFERENCE VELOCITY)

PURPOSE: TO CALCULATE THE DISC ON HULL OR TAIL INTERFERENCE VELOCITY VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXIS FROM THE DISC TOTAL (DISC SELF PLUS GROUND) INDUCED VELOCITY

DIFERN (DIFFERENTIATION)

PURPOSE TO OBTAIN THE NUMERICAL TIME DERIVATIVES OF THE HULL AND TAIL LINEAR AND ANGULAR GUST VELOCITIES

DSKIVL (DISC INDUCED VELOCITY)

PURPOSE: TO CALCULATE THE TOTAL (DISC INDUCED PLUS GROUND INDUCED) VELOCITY FOR EACH DISC (ROTOR OR PROPELLER)

DSKLOD (CALCULATION OF DSKLOD FORCES)

PURPOSE: TO CALCULATE THE DISK LOADING FOR PROPELLERS AND ROTORS FOR OUTPUT.

DVTRST (DISC THRUST VELOCITY CALCULATION)

PURPOSE: TO CALCULATE THE GUST VELOCITY OF ANY DIS (ROTOR OR PROPELLER)

D1MCOS (DERIVATIVE OF 1 MINUS THE COSINE)

PURPOSE: TO CALCULATE A VALUE FOR THE GUST DERIVATIVE WHICH WILL BE THE DERIVATIVE OF A 1 MINUS COSINE CURVE BETWEEN THE STARTING AND ENDING GUST TIMES, AND THE MAXIMUM GUST VALUE.

EIGEN (TO CALCULATE EIGEN VALUES AND EIGEN VECTORS)

PURPOSE: THIS SUBROUTINE WILL CALL AN IMSL SUBROUTINE (EIGRF) TO CALCULATE THE EIGEN V. UES AND EIGEN VECTORS OF THE MATRIX (A). THE EIGEN VECTORS WILL BE NORMALIZED, AND RETURNED AS (NEGNVT).

ESTMUO (ESTIMATE AN INTIAL GUESS FOR THE MOORING TRIM CONTROL VECTOR)

PURPOSE: TO ESTIMATE THE INTIAL MOORING TRIM CONTROL VECTOR (MUO) FOR USE IN THE ITERATIVE TRIM ALGORITHM

ESTPUO (ESTIMATE AN INITIAL GUESS FOR THE PAYLOAD TRIM CONTROL VECTOR)

PURPOSE: TO ESTIMATE THE INITIAL PAYLOAD TRIM CONTROL VECTOR (PUO), FOR USE IN THE ITERATIVE TRIM ALGORITHM

ESTUO (ESTIMATE AN INITIAL GUESS FOR TRIM CONTROL VECTOR)

PURPOSE: TO ESTIMATE THE INITIAL TRIM CONTROL VECTOR (UO) FOR USE IN THE ITERATIVE TRIM ALGORITHM.

EULRAT (EULER RATES)

PURPOSE: TO CALCULATE THE HULL EULER RATES AND LPU GIMBAL RATES FROM THE CURRENT STATE VECTOR

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EXHAST (EXHAUST)

PURPOSE: TO CALCULATE THE FORCES AND MOMENTS GENERATED BY THE EXHAUST JET

EXTRAC (EXTRACT ONE COLUMN)

PURPOSE: TO EXTRACT A SPECIFIED SIX ELEMENT COLUMN FROM A SIX BY SEVEN MATRIX.

FDBACK (FEEDBACK VARIABLES)

PURPOSE: TO OBTAIN THE FEEDBACK VARIABLES USED IN THE FLIGHT CONTROL LOOPS

FILARY

PURPOSE: TO LOAD VARIABLE VALUES INTO THE OUTPUT ARRAYS

FLAGS (SET SORTING FLAG VECTOR)

PURPOSE: TO INITIALIZE SORTING FLAG VECTOR (IMARK) FOR USE IN SUBROUTINE SORT.

FLAP (ROTOR FLAPPING ANGLES)

PURPOSE: TO CALCULATE THE ROTOR BLADE CONING AND FLAPPING ANGLES, WITH RESPECT TO THE ROTOR CONTROL AXIS.

FMSDV (FORM VECTORS FOR MOORING STABILITY DERIVATIVE CALCULATIONS)

PURPOSE: THIS SUBROUTINE WILL FORM THE TWO VECTORS WHICH WILL BE USED FOR THE MOORING STABILITY DERIVATIVE CALCULATIONS

FORCE (EXTERNAL FORCES AND MOMENTS)

PURPOSE: TO CALCULATE THE HULL AND LPU EXTERNAL FORCES AND MOMENTS BASED ON THE PRESENT STATE VECTOR

FORMSV (FORM THE SV VECTOR)

PURPOSE: THIS SUBROUTINE WILL FORM THE SV VECTOR. THIS VECTOR IS A COMBINATION OF THE STATE VECTOR FOR THE VEHCILE, THE CONTROL SYSTEM INTEGRATOR VALUES, AND A BLANK ARRAY, WHICH CAN BE USED FOR ADDITIONAL INTEGRATOR STATES, IF SO DESIRED. ALL THESE VALUES MUST BE PUT INTO ONE VECTOR, WHICH IS TO BE PASSED TO THE IMSL INTEGRATOR SUBROUTINE.

FRMGDV (FORM GUST VELOCITY VECTOR)

PURPOSE: TO OBTAIN GUST GRADIENT EFFECTS ON THE VELOCITY SENSOR MEASUREMENTS

FRMLVH (FORM LVH TRANSFORMATION MATRIX)

PURPOSE: TO GENERATE THE ORTHOGONAL MATRIX FOR TRANSFORMING VECTORS FROM THE HULL COORDINATE AXIS TO THE VERTICAL AXIS

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FRMMSV (FORM MSV VECTOR)

PURPOSE: THIS SUBROUTINE WILL FORM THE MSV VECTOR. THIS VECTOR IS A SUBSET OF THE VEHICLE STATE VECTOR S. THIS VECTOR IS PASSED TO THE IMSL INTEGRATOR SUBROUTINE.

FRMPVT (TO FORM PAYLOAD VECTORS FOR STABILITY DERIVATIVES)

PURPOSE: THIS SUBROUTINE WILL FORM THE TWO VECOTRS WHICH WILL BE USED FOR THE STABILITY DERIVATIVE CALCULATIONS OF THE PAYLOAD ONLY PROGRAM

FRMTSV (FORM THE TOTAL SV VECTOR)

PURPOSE: THIS SUBROUTINE HAS ESSENTIALLY THE SAME PURPOSE AS THE SUBORUTINE FORMSV. THIS SUB-ROUTINE WILL LOAD THE VEHICLE STATE VECTOR, THE CONTROL SYSTEM INTEGRATOR VALUES, THE BLANK INTEGRATOR SPACE AS THE SUBROUTINE FORMSV DOES. THIS SUBROUTINE WILL ALSO LOAD THE PAYLOAD STATE VECTOR (PS), INTO THE BOTTOM OF THE SV VECTOR.

FRMTVT (FORM VECTORS)

PURPOSE: THIS SUBROUTINE WILL TAKE THE VARIOUS CONTROL VARIABLES FROM THE PROGRAM, AND LOAD THEM INTO THREE DIFFERENT VECTORS. THESE VECTORS WILL BE USED BY THE STABILITY DERIVATIVE SUBROUTINES TO CREATE THE STABILITY DERIVATIVE MATRICES

FRMVTR (FORM VECTORS)

PURPOSE: THIS SUBROUTINE WILL TAKE THE VARIOUS CONTROL VARIABLES FROM THE PROGRAM, AND LOAD THEM INTO THREE DIFFERENT VECTORS. THESE VECTORS WILL BE USED BY THE STABILITY DERIVATIVE SUBROUTINES TO CREATE THE STABILITY DERIVATIVE MATRICES

FRTION (FRICTION)

PURPOSE: TO CALCULATE THE MAGNITUDE OF THE FRICTION FORCE ON THE LANDING GEAR TIRE

FUSARO (CALCULATE FUSELAGE FORCES AND MOMENTS ON EACH LPU)

PURPOSE: TO CALCULATE FUSELAGE FORCES AND MOMENTS ON EACH LPU

GEARF (GEAR FORCES)

PURPOSE: TO CALCULATE THE LANDING GEAR FORCE VECTORS ON THE HULL AT THE LANDING GEAR ATTACH POINT IN COORDINATES OF THE HULL CG REFERENCE AXIS

GEARV (GEAR VELOCITIES)

PURPOSE: TO CALCULATE THE INERTIAL VELOCITIES OF THE LANDING GEAR TIRES IN COORDINATE OF THE HULL CG REFERENCE AXIS AND LANDING GEAR STRETCH RATES

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GEFCON (GROUND EFFECT CONSTANTS)

PURPOSE: TO DETERMINE THE CALCULATED GROUND EFFECT CONSTANT-GEF

GERCPS (GEAR COMPRESSION)

PURPOSE: TO CALCULATE THE LANDING GEAR COMPRESSION FORCE (SCALAR) AND THE LANDING GEAR FORCE VECTOR IN HULL COORDINATES

GETMSD (GET THE GENERALIZED STATE DERIVATIVE VECTOR FOR THE MOORED VEHICLE)

PURPOSE: TO FORM THE STATE DERIVATIVE VECTOR, SDOT FOR THE MOORED CONDITION

GETPSD (GET PAYLOAD STATE DERIVATIVES)

PURPOSE: TO FORM THE PAYLOAD STATE DERIVATIVE VECTOR PSDOT

GETSD (GET STATE DERIVATIVES)

PURPOSE: TO FORM THE STATE DERIVATIVE VECTOR SDOT

GETSRG (GET THE SOURCE GUST)

PURPOSE: THIS SUBROUTINE WILL, IF NECESSARY, READ THE THE SOURCE GUSTS FROM THE RANDOM INPUT STRING, INDICATED BY THE FILE NUMBER (FILENM). AFTER MOVING EACH SET OF GUSTS UP ONE ROW THE NEW GUST VELOCITIES AS WELL AS THE TIME, WILL BE LOADED INTO THE LAST ROW OF THE ARRAY GSTBUF. AFTER LOADING A NEW GUST (IF NECESSARY), THIS SUBROUTINE WILL LOCATE THE TWO TIME WHICH ARE IMMEDIATELY BEFORE AND AFTER THE PRESENT TIME. IT WILL TAKE THE GUST VALUES CORRESPONDING TO THOSE TIMES, AND INTERPOLATED TO GET THE GUST VECTOR

GETT12 (GET TWO TIMES AND THE CORRESPONDING COMMANDS FOR THE CONTROL SYSTEM)

PURPOSE: TO FIND THE TWO TIMES BETWEEN WHICH THE PRESENT PROGRAM TIME IS LOCATED, AND RETURN THOSE TIMES WITH THE CORRESPONDING CONTROL SYSTEM COMMANDS TO SUBROUTINE COMGEN.

GHCIFC (GROUND ON HULL CROSSFLOW INTERFERENCE)

PURPOSE: TO CALCULATE THE GROUND ON HULL CROSSFLOW INTERFERENCE FORCE AND MOMENT VECTORS IN COORDINATES OF THE HULL CG REFERENCE AXIS

GHVIFC (GROUND ON HULL VELOCITY INTERFERENCE)

PURPOSE: TO ADJUST THE RELATIVE VELOCITY OF THE HULL CENTER OF VOLUME TO CORRECT FOR FLOW ROTATION DUE TO GROUND ON HULL INTERFERENCE

GINTRP (GUST INTERPOLATION)

PURPOSE: TO GENERATE THE GUST VELOCITIES AND GRADIENTS AT THE HULL, TAIL, AND LPU'S, BY LINEAR SPATIAL INTERPOLATION EQUATIONS

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GRAVTY (GRAVITY)

PURPOSE: TO CALCULATE THE GRAVITY FORCES ON THE HULL AND LPUS

GTAIFC (GROUND ON TAIL ANGLE OF ATTACK INTERFERENCE)

PURPOSE: TO ADJUST THE TAIL LOCAL ANGLE OF ATTACK FOR GROUND EFFECTS

GTIFC (GROUND ON TAIL INTERFERENCE)

PURPOSE: TO CALCULATE THE CORRECTED TAIL LIFT CURVE SLOPE (ZAVSQT) IN GROUND EFFECT FROM THE VALUE OUT OF GROUND EFFECT (UZAVST)

GUNITV (LANDING GEAR UNIT VECTOR)

PURPOSE: TO CALCULATE THE UNIT VECTOR DIRECTION OF THE LANDING GEAR T'RE ALONG THE GROUND IN COORDINATES OF THE INERTIAL REFERENCE AXIS

GUSGEN (GUST GENERATION)

PURPOSE: TO GENERATE THE GUSTS ON THE FOUR LPU'S AND ON THE HULL AND TAIL. THIS SUBROUTINE DOES NOT CALCULATE VALUES, IT CALLS SUBROUTINES C1MCOS, AND D1MCOS WHICH WILL CALCULATE THE GUST VALUES BASED ON THE TIME THAT IS PASSED TO THEM.

GUST (GUST)

PURPOSE: TO UPDATE ALL GUST INPUTS DURING TIME HISTORY SIMULATION

HCABLE (HULL CABLE FORCES AND MOMENTS)

PURPOSE: TO RESOLVE AND ADD UP THE TOTAL CABLE FORCES AND MOMENTS AT THE HULL CENTER OF GRAVITY, IN COORDINATES OF THE HULL CG REFERENCE AXIS

HDIFC (HULL ON DISC INTERFERENCE)

PURPOSE: TO CORRECT THE DISC (ROTOR OR PROPELLER BLADE LIFT CURVE SLOPE FOR HULL WAKE INTERFERENCE

HGCNTC (HULL GROUND CONTACT CALCULATION)

PURPOSE: TO DETERMINE WHETHER A PARTICULAR LOCATION ON THE HULL HAS CONTACTED THE GROUND, AND TO SET THE CORRESPONDING GROUND CONTACT AND MODEL ERROR FLAGS

HGEEZ (HULL INERTIAL G'S)

PURPOSE: TO CALCULATE THE VEHICLE INERTIAL ACCELERATION IN G'S IN COORDINATES OF THE HULL CG REFERENCE AXIS.

HGEOM (INPUT HULL GEOMETRY)

PURPOSE: INPUT HULL CONFIGURATION GEOMETRIES.

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HGLOAD (HULL GUST ACCELERATION LOADS)

PURPOSE: TO CALCULATE THE FORCE AND MOMENT VECTORS WITH RESPECT TO THE HULL CENTER OF VOLUME AXIS, ARISING FROM GUST ACCELERATION EFFECTS AT THE HULL CENTER OF VOLUME

HLAMOR (HEAVY LIFT AIR SHIP MOORING SIMULATION)

PURPOSE: TO SIMULATE THE THREE DEGREES OF FREEDOM (ANGULAR MOTION) OF AN AIR SHIP MOORED TO A MAST IN A POWER OFF CONDITION

HLAPAY (HEAVY-LIFT-AIRSHIP SIMULATION PROGRAM)

PURPOSE: TO SIMULATE THE NON-LINEAR SIX DEGREE OF FREEDOM MOTION OF A HEAVY LIFT AIRSHIP, I.E., A HYBIRD AIRSHIP-HELICOPTER VEHICLE

HLASIM (HEAVY-LIFT-AIRSHIP SIMULATION PROGRAM)

PURPOSE: TO SIMULATE THE NON-LINEAR SIX DEGREE OF FREEDOM MOTION OF A HEAVY LIFT AIRSHIP, I.E., A HYBRID AIRSHIP-HELICOPTER VEHICLE.

HMOVAR (HULL MOTION VARIABLES)

PURPOSE: TO CALCULATE THE HULL MOTION VARIABLES WITH RESPECT TO THE AIR MASS, WHICH ARE NEEDED FOR THE CALCULATION OF HULL FORCES AND MOMENTS.

HONLY (HULL ONLY AERODYNAMIC CALCULATIONS)

PURPOSE: TO CALCULATE THE AERODYNAMIC LOADS DUE TO THE MOTION OF THE HULL ALONE.

HRDLIM (RESTRAIN CONTROL COMMANDS TO HARD LIMITS)

PURPOSE: TO RESTRAIN THE EFFECTOR COMMANDS TO WITHIN THE MECHANICAL LIMITS SET BY THE USER IN COMMON MECLIM

HULARO (HULL-TAIL ASSEMBLY AERODYNAMIC CALCULATIONS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCE AND MOMENT VECTORS, WITH RESPECT TO THE HULL CG REFERENCE AXES; DUE TO AERODYNAMIC LOADS ON THE HULL ENVELOPE AND TAIL.

HWLOAD (HULL WIND LOADS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS ON THE HULL ONLY (EXCLUDING FINS), WHICH ARISE FROM THE NON-ACCELERATING MOTION WITH RESPECT TO THE LOCAL AIR MASS.

IACLOD (INERTIAL ACCELERATION LOADS)

PURPOSE: TO CALCULATE THE HULL AND TAIL APPARENT MASS LOADS ARISING FROM INERTIAL HULL MOTION. ALSO, SUM THESE INERTIAL ACCELERATION LOADS WITH THE PREVIOUSLY CALCULATED AERODYNAMIC LOADS (HULARO) TO OBTAIN THE TOTAL HULL AND TAIL AERODYNAMIC LOADS.

IMLOAD (INERTIAL MOORING LOAD)

PURPOSE: TO CALCULATE THE FORCES ON THE MOORING MAST AT THE ATTACH POINT TO THE HULL IN COORDINATES OF THE INERTIAL REFERENCE AXIS

INATMOS (INPUT ATMOSPHERIC PARAMETER)

PURPOSE: INPUT STEADY WIND, AIR DENSITY, AND GRAVITY

INCABL (INPUT CABLE CONSTANTS)

PURPOSE: TO INPUT THE CABLE SPRING AND DAMPING CONSTANTS

INEXST (INPUT EXHAUST PARAMTERS)

PURPOSE: TO INPUT THE LOCATION AND ORIENTATION OF THE JET EXHAUST AND ITS CONSTANT THRUST MAGNITUDE

INFCSC (INPUT THE FLIGHT CONTROL SYSTEM PARAMETERS)

PURPOSE: TO INPUT THE FLIGHT CONTROL SYSTEM PARAMETERS.

INFIFC (INPUT THOSE INTERFERENCE CONSTANTS WHICH ACT ON THE FUSELAGE)

PURPOSE: THIS SUBROUTINE READS IN THE INTERFENCE CONSTANTS RELATED TO ALL OF THE VARIOUS COMPONENTS WHICH ACT ON THE FUSELAGE

INFLOW (DISK INDUCED FLOW VELOCITY CALCULATION)

PURPOSE: TO CALCULATE THE NON-DIMENSIONAL INDUCED FLOW VELOCITY.

INGEAR (TO INPUT THE LANDING GEAR LOCATIONS AND CHARACTERISTICS)

PURPOSE: THIS SUBROUTINE WILL READ IN THE LANDING GEAR LOCATIONS LENGTH SPRING CONSTANTS AND FRICTION CONSTANTS

INGEOM (INPUT VEHICLE GEOMETRY)

PURPOSE: TO INPUT HULL CENTER-OF-VOLUME REFERENCE GEOMETRY INFORMATION

INGUST (GUST DATA)

PURPOSE: TO READ IN ALL OF THE GUST DATA AFFECTING THE SIMULATION; THIS INCLUDES THE STARTING AND ENDING TIME FOR THE (1-COSINE) GUST VALUES AT EACH OF THE SIX POINTS. IT ALSO INCLUDES THE GEOMETRY FOR THE POSITION OF THE GUST SOURCES FOR GUST STRING INPUTS, AND THE SCALE FACTOR FOR THOSE GUST SOURCES.

INHARO (INPUT AERODYNAMIC PARAMETERS)

PURPOSE: INPUT HULL-FIN CONFIGURATION AERODYNAMIC AND AERO-STATIC PARAMETERS

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INMIFC (INPUT THE INTERFRENCE AFFECTS ON CONSTANTS WHICH ACT ON THE HULL)

PURPOSE: THIS SUBROUTINE WILL READ IN THE CONSTANTS FOR THOSE AFFECTS WHICH ACT ON THE HULL

INLARO (LPU AERODYNAMIC INPUTS)

PURPOSE: INPUT THE AERODYNAMIC PARAMETERS FOR THE LPU'S

INMASS (INPUT VEHICLE MASS PROPERTIES)

PURPOSE: TO INPUT 'REAL' MASS AND MOMENTS OF INERTIA CHARACTERISTICS OF THE HULL AND LPUS

INMCLC (INPUT MECHANICAL CONTROLS)

PURPOSE: INPUT MECHANICAL LIMITS AND CONTROL MIXING CONSTANTS

INMOOR (TO INPUT THE MOORING GEOMETRY AND LOCATION)

PURPOSE: THIS SUBROUTINE WILL READ IN THE MAST LOCATION IN INERTIAL SPACE AND THE MOORING POINT RELATIVE TO THE HULL REFERENCE CENTER

INMRST (INPUT MOORING STATE COMMANDS)

PURPOSE: TO INPUT THE EULER ANGLE INCREMENTS AWAY FROM TRIM IN ORDER TO EXCITE THE MOORING SIMULATION

INMTRA (INPUT THE MOORING TRIM ANGLES)

PURPOSE: THIS SUBROUTINE WILL READ IN THE YAW ANGLE WHICH THE VEHICLE SHOULD BE TRIMMED IN CASE THERE IS NO WIND, OR THE ANGLE OFF THE WIND SHOULD A NON-SYMMETRICAL MOORING TRIM BE DESIRED. IT ALSO READS IN THE THREE ANGULAR POSITIONS OF THE TAIL

INPARO (INPUT THE PAYLOAD AERODYNAMIC PARAMETERS)

PURPOSE: THIS SUBROUTINE READS IN THE AERODYNAMIC PARAMETERS AND CAUSES THEM TO BE LOADED INTO THE CORRECT ARRAYS

INPGEO (INPUT PAYLOAD GEOMETRY)

PURPOSE: TO INPUT PAYLOAD REFERENCE CENTER BASED GEOMETRY INFORMATION

INPGST (INPUT THE PAYLOAD GUST PARAMETERS)

PURPOSE: TO READ IN THE TIMES AND VELOCITIES FOR THE ONE MINUS COSINE GUST VALUES, AND THE FLAG AND SCALE FACTORS FOR THE RANDOM GUST STRINGS

INPIFC (INPUT THE INTERFERENCE CONSTANTS FOR THOSE AFFECTS WHICH ACT ON THE PROPELLERS)

PURPOSE: INPUT THE INTERFERENCE CONSTANTS WHICH ACT ON THE PROPELLERS

INTERP (INTERPOLATE FOR THE PRESENT COMMAND)

PURPOSE: THIS SUBROUTINE WILL INTERPOLATE BETWEEN THE TWO COMMANDS CMD1 AND CMD2 TO FIND AN APPROPRIATE COMMAND VALUE FOR COM BASED ON THE PRESENT TIME.

INTGTR (MAIN INTEGRATOR)

PURPOSE: THIS SUBROUTINE SETS UP THE SB VECTOR, AND CALLS THE IMSL INTEGRATOR FOR THE MAIN PROGRAM TIME HISTORY RUN.

INTIAL (INTIALIZATION)

PURPOSE: INITIALIZE COMMONS: SVECTR, MASS, EMASMX

INTIFC (INPUT THE TAIL INTERFERENCE CONSTANTS)

PURPOSE: THIS SUBROUTINE WILL INPUT THE INTERFERENCE CONSTANTS FOR THOSE EFFECTS WHICH ACT ON THE TAIL

IN1MMD (INPUT ONE MODULE FOR MOORING SIMULATION)

PURPOSE: TO INPUT ONE, THREE BY THREE MODULE INTO THE MTVC MATRIX, GIVEN THE STARTING ROW NUMBER AND STARTING COLUMN NUMBER IN THAT MATRIX

IN1MOD (INPUT 1 MODULE)

PURPOSE: TO INPUT ONE, THREE BY THREE MODULE INTO THE TVC MATRIX, GIVEN THE STARTING ROW NUMBER AND STARTING COLUMN NUMBER IN THAT MATRIX

ITERCT (ITERATE FOR CT)

PURPOSE: TO ITERATE BETWEEN THE VALUE OF CT AND WIN UNTIL A CONVERGED SOLUTION IS FOUND.

LGEAR (LANDING GEAR FORCE AND MOMENT CALCULATIONS)

PURPOSE: TO CALCULATE THE TOTAL FORCE AND MOMENT VECTOR AT THE HULL CENTER OF GRAVITY DUE TO ALL ACTIVE LANDING GEARS, WITH REFERENCE TO THE HULL CG AXIS

LGPOS (LANDING GEAR POSITION)

PURPOSE: TO CALCULATE THE LOCATION OF THE LANDING GEAR TIRE RELATIVE TO THE LANDING GEAR ATTACH POINT IN COORDINATES OF THE HULL CG REFERENCE AXIS, AND THE LANDING GEAR TIRE LOCATION RELATIVE TO THE INERTIAL AXIS IN COORDINATES OF THE INERTIAL REFERENCE FRAME. ALSO, TO SET THE LANDING GEAR CONTACT, HULL FRAME (LANDING GEAR ATTACH POINT LOCATION) CONTACT AND MODEL ERROR FLAGS

LINEAR (LINEARIZATION ANALYSIS)

PURPOSE: TO CALCULATE STABILITY DERIVATIVE MATRICES, EIGENVALUES, AND EIGENVECTORS FOR THE PRESENT TRIM CONDITION.

LMGUES (FIRST GUESS FOR LAMDA)

PURPOSE: TO PROVIDE AN INITIAL GUESS FOR LAMDA TO SUBROUTINE CALCCT.

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IPLOTF (INITIALIZE THE PLOTTING FILE)

PURPOSE: THIS SUBROUTINE IS CALLED IF THE USER HAS REQUESTED THE PROGRAM TO WRITE ALL THE DATA TO A BINARY PLOTTING FILE. THIS SUBROUTINE WILL INITIALIZE THAT FILE BY WRITING THE PROGRAM I.D., THE JULIAN DATE, AND THE NUMBER OF OUTPUT VARIABLES THE PROGRAM WILL WRITE ON THE FILE DURING EACH TIME FRAME

INPMAS (INPUT PAYLOAD MASS PROPERTIES)

PURPOSE: TO INPUT THE MASS AND MOMENTS OF INERTIA OF THE PAYLOAD

INPROF (INPUT FLIGHT PROFILE)

PURPOSE: INPUT CONTROL SYSTEM COMMANDS FOR USE BY SUBROUTINE PROFIL

INPROP (PROPELLER AND ROTOR INPUTS)

PURPOSE: TO INPUT PROPELLER AND ROTOR CHARACTERISTICS.

INPYST (INPUT PAYLOAD STATES)

PURPOSE: THIS SUBROUTINE INPUTS PAYLOAD STATES WHICH ARE AN INCREMEMTAL PERTUBATION AWAY FROM THE TRIM VALUE WHICH WAS CALCULATED. THIS SUBROUTINE READS VALUES WHICH WILL BE ADDED ONTO THOSE VALUES WHICH WERE CALCULATED IN THE TRIM. THIS IS THIS IS DONE TO ALLOW A MEANS FOR THE PAYLOAD TO BE PERTURBED, AND IT'S DYNAMIC MOVEMENT STUDIED DURING A TIME HISTORY

INRIFC (INPUT THE INTERFERENCE CONSTANTS FOR THOSE AFFECTS WHICH ACT ON THE PROPELLERS)

PURPOSE: THIS SUBROUTINE WILL INPUT THE CONSTANTS FOR THE INTERFERENCE AFFECTS WHICH ARE ACTING ON THE ROTORS

INSERT (INSERT ONE COLUMN)

PURPOSE: TO INSERT A SIX ELEMENT VECTOR INTO A DESIRED POSITION IN A SIX BY SEVEN MATRIX.

INSTAB (TO INPUT THE STABILITY DERIVATIVE FLAGS)

PURPOSE: TO READ IN A SERIES OF FLAGS INDICATING WHICH STABILITY DERIVATIVE MATRICES ARE WANTED OUTPUT FOR THE RUN

INSTAT (INPUT INERTIAL VEHICLE STATES)

PURPOSE: INPUT INERTIAL HULL STATES FOR USE BY TRIM

INSTEP (INPUT COMPUTER ALGORITHM STEPS)

PURPOSE: INPUT INTEGRATION TIMESTEP, PRINT-INTERVAL, AND TOTAL SIMULATION TIME

LOADAM (LOAD TOTAL APPARENT MASS MATRIX)

PURPOSE: TO CALCULATE THE TOTAL HULL-TAIL ASSEMBLY APPARENT MASS MATRIX, FOR MOTIONS WITH RESPECT TO THE HULL CG REFERENCE AXIS, AT THE DESIRED DENSITY RATIO

LOADCA (LOAD CONSTRAINED ACCELERATION VECTOR)

PURPOSE: TO LOAD THE CONSTRAINED ACCELERATION VECTOR - EVECTR

LOADFM (MATRIX OF FUNCTIONALS)

PURPOSE: TO LOAD THE MATRIX OF FUNCTIONALS FMAT WITH THE HULL LINEAR AND ANGULAR DERIVATIVES ASSOCIATED WITH EACH TRIM CONTROL GUESS STORED AS COLUMNS OF THE TRIM CONTROL MATRIX UMAT.

LOADHM (LOAD HULL AERODYNAMIC MATRICES)

PURPOSE: TO LOAD THE HULL AERODYNAMIC MATRICES A-E FOR USE IN THE HULL AERODYNAMIC CALCULATION (HONLY).

LOADMT (LOAD MTVC)

PURPOSE: TO LOAD THE MOORING TVC MATRIX MTVC

LOADPM (LOAD PAYLOAD AERODYNAMIC MATRICES)

PURPOSE: TO LOAD THE PAYLOAD AERODYNAMIC MATRICES A, B, C FOR USE IN PAYLOAD AERODYNAMIC CALCULATIONS SUBROUTINE PAERO

LOADT (LOAD TVC)

PURPOSE: TO LOAD THE MATRIX TVC

LOADUA (LOAD UNCONSTRAINED ACCELERATION VECTOR)

PURPOSE: TO LOAD UNCONSTRAINED ACCELERATION VECTOR - VDREL

LODFSM (LOAD FUSELAGE STATIC AERODYNAMIC FORCE CALCULATION MATRIX)

PURPOSE: TO LOAD THE MATRIX USED IN THE CALCULATION OF THE LPU FUSELAGE AERODYNAMCI FORCES.

LODGST (LOAD GUST VECTORS)

PURPOSE: TO LOAD THE VARIOUS GUST VECTORS WITH THE RESULTS OF THE (1-COSINE) GUST MODEL AND THE GUST INPUT STRING MODEL

LODMCA (LOAD MOORING CONSTRAINED ACCELERATION VECTOR)

PURPOSE: TO LOAD THE MOORING CONSTRAINED ACCELERATION VECTOR-MEVCTR

LODMUA (LOAD UNCONSTRAINED MOORING ACCELERATION VECTOR)

PURPOSE: TO LOAD THE UNCONSTRAINED MOORING ACCELERATION VECTOR-MVDREL, WITH THE COMMANDED ACCELERATIONS FROM SUBROUTINE PROFIL

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LODSVC (LOAD THE S VECTOR)

PURPOSE: TO LOAD THE GENERALIZED VEHICLE STATE VECTOR (S) WITH THE REMAINING DEPENDANT STATES FOR THE MOORING SIMULATION

LOOP (LOOP STRUCTURE)

PURPOSE: TO CALCULATE THE CONTROL INPUT CORRESPONDING TO A SPECIFIC COMMAND LOOP

LPGEOM (INPUT LPU GEOMETRY)

PURPOSE: INPUT THE GEOMETRIC CHARACTERISTICS OF THE LPU CONFIGURATIONS.

LPUARO (LIFT PROPULSION UNIT AERODYNAMICS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS ON THE LPU FUSELAGE, ROTORS, AND PROPELLERS.

LPUTRN (LPU NON-STANDARD EULER SEQUENCE TRANSFORMATION MATRIX FORMULATIONS)

PURPOSE: TO CALCULATE THE ORTHOGONAL AND NON-ORTHOGONAL TRANSFORMATION MATRICES FOR THE LPUS

MAERO (MOORING AERODYNAMIC MASTER SUBROUTINE)

PURPOSE: TO CALL THE MOORING AERODYNAMIC MODEL SUBROUTINES WHICH GENERATE THE AERODYNAMIC LOADS ON THE HULL, TAIL, AND LPU'S

MAGCOL (CALCULATE MODIFIED EUCLIDEAN NORM OF ONE COLUMN)

PURPOSE: TO CALCULATE THE MODIFIED EUCLIDEAN NORM OF A DESIRED COLUMN OF THE MATRIX FMAT.

MASMAT (LOAD MASS MATRIX)

PURPOSE: TO FILL THE GENERALIZED MASS MATRIX WTIH THE INDIVIDUAL LPU AND HULL MASS ELEMENTS

MATRIX (LOAD MASS MATRIX)

PURPOSE: TO LOAD MASS MATRIX WITH INERTIAL MASSES AND APPARENT MASS TERMS

MAXVEC (CALCULATION OF MOORING AUXILIARY STATES)

PURPOSE: TO CALCULATE THE LOCATIONS OF THE LANDING GEAR TIRES, ATTACH POINTS, AND VARIOUS HULL LOCATIONS, AND SET RESPECTIVE CONTACT AND MODEL ERROR FLAGS

MCGDST (CENTER OF GRAVITY REFERENCE POSITION VECTORS FOR LANDING GEARS AND MOORING MAST LOCATIONS)

PURPOSE: TO CALCULATE THE POSITON VECTORS REFERENCE TO THE HULL CG AXIS BASED ON INPUT POSITION VECTOR OF THE LANDING GEAR ATTACH POINTS AND MOORING MAST ATTACH POINT

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MCLCDL (CALCULATION OF BLADE DRAG COEFFICIENTS FOR MOORING SIMULATION)

PURPOSE: TO CALCULATE THE DISK (ROTOR OR PROPELLER) AXIAL AND PERPENDICULAR DRAG COEFFICIENTS FOR THE POWER OFF MOORING SIMULATION

MCTSTP (MOORING CHECK STEP)

PURPOSE: TO ESTIMATE THE NOMINAL HIGH FREQUENCY MODE OF THE MOORING SIMULATION AND COMPARE THIS RESULT WITH THE USER INPUTED MINIMUM ALGORITHM TIME STEP

MEIGEN (CALCULATE EIGEN VALUES AND EIGEN VECTORS FOR MOORING SIMULATION)

PURPOSE: THIS SUBROUTINE WILL CALL IMSL SUBROUTINE (EGIRF) TO CALCULATE THE EIGEN VALUES AND EIGEN VECTORS OF THE MOORING MATRIX (MA). THE EIGEN VECTORS WIL BE NORMALIZED, AND RETURNED AS (MNOREV).

MEXTRC (EXTRAC ONE COLUMN)

PURPOSE: TO EXTRACT THE SPECIFIED THREE ELEMENT COLUMN FROM A THREE BY FOUR MATRIX

MFORCE (EXTERNAL FORCES AND MOMENTS FOR MOORING SIMULATION)

PURPOSE: TO CALCULATE THE HULL AND LPU EXTERNAL FORCES AND MOMENTS BASED ON THE PRESENT STATE VECTOR FOR THE MOORING SIMULATION

MINSRT (INSERT ONE COLUMN)

PURPOSE: TO INSERT A THREE ELEMENT VECTOR INTO A DESIRED POSITION IN A THREE BY FOUR MATRIX

MINTGR (MOORING INTEGRATOR)

PURPOSE: THIS SUBROUTINE SETS UP THE MSV VECTOR, AND CALLS THE IMSL INTEGRATOR TO INTEGRATE THE MOORED VEHICLE STATES DURING THE TIME HISTORY RUN

MINTIL (MOORING SIMULATION INTIALIZATION)

PURPOSE: TO INTIALIZE THOSE COMMONS IN THE MOORING SIMULATION THAT HAVE NOT BEEN INTIALIZED IN THE MAIN INTIALIZATION PROGRAM (INTIAL)

MLINAR (MOORING LINEARIZATION ANALYSIS)

PURPOSE: TO CALCULATE THE STABILITY DERIVATIVE MATRICES, EIGEN VALUES, AND EIGEN VECTORS FOR THE PRESENT MOORING TRIM CONDITION

MLODFM (MOORING LOAD MATRIX OF FUNCTIONALS)

PURPOSE: TO LOAD THE MOORING MATRIX OF FUNCTIONALS MFMAT WITH THE HULL ANGULAR TIME DERIVATIVES ASSOCIATED WITH EACH MOORING TRIM CONTROL GUESS, AS COLUMNS OF THE TRIM CONTROL MATRIX MUMAT

MLPARO (LIFT PROPULSION UNIT MOORING AERODYNAMICS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS ON THE LPU FUSELAGES, ROTORS, AND PROPELLERS IN A MOORED FLIGHT CONDITON

MMGCOL (CALCULATE EUCLIDEAN NORM OF ONE COLUMN)

PURPOSE: TO CALCULATE THE EUCLIDEAN NORM OF THE DESIRED COLUMN OF THE MATRIX MFMAT

MMMULT (MATRIX-MATRIX MULTIPLICATION)

PURPOSE: TO CALCULATE THE MATRIX PRODUCT OF TWO THREE BY THREE MATRICIES

MNORMS (CALCULATE EUCLIDEAN NORMS)

PURPOSE: TO CALCULATE THE EUCLIDEAN NORM ARRAY, MENORM, EACH ELEMENT OF WHICH CONTAINS THE EUCLIDEAN NORM OF A COLUMN OF THE FUNCTIONAL MATRIX NFMAT

MORDSK (DISK CALCULATIONS FOR MOORING SIMULATION)

PURPOSE: TO CALCULATE THE FORCES AND MOMENTS IN THE CONTROL WIND AXIS OF A DISK (ROTOR OR PROPELLER) FOR THE VEHICLE IN A MOORED (POWER OFF) FLIGHT CONDITION

MPRFIL (MOORING SIMULATION PROFILE COMMANDS)

PURPOSE: TO ISSUE GUST COMMANDS BASED ON CURRENT SIMULATION TIME

MPRPAR (MOORED PROPELLER AERODYNAMICS)

PURPOSE: TO CALCULATE THE PROPELLER FORCES AND MOMENTS ABOUT THE LPU CG REFERENCE AXIS FOR A MOORED FLIGHT CONDITION

MPTURB (PERTURB ONE MOORED VEHICLE STATE)

PURPOSE: TO GENERATE A STABILITY DERIVATIVE AND AUXILIARY STABILITY DERIVATIVE MATRIX COLUMN BY PERTURBING ONE MOORED VEHICLE STATE

MRTARO (ROTOR AERODYNAMICS FOR MOORED FLIGHT CONDITION)

PURPOSE: TO CALCULATE THE ROTOR FORCES AND MOMENTS WITH RESPECT TO THE LPU CG REFERENCE AXIS FOR THE MOORED FLIGHT CONDITION

MSORT (MOORING TRIM SORT ROUTINE)

PURPOSE: TO ARRANGE THE VECTOR OF EUCLIDEAN NORMS IN ASCENDING ORDER

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MSSAG (TO WRITE A MESSAGE)

PURPOSE: THIS SUBROUTINE WILL WRITE A MESSAGE INDICATED BY AN ERROR NUMBER (ERRNUM), THE MESSAGE IT WRITES, IT WILL FIND ON A EXTERNAL FILE (TAPE21). IT WILL ALSO WRITE THE NAME OF THE SUBROUTINE AND UP TO THREE VARIABLES WITH THEIR VALUES, WHICH WILL BE PASSED FROM THE CALLING SUBROUTINE. IT WILL TERMINATE THE PROGRAM IF QUIT IS TRUE.

MSTAB (MOORING STABILITY CALCULATIONS)

PURPOSE: TO CALCULATE THE MOORING LINEARIZED STABILITY DERIVATIVE MATRICES: MA, MC, MAAUX, MCAUX

MTPTRB (MOORING TRIM PERTUBATION)

PURPOSE: TO LOAD THE MOORING MATRIX OF TRIM CONTROL GUESSES BASED ON THE INITIAL ESTIMATE FOR MOORING TRIM CONTROL VECTOR (MU), AND PERTURBING SUCESSIVELY EACH ELEMENT OF THAT VECTOR TO FORM THE MATRIX OF GUESSES (MUMAT)

MTRIM (MOORING TRIM)

PURPOSE: TO CALCULATE THE HULL ANGULAR ORIENTATION NECESSARY TO TRIM THE VEHICLE IN A MOORED CONDITION

MTRMLM (MOORING TRIM LIMITS)

PURPOSE: TO TEST THE VARIOUS LOCATIONS OF THE HULL AND LANDING GEAR TO SEE IF THE CURRENT TRIM CONTROL GUESS IS VALID

MVMULT (MATRIX VECTOR MULTIPLICATION)

PURPOSE: TO CALCULATE THE DOT PRODUCT OF A THREE BY THREE MATRIX WITH A THREE BY ONE VECTOR

M3SCA (MATRIX SCALAR MULTIPLICATION)

PURPOSE: TO CALCULATE THE RESULT OF THE MULTIPLICATION OF A SCALAR TIMES A THREE BY THREE MATRIX

M3TNPS (MATRIX TRANSPOSE)

PURPOSE: TO FORMULATE THE TRANSPOSE OF A THREE BY THREE MATRIX

NDMLOC (NONDIMENSIONAL LOCATION)

PURPOSE: TO CALCULATE THE NONDIMENSIONAL LOCATION OF THE ROTORS, PROPELLERS, HULL, AND TAIL BASED ON THEIR RESPECTIVE NONDIMENSIONALIZING LENGTHS

NEWMU (NEW MOORING CONTROL VECTOR)

PURPOSE: TO CALCULATE THE NEXT MOORING CONTROL VECTOR GUESS, MUNEW, USED IN THE MOORING TRIM ITERATION ALGORITHM

NEWPU (NEW PAYLOAD CONTROL VECTOR)

PURPOSE: TO CALCULATE THE NEXT PAYLOAD CONTROL VECTOR GUESS, PUNEW, USED IN THE TRIM ITERATION ALGORITHM

NEWRAP (NEWTON-RAPSON CALCULATIONS)

PURPOSE: TO USE A NEWTON-RAPSON ALGORITHM TO OBTAIN THE VALUE OF THE LOCAL FUNCTION DERIVATIVE.

NEWU (NEW CONTROL VECTOR)

PURPOSE: TO CALCULATE THE NEXT CONTROL VECTOR GUESS, UNEW, USED IN THE TRIM ITERATION ALGORITHM.

NORMS (CALCULATE MODIFIED EUCLIDEAN NORMS)

PURPOSE: TO CALCULATE THE MODIFIED EUCLIDEAN NORM ARRAY ENORM, EACH ELEMENT OF WHICH CONTAINS THE MODIFIED EUCLIDEAN NORM OF A COLUMN OF THE FUNCTIONAL MATRIX FMAT.

OIATMOS (WRITE ATMOSPHERIC PARAMETERS)

PURPOSE: THIS ROUTINE CORRESPONDS TO INATMOS AND WILL WRITE THE VALUE WHICH INATMOS READS IN

OICABL (OUTPUT THE CABLE VALUES WHICH WERE READ IN)

PURPOSE: THIS SUBROUTINE WILL PRINT OUT THE CABLE VARIABLES WHICH THE USER INPUT THROUGH SUBROUTINE INCABL

OIEXST (OUTPUT THE EXHAUST INPUT VALUES)

PURPOSE: THIS SUBROUTINE WILL READ OUT THOSE VALUES WHICH WERE READ IN BY SUBROUTINE INEXST (EXHAUST FORCES AND NOZZEL LOCATION)

OIFCSC (OUTPUT THE FLIGHT CONTROL SYSTEM PARAMETERS WHICH WERE READ IN)

PURPOSE: THIS SUBROUTINE CORRESPONDS WITH SUBROUTINE INFCSC. IT WRITES OUT THOSE VALUES WHICH INFCSC HAS READ IN.

OIFIFC (TO OUTPUT THE INPUT VALUES FOR THE FUSELAGE INTERFERENCE CONSTANTS)

PURPOSE: THIS SUBROUTINE PRINTS OUT AS PART OF THE PROGRAM OUTPUT HEADING, ALL OF THE VALUES WHICH WERE INPUT FROM SUBROUTINE INFIFC. THE PRINT OUT INCLUDES THE VARIABLE UNITS A A BRIEF DESCRIPTION FOR EACH VARIABLE

OIGEAR (TO OUTPUT THE INPUT VALUES FOR THE LANDING GEARS)

PURPOSE: THIS SUBROUTINE CORRESPONDES WITH SUBROUTINE INGEAR. IT WILL PRINT OUT THOSE VALUES WHICH SUBROTUINE INGEAR READ IN WITH A DESCRIPTIVE HEADING AND THE UNITS

OIGEOM (WRITE GEOMETRY INPUT VALUES)

PURPOSE: WRITE INPUT VALUES WITH VARIABLE NAMES, UNITS, AND DESCRIPTIONS OF EACH. THIS ROUTINE CORRESPONDS TO INGEOM SUBROUTINE

OIGUST (TO OUTPUT THE GUST DATA WHICH WAS READ IN)

PURPOSE: THIS SUBROUTINE WILL ECHO OUT ALL OF THE VALUES WHICH WERE READ IN, IN SUBROUTINE INGUST

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OIHARO (WRITE AERODYNAMIC INPUT VALUES)

PURPOSE: WRITE THE AERODYNAMIC INPUT VALUES OF THE HULL WITH VARIABLES NAMES, UNITS AND DESCRIPTIONS OF EACH. THIS ROUTINE CORRESPONDS TO INAERO.

OIHIFC (OUTPUT THE INPUT VALUES FOR THE HULL INTERFRENCE CONSTANTS)

PURPOSE: THIS SUBROUTINE PRINTS OUT THOSE VALUES WHICH WERE INPUT FROM SUBROUTINE INHIFC. THE PRINT OUT IS PART OF THE PROGRAM HEADING, AND INCLUDES THE VARIABLE NAME, ITS INPUT VALUE, AND A BRIEF DESCRIPTION OF EACH VARIABLE

OILARO

PURPOSE: TO WRITE THE AERODYNAMIC INPUT VALUES OF THE LPU UNITS, WITH VARIABLE NAMES, UNITS AND DESCRIPTION OF EACH. THIS ROUTINE CORRESPONDS WITH INLARO.

OIMASS (WRITE VEHICLE MASS CHARACTERISTICS)

PURPOSE: THIS ROUTINE CORRESPONDS TO INMASS AND WILL WRITE THE VALUES WHICH INMASS READS IN

OIMCLC (WRITE MECHANICAL CONTROL SYSTEM INPUT VALUES)

PURPOSE: THE ROUTINE CORRESPONDS TO INMCLC AND WILL WRITE THE VALUES WHICH INMCLC READ IN

OIMOOR (TO OUTPUT THE MOORING GEOMETRY INPUTS)

PURPOSE: THIS SUBROUTINE WILL PRINT OUT THOSE VALUES WHICH WERE READ IN BY SUBROUTINE INMOOR. THESE VALUES ARE THE LOCATION IN INERTIAL SPACE OF THE MAST. AND THE MOORING POINT WITH RESPECT TO THE VEHICLE REFERENCE AXIS

OIMRST (TO OUTPUT THE EULER ANGLE DISPLACEMENTS FROM TRIM)

PURPOSE: THIS SUBROUTINE WILL PRINT OUT THOSE ANGLES WHICH WERE READ IN BY SUBROUTINE INMRST. THESE ANGLES INDICATE A DISPLACEMENT AWAY FROM THE TRIM CONDITION WHICH WILL TAKE PLACE AT THE BEGINNING OF TIME HISTORY. THIS PROVIDES A MEANS FOR PERTURBING THE MOORED CONDITION

OIMTRA (TO OUTPUT THE MOORING TRIM ANGLES)

PURPOSE: THIS SUBROUTINE WILL PRINT OUT THOSE VALUES WHICH WERE READ IN BY SUBROUTINE INMTRA. THESE ARE THE YAW ANGLE FOR TRIM IF THERE IS NO WIND, AND THE TAIL DEFLECTION ANGLES

OIPARO (OUTPUT THE PAYLOAD AERODYANAMIC PARAMETERS WHICH WERE READ IN)

PURPOSE: THIS SUBROUTINE WILL OUTPUT THOSE PARAMETERS WHICH WERE READ IN, IN SUBROUTINE INPARO

OIPGEO (OUTPUT THOSE PAYLOAD GEOMETRY WHICH WERE INPUT)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT THOSE PAYLOAD GEOMETRY VALUES WHICH THE USER INPUT TO THE PROGRAM

OIPGST (OUTPUT THE PAYLOAD GUST INPUT VARIABLES)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT THOSE VALUES WHICH WERE READ IN, BY SUBROUTINE INPGST

OIPIFC (OUTPUT THE INPUT VALUES FOR THE PROPELLER INTERFERENCE CONSTANTS)

PURPOSE: THIS SUBROUTINE WILL PRINT OUT THOSE INPUT VALUES READ BY SUBROUTINE INPIFC. THE VALUES WILL BE PRINTED OUT WITH THE VARIABLE NAME, AND A SHORT DESCRIPTION OF EACH VARIABLE.

OIPMAS (OUTPUT THOSE PAYLOAD MASS VALUES WHICH WERE READ IN)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT THE PAYLOAD MASS CHARACTERISTICS WHICH THE USER INPUT INTO THE PROGRAM

OIPROF (WRITE FLIGHT PROFIL VALUES)

PURPOSE: THIS ROUTINE CORRESPONDS TO INPROF AND WILL WRITE THE VALUES WHICH INPROF READS IN

OIPROP (OUTPUT THE PROPELLER AND ROTOR INPUTS)

PURPOSE: THIS SUBROUTINE CORRESPONDES WITH INPROP AND WILL PRINT OUT THOSE VALUES THAT HAVE BEEN INPUT IN INPROP

OIPYST (OUTPUT THE PAYLOAD STATES WHICH WERE READ IN)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT THOSE PAYLOAD STATE INCREMENTS WHICH WERE READ IN SUBROUTINE INPYST

OIRIFC (TO OUTPUT THE INPUT VALUES READ IN BY SUBROUTINE INRIFC)

PURPOSE: THIS SUBROUTINE PRINTS OUT THE INPUT VALUES FOR THE ROTOR INTERFERENCE CONSTANTS WHICH WERE READ IN BY SUBROUTINE INRIFC. THE PRINT OUT IS PART OF THE PROGRAM HEADER, AND INCLUDES THE VARIABLE WITH ITS VALUE AND A BRIEF DESCRIPTION

OISTAB (TO OUTPUT THE STABILITY DERIVATIVE FLAGS)

PURPOSE: TO WRITE THE STABILITY DERIVATIVE FLAGS WHICH WERE READ IN SUBROUTINE INSTAB

OISTAT (WRITE INERTIAL VEHICLE STATE INPUTS)

PURPOSE: THIS ROUTINE CORRESPONDS TO INSTAT AND WILL WRITE THE VALUES WHICH INSTAT READS IN

OISTEP (WRITE TIME INTERVALS)

PURPOSE: THIS ROUTINE CORRESPONDS TO INSTEP AND WILL WRITE THE VALUE WHICH INSTEP READS IN

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OITIFC (TO OUTPUT THE INPUT VALUES FOR THE TAIL
INTERFERENCE CONSTANTS)

PURPOSE: THIS SUBROUTINE WRITES OUT THE VALUES WHICH WERE READ IN BY SUBROUTINE INTIFC. THIS PRINT OUT IS PART OF THE PROGRAM HEADER, AND INCLUDES THE VARIABLE NAME WITH IS VALUE, AND A BRIEF DESCRIPTION

OUTOIN (WRITE HEADING AND DESCRIPTIVE COMMENTS)

PURPOSE: TO WRITE A HEADING AND DESCRIPTIVE COMMENTS OF THE RUN. TO SET UP THE UNITS ARRAY ACCORDING TO THE UNITS OPTION CHOSEN.

PAERO (PAYLOAD AERODYNAMIC CALCULATIONS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCE AND MOMENT VECTORS ACTING AT THE PAYLOAD CENTER OF GRAVITY IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS

PAXVEC (CALCULATION OF PAYLOAD AUXILIARY STATE VECTORS)

PURPOSE: TO CALCULATE THE PAYLOAD INERTIAL POSITION, RELATIVE VELOCITY AND CABLE VECTORS

PBODRT (CALCULATION OF PAYLOAD ANGULAR BODY RATES)

PURPOSE: CALCULATE THE PAYLOAD ANGULAR BODY RATES IN THE PAYLOAD CG REFERENCE AXIS, FROM THE PAYLOAD EULER RATES

PCABLE (PAYLOAD CABLE FORCES)

PURPOSE: TO CALCULATE THE TOTAL FORCES AND MOMENT EXERTED BY THE CABLES ON THE PAYLOAD AS MEASURED AT THE PAYLOAD CG IN COORDINATES OF THE CG REFERENCE AXIS

PCGDST (CENTER OF GRAVITY REFERENCED PAYLOAD VECTORS)

PURPOSE: TO CALCULATE ALL OF THE POSITION VECTORS FOR PAYLOAD CALCULATIONS REFERENCED TO THE HULL AND PAYLOAD CG REFERENCE AXIS BASED ON THE INPUT POSITION VECTORS

PELRAT (PAYLOAD EULER RATES)

PURPOSE: TO CALCULATE THE PAYLOAD EULER RATES FROM THE CURRENT PAYLOAD STATE VECTOR

PERTUB (GENERATE CONTROL PERTUBATION MATRIX)

PURPOSE: TO LOAD THE CONTROL PERTBATION MATRIX UMAT, USING THE CONTROL VECTOR U AS A STARTING POINT.

PFORCE (EXTERNAL PAYLOAD FORCES AND MOMENTS)

PURPOSE: TO CALCULATE THE PAYLOAD EXTERNAL FORCES AND MOMENTS BASED ON THE PRESENT STATE VECTOR, AND AUXILIARY STATES

PGEEZ (PAYLOAD INERTIAL G'S)

PURPOSE: TO CALCULATE THE PAYLOAD INERTIAL ACCELERATION IN SPACE G'S IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS

PGRVTY (PAYLOAD GRAVITY)

PURPOSE: TO CALCULATE THE GRAVITY FORCE ON THE PAYLOAD

PGSTGN (PAYLOAD GUST GENERATION)

PURPOSE: USING THE STARTING AND ENDING TIME, AND THE MAXIMUM GUST VALUES, WHCIH WERE INPUT, THIS SUBROUTINE WILL CALCULATE AN APPROPRIATE VALUE FOR THE VELOCITY AND ANGULAR VELOCITY OF THE GUST AT THE PRESENT TIME. THESE GUST VALUES WILL FOLLOW A ONE MINUS COSINE CURVE

PGUST (PAYLOAD GUSTS)

PURPOSE: THIS SUBROUTINE IS THE MAIN LEVEL SUBROUTINE FOR THE PAYLOAD GUST VALUES. THIS SUBROUTINE WILL GET THE GUST VALUES FROM A RANDOM GUST STRING, AND ALSO FROM ONE MINUS COSINE GUST, AND SUM THEM INTO THE TOTAL LINEAR AND ANGULAR GUST VELOCITIES

PHIFC (PROPELLER ON HULL INTERFERENCE)

PURPOSE: TO CALCULATE THE PROPELLER ON HULL CROSSFLOW CORRECTION AND PROPELLER ON HULL INTERFERENCE VELOCITY VECTOR

PINTIL (PAYLOAD INTIALIZATION)

PURPOSE: TO INTIALIZE THE PAYLOAD COMMONS

PLINAR (PAYLOAD LINEARIZATION SUBROUTINE)

PURPOSE: THIS IS THE MAIN SUBROUTINE WHICH CALLS THE LINEARIZATION, EIGEN VALUE CALCULATION, AND OUTPUT SUBROUTINES FOR THE PAYLOAD NUMERICAL LINEARIZATION ALGORITHMS

PLODFM (LOAD MATRIX OF PAYLOAD FUNCTIONAL)

PURPOSE: TO LOAD THE MATRIX OF PAYLOAD FUNCTIONALS PFMAT, WITH THE PAYLOAD LINEAR A D ANGULAR DERIVATIVES ASSOCIATED WITH EACH TRIM CONTROL GUESS, STORED AS COLUMNS OF THE TRIM MATRIX PMAT.

PMATRX (LOAD PAYLOAD MASS MATRIX)

PURPOSE: TO LOAD THE PAYLOAD MASS MATRIX WITH INERTIAL MASSES

PMOVAR (PAYLOAD MOTION VARIABLES)

PURPOSE: TO LOAD THE RELATIVE PAYLOAD MOTION VECTORS A, B, C FOR USE IN THE PAYLOAD AERODYNAMIC CALCULATIONS (PWLCAD)

PMTRML (TO PRINT THE MOORED TRIM LIMITS)

PURPOSE: THIS SUBROUTINE IS CALLED AT THE END OF THE TRIM CALCULATION. IT WILL PRINT OUT THE TRIM LIMIT FLAG COUNTERS, INDICATING HOW MANY TIMES THE VARIOUS LIMITS WERE EXCEEDED DURING THE TRIM ITERATION PROCESS

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POSHLD (POSITION HOLD CONTROL SYSTEM)

PURPOSE: TO GENERATE THE VELOCITY COMMANDS NECESSARY TO CAUSE THE VEHICLE TO HOLD IT'S POSITION MEASURED AT THE ACCELEROMETER LOCATION

PPRFIL (PAYLOAD RUN PROFILE COMMANDS)

PURPOSE: TO OBTAIN THE DESIRED PAYLOAD COMMANDS FOR THE CURRENT SIMULATION TIME

PPTURB (PERTURB ONE PAYLOAD VEHCILE STATE)

PURPOSE: TO GENERATE A STABILITY DERIVATIVE AND AUXILIARY STABILITY DERIVATIVE PAYLOAD MATRIX COLUMN, BY PERTUBING ONE PAYLOAD STATE

PQUEST (PAYLOAD INTERACTIVE QUESTIONS)

PURPOSE: THIS SUBROUUTINE WILL ASK THE INTERACTIVE QUESTIONS CONCERNING THE PAYLOAD PROGRAM. IT WILL ALSO READ IN THE LIST OF VALUES INDICATING WHICH PAYLOAD VARIAELES ARE WANTED IN THE OUTPUT. THIS SUBROUTINE IS CALLED ONLY DURING THE PAYLOAD ONLY PROGRAM

PRCOLM (PRINT THE CONDITION LIMITS FOR TRIM)

PURPOSE: TO PRINT THE COUNTERS WHICH HAVE INDICATED THE NUMBER OF TIMES VARIOUS CONDITION LIMITS WERE EXCEEDED DURING THE TRIM CALCULATIONS.

PRNDOM (PAYLOAD RANDOM GUST VALUES)

PURPOSE: THIS SUBROUTINE WILL GET THE RANDOM GUST VALUE FROM THE INPUT FILE, IF THEY HAVE BEEN REQUESTED BY THE USER (PGSTFL=TRUE). IF THE USER HAS REQUESTED A RANDOM GUST INPUTS THIS SUBROUTINE WILL CALL GETSRG, WHICH WILL RETURN A TIME INTERPOLATED GUST VECTOR FROM THE FILE NUMBER INDICATED. IF RANDOM GUSTS ARE NOT WANTED, THIS SUBROUTINE RETURNS ZEROS FOR THE GUST VALUES.

PROFIL (SIMULATION PROFILE COMMANDS)

PURPOSE: TO ISSUE ROTOR AND PROPELLER COMMANDS BASED ON CURRENT SIMULATION TIME

PRPARO (PROPELLER AERODYNAMICS)

PURPOSE: TO CALCULATE THE PROPELLER FORCES AND MOMENTS ABOUT THE LPU CG REFERENCE AXIS.

PRTEFC (PAYLOAD ROTATING COORDINATE FRAME EFFECTS)

PURPOSE: TO CALCULATE THE GYROSCOPIC AND CORIOLIS PAYLOAD FORCES AND MOMENTS FOR USE IN SUBROUTINE PFORCE

PRUNGE (FOURTH ORDER RUNGE-KUTTA NUMERICAL INTEGRATATION)

PURPOSE: TO INTEGRATE THE TIME DERIVATIVES OF THE STATE VECTORS BY A FOURTH ORDER FIXED TIME STEP PRUNGE-KUTTA SCHEME.

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PSTAB (PAYLOAD STABILITY DERIVATIVE)

PURPOSE: THIS PROGRAM WILL GENERATE THE PAYLOAD STABILITY DERIVATIVE MATRICES

PSTORE (PAYLOAD STORE)

PURPOSE: THIS SUBROUTINE IS THE MAIN OUTPUT SUBROUTINE OF THE PROGRAM. IT WILL STORE THE PAYLOAD VARIABLES AT EACH TIME FRAME, AND WILL PRINT THEM OUT IF THE PRINT TIME IS INDICATED. IT ALSO PRINTS OUT VARIOUS FLAGS INDICATING THE CONDITIONS THAT WERE ENCOUNTERED DURING THIS TIME FRAME.

PTCLSD (PAYLOAD TRIM STATE DERIVATIVE CALCULATIONS)

PURPOSE: TO CALCULATE THE PAYLOAD STATE DERIVATIVES CORRESPONDING TO TRIM STATE CONDITIONS

PTIFC (PROPELLER ON TAIL INTERFERENCE CORRECTIONS)

PURPOSE: TO CALCULATE THE PROPELLER ON TAIL INTERFERENCE VELOCITY VECTORS

PTPTRB (PAYLOAD TRIM PERTUBATION)

PURPOSE: TO LOAD THE PAYLOAD MATRIX OF TRIM CONTROL GUESSES BASED ON THE INTIAL ESTIMATE FOR PAYLOAD TRIM CONTROL VECTOR (PU), AND THE PERTURBING SUCCESSIVELY EACH ELEMENT OF THAT VECTOR TO FORM THE MATRIX OF GUESSES (PUMAT)

PTRIM

PURPOSE: TO CALCULATE THE PAYLOAD LINEAR AND ANGULAR ORIENTATION, NECESSARY TO TRIM THE PAYLOAD WITH THE DESIRED UNSTRETCHED CABLE LENGTHS

PTRMLM (PAYLOAD TRIM LIMITS)

PURPOSE: TO TEST THE VARIOUS CABLE TENSIONS TO SEE IF THE ACTIVE CABLES HAVE TENSION DURING THE TRIM CALCULATION IF ANY OF THE ACTIVE CABLES IS NOT UNDER TENSION (DURING TRIM CALCUALTIONS ONLY), TH ROR FLAG IS SET TO TRUE, AND THE ERROR COUNTER INCREMENTED BY ONE. BY SETTING THIS ERROR F THE PRESENT TRIM GUESS IS CONSIDERED ILLEGAL, AND THE TRIMMER WILL ATTEMPT TO OBTAIN A NEW GUESS, (SEE SUBROUTINE PTRIM)

PTRMRT (PAYLOAD TRIM RATES)

PURPOSE: TO CALCULATE THE LINEAR AND ANGULAR VELOCITY OF THE PAYLOAD IN IT'S TRIM STATE AS DETERMINED FROM THE VEHICLE STATES AND THE PAYLOAD ORIENTATION

PTRNFM (PAYLOAD TRANSFORMATION MATRIX FORMULATIONS)

PURPOSE: TO CALCULATE ALL THE ORTHOGONAL AND NON-ORTHOGONAL PAYLOAD TRANSFORMATION MATRICES

PTURB (PERTURB ONE VEHICLE STATE)

PURPOSE: TO GENERATE A STABILITY DERIVATIVE AND AUXILIARY STABILITY DERIVATIVE MATRIX COLUMN BY PERTURBING ONE VEHICLE STATE.

PWINDS (PAYLOAD RELATIVE WIND CALCULATIONS)

PURPOSE: TO CALCULATE THE RELATIVE VELOCITY BETWEEN THE PAYLOAD AERODYNAMIC REFERENCE CENTER, AND THE LOCAL AIR MASS, IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS

PWLOAD (PAYLOAD WIND LOAD CALCULATIONS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS AT THE PAYLOAD AERODYNAMIC REFERENCE CENTER DUE TO A RELATIVE LINEAR AND ANGULAR VELOCITIES BETWEEN THE PAYLOAD AERODYNAMIC REFERENCE CENTER AND THE LOCAL AIR MASS

QUESTN (QUESTIONS)

PURPOSE: ASK INTERACTIVE QUESTIONS FOR THE PROGRAM RUN.

RANDOM (RANDOM INPUTS)

PURPOSE: TO READ IN FOUR GUST VELOCITY VECTORS, AND INTERPOLATE THESE VALUES TO OBTAIN THE GUST PARAMETERS AT EACH COMPONENT REFERENCE CENTER FOR THE PRESENT SIMULATION TIME

RGUSTS (TO GET THE RANDOM GUST VALUES)

PURPOSE: THIS SUBROUTINE WILL GET THE RANDOM GUST VALUES AT THE GUST SOURCES FROM (GETSRG), AND TRANSPOSE THOSE VALUES TO THE HULL COORDINATES AND INTERPOLATE SPATIALLY TO FIND THE GUST VALUES AND GUST DERIVATIVES AT THE LOCATION OF THE VARIOUS COMPONENTS

RHIFC (ROTOR ON HULL INTERFERENCE EFFECTS)

PURPOSE: TO CALCULATE THE ROTOR ON HULL CROSSFLOW INTERFERENCE AND INTERFERENCE VELOCITY VECTOR

RMASS (LOAD REAL MASS ELEMENTS)

PURPOSE: TO LOAD INDIVIDUAL THREE BY THREE MASS ELEMENTS INTO THE MASS MATRIX INVMAS

ROTARO (ROTOR AERODYNAMICS)

PURPOSE: TO CALCULATE THE ROTOR FORCES AND MOMENTS WITH RESPECT TO THE LPU CG REFERENCE AXIS.

ROTEFC (ROTATING COORDINATE FRAME EFFECTS)

PURPOSE: TO CALCULATE THE GYROSCOPIC AND CORIOLIS FORCES AND MOMENTS FOR USE IN SUBROUTINE FORCE

ROTHQY (ROTOR H, Q, AND Y FORCE CALCULATIONS)

PURPOSE: TO CALCULATE THE ROTOR DRAG, TORQUE, AND Y-FORCE COEFFICIENTS.

RPFIFC (ROTOR AND PROPELLER ON FUSELAGE INTERFERENCE EFFECTS)

PURPOSE:, TO CALCULATE THE ROTOR AND PROPELLER ON FUSELAGE INTERFERENCE VELOCITY VECTORS

RPHIFC (ROTOR AND PROPELLER ON HULL INTERFERENCE)

PURPOSE: TO CORRECT THE HULL RELATIVE FREE STRING VELOCITY AND HULL CROSSFLOW COEFFICIENT FOR ROTOR AND PROPELLER INTERFERENCE EFFECTS

RPIFC (ROTOR ON PROPELLER INTERFERENCE)

PURPOSE: TO CORRECT THE PROPELLER RELATIVE FREE STRING VELOCITY FOR ROTOR INTERFERENCE VELOCITY EFFECTS

RPTIFC (ROTOR AND PROPELLER ON TAIL INTERFERENCE)

PURPOSE: TO CORRECT THE TAIL RELATIVE FREE STRING VELOCITY FOR ROTOR AND PROPELLER INTERFERENCE EFFECTS

RRNDMG (READ THE RANDOM GUST)

PURPOSE: THIS SUBROUTINE WILL READ A TIME AND A GUST VECTOR FROM AN INDICATED FILE FOR USE BY THE MAIN PROGRAM AS AN INPUT FOR A RANDOM GUST STRING OF INDEFINITE LENGTH.

RTIFC (ROTOR ON TAIL INTERFERENCE)

PURPOSE: TO CALCULATE THE ROTOR ON TAIL INTERFERENCE VELOCITY VECTOR

RUNGE (FOURTH ORDER RUNGE-KUTTA NUMERICAL INTEGRATION)

PURPOSE: TO INTEGRATE THE TIME DERIVATIVES OF THE STATE VECTORS BY A FOURTH ORDER FIXED TIME STEP RUNGE-KUTTA SCHEME

SETCMD (SET UP THE COMMAND ARRAY)

PURPOSE: THIS SUBROUTINE WILL REORGANIZE THE ARRAY CONTAINING THE FLIGHT CONTROL SYSTEM COMMANDS. FOR THE ALGORITHM OF GETT12 TO WORK PROPERLY, THIS ARRAY MUST CONTAIN A TIME OF ZERO IN IT'S FIRST LOCATION AND A NUMBER LARGER THAN THE PROGRAM SIMULATION TIME IN ITS LAST POSITION. THIS PROGRAM TESTS TO SEE IF THE FIRST COMMAND TIME READ IN WAS ZERO. IF NOT, THEN ALL THE ELEMENTS ARE MOVED, AND A ZERO IS PUT IN THE FIRST COMMAND TIME LOCATION AND THE TRIM VALUE IS PUT IN AS THE CORRESPONDING COMMAND THEN THE SUBROUTINE READS THROUGH ALL THE TIMES UNTIL THE LAST ONE IS FOUND, AND THE SIMULATION TIME IS INSERTED AFTER THE LAST COMMAND, AND THE LAST COMMAND IS DUPLICATED AS THE COMMAND CORRESPONDING TO THE SIMULATION TIME. THIS WILL CAUSE THE PROGRAM TO HOLD THE LAST COMMAND WHICH THE USER HAS INDICATED, TO BE THE COMMAND FOR THE REMAINDER OF THE SIMULATION

SETFCS (SET UP INTIAL FLIGHT CONTROL SYSTEM PARAMETERS)

PURPOSE: THIS SUBROUTINE WILL INTIALIZE THE ACCELEROMETER AND VELOCITY SENSOR LOCATIONS. THE INTEGRATOR VALUES WILL BE SET TO THE TRIM VALUES AND THE COMMAND ARRAYS WILL BE SET UP. (SEE SUBROUTINE SETCMD)

SGLFLW (SIGNAL FLOW)

PURPOSE: TO OBTAIN THE VEHICLE COMMANDS ISSUED BY THE FLIGHT CONTROL SYSTEM CORRESPONDING TO THE PRESENT SIMULATION TIME.

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SHADOW (SHADOW)

PURPOSE: TO CORRECT THE RELATIVE FREE STREAM VELOCITIES OF THE FUSELAGE, ROTORS, AND PROPELLERS FOR HULL WAKE DEFECT INTERFERENCE

SHDANG (SHADOW ANGLE CALCULATIONS)

PURPOSE: TO CALCULATE THE BETA-WAKE ANGLE AND LAMBDA-WAKE ANGLE FOR EACH OF THE ELEMENTS

SHDELM (SHADOW ELEMENT)

PURPOSE: TO CALCULATE THE BETA-WAKE DEFECT AND LAMBDA-WAKE DEFECT FOR EACH ELEMENT

SINTRP (SPATIAL INTERPOLATION)

PURPOSE: TO USE LINEAR SPATIAL INTERPOLATION TO CALCULATE THE GUST INPUT VELOCITY AT ANY LOCATION GIVEN THE GUST INPUT VELOCITIES AT TWO SOURCES

SMTOCG (SUM FORCES AND MOMENTS TO THE CG REFERENCE AXES)

PURPOSE: TO TRANSFER FORCE AND MOMENT VECTORS AT A REFERENCE AXES TO THE CG REFERENCE AXES; AND TO TRANSFORM THEIR COORDINATES INTO THE CG REFERENCE AXES.

SORT

PURPOSE: TO ARRANGE THE VECTOR OF MODIFIED EUCLIDEAN NORMS (ENORM) IN ASCENDING ORDER.

STAB (CALCULATE STABILITY DERIVATIVE MATRICES)

PURPOSE: TO CALCULATE THE LINEARIZED STABILITY DERIVATIVE MATRICES: A, B, C, AAUX, BAUX, CAUX, BPRIM, BAPRIM (SEE BELOW).

STDTRN (STANDARD EULER SEQUENCE TRANSFORMATION MATRIX FORMULATIONS)

PURPOSE: TO CALCULATE THE ORTHOGONAL AND NON-ORTHOGONAL HULL TRANSFORMATION MATRICES

STOLC (TO STORE THE LINKED COMMAND VECTOR)

PURPOSE: THIS SUBROUTINE WILL STORE THE LINKED COMMAND VECTOR AFTER ONE OF THE ITEMS HAS BEEN PERTUBED BY SUBROUTINE PTURB

STOMS (STORE MOORING STATE VECTOR)

PURPOSE: TO LOAD THE PERTUBATION STATE VECTOR INTO THE COMMON SVECTR IN ORDER TO CALCULATE THE LINEARIZED STABILITY MATRIX FOR THE MOORING SIMULATION

STOPS (STORE THE PS VECTOR)

PURPOSE: THIS SUBROUTINE IS PART OF THE STABILITY DERIVATIVE CALCULATIONS. IT WILL STORE INTO THE PS VECTOR THE PERTURBED PSLOCL VECTOR

STORE (TO STORE THE DATA FOR OUTPUT)

PURPOSE: THIS SUBROUTINE IS THE MAJOR OUTPUT SUBROUTINE OF THE PROGRAM. IT WILL PRINT THE DATA WHICH HAS BEEN STORED IN THE OUTPUT ARRAYS. IT WILL ALSO WRITE THE DATA TO OUTPUT FILES, AND PRINT MESSAGES INDICATING THE STATUS OF VARIOUS ASPECTS OF THE PROGRAM

STOS (STORE STATE VECTOR)

PURPOSE: TO LOAD THE PERTURBATION STATE VECTOR INTO COMMON SVECTR IN ORDER TO CALCULATE THE LINEARIZED SYSTEM STABILITY MATRIX.

STOTS (STORE TOTAL STATE VECTOR)

PURPOSE: TO LOAD THE PERTUBATION STATE VECTOR INTO COMMON SVECTR, AND COMMON PSVCTR IN ORDER TO CALCULATE THE LINEARIZED SYSTEM STABILITY MATRIX

STOTXG (STORE GUST PERTUBATION VECTOR)

PURPOSE: TO LOAD THE GUST PERTUBATION MATRIX INTO THE INDIVIDUAL GUST VECTORS FOR THE CALCULATION OF THE GUST STABILITY DERIVATIVE MATRICES.

STOXC (STORE XC VECTOR)

PURPOSE: TO LOAD THE PERTUBATION VECTOR OF ROTOR PROPELLER, AND TAIL SURFACE STATES PRIOR TO CALCUALTION OF STABILITY DERIVATIVES.

STOXPG (STORE THE PAYLOAD GUST VECTOR)

PURPOSE: THIS SUBROUTINE IS PART OF THE PAYLOAD STABILITY DERIVATIVE CALCULATIONS. THIS SUBROUTINE WILL STORE THE VALUES FOUND IN THE VECTOR VCTR INTO THE PAYLOAD VELOCITY AND ANGULAR VELOCITY GUST VECTORS

SUMCON (SUM CONTROLS)

PURPOSE: TO MIX INTEGRATED (LINKED) CONTROLS IN ORDER TO CALCULATE THE UNLINKED (ROTOR PROPELLER, AND TAIL SURFACE) CONTROLS

SUMFOR (SUM VEHICLE FORCES)

PURPOSE: TO CALCULATE THE TOTAL EXTERNAL FORCES ON THE VEHICLE WITH RESPECT TO THE HULL CG REFERENCE AXIS.

TALFOR (GENERALIZED TAIL FORCE AND MOMENT CALCULATIONS)

PURPOSE: A GENERALIZED SUBROUTINE WHICH CALCULATES A SINGLE TAIL FORCE OR MOMENT COMPONENT GIVEN THE CHARACTERISTIC TAIL VELOCITIES AND AERODYNAMIC ANGLES

TANGLS (TAIL AERODYNAMIC ANGLES)

PURPOSE: TO DETERMINE THE TAIL AERODYNAMIC ANGLES NEEDED IN THE CALCULATION OF THE TAIL FORCES AND MOMENTS.

TEIGEN (TO CALCULATE THE EIGEN VALUES AND EIGEN VECTORS FOR THE TOTAL HULL/PAYLOAD SYSTEM)

PURPOSE: THIS SUBROUTINE WILL CALL AND IMSL SUBROUTINE (EIGRF), TO CALCULATE THE EIGEN VALUES AND EIGEN VECTORS OF THE TOTAL HULL/PAYLOAD SYSTEM MATRIX (A). THE EIGEN VECTORS WILL BE NORMALIZED, AND RETURNED AS (NEGNVT).

TGLOAD (TAIL GUST ACCELERATION LOADS)

PURPOSE: TO CALCULATE THE AERODYNAMIC FORCES AND MOMENTS ARISING FROM THE RELATIVE WIND ACCELERATION AT THE TAIL CENTROID.

TINTGR (THE TOTAL VEHICLE/PAYLOAD INTEGRATOR INTERFACE ROUTINE)

PURPOSE: THIS SUBROUTINE IS THE INTERFACING SUBROUTINE WHICH CREATES THE SV VECTOR TO BE PASSED INTO THE SYSTEM INTEGRATOR. THIS SUBROUTINE THEN INTIALIZES VARIABLES AND CALLS THE IMSL RUNGE-KUTTA INTEGRATOR ROUTINE (DVERK).

TLINAR (LINEARIZATION ANALYSIS)

PURPOSE: TO CALCULATE STABILITY DERIVATIVE MATRICES, EIGENVALUES, AND EIGENVECTORS FOR THE PRESENT TRIM CONDITION

TMOVAR (TAIL MOTION VARIABLES)

PURPOSE: TO CALCULATE THE NECESSARY TAIL MOTION VARIABLES, ITH RESPECT TO THE LOCAL AIR MASS FOR AERODYNAMIC JRCE AND MOMENT CALCULATIONS.

TONLY (TAIL ONLY AERODYNAMIC CALCULATIONS)

PURPOSE: TO CALCULATE THE TAIL ONLY AERODYNAMIC FORCE AND MOMENT VECTORS, WITH RESPECT TO THE TAIL CENTROID AXIS.

TPTURB (PERTURB ONE VEHICLE STATE)

PURPOSE: TO GENERATE A STABILITY DERIVATIVE AND AUXILIARY STABILITY DERIVATIVE MATRIX COLUMN BY PERTUBING ONE VEHICLE STATE, FOR THE TOTAL VEHICLE WITH PAYLOAD

TQUEST (QUESTIONS)

PURPOSE: ASK INTERACTIVE QUESTIONS, FOR THE PROGRAM RUN. THIS ROUTINE IS CALLED IN A TOTAL VEHICLE PAYLOAD RUN.

TRIM

PURPOSE: TO CALCULATE THE ROTOR AND PROPELLER CONTROLS NECESSARY TO TRIM THE VEHICLE IN A DESIRED STATE

TRMLIM (TRIM LIMITS)

PURPOSE: TO TEST THE VARIOUS CONTROLS TO SEE IF THEY ARE EXCEEDING THE ALLOWED LIMITS DURING THE TRIM CALCULATION.

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TRNFRM (TRANSFORMATION MATRIX FORMULATIONS)

PURPOSE: TO CALCULATE ALL THE ORTHOGONAL AND NON-ORTHOGONAL TRANSFORMATION MATRICES

TRXFOR (TAIL AXLE FORCE COMPONENT CALCULATION)

PURPOSE: TO CALCULATE THE TAIL AXLE FORCE COMPONENT.

TSROLM (TAIL STATIC ROLLING MOMENT COMPONENT CALCULATIONS)

PURPOSE: TO CALCULATE THE TAIL STATIC ROLLING MOMENT COMPONENT, WITH RESPECT TO THE TAIL CENTROID REFERENCE AXIS

TSTAB (CALCULATE THE HULL/PAYLOAD STABILITY DERIVATIVE MATRICES)

PURPOSE: TO CALCULATE THE LINEARIZED STABILITY DERIVATIVE MATRICES: A, B, C, AAUX, BAUX, CAUX, BPRIM, BAPRIM (SEE BELOW). THIS ROUINE IS CALLED DURING A TOTAL VEHICLE AND PAYLOAD RUN.

TSTCOM (TEST INPUT COMMANDS)

PURPOSE: TO OBTAIN THE TEST INPUT COMMANDS CORRESPONDING TO THE PRESENT SIMULATION TIME

TSTWKA (TO TEST THE WAKE ANGLE)

PURPOSE: THIS SUBROUTINE WILL TEST THE WAKE ANGLES TO SEE IF THEY ARE BOTH LESS THAN 2 PI, AND GREATER THAN ZERO AND ALSO THAT ANGLE1 IS LESS THAN ANGLE2. IF ANY OF THOSE CONDITIONS ARE NOT MET, A MESSAGE IS PRINTED, AND THE PROGRAM IS TERMINATED

VORING (VORTEX RING MODEL)

PURPOSE: TO CALCULATE THE THRUST COEFFICIENT, INFLOW RATIO, AND INDUCED SPEED FOR THE ROTORS AND PROPELLERS IN THE VORTEX RING STATE.

VRNGLM (VORTEX RING LIMITS)

PURPOSE: TO CALCULATE THE LOWER LIMIT AND UPPER LIMIT FOR THE VORTEX RING STATE CORRECTED FOR GROUND EFFECTS

VVMULT (VECTOR VECTOR MULTIPLICATION)

PURPOSE: TO CALCULATE THE DOPT PRODUCT RESULT OF TWO THREE BY ONE VECTORS

V3ADD (VECTOR ADDITION)

PURPOSE: TO CALCULATE THE RESULT OF SUMMING THREE BY ONE VECTORS.

V3NORM (VECTOR EUCLIDEAN NORM)

PURPOSE: TO CALCULATE THE EUCLIDEAN NORM OF A THREE BY ONE VECTOR

V3SCA (SCALAR - VECTOR MULTIPLICATION)

PURPOSE: TO CALCULATE THE RESULT OF THE MULTIPLICATION OF A SCALAR TIMES A THREE BY ONE VECTOR

V3SUB (VECTOR SUBTRACTION)

PURPOSE: TO CALCULATE THE RESULT OF TWO THREE BY ONE VECTORS

WINDS (RELATIVE WIND CALCULATIONS)

PURPOSE: TO CALCULATE THE RELATIVE LINEAR AND ANGULAR VELOCITY ACCELERATIONS, AT EACH OF THE COMPONET REFERENCE CENTERS.

WMSDI (TO WRITE OUT THE MOORED STABILITY INCREMENTS)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT FOR THE USERS INFORMATION AT THE END OF THE STABILITY CALCULATIONS A LIST OF ALL OF THE PERTUBATION INCREMENTS WHICH WERE USED IN THE CALCULATION OF THE STABILITY DERIVATIVES. THESE INCREMENTS ARE VALUES WHICH ARE SET INTERNALLY (SUBROUTINE INTIAL) TO THE PROGRAM

WRTINC (WRITE THE STABILITY DERIVATIVE PERTUBATION INCREMENT)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT ALL OF THE PERTUBATION INCREMENT WHICH WERE USED FOR THE CALCULATION OF THE VARIOUS STABILITY DERIVATIVE MATRICES

WRTIVD (WRITE THE INVALID STABILITY DERIVATIVE VALUES)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT ALL OF THE VALUES WHICH WERE FLAGGED AS BEING INVALID BY SUBROUTINE CDERV

WRTMSB (TO WRITE OUT THE MOORED STABILITY DERIVATIVES)

PURPOSE: THIS SUBROUTINE IS THE MAIN OUTPUT SUBROUTINE FOR THE STABILITY DERIVATIVES. IT WILL PRINT OUT ALL OF THE VARIOUS MATRICES WHICH THE USER HAS REQUESTED

WRTPSB (WRITE THE PAYLOAD STABILITY DERIVATIVE)

PURPOSE: THIS SUBROUTINE IS THE OUTPUT SUBROUTINE FOR THE PAYLOAD STABILITY DERIVATIVES. IT WILL WRITE THE STABILITY DERIVATIVES MATRICES AS WELL AS THE EIGEN VALUES AND EIGEN VECTORS. IT ALSO WILL WRITE THE STABILITY DERIVATIVE MATRICES OUT TO THE BINARY FILE FOR ACCESS BY AN EXTERNAL PROGRAM

WRTSTB (WRITE THE STABILITY DERIVATIVE RESULTS)

PURPOSE: TO WRITE THE RESULTS OF THE STABILITY DERIVATIVE CALCULATIONS IN MATRIX FORMATS AND ALSO, WRITE THESE MATRICES OUT TO A FILE WHICH COULD BE LATER ACCESSED FOR OTHER PURPOSES.

WRTTSB (WRITE THE TOTAL STABILITY DERIVATIVE RESULTS)

PURPOSE: TO WRITE THE RESULTS OF THE STABILITY DERIVATIVE CALCUATIONS IN THE MATRIX FORMATS AND ALSO, WRITE THESE MATRICES OUT TO A FILE WHICH COULD BE LATER ACCESSED FOR OTHER PURPOSES. THIS ROUTINE WRITES THE RESULTS OF THE TOTAL VEHICLE WITH PAYLOAD CALCULATION

WRTVOI (WRITE OUT THE VEHCILE ONLY INCREMENTS)

PURPOSE: THIS SUBROUTINE WILL WRITE OUT THE PERTUBATION INCREMENT USED FOR THE VEHICLE ONLY STABILITY DERIVATIVE CALCULATIONS. THIS SUBROUTINE CORRESPONDS WITH SUBROUTINE WRTINC, WHICH WRITES OUT THE INCREMENT FOR THE STABILITY DERIVATIVE CALCULATIONS OF THE PAYLOAD AND VEHICLE COMBINED

APPENDIX B

ALPHABETICAL LIST OF COMMON BLOCKS WITH DEFINITIONS

ATACH--CONTAINS LPU ATTACH POINT VECTORS WITH RESPECT TO HULL CG REFERENCE AXES
/ATACH/ ATACH1, ATACH2, ATACH3, ATACH4

ATACHP--CONTAINS THE CABLE ATTACH POINTS ON THE HULL WITH RESPECT TO THE HULL CG REFERENCE AXIS
/ATACHP/ ATAHP1, ATAHP2, ATAHP3, ATAHP4

ATAHG--LANDING GEAR ATTACH POINTS ON THE HULL STRUCTURAL FRAME
/ATAHG/ ATAHG1, ATAHG2, ATAHG3, ATAHG4

ATMOS--ATMOSPHERIC PARAMETERS
/ATMOS/ AIRDEN, DENRAT, IGRAV, VWIND

AUXGST--AUXILIARY GUST STATES
/AUXGST/ DUGDXH, DUGDYH, DVGDYH,
DUGDXT, DUGDYT, DVGDYT

AUXVTR--AUXILIARY STATE VECTOR CONTAINING LPU LINEAR VELOCITIES AND INERTIAL POSITIONS
/AUXVTR/ VLPU1, LPIPO1, VLPU2, LPIPO2,
VLPU3, LPIPO3, VLPU4, LPIPO4

BTRANS--CONTAINS HULL AND LPU NON-ORTHOGONAL TRANSFORMATION MATRICES
/BTRANS/ BHEH, BEHH, BE11, B1E1, BE1H, BHE1,
BE22, B2E2, BE2H, BHE2,
BE33, B3E3, BE3H, BHE3,
BE44, B4E4, BE4H, BHE4

CABLC--CABLE DAMPING CONSTANTS
/CABLC/ CABLC1, CABLC2, CABLC3, CABLC4

CABLE--RELATIVE CABLE POSITION VECTORS IN THE HULL CG REFERENCE AXIS
/CABLE/ CABLE1, CABLE2, CABLE3, CABLE4

CABLK--CABLE SPRING CONSTANTS
/CABLK/ CABLK1, CABLK2, CABLK3, CABLK4

CALMHD--CONTAINS USER INPUT HEADING ANGLE FOR MOORED TRIM WITH NO STEADY WIND, OR INTIAL HEADING ANGLE OFF OF THE STEADY WIND WHEN A NON-SYMMETRICAL MOORED TRIM LOCATION IS SOUGHT
CALMHD/ PSIO

CBLTEN--CABLE TENSIONS-ALWAYS POSITIVE SCALAR OR ZERO
/CBLTEN/ CBLTN1, CBLTN2, CBLTN3, CBLTN4

CLOSLP--CONTAINS LOOP CLOSURE FLAGS
/CLOSLP/ ULPFLG, VLPFLG, HDTLPF,
PLPFLG, OLPFLG, TRTLPF

COMAND--FLIGHT CONTROL SYSTEM COMMANDS
/COMAND/ UCMD, VCMD, HDTCMD, PHICMD, THECMD,
TRICMD

DELTAX--CONTAINS LINEARIZATION INCREMENT VECTORS
/DELTAX/ ADELTX, BDELTX, CDELTX, BPDELX

DGUSTS--CONTAINS INTERPOLATED DATA FROM (1-COSINE) GUST INPUTS
/DGUSTS/ DVGST1, DVGST2, DVGST3, DVGST4,
DVHGST, DOHGST, DVTGST, DOTGST,
DDUDXH, DDUDYH, DDVDYH,
DDUDXT, DDUDYT, DDVDYT,
DVDRHG, DODRHG, DVDRTG, DODRTG

EMASMX--INVERTED GENERALIZED VEHICLE MASS MATRIX, CONTAINING INVMAS
/EMASMX/ INVMAS

ERATES--CONTAINS HULL EULER RATES AND LPU GIMBAL EULER RATES
/ERATES/ HULELR, GBRAT1, GBRAT2, GBRAT3, GBRAT4

FCDINT--DERIVATIVES OF THE FLIGHT CONTROL SYSTEM INTEGRATOR VALUES
/FCDINT/ UDINT, VDINT, HDDINT, PHDINT, THDINT,
TRDINT

FCSGNS--FLIGHT CONTROL SYSTEM GAINS
/FCSGNS/ KUSPED, KIU, TAXAC,
KVSPED, KIV, TAYAC,
KHDOT, KIHDOT, TAZAC,
KPHI, KIPHI, TRC[illegible]RT,
KTHETA, TITHET, [illegible]PTHRT,
KTRAT, [illegible]

FCSINT--FLIGHT CONTROL SYSTEM INTERGRATOR VALUES
/FCSINT/ UNIT, [illegible]NT, HDTINT, PHIINT, THEINT,
TRTINT

FCSLIM--FLIGHT CONTROL SYSTEM LIMITS
/FCSLIM/ UILM, ULLM, VILM, VLLM, HDTILM, HDTLLM,
PHIILM, PHILLM, THEILM, THELLM, RILM,
RLLM

FDBKFL--FEEDBACK LOGICAL FLAGS
/FDBKFL/ UFDBK, VFDBK, RFDBK

FORMOM--TAIL ONLY, AND HULL ONLY, FORCE AND MOMENT VECTORS WITH RESPECT TO THEIR OWN REFERENCE CENTERS AND THE HULL CG REFERENCE AXES--THESE ARE PASSED TO SUBROUTINE IACLOD FOR OUTPUT ONLY.
/FORMOM/ RTOAF, RTOAMO, HOABF, HOABMO

FSAROM--CONTAINS LPU AERODYNAMIC COEFFICIENT MATRICES FAROM1, FAROM2, FAROM3, FAROM4
/FSAROM/ F1AROM, F2AROM, F3AROM, F4AROM

GBACL--GIMBAL EULER ANGLE ACCELERATIONS PARAMETERS.
/GBACL/ GBACL1, GBACL2, GBACL3, GBACL4

GBUFF--VEHICLE GUST STRING BUFFERS
/GBUFF/ GS1BUF, GS2BUF, GS3BUF, GS4BUF,
EOFS1, EOFS2, EOFS3, EOFS4

GCMPRS--LANDING GEAR COMPRESSION FORCES
/GCMPRS/ GCPRS1, GCPRS2, GCPRS3, GCPRS4

GEARC--LANDING GEAR DAMPING CONSTANTS
/GEARC/ GEARC1, GEARC2, GEARC3, GEARC4

GEARK--LANDING GEAR SPRING CONSTANTS
/GEARK/ GEARK1, GEARK2, GEARK3, GEARK4

GEARLC--LANDING GEAR TIRE LOCATION WITH RESPECT TO LANDING GEAR ATTACH POINTS
/GEARLC/ GEAR1, GEAR2, GEAR3, GEAR4

GEFP--CALCULATED GROUND ON PROPELLER EFFECTS
/GEFP/ GEFP1, GEFP2, GEFP[illegible]

GEFR--CALCULATED ROTOR ON HULL INTERFERENCE EFFECTS
/GEFR/ GEFR1, GEFR2, GEFR3, GEFR[illegible]

GFRAMK-- [illegible] STRUCTURAL FRAME SPRING CONSTANTS
/GFRAMK/ GFRMK1, GFRMK2, GFRMK3, GFRMK4

GSTRNG--GUST INPUT STRING PARAMETERS
/GSTRNG/ GSTFLG, GST1SF, GST2SF, GST3SF, GS[illegible]

GUSTS--LINEAR AND ANGULAR GUST VELOCITY AT
THE COMPONENT REFERENCE CENTERS.
/GUST/ VGUST1, VGUST2, VGUST3, VGUST4,
VHGUST, OHGUST, VDRHGT, ODHGST,
VTGUST, OTGUST, VDRTGT, ODTGST

HCBLFO--CABLE FORCE AT THE HULL CABLE ATTACH
POINT IN COORDINATES OF THE HULL CG REFERENCE
AXIS
/HCBLFO/ HCBLF1, HCBLF2, HCBLF3, HCBLF4

HGCOM--HULL CENTER OF VOLUME GUST COMMANDS
/HGCOM/ HT1GST, HT2GST,
UHGMAX, VHGMAX, WHGMAX,
PHGMAX, QHGMAX, RHGMAX,
DUXHMX, DUYTMX, DUZHMX

HLAROM--HULL AERODYNAMIC MATRICES
(APPARENT AND NON-APPARENT MASS EFFECT)
/HLAROM/ HULAM, HULTAM, HAROMA, HAROMB, HAROMC,
HAROMD, HAROME

HLCNTC--HULL GROUND CONTACT FLAGS
/HLCNTC/ STGCFL, BWGCFL, BLGCFL

HULL--HULL CONFIGURATION DATA
/HULL/ HULCV, HULTH, HULDIA, HULVOL, HULARA, HULID

INVALD--THE VALUES AND POSITIONS OF
STABILITY DERIVATIVES WHICH WERE
CONSIDERED TO BE INVALID BECAUSE OF
STRONG NONLINEARITIES IN THE SYSTEM
/INVALD/ DERV12, MATIND, ROWPOS, COLPOS, LOCATR,
PRNTMS

JETHST--JET EXHAUST PARAMETERS
/JETHST/ JETHS1, EXLOC1, LP1EXH,
JETHS2, EXLOC2, LP2EXH,
JETHS3, EXLOC3, LP3EXH,
JETHS4, EXLOC4, LP4EXH

KGHCN--GROUND ON HULL INTERFERENCE CONSTANTS
/KGHCN/ KGHA, KGHB

KGP--GROUND ON PROPELLER INTERFERENCE
CONSTANTS
/KGP/ KGP1, KGP2, KGP3, KGP4

KGR--GROUND ON ROTOR INTERFERENCE
CONSTANTS
/KGR/ KGR1, KGR2, KGR3, KGR4

KGT--GROUND ON TAIL INTERFERENCE CONSTANTS
/KGT/ KGTA, KGTB

KHP--HULL ON PROPELLER INTERFRENCE
CONSTANTS
/KHP/ KHPA1, KHPB1,
KHPA2, KHPB2,
KHPA3, KHPB3,
KHPA4, KPHB4

KHR--HULL ON ROTOR INTERFERENCE
CONSTANTS
/KHR/ KHRA1, KHRB1,
KHRA2, KHRB2,
KHRA3, KHRB3,
KHRA4, KHRB4

KPF--PROPELLER ON FUSELAGE INTERFERENCE
CONSTANTS
/KPF/ KPF1, KPF2, KPF3, KPF4

KPH--CONTAINS PROPELLER ON HULL INTERFERENCE
CONSTANTS
/KPH/ KPHA1, KPHB1, KPHC1, KPHD1, KPHE1,
KPHA2, KPHB2, KPHC2, KPHD2, KPHE2,
KPHA3, KPHB3, KPHC3, KPHD3, KPHE3,
KPHA4, KPHB4, KPHC4, KPHD4, KPHE4

KPT--PROPELLER ON TAIL INTERFERENCE
CONSTANTS
/KPT/ KPTA1, KPTB1, KPTC1,
KPTA2, KPTB2, KPTC2,
KPTA3, KPTB3, KPTC3,
KPTA4, KPTB4, KPTC4

KRF--ROTOR ON FUSELAGE INTERFERENCE
CONSTANTS
/KRF/ KRF1, KRF2, KRF3, KRF4

KRH--ROTOR ON HULL INTERFERENCE CONSTANTS
/KRH/ KRHA1, KRHB1, KRHC1, KRHD1, KRHE1,
KRHA2, KRHB2, KRHC2, KRHD2, KRHE2,
KRHA3, KRHB3, KRHC3, KRHD3, KRHE3,
KRHA4, KRHB4, KRHC4, KRHD4, KRHE4

KRP--ROTOR ON PROPELLER INTERFERENCE
CONSTANTS
/KRP/ KRP1, KRP2, KRP3, KRP4

KRT--ROTOR ON TAIL INTERFERENCE CONSTANTS
/KRT/ KRTA1, KRTB1, KRTC1,
KRTA2, KRTB2, KRTC2,
KRTA3, KRTB3, KRTC3,
KRTA4, KRTB4, KRTC4

LANDGL--UNSTRETCHED LANDING GEAR LENGTHS
/LANDGL/ LGRLN1, LGRLN2, LGRLN3, LGRLN4

LGCNTC--LANDING GEAR TIRE CONTACT AND
HULL STRUCTURAL FRAME CONTACT FLAGS FOR
GROUND CONTACT
/LGCNTC/ GCFLF1, GCFLG1,
GCFLF2, GCFLG2,
GCFLF3, GCFLG3,
GCFLF4, GCFLG4

LNKCOM--LINKED COMMAND TEST INPUTS
/LNKCOM/ LKTCM1, LKTCM2, DUDCNL, DVDCNL, DWDCNL,
DPCNTL, DQCNTL, DRCNTL

LPATCH--CONTAINS VECTORS LOCATING THE LPU ATTACH
POINTS WITH RESPECT TO THE LPU CG REFERENCE AXES
/LPATCH/ LTCH1, LTCH2, LTCH3, LTCH4

LPGCOM--LPU CG REFERENCE AXES GUST COMMANDS
/LPGCOM/ L1T1GT, L2T1GT, L3T1GT, L4T1GT,
L1T2GT, L2T2GT, L3T2GT, L4T2GT,
UL1GMX, UL2GMX, UL3GMX, UL4GMX,
VL1GMX, VL2GMX, VL3GMX, VL4GMX,
WL1GMX, WL2GMX, WL3GMX, WL4GMX

LPU--LIFT PROPULSION UNITS CONFIGURATION
PARAMETERS.
/LPU/ NUMLPU, LPUID

LPUAC--CONTAINS VECTORS LOCATING THE LPU
AERODYNAMIC CENTERS WITH RESPECT TO THE LPU
REFERENCE AXES
/LPUAC/ ACLP1, ACLP2, ACLP3, ACLP4

LTRANS--CONTAINS HULL AND LPU ORTHOGONAL
TRANSFORMATION MATRICES
/LTRANS/ LHI, LIH, LH1, L1H, LH2, L2H,
LH3, L3H, LH4, L4H

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MASS--COMPONENT INERTIAL MASS CHARACTERISTICS
/MASS/ MASHUL, IHUL, MASLP1, ILPU1, MASLP2, ILPU2, MASLP3, ILPU3, MASLP4, ILPU4

MAST--CONTAINS LOCATION OF THE MOORING ATTACH POINT RELATIVE TO THE HULL AND RELATIVE TO INERTIAL SPACE
/MAST/ MASTLC, MORPT

MCLMFL--A SET OF FLAG-COUNTERS WHICH COUNT THE NUMBER OF TIMES CONTROL LIMITS ARE EXCEEDED, OR THE NUMBER OF TIMES A SINGULAR MATRIX IS ENCOUNTERED.
/MCLMFL/ THRLFL, A1SLFL, B1SLFL, THPLFL, AILLFL, ELELFL, RUDLFL

MDELTX--MOORING LINEARIZED INCREMENT VECTORS
/MDELTX/ MADLTX, MCDLTX

MECLIM--CONTAINS MECHANICAL CONTROL LIMITS
/MECLIM/ THERMX, A1SRMX, B1SRMX, THEPMX

MODLFL--AN ERROR FLAG INDICATING AN ERROR IN THE CALCULATION OF THE MODEL.
/MODLFL/ MODLER

MTRMCN--MOORING TRIM ALGORITHM CONSTANTS
/MTRMCN/ MKSTRT, MKMIN, MK, MTRMTL, MMXITR, MMXRST

MTRMFL--NUMBER OF TIMES MOORING CONTROL LIMITS ARE EXCEEDED
/MTRMFL/ GEARFL, MODLFL, HLMPFL, MSNGMT

MTRMPC--MOORING TRIM PERTUBATION CONSTANTS
/MTRMPC/ MSCALF, MIN

MUKG--TIRE FRICTION COEFFICEINTS
/MUKG/ MUKG1, MUKG2, MUKG3, MUKG4

NDHTHT--NONDIMENSIONAL HULL AND TAIL HEIGHT BASED ON HULL DIAMETER
/NDHTHT/ NDHHT, NDTHT

NDPHT--NONDIMENSIONAL PROPELLER HEIGHT BASED ON PROPELLER DIAMETER
/NDPHT/ NDPHT1, NDPHT2, NDPHT3, NDPHT4

NDRHT--NONDIMENSIONAL ROTOR HEIGHT BASED ROTOR DIAMETER
/NDRHT/ NDRHT1, NDRHT2, NDRHT3, NDRHT4

OPWANT--OUTPUT VARIABLES WANTED
/OPWANT/ HLWANT, LPWANT, HULMAX, LPUMAX

OUTDTA--OUTPUT VARIABLES.
/OUTDTA/ ZHLDTA, ZLPDTA

OUTHD--T/S HEADER WANTED AND UNITS OPTION
/OUTHD/ HEADER, UNITOP

PAROCN--PROPELLER AERODYNAMIC CONSTANTS
/PAROCN/ LCSP1, DELTP1, LCSP2, DELTP2, LCSP3, DELTP3, LCSP4, DELTP4

PATCH--CONTAINS CABLE ATTACH POINT LOCATIONS WITH RESPECT TO THE PAYLOAD CG REFERENCE AXIS
/PATCH/ PATCH1, PATCH2, PATCH3, PATCH4

PAXVTR--PAYLOAD AUXILIARY STATE VECTORS CONTAINING THE PAYLOAD RELATIVE VELOCITY AND PAYLOAD POSITION.
/PAXVTR/ VPAYRL, PAYIPO

PAYLOD--PAYLOAD CONFIGURATION DATA
/PAYLOD/ PAYCTR, PAYLTH, PAYDTH, PAYVOL, PAYARA, PAYID

PBTRNS--CONTAINS PAYLOAD NON-ORTHOGONAL TRANSFORMATION MATRICES
/PBTRNS/ BPEP, BEPP

PDLTAX--STABILITY DERIVATIVE PERTUBATIONS
/PDLTAX/ PADLTA, PODLTA

PERATS--CONTAINS PAYLOAD EULER RATES
/PERATS/ PAYELR

PFETHR--PROPELLER FEATHERING COMMANDS.
/PFETHR/ PTCOM1, PTCOM2, DTHEP1, DTHEP2, DTHEP3, DTHEP4

PGBUFF--PAYLOAD GUST STRING BUFFERS
/PGBUFF/ GPVBUG, GPOBUF, EOF3J, EOF3G

PGEOM--PROPELLER GEOMETRY CONSTANTS
/PGEOM/ NPBLD1, RADP1, SIGMP1, CORDP1, NPBLD2, RADP2, SIGMP2, CORDP2, NPBLD3, RADP3, SIGMP3, CORDP3, NPBLD4, RADP4, SIGMP4, CORDP4

PGSTRN--PAYLOAD GUST INPUT STRING PARAMETERS
/PGSTRN/ PGSTFL, PVGSCF, POGSCF

PGUSTS--LINEAR AND ANGULAR GUST VELOCITY AT PAYLOAD AERODYNAMIC CENTER
/PGUSTS/ VPGUST, OPGUST

PLTRNS--CONTAINS PAYLOAD ORTHOGONAL TRANSFORMATION MATRICES
/PLTRNS/ LPI, LIP, LPH, LHP

PMASS--PAYLOAD INERTIAL MASS CHARACTERISTICS
/PMASS/ MASPAY, IPAY, INVPMS

PMDLFL--AN ERROR FLAG INDICATING AN ERROR IN THE CALCULATION OF THE PAYLOAD MODEL
/PMDLFL/ PMDLER

POPWNT--PAYLOAD AND CABLE VARIABLES WANTED FOR OUTPUT
/POPWNT/ PYWANT, PYOPMX, CBWANT, CBOPMX

POSHCS--POSITION HOLD CONTROL SYSTEM PARAMETERS
/POSHCS/ POSHT1, POSHT2, KX, KY, KH, KPSI

POSHD--REFERENCE LOCATION FOR HOVER CONTROL
/POSHD/ FIFST, IALCT1, PSIHT1

PPRNTC--PAYLOAD PRINT INTERVAL TEST VALUE
/PPRNTC/ PPRNCK

PRINTC--THE TIME WHEN THE LAST DATA FRAME WAS PRINTED
/PRINTC/ PRNCHK

PROP--PROPELLER HUB LOCATION VECTORS.
/PROP/ PROP1, PROP2, PROP3, PROP4

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PRPRIG--PROPELLER SHAFT RIGGING ANGLES
/PRPRIG/ A1SP1, B1SP1, A1SP2, B1SP2, A1SP3, B1SP3
A1SP4, B1SP4

PSTATE--PROPELLER STATES.
/PSTATE/ THEOP1, OMEGP1, WINP1, TP1, QP1,
THEOP2, OMEGP2, WINP2, TP2, QP2,
THEOP3, OMEGP3, WINP3, TP3, QP3,
THEOP4, OMEGP4, WINP4, TP4, QP4

PSVCTR--CONTAINS PAYLOAD STATE
VECTOR PS
/PSVCETR/ PS

PTRMCN--PAYLOAD TRIM CONSTANTS
/PTRMCN/ PKSTRT, PKMIN, PK, PTRMTL, PMITR, PMXRST

PTRMFL--A SET OF FLAG-COUNTERS
WHICH COUNT THE NUMBER OF TIMES
PAYLOAD CONTROL LIMITS ARE EXCEEDED
OR THE NUMBER OF TIMES A SINGULAR
MATRIX IS ENCOUNTERED
/PTRMFL/ HRPLFL, PSNGMT

PTRMPC--PAYLOAD TRIM PERTUBATION CONSTANTS
/PTRMPC/ PSCALF, PINC

PYAROM--CONTAINS PAYLOAD AERODYNAMIC
MATRICES A, B,
/PYAROM/ PAROMA, PAROMB, PAROMC

PYGCOM--PAYLOAD AERODYNAMIC GUST COMMANDS
/PYGCOM/ PYT1GT, PYT2GT,
UPYGMX, VPYGMX, WPYGMX,
PPYGMX, QPYGMX, RPYGMX

PYOPUT--PAYLOAD OUTPUT DATA
/PYOPUT/ ZPYDTA, ZCBDTA

RAROCN--ROTOR AERODYNAMIC CONSTANTS
/RAROCN/ LCSR1, DELTR1,
LCSR2, DELTR2,
LCSR3, DELTR3,
LCSR4, DELTR4

RELVEL--CONTAINS RELATIVE VELOCITY VECTORS OF THE
ATTACH POINTS WITH RESPECT TO THE HULL CG AXES AND
THE LPU CG REFERENCE AXES.
/RELVEL/ RVELH1, RVEL1H, RVELH2, RVEL2H,
RVELH3, RVEL3H, RVELH4, RVEL4H

RGEOM--ROTOR GEOMETRY CONSTANTS
/RGEOM/ NRBLD1, RADRT1, SIGMR1, CORDR1,
NRBLD2, RADRT2, SIGMR2, CORDR2,
NRBLD3, RADRT3, SIGMR3, CORDR3,
NRBLD4, RADRT4, SIGMR4, CORDR4

RHRLOC--RELATIVE LOCATIONS OF THE LPU'S
AND TAIL CENTROID, WITH RESPECT TO THE
HULL CENTER OF VOLUME REFERENCE AXIS
/RHRLOC/ RHRLP1, RHRLP2, RHRLP3, RHRLP4, RTALOC

RMASCN--ROTOR MASS CONSTANT.
/RMASCN/ LOCNR1, LOCNR2, LOCNR3, LOCNR4

ROTOR--POSITION VECTORS L ING THE ROTOR
HUB, WITH RESPECT TO THE LPU CG REFERENCE
AXES.
/ROTOR/ ROTR1, ROTR2, ROTR3, ROTR4

RSRCLC--GUST INPUT SOURCE LOCATIONS
/RSRCLC/ RFSRCX, RASRCX, RSORCY

RSTATE--ROTOR STATES.
/RSTATE/ THEOR1,A1SR1,B1SR1,OMEGR1,WINR1,TR1,QR1,
THEOR2,A1SR2,B1SR2,OMEGR2,WINR2,TR2,QR2,
THEOR3,A1SR3,B1SR3,OMEGR3,WINR3,TR3,QR3,
THEOR4,A1SR4,B1SR4,OMEGR4,WINR4,TR4,QR4

RSWASH--ROTOR SWASH-PLATE COMMANDS
/RSWASH/ RTCOM1, RTCOM2, DTHER1, DA1SR1, DB1SR1,
DTHER2, DA1SR2, DB1SR2,
DTHER3, DA1SR3, DB1SR3,
DTHER4, DA1SR4, DB1SR4

SDOTC--COPY OF STATE DERIVATIVE VECTOR (SDOT)
/SDOTCP/ CSDOT

SENSOR--VELOCITY AND ACCELERATION SENSOR
LOCATIONS WITH RESPECT TO THE HULL CG
REFERENCE AXIS
/SENSOR/ ACELOC, VSENLC

SGUSTS--CONTAINS INTERPOLATED DATA FROM
GUST INPUT STRING
/SGUSTS/ SVGST1, SVGST2, SVGST3, SVGST4,
SVHGST, SOHGST, SVTGST, SOTGST,
SDUDXH, SDUDYH, SDVDYH,
SDUDXT, SDUDYT, SDVDYT,
SVDRHG, SODRHG, SVDRTG, SODRTG

SHDFCN--HULL ON FUSELAGE SHADOW INTERFERENCE
EFFECT CONSTANTS
/SHDFCN/BWK1F1,BWK2F1,MXBDF1,LWK1F1,LWK2F1,MXLDF1
BWK1F2,BWK2F2,MXBDF2,LWK1F2,LWK2F2,MXLDF2,
BWK1F3,BWK2F3,MXBDF3,LWK1F3,LWK2F3,MXLDF3,
BWK1F4,BWK2F4,MXBDF4,LWK1F4,LWK2F4,MXLDF4

SHDPCN--HULL ON PROPELLER SHADOW INTERFERENCE
EFFECT CONSTANTS
/SHDPCN/BWK1P1,BWK2P1,MXBDP1,LWK1P1,LWK2P1,MXLDP1,
BWK1P2,BWK2P2,MXBDP2,LWK1P2,LWK2P2,MXLDP2,
BWK1P3,BWK2P3,MXBDP3,LWK1P3,LWK2P3,MXLDP3,
BWK1P4,BWK2P4,MXBDP4,LWK1P4,LWK2P4,MXLDP4

SHDRCN--HULL ON ROTOR SHADOW INTERFERENCE
EFFECT CONSTANTS
/SHDRCN/BWK1R1,BWK2R1,MXBDR1,LWK1R1,LWK2R1,MXLDR1,
BWK1R2,BWK2R2,MXBDR2,LWK1R2,LWK2R2,MXLDR2,
BWK1R3,BWK2R3,MXBDR3,LWK1R3,LWK2R4,MXLDR3,
BWK1R4,BWK2R4,MXBDR4,LWK1R4,LWK2R4,MXLDR4

SPDINT--SPACE FOR THE DERIVATIVE OF
ANY ADDITIONAL INTEGRATOR STATES
(SEE SPRINT)
/SPDINT/ BKDSIZ, BKDINT

SPRINT--SPARE INTEGRATOR SPACE.
FUTURE DEVELOPMENT TO THE PROGRAM
MAY WANT TO INCLUDE MORE INTEGRATORS.
THIS MAY BE DONE BY LOADING THE
VALUE INTO ARRAY BLKINT
/SPRINT/ BLKSIZ, BLKINT

STABDV--LOGICAL FLAGS SET BY THE USER
TO REQUEST SPECIFIC STABILITY DERIVATIVE
MATRICES OR NOT
/STABDV/ AMATFL, BMATFL, BPMTFL, CMATFL, CPMTFL

STALLS--CONTAINS THE AERODYNAMIC
REGIMES FLAGS
/STALLS/ SYSTAL, DYSTAL, SZSTAL

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SVECTR--CONTAINS VEHICLE STATE VECTOR S
/SVECTR/ S
EQUIVALENCE [S(1), VHUL(1)], [S(4), OMGHUL(1)],
[S(7), HULPOS(1)], [S(10), HULEUL(1)],
[S(13), OMGPU1(1)], [S(16), GBANG1(1)],
[S(19), OMGPU2(1)], [S(22), GBANG2(1)],
[S(25), OMGPU3(1)], [S(28), GBANG3(1)],
[S(31), OMGPU4(1)], [S(34), GBANG4(1)]

TAUTS--TAIL SURFACE DEFLECTION EFFECTIVENESS CONSTANT
/TAUTS/ TAUA, TAUE, TAUR

TAIL--TAIL ENSEMBLE CONFIGURATION DATA
/TAIL/ NUMFIN, TALOC, TALARA, TSPAN, TALID

TDEFLC--TAIL SURFACE DEFLECTION COMMANDS
/TDEFLC/ TTCOM1, TTCOM2, DDLTAL, DDLTEL, DDLTRD

TDRVS--TAIL MOTION VARIABLE DERIVATIVES (NO LINEAR OR ANGULAR ACCELERATIONS)
/TDRVS/ XUUABT,
YBVSQT, YBSVST, YVVABT, YAPVST, YAPSVS,
YPPABT,
ZAVSQT, ZASVST, ZWWABT,
LBVSQT, LBAVST, LVVABT, LAPVST, LPSUS,
LPPABT

TGCOM--TAIL CENTROID GUST COMMANDS
/TGCOM/ TT1GST, TT2GST,
UTGMAX,VTGMAX,WTGMAX,
PTGMAX, QTGMAX, RTGMAX,
DUXTMX, DUYTMX, DVYTMX

TLAROM--TAIL AERODYNAMIC MATRICES (APPARENT MASS EFFECTS ONLY)
/TLAROM/ TALAM, TALTAM

TPARAM--TAIL AERODYNAMIC MODEL PARAMETERS
/TPARAM/ LAMTXQ, LAMTXR, LAMTZP,
AL1T, AL2T, BETA1T, BETA2T, AL1T, ALP2T

TRIMFL--A SET OF FLAG COUNTERS WHICH COUNT THE NUMBER OF TIMES CONTROL LIMITS ARE EXCEEDED, OR THE NUMBER OF TIMES A SINGULAR MATRIX IS ENCOUNTERED.
/TRIMFL/ THERFL, THEPFL, A1SRFL, B1SRFL, SNGMTX

TRMCNT--TRIM ALGORITHM CONSTANTS
/TRMCNT/ KSTART, KMIN, K, TRMTOL, EPSILN,
MXITER, MXREST

TRMQT--TRIM TERMINATION FLAG
/TRMQT/ TQUIT

TSDEFL--TAIL SURFACE DEFLECTION ANGLE
/TSDEFL/ DELTAL, DELTEL, DELTRD

UCCFWC--CONTAINS UNCORRECTED CROSSFLOW DRAG COEFFICIENT
/UCCFWC/ CCO

UCTLCS--UNCORRECTED TAIL LIFT CURVE SLOPE PARAMETER
/UCTLCS/ UZAVST

UNILST--ARRAY OF UNITS
/UNILST/ UNITS

USCLTH--UNSTRETCHED CABLE LENGTHS
/USCLTH/ USLTH1, USLTH2, USLTH3, USLTH4

VRINGP--FOUR FLAGS INDICATING A VORTEX RING ON ONE OF THE PROPELLERS.
/VRINGP/ VRINR1, VRINR2, VRINR3, VRINR4

VRINGR--FOUR FLAGS INDICATING A VORTEX RING ON ONE OF THE ROTORS
/VRINGR/ VRINR1, VRINR2, VRINR3, VRINR4

APPENDIX C

COMMON BLOCK/SUBROUTINE AND SUBROUTINE/COMMON BLOCK CROSS REFERENCES

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COMMON/SUBROUTINE CROSS REFERENCE

****

ATACH
SUBROUTINES: AUXVEC, CGDIST, LOADMT, LOADT

ATACHP
SUBROUTINES: CBLFOR, CPINC, ESTPUO, HCABLE, INTIAL, PAXVEC, PCGDST

ATAHG
SUBROUTINES: CMPINC, GEARF, LGEAR, MAXVEC, MCGDST

ATMOS
SUBROUTINES: BOYUNC, CLMTRM, COFVEC, DCFLWC, DVTRST, ESTMUO, ESTUO, FUSARO, GRAVTY, GTAIFC, HDIFC, HGEEZ, HGLOAD, HWLOAD, IACLOD, INATMOS, LOADAM, MCTSTP, MORDSK, MTRMLM, OIATMOS, PGEEZ, PGRAVTY, PRPARO, PTRMLM, PWINDS, PWLOAD, TGLOAD, TONLY, WINDS

AUXGST
SUBROUTINES: BOYGRD, BOYUNC, FILARY, FRMGDV, HGLOAD, HMOVAR, INTIAL, LODGST, TGLOAD

AUXVTR
SUBROUTINES: AUXVEC, FILARY, NDMLOC, ROTEFC, WINDS

BTRANS
SUBROUTINES: BODRAT, EULRAT, LOADUA, LODMUA, TRNFRM

CABLC
SUBROUTINES: CBLFOR, INCABL, OICABL

CABLE
SUBROUTINES: CBLFOR, CPINC, PAXVEC

CABLK
SUBROUTINES: CBLFOR, CKTSTP, INCABL, OICABL, PTRMLM

CALMHD
SUBROUTINES: CLMTRM, ESTMUO, INMTRA, OIMTRA

CBLTEN
SUBROUTINES: CBLFOR, PPTURB, PTRMLM, TPTURB

CLOSLP
SUBROUTINES: CLCSVD, CLTSVD, INFCSC, OIFCSC, SETFCS, SGLFLW

COMAND
SUBROUTINES: COMGEN, INPROF, INTIAL, OIPROF, SETFCS

DELTAX
SUBROUTINES: CPINC, INTIAL, STAB, TSTAB, WRTINC, WRTVOI

DGUSTS
SUBROUTINES: GUSGEN, INTIAL, LODGST

EMASMX
SUBROUTINES: APPMAS, CALCFC, CLCMFC, GETMSD, GETSD, INTIAL, MASMAT, RMASS

ERATES
SUBROUTINES: BODRAT, CALCSD, CLCMSD, EULRAT, FDBACK, FILARY, GEARV, GETMSD, GETSD, INSTAT, INTIAL, OISTAT, SETFCS

FCDINT
SUBROUTINES: CLCSVD, CLTSVD, INTIAL, SGLFLW

FCSGNS
SUBROUTINES: INFCSC, OIFCSC, SGLFLW

FCSINT
SUBROUTINES: CLCSVD, CLTSVD, FILARY, FORMSV, FRMTSV, INTIAL, SETFCS, SGLFLW

FCSLIM
SUBROUTINES: CLCSVD, CLTSVD, INFCSC, OIFCSC, SETFCS, SGLFLW

FDBKFL
SUBROUTINES: FDBACK, INFCSC, OIFCSC, SETFCS

FORMOM
SUBROUTINES: HULARO, IACLOD

FSAROM
SUBROUTINES: FUSARO, INLARO, OILARO

GBACL
SUBROUTINES: INTIAL, LOADUA, LODMUA

GBUFF
SUBROUTINES: INTIAL, RGUSTS

GCMPRS
SUBROUTINES: GEARF, MPTURB, MTRMLM

GEARC
SUBROUTINES: GEARF, INGEAR, OIGEAR

GEARK
SUBROUTINES: CMPINC, GEARF, INGEAR, MAXVEC, MCTSTP, MTRMLM, OIGEAR

GEARLC
SUBROUTINES: CMPINC, GEARF, LGEAR, MAXVEC, MINTIL

GERILC
SUBROUTINES: MAXVEC

GFRAMK
SUBROUTINES: GEARF, INGEAR, OIGEAR

GEFP
SUBROUTINES: PHIFC, PRFARO, PTIFC

GEFR
SUBROUTINES: RHIFC, ROTARO, RTIFC

GSTRNG
SUBROUTINES: INGUST, OIGUST, RANDOM, RGUSTS

GUSTS
SUBROUTINES: AERO, BOYUNC, FILARY, FRMGDV, MAERO, WINDS

HCBLFO
SUBROUTINES: CBLFOR, HCABLE, INTIAL

HGCOM
SUBROUTINES: GUSGEN, INGUST, INTIAL, OIGUST

HLAROM
SUBROUTINES: CFLOWC, GHCIFC, HGLOAD, HWLOAD, IACLOD, INHARO, INTIAL, LOADAM,

HLCNTC
SUBROUTINES: MAXVEC, STORE

HULL
SUBROUTINES: AUXVEC, BOYUNC, CGDIST, ESTPUO, HGCNTC, HGEOM, HULARO, IACLOD, INHARO, MAXVEC, NDMLOC, OIGEOM, PTRMLM, WINDS

IMRLOD
SUBROUTINES: IMLOAD

INVALD
SUBROUTINES: CDERV, INTIAL, WRTIVD

JETHST
SUBROUTINES: EXHAST, INEXST, OIEXST

KGHCN
SUBROUTINES: GHCIFC, GHVIFC, INHIFC, OIHIFC

KGP
SUBROUTINES: INPIFC, OIPIFC, PRPARO

KGR
SUBROUTINES: INRIFC, OIRIFC, ROTARO

KGT
SUBROUTINES: GTAIFC, GTIFC, INTIFC, OITIFC

KHP
SUBROUTINES: INPIFC, OIPIFC, PRPARO

KHR
SUBROUTINES: INRIFC, OIRIFC, ROTARO

KPF
SUBROUTINES: INFIFC, OIFIFC, RPFIFC

KPH
SUBROUTINES: INHIFC, OIHIFC, PHIFC

KPT
SUBROUTINES: INTIFC, OITIFC, PTIFC

KRF
SUBROUTINES: INFIFC, OIFIFC, RPFIFC

KRH
SUBROUTINES: INHIFC, OIHIFC, RHIFC

KRP
SUBROUTINES: INPIFC, OIPIFC, RPIFC

KRT
SUBROUTINES: INTIFC, OITIFC, RTIFC

LANDGL
SUBROUTINES: CMPINC, GEARF, INGEAR, MAXVEC, OIGEAR

LGNCTC
SUBROUTINES: GEARF, MAXVEC, STORE

LNKCOM
SUBROUTINES: INPROF, OIPROF, TSTCOM

LPATCH
SUBROUTINES: AUXVEC, CGDIST, LOADMT, LOADT

LPGCOM
SUBROUTINES: GUSGEN, INGUST, INTIAL, OIGUST

LPU
SUBROUTINES: LPGEOM, OIGEOM

LPUAC
SUBROUTINES: CGDIST, FUSARO, WINDS

LTRANS
SUBROUTINES: AUXVEC, BODRAT, BOYUNC, CLCMSD, CLMTRM, ESTPUO, ESTUO, EULRAT, FDBACK, FRTION, GEARF, GEARV, GETMSD, GETSD, GINTRP, GRAVTY, GUNITV, HGCNTC, LGPOS, LOADCA, LOADMT, LOADT, LODMCA, LODSVC, NDMLOC, PAXVEC, POSHLD, PRPARO, PTRMFM, RGUSTS, ROTARO, SETFCS, SHADOW, SUMFOR, TRNFRM, WINDS

MASS
SUBROUTINES: GRAVTY, INMASS, INTIAL, MASMAT, MCTSTP, MTRMLM, OIMASS, ROTEFC

MAST
SUBROUTINES: CMAXAI, INMOOR, LOADMT, LODMCA, LODSVC, MCGDST, OIMOOR

MCLMFL
SUBROUTINES: HRDLIM, STORE

MDELTX
SUBROUTINES: CMPINC, MINTIL, MSTAB, WMSDI

MECLIM
SUBROUTINES: HRDLIM, INMCLC, OIMCLC, TRMLIM

MODLFL
SUBROUTINES: CALCCT, ESTMUO, MAXVEC, NEWMU, NEWU

MUKG
SUBROUTINES: INGEAR, OIGEAR

MTRMCN
SUBROUTINES: MINTIL, MTRIM, NEWMU

MTRMFL
SUBROUTINES: MINTIL, MTRMLM, PMTRML, NEWMU

MTR[illegible]
SUBROUTINES: MINTIL, MTPTRB

MUKG
SUBROUTINES: GEARF, INGEAR

NDHTHT
SUBROUTINES: GHCIFC, GHVIFC, GTAIFC, GTIFC, NDMLOC

NDPHT
SUBROUTINES: NDMLOC, PRPARO

NDRHT
SUBROUTINES: NDMLOC, ROTARO

OPWANT
SUBROUTINES: QUESTN, STORE, TQUEST

OUTDTA
SUBROUTINES: BOYUNC, CALCFC, CFLOWC, CLCMFC, EXHAST, FDBACK, FILARY, GEARF, GHVIFC, GTIFC, HCABLE, HGEEZ, HGLOAD, HMOVAR, HONLY, HULARO, HWLOAD, IACLOD, IMLOAD, LGEAR, LODGST, LPUARO, MAXVEC, MLPARO, NDMLOC, PHIFC, POSHLD, PROFIL, PRPARO, RGUSTS, RHIFC, ROTARO, RPFIFC, RPIFC, RPTIFC, SGLFLW, STORE, TANGLS, TGLOAD, TONLY, WINDS

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OUTHD
SUBROUTINES: CALCHP, OIATMOS, OIEXST, OIFCSC, OIGEAR, OIGEOM, OIGUST, OIHARO, OIHIFC, OILARO, OIMASS, OIMCLC, OIMOOR, OIPIFC, OIPROF, OIPROP, OIRIFC, OISTAT, OISTEP, OITIFC, OUTOIN

PAROCN
SUBROUTINES: ESTUO, INLARO, MPRPAR, OILARO, PRPARO, TRMLIM

PATCH
SUBROUTINES: CBLFOR, CPINC, ESTPUO, PAXVEC, PCABLE, PCGDST

PAXVTR
SUBROUTINES: CABLEV, GETPSD, PAXVEC

PAYLOD
SUBROUTINES: ESTPUO, INPGEO, OIPGEO, PAERO, PCGDST, PTRMLM, PWINDS

PBTRNS
SUBROUTINES: PBODRT, PELRAT, PTRNFM

PDLTAX
SUBROUTINES: CPINC, PINTIL, PSTAB, TSTAB, WRTINC

PERATS
SUBROUTINES: GETPSD, INPYST, PBODRT, PELRAT, PINTIL

PFETHR
SUBROUTINES: INPROF, INTIAL, OIPROF, TSTCOM

PGBUFF
SUBROUTINES: PINTIL, PRNDOM

PGEOM
SUBROUTINES: DSKLOD, ESTUO, LPGEOM, MPRPAR, NDMLOC, OIGEOM, PHIFC, PRPARO

PGSTRN
SUBROUTINES: INPGST, OIPGST, PRNDOM

PGUSTS
SUBROUTINES: FRMPVT, FRMTVT, PGUSTS, PINTIL, PWINDS, STOTXG, STOXPG

PLTRNS
SUBROUTINES: CABLEV, CBLFOR, PAXVEC, PGRAVTY, PRNDOM, PTRMRT, PTRNFM, PWINDS

PMASS
SUBROUTINES: CKTSTP, GETPSD, [illegible], OIPMAS PGRAVTY, PINTIL, [illegible]PX, PRTEFC, PTRMLM

PMDLFL
SUBROUTINES: NEWPU

POPWNT
SUBROUTINES: PSTORE, TQUEST

POSHCS
SUBROUTINES: COMGEN, INFCSC, MINTIL, OIFCSC, POSHLD, STORE

POSHD
SUBROUTINES: INTIAL, POSHLD

PPRN[illegible]
SUBROUTINES: PINTIL, PSTORE

PRINTC
SUBROUTINES: INTIAL STORE

PROP
SUBROUTINES: CGDIST, MPRPAR, NDMLOC, PRPARO, WIN[illegible]

PRPRIG
SUBROUTINES: ESTUO, LPGEOM, MPRPAR, OIGEOM, PRPA[illegible]

PSTATE
SUBROUTINES: CALCHP, CONTRL, DSKLOD, ESTUO, FILARY, FRMTVT, FRMVTR, INPROP, INTIAL, LOADFM, NEWU, OIPROP, PHIFC, PROFIL, PRPARO, PTIFC, STOLC, STOXC, TRIM, TRMLIM

PSVCTR
SUBROUTINES: CABLEV, CLTSVD, ESTPUO, FRMPVT, FRMTSV, FRMTVT, GETPSD, INPYST, NEWPU, PAXVEC, PBODRT, PELRAT, PGEEZ, PINTIL, PLODFM, PRTEFC, PSTORE, PTRIM, PTRMLM, PTRMRT, PTRNFM, PWINDS, STOPS, STOTS

PTRMCN
SUBROUTINES: NEWPU, PINTIL, PTRIM

PTRMFL
SUBROUTINES: NEWPU, PINTIL, PTRIM, PTRMLM

PTRMP
SUBROUTINES: PINTIL, PTPTRB

PYAROM
SUBROUTINES: LOADPM, PINTIL, PWLOAD

PYGCOM
SUBROUTINES: INPGST, OIPGST, PGSTGN

PYOPUT
SUBROUTINES: CBLFOR, PAERO, PAXVEC, PCABLE, PGEEZ, PSTORE, PWINDS, PWLOAD

RAROCN
SUBROUTINES: ESTUO, INLARO, MRTARO, OILARO, ROTARO

RELVEL
SUBROUTINES: AUXVEC, LOADCA, LODMCA

RGEOM
SUBROUTINES: DSKLOD, ESTUO, LPGEOM, MRTARO, NDMLOC, OIGEOM, RHIFC, ROTARO

RHRLOC
SUBROUTINES: AUXVEC, CGDIST, GINTRP HGEOM, OIGEOM

RMASCN
SUBROUTINES: INMASS, OIMASS, ROTARO

ROTOR
SUBROUTINES: CGDIST, MRTARO, NDMLOC, ROTARO, WINDS

RSRCLC
SUBROUTINES. GINTRP, INGUST, OIGUST

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RSTATE
SUBROUTINES: CALCHP, CONTRL, DSKLOD, ESTUO, FILARY, FRMTVT, FRMVTR, INPROP, INTIAL, LOADFM, MRTARO, NEWU, OIPROP, PROFIL, RHIFC, ROTARO, RTIFC, STOLC, STOXC, TRIM, TRMLIM

RSWASH
SUBROUTINES: INPROF, INTIAL, OIPROF, TSTCOM

SDOTCP
SUBROUTINES: CALCSD, FDBACK

SENSOR
SUBROUTINES: FDBACK, INTIAL, POSHLD, WINDS

SGUSTS
SUBROUTINES: FMSDV, FRMTVT, FRMVTR, INTIAL, LODGST, RANDOM, STOTXG, STOXG

SHDFCN
SUBROUTINES: INFIFC, OIFIFC, SHADOW

SHDPCN
SUBROUTINES: INPIFC, OIPIFC, SHADOW

SHDRCN
SUBROUTINES: INRIFC, OIRIFC, SHADOW

SPDINT
SUBROUTINES: CLCSVD, CLTSVD, INTIAL

SPRINT
SUBROUTINES: CLCSVD, CLTSVD, FORMSV, FRMTSV, INTIAL

STABDV
SUBROUTINES: INSTAB, LINEAR, MLINAR, MSTAB, OISTAB, PLINAR, STAB, TLINAR, TSTAB, WRTMSB, WRTPSB, WRTSTB, WRTTSB

STALLS
SUBROUTINES: STORE, TONLY

SVECTR
SUBROUTINES: AUXVEC, BODRAT, BOYUNC, CABLEV, CLCSVD, CLMSVD, CLMTRM, CLTSVD, ESTMUO, EULRAT, FDBACK, FILARY, FMSDV, FORMSV, FRMLVH, FRMMSV, FRMTSV, FRMTVT, FRMVTR, GEARV, GETMSD, GETSD, GHCIFC, HGCNTC, HGEEZ, HMOVAR, INMRST, INSTAT, INTIAL, LGPOS, LOADCA, LODMCA, LODSVC, LPGEOM, MLODFM, MTRIM, MTRMLM, NDMLOC, NEWMU, OIGEOM, OISTAT, PAXVEC, POSHLD, PTRMRT, ROTARO, ROTEFC, SETFCS, STOMS, STOX, STOTS, TRMFRM, WINDS

TAUTS
SUBROUTINES: NDMLOC, OIGEOM, TANGLS, TMOVAR, TONLY, WINDS

TAUTS
SUBROUTINES: INHARO, O HARO, TANGLS, TRMLIM

TDEFLC
SUBROUTINES: INPROF, OIPROF, TSTCOM

TDRVS
SUBROUTINES: GTAIFC, GTIFC, INHARO, OI' TONLY

TGCOM
SUBROUTINES: GUSGEN, INGUST, INTIAL, OIGUST

TLAROM
SUBROUTINES: IACLOD, INHARO, INTIAL, LOADAM, TGLOAD

TPARAM
SUBROUTINES: HULARO, INHARO, OIHARO, TONLY

TRIMFL
SUBROUTINES: INTIAL, NEWU, PRCOLM, TRMLIM

TRMCNT
SUBROUTINES: INTIAL, NEWU, PERTUB, TRIM

TRMQT
SUBROUTINES: INTIAL, MTRIM, PTRIM, TRIM

TSDEFL
SUBROUTINES: ESTUO, FRMTVT, FRMVTR, INMTRA, INTIAL, LOADFM, NEWU, OIMTRA, PROFIL, STOLC, STOXC, TNAGLS, TRIM, TRMLIM

UCCFWC
SUBROUTINES: CFLOWC, INHARO

UCTLCS
SUBROUTINES: GTIFC, INHARO

UNILST
SUBROUTINES: OIATMOS, OICABL, OIEXST, OIFCSC, OIFIFC, OIGEAR, OIGEOM, OIGUST, OIHARO, OIHIFC, OILARO, OIMASS, OIMCLC, OIMOOR, OIMRST, OIMTRA, OIPARO, OIPGEO, OIPGST, OIPIFC, OIPMAS, OIPROF, OIPROP, OIPYST, OIRIFC, OISTAT, OISTEP, OITIFC, OUTOIN

UUCLTH
SUBROUTINES: CBLFOR, CPINC, ESTPUO, INPGEO, OIPGEO

VRINGP
SUBROUTINES: PRPARO, STORE

VRINCR
SUBROUTINES: ROTARO, STORE

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*****************************************************************************
                    SUBROUTINE/COMMON CROSS REFERENCE
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HLAMOR
  COMMON BLOCKS:  NONE

HLAPAY
  COMMON BLOCKS:  NONE

HLASIM
  COMMON BLOCKS:  NONE

AEFFCT
  COMMON BLOCKS:  NONE

AERO
  COMMON BLOCKS:  GUSTS

AMASMA
  COMMON BLOCKS:  NONE

AFPMAS
  COMMON BLOCKS:  EMASMX

AROTRN
  COMMON BLOCKS:  NONE

AUXVEC
  COMMON BLOCKS:  ATACH, AUXVTR, HULL, LPATCH,
                  LTRANS, RELVEL, RHRLOC, SVECTR

AVLIFT
  COMMON BLOCKS:  NONE

BODRAT
  COMMON BLOCKS:  BTRANS, ERATES, LTRANS, SVECTR

BOYUNC
  COMMON BLOCKS:  ATMOS, AUXGST, GUSTS, HULL,
                  LTRANS, OUTDTA, SVECTR

CABLEV
  COMMON BLOCKS:  PAXVTR, PLTRNS, PSVCTR, SVECTR

CALCCT
  COMMON BLOCKS:  MODLFL

CALCDL
  COMMON BLOCKS:  NONE

CALCFC
  COMMON BLOCKS:  EMASMX, OUTDTA

CALCHP
  COMMON BLOCKS:  OUTHD, PSTATE, RSTATE

CALCSD
  COMMON BLOCKS:  ERATES, SDOTCP

CALCTA
  COMMON BLOCKS:  NONE

CBLFOR
  COMMON BLOCKS:  ATACHP, CABLC, CABLE, CABLK,
                  CBLTEN, HCBLFO, PATCH, PLTRNS,
                  PYOPUT, USCLTH

CBLTEN
  COMMON BLOCKS:  NONE

CDERV
  COMMON BLOCKS:  INVALD

CFLOWC
  COMMON BLOCKS:  HLAROM, OUTDTA, UCCFWC

CGDIST
  COMMON BLOCKS:  ATACH, HULL, LPATCH, LPUAC,
                  PROP, RHRLOC, ROTOR, TAIL

CKTSTP
  COMMON BLOCKS:  CABLK, PMASS

CLCEFM
  COMMON BLOCKS:  NONE

CLCMFC
  COMMON BLOCKS:  EMASMX, OUTDTA

CLCMSD
  COMMON BLOCKS:  ERATES, LTRANS

CLCPSD
  COMMON BLOCKS:  NONE

CLCSVD
  COMMON BLOCKS:  CLOSLP, FCDINT, FCSINT, FCSLIM,
                  SPDINT, SPRINT, SVECTR

CLMSVD
  COMMON BLOCKS:  SVECTR

CLMTRM
  COMMON BLOCKS:  ATMOS, CALMHD, LTRANS, SVECTR

CLTSTP
  COMMON BLOCKS:  NONE

CLTSVD
  COMMON BLOCKS:  CLOSLP, FCDINT, FCSINT, FCSLIM,
                  PSVCTR, SPDINT, SPRINT, SVECTR

CMAXAI
  COMMON BLOCKS:  MAST

CMFINC
  COMMON BLOCKS:  ATAHG, GEARK, GEARLC, LANDGL,
                  MDELTX

COFVEC
  COMMON BLOCKS:  ATMOS

COMGEN
  COMMON BLOCKS:  COMAND, POSHCS

CONTRL
  COMMON BLOCKS:  PSTATE, RSTATE

CPINC
  COMMON BLOCKS:  ATACHP, CABLE, DELTAX, PATCH,
                  PDLTAX, USCLTH

CROSOP
  COMMON BLOCKS:  NONE

CROSS
  COMMON BLOCKS:  NONE

CUNITV
  COMMON BLOCKS:  NONE

C1MCOS
  COMMON BLOCKS:  NONE

DCFLWC
  COMMON BLOCKS:  ATMOS

DEFCT
  COMMON BLOCKS:  NONE
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DHTIVL
COMMON BLOCKS: NONE

DSKIVL
COMMON BLOCKS: NONE

DSKLOD
COMMON BLOCKS: PGEOM, PSTATE, RGEOM, RSTATE

DVTRST
COMMON BLOCKS: ATMOS

D1MCOS
COMMON BLOCKS: NONE

EIGEN
COMMON BLOCKS: NONE

ESTMUO
COMMON BLOCKS: ATMOS, CALMHD, MODLFL, SVECTR

ESTPUO
COMMON BLOCKS: ATACHP, HULL, LTRANS, PATCH, PAYLOD, PSVCTR, USCLTH

ESTUO
COMMON BLOCKS: ATMOS, LTRANS, PAROCN, PGEOM, PRPRIG, PSTATE, RAROCN, RGEOM, RSTATE, TSDEFL

EULRAT
COMMON BLOCKS: BTRANS, ERATES, LTRANS, SVECTR

EXHAST
COMMON BLOCKS: JETHST, OUTDTA

EXTRAC
COMMON BLOCKS: NONE

FDBACK
COMMON BLOCKS: ERATES, FDBKFL, LTRANS, OUTDTA, SDOTCP, SENSOR, SVECTR

FILARY
COMMON BLOCKS: AUXGST, AUXVTR, ERATES, FCSINT, GUSTS, OUTDTA, PSTATE, RSTATE, SVECTR

FLAGS
COMMON BLOCKS: NONE

FLAP
COMMON BLOCKS: NONE

FMSDV
COMMON BLOCKS: SGUSTS, SVECTR

FORCE
COMMON BLOCKS: NONE

FORMSV
COMMON BLOCKS: FCSINT, SPRINT, SVECTR

FRMGDV
COMMON BLOCKS: AUXGST, GUSTS

FRMLVH
COMMON BLOCKS: SVECTR

FRMMSV
COMMON BLOCKS: SVECTR

FRMPVT
COMMON BLOCKS: PGUSTS, PSVCTR

FRMTSV
COMMON BLOCKS: FCSINT, PSVCTR, SPRINT, SVECTR

FRMTVT
COMMON BLOCKS: PGUSTS, PSTATE, PSVCTR, RSTATE, SGUSTS, SVECTR, TSDEFL

FRMVTR
COMMON BLOCKS: PSTATE, RSTATE, SGUSTS, SVECTR, TSDEFL

FRTION
COMMON BLOCKS: LTRANS

FUSARO
COMMON BLOCKS: ATMOS, FSAROM, LPUAC

GEARF
COMMON BLOCKS: ATAHG, GCMPRS, GEARC, GEARK, GEARLC, GFRAMK, LANDGL, LGCNTC, LTRANS, MUKG, OUTDTA

GEARV
COMMON BLOCKS: ERATES, LTRANS, SVECTR

GEFCON
COMMON BLOCKS: NONE

GERCPS
COMMON BLOCKS: NONE

GETMSD
COMMON BLOCKS: EMASMX, ERATES, LTRANS, SVECTR

GETPSD
COMMON BLOCKS: PAXVTR, PERATS, PMASS, PSVCTR

GETSD
COMMON BLOCKS: EMASMX, ERATES, LTRANS, SVECTR

GETSRG
COMMON BLOCKS: NONE

GETT12
COMMON BLOCKS: NONE

GHCIFC
COMMON BLOCKS: HLAROM, KGHCN, NDHTHT, SVECTR

GHVIFC
COMMON BLOCKS KGHCN, NDHTHT, OUTDTA

GINTRP
COMMON BLOCKS: LTRANS, RHRLOC, RSRCLC

GRAVTY
COMMON BLOCKS: ATMOS, LTRANS, MASS

GTAIFC
COMMON BLOCKS: ATMOS, KGT, NDHTHT, TAIL, TDRVS

GTIFC
COMMON BLOCKS: KGT, NDHTHT, OUTDTA, TDRVS, UCTLCS

GUNITV
COMMON BLOCKS: LTRANS

GUSGEN
COMMON BLOCKS: DGUSTS, [illegible]COM, LPGCOM, TGCOM

GUST
COMMON BLOCKS: NONE

ORIGINAL PAGE IS
OF POOR QUALITY

HCABLE
COMMON BLOCKS: ATACHP, HCBLFO, OUTDTA

HDIFC
COMMON BLOCKS: ATMOS

HGCNTC
COMMON BLOCKS: HULL, LTRANS, SVECTR

HGEEZ
COMMON BLOCKS: ATMOS, OUTDTA, SVECTR

HGEOM
COMMON BLOCKS: HULL, RHRLOC, TAIL

HGLOAD
COMMON BLOCKS: ATMOS, AUXGST, HLAROM, OUTDTA

HMOVAR
COMMON BLOCKS: AUXGST, OUTDTA, SVECTR

HONLY
COMMON BLOCKS: OUTDTA

HRDLIM
COMMON BLOCKS: MCLMFL, MECLIM

HULARO
COMMON BLOCKS: FORMOM, HULL, OUTDTA, TAIL, TPARAM

HWLOAD
COMMON BLOCKS: ATMOS, HLAROM, OUTDTA

IACLOD
COMMON BLOCKS: ATMOS, FORMOM, HLAROM, HULL, OUTDTA, TAIL, TLAROM

IMLOAD
COMMON BLOCKS: IMROLD, OUTDTA

INATMOS
COMMON BLOCKS: ATMOS

INCABL
COMMON BLOCKS: CABLC, CABLK

INEXST
COMMON BLOCKS: JETHST

INFCSC
COMMON BLOCKS: CLOSLP, FCSGNS, FCSLIM, FDBKFL, POSHCS

INFIFC
COMMON BLOCKS KPF, KRF, SHDFCN

INFLOW
COMMON BLOCKS: NONE

INGEAR
COMMON BLOCKS: GEARC, GEARK, GFRAMK, LANDGL, MUKG

INGEOM
COMMON BLOCKS: NONE

INGUST
COMMON BLOCKS: GSTRNG, HGCOM, LPGCOM, RSRCLC, TGCOM

INHARO
COMMON BLOCKS: HLAROM, HULL, TAIL, TAUTS, TDRVS, TLAROM, TPARAM, UCCFWC, UCTLCS

INHIFC
COMMON BLOCKS: KGHCN, KPH, KRH

INLARO
COMMON BLOCKS: FSAROM, PAROCN, RAROCN

INMASS
COMMON BLOCKS: MASS, RMASCN

INMCLC
COMMON BLOCKS: MECLIM

INMOOR
COMMON BLOCKS: MAST

INMRST
COMMON BLOCKS: SVECTR

INMTRA
COMMON BLOCKS: CALMHD, TSDEFL

INPARO
COMMON BLOCKS: NONE

INPGEO
COMMON BLOCKS: PAYLOD, USCLTH

INPGST
COMMON BLOCKS: PGSTRN, PYGCOM

INPIFC
COMMON BLOCKS: KGP, KHP, KRP, SHDPCN

INPMAS
COMMON BLOCKS: PMASS

INPROF
COMMON BLOCKS: COMAND, LNKCOM, PFETHR, RSWASH, TDEFLC

INPROP
COMMON BLOCKS: ..TATE, RSTATE

INPYST
COMMON BLOCKS: PERATS, PSVCTR

INRIFC
COMMON BLOCKS: KGR, KHR, SHDRCN

INSERT
COMMON BLOCKS: NONE

INSTAB
COMMON BLOCKS: STABDV

INSTAT
COMMON BLOCKS: ER..ES, SVECTR

INSTEP
COMMON BLOCKS: NONE

INTERP
COMMON BLOCKS: NONE

INTGTR
COMMON BLOCKS: NONE

ORIGINAL PAGE IS
OF POOR QUALITY

INTIAL
COMMON BLOCKS: ATACHP, AUXGST, COMAND, DELTAX, DGUSTS, EMASMX, ERATES, FCDINT, DCSINT, GBACL, GBUFF, HCBLFO, HGCOM, HLAROM, INVALD, LPGCOM, MASS, PFETHR, POSHD, PRINTC, PSTATE, RSTATE, RSWASH, SENSOR, SGUSTS, SPDINT, SPRINT, SVECTR, TGCOM, TLAROM, TRIMFL, TRMCNT, TRMOT, TSDEFL

INTIFC
COMMON BLOCKS: KGT, KPT, KRT

IN1MMD
COMMON BLOCKS: NONE

IN1MOD
COMMON BLOCKS: NONE

IPLOTF
COMMON BLOCKS: NONE

ITERCT
COMMON BLOCKS: NONE

LGEAR
COMMON BLOCKS: ATAHG, GEARLC, OUTDTA

LGPOS
COMMON BLOCKS: LTRANS, SVECTR

LINEAR
COMMON BLOCKS: STABDV

LMGUES
COMMON BLOCKS: NONE

LOADAM
COMMON BLOCKS: ATMOS, HLAROM, TLAROM

LOADCA
COMMON BLOCKS: LTRANS, RELVEL, SVECTR

LOADFM
COMMON BLOCKS: PSTATE, RSTATE, TSDEFL

LOADH
COMMON BLOCKS: HLAROM

LOADMT
COMMON BLOCKS: ATACH, LPATCH, LTRANS, MAST

LOADPM
COMMON BLOCKS: PYAROM

LOADT
COMMON BLOCKS: ATACH, LPATCH, LTRANS

LOADUA
COMMON BLOCKS: BTRANS, GBACL

LODFSM
COMMON BLOCKS: NONE

LODGST
COMMON BLOCKS: AUXGST, DGUSTS, OUTDTA, SGUSTS

LODMCA
COMMON BLOCKS: LTRANS, MAST, RELVEL, SVECTR

LODMUA
COMMON BLOCKS: BTRANS, GBACL

LODSVC
COMMON BLOCKS: LTRANS, MAST, SVECTR

LOOP
COMMON BLOCKS: NONE

LPGEOM
COMMON BLOCKS: LPU, PGEOM, PRPRIG, RGEOM, SVECTR

LPUARO
COMMON BLOCKS: OUTDTA

LPUTRN
COMMON BLOCKS: NONE

MAERO
COMMON BLOCKS: GUSTS

MAGCPL
COMMON BLOCKS: NONE

MAGMAT
COMMON BLOCKS: EMASMX, MASS

MATRIX
COMMON BLOCKS: NONE

MAXVEC
COMMON BLOCKS: ATAHG, GEARK, GEARLC, GERILC, HLCNTC, HUL , LANDGL, LGCNTC, MODLFL, OUTDTA

MCGDST
COMMON BLOCKS: ATAHG, MAST

MCLCDL
COMMON BLOCKS: NONE

MCTSTP
COMMON BLOCKS: ATMOS, GEARK, HLAROM, MASS

MEIGEN
COMMON BLOCKS: NONE

MEXTRC
COMMON BLOCKS: NONE

MFORCE
COMMON BLOCKS: NONE

MINSRT
COMMON BLOCKS: NONE

MINTGR
COMMON BLOCKS: NONE

MINTIL
COMMON BLOCKS: GEARLC, MPILTX, MTRMCN, MTRMFL, MTRMPC, POSHCS

MLINAR
COMMON BLOCKS: STABDV

MLODFM
COMMON BLOCKS: SVECTR

MLPARO
COMMON BLOCKS: OUTDTA

MMGCOL
COMMON BLOCKS: NONE

MMMULT
COMMON BLOCKS: NONE

ORIGINAL PAGE IS OF POOR QUALITY

MNORMS
COMMON BLOCKS: NONE

MORDSK
COMMON BLOCKS: ATMOS

MPRFIL
COMMON BLOCKS: NONE

MPRPAR
COMMON BLOCKS: PAROCN, PGEOM, PROP, PRPRIG

MPTURB
COMMON BLOCKS: GCMPRS

MRTARO
COMMON BLOCKS: RAROCN, RGEOM, ROTOR, RSTATE

MSORT
COMMON BLOCKS: NONE

MSSAG
COMMON BLOCKS: NONE

MSTAB
COMMON BLOCKS: MDELTX, STABDV

MTPTRB
COMMON BLOCKS: MTRMPC

MTRIM
COMMON BLOCKS: MTRMCN, SVECTR, TRMOT

MTRMLM
COMMON BLOCKS: ATMOS, GCMPRS, GEARK, MASS, MTRMFL, SVECTR

MVMULT
COMMON BLOCKS: NONE

M3JCA
COMMON BLOCKS: NONE

M3TNPS
COMMON BLOCKS: NONE

NDMLOC
COMMON BLOCKS: AUXVTR, HULL, LTRANS, NDHTHT NDPHT, NDRHT, OUTDTA, PGEOM, PROP, RGEOM, ROTOR, SVECTR, TAIL

NEWMU
COMMON BLOCKS: MODLFL, MTRMCN, MTRMFL, SVECTR

NEWPU
COMMON BLOCKS: PMDLFL, PSVCTR, PTRMCN, PTRMFL

NEWRAF
COMMON BLOCKS: NONE

NEWU
COMMON BLOCKS: MODLFL, PSTATE, RSTATE, TRIMFL, TRMCNT, TSDEFL

NORMS
COMMON BLOCKS: NONE

OIATMOS
COMMON BLOCKS: ATMOS, OUTHD, UNILST

OICABL
COMMON BLOCKS: CABLC, CABLK, UNILST

OIEXST
COMMON BLOCKS: JETHST, OUTHD, UNILST

OIFCSC
COMMON BLOCKS: CLOSLP, FCSGNS, FCSLIM, FDBKFL, POSHCS, UNILST

OIF.[illegible]
COMMON BLOCKS: KPF, KRF, OUTHD, SHDRCN, UNILST

OIGEAR
COMMON BLOCKS: GEARC, GEARK, GFRAMK, LANDGL, MUKG, OUTHD, UNILST

OIGEOM
COMMON BLOCKS: HULL, LPU, OUTHD, PGEOM, PRPRIG, RGEOM, RHRLOC, SVECTR, TAIL, UNILST

OIGUST
COMMON BLOCKS: GSTRNG, HGCOM, LPGCOM, OUTHD, RSRCLC, TGCOM, UNILST

OIHARO
COMMON BLOCKS: [illegible] TAUTS, TDRVS, TPARAM, UNILST

OIHIFC
COMMON BLOCKS: KGHCN, KPH, KRH, OUTHD, UNILST

OILARO
COMMON BLOCKS: FSAROM, OUTHD, PAROCN, RAROCN, UNILST

OIMASS
COMMON BLOCKS: MASS, OUTHD, RMASCN, UNILST

OIMCLC
COMMON BLOCKS: MECLIM, OUTHD, UNILST

OIMOOR
COMMON BLOCKS: MAST, OUTHD, UNILST

OIMRST
COMMON BLOCKS: UNILST

OIMTRA
COMMON BLOCKS: CALMHD, TSDEFL, UNILST

OIPARO
COMMON BLOCKS: UNILST

OIPGEO
COMMON BLOCKS: PAYLOD, UNILST, USCLTH

OIPGST
COMMON BLOCKS: PGSTRN, PYGCOM, UNILST

OIPIFC
COMMON BLOCKS: KGP, KHP, KRP, OUTHD, SHDPCN, UNILST

OIPMAS
COMMON BLOCKS: PMASS UNILST

OIPROF
COMMON BLOCKS: CONAND, LNKCOM, OUTHD, PFETHR, RSWASH, TDEFLC, UNILST

OIPROP
COMMON BLOCKS: OUTHD, PSTATE, RSTATE, UNILST

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OIFYST
  COMMON BLOCKS: UNILST

OIRIFC
  COMMON BLOCKS: KGR, KHR, OUTHD, SHDRCN, UNILST

OISTAB
  COMMON BLOCKS: STABDV

OISTAT
  COMMON BLOCKS: ERATES, OUTHD, SVECTR, UNILST

OISTEP
  COMMON BLOCKS: OUTHD, UNILST

OITIFC
  COMMON BLOCKS: KGT, KPT, KRT, OUTHD, UNILST

OUTOIN
  COMMON BLOCKS: OUTHD, UNILST

PAERO
  COMMON BLOCKS: PAYLOD, PYOPUT

PAXVEC
  COMMON BLOCKS: ATACHP, CABLE, LTRANS, PATCH, PAXVTR, PLTRNS, PSVCTR, PYOPUT, SVECTR

PBODRT
  COMMON BLOCKS: PBTRNS, PERATS, PSVCTR

PCABLE
  COMMON BLOCKS: PATCH, PYOPUT

PCGDST
  COMMON BLOCKS: ATACHP, PATCH, PAYLOD

PELRAT
  COMMON BLOCKS: PBTRNS, PERATS, PSVCTR

PERTUB
  COMMON BLOCKS: TRMCNT

PFORCE
  COMMON BLOCKS: NONE

PGEEZ
  COMMON BLOCKS: ATMOS, PSVCTR, PYOPUT

PGRAVTY
  COMMON BLOCKS: ATMOS, PLTRNS, PMASS

PGSTGN
  COMMON BLOCKS: PYGCOM

PGUST
  COMMON BLOCKS: PGUSTS

PHIFC
  COMMON BLOCKS: GEFP, KPH, OUTDTA, PGEOM, PSTATE

PINTIL
  COMMON BLOCKS: PDLTAX, PERATS, PGBUFF, PGUSTS, PMASS, PPRNTC, PSVCTR, PTRMCN, PTRMFL, PRTMPC, PYAROM

PLINAR
  COMMON BLOCKS: STABDV

PLODFM
  COMMON BLOCKS: PSVCTR

PMATRX
  COMMON BLOCKS: PMASS

PMOVAR
  COMMON BLOCKS: NONE

PMTRML
  COMMON BLOCKS: MTRMFL

POSHLD
  COMMON BLOCKS: LTRANS, OUTDTA, POCHCS, POSHD, SENSOR, SVECTR

PPRFIL
  COMMON BLOCKS: NONE

PPTURB
  COMMON BLOCKS: CBLTEN

PRCOLM
  COMMON BLOCKS: TRMFL

PRNDOM
  COMMON BLOCKS: PGBUFF, PGSTRN, PLTRNS

PROFIL
  COMMON BLOCKS: OUTDTA, PSTATE, RSTATE, TSDEFL

PRPARO
  COMMON BLOCKS: ATMOS, GEFP, KGP, KHP, LTRANS, NDPHT, OUTDTA, PAROCN, PGEOM, PROP, PRPRIG, PSTATE, VRINGP

PRTEFC
  COMMON BLOCKS: PMASS, PSVCTR

PSTAB
  COMMON BLOCKS: PDLTAX

PSTORE
  COMMON BLOCKS: POPWNT, PPRNTC, PSVCTR, PYOPUT

PTCLSD
  COMMON BLOCKS: NONE

PTIFC
  COMMON BLOCKS: GEFP, KPT, PSTATE

PTPTRB
  COMMON BLOCKS: PTRMP

PTRIM
  COMMON BLOCKS: PSVCTR, PTRMCN, PTRMFL, TRMQT

PTRMLM
  COMMON BLOCKS: ATMOS, CABLK, CBLTEN, HULL, PAYLOD, PMASS, PSVCTR, PTRMFL

PTRMRT
  COMMON BLOCKS: PLTRNS, PSVCTR, SVECTR

PTRNFM
  COMMON BLOCKS: LTRANS, PBTRNS, PLTRNS, PSVCTR

PTURB
  COMMON BLOCKS: NONE

PWINDS
  COMMON BLOCKS: ATMOS, PAYLOD, PGUSTS, PLTRNS, PSVCTR, PYOPUT

PWLOAD
  COMMON BLOCKS: ATMOS, PYAROM, PYOPUT

C-2

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QUESTN
COMMON BLOCKS: OPWANT

RANDOM
COMMON BLOCKS: GSTRNG, SGUSTS

RGUSTS
COMMON BLOCKS: GBUFF, GSTRNG, LTRANS, OUTDTA

RHIFC
COMMON BLOCKS: GEFR, KRH, OUTDTA, RGEOM, RSTATE

RMASS
COMMON BLOCKS: EMASMX

ROTARO
COMMON BLOKCS: GEFR, KGR, KHR, LTRANS, NDRHT, OUTDTA, RAROCN, RGEOM, RMASCN, ROTOR, RSTATE, SVECTR, VRINCR

ROTEFC
COMMON BLOCKS: AUXVTR, MASS, SVECTR

ROTHQY
COMMON BLOCKS: NONE

RPFIFC
COMMON BLOCKS: KPF, KRF, OUTDTA

RPHIFC
COMMON BLOCKS: NONE

RPFIC
COMMON BLOCKS: KRP, OUTDTA

RPTIFC
COMMON BLOCKS: OUTDTA

RTIFC
COMMON BLOCKS: GEFR, KRT, RSTATE

SETFCS
COMMON BLOCKS: CLOSLP, COMAND, ERATES, FCSINT, FCSLIM, FDBKFL, SVECTR

SGLFLW
COMMON BLOCKS: CLOSLP, FCDINT, FCSSNS, FCSINT, FCSLIM, OUTDTA

SHADOW
COMMON BLOCKS: LTRANS, SHDFCN, SHDPCN, SHDRCN

SHDANG
COMMON BLOCKS: NONE

SHDELM
COMMON BLOCKS: NONE

SINTRP
COMMON BLOCKS: NONE

SMOTCG
COMMON BLOCKS: NONE

SORT
COMMON BLOCKS. NONE

STAB
COMMON BLOCKS. DELTAX, STABDV

STDTRN
COMMON BLOCKS: NONE

STOLC
COMMON BLOCKS: PSTATE, RSTATE, TSDEFL

STOMS
COMMON BLOCKS: SVECTR

STOPS
COMMON BLOCKS: PSVCTR

STORE
COMMON BLOCKS: HLCNTC, LGCNTC, MCLMFL, OPWANT, OUTDTA, POSHCS, PRINTC, STALLS, VRINGP, VRINGR

STOS
COMMON BLOCKS: SVECTR

STOTS
COMMON BLOCKS: PSVCTR, SVECTR

STOTXG
COMMON BLOCKS: PGUSTS, SGUSTS

STOXC
COMMON BLOCKS: PSTATE, RSTATE, TSDEFL

STOXG
COMMON BLOCKS: SGUSTS

STOXPG
COMMON BLOCKS: PGUSTS

SUMCON
COMMON BLOCKS: NONE

SUMFOR
COMMON BLOCKS: LTRANS

TALFOR
COMMON BLOCKS: NONE

TANGLS
COMMON BLOCKS: OUTDTA, TAIL, TAUTS, TSDEFL

TEIGEN
COMMON BLOCKS: NONE

TGLOAD
COMMON BLOCKS: ATMOS, AUXGST, OUTDTA, TLAROM

TINTGR
COMMON BLOCKS: NONE

TLINAR
COMMON BLOCKS: STABDV

TMOVAR
COMMON BLOCKS: TAIL

TONLY
COMMON BLOCKS: ATMOS, OUTDTA, STALLS, TAIL, TDRVS, TPARAM

TPTURB
COMMON BLOCKS: CBLTEN

TQUEST
COMMON BLOCKS: OPWANT, POPWNT

TRIM
COMMON BLOCKS: PSTATE, RSTATE, TRMCNT, TRMQT, TSDEFL

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```
TRMLIM
  COMMON BLOCKS:  MECLIM, PARDCN, PSTATE, RSTATE,
                  TAUTS, TRIMFL, TSDEFL

TRNFRM
  COMMON BLOCKS:  FTRANS, LTRANS, SVECTR

TRXFOR
  COMMON BLOCKS:  NONE

TSROLM
  COMMON BLOCKS:  NONE

TSTAB
  COMMON BLOCKS:  DELTAX, PDLTAX, STABDV

TSTCOM
  COMMON BLOCKS:  LNKCOM, MFETHR, RSWASH, TDEFLC

TSTWKA
  COMMON BLOCKS:  NONE

VORINO
  COMMON BLOCKS:  NONE

VRNOLM
  COMMON BLOCKS:  NONE

VVMULT
  COMMON BLOCKS:  NONE

V3ADD
  COMMON BLOCKS:  NONE

V3NORM
  COMMON BLOCKS:  NONE

V3SCA
  COMMON BLOCKS:  NONE

V3SUB
  COMMON BLOCKS:  NONE

WINDS
  COMMON BLOCKS:  ATMOS, AUXVTR, GUSTS, HULL,
                  LPUAC, LTRANS, OUTDIA, PROP,
                  ROTOR, SENSOR, SVECTR, TAIL

WMSDI
  COMMON BLOCKS:  MDELTX

WRTINC
  COMMON BLOCKS:  DELTAX, PDLTAX

WRTIVD
  COMMON BLOCKS:  INVALD

WRTMSB
  COMMON BLOCKS:  STABDV

WRTPSB
  COMMON BLOCKS:  STABDV

WRTSTB
  COMMON BLOCKS:  STABDV

WRTTSB
  COMMON BLOCKS:  STABDV

WRTVOI
  COMMON BLOCKS:  DELTAX
```

APPENDIX D

CALLING-CALLED AND CALLED-CALLING SUBROUTINE CROSS REFERENCES

Example:

Subroutine BODRAT calls:

Subroutines MVMULT
V3ADD

Subroutine DSKIVL is called by:

Subroutines PRPARO
ROTARO

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****

SUBROUTINE CALL CROSS REFERENCE

****

AEFFCT
  CALL SUBROUTINES: NONE

AERO
  CALL SUBROUTINES: GHVIFC, GTIFC, HULARO, LHUARO,
                     NDMLOC, RPHIFC, RPTIFC, SHADOW,
                     WINDS

AMASMA
  CALL SUBROUTINES: NONE

APPMAS
  CALL SUBROUTINES: MSSAG

AROTRN
  CALL SUBROUTINES: MMMULT, MVMULT, M3TNPS

AUXVEC
  CALL SUBROUTINES: CROSS, MVMULT, V3ADD, V3SUB

AVLIFT
  CALL SUBROUTINES: NONE

BODRAT
  CALL SUBROUTINES: MVMULT, V3ADD

BOYUNC
  CALL SUBROUTINES: MVMULT, V3ADD, V3SCA

CABLEV
  CALL SUBROUTINES: CROSS, MVMULT

CALCCT
  CALL SUBROUTINES: INFLOW, ITERCT, LMGUES, MSSAG

CALCDL
  CALL SUBROUTINES: NONE

CALCFC
  CALL SUBROUTINES: LEQT2F, MSSAG, VMULFF, VMULFM

CALCHP
  CALL SUBROUTINES: NONE

CALCSD
  CALL SUBROUTINES: AUXVEC, BODRAT, CALCFC, EULRAT,
                     FORCE, GETSD, HGEEZ, IACLOD,
                     LOADCA, LOADT, LOADUA, MAXVEC,
                     PROFIL, TRNFRM

CALCTA
  CALL SUBROUTINES: NONE

CBLFOR
  CALL SUBROUTINES: CABLEV, CBLTEN, CUNITV, VVMULT,
                     V3SCA

CBLTEN
  CALL SUBROUTINES: NONE

CDERV
  CALL SUBROUTINES: NONE

CFLOW
  CALL SUBROUTINES: NONE

CGDIST
  CALL SUBROUTINES: V3SCA, V3SUB

CKTSTP
  CALL SUBROUTINES: CLTSTP, MSSAG

CLCEFM
  CALL SUBROUTINES: SMOTCG

CLCMFC
  CALL SUBROUTINES: LEQT2F, MSSAG, VMULFF, VMULFM

CLCMSD
  CALL SUBROUTINES: AUXVEC, BODRAT, CLCMFC, EULRA,
                     GETMSD, HGEEZ, IACLOD, IMLOAD,
                     LOADMT, LODMCA, LODMUA, LODSVC
                     MAXVEC, MFORCE, MPRFIL, TRNFRM

CLCPSD
  CALL SUBROUTINES: GETPSD, PAXVEC, PFORCE, PGEEZ,
                     PPRFIL, PTRNFM

CLCSVD
  CALL SUBROUTINES: CALCSD, MSSAG

CLMSVD
  CALL SUBROUTINES: CLCMSD

CLMTRM
  CALL SUBROUTINES: MVMULT

CLTSTP
  CALL SUBROUTINES: NONE

CLTSVD
  CALL SUBROUTINES: CALCSD, CLCPSD, MSSAG

CMAXAI
  CALL SUBROUTINES: V3NORM

CMPINC
  CALL SUBROUTINES: CMAXAI, MSSAG

COFVEC
  CALL SUBROUTINES: NONE

COMGEN
  CALL SUBROUTINES: GETT12, INTERP, POSHLD

CONTRL
  CALL SUBROUTINES: COMGEN, FDBACK, SGLFLW, SUMCON

CPINC
  CALL SUBROUTINES: MSSAG, V3NORM

CROSOP
  CALL SUBROUTINES: NONE

CROSS
  CALL SUBROUTINES: CROSOP, MVMULT

CUNITV
  CALL SUBROUTINES: MVMULT, V3NORM, V3SCA

C1MCOS
  CALL SUBROUTINES: MSSAG

DCFLWC
  CALL SUBROUTINES: NONE

DEFCT
  CALL SUBROUTINES: MSSAG

DHTIVL
  CALL SUBROUTINES: NONE

DSKIVL
  CALL SUBROUTINES: MVMULT

DSKLOD
  CALL SUBROUTINES: NONE

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```
DVTRST
  CALL SUBROUTINES:  MSSAG

DIMCOS
  CALL SUBROUTINES:  MSSAG

EIGEN
  CALL SUBROUTINES:  EIGRF, MSSAG

ESTMUO
  CALL SUBROUTINES:  CLCMSD, MSSAG, MTRMLM

ESTPUO
  CALL SUBROUTINES:  PTCLSD, PTRMLM

ESTUO
  CALL SUBROUTINES:  FORCE, MVMULT, SUMCON, SUMFOR,
                     TRMLIM

EULRAT
  CALL SUBROUTINES:  MVMULT, V3SUB

EXHAST
  CALL SUBROTUINES:  CLCEFM

EXTRAC
  CALL SUBROUTINES:  NONE

FDBACK
  CALL SUBROUTINES:  CROSS, MVMULT, WINDS

FILARY
  CALL SUBROUTINES:  NONE

FLAGS
  CALL SUBROUTINES:  NONE

FLAP
  CALL SUBROUTINES:  NONE

FMSDV
  CALL SUBROUTINES:  NONE

FORCE
  CALL SUBROUTINES:  AERO, GRAVTY, HCABLE, LGEAR,
                     ROTEFC

FORMSV
  CALL SUBROUTINES:  MSSAG

FRMGDV
  CALL SUBROUTINES:  MVMULT

FRMLVH
  CALL SUBROUTINES:  M3TNPS

FRMMSV
  CALL SUBROUTINES:  NONE

FRMPVT
  CALL SUBROUTINES:  NONE

FRMTSV
  CALL SUBROUTINES:  MSSAG

FRMTVT
  CALL SUBROUTINES:  NONE

FRMVTR
  CALL SUBROUTINES:  NONE

FRTION
  CALL SUBROUTINES:  MVMULT

FUSARO
  CALL SUBROUTINES:  MVMULT, SMOTCG

GEARF
  CALL SUBROUTINES:  FRTION, GEARV, GERCPS, GUNITV,
                     MVMULT, V3ADD, V3SCA

GEARV
  CALL SUBROUTINES:  CROSS, MVMULT, V3ADD, V3NORM

GEFCON
  CALL SUBROUTINES:  MMMULT, MVMULT

GERCPS
  CALL SUBROUTINES:  V3NORM

GETMSD
  CALL SUBROUTINES:  MSSAG, MVMULT, VMULFF

GETPSD
  CALL SUBROUTINES:  MSSAG, PELRAT, VMULFF

GETSD
  CALL SUBROUTINES:  MSSAG, MVMULT, VMULFF

GETSRG
  CALL SUBROUTINES:  INTERP, MSSAG

GETT12
  CALL SUBROUTINES:  MSSAG

GHCIFC
  CALL SUBROUTINES:  NONE

GHVIFC
  CALL SUBROUTINES:  FRMLVH, MVMULT

GINTRP
  CALL SUBROUTINES:  MVMULT, SINTRP

GRAVTY
  CALL SUBROUTINES:  MVMULT, V3SCA

GTAIFC
  CALL SUBROUTINES:  NONE

GTIFC
  CALL SUBROUTINES:  NONE

GUNITV
  CALL SUBROUTINES:  MVMULT, V3SCA

GUSGEN
  CALL SUBROUTINES:  C1MCOS, D1MCOS

GUST
  CALL SUBROUTINES:  GUSGEN, RANDOM

HCABLE
  CALL SUBROUTINES:  SMOTCG

HDIFC
  CALL SUBROUTINES:  NONE

HGCNTC
  CALL SUBROUTINES:  MVMULT, V3ADD

HGEEZ
  CALL SUBROUTINES:  CROSS, V3ADD

HGEOM
  CALL SUBROUTINES:  MSSAG

HGLOAD
  CALL SUBROUTINES:  MSSAG, VMULFF
```

ORIGINAL PAGE IS
OF POOR QUALITY

HLAMOR
  CALL SUBROUTINES: AEFFCT, AUXVEC, BODRAT, CGDIST, CLCMSD, IMSL, INATMOS, INFIFC, INGEAR, INGEOM, INGUST, INHARO, INHIFC, INLARO, INMASS, INMOOR, INMRST, INMTRA, INPIFC, INRIFC, INSTAB, INSTEP, INTIAL, INTIFC, LODSVC, MATRIX, MAXVEC, MCGDST, MCTSTP, MINTGR, MINTIL, MLINAR, MSSAG, MTRIM, QUESTN, STORE, TRNFRM, UERSET

HLAPAY
  CALL SUBROUTINES: AEFFCT, AUXVEC, BODRAT, CALCSD, CGDIST, CKTSTP, CLCPSD, IMSL, INATMOS, INCABL, INEXST, INFCSC, LPINFIFC, INGEAR, INGEOM, INGUST, INHARO, INHIFC, INLARO, INMASS, INMCLC, INMOOR, INPARO, INPGEO, INPGST, INPIFC, INPMAS, INPROF, INPROP, INPYST, INRIFC, INSTAB, INSTEP, INTIAL, INTIFC, MATRIX, MCDGST, MSSAG, PAXVEC, PCGDST, PINTIL, PMATRX, PSTORE, PTRIM, PTRMRT, PTRNFM, SETFCS, STORE, TINTGR, TLINAR, TQUEST, TRIM, TRNFRM, UERSET

HLASIM
  CALL SUBROUTINES: AEFFCT, AUXVEC, BODRAT, CALCSD, CGDIST, IMSL, INATMOS, INEXST, INFCSC, INFIFC, INGEAR, INGEOM, INGUST, INHARO, INHIFC, INLARO, INMASS, INMCLC, INMOOR, INPIFC, INPROF, INPROP, INRIFC, INSTAB, INSTAT, INSTEP, INTGTR, INTIAL, INTIFC, LINEAR, MATRIX, MAXVEC, MCGDST, MSSAG, QUESTN, SETFCS, STORE, TRIM, TRNFRM, UERSET

HMOVAR
  CALL SUBROUTINES: NONE

HONLY
  CALL SUBROUTINES: HGLOAD, HMOVAR, HWLOAD

HRDLIM
  CALL SUBROUTINES: NONE

HULARO
  CALL SUBROUTINES: BOYUNC, HONLY, SMOTCG, TONLY, V3SUB

HWLOAD
  CALL SUBROUTINES: GHCIFC, MSSAG, MVMULT, VMULFF

IACLOD
  CALL SUBROUTINES: CROSS, LOADAM, MSSAG, VMULFF, V3ADD

IMLOAD
  CALL SUBROUTINES: MVMULT, V3SCA

INATMOS
  CALL SUBROUTINES: MSSAG, OIATMOS

INCABL
  CALL SUBROUTINES: MSSAG, OICABL

INEXST
  CALL SUBROUTINES: AROTRN, OIEXST, V3SUB

INFCSC
  CALL SUBROUTINES: MSSAG, OIFCSC

INFIFC
  CALL SUBROUTINES: OIFIFC, TSTWKA

INFLOW
  CALL SUBROUTINES: MSSAG, ZRPOLY

INGEAR
  CALL SUBROUTINES: MSSAG, OIGEAR

INGEOM
  CALL SUBROUTINES: HGEOM, LPGEOM, OIGEOM

INGUST
  CALL SUBROUTINES: MSSAG, OIGUST

INHARO
  CALL SUBROUTINES: AMASMA, LOADHM, MSSAG, OIHARO

INHIFC
  CALL SUBROUTINES: MSSAG, OIHIFC

INLARO
  CALL SUBROUTINES: LODFSM, MSSAG, OILARO

INMASS
  CALL SUBROUTINES: MSSAG, OIMASS

INMCLC
  CALL SUBROUTINES: MSSAG, OIMCLC

INMOOR
  CALL SUBROUTINES: MSSAG, OIMOOR

INMRST
  CALL SUBROUTINES: OIMRST, TRNFRM

INMTRA
  CALL SUBROUTINES: OIMTRA

INPARO
  CALL SUBROUTINES: LOADPM, OIPARO

INPGEO
  CALL SUBROUTINES: MSSAG, OIPGEO

INPGST
  CALL SUBROUTINES: MSSAG, OIPGST

INPIFC
  CALL SUBROUTINES: MSSAG, OIPIFC, TSTWKA

INPMAS
  CALL SUBROUTINES: MSSAG, OIPMAS

INPROF
  CALL SUBROUTINES: MSSAG, OIPROF

INPROP
  CALL SUBROUTINES: MSSAG, OIPROP

INPYST
  CALL SUBROUTINES: OIPYST, PBODRT, PTRNFM

INRIFC
  CALL SUBROUTINES: MSSAG, OIRIFC, TSTWKA

INSERT
  CALL SUBROUTINES: NONE

INSTAB
  CALL SUBROUTINES: OISTAB

INSTAT
  CALL SUBROUTINES: MSSAG, OISTAT

ORIGINAL PAGE IS
OF POOR QUALITY

INSTEP
CALL SUBROUTINES: MSSAG, OISTEP

INTERP
CALL SUBROUTINES: MSSAG

INTGTR
CALL SUBROUTINES: CLCSVD, DVERK, FORMSV, MSSAG

INTIAL
CALL SUBROUTINES: NONE

INTIFC
CALL SUBROUTINES: MSSAG, OITIFC

IN1MMD
CALL SUBROUTINES: MSSAG

IN1MOD
CALL SUBROUTINES: MSSAG

IPLOTF
CALL SUBROUTINES: JDATE

ITERCT
CALL SUBROUTINES: MSSAG, NEWRAP, VORING, VRNGLM

LGEAR
CALL SUBROUTINES: GEARF, SMOTCG, V3ADD

LGPOS
CALL SUBROUTINES: MVMULT, V3ADD

LINEAR
CALL SUBROUTINES: EIGEN, STAB, WRTSTB

LMGUES
CALL SUBROUTINES: MSSAG, ZQADR

LOADAM
CALL SUBROUTINES: NONE

LOADCA
CALL SUBROUTINES: CROSS, MVMULT

LOADFM
CALL SUBROUTINES: CALCSD, EXTRAC, INSERT, SUMCON

LOADHM
CALL SUBROUTINES: NONE

LOADMT
CALL SUBROUTINES: CROSOP, IN1MMD, MMMULT, M3SCA

LOADPM
CALL SUBROUTINES: NONE

LOADT
CALL SUBROUTINES: CROSOP, IN1MOD, MMMULT, M3SCA

LOADUA
CALL SUBROUTINES: MVMULT

LODFSM
CALL SUBROUTINES: NONE

LODGST
CALL SUBROUTINES: CROSS, V3ADD

LODMCA
CALL SUBROUTINES: CROSS, MVMULT

LODMUA
CALL SUBROUTINES: MVMULT

LODSV
CALL SUBROUTINES: CROSS, MVMULT, V3SCA, V3SUB

LOOP
CALL SUBROUTINES: NONE

LPGEOM
CALL SUBROUTINES: MSSAG

LPUARO
CALL SUBROUTINES: CALCHP, DSKLOD, EXHAST, FUSARO, PRPARO, ROTARO, RPFIFC, RPIFC

LPUTRN
CALL SUBROUTINES: MMMULT, M3TNPS

MAERO
CALL SUBROUTINES: GHVIFC, GTIFC, HULARO, MLPARO, NDMLOC, SHADOW, WINDS

MAGCOL
CALL SUBROUTINES: NONE

MASMAT
CALL SUBROUTINES: APPMAS, LINVIF, MSSAG, RMASS

MATRIX
CALL SUBROUTINES: LOADAM, MASMAT

MAXVEC
CALL SUBROUTINES: HGCNTC, LGPOS

MCGDST
CALL SUBROUTINES: V3SUB

MCLCDL
CALL SUBROUTINES: NONE

MCTSTP
CALL SUBROUTINES: CLTSTP, MSSAG

MEIGEN
CALL SUBROUTINES: EIGRF, MSSAG

MEXTRC
CALL SUBROUTINES: NONE

MFORCE
CALL SUBROUTINES: CLMTRM, GRAVTY, LGEAR, MAERO, ROTEFC

MINSRT
CALL SUBROUTINES: NONE

MINTGR
CALL SUBROUTINES: CLMSVD, DVERK, FRMMSV, MSSAG

MINTIL
CALL SUBROUTINES: NONE

MLINAR
CALL SUBROUTINES: CMPINC, MEIGEN, MSTAB, WRTMSB

MLODFM
CALL SUBROUTINES: CLCMSD, MEXTRC, MINSRT

MLPARO
CALL SUBROUTINES: FUSARO, MPRPAR, MRTARO

MMGCOL
CALL SUBROUTINES: NONE

MMMULT
CALL SUBROUTINES: NONE

ORIGINAL PAGE IS
OF POOR QUALITY

MNORMS
  CALL SUBROUTINES: MMGCOL, MSORT

MORDSK
  CALL SUBROUTINES: NONE

MPRFIL
  CALL SUBROUTINES: GUST

MPRPAR
  CALL SUBROUTINES: AROTRN, MCLCDL, MORDSK, MVMULT, SMTOCG

MPTURB
  CALL SUBROUTINES: CDERV, CLCMSD, MSSAG, STOMS, STOXG

MRTARO
  CALL SUBROUTINES: AROTRN, MCLCDL, MORDSK, MVMULT, SMTOCG

MSORT
  CALL SUBROUTINES: NONE

MSSAG
  CALL SUBROUTINES: NONE

MSTAB
  CALL SUBROUTINES: FMSDV, MPTURB

MTPTRB
  CALL SUBROUTINES: NONE

MTRIM
  CALL SUBROUTINES: CLCMSD, ESTMUO, MEXTRC, MINSRT, MLODFM, MNORMS, MTPTRB, NEWMU, PMTRML

MTRMLM
  CALL SUBROUTINES: NONE

MVMULT
  CALL SUBROUTINES: NONE

M3SCA
  CALL SUBROUTINES: NONE

M3TNPS
  CALL SUBROUTINES: NONE

NDMLOC
  CALL SUBROUTINES: MMMULT, MSSAG, MVMULT, V3ADD

NEWMU
  CALL SUBROUTINES: CLCMSD, LEQT2F, MTRMLM

NEWPU
  CALL SUBROUTINES: LEQT2F, PTCLSD, PTRMLM

NEWRAP
  CALL SUBROUTINES: MSSAG

NEWU
  CALL SUBROUTINES: CALCSD, LEQT2F, SUMCON, TRMLIM

NORMS
  CALL SUBROUTINES: FLAGS, MAGCOL, SORT

OIATMOS
  CALL SUBROUTINES: NONE

OICABL
  CALL SUBROUTINES: NONE

OIEXST
  CALL SUBROUTINES: NONE

OIFCSC
  CALL SUBROUTINES: NONE

OIFIFC
  CALL SUBROUTINES: NONE

OIGEAR
  CALL SUBROUTINES: NONE

OIGEOM
  CALL SUBROUTINES: NONE

OIGUST
  CALL SUBROUTINES: NONE

OIHARO
  CALL SUBROUTINES: NONE

OIHIFC
  CALL SUBROUTINES: NONE

OILARO
  CALL SUBROUTINES: NONE

OIMASS
  CALL SUBROUTINES: NONE

OIMCLC
  CALL SUBROUTINES: NONE

OIMOOR
  CALL SUBROUTINES: NONE

OIMRST
  CALL SUBROUTINES: NONE

OIMTRA
  CALL SUBROUTINES: NONE

OIPARO
  CALL SUBROUTINES: NONE

OIPGEO
  CALL SUBROUTINES: NONE

OIPGST
  CALL SUBROUTINES: NONE

OIPIFC
  CALL SUBROUTINES: NONE

OIPMAS
  CALL SUBROUTINES: NONE

OIPROF
  CALL SUBROUTINES: NONE

OIPROP
  CALL SUBROUTINES: NONE

OIPYST
  CALL SUBROUTINES: NONE

OIRIFC
  CALL SUBROUTINES: NONE

OISTAB
  CALL SUBROUTINES: NONE

OISTAT
  CALL SUBROUTINES: NONE

OISTEP
  CALL SUBROUTINES: NONE

OITIFC
CALL SUBROUTINES: NONE

OUTOIN
CALL SUBROUTINES: NONE

PAERO
CALL SUBROUTINES: PMOVAR, PWINDS, PWLOAD, SMOTCG

PAXVEC
CALL SUBROUTINES: MVMULT, V3ADD, V3SUB

PBODRT
CALL SUBROUTINES: MVMULT

PCABLE
CALL SUBROUTINES: CBLFOR, SMOTCG

PCGDST
CALL SUBROUTINES: V3SCA, V3SUB

PELRAT
CALL SUBROUTINES: MVMULT

PERTUB
CALL SUBROUTINES: NONE

PFORCE
CALL SUBROUTINES: PAERO, PCABLE, PGRVTY PRTEFC

PGEEZ
CALL SUBROUTINES: CROSS, V3ADD

PGRVTY
CALL SUBROUTINES: MVMULT, V3SCA

PGSTGN
CALL SUBROUTINES: C1MCOS

PGUST
CALL SUBROUTINES: PGSTGN, PRNDOM

PHIFC
CALL SUBROUTINES: DCFLWC, DHTIVL, DVTRST

PINTIL
CALL SUBROUTINES: NONE

PLINAR
CALL SUBROUTINES: CPINC, EIGEN, PSTAB, WRTPSB

PLODFM
CALL SUBROUTINES: EXTRAC, INSERT, PTCLSD

PMATRX
CALL SUBROUTINES: LINV1F, MSSAG

PMOVAR
CALL SUBROUTINES: NONE

PMTRML
CALL SUBROUTINES: NONE

POSHLD
CALL SUBROUTINES: MVMULT

PPRFIL
CALL SUBROUTINES: PGUST

PPTURB
CALL SUBROUTINES: CDERV, CLCPSD, MSSAG, STOPS,
STOXPG

PRCOLM
CALL SUBROUTINES: NONE

PRNDOM
CALL SUBROUTINES: GETSRG, MVMULT

PROFIL
CALL SUBROUTINES: CONTRL, GUST, HRDLIM, TSTCOM

PRPARO
CALL SUBROUTINES: AR[illegible]N, AVLIFT, CALCCT, CALCDL
COFVEC, DSKIVL, GEFCON, HDIFC,
MMMILT, MVMULT, SMOTCG

PRTEFC
CALL SUBROUTINES: CROSS, MVMULT, V3SCA

PSTAB
CALL SUBROUTINES: FRMPVT, PPTURB

PSTORE
CALL SUBROUTINES: NONE

PTCLSD
CALL SUBROUTINES: CLCPSD, PTRMRT, PTRNFM

PTIFC
CALL SUBROUTINES: DHTIVL

PTPTRB
CALL SUBROUTINES: NONE

PTRIM
CALL SUBROUTINES: ESTPUO, EXTRAC, INSERT, NEWPU,
NORMS, PLODFM, PTCLSD, PTPTRB

PTRMLM
CALL SUBROUTINES: NONE

PTRMRT
CALL SUBROUTINES: CROSS, MVMULT, V3ADD

PTRNFM
CALL SUBROUTINES: MMMULT, M3TNPS, STDTRN

PTURB
CALL SUBROUTINES: CALCSD, CDERV, MSSAG, STOLC,
STOS, STOXC, STOX[illegible]

PWINDS
CALL SUBROUTINES: CROSS, MVMULT, V3ADD, V3SUB

PWLOAD
CALL SUBROUTINES: MVMULT

QUESTN
CALL SUBROUTINES: IPLOTF, MSSAG, OUTOIN

RANDOM
CALL SUBROUTINES: RGUSTS

RGUSTS
CALL SUBROUTINES: GETSRG, GINTRP, MVMULT

RHIFC
CALL SUBROUTINES: DCFLWC, DHTIVL, DVTRST

RMASS
CALL SUBROUTINES: MSSAG

ROTARO
CALL SUBROUTINES: AROTRN, AVLIFT, CALCCT, CALCSD
COFVEC, DSKIVL, FLAP, GEFCON,
HDIFC, MMMULT, MVMULT, ROTHQY,
SMOTCG

ROTEFC
CALL SUBROUTINES: CROSS, MVMULT, V3SCA

ORIGINAL PAGE IS
OF POOR QUALITY

ROTHQY
  CALL SUBROUTINES: NONE

RPFIFC
  CALL SUBROUTINES: V3SCA

RPHIFC
  CALL SUBROUTINES: CFLOWC, PHIFC, RHIFC

RPIFC
  CALL SUBROUTINES: V3SCA, V3SUB

RPTIFC
  CALL SUBROUTINES: PTIFC, RTIFC

RTIFC
  CALL SUBROUTINES: DHTIVL

SETFCS
  CALL SUBROUTINES: GUST, MSSAG, MVMULT, SETCMD, V3SUB, WINDS

SGLFLW
  CALL SUBROUTINES: LOOP

SHADOW
  CALL SUBROUTINES: SHDELM

SHDANG
  CALL SUBROUTINES: MVMULT

SHDELM
  CALL SUBROUTINES: DEFCT, SHDANG

SINTRP
  CALL SUBROUTINES: MSSAG

SMTOCG
  CALL SUBROUTINES: CROSS, MVMULT, V3ADD

SORT
  CALL SUBROUTINES: NONE

STAB
  CALL SUBROUTINES: FRMVTR, FTURB

STDTRN
  CALL SUBROUTINES: M3TNPS

STOLC
  CALL SUBROUTINES: SUMCON

STOMS
  CALL SUBROUTINES: NONE

STOPS
  CALL SUBROUTINES: PELRAT, PTRNFM

STORE
  CALL SUBROUTINES: FILARY

STOS
  CALL SUBROUTINES: BODRAT, EULRAT, TRNFRM

STOTS
  CALL SUBROUTINES: BODRAT, EULRAT, PELRAT, PTRNFM TRNFRM

STOTXG
  CALL SUBROUTINES: NONE

STOXC
  CALL SUBROUTINES: NONE

STOXG
  CALL SUBROUTINES: NONE

STOXPG
  CALL SUBROUTINES: NONE

SUMCON
  CALL SUBROUTINES: NONE

SUMFOR
  CALL SUBROUTINES: MVMULT

TALFOR
  CALL SUBROUTINES: NONE

TANGLS
  CALL SUBROUTINES: CALCTA, GTAIFC

TEIGEN
  CALL SUBROUTINES: EIGRF, MSSAG

TGLOAD
  CALL SUBROUTINES: MSSAG, VMULFF

TINTGR
  CALL SUBROUTINES: CLTSVD, DVERK, FRMTSV, MSSAG

TLINAR
  CALL SUBROUTINES: CPINC, TEIGEN, TSTAB, WRTTSB

TMOVAR
  CALL SUBROUTINES: NONE

TONLY
  CALL SUBROUTINES: TALFOR, TANGLS, TGLOAD, TMOVAR TRXFOR, TSROLM

TPTURB
  CALL SUBROUTINES: CALCSD, CDERV, CLCPSD, MSSAG, STOLC, STOTS, STOTXG, STOXC

TQUEST
  CALL SUBROUTINES: IPLO.., MSSAG, OUTOIN

TRIM
  CALL SUBROUTINES: ALCSD, ..TUO, EXTRAC, INSERT LOADFM, N..WU, NORMS, PERTUB, PRCOLM, SUMCON

TRMLIM
  CALL SUBROUTINES: NONE

TRNFRM
  CALL SUBROUTINES: LPUTRN, STDTRN

TRXFOR
  CALL SUBROUTINES: NONE

TSROLM
  CALL SUBROUTINES: MSSAG

TSTAB
  CALL SUBROUTINES: FRMTVT, TPTURB

TSTCOM
  CALL SUBROUTINES: SUMCON

TSTWKA
  CALL SUBROUTINES: MSSAG

VORING
  CALL SUBROUTINES: MSSAG

VRNGLM
  CALL SUBROUTINES: NONE

VVMULT
  CALL SUBROUTINES: NONE

ORIGINAL PAGE IS
OF POOR QUALITY

V3ADD
  CALL SUBROUTINES: NONE

V3NORM
  CALL SUBROUTINES: NONE

V3SCA
  CALL SUBROUTINES: NONE

V3SUB
  CALL SUBROUTINES: NONE

WINDS
  CALL SUBROUTINES: CROSS, FRMGDV, LODGST, MVMULT,
  V3ADD, V3SUB

WMSDI
  CALL SUBROUTINES: NONE

WRTINC
  CALL SUBROUTINES: NONE

WRTIVD
  CALL SUBROUTINES: MSSAG

WRTMSB
  CALL SUBROUTINES: WMSDI, WRTIVD

WRTPSB
  CALL SUBROUTINES: WRTIVD

WRTSTB
  CALL SUBROUTINES: WRTIVD, WRTVOI

WRTTSB
  CALL SUBROUTINES: WRTINC, WRTIVD

WRTVOI
  CALL SUBROUTINES: NONE

ORIGINAL PAGE IS
OF POOR QUALITY

AEFFCT
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

AERO
SUBROUTINES: FORCE

AMASMA
SUBROUTINES: INHARO

APPMAS
SUBROUTINES: MASMAT

AROTRN
SUBROUTINES: INEXST, MPRPAR, MRTARO, PRPARO, ROTARO

AUXVEC
SUBROUTINES: CALCSD, CLCMSD, HLAMOR, HLAPAY, HLASIM

AVLIFT
SUBROUTINES: PRPARO, ROTARO

BODRAT
SUBROUTINES: CALCSD, CLCMSD, HLAMOR, HLAPAY, HLASIM, STOS, STOTS

BOYUNC
SUBROUTINES: HULARO

CABLEV
SUBROUTINES: CBLFOR

CALCCT
SUBROUTINES: PRPARO, ROTARO

CALCDL
SUBROUTINES: PRPARO

CALCFC
SUBROUTINES: CALCSD

CALCHP
SUBROUTINES: LPUARO

CALCSD
SUBROUTINES: CLCSVD, CLTSVD, HLAPAY, HLASIM, LOADFM, NEWU, PTURB, ROTARO, TPTURB, TRIM

CALCTA
SUBROUTINES: TANGLS

CBLFOR
SUBROUTINES: PCABLE

CBLTEN
SUBROUTINES: CBLFOR

CDERV
SUBROUTINES: MPTURB, PPTURB, PTURB, TPTURB

CFLOW
SUBROUTINES: RPHIFC

CGDIST
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

CKTSTP
SUBROUTINES: HLAPAY

CLCEFM
SUBROUTINES: EXHAST

CLCMFC
SUBROUTINES: CLCMSD

CLCMSD
SUBROUTINES: CLMSVD, ESTMUO, HLAMOR, MLODFM, MPTURB, MTRIM, NEWMU

CLCPSD
SUBROUTINES: CLTSVD, HLAPAY, PPTURB, PTCLSD, TPTURB

CLCSVD
SUBROUTINES: INTGTR

CLMTRM
SUBROUTINES: MFORCE

CLMSVD
SUBROUTINES: MINTGR

CLTSTP
SUBROUTINES: CKTSTP, MCTSTP

CLTSVD
SUBROUTINES: TINTGR

CMAXAI
SUBROUTINES: CMPINC

CMPINC
SUBROUTINES: MLINAR

COFVEC
SUBROUTINES: PRPARO, ROTARO

COMGEN
SUBROUTINES: CONTRL

CONTRL
SUBROUTINES: PROFIL

CPINC
SUBROUTINES: PLINAR, TLINAR

CROSOP
SUBROUTINES: CROSS, LOADMT, LOADT

CROSS
SUBROUTINES: AUXVEC, CABLEV, FDBACK, GEARV, HGEEZ, IACLOD, LOADCA, LODGST, LODMCA, LODSVC, PGEEZ, PRTEFC, PTRMRT, PWINDS, ROTEFC, SMOTCG, WINDS

CUNITV
SUBROUTINES: CBLFOR

C1MCOS
SUBROUTINES: GUSGEN, PGSTGN

DCFLWC
SUBROUTINES: PHIFC, RHIFC

DEFLT
SUBROUTINES: SHDELM

DHTIVL
SUBROUTINES: PHIFC, PTIFC, RHIFC, RTIFC

DSKIVL
SUBROUTINES: PRPARO, ROTARO

DSKLOD
SUBROUTINES: LPUARO

ORIGINAL PAGE IS
OF POOR QUALITY

DVERK
  SUBROUTINES: INTGTR, MINTGR, TINTGR

DVTRST
  SUBROUTINES: PHIFC, RHIFC

DIMCOS
  SUBROUTINES: GUSGEN

EIGEN
  SUBROUTINES: LINEAR, PLINAR

EIGRF
  SUBROUTINES: EIGEN, MEIGEN, TEIGEN

ESTMUO
  SUBROUTINES: MTRIM

ESTPUO
  SUBROUTINES: PTRIM

ESTUO
  SUBROUTINES: TRIM

EULRAT
  SUBROUTINES: CALCSD, CLCMSD, STOS, STOTS

EYHAST
  SUBROUTINES: LPUARO

EXTRAC
  SUBROUTINES: LOADFM, FLODFM, PTRIM, TRIM

FDBACK
  SUBROUTINES: CONTRL

FLAGS
  SUBROUTINES: NORMS

FLAP
  SUBROUTINES: ROTARO

FILARY
  SUBROUTINES: STORE

FMSDV
  SUBROUTINES: MSTAB

FORCE
  SUBROUTINES: CALCSD, ESTUO

FORMSV
  SUBROUTINES: INTGTR

FRMGDV
  SUBROUTINES: WINDS

FRMLVH
  SUBROUTINES: GHVIFC

FRMMSV
  SUBROUTINES: MINTGR

FRMPVT
  SUBROUTINES: PSTAB

FRMTSV
  SUBROUTINES: TINTGR

FRMTVT
  SUBROUTINES: TSTAB

FRMVTR
  SUBROUTINES: STAB

FRTION
  SUBROUTINES: GEARF

FUSARO
  SUBROUTINES: LPUARO, MLPARO

GEARF
  SUBROUTINES: LGEAR

GEARV
  SUBROUTINES: GEARF

GEFCON
  SUBROUTINES: PRPARO, ROTARO

GERCFS
  SUBROUTINES: GEARF

GETMSD
  SUBROUTINES: CLCMSD

GETPSD
  SUBROUTINES: CLCPSD

GETSD
  SUBROUTINES: CALCSD

GETSRG
  SUBROUTINES: PRNDOM, RGUSTS

GETT12
  SUBROUTINES: COMGEN

GHCIFC
  SUBROUTINES: HWLOAD

GHVIFC
  SUBROUTINES: AERO, MAERO

GINTRP
  SUBROUTINES: RGUSTS

GRAVTY
  SUBROUTINES: FORCE, MFORCE

GTAIFC
  SUBROUTINES: TANGLS

GTIFC
  SUBROUTINES: AERO, MAERO

GUNITV
  SUBROUTINES: GEARF

GUSGEN
  SUBROUTINES: GUST

GUST
  SUBROUTINES: MPRFIL, PROFIL, SETFCS

HCABLE
  SUBROUTINES: FORCE

HDIFC
  SUBROUTINES: PRPARO, ROTARO

HGCNTC
  SUBROUTINES: MAXVEC

HGEEZ
  SUBROUTINES: CALCSD, CLCMSD

HGEOM
  SUBROUTINES: INGEOM

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HGLOAD
SUBROUTINES: HONLY

HMOVAR
SUBROUTINES: HONLY

HONLY
SUBROUTINES: HULARO

HRDLIM
SUBROUTINES: PROFIL

HULARO
SUBROUTINES: AERO, MAERO

HWLOAD
SUBROUTINES: HONLY

IACLOD
SUBROUTINES: CALCSD, CLCMSD

IMLOAD
SUBROUTINES: CLCMSD

IMSL
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INATMOS
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INCABL
SUBROUTINES: HLAPAY

INEXST
SUBROUTINES: HLAPAY, HLASIM

INFCSC
SUBROUTINES: HLAPAY, HLASIM

INFIFC
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INFLOW
SUBROUTINES: CALCCT

INGEAR
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INGEOM
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INGUST
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INHARO
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INHIFC
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INLARO
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INMASS
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INMCLC
SUBROUTINES: HLAPAY, HLASIM

INMOOR
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INMRST
SUBROUTINES: HLAMOR

INMTRA
SUBROUTINES: HLAMOR

INPARO
SUBROUTINES: HLAPAY

INPGEO
SUBROUTINES: HLAPAY

INPGST
SUBROUTINES: HLAPAY

INPIFC
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INPMAS
SUBROUTINES: HLAPAY

INPROF
SUBROUTINES: HLAPAY, HLASIM

INPROP
SUBROUITNES: HLAPAY, HLASIM

INPYST
SUBROUTINES: HLAPAY

INRIFC
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INSERT
SUBROUTINES: LOADFM, PLODFM, PTRIM, TRIM

INSTAB
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INSTAT
SUBROUTINES: HLAPAY, HLASIM

INSTEP
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INTERP
SUBROUTINES: COMGEN, GETSRG

INTGTR
SUBROUTINES: HLASIM

INTIAL
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

INTIFC
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

IN1MMD
SUBROUTINES: LOADMT

IN1MOD
SUBROUTINES: LOADT

IPLOTF
SUBROUTINES: QUESTN, TQUEST

ITERCT
SUBROUTINES: CALCCT

JDATE
SUBROUTINES: IPLOTF

LEQT2F
SUBROUTINES: CALCFC, CLCMFC, NEWMU, NEWPU, NEWU

LGEAR
SUBROUTINES: FORCE, MFORCE

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LGPOS
SUBROUTINES: MAXVEC

LINEAR
SUBROUTINES: HLASIM

LINV2F
SUBROUTINES: MASMAT, PMATRX

LMGUES
SUBROUTINES: CALCCT

LOADAM
SUBROUTINES: IACLOD, MATRIX

LOADCA
SUBROUTINES: CALCSD

LOADFM
SUBROUTINES: TRIM

LOADHM
SUBROUTINES: INHARO

LOADMT
SUBROUTINES: CLCMSD

LOADPM
SUBROUTINES: INPARO

LOADT
SUBROUTINES: CALCAD

LOADUA
SUBROUTINES: CALCSD

LODFSM
SUBROUTINES: INLARO

LODGST
SUBROUTINES: WINDS

LODMCA
SUBROUTINES: CLCMSD

LODMUA
SUBROUTINES: CLCMSD

LODSV
SUBROUTINES: CLCMSD, HLAMOR

LOOP
SUBROUTINES: SGLFLW

LPGEOM
SUBROUTINES: INGEOM

LPUARO
SUBROUTINES: AERO

LPUTRN
SUBROUTINES: TRNFRM

MAERO
SUBROUTINES: MFORCE

MAGCOL
SUBROUTINES: NORMS

MASMAT
SUBROUTINES: MATRIX

MATRIX
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

MAXVEC
SUBROUTINES: CALCSD, CLCMSD, HLAMOR, HLAPAY, HLASIM

MCGDST
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

MCLCDL
SUBROUTINES: MPRPAR, MRTARO

MCTSTP
SUBROUTINES: HLAMOR

MEIGEN
SUBROUTINES: MLINAR

MEXTRC
SUBROUTINES: MLODFM, MTRIM

MFORCE
SUBROUTINES: CLCMSD

MINSRT
SUBROUTINES: MLODFM, MTRIM

MINTGR
SUBROUTINES: HLAMOR

MINTIL
SUBROUTINES: HLAMOR

MLINAR
SUBROUTINES: HLAMOR

MLPARO
SUBROUTINES: MAERO

MLODFM
SUBROUTINES: MTRIM

MMGCOL
SUBROUTINES: MNORMS

MMMULT
SUBROUTINES: AROTRN, CEFCON, LOADMT, LOADT, LPUTRN, NDMLOC, PRPARO, PTRNFM, ROTARO

MNORMS
SUBROUTINES: MTRIM

MORDSK
SUBROUTINES: MPRPAR, MRTARO

MPRFIL
SUBROUTINES: CLCMSD

MPRPAR
SUBROUTINES: MLPARO

MPTURB
SUBROUTINES: MSTAB

MRTARO
SUBROUTINES: MLPARO

MSORT
SUBROUTINES: MNORMS

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OF POOR QUALITY

MSSAO
SUBROUTINES: APPMAS, CALCCT, CALCFC, CKTSTP, CLCMFC, CLCSVD, CLTSVD, MCPINC, CPINC, C1MCOS, DEFCT, DVTRST, D1MCOS, EIGEN, ESTMUO, FORMSV, FRMTSV, GETMSD, GETPSD, GETSD, GETSRG, GETT12, HGEOM, HGLOAD, HLAMOR, HLAPAY, HLASIM, HWLOAD, IACLOD, INATMOS, INCABL, INFCSC, INFLOW, INGEAR, INGUST, INHARO, INHIFC, INLARO, INMASS, INMCLC, INMOOR, INPGEO, INPGST, INPIFC, INPMAS, INPROF, INPROP, INRIFC, INSTAT, INSTEF INTERP, INTGTR, INTIFC, IN1MMD, IN1MOD, ITERCT LMGUES, LPGEOM, MASMAT, MCTSTP, MEIGEN, MINTGR, MPTURB, NDMLOC, NEWRAP, PMATRX, PPTURB, PTURB, QUESTN, RMASS, SETFCS, SINTRP, TEIGEN, TGLOAD, TINTGR, TPTURB, TQUEST, TSROLM, TSTWKA, VORING, WRTIVD

MSTAB
SUBROUTINES: MLINAR

MTPTRB
SUBROUTINES: MTRIM

MTRIM
SUBROUTINES: HLAMOR

MTRMLM
SUBROUTINES: ESTMUO, NEWMU

MVMULT
SUBROUTINES: AROTRN, AUXVEC, BODRAT, BOYUNC, CABLEV, CLMTRM, CROSS, CUNITV, DSKIVL, ESTUO, EULRAT, FDBACK, FRMGDV, FRTION, FUSARO, GEARF, GEARV, GEFCON, GETMSD, GETSD, GHVIFC, GINTRP, GRAVTY, GUNITV, HGCNTC, HWLOAD, IMLOAD, LGPOS, LOADCA, LOADUA, LODMCA, LODMUA, LODSVC, MPRPAR, MRTARO, NDMLOC, PAXVEC, PBODRT, PELRAT, PGRAVTY, POSHLD, PRNDOM, PRPARO, PRTEFC, PTRMRT, PWINDS, PWLOAD, RGUSTS, ROTARO, ROTEFC, SETFCS, SHDANG, SMOTCG, SUMFOR, WINDS

M3SCA
SUBROUTINES: LOADMT, LOADT

M3TNPS
SUBROUTINES: AROTRN, FRMLVH, LPUTRN, PTRNFM, STDTRN

NDMLOC
SUBROUTINES: AERO, MAERO

NEWMU
SUBROUTINES: MTRIM

NEWPU
SUBROUTINES: PTRIM

NEWRAP
SUBROUTINES: ITERCT

NEWU
SUBROUTINES: TRI..

NORMS
SUBROUTINES: ?TRIM, TRIM

OIATMOS
SUBROUTINES: INATMOS

OICABL
SUBROUTINES: INCABL

OIEXST
SUBROUTINES: INEXST

OIFCSC
SUBROUTINES: INFCSC

OIFIFC
SUBROUTINES: INFIFC

OIGEAR
SUBROUTINES: INGEAR

OIGEOM
SUBROUTINES: INGEOM

OIGUST
SUBROUTINES: INGUST

OIHARO
SUBROUTINES: INHARO

OIHIFC
SUBROUTINES: INHIFC

OILARO
SUBROUTINES: INLARO

OIMASS
SUBROUTINES: INMASS

OIMCLC
SUBROUTINES: INMCLC

OIMOOR
SUBROUTINES: INMOOR

OIMRST
SUBROUTINES: INMRST

OIMTRA
SUBROUTINES: INMTRA

OIPARO
SUBROUTINES: INPARO

OIPGEO
SUBROUTINES: INPGEO

OIPGST
SUBROUTINES: INPGST

OIPIFC
SUBROUTINES: INPIFC

OIPMAS
SUBROUTINES: INPMAS

OIPROF
SUBROUTINES: INPROF

OIPROP
SUBROUTINES: INPROP

OIPYST
SUBROUTINES: INPYST

OIRIFC
SUBROUTINES: INRIFC

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OISTAB
SUBROUTINES: INSTAB

OISTAT
SUBROUTINES: INSTAT

OISTEP
SUBROUTINES: INSTEP

OITIFC
SUBROUTINES: INTIFC

OUTPIN
SUBROUTINES: QUESTN, TQUEST

PAERO
SUBROUTINES: PFORCE

PAXVEC
SUBROUTINES: CLCPSD, HLAPAY

PBOIRT
SUBROUTINES: INPYST

PCABLE
SUBROUTINES: PFORCE

PCGDST
SUBROUTINES: HLAPAY

PELRAT
SUBROUTINES: GETPSD, STOPS, STOTS

PERTUB
SUBROUTINES: TRIM

PFORCE
SUBROUTINES: CLCPSD

PGEEZ
SUBROUTINES: CLCPSD

PGRVTY
SUBROUTINES: PFORCE

PGSTCN
SUBROUTINES: PGUST

PGUST
SUBROUTINES: PPRFIL

PHIFC
SUBROUTINES: RPHIFC

PINTIL
SUBROUTINES: HLAPAY

PLODFM
SUBROUTINES: PTRIM

PMATRX
SUBROUTINES: HLAPAY

PMOVAR
SUBROUTINES: PAERO

PMTRML
SUBROUTINES: MTRIM

POOHD
SUBROUTINES: COMGEN

PPRFIL
SUBROUTINES: CLCPSD

PPTURB
SUBROUTINES: PSTAB

PRCOLM
SUBROUTINES: TRIM

PRNDOM
SUBROUTINES: PGUST

PROFIL
SUBROUTINES: CALCSD

PRPARO
SUBROUTINES: LPUARO

PRTEFC
SUBROUTINES: PFORCE

PSTORE
SUBROUTINES: HLAPAY

PSTAB
SUBROUTINES: PLINAR

PTCLSD
SUBROUTINES: NEWPU, PLODFM, PTRIM

PTIFC
SUBROUTINES: RPTIFC

PTPTRB
SUBROUTINES: PTRIM

PTRIM
SUBROUTINES: HLAPAY

PTRMLM
SUBROUTINES: ESTPUO, NEWPU

PTRMRT
SUBROUTINES: HLAPAY, PTCLSD

PTRNFM
SUBROUTINES: CLCPSD, HLAPAY, INPYST, PTCLSD, STOPS, STOTS

PTURB
SUBROUTINES: STAB

PWINDS
SUBROUTINES: PAERO

PWLOAD
SUBROUTINES: PAERO

QUESTN
SUBROUITNES: HLAMOR, HLASIM

RANDOM
SUBROUTINES: GUST

RGUSTS
SUBROUTINES: RANDOM

RHIFC
SUBROUTINES: RPHIFC

RMASS
SUBROUTINES: MASMAT

ROTARO
SUBROUTINES: LPUARO

ROTEFC
SUBROUTINES: FORCE, MFORCE

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ROTHOY
SUBROUTINES: ROTARO

RPHIFC
SUBROUTINES: AERO

RPIFC
SUBROUTINES: LPUARO

RPTIFC
SUBROUTINES: AERO

RTIFC
SUBROUTINES: RPTIFC

SETFCS
SUBROUTINES: HLAPAY, HLASIM

SGLFLW
SUBROUTINES: CONTRL

SHADOW
SUBROUTINES: AERO, MAERO

SHDANG
SUBROUTINES: SHDELM

SHDELM
SUBROUTINES: SHADOW

SINTRP
SUBROUTINES: GINTRP

SMOTCG
SUBROUTINES: CLCEFM, FUSARO, HCABLE, HULARO, LGEAR, MPRPAR, MRTARO, PAERO, PCABLE, PRPARO, ROTARO

SORT
SUBROUTINES: NORMS

STAB
SUBROUTINES: LINEAR

STDTRN
SUBROUTINES: PTRNFM, TRNFRM

STOLC
SUBROUTINES: PTURB, TPTURB

STOMS
SUBROUTINES: MPTURB

STOPS
SUBROUTINES: PPTURB

STORE
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

STOS
SUBROUTINES: PTURB, TPTURB

STOTS
SUBROUTINES: TPTURB

STOTXG
SUBROUTINES: TPTURB

STOXC
SUBROUTINES: PTURB, TPTURB

STOXG
SUBROUTINES: PTURB

STOXPG
SUBROUTINES: PPTURB

SUMCON
SUBROUTINES: CONTRL, ESTUO, LOADFM, NEWU, STOLC, TRIM, TSTCOM

SUMFOR
SUBROUTINES: ESTUO

TALFOR
SUBROUTINES: TONLY

TANGLS
SUBROUTINES: TONLY

TEIGEN
SUBROUTINES: TLINAR

TGLOAD
SUBROUTINES: TONLY

TINTGR
SUBROUTINES: HLAPAY

TLINAR
SUBROUTINES: HLAPAY

TMOVAR
SUBROUTINES: TONLY

TONLY
SUBROUTINES: HULARO

TPTURB
SUBROUTINES: TSTAB

TQUEST
SUBROUTINES: HLAPAY

TRIM
SUBROUTINES: HLAPAY, HLASIM

TRMLIM
SUBROUTINES: ESTUO, NEWU

TRNFRM
SUBROUTINES: CALCSD, CLCMSD, HLAMOR, HLAPAY, HLASIM, INMRST, STOS, STOTS

TRXFOR
SUBROUTINES: TONLY

TSROLM
SUBROUTINES: TONLY

TSTAB
SUBROUTINES: TLINAR

TSTCOM
SUBROUTINES: PROFIL

TSTWKA
SUBROUTINES: INFIFC, INPIFC, INRIFC

UERSET
SUBROUTINES: HLAMOR, HLAPAY, HLASIM

VMULFF
SUBROUTINES: CALCFC, CLCMFC, GETMSD, GETPSD, GETSD, HGLOAD, HWLOAD, IACLOD, TGLOAD

VMULFM
SUBROUTINES: CALCFC, CLCMFC

VORING
  SUBROUTINES: ITERCT

VRNGLM
  SUBROUTINES: ITERCT

VVMULT
  SUBROUTINES: CBLFOR

V3ADD
  SUBROUTINES: AUXVEC, BODRAT, BOYUNC, GEARF, GEARV, HGCNTC, HGEEZ, IACLOD, LGEAR, LGPOS, LODGST, NDMLOC PAXVEC, PGEEZ, PTRMRT, PWINDS, SMOTCG, WINDS

V3SCA
  SUBROUTINES: BOYUNC, CBLFOR, CGDIST, CUNITV, GEARF, GRAVTY, GUNITV, IMLOAD, LODSVC, PCGDST, PGRAVTY, PRTEFC, ROTEFC, RPFIFC, RPIFC

V3SUB
  SUBROUTINES: AUXVEC, CGDIST, EULRAT, HULARO, INEXST, LODSVC, MCGDST, PAXVEC, PCGDST, PWINDS, RPIFC, SETFCS, WINDS

V3NORM
  SUBROUTINES: CMAXAI, CPINC, CUNITV, GEARV, GERCPS

WINDS
  SUBROUTINES: AERO, FDBACK, MAERO, SETFCS

WMSDI
  SUBROUTINES: WRTMSB

WRTINC
  SUBROUTINES: WRTTSB

WRTIVD
  SUBROUTINES: WRTMSB, WRTPSB, WRTSTB, WRTTSB

WRTMSB
  SUBROUTINES: MLINAR

WRTPSD
  SUBROUTINES: PLINAR

WRTSTB
  SUBROUTINES: LINEAR

WRTTSB
  SUBROUTINES: TLINAR

WRTVOI
  SUBROUTINES: WRTSTB

ZRPOLY
  SUBROUTINES: INFLOW

ZQADR
  SUBROUTINES: LMGUES

APPENDIX E

ALPHABETICAL DICTIONARY OF PROGRAM VARIABLES

A--LINEARIZED RIGID BODY SYSTEM MATRIX. (CHARACTERISTIC MATRIX). (ARG)

AAUX--LINEARIZED AUXILIARY RIGID BODY SYSTEM MATRIX FOR CALCULATION OF CONSTRAINT FORCES. (ARG)

ACELOC--LOCATION OF THE ACCELEROMETER PACKAGE (3) ON THE HULL IN COORDINATES OF THE HULL CG REFERENCE AXIS. (SENSOR)

ACLP1 **** FOUR VECTORS LOCATING EACH LPU
ACLP2 * REFERENCE AERODYNAMIC CENTER
ACLP3 * WITH RESPECT TO THE LPU CG
ACLP4 **** REFERENCE AXES (LPUAC)

ACROS--THREE BY THREE VECTOR CONTAINING THE SKEW SYMMETRIC CROSS PRODUCT OPERATOR MATRIX (ARG)

ACROSB--A THREE BY ONE VECTOR CONTAINING THE RESULT OF THE CROSS PRODUCT OF AVECTR WITH BVECTR (ACROSB = AVECTR X BVECTR) (ARG)

ADELTX--LINEARIZATION PERTUBATION INCREMENTS ON THE STATE VECTOR ELEMENTS. (DELTAX)

ADOTB--SCALAR RESULT OF VECTOR DOT PRODUCT OF VECTORS VECTRA AND VECTOR VECTRB. (ARG)

AILLFL--AILERON DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

AIRDEN--REFERENCE ATMOSPHERIC DENSITY (ATMOS)

ALAV1 ****
ALAV2 * AVERAGE BLADE ANGLE OF
ALAV3 * ATTACK (ROTOR OR PROPELLER)
ALAV4 **** (ARG)

ALPT--TAIL ROLLING ANGLE OF ATTACK (ARG)

ALPTO--TAIL ROLLING ANGLE OF ATTACK WITHOUT AILERON EFFECTS.

ALP1T--THE ROLLING STALL ANGLE OF ATTACK-1 (START OF STALL TRANSITION REGIME). (TPARAM)

ALP2T--TAIL ROLLING STALL ANGLE OF ATTACK-2 (END OF STALL REGIME). (TPARAM)

ALT--TAIL ANGLE OF ATTACK. (ARG)

AL1T--TAIL STALL ANGLE OF ATTACK-1 (START OF STALL TRANSITION REGIME) (TPARAM)

AL2T--TAIL STALL ANGLE OF ATTACK-2 (END OF TAIL TRANSITION REGIME) (TPARAM)

AMATFL--SYSTEM A-MATRIX STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE SYSTEM MATRIX (CHARACTERISTIC MATRIX) (STABDV)

AMATRX--A THREE BY THREE MATRIX (ARG)

ANGLE--ELEMENT WAKE ANGLE. (ARG)

ANGLE1--LOWER BOUNDARY OF THE HULL ON COMPONENT WAKE ANGLE. (ARG)

ANGLE2--UPPER BOUNDARY OF THE HULL ON COMPONENT WAKE ANGLE. (ARG)

ATACH1 **** FOUR VECTORS LOCATING EACH LPU
ATACH2 * ATTACH POINT ON THE HULL, WITH
ATACH3 * RESPECT TO THE HULL CG
ATACH4 **** REFERENCE AXES (ATACH)

ATAHG--VECTOR LOCATING LANDING GEAR ATTACH POINTS ON HULL FRAME WITH RESPECT TO THE HULL CENTER OF GRAVITY IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

ATAHG1 **** VECTORS WHICH LOCATE LANDING
ATAHG2 * GEAR ATTACH POINTS ON HULL
ATAHG3 * FRAME WITH RESPECT TO THE HULL
ATAHG4 **** CENTER OF GRAVITY IN THE HULL CG REFERENCE AXIS. (ATAHG)

ATA[illegible]--VECTOR LOCATING A HULL CABLE AT[illegible]H POINT WITH RESPECT TO THE HULL CG REFERENCE AXIS. (ARG)

ATAHP1 **** FOUR VECTORS LOCATING THE
ATAHP2 * CABLE ATTACH POINTS ON THE
ATAHP3 * HULL WITH RESPECT TO THE HULL
ATAHP4 **** CG REFERENCE AXIS. (ATACHP)

AVECTR--A THREE BY ONE VECTOR (ARG)

AVLU--IMAGINARY PART OF EIGEN VALUE

AVTR--IMAGINARY PART OF EIGEN VECTOR

AXACC--X-ACCELEROMETER MEASUREMENT (UNITS: LENGTH/TIME**2). (ARG)

AXCGG--HULL CG INERTIAL X-ACCELERATION IN G'S. (ARG)

AXMTCL--COLUMN OF STABILITY DERIVATIVE AUXILIARY MATRIX BEING EVALUATED. (ARG)

AYACC--Y-ACCELEROMETER MEASUREMENT (UNITS: LENGTH/TIME**2). (ARG)

AYCGG--HULL CG INERTIAL Y-ACCELERATION IN G'S. (ARG)

AZACC--Z-ACCELEROMETER VALUE (UNITS: LENGTH/TIME**2). (ARG)

AZCGG--HULL CG INERTIAL Z-ACCELERATION IN G'S. (ARG)

AOR--ROTOR BLADE CONING ANGLE. (ARG)

AOR1 **** ROTOR BLADE CONING ANGLE,
AOR2 * WITH RESPECT TO THE
AOR3 * CONTROL AXES.
AOR4 ****

A1NAME--VARIABLE NAME OF THE VALUE IN ANGLE1. (ARG)

A--LINEARIZED RIGID BODY SYSTEM MATRIX. (CHARACTERISTIC MATRIX). (ARG)

AAUX--LINEARIZED AUXILIARY RIGID BODY SYSTEM MATRIX FOR CALCULATION OF CONSTRAINT FORCES. (ARG)

ACELOC--LOCATION OF THE ACCELEROMETER PACKAGE (3) ON THE HULL IN COORDINATES OF THE HULL CG REFERENCE AXIS. (SENSOR)

ACLP1 **** FOUR VECTORS LOCATING EACH LPU
ACLP2   * REFERENCE AERODYNAMIC CENTER
ACLP3   * WITH RESPECT TO THE LPU CG
ACLP4 **** REFERENCE AXES (LPUAC)

ACROS--THREE BY THREE VECTOR CONTAINING THE SKEW SYMMETRIC CROSS PRODUCT OPERATOR MATRIX (ARG)

ACROSB--A THREE BY ONE VECTOR CONTAINING THE RESULT OF THE CROSS PRODUCT OF AVECTR WITH BVECTR (ACROSB = AVECTR X BVECTR) (ARG)

ADELTX--LINEARIZATION PERTUBATION INCREMENTS ON THE STATE VECTOR ELEMENTS. (DELTAX)

ADOTB--SCALAR RESULT OF VECTOR DOT PRODUCT OF VECTORS VECTRA AND VECTOR VECTRB. (ARG)

AILLFL--AILERON DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

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ALAV3   * ATTACK (ROTOR OR PROPELLER)
ALAV4 **** (ARG)

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ALPTO--TAIL ROLLING ANGLE OF ATTACK WITHOUT AILERON EFFECTS.

ALP1T--THE ROLLING STALL ANGLE OF ATTACK-1 (START OF STALL TRANSITION REGIME). (TPARAM)

ALP2T--TAIL ROLLING STALL ANGLE OF ATTACK-2 (END OF STALL REGIME). (TPARAM)

ALT--TAIL ANGLE OF ATTACK. (ARG)

AL1T--TAIL STALL ANGLE OF ATTACK-1 (START OF STALL TRANSITION REGIME) (TPARAM)

AL2T--TAIL STALL ANGLE OF ATTACK-2 (END OF TAIL TRANSITION REGIME) (TPARAM)

AMATFL--SYSTEM A-MATRIX STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE SYSTEM MATRIX (CHARACTERISTIC MATRIX) (STABDV)

AMATRX--A THREE BY THREE MATRIX (ARG)

ANGLE--ELEMENT WAKE ANGLE. (ARG)

ANGLE1--LOWER BOUNDARY OF THE HULL ON COMPONENT WAKE ANGLE. (ARG)

ANGLE2--UPPER BOUNDARY OF THE HULL ON COMPONENT WAKE ANGLE. (ARG)

ATACH1 **** FOUR VECTORS LOCATING EACH LPU
ATACH2   * ATTACH POINT ON THE HULL, WITH
ATACH3   * RESPECT TO THE HULL CG
ATACH4 **** REFERENCE AXES (ATACH)

ATAHG--VECTOR LOCATING LANDING GEAR ATTACH POINTS ON HULL FRAME WITH RESPECT TO THE HULL CENTER OF GRAVITY IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

ATAHG1 **** VECTORS WHICH LOCATE LANDING
ATAHG2   * GEAR ATTACH POINTS ON HULL
ATAHG3   * FRAME WITH RESPECT TO THE HULL
ATAHG4 **** CENTER OF GRAVITY IN THE HULL CG REFERENCE AXIS. (ATAHG)

ATAHP--VECTOR LOCATING A HULL CABLE ATTACH POINT WITH RESPECT TO THE HULL CG REFERENCE AXIS. (ARG)

ATAHP1 **** FOUR VECTORS LOCATING THE
ATAHP2   * CABLE ATTACH POINTS ON THE
ATAHP3   * HULL WITH RESPECT TO THE HULL
ATAHP4 **** CG REFERENCE AXIS. (ATACHP)

AVECTR--A THREE BY ONE VECTOR (ARG)

AVLU--IMAGINARY PART OF EIGEN VALUE

AVTR--IMAGINARY PART OF EIGEN VECTOR

AXACC--X-ACCELEROMETER MEASUREMENT (UNITS: LENGTH/TIME**2). (ARG)

AXCGG--HULL CG INERTIAL X-ACCELERATION IN G'S. (ARG)

AXMTCL--COLUMN OF STABILITY DERIVATIVE AUXILIARY MATRIX BEING EVALUATED. (ARG)

AYACC--Y-ACCELEROMETER MEASUREMENT (UNITS: LENGTH/TIME**2). (ARG)

AYCGG--HULL CG INERTIAL Y-ACCELERATION IN G'S. (ARG)

AZACC--Z-ACCELEROMETER VALUE (UNITS: LENGTH/TIME**2). (ARG)

AZCGG--HULL CG INERTIAL Z-ACCELERATION IN G'S. (ARG)

A0R--ROTOR BLADE CONING ANGLE. (ARG)

A0R1 **** ROTOR BLADE CONING ANGLE,
A0R2   * WITH RESPECT TO THE
A0R3   * CONTROL AXES.
A0R4 ****

A1NAME--VARIABLE NAME OF THE VALUE IN ANGLE1. (ARG)

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A2NAME--VARIABLE NAME OF THE VALUE IN ANGLE2. (ARG)

A1R--ROTOR DISC BACKWARD FLAPPING ANGLE. (ARG)

A1R1 **** ROTOR BLADE LONGITUDINAL
A1R2 * FLAPPING ANGLE, WITH
A1R3 * RESPECT TO THE CONTROL
A1R4 **** AXIS. POSITIVE FOR BACKWARD FLAPPING.

A1S--LATERAL CONTROL AXIS DEFLECTION. (ARG)

A1SE1 **** JET EXHAUST LATERAL EULER
A1SE2 * ANGLE ORIENTATION WITH RES-
A1SE3 * PECT TO CG AXIS. A POSITIVE
A1SE4 **** JET EXHAUST ANGLE IS IN A POSITIVE SENSE ABOUT THE POSITIVE X-AXIS (ARG)

A1SLFL--ROTOR LATERAL CYCLIC PITCH DEFLECTION LIMIT FLAG INDICATING MAXIMUM ALLOWED MECHANICAL VALUE WAS EXCEEDED. (MCLMFL)

A1SP1 **** PROPELLER SHAFT LATERAL
A1SP2 * EULER ANGLE ORIENTATION
A1SP3 * WITH RESPECT TO THE LPU
A1SP4 **** CG AXES. A POSITIVE DEFLECTION IS IN A POSITIVE SENSE ABOUT THE POSITIVE X-AXIS.. (PRPRIG)

A1SR--UNIFORM ROTOR LATERAL CYCLIC CONTROL (ARG)

A1SRFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE ROTOR SHAFT LATERAL EULER ANGLES IS GREATER THAN THE ALLOWED MAXIMUM VALUE(A1SRMX). (MCLMFL)

A1SRMX--MAXIMUM ROTOR LATERAL CONTROL AXES (SWASH PLATE) DEFLECTION.(MECLIM)

A1SR1 **** ROTOR BLADE LATERAL CONTROL
A1SR2 * AXIS DEFLECTION, WITH RESPECT
A1SR3 * TO THE SHAFT AXES. A POSITIVE
A1SR4 **** DEFLECTION IS IN A POSITIVE SENSE ABOUT THE POSITIVE X-AXIS. (RSTATE)

B--LINEARIZED INDIVIDUAL (NOT LINKED) CONTROL INPUT MATRIX. (ARG)

BAPRIM--LINEARIZED LINKED CONTROL INPUT MATRIX FOR THE CALCULATION OF CONSTRAINT FORCES. (ARG)

BAUX--LINEARIZED INDIVIDUAL (NOT LINKED) CONTROL INPUT MATRIX FOR THE CALCULATION OF CONSTRAINT FORCES. (ARG)

BDELTX--LINEARIZATION INCREMENTS FOR UNLINKED CONTROLS. (DELTAX)

BEHH--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS THE HULL ANGULAR BODY RATES TO EULER RATES (BTRANS)

BELPH--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS THE ANGULAR BODY RATES OF AN LPU, GIVEN IN HULL COORDINATES, TO LPU EULER RATES (ARG)

BELPLP--A NON-ORTHOGONAL MATRIX WHICH TRANSFORMS LPU ANGULAR BODY RATES GIVEN IN LPU COORDINATES, TO LPU EULER RATES (ARG)

BEPP--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS THE PAYLOAD ANGULAR BODY RATES TO THE EULER RATES. (PBTRNS)

BETAT--TAIL SIDE SLIP ANGLE. (ARG)

BETA1T--LATERAL TAIL STALL ANGLE OF SLIDE SLIP-1 (START OF SIDE SLIP STALL TRANSITION REGIME). (TPARAM)

BETA2T--STALL ANGLE OF SIDE SLIP-2 (END OF SIDE SLIP STALL TRANSITION REGIME). (TPARAM)

BETELM--BETA-WAKE ANGLE

BETWK1--BETA-WAKE ANGLE FOR START OF SHADOW REGION. (ARG)

BETWK2--BETA-WAKE ANGLE FOR END OF SHADOW REGION. (ARG)

BE1H **** FOUR NON-ORTHOGONAL MATRICES
BE2H * WHICH TRANSFORMS THE LPU ANGULAR
BE3H * BODY RATES GIVEN IN HULL
BE4H **** COORDINATES TO LPU EULER RATES (BTRANS)

BE11 **** FOUR NON-ORTHOGONAL MATRICES
BE22 * WHICH TRANSFORMS THE LPU ANGULAR
BE33 * BODY RATES GIVEN IN LPU
BE44 **** COORDINATES TO LPU EULER RATES (BTRANS)

BHEH--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS THE HULL EULER RATES TO HULL ANGULAR BODY RATES (BTRANS)

BHELP--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS LPU EULER RATES TO LPU ANGULAR BODY RATES IN HULL COORDINATES (ARG)

BHE1 **** FOUR NON-ORTHOGONAL MATRICES
BHE2 * WHICH TRANSFORM THE LPU EULER
BHE3 * RATES TO LPU ANGULAR BODY RATES
BHE4 **** GIVEN IN HULL COORDINATES (BTRANS)

BLGCFL--VEHICLE BELLY GROUND CONTACT FLAG (HLCNTC)

BLKINT--A BLANK ARRAY WHICH CAN BE USED TO INSERT ADDITIONAL INTEGRATOR STATES, IF DESIRED.(SPRINT)

BLKSIZ--THE LENGTH OF THE ARRAY BLKINT. (SPRINT)

BLPELP--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS LPU EULER RATES TO LPU ANGULAR BODY RATES IN LPU COORDINATES (ARG)

BMATFL--INDIVIDUAL (NOT LINKED) CONTROL STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE INDIVIDUAL CONTROL DERIVATIVE MATRICES. (STABDV)

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BMATRX--A THREE BY THREE MATRIX (ARG)

BPDELX--LINEARIZATION INCREMENTS FOR LINKED CONTROLS. (DELTAX)

BPEP--NON-ORTHOGONAL MATRIX WHICH TRANSFORMS THE PAYLOAD EULER RATES TO PAYLOAD BODY RATES. (PBTRNS)

BPMTFL--LINKED CONTROL STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE LINKED STABILITY MATRICES. (STABDV)

BPRIM--LINEARIZED MATRIX FOR LINKED CONTROL INPUTS. (ARG)

BTDLTX--LINEARIZATION INCREMENTS FOR TAIL DEFLECTION CONTROLS. (AILERON, ELEVATORS, AND RUDDER).

BVECTR--A THREE BY ONE VECTOR (ARG)

BWGCFL--VEHICLE BOW GROUND CONTACT FLAG (HLCNTC)

```
BWK1F1 **** BETA-WAKE ANGLE FOR
BWK1F2    * START OF SHADOW REGION FOR
BWK1F3    * FUSELAGES. (SHDFCN)
BWK1F4 ****
```

```
BWK1P1 **** BETA-WAKE ANGLE FOR
BWK1P2    * START OF SHADOW REGION FOR
BWK1P3    * PROPELLERS. (SHDPCN)
BWK1P4 ****
```

```
BWK1R1 **** BETA-WAKE ANGLE FOR
BWK1R2    * START OF SHADOW REGION
BWK1R3    * FOR ROTORS. (SHDRCN)
BWK1R4 ****
```

```
BWK2F1 **** BETA-WAKE ANGLE FOR
BWK2F2    * END OF SHADOW REGION
BWK2F3    * FOR FUSELAGES. (SHDFCN)
BWK2F4 ****
```

```
BWK2P1 **** BETA-WAKE ANGLE FOR
BWK2P2    * END OF SHADOW REGION
BWK2P3    * FOR PROPELLERS. (SHDPCN)
BWK2P4 ****
```

```
BWK2R1 **** BETA-WAKE ANGLE FOR
BWK2R2    * END OF SHADOW REGION
BWK2R3    * FOR ROTORS. (SHDRCN)
BWK2R4 ****
```

```
B1E1 **** FOUR NON-ORTHOGONAL MATRICES
B2E2    * WHICH TRANSFORM THE LPU EULER
B3E3    * RATES TO LPU ANGULAR BODY RATES
B4E4 **** GIVEN IN LPU COORDINATES (BTRANS)
```

B1R--ROTOR DISC SIDEWAYS FLAPPING ANGLE (POSITIVE TO THE RIGHT, WHEN LOOKING AT THE ROTOR FROM THE REAR). (ARG)

```
B1R1 **** ROTOR BLADE LATERAL
B1R2    * FLAPPING ANGLE, WITH
B1R3    * RESPECT TO THE CONTROL
B1R4 **** AXES.  POSITIVE FOR FLAPPING
          TOWARD THE RIGHT.
```

B1S--LONGITUDINAL CONTROL AXIS DEFLECTION. POSITIVE DEFLECTION IS PITCH DOWN (A NEGATIVE ROTATION ABOUT THE POSITIVE Y-LPU CG REFERENCE AXIS.) (ARG)

```
B1SE1 **** JET EXHAUST LONGITUDINAL
B1SE2    * EULER ANGLE ORIENTATION WITH
B1SE3    * RESPECT TO THE LPU CG AXIS.
B1SE4 **** A POSITIVE JET EXHAUST
           LONGITUDINAL EULER
           ANGLE IS TAKEN IN A NEGATIVE
           SENSE ABOUT THE POSITIVE
           Y-LPU CG REFERENCE AXIS (ARG)
```

B1SLFL--ROTOR LONGITUDINAL CYCLIC PITCH DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

```
B1SP1 **** PROPELLER SHAFT LONGITUDINAL
B1SP2    * EULER ANGLE ORIENTATION
B1SP3    * WITH RESPECT TO THE LPU CG
B1SP4 **** AXES.  A POSITIVE DEFLECTION
           IS TAKEN IN A NEGATIVE SENSE
           ABOUT THE POSITIVE Y-LPU CG
           REFERENCE AXIS. (PRPRIG)
```

B1SRFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE ROTOR LONGITUDINAL CYCLIC PITCH ANGLE EXCEEDS THE MAXIMUM ALLOWED VALUE(B1SRMX). (MCLMFL)

B1SRMX--MAXIMUM ROTOR LONGITUDINAL CONTROL AXES (SWASH PLATE) DEFLECTION. (MECLIM)

```
B1SR1 **** ROTOR LONGITUDINAL
B1SR2    * CYCLIC PITCH ANGLE WITH
B1SR3    * RESPECT TO SHAFT AXES.
B1SR4 **** A POSITIVE DEFLECTION IS
           TAKEN IN A NEGATIVE SENSE
           ABOUT THE POSITIVE Y-LPU
           CG REFERENCE AXIS.(RSTATE)
```

C--LINEARIZED MATRIX FOR GUST INPUTS. (ARG)

CABLC--CABLE DAMPING CONSTANT. (ARG)

```
CABLC1 ****
CABLC2    * CABLE DAMPING CONSTANTS
CABLC3    * (CABLC)
CABLC4 ****
```

CABLE--VECTOR LOCATING THE RELATIVE LOCATION OF A PAYLOAD CABLE ATTACH POINT RELATIVE TO A HULL PAYLOAD ATTACH POINT IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

```
CABLE1 **** FOUR VECTORS LOCATING THE
CABLE2    * CABLE ATTACH POINTS ON THE
CABLE3    * PAYLOAD RELATIVE TO THE
CABLE4 **** CABLE ATTACH POINTS ON THE HULL
            IN COORDINATES OF THE HULL CG
            REFERENCE AXIS. (CABLE)
```

CABLK--CABLE SPRING CONSTANT. (ARG)

```
CABLK1 ****
CABLK2    * CABLE SPRING CONSTANTS
CABLK3    * (CABLK)
CABLK4 ****
```

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CAUX--LINEARIZED MATRIX FOR GUST INPUTS TO CALCULATE CONTRAINT FORCES. (ARG)

CA1SR1 **** UNIFORM ROTOR LATERAL
CA1SR2 * CYCLIC SETTING FROM
CA1SR3 * SUBROUTINE SUMCON.
CA1SR4 **** (ARG)

CBLTH--SCALAR LENGTH OF THE VECTOR BETWEEN THE HULL CABLE ATTACH POINT AND THE RESPECTIVE PAYLOAD CABLE ATTACH POINT. (ARG)

CBLTH1 **** MAGNITUDES OF THE DISTANCE
CBLTH2 * BETWEEN THE CABLE ATTACH
CBLTH3 * POINT ON THE PAYLOAD AND THE
CBLTH4 **** RESPECTIVE CABLE ATTACH POINT ON THE HULL; EQUALS THE ACTUAL CABLE LENGTH WHEN THE CABLE LENGTH IS GREATER THAN OR EQUAL TO THE UNSTRETCHED CABLE LENGTH.

CBLTN--CABLE TENSION (ALWAYS A POSITIVE SCALAR). (ARG)

CBLTN1 **** CABLE TENSION MAGNITUDES (ALWAYS
CBLTN2 * POSITIVE). (CBLTEN)
CBLTN3 *
CBLTN4 ****

CBOPMX--THE NUMBER OF CABLE VARIABLES WANTED ON OUTPUT. (POPWNT)

CBWANT--AN ARRAY CONTAINING THE CODE NUMBERS FOR THE CABLE VARIABLES WANTED ON OUTPUT. (POPWNT)

CB1SR1 **** ROTOR LONGITUDINAL
CB1SR2 * CYCLIC PITCH SETTING
CB1SR3 * FROM SUBROUTINE
CB1SR4 **** SUMCON. (ARG)

CCDSDM--LINKED CONTROL STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE LINKED STABILITY MATRICES. (STABDV)

CCO--INITIAL (UNCORRECTED) VALUE FOR CROSSFLOW DRAG PARAMETER (YVVABH ON INPUT). (UCCFWC)

CDAX--AXIAL DRAG COEFFICIENT OF DISC (ROTOR OR PROPELLER) BLADE FOR MOORING AERODYNAMIC CALCULATIONS. (ARG)

CDELTX--LINEARIZATION INCREMENTS FOR GUST DERIVATIVE MATRICES. (DELTAX)

CDFLAG--A CONDITION FLAG WHICH INDICATES THE CONDITION WHICH TERMINATED THE ITERATION FOR THE CALCULATION OF THE THRUST COEFFICEINT. (ARG)

CDLTAL--AILERON DEFLECTION SETTING FROM SUBROUTINE SUMCON. (ARG)

CDLTEL--ELEVATOR DEFLECTION SETTING FROM SUBROUTINE SUMCON. (ARG)

CDLTRD--RUDDER DEFLECTION SETTING FROM SUBROUTINE SUMCON. (ARG)

CDPN--CROSSFLOW (PERPENDICULAR) DISC (ROTOR OR PROPELLER) BLADE DRAG CO-EFFICIENT FOR MOORING AERODYNAMIC CALCULATIONS. (ARG)

CFMTFL--CONSTRAINT FORCE STABILITY DERIVATIVE MATRIX FLAG: TRUE EQUALS CALCULATE LINEARIZED CONSTRAINT FORCE EQUATIONS. (STABDV)

CFSDM--CONSTRAINT FORCE STABILITY DERIVATIVE MATRIX FLAG: TRUE EQUALS CALCULATE LINEARIZED CONSTRAINT FORCE EQUATIONS. (STABDV)

CH--DISC H-FORCE (DISC DRAG) COEFFICIENT. (

CHR--ROTOR H-F [illegible] DRAG) COEFFICIENT I [illegible] ONTROL WIND AXES. POSITIVE [illegible] CIENT ACTS ALONG THE NEGATIVE X-CONTROL WIND AXIS DIRECTION. (ARG)

CLAV1 ****
CLAV2 * AVERAGE BLADE LIFT COEFFICIENT
CLAV3 * (ROTOR OR PROPELLER). (ARG)
CLAV4 ****

CLMTMO--CALM TRIM MOMENT USED IN MOORING TRIM ALGORITHM TO ORIENT THE MOORED VEHICLE TO THE DESIRED HEADING (PSIO). THIS MOMENT IS SET TO ZERO AFTER TRIM IS ACHIEVED. (ARG)

CLRAT--CABLE LINEAR STRETCH RATE ALONG THE CABLE UNIT VECTOR DIRECTION (ARG)

CLRAT1 **** CABLE LINEAR STRETCH RATES
CLRAT2 * DIRECTED CO-LINEARLLY
CLRAT3 * ALONG THE CABLE UNIT VECTOR
CLRAT4 **** DIRECTION. (ARG)

CMATFL--GUST INPUT STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE GUST DERIVATIVE MATRICES. (STABDV)

CMATRX--A THREE BY THREE MATRIX CONTAINING THE PRODUCT OF MATRICES AMATRX AND BMATRX (CMATRX = AMATRX * BMATRX) (ARG)

CMAX--COLUMN OF FMAT CORRESPONDING TO MAXIMUM MODIFIED EUCLIDEAN NORM (ARG)

CMD--VELOCITY COMMAND TABLE. (ARG)

CMD1--COMMAND AT T1COM. (ARG)

CMD2--COMMAND AT T2COM. (ARG)

CMIN--COLUMN OF MATRIX MFMAT CORRESPONDING TO MINIMUM EUCLIDEAN NORM (ARG)

COLPOS--THE STABILITY DERIVATIVE MATRIX COLUMN NUMBER FOR THE STABILITY DERIVATIVE VALUE BEING CALCULATED.(INVALD)

COLUMN--DESIRED COLUMN POSITION IN MATRIX (MATRIX) WHERE VECTOR (VECTOR) IS TO BE INSERTED (ARG).

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COM--INTERPOLATED COMMAND AT PRESENT TIME. LINEAR INTERPOLATION FOR TIMES BETWEEN COMMAND TIMES FROM COMMAND TABLE. SET EQUAL TO LAST COMMAND IF CURRENT TIME EXCEEDS LAST TIME ON COMMAND TABLE. SET EQUAL TO TRIM COMMAND IF NO COMMAND AT TIME EQUALS ZERO IS SUPPLIED IN COMMAND TABLE (ARG)

COMPLV--COMPLEMENTARY VELOCITY: SINGLE VELOCITY COMPONENT USED IN TAIL FORCE MODEL FOR THE TRANSITION FLIGHT REGIME. (ARG)

CONST--CONSTANT FOR CALCULATION OF TAIL LOADS DUE TO ROLLING ANGLE OF ATTACK (EQUALS TAILSPAN/2, AND EQUALS ONE FOR OTHER TAIL LOADS) (ARG)

CONTL--LINKED CONTROL. (ARG)

CORDP1 **** EFFECTIVE PROPELLER BLADE
CORDP2 * CORD MEASURED AT THE THREE-
CORDP3 * QUARTERS RADIUS STATION.
CORDP4 **** (PGEOM)

CORDR1 **** EFFECTIVE ROTOR BLADE
CORDR2 * CORD MEASURED AT THE THREE-
CORDR3 * QUARTERS RADIUS STATION.
CORDR4 **** (RGEOM)

CQ--CONTROL WIND AXES TORQUE COEFFICIENT(ROTOR OR PROPELLER).(ARG)

CQR--ROTOR TORQUE COEFFICIENT IN THE CONTROL WIND AXES. A POSITIVE ROTOR TORQUE INDICATES THE APPLICATION OF A MOMENT ABOUT THE POSITIVE Z-CONTROL WIND AXES. (ARG)

CSDOT--COPY OF THE STATE DERIVATIVE VECTOR FOR USE IN CALCULATING THE ACCELEROMETER FEEDBACK VALUES. (SDOTCP)

CT--CONTROL WIND AXES THRUST COEFFICIENT(ROTOR OR PROPELLER). (ARG)

CTHEP1 **** UNIFORM PROPELLER
CTHEP2 * COLLECTIVE PITCH
CTHEP3 * SETTING FROM SUB-
CTHEP4 **** ROUTINE SUMCON. (ARG)

CTHER1 **** UNIFORM ROTOR COLLECTIVE
CTHER2 * PITCH SETTING FROM
CTHER3 * SUBROUTINE SUMCON.
CTHER4 **** (ARG)

CT1 ****
CT2 * CONTROL WIND AXES THRUST
CT3 * COEFFICIENT FOR LPU1-4. (ARG)
CT4 ****

CTR--ROTOR CONTROL WIND THRUST COEFFICIENT. (ARG)

CVECTR--THREE BY ONE VECTOR RESULT OF THE ADDITION OF AVECTR AND BVECTR (CVECTR = AVECTR + BVECTR)

CY--CONTROL WIND AXES Y-FORCE (LATERAL FORCE) COEFFICIENT: ROTOR OR PROPELLER. (ARG)

CYR--ROTOR CONTROL WIND Y-FORCE (LATERAL FORCE) COEFFICIENT. (ARG)

DA1SR1 ****
DA1SR2 * COMMANDED ROTOR LATERAL
DA1SR3 * CYCLIC DEFLECTION INCREMENT
DA1SR4 **** (RSWASH).

DB1SR1 ****
DB1SR2 * COMMANDED ROTOR LONGITUDINAL
DB1SR3 * CYCLIC DEFLECTION INCREMENT
DB1SR4 **** (RSWASH).

DCFLC--DISC ON HULL CROSSFLOW COEFFICIENT CORRECTION. (ARG)

DDLTAL--AILERON TEST COMMAND INCREMENT (TDELFC)

DDLTEL--ELEVATOR TEST COMMAND INCREMENT (TDELFC)

DDLTRD--RUDDER TEST COMMAND INCREMENT (TDELFC)

DDUDXH--COMPONENT OF DUGDXH OBTAINED FROM (1-COSINE) GUST INPUTS. (DGUSTS)

DDUDXT--COMPONENT OF DUGSXT OBTAINED FROM (1-COSINE) GUST INPUTS. (DGUSTS)

DDUDYH--COMPONENT OF DUGDYH OBTAINED FROM (1-COSINE) GUST INPUTS. (DGUSTS)

DDUDYT--COMPONENT OF DUGDYT OBTAINED FROM (1-COSINE) GUST INPUTS. (DGUSTS)

DEFECT--ELEMENT WAKE ANGLE DEFECT. (ARG)

DELTA--THE PERTUBATION INCREMENT USED IN THE CALCULATION OF THE STABILITY DERIVATIVE. (ARG)

DELTAA--CONSTANT TERM IN QUADRATIC FUNCTION OF BLADE ANGLE OF ATTACK FOR BLADE (ROTOR OR PROPELLER) PROFILE DRAG COEFFICIENT. (ARG)

DELTAB--LINEAR TERM IN QUADRATIC FUNCTION OF LOCAL ANGLE OF ATTACK FOR BLADE PROFILE DRAG COEFFICIENT. (ARG)

DELTAC--QUADRATIC TERM IN QUADRATIC FUNCTION OF BLADE LOCAL ANGLE OF ATTACK FOR BLADE PROFILE DRAG COEFFICIENT. (ARG)

DELTAL--AILERON ANGLE. POSITIVE AILERON DEFLECTION WILL PRODUCE A NEGATIVE TAIL ROLLING MOMENT. (TSDEFL)

DELTAX--LINEARIZATION PERTURBATION INCREMENT FOR MATRIX COLUMN BEING EVALUATED. (ARG)

DELTEL--ELEVATOR ANGLE. POSITIVE ELEVATOR DEFLECTION ANGLE WILL PRODUCE A NEGATIVE Z-TAIL FORCE. (TSDEFL)

DELTP1 **** CALCULATED PROPELLER BALDE
DELTP2 * DRAG COEFFICIENT BASED ON
DELTP3 * QUADRATIC FUNCTION OF BLADE
DELTP4 **** ANGLE OF ATTACK (ARG)

DELTRD--RUDDER ANGLE. POSITIVE RUDDER DEFLECTION ANGLE WILL PRODUCE A POSITIVE Y-TAIL FORCE. (TSDEFL)

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DELTR1 **** CALCULATED ROTOR BLADE DRAG
DELTR2 * COEFFICIENT BASED ON
DELTR3 * QUADRATIC FUNCTION OF BLADE
DELTR4 **** ANGLE OF ATTACK. (ARG)

DENRAT--ATMOSPHERIC DENSITY RATIO.(ATMOS)

DERVFL--LOGICAL; TRUE EQUALS CALCULATE STABILITY DERIVATIVES; FALSE EQUALS DO NOT CALCULATE STABILITY DERIVATIVES (ARG)

DERV12--A MATRIX CONTAINING THE DERIVATIVE FROM THE FORWARD PERTUBATION AND THE DERIVATIVE FROM THE BACKWARD PERTUBATION OF THE STABILITY DERIVATIVES. THE NUMBERS INSERTED INTO THIS MATRIX, ARE VALUES WHICH BECAUSE OF STRONG NONLINEARITIES OF THIS SYSTEM ARE NOT CONSIDERED TO BE VALID. (INVALD)

DHLEUL--EULER ANGLE INCREMENTS AWAY FROM MOORED TRIM ANGLES TO EXCITE THE VEHICLE FOR TIME HISTORY SIMULATION.

DHOTIV--DISC ON HULL OR TAIL INTERFERENCE VELOCITY. (ARG)

DHRPYL--PAYLOAD LOCATION INCREMENTS.

DLALFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE AILERON DEFLECTION ANGLE IS GREATER THAN THE ALLOWED MAXIMUM VALUE (DLALMX). (TRIMFL)

DLALMX--MAXIMUM AILERON DEFLECTION ANGLE. (MECLIM)

DLELFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE ELEVATOR DEFLECTION ANGLE IS GREATER THAN THE ALLOWED MAXIMUM VALUE (DLELMS). (TRIMFL)

DLELMX--MAXIMUM ELEVATOR DEFLECTION ANGLE. (MECLIM)

DLRDFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE RUDDER DEFLECTION ANGLE IS GREATER THAN THE ALLOWED MAXIMUM VALUE (DLRDMX). (TRIMFL)

DLRDMX--MAXIMUM RUDDER DEFLECTION ANGLE. (MECLIM)

DLTP1A **** CONSTANT TERM IN QUADRATIC
DLTP2A * FUNCTION FOR PROPELLER
DLTP3A * BLADE PROFILE DRAG
DLTP4A **** COEFFICIENT (PAROCN)

DLTP1B **** LINEAR TERM IN QUADRATIC
DLTP2B * FUNCTION FOR PROPELLER
DLTP3B * BLADE PROFILE DRAG
DLTP4B **** COEFFICIENT (PAROCN)

DLTP1C **** QUADRATIC TERM IN QUADRATIC
DLTP2C * FUNCTION FOR PROPELLER
DLTP3C * BLADE PROFILE DRAG
DLTP4C **** COEFFICIENT (PAROCN)

DLTR1A **** CONSTANT TERM IN QUADRATIC
DLTR2A * EQUATION FOR ROTOR PROFILE
DLTR3A * DRAG COEFFICIENT (RAROCN)
DLTR4A ****

DLTR1B **** LINEAR TERM IN QUADRATIC
DLTR2B * FUNCTION FOR ROTOR BLADE
DLTR3B * PROFILE DRAG COEFFICIENT
DLTR4B **** (RAROCN)

DLTR1C **** QUADRATIC TERM IN QUADRATIC
DLTR2C * FUNCTION FOR ROTOR BLADE
DLTR3C * DRAG COEFFICIENT (RAROCN)
DLTR4C ****

DODRHG--COMPONENT OF ODHGST OBTAINED FROM TIME DERIVATIVES OF (1-COSINE) GUST INPUTS. (DGUSTS)

DODRTG--COMPONENT OF ODTGST OBTAINED FROM TIME DERIVATIVES OF (1-COSINE) GUST INPUTS. (DGUSTS)

DOHGST--COMPONENT OF OHGUST OBTAINED FROM TIME DERIVATIVES OF (1-COSINE) GUST INPUTS. (DGUSTS)

DOPGST--PAYLOAD ONE MINUS COSINE ANGULAR GUST VELOCITY INCREMENTS. (ARG)

DOTGST--COMPONENT OF OTGUST OBTAINED FROM TIME DERIVATIVES OF (1-COSINE) GUST INPUTS. (DGUSTS)

DPCNTL--ROLL CONTROL COMMAND INCREMENT (LNKCOM)

DPYELR--PAYLOAD EULER RATE INCREMENTS

DPYEUL--PAYLOAD EULER ANGLE INCREMENTS

DQCNTL--PITCH CONTROL COMMAND INCREMENT (LNKCOM)

DRCNTL--YAW CONTROL COMMAND INCREMENT (LNKCOM)

DSKIV--DISC INDUCED VELOCITY (INCLUDES GROUND INDUCED VELOCITIES) (ARG)

DSKLP1 ****
DSKLP2 * DISC LOADING ON THE PROPELLER
DSKLP3 * (ARG)
DSKLP4 ****

DSKLR1 ****
DSKLR2 * DISC LOADING ON THE ROTOR.
DSKLR3 * (ARG)
DSKLR4 ****

DTHEP1 ****
DTHEP2 * COMMANDED PROPELLER
DTHEP3 * COLLECTIVE PITCH INCREMENT.
DTHEP4 **** (PFETHR)

DTHER1 ****
DTHER2 * COMMANDED ROTOR
DTHER3 * COLLECTIVE PITCH INCREMENT.
DTHER4 **** (RSWASH)

DUDCNL--AXIAL FORCE CONTROL COMMAND INCREMENT. (LNKCOM)

DUGDXH--RATE OF CHANGE OF AXIAL HULL-GUST VELOCITY WITH RESPECT TO AXIAL LOCATION. (AUXGST)

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DUGDXT--RATE OF CHANGE OF AXIAL TAIL-GUST VELOCITY WITH RESPECT TO AXIAL POSITION. (AUXGST)

DUGDYH--RATE OF CHANGE OF AXIAL HULL-GUST VELOCITY WITH RESPECT TO LATERAL POSITION. (AUXGST)

DUGDYT--RATE OF CHANGE OF AXIAL TAIL-GUST VELOCITY WITH RESPECT TO LATERAL POSITION. (AUXGST)

DUXHMX--MAXIMUM COMMANDED RATE OF CHANGE OF AXIAL HULL-GUST VELOCITY, WITH RESPECT TO AXIAL LOCATION. (HGCOM)

DUXTMX--MAXIMUM COMMANDED RATE OF CHANGE OF AXIAL TAIL-GUST VELOCITY, WITH RESPECT TO AXIAL POSITION. (TGCOM)

DUYHMX--MAXIMUM COMMANDED RATE OF CHANGE OF AXIAL HULL-GUST VELOCITY, WITH RESPECT TO LATERAL POSITION. (HGCOM)

DUYTMX--MAXIMUM COMMANDED RATE OF CHANGE OF AXIAL TAIL-GUST VELOCITY, WITH RESPECT TO LATERAL POSITION. (TGCOM)

DVDCNL--SIDE FORCE CONTROL COMMAND INCREMENT. (LNFCOM)

DVGDYH--RATE OF CHANGE OF LATERAL HULL-GUST VELOCITY WITH RESPECT TO LATERAL POSITION. (AUXGST)

DVGDYT--RATE OF CHANGE OF LATERAL TAIL-GUST VELOCITY WITH RESPECT TO LATERAL POSITION. (AUXGST)

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DVGST1 **** COMPONENTS OF VGUST1-4 OBTAINED
DVGST2    * FROM INTERPOLATION
DVGST3    * OF THE (1-COSINE) GUST INPUTS
DVGST4 **** IN COORDINATES OF THE
            LPU CG REFERENCE AXIS (DGUSTS)
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DVHGST--COMPONENT OF VHGUST OBTAINED FROM TIME DERIVATIVE OF (1-COSINE) GUST INPUTS (DGUSTS)

DVPGST--ONE MINUS COSINE LINEAR GUST VELOCITY INCREMENTS. (ARG)

DVTGST--COMPONENT OF VTGUST OBTAINED FROM TIME DERIVATIVE OF (1-COSINE) GUST INPUTS (DGUSTS)

DVYHMX--MAXIMUM COMMANDED RATE OF CHANGE OF LATERAL HULL-GUST VELOCITY, WITH RESPECT TO LATERAL POSITION. (HGCOM)

DVPYLD--PAYLOAD VELOCITY INCREMENTS

DVYTMX--MAXIMUM COMMANDED RATE OF CHANGE OF LATERAL TAIL-GUST VELOCITY, WITH RESPECT TO LATERAL POSITION. (TGCOM)

DWDCNL--VERTICAL FORCE CONTROL COMMAND INCREMENT; POSITIVE DOWNWARD. (LNFCOM)

DYNAPM--DYNAMIC PAYLOAD MOMENT. (ARG)

DYSTAL--AERODYNAMIC REGIME FLAG FOR DYNAMI Y-FORCE TAIL CALCULATIONS. (STALLS)

EGNVLU--EIGEN VALUES. (ARG)

ELELFL--ELEVATOR DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

EMASS--EFFECTIVE MASS FOR APPROXIMATE ALGORITHM STEP CALCULATIONS. (ARG)

ENDTRM--LOGICAL; TRUE EQUALS END TRIM MAP SEQUENCE; FALSE EQUALS OBTAIN NEXT TRIM STATE

ENORM--VECTOR OF MODIFIED EUCLIDEAN NORMS OF THE COLUMNS OF MATRIX FMAT. (ARG)

EOFFLG--AN END OF FILE FLAG

EPSILN--CONTROL PERTUBATION FACTOR (TRMCNT)

ERRNUM--A ERROR NUMBER REFERRING TO TAPE21. (ARG)

ERROR--ERROR CONDITION FLAG-TRUE IF MAXIMUM CONTROL DEFLECTIONS ARE EXCEEDED OR AN IMSL ERROR IS ENCOUNTERED IN THE CALCULATION OF A NEW CONTROL VECTOR GUESS. (ARG)

EXLOC--VECTOR LOCATING THE JET EXHAUST NOZZEL, WITH RESPECT TO THE LPU CG, IN COORDINATES OF THE LPU CG REFERENCE AXIS

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EXLOC1 **** FOUR VECTORS LOCATING THE
EXLOC2    * EXHAUST NOZELL OF EACH LPU
EXLOC3    * RELATIVE TO THE LPU CG IN
EXLOC4 **** COORDINATES OF THE LPU CG
            REFERENCE AXIS (JETHST)
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EVECTR--CONSTRAINED ACCELERATION VECTOR (ARG)

FACW--DISC FORCE VECTOR WITH RESPECT TO THE CONTROL WIND AXES. (ARG)

FC--VECTOR OF ATTACH POINT CONSTRAINT FORCES AND MOMENTS (ARG)

FILENM--LOGICAL UNIT NUMBER FOR READING OF GUST STRING INPUTS. (ARG)

FMAT--MATRIX OF FUNCTIONALS: EACH COLUMNS CONTAINS THE SIXTH LINEAR AND ANGULAR ACCELERATIONS OF THE HULL ASSOCIATED WITH THE RESPECTIVE TRIM CONTROL COLUMN VECTOR OF MATRIX UMAT. (ARG)

FNEW--NEW FUNCTIONAL ASSOCIATED WITH NEW CONTROL VECTOR UNEW (ARG)

FORCE--FORCE VECTOR WITH RESPECT TO CG REFERENCE AXES(NEW AXES). (ARG)

FORCOM--TAIL FORCE OR MOMENT COMPONENT. (ARG)

FOREF--FORCE VECTOR WITH RESPECT TO REFERENCE AXES (OLD AXES). (ARG)

FRCTMG--MAGNITUDE OF FRICTION FORCE ON LANDING GEAR. (ARG)

FRSTCM--INTIAL COMMAND (TRIM VALUE). (ARG)

FRTMG1 ****
FRTMG2 * MAGNITUDE OF ROLLING FRICTION
FRTMG3 * FORCES OF THE LANDING GEAR
FRTMG4 ****

FUNCT--NEWTON-RAPHSON ITERATIVE MINIMIZATION FUNCTION. (ARG)

FUNCTD--NEWTON-RAPHSON ITERATIVE FUNCTION DERIVATIVE. (ARG)

FUSFO1 **** FUSELAGE AERODYNAMIC FORCE
FUSFO2 * VECTOR WITH RESPECT TO THE
FUSFO3 * LPU CG REFERENCE AXES.
FUSFO4 **** (ARG)

FUSMO1 **** FUSELAGE AERODYNAMIC MOMENT
FUSMO2 * VECTOR WITH RESPECT TO THE
FUSMO3 * LPU CG REFERENCE AXES.
FUSMO4 **** (ARG)

F1AROM **** LPU FUSELAGE AERODYNAMIC
F2AROM * COEFFICIENT MATRIX
F3AROM * (FSAROM)
F4AROM ****

GA--THE GUST SOURCE STABILITY DERIVATIVE MATRIX RELATING THE GUST SOURCE VELOCITIES WITH THE GUST VELOCITIES ACCELERATIONS AND AT THE VEHICLE COMPONENTS (ARG)

GAHBFO--HULL BUOYANCY FORCE VECTOR ARISING FROM GUST ACCELERATIONS

GAMMAH--ANGLE (FROM VERTICAL) OF THE RELATIVE ANGULAR VELOCITY VECTOR IN THE HULL Y-Z PLANE

GBACL1 **** FOUR VECTORS CONTAINING
GBACL2 * LPU GIMBAL ACCELERATION
GBACL3 * COMMANDS. (GBACL)
GBACL4 ****

GBANG1 **** FOUR VECTORS EACH CONTAINING
GBANG2 * THE LPU EULER ANGLES, WITH
GBANG3 * RESPECT TO THE HULL REFERENCE
GBANG4 **** AXES: PHI, THETA, PSI.(SVECTR)

GBRAT1 **** FOUR VECTORS CONTAINING THE LPU
GBRAT2 * GIMBAL EULER RATES; ORDER OF
GBRAT3 * ARRAY STORAGE: PHIDOT, THEDOT,
GBRAT4 **** PSIDOT. (ERATES)

GCFLAG--GROUND CONTACT FLAG. TRUE ELEMENT (HULL STERN LANDING GEAR TIRE ETC.) IS CONTACTING THE GROUND. FALSE EQUALS ELEMENT IS NOT CONTACTING THE GROUND. (ARG)

GCFLF--GROUND CONTACT OF LANDING GEAR FRAME ATTACH POINT. TRUE EQUALS ATTACH POINT OF LANDING GEAR ON HULL STRUCTURAL FRAME HAS CONTACTED THE GROUND. FALSE EQUALS LANDING GEAR ATTACH POINT HAS NOT CONTACTED THE GROUND. (ARG)

GCFLF1 **** LANDING GEAR COMPRESSION
GCFLF2 * FORCE VECTORS IN COORDINATES
GCFLF3 * OF THE HULL CG REFERENCE AXES
GCFLF4 **** (LGCNTC)

GCFLG--LOGICAL FLAG INDICATING TIRE CONTACT WITH GROUND. TRUE EQUALS TIRE IS TOUCHING GROUND. FALSE EQUALS TIRE IS NOT TOUCHING GROUND. (ARG)

GCFLG1 **** LOGICAL FLAG: TRUE EQUALS LAND-
GCFLG2 * ING GEAR TIRE CONTACTS WITH
GCFLG3 * GROUND. FALSE EQUALS LANDING
GCFLG4 **** GEAR TIRE NOT TOUCHING GROUND. (LGCNTC)

GCFOR--LANDING GEAR COMPRESSION FORCE VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

GCFOR1 **** GEAR COMPRESSION FORCE
GCFOR2 * VECTORS (INCLUDING SPRING
GCFOR3 * FORCE AND DAMPING FORCE; NOT
GCFOR4 **** FRICTION FORCE) IN COORDINATES OF THE HULL CG REFERENCE AXIS

GCPRS--MAGNITUDE OF LANDING GEAR COMPRESSION FORCE. (ARG)

GCPRS1 ****
GCPRS2 * MAGNITUDE OF LANDING GEAR
GCPRS3 * COMPRESSION FORCE (GCMPRS)
GCPRS4 ****

GDELTX--THE GUST SOURCE STABILITY DERIVATIVE MATRIX INCREMENT (ARG)

GDSDM--GUST INPUT STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE GUST DERIVATIVE MATRICES. (STABDV)

GEAR--VECTOR LOCATING LANDING GEAR TIRE WITH RESPECT TO LANDING GEAR ATTACH POINT ON FRAME IN COORIDINATES OF HULL CG REFERENCE AXIS. (ARG)

GEAR1 **** FOUR VECTORS WHICH LOCATE THE
GEAR2 * LANDING GEAR TIRES WITH RESPECT
GEAR3 * TO THE LANDING GEAR ATTACH POINTS
GEAR4 **** ON THE FRAME IN COORDINATES OF THE HULL CG REFERENCE AXIS. (GEARLC)

GEARC--DAMPING CONSTANT FOR LANDING GEAR (ARG)

GEARC1 ****
GEARC2 * DAMPING CONSTANTS OF THE
GEARC3 * LANDING GEAR (GEARC)
GEARC4 ****

GEARFL--FOUR ELEMENT VECTOR CONTAINING COUNTERS FOR THE NUMBER OF TIMES AN ILLEGAL GEAR CONDITION WAS ENCOUNTERED DURING TRIM (MTRMFL)

GEARK--SPRING CONSTANT FOR LANDING GEAR (ARG)

GEARK1 ****
GEARK2 * SPRING CONSTANTS OF THE
GEARK3 * LANDING GEARS. (GEARK)
GEARK4 ****

GEARVL--INERTIAL VELOCITY OF LANDING GEAR TIRE IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

GEF--GROUND EFFECT CONSTANT. (ARG)

GEFP1 ****
GEFP2 * CALCULATED GROUND EFFECT
GEFP3 * ON PROPELLERS. (GEFP)
GEFP4 ****

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GEFR1 ****
GEFR2 * CALCULATED GROUND ON ROTOR
GEFR3 * INTERFERENCE CORRECTION. (GEFR)
GEFR4 ****

GENFOR--GENERALIZED VECTOR OF EXTERNAL HULL AND LPU FORCES AND MOMENTS (ARG)

GERFO1 **** LANDING GEAR FORCE VECTORS
GERFO2 * IN COORDINATES OF THE HULL
GERFO3 * CG REFERENCE AXIS.
GERFO4 **** (ARG)

GERUV--UNIT VECTOR IN INERTIAL AXIS SPECIFYING THE DIRECTION OF THE LANDING GEAR TIRE IN THE X-Y INERTIAL PLANE. (ARG)

GERIL--VECTOR LOCATING THE LANDING GEAR TIRE WITH RESPECT TO THE INERTIAL FRAME IN COORDINATES OF THE INERTIAL REFERENCE AXIS. (ARG)

GERIL1 **** VECTORS LOCATING THE INERTIAL
GERIL2 * LOCATION OF THE LANDING GEAR
GERIL3 * TIRES IN COORDINATES OF THE
GERIL4 **** INERTIAL REFERENCE AXIS. (GERILC)

GFFOR1 **** LANDING GEAR FRICTION FORCE
GFFOR2 * VECTORS IN COORDINATES OF
GFFOR3 * THE HULL CG REFERENCE AXIS.
GFFOR4 **** (ARG)

GFRMK1 **** SPRING CONSTANTS FOR THE
GFRMK2 * HULL FRAME WHICH SUPPORTS THE
GFRMK3 * LANDING GEAR ATTACH POINTS
GFRMK4 **** (GFRAMK)

GGHBFO--HULL BUOYANCY FORCE VECTOR ARISING FROM GUST GRADIENTS. (ARG)

GHCIFO--GROUND ON HULL CROSSFLOW INTERFERENCE FORCE VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

GHCIMO--GROUND ON HULL CROSSFLOW INTERFERENCE MOMENT VECTOR, IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

GRAT--LANDING GEAR LINEAR EXPANSION RATE POSITIVE INDICATES LANDING GEAR IS EXPANDING. NEGATIVE INDICATES LANDING GEAR IS CONTRACTING. (ARG)

GRAT1 **** LANDING GEAR LINEAR EXPANSION
GRAT2 * RATES. POSITIVE RATE FOR
GRAT3 * LANDING GEAR EXPANDING, NEGATIVE
GRAT4 **** RATE FOR LANDING GEAR CONTRACTING (ARG)

GSTBUF--A BUFFER CONTAINING THE TIMES AND GUST VALUES FOR FAST GUSTS WHICH HAVE BEEN READ FROM THE RANDOM GUST INPUT STRING. (ARG)

GSTDRV--GUST VELOCITY DERIVATIVE. (ARG)

GSTDSN--GUST GRADIENT CONTRIBUTIONS TO THE GUST VELOCITIES MEASURED AT THE VELOCITY CENTER. (ARG)

GSTFLG--LOGICAL FLAG: TRUE EQUALS GUST STRING INPUTS DESIRED, FALSE EQUALS GUST STRING INPUTS NOT DESIRED. (GSTRNG)

GSTSCF--SCALE FACTOR FOR GUST STRING INPUTS. (GSTRNG)

GST1SF ****
GST2SF * GUST INPUT STRING SCALE
GST3SF * FACTORS. (GSTRNG)
GST4SF ****

GSV--THE GUST SOURCE VECTOR (ARG)

GUST--GUST COMMAND COMPONENT. (ARG)

GUSTT1--COMMANDED GUST STARTING TIME. (ARG)

GUSTT2--COMMANDED GUST ENDING TIME. (ARG)

GUSTVT--A VECTOR MADE UP OF ALL THE GUST VELOCITIES ACCELERATIONS AND GRADIENTS AT THE VARIOUS VEHICLE COMPONENTS (ARG)

H--(DISC DRAG). POSITIVE H-FORCE IS ALONG THE NEGATIVE X-CONTROL WIND AXES DIRECTION. (ARG)

HABFOR--HULL-TAIL ASSEMBLY AERO-BUOYANCY FORCE VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXES. (ARG)

HABMOM--HULL-TAIL ASSEMBLY AERO-BUOYANCY MOMENT VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXES. (ARG)

HAROMA--HULL AERODYNAMIC MATRIX-A. (HLAROM)

HAROMB--HULL AERODYNAMIC MATRIX-B. (HLAROM)

HAROMC--HULL AERODYNAMIC MATRIX-C. (HLAROM)

HAROMD--HULL AERODYNAMIC MATRIX-D. (HLAROM)

HAROME--HULL AERODYNAMIC MATRIX-E. (HLAROM)

HBACFO--HULL-TAIL ASSEMBLY ACCELERATION FORCE VECTOR WITH RESPECT TO THE CG REFERENCE AXIS.

HBACMO--HULL TAIL ASSEMBLY ACCELERATION MOMENT VECTOR WITH RESPECT TO THE HULL CG REFERENCE AXIS.

HCACFO--HULL ONLY CENTER OF VOLUME ACCELERATION FORCE VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS.

HCACMO--HULL ONLY CENTER OF VOLUME ACCELERATION MOMENT VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS.

HCBLFO--TOTAL CABLE FORCE AT THE HULL CG IN COORDINATES OF THE HULL CG REFERENCE AXIS. (HCABLF)

HCBLF1 **** CABLE FORCE VECTORS AT
HCBLF2 * THE HULL ATTACH POINTS IN
HCBLF3 * COORDINATES OF THE HULL CG
HCBLF4 **** REFERENCE AXIS. (HCABLF)

HCBLMO--TOTAL CABLE MOMENT ABOUT THE HULL CG IN COORDINATES TO THE HULL CG REFERENCE AXIS.

HULMAX--THE MAXIMUM NUMBER OF HULL VARIABLES WANTED ON OUTPUT. (OPWANT)

HULPOS--HULL CG REFERENCE AXES INERTIAL POSITION IN INERTIAL COORDINATES (SVECTR)

HULTAM--HULL APPARENT MASS MATRIX, FOR MOTIONS ABOUT THE HULL CG REFERENCE AXES. (HLAROM)

HULTH--HULL OVERALL LENGTH (HULL)

HULVOL--TOTAL DISPLACED VOLUME OF EXTERNAL HULL ENVELOPE (HULL)

IERR--ACCELEROMTER INERTIAL POSITION ERROR SIGNAL.

IGRAV--EARTH'S GRAVITATIONAL ACCELERATION VECTOR (ATMOS)

IHUL--HULL INERTIA TENSOR (MASS)

IHULXX--HULL MOMENT OF INERTIA ABOUT THE HULL CG X-AXES

IHULXZ--HULL PRODUCT OF INERTIA WITH RESPECT TO THE HULL CG XZ-AXES

IHULYY--HULL MOMENT OF INERTIA ABOUT THE HULL CG Y-AXES

IHULZZ--HULL MOMENT OF INERTIA ABOUT THE HULL CG Z-AXES

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ILPU1 ****
ILPU2    * FOUR LPU INERTIA TENSORS (MASS)
ILPU3    *
ILPU4 ****

ILP1XX ****
ILP2XX    *  LPU MOMENT OF INERTIA ABOUT
ILP3XX    *  THE LPU CG X AXES. (ARG)
ILP4XX ****

ILP1XZ ****
ILP2XZ    * LPU PRODUCTS OF INERTIA ABOUT
ILP3XZ    * THE LPU CG XZ AXES. (ARG)
ILP4XZ ****

ILP1YY ****
ILP2YY    * LPU MOMENT OF INERTIA ABOUT
ILP3YY    * THE LPU CG Y AXES. (ARG)
ILP4YY ****

ILP1ZZ ****
ILP2ZZ    * LPU MOMENT OF INERTIA ABOUT
ILP3ZZ    * THE LPU CG Z AXES. (ARG)
ILP4ZZ ****
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IMARK--A VECTOR FLAG WHICH ON OUTPUT CONTAINS A CONSECUTIVELY ORDERED STRING OF COLUMN NUMBERS: THE FIRST ELEMENT CONTAINING THE COLUMN NUMBER OF THE BEST GUESS AND THE LAST ELEMENT CONTAINING THE COLUMN OF THE POOREST GUESS ACCORDING TO THE MODIFIED EUCLIDEAN NORM CRITERIA

INTLIM--CIRCUIT INTEGRATOR LIMIT. (ARG)

INTOUT--CIRCUIT INTEGRATOR VALUE. (ARG)

INVMAS--INVERTED GENERALIZED VEHICLE EFFECTIVE MASS MATRIX. THIS ARRAY INITIALLY CONTAINS THE UNINVERTED MATRIX, BUT IS RELOADED IN THE SUBROUTINE MASMAT IN ORDER TO SAVE COMPUTER STORAGE. (EMASMX)

INVPMS--INVERTED PAYLOAD MASS MATRIX. THIS ARRAY INITIALLY CONTAINS THE UN-INVERTED MATRIX, BUT IS RELOADED IN THE SUBROUTINE MASMAT IN ORDER TO SAVE COMPUTER STORAGE. (PMASS)

IPAY--PAYLOAD INERTIA TENSOR. (PMASS)

IPAYXX--PAYLOAD MOMENT OF INERTIA ABOUT THE PAYLOAD CG X-AXIS.

IPAYXZ--PAYLOAD PRODUCT OF INERTIA WITH RESPECT TO THE PAYLOAD CG XZ-AXIS.

IPAYYY--PAYLOAD MOMENT OF INERTIA ABOUT THE PAYLOAD CG Y-AXIS

IPAYZZ--PAYLOAD MOMENT OF INERTIA ABOUT THE PAYLOAD CG Z-AXIS

ITENSR--A THREE BY THREE INERTIAL TENSOR (ARG)

ITER--NUMBER OF ITERATIONS TAKEN DURING TRIM SOLUTION

IVSORC--INERTIAL GUST VECTOR AT GUST SOURCE AFTER SCALING AND TIME INTERPOLATION. (ARG)

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IVSOR1 **** INERTIAL VELOCITY VECTOR
IVSOR2    * FOR THE GUST STRING INPUT
IVSOR3    * AT EACH OF FOUR SOURCES.
IVSOR4 **** (ARG)

JETFO1 **** EXHAUST FORCE VECTOR
JETFO2    * IN COORDINATES TO THE
JETFO3    * LPU CG REFERENCE AXIS
JETFO4 **** (JETHST)
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JETHS--MAGNITUDE OF JET THRUST FORCE

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JETHS1 ****
JETHS2    * JET EXHAUST MAGNITUDES
JETHS3    * (ARG)
JETHS4 ****

JETMO1 **** EXHAUST MOMENT VECTOR
JETMO2    * IN COORDINATES TO THE
JETMO3    * LPU CG REFERENCE AXIS
JETMO4 **** (ARG)
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K--PROPORTIONAL GAIN. (ARG)

K--TRIM ALGORITHM CONSTANT (TRMCNT)

KCONST--TOTAL SPRING CONSTANT FOR APPROXIMATE ALGOIRTHM STEP CALCULATION (ARG)

KDHA--DISC ON HULL INTERFERENCE CONSTANT-A. (ARG)

KDHB--DISC ON HULL INTERFERENCE CONSTANT-B. (ARG)

HCGAM--COMPONENT(HULL OR TAIL), APPARENT MASS MATRIX FOR MOTIONS, WITH RESPECT TO THE HULL CG REFERENCE AXES. (ARG)

HDOT--VERTICALLY UPWARD VELOCITY OF THE HULL CENTER OF GRAVITY ALONG THE MINUS Z INERTIAL AXIS. (ARG)

HDTCMD--VERTICAL VELOCITY COMMAND TABLE. (COMAND)

HDTCOM--VERTICAL VELOCITY COMMAND. (ARG)

HDTILM--VERTICAL VELOCITY CIRCUIT INTEGRATOR LIMIT. (FCSLIM)

HDTINT--VERTICAL VELOCITY CIRCUIT INTEGRATOR VALUE. (SASINT)

HDTLLM--VERTICAL VELOCITY CIRCUIT LOOP LIMIT. (FCSLIM)

HDTLPF--FLIGHT CONTROL SYSTEM FLAG INDICATING HDOT LOOP IS CLOSED. (CLOSLP)

HEADER--T/F HEADER WANTED OR NOT WANTED (OUTHD)

HGERFO--TOTAL (SUM OF ALL ACTIVE) LANDING GEAR FORCE VECTOR EXERTED ON THE HULL IN COORDINATES OF THE HULL CG REFERENCE AXIS (ARG)

HGERMO--TOTAL (SUM OF ALL ACTIVE) LANDING GEAR MOMENTS AT THE HULL CENTER OF GRAVITY IN COORDINATES OF THE HULL CG REFERENCE AXIS (ARG)

HGRFOR--HULL GRAVITY FORCE VECTOR (ARG)

HGRMO1 **** LANDING GEAR MOMENT VECTORS
HGRMO2 * EXERTED ON THE HULL AT THE
HGRMO3 * HULL CENTER OF GRAVITY IN
HGRMO4 **** COORDINATES OF THE HULL CG REFERENCE AXIS (ARG)

HLMPFL--COUNTER CONTAINING THE NUMBER OF TIMES AN ILLEGAL HULL POSITION WAS ENCOUNTERED DURING MOORING TRIM. (MTRMFL)

HLWANT--ARRAY OF NUMBERS INDICATING THE HULL OUTPUT VARIABLES WANTED. (OUTDTA)

HOTAFO--HULL ONLY TOTAL AERODYNAMIC FORCE VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (ARG)

HOTAMO--HULL ONLY TOTAL AERODYNAMIC MOMENT VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (ARG)

HPGGMA--HULL-GUST GRADIENT PRIME-MATRIX. CONTAINS LINEAR COMBINATIONS OF HULL-GUST VELOCITIES, ANGULAR VELOCITIES, AND SHEAR GRADIENTS FOR THE CALCULATION OF HULL-GUST GRADIENT LOADS. (ARG)

HPP1 ****
HPP2 * POWER ON THE PROPELLERS.
HPP3 * (ARG)
HPP4 ****

HPR1 ****
HPR2 * POWER ON THE ROTORS.
HPR3 * (ARG)
HPR4 ****

HRCLV--THE RELATIVE VELOCITY OF A PAYLOAD CABLE ATTACH POINT RELATIVE TO THE RESPECTIVE HULL PAYLOAD CABLE ATTACH POINT IN COORDINATES OF THE HULL CG REFER- ERNCE AXIS. (ARG)

HRPCH1 **** FOUR VECTORS LOCATING THE
HRPCH2 * CABLE ATTACH POINTS ON THE
HRPCH3 * PAYLOAD WITH RESPECT TO THE
HRPCH4 **** HULL CG REFERENCE AXIS. (ARG)

HRPLFL--COUNTER FOR THE NUMBER OF TIMES AND IMPROPER PAYLOAD LOCATION GUESS IS MADE IN THE PAYLOAD TRIM ROUTINE. (PTRMFL)

HRPYLC--LOCATION OF THE PAYLOAD CENTER OF GRAVITY WITH RESPECT TO THE HULL CG REFERENCE AXIS, IN COORDINATES OF THE HULL CG REFERENCE AXIS. (PSVCTR)

HTOTAF--HULL-TAIL ASSEMBLY TOTAL AERODYNAMIC FORCE VECTOR WITH RESPECT TO THE HULL CG REFERENCE AXIS. (ARG)

HTOTAM--HULL-TAIL ASSEMBLY TOTAL AERODYNAMIC MOMENT VECTOR WITH RESPECT TO THE HULL CG REFERENCE AXIS. (ARG)

HT1GST--STARTING TIME FOR HULL-GUST COMMANDS. (HGCOM)

HT2GST--ENDING TIME FOR HULL-GUST COMMANDS. (HGCOM)

HUCBL--UNIT VECTOR LOCATING A PAYLOAD CABLE ATTACH POINT RELATIVE TO A RES- PECTIVE HULL PAYLOAD ATTACH POINT IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

HULAM--HULL APPARENT MASS MATRIX FOR MOTIONS ABOUT THE HULL CENTER OF VOLUME REFERENCE AXIS. (HLAROM)

HULARA--HULL SIDE PROJECTED AREA (HULL)

HULCV--LOCATION OF HULL CENTER OF VOLUME WITH RESPECT TO THE HULL CG REFERENCE AXES (HULL)

HULDIA--HULL MAXIMUM DIAMETER (HULL)

HULDTA--ARRAY OF HULL VARIABLES WANTED IN OUTPUT. (ARG)

HULELR--EULER ANGLE RATES OF THE HULL CG REFERENCE AXES WITH RESPECT TO AN INERTIAL FRAME. STORAGE: PHIDOT, THEDOT, PSIDOT. (ERATES)

HULEUL--EULER ANGLES OF THE HULL CG REFERENCE AXES WITH RESPECT TO AN INERTIAL FRAME; PHI,THETA,PSI (SVECTR)

HULID--HULL CONFIGURATION IDENTIFIER (HULL)

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OF POOR QUALITY

KDHOTX--DISC ON HULL OR TAIL INTERFERENCE CONSTANT FOR X-AXIS VELOCITIES. (ARG)

KDHOTY--DISC ON HULL OR TAIL INTERFERENCE CONSTANT FOR Y-AXIS VELOCITIES. (ARG)

KDHOTZ--DISC ON HULL OR TAIL INTERFERENCE CONSTANT FOR Z-AXIS VELOCITIES. (ARG)

KGD--INTERFERENCE CONSTANT FOR GROUND ON DISC. (ARG)

KGHA--GROUND ON HULL INTERFERENCE CONSTANT-A. (KGHCN)

KGHB--GROUND ON HULL INTERFERENCE CONSTANT-B. (KGHCN)

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KGP1 ****
KGP2     * GROUND ON PROPELLER INTER-
KGP3     * FERENCE CONSTANTS. (KGP)
KGP4 ****
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KGR1 ****
KGR2     * GROUND ON ROTOR INTERFERENCE
KGR3     * CONSTANTS. (KGR)
KGR4 ****
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KGTA--GROUND ON TAIL INTERFERENCE CONSTANT-A. (KGT)

KGTB--GROUND ON TAIL INTERFERENCE CONSTANT-B. (KGT)

KH--VERTICAL HEIGHT HOLD CIRCUIT PROPORTIONAL GAIN. (POSHCS)

KHDA--HULL ON DISC INTERFERENCE CONSTANT-A. (ARG)

KHDB--HULL ON DISC INTERFERENCE CONSTANT-B. (ARG)

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KHPA1 ****
KHPA2     * HULL ON PROPELLER INTER-
KHPA3     * FERENCE CONSTANTS-A. (KHP)
KHPA4 ****
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KHPB1 ****
KHPB2     * HULL ON PROPELLER INTER-
KHPB3     * FERENCE CONSTANTS-B. (KHP)
KHPB4 ****
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KHRA1 ****
KHRA2     * HULL ON ROTOR INTERFERENCE
KHRA3     * CONSTANTS-A. (KHR)
KHRA4 ****
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KHRB1 ****
KHRB2     * HULL ON ROTOR INTERFERENCE
KHRB3     * CONSTANTS-B. (KHR)
KHRB4 ****
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KHDOT--VERTICAL VELOCITY CIRCUIT PROPORTIONAL GAIN. (FCSGNS)

KI--INTEGRAL GAIN. (ARG)

KIHDOT--VERTICAL VELOCITY CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KIPHI--ROLL ANGLE CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KIR--YAW RATE CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KITHET--PITCH ANGLE CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KIU--FORWARD SPEED CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KIV--LATERAL VELOCITY CIRCUIT INTEGRATOR GAIN. (FCSGNS)

KMIN--MINIMUM K BEFORE RESTARTING PERTUBATION PROCEDURE (TRMCNT)

```
KPF1 ****
KPF2     * PROPELLER ON FUSELAGE INTER-
KPF3     * FERENCE CONSTANTS. (KPF)
KPF4 ****
```

```
KPHA1 ****
KPHA2     * PROPELLER ON HULL INTER-
KPHA3     * FERENCE CONSTANT-A. (KPH)
KPHA4 ****
```

```
KPHB1 ****
KPHB2     * PROPELLER ON HULL INTER-
KPHB3     * FERENCE CONSTANT-B. (KPH)
KPHB4 ****
```

```
KPHC1 ****
KPHC2     * PROPELLER ON HULL INTER-
KPHC3     * FERENCE CONSTANT-C. (KPH)
KPHC4 ****
```

```
KPHD1 ****
KPHD2     * PROPELLER ON HULL INTER-
KPHD3     * FERENCE CONSTANT-D. (KPH)
KPHD4 ****
```

```
KPHE1 ****
KPHE2     * PROPELLER ON HULL INTER-
KPHE3     * FERENCE CONSTANT-E. (KPH)
KPHE4 ****
```

KPHI--ROLL ANGLE CIRCUIT PROPORTION GAIN (FCSGNS)

KPSI--HEADING ANGLE HOLD PROPORTIONAL GAIN. (POSHCS)

```
KPTA1 ****
KPTA2     * PROPELLER ON TAIL INTER-
KPTA3     * FERENCE CONSTANT-A. (KPT)
KPTA4 ****
```

```
KPTB1 ****
KPTB2     * PROPELLER ON TAIL INTER-
KPTB3     * FERENCE CONSTANT-B. (KPT)
KPTB4 ****
```

```
KPTC1 ****
KPTC2     * PROPELLER ON TAIL INTER-
KPTC3     * FERENCE CONSTANT-C. (KPT)
KPTC4 ****
```

```
KRF1 ****
KRF2     * ROTOR ON FUSELAGE INTERFERENCE
KRF3     * CONSTANTS. (KRF)
KRF4 ****
```

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KRHA1 ****
KRHA2 * ROTOR ON HULL INTERFERENCE
KRHA3 * CONSTANT-A. (KRH)
KRHA4 ****

KRHB1 ****
KRHB2 * ROTOR ON HULL INTERFERENCE
KRHB3 * CONTSTANT-B. (KRH)
KRHB4 ****

KRHC1 ****
KRHC2 * ROTOR ON HULL INTERFERENCE
KRHC3 * CONSTANT-C. (KRH)
KRHC4 ****

KRHD1 ****
KRHD2 * ROTOR ON HULL INTERFERENCE
KRHD3 * CONSTANT-D. (KRH)
KRHD4 ****

KRHE1 ****
KRHE2 * ROTOR ON HULL INTERFERENCE
KRHE3 * CONSTANT-E. (KRH)
KRHE4 ****

KRP1 ****
KRP2 * ROTOR ON PROPELLER INTER-
KRP3 * FERENCE CONSTANTS. (KRP)
KRP4 ****

KRTA1 ****
KRTA2 * ROTOR ON TAIL INTERFERENCE
KRTA3 * CONSTANT-A. (KRT)
KRTA4 ****

KRTB1 ****
KRTB2 * ROTOR ON TAIL INTERFERENCE
KRTB3 * CONSTANT-B. (KRT)
KRTB4 ****

KRTC1 ****
KRTC2 * ROTOR ON TAIL INTERFERENCE
KRTC3 * CONSTANT-C. (KRT)
KRTC4 ****

KSTART--STARTING VALUE OF CONSTANT K
(TRMCNT)

KTHETA--PITCH ANGLE CIRCUIT
PROPORTIONAL GAIN. (FCSGNS)

KTRAT--TURN RATE CIRCUIT
PROPORTIONAL GAIN. (FCSGNS)

KUSPED--FORWARD SPEED CIRCUIT
PROPORTIONAL GAIN. (FCSGNS)

KVSPED--LATERAL VELOCITY CIRCUIT
PROPORTIONAL GAIN. (FCSGNS)

KX--FORWARD LOCATION HOLD CIRCUIT
PROPORTIONAL GAIN. (POSHCS)

KY--LATERAL POSITION HOLD CIRCUIT
PORPORTIONAL GAIN. (POSHCS)

LAMDA--INFLOW RATIO; ROTOR OR
PROPELLER. (ARG)

LAMDAH--ANGLE (FROM VERTICAL) OF THE
RELATIVE LINEAR VELOCITY VECTOR IN THE
HULL Y-Z PLANE

LAMDAT--TAIL LENGTH SCALE FACTOR (TPARAM)

LAMDAW--NON-DIMENSIONAL ASCENT SPEED;
ROTOR OR PROPELLER. (ARG)

LAMDPH--HULL CROSSFLOW ROTATION
ANGLE DUE TO GROUND INTERFERENCE

LAMELM--LAMBDA-WAKE ANGLE

LAMR--ROTOR INFLOW RATIO. (ARG)

LAMTXQ--X-TAIL ARM SCALE FACTOR
FOR TRANSFERRING PITCHING MOMENTS. (TPARAM)

LAMTXR--X-TAIL ARM SCALE FACTOR FOR
TRANSFERRING YAWING MOMENTS. (TPARAM)

LAMTZP--Z-TAIL ARM SCALE FACTOR FOR
TRANSFERRING ROLLING MOMENTS. (TPARAM)

LAMTZQ--Z-TAIL ARM SCALE FACTOR FOR
TRANSFERRING PITCHING MOMENTS. (TPARAM)

LAPSVS--TAIL ROLLING MOMENT DERIVATIVE WITH
RESPECT TO: ALPHA-P * ABS(ALPHA-P) * (VPT**2
(TDRVS)

LAPVST--TAIL ROLLING MOMENT DERIVATIVE
WITH RESPECT TO: ((ALPHA-P * (VPT**2.))
(TDRVS)

LAMWK1--LAMBDA-WAKE ANGLE FOR
START OF SHADOW REGION. (ARG)

LAMWK2--LAMBDA-WAKE ANGLE FOR END
OF SHADOW REGION. (ARG)

LBAVST--TAIL ROLLING MOMENT DERIVATIVE WITH
RESPECT TO: BETA*ALPHA*(VXY**2). (TDRVS)

LBVSQT--TAIL ROLLING MOMENT DERIVATIVE
WITH RESPECT TO: (BETA*(VXYT**2.))
(TDRVS)

LCGREF--ORTHOGONAL TRANSFORMATION
MATRIX WHICH TRANSFORMS COORDINATES
FROM THE REFERENCE AXES (OLD AXES)
TO THE CG REFERENCE AXES (NEW AXES). (ARG)

LCS--BLADE LIFT CURVE SLOPE (ARG)

LCSE--EFFECTIVE LIFT CURVE SLOPE
AFTER HULL INTERFERENCE CORRECTIONS
HAVE BEEN MADE. (ARG)

LCSP1E ****
LCSP2E * EFFECTIVE PROPELLER LIFT
LCSP3E * CURVE SLOPE. (ARG)
LCSP4E ****

LCSP1 ****
LCSP2 * PROPELLER BLADE LIFT CURVE
LCSP3 * SLOPE. (FARDCN)
LCSP4 ****

LCSR1E ****
LCSR2E * EFFECTIVE ROTOR LIFT
LCSR3E * CURVE SLOPE (ARG)
LCSR4E ****

LCSR1 ****
LCSR2 * ROTOR BLADE LIFT CURVE
LCSR3 * SLOPE. (FARDCN)
LCSR4 ****

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LCWLP--ORTHOGONAL MATRIX, WHICH TRANSFORMS VECTORS FROM THE LPU CG REFERENCE AXES TO THE CONTROL WIND CG REFERENCE AXES. (ARG)

LENGTH--NUMBER OF COLUMNS OF STABILITY MATRIX BEING EVALUATED (ARG)

LGRLN--UNSTRETCHED (RELAXED) LANDING GEAR LENGTH. THIS VALUE SHOULD ALWAYS BE POSITIVE. (ARG)

LGRLN1 **** UNSTRETCHED (RELAXED) LANDING
LGRLN2 * GEAR LENGTH. THESE VALUES MUST
LGRLN3 * ALL BE POSITIVE. (LANDGL)
LGRLN4 ****

LHI--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE INERTIAL FRAME TO COORDINATES IN THE HULL CG REFERENCE FRAME (LTRANS)

LHLP--ORTHOGONAL MATRIX WHICH TRANSFORMS VECTORS FROM THE LPU CG REFERENCE AXES TO THE HULL CG REFERENCE AXES (ARG)

LHP--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE PAYLOAD CG REFERENCE AXIS TO COORDINATES IN THE HULL CG REFERENCE AXIS. (PLTRNS)

LHV--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES FROM THE VERTICALLY ORIENTED AXIS (HEADING ANGLE IS ASSUMED EQUAL TO ZERO) TO THE HULL CG REFERENCE AXIS. (ARG)

LH1 **** FOUR ORTHOGONAL MATRICES WHICH
LH2 * TRANSFORM VECTORS GIVEN IN THE
LH3 * LPU CG REFERENCE AXES TO THE
LH4 **** HULL CG REFERENCE AXES (LTRANS)

LIH--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES GIVEN IN THE HULL CG REFERENCE AXES TO THE INERTIAL REFERENCE AXES (LTRANS)

LILP--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE LPU CG REFERENCE AXIS TO COORDINATES IN THE INERTIAL REFERENCE AXIS. (ARG)

LINDRV--LINEAR TAIL AERODYNAMIC DERIVATIVE IN THE PRE-STALL RANGE. (ARG)

LIP--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE PAYLOAD CG REFERENCE AXIS TO COORDINATES IN THE INERTIAL REFERENCE AXIS. (PLTRNS)

LKTCM1--STARTING TIME FOR LINKED CONTROL COMMANDS. (LNKCOM)

LKTCM2--ENDING TIME FOR LINKED CONTROL COMMANDS. (LNKCOM)

LLPCW--ORTHOGONAL MATRIX, WHICH TRANSFORMS VECTORS FROM THE CONTROL WIND AXES TO THE LPU CG REFERENCE AXES. (ARG)

LLPH--ORTHOGONAL MATRIX WHICH TRANSFORMS VECTORS FROM THE HULL CG REFERENCE AXES TO THE LPU CG REFERENCE AXES (ARG)

LOCA--LOCATION OF SOURCE-A FOR SPATIAL GUST INTERPOLATION. (ARG)

LOCATE--LOCATION OF COMPONENT REFERENCE AXIS (HULL OR TAIL), WITH RESPECT TO THE HULL CG REFERENCE AXES.(ARG)

LOCATR--A POINTER INDICATING THE NEXT AVAILABLE SPACE FOR INVALID STABILITY DERIVATIVES, FOR USE IN THE COMMON INVALD. (INVALD)

LOCB--LOCATION OF SOURCE-B FOR SPATIAL GUST INTERPOLATION. (ARG)

LOCC--LOCATION OF SOURCE-C FOR SPATIAL GUST INTERPOLATION. (ARG)

LOCNR1 ****
LOCNR2 * ROTOR BLADE LOCK NUMBER
LOCNR3 * (RMASCN)
LOCNR4 ****

LOOPLM--CIRCUIT LOOP LIMIT. (ARG)

LPAF1 ****
LPAF2 * LPU AERODYNAMIC FORCE VECTOR
LPAF3 * IN COORDINATES OF THE LPU CG
LPAF4 **** REFERENCE AXES. (ARG)

LPAMO1 ****
LPAMO2 * LPU AERODYNAMIC MOMENT VECTOR
LPAMO3 * IN COORDINATES OF THE LPU CG
LPAMO4 **** REFERENCE AXES. (ARG)

LPDOT--COMPONENT (HULL OR TAIL), ROLLING MOMENT ABOUT THE COMPONENT REFERENCE AXIS, DUE TO ROLLING ACCELERATION ABOUT THE COMPONENT REFERENCE AXIS. (ARG)

LPDOTH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO ROLLING ACCELERATION (HDTDRV)

LPDOTT--TAIL ROLLING MOMENT DERIVATIVE WITH RESPECT TO ROLLING ACCELERATION (TDTDRV)

LPGRF1 ****
LPGRF2 * FOUR VECTORS CONTAINING THE
LPGRF3 * LPU GRAVITY FORCES (ARG)
LPGRF4 ****

LPH--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE HULL CG REFERENCE AXIS TO COORDINATES IN THE PAYLOAD CG REFERENCE AXIS. (PLTRNS)

LPI--ORTHOGONAL MATRIX WHICH TRANSFORMS COORDINATES IN THE INERTIAL REFERENCE AXIS TO COORDINATES IN THE PAYLOAD CG REFERENCE AXIS. (PLTRNS)

LPIPO1 **** FOUR VECTORS CONTAINING THE
LPIPO2 * INERTIAL POSITION OF EACH
LPIPO3 * LPU CG WITH RESPECT TO INERTIAL
LPIPO4 **** CG REFERENCE AXES IN COORDINATES OF THE REFERENCE AXIS (AUXVTR)

LPPABH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: P*ABS(P) (ARG)

LPPABP--PAYLOAD ROLLING MOMENT WITH RESPECT TO P*ABS(P).

LPPABT--TAIL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: P*ABS(P) (TDRVS)

LPUABH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: P*ABS(U) (ARG)

LPUDTA--ARRAY OF LPU VARIABLES WANTED ON OUTPUT. (ARG)

LPUEXH--ORTHOGONAL MATRIX WHICH TRANSFORMS VECTORS IN THE EXHAUST REFERENCE AXIS TO COORDINATES OF THE LPU CG REFERENCE AXIS

LPUID--LPU CONFIGURATION IDENTIFIER (LPU)

LPUMAX--THE MAXIMUM NUMBER OF LPU VARIABLES WANTED ON OUTPUT. (OPWANT)

LPWANT--ARRAY OF NUMBERS INDICATING LPU OUTPUT VARIABLES WANTED. (OUTDTA)

LP1EXH **** ORTHOGONAL TRANSFORMATIONS
LP2EXH * TO CONVERT FORCES IN THE
LP3EXH * EXHAUST REFERENCE AXIS TO
LP4EXH **** THE LPU CG REFERENCE AXIS (JETHST)

LQBRH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: QB*R. (ARG)

LQRH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: Q*R (ARG)

LRBQH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: RB*Q. (ARG)

LTCH1 **** FOUR VECTORS LOCATING EACH LPU
LTCH2 * ATTACH POINT WITH RESPECT TO
LTCH3 * LPU CG REFERENCE AXES
LTCH4 **** (LPATCH)

LVDOT--COMPONENT (HULL OR TAIL), ROLLING MOMENT ABOUT THE COMPONENT REFERENCE AXIS, DUE TO LATERAL ACCELERATION OF THE COMPONENT REFERENCE AXIS. (ARG)

LVDOTH--THE HULL MOMENT ROLLING DERIVATIVE WITH RESPECT TO THE LATERAL ACCELERATION.

LVDOTT--TAIL ROLLING MOMENT DERIVATIVE WITH RESPECT TO LATERAL ACCELERATION (TDTDRV)

LVH--ORTHOGOANL MATRIX WHICH TRANSFORMS COORDINATES IN THE HULL CG REFERENCE AXIS TO COORDINATES IN THE VERTICALLY ORIENTED REFERENCE AXIS (HEADING ANGLE IS ASSUMED EQUAL TO ZERO). (ARG)

LVVABT--TAIL ROLL MOMENT DERIVATIVE WITH RESPECT TO: V*ABS(V) (TDRVS)

LVWH--HULL ROLLING MOMENT DERIVATIVE WITH RESPECT TO: V*W (ARG)

LVWP--PAYLOAD ROLLING MOMENT DERIVATIVE WITH RESPECT TO V*ABS(U)

LWK1F1 **** LAMBDA-WAKE ANGLE FOR
LWK1F2 * START OF SHADOW REGION
LWK1F3 * FOR FUSELAGES. (SHDFCN)
LWK1F4 ****

LWK1P1 **** LAMBDA-WAKE ANGLE FOR
LWK1P2 * START OF SHADOW REGION
LWK1P3 * FOR PROPELLERS. (SHDPCN)
LWK1P4 ****

LWK1R1 **** LAMBDA-WAKE ANGLE FOR
LWK1R2 * START OF SHADOW REGION
LWK1R3 * FOR ROTORS. (SHDRCN)
LWK1R4 ****

LWK2F1 **** LAMBDA-WAKE ANGLE FOR
LWK2F2 * END OF SHADOW REGION FOR
LWK2F3 * FUSELAGES. (SHDFCN)
LWK2F4 ****

LWK2P1 **** LAMBDA-WAKE ANGLE FOR
LWK2P2 * END OF SHADOW REGION FOR
LWK2P3 * PROPELLERS. (SHDPCN)
LWK2P4 ****

LWK2R1 **** LAMBDA-WAKE ANGLE FOR
LWK2R2 * END OF SHADOW REGION
LWK2R3 * FOR ROTORS. (SHDRCN)
LWK2R4 ****

L1H **** FOUR ORTHOGONAL MATRICES WHICH
L2H * TRANSFORM VECTORS GIVEN IN THE
L3H * HULL CG REFERENCE AXES TO THE
L4H **** LPU CG REFERENCE AXES (LTRANS)

L1T1GT--STARTING TIME FOR LPU-1 GUST COMMANDS. (LPGCOM)

L1T2GT--ENDING TIME FOR LPU-1 GUST COMMANDS. (LPGCOM)

L2T1GT--STARTING TIME FOR LPU-2 GUST COMMANDS. (LPGCOM)

L2T2GT--ENDING TIME FOR LPU-2 GUST COMMANDS. (LPGCOM)

L3T1GT--STARTING TIME FOR LPU-3 GUST COMMANDS. (LPGCOM)

L3T2GT--ENDING TIME FOR LPU-3 GUST COMMANDS. (LPGCOM)

L4T1GT--STARTING TIME FOR LPU-4 GUST COMMANDS. (LPGCOM)

L4T2GT--ENDING TIME FOR LPU-4 GUST COMMANDS. (LPGCOM)

MA--(MOORED) LINEARIZED RIGID BODY SYSTEM MATRIX. (CHARACTERISTIC MATRIX) (ARG)

MAAUX--(MOORED) LINEARIZED AUXILIARY RIGID BODY SYSTEM MATRIX FOR CALCULATION OF CONSTRAINT FORCES. (ARG)

MACW--DISC MOMENT VECTOR WITH RESPECT TO THE CONTROL WIND AXIS. (ARG)

MADLTX--INCREMENT FOR MOORED A MATRIX STABILITY DERIVATIVE CALCULATIONS. (MDELTX)

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MASHUL--MASS OF THE HULL COMPONENT INCLUDES ENVELOPE, FINS, SUPPORT STRUCTURES, AND INTERNAL GASES (MASS)

MASLP1 ****
MASLP2 * MASSES OF THE FOUR LPUS (MASS)
MASLP3 *
MASLP4 ****

MASPAY--MASS OF THE PAYLOAD. (PMASS)

MASS--A MASS ELEMENT (ARG)

MASTLC--VECTOR LOCATING THE ATTACH POINT OF THE MOORING MAST TO THE VEHICLE WITH RESPECT TO THE INERTIAL REFERENCE AXIS IN COORDINATES OF THE INERTIAL REFERENCE AXIS. (MAST)

MATCOL--COLUMN OF STABILITY MATRIX BEING EVALUATED. (ARG)

MATFLG--A FLAG INDICATING WHICH STABILITY MATRIX THESE CALCULATIONS APPLY TO. (ARG)

MATIND--THIS IS AN ARRAY OF FLAGS, WHICH INDICATE THE STABILITY DERIVATIVE MATRIX, WHICH THE CORRESPONDING VALUE FOUND IN DERV12 COMES FROM (INVALD)

MATRIX--A THREE BY THREE MATRIX (ARG)

MATRIX--A SIX BY SEVEN MATRIX (ARG)

MATRIX--A THREE BY FOUR MATRIX (ARG)

MAXGST--COMMANDED MAXIMUM GUST AMPLITUDE. (ARG)

MC--LINEARIZED MATRIX FOR GUST INPUTS TO THE MOORING SIMULATION. (ARG)

MCAUX--(MOORED)LINEARIZED MATRIX FOR GUST INPUTS TO CALCULATE CONSTRAINT FORCES (ARG)

MCDLTX--INCREMENT FOR MOORED C MATRIX STABILITY DERIVATIVE CALCULATIONS (MDELTX)

MDELTA--(MOORED) THE PERTUBATION INCREMENT USED IN THE CALCULATION OF THE STABILITY DERIVATIVE. (ARG)

MDOTV--A SCALAR CONTAINING THE DOT PRODUCT OF MATRIX AND VECTOR (ARG)
(MDOTV = MATRIX DOT VECTOR)

MEGNVL--(MOORED)EIGEN VALUES. (ARG)

MENORM--VECTOR OF EUCLIDEAN NORMS OF THE COLUMNS OF MATRIX MFMAT. SUMMAX IS THE MAXIMUM EUCLIDEAN NORM. SUMMIN IS THE MINIMUM EUCLIDEAN NORM. (ARG)

MESAGE--A ONE HUNDRED TWENTY CHARACTER MAXIMUM HOLLERITH MESSAGE (ARG)

MEVCTR--(MOORED) CONSTRAINED ACCELERATION VECTOR. (ARG)

MFC--(MOORED) VECTOR OF ATTACH POINT CONSTRAINT FORCES AND MOMENTS (ARG)

MFMAT--MOORED MATRIX OF FUNCTIONALS: EACH COLUMN CONTAINS THE THREE ANGULAR ACCELERATIONS OF THE HULL ASSOCIATED WITH THE RESPECTIVE MOORED TRIM CONTROL COLUMN VECTOR OF MATRIX MUMAT. (ARG)

MFNEW--NEW FUNCTIONAL ASSOCIATED WITH NEW CONTROL VECTOR MUNEW. (ARG)

MINC--ADDITIVE INCREMENT FOR PERTURBING MOORING CONTROL VECTOR DURING TRIM SOLUTION (MTRMPC)

MINSTP--MINIMUM TIME STEP ALLOWED FOR THE PROGRAM INTEGRATOR TO PROVIDE THE USER A MEANS OF CONTROLLING RUN TIME AND COST. (ARG)

MK--MOORING TRIM ALGORITHM CONSTANTS (MTRMCN)

MKMIN--(MOORED) MINIMUM K BEFORE RESTARTING PERTUBATION PROCEDURE (MTRMCN)

MKSTRT--(MOORED) STARTING VALUE OF CONSTANT K (MTRMCN)

MMXITR--(MOORED) MAXIMUM NUMBER OF TRIM ITERATIONS BEFORE TRIM ATTEMPT IS TERMINATED (MTRMCN)

MMXRST--(MOORED) MAXIMUM NUMBER OF TRIM RESTARTS (MTRMCN)

MNOREV--(MOORED) NORMALIZED EIGEN VECTORS. (ARG)

MOCRV1 **** FOUR VECTORS CONTAINING THE
MOCRV2 * PRODUCT OF MASS, TIMES THE
MOCRV3 * CROSS PRODUCT OF THE LPU
MOCRV4 **** ANGULAR BODY RATES, WITH THE
LPU LINEAR VELOCITIES (ARG)

MODLER--ERROR CONDITION FLAG-TRUE IF ERROR IS ENCOUNTERED IN THE CALCULATION OF COMPONENT FORCES DURING THE TRIM ALGORITHM FOR THE DETERMINATION OF A NEW CONTROL VECTOR GUESS. (ARG)

MODLFL--COUNTER FOR NUMBER OF TIMES MODEL ERROR FLAG IS ENCOUNTERED DURING MOORING TRIM. (ARG)

MODULE--A THREE BY THREE MODULE TO BE INSERTED INTO TVC (ARG)

MOHCRV--PRODUCT OF HULL MASS TIMES THE CROSS PRODUCT OF HULL ANGULAR BODY RATES WITH HULL LINEAR VELOCITY VECTOR (ARG)

MOMARM--FORCE MOMENT ARM, WHICH LOCATES THE REFERENCE AXES WITH RESPECT TO THE CG AXES, INCOORDIANATES OF THE CG AXES. (ARG)

MOMENT--MOMENT VECTOR ABOUT THE CG REFERENCE AXES IN COORDINATES OF THE CG REFERENCE AXES (NEW AXES). (ARG)

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MOPCRV--PRODUCT OF PAYLOAD MASS TIMES THE CROSS PRODUCT OF THE PAYLOAD ANGULAR BODY RATES WITH THE PAYLOAD LINEAR VELOCITY VECTOR (PMASS)

MOREF--MOMENT VECTOR ABOUT THE REFERENCE AXES IN COORDINATES OF THE REFERENCE AXES (OLD AXES). (ARG).

MORLOD--MOORING LOAD FORCE VECTOR ON THE MOORING MAST IN COORDINATES OF THE INERTIAL REFERENCE AXIS. (IMRLOD)

MORPT--LOCATION OF MOORING MAST ATTACH POINT ON HULL RELATIVE TO HULL CG IN COORDINATES OF THE HULL CG REFERENCE AXIS. (MAST)

MPBRH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: PB*R. (ARG)

MQDOT--COMPONENT (HULL OR TAIL), PITCHING MOMENT, ABOUT THE COMPONENT REFERENCE AXIS: DUE TO PITCHING ACCELERATION OF THE COMPONENT REFERENCE AXIS. (ARG)

MQDOTH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO PITCHING ACCELERATION (HDTDRV)

MQDOTT--TAIL PITCHING MOMENT DERIVATIVE WITH RESPECT TO PITCHING ACCELERATION (TDTDRV)

MQQABH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: Q*ABS(Q) (ARG)

MQQABP--PAYLOAD PITCHING MOMENT DERIVATIVE WITH RESPECT TO Q*ABS(Q).

MQWABH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: Q*ABS(W) (ARG)

MRBPH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: RB*P. (ARG)

MRPH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: R*P (ARG)

MSCALF--MULTIPLICATIVE SCALE FACTOR FOR PERTURBING MOORING CONTROL VECTOR DURING MOORING TRIM SOLUTION. (MTRMPC)

MSDOT--TIME DERIVATIVES OF THE MOORING STATE VECTOR MS. (ARG)

MSLOCL--LOCAL COPY OF PERTURBED MOORING STATE VECTOR. (ARG)

MSNGMT--COUNTER WHICH KEEPS TRACK OF NUMBER OF TIMES A SINGULAR MATRIX IS ENCOUNTERED FOR THE CALCULATION OF A NEW MOORING TRIM CONTROL VECTOR (MTRMFL)

MSV--(MOORING) STATE VEHICLE VECTOR (ARG)

MSVL--LENGTH OF THE MSV VECTOR. (ARG)

MTRMTL--(MOORED) EUCLIDEAN NORM TOLERANCE CRITERION BEFORE TERMINATION (MTRMCN)

MTVC--A THIRTY BY TWENTY-SEVEN CONSTRAINT CONDITIONER (MOORING) MATRIX. (ARG)

MU--TIP SPEED RATIO. (ARG)

MU--MOORING TRIM CONTROL VECTOR, AT THE START OF THE TRIM THIS CONTAINS THE INITIAL GUESS. AT THE COMPLETION OF THE TRIM, THIS CONTAINS THE CONVERGED OR (BEST) SOLUTION. (ARG)

MUKG1 **** ROLLING FRICTION CONSTANTS
MUKG2 * FOR THE LANDING GEAR TIRES.
MUKG3 * THESE VALUES SHOULD ALWAYS
MUKG4 **** BE POSITIVE. (MUKG)

MUKGR--COEFFICIENT OF ROLLING FRICTION OF THE LANDING GEAR. (ARG)

MUMAT--MOORED CONTROL PERTUBATION MATRIX. THE FIRST COLUMN CONTAINS THE INTIAL OR HOME MOORED CONTROL VECTOR. THE REMAINING THREE COLUMNS CONTAIN PERTUBATION CONTROL VECTORS IN WHICH EACH COLUMN IS PERTURBED WITH RESPECT TO ONLY ONE OF IT'S ELEMENTS. (ARG)

MUNEW--NEW MOORING TRIM VECTOR. (ARG)

MUR--ROTOR TIP SPEED RATIO. (ARG)

MUWH--HULL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: U*W (ARG)

MUWP--PAYLOAD PITCHING MOMENT DERIVATIVE WITH RESPECT TO U*ABS(V)

MXBDFC--MAXIMUM BETA-WAKE DEFECT. (ARG)

MVDREL--(MOORING) RELATIVE ACCELERATION VECTOR AT THE CONSTRAINT POINTS (ANGULAR DEGREES OF FREEDOM ONLY). (ARG)

MWWABT--TAIL PITCHING MOMENT DERIVATIVE WITH RESPECT TO: W*ABS(W) (TDRVS)

MXBDF1 ****
MXBDF2 * MAXIMUM BETA-WAKE DEFECT
MXBDF3 * FOR FUSELAGES. (SHDFCN)
MXBDF4 ****

MXBDP1 ****
MXBDP2 * MAXIMUM BETA-WAKE DEFECT
MXBDP3 * FOR PROPELLERS. (SHDPCN)
MXBDP4 ****

MXBDR1 ****
MXBDR2 * MAXIMUM BETA-WAKE DEFECT
MXBDR3 * FOR ROTORS. (SHDRCN)
MXBDR4 ****

MXDFCT--ELEMENT MAXIMUM WAKE DEFECT. (ARG)

MXITER--MAXIMUM NUMBER OF TRIM ITERATIONS BEFORE TRIM ATTEMPT IS TERMINATED (TRMCNT)

MXLDFC--MAXIMUM LAMBDA-WAKE DEFECT (ARG)

MXLDF1 ****
MXLDF2 * MAXIMUM LAMBDA-WAKE DEFECT
MXLDF3 * FOR FUSELAGES. (SHDFCN)
MXLDF4 ****

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MXLDP1 ****
MXLDP2 * MAXIMUM LAMBDA-WAKE DEFECT
MXLDP3 * FOR PROPELLERS. (SHDPCN)
MXLDP4 ****

MXLDR1 ****
MXLDR2 * MAXIMUM LAMBDA-WAKE DEFECT
MXLDR3 * FOR ROTORS. (SHDRCN)
MXLDR4 ****

MXREST--MAXIMUM NUMBER OF TRIM RESTARTS (TRMCNT)

NBLADS--NUMBER OF BLADES ON EACH ROTOR (IDENTICAL CONFIGURATION FOR ALL LPUS) (LPU)

NBVSQT--TAIL YAWING MOMENT DERIVATIVE WITH RESPECT TO: (BETA*(VTO:T**2.)) (TDRVS)

NDHHT--NONDIMENSIONAL HULL HEIGHT BASED ON HULL MAXIMUM DIAMETER. (NDHTHT)

NDIMDH--NONDIMENSIONAL DISC HEIGHT BASED ON DISC DIAMETER. (ARG)

NDPHT1 **** NONDIMENSIONAL PROPELLER
NDPHT2 * HEIGHT BASED ON PROPELLER
NDPHT3 * DIAMETER. (NDPHT)
NDPHT4 ****

NDRHT1 **** NONDIMENSIONAL ROTOR HEIGHT
NDRHT2 * BASED ON ROTOR DIAMETER
NDRHT3 * (NDRHT)
NDRHT4 ****

NDTHT--NONDIMENSIONAL TAIL HEIGHT BASED ON TAIL SPAN. (NDHTHT)

NEGNVT--NORMALIZED EIGEN VECTORS. (ARG)

NEGPER--THE RESULTS OF THE NEGATIVE PERTUBATION OF THE STABILITY DERIVATIVE CALCULATION.

NEXGST--GUST VECTOR AT FIRST TIME INCREMENT FOLLOWING PRESENT SIMULATION TIME AT GUST SOURCE. (ARG)

NEXTIM--TIME OF FIRST GUST FOLLOWING PRESENT SIMULATION TIME. (ARG)

NORM--MODIFIED EUCLIDEAN NORM OF A SIX BY ONE VECTOR. (ARG)

NORM--EUCLIDEAN NORM OF A THREE BY ONE VECTOR (ARG)

NPBLD1 ****
NPBLD2 * NUMBER OF PROPELLER BLADES
NPBLD3 * PER PROPELLER DISC. (PGEOM)
NPBLD4 ****

NPBQH--HULL YAWING DERIVATIVE WITH RESPECT TO: PB*Q. (ARG)

NPQH--HULL YAWING MOMENT DERIVATIVE WITH RESPECT TO: P*Q (ARG)

NQBPH--HULL YAWING DERIVATIVE WITH RESPECT TO: QB*P. (ARG)

NRBLD1 ****
NRBLD2 * NUMBER OF ROTOR BLADES
NRBLD3 * PER ROTOR DISC. (RGEOM)
NRBLD4 ****

NRDOT--COMPONENT (HULL OR TAIL), YAW ANGLE MOMENT, ABOUT THE COMPONENT REFERENCE AXIS: DUE TO YAWING ACCELERATION OF THE COMPONENT REFERENCE AXIS. (ARG)

NRDOTH--HULL YAWING MOMENT DERIVATIVE WITH RESPECT TO YAW ACCELERATION (HDTDRV)

NRDOTT--TAIL YAWING MOMENT DERIVATIVE WITH RESPECT TO YAWING ACCELERATION (TDTDRV)

NRRABH--HULL YAWING MOMENT DERIVATIVE WITH RESPECT TO: R*ABS(R) (ARG)

NRRABP--PAYLOAD YAWING DERIVATIVE WITH RESPECT TO R*ABS(R).

NRVABH--HULL YAWING MOMENT DERIVATIVE WITH RESPECT TO: R*ABS(V) (ARG)

NTRIM--TRIM INTEGER NUMBER IDENTIFIER. (ARG)

NUMFIN--NUMBER OF FINS IN TAIL ENSEMBLE (TAIL)

NUMLPU--NUMBER OF LIFT PROPORTION UNITS (LPUS) (LPU)

NUVH--HULL YAWING MOMENT DERIVATIVE WITH RESPECT TO: U*V (ARG)

NUVP--PAYLOAD ROLLING MOMENT DERIVATIVE WITH RESPECT TO U*ABS(W).

NVVABT--TAIL YAWING MOMENT DERIVATIVE WITH RESPECT TO: V*ABS(V) (TDRVS)

OCRIO1 **** FOUR VECTORS CONTAINING THE
OCRIO2 * CROSS PRODUCT OF EACH LPU
OCRIO3 * ANGULAR BODY RATE WITH ITS
OCRIO4 **** ANGULAR MOMENTUM VECTOR (ARG)

OCRSV1 **** FOUR VECTORS CONTAINING THE
OCRSV2 * CROSS PRODUCTS OF THE LPU
OCRSV3 * ANGULAR BODY RATES WITH THE LPU
OCRSV4 **** LINEAR VELOCITY VECTORS (ARG)

ODHGST--ANGULAR GUST ACCELERATION AT THE HULL CENTER OF VOLUME. (GUSTS)

ODTGST--ANGULAR GUST ACCELERATION AT THE TAIL CENTROID. (GUSTS)

OHCIOM--CROSS PRODUCT OF HULL ANGULAR VELOCITY VECTOR WITH HULL ANGULAR MOMENTUM VECTOR (ARG)

OHCRSV--CROSS PRODUCT OF HULL ANGULAR RATE WITH HULL LINEAR VELOCITY VECTOR (ARG)

OHGUST--HULL CENTER OF VOLUME ANGULAR GUST VELOCITY. (GUSTS)

OMEGP1 ****
OMEGP2 * PROPELLER SPIN RATE. (PSTATE)
OMEGP3 *
OMEGP4 ****

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PBET1T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE OF SIDE SLIP-1. (ARG)

PBET2T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE OF SIDE SLIP-2. (ARG)

PB1SR1 **** TEST COMMAND ROTOR LONG-
PB1SR2 * ITUDINAL CYCLIC DEFLECTION
PB1SR3 * INCREMENT PB1SR1-4 EQUALS
PB1SR4 **** DB1SR1-4 FOR TIME .GE. RTCOM1

P --LINEARIZED PAYLOAD MATRIX FOR GUST INPUTS. (ARG)

PCAUX--LINEARIZED PAYLOAD MATRIX FOR GUST INPUTS TO CALCULATE CONSTRAINT FORCES. (ARG)

PCBLFO--TOTAL CABLE FORCE VECTOR ACTING AT THE PAYLOAD CG IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (ARG)

PCBLF1 **** PAYLOAD CABLE FORCE VECTOR
PCBLF2 * AT PAYLOAD C.G. IN COORD-
PCBLF3 * INATES OF THE PAYLOAD C.G.
PCBLF4 **** REFERENCE AXIS (ARG)

PCBLMO--TOTAL CABLE MOMENT ACTING ABOUT THE PAYLOAD CG IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (ARG)

PCDLTA--PAYLOAD LINEARIZATION INCREMENTS FOR THE CALCULATION OF THE C(GUST) MATRIX. (PDLTAX)

PCFLWC--PROPELLER ON HULL CROSSFLOW CORRECTION. (ARG)

PCONTL--VEHICLE COUPLED ROLL CONTROL. (ARG)

PCWR--ROTOR CONTROL WIND AXIS ROLL RATE. (ARG)

PDLTAL--TEST COMMAND AILERON DEFLECTION INCREMENT, PDLTAL = DDLTAL FOR TIME .GE. TTCOM1 .OR. .LT. TTCOM2. (ARG)

PDLTEL--TEST COMMAND ELEVATOR DELFECTION INCREMENT, PDLTEL = DDLTEL FOR TIME .GE. TTCOM1 .OR. .LT. TTCOM2. (ARG)

PDLTRD--TEST COMMAND RUDDER DEFLECTION INCREMENT, PDLTRD = DDLTRD FOR TIME .GE. TTCOM1 .OR. .LT. TTCOM2. (ARG)

PFIV1 **** PROPELLER ON FUSELAGE INTER-
PFIV2 * FERENCE VELOCITY VECTORS IN
PFIV3 * COORDINATES OF THE LPU CG
PFIV4 **** REFERENCE AXIS (ARG)

PFNEW--NEW PAYLOAD FUNCTIONAL ASSOCIATED WITH NEW PAYLOAD CONTROL VECTOR PUNEW. (ARG)

PGNFOR--PAYLOAD GENERALIZED FORCE VECTOR. (ARG)

PGOSCF--A SCALE FACTOR TO BE APPLIED TO THE RANDOM GUST ANGLE VELOCITIES ON INPUT (PYGCOM)

PGRFOR--PAYLOAD GRAVITY FORCE VECTOR IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (ARG)

PGSTFL--T/F A FLAG INDICATING THAT RANDOM GUSTS ARE TO BE TURNED ON. (PYGCOM)

PGVSCF--A SCALE FACTOR TO BE APPLIED TO THE RANDOM GUST ANGLE VELOCITIES ON INPUT (PYGCOM)

PHGMAX--THE MAXIMUM GUST ROLLING VELOCITY, ACTING ON THE HULL CENTER OF VOLUME. (HGCOM)

PHI--HULL CG REFERENCE AXIS EULER ROLL ANGLE. (ARG)

PHICMD--ROLL ANGLE COMMAND TABLE. (COMAND)

PHICOM--ROLL ANGLE COMMAND. (ARG)

PHIHUL--HULL EULER ROLL ANGLE (SVECTR)

PHIILM--ROLL ANGLE CIRCUIT INTEGRATION LIMIT. (FCSLIM)

PHIINT--ROLL ANGLE CIRCUIT INTEGRATOR VALUE. (SASINT)

PHILLM--ROLL ANGLE CIRCUIT LOOP LIMIT. (FCSLIM)

PHIVEL--PROPELLER ON HULL INTERFERENCE VELOCITY IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

PINC-- [illegible] INCREMENT FOR PERTURBING PAYLOAD CONTROL VECTOR DURING TRIM SOLUTION

PK--PAYLOAD TRIM ALGORITHM CONSTANT (PTRMCN)

PKMIN--MINIMUM PK BEFORE RESTARTING PERTUBATION PROCEDURE. (PTRMCN)

PKSTRT--STARTING VALUE OF CONSTANT PK. (PTRMCN)

PLOT--T/F PLOTTING FILES WANTED. (ARG)

PLPFLG--FLIGHT CONTROL SYSTEM FLAG INDICATING P LOOP IS CLOSED. (CLOSLP)

PMXITR--MAXIMUM NUMBER OF PAYLOAD TRIM ITERATIONS BEFORE PAYLOAD TRIM ATTEMPT IS TERMINATED. (PTRMCN)

PMXRST--MAXIMUM NUMBER OF PAYLOAD TRIM RESTARTS BEFORE TERMINATION. (PTRMCN)

POGSCF--A SCALE FACTOR TO BE APPLIED TO THE RANDOM GUST ANGULAR VELOCITIES ON INPUT. (PYGCOM)

POSHT1--POSITION CONTROL STARTING TIME (POSHCS)

POSHT2--POSITION CONTROL ENDING TIME (POSHCS)

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OMEGR--ROTOR SPIN RATE. (ARG)

OMEGR1 ****
OMEGR2 * ROTOR SPIN RATE. (RSTATE)
OMEGR3 *
OMEGR4 ****

OMGDHL--HULL ANGULAR ACCELERATION WITH RESPECT TO THE HULL CG REFERENCE AXIS. (SDOTCP)

OMGHUL--HULL ANGULAR VELOCITY VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXES. (SVECTR)

OMGPAY--PAYLOAD ANGULAR VELOCITY VECTOR IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (PSVCTR)

OMGPU1 **** FOUR VECTORS CONTAINING THE
OMGPU2 * LPU ABSOLUTE ANGULAR BODY RATES
OMGPU3 * (SVECTR)
OMGPU4 ****

OPCIOM--CROSS PRODUCT OF THE PAYLOAD ANGULAR VELOCITY VECTOR WITH THE PAYLOAD MOMENTUM VECTOR. (ARG)

OPGUST--PAYLOAD REFERENCE CENTER ANGULAR GUST VELOCITY. (PAYGST)

ORGNAL--THE ORIGINAL VALUE BEFORE PERTUBATION IN CALCULATING THE STABILITY DERIVATIVES. (ARG)

OTGUST--TAIL CENTROID ANGULAR GUST VELOCITY. (GUSTS)

PA--LINEARIZED PAYLOAD RIGID BODY SYSTEM MATRIX (PAYLOAD CHARACTERISTIC MATRIX). (ARG)

PAAUX--LINEARIZED AUXILIARY PAYLOAD RIGID BODY SYSTEM MATRIX FOR CALCULATION OF CONSTRAINT FORCES. (ARG)

PADLTA--PAYLOAD LINEARIZATION INCREMENTS FOR THE A-MATRIX CALCULATION. (PDLTAX)

PALPT--SUPPLEMENTARY (PRIME) TAIL ROLLING ANGLE OF ATTACK. (ARG)

PALPTO--SUPPLEMENTARY (PRIME) TAIL ROLLING ANGLE OF ATTACK WITHOUT AILERON AFFECTS. (ARG)

PALP1T--SUPPLEMENTARY (PRIME) STALL ROLLING ANGLE OF ATTACK-1. (ARG)

PALP2T--SUPPLEMENTARY (PRIME) TAIL STALL ROLLING ANGLE OF ATTACK-2. (ARG)

PALT--SUPPLEMENTARY (PRIME) TAIL ROLLING ANGLE OF ATTACK. (ARG)

PAL1T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE OF ATTACK-1. (ARG)

PAL2T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE OF ATTACK-2. (ARG)

PANGLE--SUPPLEMENTARY (PRIME) TAIL WIND ANGLE. (ARG)

PAP1TO--SUPPLEMENTARY (PRIME) STALL ROLLING ANGLE OF ATTACK-1 WITHOUT AILERON AFFECTS. (ARG)

PAP2TO--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE OF ATTACK-2 WITHOUT AILERON AFFECTS. (ARG)

PAROMA--PAYLOAD AERODYNAMIC MATRIX-A (PYAROM)

PAROMB--PAYLOAD AERODYNAMIC MATRIX-B (PYAROM)

PAROMC--PAYLOAD AERODYNAMIC MATRIX-C (PYAROM)

PATCH--VECTOR LOCATING A PAYLOAD CABLE ATTACH POINT WITH RESPECT TO THE PAYLOAD CG REFERENCE AXIS. (ARG)

PATCH1 **** FOUR VECTORS LOCATING THE
PATCH2 * CABLE ATTACH POINTS ON THE
PATCH3 * PAYLOAD WITH RESPECT TO THE
PATCH4 **** PAYLOAD CG REFERENCE AXIS.
(PATCH)

PAXCGG--PAYLOAD CG INERTIAL X-ACCELERATION IN G S.

PAYARA--PAYLOAD FRONT PROJECTED AREA (REFERENCE AREA). (PAYLOD)

PAYCGG--PAYLOAD CG INERTIAL Y-ACCELERATION IN G S.

PAYCTR--VECTOR LOCATING THE PAYLOAD REFERENCE CENTER WITH RESPECT TO THE PAYLOAD CG REFERENCE AXIS. (PAYLOD)

PAYDTH--PAYLOAD DEPTH. (PAYLOD)

PAYELR--EULER ANGLE RATES OF THE PAYLOAD CG REFERENCE AXIS, WITH RESPECT TO AN INERTIAL FRAME. (PERATS)

PAYEUL--EULER ANGLES OF THE PAYLOAD CG REFERENCE AXIS WITH RESPECT TO AN INERTIAL FRAME: PHI, PHETA, PSI. (PSVCTR)

PAYID--PAYLOAD CONFIGURATION IDENTIFIER. (PAYLOD)

PAYIPO--LOCATION OF THE PAYLOAD CENTER OF GRAVITY WITH RESPECT TO THE INERTIAL FRAME. (PAXVTR)

PAYLTH--PAYLOAD REFERENCE LENGTH. (PAYLOD)

PAYVOL--PAYLOAD VOLUME. (PAYLOD)

PAZCGG--PAYLOAD CG INERTIAL Z-ACCELERATION IN G S.

PA1SR1 **** TEST COMMAND FOR ROTOR
PA1SR2 * LATERAL CYCLIC DEFLECTION
PA1SR3 * INCREMENT EQUALS DA1SR1-4 FOR
PA1SR4 **** TIME .GE. RTCOM1 .OR. .LT.
RTCOM2. (ARG)

PBETAT--SUPPLEMENTARY (PRIME) TAIL ANGLE OF SIDE SLIP. (ARG)

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POSFER--THE RESULT OF THE POSITIVE PERTURBATION OF THE STABILITY DERIVATIVE CALCULATION. (ARG)

PPABST--TAIL POST STALL VELOCITY PARAMETER P*ABS(P). (ARG)

PPLOT--T/F PLOTTING FILES WANTED OR NOT (ARG)

PPOS--COLUMN NUMBER OF STABILITY DERIVATIVE MATRIX BEING EVALUATED. (ARG)

PPYGMX--MAXIMUM PAYLOAD ROLLING GUST (1-MINUS-COSINE SHAPE). (PYGCOM)

PREFRM--IMSL LIBRARY PREFORMACE INDEX FOR EIGEN VLAUE CALCULATIONS. (ARG)

PRNCHK--SIMULATION TIME OF LAST STATE VARIABLE PRINTOUT

PRNTMS--A FLAG INDICATING THAT A MESSAGE SHOULD BE PRINTED STATING THAT THE ARRAY OF INVALID STABILITY DERIVATIVES WAS FILLED UP AND SOME OF THE INVALID DERIVATIVES MAY NOT HAVE FLAGGED. (INVALD)

PROGID--THE PROGRAM IDENTIFIER. THIS VARIABLE CONTAINS "HLAPAY", "HLASIM", OR "HLAMOR, WHICH IDENTIFIES THE PROGRAM CURRENTLY BEING EXECUTED

PROP1 **** FOUR VECTORS LOCATING
PROP2 * EACH PROPELLER HUB, WITH
PROP3 * RESPECT TO THE CG REFERENCE
PROP4 **** AXES. (PROP)

PRPFO1 **** PROPELLER AERODYNAMIC FORCE
PRPFO2 * VECTOR, WITH RESPECT TO THE
PRPFO3 * LPU CG REFERENCE AXIS. (ARG)
PRPFO4 ****

PRPIV1 **** PROPELLER INDUCED VELOCITY
PRPIV2 * VECTORS IN COORDINATES OF
PRPIV3 * THE LPU CG REFERENCE AXIS.
PRPIV4 **** (ARG)

PRPMO1 **** PROPELLER AERODYNAMIC MOMENT
PRPMO2 * VECTOR, WITH RESPECT TO THE
PRPMO3 * LPU CG REFERENCE AXES. (ARG)
PRPMO4 ****

PS--PAYLOAD STATE VECTOR. (PSVCTR)

PSCALF--MULTIPLICATIVE SCALE FACTOR FOR PERTURBING PAYLOAD CONTROL VECTOR DURING PAYLOAD TRIM SOLUTION.

PSDOT--DUPLICATE COPY OF STATE DERIVATIVE VECTOR FROM MOST RECENT TIMESTEP. (SDOTCP)

PSIERR--HEADING ANGLE ERROR SIGNAL.

PSIHUL--HULL EULER HEADING ANGLE. (SVECTR)

PSIMPL--T/F TIME HISTORY TO BE CALCULATED OR NOT. (ARG)

PSIO--HEADING ANGLE WITH RESPECT TO THE INERTIAL FRAME OF THE MOORED VEHICLE WITH NO INERTIAL WIND, OR INITIAL HEADING ANGL OFF OF THE STEADY WIND FOR TRIM ALGORITHM INTIALIZATION. THE LATTER OPTION IS TO FIND TRIM STATES NOT ALIGNED WITH THE STEADY WIND. (CALMHD)

PSLOCL--LOCAL COPY OF PS VECTOR. USED ONLY DURING PAYLOAD LINEARIZATION PROCESS. (ARG)

PSNGMT--COUNTER FOR THE NUMBER OF TIMES A SINGLE MATRIX IS ENCOUNTERED IN THE PAYLOAD TRIM ROUTINE. (PTRMFL)

PSTA1T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE-1. (ARG)

PSTA2T--SUPPLEMENTARY (PRIME) TAIL STALL ANGLE-2. (ARG)

PTCHRT--PITCH RATE (EULER RATE OR BODY AXIS PITCH RATE). (ARG)

PTCOM1--STARTING TIME FOR PROPELLER CONTROL COMMANDS. (PFETHR)

PTCOM2--ENDING TIME FOR PROPELLER CONTROL COMMANDS. (PFETHR)

PTGMAX--THE MAXIMUM GUST ROLLING VELOCITY, ACTING AT THE TAIL CENTROID (TGCOM)

PTHEP1 **** TEST COMMAND PROPELLER
PTHEP2 * COLLECTIVE PITCH INCREMENT,
PTHEP3 * PTHEP1-4 EQUALS DTHEP1-4 FOR
PTHEP4 **** TIME .GE. PTCOM1 .OR. .LT. PTCOM2. (ARG)

PTHER1 **** TEST COMMAND ROTOR
PTHER2 * COLLECTIVE PITCH INCREMENT,
PTHER3 * PTHER1-4 EQUALS DTHER1-4 FOR
PTHER4 **** TIME .GE. RTCOM1 .OR. .LT. RTCOM2. (ARG)

PTIVEL--PROPELLER ON TAIL INTERFERENCE VELOCITY VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

PTRMAP--THE NUMBER OF PAYLOAD TRIM MAPS TO BE CALCULATED. (ARG)

PTRMCV--PAYLOAD TRIM CONVERGED FLAG. (ARG)

PTRMTL--MODIFIED EUCLIDEAN NORM TOLERANCE CRITERION FOR PAYLOAD TRIM. (PTRMCN)

PU--PAYLOAD TRIM CONTROL VECTOR. AT THE START OF THE TRIM THIS CONTAINS THE INTIAL GUESS. AT THE COMPLETION OF THE TRIM, THIS CONTAINS THE CONVERGED (OR BEST) SOLUTION. (ARG)

PUCBL--UNIT VECTOR LOCATING A PAYLOAD CABLE ATTACH POINT RELATIVE TO A RESPECTIVE HULL PAYLOAD CABLE ATTACH POINT IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (ARG)

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PUMAT--PAYLOAD CONTROL PERTUBATION MATRIX. THE FIRST COLUMN CONTAINS THE INITIAL OR HOME PAYLOAD CONTROL VECTOR. THE REMAINING SIX COLUMNS CONTAIN THE PERTURATION PAYLOAD CONTROL VECTORS IN WHICH EACH COLUMN IS PERTURBED WITH RESPECT TO ONLY ONE OF ITS ELEMENTS. (ARG)

PUNEW--NEW PAYLOAD TRIM VECTOR. (ARG)

PVGSCF--A SCALE FACTOR TO BE APPLIED TO THE PAYLOAD GUST VELOCITIES INPUT. (PYGCOM)

PXGBAR--PAYLOAD GUST STATE PERTUBATION VECTOR. (ARG)

PYAFOR--PAYLOAD AERODYNAMIC FORCE VECTOR WITH RESPECT TO THE PAYLOAD CG REFERENCE AXIS.

PYAMOM--PAYLOAD AERODYNAMIC MOMENT VECTOR WITH RESPECT TO THE PAYLOAD CG REFERENCE AXIS.

PYOPMX--THE NUMBER OF PAYLOAD VARIABLES WANTED ON OUTPUT. (POPWNT)

PYT1GT--STARTING TIME FOR PAYLOAD (1-MINUS-COSINE GUST). (PYGCOM)

PYT2GT--ENDING TIME FOR PAYLOAD (1-MINUS-COSINE GUST). (PYGCOM)

PYWANT--AN ARRAY CONTAINING THE CODE NUMBERS INDICATING WHICH PAYLOAD VARIABLES ARE WANTED IN OUTPUT. (POPWNT)

Q--DISC TORQUE; POSITIVE TORQUE INDICATES THAT THE DISC IS ATTEMPTING TO REDUCE THE ANGULAR SPIN RATE. NEGATIVE TORQUE INDICATES THAT THE DIS IS ATTEMPTING TO INCREASE THE ANGULAR SPIN RATE. A POSITIVE TORQUE IS ABOUT THE POSITIVE Z-CONTROL WIND AXIS. (ARG)

QCONTL--VEHICLE COUPLED PITCH CONTROL. (ARG)

QCWR--ROTOR CONTROL WIND AXES PITCH RATE. (ARG)

QHGMAX--THE MAXIMUM GUST PITCHING VELOCITY ACTING AT THE HULL CENTER OF VOLUME. (HGCOM)

QLPFLG--FLIGHT CONTROL SYSTEM FLAG INDICATING Q LOOP IS CLOSED. (CLOSLP)

QPYGMX--PAYLOAD MAXIMUM PITCHING GUST (1-MINUS-COSINE SHAPE). (PYGCOM)

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QP1 **** PROPELLER TORQUE, APPLIED BY THE
QP2    * PROPELLER ONTO THE SHAFT.  A
QP3    * POSITIVE PROPELLER TORQUE, IS ONE
QP4 **** WHICH TENDS TO SLOW DOWN THE
         ANGULAR PROPELLER SPEED. (ARG)
```

QQABST--TAIL STALL VELOCITY PARAMETER Q*ABS(Q). (ARG)

```
QR1 **** ROTOR TORQUE, APPLIED BY THE ROTOR
QR2    * ONTO THE SHAFT.  A POSITIVE ROTOR
QR3    * TORQUE IS ONE WHICH TENDS TO TWIST
QR4 **** THE LPU'S ABOUT THE POSITIVE LPU CG
         REFERENCE AXES. (RSTATE)
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QTGMAX--THE MAXIMUM GUST PITCHING VELOCITY, ACTING AT THE TAIL CENTROID. (TGCOM)

QUIT--LOGICAL VARIABLE; TRUE EQUALS TERMINATE PROGRAM, FALSE EQUALS CONTINUE EXECUTING PROGRAM (ARG)

RACELC--RELATIVE ACCELEROMETER LOCATION. (ARG)

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RACLP1 **** FOUR VECTORS LOCATING THE LPU
RACLP2    * AERODYNAMIC CENTER OF EACH
RACLP3    * LPU, WITH RESPECT TO THE LPU
RACLP4 **** FUSELAGE REFERENCE AXES (ARG)
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RAD--DISC RADIUS. (ARG)

RAD--DISC (ROTOR OR PROPELLER) RADIUS. (ARG)

RADIUS--RADIUS OF THE ROTOR OR PROPELLER

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RADP1 ****
RADP2    * PROPELLER DISC RADIUS.
RADP3    * (PGEOM)
RADP4 ****
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RADRT1 ****
RADRT2    * ROTOR RADIUS (RGEOM)
RADRT3    *
RADRT4 ****
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RASRCX--LOCATES THE AFT GUST INPUT SOURCE LOCATIONS WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (RSRCLC)

```
RATCH1 **** FOUR VECTORS LOCATING THE
RATCH2    * ATTACH POINT OF THE LPU ON
RATCH3    * THE HULL, WITH RESPECT TO
RATCH4 **** THE HULL CENTER OF VOLUME
            REFERENCE AXES (ARG)
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RATEFB--RATE FEEDBACK VALUE. (ARG)

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RATHG1 **** VECTORS LOCATING THE GEAR
RATHG2    * ATTACH POINT ON THE HULL
RATHG3    * STRUCTURAL FRAME WITH
RATHG4 **** RESPECT TO HULL CENTER OF
            VOLUME IN COORDINATES OF THE
            HULL CG REFERENCEAXIS. (ARG)
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```
RATHP1 **** FOUR VECTORS LOCATING
RATHP2    * EACH CABLE ATTACH POINT
RATHP3    * ON THE HULL, WITH RESPECT
RATHP4 **** TO THE HULL CENTER OF VOLUME
            IN COORDINATES OF THE HULL
            CENTER OF VOLUME REFERENCE
            AXIS. (ARG)
```

RCFLWC--ROTOR ON HULL CROSSFLOW CORRECTION. (ARG)

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RCGLP1 **** FOUR VECTORS LOCATING EACH LPU
RCGLP2    * CG WITH RESPECT TO THE LPU
RCGLP3    * FUSELAGE REFERENCE AXES
RCGLP4 **** (ARG)
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RCONTL--VEHICLE COUPLED YAW CONTROL. (ARG)

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RCTSTP--RECOMMENDED MINIMUM ALGORITHM TIME STEP: ESTIMATED TO BE ONE TENTH OF THE SPRING PERIOD. (ARG)

REFAM--COMPONENT (HULL OR TAIL), APPARENT MASS MATRIX: DUE TO MOTIONS OF THE COMPONENT REFERENCE CENTER. (ARG)

REXLC1 **** FOUR VECTORS LOCATING THE
REXLC2 * POSITION OF THE JET EXHAUST
REXLC3 * NOZZLES WITH RESPECT TO THE
REXLC4 **** FUSELAGE REFERENCE AXIS

RFDBK--FEEDBACK FLAG: TRUE EQUALS HULL CG BODY AXIS YAW RATE FEEDBACK, FALSE EQUALS HULL CG AXIS EULER YAW RATE (PSIDOT) FEEDBACK. (FDBKFL)

RFIV1 **** ROTOR ON FUSELAGE INTERFERENCE
RFIV2 * VELOCITY VECTORS IN COORDINATES
RFIV3 * OF THE LPU CG REFERENCE AXIS
RFIV4 **** (ARG)

RFSRCX--LOCATES THE FORWARD GUST INPUT SOURCE LOCATION WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (RSRCLC)

RHBFOR--TOTAL HULL BUOYANCY FORCE VECTOR ARISING FROM GUST ACCELERATION, GUST GRADIENT, AND AERO-STATIC CONTRI-BUTIONS. THIS VECTOR IS GIVEN IN IN COORDINATES OF THE HULL CENTER OF VOLUME REFERENCE AXES. (ARG)

RHGMAX--THE MAXIMUM GUST YAWING VELOCITY, ACTING AT THE HULL CENTER OF VOLUME. (HGCOM)

RHIVEL--ROTOR ON HULL INTERFERENCE VELOCITY VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

RHMOTA--HULL RELATIVE MOTION VECTOR-A FOR HULL AERODYNAMIC CALCULATIONS. (ARG)

RHMOTB--HULL RELATIVE MOTION WITH RESPECT TO THE AIR MASS VECTOR-B, FOR HULL AERO-DYNAMIC CALCULATIONS. (ARG)

RHMOTC--HULL RELATIVE MOTION WITH RESPECT TO THE AIR MASS VECTOR-C, FOR HULL AERO-DYNAMIC CALCULATIONS. (ARG)

RHMOTD--HULL RELATIVE MOTION WITH RESPECT TO THE AIR MASS VECTOR-D, FOR HULL AERO-DYNAMIC CALCULATIONS. (ARG)

RHMOTE--HULL RELATIVE MOTION WITH RESPECT TO THE AIR MASS VECTOR-E, FOR HULL AERO-DYNAMIC CALCULATIONS. (ARG)

RHMOTF--HULL RELATIVE MOTION WITH RESPECT TO THE AIR MASS VECTOR-F, FOR HULL AERO-DYNAMIC CALCULATIONS. (ARG)

RHOAF--HULL ONLY AERODYNAMIC FORCE VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (ARG)

RHOAMO--HULL ONLY AERODYNAMIC MOMENT VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME REFERENCE AXIS. (ARG)

RHOGFO--HULL ONLY GUST ACCELERATION FORCE VECTOR IN COORDINATES OF THE HULL CENTER OF VOLUME REFERENCE AXES. (ARG)

RHOGMO--HULL ONLY GUST ACCELERATION MOMENT VECTOR IN COORDINATES OF THE HULL CENTER OF VOLUME REFERENCE AXES. (ARG)

RHOWFO--HULL ONLY WIND FORCE VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME. EXCLUDES THOSE FORCES DUE TO GUST ACCELERATION TERMS. (ARG)

RHOWMO--HULL ONLY WIND MOMENT VECTOR WITH RESPECT TO THE HULL CENTER OF VOLUME. EXCLUDES THOSE TERMS DUE TO GUST ACCELERATION EFFECTS. (ARG)

RHRLP1 **** FOUR VECTORS LOCATING
RHRLP2 * EACH LPU CENTER OF GRAVITY
RHRLP3 * WITH RESPECT TO THE HULL
RHRLP4 **** CENTER OF VOLUME REFERENCE AXIS. (RHRLOC)

RHULCG--LOCATION OF HULL CENTER OF GRAVITY WITH RESPECT TO HULL CENTER OF VOLUME REFERENCE AXES. (ARG)

RILM--TURN RATE CIRCUIT INTEGRATOR LIMIT. (FCSLIM)

RLLM--TURN RATE CIRCUIT LOOP LIMIT. (SASINT)

RLOC--VECTOR LOCATING VEHICLE PARTS (E.G. HULL BOW, HULL STERN, ETC.) WITH RESPECT TO THE HULL CENTER OF VOLUMN IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

RLTCH1 **** FOUR VECTORS LOCATING EACH
RLTCH2 * ATTACH POINT ON THE LPU
RLTCH3 * WITH RESPECT TO THE LPU
RLTCH4 **** FUSELAGE REFERENCE AXES (ARG)

RMORPT--VECTOR LOCATING THE ATTACH POINT OF THE MOORING MAST TO THE VEHICLE RELATIVE TO THE HULL CENTER OF VOLUME IN COORDINATES OF THE HULL CG REFERENCE AXIS. (ARG)

ROHLCV--HULL CENTER OF VOLUME RELATIVE ANGULAR VELOCITY, WITH RESPECT TO THE AIR MASS. (ARG)

ROLLRT--ROLL RATE (EULER RATE OR BODY AXIS ROLL RATE). (ARG)

ROPAYC--RELATIVE ANGULAR VELOCITY OF THE PAYLOAD AERODYNAMIC REFERENCE CENTER, WITH RESPECT TO THE LOCAL AIR MASS IN COORDINATES OF THE PAYLOAD CG RFERENCE AXIS. (ARG)

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ROTAIL--TAIL CENTROID ANGULAR
VELOCITY, WITH RESPECT TO THE AIR
MASS. (ARG)

ROTFO1 **** ROTOR AERODYNAMIC FORCE
ROTFO2 * VECTOR, WITH RESPECT TO
ROTFO3 * THE LPU CG REFERENCE AXIS.
ROTFO4 **** (ARG)

ROTIV1 **** ROTOR INDUCED VELOCITY
ROTIV2 * VECTORS IN COORDINATES OF
ROTIV3 * THE LPU CG REFERENCE AXIS
ROTIV4 **** (ARG)

ROTMO1 **** ROTOR AERODYNAMIC MOMENT
ROTMO2 * VECTOR ABOUT THE LPU CG
ROTMO3 * REFERENCE AXES, WITH RESPECT
ROTMO4 **** TO COORDINATES GIVEN IN THE LPU
CG REFERENCE AXES. (ARG)

ROTR1 **** FOUR VECTORS LOCATING THE
ROTR2 * ROTOR HUB, WITH RESPECT TO
ROTR3 * THE LPU CG IN COORDINATES OF
ROTR4 **** THE LPU CG REFERENCE AXES.
(ROTOR)

ROW--THE ROW POSITION IN THE MATRIX
(ARG)

ROWPOS--ARRAY OF STABILITY DERIVATIVE
MATRIX ROW POSITIONS WHICH ARE BEING
FLAGGED BECAUSE THEY ARE INVALID. (INVALD)

RPAYCC--VECTOR LOCATING THE CENTER
OF GRAVITY WITH RESPECT TO THE PAYLOAD
REFERENCE CENTER IN COORDINATES OF THE
REFERENCE CENTER AXIS. (ARG)

RPIV1 **** ROTOR ON PROPELLER INTERFERENCE
RPIV2 * VELOCITY VECTORS IN COORDINATES
RPIV3 * OF THE LPU CG REFERENCE AXIS
RPIV4 **** (ARG)

RPMOTA--PAYLOAD RELATIVE MOTION WITH
RESPECT TO THE AIR MASS VECTOR-A
(ARG)

RPMOTB--PAYLOAD RELATIVE MOTION WITH
RESPECT TO THE AIR MASS VECTOR-B
(ARG)

RPMOTC--PAYLOAD RELATIVE MOTION WITH
RESPECT TO THE AIR MASS VECTOR-C
(ARG)

RPROP1 **** FOUR VECTORS LOCATING THE
RPROP2 * PROPELLER HUB OF EACH LPU WITH
RPROP3 * RESPECT TO COORDINATES IN THE
RPROP4 **** LPU FUSELAGE REFERENCE AXES.
(ARG)

RPTCH1 **** FOUR VECTORS LOCATING THE
RPTCH2 * CABLE ATTACH POINTS ON
RPTCH3 * THE PAYLOAD WITH RESPECT
RPTCH4 **** TO THE PAYLOAD REFERENCE
CENTER IN COORDINATES OF
PAYLOAD REFERNCE AXIS. (ARG)

RPWFOR-- AYLOAD WIND FORCE AT THE
PAYLOAD AERODYNAMIC REFERENCE
CENTER IN COORDINATES OF THE PAY-
LOAD CG REFERENCE AXIS. (ARG)

RPWMOM--PAYLOAD WIND MOMENT ABOUT
THE PAYLOAD AERODYNAMIC REFERENCE
CENTER IN COORDINATES OF THE PAY-
LOAD CG REFERENCE AXIS. (ARG)

RPYGMX--MAXIMUM VALUE OF PAYLOAD YAWING
GUST (1-MINUS-COSINE SHAPE). (PYGCOM)

RRABST--TAIL STALL VELOCITY
PARAMETER R*ABS(R). (ARG)

RROTR1 **** FOUR VECTORS LOCATING
RROTR2 * EACH ROTOR HUB WITH RESPECT
RROTR3 * TO COORDINATES IN THE LPU
RROTR4 **** FUSELAGE REFERENCE AXES. (ARG)

RSORCY--LOCATES THE LATERAL
(SYMMETRIC ABOUT THE X-AXIS) POSITION
OF THE GUST INPUT SOURCES; THIS VALUE
MUST BE POSITIVE. (RSRCLC)

RTALOC--VECTOR LOCATING THE TAIL REFERENCE
CENTER WITH RESPECT TO THE HULL CENTER OF
VOLUME REFERENCE AXES (ARG)

RTCOM1--STARTING TIME FOR ROTOR CONTROL
COMMANDS. (RSWASH)

RTCOM2--ENDING TIME FOR ROTOR CONTROL
COMMANDS. (RSWASH)

RTGMAX--THE MAXIMUM GUST YAWING
VELOCITY, ACTING AT THE TAIL
CENTROID. (TGCOM)

RTIVEL--ROTOR ON TAIL INTERFERENCE
VELOCITY VECTOR IN COORDINATES OF
THE HULL CG REFERENCE AXIS (ARG)

RTOAF--TAIL ONLY AERODYNAMIC
FORCE VECTOR, WITH RESPECT TO
THE TAIL CENTROID AXIS. (ARG)

RTOAMO--TAIL ONLY AERODYNAMIC
MOMENT VECTOR, WITH RESPECT TO
THE TAIL CENTROID AXIS. (ARG)

RTOGFO--RELATIVE TAIL ONLY GUST FORCE VECTOR
AT THE TAIL CENTROID. (ARG)

RTOGMO--RELATIVE TAIL ONLY GUST MOMENT
VECTOR WITH RESPECT TO THE TAIL CENTROID.
(ARG)

RUDLFL--RUDDER DEFLECTION LIMIT FLAG
INDICATING MAXIMUM MECHANICAL ALLOWED
VALUE WAS EXCEEDED. (MCLMFL)

RV--RELATIVE AIR MASS VELOCITY
AT THE HUB, WITH RESPECT TO THE
LPU CG REFERENCE AXES. (ARG)

RVCW--RELATIVE VELOCITY OF THE DISC (ROTOR
OR PROPELLER) WITH RESPECT TO THE LOCAL
AIR MASS IN COORDINATES OF THE CONTROL
WIND REFERENCE AXIS. (ARG)

RVELEM--RELATIVE VELOCITY OF ELEMENT
WITH RESPECT TO THE LOCAL AIR MASS.

RVELH1 **** FOUR VECTORS CONTAINING THE
RVELH2 * RELATIVE LINEAR VELOCITIES
RVELH3 * OF THE ATTACH POINT, WITH
RVELH4 **** RESPECT TO THE HULL CG AXES,
GIVEN IN COORDINATES OF THE
HULL CG AXES (RELVEL)

RVEL1H **** FOUR VECTORS CONTAINING THE
RVEL2H   * RELATIVE LINEAR VELOCITIES OF
RVEL3H   * EACH ATTACH POINT, WITH RESPECT
RVEL4H **** TO EACH LPU CG AXES, GIVEN IN
            COORDINATES OF THE LPU CG AXES
            (RELVEL)

RVFUS1 **** RELATIVE VELOCITY OF THE
RVFUS2   * FUSELAGE AERODYNAMIC CENTERS
RVFUS3   * WITH RESPECT TO THE AIR MASS
RVFUS4 **** IN COORDINATES OF THE LPU CG
            REFERENCE AXIS. (ARG)

RVHLCV--HULL CENTER OF VOLUME RELATIVE VELOCITY, WITH RESPECT TO THE AIR MASS IN COORDINATES OF THE HULL CG REFERENCE AXES (ARG)

RVLU--REAL PART OF EIGEN VALUE

RVPAYC--RELATIVE LINEAR VELOCITY OF THE PAYLOAD REFERENCE CENTER, WITH RESPECT TO THE LOCAL AIR MASSIN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (ARG)

RVPRP1 **** RELATIVE VELOCITY OF THE
RVPRP2   * PROPELLER SHAFT, WITH RESPECT
RVPRP3   * TO THE AIR MASS AND
RVPRP4 **** IN COORDINATES OF THE LPU CG
            REFERENCE AXES. (ARG)

RVROT1 **** RELATIVE AIR MASS VELOCITY,
RVROT2   * WITH RESPECT TO THE ROTOR HUB,
RVROT3   * IN COORDINATES OF THE LPU CG
RVROT4 **** REFERENCE AXES. (ARG)

RVSNLC--RELATIVE VELOCITY SENSOR LOCATION. (ARG)

RVTAIL--TAIL CENTROID RELATIVE VELOCITY WITH RESPECT TO THE AIR MASS IN COORDINATES OF THE HULL CG REFERENCE AXES. (ARG)

RVTR--REAL PART OF EIGEN VECTOR

S--VECTOR OF VEHICLE STATES (SVECTR)

SA1SR1 **** FLIGHT CONTROL SYSTEM
SA1SR2   * COMMAND FOR ROTOR LATERAL
SA1SR3   * CYCLIC DEFLECTION. (ARG)
SA1SR4 ****

SB1SR1 **** FLIGHT CONTROL SYSTEM
SB1SR2   * COMMAND FOR ROTOR
SB1SR3   * LONGITUDINAL CYCLIC
SB1SR4 **** DEFLECTION. (ARG)

SCALAR--A SCALAR (ARG)

SCALMA--A THREE BY THREE MATRIX CONTAINING THE RESULT OF THE MULTIPLICATION OF SCALAR TIMES MATRIX ([SCALMA] = SCALAR X [MATRIX]) (ARG)

SCDSDM--INDIVIDUAL (NOT LINKED) CONTROL STABILITY DERIVATIVE CALCULATION FLAG. TRUE EQUALS CALCULATE INDIVIDUAL CONTROL DERIVATIVE MATRICES. (STABDV)

SCOLMN--STARTING COLUMN NUMBER FOR LOADING A MATRIXMODULE INTO A LARGER COMPOSITE MATRIX

SDLTAL--FLIGHT CONTROL SYSTEM COMMAND FOR AILERON DEFLECTION (ARG)

SDLTEL--FLIGHT CONTROL SYSTEM COMMAND FOR ELEVATOR DEFLECTION (ARG)

SDLTRD--FLIGHT CONTROL SYSTEM COMMAND FOR RUDDER DEFLECTION (ARG)

SDOT--TIME DERIVATIVES OF THE STATE VECTOR S (ARG)

SDSDM--A SYSTEM FLAG FOR CALCULATION OF STABILITY DERIVATIVE MATRIX "A". TRUE EQUALS CALCULATE SYSTEM MATRIX (CHARACTERISTIC MATRIX) (STABDV)

SDUDXH--COMPONENT OF DUGDXH OBTAINED FROM SPATIAL INTEROPOLATION OF GUST INPUT STRINGS. (ARG)

SDUDXT--COMPONENT OF DUGDXT OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SDUDYH--COMPONENT OF DUGDYH OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SDUDYT--COMPONENT OF DUGDYT OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SDVDYH--COMPONENT OF DVGDYH OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SDVDYT--COMPONENT OF DVGDYT OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SIGMA--SOLIDITY RATIO (ARG)

SIGMP1 ****
SIGMP2   * PROPELLER SOLIDITY RATIO
SIGMP3   * (PGEOM)
SIGMP4 ****

SIGMR1 ****
SIGMR2   * ROTOR SOLIDITY RATIO
SIGMR3   * (RGEOM)
SIGMR4 ****

SIMFL--LOGICAL; TRUE EQUALS CALCULATE SIX DEGREES OF FREEDOM TIME HISTORIES

SLOCAL--LOCAL COPY OF S VECTOR. USED ONLY DURING LINEARIZATION PROCESS. (ARG)

SLOCAL--LOCAL COPY OF PERTURBED VEHICLE STATE VECTOR

SNGMTX--COUNTER FOR THE NUMBER OF TIMES A SINGULAR MATRIX IS ENCOUNTERED TRIM. (MCLMFL)

SODRHG--COMPONENT OF ODHGST OBTAINED FROM TIME DERIVATIVE OF GUST INPUT STRINGS. (ARG)

SODRTG--COMPONENT OF ODTGST OBTAINED FROM TIME DERIVATIVE OF GUST INPUT STRINGS. (ARG)

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SOHGST--COMPONENT OF OHGUST OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SOTGST--COMPONENT OF OTGUST OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SOMGP1 **** FLIGHT CONTROL SYSTEM
SOMGP2 * COMMAND FOR PROPELLER
SOMGP3 * ANGULAR RATE. (ARG)
SOMGP4 ****

SOMGR1 **** FLIGHT CONTROL SYSTEM
SOMGR2 * COMMAND FOR ROTOR
SOMGR3 * ANGULAR RATE. (ARG)
SOMGR4 ****

SOPGST--PAYLOAD ANGULAR GUST VELOCITY VECTOR OBTAINED FROM PAYLOAD GUST INPUT STRINGS. (ARG)

SORDRV--AERODYNAMIC PRE-STALL TAIL SQUARE LAW DERIVATIVE. (ARG)

SROWN--STARTING ROW NUMBER FOR LOADING ONE MATRIX MODULE INTO A COMPONENT MATRIX

STALFG--AERODYNAMIC REGIME FLAG FOR CALCULATIONS OF THE TAIL FORCE COMPONENTS. (ARG)

STALVL--REPRESENTATIVE VELOCITY PARAMETER (VELCTY*ABS(VELCTY)) FOR POST STALL REGIME AERODYNAMIC CALCULATIONS. (ARG)

STAL1T--TAIL STALL ANGLE-1 (ALWAYS POSITIVE AND IN FIRST QUADRANT). (ARG)

STAL2T--TAIL STALL ANGLE-2 (ALWAYS POSITIVE AND IN FIRST QUADRANT). (ARG)

STATBF--HULL AERO-STATIC BUOYANCY FORCE VECTOR.

STATER--STATE FEEDBACK ERROR (STATER EQUALS STAT MINUS STATE FEED BACK). (ARG)

STATFB--STATE FEEDBACK VALUE. (ARG)

STATPF--STATIC AERODYNAMIC PAYLOAD FORCE IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS (ARG)

STATPM--STATIC AERODYANMIC PAYLOAD MOMENT ABOUT THE PAYLOAD AERODYNAMIC REFERENCE CENTER, IN COORDINATES OF THE CG REFERENCE AXIS (ARG)

STBDER--ONE VALUE OF A STABILITY DERIVATIVE MATRIX. (ARG)

STGCFL--VEHICLE STERN GROUND CONTACT FLAG (HLCNTC)

STHEP1 **** FLIGHT CONTROL SYSTEM
STHEP2 * COMMAND FOR PROPELLER
STHEP3 * COLLECTIVE PITCH. (ARG)
STHEP4 ****

STHER1 ***** FLIGHT CONTROL SYSTEM
STHER2 * COMMAND FOR ROTOR
STHER3 * COLLECTIVE PITCH. (ARG)
STHER4 ****

STLDRV--AERODYNAMIC TAIL DERIVATIVE IN THE POST STALL RANGE. (ARG)

SUBNAM--A CHARACTER STRING WITH THE NAME OF A SUBROUTINE. (ARG)

SUMMAX--THE MAXIMUM MODIFIED EUCLIDEAN NORM. (ARG)

SUMMIN--THE MINIMUM MODIFIED EUCLIDEAN NORM. (ARG)

SUMNEW--EUCLIDEAN NORM ASSOCIATED WITH NEW TRIM VECTOR UNEW (ARG)

SV--THE STATE VECTOR CONTAINING ALL OF THE INTEGRATOR STATES, INCLUDING THE VEHICLE STATE VECTOR, THE CONTROL SYSTEM INTEGRATOR VALUES, THE BLANK INTEGRATOR ARRAY, AND THE PAYLOAD STATES IF THE PAYLOAD IS INCLUDED. (ARG)

SVDRHG--COMPONENT OF VDRHGT OBTAINED FROM TIME DERIVATIVE OF GUST INPUT STRINGS. (ARG)

SVDRTG--COMPONENT OF VDRTGT OBTAINED FROM TIME DERIVATIVE OF GUST INPUT STRINGS. (ARG)

SVGST1 **** COMPONENTS OF VGUST1-4
SVGST2 * OBTAINED FROM SPATIAL
SVGST3 * INTERPOLATION OF THE
SVGST4 **** GUST INPUT STRINGS, IN COORDINATES OF THE LPU CG REFERNCE AXIS. (ARG)

SVHGST--COMPONENT OF VHGUST OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SVLNTH--LENGTH OF THE SV VECTOR

SVPGST--PAYLOAD LINEAR GUST VELOCITY VECTOR OBTAINED FROM PAYLOAD GUST INPUT STRINGS. (ARG)

SVTGST--COMPONENT OF VTGUST OBTAINED FROM SPATIAL INTERPOLATION OF GUST INPUT STRINGS. (ARG)

SYSTAL--AERODYNAMIC REGIME FLAG FOR STATIC Y-FORCE TAIL CALCULATIONS. (STALLS)

SZSTAL--AERODYNAMIC REGIME FLAG FOR STATIC Y-FORCE TAIL CALCULATIONS. (STALLS)

T--DISC THRUST. POSITIVE THRUST IS ALONG THE NEGATIVE Z-CONTROL WIND AXES. (ARG)

T--RATE GAIN. (ARG)

TALAM--TAIL APPARENT MASS MATRIX, FOR MOTIONS ABOUT THE TAIL CENTROID. (TLAROM)

TALARA--TAIL ENSEMBLE REFERENCE AREA (TAIL)

TALID--TAIL ENSEMBLE CONFIGURATION IDENTIFIER (TAIL)

TALOC--LOCATION OF TAIL ENSEMBLE REFERENCE CENTER, WITH RESPECT TO THE HULL CG REFERENCE AXES (TAIL)

TALTAM--TAIL APPARENT MASS MATRIX, FOR MOTIONS ABOUT THE HULL CG REFERENCE AXIS. (TLAROM)

TAUA--AILERON SURFACE DEFLECTION EFFECTIVENESS CONSTANTS (TAUTS)

TAUE--ELEVATOR SURFACE DEFLECTION EFFECTIVENESS CONSTANTS (TAUTS)

TAUR--RUDDER SURFACE DEFLECTION EFFECTIVENESS CONSTANTS (TAUTS)

TAXAC--X-ACCELEROMETER GAIN. (FCSGNS)

TAYAC--Y-ACCELEROMETER GAIN. (FCSGNS)

TAZAC--Z-ACCELEROMETER GAIN. (FCSGNS)

TCACFO--TAIL ONLY CENTROID AXIS ACCELERATION FORCE VECTOR WITH RESPECT TO THE TAIL CENTROID REFERENCE AXIS.

TCACMO--TAIL ONLY CENTROID AXIS ACCELERATION MOMENT VECTOR WITH RESPECT TO THE TAIL CENTROID REFERENCE AXIS.

TCLL--TAIL LIFT CURVE SLOPE GROUND EFFECT CORRECTION FACTOR.

TCOM--SIMULATION TIME AT WHICH COMMANDS ARE ISSUED (COMAND)

TGGAMF--TAIL GUST GRADIENT APPARENT MASS FORCE WITH RESPECT TO THE TAIL CENTROID OF AXIS.

TGGAMM--TAIL GUST GRADIENT APPARENT MASS MOMENT WITH RESPECT TO THE TAIL CENTROID OF AXIS.

THECMD--PITCH ANGLE COMMAND TABLE. (COMAND)

THECOM--PITCH ANGLE COMMAND. (ARG)

THEHUL--HULL EULER PITCH ANGLE (POSITIVE NOSE UP). (SVECTR)

THEILM--PITCH ANGLE CIRCUIT INTEGRATION LIMIT. (FCSLIM)

THEINT--PITCH ANGLE CIRCUIT INTEGRATOR VALUE. (SASINT)

THELLM--PITCH ANGLE CIRCUIT LOOP LIMIT. (FCSLIM)

THEPFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE PROPELLER COLLECTIVE PITCH IS GREATER THAN THE MAXIMUM ALLOWED VALUE(THEPMX). (MCLMFL)

THEPMX--MAXIMUM PROPELLER COLLECTIVE PITCH ANGLE. (MECLIM)

THERFL--A COUNTER-FLAG TO INDICATE THE NUMBER OF TIMES THE ROTOR COLLECTIVE PITCH EXCEEDS THE MAXIMUM ALLOWED VALUE(THERMX). (MCLMFL)

THERMX--MAXIMUM ROTOR COLLECTIVE PITCH ANGLE. (MECLIM)

THETA--HULL CG REFERENCE AXIS EULER PITCH ANGLE. (ARG)

THETO--BLADE COLLECTIVE PITCH AT THE THREE-QUARTERS RADIUS STATION (ARG)

THETOP--UNIFORM PROPELLER COLLECTIVE PITCH (ARG)

THETOR--UNIFORM ROTOR COLLECTIVE PITCH (ARG)

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THEOP1 ****
THEOP2    * PROPELLER PITCH ANGLE.
THEOP3    * (PCONTL)
THEOP4 ****
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THEOP1 ****
THEOP2    * PROPELLER BLADE COLLECTIVE
THEOP3    * PITCH AT THE THREE-QUARTER
THEOP4 **** RADIUS STATION. (PSTATE)
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THEOR--ROTOR COLLECTIVE PITCH ANGLE. (ARG)

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THEOR1 **** ROTOR BLADE COLLECTIVE
THEOR2    * PITCH MEASURED AT THE
THEOR3    * THREE-QUARTER RADIUS STATION.
THEOR4 **** (RSTATE)
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THEOR1 ****
THEOR2    * ROTOR COLLECTIVE
THEOR3    * PITCH ANGLE. (RTCONTL)
THEOR4 ****
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THPLFL--PROPELLER COLLECTIVE PITCH DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

THRLFL--ROTOR COLLECTIVE PITCH DEFLECTION LIMIT FLAG INDICATING MAXIMUM MECHANICAL ALLOWED VALUE WAS EXCEEDED. (MCLMFL)

TH1GST--THE STARTING TIME FOR THE GUST ACTING AT THE HULL CENTER OF VOLUME. (HGCOM)

TH2GST--THE ENDING TIME FOR THE GUST ACTING AT THE HULL CENTER OF VOLUME. (HGCOM)

TIAC--GROUND ON TAIL INDUCED ANGLE OF ATTACK CORRECTION (TAUTS)

TIME--CURRENT SIMULATION TIME (ARG)

TIMINC--TIME INCREMENT BETWEEN PRESENT AND LAST TIME THAT SUBROUTINE SGLFLW WAS CALLED. (ARG)

TIMSTP--NUMERICAL INTEGRATION MAXIMUM TIME STEP

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TOTAFO--TAIL ONLY TOTAL AERO-DYNAMIC FORCE VECTOR WITH RESPECT TO THE TAIL CENTROID REFERENCE AXIS.

TOTAMO--TAIL ONLY TOTAL AERO-DYNAMIC MOMENT VECTOR WITH RESPECT TO THE TAIL CENTROID REFERENCE AXIS.

TOTTAM--TOTAL HULL-TAIL APPARENT MASS MATRIX, FOR MOTIONS ABOUT THE HULL CG REFERENCE AXES. (ARG)

TPLOT--THE TRIM INCREMENT FOR WRITING THE PLOTTING FILES OUT TO A BINARY FILE, FOR ACCESS AT A LATER TRIM. (PYGCOM)

TPRINT--OUTPUT PRINT INTEGRATOR (ARG)

TPSD--TIP SPEED (ARG)

TPTHRT--PITCH RATE GAIN. (FCSGNS)

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TP1 ****
TP2    * PROPELLER THRUSTS (PSTATE)
TP3    *
TP4 ****
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TQUIT--LOGICAL FLAG: TRUE EQUALS TERMINATE TRIM, FALSE EQUALS CONTINUE TRIM.

TRMAPS--NUMBER OF TRIM MAPS WANTED. (ARG)

TRATCM--TURN RATE COMMAND. (ARG)

TRMCNV--TRIM CONVERGED FLAG (T-TRIM CONVERGED). (ARG)

TRMTOL--EUCLIDEAN NORM TOLERANCE CRITERION BEFORE TERMINATION (TRMCNT)

TRNPOZ--A THREE BY THREE MATRIX CONTAINING THE TRANSPOSE OF MATRIX (ARG)

TROLRT--ROLL RATE GAIN. (FCSGNS)

TRTCMD--TURN RATE COMMAND TABLE. (COMAND)

TRTINT--TURN RATE CIRCUIT INTEGRATOR VALUE. (SASINT)

TRTLPF--FLIGHT CONTROL SYSTEM FLAG INDICATING TURN RATE LOOP IS CLOSED. (CLOSLP)

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TR1 ****
TR2    * ROTOR THRUSTS. (RSTATE)
TR3    *
TR4 ****
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TSIM--TOTAL SIX DEGREE OF FREEDOM SIMULATION TIME. (ARG)

TSLMOM--TAIL STATIC ROLLING MOMENT COMPONET ABOUT THE TAIL CENTROID REFERENCE AXIS. (ARG)

TSPAN--TAIL ENSEMBLE SPAN. (TAIL)

TTCOM1--STARTING TIME FOR TAIL SURFACE DEFLECTION COMMANDS (TDEFLC)

TTCOM2--ENDING TIME FOR TAIL SURFACE DEFLECTION COMMANDS (TDEFLC)

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TTHEP1 ****
TTHEP2    * UNIFORM PROPELLER COLLECTIVE
TTHEP3    * PITCH TRIM SETTING (PTRIM)
TTHEP4 ****
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TTHER1 ****
TTHER2    * UNIFORM ROTOR COLLECTIVE
TTHER3    * PITCH TRIM SETTING (RTRIM)
TTHER4 ****
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TT1GST--THE STARTING TIME FOR THE GUST ACTING AT THE TAIL CENTROID (TGCOM)

TT2GST--THE ENDING TIME FOR THE GUST ACTING AT THE TAIL CENTROID. (TGCOM)

TURNRT--TURN RATE (EULER RATE OR BODY AXIS YAW RATE). (ARG)

TVC--A THIRTY BY TWENTY-FOUR CONSTRAINT CONDITIONER MATRIX

TWINVD--TOTAL DISC INDUCED VELOCITY (DISC INDUCED PLUS GROUND INDUCED). (ARG)

TXFOR--TAIL AXIAL FORCE COMPONENT. (ARG)

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TYPE1 **** A TYPE, EITHER REAL
TYPE2    * INTEGER OR LOGICAL
TYPE3 **** (ARG)
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T1COM--COMMAND TIME FROM COMMAND TABLE JUST PRECEEDING CURRENT TIME. (ARG)

T2COM--COMMAND TIME FROM COMMAND TABLE JUST AFTER CURRENT TIME. (ARG)

U--TRIM CONTROL VECTOR. AT THE START OF TRIM CONTAINS THE INITIAL GUESS, AT THE COMPLETION OF TRIM CONTAINS THE CONVERGED SOLUTION. (ARG)

UCMD--FORWARD VELOCITY COMMAND TABLE. (COMAND)

UCOM--FORWARD VELOCITY COMMAND. (ARG)

UCW--RELATIVE AIR MASS VELOCITY (ARG)

UDCNTL--VEHICLE COUPLED AXIAL CONTROL. (ARG)

UFDBK--FEEDBACK FLAG: TRUE EQUALS HULL BODY AXIS X-VELOCITY FEEDBACK, FALSE EQUALS HULL X-VELOCITY SENSOR FEEEDBACK. (FDBKFL)

UHGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE HULL CENTER OF VOLUME IN THE X DIRECTION. (HGCOM)

UILM--X-SPEED CIRCUIT INTEGRATION LIMIT. (FCSLIM)

UINT--X-SPEED CIRCUIT INTEGRATOR VALUE. (SASINT)

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ULLM--X-SPEED CIRCUIT LOOP LIMIT. (FSCLIM)

ULPFLG--FLIGHT CONTROL SYSTEM FLAG INDICATING U LOOP IS CLOSED. (CLOSLP)

UL1GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-1 IN THE X-LPU BODY AXES DIRECTION. (LPGCOM)

UL2GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-2 IN THE X-LPU BODY AXES DIRECTION. (LPGCOM)

UL3GMX--MAXIMUM GUST VELOCITY ACTING ON THE LPU-3 IN THE X-LPU BODY AXES DIRECTION. (LPGCOM)

UL4GMX--MAXIMUM GUST VELOCITY ACTING ON THE LPU-4 IN X-LPU BODY AXES DIRECTION. (LPGCOM)

UMAT--CONTROL PERTUBATION MATRIX. THE FIRST COLUMN CONTAINS THE INITIAL OR HOME CONTROL VECTOR, THE REMAINING SIX COLUMNS CONTAIN PERTUBATION CONTROL VECTORS IN WHICH EACH COLUMN IS PERTUB WITH RESPECT TO ONLY ONE OF ITS ELEMENTS. (ARG)

UNITOP--T/F, UNITS SHOULD BE ENGLISH OR METRIC. (OUTHD)

UNEW--NEW TRIM VECTOR (ARG)

UNITS--ARRAY OF UNITS USED IN RUN (UNILST)

UPYGMX--MAXIMUM PAYLOAD AXIAL GUST VELOCITY (1-MINUS-COSINE SHAPE). (PYGCOM)

USLTH--CABLE UNSTRETCH LENGTH (ALWAYS A POISITVE SCALAR). (ARG)

USLTH1 ****
USLTH2 * CABLE UNSTRETCHED
USLTH3 * LENGTHS. (USCLTH)
USLTH4 ****

UTGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE TAIL CENTROID IN THE X DIRECTION. (TGCOM)

UUABST--TAIL STALL VELOCITY PARAMETER U*ABS(U). (ARG)

UZAVST--UNCORRECTED (OUT OF GROUND EFFECT) TAIL Z-FORCE DERIVATIVE WITH RESPECT TO: VXZT**2(EQUALS ZAVSQT ON INPUT). (UCTLCS)

VAL1 **** VALUES OF A VARIABLE
VAL2 * TO BE PRINTED OUT FROM
VAL3 **** SUBROUTINE MSSAG. (ARG)

VAR1--VARIABLE VALUE IN QUESTION (ARG)

VAR1NM **** A CHARACTER STRING WITH
VAR2NM * THE NAME OF A VARIABLE.
VAR3NM **** (ARG)

VCMD--SIDE VELOCITY (Y-AXIS) COMMAND TABLE. (COMAND)

VCOM--SIDE VELOCITY (Y-AXIS) COMMAND. (ARG)

VCTR--VECTOR OF TRIM STATES (DYNAMIC VARIABLES, CONTROL VARIABLES, OR GUST VARIABLES) FOR THE STABILITY DERIVATIVE AND AUXILIARY STABILITY DERIVATIVE MATRICES BEING EVALUATED. (ARG)

VCTRFL--PAYLOAD STABILITY DERIVATIVE CALCULATION FLAG. VCTRFL=1: CALCULATE PAYLOAD A MATRIX; VCTRFL=3: CALCUALTE PAYLOAD C MATRIX (GUST MATRIX). (ARG)

VDCNTL--VEHICLE COUPLED LATERAL CONTROL. (ARG)

VDHGST--HULL CENTER OF VOLUME GUST ACCELERATION MEASURED IN THE ROTATING FRAME OF THE HULL CG REFERENCE AXIS (GUSTS)

VDREL--RELATIVE ACCELERATION VECTOR AT THE CONSTRAINT POINTS (ANGULAR DEGREES OF FREEDOM ONLY)

VDRHGT--HULL CENTER OF VOLUME INERTIAL GUST ACCELERATION GIVEN IN COORDINATES OF THE HULL CG REFERENCE AXIS (GUSTS)

VDRTGT--TAIL CENTROID INERTIAL GUST ACCELERATION IN COORDINATES OF THE HULL CG REFERENCE AXIS (GUSTS)

VDTGST--TAIL CENTROID WIND ACCELERATION MEASURED IN THE ROTATING HULL CG REFERENCE AXIS. (ARG)

VDTHUL--HULL LINEAR ACCELERATION WITH RESPECT TO THE HULL CG REFERENCE AXIS. (SDOTCP)

VECTOR--A THREE BY ONE VECTOR. (ARG)

VECTOR--A SIX ELEMENT VECTOR CONTAINING THE DESIRED COLUMN FROM THE MATRIX, MATRIX. (ARG)

VECTOR--A THREE ELEMENT VECTOR CONTAINING THE DESIRED COLUMN FROM MATRIX, MATRIX (ARG)

VECTRA--A THREE BY ONE VECTOR. (ARG)

VECTRB--A THREE BY ONE VECTOR. (ARG)

VELA--VELOCITY OF SOURCE-A FOR SPATIAL GUST INTERPOLATION. (ARG)

VELB--VELOCITY OF SOURCE-B FOR SPATIAL GUST INTERPOLATION. (ARG)

VELC--VELOCITY OF SOURCE-C FOR SPATIAL GUST INTERPOLATION. (ARG)

VELCTY--REPRESENTATIVE TAIL VELOCITY FOR AERODYNAMIC COMPONENT CALCULATION IN THE PRE-STALL AND STALL TRANSITION REGIEME. (ARG)

VFDBK--FEEDBACK FALG; TRUE EQUALS HULL CG BODY AXIS Y-VELOCITY FEEDBACK, FALSE EQUALS HULL Y-VELOCITY SENSOR FEEDBACK. (FDBKFL)

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VGUST1 **** TIME DEPENDENT GUST VELOCITIES
VGUST2 * AT EACH LPU CENTER OF GRAVITY
VGUST3 * IN COORDINATES OF THE LPU CG
VGUST4 **** REFERENCE AXES. (GUSTS)

VHGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE HULL CENTER OF VOLUME IN THE Y DIRECTION. (HGCOM)

VHGUST--HULL CENTER OF VOLUME TIME TIME DEPENDENT GUST VELOCITY VECTOR IN COORDINATES OF THE HULL CG REFERENCE AXES. (GUSTS)

VHSENS--RELATIVE AIR MASS VELOCITY AT THE VELOCITY SENSOR LOCATION. (ARG)

VHUL--VELOCITY OF THE HULL CG REFERENCE AXIS IN COORDINATES OF THE HULL CG REFERENCE AXIS. (SVECTR)

VHWIND--INERTIAL (STEADY) WIND VELOCITY VECTOR IN HULL CG REFERENCE COORDINATES

VILM--Y-SPEED INTEGRATION LIMIT. (FCSLIM)

VINT--Y-SPEED INTEGRATOR VALUE. (SASINT)

VLLM--Y-SPEED LOOP LIMIT. (FCSLIM)

VLPFLG--FLIGHT CONTROL SYSTEM FLAG INDICATING V LOOP IS CLOSED. (CLOSLP)

VLPU1 **** FOUR VECTORS CONTAINING THE
VLPU2 * LINEAR VELOCITIES OF EACH
VLPU3 * LPU IN THE LPU CG REFERENCE
VLPU4 **** AXES (AUXVTR)

VLVLAB--REPRESENTATIVE VELOCITY PARAMETER (VELCTY*ABS(VELCTY)) FOR POST STALL REGIME AERODYNAMIC CALCULATIONS. (ARG)

VL1GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-1 IN THE Y-LPU BODY AXES DIRECTION. (LPGCOM)

VL2GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-2 IN THE Y-LPU BODY AXES DIRECTION. (LPGCOM)

VL3GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-3 IN THE Y-LPU BODY AXES DIRECTION. (LPGCOM)

VL4GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-4 IN THE Y-LPU BODY AXES DIRECTION. (LPGCOM)

VPAYLD--PAYLOAD CG REFERENCE AXIS VELOCITY VECTOR WITH RESPECT TO INERTIAL SPACE IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (PSVCTR)

VPAYRL--RELATIVE VELOCITY OF THE PAYLOAD CENTER OF GRAVITY AS SEEN FROM THE HULL CENTER OF GRAVITY IN COORDINATES OF THE HULL CG REFERENCE AXIS. (PAXVTR)

VPGUST--PAYLOAD REFERENCE CENTER TIME DEPENDENT GUST VELOCITY VECTOR IN COORDINATES OF THE PAYLOAD CG REFERENCE AXIS. (PAYGST)

VPT--TAIL ROLLING VELOCITY. (ARG)

VPYGMX--MAXIMUM VALUE OF PAYLOAD SIDE GUST (1-MINUS-COSINE SHAPE). (PYGCOM)

VRINGF--VORTEX RING LOGICAL FLAG: TRUE EQUALS DISC IS IN THE VORTEX RING STATE. (ARG)

VRINP1 **** FLAG INDICATING THE PROPELLER
VRINP2 * HAS ENCOUNTERED THE VORTEX
VRINP3 * RING STATE. (VRINGP)
VRINP4 ****

VRINR1 **** FLAG INDICATING THE
VRINR2 * ROTOR HAS ENCOUNTERED
VRINR3 * THE VORTEX RING STATE.
VRINR4 **** (VRINGR)

VRLLIM--VORTEX RING STATE REGION LOWER LIMIT

VRULIM--VORTEX RING STATE REGION AT THE LIMIT

VSENLC--VELOCITY CENTER LOCATION ON THE HULL WITH RESPECT TO THE HULL CG REFERENCE AXIS. (SENSOR)

VSORC1 **** FOUR VECTORS CONTAINING
VSORC2 * THE GUST INPUT VELOCITIES
VSORC3 * AT EACH INPUT SOURCE IN
VSORC4 **** COORDINATES OF THE HULL CG REFERENCE AXIS (NUMBERING SYSTEM IS THE SAME AS THE LPU'S: SOURCE ONE IS POSITIVE X AND NEGATIVE Y, ETC.). (ARG)

VTGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE TAIL CENTROID IN THE Y DIRECTION. (TGCOM)

VTGUST--TAIL CENTROID TIME DEPENDENT GUST VELOCITY IN COORDINATES OF THE HULL CG REFERENCE AXES. (GUSTS)

VTHRST--DISC THRUST VELOCITY. (ARG)

VTOTT--TOTAL TAIL VELOCITY MAGNITUDE. (ARG)

VVABST--TAIL STALL VELOCITY PARAMETER V*ABS(V). (ARG)

VWIND--VECTOR OF STEADY WIND COMPONENTS IN INERTIAL FRAME COORDINATES (ATMOS)

VXYT--TAIL SIDE SLIP VELOCITY PARAMETER. (ARG)

VXZ--DISC HUB VELOCITY. (ARG)

VXZBAR--NON-DIMENSIONAL DISC HUB VELOCITY. (ARG)

VXZT--TAIL ANGLE ATTACK VELOCITY PARAMETER. (ARG)

VYZVAT--TAIL STALL VELOCITY PARAMETER (ARG)

VYZWAT--TAIL STALL VELOCITY PARAMETER (ARG)

WAKEA1--WAKE ANGLE FOR START OF SHADOW REGION. (ARG)

WAKEA2--WAKE ANGLE FOR END OF SHADOW REGION. (ARG)

WCW--DESCENT SPEED(ROTOR OR PROPELLER. (ARG)

WCWBAR--NON-DIMENSIONAL DISK DESCENT VELOCITY. (ARG)

WDCNTL--VEHICLE COUPLED VERTICAL CONTROL(POSITIVE Z-DIRECTION DOWNWARD) (ARG)

WHGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE HULL CENTER OF VOLUME IN THE Z DIRECTION. (HGCOM)

WIN--INDUCED VELOCITY. THE INFLOW VELOCITY IS CONSIDERED POSITIVE WHEN THE ASSOCIATED THRUST VECTOR ACTS ALONG THE NEGATIVE Z CONTROL WIND AXES DIRECTION (UPWARD); THEREFORE, THE INDUCED VELOCITY WILL ACT ALONG THE POSITIVE Z CONTROL WIND AXIS DIRECTION. IN THE CALCULATION OF TOTAL INFLOW RATIO (LAMDA), A POSITIVE VALUE OF INDUCED FLOW (WIN), IS CONSIDERED TO BE A NEGATIVE LPU RELATIVE VELOCITY. (ARG)

WINBAR--NON-DIMENSIONAL DIS INFLOW RATIO. (ARG)

WINP1 ****
WINP2 * PROPELLER INDUCED FLOW VELO-
WINP3 * CITY (PSTATE)
WINP4 ****

WINR1 ****
WINR2 * ROTOR INDUCED FLOW VELOCITY.
WINR3 * (RSTATE)
WINR4 ****

WL1GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-1 IN THE Z-LPU BODY AXES DIRECTION. (LPGCOM)

WL2GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-2 IN THE Z-LPU BODY AXES DIRECTION. (LPGCOM)

WL3GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-3 IN THE Z-LPU BODY AXES DIRECTION. (LPGCOM)

WL4GMX--MAXIMUM GUST VELOCITY ACTING ON LPU-4 IN THE Z-LPU BODY AXES DIRECTION. (LPGCOM)

WPYGMX--MAXIMUM PAYLOAD DOWNWARD GUST (1-MINUS-COSINE SHAPE). (PYGCOM)

WTGMAX--THE MAXIMUM GUST VELOCITY ACTING AT THE TAIL CENTROID IN THE Z DIRECTION. (TGCOM)

WWABST--TAIL STALL VELOCITY PARAMETER W*ABS(W). (ARG)

X--RESULTANT VEHICLE AXLE FORCE WITH RESPECT TO THE HULL CG REFERENCE X AXIS. (ARG)

XCBAR--CONTROL STATE PERTUBATION VECTOR. (ARG)

XGBAR--GUST STATE PERTUBATION VECTOR. (ARG)

XQWH--HULL X-FORCE DERIVATIVE WITH RESPECT TO: Q*W (ARG)

XRVH--HULL X-FORCE DERIVATIVE WITH RESPECT TO: R*V (ARG)

XSPEED--FORWARD SPEED (VHSENS(1) OR VHUL(1)). (ARG)

XUDOT--COMPONENT (HULL OR TAIL), AXLE FORCE WITH RESPECT TO THE COMPONENT REFERENCE AXIS: DUE TO MOTIONS OF THE COMPONENT REFERENCE AXIS. (ARG)

XUDOTH--HULL X-FORCE DERIVATIVE WITH RESPECT TO LONGITUDINAL ACCELERATION (HDTDRV)

XUUABH--HULL X-FORCE DERIVATIVE WITH RESPECT TO: U*ABS(U) (ARG)

XUUABP--PAYLOAD X-FORCE DERIVATIVE WITH RESPECT TO U*ABS(U).

XUUABT--TAIL X-FORCE DERIVATIVE WITH RESPECT TO: U*ABS(U) (TDRVS)

XUUAF1 **** LPU FUSELAGE X-FORCE
XUUAF2 * DERIVATIVE WITH RESPECT TO
XUUAF3 * U * ABS(U). (ARG)
XUUAF4 ****

Y--RESULTANT VEHICLE Y-FORCE WITH RESPECT TO THE HULL CG AXES. Y-DISC FORCE ALONG THE POSITIVE Y-CONTROL WIND AXES. (ARG)

YAPSVS--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO: ALPHA-P*ABS(ALPHA-P) * (VPT**2). (TDRVS)

YAPVST--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO: (ALPHA-P * (VPT**2.)) (TDRVS)

YBSVST--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO: (BETA*2. (VXYT**2.)) (TDRVS)

YBVSQT--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO: (BETA*(VXYT**2.)) (TDRVS)

YPPABT--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO: P*ABS(P) (TDRVS)

YPWH--HULL Y-FORCE DERIVATIVE WITH RESPECT TO: P*W (ARG)

YRDOTT--TAIL Y-FORCE DERIVATIVE WITH RESPECT TO ROLLING ACCELERATION (TDTDRV)

YRRABH--HULL Y-FORCE DERIVATIVE WITH RESPECT TO: R*ABS(R) (ARG)

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YRUH--HULL Y-FORCE DERIVATIVE WITH
RESPECT TO: R*U (ARG)

YRVABH--HULL Y-FORCE DERIVATIVE WITH
RESPECT TO: R*ABS(V). (ARG)

YRVH--HULL Y-FORCE DERIVATIVE WITH
RESPECT TO: R*V (ARG)

YSPEED--LATERAL SPEED (VHSENS(2) OR
VHUL(2)). (ARG)

YVDOT--COMPONENT (HULL OR TAIL),
Y-FORCE, WITH RESPECT TO THE
COMPONENT REFERENCE AXIS: DUE TO
LATERAL ACCELERATION OF THE COMPONENT
REFERENCE AXIS. (ARG)

YVDOTH--HULL Y-FORCE DERIVATIVE WITH
RESPECT TO LATERAL ACCELERATION (HDTDRV)

YVDOTT--TAIL Y-FORCE DERIVATIVE WITH
RESPECT TO LATERAL ACCELERATION (TDTDRV)

YVVAF1 **** LPU FUSELAGE Y-FORCE
YVVAF2 * DERIVATIVE WITH RESPECT TO
YVVAF3 * V * ABS(V). (ARG)
YVVAF4 ****

YVVABH--HULL Y-FORCE DERIVATIVE WITH
RESPECT TO: V*ABS(V) (ARG)

YVVABP--PAYLOAD Y-FORCE DERIVATIVE
WITH RESPECT TO V*ABS(V).

YVVABT--TAIL Y-FORCE DERIVATIVE WITH
RESPECT TO: V*ABS(V) (TDRVS)

Z--RESULTANT VEHICLE Z-FORCE
WITH RESPECT TO THE HULL CG Z AXES (ARG)

ZASVST--TAIL Z-FORCE DERIVATIVE
WITH RESPECT TO: (ALPHA**2 (VXZT**2))
(TDRVS)

ZAVSQT--TAIL Z-FORCE DERIVATIVE
WITH RESPECT TO: (ALPHA * (VXZT**2))
(TDRVS)

ZCDDTA--OUTPUT VARIABLES FOR THE CABLES

ZETAH-- GAMMAH - LAMBDA

ZHLDTA--ARRAY OF HULL VARIABLES AVAILABLE
FOR OUTPUT. (ARG)

ZLPDTA--ARRAY OF LPU VARIABLES
WANTED IN OUTPUT. (ARG)

ZPVH--HULL Z-FORCE DERIVATIVE WITH
RESPECT TO: P*V (ARG)

ZPYDTA--OUTPUT VARIABLES FOR THE PAYLOAD

ZQQABH--HULL Z-FORCE DERIVATIVE
WITH RESPECT TO: Q*ABS(Q) (ARG)

ZQUH--HULL Z-FORCE DERIVATIVE WITH
RESPECT TO: Q*U (ARG)

ZQWABH--HULL Z-FORCE DERIVATIVE WITH
RESPECT TO: Q*ABS(W). (ARG)

ZQWH--HULL Z-FORCE DERIVATIVE WITH
RESPECT TO: Q*W (ARG)

ZWDOT--COMPONENT (HULL OR TAIL),
Z-FORCE, WITH RESPECT TO THE
COMPONENT REFERENCE AXIS: DUE TO
VERTICAL ACCELERATION (IN THE Z
DIRECTION) OF THE COMPONENT AXIS.
(ARG)

ZWDOTH--HULL Z-FORCE DERIVATIVE
WITH RESPECT TO NORMAL ACCELERATION
(HDTDRV)

ZWDOTT--TAIL Z-FORCE DERIVATIVE
WITH RESPECT TO NORMAL ACCELERATION
(TDTDRV)

ZWWABH--HULL Z-FORCE DERIVATIVE
WITH RESPECT TO: W*ABS(W) (ARG)

ZWWABP--PAYLOAD Z-FORCE DERIVATIVE
WITH RESPECT TO W*ABS(W).

ZWWABT--TAIL Z-FORCE DERIVATIVE
WITH RESPECT TO: W*ABS(W) (TDRVS)

ZWWAF1 **** LPU FUSELAGE Z-FORCE
ZWWAF2 * DERIVATIVE WITH RESPECT TO
ZWWAF3 * W * ABS(W). (ARG)
ZWWAF4 ****