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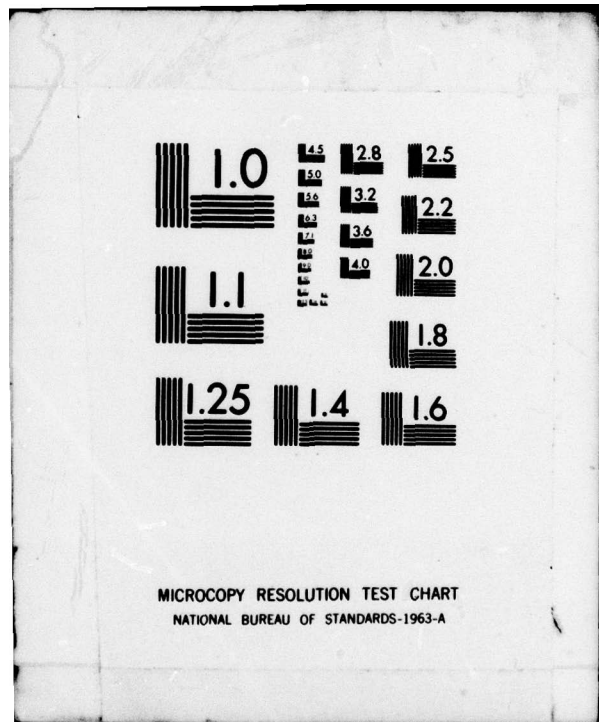
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A COMPUTERIZED VSTOL/SMALL PLATFORM LANDING  
DYNAMICS INVESTIGATION MODEL

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Ronald L. Nave

Air Vehicle Technology Department  
NAVAL AIR DEVELOPMENT CENTER  
Warminster, Pennsylvania 18974

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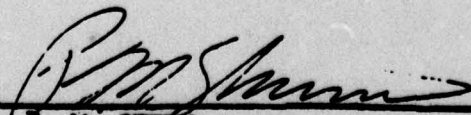
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>A digital computer program has been developed to investigate the dynamic interaction between VSTOL aircraft and ships. The model includes the ship, aircraft, pilot, and air turbulence. At present the aircraft model is configured to represent the AV8A Harrier, but other aircraft may be simulated by simple program changes.</p>		

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S U M M A R Y

A batch process digital computer program has been developed which can simulate the take-off and landing of VSTOL aircraft aboard ship. The program consists of a group of basic subroutines applicable to any aircraft and a set of specific aircraft model subroutines which have been configured to represent the AV8A Harrier. The aircraft model includes nonlinear aerodynamics, engine and reaction control response, stability augmentation and actuator dynamics, and a simplified landing gear model.

Ship dynamics are modeled as six degree of freedom sinusoidal motion. The ship is assumed to have a fixed mean position about which it oscillates. Wind over the deck is composed of a steady induced wind equal to the ship speed plus a separate North and East component of natural wind which can be independently specified. At present no turbulence model specifically designed for VSTOL aircraft exists, but a model developed for conventional carriers is incorporated. This subroutine calculates free air turbulence as well as ship wake turbulence which may be varied in amplitude. The wake intensity is calculated as a function of range, altitude, and lateral position relative to the flight deck.

A pilot model subroutine provides both open loop and closed loop control inputs. Thus far, the pilot model has been used only to investigate aircraft response, and, hence, it has not been constructed to accurately represent true pilot dynamics. The pilot model can now execute a short take-off and climb to specified altitude, and a side step from hover to a vertical landing using closed loop control as well as step, doublet, pulse, and sinusoidal inputs to each control.

Three data output options are provided. These consist of a printout of specified variables versus time, a statistical summary, and a Calcomp plot of a maximum of 14 variables versus time.

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## I N T R O D U C T I O N

The anticipated deployment of VSTOL aircraft aboard small escort vessels necessitates the development of methods for analytically predicting the performance and handling characteristics of these aircraft in this relatively undefined environment. A thorough analysis of landing and take-off dynamics should include all of the components involved both as individual elements and as a total interactive system.

As a minimum, the following elements should be considered:

- Aircraft aerodynamics
- Engine and reaction control dynamics
- Stability augmentation and control system
- Landing gear, catapult, and arresting gear, if used
- Ship motion
- Atmospheric turbulence
- Ship induced turbulence
- Aircraft/Engine airflow interaction with the ship
- Pilot dynamics
- Pilot visual displays and landing aids
- Landing signal officer influence on pilot performance.

The method of approaching this problem was to develop a digital simulation program which incorporated as many of the system elements as possible in separate subroutines which could be changed easily. In addition, most system parameters have been placed in common arrays so that these values may be changed without recompiling the subroutines.

The program is divided into a group of basic routines which are independent of aircraft configuration. These basic routines handle trim initialization, coordinate transformations, the integration of differential equations, and the interpolation of tabulated nonlinear functions. Control inputs, forces and moments, and disturbance inputs are determined by user supplied routines which must be varied to represent specific aircraft types and atmospheric conditions.

Each of the VSTOL system elements is complicated and important enough to justify a large effort to investigate its impact. However, due to the limits of time, a decision was made to develop a simple description of all of the elements rather than concentrating the effort on one or two areas. This made it possible to develop an overall frame work to which more sophisticated and accurate model formulations may be added as they become available. The basic subroutines were adapted from a simulation program used at the NASA Ames Research Center to perform moving base real time simulations. The user routines were configured to represent the AV8A Harrier using the best data currently available.

At the present time, the model addresses the first nine of the eleven model components described above. No model description of the LSO or the pilot landing aids is presently incorporated because it would be very difficult to develop meaningful models of these two components. A piloted aircraft simulation with a high resolution wide field visual display is probably the only way other than flight testing to thoroughly evaluate

the LSO task and the effectiveness of various pilot displays and landing aids. A dual simulation including both the pilot and the LSO would probably be the ideal approach.

The aircraft model includes an aerodynamics subroutine which determines the three force and three moment coefficients by interpolating tabulated values of aerodynamic functions. A separate subroutine is used to represent the Pegasus 11 engine operating at low altitude and Mach number. Engine RPM, nozzle angle, and reaction control thrust dynamics are included in the equations.

A simplified model of the landing gear including vertical force, braking force, and pitching moment is also incorporated.

#### GENERAL PROGRAM DESCRIPTION

The VSTOL simulation program currently consists of a main program, 31 subroutines, and a data input deck. These subroutines are functionally divided into four groups as follows:

##### Trim Routines

- Setup
- Bsetup
- Bquiet
- Minv

##### Basic Equation Calculations

- Loop2
- Loop3
- Bveloc
- Btrans
- Brotate
- Balfbet
- Batmos
- Lookup
- TAB1
- ARDC62
- RAND

##### User Supplied Model Structure

- Pilot
- Engine
- Aero2
- Contr2
- Gears
- WINDC
- Ship
- Deck

##### Data Input/Output

- DatSav
- DPlot
- Timehis

Show  
 Printo  
 Tabrd  
 BICPRI  
 Block Data

System routines are used to generate a CALCOMP plotting tape, and to invert the state matrix during the trim sequence.

SUBROUTINE DESCRIPTION

MAIN PROGRAM

The main program controls input and output of data and the calling sequence of the basic and user subroutines. A series of runs may be made to investigate various configurations with changes between each run. Also, multiple runs with a fixed configuration may be made to evaluate the statistical response to turbulence or other external disturbances.

The main program loads all function tables by calling subroutine TABRD. This subroutine loads all nonlinear function tables required by the simulation from data cards contained in the load deck each time the program is run. These tables include aerodynamics, thrust functions, control gearing, landing gear forces, and turbulence functions.

After all parameters are specified for a given run, a trim calculation is performed which adjusts specified control parameters until all forces and moments are balanced. This is achieved by cycling through subroutine setup. When the trim criteria is satisfied, the switch parameter ITPROG is set to 0. This causes the trim process to terminate and calls subroutine BICPRI which prints the initial values of all aircraft states and control positions. The program currently performs all calculations in English units and converts them to metric units for the trim printout. Inputs are specified in English units.

The dynamic portion of the program next calculates the aircraft time response to specified control inputs by cycling through the two major subroutines LOOP2 and LOOP3. The run is terminated when the running variable time exceeds the specified maximum routine variable RTIME. If a landing approach is simulated, the run will be terminated when the landing gears touch the deck or runway provided parameter JLAND is set to 1 before the run and ISTAT = 1.

Data output is provided by selecting values for parameters ITHIS, IUPLOT, and ISTAT. ITHIS = 1 provides a time history printout. IUPLOT = 1 causes a CALCOMP plot tape to be loaded, and ISTAT = 1 provides a statistical summary of each run as well as consecutive run landing statistics.

Print variables may be changed from run to run by specifying IREAD1 = 1. Plot variables are changed by setting IREAD2 = 1. These flags

cause new values of arrays IPRINT(I) and IPLOT(I) to be read. Each number in these integer arrays specifies one variable to be plotted or printed as well as selecting either English or metric units for the output.

#### PILOT

Subroutine PILOT is designed to provide control inputs representative of pilot action. A variety of control strategies are currently included which may be selected by choosing values of variables ITASK, NCHK, and MCHK. The current control laws were established with the intention of achieving a stable rapid response rather than accurately simulating true pilot capabilities and dynamics. The following control strategies are currently programmed:

- |           |   |
|-----------|---|
| ITASK = 1 | Release brake, begin takeoff roll, retard throttle and brake to a stop.   |
| ITASK = 2 | Execute a rolling vertical takeoff, transition to wing borne flight, climb to a specified altitude, level off, and hold altitude. |
| ITASK = 3 | Execute a side step and vertical landing starting from a hover relative to the landing point.                                     |
| ITASK = 4 | Move the throttle sinusoidally about a hover trim condition.  |
| ITASK = 5 | Open loop control inputs as specified by variables NCHK and MCHK.   |
| MCHK = 1  | Throttle input  |
| MCHK = 2  | Longitudinal stick input  |
| MCHK = 3  | Lateral stick input   |
| MCHK = 4  | Nozzle angle input  |
| MCHK = 5  | Rudder input  |
| NCHK = 0  | No input  |
| NCHK = 1  | Step input  |
| NCHK = 2  | Pulse input   |
| NCHK = 3  | Doublet input   |
| NCHK = 4  | Sinusoidal input  |

Subroutine PILOT provides lateral and longitudinal stick inputs, rudder pedal, throttle, nozzle commands, plus discrete brake application and water injection commands. In addition to the described options, the longitudinal stick may be matched to flight measured values of elevator position. If parameter I2DOF = 1, the stick position is calculated by first subtracting the calculated value of elevator due to pitch SAS from the tabulated value of total elevator versus time. The stick position is then determined by interpolating tabulated values of stick versus elevator position.

**BLOCK DATA**

Block data is used to initialize parameters located in common arrays.

**CONTR2**

CONTR2 calculates aileron, elevator, and rudder position commands based on pilot inputs. It also simulates the operation of the stability augmentation system (SAS) and the elevator and aileron power actuators. The pitch SAS is driven by a pitch rate signal modified by a gain and a lead-lag network. This command drives the stabilizer and the rear pitch jet. The SAS operation is nonlinear at low speeds because the front pitch jet is not connected to the stabilization system, and the SAS cannot generate nose up moments in hover. Roll damping is improved by driving the ailerons and roll reaction jets with a filtered roll rate signal. The lateral dynamics are augmented by driving the yaw reaction jet with yaw rate and lateral acceleration. All three SAS channels include position command limits. In addition to direct control links, there is an interconnect from the aileron to the yaw reaction jet which counteracts adverse yaw characteristics. The three channels of the stability augmentation system may be individually disconnected by setting variables IQDAMP, IPDAMP, or IRDAMP to zero. These correspond to the pitch, roll, and yaw dampers, respectively. Figure 1 illustrates the SAS.

A special 2 degree of freedom mode may be selected for use in comparing flight data with simulated data. When parameter I2DOF is set to 1, the elevator follows a tabulated function of time rather than the value dynamically computed by the computer.

**GEARS**

Subroutine GEARS provides a simplified model of the landing gear longitudinal forces and the pitching moment. The model assumes that all gear forces are produced by the nose and main gears. The compression of each landing gear element is calculated as being equal to the difference between the undeflected gear height and the height of the deck directly beneath each wheel. Force is assumed to act normal to the deck with a magnitude determined as a tabulated function of compression. An additional force term is added which is proportional to the rate of compression of each strut. This term was sized to provide a reasonably well damped response, but is not based on measured data. Pitching moment is calculated by multiplying the nose and main gear normal force and friction force by their respective moment arms.

Axial force is assumed to be proportional to the normal force and acts in a direction opposite to the relative velocity or tendency toward motion between the deck and the aircraft. Based on experimental data, the rolling friction coefficient is assigned a value of .03 for free rolling and .6 with brakes applied. All forces are generated in deck axes and are then transformed into body axes. Body axis Z force is limited to acting in an upward or negative Z direction. The gear model is illustrated in Figure 2.

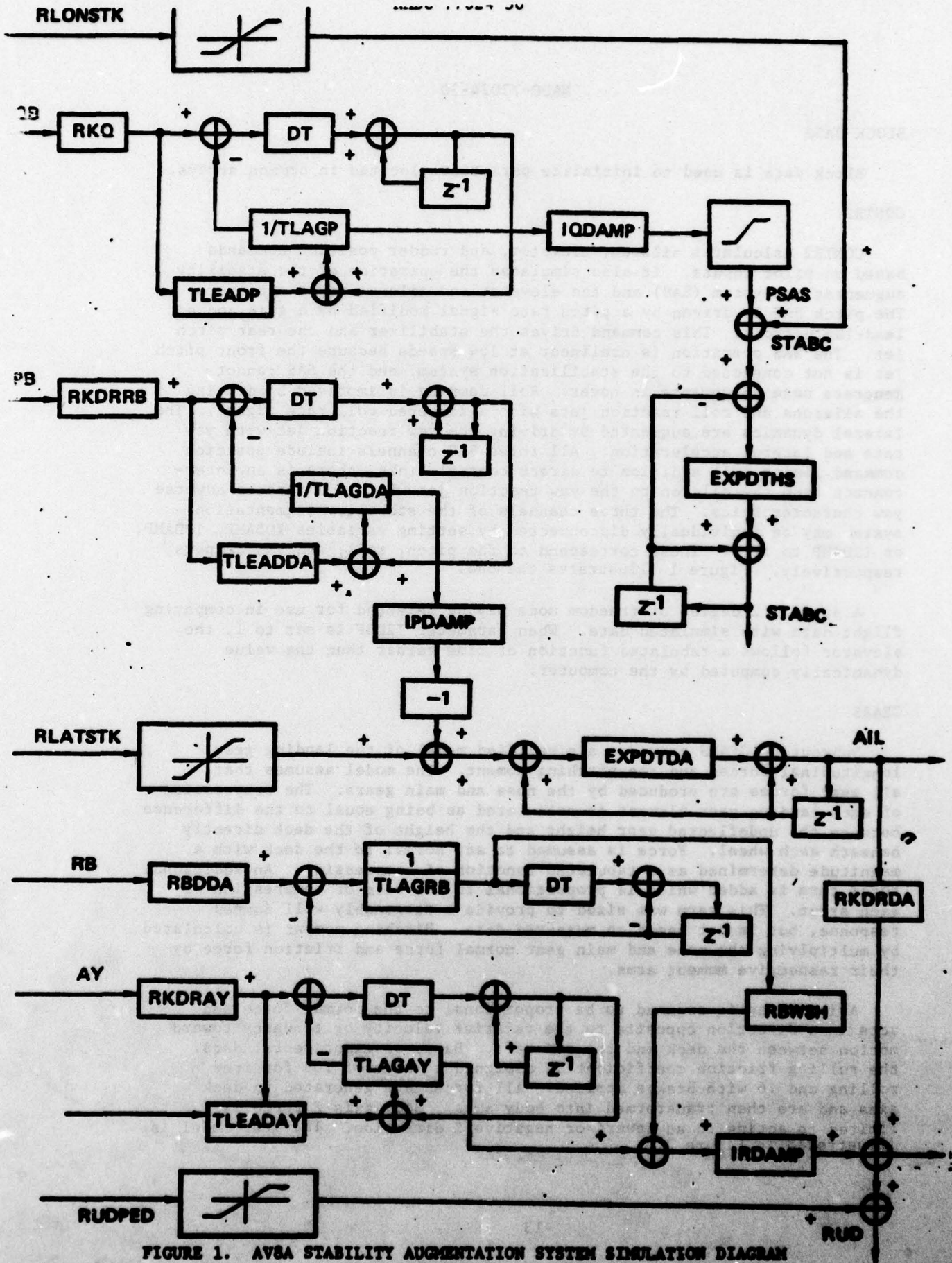


FIGURE 1. AV8A STABILITY AUGMENTATION SYSTEM SIMULATION DIAGRAM

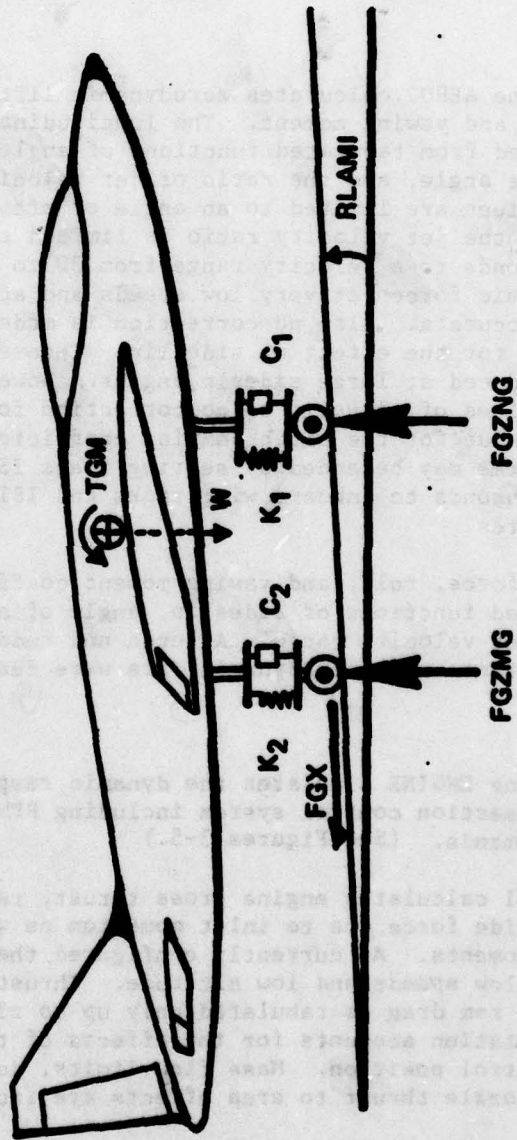


FIGURE 2. LANDING GEAR FORCE DIAGRAM

No roll or yaw moment or side force is currently included in the landing gear equations. However, a clamp is placed on the roll angle and roll rate when both the left and right wing gears are in contact with the deck. The aircraft bank angle is set equal to the deck tilt angle as measured along the aircraft Y axis. An additional clamping function is added to attitude and pitch rate when the main and nose gear are fully compressed. Finally, a flag is set when the gear deflection exceeds the maximum value. This flag may be used to terminate the program. This is indicated in the program by the statement ICRASH = 1.

## AERO2

Subroutine AERO2 calculates aerodynamic lift, drag, side force, roll, pitch, and yawing moment. The longitudinal non-dimensional coefficients are determined from tabulated functions of angle of attack, stabilizer, engine nozzle angle, and the ratio of jet velocity to airspeed. The tabulated values are limited to an angle of attack range from -5 to +20 degrees, and the jet velocity ratio is limited to a range from 5.4 to 11.9. This corresponds to a velocity range from 30 to 65 m/sec. As a result, the aerodynamic forces at very low speeds and at large angles of attack may not be accurate. Also, no correction is made to the longitudinal coefficients for the effect of sideslip. Theoretically, the wing lift should be reduced at large sideslip angles. However, no data is available for large values of sideslip so no correction for sideslip is included. A constant value for the pitch damping coefficient was assumed. Corrections for wing stores may be added by setting flags ISTORE1 and ISTORE2 = 1. ISTORE1 corresponds to inboard wing tanks and ISTORE2 corresponds to outboard stores.

Lateral force, roll, and yawing moment coefficients are calculated from tabulated functions of sideslip, angle of attack, engine nozzle angle, and jet velocity ratio. Aileron and rudder effectiveness are assumed constant. All aerodynamic data were derived from reference (a).

## ENGINE

Subroutine ENGINE simulates the dynamic response of the Pegasus 11 engine and reaction control system including RPM and nozzle angle response to pilot commands. (See Figures 3-5.)

The model calculates engine gross thrust, ram drag, pitch and yaw moment and side force due to inlet momentum as well as reaction control forces and moments. As currently configured, the model is intended for use only at low speeds and low altitude. Thrust is varied with air density, but ram drag is tabulated only up to .3 Mach. The reaction jet thrust computation accounts for the effects of temperature, air density, RPM, and control position. Mass flow limits, duct losses, and non-linear RCS nozzle thrust to area effects are included.

Front and rear main nozzle static thrust are determined from tabulated functions of RPM and reaction control mass flow. Total gross thrust is determined by adding an increment to the static thrust which depends on RPM and Mach number. Ram drag is calculated as a function of RPM and

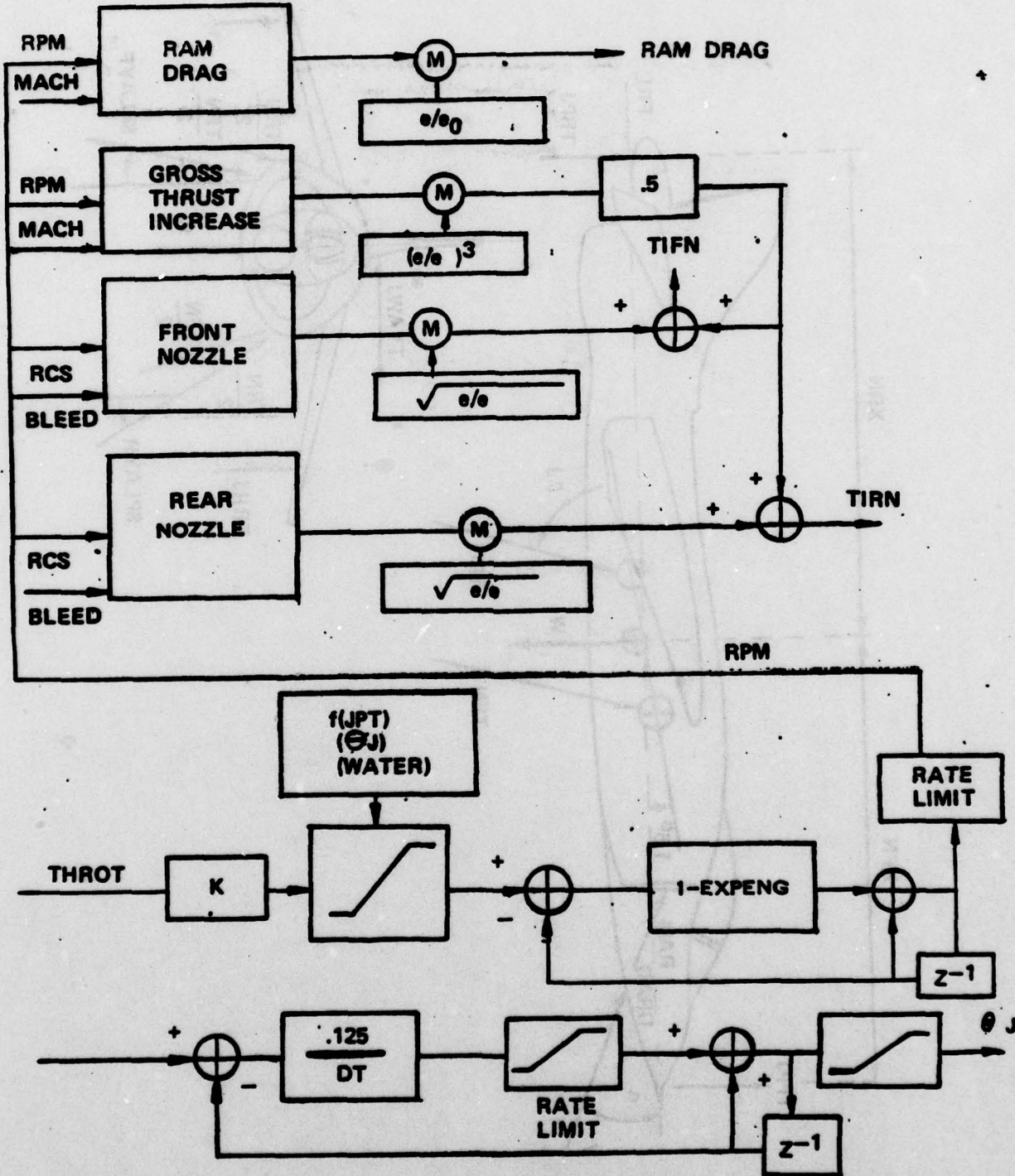


FIGURE 3. ENGINE SIMULATION DIAGRAM

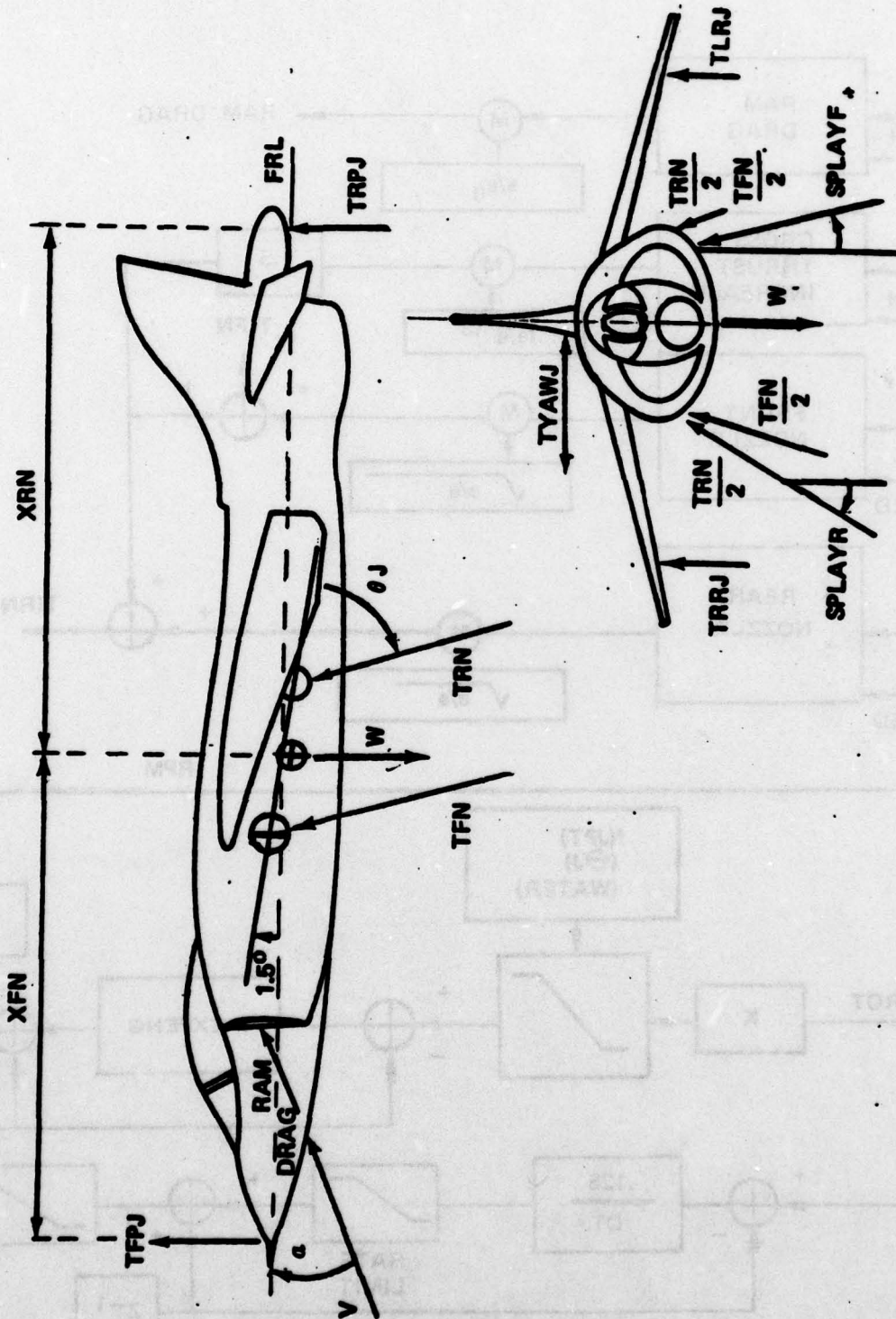


FIGURE 4. ENGINE FORCE DIAGRAM

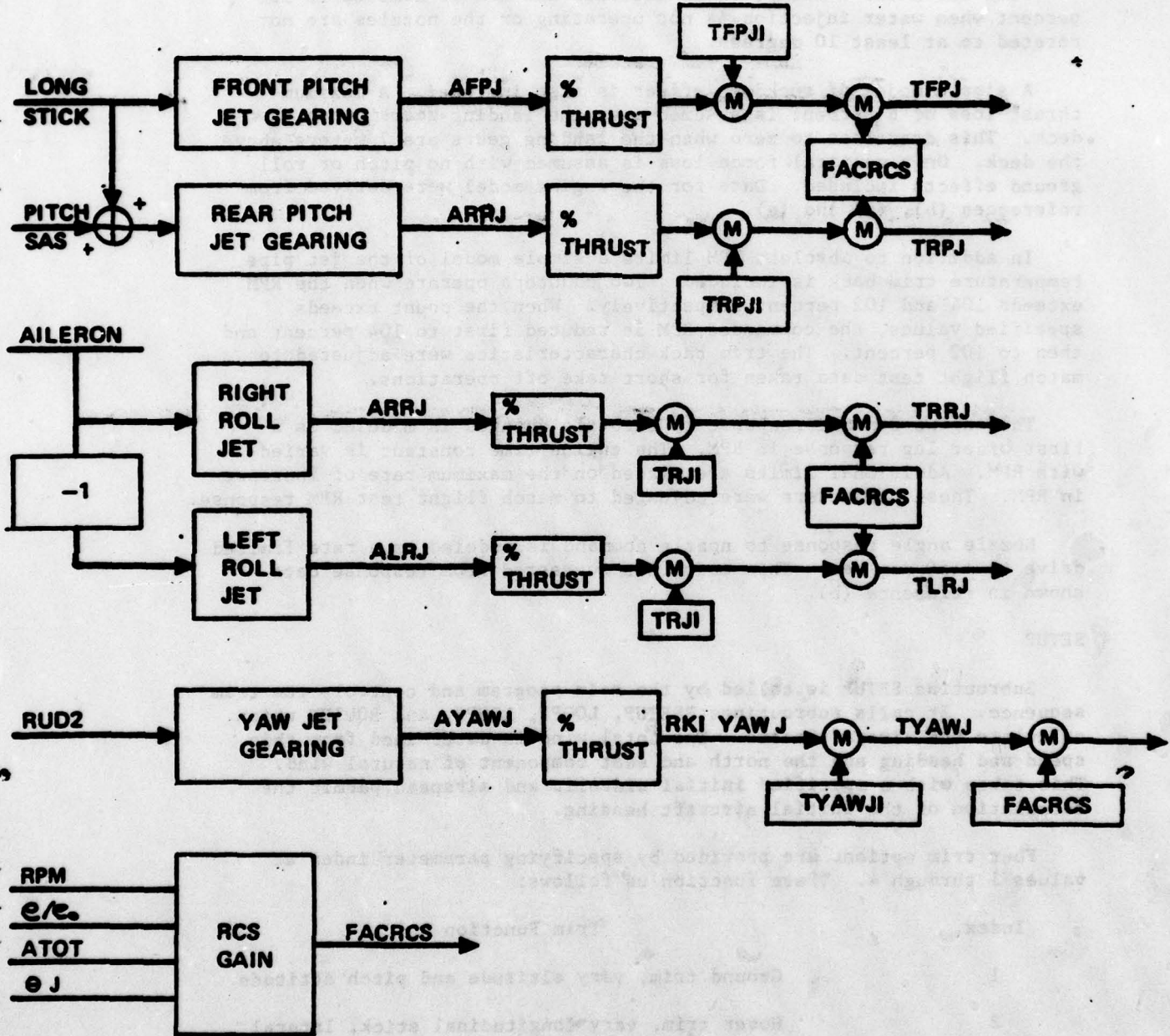


FIGURE 5. REACTION CONTROL SYSTEM SIMULATION DIAGRAM

Mach number. In all cases, engine characteristics at low RPM were extrapolated from data available at an RPM of 85 percent or higher. Lateral and longitudinal orientation of each lift and control nozzle is accounted for and the total forces and moments are summed in body axes.

Fuel and water consumption is included and RPM is limited to 102 percent when water injection is not operating or the nozzles are not rotated to at least 10 degrees.

A simple model of suckdown effect is also included. A maximum thrust loss of 6 percent is assumed when the landing gears touch the deck. This decreases to zero when the landing gears are 7 meters above the deck. Only vertical force loss is assumed with no pitch or roll ground effects included. Data for the engine model were derived from references (b), (c) and (e).

In addition to absolute RPM limits a simple model of the jet pipe temperature trim back is included. Two counters operate when the RPM exceeds 104 and 102 percent, respectively. When the count exceeds specified values, the commanded RPM is reduced first to 104 percent and then to 102 percent. The trim back characteristics were adjusted to match flight test data taken for short take off operations.

The engine dynamic response to throttle changes is modeled as a first order lag response in RPM. The engine time constant is varied with RPM. Additional limits are placed on the maximum rate of increase in RPM. These parameters were adjusted to match flight test RPM response.

Nozzle angle response to nozzle command is modeled as a rate limited drive of +150 deg/sec. This model was suggested from response data shown in reference (b).

#### SETUP

Subroutine SETUP is called by the main program and controls the trim sequence. It calls subroutines BSETUP, LOOP2, LOOP3, and BQUIET which calculate the aircraft state. The total wind is determined from ship speed and heading and the north and east component of natural wind. This, taken with a specified initial sideslip and airspeed, permit the calculation of the initial aircraft heading.

Four trim options are provided by specifying parameter index at values 1 through 4. These function as follows:

Index	Trim Function
1	Ground trim, vary altitude and pitch attitude.
2	Hover trim, vary longitudinal stick, lateral stick, throttle, pitch attitude, rudder, and bank angle.

- 3 Transition flight - vary longitudinal stick, throttle, lateral stick, nozzle angle, rudder, and bank angle.
- 4 Conventional flight - vary longitudinal stick, airspeed, lateral stick, throttle, rudder, and sideslip.

## DATSAV

Subroutine DATSAV loads an array with values of 14 variables in either English or metric units plus the value of time in seconds. The 14 variables and the units of the variable are determined by integer array IPLOT. Each value of IPLOT specifies the conversion factor, the array, and the array element to be plotted. The 3 right digits of the value of IPLOT(I) specifies the array element to be plotted. These range from 1 to 200 for the B array and 1 to 500 for the A array. The fourth digit from the right specifies the array with 1 = A and 2 = B. The left two digits specify the conversion factor required to convert from English units to plotting units which may be either English or metric. The last two digits may range from 01 to 12 as follows:

Digit Value	Conversion Factor	
01	1	nondimensional or English print
02	4.4418	LBF to Newton
03	.45359	LBM to kilogram
04	14.5919	Slugs to kilograms
05	.3048	Feet to meters
06	.092903	Feet <sup>2</sup> to meter <sup>2</sup>
07	.0283168	Feet <sup>3</sup> to meter <sup>3</sup>
08	515.3089	Slug/feet <sup>3</sup> to kilogram/meter <sup>3</sup>
09	47.8115	Pound/feet <sup>2</sup> to newton/meter <sup>2</sup>
10	1.3538	Slug-foot <sup>2</sup> to kilogram-meter <sup>2</sup>
11	6.4516 inch <sup>2</sup>	to centimeter <sup>2</sup>
12	2.54	inch to centimeters

In addition to storing the plot variables in appropriate dimensional form, DATSAV also determines the maximum and minimum value of each plot variable. These values are stored in the array PSCALE which may be used to automatically scale the plots.

## PRINTO

Subroutine PRINTO provides a statistical summary giving minimum, maximum, RMS, and average values of selected variables specified in subroutine SHOW. In addition touchdown and deck edge crossing points are recorded, and a statistical summary of the touchdown data is provided for multiple runs.

## SHOW

Subroutine SHOW, which is called by LOOP2 when ISTAT = 1, collects data on 17 parameters selected by the user. The maximum, minimum, average, and RMS value of each parameter is calculated at each program iteration.

Data gathering is divided into 3 segments depending on airspeed and nozzle angle. Airspeeds less than 30 meter/second with nozzle angles greater than 60 degrees and wheels off the ground designate a hover condition. Airspeeds greater than 30 meter/second with nozzle angles greater than 20 degrees and wheels off the ground designate a transition condition. Airspeed greater than 30 meter/second with nozzle angles less than 20 degrees designate conventional flight. In addition to the data averaging, discrete data points are stored when the aircraft crosses the deck edge and when the wheels touch the deck.

## DPLOT

Subroutine DPLOT loads a Calcomp magnetic tape which will produce plots having a format identical to that of an 8 channel brush recorder plot. This permits the direct overlay of simulation plots and flight test plots. The variable magnitude is plotted along the Y axis, and time is plotted along the X axis. Plot time scale is specified by variable CHTSP. The ordinate scale is specified by the array scale which determines the maximum and minimum value of each of the 14 plots. The overall size of the plots is proportional to the value of variable FAC. The standard value is 1.0 for matching brush records. If variable ISCALE = 1, the present scale factors are ignored and the plots are scaled on the basis of the maximum and minimum values encountered during the run. Plot abscissa titles are varied automatically when the plot variables are selected. The plot titles are loaded in block data for all variables stored in the A and B areas.

## TIMEHIS

Subroutine TIMEHIS, which is called by AV8A2, prints 11 selected variables plus the value of time at specified time intervals. The time interval is determined in the main program by variable DTIM2. The variables and the choice of English or metric units are specified by array IPRNT(11) in the same way that the plot variables are specified by IPLOT(I). Both IPLOT(14) and IPRNT(11) may be updated from run to run as specified in the main program.

## WINDC

WINDC provides a model of free air turbulence and ship air wake. The model was developed for conventional carrier landing analysis. As such, it is not specifically representative of the air wake environment around a small platform ship. However, the inputs provide a qualitative indication of gust response. It is planned to modify this subroutine as soon as wind tunnel results of ship model tests become available. Random turbulence is simulated by filtering the output of a Gaussian

random number generator in order to shape the frequency content of the simulated turbulence. Five distinct random turbulence components are generated. Three represent the orthogonal components of free air turbulence which are assumed to have constant statistical properties. Two components are used to represent the vertical and horizontal random components of the ship wake. The random burble varies in magnitude and frequency with range to the ship.

In addition to the linear filtering network, the random number sequences are multiplied by a unit magnitude sine wave. This has the effect of shifting the center frequency of the random number sequence by an amount  $+W$  where  $W$  is the frequency of the sine wave. The value of  $W$  may be selected to match simulated turbulence with measured turbulence spectra.

The linear filter used to shape the signals cuts off the high frequency components of the random number generator spectrum. Filter coefficients are calculated as functions of trim airspeed and integration step size. An increase in airspeed results in an increase in the frequency of the turbulence. Because of the formulation, the turbulence magnitude approaches zero as the airspeed is reduced. Therefore, a minimum value of 20 meters per second is specified in order to provide disturbances at low airspeed. This is a somewhat arbitrary fix, and its accuracy is unverified. The minimum value was selected as a representative wind overdeck.

The U and W components of the free air turbulence are each processed through a first order filter. The V gust component is filtered through a second order filter. These filters are intended to duplicate the gust spectrum specified in MIL SPEC AR-40. Although the free air turbulence is calculated in body axis components, it is assumed to be independent of aircraft position and orientation.

The ship wake portion of the turbulence, however, is a function of ship speed, ship pitch, aircraft position relative to the ship, and aircraft attitude. The wake intensity is somewhat arbitrarily assumed to decrease exponentially as the aircraft moves left or right of the extended ship center line. No provision is made for the expanded wake that occurs when the ship is yawed with respect to the relative wind. In addition to lateral limits on the wake, the wake is assumed to vanish above a specified altitude which increases with range behind the ship. Within the altitude and lateral bounds, the steady and random components of the wake vary with range. The burble is composed of seven components. They are as follows:

UBSS	Steady U velocity degradation
WBSS	Steady W velocity upwash/downwash
UB1	U velocity due to deck pitching velocity
WB1	W velocity due to deck pitching velocity
UB2	Random U burble velocity

WB2            Random W burble velocity  
 VYBR           Random lateral burble velocity

UBSS and WBSS are functions of range and wind over the deck. The deck motion induced wake components UB1 and WB1 are functions of closing speed, ship pitch and range behind the stern. The random components of the burble UB2 and WB2 are functions of range to touch down and ship speed. VYBR, the lateral component of the burble, is assumed equal to the vertical component WB2. Burble components are computed in ship axes, first converted to north, east, down inertial axes, and are then transformed into aircraft body axes. The three burble components are then summed with the free air turbulence components to form a total turbulence velocity vector.

Various turbulence options may be selected by setting appropriate switches. Any one of ten random sequences may be repeated by setting variable IONCE equal to values from one to ten. If IONCE = 0, the random sequence will continue from one run to the next. In this way, various airplane configurations may be subjected to identical turbulence conditions, or a particular configuration may be repeated and subjected to non-repetitive turbulence in order to determine the statistical characteristics of the response of a fixed aircraft/pilot configuration. The burble characteristics may be held constant by setting IBFRZ = 1. This causes the burble model to act as though the aircraft was at a fixed range XFRZ behind the ship. Setting IWIND = 0 eliminates all turbulence while ILTURB = 0 sets the free air turbulence components equal to zero. Variables SUBSW and SWBSW provide magnitude scale factors on the steady burble components. Finally, the magnitude of the random components are selected by setting values for the seven elements of the array GR(I).

In addition to calculating the current values of the turbulence vector, WINDC also calculates the statistics of each wind component including average and RMS values.

#### SHIP

Subroutine SHIP provides a six degree of freedom representation of ship motion. The equations are adapted directly from reference (d) and represent the motion of a DLG-26 class destroyer in sea state 5 with 10 knots ship speed, 13 meter/sec (26 knots) wind and 150 degree heading with respect to the wave crests. This approximates a worst possible condition in which flight operations may be attempted.

#### SUBROUTINE DECK

Subroutine DECK computes the inertial position of the ideal touchdown point and the velocity and height of the deck at a point directly beneath each of the four landing gears. It sets a flag IOVDK to one if the aircraft is over the deck edge, and sets array element ITOUCH(I) = 1 when the Ith element of the four landing gears touch the deck. This information is used to calculate landing gear forces and to determine when touchdown occurs.

## LOOP3

LOOP3 is part of the basic simulation package developed by NASA Ames. It integrates aircraft inertial velocity to determine position. It also calculates vertical and horizontal flight path angles. LOOP3 is called by the main program at a normal rate of 10 times per second. It in turn calls subroutine DECK which computes ship motion and landing gear position.

## LOOP2

LOOP2, which is called by the main program at a normal rate of 20 times per second, computes body axis forces and moments and integrates the forces to determine inertial velocities and altitude. It calls brotate which integrates the torque equations, and BTRANS which calculates the Euler angle transformations. BVELOC, BALFBET, SHOW, PILOT, CONTR2, ENGINE, AERO2, and WINDC are also called by LOOP2.

In addition to the basic function, a landing gear position clamp is included. When the brakes are set, the wheels are in contact with the deck, and the relative velocity between the wheels and deck is less than two feet per second; the aircraft position is fixed relative to the deck. This allows the aircraft to brake to a stop without oscillating back and forth as would occur without the clamp.

## BQUIET

Subroutine BQUIET computes a gradient matrix relating aircraft state error  $u, v, w, Q, P, R$  to control inputs. The error matrix is used to compute a weighted least square error matrix which is non-singular even if the number of controls is less than the number of states. The error squared matrix is inverted by subroutine MINV and used to compute a gradient step of the selected control variables intended to minimize the state error. Slight modifications were made to the NASA Ames version of this subroutine which appear to improve the efficiency somewhat. In contrast to the original version, the gradient is evaluated only once at the beginning of the trim procedure. Then a maximum of 25 steps are taken with the fixed gradient. After each step is taken, the trim error is evaluated. If the weighted squared error is less than 90 percent of the past value of this error, the old gradient is retained. Otherwise, a new gradient is calculated. Also, the step size is reduced after each step to ensure convergence. When the gradient is reevaluated, the step gain is returned to the initial value. A special trim sequence is provided for trimming the aircraft on the deck in which only altitude and pitch attitude are varied.

The trim sequence is terminated when the error criterion is satisfied or the maximum trim iteration count is exceeded. A failure to trim within the specified number of iterations usually indicates some error in the aircraft model structure. Providing a good initial guess for the trim variables will greatly improve the rate of convergence.

**BVELOC**

Subroutine BVELOC computes body axis turbulence given inertial turbulence or inertial turbulence components given body axis components depending on the value of IETURB. It also computes the inertial wind, aircraft relative inertial velocity, and body axis relative wind components.

**BTRANS**

BTRANS computes the sine and cosine of the aircraft elevation, bank, and heading angles. These six values are then used to compute the nine elements of the Euler angle transformation matrix. This matrix is used to transform position, velocity, and acceleration from body axes to inertial axes. The reverse transformation is achieved using the transpose of the matrix.

**BROTATE**

Subroutine BROTE computes the rotational motions of the aircraft. Angular accelerations are computed in body axes and integrated to yield pitch, roll, and yaw rates. These rates are converted to inertial Euler angle rates which are then integrated to yield elevation, bank, and heading angles. In addition to the basic function, a heading clamp is provided. This serves as a substitute for landing gear yawing moment when the aircraft is on the deck. Changes in yaw angle are prevented when both the main and nose gear touch the deck.

The angular acceleration equations are formulated to include constant magnitude rotor angular momentum and cross products of inertia. Changes in rotor speed or configuration are not accounted for at present. However, the inertial coefficients could be computed and updated during the simulation run if they were required.

A more basic limitation occurs because the angular rate transformation is ill-defined at pitch angles of  $\pm 90$  degrees. Thus, the simulation cannot be used for spins or vertical climb or dive maneuvers.

A special reduced degree of freedom option is provided for use in matching flight test data. When the switch I2DOF is set to one, the computed pitch attitude and pitch rate are ignored and tabulated values of pitch attitude versus time obtained from flight measurement are substituted. The tabulated values are also differentiated to determine pitch rate. Using this procedure, the aerodynamic and engine parameters of the simulation may be more easily adjusted to match measured flight trajectories.

**BALFBET**

Subroutine BALFBET computes the aircraft angle of attack, sideslip, rate of change of sideslip and angle of attack and the airspeed given the three body axis components of velocity, and the body axis angular rates.

**BATMOS**

Subroutine **BATMOS** determines air density, the speed of sound, Mach number, dynamic pressure, total and ambient temperature, total and ambient pressure, and the equivalent airspeed based on standard atmospheric properties. It corrects for non-standard temperature based on a temperature increment specified by the user.

**LOOKUP**

Subroutine **LOOKUP** handles the linear interpolation of tabulated functions of 1, 2, or 3 variables. One of three search modes may be selected by setting variable **meth** equal to 1, 2, or 3. In addition, if the arguments exceed the tabulated values, option switches permit linear extrapolation, the return of the last value, or the setting of an error flag.

**TAB1 (A, B, C, N, ND)**

**TAB1** returns to the calling program a single value determined as a function of the calling arguments. The first three parameters are arguments of the **LOOKUP** table, the fourth specifies the first table number referenced and the last parameter specifies the number of tables referenced. If the function depends on one or two parameters, only one table must be supplied for each value of the third variable. In addition to supplying the function value, **TAB1** also prints an error message when the table arguments exceed the tabulated bounds.

**TABRD**

**TABRD** is called only during the setup procedure. It reads tabulated data points used in the interpolation routine from cards and loads them into designated arrays. At present, all of the tables must be loaded as a block when the deck is loaded. Individual tables cannot be updated between runs without reloading the program.

**RAND**

Subroutine **RAND** is a standard library subroutine which returns a random number each time it is called. Repeated calls to this subroutine produces a sequence of normally distributed numbers with zero mean and unit variance.

**ARDC62**

This subroutine contains the standard atmospheric density and speed of sound tables which are valid from 0 to 240,000 feet above sea level. Values of density and speed of sound are tabulated every 2000 feet. The subroutine returns one value of density and one value of the speed of sound given altitude as an input.

## BSETUP

Subroutine BSETUP initializes aircraft position, velocity, and attitude during the trim procedure. It calculates initial values of weight and the inertial coefficients used by BRODATE to integrate the torque equations. Aircraft position can be specified with respect to the pilot eye location if ICG = 0, or with respect to aircraft cg if ICG = 1.

Angular velocities are initialized in body axis rates if IEULR = 0, and by Euler angle rates if IEULR = 1.

Airspeed may be initialized in knots, or Mach number, depending on the value of IMACH. It may be also specified by setting the values for the three components of body axis velocities, UB, VB, and WB. This is equivalent to specifying airspeed, angle of attack, and sideslip. For conventional flight, trim angle of attack is fixed and trim pitch attitude is varied to achieve the desired initial flight path angle.

## MINV (HTH, M, DET, LM, MM)

Subroutine MINV is a standard library routine called during trim. It calculates the inverse of a matrix and the determinant. Array HTH initially contains the original matrix, and it holds the inverse after the subroutine returns. M specifies the dimension of the array, and DET is the value of the determinant. LM and MM are single dimensioned arrays equal in size to the dimension of the two dimension array.

## P R E L I M I N A R Y   S I M U L A T I O N   R E S U L T S

A series of simulation runs have been made in an attempt to verify the accuracy of the computer model. To date, this attempt has been limited by the scarcity of fully instrumented open and closed loop aircraft response data. The only data available thus far has been from short take-offs made aboard ship. No data has been available for hover or conventional flight.

Although no comparison flight data was available, it was known that the Harrier is unstable although controllable in hover and low speed flight. Simulation results illustrated in Figures 6-11 agree with this assumption. With stability augmentation off, the aircraft diverges in all axes when subjected to an elevator doublet starting from a jet supported trim condition of 0 and 18 m/sec airspeed. If the stability augmentation system is engaged, the pitch response is stabilized, but the airspeed still appears to diverge. The simulation predicts an aperiodic divergence in roll with SAS off. With the SAS engaged, the lateral response is greatly reduced, but the aircraft still is unstable.

Figure 12 illustrates the aircraft pitch response at 51 m/sec with SAS off. This simulation predicts that the aircraft is unstable and has a very rapid aperiodic divergence. This agrees with reference (b) which predicts a time to double amplitude of 1.95 seconds at a 51 m/sec trim.

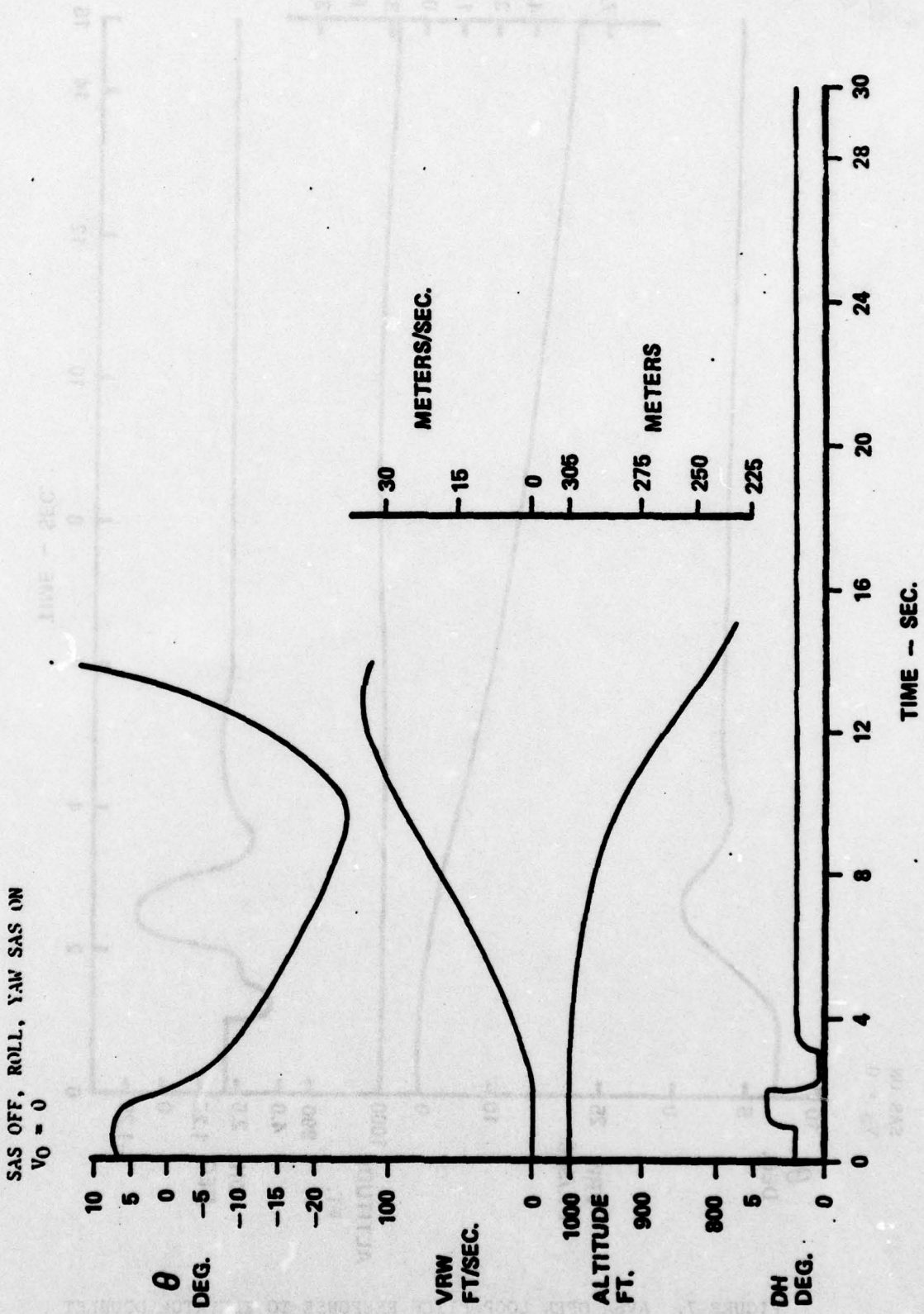


FIGURE 6. AV8A OPEN LOOP RESPONSE TO ELEVATOR DOUBLET

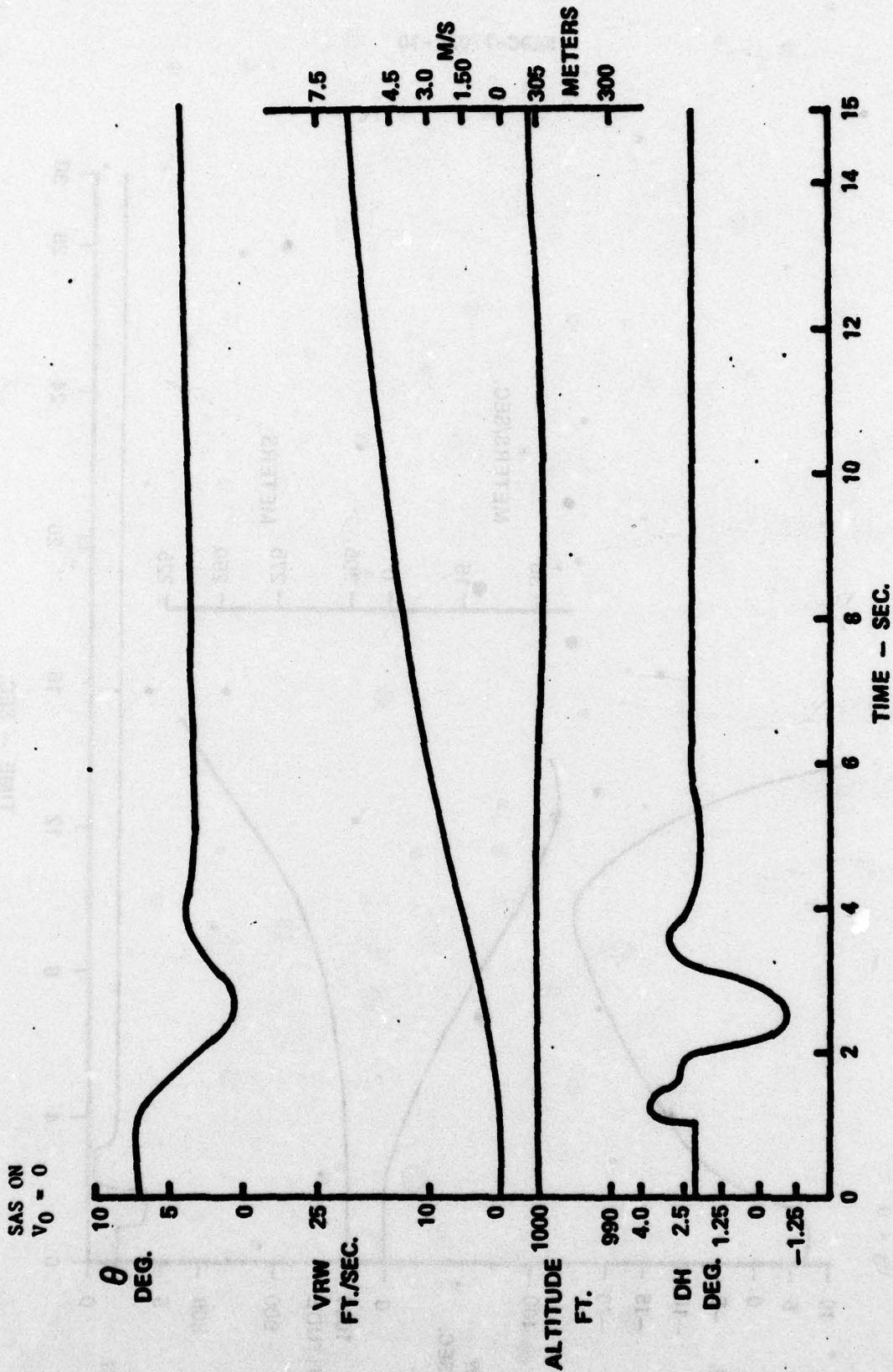


FIGURE 7. AV8A OPEN LOOP PITCH RESPONSE TO ELEVATOR DOUBLET

SAS OFF,  $V_0 = 0$

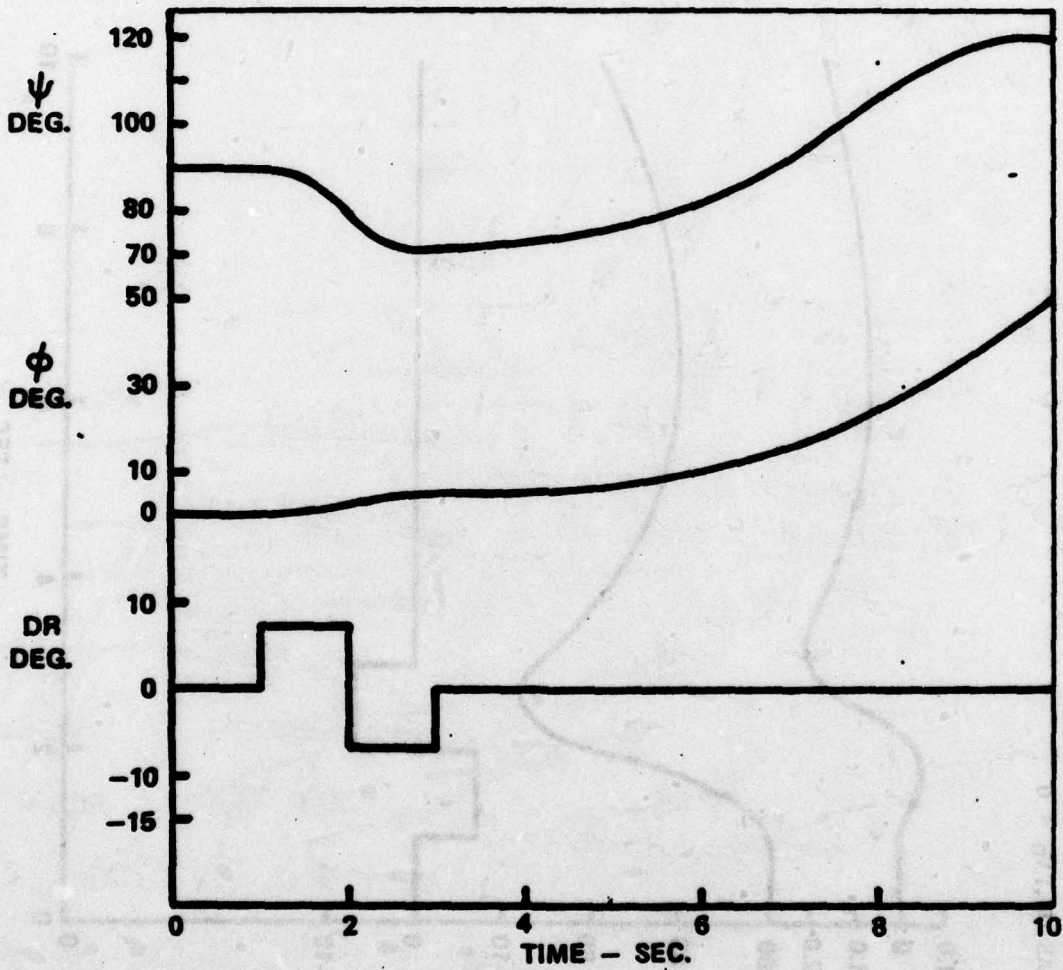


FIGURE 8. AV8A OPEN LOOP RESPONSE TO RUDDER DOUBLET

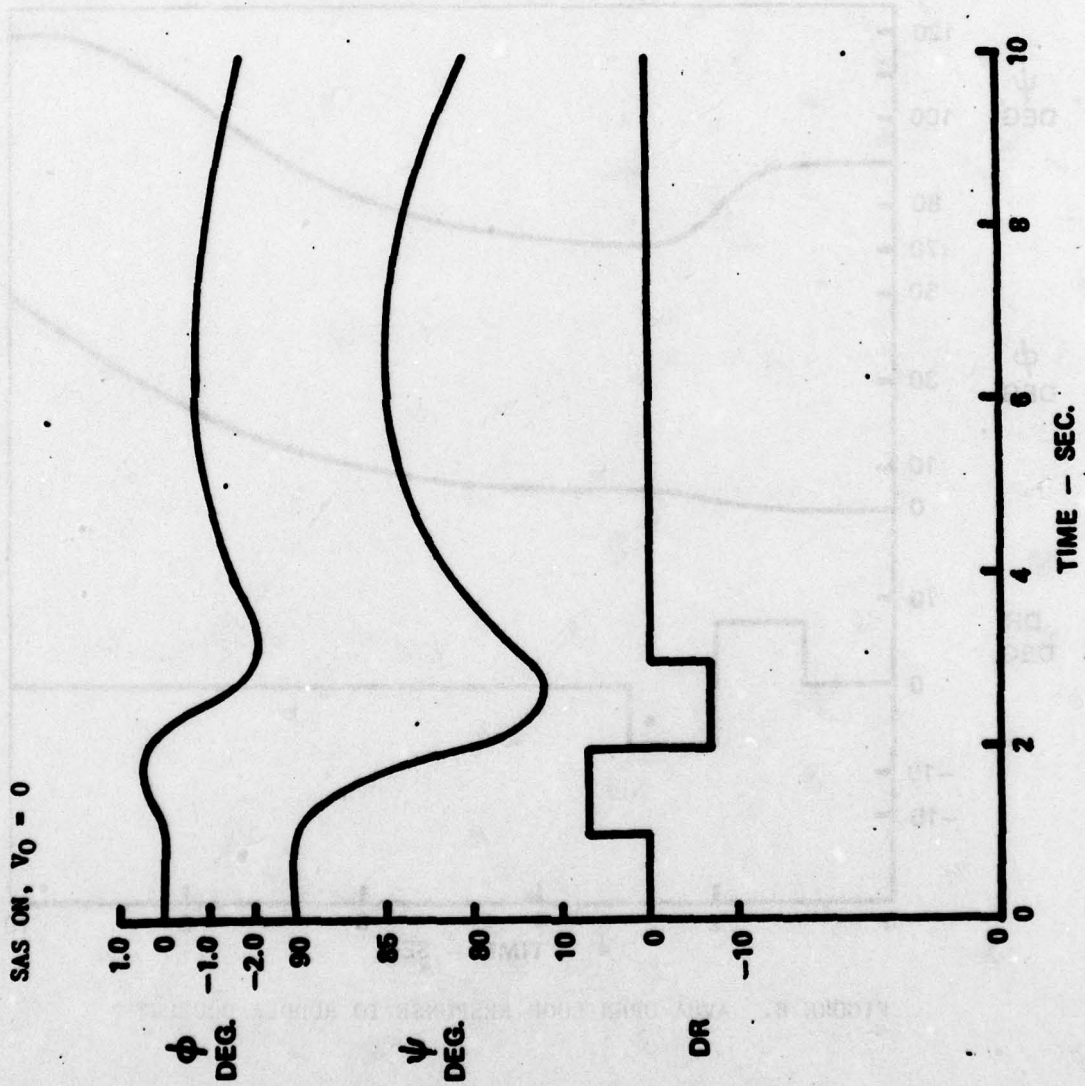


FIGURE 9. AV8A OPEN LOOP YAW RESPONSE TO RUDDER DOUBLET

NADC-77024-30

V = 35 KNOTS, SAS OFF  
(18 METER/SEC)

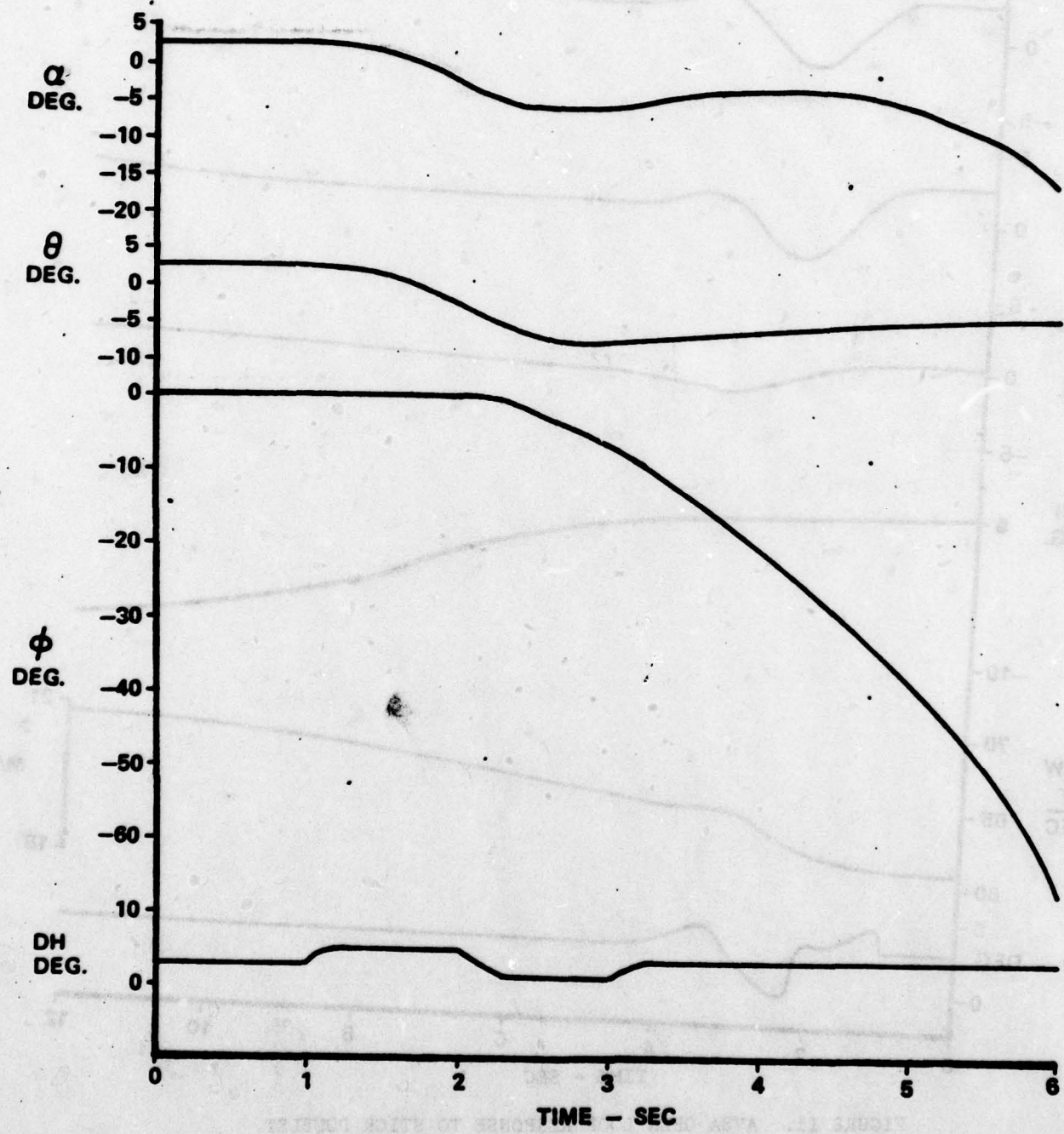


FIGURE 10. AV8A OPEN LOOP STICK DOUBLET

SAS ON

V = 35 KNOTS,  
(18 METER/SEC)

H = 1000 FT  
(304.8 METERS)

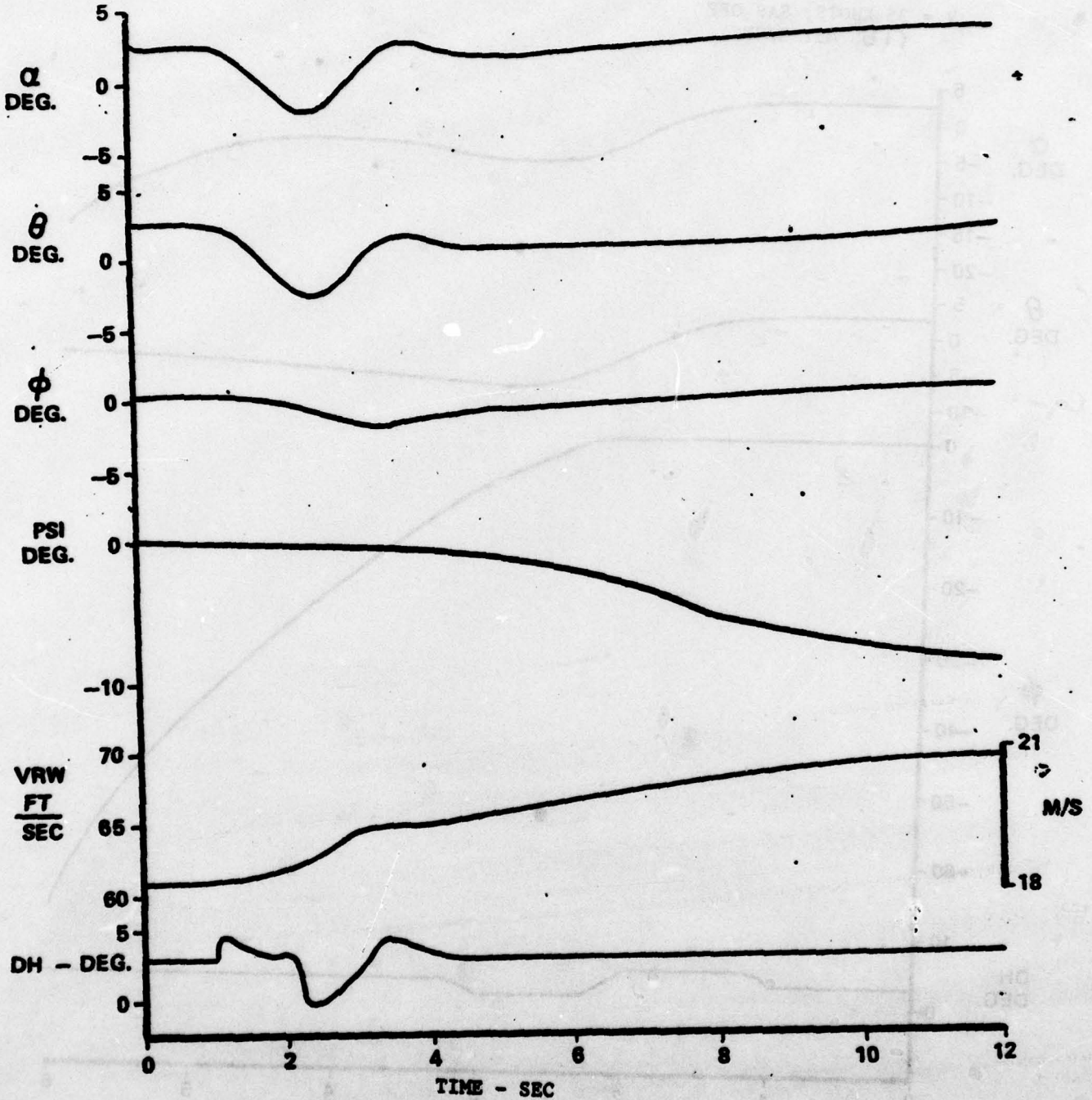


FIGURE 11. AV8A OPEN LOOP RESPONSE TO STICK DOUBLET

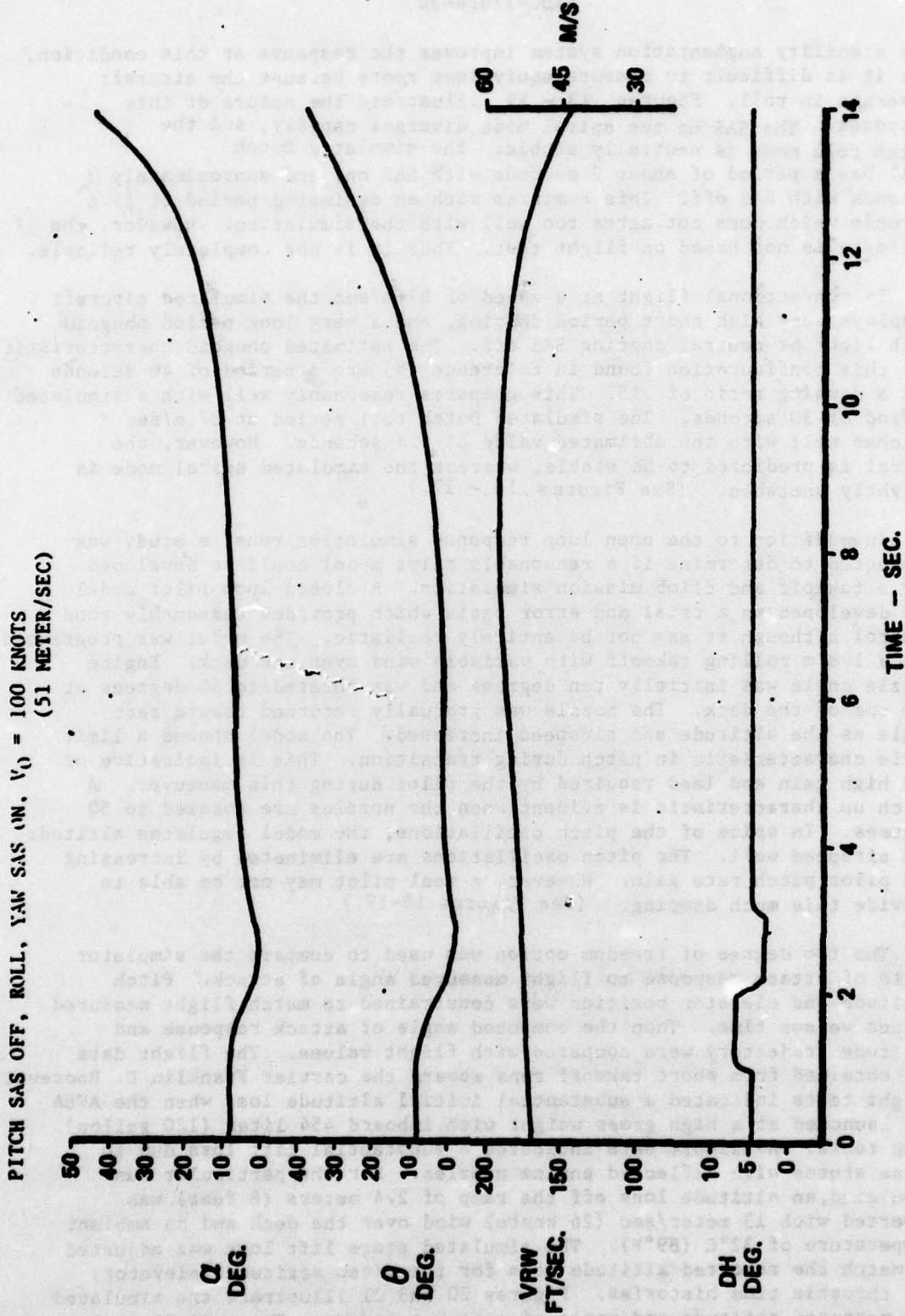


FIGURE 12. AV8A OPEN LOOP RESPONSE TO STICK DOUBLET

The stability augmentation system improves the response at this condition, but it is difficult to measure equivalent roots because the aircraft diverges in roll. Figures 13 - 15 illustrate the nature of this response. The SAS on the spiral mode diverges rapidly, and the Dutch roll mode is neutrally stable. The simulated Dutch roll has a period of about 2 seconds with SAS on, and approximately 3 seconds with SAS off. This compares with an estimated period of 11.6 seconds which does not agree too well with the simulation. However, the estimate is not based on flight test. Thus, it is not completely reliable.

In conventional flight at a speed of 87 m/sec, the simulated aircraft displays very high short period damping, and a very long period phugoid with light or neutral damping SAS off. The estimated phugoid characteristics for this configuration found in reference (b) are a period of 40 seconds and a damping ratio of .15. This compares reasonably well with a simulated period of 30 seconds. The simulated Dutch roll period at 87 m/sec matches well with the estimated value of 3.4 seconds. However, the spiral is predicted to be stable, whereas the simulated spiral mode is slightly unstable. (See Figures 16 - 17.)

In addition to the open loop response simulation runs, a study was conducted to determine if a reasonable pilot model could be developed for a takeoff and climb mission simulation. A closed loop pilot model was developed on a trial and error basis which provides reasonably good control although it may not be entirely realistic. The model was programmed for a 198 m rolling takeoff with variable wind over the deck. Engine nozzle angle was initially ten degrees and was rotated to 50 degrees at the end of the deck. The nozzle was gradually returned toward zero angle as the altitude and airspeed increased. The model showed a limit cycle characteristic in pitch during transition. This is indicative of the high gain and lead required by the pilot during this maneuver. A pitch up characteristic is evident when the nozzles are rotated to 50 degrees. In spite of the pitch oscillations, the model regulates altitude and airspeed well. The pitch oscillations are eliminated by increasing the pilot pitch rate gain. However, a real pilot may not be able to provide this much damping. (See Figures 18-19.)

The two degree of freedom option was used to compare the simulator angle of attack response to flight measured angle of attack. Pitch attitude and elevator position were constrained to match flight measured values versus time. Then the computed angle of attack response and altitude trajectory were compared with flight values. The flight data was obtained from short takeoff runs aboard the carrier Franklin D. Roosevelt. Flight tests indicated a substantial initial altitude loss when the AV8A was launched at a high gross weight with inboard 454 liter (120 gallon) wing tanks. Available data indicated a substantial lift loss due to these stores with deflected engine nozzles. For the particular run simulated, an altitude loss off the ramp of 2.4 meters (8 feet) was reported with 13 meter/sec (26 knots) wind over the deck and an ambient temperature of 32°C (89°F). The simulated store lift loss was adjusted to match the reported altitude loss for the given attitude, elevator, and throttle time histories. Figures 20 and 21 illustrate the simulated and measured attitude and angle of attack response. The overall angle

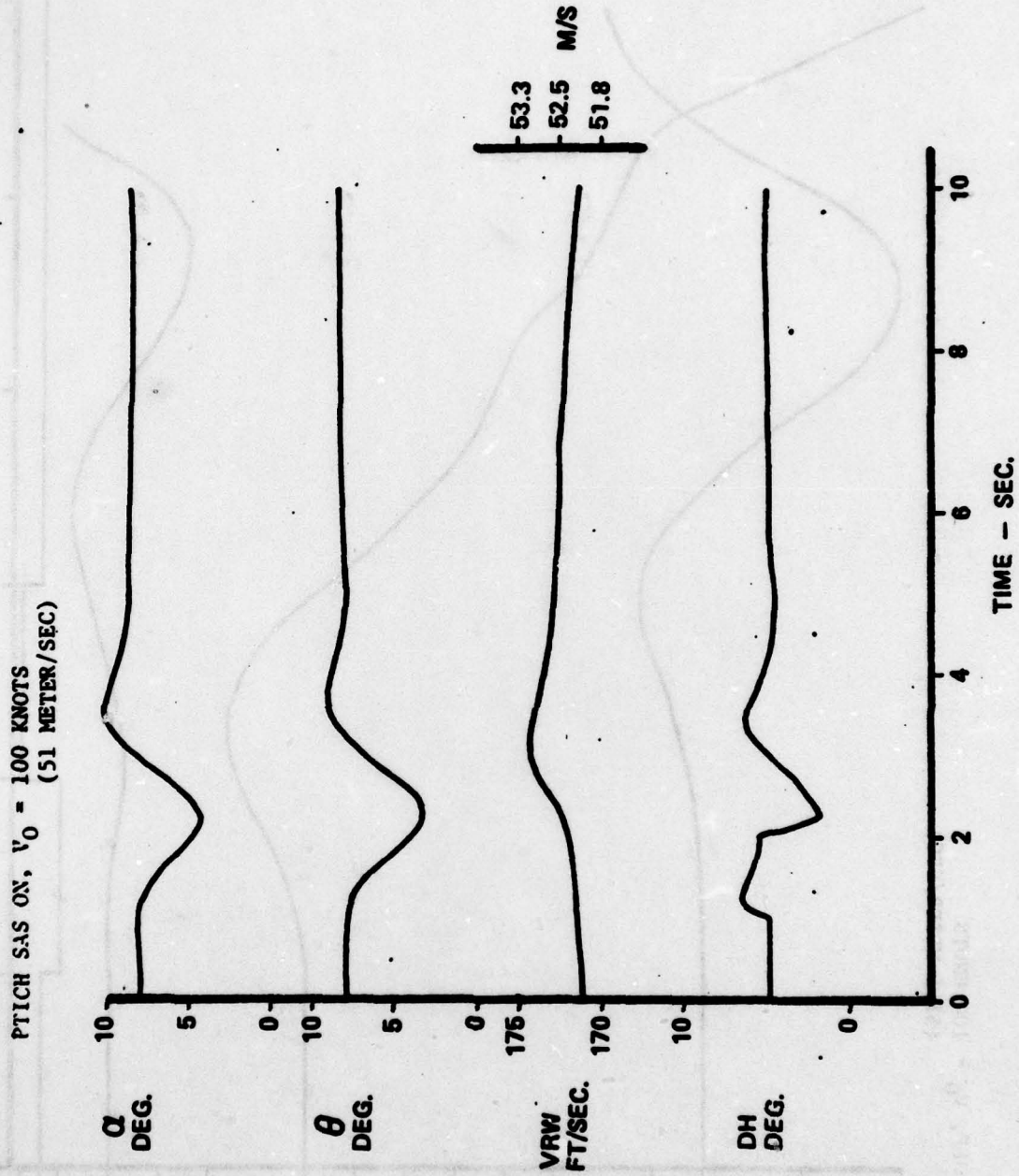


FIGURE 13. AV8A OPEN LOOP RESPONSE TO STICK DOUBLET

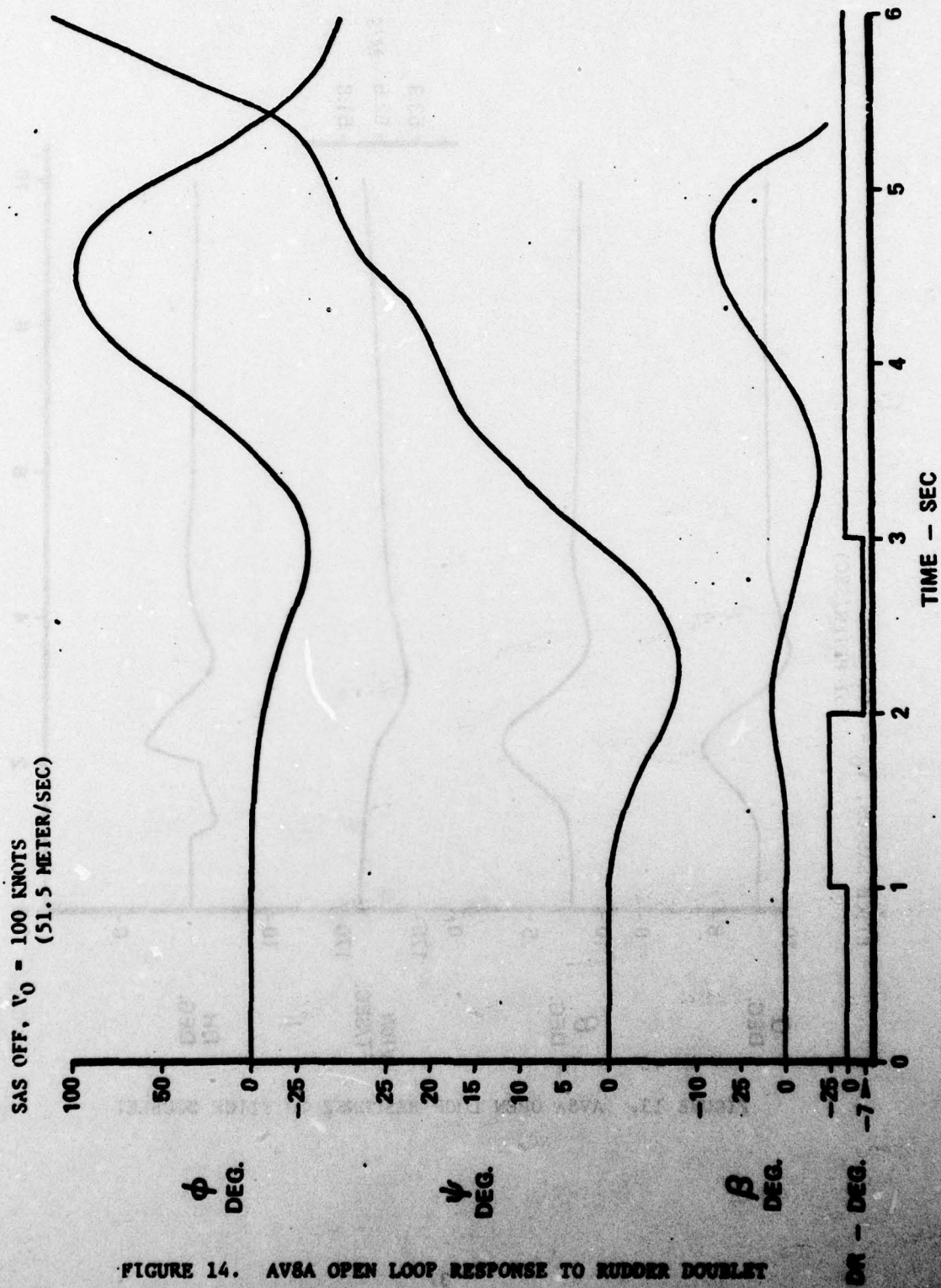


FIGURE 14. AVSA OPEN LOOP RESPONSE TO RUDDER DOUBLET

SAS ON,  $V_0 = 100$  KNOTS  
(51.5 METER/SEC)

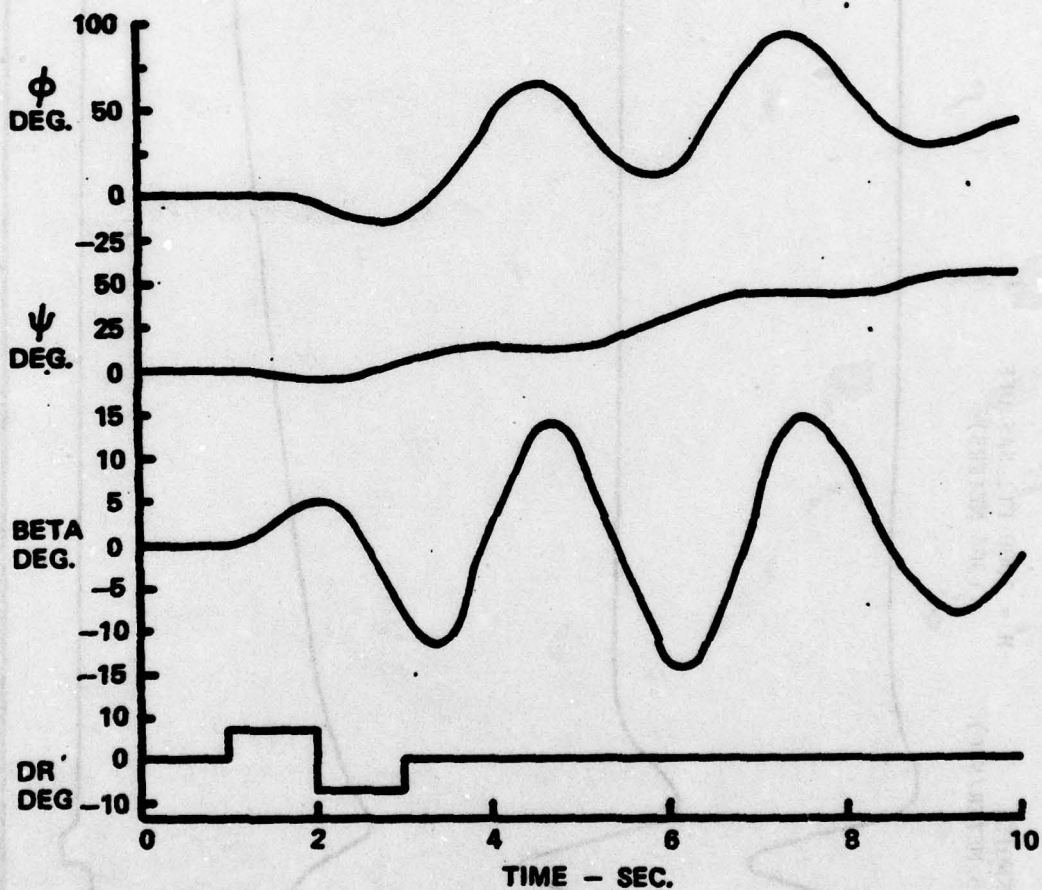


FIGURE 15. AV8A OPEN LOOP RESPONSE TO RUDDER DOUBLET

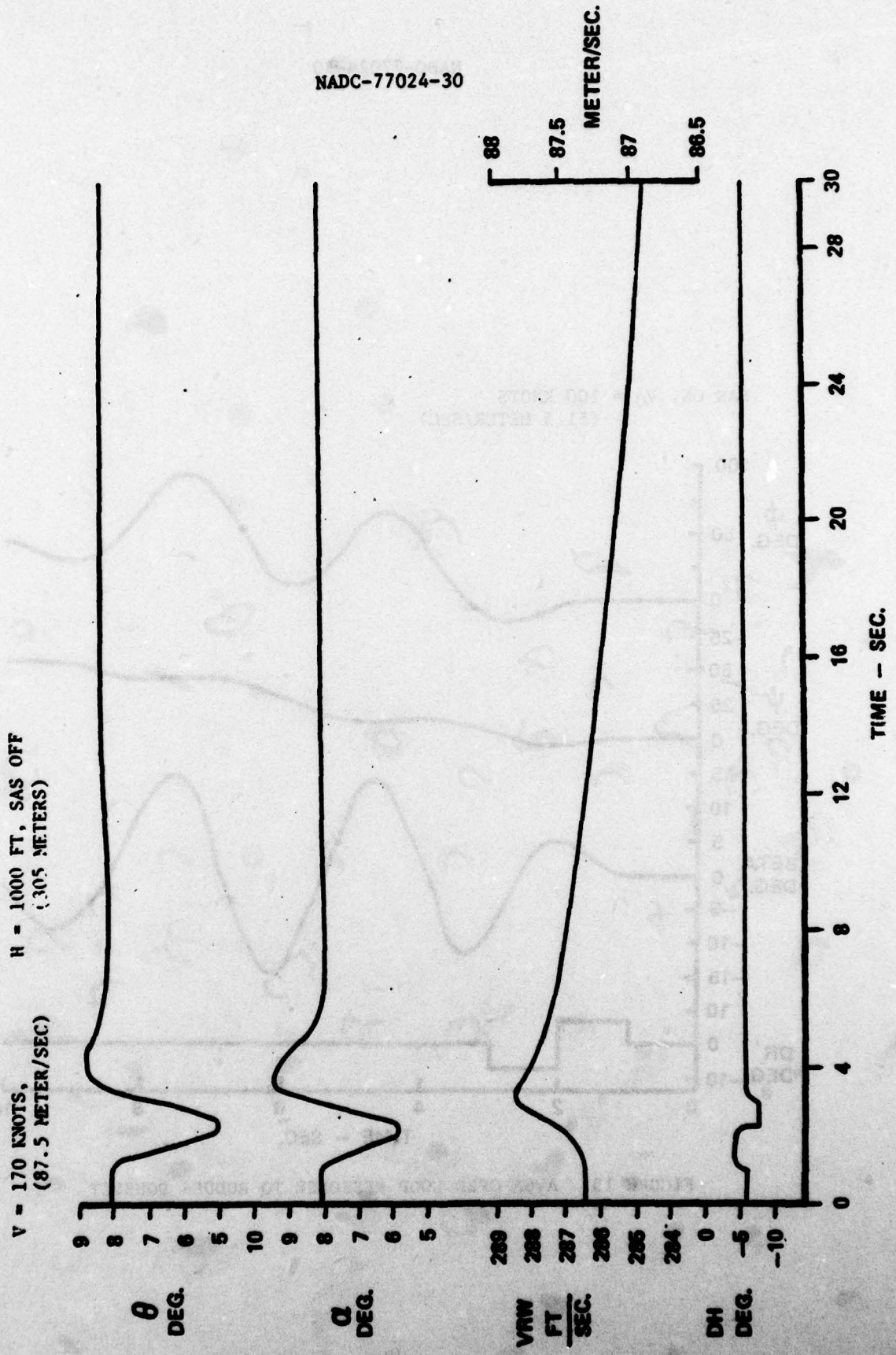


FIGURE 16. AV8A OPEN LOOP STICK DOUBLET

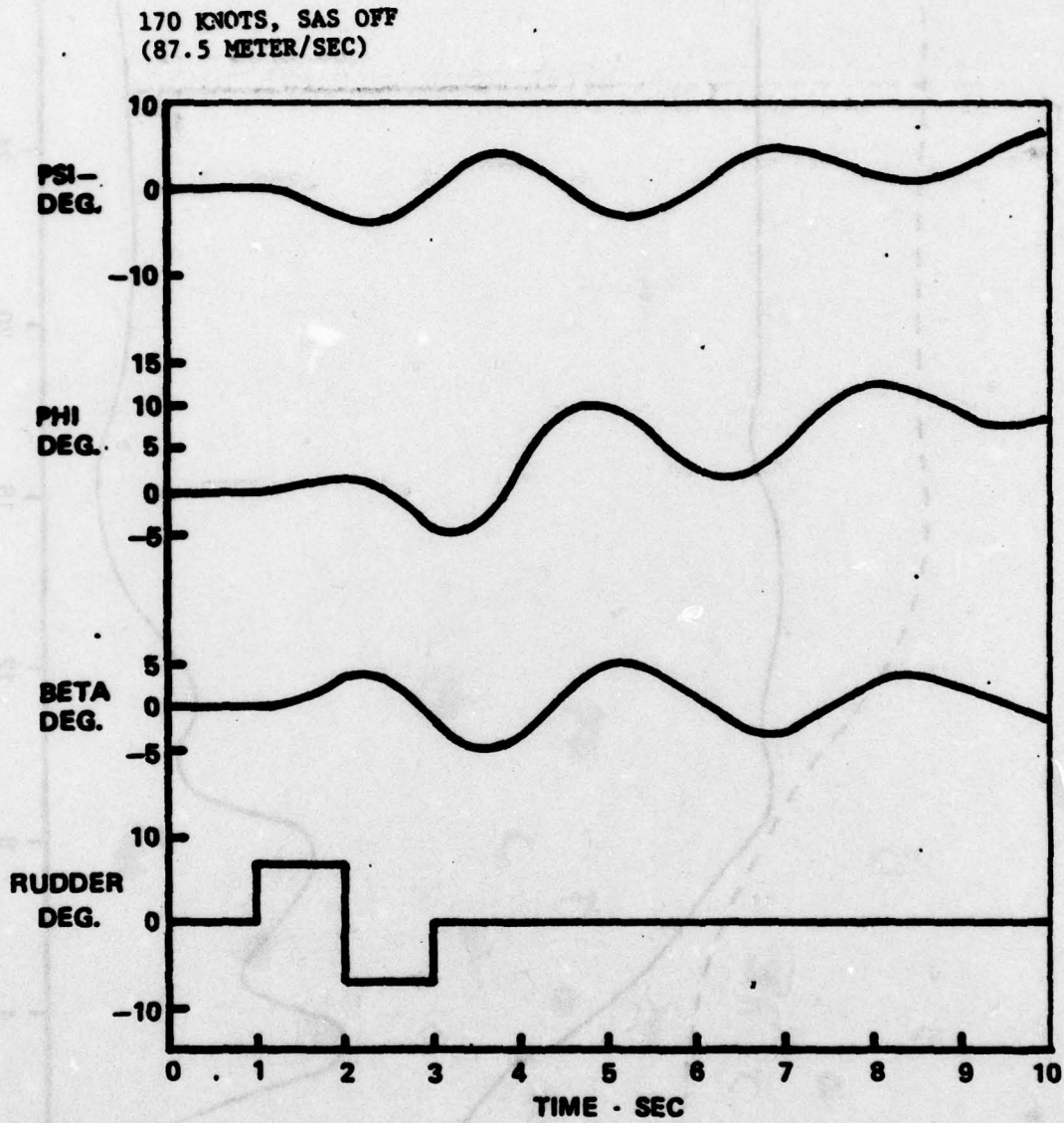


FIGURE 17. AV8A OPEN LOOP RUDDER DOUBLET

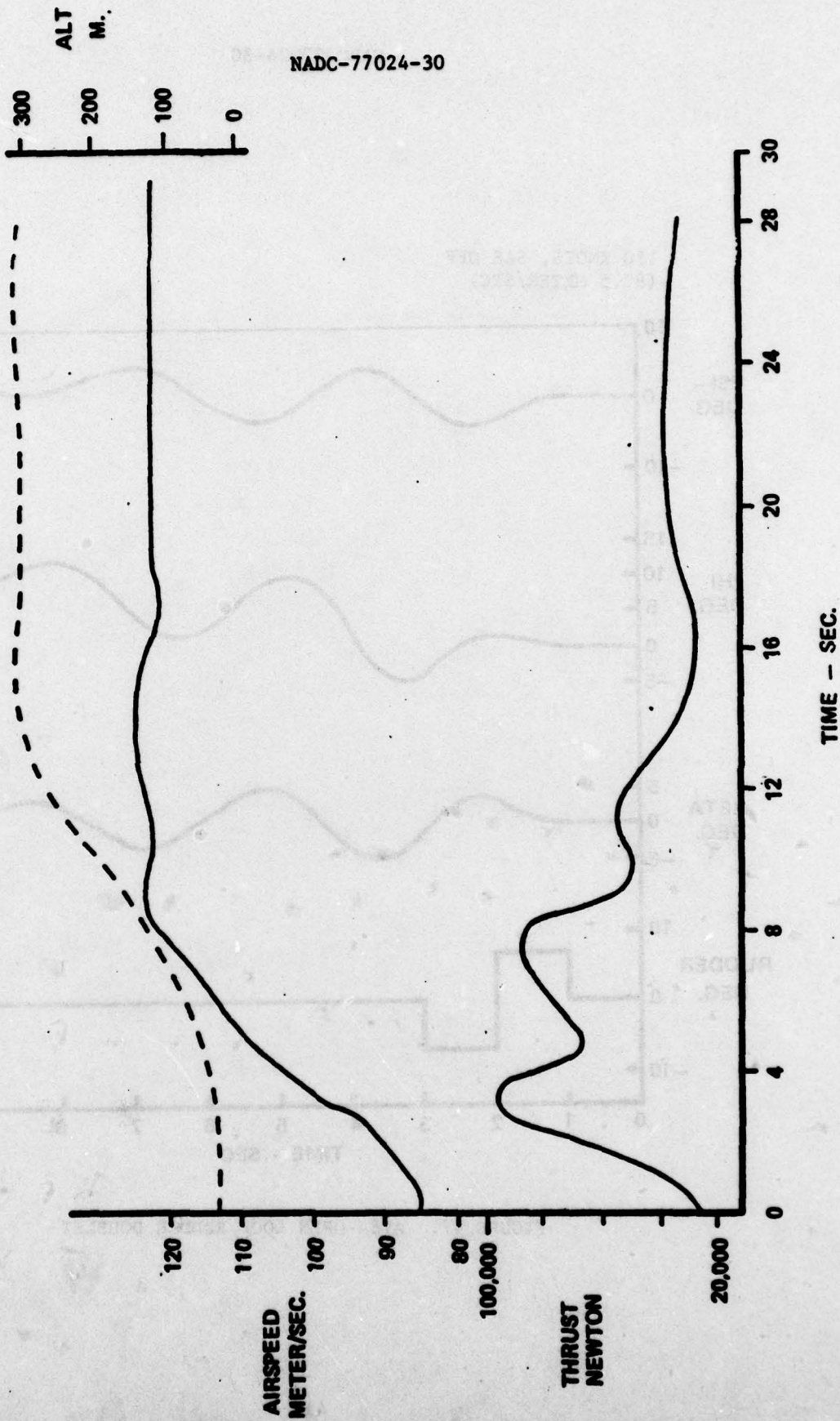


FIGURE 18. AV8A SIMULATED CLIMB RESPONSE

15 METER/SEC WIND OVER DECK, 168 METERS DECK ROLL, LOW PILOT PITCH DAMPING

W = 9761 KG  
 W = (21,500 LB)

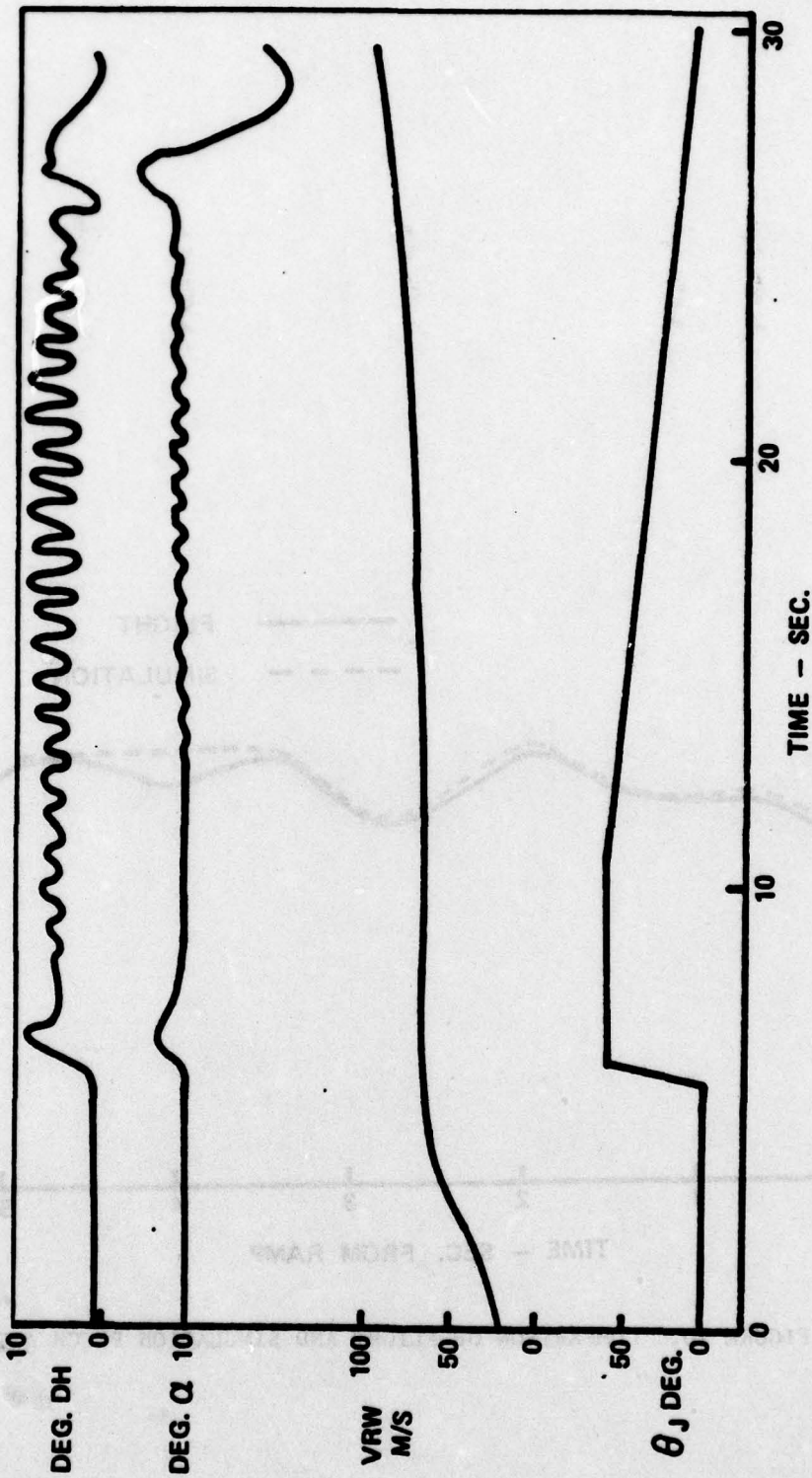


FIGURE 19. AV8A SIMULATED SHORT TAKEOFF

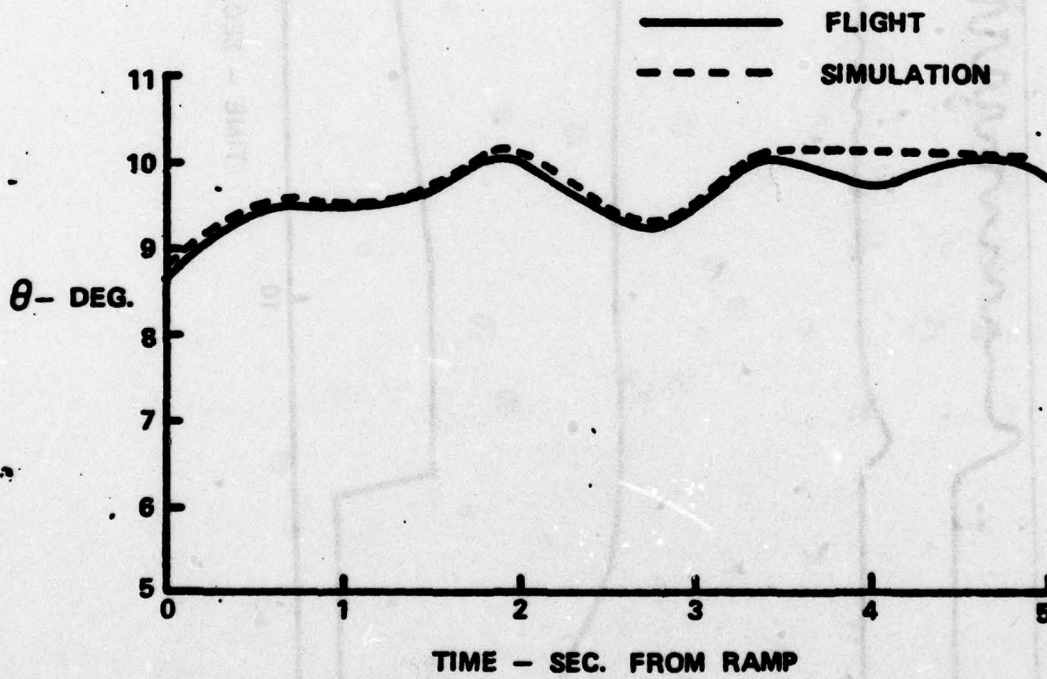


FIGURE 20. COMPARISON OF FLIGHT AND SIMULATION PITCH ATTITUDE

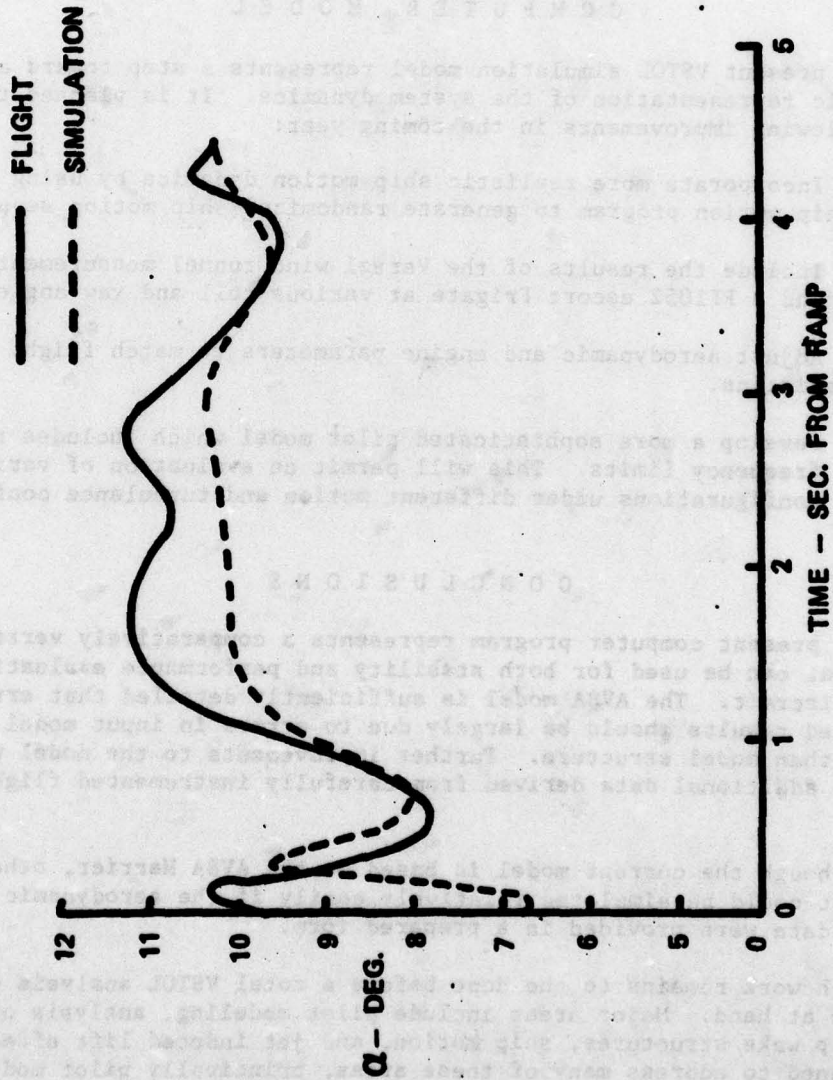


FIGURE 21. COMPARISON OF FLIGHT AND SIMULATION ANGLE OF ATTACK - DEG.

of attack match is reasonably close although not exact. There are two possible explanations to this discrepancy. First, the measured angle of attack includes distortion due to induced flow. Second, the induced lift versus airspeed may not be modeled accurately. If the measured angle of attack is assumed accurate, it indicates that the aircraft initially sinks faster than the simulated values and then arrests sink rate faster than the model. However, the actual aircraft altitude trajectory was not measured. Thus, it is not possible to determine the source of the discrepancy. Nevertheless, the simulation is capable of accurately predicting performance trends due to variation in weight, thrust, and wind over the deck.

#### PLANNED IMPROVEMENTS TO COMPUTER MODEL

The present VSTOL simulation model represents a step toward a truly realistic representation of the system dynamics. It is planned to make the following improvements in the coming year:

1. Incorporate more realistic ship motion dynamics by using the NSRDC ship motion program to generate randomized ship motion sequences.
2. Include the results of the Vertol wind tunnel measurement of the wake behind a FF1052 escort Frigate at various roll and yaw angles.
3. Adjust aerodynamic and engine parameters to match flight response characteristics.
4. Develop a more sophisticated pilot model which includes response lag and frequency limits. This will permit an evaluation of various control configurations under different motion and turbulence configurations.

#### CONCLUSIONS

The present computer program represents a comparatively versatile tool that can be used for both stability and performance evaluations of VSTOL aircraft. The AV8A model is sufficiently detailed that errors in predicted results should be largely due to errors in input model parameters rather than model structure. Further improvements to the model will require additional data derived from carefully instrumented flight tests.

Although the current model is based on the AV8A Harrier, other VSTOL aircraft could be simulated relatively easily if the aerodynamic and engine data were provided in a prepared form.

Much work remains to be done before a total VSTOL analysis capability will be at hand. Major areas include pilot modeling, analysis of turbulence and ship wake structures, ship motion, and jet induced lift effects. It is planned to address many of these areas, principally pilot modeling

and turbulence modeling in the coming fiscal year. Regular updates to the computer model will be made as additional data becomes available.

R E F E R E N C E S

- (a) AV8A Aerodynamic Characteristics, Report No. MDCA1410, McDonnell Aircraft Company, 31 Jan 1972
- (b) AV8A Estimated Flying Qualities, Report No. MDCA1411, McDonnell Aircraft Company, 31 Jan 1972
- (c) AV8A Propulsion System, Report No. MDCA1412, McDonnell Aircraft Company, 31 Jan 1972
- (d) A Study of Helicopter Landing Behavior on Small Ships, Roy M. Tuttle, Journal of the American Helicopter Society, Volume 21, Number 2, Apr 1976
- (e) P-1127 (XV-6A) VSTOL Handling Qualities Evaluation, Gordon A. McKinzie, et.al., Technical Report No. 68-10, Air Force Flight Test Center, Aug 1968
- (f) Introduction to the Statistical Dynamics of Automatic Control Systems - Solodovnikov, V. V., Dover Publications Inc.
- (g) MIL SPEC AR-40A, Automatic Carrier Landing System Airborne Subsystem, General Requirements For

## LIST OF SYMBOLS

ALPHA	angle of attack - deg
BETA	sideslip angle - deg
CD	drag coefficient
CL	lift coefficient
$C_l$	rolling moment coefficient
$C_{lDR}$	rolling moment coefficient per degree of rudder - 1/deg
CM	pitching moment coefficient
CN	yawing moment coefficient
$CN_{DA}$	yawing moment coefficient per degree of aileron - 1/deg
$CN_p$	yawing moment coefficient per unit roll rate - 1/rad
CY	side force coefficient
C1, C2	landing gear damping coefficient - $\frac{\text{Newton-sec}}{\text{meter}}$ ( $\frac{\text{lb-sec}}{\text{ft}}$ )
DH	elevator - deg
DR	rudder - deg
JPT	jet pipe temperature
K1, K2	landing gear model spring coefficients - $\frac{\text{Newton}}{\text{meter}}$ ( $\frac{\text{lb}}{\text{ft}}$ )
$\ddot{P}$	roll acceleration - $\text{rad/sec}^2$
$\ddot{Q}$	pitch acceleration - $\text{rad/sec}^2$
$\ddot{R}$	yaw acceleration - $\text{rad/sec}^2$
RCS	reaction control system
RMS	root mean square
RPM	revolutions per minute
SAS	stability augmentation system
$T/T_{\text{max}}$	percent reaction control thrust

## LIST OF SYMBOLS (CONT'D)

u	X body axis airspeed component - m/s (ft/sec)
$\dot{u}$	rate of change of u - m/s <sup>2</sup> (ft/sec <sup>2</sup> )
UBSS	steady state horizontal burble component - m/s (ft/sec)
UB1	horizontal turbulence due to ship pitch - m/s (ft/sec)
UB2	horizontal turbulence due to random burble - m/s (ft/sec)
$u/V_s$	ratio of horizontal burble velocity to ship speed
V	Y body axis airspeed component - m/s (ft/sec)
$\dot{V}$	rate of change of V - m/s <sup>2</sup> (ft/sec <sup>2</sup> )
VEQ	equivalent airspeed - m/s (kts)
VO	trim airspeed - m/s (ft/sec)
VRW	true airspeed - m/s (ft/sec)
VYBR	lateral burble component - m/s (ft/sec)
W	Z body axis air velocity component - m/s (ft/sec)
WBSS	steady vertical burble component - m/s (ft/sec)
WB1	vertical burble velocity due to deck pitch - m/s (ft/sec)
WB2	random component of vertical burble velocity - m/s (ft/sec)
$\dot{W}$	rate of change of aircraft Z axis velocity WRT air - m/s (ft/sec)
$\alpha$	angle of attack - deg
$\beta$	angle of sideslip - deg
$\Delta C_L$	increment in lift coefficient due to stores
$\theta$	pitch attitude - deg
$\mu_x$	wheel braking coefficient
$\phi$	bank angle - deg
$\psi$	yaw angle - deg

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APPENDIX A  
COMPUTER LISTING

THIS LISTING IS A REPRODUCTION OF THE ORIGINAL DOCUMENT

NADC-77024-30

SECRET  
DISSEMINATION

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PROGRAM AVBAP(INPUT,OUTPUT,TAPE1,TAPE2,TAPE10,TAPE97,TAPE#OUTPUT)
COMMON/XFLOAT/A(500)/FIXED/IA(200)
COMMON/CF/R(200)/ICRF/IB(50)
COMMON/DAT/DATTIT(15),DATNO(40),CHTSP,SCALE(28),
1) TMAX,NPLOT(14),ISCALE
COMMON/HPLOCK/IPLOT(14),IPRNT(11)
COMMON/GAIN/GA(100)

```

C

```

DIMENSION NODAT(14),U(4)
EQUIVALENCE(STAR,H(1)),(AIL,B(2)),(RUD,R(3)),(RLONSTK,B(7))
EQUIVALENCE(PLATSTK,H(9)),(RHDMPED,B(11)),(THROT,B(14)),(RNI,R(19))
1) (TTHM,H(17)),(TOTMM,B(20))
EQUIVALENCE(IGHAD,IR(31))
EQUIVALENCE(IH(22),NCHK)
EQUIVALENCE(ISTAT,IH(42))
EQUIVALENCE(UTIME,A(30))
EQUIVALENCE(ITHIS,IH(40)),(IUPLOT,IR(41))
EQUIVALENCE(A(334),OTIM),(OTIM1,A(339)),(TI,A(336))
EQUIVALENCE(J2,IH(49)),(JLAND,IB(50))
EQUIVALENCE(J1,IA(116))
EQUIVALENCE(A(238),VECTC)
1) (IA(1),IMODE),(IA(114),MACH),(A(241),MIC),(A(151),FB)
2) (IA(6),IFLAT),(A(254),CG),(IA(103),ITRMP),(IA(105),NRUN)
3) (IA(14),ICOMU),(IA(23),ITPROG),(IA(61),IDT1),(IA(62),IDT2)
4) (IA(63),IDT3),(A(303),TIME),(IA(102),ITRIM),(IA(111),ITRMC)
EQUIVALENCE(OT3,A(169))
EQUIVALENCE(IA(194),M2)
EQUIVALENCE(FREQCK,GA(18))
EQUIVALENCE(ITD,IR(14)),(ILAND,IR(3)),(ICRASH,IB(9))
EQUIVALENCE(IZFNO,IH(4))
EQUIVALENCE(IA(23),DTIM2)
EQUIVALENCE(MUSED,IA(180))

```

C

```

DIMENSION MESSAGE(15)

```

C

```

INTEGER MDATA
DATA DTIM2/,2/
DATA JG4/ZH G/,JSC4/SHSCALE/,JNP/SHNPLOT/,JCH/SHCHTSP/,
1) 4DATA/4MMDAT/,JM/ZH H/,JIB/ZHIB/
DATA JA/ZH A/,JIA/ZHIA/
DATA IPND/4MFD/
DATA IUIAT/4HSTAR,4H      ,4HAIL,4H      ,4HDR,4H      ,4HNLNST,4HK
1)      ,4HITST,4HK      ,4HTHRO,4HT      ,4HRNI,4H      ,4HTOTR,4HM
2)      ,4HTHII,4M      /
DATA U/4HDEC,4HDEC,4HDEC,4HCH,4HCH,4HDEC,4HPCT,4HNEWT,
1) 4HIG,4/
DATA ITIT/4HVVRA/
DATA ITHIS/1/,IUPLOT/0/,ISTAT/0/
DATA IUDATA/4MUOAT/
DATA UTIM/,05/
DATA J2/100/,JLAND/0/
DATA OTIM1/,.1/
DATA JHIM/0/
DATA TI/2./
DATA IEON/IM//

```

```

DATA IFLANK/4M /
DATA IDATA/4M DATA/
DATA IOPRN/4MOPRN/
.....
C
C DATA INPUT SECTION
C
00501 READ 2071,NPUN
02071 FORMAT(I2)
      NUSED=1
      IF(NMUN.FO.0) STOP 4
00500 READ 1000,NAME,RTIME
C
C CHECK FOR SPECIAL SYMBOLS
      N? = 1
      IF(NAME.NE.IDATA) GO TO 650
C
C PREPARE TO READ DATA
C
      PRINT 2006
C
C READ INPUT CARDS
C
C
00540 READ 1010,IFU,NCOMMON,NCELL,VALUE,MESSAGE
      IF(IEU.FO.IFDD) GO TO 500
      GO TO (550,600,610,620,630,640,641,642) NCOMMON
C
C FLOATING POINT COMMON
C
00550 A(NCELL) = VALUE
      PRINT 2000,JA,NCELL,VALUE,MESSAGE
      GO TO 540
C
C INTEGER COMMON
C
00600 IA(NCELL) = VALUE
      PRINT 2005,JA,NCELL,IA(NCELL),MESSAGE
      GO TO 540
00610 GA(NCELL) = VALUE
      PRINT 2000,JGA,NCELL,VALUE,MESSAGE
02000 FORMAT(10X,14M DATA INPUT TO 'A5.2M( '13.2M ) '8MCOMMON = '
      ) F10.4,5X,15A4)
      GO TO 540
00620 SCALE(NCELL) = VALUE
      PRINT 2000,JSCA,NCELL,VALUE,MESSAGE
      GO TO 540
00630 WPL0T(NCELL) = VALUE
      PRINT 2005,JWP,NCELL,VALUE,MESSAGE
02005 FORMAT(10X,14M DATA INPUT TO 'A5.2M( '13.12M ) COMMON = '
      ) I10.5X,15A4)
      GO TO 540
00640 CNTSH = VALUE
      PRINT 2000,JCH,NCELL,VALUE,MESSAGE
      GO TO 540

```

```

00A41 R(NCELL)=VALUE
      PRINT 2000,JR,NCELL,VALUE,MESSAGE
      GO TO 540
00A42 I(NCELL)=VALUE
      PRINT 2005,JI,NCELL,IH(NCELL),MESSAGE
      GO TO 540
C
C.....
C
C      CHECK IF USER IS REQUESTING INPUT
C
00A50 CONTINUE
      IF(NAME.NE.MIDATA) GO TO 660
00A51 RFAC 1011,IED,NCOMMON,NCELL,VALUE,MESSAGE
      IF(IED.FQ.(FOD)) GO TO 500
      GO TO(ASZ,AS3) NCOMMON
00A52 DATI(I(NCELL))=VALUE
      PRINT 1011,IFD,NCOMMON,NCELL,VALUE,MESSAGE
      GO TO 651
00A53 DATA(NCELL)=VALUE
      PRINT 1011,IFD,NCOMMON,NCELL,VALUE,MESSAGE
01011 FORMAT(A1,I1.5X,I3.A10.15A4)
      GO TO 651
00A60 CONTINUE
      IF(NAME.NE.IIDATA) GO TO 700
C
C      USER REQUESTING DATA
C
      CALL TAPND(1,YJ,NG)
      GO TO 500
C
C.....
C
C
00700 IF(NAME.NE.IOPRN) GO TO 950
      RFAC 700,I1READ,I2RFAC,ISCALE
00704 FORMAT(J1Y,I1)
      IF(I1READ.NE.0) READ 703,(IPL0T(I),I=1,14)
      IF(I2READ.NE.0) READ 703,(IPNT(I),I=1,11)
00703 FORMAT(H110)
00701 CONTINUE
      TIME=0.0
      I=0
      PRINT 2010
      ITUMC=1
      ITUMF=0
      ITUMG=1
      J1=J2=10
      J1=1
00704 CONTINUE
      CALL SETUP
      IF(I1MOR.FU.0) GO TO 800
      J1=J1+1
      IF(J1.GT.J3) GO TO 8000
      IF(J1.GT.J2.AND.IURAN.EQ.1) GO TO 8000

```

```

GO TO 7999
00000 CONTINUE
00000 CONTINUE
      PRINT 3000,J1
03000 FORMAT(10X,25H TRIM TERMINATED AFTER          .I3, 11H ITERATIONS)
      N1=0
      IZERO=0
      IF(INZ.FO.1) IZERO=1
      IF(IZERO.EQ.1) CALL PRINTO
      IZERO=0
      IF(IUPLDT.FO.1) CALL DATSAV
      PLSTKM=2.54*RLONSTK
      RLSTKM=2.54*RLATSTK
      TMET=TOTRM*4.44E
      CALL MICMFI(ITIT,STAR,AIL,RUD,RLNSTKM,RLTSTKM,THROT,RN1,TMET,
1  TMTN,NUDAT,U)
      PRINT 2007,RTIME
      RTIME1=0.
      ICODE=1
00010 CONTINUE
      IF(TIME-RTIME1) 031,032,032
00032 IF(ITMIS.EQ.1) CALL TIMEHIS(TIME)
      N1=N1+1
      DTIM=DTIM*2
      IF(TIME.LT.T1.AND.NCHK.GT.0.AND.FREQCK.EQ.0) DTIM=DTIM1
      IF(NCHK.GT.0.AND.FREQCK.GT.0) DTIM=.25/FREQCK
      RTIME1=DTIM*N1
      IF(TIME.GE.T1.AND.NCHK.GT.0.AND.FREQCK.EQ.0) RTIME1=DTIM*N1-
1  /DTIM*DTIM*T1
00031 CONTINUE
      CALL LOOP2
      CALL LOOP3
      IF(IUPLDT.FO.1) CALL DATSAV
      CALL LOOP2
      CALL LOOP3
      IF(IUPLDT.EQ.1) CALL DATSAV
      IF(TIME.GE.RTIME) GO TO 050
      IF(ITD.EQ.1.AND.JLAND.EQ.1) GO TO 050
      IF(ICRASH.EQ.1) GO TO 050
      GO TO 010
C CHECK FOR PRINT REQUEST
00050 IF(ITMIS.FO.1) CALL TIMEHIS(TIME)
      PRINT 051,JLAND,ITD,ICRASH
00051 FORMAT(10X,MMJLAND= .I2,5MITD= .I2,0MICRASH= .I2)
C
C PRINT REQUESTED
      IF(NCHK.GT.0.OR.ISTAT.EQ.0) GO TO 702
      CALL PRINTO
00702 CONTINUE
      IF(IUPLDT.FO.1) CALL DPLOT
      N2=N2+1
      IF(N2=NNLM) 701,701,501
C READ END.....COMMAND NOT RECOGNIZED
00990 PRINT 2000,NAME
      STOP 0

```

C POINT FORMAT STATEMENTS

C

C

01000 FORMAT(1X,A6,5X,09.0)

C

01010 FORMAT(A1,11,5X,I3,G10.0,15A4)

01020 FORMAT(A1,A3,19A4)

C

C

02006 FORMAT(1M1,///,20X,30(1M°),/,20X,1M°,20X,1M°,/,20X,1M°,10X  
1,11MINPUT DATA ,8X,1M°,/,20X,1M°,20X,1M°,/,20X,30(1M°))

C

02007 FORMAT(1M1,///,20X,30(1M°),/,20X,1M°,20X,1M°,/,20X,1M°,10X,  
1 AMOPENATE ,11X,1M°,/,20X,1M°,7X,10MIN TIME ,F7.2,5X,1M°,/  
2,20X,1M°,20X,1M°,/,20X,30(1M°))

C

02010 FORMAT(1M1,///,20X,30(1M°),/,20X,1M°,20X,1M°,/,20X,1M°,10X  
1,10MTRIM MONE ,4X,1M°,/,20X,1M°,20X,1M°,/,20X,30(1M°))

C

02050 FORMAT(1M,/,10X,35MUNIVEM CONTROL CARD ERROR ..... \*A4)

02060 FORMAT(1X,A1,A3,19A4)

C

C

END

.....

SUBROUTINE SETUP

COMMON/XFLOAT/A(500)/FIXED/IA(200)

COMMON/CHF/R(200)/ICHF/IR(50)

EQUIVALENCE (A(25),ALFA), (VUIC,A(229)), (PHIIC,A(230)), (THETIC,

1 A(231)), (PSIIC,A(232)), (MIC,A(241))

EQUIVALENCE (IA(65),ID), (IA(111),KTRIM), (IA(102),ITRIM),

1 (ITPMP,IA(103)), (ICPMT,IA(124)), (ITRMCN,IA(111)), (ITPROG,IA(23))

EQUIVALENCE (IYUFT,IA(110))

EQUIVALENCE (A(110),CONUSE)

EQUIVALENCE (STMETR,A(114)), (CTMETR,A(115))

EQUIVALENCE (VUB,A(76)), (VEW,A(77)), (VDW,A(78))

EQUIVALENCE (PZU,A(354)), (METAIC,H(37))

EQUIVALENCE (STAR,H(1)), (THSTAR,H(4)), (HLNSTKO,B(8))

1 (MLTSTRG,H(10)), (RPRD0,H(21)), (THHOTIC,B(15)), (RLONSTR,B(7))

EQUIVALENCE (MLATSTR,H(9)), (MUNPEU,A(11)), (THHOT,H(14)),

1 (THNIC,H(14)), (THTNC,B(16)), (NNI,H(19)), ( THTN,H(17))

EQUIVALENCE (THWTM,H(22)), (THWTX,H(23)), (THTMN,H(24)),

1 (THTMX,H(24)), (PHIMN,H(26)), (PHIMX,H(27)), (PEDMN,H(28)),

2 (PEDMX,H(29)), (THTMN,H(33)), (THTMX,H(34))

EQUIVALENCE (VSA,H(30)), (VNDIC,H(35)), (VEWIC,H(36))

EQUIVALENCE (METAIC,H(37)), (STRMIN,H(38)), (STKMAX,B(39)),

1 (RLSMIN,H(40)), (PLSMAX,H(41))

EQUIVALENCE (ITPROG,IA(23)), (ITM,A(105)), (FN,A(106)), (FE,A(109))

EQUIVALENCE (FU,A(150)), (WAIT,A(177)), (CL,A(131)), (SPSI,A(14))

EQUIVALENCE (CPSI,A(115)), (MHO,A(103)), (CHORD,A(102)), (AREA,A(100))

```

EQUIVALENCE (ORAR,A(178)),(VRW,A(70))
EQUIVALENCE (VN,A(64)),(VE,A(65))
EQUIVALENCE (VEVIC,A(234))
EQUIVALENCE (J1,IA(118))
EQUIVALENCE (IH(19),IHIT)
EQUIVALENCE (H(80),RLAM1),(RLAM2,H(81))
DATA THRTMN/0.,THRTMX/102.,THTMN/-20.,THTMX/30./
DATA PHIMN/-4.,PHIMX/5.,PEDMN/-2.,PEDMX/2./
DATA THTMN/0.,THTMX/98.,STKMN/-7.5,STKMX/4.,RLSMN/-4./
DATA RLSMX/4./
IHIT=U
CTHETR =COS(COURSE)
STHETR=SIN(COURSE)
VW=-VS*CTHETR+VNW*IC
VW=-VS*STHETR+VW*IC
VNT=VNW
VET=VEW
IF (VNT) 1011,1012,1011
01011 CONTINUE
PSIWD=ATAN2(VET,VNT)*R2D
GO TO 1013
01012 PSIWD=90.*SIGN(1.,VET)
IF (VET.EQ.0.) PSIWD=0.
01013 CONTINUE
PSIIC=PSIWD-BETAIC
CALL MSETUP
CALL L00M2
CALL L00M3
CALL L00M2
IF (J1.EQ.2) GO TO 1014
CALL MSETUP
CALL L00M2
CALL L00M3
CALL L00M2
1014 CONTINUE
GO TO (1001,1010,1020,1030) ,INDEXT
01001 CONTINUE
IHIT=I
CALL MUIIFT(2,THETIC,THTMN,THTMX,HIC,0.,100.,
10.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.)
H1STK(0)=0.
WPEDO=U.
THROTIC=THROTIC
PHIIC=RLAM2*47.3
PRINT 200,THETIC,PHIIC,HIC
200 FORMAT(4X,ANTHETIC= ,F8.2,6MPHIIC= ,F8.2,6MHIC= ,F8.2 )
GO TO 500
01010 CONTINUE
CALL MUIIFT(4,RLNSTKO,STKMN,STKMX,THROTIC,THRTMN,THRTMX,
1,RLTSTK(1),RLSMN,RLSMX,THETIC,THTMN,THTMX,RPEDO,PEDMN,PEDMX,
2,PHIIC,PHIIN,PHIMX)
PRINT 201,THROTIC,RLNSTKO,RLTSTAU,PHIIC,WPEDO,THETIC,PSIIC
00201 FORMAT(7X,ANTHROTIC= ,F8.3,6MRLNB= ,F8.3,6MRLAT= ,F8.3,6MPHIIB
1 ,F8.2,6MPHIB= ,F8.2,6MTHETIB= ,F8.2,6MPSIB= ,F8.2)
GO TO 500

```

```

01020 CALL BUJLET(A,RLNSTKO,STKMIN,STAMAX,THROTIC,THRTMN,THRTMX,
1PLTSTKO,PLSMIN,PLSMAX,THTNIC,THTNMN,THTNMX,RPEDO,PEOMN,PEOMX,
2PHIIC,PHIMN,PHIMX)
ENI=THROTIC
THTN=THTNIC
POINT 202,RLNSTKO,THROTIC,PLTSTKO,THTNIC,RPEDO,PHIIC
00202 FORMAT(10X, 4HRLNSTKO ,F10.5,4HTHROTIC ,F10.5,4HPLTSTKO
1,F10.5, 4HTHTNIC ,F10.5, 4HRPEDO ,F10.5,4HPHIIC ,F10.5)
GO TO 500
01030 VSC=VEVIC**2
CALL BUJLET(A,RLNSTKO,STKMIN,STAMAX,VSQ,2500.,160000.,
1PLTSTKO,PLSMIN,PLSMAX,THROTIC,THRTMN,THRTMX,RPEDO,PEOMN,PEOMX,
2HETAIC,.,.,.4.)
VFJIC=VSQNT(VSQ)
THROT=THROTIC
PHI=THROT
POINT 203,THROTIC,RLNSTKO,VEVIC,PLTSTKO,RPEDO,HETAIC
00203 FORMAT(5X,4HTHROTIC= ,F8.2,4HRLNSTKO= ,F8.2,4HVEVIC= ,F8.2,
1HPLTSTKO= ,F8.2,4HRPEDO= ,F8.2,4HHETAIC= ,F8.2)
00500 CONTINUE
RETURN
END

```

.....

SUBROUTINE RSETUP

```

C
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/R(200)/ICHF/IB(50)
C
DIMENSION XMC(10)
DIMENSION DXPA(15),DYPA(15),DZPA(15)
C
EQUIVALENCE (ALFA,A(25)),(BETA,A(26)),(ALFAR,A(27)),(BETAR,A(28))
EQUIVALENCE (ALFD,A(29)),(HETD,A(30)),(SALPH,A(31)),(CALPH,A(32))
EQUIVALENCE (HETA,A(33)),(CHETA,A(34))
EQUIVALENCE (ALFAIC,H(42))
EQUIVALENCE (PMI ,A(1 )),(THET ,A(2 )),(PSI ,A(3 )),
1 (PHI ,A(4 )),(THET ,A(5 )),(PSI ,A(6 )),
2 (T1 ,A(16 )),(T2 ,A(17 )),(T3 ,A(18 )),
3 (T12 ,A(19 )),(T22 ,A(20 )),(T32 ,A(21 )),
4 (T13 ,A(22 )),(T23 ,A(23 )),(T33 ,A(24 )),
5 (PH ,A(37 )),(OH ,A(38 )),(NH ,A(39 )),
6 (GAMV ,A(35 )),(GAMH ,A(36 ))
C
EQUIVALENCE (VN ,A(64 )),(VE ,A(65 )),(VD ,A(66 )),
1 (VFF ,A(67 )),(VT ,A(68 )),(VRV ,A(70 )),
2 (VMH ,A(72 )),(VFH ,A(73 )),(VDR ,A(74 )),
3 (VFJ ,A(75 )),(VNV ,A(76 )),(VEW ,A(77 )),
4 (VDW ,A(78 )),(ALT ,A(83 )),(LON ,A(84 )),
5 (LAT ,A(85 )),(CLAT ,A(87 )),IG ,A(87 ))
C
EQUIVALENCE (MPH,A(105)),(MH,A(106)),(MTV,A(109))

```

1 (COURSE,A(110)),(XLATR,A(111)),(XLONR,A(112)),  
 2 (CLATR ,A(113)),(STMETH,A(114)),(CTMETR,A(115)),  
 3 (XIXA ,A(116)),(XIYY ,A(117)),(XIZZ ,A(118)),  
 4 (XIXZ ,A(119)),(XMC(1),A(120)),(XMASS ,A(130)),  
 5 (DT1 ,A(167)),(DT2 ,A(168)),(DT3 ,A(169)),  
 6 (MP ,A(170)),(A(364),RMOZ)

C

EQUIVALENCE

1 (MCG ,A(176)),(WAIT ,A(177)),(MHO ,A(183)),  
 2 (SOUND ,A(209)),(PHIIC ,A(230)),(THETIC,A(231)),  
 3 (PSIIC ,A(232)),(GAMVIC,A(233)),(GAMMIC,A(234)),  
 4 (PSIC ,A(235)),(OBIC ,A(236)),(RNIC ,A(237)),  
 5 (VFOIC ,A(238)),(XIC ,A(239)),(YIC ,A(240))  
 EQUIVALENCE (XP,A(225)),(YP,A(226)),(ZP,A(227))

C

EQUIVALENCE (MIC ,A(241)),(WAITIC,A(242)),(XIXXIC,A(243)),

1 (XIYYIC,A(244)),(XIZZIC,A(245)),(XIXZIC,A(246))  
 EQUIVALENCE (A(358),R2R),(A(359),R2D)  
 EQUIVALENCE (A(0375),XMCC1 )  
 EQUIVALENCE (A(0376),XMCC2 )  
 EQUIVALENCE (A(0377),XMCC3 )  
 EQUIVALENCE (A(0378),XMCC4 )  
 EQUIVALENCE (A(0379),XMCC5 )  
 EQUIVALENCE (A(0380),XMCC6 )  
 EQUIVALENCE (A(0381),XMCC7 )  
 EQUIVALENCE (A(0382),EXMX )  
 EQUIVALENCE (A(0383),EXMY )  
 EQUIVALENCE (A(0384),FXM2 )  
 EQUIVALENCE (UBIC,A(406)),(VBIC,A(407)),(WBIC,A(408))

C

EQUIVALENCE (IFLAT,IA(6 )),(IDT1 ,IA(61 )),(IDT2 ,IA(62 )),

1 (IDT3 ,IA(63 )),(IC6 ,IA(64 ))  
 EQUIVALENCE (ID,IA(65))  
 EQUIVALENCE (IMACH,IA(114)),(XMACH,A(71))

C

EQUIVALENCE (A(10),SPHI),(A(11),CPHI)

1 (A(14),SPSI),(A(15),CPSI)  
 2 (A(12),STMT),(A(13),CTMT)  
 EQUIVALENCE (A(7),PHIU),(A(8),THEO),(A(9),PSID)  
 EQUIVALENCE (A(43),PLM),(A(44),ULH),(A(45),RLR)  
 EQUIVALENCE (IFULR,IA(184))  
 EQUIVALENCE (INDXT,IA(110))  
 EQUIVALENCE (DZPA(1),A(210)),(DZPA(1),A(257))  
 EQUIVALENCE (WAITO,A(251)),(WAITIC,A(246)),(WFUELIC,A(247))  
 EQUIVALENCE (ASTONE,A(252))  
 DATA OMEG/72005E-4,RE/2.0000E7/

C

C

C

C

C

C

C

C

C

SETUP INITIALIZES PILOT POSITION OR AIRCRAFT C.G. POSITION AS  
 DEFINED. INITIALIZES LONGITUDE,LATITUDE,VN,VE,VD,VEE,VNR,VER,VDR,  
 VD,WEIGHT,MASS,INERTIAS,PSIH,THETH,PHIH,PSI,THET,PHI,SINES AND  
 COSINES OF PSIR,THETR,PHIR,T11 THROUGH T33, AND LOOP CYCLE TIMES

```

C
C      IN MILLISECONDS
C
C      INPUTS  PSIIC,THETIC,PHIIC,GAMVIC,GAMHIC,XIC,YIC,MIC,PBIC,OBIC,
C              PHIC,VEQIC,WAITIC,XIXXIC,XIYYIC,XI7ZIC,XIXZIC,THETRR,
C              XLATH,XLONR,HR,T11 THROUGH T33,XP,YP,ZP,VNW,VEW,VDW,INT1,
C              INT2,INT3,ICG,IFLAT
C
C      OUTPUTS PSI,THFT,PHI,PSIR,THETR,PHIR,CLATR,STMETR,CTMETR,RH,HPR,
C              HCR,ALT,HTV,XLAT,XLON,CLAT,PB,QH,RB,VEQ,VT,SOUND,RHO,VN,
C              VE,VD,VEE,VNH,VER,VDR,VHW,WAIT,XMASS,XIXX,XIYY,XIXZ,
C              XMC(1) THROUGH XMC(10),DT1,DT2,DT3
C
C      ID=1
C
C*****INITIALIZE PSI,THET,PHI
C
C      PSI=PSIIC
C      THFT=THETIC
C      PHI=PHIIC
C      PSIR=PSI*0.02R
C      THFTR=THFT*0.02R
C      PHIR=PHI*0.02R
C
C*****INITIALIZE SINES AND COSINES OF PSIR,THETR,PHIR * TRANSFORMATIONS
C
C      CALL MTRANS
C
C***** INITIALIZE SINES AND COSINES OF THETR
C
C      STMETR= SIN(COURSE)
C      CTMETR= COS(COURSE)
C      CLATR= CUS(XLATR)
C
C*****INITIALIZE ALT,HPR,XLAT,XLON ([CG=1] MEANS INPUT POS. I.C.S AT C.G)
C
C      HCR=HCR
C      IF([CG] 10.10.20
00010 HCR=HIC
C      ALT=HPR*HR*713*XP*723*YP*733*ZP
C      HCR=ALT-HR
C      SIMA=711*XP*721*YP*731*ZP
C      SIMB=712*XP*722*YP*732*ZP
C      XDIR=711*CTMETR*SUMA-STMETR*SIMB
C      YDIR=712*CTMETR*SUMB-STMETR*SUMA
C      GO TO 30
00020 HCR=HIC

```

```

ALT=HCG*HR
WPD=HCG*-T13*XP-T23*YP-T33*ZP
XDUM=XIC
YDUM=YIC
00030 XLAT=(XDUM*CTHETR-YDUM*STHETR)/RH*XLATR
XLON=(ADUM*STHETR+YDUM*CTHETR)/(CLATH*RR)*XLONR
CLAT=COS(XLAT)
HTV=HE*ALT
C*****INITIALIZE PH,OR,RB
C
C IF IFIR=1, THE INITIAL RATES ARE INPUT AS EULER RATES.
C PHIC REPLACED BY PHIC, THED REPLACED BY QBIC, PSID REPLACED BY RBIC
C
C IF (IEULM .EQ. 0) GO TO 797
C
C ASSUMED FULEM RATE SETUP
PHID=PHIC*02R
THED=QHIC*02R
PSID=HHIC*02R
PR=PHIU-PSID*STHT*PLR
LR=THED*CPHI-PSID*SPHI*CTHT*OLR
LR=PSID*CPHI*CTHT-THED*SPHI*RLR
GO TO 798
C
00797 CONTINUE
C REGULAR INPUT
PHID=PHIC*02R
THED=QHIC*02R
LR=PSID*CPHI*02R
708 CONTINUE
C
C INITIALIZE R407
C
C CALL WATMOS
C
C*****INITIALIZE VELOCITIES FROM EQUIVALENT AIRSPEED IN KNOTS
C*****VELOCITY INITIALIZATION*****
C
C IF IMACH=1, THE INPUT VELOCITY VEQIC IS IN MACH NUMBERS
C
C IF IMACH=-1, THE VELOCITY IS INITIALIZED IN BODY AXES
C
C IF THE AIRCRAFT IS ON THE GROUND, VEQIC IS THE GROUND (TAXI) VELOCITY
C
C IF THE AIRCRAFT IS AIRBORNE, VEQIC IS THE EQUIVALENT VELOCITY (WITH
C RESPECT TO THE AIR MASS).
C
C GAMVIC AND GAMMIC ARE THE INERTIAL VELOCITY VECTOR DIRECTIONAL ANGLES
C AND, AS SUCH, IGNORE VARIATIONS IN THE WIND MAGNITUDE AND DIRECTION.
C
STORE=0.59264*SQRT(RHO/RHOZ)
IF (IMACH) 51,53,53
53 DUM=VEQIC*(SOUND*IMACH*(1-IMACH)/STORE)
C
C*****INITIALIZE SINES AND COSINES OF GAMV AND GAMH

```

```

C
  GAMV=GAMVIC*02R
  SGV=SIN(GAMV)
  CRV=COS(GAMV)
  GAMH=GAMHIC*02R
  SGH=SIN(GAMH)
  CGH=COS(GAMH)
  CH=2.*(V1)*SGV-VEW*CGV*SGH-VNH*CGV*CGH
  CC=VNH**2+VFW**2+VDW**2-DUM**2
  AA=Cd**2-4.*CC
  IF(AA)42.44.44
42  VT=-.5*CH
    GO TO 50
44  VT=.5*(-CH*SQRT(AA))
50  VNV=VT*CRV*CGH
    VFF=VT*CGV*SGH
    VNB=VT*SGV
    VNH=VN-VNB
    VEW=VEE-VFW
    VDW=VU-VUW
    GO TO 52
00051 V1=T11*HIC*T21*VHIC*T31*WBIC
      V2=T12*UHIC*T22*VHIC*T32*WHIC
      V3=T13*UHIC*T23*VHIC*T33*WBIC
C
  VNV=VNH*VNB
  VFF=VEW*VEW
  VNB=VDW*VDW
C
  VEQIC=STORE*SQRT(VNR**2+VER**2+VOR**2)
C
  PAD=VN**2+VFF**2
  VT=SQRT(PAD*VU**2)
  V3=SQRT(PAD)
C
  GAMVIC=0.0
  GAMHIC=0.0
  IF(VT.EQ.0.) GO TO 52
  GAMVIC=ATAN2(-VD.VG)*R2D
  IF(PAD.FQ.0.) GO TO 52
  GAMHIC=ATAN2(VFF.VN)*H2D
  SGV=SIN(GAMVIC*02R)
  CRV=COS(GAMVIC*02R)
  SGH=SIN(GAMHIC*02R)
  CGH=COS(GAMHIC*02R)
C
052  CONTINUE
      V1=SQRT(VFR**2+VNR**2)
      IF(V1.EQ.0..OR.INDEX.LT.3) GO TO 54
      GAMJDE=ATAN2(VLH.V1)*57.3
      TWFTIC=ALFATC+GAMJDE
054  CONTINUE
      IF(IFLAT) 40.00.55
55  VE=VFE
    GO TO 65

```



```

SUBROUTINE ROUIET(NCONT,C1,CMIN1,CMAX1,C2,CMIN2,CMAX2
1.          C3,CMIN3,CMAX3,C4,CMIN4,CMAX4
2.          C5,CMIN5,CMAX5,C6,CMIN6,CMAX6)
C
C R. MCFARLAND -CSC- OCT. 19, 1972
C MODIFIED FEB 21, 1973 BY R.E. MCFARLAND
C TO (A) ESTABLISH ONE PERCENT OF RANGE AS THE PARTIAL EVAL. SIZE
C AND (R) TO MAKE THE LINEAR TRIM QUANTITIES EQUAL TO
C UHD, VRD, AND WRD RATHER THAN VND, VED, AND VDD WHICH DO NOT
C PERMIT TURNS. IMPLEMENTED FOR 360 JUNE, 73 BY F. WATSON, CSC
C
C COMMON/XFLOAT/A(500)/FIXED/IA(200)
C COMMON/CHF/H(200)/ICF/IF(50)
C
C A BASIC ROUTINE FOR NULLING THE ANGULAR AND LINEAR ACCELERATION VECTOR
C BY MANIPULATION OF THE NCONT C'S (SIX IS MAXIMUM).
C
C ITPROG WILL AUTOMATICALLY RESET IF -
C ANG.ACCEL. LESS THAN .0005 RAD/SEC2
C LIN.ACCEL. LESS THAN .01 FT/SEC2
C
C ITRMCM IS THE CONTROL SWITCH FOR THIS ROUTINE
C
C ON-THE-GROUND TRIM IS AUTOMATIC IF IMIT=1. THE CALLING SEQUENCE, IN
C THIS INSTANCE IS IGNORED
C
C DIMENSION STATE(6)
C DIMENSION MDECK(5)
C DIMENSION YZ(6),H(6,6),DX(6),V(6),MTH(6,6),W(6),LM(6),MM(6)
C DIMENSION DQC(6),DQC1(6),DQZ(6),WZ(6),QC(6)
C DIMENSION CK(6),CMIN(6)
C DIMENSION CONT(6)
C EQUIVALENCE (A(397),CONT(1))
C EQUIVALENCE (A(413),UHD),(A(414),VRD),(A(415),WRD)
C EQUIVALENCE (ITHAD,IA(166)),(IA(167),IM)
C EQUIVALENCE (IA(174),IREVAL)
C
C THE ACCEPTANCE CRITERIA ORDER IS -
C QHD,UHD,RHD,UHD,RHU,VHD
C AND ONLY THE FIRST TWO ARE USED FOR GROUND TRIM.
C
C
C
C THE ORDER FOR STATE IS -
C QHD,UHD,RHU,UHD,VHD,WHD
C
C
C EQUIVALENCE (IA(21),IEVAL)
C EQUIVALENCE (IGHAD,IH(31))
C EQUIVALENCE (ITRMCM,IA(111)),(ITHMP,IA(103)),(ITRIM,IA(102))
1.(PDU,A(55)),(QHD,A(56)),(RHD,A(57)),(VND,A(88)),(VED,A(89))
2.(VDD,A(90)),(ITPROG,IA(23)),(GAMVIC,A(233)),(PHIC,A(230))
3.(MIC,A(241)),(IMIT,IH(14)),(THETIC,A(231)),(XNG,A(184))
4.((RGT,IA(110)),(RGT,IA(111))

```

```

C
EQUIVALENCE (STATE(1),A(391))
EQUIVALENCE (RLAM2,B(81)),(RLAM1,B(80))
EQUIVALENCE (HUECK(1),A(272))
EQUIVALENCE (XRG,A(145)),(ZHG,A(258)),(ICG,IA(64))
EQUIVALENCE (ZP,A(227)),(XP,A(225)),(STMT,A(12)),(CTMT,A(13))
EQUIVALENCE (ZNG,A(257)),(R2D,A(359)),(THETR,A(5))
EQUIVALENCE (IA(110),INDEXT)

C
DATA GAIN/1./,NHALF/10/
DATA INEW/0/
DATA HSCALE1/1./,HSCALE2/1./
DATA DQZ/0.0005,0.01,0.0005,0.01,0.0005,0.01/
DATA XIJK/.4/

C
DATA DUC1/6*.01/
D1 = UHU
D2 = VBU
D3 = WBU
IF (ITMMP) 10,10,60
00010 IF (ITMMP) 50,50,20
00020 IF (IM) 160,160,30
00030 CONTINUE
ITMMP=0
00040 STATE(1)=PRD
STATE(2)=UHD
STATE(3)=PRD
STATE(4) = D1
STATE(5) = D2
STATE(6) = D3
IF (IMIT) 41,41,48
00041 GO TO (47,44,45,44,43,42),N
00042 CONT(6)=C6
00043 CONT(5)=C5
00044 CONT(4)=C4
00045 CONT(3)=C3
00046 CONT(2)=C2
00047 CONT(1)=C1
00048 CONTINUE
00050 CONTINUE
IF (INEVAL.EQ.0) INEW=0
RETURN

C
00060 CONTINUE
IF (ITMMP) 70,70,63
00063 IF (IMIT-IMITP) 70,160,70
C
00070 DO 72 I=1,6
W(I)=DQZ(I)/DQZ(I)
00072 CONTINUE
GAIN=1.
TSPAU=0
TSTFP=0

C
IF (IMIT) 120,120,80

```

C GROUND TRIM SETUP

```

00080 GAMVIC=0.
      PH1IC=BLAN2*HR2D
      INITP=1
      N=2
      M=2
      ZX=SQRT((ZNG-ZRG)**2+(XNG-XRG)**2)
      THETA=ATAN2((ZNG-ZRG),ZX)*RLAM1
      THFTIC=RPD*THETP
      STMT=SIN(THFTP)
      CTMT=COS(THFTP)
      IF(ICG) H2=H2.84
00082 HICMAX=(ZNG-ZP1)*CTMT*(XP-XRG)*STMT*HDECK(1)+1.
      CMIN(2)=HICMAX-3.
      GO TO 96
00084 HICMAX=ZNG*CTMT-XRG*STMT*HDECK(1)+1.
      CMIN(2)=HICMAX-3.
00086 CM(2)=HICMAX-CMIN(2)
      Z1=7NG-7HG+1.
      TMTMAX=TAN2(Z1, SQRT(Z1**2*(XNG-XRG)**2))*R2D *RLAM1*R2D
      Z2=7NG-7HG-1.
      CMIN(1)=ATAN2(Z2, SQRT(Z2**2*(XNG-XRG)**2))*R2D *RLAM1*R2D
      CK(1)=T-TMAX-CMIN(1)
      DDC(1)=.01
      DDC(2)=.01
      GO TO 140

```

C NORMAL TRIM SETUP

```

00120 HENCONT
      P=4
      I=ITP=0
      DO 130 I=1,4
00130 DDC(I)=DDC(I)
00132 GO TO (131,137,136,135,134,133),M
00133 CK(4)=CMAX6-CMIN6
      CMIN(6)=CMIN6
00134 CK(5)=CMAX5-CMIN5
      CMIN(5)=CMIN5
00135 CK(4)=CMAX4-CMIN4
      CMIN(4)=CMIN4
00136 CK(3)=CMAX3-CMIN3
      CMIN(3)=CMIN3
00137 CK(2)=CMAX2-CMIN2
      CMIN(2)=CMIN2
00138 CK(1)=CMAX1-CMIN1
      CMIN(1)=CMIN1
00140 ITDPP=1
      IEVAL=0
      JJ=0

```

C ESTABLISH STATE VECTOR

```

00160 GO TO (166,165,164,163,162,161),M
00161 G7(6) = 02
00162 G7(5) = HHD
00163 G7(4) = 01
00164 G7(3) = PHU
00165 G7(2) = 03

```

```

00100 Q7(1)=QHD
      PRINT 507,(QZ(I),I=1,6)
00502 FORMAT(10X,7H07(1)= ,6G13.5)
C ACCEPTANCE
C
      ITPROG=1
      DO 204 I=1,6
      IF (ABS(QZ(I))-DQZ(I)) 204,204,206
00204 CONTINUE
      ITPROG=0
00206 CONTINUE
      IF (ITPROG.EQ.0) RETURN
00180 GO TO (181,185,184,183,182,181),N
00181 CC(6)=(C6-CMIN(6))/CK(6)
00182 CC(5)=(C5-CMIN(5))/CK(5)
00183 CC(4)=(C4-CMIN(4))/CK(4)
00184 CC(3)=(C3-CMIN(3))/CK(3)
00185 CC(2)=(C2-CMIN(2))/CK(2)
00186 CC(1)=(C1-CMIN(1))/CK(1)
00190 IF (JJ) 200,200,220
00200 IF (IGHAD.EQ.1.AND.ISTEP.LE.25) GO TO 201
      DO 210 I=1,6
00210 Y7(I)=Q7(I)
      ERSOP=0.
      DO 215 I=1,6
00215 ERSOP=ERSOP+(YZ(I)*W(I))**2
      GO TO 203
00201 ERSO=0.
      DO 202 J=1,6
00202 ERSO=ERSO+(QZ(J)*W(J))**2
      ERSOP1=.4*ERSOP
      IF (ERSO.GT.ERSOP1) IGHAD=0
      IF (IGHAD.EQ.0) ISTEP=0
      PRINT 515, ERSO,ERSOP
00515 FORMAT(10X,6HERSO= ,613.5,10H ERSOP= ,613.5)
      IF (IGHAD.EQ.0) GO TO 200
      ERSOP=ERSO
      GO TO 337
00203 CONTINUE
      IF (IMIT) 209,209,217
00209 GO TO (216,215,214,213,212,211),N
00211 CONT(6)=C6
00212 CONT(5)=C5
00213 CONT(4)=C4
00214 CONT(3)=C3
00215 CONT(2)=C2
00216 CONT(1)=C1
00217 CONTINUE
      STATE(1)=PHD
      STATE(2)=QHD
      STATE(3)=WHH
      STATE(4)= 01
      STATE(5)= 02
      STATE(6)= 03
C

```

```

      JJ=1
C
C      IFVAL=1
C
      GO TO 310
00220 DO 230 I=1,M
00230 H(I,JJ)=(OZ(I)-YZ(I))/DRC(JJ)
C
      GC(JJ)=GC(JJ)-DRC(JJ)
C
      IF(INEW) 240,240,290
00240 IFVAL = 0
C
00290 CONTINUE
C
      IF(JJ=N) 300,320,320
C
00300 JJ=JJ+1
      IFVAL=0
C
00310 OC(JJ)=OC(JJ)+DRC(JJ)
      IM=0
C
      GO TO 390
C
00320 CONTINUE
      UJ=0
      INFW=1
      IFVAL=0
      IM=1
      DO 330 L=1,N
      DO 330 J=1,M
      HTH(L,J)=0.
      DO 330 I=1,M
00330 HTH(L,J)=HTH(L,J)+H(I,L)*H(I,J)*W(I)
C
      POINT 503,((H(I,J),I=1,6),J=1,6)
00503 FORMAT(10X,8HH(I,J)= ,/0.6(6013.5,/))
      CALL MINV(HTH,M,DET,LM,MM)
      IGRAD=1
      GAJH=1.
      IF(INDEXT.EQ.1) GAIN=.5
C
00337 CONTINUE
      IF(ISTEP.GT.0) GO TO 336
      GO TO 336
00338 DO 339 J=1,6
00339 Y7(J)=O7(J)
00339 CONTINUE
      DO 340 I=1,M
      V(I)=0.
      DO 340 J=1,M
00340 V(I)=V(I)-H(J,I)*OYZ(J)*W(J)
C

```

```

00350  DO 350 I=1,N
      DX(I)=0.
00350  DO 350 J=1,N
      DX(I)=DX(I)+MTH(I,J)*V(J)
      ISTEP=ISTEP+1
      IF (ISTEP.EF.25) IGRAD=0
      IF (IGHAD.FF.0) ISTEP=0
      IF (INDEXT.EQ.1) GO TO 351
      GO TO 352
00351  CONTINUE
      DET=M(1,1)*M(2,2)-M(2,1)*M(1,2)
      DX(2)=(1.*YZ(1)*M(1,2)-YZ(2)*M(1,1))/(DET*1.)
      DX(1)=(-YZ(1)*M(2,2)+1.*YZ(2)*M(2,1))/(DET*1.)
      POINT 353,DX(1),DX(2),Y7(1),YZ(2)
00353  FORMAT(1X,7MDX(1)= ,F10.5,7MDX(2)= ,F10.5,7MYZ(1)= ,F10.5,
      1 7MYZ(2)= ,F10.5)
00352  CONTINUE
C
C
C Y IJK PERCENT MAXIMUM EXCURSION
C
      RSCALE1=1.
      RSCALE2=1.
      XIJK=.4
      IF (INDEXT.EQ.1) XIJK=.2
00360  DO 370 I=1,N
      XX=DX(I)
      IF (XX-XIJK) 363,363,362
00362  RSCALE1=XIJK/XX
      GO TO 364
00363  IF (XX+XIJK) 364,369,369
00364  RSCALE1=-XIJK/XX
00364  CONTINUE
      IF (RSCALE1.LT.RSCALE2) RSCALE2=RSCALE1
00370  CONTINUE
      IF (IGHAD.EQ.1) GAIN=GAIN*.97
      DO 371 I=1,N
00371  OC(I)=UC(I)+DX(I)*GAIN*RSCALE2
C
00390  DO 395 I=1,N
      XY=OC(I)
      IF (XY) 392,392,393
00392  OC(I)=0.05
      GO TO 395
00393  IF (XY-1.0) 395,394,394
00394  UC(I)=0.45
00395  CONTINUE
      IF (IMIT) 396,400,396
00396  TIC=OC(2)*OC(2)+CMIN(2)
      TWFTIC=OC(1)*OC(1)+CMIN(1)
      POINT 397,OC(1),OC(2)
00397  FORMAT(1X,7MOC(1)= ,F10.5,1X,7MOC(2)= ,F10.5)
      GO TO 407
00400  CONTINUE
      GO TO (406,405,404,403,402,401),N

```

```

00401 C6=NC(6)*CK(6)*CMIN(6)
00402 C5=NC(5)*CK(5)*CMIN(5)
00403 C4=NC(4)*CK(4)*CMIN(4)
00404 C3=NC(3)*CK(3)*CMIN(3)
00405 C2=NC(2)*CK(2)*CMIN(2)
00406 C1=NC(1)*CK(1)*CMIN(1)
00407 CONTINUE
      RETURN
      END
  
```

.....

SUBROUTINE LOOP2

```

C
C MODIFIED BY P.E. MCFARLAND JAN.14.1974
C .....
C * LOOP2 IS A COMBINATION OF FSAA BASIC SLOOP1 AND SLOOP2
C *
C * LOOP2 CALLS THE FOLLOWING SUBROUTINES---
C * NOTE: SUBROUTINES IN PARENTHESES HAVE BEEN CODED IN-LINE
C *
C *   CONTM2
C *   AFRU2
C *   WINUC
C *   (HTOUQUF)
C *   HROTATE
C *   (HFTOTAL)
C *   RTRANSFO
C *   (HVERTICA)
C *   (HMOUZION)
C *   HVELOCIT
C *
C *   (HACCELERATION)
C .....
C *
C * IF NIUSEU=1, THIS LOOP USES DT1 AS THE FRAME TIME
C *           2           DT2
C *
C .....
C * AUTHOR: D. JONES -CSC- APRIL 1973
C .....
C
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/4(200)/ICHF/IB(50)
DIMENSION DXPA(15),DYPA(15),DZPA(15)
DIMENSION ITOUCH(5),VDKN(7),VDKE(7)
EQUIVALENCE (VW,A(454))
EQUIVALENCE (ITOUCH(1),IA(10)),(IHRK,IB(29)),(VDKN(1),A(433))
EQUIVALENCE (F6X,A(455))
EQUIVALENCE (VDKE(1),A(440))
C
C
EQUIVALENCE (CPHI ,A(011)),(STHT ,A(012)),(CTHT ,A(013))
  
```

C  
 EQUIVALENCE (T11 ,A(16 )) ,  
 000001 (T21 ,A(17 )) , (T31 ,A(18 )) , (T12 ,A(19 )) ,  
 000002 (T22 ,A(20 )) , (T32 ,A(21 )) , (T13 ,A(22 )) ,  
 000003 (T23 ,A(23 )) , (T33 ,A(24 ))

C  
 EQUIVALENCE (PH ,A(37 )) ,  
 000002 (QH ,A(38 )) , (RH ,A(39 )) , (PHD ,A(55 )) ,  
 000003 (QHD ,A(56 )) , (RHD ,A(57 )) ,  
 000004 (VN ,A(64 )) , (VF ,A(65 )) , (VD ,A(66 )) ,  
 000005 (VEE ,A(67 ))  
 EQUIVALENCE (DXPA(1) ,A(184 )) , (DYPA(1) ,A(210 )) , (DZPA(1) ,A(257 ))  
 EQUIVALENCE (SPS) ,A(14 )) , (CPS) ,A(15 ))  
 EQUIVALENCE (XP ,A(225 )) , (YP ,A(226 )) , (ZP ,A(227 ))  
 EQUIVALENCE (IGEAR ,IA(104 ))  
 EQUIVALENCE (WAIT ,A(177 ))  
 EQUIVALENCE (ISTAT ,IR(42 ))  
 EQUIVALENCE (INCHK ,IB(22 ))

C  
 EQUIVALENCE (ALTD ,A( 80 )) , (ALT ,A( 83 )) , (SLAT ,A( 86 )) ,  
 000002 (CLAT ,A( 87 )) , (VNU ,A( 88 )) ,  
 000003 (VED ,A(89 )) , (VOD ,A(90 )) , (AX ,A(91 )) ,  
 000004 (AY ,A(92 )) , (AZ ,A(93 )) , (AXP ,A(94 )) ,  
 000005 (AYP ,A(95 )) , (AZP ,A(96 )) , (B ,A( 97 )) ,  
 000006 (RTV ,A(104 )) , (XMASS ,A(130 ))

C  
 EQUIVALENCE (FAY ,A(136 )) , (FAY ,A(137 )) , (FAZ ,A(138 )) ,  
 000001 (FEX ,A(139 )) , (FEY ,A(140 )) , (FEZ ,A(141 )) ,  
 000002 (FGX ,A(142 )) , (FGY ,A(143 )) , (FGZ ,A(144 )) ,  
 000003 (FTX ,A(145 )) , (FTY ,A(146 )) , (FTZ ,A(147 ))

C  
 EQUIVALENCE (FN ,A(148 )) , (FE ,A(149 )) , (FD ,A(150 )) ,  
 000001 (FG ,A(151 ))

C  
 EQUIVALENCE (TAL ,A(155 )) , (TAM ,A(156 )) , (TAN ,A(157 )) ,  
 000001 (TEL ,A(158 )) , (TEM ,A(159 )) , (TEN ,A(160 )) ,  
 000002 (TGL ,A(161 )) , (TGM ,A(162 )) , (TGN ,A(163 )) ,  
 000003 (TTL ,A(164 )) , (TTM ,A(165 )) , (TTN ,A(166 ))

C  
 EQUIVALENCE (DT1 ,A(167 )) , (DT2 ,A(168 ))

C  
 EQUIVALENCE (MR ,A(170 )) ,  
 EQUIVALENCE (MCR ,A(176 )) , (IMODE ,IA(1 )) , (IFLAT ,IA(6 )) , (IFFCI ,IA(7 ))  
 EQUIVALENCE (ITRIM ,IA(102 )) , (NRUN ,IA(105 )) , (NUSED ,IA(180 ))  
 EQUIVALENCE (VX ,A(200 )) , (VY ,A(201 ))  
 EQUIVALENCE (WFHFL ,A(244 )) , (WJAT ,A(250 )) ,  
 000001 WAITG ,A(251 )) , (WSTONE ,A(252 ))

C  
 C  
 C  
 DATA RATE/16.1/  
 DATA TS/0.0/UMFR/.72685E-4/

C  
 C  
 DT1=DT2





00020 IF (IMODE) 30.90.40

C

00030 VDDP=VDD

VDP=VD

DELTH=0.5\*DTI

GOTO 40

C

00040 IF (IFFCI) 50.50.90

0050 VDP=VD + DELTH\*(3.0\*VDD-VDDP)

VDDP=VDD

ALT=ALT - DELTH\*(VD-VDP)

VDP=VD

90 ALTQ=-VD

PCQ=ALT-MR

C

C

C

C

.....

• THE FOLLOWING IS EQUIVALENT TO -BHORIZON- IN-LINE CODED

.....

C

C

C

C

C

C

C

C

C

• THIS PORTION CALCULATES FN,FE,VND,VED,INTEGRATES TO GET VN,VE.

• CALCULATES VEE

.....

• INPUTS- T11,T21,T31,T12,T22,T32,FTX,FTY,FTZ,XMASS,RTV,SLAT,CLAT,

• IMODE,IFLAT,IFFCI

.....

• OUTPUTS- FN,FE,VND,VED,VN,VE,VEE

.....

FN=T11\*FTX+T21\*FTY+T31\*FTZ

FE=T12\*FTX+T22\*FTY+T32\*FTZ

TEMP=1./XMASS

IF (IFLAT) 200.100.200

C

C.....ROTATING PART

C

100 TLAT=SLAT/CLAT

TEMP1=1./RTV

VND=FN\*TEMP+(VN\*VD-VE\*\*2\*TLAT)\*TEMP1

VED=FE\*TEMP+(VE\*VD+VN\*VE\*TLAT)\*TEMP1

GOTO 300

C

C.....FLAT EARTH

C

200 VND=FN\*TEMP

VED=FE\*TEMP

300 IF (IMODE) 400.700.500

00400 VNDP=VND

VDP=VD

GOTO 700

500 IF (IFFCI) 600.600.700

00400 VDP=VD + DELTH\*(3.0\*VND-VNDP)

VNDP=VND

VE=VF + DELTH\*(3.0\*VED-VEDP)

```

VEDP=VED
VEF=VE
700  FTX1=FLX*FAX-WAIT*STMT
    IF (ABS (FTX1).GT.ABS (FGXM)) GO TO 702
    IF (IRAK.EQ.1.AND.ITOUCH(2).EQ.1.AND.ABS (VR).LT.2.) GO TO 701
    GO TO 702
0701  VN=VDKN(1)
    VF=VDKF(1)
    VEE=VE
0702  CONTINUE
    IF (IFLAT) 900.800.900
C
C*****ROTATING EARTH
C
800  VFF=VE-OMEG*PTV*CLAT
900  CONTINUE
    VX=VN*CPSI+VE*SPSI
    VY=VE*CPSI-VN*SPSI
    VDE=VDKN(1)*CPSI+VDKE(1)*SPSI
    VR=VX-VDR
C
C
C          *****
C          * CALL SUBROUTINE TO CALCULATE INERTIAL VEL.*
C          * W.H.T. INERTIAL WIND COMPONENTS, AND      *
C          * BODY AXIS VELOCITEIS U,V, AND W          *
C          *****
C
C      CALL BVELOC
C
C          *****
C          * CALL SUBROUTINE TO CALCULATE QUANTITIES *
C          * RELATIVE TO ALPHA AND META              *
C          *****
C
C      CALL BAFRET(DT?)
C
C
C
C          *****
C          * THE FOLLOWING IS EQUIVALENT TO -ACCELERATION- IN-LINE CODED *
C          *****
C          * THIS PORTION CALCULATES BODY AXIS CG, AND PILOT ACCELERATIONS *
C          * INPUTS- VDD,XMASS,FG,T11,T21,T31,T12,T22,T32,T13,T23,T33,VND,VED,*
C          *          PH,OH,PH,PBD,OH,D,RBD,XP,YP,ZP
C          *          *****
C          * OUTPUTS- AX,AY,AZ,AXP,AYP,AZP
C          *          *****
C
C      AX=FTX/XMASS

```



```

3      (YCG  .A(175)).(MCG  .A(176)).
3      (GAMV .A(35 )).(GAMH .A(36 )).(PL  .A(40 )).
4      (QL   .A(41 )).(RL   .A(42 )).(PLB .A(43 )).
5      (ULR  .A(44 )).(RLB  .A(45 )).(VN  .A(64 ))
C
EQUIVALENCE (VE  .A(65 )).(VD  .A(66 )).(VEE .A(67 )).
1      (VT  .A(68 )).(VG  .A(69 )).(VNR .A(72 )).
2      (VER  .A(73 )).(VDR .A(74 )).(SLAT .A(86 )).
3      (CLAT.A(87)).(RTV.A(109)).(DT3.A(169))

```

```

C
EQUIVALENCE (IFLAT.IA(6))
EQUIVALENCE (IMODE.IA(1)).(IFFCI.IA(7))
EQUIVALENCE (INALG3.IA(89))
1.( A(83) . ALT)
EQUIVALENCE (A(130).XMASS)
EQUIVALENCE (XP.A(225)).(YP.A(226)).(ZP.A(227))
EQUIVALENCE (NUSFD.IA(180))
EQUIVALENCE (DT2.A(168))

```

```

C
C
C      DATA TS/0./,RE/20898906./
C
C
C
C
C
C

```

```

C
C
C      MISEN=1
C      DT1=DT2*NUSFD
C      IFFCI=0
C
C
C

```

```

C
C
C      CALL BATMOS
C
C

```

```

C
C*****THIS PORTION OF THE PROGRAM CALCULATES RADIUS TO CG.
C
C*****GRAVITY FORCE,LATITUDE AND LONG-
C
C*****ITIME UOT. INTEGRATES TO GET LATITUDE AND LONGITUDE. AND CALCULATE
C
C*****SINE AND COSINE OF LATITUDE
C
C*****INPUTS- WAIT,VN,VEE,ALT,IMODE
C
C*****OUTPUTS-RTV,FG,XLATD,XLOND,XLAT,XLON,SLAT,CLAT
C
C*****RADIUS AND GRAVITY FORCE
C

```

```

RTV=ALT*RE
FG=WAIT*(RE/RTV)**2
G=FG/XMASS

```

```

C
C*****LATITUDE AND LONGITUDE
C
      XLATD=VN/RTV
      XLOND=VEE/(CLAT*RTV)
      IF(IMODE) 10,30,20
00010 XLOND=XLOND
      XLATD=XLATD
      DELTH=0.5*DTI
      GO TO 30
00020 IF (IFFCI.EQ.1) GO TO 30
      XLON=XLON + DELTH*(XLOND+XLOND)
      XLOND=XLOND
      XLAT=XLAT + DELTH*(XLATD+XLATD)
      XLATD=XLATD
00030 SLAT=SIN(XLAT)
      CLAT=COS(XLAT)
C
C
C*****
C
C*****THIS PORTION OF THE PROGRAM CALCULATES NORTH AND
C
C          YP
C*****EAST POSITION OF C.G. X AND Y POSITION
C
C*****INPUTS-RP,XLAT,XLATR,XLONR,T11,T12,T13,T21,T22,T23,T31,T32,T33,XP,
C
C*****ZP,CLATR,STHETR,CTHETR,HPR
C
C*****OUTPUTS-DNR,DER,XCG,YCG,XPR,YPR,HPR
C
C*****NORTH AND EAST POSITION OF C.G. FROM RUNWAY (0,0) COORDINATES
C
      DNR=DNR*(XLAT-XLATR)
      DER=DER*(CLATR*(XLON-XLONR))
C
C      TITLE   JAN 6, 1973          LOOP3
C*****X AND Y POSITION OF C.G. W.R.T. RUNWAY
C
      XCG=DNR*CTHETR+DER*STHETR
      YCG=-DNR*STHETR+DER*CTHETR
C
C*****X,Y, AND H POSITION OF PILOT W.R.T. RUNWAY
C
      DNR=DNR+T11*XP+T21*YP+T31*ZP
      DER=DER+T12*XP+T22*YP+T32*ZP
      XPR=DNR*CTHETR+DER*STHETR
      YPR=-DNR*STHETR+DER*CTHETR
      HPR=HCG-T13*XP-T23*YP-T33*ZP
C
C*****

```

```

C
C*****THIS PORTION OF THE PROGRAM CALCULATES INERTIAL P,Q, AND R
C
C*****DUE TO NON-FLAT EARTH, TRUE AIR
C
C*****SPEED, GROUND VELOCITY, FLIGHT PATH ANGLES IN VERTICAL AND HORIZONTAL
C
C*****INERTIAL PLANE
C
C
C*INPUTS- VN,VE,VD,VEE,RTV,SLAT,CLAT,T11,T12,T13,T21,T22,T23,T31,T32,T33
C
C*****      VNR,VER,VDR
C
C
C*****OUTPUTS- PL,QL,RL,PLR,QLB,RLB,VT,VG,GAMV,GAMH
C
C
C*****INERTIAL P,Q,R (IFLAT=1 MEANS FLAT EARTH-OTHERWISE ROTATING)
C
      IF (IFLAT) 100,100,200
00100  PL=VE/RTV
      QL=-VN/RTV
      PL=-VE*SLAT/(RTV*CLAT)
      PLH=T11*PL+T12*QL+T13*RL
      QLH=T21*PL+T22*QL+T23*RL
      RLH=T31*PL+T32*QL+T33*RL
      GO TO 300
00200  PL=0.0
      QL=0.0
      PL=0.0
      PLH=0.0
      QLH=0.0
      PLR=0.0
C
C*****FLIGHT PATH ANGLES, GROUND VELOCITY AND TRUE AIRSPEED
C
00300  PAD=VN**2 +VEE**2
      VT=SQRT(PAD+VD**2)
      VR=SQRT(PAD)
      IF (VT.EQ.0.0) GO TO 350
      GAMV=ATAN2(-VD,VG)
      IF (PAD.FU.0.0) GO TO 400
      GAMH=ATAN2(VFE,VN)
00350  CONTINUE
00400  CONTINUE
C
C*****
C
C*****THIS PORTION OF THE PROGRAM CALLS THE USER ROUTINES FOR
C
C*****THE THIRD LOOP ENGINE CONTROL SYSTEM,ENGINE AND SPECIAL
C
C*****UTILITY FUNCTIONS
C

```



```

C .....
C .....
C * MODE CUNTHOL...(-1) IS "I.C.", (0) IS "HOLD", (1) IS "OPERATE" *
C .....
C
C   IF (IMODE) 2,3,3
C
C   2 CALL ARDC62(0.0,SOUNDZ,RHOZ)
C
C   .....
C   * "ICOND" IS CONSTANT DENSITY SELECTION SWITCH *
C   * *
C   * IF "ICOND" SET TO (1), ALL CALCULATIONS ARE REFERENCED TO *
C   * THE DENSITY AT THE ALTITUDE SPECIFIED BY "MRHOZ" *
C   .....
C
C   3 IF (ICOND) 4,4,6
C
C   4 XX=ALT
C     GO TO 7
C
C   6 XX=MRHOZ
C
C   7 CONTINUE
C     CALL ARDC62(XX,SOUND,RHO)
C
C
C   .....
C   * "TR" IS THE TOT. TEMPERATURE RATIO *
C   * "PR" IS THE TOT. PRESSURE RATIO *
C   .....
C
C   TR=1.-.2*XMACH**2
C
C   IF (XMACH-XM1) 11,11,12
C
C   00011 PR=TR*TR*TR*TR*TR*TR*TR
C     GO TO 13
C
C   00012 IF (XMACH) 121,121,122
C
C   00121 PR=1.0
C     GO TO 13
C
C   00122 CONTINUE
C     TEMP1=XMACH**2
C     TEMP2=7.-1./TEMP1
C     PR=160.9*TEMP1/(TEMP2*TEMP2*TEMP2)
C
C   00013 IF (ALT-MLFV) 40,40,50
C
C   .....
C   * "TAMH" IS AMBIENT TEMPERATURE IN DEGREES KELVIN *
C   * "PAMH" IS AMBIENT PRESSURE IN LB/FT2 *
C   * "TAMRH" IS RATIO OF "TAMH" AT ALTITUDE TO SAME AT SEA LEVEL *

```

C • "PAMB" IS RATIO OF "PAMB" AT ALTITUDE TO SAME AT SEA LEVEL •  
 C • "PTOT" IS TOTAL PRESSURE •  
 C • "TTOT" IS TOTAL TEMPERATURE •  
 C .....

C  
 00040 TAMRR=1.-6.875E-6\*ALT  
 PAMRR=TAMRR\*\*5.256  
 GO TO 60

C  
 00050 TAMHR=.751895  
 PAMHR=.2234\*EXP(-4.806E-5\*(ALT-HLEV))

C  
 00060 CONTINUE  
 TAMR=DELAT\*TAMBR+TEMPZ\*.555555  
 PAMH=PAMHR\*PPES?

C  
 PTOT=PH\*PAMR  
 TTOT=TH+TAMP

C  
 C .....  
 C • "RHO" IS DENSITY OF AIR AT ALTITUDE •  
 C • "SOUND" IS SPEED OF SOUND AT ALTITUDE •  
 C •  
 C • "RHO" AND "SOUND" ARE MODIFIED BY DELTA TEMPERATURE EFFECT •  
 C • "DELAT" IS THE DELTA TEMPERATURE DIFFERENCE OF DESIRED •  
 C • AMBIENT FROM STANDARD TEMPERATURES IN DEGREES CENTIGRADE •  
 C .....

C  
 YCON=TAMR/(TAMR-DELAT)  
 SORTMPH=SQRT(YCON)

C  
 PHO=PHO/YCON  
 SOUNND=SOUND\*SQRT(YCON)

C  
 C .....  
 C • "XMACH" IS MACH NO. •  
 C • "QDAMP" IS DYNAMIC PRESSURE •  
 C • "QDARC" IS IMPACT PRESSURE •  
 C • "VFO" IS EQUIVALENT AIRSPEED IN KNOTS •  
 C • "VCAL" IS CALIBRATED AIRSPEED IN KNOTS •  
 C .....

C  
 XMACH=VNH/SOUND

C  
 QDAP=.5\*PHO\*VNH\*\*2

C  
 QDARC=PTOT-PAMH

C  
 VFO=.54249\*VNH\*SQRT(RHO/RHOZ)

C  
 IF (VEQ .LT. 10.) GO TO 70  
 VCAL=.54249\*SOUNDZ\*SQRT(5.0\*((QDARC/PRESZ\*.1.0)\*\*.2857-1.0))  
 G) TO 71

C  
 00070 CONTINUE

VCAL = VEO  
 C 00071 RETURN  
 END



SUBROUTINE ROTATE(DELTA)  
 C MODIFIED BY R.E. MCFARLAND JAN.14,1974

C COMMON/XFLOAT/A(500)/IFIXED/IA(200)  
 COMMON/CHF/R(200)/ICBF/IB(50)

C DIMENSION XMC(10)  
 DIMENSION ITOUCH(5)

C EQUIVALENCE (ITOUCH(1),IA(10))  
 EQUIVALENCE (PMI ,A(1 )),(THET ,A(2 )),(PSI ,A(3 ))  
 1 (PHIR ,A(4 )),(THETR ,A(5 )),(PSIR ,A(6 ))  
 2 (PHID ,A(7 )),(THEU ,A(8 )),(PSID ,A(9 ))  
 3 (SPHI ,A(10 )),(CPHI ,A(11 )),(STHT ,A(12 ))  
 4 (CTHT ,A(13 )),(SPSI ,A(14 )),(CPSI ,A(15 ))  
 5 (PH ,A(17 )),(QR ,A(18 )),(RH ,A(19 ))

C EQUIVALENCE (PSIS,B(84))  
 EQUIVALENCE (PLR ,A(43 )),(OLB ,A(44 )),(RLB ,A(45 ))  
 1 (PT ,A(46 )),(OT ,A(47 )),(RT ,A(48 ))  
 2 (PHWN ,A(49 )),(QBWN ,A(50 )),(RHWN ,A(51 ))  
 3 (PTIRB ,A(52 )),(OTURN ,A(53 )),(RTURN ,A(54 ))  
 4 (PHD ,A(55 )),(ORD ,A(56 )),(RRD ,A(57 ))  
 5 (XMC(1),A(120)),(TTL ,A(164)),(TTM ,A(165))  
 6 (TTN ,A(166))

C EQUIVALENCE (TIME,A(303))  
 EQUIVALENCE (A(358),D2H),(A(359),R2D)  
 EQUIVALENCE (A(0375),XMCC1 )  
 EQUIVALENCE (A(0376),XMCC2 )  
 EQUIVALENCE (A(0377),XMCC3 )  
 EQUIVALENCE (A(0378),XMCC4 )  
 EQUIVALENCE (A(0379),XMCC5 )  
 EQUIVALENCE (A(0380),XMCC6 )  
 EQUIVALENCE (A(0381),XMCC7 )

C EQUIVALENCE (IMODE,IA(1))  
 EQUIVALENCE (IA(16),I2DOF)

C DOUBLE PRECISION DTIME  
 DATA TS/0.0/  
 DATA I2DOF/0/  
 DATA PI/3.1415927/

C  
 C

```

C*****ROTATE CALCULATES PBD,QBD,RBD, INTEGRATES TO GET PB,QB,RB,CALCULATES
C
C*****PRAW,QRWN,RBWN,PT,QT,RT,THED,PSIU,PHID, INTEGRATES TO GET THEIR,
C
C*****PSIR,PHIR CALCULATES THET,PSI,PHI
C
C
C*****INPUTS- TTL,TTM,TTN,XMC(1) THROUGH XMC(10),PLB,QLB,HLB,PTURB,QTURB,
C
C*****          HTURB,SPHI,CPHI,STHT,CTHT
C
C
C*****OUTPUTS-PBD,QBD,RBD,PB,QB,RH,PRAW,QRWN,RBWN,PT,QT,RT,THED,PSID,PHI
C
C*****          THETR,PSIR
C
C
C          IF (IMODE.EQ.-1) GO TO 1
C          GO TO 2
00001  P<I>SP=PSIS
P<I>IAP=PSIA
00002  CONTINUE
PRD=(XMC(1)*RH+XMC(2)*PB)*QB+XMC(3)*TTL+XMC(4)*TTN
1      + XMC(1)*QB + XMC(5)*RA - XMC(6)*PB
QRN=XMC(5)*RA*PA+XMC(6)*(RB**2-PA**2)+XMC(7)*TTM
1      - XMC(2)*RA + XMC(3)*PA
PRN=(XMC(8)*PH+XMC(9)*HE)*QB+XMC(4)*TTL+XMC(10)*TTN
1      + XMC(4)*QB + XMC(6)*HB - XMC(7)*PB
IF (IMODE) 10,30,20
00010  QANP=UHD
RANP=HMD
PANP=PHD
DT02=.5*DELT
DTIME=0.
TIME=0.
GO TO 30
20  P<I>=PH+UTO2*(3.0*PRD-PRDP)
P<I>N<I>=PH<I>
Q<I>=QH+UTO2*(3.0*QBD-QBDP)
Q<I>N<I>=UHD
TIME<I>=TIME+DELT
IF (I2DOP.EQ.1) QH=.017452/DELT*(TAB1(TIME<I>,0.,0.,.67,1)-TAB1(
1  TIME<I>,0.,0.,.67,1))
R<I>=RA+DT02*(3.0*RRD-RRDP)
R<I>N<I>=HMD
DTIME<I>=DTIME+DELT
TIME<I>=UTIME
00030  P<I>=PH-PLH
Q<I>=QH-QLH
P<I>=RH-PLH
PRAW=PH+HTURB
QRWN=(H+NTURB
R<I>=RH+HTURB
THETR=HT*CPHI-RT*SPHI
CTHT=CTHT

```

```

IF (ABS(CTMT)) .LT. .001) CTMT=SIGN(.001,CTMT)
PSID=(QT*SPHI*RT*CPHI)/CTMT
PHID=MT*PSID*STMT
IF (IMODE) 60,70,50
00050 THETR=THETR + DT02*(THED-DUM)
IF (IPDOF.EQ.1) THETR=.017452*TAU1(TIME,0..0..67.1)
PSIR=PSIH + DT02*(PSID*DUMP)
PHIR=PHIH + DT02*(PHID*DUMA)
C MFADING CLAMP WHEN GEARS TOUCH
IF (ITOUCH(1).EQ.0) PSIR=PSIR
IF (ITOUCH(1).EQ.1.AND.ITOUCH(2).EQ.1) PSIR=PSIR*PSIS-PSIS*
PSIH=PSIR
PSIS=PSIS
C REDUCE ANGLFS TO +/- 180 DEGREES
I1=THETR/PI
IF (I1.EQ.0) GO TO 51
THETR=(I1+1)*PI+THETR
51 I2=PSIS/PI
IF (I2.EQ.0) GO TO 52
PSIH=(I2+1)*PI+PSIR
52 IF (I3.EQ.0) GO TO 53
PHIR=PHIH-(I3+1)*PI
53 CONTINUE
00060 THET=THETR*020
PHI=PHIR*020
PSI=PSIR*020
DIM=THEI
DIMH=PSIH
DIMV=PHID
00070 CONTINUE
RETURN
END

```

.....

```

C SURROUTINE ARDC62(ALT,SPSND,DENSTY)
C
C AUTHOR M P RUMWEN AND R E MCFARLAND FOR W400
C SIGMA SEVEN VERSION BY R SHINLEY
C IBM 360 VERSION BY D JONES -CSC- FEB 73

```

```

C CALLING SEQUENCE IS
C
C CALL ARDC62(ALT,SPSND,DENSTY)

```

```

C
C DIMENSION SPS(121),DFNS(121)
C DIMENSION DENS1(20),DENS2(20),DENS3(20),DENS4(20)
C 1, DENS5(20),DENS6(20),SPS1(20),SPS2(20),SPS3(20)
C 2, SPS4(20),SPS5(20),SPS6(20)
C EQUIVALENCE (DENS(1),DENS1(1)),(DENS(21),DENS2(1))

```

1. (DFNS(4),DENS3(1)),(DENS(6),DENS4(1))  
 2. (DFNS(8),DENS5(1)),(DENS(10),DENS6(1))  
 3. (SPS(1),SPS1(1)),(SPS(2),SPS2(1)),(SPS(4),SPS3(1))  
 4. (SPS(6),SPS4(1)),(SPS(8),SPS5(1)),(SPS(10),SPS6(1))

C

DATA DENS1/2.37701E-3  
 1. 2.24098E-3  
 1. 2.11099E-3  
 1. 1.98684E-3  
 1. 1.86836E-3  
 1. 1.75537E-3  
 1. 1.64768E-3  
 1. 1.54511E-3  
 1. 1.44751E-3  
 1. 1.35469E-3  
 1. 1.26649E-3  
 1. 1.18276E-3  
 1. 1.10333E-3  
 1. 1.02905E-3  
 1. .95676E-3  
 1. .88432E-3  
 1. .82557E-3  
 1. .76538E-3  
 1. .70860E-3  
 1. .64419E-3/

DATA DENS2/.585146E-3  
 1. .531517E-3  
 1. .482801E-3  
 1. .438554E-3  
 1. .398359E-3  
 1. .361850E-3  
 1. .328686E-3  
 1. .298561E-3  
 1. .271197E-3  
 1. .246341E-3  
 1. .223765E-3  
 1. .203256E-3  
 1. .184627E-3  
 1. .167616E-3  
 1. .151455E-3  
 1. .137615E-3  
 1. .124744E-3  
 1. .113107E-3  
 1. .102564E-3  
 1. .043066E-3/

DATA DENS3/.064453E-3  
 1. 7.6714E-5  
 1. 6.9701E-5  
 1. 6.3349E-5  
 1. 5.7588E-5  
 1. 5.2370E-5  
 1. 4.7635E-5  
 1. 4.3341E-5  
 1. 3.9443E-5  
 1. 3.5908E-5

1. 3.2696E-5  
 1. 2.9781E-5  
 1. 2.7132E-5  
 1. 2.4694E-5  
 1. 2.2414E-5  
 1. 2.0357E-5  
 1. 1.8501E-5  
 1. 1.6427E-5  
 1. 1.5315E-5  
 1. 1.3948E-5/  
 DATA DENS4/1.271E-5

1. 1.1592E-5  
 1. 1.0579E-5  
 1. 9.6601E-6  
 1. 8.8271E-6  
 1. 8.0707E-6  
 1. 7.3834E-6  
 1. 6.7594E-6  
 1. 6.1916E-6  
 1. 5.6744E-6  
 1. 5.2045E-6  
 1. 4.7757E-6  
 1. 4.3847E-6  
 1. 4.0282E-6  
 1. 3.7026E-6  
 1. 3.4052E-6  
 1. 3.1333E-6  
 1. 2.8848E-6  
 1. 2.6627E-6  
 1. 2.4683E-6/  
 DATA DENS5/2.2881E-6

1. 2.1212E-6  
 1. 1.9664E-6  
 1. 1.8230E-6  
 1. 1.6900E-6  
 1. 1.5668E-6  
 1. 1.4525E-6  
 1. 1.3524E-6  
 1. 1.2588E-6  
 1. 1.1713E-6  
 1. 1.0896E-6  
 1. 1.0132E-6  
 1. 9.4145E-7  
 1. 8.7537E-7  
 1. 8.1326E-7  
 1. 7.5532E-7  
 1. 7.0126E-7  
 1. 6.5085E-7  
 1. 6.0367E-7  
 1. 5.6011E-7/  
 DATA DENS6/5.1932E-7

1. 4.6134E-7  
 1. 4.4746E-7  
 1. 4.1664E-7  
 1. 3.8732E-7



1. 976.450 /  
DATA SPS3/977.799  
1. 978.95  
1. 980.29  
1. 981.62  
1. 982.95  
1. 984.28  
1. 985.61  
1. 986.93  
1. 988.26  
1. 989.58  
1. 990.90  
1. 992.21  
1. 993.53  
1. 995.41  
1. 999.07  
1. 1002.72  
1. 1006.36  
1. 1009.98  
1. 1013.59  
1. 1017.19 /

DATA SPS4/1020.77  
1. 1024.34  
1. 1027.89  
1. 1031.44  
1. 1034.97  
1. 1038.48  
1. 1041.99  
1. 1045.48  
1. 1048.96  
1. 1052.43  
1. 1055.88  
1. 1059.33  
1. 1062.76  
1. 1066.18  
1. 1069.59  
1. 1072.99  
1. 1076.37  
1. 1079.75  
1. 1082.02  
1. 1082.02 /

DATA SPS5/1082.02  
1. 1082.02  
1. 1082.02  
1. 1082.02  
1. 1082.02  
1. 1082.02  
1. 1079.63  
1. 1077.23  
1. 1074.82  
1. 1072.40  
1. 1069.98  
1. 1067.56  
1. 1065.13

```

1.      1062.69
1.      1060.25
1.      1057.81
1.      1055.36
1.      1052.90
1.      1050.44 /

```

```

DATA SPS6/1047.98
1.      1045.50
1.      1040.63
1.      1035.65
1.      1030.65
1.      1025.62
1.      1020.57
1.      1015.49
1.      1010.39
1.      1005.26
1.      1000.11
1.      994.94
1.      989.73
1.      984.50
1.      979.25
1.      973.96
1.      968.65
1.      963.31
1.      957.94
1.      952.55 /

```

```

DATA SPS(121)/947.12/

```

```

C
C

```

```

M=ALT
IF(ALT.LT.0.0) M=0.0
IF(ALT.GT.240000.) M=240000.

```

```

C
C FIND ALT INCREMENT AND FRACTION N
C

```

```

IALT=M*0.0005 +1
ALTF=(M-(IALT-1)*2000)*0.0005

```

```

C
C CALCULATE DENSITY AND SPEED OF SOUND
DENS=DENS(IALT)-(DENS(IALT)-DENS(IALT+1))*ALTF
SPSND=SPS(IALT)-(SPS(IALT)-SPS(IALT+1))*ALTF

```

```

C
C
C RETURN
C
C END

```

.....

```

SUBROUTINE BALFBET(DELTA)

```

```

C
C .....
C
C * BALFBET CALCULATES ALFO,RETD,ALFAR,BETAR,ALFA,BETA, AND SINE AND *

```

```

C      AND UBD,VBD,WBD,AND VRW--AS OF APRIL 20,1974 (FROM BATMOSPH)
C      *
C      * COSINE OF ALFA AND BETAR
C      *
C      * INPUTS= UB,VR,WR,
C      *
C      * OIUTPUTS=ALFAR,ALFA,SALPH,CALPH,BETAR,BETA,ALFD,BETD,SBETA,CBETA
C      *
C      *.....*
C      * UPDATED 27 DEC 73 TO REFLECT CHANGES MADE TO CURRENT FSAF VERSION*
C      *.....*
C      COMMON/XFLOAT/A(500)/IFIXED/IA(200)
C
C      EQUIVALENCE (ALFA ,A(25 )),(BETA ,A(26 )),(ALFAR ,A(27 )),
1      (BETAR ,A(28 )),(ALFD ,A(29 )),(BETD ,A(30 )),
2      (SALPH ,A(31 )),(CALPH ,A(32 )),(SBETA ,A(33 )),
3      (CBETA ,A(34 )),(OR ,A(38 )),(RB ,A(39 )),
4      (UR ,A(58 )),(VR ,A(59 )),(WB ,A(60 )),
5      (DZR ,A(358)),(R2D ,A(359))
C
C      EQUIVALENCE (A(413),UMD),(A(414),VRD),(A(415),WBD)
1      (A(416),VRW),(A(417),VTWN),(A(418),VTWE)
2      (A(419),VTWN),(A(420),VND),(A(421),VED),(A(422),VDD)
3      (A(423),PT),(A(424),OT),(A(425),RT),(A(426),T11),(A(427),T21)
4      (A(428),T31),(A(429),T12),(A(430),T22),(A(431),T32)
5      (A(432),T13),(A(433),T23),(A(434),T33)
EQUIVALENCE (ITOMTR, IA(187))
EQUIVALENCE (IMODE,IA(1))
C
C      DATA ITOMTR/0/
C
C      *.....*
C      * "ALFA" IS ANGLE OF ATTACK IN DEGREES
C      * "BETA" IS ANGLE OF SIDESLIP IN DEGREES
C      *
C      * NOTATION AS FOLLOWS... H-SUFFIX INDICATES RADIAN MEASURE
C      *                               D-SUFFIX INDICATES DERIVATIVE
C      *                               S-PREFIX INDICATES SINE OF ANGLE
C      *                               C-PREFIX INDICATES COSINE OF ANGLE
C      *.....*
C
C      *.....*
C      * TO PROTECT ALFA AND BETA FOR UR=VR=WB=0.0
C      *.....*
C
C      IF (ABS(UR).LT.0.00001) UB=SIGN(0.00001,UR)
C
C      ALFAR=ATAN2(WB,UR)
C      ALFA=ALFAR/R2D
C      SALPH=SIN(ALFAR)
C      CALPH=COS(ALFAR)

```

AD-A073 587

NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AIR VEHICL--ETC F/G 1/2  
A COMPUTERIZED VSTOL/SMALL PLATFORM LANDING DYNAMICS INVESTIGAT--ETC(U)  
SEP 77 R L NAVE

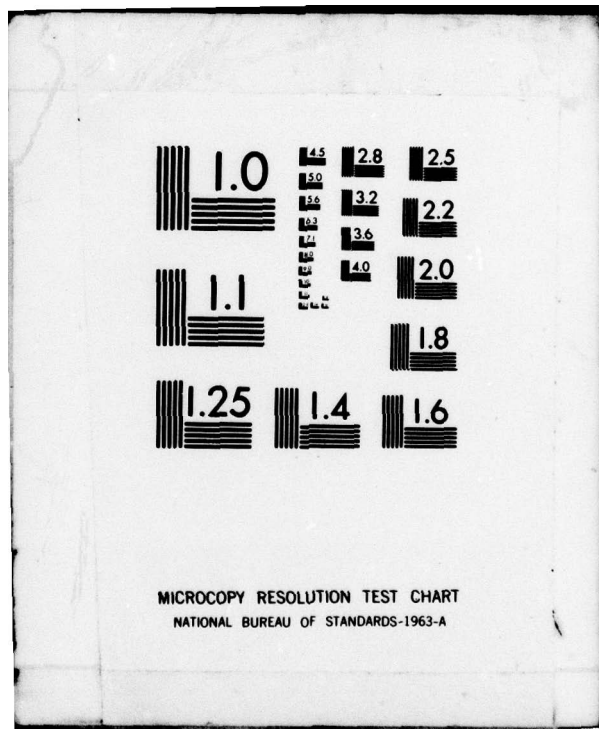
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NADC-77024-30

AM

2 OF 4  
AD  
A073587





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

C  
C  
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C

```

.....
*
* BTRANSFORM CALCULATES SINES AND COSINES OF PSIR,THETR,PHIR, AND
* TRANSFORMATION ELEMENTS T11,T21,T31,T12,T22,T32,T13,T23,T33
*
* INPUTS-PSIR,THETR,PHIR
*
* OUTPUTS-SPSI,STHT,SPHI,CPHI,CTHT,CPHI,T11,T21,T31,T12,T22,T32,
*          T13,T23,T33
*
.....

```

COMMON/XFLOAT/A(500)/IFIXED/IA(200)

C  
1  
2  
3  
4  
5

```

EQUIVALENCE (PHIR ,A(4 )),(THETR ,A(5 )),(PSIR ,A(6 )),
(SPHI ,A(10 )),(CPHI ,A(11 )),(STHT ,A(12 )),
(CTHT ,A(13 )),(SPSI ,A(14 )),(CPSI ,A(15 )),
(T11 ,A(16 )),(T21 ,A(17 )),(T31 ,A(18 )),
(T12 ,A(19 )),(T22 ,A(20 )),(T32 ,A(21 )),
(T13 ,A(22 )),(T23 ,A(23 )),(T33 ,A(24 ))

```

C  
C  
C

```

SPHI=SIN(PHIR)
CPHI=COS(PHIR)
SPSI=SIN(PSIR)
CPSI=COS(PSIR)
STHT=SIN(THETR)
CTHT=COS(THETR)

```

C

```

T11=CTHT*CPSI
T21=SPHI*STHT*CPSI-CPHI*SPSI
T31=CPHI*STHT*CPSI+SPHI*SPSI
T12=CTHT*SPSI
T22=CPHI*STHT*SPSI-CPHI*CPSI
T32=CPHI*STHT*SPSI+SPHI*CPSI
T13=-STHT
T23=SPHI*CTHT
T33=CPHI*CTHT

```

C  
C

```

RETURN
END

```

.....

SUBROUTINE AVELOC

C  
C

.....

```

DUM2=UB**2+WB**2
DUM = SQRT(DUM2)
DUM1 = SIGN(DUM,UB)
PETA = ATAN2(WB,DUM1)
SETA=HETAP*P2D
SPTA=SIN(HETAH)
COSTA=COS(HETAH)
C VRV CALCULATION (FROM ATMOSP)
VRW2=DUM**2-VR**2
VRW=SQRT(VRW2)
IF(IMODE.EQ.-1) GO TO 35

C
C WIND ACCELERATION INCLUDING TURBULENCE AND WIND VARIATIONS
C
IF(DELTA.EQ.0.) GO TO 35
ATWN=(VTWN-VTWNP)/DELTA
ATWE=(VTWE-VTWE P)/DELTA
ATWD=(VTWD-VTWD P)/DELTA
GO TO 36
00035 ATWN=0.
ATWE=0.
ATWD=0.
00036 CONTINUE
VTWNP=VTWN
VTWEP=VTWE
VTWDP=VTWD
C RELATIVE ACCELERATIONS
RAV=VND-ATWN
RAE=VED-ATWE
RAD=VND-ATWD
C BODY AXIS ACCELERATIONS
UAH=PT*VH-(GT*WB+T11*RAH+T12*RAE+T13*RAD)
VAH=PT*VH-KT*UH+T21*RAH+T22*RAE+T23*RAD
WAH=GT*UH-PT*VH+T31*RAH+T32*RAE+T33*RAD
C
IF(IMOIF) 38,39,39
00038 IF(ITOMTH.NE.1) GO TO 39
ALFD=0.
HFTD=0.
GO TO 40
00039 IF(VHW-.1) 41,41,42
00041 ALFD=0.
HFTD=0.
GO TO 40
00042 ALFD=(UH*WAH-WB*UBD)/DUM2
HFTD=(DUM2*VBD-(UB*UBD+WB*WBD)*VB)/(DUM1*VRW2)
00040 PFTUHN
END

```

99

.....

SUBROUTINE STRANS

C \*  
 C \* VELOCITY CALCULATES THE INERTIAL VELOCITIES WITH RESPECT TO THE \*  
 C \* INERTIAL WIND COMPONENTS, AND THE BODY AXIS VELOCITIES U,V,W \*  
 C \*  
 C \* INPUTS- VN,VFE,VD,VNW,VEW,VDW,T11,T21,T31,T12,T22,T32,T13,T23,T33 \*  
 C \*  
 C \* OUTPUTS- VNR,VER,VDR,UB,VB,WB \*  
 C \* UTURR,VTURR,WTURR \*  
 C \*  
 C .....

COMMON/XFLOAT/A(500)/IFIXED/IA(200)

EQUIVALENCE (T11 ,A(16 )),(T21 ,A(17 )),(T31 ,A(18 ))  
 1 (T12 ,A(19 )),(T22 ,A(20 )),(T32 ,A(21 ))  
 2 (T13 ,A(22 )),(T23 ,A(23 )),(T33 ,A(24 ))  
 3 (UH ,A(58 )),(VH ,A(59 )),(WH ,A(60 ))  
 4 (UTURB ,A(61 )),(VTURB ,A(62 )),(WTURB ,A(63 ))  
 5 (VN ,A(64 )),(VD ,A(66 )),(VEE ,A(67 ))  
 6 (VNR ,A(72 )),(VER ,A(73 )),(VDR ,A(74 ))  
 7 (VNW ,A(76 )),(VEW ,A(77 )),(VDW ,A(78 ))  
 EQUIVALENCE (IA(185),IETURR),(A(419),VNTURR)  
 1,(A(420),VETURR),(A(421),VDTURR),(A(416),VTWN)  
 2,(A(417),VTWF),(A(418),VTWD)

.....  
 \* NORTH, EAST, DOWN VELOCITIES INCLUDING WINDS \*  
 \* W.R.T. THE RUNWAY \*  
 .....

C IF IETURR .EQ. 1, THE RANDOM TURBULENCE IS ALREADY GENERATED IN THE  
 C EARTH AXES AS VNTURR, VETURR, VDTURR. OTHERWISE, THIS ROUTINE  
 C EXPECTS UTURR, VTURR, WTURR.

.....  
 \* BODY AXIS VELOCITIES INCLUDING TURBULENCE \*  
 .....

IF (IETURR .EQ. 0) GO TO 10  
 UTURR = T11\*VNTURR+T12\*VETURR+T13\*VDTURR  
 VTURR = T21\*VNTURR+T22\*VETURR+T23\*VDTURR  
 WTURR = T31\*VNTURR+T32\*VETURR+T33\*VDTURR  
 GO TO 20  
 00010 VNTURR = T11\*UTURR+T21\*VTURR+T31\*WTURR  
 VETURR = T12\*UTURR+T22\*VTURR+T32\*WTURR  
 VDTURR = T13\*UTURR+T23\*VTURR+T33\*WTURR  
 C  
 00020 VTWN = VNW+VNTURR  
 VTWF = VEW+VETURR  
 VTWD = VDW+VDTURR

C

```
VNR = VN-VTWN
VER = VEE-VTWE
VDR = VD-VTWD
UR = T11*VNR+T12*VER+T13*VDR
VR = T21*VNR+T22*VER+T23*VDR
WR = T31*VNR+T32*VER+T33*VDR
```

C  
C  
C

```
RETURN
END
```

.....

```

SUBROUTINE TABRD(NUMTBL,NZ,NG)
COMMON/TABLE/NUMPTS(3500)
COMMON/TAROUT/NIMTBL,ISEO
COMMON/XTRAP/METH,IACT(3,93)
COMMON/FIND/IMKRV(3,93)
DIMENSION ISCR(3)
DIMENSION XUMPTS(3500),LABEL(25)
EQUIVALENCE (XUMPTS(1),NUMPTS(1)),(DUMMY(1),MUMMY)
DIMENSION DUMMY(10)
DATA ICNT1/0/
MCR=0
ICNT1=ICNT1+1
PRINT 500,ICNT1
500 FORMAT(1H0,10X,30H SUBROUTINE TABRD ENTERED          .10X,13,
15X,6HTIMES )
MCR=1
GO TO 10
ENTRY TABWRT
PRINT 100
100 FORMAT(1H1)
MCR=1
10 IZ=IAMS(NZ)
NIMTBL = NUMTBL
NG=0
NUMPTS(1)=IZ+IZ+IZ
ITALE=0
102 PFAD(47,57) K=L1N,L2N,ISCR,LABEL,ISEO
IF(K.EQ.0) GOTO 4
ITALE=ITALE+1
DO 20 ICHSE=1,3
IACT(ICHSE,ITALE)=ISCR(ICHSE)+1
20 IOPFV(ICHSE,ITALE)=1
IOFV(3,ITALE)=ITALE
IF(MCR.EQ.0) GOTO 3
4 PRINT 1, K,L1N,L2N,LABEL,ISEO
1 FORMAT(3I5,14X,25A2,146)
57 FORMAT(4X,14,2I2,3I1,1X,25A2,12)
3 IF(ISEO) 69,58,69

```

```

58 IF(K) 99, 99, 59
59 M = IZ * NIMTBL
   NUMPTS(M) = LIN
   M = M * IZ
   NUMPTS(M) = L2N
   IF (NUMTAL-NIMTBL) 17,70,17
17 NUMPTS(NIMTBL) = MUMMY
70 N1 = (LIN-1) / 9 + 1
   DO 66 IS = 1,N1
   L3 = (IS-1) * 9 + 1
   IF (IS-N1) 60, 61, 60
60 L4 = L3 + 8
   GO TO 62
61 L4 = LIN
62 L5 = NUMPTS(NIMTBL) + 1
   L6 = L5 + L3
   L7 = L5 + L4
   JJ = 0
   LM = L5 + LIN
   LN = LM + L2N
63 READ(97,64) (DUMMY(K),K=1,10),ISEQ
64 FORMAT (10F7.0,I2)
   IF (MCR.EQ.0) GO TO 5
6 PRINT 2, DUMMY,ISEQ
2 FORMAT(10E12.4,I5)
3 XIUMPTS(L5) = DUMMY(1)
   K = 2
   DO 65 J = L6,L7
   XIUMPTS(J) = DUMMY(K)
   NMAX=J
65 K = K+1
   ISOO = (IS-1)*(L2N+1)+JJ+1
   IF (ISEQ-ISOO) 69,66,69
66 L6 = LN + L3
   L7 = LN + L4
   L5 = LM + 1 + JJ
   IF (JJ-L2N) 67,68,69
67 JJ = JJ + 1
   LN = LN + LIN
   GO TO 63
68 CONTINUE
109 MUMMY = NUMPTS(NIMTBL) * (LIN+1) * (L2N+1)
108 NIMTBL = NIMTBL + 1
   GO TO 102
69 NR = 1
90 PRINT 110,NMAX
110 FORMAT('...*16.2X* LOCATIONS IN NUMPTS ARRAY WERE LOADED *')
   RETURN
   END

```

.....

FUNCTION TAR1(A,R,C,N,ND)

```

DATA IEHPRT/1/
CALL LOOKUP(A,B,C,N,N*ND-1,FC,NG)
NR1=NG*1
GOTO (6,2,2,7,2,2,7,7),NG1
7 IF(IEHPRT.EQ.1) GO TO 6
PRINT 1000,N,A,R,C,FC
6 TA91=FC
RETURN
2 PRINT 1001,NG
RETURN
1000 FORMAT(* ..... OFF TABLE *,I3,* ARG5=*,J(E10.4,1X),* .. FUNC.= *,
1 E10.4)
1001 FORMAT(* ..... TABLE ERROR , NG = *,I1)
END

```

```

.....
SUBROUTINE LOOKUP(A1,A2,A3,MINTBL,MAXTBL,FCT,NG)
.....
C METH: KEY FOR TYPE SEARCH
C 1 - STANDARD ORDER SEARCH
C 2 - MEMORY SEARCH
C 3 - BINARY SEARCH
C IACT(ARG,TAHLE): KEY FOR OFF TABLE ACTION
C 1 - SET FCT=0,NG=3
C 2 - HOLD LAST TABLE VALUE OF FCT, SET NG=6
C 3 - LINEARLY EXTRAPOLATE FCT, SET NG=7
C .....
COMMON/TAHOUT/NIMTBL,ISOO
COMMON/TABLE/NIMPTS(3500)
COMMON/XTHAP/METH,IACT(3,93)
COMMON/FIND/IPREV(3,93)
EQUIVALENCE (X(1),NIMPTS(1))
DIMENSION X (1),ARG(3)
DATA INIT/0/
METH=2
FLAG=ALOR(2,0)
FCT=0.0
NR=0
I7=NIMPTS(1)/3
00070 IF(MINTBL-MAXTBL)71,71,110
00071 DO 73 II=MINTBL,MAXTBL
N.J=NIMPTS(II)+1
IF(43-X(NJ))72,74,73
00072 IF(II-MINTBL) 110,112,75
00073 CONTINUE
II=MAXTBL
GO TO 112
00075 IK= 1
IL =2
NJ=NJ
00101 DO 47 IF=IK,IL
NJ=NIMPTS(II)+1

```

```

NI = IZ+II
IO = NUMPTS(NI)
IP = IO+NJ
IARG=1
ARG(1)=A1
NJIP=NJ
IOIH=IO
IF (A1.GT.X(NJ+IO)) GO TO 212
IF (A1.LT.X(NJ+1)) GO TO 312
GO TO (40,41,42),METH
00076 IQ=IQIH
IQ=IQIA
MN=INU
IPREV(1,II)=IO
GO TO 40
C      BINARY SEARCH SECTION
00042 ILOW=1
IH=IOIP
IF (X(IH+NJIP) .NE. ARG(IARG)) GO TO 43
IQIA=IH
00056 IQIH=-1
IND=NJIP+IQIA
00057 GO TO (70,81),IARG
43 IF (X(ILOW+NJIP) .NE. ARG(IARG)) GO TO 44
IQIA=ILOW
GO TO 56
44 FL=IOIH
MIMIT=(ALOG(EL)/ELOG2)+1.0
DN 45 KNT=1.MIMIT
MID=ILOW+(IH-ILOW)/2
IND=NJIP+MID
IF (ARG(IARG)-X(IND)) 46.55.48
46 IF (ARG(IARG)-X(IND-1)) 47.51.50
47 IH=MID
GO TO 45
48 IF (ARG(IARG)-X(IND+1)) 52.53.49
49 ILOW=MID
45 CONTINUE
GO TO 110
55 IQIA=MID
GO TO 56
51 IQIA=MID-1
GO TO 56
53 IQIA=MID+1
GO TO 56
50 IQIA=MID
54 IQIH=1
IND=NJIP+IQIA
GO TO 57
52 IQIA=MID+1
GO TO 54
C      MEMORY SEARCH SECTION
41 IQIA=IPREV(IARG,II)
IND=NJIP+IQIA
IF (ARG(IARG)-X(IND)) 60.61.62

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60 IF(ARG(IARG)-X(IND-1)) 63.64.65
63 IND=IND-1
GO TO 60
64 IND=IND-1
61 IQIA=IND-NJIP
GO TO 56
65 IQIA=IND-NJIP
GO TO 54
62 IF(ARG(IARG)-X(IND+1)) 66.67.68
6A IND=IND+1
GO TO 62
67 IND=IND+1
GO TO 61
66 IND=IND+1
GO TO 65
C STANDARD ORDER SEARCH
40 DO 77 IQIA=1,IQIA
IND=NJIP-IQIA
IF(ARG(IARG)-X(IND)) 54.56.77
77 CONTINUE
GO TO 110
00080 NI=N+12
IA = NUMPTS(NI)
IARG=2
ARG(2)=A2
NJIP=IP
IQIR=IH
IF(A2 .GT. X(IP-IB)) GO TO 212
IF(A2 .LT. X(IP-1)) GO TO 312
GO TO (40.41.42), METH
81 IM=IQIA
IA=IQIA
NS=IND
IPREV(2,II)=IA
00085 NE=IP-IM+IO+IO*IA-IO
NR=NE-IO
IF(IAR=IM) 86.88.91
00086 IF (X(NE)-99998.5E9) 87.113.113
00087 FCT = X(NE)
GO TO 45
00088 IF (IG) 89.110.93
89 IF (AMAX)(X(NE),X(NR))-99998.5E9) 90.113.113
90 FCT = X(NE)-(X(NS)-A2)*(X(NE)-X(NN))/(X(NS)-X(NS-1))
GO TO 45
91 IF (AMAX)(X(NE),X(NR),X(NE-1),X(NN-1))-99998.5E9) 92.113.113
92 FCT = ((X(NS)-A2)*((X(NN)-A1)*X(NR-1)-(X(NN-1)-A1)*X(NR))
1)-(X(NS-1)-A2)*((X(NN)-A1)*X(NE-1)-(X(NN-1)-A1)*X(NE)))
2/((X(NS)-X(NS-1))*(X(NN)-X(NN-1)))
GO TO 45
93 IF (AMAX)( X(NE), X(NE-1))-99998.5E9) 94.113.113
94 FCT = X(NE)-( X(NN)-A1)*( X(NE)- X(NE-1))/( X(NN)- X(NN-1))
95 GO TO (46.98.99).IF
96 DIMS76 =FCT
GO TO 47
C X OR Y VALUE OFF TOP OF TABLE

```

```

212 IF (IACT(IARG,II) .GT. 1) GO TO 11
    GO TO 12
11  IQTA=IUIB
    INDN=JIP*IQIA
    IGIN=1
    NR=7
    IF (IACT(IARG,II) .EQ. 3) GO TO (76,81), IARG
    IGIN=-1
    NR=6
    GO TO (76,81), IARG
C    X OR Y VALUE OFF BOTTOM OF TABLE
312 IPNTR=IACT(IARG,II)
    GO TO (12,13,14), IPNTR
12  NR=3
    RETURN
13  IGIN=-1
    IQTA=1
    INDN=JIP*IQIA
    NR=6
    GO TO (76,81), IARG
14  IGIN=1
    IQTA=2
    INDN=JIP*IQIA
    NR=7
    GO TO (76,81), IARG
97  II=II-1
98  FCT=DUMSTG-(X(NM)-A3)*(DUMSTG-FCT)/(X(NM)-X(NJ))
99  RETURN
74  IK=3
    IL=3
    GO TO 101
110 NR=2
    GO TO 99
C    7 VALUE OFF TABLE
112 IPNTR=IACT(3,II)
    GO TO (12,21,22), IPNTR
21  IK=3
    IL=3
    NR=4
    NM=NJ
    GO TO 101
22  IF (MINTBL .EQ. MAXTBL) GO TO 12
    IF (II .EQ. MINTBL) II=MINTBL+1
    IK=1
    IL=2
    NM=NJ
    NR=6
    GO TO 101
113 NR=4
    GO TO 99
    END

```

```

SUBROUTINE TIMEHIS(TIME)
  COMMON/XFLOAT/A(500)/IFIXED/IA(200)
  COMMON/CHF/H(200)/ICHF/IB(50)
  COMMON/GAIN1/GA(100)
  COMMON/THLOCK/TPRNTA(500),TPRNTB(200)
  COMMON/DHLOCK/IPL0T(14),IPRNT(11)
  COMMON/CONEM/EMCONV(15),PSCALE(2,14)
  DIMENSION IP1(11),IP2(11),IP3(11),RPRNT(11),DPRNT(11)
  DATA(IPRNT(I),I=1,11)/ 11025,11002,51080,11001,11003,51083,51070,
1  51174,12001,12019,12017 /
  DATA TIT1/6HTIMEF-S /
  IF(TIME.GT.0.) GO TO 10
  DO 1 J=1,11
  IP1(J)=IPRNT(J)/10000
  IP2(J)=(IPRNT(J)-IP1(J)*10000)/1000
  IP3(J)=IPRNT(J)-IP1(J)*10000-IP2(J)*1000
00001 CONTINUE
  DO 2 J=1,11
  IF(IP2(J).EQ.1) RPRNT(J)=TPRNTA(IP3(J))
  IF(IP2(J).EQ.2) RPRNT(J)=TPRNTB(IP3(J))
00002 CONTINUE
  PRINT 3,TIT1,(RPRNT(I),I=1,11)
00003 FORMAT(1X,A6,11(A10,1X))
00010 CONTINUE
  DO 11 J=1,11
  IF(IP2(J).EQ.1) DPRNT(J)=A(IP3(J))*EMCONV(IP1(J))
  IF(IP2(J).EQ.2) DPRNT(J)=R(IP3(J))*EMCONV(IP1(J))
00011 CONTINUE
  PRINT 5,TIME,(DPRNT(I),I=1,11)
00005 FORMAT(1X,F5.2,11(1X,G10.4))
  RETURN
END

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SUBROUTINE DPLOT
  COMMON/XFLOAT/A(500)/IFIXED/IA(200)
  COMMON/CHF/H(200)/ICHF/IB(50)
  COMMON/GAIN1/GA(100)
  COMMON/THLOCK/TPRNTA(500),TPRNTB(200)
  COMMON/UAT/DATTIT(15),DATHD(40),CHTSP,SCALE(2,14),
1  TMMAX,NPLOT(14),ISCALE
  COMMON/UAT2/DATPLT(300,15)
  COMMON/DHLOCK/IPL0T(14),IPRNT(11)
  COMMON/CONEM/EMCONV(15),PSCALE(2,14)
  COMMON/SCP/MTHANS(14),MPLOT(14),IDAT(14)
  DIMENSION DATHD(6),DATHD2(6),DATHD3(6),DATHD4(6),DATHD5(6),
1  DATHD6(6),DATHD7(7)
  DIMENSION TRUF(1024)
  EQUIVALENCE(FAC,GA(1))
  EQUIVALENCE(NCNT,IR(36))
  EQUIVALENCE(NHUN,IA(105))
  EQUIVALENCE(WAITIC,A(242))

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EQUIVALENCE (WAIT,A(177))
EQUIVALENCE (CG,A(256))
EQUIVALENCE (VEOIC,A(238))
EQUIVALENCE (ILTURB,IR(21)),(IWIND,IB(20)),(NCHK,IS(22))
EQUIVALENCE (RKO,B(160)),(TLEADP,B(161)),(RKORRB,B(167))
EQUIVALENCE (TLAGRB,R(168)),(RKORAY,B(169)),(TLEADAY,B(170))
EQUIVALENCE (TLAGAY,R(171)),(RKORDA,R(176)),(RPBDA,B(179))
EQUIVALENCE (TLEADA,R(180)),(TLAGDA,B(181))
EQUIVALENCE (TAUACDA,H(186)),(TAUACHS,H(187))
EQUIVALENCE (IPDAMP,IR(26)),(IQUAMP,IR(27)),(IRDAMP,IR(28))
EQUIVALENCE (MMAG,B(104)),(PITCHM,H(110))
DATA (NPLT(I),I=1,14)/14*1/
DATA CMTSP/,1968/
DATA FAC/1./
DATA ((SCALE(I,J),I=1,2),J=1,14)/2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,-2,100,0,150,0,,
1 110.,40.,20.,-5.,20.,-20.,0.,-100.,150.,0.,75.,25.,5.,-5.,10.,
2 -10.,20.,-5.,50.,-50./
DATA (DATTI(J),J=1,15)/10HRLONSTK-IN,10HRLATSTK-IN,
1 10HRLUPD-IN,10HRTNC-D,10HTROT-D,10HRET-D,
2 10HMMI-D,10HPSI-D,10HVRW-F/S,10HALT-FT.,
3 10HALTD-F/S,10HME-FT.,10HALFA-UEG,10HVE-FT.,
4 10HTIME-SEC. /
DATA (DATHD(J),J=1,40)/10HAV-BA,10HSIMULATION,
110M,10M,10HRRN=,10M,
210MWFIGHT=,10M,10M CG=,10M,
4 10HVEOIC=,10M,10HRRKO=,10M,10M,
510MLEAP=,10M,10HRKORR=,10M,
510MTLAGWP=,10M,10HRKORAY=,10M,
610HRPHUA=,10M,10HTLAGRB=,10M,
7 10HILTURB=,
7 10M,10HIWIND=,10M,10HNCHK=,
810M,10HIPDAMP=,10M,10HMMAG=,
910M,10HPITCHM=,10M,10HIQDAMP=,
110M /
DATA UATHD7(5)/10HCHART SPD, /DATHD7(7)/10MINCH/SEC /
DATA ISCALE/1/
DATA (EMCONV(I),I=1,15)/1.,4.4418, .45359,14.5919,.3048,.092903,
1 .0243168,515.3089,47.8115,1.3538,6.4516,2.54,1.,1.,1./
ENGLISH TO METRIC CONVERSION EMCONV(I)
C 1 1.
C 2 4.4418 LBF TO NEWTON
C 3 .45359 LB-M TO KILOGRAMS
C 4 14.5919 SLUG TO KILOGRAMS
C 5 .3048 FT TO METERS
C 6 .092903 FT**2 TO METER**2
C 7 .0243168 FT**3 TO METER**3
C 8 515.3089 SLUG/FT**3 TO KILOGRAM/METER**3
C 9 47.8115 LB-F/FT**2 TO NEWTON/METER**2
C 10 1.3538 SLUG-FT**2 TO KILOGRAM-M**2,FT-LB-F TO NTN-M.
C 11 6.4516 IN**2 TO CM**2
C 12 2.54 IN TO CM
PRINT 105
00105 FORMAT(10X,15NDPLOT CALLED )
DATHU(3)=DATE(0)
DATHU(4)=TIME(A)

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00100  FORMAT(I10)
00101  FORMAT(A10)
00102  FORMAT(F10.4)
      HEWIND 2
      WRITE(2,100) NRUN
      WRITE(2,102) WATTIC
      WRITE(2,102) CG
      WRITE(2,102) VEOIC
      WRITE(2,102) RKQ
      WRITE(2,102) TLEADP
      WRITE(2,102) MKDRRB
      WRITE(2,102) TLAGRB
      WRITE(2,102) PKDRAY
      WRITE(2,102) MPRDA
      WRITE(2,102) TLAGRB
      WRITE(2,100) 1LTURB
      WRITE(2,100) IWIND
      WRITE(2,100) NCHK
      WRITE(2,100) IPDAMP
      WRITE(2,102) MMAG
      WRITE(2,102) PITCHM
      WRITE(2,100) IQDAMP
      WRITE(2,102) CHTSP
      RFWIND 2
      READ(2,101) DATHD(6)
      READ(2,101) DATHD(8)
      READ(2,101) DATHD(10)
      READ(2,101) DATHD(12)
      READ(2,101) DATHD(14)
      READ(2,101) DATHD(16)
      READ(2,101) DATHD(18)
      READ(2,101) DATHD(20)
      READ(2,101) DATHD(22)
      READ(2,101) DATHD(24)
      READ(2,101) DATHD(26)
      READ(2,101) DATHD(28)
      READ(2,101) DATHD(30)
      READ(2,101) DATHD(32)
      READ(2,101) DATHD(34)
      READ(2,101) DATHD(36)
      READ(2,101) DATHD(38)
      READ(2,101) DATHD(40)
      READ(2,101) DATHD7(6)
      X=MAX(TPMAX)*CHTSP
      IF(1/SCALE.EQ.0) GO TO 400
      DO 200 I=1,14
      IF(ABS(PSCALE(2,I)).GT.ABS(PSCALE(1,I)))PSCALE(1,I)=
1  ABS(PSCALE(2,I))
00200 CONTINUE
      DO 300 I=1,14
      IF(ABS(PSCALE(1,I)).LT..00001)PSCALE(1,I)=SIGN(.00001,PSCALE(1,I))
      t=ALOG10(PSCALE(1,I))
      N=F
      IF(F.LT.0.) N=E-1.
      C=E-N

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D=10.**C
IF((1..LT.D).AND.(D.LT.2.)) D=2.
IF((2..LT.D).AND.(D.LT.2.5)) D=2.5
IF((2.5.LT.D).AND.(D.LT.5.)) D=5.
IF(5..LT.D) D=10.
PSCALE(1,1)=D*10.**N
IF(PSCALE(2,1).GT.0.) PSCALE(2,1)=0.
IF(PSCALE(2,1).EQ.0.) GO TO 300
PSCALE(2,1)=-PSCALE(1,1)
00300 CONTINUE
DO 350 J=1,14
SCALE(1,J)=PSCALE(1,J)
SCALE(2,J)=PSCALE(2,J)
IF(SCALF(1,J).EQ.SCALF(2,J)) SCALE(1,J)=SCALE(2,J)+1.
00350 CONTINUE
00400 CONTINUE
DO 10 I=1,6
DATHD1(I)=DATHD(I)
DATHD2(I)=DATHD(6+I)
DATHD3(I)=DATHD(12+I)
DATHD4(I)=DATHD(18+I)
DATHD5(I)=DATHD(24+I)
DATHD6(I)=DATHD(30+I)
00010 CONTINUE
K=0
DO 11 I=1,4
00011 DATHD7(I)=DATHD(36+I)
CALL PLOTS(IRUF,1024,1)
CALL FACTOR(FAC)
CALL PLOT(0.,40.,-3)
CALL PLOT(0.,-1.,-3)
CALL SYMHOL(2.,0.,.15,DATHD1,0.,60)
CALL SYMHOL(2.,-.25.,.15,DATHD2,0.,60)
CALL SYMHOL(2.,-.5.,.15,DATHD3,0.,60)
CALL SYMHOL(2.,-.75.,.15,DATHD4,0.,60)
CALL SYMHOL(2.,-1.,.15,DATHD5,0.,60)
CALL SYMHOL(2.,-1.25.,.15,DATHD6,0.,60)
CALL SYMHOL(2.,-1.5.,.15,DATHD7,0.,70)
DO 110 J=1,14
IF(SCALF(1,J).EQ.SCALF(2,J)) SCALE(1,J)=SCALE(2,J)+1.
IF(MPLOT(J).EQ.0) K=K+1
IF(MPLOT(J).EQ.0) GO TO 110
IF(MPLOT(J).EQ.1) DATTIT(J)=TPRNTA(IDAT(J))
IF(MPLOT(J).EQ.2) DATTIT(J)=TPRNTB(IDAT(J))
YTIT=-2.787-1.824*(J-K-1)
IF(J.GE.9) YTIT=-3.287-1.824*(J-K-1)
DATT=DATTIT(J)
CALL SYMHOL(0.,YTIT,.15,DATT,0.,10)
CALL NUMBER(1.,YTIT+.787,.15,SCALE(1,J),0.,2)
CALL NUMBER(1.,YTIT-.787,.15,SCALE(2,J),0.,2)
CALL PLOT(2.,YTIT-.787,3)
CALL PLOT(2.,XMAX,YTIT-.787,2)
CALL PLOT(2.,XMAX,YTIT+.787,2)
CALL PLOT(2.,YTIT+.787,2)
CALL PLOT(2.,YTIT-.787,2)

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CALL PLOT(2.,YTIT,2)
CALL PLOT(2.,XMMAX,YTIT,2)
CALL PLOT(2.,YTIT,3)
JM=TMMAX+1.
DO 20 I=1,JM
CALL PLOT(2.,CHTSP*I,YTIT+.1,3)
CALL PLOT(2.,CHTSP*I,YTIT-.1,2)
00020 CONTINUE
XN=2.
XIP=2.
Y0=YTIT-.787*(DATPLT(1,J)-SCALE(2,J))*1.574/(SCALE(1,J)
1 -SCALE(2,J))
CALL PLOT(X0,Y0,3)
NCNT1=NCNT-1
DO 40 I=2,NCNT1
XI=2.+CHTSP*DATPLT(I,15)
IF(XI.LT.XIP) XI=XIP
XIP=XI
IF(DATPLT(I,J).GT.SCALE(1,J)) DATPLT(I,J)=SCALE(1,J)
IF(DATPLT(I,J).LT.SCALE(2,J)) DATPLT(I,J)=SCALE(2,J)
YI=YTIT-.787*(DATPLT(I,J)-SCALE(2,J))*1.574/(SCALE(1,J)
1 -SCALE(2,J))
CALL PLOT(XI,YI,2)
00040 CONTINUE
CALL PLOT(0.,YTIT-1.824,3)
00110 CONTINUE
XP=6.+XMMAX
IF(XP.LT.12.)XP=12.
CALL PLOT(XP,0.,999)
RETURN
END

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SUBROUTINE SHOW
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/R(200)/ICHF/IB(50)
COMMON/DATA/D(300)
DIMENSION ICMNBF(4,3)
DIMENSION PAP(17)
DIMENSION NIM(3)
DIMENSION AV(17,3),STD(17,3),XMIN(17,3),OMAX(17,3)
DIMENSION IPPOINT(11)
DIMENSION MDTKE(7)
DIMENSION ITOUCH(5)
EQUIVALENCE(ITOUCH(1),IA(10))
EQUIVALENCE(JLAND,IB(50))
EQUIVALENCE(A(001),PHI)
EQUIVALENCE(A(2),THET)
EQUIVALENCE(A(3),PST)
EQUIVALENCE(A(25),ALFA)
EQUIVALENCE(A(26),BETA)
EQUIVALENCE(A(35),GAMV)

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EQUIVALENCE (A(75),VEQ)
EQUIVALENCE (A(80),ALTD)
EQUIVALENCE (A(231),THETIC)
EQUIVALENCE (A(232),PSIIC)
EQUIVALENCE (A(238),VEQIC)
EQUIVALENCE (A(359),R2D)
EQUIVALENCE (OR,A(38))
EQUIVALENCE (VHW,A(70)),(TMTN,B(17))
EQUIVALENCE (THROT,B(14)),(RLONSTK,B(17)),(ME,B(140)),(XE,B(141))
EQUIVALENCE (YE,B(142)),(XCG,A(174)),(YCG,A(175))
EQUIVALENCE (AIL,B(2)),(MUDPED,B(11)),(RLATSTK,B(9)),(ALTCOM,B(143)
000001 ),(ALTCOM,H(144)),(MLNSTK,B(8)),(THROTIC,B(15)),(ALFAIC,R(42)
000002 ),(TUTM,H(20)),(YCOM,H(145)),(XCOM,B(146)),(ITOUCH(1),IA(10))
EQUIVALENCE (ALT,A(83)),(RLTSTK,B(10)),(VX,A(200)),(VY,A(201))
EQUIVALENCE (PSICOM,R(150)),(PHICOM,R(148)),(THETCOM,B(147))
EQUIVALENCE (VXCOM,R(149))
EQUIVALENCE (ALTCOM,R(143)),(ALTCOM,H(146))
EQUIVALENCE (IA(1),IMODE)
EQUIVALENCE (IOVOK,IA(15))
EQUIVALENCE (IMOV,IH(1)),(ICON,IB(2)),(ITRANS,IB(6))
EQUIVALENCE (ILAND,IH(3))
EQUIVALENCE (IA(83),ISHOV)
EQUIVALENCE (IA(84),INUMHR)
EQUIVALENCE (IA(90),ICHNRF(1,1))
EQUIVALENCE (MOTDKE(1),A(447))
EQUIVALENCE (IA(105),NRUN)
EQUIVALENCE (R(20),TOTRM)
EQUIVALENCE (IH(4),IZERO)
EQUIVALENCE (IH(10),ISHPRT)
EQUIVALENCE (IH(011),ICOPY)
EQUIVALENCE (IH(014),ITD)
EQUIVALENCE (IH(017),USER)
EQUIVALENCE (I(250),NUM(1))
EQUIVALENCE (I(04),PAR(1))
EQUIVALENCE (I(021),AV(1))
EQUIVALENCE (I(072),STU(1))
EQUIVALENCE (I(123),XMIN(1))
EQUIVALENCE (I(174),OMAX(1))
EQUIVALENCE (I(225),DPOINT(1))
EQUIVALENCE (I(240),NEXT)
EQUIVALENCE (UTURB,A(61)),(VTURB,A(62)),(WTURB,A(63))
EQUIVALENCE (XF1,A(499)),(YE1,A(498))
EQUIVALENCE (ALTD,A(80)),(ALTCOM,R(144))
DATA (ICHNRF(1,L),L=1,3)/3,4,5/
DATA (ICHNRF(2,L),L=1,3)/11,12,13/
DATA (ICHNRF(3,L),L=1,3)/19,20,21/
DATA (ITOP/10)
IF (IMODE) 10,900,100
00010 CONTINUE
IN=0
DO 11 I=1,3
NUM(I)=0
DO 11 J=1,17
AV(J,I)=0.0
STO(J,I)=0.0

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XMIN(J,I)=1.0E9
QMAX(J,I)=-1.0E9
00011 CONTINUE
DO 12 J=1,11
DPNINT(J)=0.0
00012 CONTINUE
00100 CONTINUE
ITD=0
IF (JLAND) 2,2,1
00001 ITD=0
DO 3 J=1,4
IF (ITOUCH(J).EQ.1) ITD=1
00003 CONTINUE
00002 CONTINUE
IMOV=0
ICON=0
ITRANS=0
IF (VRW.LT.100..AND.TMTN.GT.60..AND.ITDP.EQ.0) IMOV=1
IF (VRW.GT.100..AND.TMTN.GT.20..AND.ITDP.EQ.0) ITRANS=1
IF (VRW.GT.100..AND.TMTN.LT.20..AND.ITDP.EQ.0) ICON=1
MORF=IMODE
IF (ICON) 102,102,101
00101 CONTINUE
K=1
GO TO 401
00102 CONTINUE
IF (ITRANS) 301,301,201
00201 CONTINUE
K=2
GO TO 401
00301 IF (IMOV) 609,609,302
00302 K=3
00401 CONTINUE
PAR(1)=RHLNSTK-PLNSTKO
PAR(2)=OH
PAR(3)=THROT-THROTIC
PAR(4)=RLATSTK-RLTSTKO
PAR(5)=RHUIPED
PAR(6)=XE1
PAR(7)=YE1
PAR(8)=ALTD-ALTDCOM
PAR(9)=UTIPR
PAR(10)=VTUWR
PAR(11)=VX-VXCOM
PAR(12)=THET-THFTCOM
PAR(13)=META
PAR(14)=PSI-PSICOM
PAR(15)=PHI-PHICOM
PAR(16)=ALT-ALTCOM
PAR(17)=WTURR
[ON 402 J=1..7
AV(J,K)=AV(J,K)+PAR(J)
STN(J,K)=STN(J,K)+PAR(J)*2
IF (PAR(J).GT.QMAX(J,K)) QMAX(J,K)=PAR(J)
IF (PAR(J).LT.XMIN(J,K)) XMIN(J,K)=PAR(J)

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00402 CONTINUE
      NIM(1)=NUM(1)+ICON
      NIM(2)=NUM(2)+ITRANS
      NIM(3)=NUM(3)+IMOV
00501 CONTINUE
      IF (JLAND.EQ.0) GO TO 609
      IF (IOVUK) 601,601,502
00502 CONTINUE
      IF (IOA) 503,503,601
00503 CONTINUE
      DPOINT(1)=THFT
      DPOINT(2)=ALT-ALTCOM
      DPOINT(3)=YE
      IDA=1
00601 CONTINUE
      IF (ITO) 604,604,603
00603 CONTINUE
      DPOINT(4)=XE
      DPOINT(5)=YE
      DPOINT(6)=THFT
      DPOINT(7)=ALFA
      DPOINT(8)=PSI
      DPOINT(9)=PMI
      DPOINT(10)=META
      DPOINT(11)=ALTD-MOTDKE(2)
      ITD=1
00609 CONTINUE
      ITDP=ITD
00900 CONTINUE
      PFTIIRN
      END

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SUBROUTINE DATSAV
COMMON/XFLOAT/A(500)/FIXED/IA(200)
COMMON/CHF/R(200)/ICRF/IB(50)
COMMON/DAT/DATTT(15),DATHD(40),CHTSP,SCALE(20),
1 TMMAX,MPLT(14),ISCALE
COMMON/DAT2/DATPLT(300,15)
COMMON/DHLOCK/IPLT(14),IPRNT(11)
COMMON/CONEM/EMCONV(15),PSCALE(2,14)
COMMON/SCP/MYTHANS(14),MPLT(14),IDAT(14)
EQUIVALENCE (IA(1),IMODE)
EQUIVALENCE (NCNT,IB(36))
EQUIVALENCE (MTIME,A(304))
EQUIVALENCE (A(303),TIME)
DATA (IPLT(I),I=1,14)/122007,122009,122011,12016,12014,
1 11002,11001,11003,51070,5108J,51080,52140,11025,52142/
DATA ISCALE/0/
DATA ISET/0/
IF (IMODE) 1,1,6
00001 IF (ISET) 2,1000

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00002  DO 3 J=1,15
      DO 3 I=1,300
00003  DATPLT(I,J)=0.
      DO 7 J=1,14
      PSCALE(1,J)=-1.E9
      PSCALE(2,J)=1.E9
00007  CONTINUE
      DO 100 J=1,14
      MTRANS(J)=IPL0T(J)/10000
      MPLOT(J)=(IPL0T(J)-MTRANS(J)*10000)/1000
      IDAT(J)=IPL0T(J)-MTRANS(J)*10000-MPLOT(J)*1000
00100  CONTINUE
      ISFT=1
      NCNT=0
      TMMAX=0.
      TIM2=0.
      GO TO 1000
00006  ISFT=0
      DTIME=TIME/300.
      IF (TIME-LE.15.) DTIME=.05
      IF (TIME-TIM2) 1000,4,4
00004  TIM2=TIM2+DTIME
      NCNT=NCNT+1
      IF (NCNT.GT.300) GO TO 1000
      DO 200 J=1,14
      IF (MPLOT(J).EQ.1) DATPLT(NCNT,J)=A(IDAT(J))*EMCONV(MTRANS(J))
      IF (MPLOT(J).EQ.2) DATPLT(NCNT,J)=B(IDAT(J))*EMCONV(MTRANS(J))
      IF (DATPLT(NCNT,J).GT.PSCALE(1,J)) PSCALE(1,J)=DATPLT(NCNT,J)
      IF (DATPLT(NCNT,J).LT.PSCALE(2,J)) PSCALE(2,J)=DATPLT(NCNT,J)
00200  CONTINUE
      DATPLT(NCNT,15)=TIME
      TMMAX=TIME
01000  CONTINUE
      IF (NCNT.GE.300) NCNT=300
      RETURN
      END

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SUBROUTINE PRINTO
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/B(200)/ICBF/IB(50)
COMMON/DATA/D(300)
DIMENSION AUP(11,2)
DIMENSION AUT(11,2)
DIMENSION AV(17,3),STD(17,3),XMIN(17,3),QMAX(17,3)
DIMENSION DATE1(2)
DIMENSION DPOINT(11)
DIMENSION MI(17,2)
DIMENSION MJ(4,4)
DIMENSION MK(11,2)
DIMENSION KC(6)
DIMENSION KD(6)

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DIMENSION NUM(3)
DIMENSION OUT(8,3)
DIMENSION PAR(17)
DIMENSION SUM(8,3)
EQUIVALENCE (IA(1),IMODE)
EQUIVALENCE (IA(083),ISHOW)
EQUIVALENCE (IA(084),INUMBR)
EQUIVALENCE (IA(90),ICHNMF)
EQUIVALENCE (IA(105),NRUN)
EQUIVALENCE (IB(4),IZERO)
EQUIVALENCE (IB(10),ISMPHT)
EQUIVALENCE (IB(011),ICOPY)
EQUIVALENCE (IB(014),ITD)
EQUIVALENCE (IB(015),IDA)
EQUIVALENCE (D(250),NUM(1))
EQUIVALENCE (D(04),PAR(1))
EQUIVALENCE (D(021),AV(1))
EQUIVALENCE (D(072),STD(1))
EQUIVALENCE (IA(199),N2)
EQUIVALENCE (D(123),XMIN(1))
EQUIVALENCE (D(174),QMAX(1))
EQUIVALENCE (D(225),DPOINT(1))
EQUIVALENCE (D(240),NEXT)
EQUIVALENCE (TAF,A(493)),(TVF,A(492)),(TSCPSEC,A(491))
EQUIVALENCE (PEDAF,A(490)),(PEOVF,A(489)),(PEOSC,A(488))
EQUIVALENCE (RLNAF,A(487)),(RLNVF,A(486)),(RLNSC,A(485))
EQUIVALENCE (RLTAF,A(484)),(RLTVF,A(483)),(RLTSC,A(482))
DATA ICOPY/1/
DATA (KC(I),I=1,6)/1,4,7,10,13,16/
DATA (KD(I),I=1,6)/3,6,9,12,15,17/
DATA (MI(1,I),I=1,2)/4MOLON,4MSTK /
DATA (MI(02,I),I=1,2)/4MQH,4M /
DATA (MI(03,I),I=1,2)/4MOTHR,4MT /
DATA (MI(4,I),I=1,2)/4MOLAT,4MSTK /
DATA (MI(05,I),I=1,2)/4MRUDP,4MHD /
DATA (MI(6,I),I=1,2)/4MXF1,4M /
DATA (MI(7,I),I=1,2)/4MYF1,4M /
DATA (MI(8,I),I=1,2)/4MALTD,4ME /
DATA (MI(9,I),I=1,2)/4MITUR,4MB /
DATA (MI(10,I),I=1,2)/4MVTUM,4MB /
DATA (MI(11,I),I=1,2)/4MVXE,4M /
DATA (MI(12,I),I=1,2)/4MTHET,4ME /
DATA (MI(13,I),I=1,2)/4MBETA,4M /
DATA (MI(14,I),I=1,2)/4MPSIE,4M /
DATA (MI(15,I),I=1,2)/4MPHIE,4M /
DATA (MI(16,I),I=1,2)/4MALTE,4M /
DATA (MI(17,I),I=1,2)/4MTUR,4MB /
DATA (MJ(1,I),I=1,4)/4MTHET,4M MA,4MXIMU,4MM /
DATA (MJ(2,I),I=1,4)/4MTHET,4MA MI,4MNI MU,4MM /
DATA (MJ(3,I),I=1,4)/4MZF,4M MA,4MXIMU,4MM /
DATA (MJ(4,I),I=1,4)/4MZF,4M MI,4MNI MU,4MM /
DATA (MK(01,I),I=1,2)/4MTHET,4MA /
DATA (MK(2,I),I=1,2)/4M ME,4M /
DATA (MK(3,I),I=1,2)/4M YE,4M /
DATA (MK(4,I),I=1,2)/4M XE,4M /

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DATA(MK(5,I),I=1,2)/4M YE .4M /
DATA(MK(06,I),I=1,2)/4MTHET,4MA /
DATA(MK(07,I),I=1,2)/4MALFA .4M /
DATA(MK(08,I),I=1,2)/4M PSI .4M /
DATA(MK(09,I),I=1,2)/4MPHI .4M /
DATA(MK(10,I),I=1,2)/4MBETA,4M /
DATA(MK(11,I),I=1,2)/4MHALTD ,4ME /
DATA NMF C/2/
IF(IZEHO) 201,201,101
00101 CONTINUE
ANO=0.0
DO 102 I=1,3
DO 102 J=1,8
SUM(J,I)=0.0
OUT(J,I)=0.0
102 CONTINUE
DO 103 I=1,2
DO 103 J=1,11
AUM(J,I)=0.0
FIT(J,I)=0.0
103 CONTINUE
201 CONTINUE
301 CONTINUE
DATE1(1)=DATE(D)
DATE1(2)=TIME(D)
IF(ITD.NE.1.OR.IDA.NE.1.) GO TO 304
ANO=ANO-1.
DO 302 I=1,3
SUM(1,I)=SUM(1,I)+OMAX(10,I)
SUM(2,I)=SUM(2,I)+XM(10,I)
SUM(3,I)=SUM(3,I)+OMAX(16,I)
SUM(4,I)=SUM(4,I)+XM(16,I)
SUM(5,I)=SUM(5,I)+OMAX(10,I)**2
SUM(6,I)=SUM(6,I)+XM(10,I)**2
SUM(7,I)=SUM(7,I)+OMAX(16,I)**2
SUM(8,I)=SUM(8,I)+XM(16,I)**2
OUT(1,I)=SUM(1,I)/ANO
OUT(2,I)=OUT(2,I)/ANO
OUT(3,I)=SUM(3,I)/ANO
OUT(4,I)=SUM(4,I)/ANO
OUT(5,I)=SQRT(SUM(5,I)/ANO-OUT(1,I)**2)
OUT(6,I)=SQRT(SUM(6,I)/ANO-OUT(2,I)**2)
OUT(7,I)=SQRT(SUM(7,I)/ANO-OUT(3,I)**2)
OUT(8,I)=SQRT(SUM(8,I)/ANO-OUT(4,I)**2)
302 CONTINUE
DO 303 J=1,11
AUM(J,1)=AUM(J,1)+DPOINT(J)
AUM(J,2)=AUM(J,2)+DPOINT(J)**2
FIT(J,1)=AUM(J,1)/ANO
FIT(J,2)=SQRT(AUM(J,2)/ANO-FIT(J,1)**2)
303 CONTINUE
304 CONTINUE
DO 4002 J=1,17

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D0 4002 I=1,3
IF (NUM(I).EQ.0.) GO TO 305
AV(J,I)=AV(J,I)/NUM(I)
STD1=STD(J,I)/NUM(I)-AV(J,I)**2
IF (STD1.LT.0.) GO TO 306
STD(J,I)=SQRT(STD(J,I)/NUM(I)-AV(J,I)**2)
GO TO 307
305 AV(J,I)=0.
306 STD(J,I)=0.
307 CONTINUE
4002 CONTINUE
KRIIN=2
D0 6000 LL=1,ICOPY
IPAGE=1
PRINT 5000
PRINT 5001,MRUN,DATE1(1),DATE1(2),IPAGE
PRINT 5021
PRINT 5025
PRINT 5022,NUM(1),NUM(2),NUM(3)
PRINT 5023
D0 6001 MU=1,6
IC=KC(MU)
IN=KD(MU)
PRINT 5016
PRINT 5024,(((HI(I,J),J=1,2),(AV(I,J),STD(I,J),OMAX(I,J)
000001 .,MIN(I,J),J=1,3),I=IC,ID))
4001 CONTINUE
IPAGE=IPAGE+1
PRINT 5011
PRINT 5001,MRUN,DATE1(1),DATE1(2),IPAGE
PRINT 5027,ANO
PRINT 5033
PRINT 5028
PRINT 5017
PRINT 5029,(HJ(1,J),J=1,4),OUT(1,1),OUT(5,1),OUT(1,2),OUT(5,2)
000001 .,OUT(1,3),OUT(5,3)
PRINT 5029,(HJ(2,J),J=1,4),OUT(2,1),OUT(6,1),OUT(2,2),OUT(6,2)
000001 .,OUT(2,3),OUT(6,3)
PRINT 5029,(HJ(3,J),J=1,4),OUT(3,1),OUT(7,1),OUT(3,2),OUT(7,2)
000001 .,OUT(3,3),OUT(7,3)
PRINT 5029,(HJ(4,J),J=1,4),OUT(4,1),OUT(8,1),OUT(4,2),OUT(8,2)
000001 .,OUT(4,3),OUT(8,3)
PRINT 5016
PRINT 5030
PRINT 5016
PRINT 5031,(((HK(I,J),J=1,2),OPOINT(I),BUT(I,1),BUT(I,2),I=1,3)
PRINT 5016
PRINT 5032
PRINT 5016
PRINT 5031,(((HK(I,J),J=1,2),OPOINT(I),BUT(I,1),BUT(I,2),I=4,11)
PRINT 5011
6000 CONTINUE
PRINT 7000
PRINT 7001,TAF,TVF,TSCPSEC
PRINT 7002,PEDAF,PEDVF,PEDSC

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PRINT 7003,RLNAF,RLNVF,RLNSC
PRINT 7004,RLTAF,RLTVF,RLTSC
7000 FORMAT(10X,30H PILOT WORK LOAD FUNCTIONS )
7001 FORMAT(10X,10H TAF= ,F10.4,10H TVF= ,F10.4,10HTSCPSEC=
1 ,F10.4)
7002 FORMAT(10X,10HPFDAF= ,F10.4,10H PEDVF= ,F10.4,10MPEDSC=
1 ,F10.4)
7003 FORMAT(10X,10HRLNAF= ,F10.4,10HRLNVF= ,F10.4,10HRLNSC=
1 ,F10.4)
7004 FORMAT(10X,10H RLTAF= ,F10.4,10H RLTVF= ,F10.4,10H RLTSC=
1 ,F10.4)
00000 RETURN
05000 FORMAT(42X,17HCRF FLIGHT DATA )
05001 FORMAT(12X,12HRIIN NUMRER ,I4,20X,6HDATE ,2A10,16X,6HPAGE
000001 ,I4)
05011 FORMAT(1M1)
05016 FORMAT(1M0)
05017 FORMAT(1M )
05021 FORMAT(1M0,40X,17HSTATISTICAL DATA )
05022 FORMAT(1M0,15X,20HFIRST INTERVAL SAMPLE SIZE ,I5
000001, 7X,20HSECOND INTERVAL SAMPLE SIZE ,I5
000002 ,7X,20HTHIRD INTERVAL SAMPLE SIZE ,I5)
05023 FORMAT(1M0,15X,4HMEAN,7X,3HRMS,3X,7HMAXIMUM,3X,7HMINIMUM
000001 , 6X,4HMEAN,7X,3HRMS,3X,7HMAXIMUM,3X,7HMINIMUM
000002 , 6X,4HMEAN,7X,3HRMS,3X,7HMAXIMUM,3X,7HMINIMUM)
05024 FORMAT(1M ,2A4, 1X,12F10.3)
05025 FORMAT(1M0,15X,10MCNVNTNAL ,30X
000001, 21HTRANSITION MODE ,19X,
000002 24H MOVE MODE )
05026 FORMAT(1M0,40HPROR - PRINTOUT CALLED WHEN ISHPRT = 0 )
05027 FORMAT( 1M0,19X,40HCONSECUTIVE RUN AVERAGES AND STANDARD DEVIATION
000001S,20X,F3.0,2X,4HRUNS)
05028 FORMAT(1M0,29X,10H AVERAGE ,6X,10H RMS
000001 , 6X,10H AVERAGE ,6X,10H RMS
000002, 6X,10H AVERAGE,6X,10H RMS )
05029 FORMAT(10X,4A4, 4X,6(F10.4,6X))
05030 FORMAT(1M0,19X,18HVALUES AT THE CAMP ,27X,7HAVERAGE ,13X,3HRMS )
05031 FORMAT(10X,2A4,4X,F10.4,30X,F10.4,6X,F10.4)
05032 FORMAT(1M0,19X,20HTOUCHDOWN PARAMETERS )
05033 FORMAT(1M0,29X ,10MCNVNTNAL
000001,29X,21HTRANSITION MODE
000002 ,11X,24HMOVE MODE )
END

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FLOCK DATA
COMMON/CHF/A(200)/ICHF/IB(50)
COMMON/THLOCK/TPRNTA(500),TPRNTB(200)
COMMON/IFLOAT/A(500)/IFIXED/IA(200)
DIMENSION TPA1(50),TPA2(50),TPA3(50),TPA4(50),TPA5(50),TPA6(50),
TPA7(50),TPA8(50),TPA9(50),TPA10(50),TPB1(50),TPB2(50),TPB3(50),
2TPB4(50)

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DIMENSION DXPA(15),DYPA(15),DZPA(15)
EQUIVALENCE(TPA1(1),TPRNTA(1)),(TPA2(1),TPRNTA(5)),
1(TPA3(1),TPRNTA(10)),(TPA4(1),TPRNTA(15)),(TPA5(1),TPRNTA(20))
2,(TPA6(1),TPRNTA(25)),(TPA7(1),TPRNTA(30)),(TPA8(1),TPRNTA(35))
3,(TPA9(1),TPRNTA(40)),(TPA10(1),TPRNTA(45))
EQUIVALENCE(TPHNTB(1),TPH1(1)),(TPRNTB(5),TPB2(1)),(TPRNTB(10),
1TPB3(1)),(TPRNTB(15),TPB4(1))
EQUIVALENCE(SPAN,A(181)),(CHORD,A(182)),(DT,A(186)),(AREA,A(189))
1,(DZR,A(354)),(R2D,A(359))
EQUIVALENCE(PTURB,A(52)),(QTURB,A(53)),(RTURB,A(54))
EQUIVALENCE(A(47),G),(XMASS,A(130)),(DXPA(1),A(184))
EQUIVALENCE(TB(1),ICOPY)
EQUIVALENCE(DYPA(1),A(210)),(VDIC,A(229)),(PHIIC,A(230))
EQUIVALENCE(THETIC,A(231)),(PSIIC,A(232)),(GAMVIC,A(233)),(GAMMIC
1,A(234)),(PRIC,A(235)),(OHIC,A(236)),(RHIC,A(237)),(VEQIC,
2A(238)),(XIC,A(239)),(YIC,A(240)),(MIC,A(241)),(XIXXIC,A(243))
EQUIVALENCE(XIYYIC,A(244)),(XIZZIC,A(245)),(XIXZIC,A(246)),
1(XIYFLIC,A(247)),(XWATIC,A(248)),(XWAITO,A(251)),(DZPA(1),A(257))
EQUIVALENCE(RZD,A(358)),(R2D,A(359)),(THROTIC,B(15))
EQUIVALENCE(THTNIC,H(18)),(VS,B(30)),(VNMVIC,B(35))
EQUIVALENCE(VEWVIC,B(36)),(BETAVIC,H(37)),(ALFVIC,H(42))
EQUIVALENCE(IFLAT,IA(6)),(IDT1,IA(61)),(IDT2,IA(62)),(IDT3,
1IA(63)),(ICR,IA(64)),(IGEAR,IA(104)),(INRUN,IA(105)),(INDEXT,
2IA(110)),(IMACH,IA(114)),(NUSED,IA(160)),(IFULR,IA(164)),
3(ITASK,TH(30))
EQUIVALENCE(TFPJ1,B(49)),(TRPJ1,B(50)),(TRJ1,B(51))
EQUIVALENCE(COURSE,A(110))
EQUIVALENCE(TYAWJ1,B(52))
EQUIVALENCE(R(53),WDDOT1)
EQUIVALENCE(IFLAT,IA(6))
DATA IFLAT/1/
DATA WDDOT1/5.6/
DATA ICOPY/1/
DATA SPAN/25.25/,CHORD/7.95/,DT/.05/,AREA/201./,DZR/.01745/,
1 R2D/57.3/
DATA PTURB/0./,QTURB/0./,RTURB/0./
DATA ALFVIC/R./
DATA VNTURB/0./,VETURB/0./,VDTURB/0./,VNV/0./,VEN/0./,VDW/0./
DATA IDT1/25/,IDT2/50/,IDT3/100/
DATA COURSE/0./
DATA VS/50./
DATA VEWVIC/0./,VNMVIC/-10./
DATA GAMVIC/0./,GAMMIC/0./
DATA PHIC/0./,OHIC/0./,RHIC/0./
DATA PHIIC/0./,THETIC/0./,PSIIC/0./
DATA (DXPA(I):I=1,15)/ 6.64,-4.5,-5.75,-5.75,0.,50.,18.88,
125.44,31.83,11.44,50.44,49.9,34.925,34.925,24.51/
DATA (DYPA(I):I=1,15)/ 0.,0.,8.36,-8.36,0.,0.,0.,0.,0.,0.,0.,0.,
1 11.06,-11.06,0./
DATA (DZPA(I):I=1,15)/5.67,4.7,4.5,4.5,13.,5.,4.,7.75,7.429,
1 0.,0.,10.84,0.,0.,8.015/
DATA XFLIC/500./,XWATIC/100./,TFPJ1/450./,TRPJ1/1110./
DATA THJ1/612./,TYAWJ1/450./
DATA XIC/100./,YIC/100./
DATA XIXXIC/4295./,XIYYIC/25356./,XIZZIC/27506./,XIXZIC/876./

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DATA ICG/1/  
 DATA WAITO/12500./  
 DATA ITASK/2/  
 DATA INDEXT/4/  
 DATA NUSED/2/  
 DATA G/32.2/  
 DATA IGEAP/1/  
 DATA VDIC/0./  
 DATA(TPA1(I),I=1,50)/10M PHI-DEG. .10M THETA-DEG.10M PSI-DEG. .  
 1 10M PHIN-RAD .10M THETR-RAD .  
 210M PSIN-WAD).10M PHID-R/S .10M THED R/S .10M PSID W/S .  
 310M SINE PHI .10M COSINEPHI.10M SIN THET .10M COS THET .10M SINPSI  
 4 .10M COSINEPSI.10M T11 .10M T21 .10M T31 .  
 110M T12 .10M T22 .10M T32 .10M T13 .10M T23  
 1 .10M T33 .10M ALFA-DEG..10M BETA-DEG .10M ALFAR-RAD.  
 110M RETAR-RAD.10M ALFD-R/S..10M BETA-R/S..10M SALPH .10M CALPH  
 1 .10M SIN RETA .10M COS RETA .10M GAMV-RAD..10M GAMH-RAD. .  
 110M PH-WAD/S..10M QR-R./S. .10M MR-R./S. .10M PL-R/S. .10M QL-R/S  
 1 .10M RL-RAD/S..10M PLH-R/S. .10M OLB-R/S .10M RLB-R/S. .  
 110M PT-W/S. .10M QT-W/S .10M MT-P/S. .10M PHWN-R/S..10M QRWN-R  
 1/S. /  
 DATA(TPA2(I),I=1,50)/10M PHWN-R/S. .10M PTURH-R/S .  
 110M QTURH-R/S.10M RTURH-R/S.10M PHD-M/S2 .10M QBD-R/S2 .10M RBD-R/  
 1S2 .10M UR-M./S. .10M VR-M./S. .10M WR-M./S. .10M UTURB-M/S.10M VT  
 1URR-M/S.10M WTURR-M/S.10M VN-M/S .10M VE-M/S .10M VD-M./S. .  
 110M VEE-M/S .10M VT-M/S .10M VG-M/S .10M VRW-M/S .10M MACH-  
 1M. .10M VNP-M/S .10M VER-M/S .10M VDR-M/S .10M VEQ-KNOTS.  
 110M VNW-M/S .10M VFW-M/S .10M VOW-M/S .10M .10M ALTD-  
 1M/S.10M XLOND-R/S.10M XLATD-R/S. .10M ALT-MTR .10M XLON-RAD .  
 110M XLAT-RAD .10M SINLAT .10M COS LAT .10M VND-M/S2 .10M VFD-M/  
 1S2 .10M VND-M/S2 .10M AX-M/S2 .10M AY-M/S2 .10M AZ-M/S2 .10M AX  
 1M-M/S2 .10M AYP-M/S2 .10M AZP-M/S2 .10M G-M/S2 .10M .  
 1 10M .10M /  
 DATA(TPA3(I),I=1,50)/10M VCAL-KTS .10M .10M XPR-METER .  
 110M YPR-METER.10M HPR-METER.10M DNR-METER.10M DER-METER.10M PR-MET  
 1ER .10M MTV-METER.10M COUNSE-R.10M XLATR-RAD..10M XLONR-RAD..10M CLA  
 1TR-RAD. .10M SIN THETR .10M COS THETR .10M XIX-KG-M2.10M IYY-KG-M2.  
 110M XZZ-KG-M2.10M XIX-KG-M2.10M XMC(1) .10M XMC(2) .10M XMC(3)  
 1 .10M XMC(4) .10M XMC(5) .10M XMC(6) .10M XMC(7)  
 110M XMC(8) .10M XMC(9) .10M XMC(10) .10M XMASS-KG .10M CL  
 1 .10M CD .10M CX .10M CY .10M CZ .10M F  
 1AX-NTN .10M FAY-NTN .10M FAZ-NTN .10M FAX-NTN .10M FEY-NTN .  
 110M FEZ-NTN .10M FGZ-NTN .10M FGY-NTN .10M FGZ-NTN .10M FTZ-NT  
 1N .10M FTY-NTN .10M FTZ-NTN .10M FNORTH-NTN.10M FEAST-NTN .  
 110M FDOWN-NTN /  
 DATA(TPA4(I),I=1,50)/10M FG-NTN .10M CROLL MOM.10M CPITCHMOM .  
 110M CYAW MOM .10M TAL-NT-M .10M TAM-NT-M. .10M TAN-NT-M .10M TEL-NT-  
 1M  
 1 .10M TEN-NT-M .10M TEN-NT-M. .10M TGL-NT-M .10M TGM-NT-M .10M TGN-  
 1NT .10M TTL-NT-M .10M TTM-NT-M .10M TTN-NT-M .10M DT1-SEC .  
 110M DT2-SEC .10M DT3-SFC .10M MR-METER .10M .10M  
 1 .10M .10M XCG METER.10M YCG METER.10M WCG METER .  
 110M WAIT-KG .10M ORAW-NT/M2.10M WBARC-N/M2.10M AREA-M2 .10M SPAN-  
 1M. .10M CHORD-M. .10M RHO-KG/M3 .10M XNOSG-M .10M XMAING-M .10M X  
 1KUNG-M .10M XLWNG-M .10M DXPLT-M .10M DXTAIL-M .10M DXRMDRG-M.

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1 10HXFRNTNOZ-M.10HXREARMOZ-M.10MDXPJET-M .10MDXREARPJ-M.10MDXYAW
1JET-M.10MDXRWBJ-M .10MDXLWBJ-M .10M DXCG-M .10M
110M VX-M/S
DATA(TPA5(I).I=1.50)/10M VY-M/S .7*(10M )10M SOUND-M/S
1.10M DYNUSG-M .10M DYMAIN-M .10M DYRWNGG-M. 10MDYLWNG-G-M.10M DYPL
1T-M .10MDYTAIL-M .10MDYRMDRG-M .10MDYFRNTNZ-M .10MDYREARNZ-M .
110MDYFPTCHJ-M.10MDYRPTCHJ-M.10MDYVWJ-M- .10MDYHWG-J-M .10M DYLWG
1J-M .10MDYCG-M .10M XPILOT-M .10M YPILOT-M .10M ZPILOT-M .10M
1 .10M VOIC-M/S .10M PHIC-DEG.10M THETIC-D..10M PSIIC-D. .
110M GAMVIC-D..10M GAMHIC-D..10M PVIC-R/S. .10M QVIC-R/S..10M WVIC-R
1/S..10M VVIC-R/S.10M XIC-METER.10M YIC-METER.10M MIC-METER.10M WAI
1TIC-KG .10MXIXIC KM2 .10MXIYYIC KM2.10MXIZZIC KMS.10MXIXZIC KMS.
1 10MWFU
1ELIC-KG.10MWWAITIC-KG.10M WFUEL-KG .10M WWT-KG /
DATA(TPA6(I).I=1.50)/10M WAITO-KG .10M WSTORE-KG.10M
110M DXCGO-M .10M DZCGO-M .10M CG-PCT .10M DNOSG-M .10MDZMNG-M
1 .10MDZPBG-M .10MDZLWG-M .10MDZPLT-M .10MDZTAIL-M
110MDZRMDRG-M .10MDZFNZ-M .10MDZRNZ-M .10MDZFPPTCHJ-M.10MDZPTCH
1J-M.10MDZYAW-J-M .10MDZFWG-J-M .10MDZLWG-J-M .10MZCG-CGR-M .10MDE
1CK(1)-M.10MDECK(2)-M.10MDECK(3)-M.10MDECK(4)-M.10MDECK(5)-M.2*
1(10M )10MXIGNG-M .10MXIGMG-M. .10MXIGRWG-M
1 10MXIGLWG-
1M .2*(10M )10MYIGNG-M .10MYIRMG-M .10MYIGRWG-M
110MYIGLWG-M .2*(10M )10MHIRNG-M .10MHIGMG-M
1 10MHIGRWG-M .10MHIGLWG-M .6*(10M ) /
DATA(TPA7(I).I=1.50)/2*(10M )10M TIME-SEC .10M RTIME-SEC
1.27*(10M )10MTEMPRAT .10MPRESRAT
110M .10M DTIM1-SEC.10M T1-SEC .14*(10M ) /
DATA(TPA8(I).I=1.50)/7*(10M )10M DZH-RAD/D.10MR2D-D/RAD
1 .4*(10M )
1.10MRRMOZ-KG/M3.10MRRMOZ-M .10MTRM-DEG-K .10MPMH-N/M2
110MTTOT-NTN .10M PTOI-N/M2.10M DELAT-K .10MSQTEMPR
13*(10M )10MXMCC1-1/S..10MXMCC2-1/S..10MXMCC3-1/S .10MXM
1C4-1/S..10MXMCC5-1/S..10MXMCC6-1/S..10MXMCC7-1/S..10MEXM-NMS.
110MEXMY-NMS .10MEXM2-NMS .6*(10M )10M STATE(1)
110M STATE(2) .10M STATE(3) .10M STATE(4) .10M STATE(5) .10M STATE(
16) .10M CONT(1) .10M CONT(2) .10M CONT(3) .10M CONT(4) /
DATA(TPA9(I).I=1.50)/10M CONT(5) .10M CONT(6) .3*(10M )
1.10M UVIC-M/S .10M VVIC-M/S .10M WVIC-M/S .4*(10M )
110M VHD-M/S2 .10M VHD-M/S2 .10M WHD-M/S2 .10MVTUN-M/S .10MVTWF-M/
1S .10M VTD-M/S .10MVTUWB-M/S.10MVTURH-M/S.10MVTURH-M/S.
111*(10M )10MVKNOS-M5.10MVONMN-M/S .10MVONRW-M/S
110MVONLW-M/S.3*(10M )10MVDENS-M/S .10MVDEN-M/S
1 10MVDFW-M .10MVDFWG-M .3*(10M )10MMDTDCG-M
1 .10MMDTNG-M/S .10MMDTNG-M/S .10MMDTNG-M/S /
DATA(TPA10(I).I=1.50)/10MMDTDL4-M/S.2*(10M )10M VR-M/S
1 .4*(10M )
DATA(TPH1(I).I=1.50)/10M STAB-DEG..10M AIL-DEG .10M HUD-DEG.
110M .10M STAB1-DEG.10M PSAS-D .10MRLONSTK-CM.10MRLNSTKO
1-CM .10MPLATSTK-CM.10MPLTSTKO-CM.10MRUPEO-CM .10M YSAS-DEG .10MR
1SAS-DEG .10MTRQT-DEG .10MTRQTC-D..10MTRTNC-DEG..10MTRTN-DEG
110MTRNIC-DEG.10MTRN1-PCT .10M TRUT-NTN .10MTRPEDO-CM .10MTRTNN
1(10M).10MTRPTX-DEG.10MTRTNN-DEG .10MTRTX-DEG .10MTRTNN-DEG .10MTRN
1MX-DEG .10M PEUMM-CM .10M PEDMX-CM .10M VS-M/S .2*(10M
1).10MTRTNN-DEG.10MTRTNN-DEG.10MVNWRIC-M/S.10MVEWHIC-M/S.10MRETAI

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1(-DEG,10HSTKMIN-CM,10H STKMAX-CM,10HRLSMIN-CM,10HRLSMAX-CM,
110M ALFAIC-D,10M,10M TFPJ-NTN,10MTRPJ-NTN,10M TYAWJ
1-NTN,10M TPRJ-NTN,10M TLRJ-NTN,10M TFPJ1-NTN,10MTRPJ1-NTN /
DATA(TPR2(I),I=1,50)/10M TKJ1-NTN,10M TYAWJ1-NTN,10M WDOT2-KG,
12*(10M,10M TAUENG-S,10M HDRAJ-NTN,10M TFN-NTN,
110M THN-NTN,10M VJRC5-M/S,10M UGE-PCT,10M,10M GEF1
1,10M GEF2-1/M,10M ALTGE-NTN,10M FCR-KG/S,10M ALKJ-CM2,
110M AFPJ-CM2,10M ARPJ-CM2,10M ARJ-CM2,10M AYAWJ-CM2,10M CSPLAY
IF,10M CSPLAYN,10M CRJ,10M CFPJA,10M CWPJA,10M SFP
1JA,10M SRPJA,10M SRJ,10M RLAM1-RAD,10M RLAM2,
110M PHIS-RAD,10M THETS-RAD,10M MSIS-RAD,10M THETDSR/S,
110M PHISD-M/S,10M PSTSD-R/S,10M HEAVE-M,10M HEAVED-M/S,10M SURGE-M
1,10M CURRED-M/S,10M SWAY-M,10M SWAYD-M/S,10M X15-M,
110M X25-METER,10M Y15-METER,10M Y25-METER,10M X35-METER,10M M35-ME
1TER,10M M15-METER /
DATA(TM3(I),I=1,50)/10M XTD-METER,10M YTD-METER,10M M15-METER,
110M M15-METER,10M PHIRAD-RAD,10M PHIRAD-RAD,10M MEGH-M/S,10M MFGW-R
1/S,10M DOLL-MAD,10M PITCHM-RAD,10M MEGP-M/S,10M PHIP-RAD,10M YAW
1M-RAD,10M MEGY-R/S,10M PHIV-RAD,10M SURGM-M,10M MEGSRG-RS,
110M PHISW-M,10M SWAYM-M,10M MFGSWY-M/S,10M PHISWY-R,10M VJD
1,10M CDD 1/MAD,10M CLADOT-1/R,10M CLP-1/RAD,10M CMQ-1/RAD,10M CYD
1R-1/D,10M CYH-1/RAD,10M CLDA-1/D,10M CLQ-1/RAD,10M MADT-1/R,
110M CNDR-1/D,10M CNR-1/RAD,10M CYDA-1/DEG,10M CYP-1/MAD,4*(10M
1,10M ME-METER,10M XE-METER,10M YE-METER,10M ALTCOM-M,
110M ALTCOM-M,10M COM-M,10M COM-M,10M METCOM-D,10M PHICOM-
1DER,10M XCOM-M/S,10M PSICOM-D, /
DATA(TM4(I),I=1,50)/2*(10M,10MUGST-M2/S2,10MVGST-M2/S2
1,10MUGST-M2/S2,10M XFR2-M,10M SWBSW,10M SUNSW,10M
1,10M RQ-U/R/S,10M LEADP-S,10M PSAS1-DEG,10M PSAS11-D-S,
110M,10M HWSMI-D-S,10M HWSH-D,10M HKDRB-D/S,10M LAGRB-
1S,10M RPHA DMS2,10M LEADAY-S,10M LAGAY-S,10M AYFILT-D,
110M AYFILT-D,10M SAS2-D,10M INCT-D,10M RKORDA-D/D,10M SAS1-D
1,10M SASLIM-D,10M RPHA-D/R/S,10M LEADA-S,10M LAGUA-S,10M PBW
1SW-D,10M PWSMI-D,10M PSASLIM-D,10M AILC-D,10M TAUACOA-S,
110M TAUCHS-S,10M HUD2-D,10M XTD1-M,10M YTD1-M,10M TAUALPH
1-S,4*(10M) /
END

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C TITLE RICPRINT
C SURROUTINE RICPRI(TITLE,A1,A2,A3,A4,A5,A6,A7,A8,A9,NODAT,U)
C
C COMMON /XFLOAT/A(500)/IFIXED/IA(200)
C
C AUTHORS -M.STEWART AND D. ASTILL- COMPUTER SCIENCES CORPORATION
C
C INFORMATION SUPPLIED IN CALLING SEQUENCE
C
C TITLE ... IS WORD CONTAINING 4 HOLLERITH CHARACTERS FOR PRINTOUT
C A1 HEADING
C A2

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. . . . . VARIABLES TO BE PRINTED  
 . . . . .  
 A9 . . . . .  
 NQDAT ... ARRAY (DIMENSIONED 18) TWO WORDS TO EACH VARIABLE. EACH  
 PAIR CONTAINS 8 HOLLERITH CHARACTERS TO BE USED AS  
 VARIABLE NAME ON PRINTOUT  
 U ... ARRAY (DIMENSIONED 9) EACH WORD CONTAINS 4 HOLLERITH  
 CHARACTERS DESCRIBING UNITS OF VARIABLE

EQUIVALENCE (A(1),PHI),(A(2),THET),(A(3),PSI),(A(25),ALFA)  
 1.(A(26),META),(A(29),ALFD),(A(30),METD),(A(35),GAMV)  
 2.(A(36),GAMH),(A(37),PB),(A(38),QB),(A(39),RB),(A(55),PHO)  
 3.(A(56),QRO),(A(57),RHO),(A(64),VN),(A(65),VE),(A(66),VO)  
 4.(A(70),VRW),(A(71),XMACH),(A(75),VEO),(A(88),VNO),(A(89),VED)  
 5.(A(90),VDD),(A(116),XIXX),(A(117),XIYY),(A(118),XIZZ)  
 6.(A(119),XIX7),(A(131),CL),(A(132),CO),(A(133),CX),(A(134),CY)  
 7.(A(135),CZ),(A(136),FAX),(A(137),FAY),(A(138),FAZ),(A(152),CLL)  
 8.(A(153),CLM),(A(154),CLN),(A(155),TAL),(A(156),TAM)  
 9.(A(157),TAN),(A(177),WAT),(A(180),AHEA),(A(181),SPAN)  
 A.(A(182),CHOPU),(A(256),CG)  
 EQUIVALENCE (FFX,A(139)),(FEY,A(140)),(FEZ,A(141)),(FGX,A(142))  
 1.(FGY,A(143)),(FGZ,A(144)),(FTX,A(145)),(FTY,A(146))  
 2.(FTZ,A(147)),(TEL,A(158)),(TEM,A(159)),(TEN,A(160))  
 3.(TGL,A(161)),(TGM,A(162)),(TGN,A(163)),(TTL,A(164))  
 4.(TTM,A(165)),(TTN,A(166))  
 EQUIVALENCE (XCR,A(174)),(YCG,A(175)),(MCG,A(176))  
 EQUIVALENCE (P2D ,A(359))  
 EQUIVALENCE (N4MIN,IA(105))  
 EQUIVALENCE (IA(199),N2)

C  
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C

DIMENSION NQDAT(18),U(9)  
 DIMENSION UDAT(15),ODAT(85)

DATA UDAT/4HDFG,4HR/S,4HR/S2,4HNTN,4HN-M,4HM/S,4HM/S2,  
 14H4ETH,4HRGM2,4HMTR2,4HPCT,4HKTS,4HKB,4H,4H /

DATA UDAT  
 1/4H PH,4HI,4H TH,4HET,4H PS,4H AL,4HFA,4H RE,4HTA,  
 24H GA,4HNV,4HFD,4HTD,4HMH,4H PB,4H,4H QB,4H RR,  
 34H CD,4H CL,4H CX,4H CY,4H CZ,4HL,4HM,4HN,  
 44H FA,4HX,4HY,4HZ,4H TA,4H VN,4H VE,4H VO,4H VR,  
 54H W,4H X,4H XM,4HACH,4H XC,4HG,4H YC,4H MC,4H XI,  
 64H XX,4HYY,4HYZ,4HXZ,4H WA,4HIT,4H CG,4H SP,4HAN,  
 74H CM,4HORD,4H AR,4HEA,4H DE,4H DA,4H DR,4H,4H FE,  
 84H FG,4H FT,4H TE,4H TG,4H TT,4HP1,4HP2,4HP3,4HP4,  
 94H T1,4H T2,4H T3,4H T4,4HO,4H DX,4H DY,4H NH,  
 A 4H,4HKB,4H,4H,4H /

V04K=VHV/1.69  
 G44NR=GAMH/R20  
 G44VO=GAMV/R20

CALL DATE (DMY)  
CALL TIME (HMS)  
PRINT 1, TITLE

C PRINT 1000 ,N2,DMY,HMS  
C CONVERT ALL VARIABLES TO METRIC UNITS FOR IC PRINTOUT

EMLRKG=.45359  
EMINF=1.3556  
EMMAS=14.5419  
EMFDRC=4.41R  
EMTOPU=1.3546  
EMFTM=.304H  
EMICM=2.54  
EMAREA=.042903  
EMKMS=.51479  
EMMMS=.447039  
EMDHS=47.8113  
XIXM=XIXX\*EMINF  
XIYMXIYX\*EMINF  
XI7M=XI7Z\*EMINF  
XIX7M=XIX7\*EMINF  
VATTM=VATT\*EMLXKG  
SPANM=SPAN\*EMFTM  
CMQDM=CMQD\*EMFTM  
ADPAMB=ADPA\*EMMFA  
XCGM=XCG\*EMFTM  
YCGM=YCG\*EMFTM  
HCGM=HCG\*EMFTM  
FAYM=FAY\*EMFDRC  
F7M=F7\*EMFDRC  
FFXM=FFX\*EMFDRC  
FFYM=FFY\*EMFDRC  
FF7M=FFZ\*EMFDRC  
FGXM=FGX\*EMFDRC  
FGYM=FGY\*EMFDRC  
FG7M=FGZ\*EMFDRC  
FTYM=FTX\*EMFDRC  
FT7M=FTZ\*EMFDRC  
TALM=TAL\*EMTONU  
TAMM=TAM\*EMTONU  
TANM=TAN\*EMTONU  
TELM=TEL\*EMTONU  
TEM=TEM\*EMTONU  
TENM=TEN\*EMTONU  
TEL=TEL\*EMTONU  
TGM=TGM\*EMTONU  
TANM=TAN\*EMTONU  
TTLM=TTL\*EMTONU  
TTM=TTM\*EMTONU  
TTN=TTN\*EMTONU  
VVM=VM\*EMFTM  
VFM=VF\*EMFTM  
VDM=VD\*EMFTM

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VNOM=VND*EMFTM
VFNH=VED*EMFTM
VNOM=VDD*EMFTM
VRWM=VRW*EMFTM
PRINT 2,QDAT(45),QDAT(46),XIXM,UOAT(9),QDAT(45),QDAT(47),XIYYM,
000001,UOAT(4),QDAT(45),QDAT(48),XIZZM,UOAT(9)
C
PRINT 2,QDAT(45),QDAT(49),XIXZM,UOAT(9),QDAT(50),QDAT(51),WAITM,
000001,UOAT(13),QDAT(52),QDAT(16),CR
C
PRINT 2,QDAT(53),QDAT(54),SPANM,UOAT(8),QDAT(55),QDAT(56),CHOROM
000001,UOAT(8),UOAT(57),QDAT(58),AREAM,UOAT(10)
PRINT 3
C
PRINT 2, NQDAT(1),NQDAT(2),A1,U(1)
000001, NQDAT(3),NQDAT(4),A2,U(2)
000002, NQDAT(5),NQDAT(6),A3,U(3)
C
PRINT 2, NQDAT(7),NQDAT(8),A4,U(4)
000001, NQDAT(9),NQDAT(10),A5,U(5)
000002, NQDAT(11),NQDAT(12),A6,U(6)
C
PRINT 2, NQDAT(13),NQDAT(14),A7,U(7)
000001, NQDAT(15),NQDAT(16),A8,U(8)
000002, NQDAT(17),NQDAT(18),A9,U(9)
PRINT 3
C
C
C
C
PRINT 2,QDAT(78),QDAT(81),XCGM,UOAT(8),QDAT(79),QDAT(81),YCGM
000001,UOAT(8),QDAT(80),QDAT(81),MCGM,UOAT(8)
PRINT 2,QDAT(1),QDAT(2),PHI,UOAT(1),QDAT(3),QDAT(4),TMET
000001,UOAT(1),QDAT(5),QDAT(2),PSI,UOAT(1)
C
PRINT 2,QDAT(6),QDAT(7),ALFA,UOAT(1),QDAT(8),QDAT(9),BETA
000001,UOAT(1),QDAT(10),QDAT(11),GAMMU ,UOAT(1)
C
PRINT 2,QDAT(6),QDAT(12),ALFU,UOAT(2),QDAT(8),QDAT(13),RETO
000001,UOAT(2),QDAT(10),QDAT(14),GAMMU ,UOAT(1)
PRINT 3
C
PRINT 2,QDAT(15),QDAT(16),PR,UOAT(2),QDAT(17),QDAT(16),OB
000001,UOAT(2),QDAT(18),QDAT(16),MH,UOAT(2)
C
PRINT 2,QDAT(15),QDAT(19),PHD,UOAT(3),QDAT(17),QDAT(19),QBD
000001,UOAT(3),QDAT(18),QDAT(19),RHO,UOAT(3)
PRINT 3
C
C
PRINT 2,QDAT(20),QDAT(16),CD,UOAT(14),QDAT(21),QDAT(16),CL
PRINT 2,QDAT(22),QDAT(16),CX,UOAT(14),QDAT(23),QDAT(16),CY
000001,UOAT(14),QDAT(24),QDAT(16),CZ
C
PRINT 2,QDAT(21),QDAT(25),CLL,UOAT(14),QDAT(21),QDAT(26),CLM

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000001 .U(14).Q(21).Q(27).CLN
      PRINT 3
C
      PRINT 2.Q(24).Q(29).FAXM.U(4).Q(28).Q(30).FAYM
000001.U(4).Q(28).Q(31).FAZM.U(4)
      PRINT 2.Q(63).Q(29).FEYM.U(4).Q(63).Q(30).FEYM
000001.U(4).Q(63).Q(31).FEZM.U(4)
C
      PRINT 2.Q(64).Q(29).FGYM.U(4).Q(64).Q(30).FGYM
000001.U(4).Q(64).Q(31).FGZM.U(4)
      PRINT 2.Q(65).Q(29).FTYM.U(4).Q(65).Q(30).FTYM
000001.U(4).Q(65).Q(31).FTZM.U(4)
      PRINT 3
C
      PRINT 2.Q(32).Q(25).TALM.U(5).Q(32).Q(26).TAMM
000001.U(5).Q(37).Q(27).TANM.U(5)
      PRINT 2.Q(66).Q(25).TELM.U(5).Q(66).Q(26).TEMN
000001.U(5).Q(66).Q(27).TENM.U(5)
C
      PRINT 2.Q(67).Q(25).TGLM.U(5).Q(67).Q(26).TGMN
000001.U(5).Q(67).Q(27).TGNM.U(5)
C
      PRINT 2.Q(68).Q(25).TTLM.U(5).Q(68).Q(26).TTMN
000001.U(5).Q(68).Q(27).TTNM.U(5)
      PRINT 3
C
      PRINT 2.Q(33).Q(19).VNDM.U(7).Q(34).Q(19).VEDM
000001.U(7).Q(35).Q(19).VDDM.U(7)
      PRINT 2.Q(36).Q(37).VRMM.U(6).Q(36).Q(38).VEO
000001.U(12).Q(39).Q(40).XWACH
      PRINT 2.Q(36).Q(42).VPMK.U(12)
      PRINT 3
C
C
C
C
C
C
      RETURN
      1 FORMAT(1M1.35X.A4.27H INITIAL CONDITION PRINTOUT/ )
      2 FORMAT(10X.2A4.1M=.F11.4.1X.A4.5X.2A4.1M=.E11.4.1X.A4.5X
000001.      2A4.1M=.F11.4.1X.A4)
000003 FORMAT(1M0)
01000 FORMAT(10X.10HRUN NUMBER.4X.13.15X.5MDATE1.3X.A9.14X.5MTIME
000002 .3X.A10/)
      ENN

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SHAREOUTLINE WINDC
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/M(200)/ICHF/II(50)
COMMON/GAINI/GA(100)

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EQUIVALENCE (T11,A(16)),(T21,A(17)),(T31,A(18))
1 ,(T12,A(19)),(T22,A(20)),(T32,A(21))
2 ,(T13,A(22)),(T23,A(23)),(T33,A(24))
EQUIVALENCE (VNTURB,A(419)),(VETURB,A(420)),(VOTURB,A(421))
EQUIVALENCE (A(61),UTURB)
EQUIVALENCE (A(62),VTURB)
EQUIVALENCE (A(63),WTURB)
EQUIVALENCE (A(70),VRW)
EQUIVALENCE (A(164),DT)
EQUIVALENCE (A(238),VEIC)
EQUIVALENCE (XCR,A(174)),(YCB,A(175)),(STMETR,A(114)),(CTMETR,
1 A(115))
EQUIVALENCE (ALT,A(83))
EQUIVALENCE (A(303),TIME)
EQUIVALENCE (IA(1),IMODE)
EQUIVALENCE (IONCE,IR(16))
EQUIVALENCE (VS,R(30))
EQUIVALENCE (PHIP,H(112))
EQUIVALENCE (OMEAR,R(111))
EQUIVALENCE (UGST,B(153)),(VOST,B(154)),(WOST,B(155))
EQUIVALENCE (XFR7,B(156)),(SWBSW,R(157)),(SUBSW,B(158))
EQUIVALENCE (IB(18),IPITCH)
EQUIVALENCE (PITCHM,H(110))
EQUIVALENCE (NCHK,IR(22))
EQUIVALENCE (R(45),X2S),(B(94),X1S)
EQUIVALENCE (ILHURB,IR(25))
EQUIVALENCE (IMFRZ,IR(24)),(IWIND,IB(20)),(ILTURB,IB(21))
EQUIVALENCE (GA(30),GR(1))
EQUIVALENCE (MIS,R(100))
EQUIVALENCE (IUISCT,IA(50))
EQUIVALENCE (FHTN,H(194)),(FRTE,B(195)),(FRTO,R(196)),(VMH,B(197))
EQUIVALENCE (VME,H(198)),(VMD,B(199)),(TOTURB,B(200))
DIMENSION RD(7),GR(7)
DIMENSION RDY(7),RDYI(7),IROST(7),IROSI(7,10)
DIMENSION RDX(7)
DATA SWPSW/1./,SUBSW/1./
DATA INET/0/
DATA TIMJ/0./
DATA (GH(I),I=1,7)/6.,6.,125.,125.,25.,3.,3./
DATA HUA/1/
DATA MI/3.141592/
DATA FC/5./
DATA (IROST(I),I=1,7)/1,3,5,7,9,11,13/
DATA IUHT/0./,IVRT/0./,IWBHT/0/
DATA ZH1/.001/,ZR2/1.5/,YR1/.001/,YR2/1.5/
DATA XFR7/150./
DATA ((IROSI(I,J),I=1,7),J=1,10)/1,3,5,7,9,11,13,13,1,3,5,7,9,11,
1 11,13,1,3,5,7,9,9,11,13,1,3,5,7,7,9,11,13,1,3, 5,5,7,9,11,
1 13,1,3,3, 5,7,9,11,13,1,15,17,19,21,23,25,27,27,15,17,19,21,
3 23,25,27,15,17,19,21,23/
IF (IUISCT) 7,7,30
IF (IWBHT) 2,3,4
CONTINUE
RT=OUT
V0=VFUIC=1.689

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IF (VU.LT.60) VO=60.
RK10=SQRT(3.14159*5900.)*.003
RK11=SQRT(5400.*3.14159)*3.*VO/400000.
S110=-VO/1000.
S210=-3.*VO/400.
Z01=EXP(S110*DT)
Z02=EXP(S210*DT)
Z11=-1./(S110-S210)*RK10*(1.-Z01)
Z12=1./(S110-S210)*RK10*(1.-Z02)
Z13=-1./(S210-S110)*RK11*(1.-Z01)/S110
Z14=1./(S210-S110)*RK11*(1.-Z02)/S210
Z011 =EXP(-VO/100.*DT2)
Z111=SQRT(71.63*3.14159)/100.*(1.-Z011)
Z0112=EXP(-VO/100.*DT2)
Z112=SQRT(200.*3.14159)/100.*(1.-Z0112)
IX=2**24-3
DO 10 I=1,7
  R0X(I)=0.
  R0Y(I)=0.
  IF (IONCE.GT.0) IRDST(I)=IRDSI(I,IONCE)
09010 CONTINUE
  RN1=.044*SORT(PI)
  BC=2.*FC*PI
  IF (VEUIC.NE.VEQICP) IZX=1
  VEQICP=VEUIC
3 CONTINUE
  BRSS=0.
  URSS=0.
  UR2S=0.
  UR5P=0.
  RN4=0.
  RN3=0.
  UR=0.
  WR=0.
  WR2S=0.
  UR2SS=0.
  VRSA=0.
  VRSA=0.
  URSA=0.
  WRSA=0.
  WRSA=0.
  UR2TA=0.
  WR2TA=0.
  WR2SS=0.
  URSS=0.
  VR1=0.
  VR2=0.
  VR3=0.
  VR4=0.
  VR5=0.
  VR6=0.
  URSS=0.
  VRSS=0.
  VRSS=0.
  Z0S=0.

```

```

YRS=0.
ZRS=0.
YRS=0.
FACV=EXP(-ARS(YCG)/100.)
ALT1=MIS*50.-XCG*.1
FAC7=1.
IF(ALT.GT.ALT1) FACZ=EXP((ALT1-ALT)/50.)
FACW=FACV*FACZ
XD=XCG
UTURN=-VS*SUMSW*FACW*TAB1(XD,0.,0.,68,1)
BTURN=-VS*SWHSW*FACW*TAB1(XD,0.,0.,69,1)
VTURN=0.
TIM3=0.
ZQ=0.
YQ=0.
RFTIUN
CONTINUE
4 IF(I=IND.FQ,0)RETURN
IF(MCHK.GT.0) RFTURN
FACV=EXP(-ARS(YCG)/100.)
ALT1=MIS*50.-XCG*.1
FAC7=1.
IF(ALT.GT.ALT1) FACZ=EXP((ALT1-ALT)/50.)
FACW=FACV*FACZ
XD=XCG
IF(UBFHZ.FQ,1) XD=-XFRZ
UMSS1=-VS*TAB1(XD,0.,0.,68,1)
UMSS=UMSS1*SUMSW*FACW
IF(ILBUNH)21,21,20
00021 UMSS1=-VS*TAB1(XD,0.,0.,69,1)
UMSS=UMSS1*SWHSW*FACW
GO TO 22
00020 UMSS1=-VS*TAB1(XD,0.,0.,70,1)
UMSS=UMSS1*SWHSW*FACW
00022 CONTINUE
VSD=1./(.45*VS)
CTERM=COS(04.60*(1.+(VW-VS)*VSD)*TIME+XD*VSD*PHIP-1.57)))*IPITCH
UMIK=2.22*.0004*XD
IF(UMIK.LT.0,U) UMIK=0.0
UMI=IPITCH*VS*UMIK*CTERM*FACW
IF(XCG.GT.X25) UMI=0.
WMIK=4.40*.001*XD
IF(WMIK.LE.0,U) WMIK=0.0
WMI=IPITCH*VS*WMIK*CTERM*FACW
IR(XCG.LT.-253A.) WMI=0.
IF(XCG.GT.X25) WMI=0.
SINWCT=SIN(WC*TIME)
DO 1 I=1,7
CALL RAND(IRUST(I),IX,1,1,U)
ORX(I)=I
NDY(I)=NDX(I)-NDY(I)
NDY(I)=NDY(I)*RDA*RDY(I)*DT
ND(I)=NDY(I)*SINWCT
1 CONTINUE

```

```

SIH2=TAH1(XD*0.,0.,71.1)
TIH2=TAH1(XD*0.,0.,72.1)
DTOT=DT/TIH2
UJZ=UBZP*(1.-DTOT)+VS*SUBZ*1.414*SQRT(1./TUBZ)*DTOT*RD(1)*GR(1)
UJZP=UJZ
DTOTW=DT/3.33
WR2=WBZP*(1.-DTOTW)+.035*VS*.748*DTOTW*ND(2)*GR(2)
IF(XD.LT.-2540.) WR2=0.
IF(XD.GT.X1S) WR2=0.
WRZP=WRZ
VYRZ=WRZ
VXHZ=UHSS+UR1+UJZ
VNHR=VXSS+UH1+VH2
VYHR=VYSS+CTHETR-VYRZ*STHETR
VFHR=VYHR+CTHETR-VYRZ*STHETR
UJZT=T11*VNHZ+T12*VEHR+T13*VDHR
VJZT=T21*VNHR+T22*VEHR+T23*VDHR
WJZT=T31*VNHZ+T32*VEHR+T33*VDHR
IF(IJHT.EQ.1) UJZT=0.
IF(IJHT.EQ.1) VJZT=0.
IF(IJHT.EQ.1) WJZT=0.
WRZ=ZU11*WRZ+Z111*RD3
UJZ=RU(3)*GR(3)
UJZ=ZU11*UG+Z111*WD4
WJZ=RU(4)*GR(4)
VJ1=ZU1*VG1+Z11*RD5P
VJ2=ZU2*VG2+Z12*RD5P
VJ3=ZU3*VG3+Z13*RD5P
VJ4=ZU4*VG4+Z14*RD5P
WJ5P=RU(5)*GR(5)
VJ5=VG1+VJ2+VJ3+VJ4
IF(ILTIHH.EQ.1) GO TO 5
UG=0.0
VG=0.
WR=0.
CONTINUE
UJZH=UJZT+UG
VJZH=VJZT+VG
WJZH=WJZT+WG
ZUWHN1=WN(1)*GR(6)+(ZR1)*ABS(XD)+ZR2)
VUWHN1=WN(17)*GR(4)+(YR1)*ABS(XD)+YR2)
UJZSS=UJZS+UJZ
VJZSS=VJZS+VJZ
WJZSS=WJZS+WJZ
UJZSS=UJZS+NT*UJZ**2
VJZSS=VJZS+NT*VJZ**2
WJZSS=WJZS+NT*WJZ**2
ZUJZ=ZUJZ+ZU
VJZ=VJZ+VJ
WJZ=WJZ+WJ
ZUJZSS=ZUJZS+NT*ZU**2
VJZSS=VJZS+NT*VJ**2
WJZSS=WJZS+NT*WJ**2

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00025 IF (TIME) 30.30.25
CONTINUE
RAY=TIME/DT
VRS=VPS/RAV
ZRS=ZHS/RAV
URS=UGS/RAV
VRS=VGS/RAV
WRS=WGS/RAV
IMP=IMP/RAV
WRT=WR/RAV
URST=URSS/TIME
VRST=VRSS/TIME
URST=UGSS/TIME
VRST=VGSS/TIME
WRST=WRSS/TIME
ZRS=ZHS/TIME
YRS=YHS/TIME

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00030 CONTINUE
IF (DISC) 37.37.33
33 CONTINUE
FRT=AMAXI (FRTN,FRTS,FRTD)
FM=FM*(TIME-TDTURB)
IF (PHASE=0.2H) 34.34.36
34 IF (TIME-TDTURB) 36.36.35
35 VNTIHR=.5*VMD*(1.-COS (FRTN*(TIME-TDTURB)))
VFTIHR=.5*VMD*(1.-COS (FRTS*(TIME-TDTURB)))
VDTIHR=.5*VMD*(1.-COS (FRTD*(TIME-TDTURB)))
GO TO 37
36 VNTIHR=0.
VFTIHR=0.
VDTIHR=0.
37 CONTINUE
RETURN
END

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SIMROUTIME RAND (IU,IX,K,N,U)
DIMENSION U(N)
IF (K) 11.7.11
7 DO 4 I=1,7
I1=IU*IX
4 U(I)=I1/201474976710655.
RETURN
11 DO 13 J=1,N
S=0.
DO 12 J=1,12
I1=IU*IX
12 S=S+I1
13 U(I)=S/201474976710655.-6.
RETURN
END

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SUBROUTINE CONTR2
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/R(200)/ICHF/IB(50)
EQUIVALENCE(AIL,R(2))
EQUIVALENCE(RUU,R(3))
EQUIVALENCE(STAH1,B(5))
EQUIVALENCE(PSAS,H(6))
EQUIVALENCE(RLONSTK,R(7))
EQUIVALENCE(PLATSTK,R(9))
EQUIVALENCE(PUDWFD,R(11))
EQUIVALENCE(YSAS,H(12))
EQUIVALENCE(PSAS,H(13))
EQUIVALENCE(A(37),PH)
EQUIVALENCE(QH,A(38))
EQUIVALENCE(RH,A(39))
EQUIVALENCE(AY,A(92))
EQUIVALENCE(IMODE,IA(1))
EQUIVALENCE(IMDAMP,IM(26))
EQUIVALENCE(TODAMP,IM(27))
EQUIVALENCE(IMUAMP,IM(28))
EQUIVALENCE(DT,A(164))
EQUIVALENCE(RKU,R(160))
EQUIVALENCE(TLEADP,H(161))
EQUIVALENCE(PSAS1,B(162))
EQUIVALENCE(PSAS1I,H(163))
EQUIVALENCE(RHWSH1,H(165))
EQUIVALENCE(RHWSH1B(166))
EQUIVALENCE(RKURRH,R(167))
EQUIVALENCE(TLAGRH,R(168))
EQUIVALENCE(RKDRAY,R(169))
EQUIVALENCE(TLEADAY,H(170))
EQUIVALENCE(TLAGAY,H(171))
EQUIVALENCE(AYFILT1,R(172))
EQUIVALENCE(STAH,H(1))
EQUIVALENCE(AYFILT,B(173)),(YSAS2,R(174)),(RINCNCCT,R(175)),
1 (RKDRUA,H(176)),(B(177),YSAS1),(YSASLIM,B(178)),(RPHDA,B(179)),
2 (TLEADU,H(180)),(TLAGDA,B(181)),(RHWSH,H(182)),(RHWSH1,R(183)),
3 (PSASLIM,H(184)),(AILC,H(185)),(TAUACDA,R(186)),(TAUACMS,
4 F(187)),(MUD2,H(188))
EQUIVALENCE(IA(16),TZDOF),(TIME,A(303))
DATA MKU/ZH,363/.TLEADP/.164/.TLAGP/.741/.PSASLIM/1.5/
DATA RKUWDA/.54/.RPHDA/19.825/.TLEADDA/.781/
DATA TLAGDA/1.24/
DATA TAUACMS/.0433/.TLAGPB/3.11/.RKDRHA/38.33/.RKDRAY/.83/
DATA TLAGAY/.25/.TLAGAY/.125/.YSASLIM/5./HSASLIM/2./
DATA TAUACDA/.04/.IMDAMP/1/.INDAMP/1/.TODAMP/1/
IF(IMODE)1,100,2
00001 PSAS1=0.
      PWSH1=0.
      RHWSH1=0.
      AYFILT1=0.
      PWSH1=0.
      EXPH1MS=1.-EXP(-DT/TAUACMS)
      EXPH1A=1.-EXP(-DT/TAUACDA)
      ATL=AILC

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STAH=STANC
00002 CONTINUE
STAR1=TAH1(RLONSTK*0.0001,1)
PSAS1=(PSAS1)-(RKQ*OR-PSAS1)*DT
PSAS1=(PSAS1)+(HKQ*LEADP*QB)/TLAGP
PSAS1=PSAS1*QUAMP
PSAS=PSAS1
IF (ABS(PSAS1).GT.PSASLIM) PSAS=SIGN(PSASLIM,PSAS1)
STANC=STAH1+PSAS
STAR=STAR+EXPDTMS*(STANC-STAB)
IF (I*UUF.EQ.1) STAB=TAH1(TIME,0.0001,74,1)
C YAW SAS
PBWSH=(PBWSH)+(RWBSH)*DT
WBWSH=(WBWSH)+(RWBSH)/TLAGR
AYFILT=(AYFILT)+(RKDRAY*AY-AYFILT)*DT
AYFILT=(AYFILT)+(RKDRAY*LEADAY*AY)/TLAGAY
PBWSH=(PBWSH)+(RPHDA*PBWSH)*DT
PBWSH=(PBWSH)+(RPHDA*LEADDA*PBWSH)/TLAGDA
PBWSH=PBWSH
IF (ABS(PBWSH).GT.PSASLIM) PBWSH=SIGN(PSASLIM,PBWSH)
WSAS=(WBWSH)*WDAMP
AILC=TAH1(PLATSTK*0.0001,3,1)
AIL=AIL*EXPDTMS*(AILC-WSAS-AIL)
PINCNT=AILC-WSAS
YSAS2=(WBWSH*AYFILT)*WDAMP
YSAS1=YSAS2-PINCNT
YSAS=YSAS1
IF (ABS(YSAS1).GT.YSASLIM) YSAS=SIGN(YSASLIM,YSAS1)
C ROLL SAS
RUD=TAH1(RUDDP*0.0001,2,1)
RUD1=RUD
RUD2=RUD1+YSAS
00100 CONTINUE
IF (IMODE) 101,101,102
00101 STAH=STANC
AIL=AILC
00102 CONTINUE
RETURN
END

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SIMROUTINE AFR02
COMMON/CHF/R(200)/ICRF/IR(50)
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
EQUIVALENCE(ALT,A(83))
EQUIVALENCE(STAR,H(1)),(RUD,H(3)),(AIL,H(2)),(TMTN,H(17))
EQUIVALENCE(TIME,A(303)),(IMODE,IA(1)),(VJR,H(122)),
000001 (D7CG,A(144)),(D7CG,A(271)),(CMUH,A(182)),(SPAN,A(181)),
000002 (WFA,A(140)),(ORAR,A(174)),(HMACH,A(71)),(VRW,A(70))
EQUIVALENCE(RH,A(143)),(CDQ,H(123)),(CLADOT,H(124)),(CLP,H(125))
EQUIVALENCE(CMU,H(126)),(CYDR,H(127)),(CYH,H(128)),(CLDA,H(129)),
000003 (CLO,H(130)),(CMADT,H(131)),(CMUH,H(132)),(CNR,H(133)),(CYDA,

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000002H(134)。(CYP.H(135))。(DXCGO.A(254))。(DZCGO.A(255))
EQUIVALENCE(PHWN.A(49))。(QBWN.A(50))。(RWBN.A(51))
EQUIVALENCE(PTURN.A(52))。(OTURN.A(53))。(RTURN.A(54))
EQUIVALENCE(A(25).ALFA)。(A(26).BETA)。(A(29).ALFD)。(A(31).SALPH)
000001(A(32).CALPH)。(A(37).PH)。(A(38).UR)。(A(39).RB)。(A(155).TAL)
000002(A(156).TAM)。(A(157).TAN)
EQUIVALENCE(VEG.A(75))
EQUIVALENCE(TFN.R(54))。(TRN.H(59))
EQUIVALENCE(FAX.A(136))。(FAY.A(137))。(FAZ.A(138))
EQUIVALENCE(CL.A(131))。(CD.A(132))。(CX.A(133))。(CY.A(134))
EQUIVALENCE(CZ.A(135))。(CLL.A(152))。(CLM.A(153))。(CLN.A(154))
EQUIVALENCE(R(151).CMSTR1)。(CLSTR3.B(152))
EQUIVALENCE(ISTOR1.IH(37))。(ISTOR2.IH(38))
DATA CMSTR1/.05/.CDSTR1/.0052/
DATA CLSTR3/0./
DATA ISTOR1/1/.ISTOR2/1/
DATA CLSTR2/0./。CMSTR2/0./。CDSTR2/.01345/
DATA C00/0./。CLADOT/0./。CLP/-。3152/。CMU/-10.49/
000001CYP/。00165/。CYP/。4469/。CLDA/。0017/。CLQ/4.87/
000002CMAOT/-10./。CMOP/-。0011/。CNR/-。45/。CYUA/0./
000003CYP/。07/。DXCGO/28.5/。DZCGO/8.015/
IF(OHAR)1.1.2
1 VJR=11.4
VFR=1000.
GO TO 3
2 VJR=SQRT((TFN*TRN)/(OHAR*13.))
3 CONTINUE
IF(VJM.GT.0.) VER1=VJR
VFR=1./VFR1
IF(TMTN.LE.30. AND.VJR.GE.5.4) VJR=5.4
IF(VJM.LT.5.4) VJR=5.4
IF(VJM.GT.11.9)VJR=11.4
CF=ORAH*AWEA
L4N=PH*PTURR
L4N=PH*PTURR
L4N=PH*PTURR
L5=PH*H*CALPH*RWBN*SALPH
L5=PH*H*CALPH*RWBN*SALPH
IF(VPR=1.)4.4.5
4 C02V=U.
R02V=U.
GO TO 6
5 CONTINUE
C02V=CM(OHD)/(2.*VRW)
R02V=SPAN/(2.*VRW)
6 CONTINUE
CLSTR1=TAH1(VER.TMTN,0.,73.1)
CLTANK=CLSTR3
IF(TMTN.LE.50.) CLTANK=CLSTR3*TMTN/50.
CLSTORE=(CLSTR1*CLTANK)*ISTOR1*CLSTR2*ISTOR2
C1STORE=(CUSTH1*ISTOR1*CDSTR2*ISTOR2
CMTANK=CMSTR1
IF(TMTN.LF.45.) CMTANK=CMSTR1*TMTN/45.
C4STORE=CMTANK*ISTOR1*CMSTR2*ISTOR2
CL1=TAH1(ALFA.STAB.TMTN,37.6)

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CL2=TAH1(ALFA,STAB,TMTN,43,3)
CL3=CL1+(CL2-CL1)*(VJH-5.4)/6.5
CL=CL3*(CLADOT*ALFD+CLQ*QBWN)*CO2V+CLSTORE
CN1=TAH1(ALFA,STAB,TMTN,46,6)
CN2=TAH1(ALFA,STAB,TMTN,52,3)
CN3=CU1+(CN2-CN1)*(VJR-5.4)/6.5
CN=CN3*(CNO*QHYN)*CO2V+CNSTORE
CX=-CO*CALPH+CL*SALPH
C7=-CO*SALPH-CL*CALPH
C41=TAH1(ALFA,STAB,TMTN,55,6)
C42=TAH1(ALFA,STAB,TMTN,61,3)
CM1=CM1+(CM2-CM1)*(VJH-5.4)/6.5 +CMSTORE
CLM=CM3+CO2V*(CMADT*ALFD+CMQ*QBWN)
000001 -CZ*(DAG-DXCRQ)/CHQHD+CX*(DZCG-DZCGO)/CHORD
QSH=UF*SPAN
QSC=UF*CHQHD
FAZ=UF*CX
FA7=UF*CZ
CY1=TAH1(HETA,ALFA,TMTN,19,3)
CY2=TAH1(HETA,ALFA,TMTN,22,2)
CY3=CY1+(CY2-CY1)*(VJH-5.4)/6.5
CY=CY3*(YDP*HUN+CYDA*AIL+(CYP*PS+CYR*RS)*BO2V
CLL1=TAH1(HETA,ALFA,TMTN,24,3)
CLL2=TAH1(HETA,ALFA,TMTN,27,2)
CLL3=CLL1+(CLL2-CLL1)*(VJR-5.4)/6.5
CLOH=TAH1(VF,0.0,0.34,1)
CL4=TAH1(ALFA,0.0,0.36,1)
CLL5=CLL3+CLOH*HUN+CLDA*AIL*(CLR*RS+CLP*PS)*BO2V
CN1=TAH1(HETA,ALFA,TMTN,29,3)
CN2=TAH1(HETA,ALFA,TMTN,32,2)
CN3=CN1+(CN2-CN1)*(VJR-5.4)/6.5
CNH1=TAH1(ALFA,0.0,0.35,1)
CNH2=TAH1(ALFA,0.0,0.66,1)
CNS=CN3+CNH1*AIL+CNH2*HUN*(CNP*PS+CNH*RS)*BO2V
CLL=CLL5+CALPH-CNS*SALPH
CLM=CLL5*SALPH+CNS*CALPH
TAL=OSH*CLL
TAM=USC*CLM
TAN=USH*CLN
FAY=UF*CY
JFTIYH
END

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SINGOUTIME GEARS
COMMON/CHF/R(200)/[CHF/IG(50)
COMMON/XFLNAT/A(500)/[FIXED/IA(200)
DIMENSION DYP(15),DXPA(15),DZPA(15)
DIMENSION MDTXK(7),MDECK(5),MIG(4),ITOUCH(5)
EQUIVALENCE (FAZ,A(136)),(FEZ,A(141))
EQUIVALENCE (MDTXK(1),A(447)),(MIG(1),A(291)),(MDECK(1),A(272))
EQUIVALENCE (MLAM1,M(HU)),(M(H1),QLAM2),(DT,A(166)),(IMODE,IA(1))

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EQUIVALENCE (FEX,A(139)), (FAX,A(136)), (WAIT,A(177))
EQUIVALENCE (PH,A(37)), (ITOUCH(1),IA(10))
EQUIVALENCE (DYPA(1),A(210)), (DXPA(1),A(164)), (DZPA(1),A(257))
EQUIVALENCE (FGXM,A(455))
EQUIVALENCE (ALT,A(83)), (PHIR,A(4)), (PSIR,A(6)), (THETR,A(5))
EQUIVALENCE (UNP,A(106)), (DER,A(107))
EQUIVALENCE (VRW,A(70))
EQUIVALENCE (VP,A(454))
EQUIVALENCE (VX,A(200))
EQUIVALENCE (FGX,A(142)), (FGY,A(143)), (VN,A(64)), (VE,A(65)),
2 (CPSI,A(15)), (SPSI,A(14)), (FGZ,A(144)), (TGM,A(162)),
3 (TGL,A(161)), (TGN,A(163)), (PHIR,A(4)), (THETR,A(5)), (ALT,A(83)),
4 (ALTD,A(80)), (PSIP,A(6))
EQUIVALENCE (IMRAK,IR(24))
EQUIVALENCE (IR(4),ICRASH)
EQUIVALENCE (SPHI,A(10)), (CPHI,A(11)), (STHT,A(12)), (CTHT,A(13))
EQUIVALENCE (IMG, IA(11))
EQUIVALENCE (UH, A(38))
EQUIVALENCE (ALT,A(83)), (ALTD,A(80))
DATA RMUX,A/
RMUX=.A
IF (IMRAK,EO,U) RMUX=.03
D7NG=IMG(1)-MDECK(2)
D7MG=IMG(2)-MDECK(3)
IF (IMU(1),1).2
00001 D7MG=07NG
D7MG=07MG
D7MG=07MG
IF (D7MG1.GT.0.) DZMG1=0.
D7MG=07MG(3)-DYP(4)
D7MG=07MG(1)-DXP(2)
00002 CONTINUE
RLAM1U=(MOTDKE(2)-MOTDKE(3))/DXGEAR
RLAM2U=(MOTDKE(5)-MOTDKE(4))/DYGEAR
FGZNG=TAM1(DZMG,0.,0.,64,1)*ITOUCH(1)*((DZMG-DZMG0)/DT*2500.
1 *250.*DZMG)
FGZMG=TAM1(DZMG,0.,0.,65,1)*ITOUCH(2)*((DZMG-DZMG0)/DT*2500.
1 *250.*DZMG)
D7MG=07MG
D7MG=07MG
FGZ=FGZNG+FGZMG
IF (FGZ.GT.0.) FGZ=0.
IF (VR.WE.0.) FGX=(RMUX*FGZMG+.03*FGZNG)*SIGN(1.,VR)
IF (ABS(VW).LT.01) FGX=(-(FAX-FEX)*COS(THETR-RLAM1)*SIN(RLAM1)+
1 WAIT*(FAZ+FEZ)*SIN(THETR-RLAM1))*ITOUCH(2)
FGX=-((RUX*FGZMG+.03*FGZNG)
IF (ABS(FGX).GT.FGX) FGX=SIGN(FGX,FGX)
TGZ=-FGZNG*(DXPA(1))-FGZMG*(DXPA(2))+FGX*(DZPA(2)+DZMG1)
IF (ITOUCH(3).EQ.1.AND.ITOUCH(4).EQ.1) GO TO 3
GO TO 4
00003 DZMG=RLAM2U
DZMG=RLAM2
00004 CONTINUE
IF (IMU(1),EO,-1) GO TO 20
IF (DZMG.LT.-1.AND.D7MG.LT.-1.) GO TO 7

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00007  GO TO 6
        ALT0=H0TDKF(1)
        QH=PLAM10
        Z1=DZPA(1)+DZNG
        Z2=DZPA(2)+DZMG
        Z3=Z1-Z2
        X1=DZPA(1)-DXPA(2)
        THT1=ATAN2(Z3,X1)
        THTM=THT1+HLAM1
00008  GO TO 20
        IF (DZNG.LT.-1.AND.QH.LT.0.) QH=0.
        IF (DZMG.LT.-1..AND.QH.GT.0.) QH=0.
00020  CONTINUE
        TGN=0.
        TGL=0.
        CLAM1=COS(PLAM1)
        SLAM1=SIN(PLAM1)
        FG7=FG7*CLAM1-FGX*SLAM1
        FGX1=FGX*CLAM1+FGZ*SLAM1
        FGZ1=FGZ1*CTHT+FGX1*STHT
        FGX=FGX1*CTHT-FG71*STHT
        IF (IMODE.EQ.-1) ICRASH=0
        IF (DZNG.LE.-2..AND.DZMG.LT.-2..AND.IMODE.EQ.1) ICRASH=1
        IF (FGZ.GT.0.) FGZ=0.
        RETURN
END
SUBROUTINE ENGINE
COMMON/GAIN/GA(100)
COMMON/XFL0AT/A(500)/FIXED/IA(200)
COMMON/CHF/H(200)/ICHF/IB(50)
DIMENSION HDECK(5)
DIMENSION HIG(6)
EQUIVALENCF (HUD,B(3)), (TMTN,G(17))
EQUIVALENCF (PLONSTK,H(7))
EQUIVALENCF (ICOUNTM,H(47)), (ICOUNTN,IB(48))
EQUIVALENCF (IMODE,IA(1)), (VJR,B(122)),
1 (D7CG,A(271)), (CHORD,A(152)), (SPAN,A(181)),
2 (ARFA,A(150)), (QHAR,A(178)), (PMACH,A(71)), (VPM,A(70))
EQUIVALENCF (STAR,B(1)), (STAH1,B(5)), (HUD2,B(188))
EQUIVALENCF (MIL,H(2))
EQUIVALENCF (GA,M4), (PMMAX)
EQUIVALENCF (STEMPH,A(371)), (RNI,H(19)), (PHO,A(183)), (TMTNC,H(16))
1), (TFPJ,H(44)), (R(45),TRPJ), (H(46),TYAWJ), (TRHJ,H(47)), (TLRJ,H(48))
2), (IFPJ,H(49)), (TRPJ1,B(50)), (TRJ1,H(51)), (TYAWJ1,H(52)),
3 (THPT,H(14)), (YSWAT,H(7)), (YSAS,H(12)), (WOODOT1,H(53)), (A(250),
4 VVAT), (XFUEL,A(244)), (IFUEL,H(14)), (TAUENG,H(56)), (HDRAG,B(57)),
5 (R(48),TFH), (H(54),THN), (H(60),VJQCS), (TMTN,H(17)), (LUGE,H(61)),
6 (ALT1,H(42)), (DXCG,A(198)), (XFN,A(191)),
7 (ZFN,A(264)), (ZRN,A(192)), (ZRN,A(265)), (ZHDRAG,A(263)),
8 (XWJAG,A(190)), (XFPJ,A(193)), (XRPJ,A(194)), (XRRJ,A(196)),
9 (YRPJ,A(222)), (ZYAWJ,A(2nd)), (ZYAWJ,A(195))
EQUIVALENCF (HIG(1),A(291))
EQUIVALENCF (ALTGF2,GA(94)), (GEF1,H(63)), (GEF2,B(64)), (B(65),ALTGE1)
1)
EQUIVALENCF (PMACH,A(71))

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EQUIVALENC (FCR,B(66)),(TOTM,B(20)),(AFPJ,B(68)),(AMPJ,B(69))  
 EQUIVALENC (APRJ,B(70)),(ALRJ,B(67))  
 EQUIVALENC (AYWJ,B(71)),(CSPLAYF,B(72)),  
 1(CSPJAYH,H(73)),(CRJ,H(74)),(CFPJA,H(75)),(CRPJA,B(76)),  
 2(SRPJA,H(77)),(SRPJA,B(78)),(SRJ,H(79)),(VJR,B(122))  
 EQUIVALENC (DT,A(168))  
 EQUIVALENC (FEY,A(139)),(FEY,A(140)),(FEZ,A(141)),(TEM,A(159)),  
 1(TFL,A(154)),(TFN,A(160)),(SALPH,A(31)),(CALPH,A(32)),  
 2 (SMETA,A(33)),(CBETA,A(34))  
 EQUIVALENC (IMODE,IA(1)),(TMTNIC,H(18)),(WFUELIC,A(247)),  
 1 (WVATIC,A(244))  
 EQUIVALENC (CG,A(256))  
 EQUIVALENC (DXC60,A(254))  
 EQUIVALENC (TMTOTIC,H(15))  
 EQUIVALENC (HUFCK(1),A(272))  
 EQUIVALENC (ALT,A(83))  
 EQUIVALENC (M(20),TOTM)  
 EQUIVALENC (RA(90),TMCOR)  
 EQUIVALENC (IMOV,IM(1))  
 DATA TMCOR/.9933/  
 DATA ICOUNTM/140/,ICOUNTN/200/  
 DATA GEF1/0./,GEF2/0./  
 DATA CSPLAYF/.446/,CSPLAYH/.9778/,CFPJA/.991/,CRPJA/.9902/  
 DATA CRJ/1./,SRPJA/-.133/,SRPJA/.1396/,SRJ/0./  
 DATA ICOUNTM/140/,ICOUNTN/400/  
 DATA HMMAX/105./  
 DATA CG/10.7/  
 DATA DXC60/28.5/  
 DATA FCH/.06/  
 DATA TMTMHT/150./  
 DATA HMOZ/.002377/  
 DATA ALTGE1/10./,ALTGE2/20./  
 IF (IMODE) 81.81.79

00061 CONTINUE  
 (DGE1=(GEF2-GEF1)/ALTGE1  
 (DGE2=(GEF2/(ALTGE2-ALTGE1))  
 ICOUNT=0  
 ACOUNT=0  
 NCOUNT=0  
 TMTN=TMTNIC  
 IF (SUTEMPR.EQ.0.) SUTEMPR=1.  
 TMTOT=TMTOTIC  
 TMTNC=TMTNIC  
 WVAT=WVATIC  
 WFUEL=WFUELIC  
 (M)=TMTOT  
 (N)=MHN1

00079 CONTINUE  
 DXC60=DXC60+CHORD\*(CG-10.7)/100.  
 AFPJ=TAH1\*(PLONSTK\*0.0006+1)  
 APRJ=TAH1\*(STAN\*0.0005+1)  
 ARPJ=TAH1\*(A1L\*0.0006+1)  
 ALRJ=TAH1\*(A1L\*0.0006+1)  
 AYWJ=TAH1\*(MID2\*0.0007+1)  
 (M2)=MHN1/SUTEMPR

```

RRMO=HMO/RMOZ
ATOT=AFPJ+ARPJ+ARRJ+ALRJ+AYAWJ
PRODUCT=TAB1(ATOT,0.,0.,0.,1)
RN3=RN2/100.
NSW1=RN3+1.
00010 GO TO(10,20),NSW1
VJPCS=23.43*RN2
RMUMAX=23.*RN3*RKNRCS
GO TO 30
00020 VJPCS=RN2*(-1+3.24*RN2*(3.3455-.016748*RN2))
RMUMAX=23.*RKNRCS
00030 CONTINUE
C NOZLF ANGLE RESPONSE
TMTNE=TMTNC-TMTN
DTMTN=TMTNRAT*DT
IF(ABS(TMTNE)-DTMTN)40,40,50
00040 TMTN=TMTNC
GO TO 40
00050 TMTN=TMTN+DTMTN*SIGN(1.,TMTNE)
00060 CONTINUE
IF(TMTN-40.5) 90,100,100
00100 TMTN=40.5
GO TO 120
00090 IF(TMTN)110,110,120
00110 TMTN=0.
00120 CONTINUE
IF(TMTN.LT.20.) GO TO 121
GO TO 122
00121 SPLAYR=7.5-TMTN*.025
GO TO 125
00122 SPLAYR=.41245+TMTN*(-.012496+.0008437*TMTN)
00125 CSPLAYR=COS(SPLAYR/57.3)
C REACTION CONTROL EFFECTIVENESS
TMTNR=TMTN/20.
IF(TMTNR)131,131,129
00129 IF(TMTNR-20.)130,140,140
00131 RKNRCS=0.
GO TO 150
00130 RKNRCS=TMTNR*(-.100762+TMTNR*(3.292+TMTNR*(-2.1689-.0223*TMTNR)))
GO TO 150
00140 RKNRCS=1.
00150 CONTINUE
C RCS IMPUST CALCULATION
C HMO IMPUST PRESSURE AT NPCT/DUCT PRESSURE AT 100 PCT
IF(HNJ-.5)151,151,152
00151 RN4=.0738*RN3
GO TO 153
00152 RN4=-.3162+1.3162*RN3
00153 CONTINUE
FACRCS=RKNRCS*RRMO*RN4*PRODUCT
AFPJ=TAH1(AFPJ,0.,0.,9,1)
ARRJ=TAH1(ARRJ,0.,0.,10,1)
ALRJ=AFPJ+FACRCS*ARRJ
AYAWJ=TAH1(AYAWJ,0.,0.,11,1)

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00160 IF (RDU2) 160,160,170
      TYAWJ=-TYAWJ*FACRCS*RK1YAWJ
      GO TO 160
00170 TYAWJ=TYAWJ*FACRCS*RK1YAWJ
00180 CONTINUE
      IF (ALL) 200,210,220
00200 RK1HKJ=TAR) (ARRJ,0..0..12,1)
      RK1LHJ=TAR) (ALPJ,0..0..13,1)
      TRPJ=TWJ*FACRCS*RK1HRJ
      TLRJ=TWJ*FACRCS*RK1LRJ
      GO TO 230
00210 TRPJ=0.
      TLRJ=0.
      GO TO 230
00220 RK1HKJ=TAR) (ARRJ,0..0..13,1)
      RK1LRJ=TAR) (ALPJ,0..0..12,1)
      TWJ=-TWJ*FACRCS*RK1HKJ
      TLWJ=TWJ*FACRCS*RK1LHJ
00230 CONTINUE
      RMHCS=32.2*(TRPJ+TRPJ*ABS(TYAWJ)+ABS(TRRJ)+ABS(TLRJ))/
      1 (VJHCS+1.)
      A IF (RMHCS.EQ.0.) GO TO 232
        IF (RMHCS.GT.WMDMAX) GO TO 231
        GO TO 232
00231 CONTINUE
      RMHCS=WMDMAX/RMHCS
      TRPJ=TRPJ*RMHCS
      TRRJ=TRRJ*RMHCS
      TLRJ=TLRJ*RMHCS
      TWJ=TWJ*RMHCS
      TLWJ=TLWJ*RMHCS
      RMHCS=WMDMAX
00232 CONTINUE
C ENGINE RPM COMMAND
      HNC=TRPUT
      IF (RNC.GT.104..AND.MCOUNT.EQ.1) RNC=104.
      IF (RNC.GT.102..AND.MCOUNT.EQ.1) RNC=102.
C WATER INJECTION CONTROL
      IF (ISWAT.FD.0.) WWDOT=0.
      IF (ISWAT.FD.1..AND.WN1.GT.42.) WWDOT=WWDOT1
      IF (WAT.LF.0.) WWDOT=0.
      IF (WAT.LT.42.) WWDOT=0.
      WAT=0.42-WWDOT*DT
      IF (WAT.LF.0.) WAT=0.
C THROTTLE COMMAND LIMITER
      IF (WNC.GT.WMDMAX) WNC=WMDMAX
      IF (WNC.GT.102..AND.WWDOT.EQ.0.) WNC=102.
      IF (WNC.GT.102..AND.WTN.LT.10.) WNC=102.
      WFIIFL=WFIIFL-FCR*RN)*DT
      WFIIFL=0
      IF (WFIIFL) 260,260,270
00270 WNC=0.
      GO TO 260
00280 WNC=WNC+.50*DT
      WFIIFL=1

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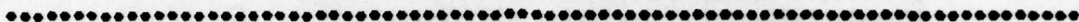
00280 RNC=RNC-RNC1
      IF (RNC.LE.0.) RNC=0.
      IF (WFUEL.LT.0.) WFUEL=0.
      IF (IMODE) 291,291,292
291 DTAIL=.05
      GO TO 293
292 CONTINUE
      TAILFNU=TANI (RN1,0..0..14.1)
      DTAIL=DT/TAIENG
293 CONTINUE
      EXPENG=XP (-DTAIL)
      RN1=RN1*(1.-EXPENG)*(RNC-RN1)
      IF (IMOV.FO.1) GO TO 281
      IF (RN1.LT.RNIP) GO TO 281
      IF (RN1.LT.70.) DRPM=12.5*DT
      IF (RN1.GT.70..AND.RN1.LT.90.) DRPM=24.*DT
      IF (RN1.GT.90.) DRPM=DT*(111.-RN1)
      HNS=RN1*URPM
      IF (RN1.GT.HNS) RN1=RNIP+URPM
00281 CONTINUE
      RNIP=RN1
C ENGINE RPM COUNTER
      IF (RN1.GT.102..AND.RN1.LT.104) ICOUNT=ICOUNT+1
      IF (RN1.GF.104.) ICOUNT=ICOUNT+2
      IF (RN1.LE.100.) ICOUNT=ICOUNT-1
      IF (ICOUNT.LE.0) ICOUNT=0
      IF (ICOUNT.F.LE.0) MCOUNT=0
      IF (ICOUNT.F.LE.0) NCOUNT=0
      IF (ICOUNT.F.GF.ICOUNTM) MCOUNT=1
      IF (ICOUNT.F.GT.ICOUNTN) NCOUNT=1
C NO77LE THRUST
      SQRHNS=SQR (RNM)
      DTTHST=.5*TANI (RN1,RMACH.0..15.1)*RRMO**3
      TIFN=TANI (RN1,RMCS.0..16.1)
      DTTHST=TANI (RN1,RMACH.0..10.1)
      TIFN=SQRHNS*THCOR*TIFN*DTTHST
      TIFN=TANI (RN1,RMCS.0..17.1)
      TIFN=SQRHNS*THCOR*TIFN*DTTHST
C ENGINE AND RCS FORCE AND MOMENT CALCULATION
      SINTHNS=IN (THTN/57.3*.026178)
      COSTHNS=COS (THTN/57.3*.026178)
C GROUND EFFECT FACTOR
      ALT1=HIG(2)-HUFCK(3)
      IF (ALT1.LT.0.) ALT1=0.
      IF (ALT1-ALTGF1) 294,295,295
294 DRF=GEF1*DRGF1*ALT1
      GO TO 320
295 IF (ALT1-ALTGF2) 300,310,310
300 DRF=GEF2*DRGF2*(ALT1-ALTGE1)
      GO TO 320
310 DRF=0.
320 CONTINUE
      FF7=SINTHNS*(-TFN*CSPLAYF-TRN*CSPLAYR)-CFPJ*TFPJ-CHPJ*TRPJ
      I -CFHJ*(THHJ*LRJ)-RDRAG*SALPH*CHETA
      FF/=FEZ*(1.+UGF)

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FEY=CSTHTN*(CSPLAYF*TFN+CSPLAYM*TRN)+SFPJA*TFPJ+SRPJA*TRPJ
1 -RDRAG*CALPH*CBETA*SRJ*(TRRJ*TLRJ)
FEY=TYAWJ-RDRAG*SBETA
TFM=CSPLAYF*TFN*(SNTHTN*(DXCG-XFN)+CSTHTN*(DZCG-ZFN))
1 -CSPLAYM*TRN*(SNTHTN*(DXCG-XRN)+CSTHTN*(DZCG-ZRN))
2 -RDRAG*(CALPH*(DZCG-ZRDRAG)+SALPH*(DXCG-XRDRAG))*CBETA
3 -CFPJ*TFPJ*(DXCG-XFPJ)+CFPJ*TRPJ*(DXCG-XRPJ)
4 -(TRMJ*TLRJ)*(DXCG-XHRJ)
TFL=(TLNJ*TRMJ)*YRRJ*TYAWJ*(DZCG-ZYAWJ)+FEY*(ZDRAG-DZCG)
TFM=TYAWJ*(DXCG-XYAWJ)-RDRAG*SBETA*CALPH*(DXCG-XRDRAG)
TOTM=TM*TFN
*FTIMN
END

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SUBROUTINE SHIP
COMMON/CHF/R(200)/ICRF/IB(50)
COMMON/XFLD/AT/A(500)/FIXED/IA(200)
COMMON/NK1/TITLE(8),HEAD,SPEED,NBPEC,SIGMH(3),TMDAL(3),
1 P1,XCF1,H(D,NB,OV,NCHN,NREC,KPTS,DELT,SH,TRUN,NPTS,CTITL(19)
DIMENSION CTJ(13,4),XIJ(13,4),THIST(19,3,30),XLAST(13,3)
DIMENSION DID(48)
EQUIVALENCE (TITLE,DID)
EQUIVALENCE (TIME,A(303)),(RTIME,A(304))
EQUIVALENCE (DT,A(169))
EQUIVALENCE (PHIS,B(62)),(THETS,B(43)),(PSIS,B(84)),(THETSD,R(85))
EQUIVALENCE (PHISD,B(86)),(PSISD,B(87)),(MFAVE,B(88)),(MEAVED,
1 H(44)),(SURGF,B(90)),(SURGFD,B(91)),(SWAY,B(92)),(SWAYD,R(93))
EQUIVALENCE (MMAG,B(104)),(PHIMV,B(106)),(OMEGH,B(107)),
1 G(105),PHIRQL,(OMEGH,B(108)),(MOLLN,R(109)),(PITCHM,B(110))
EQUIVALENCE (OMEGP,R(111)),(PHIP,B(112)),(YAWM,B(113))
EQUIVALENCE (OMEGY,B(114)),(PHIY,B(115)),(SURGM,B(116)),(OMEGS,
1 H(117)),(PHISMG,B(118)),(SWAYM,B(119)),(OMEGSWY,B(120)),
2 (OMTSWY,B(121))
EQUIVALENCE (COURSE,A(110)),(IMODE,IA(1)),(M(192),WAVMT)
EQUIVALENCE (ITAPE,IA(24)),(ISTART,IA(25)),(IFILE,IA(26)),
1 (IA(27),K1),(IFILMX,IA(28)),(JSTART,IA(29))
DATA SWAYM/3.38/OMEGSWY/.764/PHISWY/3.14159/
DATA MMAG/5.7/OMEGM/.786/PHIMV/4.71236/
DATA UMFHP/.836/
DATA RULLY/6.849/OMEGH/.706/PHIRQL/0./PITCHM/3.059/
DATA PHIV/1.57079/YAWM/.689H/OMEGY/.753/PHIY/1.57079/
DATA SURGM/1.36/OMEGSG/.8/PHISMG/1.57079/
DATA HCU/57.3/
DATA IFILE/1/
DATA ITAPE/1/
DATA IFILMX/6/ISTART/0/ISTART/1/JSTART/1/K1/1/
IF (I'QUEM-I'MODE)400,401,400
400 ICFY=0
401 IF (ITAPE)500,500,501
500 CONTINUE
P1SQ=YAWM*OMEGY*CUS(OMEGY*TIME+PHIY)

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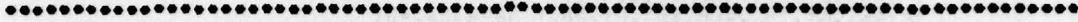
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00280 RNC=RNC-RNC1
      IF (RNC.LE.0.) RNC=0.
      IF (WFUEL.LT.0.) WFUEL=0.
      IF (IMODE) 291, 291, 292
291  DTAII=.05
      GO TO 293
292  CONTINUE
      TAIENG=TAH1 (RN1,0.,0.,14,1)
      DTAII=DT/TAIENG
293  CONTINUE
      EXPENG=EXP (-DTAII)
      RN1=RN1*(1.-EXPENG)+(RNC-RN1)
      IF (IMOV.FO.1) GO TO 281
      IF (RN1.LT.RNIP) GO TO 281
      IF (RN1.LT.70.) DRPM=12.5*DT
      IF (RN1.GT.70..AND.RN1.LT.90.) DRPM=24.*DT
      IF (RN1.GT.90.) DRPM=DT*(111.-RN1)
      WNS=RNIP*DRPM
      IF (RN1.GT.WNS) RN1=RNIP*URPM
00281 CONTINUE
      RNIP=RN1
C  ENGINE RPM COUNTER
      IF (RN1.GT.102..AND.RN1.LT.104) ICOUNT=ICOUNT+1
      IF (RN1.GF.104.) ICOUNT=ICOUNT+2
      IF (RN1.LE.100.) ICOUNT=ICOUNT-1
      IF (ICOUNT.LE.0) ICOUNT=0
      IF (ICOUNT.LE.0) MOUNT=0
      IF (ICOUNT.LE.0) NCOUNT=0
      IF (ICOUNT.GF.ICOUNTM) MOUNT=1
      IF (ICOUNT.GT.ICOUNTN) NCOUNT=1
C  NOZZLE THRUST
      SQRHRESUNT (RHHO)
      DTHTST=.5*TAH1 (RN1,RMACH,0.,15,1)*RHHO**3
      TIFN=TAH1 (RN1,RMACH,0.,16,1)
      DRAG=DRAG*TAH1 (RN1,RMACH,0.,10,1)
      TIFN=SQRT(TIFN*DRAG)*TIFN*DRAG*THST
      TIFN=TAH1 (RN1,RMACH,0.,17,1)
      TIFN=SQRT(TIFN*DRAG)*TIFN*DRAG*THST
C  ENGINE AND WPS FORCE AND MOMENT CALCULATION
      SMTHTN=IN (THTN/57.3*.026178)
      CSTHTN=COS (THTN/57.3*.026178)
C  GROUND EFFECT FACTOR
      ALTI=H(2)-H(DCK(3))
      IF (ALTI.LT.0.) ALTI=0.
      IF (ALTI-ALTGF1) 290, 295, 295
290  DRF=REF1*DRGF1*ALTI
      GO TO 320
295  IF (ALTI-ALTGF2) 300, 310, 310
300  DRF=REF2*DRGF2*(ALTI-ALTGF1)
      GO TO 320
310  DRF=0.
320  CONTINUE
      FF7=SMTHTN*(-TFN*CSPLAYF-TRN*CSPLAYR)-CFPJ*TFPJ-CHPJ*TRPJ
      I  -CHPJ*(THNJ*TLPJ)-RDRAG*SALPH*CHETA
      FF7=FF7*(1.+DRF)

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FEY=CSTHTN*(CSPLAYF*TFN*CSPLAYK*TRN)*SFPJA*TFPJ*SRPJA*TRPJ
1 -HNRAG*CALPH*CBETA*SRJ*(TRRJ*TLRJ)
FEY=TYAWJ*HNRAG*SBETA
TFN=CSPLAYF*TFN*(SNTHTN*(DXCG-XFN)*CSTHTN*(DZCG-ZFN))
1 *CSPLAYK*TRN*(SNTHTN*(DXCG-XRN)*CSTHTN*(DZCG-ZRN))
2 -HNRAG*(CALPH*(DZCG-ZPDRAG)-SALPH*(DXCG-XRDRAG))*CBETA
3 *CFPJ*TFPJ*(DXCG-XFPJ)*CHPJ*THPJ*(DXCG-XHPJ)
4 *(THPJ*TLRJ)*(DXCG-XHPJ)
TFE=(TLWJ*TRWJ)*YRRJ*TYAWJ*(DZCG-ZYAWJ)*FEY*(ZNDRAG-DZCG)
TFN=TYAWJ*(DXCG-XYAWJ)*HNRAG*SBETA*CALPH*(DXCG-XRDRAG)
TOTUM=TMN*TFN
*ETIHN
END
    
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SUBROUTINE SHIP
COMMON/CHF/R(200)/ICRF/IB(50)
COMMON/XFLDAT/A(500)/FIXED/IA(200)
COMMON/MK1/TITLE(8),HEAD,SPEED,NBPEC,SIGWH(3),TMODAL(3),
1 PI,XCFI,HD,ND,OW,NCHN,NREC,KPTS,DELT,SH,TRUN,NPTS,CTITL(19)
DIMENSION CIJ(13,4),XIJ(13,4),THIST(19,3,30),KLAST(13,3)
DIMENSION DID(48)
EQUIVALENCE(TITLE,DID)
EQUIVALENCE(TIME,A(303)),(RTIME,A(304))
EQUIVALENCE(DT,A(169))
EQUIVALENCE(PHIS,H(82)),(THETS,D(43)),(PSIS,B(84)),(THETSD,R(85))
EQUIVALENCE(PHISD,H(86)),(PSISD,D(87)),(HFAVE,H(88)),(HEAVED,
1 H(89)),(SURGF,H(90)),(SURGFD,H(91)),(SWAY,H(92)),(SWAYD,R(93))
EQUIVALENCE(HNRAG,R(104)),(PHINV,H(106)),(OMEGH,H(107)),
1 R(108)),(PHINOL), (OMEGH,H(108)),(ROLLM,R(109)),(PITCHM,H(110))
EQUIVALENCE(OMEGP,H(111)),(PHIP,H(112)),(YAWM,H(113))
EQUIVALENCE(OMEGY,H(114)),(PHIY,H(115)),(SURGM,H(116)),(OMEGS0,
1 H(117)),(PHISMG,H(118)),(SWAYM,H(119)),(OMEGSWY,H(120)),
2 (PHISWY,H(121))
EQUIVALENCE(COURSE,A(110)),(IMODE,IA(1)),(H(192),NAVMT)
EQUIVALENCE(ITAPE,IA(24)),(ISET,IA(25)),(ISET,IA(26)),
1 (IA(27),K1),(IFILM,IA(28)),(JSTART,IA(29))
DATA SWAYM/3.38/,OMEGSWY/.764/,PHISWY/3.16159/
DATA HNRAG/5.3/,OMEGH/.786/,PHINV/4.71238/
DATA UMGRP/.836/
DATA ROLLM/H.849/,OMEGH/.706/,PHINOL/0./,PITCHM/3.059/
DATA PHIP/1.57079/,YAWM/.689H/,UMEGY/.753/,PHIY/1.57079/
DATA SURGM/1.38/,OMEGS0/.8/,PHISMG/1.57079/
DATA HED/57.3/
DATA IFILF/1/
DATA ITAPE/1/
DATA IFILM/6/,ISET/0/,ISET/1/,JSTART/1/,JSTART/1/,K1/1/
IF(I*OUEP=IMODE)400,401,400
400 ISET=0
401 IF(ITAPE)500,500,501
500 CONTINUE
PCIS0=YAWM*OMEGY*CUS(OMEGY*TIME*PHIY)
    
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PHISD=ROLL*OMEGA*cos(TIME*OMEGA+PHIROL)
THETS=PITCH*OMEGA*sin(OMEGA*TIME+PHIP)
THETSU=PITCH*OMEGA*cos(TIME+PHIP)
PETS=YAW*OMEGA*sin(OMEGA*TIME+PHIY)
PETSU=YAW*OMEGA*cos(OMEGA*TIME+PHIY)
PHIS=ROLL*OMEGA*sin(OMEGA*TIME+PHIROL)
SHORF=SI*OMEGA*sin(OMEGA*TIME+PHISR)
SHORFU=SI*OMEGA*cos(OMEGA*TIME+PHISR)
SWAY=SWAY*OMEGA*sin(OMEGA*TIME+PHISWY)
SWAYU=SWAY*OMEGA*cos(OMEGA*TIME+PHISWY)
HEAVE=HEAVE*OMEGA*sin(OMEGA*TIME+PHIHV)
HEAVEU=HEAVE*OMEGA*cos(OMEGA*TIME+PHIHV)
GO TO 1000
501 IF (TIME) 502,502,503
502 IF (ISET) 504,504,1000
504 ISET=1
T1=0.
T2=0.
IF (IFILE.GT.IFILMX) IFILE=IFILMX
DO 600 J=1,IFILE
JKFILE=0
1 JKFILE=JKFILE+1
READ(10) DID
IF (DID(10)) 1.2
2 CONTINUE
IF (1-IFILE) 520,510,520
510 WRITE(6,3) JKFILE
3 FORMAT(10X,JKFILE,110)
WRITE(6,1005) TITLE
1005 FORMAT(10,19X,8A10//)
WRITE(6,1006) MPAD,SPED,SR,TRUN,SIGWH,MODAL,K1
1006 FORMAT(30X,HEADING =,F6.0, DEG,10X,SPED =,F6.2, KNOTS /
130X,SAMPLE RATE =,F6.2, SAM/SEC,10X,RUN TIME =,F6.2, SEC /
1//,10X,3(AX, SIGNIF, WF =,F6.2, FEET,2X)/,10X,3(AX,MODAL
2 OFR =,F6.1, SEC,2X)//,0X,K1 =,I5)
WRITE(6,1007) PI,X2PI,ND,NW,DW,NCHN,NREC,KPTS,DELT,SR,TRUN,NPTS
1007 FORMAT(10X,PI =,F10.5, X2PI =,F10.5, ND =,F10.5,
1 10X,NW =,F10.5, DW =,F10.5, NCHN =,F10.5, NREC =,F10.5,
2 10X,NPTS =,F10.5, DT =,F10.5, SR =,F10.5, TRUN =,F10.5,
3 NPTS =,F10.5)
IF (JSTART.LT.1) JSTART=1
NMAX=KPTS-3
IF (JSTART.GT.NMAX) JSTART=NMAX
GO TO 730
570 DO 100 I=1,NREC
READ(10) THIST
100 CONTINUE
GO TO 500
530 DO 200 PH=1,ISTART
READ(10) THIST
200 CONTINUE
500 CONTINUE
F1=1./((2.*DELT)
C1=-.5/((DELT*DELT)
I1=.5/((DELT*DELT)

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DO 201 K=1,3
DO 201 L=1,13
XLAST(L,K)=THIST(L,K,3-KPTS)
201 CONTINUE
J=JSTART+1
HAVHT=THIST(1,K1,J)
SHORE=THIST(2,K1,J)
SWAY=THIST(3,K1,J)
HFAVF=THIST(4,K1,J)
FMIS=THIST(5,K1,J)
THFTS=THIST(6,K1,J)
PCTS=THIST(7,K1,J)+COURSE
SHRGE=THIST(8,K1,J)
SWAYD=THIST(9,K1,J)
HFAVD=THIST(10,K1,J)
FMISD=THIST(11,K1,J)
THFTSD=THIST(12,K1,J)
PCTSD=THIST(13,K1,J)
GO TO 1000
503 CONTINUE
IF (TIME-T1) #01,800,800
#00 T1=T+DELTA
IF (J-KPTS+2) #04,804,806
#03 CONTINUE
IF (J.EQ.(KPTS+2)) J=2
#04 DO #05 P=1,4
DO #05 L=1,13
X1J(L,K)=THIST(L,K1,J-2+K)
#05 CONTINUE
IF (J.EQ.(KPTS-2)) READ(10) THIST
J=J+1
GO TO #30
#06 IF (J-KPTS+1) #08,808,810
#08 DO #09 L=1,13
X1J(L,1)=XLAST(L,1)
X1J(L,2)=XLAST(L,2)
X1J(L,3)=XLAST(L,3)
X1J(L,4)=THIST(L,K1,1)
#09 CONTINUE
J=J+1
GO TO #30
#10 IF (J-KPTS) #11,811,815
#11 DO #12 L=1,13
X1J(L,1)=XLAST(L,2)
X1J(L,2)=XLAST(L,3)
X1J(L,3)=THIST(L,K1,1)
#12 X1J(L,4)=THIST(L,K1,2)
J=J+1
GO TO #30
#15 IF (J-KPTS-1) #16,816,803
#16 DO #17 L=1,13
X1J(L,1)=XLAST(L,3)
X1J(L,2)=THIST(L,K1,1)
X1J(L,3)=THIST(L,K1,2)
X1J(L,4)=THIST(L,K1,3)

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A17 CONTINUE
    J=J+1
A30 CONTINUE
    IF (J.EQ.3) GO TO 820
    GO TO 823
A20 DO 822 K=1,3
    DO 824 L=1,13
    XLAST(L,K)=THIST(L,K),K-3*KPTS)
A22 CONTINUE
A23 CONTINUE
    DO 840 L=1,13
    CIJ(L,1)=XIJ(L,2)
    CIJ(L,2)=41*(XIJ(L,3)-XIJ(L,1))
    CIJ(L,3)=C1*(XIJ(L,4)-4.*XIJ(L,3)+5.*XIJ(L,2)-2.*XIJ(L,1))
    CIJ(L,4)=D1*(XIJ(L,4)-3.*XIJ(L,3)+3.*XIJ(L,2)-XIJ(L,1))
A40 CONTINUE
A01 CONTINUE
    IF ((TIME-T2).GE.DELT)T2=T2+DELT
    DT1=T1-T2
    DT12=DT1*DT1
    DT13=DT12*DT1
    SVAHT=CIJ(1,1)*CIJ(1,2)*DT1+CIJ(1,3)*DT12+CIJ(1,4)*DT13
    SVAH=CIJ(2,1)*CIJ(2,2)*DT1+CIJ(2,3)*DT12+CIJ(2,4)*DT13
    SVAI=CIJ(3,1)*CIJ(3,2)*DT1+CIJ(3,3)*DT12+CIJ(3,4)*DT13
    SVAJ=CIJ(4,1)*CIJ(4,2)*DT1+CIJ(4,3)*DT12+CIJ(4,4)*DT13
    SVAK=CIJ(5,1)*CIJ(5,2)*DT1+CIJ(5,3)*DT12+CIJ(5,4)*DT13
    SVAL=CIJ(6,1)*CIJ(6,2)*DT1+CIJ(6,3)*DT12+CIJ(6,4)*DT13
    SVAL=CIJ(7,1)*CIJ(7,2)*DT1+CIJ(7,3)*DT12+CIJ(7,4)*DT13+ COURSE
    SVAH=CIJ(8,1)*CIJ(8,2)*DT1+CIJ(8,3)*DT12+CIJ(8,4)*DT13
    SVAI=CIJ(9,1)*CIJ(9,2)*DT1+CIJ(9,3)*DT12+CIJ(9,4)*DT13
    SVAJ=CIJ(10,1)*CIJ(10,2)*DT1+CIJ(10,3)*DT12+CIJ(10,4)*DT13
    SVAK=CIJ(11,1)*CIJ(11,2)*DT1+CIJ(11,3)*DT12+CIJ(11,4)*DT13
    SVAL=CIJ(12,1)*CIJ(12,2)*DT1+CIJ(12,3)*DT12+CIJ(12,4)*DT13
    SVAL=CIJ(13,1)*CIJ(13,2)*DT1+CIJ(13,3)*DT12+CIJ(13,4)*DT13
    IF (TIME.GE. RTIME)HEWIND 10
1800 CONTINUE
    IMODEF=IMODEF
    RTIME=RTIME
    ENO

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SUBROUTINE NFCK
COMMON/XP/LOAT/A(500)/IFIXED/IA(200)
COMMON/CHF/P(200)/ICHF/IB(50)
DIMENSION ITOUCH(5)
DIMENSION VOKN(7),VOKK(7)
DIMENSION MDTOKF(7)
DIMENSION XDTOKD(7),YDTOKD(7),MDTOKD(7),DXPA(15),DYP(15)
DIMENSION DZPA(15),MDECH(7),MIB(6),XIG(6),YIG(6),XIRD(6),YIG(6)
EQUIVALFNCF(MF,M(140)),(XE,M(141)),(YE,M(142))
FOUIVALFNCF(MFCR,A(174)),(DYCB,A(175)),(MCR,A(176)),(A(16),T1),
1(T2),A(17)),(TJ),A(18)),(T12,A(19)),(T22,A(20)),(T32,A(21)),

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2(T13,A(22)),(T23,A(23)),(T33,A(24)),(DXPA(1),A(184)),
3(DYPA,A(210)),(DZPA(1),A(257)),(MDECK(1),A(272)),(XIG(1),
4A(279))
EQUIVALENCE(YIG(1),A(265)),(XIG(1),A(291)),(VX,A(200)),(VY,A(201))
EQUIVALENCE(XCGP,A(203)),(YCGP,A(204))
EQUIVALENCE(ICRASH,IP(9)),(PLAM1,H(40)),(PLAM2,B(81))
EQUIVALENCE(PHIS,H(82)),(THETS,H(83)),(PSIS,R(84)),(THEYSD,B(85))
EQUIVALENCE(PHISD,H(86)),(PSISD,H(87)),(HEAVE,B(88)),(HEAVED,
IP(89)),(SUNGE,H(90)),(SUNGED,H(91)),(SWAY,H(92)),(SWAYD,H(93))
EQUIVALENCE(XIS,H(94)),(XISD,H(95)),(YIS,H(96)),(YISD,H(97))
EQUIVALENCE(X3S,H(98)),(X3SD,H(99)),(MIS,H(100)),(XTD,B(101))
EQUIVALENCE(YTD,R(102))
EQUIVALENCE(XTDI,B(109)),(YTDI,B(190))
EQUIVALENCE(ALT,A(83))
EQUIVALENCE(IJVDK,IA(15))
EQUIVALENCE(ILAND,IR(3)),(ITOUCH,IA(10))
EQUIVALENCE(MIPS,H(103))
EQUIVALENCE(DNH,A(106)),(DEN,A(107))
EQUIVALENCE(VURN(1),A(433)),(MOTDKE(1),A(447))
EQUIVALENCE(MTU,B(13))
DATA XIS/-200./,XISD/0./,YIS/-50./,YISD/50./,X3S/400./,X3SD/100./
DATA MIS/30./,XTD/-100./,YTD/0./,MOTDKE/4.6/,MIPS/30./
DATA ILAND/1/
C COMPUTE GEAR LOCATIONS IN INERTIAL AXES
DO 10 J=1,4
XIG(J)=(DNR*DXPA(J)*T11+DYPA(J)*T21+DZPA(J)*T31
YIG(J)=(DEN*DXPA(J)*T12+DYPA(J)*T22+DZPA(J)*T32
MIG(J)=ALT-DXPA(J)*T13-DYPA(J)*T23-DZPA(J)*T33
10 CONTINUE
IJVDK=0
IF(ILAND)100,100,1
C ILAND=0 MEANS LAND ON NORTH RUNWAY,ILAND=1 MEANS LAND ON SHIP
1 CONTINUE
CALL SHIP
C COMPUTE AIRCRAFT CG LOCATIONS IN DECK AXES
DATA UCP/.01754/
PSIS=SPSIS*DNH
XIC=COS(PSIS)
SPSIS=SPSIN(PSIS)
XTD=DNH*XIC+DER*SPSIS-SURGE
YTD=DNH*XIC*CKSTC-DNR*SPSIS-SWAY
THETS=THETS+UZR
CTHTS=COS(THETS)
STHTS=SIN(THETS)
PHIS=PHIS*DNH
SPHIS=SPHIS*DNH
CPHTS=COS(PHIS)
T11=CTHTS*CPHTS
T21=CSPHTS*STHTS*CPHTS-CPHTS*SPHTS
T31=CSPHTS*STHTS*CPHTS+SPHTS*SPHTS
T12=CTHTS*CPHTS
T22=CSPHTS*STHTS*SPHTS-SPHTS*CPHTS
T32=CSPHTS*STHTS*SPHTS+SPHTS*CPHTS
T13=CSPHTS
T23=CSPHTS*CTHTS

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T335=CPHIS*CTHTS
C COMPUTE GEAR LOCATIONS IN THE THET=0,PHI=0,SPSIS AXES
DO 6 J=1,4
XIGD(J)=XIG(J)*CPSIS+YIG(J)*SPSIS-SURGE
YIGD(J)=YIG(J)*CPSIS-XIG(J)*SPSIS-SWAY
CONTINUE
6 COMPUTE DECK HEIGHT BENFATH GEARS AND CG
HDECK(1)=HFAVE+HIPS*T335-XID*T135-YID*T235+HIS-HIPS
DO 7 J=1,4
HDECK(J+1)=HFAVE-XIGD(J)*T135-YIGD(J)*T235+HIPS*(T335-1.)+HIS
CONTINUE
7 COMPUTE DISTANCE FROM CG TO TOUCHDOWN POINT IN NORTH EAST AXES
XTD=(XTU+SURGE)*CPSIS-(YTD+SWAY)*SPSIS
YTD=(XTI+SURGE)*SPSIS+(YTD+SWAY)*CPSIS
XF=DNM-XTDI
YF=DEF-YTDI
HTD=HFAVE-XID*T135-YID*T235+HIPS*T335+HIS-HIPS
HF=HIG(2)-HTD
IF(XTD-XIS)100,2,2
IF(YTD-YIS)3,3,100
3 IF(YTD-YIS)100,100,4
4 IF(YTD-YIS)5,5,100
CONTINUE
I000K=1
C COMPUTE X,Y VELOCITIES OF DECK TOUCHDOWN POINTS TO DETERMINE RELATIVE
DECK GEAR VELOCITIES
XDTDKD(1)=-HIPS*THETSD-YID*PSISD
YDTDKD(1)=XID*PSISD+HIPS*PHISD
HDTDKD(1)=XID*THETSD-YID*PHISD
DO 8 J=1,4
XDTDKD(J+1)=-HIPS*THETSD-YIGD(J)*PSISD
YDTDKD(J+1)=XIGD(J)*PSISD+HIPS*PHISD
HDTDKD(J+1)=XIGD(J)*THETSD-YIGD(J)*PHISD
CONTINUE
8 SURGEDE=SURGEI+CPSIS-SWAYD*SPSIS
SURGEDE=SURGEI*SPSIS+SWAYD*CPSIS
DO 9 J=1,5
VDECK(J)=XDTDKD(J)*T115+YDTDKD(J)*T215-HDTDKD(J)*T315+SURGEDN
VDECK(J)=XDTDKD(J)*T125+YDTDKD(J)*T225-HDTDKD(J)*T325+SURGEDE
HDTDKD(J)=-XDTDKD(J)*T135+YDTDKD(J)*T235+HDTDKD(J)*T335+HEAVED
CONTINUE
9 YDECK(1)=YDECK(1)
XDECK(1)=XDECK(1)
XDECK(2)=XDECK(2)
FLAM1=(HDECK(5)-HDECK(4))/(2.*YNG)
FLAM2=(HDECK(2)-HDECK(3))/(XNG-XMG)
GO TO 10
100 DO 11 J=1,5
HDECK(J)=0.
VDECK(J)=0.
XDECK(J)=0.
HDTDKD(J)=0.
CONTINUE
11 FLAM1=0.
FLAM2=0.

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101 CONTINUE
    GO TO 14
    IF (MIG(J) - MDECK(J+1)) 12, 12, 13
12  ITOUCH(J) = 1
    GO TO 14
13  ITOUCH(J) = 0
14  CONTINUE
    RETURN
    END
    
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SUBROUTINE PILOT
COMMON/XFLOAT/A(500)/IFIXED/IA(200)
COMMON/CHFR/R(200)/ICHF/IR(50)
COMMON/GAIN1/GA(100)
DIMENSION THTEL(20),OHL(20),XEL(20),VYL(20),PHIEL(20),NLAG(20),
IPAL(20),SIFL(20),RHL(20),ALTEL(20),ALTOEL(20),ALTEIL(20),ALTODEL(
I 20),YEL(20)
DIMENSION VXL(20)
DIMENSION MDTIME(7)
EQUIVALENCE(IA(1),IMODE)
EQUIVALENCE(THETA,A(5)),(PSIR,A(6)),(PHIR,A(4))
EQUIVALENCE(ALFA,A(25)),(BETA,A(26)),(PR,A(37)),(OR,A(38))
EQUIVALENCE(XCG,A(174)),(YCG,A(175))
1 (A(39),RH),(VRW,A(70)),(ALTO,A(80)),(ALT,A(83))
EQUIVALENCE(IMRAK,IR(29)),(IOVK,IA(15)),(HLNSTK,B(7))
EQUIVALENCE(HLNSTK,B(8)),(HLATSTK,H(9)),(HLTSTK,B(10))
1 (RHUMFD,H(11)),(THROT,H(14)),(THNOTIC,B(15)),(THTNC,B(16))
EQUIVALENCE(RPED,H(21)),(HE,B(140)),(XE,H(141)),(YE,H(142))
EQUIVALENCE(ALTCOM,H(143)),(ALTUCOM,H(144)),(YCOM,H(145))
EQUIVALENCE(XCOM,H(146)),(THETCOM,H(147)),(PHICOM,H(148))
EQUIVALENCE(VXCOM,H(149)),(XTDI,H(149)),(YTDI,H(150))
EQUIVALENCE(CPSI,A(15)),(SPSI,A(14)),(PHIIC,A(230))
EQUIVALENCE(THETIC,A(231))
EQUIVALENCE(ITASK,IR(30))
EQUIVALENCE(VE,A(65)),(VN,A(64)),(CTHETH,A(115)),(STHETH,A(114))
EQUIVALENCE(ALFAIC,H(42))
EQUIVALENCE(NLAG(1),IA(30))
EQUIVALENCE(VX,A(200)),(VY,A(201)),(THTNIC,B(18))
EQUIVALENCE(YCG,A(175)),(OT,A(104))
EQUIVALENCE(IMNDOFF,IR(5))
EQUIVALENCE(IMOLD,IR(17)),(ISET,IR(12))
EQUIVALENCE(ISWAT,IR(7))
EQUIVALENCE(TIME,A(303))
EQUIVALENCE(MDTIME(1),A(447))
EQUIVALENCE(MCHK,IR(22)),(FREQCK,GA(18)),(TD,GA(19)),(TI,GA(20))
EQUIVALENCE(H(150),PSICOM)
EQUIVALENCE(TZ,GA(21)),(HMAG,GA(22)),(MCHK,IR(23))
EQUIVALENCE(INDFXT,IA(110))
EQUIVALENCE(XCG,A(174))
EQUIVALENCE(VH,A(454))
EQUIVALENCE(GA(36),VEH1), (GA(37),ALT1), (GA(38),RK1V), (GA(39),
    
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1  RK2V)
EQUIVALENCE (GA(41),HKRI01), (GA(42),HKRI02)
EQUIVALENCE (GA(43),ALT2), (GA(44),RKTHT1), (GA(45),RKALPH)
EQUIVALENCE (GA(46),THET1), (GA(47),ALT3), (GA(48),RKALTD)
EQUIVALENCE (GA(49),THETC), (RKTHT2,GA(50)), (RKTHT3,GA(51)), (RKTHT4
1  ,GA(52))
EQUIVALENCE (HKYP,GA(53)), (HKVE,GA(54)), (HKPSI,GA(55))
EQUIVALENCE (GA(56),RKPHILT), (RKPLT,GA(57))
EQUIVALENCE (GA(58),RKTMLN), (GA(59),RKQLN), (GA(60),RKNOZLN)
EQUIVALENCE (GA(61),VRW1), (GA(62),ALT4), (GA(63),THTNC1), (GA(64),
1  XCG1), (GA(65),VRW2), (GA(66),VRW3), (GA(67),VRW4), (GA(68),ALT5)
EQUIVALENCE (GA(69),RKTHT5), (HKVY1,GA(70)), (HKVX1,GA(71))
EQUIVALENCE (HKVY2,GA(72)), (RKVX2,GA(73)), (GA(74),RKYPH1), (GA(75),
1  RKPHVY)
EQUIVALENCE (GA(76),RLNTH2), (GA(77),MLNQB2)
EQUIVALENCE (GA(78),RLTPH2), (GA(79),RLTPB2)
EQUIVALENCE (GA(80),RPH1), (GA(81),RPPS1)
EQUIVALENCE (NIC,A(241))
EQUIVALENCE (GA(82),RTHROT), (GA(83),RTHROT1), (GA(84),RTHROT2)
EQUIVALENCE (GA(85),ALPTH1)
EQUIVALENCE (GA(86),JCG2)
EQUIVALENCE (GA(87),TPITCH), (GA(88),THET2)
EQUIVALENCE (PSAS,H(8)), (STAH,H(1))
EQUIVALENCE (IZUOF,IA(16))
EQUIVALENCE (MTU,H(31))
EQUIVALENCE (INTBACK,IN(32))
EQUIVALENCE (HMOV,H(32))
EQUIVALENCE (VIND,A(90)), (RTHROT3,GA(91))
EQUIVALENCE (RALTTHR,GA(92)), (RALTD,GA(93))
EQUIVALENCE (A(500),PSI)
EQUIVALENCE (NIC,A(241))
EQUIVALENCE (GA(95),THRESH1), (GA(96),THRESH2), (GA(97),THRESH3),
1  (GA(98),THRESH4), (GA(99),TRX), (GA(100),TRY)
EQUIVALENCE (XE1,A(449)), (YE1,A(448)), (XE2,A(447)), (YE2,A(446))
EQUIVALENCE (RKTHT6,A(445)), (HKYPMAX,A(446))
EQUIVALENCE (RLTAF,A(444)), (RLTVF,A(443)), (RLTSC,A(442))
EQUIVALENCE (TAF,A(443)), (TVF,A(442)), (TSCPSEC,A(441))
EQUIVALENCE (RLNAF,A(447)), (RLNVF,A(446)), (RLNSC,A(445))
EQUIVALENCE (PEDAF,A(440)), (PEDVF,A(449)), (PEDSC,A(444))
DATA RALTTHR/.2/,RALTD/-.5/
DATA INTBACK/0/
DATA HMOV/10./
DATA THET1/.1396/
DATA JCG2/500./
DATA ALT2/50./
DATA RKTHT5/.01/,RKTHT6/.02/
DATA TRX/3./,TRY/5./,RKYPMAX/-.03/
DATA HKYPH1/-.01/,RLNTH2/15./,MLNQB2/10.5/
DATA RTHROT/-.5/
DATA RLTPH2/-10./,RPH1/5./,RPPS1/2./
DATA RLTPH1/2/-10./
DATA ALPTH1/5./
DATA TPITCH/15./,THET2/.209 /
DATA VPH1/10./,ALT1/300./,RK1V/3./,RK2V/1./
DATA INHIOFF/0/

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DATA VHW1/270./  
 DATA WKWU1/5./,RKRII2/-.1/  
 DATA ALPHM1/0./  
 DATA RKTHT1/.01/,RKALPH/-.5/  
 DATA ALT3/1000./,WKALTD/.25/  
 DATA T24/.1/,T30/.1/,T44/.2/,T54/.2/  
 DATA (NLAG(I)).I=1,14/14\*1/  
 DATA THRESH1/.05/,THRESH2/.05/,THRESH3/.25/,THRESH4/.25/  
 DATA THICO/.02/,RKTHT2/-.005/,RKTHT3/-.01/,RKTHT4/-.0005/  
 DATA WKVF/-.002/,RKVF/-.01/,WKPSI/-1./  
 DATA WKPHILT/-20./,RKPLT/-12./  
 DATA WKTHLN/25./,RKULN/7.5/,RKNUZLN/.02/  
 DATA ALT4/40./,THTNC1/55./,XCG1/350./  
 DATA VHW2/200./,VHW3/230./,VHW4/300./,ALT5/600./  
 DATA WTHW1/-c./,RTHPOT1/-3./,RTHPOT2/0./  
 DATA T0/1./,T1/2./,T2/3./,RHAG/1./  
 DATA KLNSTK0/.6/  
 DATA WTHWOT3/U./  
 DATA TUFL1/.4/,TUFL2/.4/  
 IF (IMOD) 1,1,2

1

WLNSTK=WLNSTK0  
 WTHWOT3=0.  
 I=PAK=1  
 THTNC1=2.  
 ISWAT=1  
 ISWATCP=1  
 ISWATCS=1  
 TUFL3=TUFL1+TUFL2  
 F107LN=EXP(-DT/T2P)  
 F107LT=EXP(-DT/T3P)  
 F107HT=EXP(-DT/T4P)  
 F107T=EXP(-DT/T5P)  
 KLNSTK=0.  
 PLAT=0.  
 WIND=0.  
 THT=0.  
 THTU=0.  
 IWS=0  
 WINDU=0.  
 PLT1/0L=0.  
 WLN10L=0.  
 IV=0  
 IVC=0  
 IVC=0  
 PENAF=0.  
 PENVF=0.  
 PLNAF=0.  
 PLNVF=0.  
 PLVFC=0.  
 TAF=0.  
 TVF=0.  
 TSC=0.  
 PLTAF=0.  
 PLTVF=0.

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PLTSC1=0.
IF (ALT=ALT3+10.) 17.6.6
A  THFTC=THETR
   VXCOM=VHW
   THFTRC1=0.
   ICLIN=0
   SWITCH=0.
   I401.D=1
   IALTI=1
   GO TO 8
7  CONTINUE
   IALTI=0
   ICLIN=1
   THOL=0
   THFTHC2=0.
   THFTHC1=0.
A  CONTINUE
   THFTHC=THETR
   CPST=C(S(PSTW))
   SPSI=S(SIN(PSTW))
   XCOM=XE+CPSTI+YE+SPSI
   IF (ABS(XCOM).LT.1.) XCOM=SIGN(1.0,XCOM)
   YCOM=YE+CPSTI-XE+SPSI
   VXCOM=VX
   XF=XCOM
   YF=YCOM
   IF (SIGN(1.,VXCOM).EQ.SIGN(1.,XCOM)) VXCOM=-.1*XCOM
   VFC=H(M)DKE(1).
   VFI=0.
   SFTH=0
   THFTC=THFTIC
   XCOM=XCOM
   ALFT=ALFA
   PWICOM=0.
   YCOM=YCOM
   VHW=VHW
   ALTCUM=ALT
   ALTUCUM=0.
   THFTC=THFTIC
   PLATST=PLSTKO
   ALTI=0.
   THROT=THROTIC
   THRTMIN=THROTIC-5.
   THLIM1=100.-THROTIC
   THLIM2=102.-THROTIC
   THLIM3=THRTMIN-THROTIC
   UNDE=UNDE
   GO TO 100
2  CONTINUE
   GO TO (10,20,30,40,50,60),ITASK
10 CONTINUE
   THROT=700.*TIME/50.
   IF (THROT.GT.100.) THROT=100.
   PLONSTK=PLNSTKO
   PLATSTK=0.

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IRRAK=1
IF (TIME.GT.2.) IRRAK=0
ISWAT=0
TMTNC=0.
IF (VW.GT.100.) SETIRRAK=1.
IF (SETHAK.FO.1.) IRRAK=1
IF (SETHAK.EU.1.) TRET=1.
IF (THET.EU.1.) THROT=0.
TMAA=20.
GO TO 110
20 CONTINUE
VF=YCG
CNOZ=COS(TMTNC/57.3)
SNOZ=SIN(TMTNC/57.3)
IRWAK=0
IF (TIME.LF.2.) IRRAK=1
IF (VW.GT..25) IRWAK=0
VFR=VXCOM-VRW
VFI=VEH]+VFR*DT
IF (ABS(VFI).GT.VEH)] VERI=SIGN(VERI,VERI)
IF (ALT.LT.ALT1) VERI=0.
THROTUL=THROT
THROT=THROTIC*(RK1V*VER+RK2V*VEH)*CNOZ+SNOZ*(ALTTMR*(ALTCOM-ALT)
+ALTUF*WALTDI)
IF (ALT.LT.ALT5.AND.THROT.LT.100.) THROT=100.
IF (THROT.GT.(THROTUL-DTHROT)) THROT=THROTUL-DTHROT
IF (THROT.LT.(THROTUL-DTHROT)) THROT=THROTUL-DTHROT
IF (VW.LT.VW1) THROT=106.
WINDP=KRWIND)*KRWINDU2*BETA*RPEDU
IF (IMUL1) 31,31,32
31 CONTINUE
C PITCH COMMAND
IF (ALFTW.LT.ALFTW1) ALFTW=ALFTW+.2
ALTCOM=ALT0
IF (ALTCOM.LT.0.) ALTCOM=0.
THETC3=ALFTW/57.3*ALTCOM/VRW
THETC=THETC2+.3*(THETC3-THETN)*DT
THETC=THETC2+THETC3
ALTCOM=ALT
ALTCOM1=ALTCOM
SWITCH=1
IF (THETC.LT.THET1) THETC=THET1
IF (THETC.GT.THET2.AND.(TMTNC.GT.10..OR.XCG.LT.XCG1)) THETC=THET2
IF (ALT.GT.(ALT3-(ALT0*2)/20.)) ALT5=ALT
THETC1=THETC
IF (THETC1.GT..5) THETC1=.5
THETC0=THETC1-ALFA/57.3
GO TO 33
32 CONTINUE
SWITCH=SWITCH+.95
THETC1=THETC1*.95
ALTCOM=ALTCOM1*(1.-(ALT-ALT5)/(ALT3-ALT5))*2)
IF (ALTI.FO.1) ALTCOM=0.
ALTCOM=ALT
IF (ABS(ALT-ALTJ).LT.20.) IALT]=1

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IF (IALTI.FQ.1) ALTCOM=ALT3
  ALTF=ALT-ALTCOM
  ALTDE=ALTD-ALTDCOM
  IF (AMS(ALTE).GT.50.) ALTE=SIGN(50.,ALTE)
  IF (ARS(ALTDE).GT.30.) ALTDE=SIGN(30.,ALTDE)
  IF (ALT.GT.ALT3) IALTI=1
  ALTEI=ALTEI+ALTE*DT
  IF (AMS(ALTEI).GT.200.) ALTEI=SIGN(200.,ALTEI)
  THETRC=THETRC1*(1.-SWITCH)*(THETCO+CNOZ*(RKHT2*ALTE
1  *RKHT3+ALTD*RKHT4*ALTEI))
  DTH=THETHC-THETRCP
  IF (AMS(DTH).GT.01) THETHC=THETRCP+SIGN(.01,DTH)
  IF (THETHC.LT.THETRCP.AND.ALFA.LT.1.) THETRC=THETRCP
33  CONTINUE
  IF (THETHC.GT.5) THETRC=.5
  IF (THETHC.LT.-1) THETRC=-1
  THETHC=THETRC
  THETCOM=THETHC*.57.3
  PHIC=HKY*.YF*HKVE*(VE*CTHETR-VN*STHETR)+HKPSI*PSIR
  IF (ARS(PHIC).GT.4) PHIC=SIGN(.4,PHIC)
  PHICOM=PHIC*.57.3
  PLATSTR=PKPHILT*(PHIR-PHIC)+HKPLT*PB*RLTSTKO
  PLONSTR=PKTHLN*(THETP-THETRC)+RKQLN*GB*RLNSTKO+RKNOZLN*(THTNC-
1  THTNIC)
C  TRM FOLLOWER
  HLNSTKO=PLNSTKO*(HLNSTK-PLNSTKO)*.004*(IMODE+1)
  ISWAT=1
  IF (THTNC.GT.1.AND.XC6.GT.XC61.AND.ALT.LT.ALT4) THTNC=THTNC1
  IF (ALT.GT.ALT4.AND.ALTD.GT.0.AND.VRW.GT.VRW2) THTNC=THTNC-2.5*DT
  IF (ALT.GT.ALT4.AND.ALTD.GT.0.AND.VRW.GT.VRW3) THTNC=THTNC-5.*DT
  IF (ALT.GT.ALT4.AND.ALTD.GT.0.AND.VRW.GT.VRW4) THTNC=THTNC-10.*DT
  IF (THTNC.LT.0) THTNC=0.
  IF (ALT.GT.ALT5) IMODE=1
  IF (IMODE.FQ.1.AND.XC6.LT.XC62.AND.THETH.LT.26.AND.THETR.GT.07.
1  AND.ARS(PHIC).LT.2) GO TO 34
  GO TO 35
34  PLONSTR=PLNSTKO
  PLATSTR=PLTSTKO
  HIRPFU=HWE DO
  THTOT=100.
35  CONTINUE
  GO TO 110
30  CONTINUE
  IF (TIME.GF.1) GO TO 301
  ISWAT=0
  ICWAT=0
  ISWATCP=0
301  CONTINUE
  XZ=XZ*CMSI+VE*SPSI
  VXCOM=(VXCOM+VERI)*(XZ/XCOM)
  VZ=VZ*VZ+.2*(VXCOM-VZ)*DT*RK2V
  IF (AMS(XZ).LT.10) IXSV=1
  IF (IXS.FQ.0) XCOM=XZ
  IF (IXS.FQ.0) XCOM1=XCOM
  IF (IXS.FQ.1) XCOM1=XCOM1*.97

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IF (Y54.FD.1) XCOM=XCOM1
XF1=XE2-XCOM
XFIL(1)=YF1
YF2=YE*CMSI-YF*SPSI
YCOM=(YCOMO-20.)*(XE2/XCOMO)-20.
IF (Y54.FD.0) YCOM1=YCOM
IF (Y54.FD.1) YCOM1=YCOM1+.47
IF (Y54.FD.1) YCOM=YCOM1
IF (ANS(XE2).LT.10..AND.ANS(VX).LT.2.) IYSW=1
YF1=YC2-YCOM
YFIL(1)=YF1
  THFTO=THETIC/57.3
IF (X54.FD.1) WKHT5=1.02*WKHT5
IF (WKHT5.NE.WKHT6) WKHT5=WKHT6
WKVX=WKHT5*THX
VXL(1)=VX-VXCOM
THFTPC=WKHT5*XFIL(NLAG(13))+WKVX*VXL(NLAG(14))+THETO
IF (Y54.FD.1) WKYPH1=WKYPH1*1.02
IF (WKYPH1.LT.WKYPHMAX) WKYPH1=WKYPHMAX
WKPH1VY=THY*WKYPH1
VYL(1)=VY
PHIC=WKYPH1*YEIL(NLAG(1))+WKPH1VY*VYL(NLAG(2))+PHIIC/57.3
IF (ANS(PHIC).GT..3) PHIC=SIGN(.3,PHIC)
IF (THETHC.GT..3) THETHC=.3
IF (THETHC.LT.0.) THETHC=0.
THFTL(1)=THFTH
THFR=THETEL(NLAG(3))
GHL(1)=GH
HLNST1=HLNST2*(THFR-THETHC)+RLNUB2*OBL(NLAG(4))
IF (ANS(HLNST1-PLN1OLD).LT.THRESH1) RLNST1=RLN1OLD
IF (PLNST1.NE.HLN1OLD) RLNAF=RLNAF+1.
HLNVF1=(PLNST1-PLN1OLD)/DT
HLNVF2=ANS(RLNVF1)
HLNVF3=HLNVF3+HLNVF2
RLNVF=HLNVF3/(TIME+.05)
SGNLNV=SIGN(1.,RLNVF1)
IF (ANS(RLNVF1).LT..5) SGNLNV=0.
IF ((SGNLNV*SGNLNV).EQ.0..AND.SGNLNV.NE.0.) RLNSC1=RLNSC1+1.
HLNSC=HLNSC1/(TIME+.05)
SGNLNV0=SGNLNV
HLN1OLD=PLNST1
HLNST2=EXPZLN*(RLNST2-HLNST1)+RLNST1
IF (HLNST2.LT.(-7.5-RLNSTK)) RLNST2=-7.5-RLNSTK
IF (HLNST2.GT.(3.7-RLNSTK)) HLNST2=3.7-RLNSTK
HLNSTK=HLNST2-PLNSTK
PHTEL(1)=PH1R
PHL(1)=PH
PLAT1=PLTH12*(PHIEL(NLAG(5))-PHIC)+HLTPB2*PHL(NLAG(6))
IF (ANS(PLAT1)-PLT1OLD).LT.THRESH2) PLAT1=PLT1OLD
IF (PLAT1.NE.PLT1OLD) PLTAF=PLTAF+1.
PLATVF1=(PLAT1-PLT1OLD)/DT
PLTVF2=ANS(PLATVF1)
PLTVF3=PLTVF3+PLTVF2
PLTVF=PLTVF3/(TIME+.05)
SGNLTV=SIGN(1.,PLATVF1)

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IF (ABS(HLATVF1).LT.2) SGNLTV=0.
IF ((SGNLTV+SGNLTV0).EQ.0..AND.SGNLTV.NE.0.) RLTSCL=RLTSCL+1.
RLTSC=RLTSCL/(TIME+.05)
SGNLTV=(SGNLTV
RLT10L1)=RLAT1
PLAT2=EXPL7LT*(HLAT2-RLAT1)+RLAT1
HLATSTK=HLAT2*HLTSTKO
RML(1)=RML
PSTC=PSI#
IF (ABS(PSTC).GT.1.) PSTC=SIGN(1.,PSTC)
PSTCOM=PSIC*57.3
PSTFL(1)=PSTP-PSTC
IF (ABS(PSTEL(1)).GT.3) PSTEL(1)=SIGN(3.,PSTEL(1))
H171=H171+RML(NLAG(7)) *RPSI1+PSTEL(NLAG(8))
HETA1=HETA
IF (ABS(HETA1).GT.30.) HETA1=SIGN(30.,HETA1)
H10P1=H10P1+RKHU2*HETA1
IF (ABS(H10P1-H10D0).LT.THRESH3) H10P1=H10D0
IF (R10U1.NE.H10D0) PEDAF=PEDAF+1.
PFDFV1=(H10P1-H10D0)/UT
PFDFV2=ABS(PDFVF1)
PFDFV3=PFDFV2+PFDFV2
PFDFV=PFDFV3/(TIME+.05)
SGNPV=SIGN(1.,PFDFV)
IF (ABS(PDFVF1).LT.2.) SGNPV=0.
IF ((SGNPV+SGNPV0).EQ.0..AND.SGNPV.NE.0.) PEDSCI=PEDSCI+1.
PEDSC=PEDSC/(TIME+.05)
SGNPV0=SGNPV
R10D1=H10D1
R10P2=EXPL7H*(R10P2-R10D1)+R10D1
R10P2=H10P2+R10D1
P1TCOM=PHTC*57.3
THETCOM=THETC*57.3
ALTCOM=ALT
IF (ABS(XF).LT.10..AND.ABS(YE).LT.10.) IYZ=1
IF (IYZ.EQ.0) ALTCOM=HTC
IF (ABS(ALT-HTDU-MHOV).LT.5) IHSW=1
IF (IHSW.EQ.1) ALTCOM=HTDU+MHOV
ALTCOM=0.
IF (IYZ.NE.0.) ALTCOM=-5.*(ALT-HTDU-MHOV)/(HTC-
HTDU-MHOV)
IF (INTHACK.FO.1) ALTCOM=HTDU+MHOV
ALTE=ALT-ALTCOM
IF (ABS(ALTE).GT.10.) ALTE=SIGN(10.,ALTE)
ALTEI=[ALTE]+INT*ALTE
IF (ABS(ALTEI).GT.100.) ALTEI=SIGN(100.,ALTEI)
IF (INTHACK.FO.1) ALTDRE=HTDRE(1)
ALTDRE=ALTEI-ALTCOM
IF (ABS(ALTDRE).GT.5.) ALTDRE=SIGN(5.,ALTDRE)
ANDECK=(HTDRE(1)-VDECKP)/OT
VDFCKP=HTDRE(1)
ALTDRE=VDFCKP-ANDECK
IF (ABS(ALTDRE).GT.5.) ALTDRE=SIGN(5.,ALTDRE)
ALTEFL(1)=ALTE
ALTEIL(1)=ALTEI

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ALTDDEL(1)=ALTDDE
ALTDDEL(1)=ALTDDE
IF (TTHROT.LT.TDEL3) GO TO 37
THROT1=THROT*ALTEL(NLAG(9))+RTHROT1*ALTDDEL(NLAG(10))
1-RTHROT2*ALTFIL(NLAG(11))+RTHROT3*ALTDDEL(NLAG(12))
IF (THROT1.GT.THLIM1) THROT1=THLIM1
IF (THROT1.LT.THLIM3) THROT1=THLIM3
IF (THROT1.GT.THLIM2.AND.ISWAT.EQ.0) THROT1=THLIM2
IF (THROT1.GT.101.AND.ISWAT.EQ.0) ISWATC=1
IF (THROT1.LT.99.AND.ISWAT.EQ.1) ISWATC=0
IF (ISWATC.NF.ISWATC) TTHROT=U.
37 CONTINUE
IF (TTHROT.LT.TDEL1) GO TO 38
ISWAT=ISWATC
IF (TTHROT.LT.TDEL3) GO TO 38
IF (ABS(THROT1-THROT0).LT.THRESH) THROT1=THROT0
IF (THROT1.NF.THROT0) TAF=TAF+1.
TVF1=(THROT1-THROT0)/UT
TVF2=ABS(TVF1)
TVF3=TVF3+TVF2
TVF=TVF3/(TIME+.05)
SGNTV=SIGN(1.,TVF1)
IF (ABS(TVF1).LT.2.) SGNTV=0.
IF ((SGNTV+SGNTV0).EQ.0.AND.SGNTV.NE.0.) TSC=TSC+1.
TSCPSEC=TSC/(TIME+.05)
SGNTV0=SGNTV
THROT0=THROT1
THROT2=EXPZT*(THROT2-THROT1)+THROT1
THROT=THROT1C+THROT2
IF (THROT.LT.THRTMIN) THROT=THRTMIN
38 TTHROT=TTHROT+DT
ISWATC=ISWATC
THTNC=THTNC
DO 36 I=1,14
THFTFL(21-I)=THFTFL(20-I)
CAL(21-I)=CAL(20-I)
XFIL(21-I)=XFIL(20-I)
YFIL(21-I)=YFIL(20-I)
VXL(21-I)=VXL(20-I)
VYL(21-I)=VYL(20-I)
PHIFL(21-I)=PHIFL(20-I)
PHL(21-I)=PHL(20-I)
PSIFL(21-I)=PSIFL(20-I)
RAI(21-I)=RAI(20-I)
ALTEL(21-I)=ALTEL(20-I)
ALTDDEL(21-I)=ALTDDEL(20-I)
ALTFIL(21-I)=ALTFIL(20-I)
ALTDDEL(21-I)=ALTDDEL(20-I)
3A CONTINUE
GO TO 110
40 THTNC=1.
THROT=100.+6.*SIN(5.*TIME)
ISWAT=1
TMAX=13.
GO TO 110

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60  RMACH=.3
90  THROT=THROTIC
    TQUWAT=1
    RLONSTK=RLONSTKO
    RLATSTK=RLATSTKO
    RUJDED=RUJDED0
    THTNC=THTNIC
    RINPUT=0.
    IF (NCHK.EQ.1) GO TO 51
    IF (NCHK.EQ.2) GO TO 52
    IF (NCHK.EQ.3) GO TO 53
    IF (NCHK.EQ.4) GO TO 54
    GO TO 55
51  RINPUT=RMA6
    IF (TIME.LT.T0) RINPUT=0.
    GO TO 55
52  RINPUT=RMA6
    IF (TIME.LT.T0) RINPUT=0.
    IF (TIME.GT.T1) RINPUT=0.
    GO TO 55
53  IF (TIME.LT.T1) RINPUT=RMA6
    IF (TIME.LT.T0) RINPUT=0.
    IF (TIME.GT.T1) RINPUT=-RMA6
    IF (TIME.GT.T2) RINPUT=0.
    GO TO 55
54  RINPUT=RMA6*SIN(FREQ*(TIME-T0))
    IF (TIME.LT.T0) RINPUT=0.
55  CONTINUE
    IF (NCHK.EQ.1) THROT=THROTIC+RINPUT
    IF (NCHK.EQ.2) RLONSTK=RLONSTKO+RINPUT
    IF (NCHK.EQ.3) RLATSTK=RLATSTKO+RINPUT
    IF (NCHK.EQ.4) THTNC=THTNIC+RINPUT
    IF (NCHK.EQ.5) RUJDED=RUJDED0+RINPUT
110 CONTINUE
    IF (ABS(RUJDED).GT.2.) RUJDED=SIGN(2.,RUJDED)
    STAN=STAN+RMA6
    IF (I2UUF.EQ.1) PLONSTK=TAH1(STAN,0.,0.,75.1)
    IF (PLONSTK.GE.3.7) PLONSTK=3.7
    IF (PLONSTK.LE.-7.5) PLONSTK=-7.5
    IF (ABS(PLATSTK).GE.4.) PLATSTK=SIGN(4.,PLATSTK)
    IF (THROT.GT.106.) THROT=106.
    IF (THROT.LT.60.) THROT=60.
100 CONTINUE
    IF (I2UUF) 3.5.5
3   07 * I=1.20
    THRTFL(I)=0.
    CRFL(I)=0.
    XFIL(I)=XE2-XCOM0
    YFIL(I)=YE1-YCOM0
    VYL(I)=VY
    PWFL(I)=0.
    PRFL(I)=PM
    PSTFL(I)=0.
    HUL(I)=HM
    ALTFL(I)=0.

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ALTDL(1)=0.
ALTEIL(1)=0.
ALTDL(1)=0.
VXL(1)=VX-VXCOMD
4 CONTINUE
5 CONTINUE
  RETURN
END

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11301111	STARILATOR VS STICK										
-7.5	-6.6	-5.5	-4.35	-3.1	-2.05	-1.7	-0.5	0.6		01	
-10.	-4.	-6.	-4.	-2.	-0.5	0.	2.	4.		02	
1.6	2.5	3.3	3.7							03	
6.	8.	10.	11.3							04	
20201111	RUDDER VS PEDAL										
-2.1	2.1									01	
-15.	15.									02	
30701111	AILERON VS LATERAL STICK										
-4.	-2.5	-2.066	0.	2.066	2.5	4.				01	
-12.	-7.5	-6.2	0.	6.2	7.5	12.				02	
40601111	FRON PITCH JET AREA VS ATICK										
-7.5	-3.9	-0.5	3.7							1	
7.23	7.23	0.	0.							2	
50701111	REAR PITCH JET AREA VS STABILATOR										
-10.	2.	4.	6.	8.	10.	11.3				1	
0.	0.	2.17	4.34	6.51	8.68	8.68				2	
60701111	ROLL JET AREA VS AILERON										
-12.	-7.5	-6.2	0.	6.2	7.5	12.				1	
4.2	4.2	3.696	0.	0.	.54	4.2				2	
70501111	YAW JET AREA VS RUDDER										
-15.	-10.	0.	10.	15.						01	
7.5	3.5	0.	3.5	3.5						2	
80401111	DUCT PRESSURE RATIO VS NOZZLE TOTAL AREA										
0.	2.	4.	6.	8.	10.	12.	14.	20.5		1	
1.	.476	.968	.963	.959	.955	.95	.946	.5		2	
90501111	FRONT PITCH JET FORCE/MAX VS AREA										
0.	2.	4.	6.	7.4						1	
0.	.2712	.543	.68	1.						2	
10601111	REAR PITCH JET FUNCTION VS AREA										
0.	2.	4.	6.	7.4	9.					1	
0.	.337	.548	.793	.897	1.					2	
110501111	YAW JET FUNCTION										
0.	1.	2.	3.	3.5						1	
0.	.1428	.51428	.686	1.						2	
120501111	UP THRUST ROLL JET FUNCTION										
0.	2.	3.	4.	4.2						1	
0.	.53	.74	.973	1.						2	
130601111	DOWN THRUST ROLL JET FUNCTION										
0.	.4	1.8	2.8	3.8	4.2					1	
0.	.04	.19	.275	.36	.388					02	
141001111	ENGINE TIME CONSTANT VS RPM										

	0.	50.	60.	75.	81.5	87.	91.5	95.5	99.6	1
	3.25	1.1	.55	.4	.270	.2	.17	.15	.15	2
	106.									3
	.15									4
	151404111	GROSS THRUST INCREASE DUE TO FORWARD SPEED								
	0.	25.	30.	40.	50.	60.	70.	80.	90.	1
										2
.1	0.	14.7	19.3	33.49	54.	79.52	120.00	163.	225.	3
.2	0.	55.7	74.	131.	200.	306.	493.	626.	865.	4
.3	0.	97.	129.	194.	362.	531.	860.	1080.	1503.	5
	94.	100.	102.	104.	100.					6
										7
.1	245.	319.	343.	352.	367.					8
.2	979.	1041.	1209.	1340.	1443.					9
.3	1433.	1421.	2114.	2257.	2690.					10
	161403111	FRONT MAIN NOZZLE STATIC THRUST								
	0.	25.	30.	40.	50.	60.	70.	80.	90.	1
	0.	700.	921.	1514.	2269.	3116.8	4144.	5502.	7000.	2
9.	0.	594.	808.	1401.6	2150.	3004.1	4031.	5390.	6887.	3
10.	0.	0.	0.	603.0	1350.	2206.	3233.	4591.	6080.	4
	94.	100.	102.	104.	106.					5
	8047.	8485.	9169.	9380.	9462.					6
9.	7433.	8772.	9069.	9341.	9367.					7
10.	7135.	8087.	8442.	9020.	9242.					8
	171403111	REAR NOZZLE STATIC THRUST								
	0.	25.	30.	40.	50.	60.	70.	80.	90.	1
9.	0.	125.7	198.7	420.	839.	1434.	2295.	3823.	5870.	2
9.	0.	0.	0.	0.	369.8	965.	1826.	3353.	5409.	3
10.							410.	1945.	4001.	4
	94.	100.	102.	104.	106.					5
	7410.	8433.	9519.	9979.	10167.					6
9.	6940.	8460.	9067.	9622.	9479.					7
10.	5532.	6479.	7621.	8714.	9160.					8
	101304222	RAM DRAG VS MACH								
	0.	20.0	40.	60.	80.	85.	87.5	89.	94.	1
.1	0.	201.	313.	546.	850.	944.	1001.	1038.	1150.	3
.2	0.	540.	751.	1243.	1850.	2027.	2146.	2215.	2432.	4
.3	704.	1132.	1454.	2252.	2900.	3152.	3555.	3644.	3907.	5
	100.	102.	104.	106.						6
										7
.1	1299.	1346.	1394.	1442.						8
.2	2680.	2744.	2859.	2940.						9
.3	4217.	4322.	4426.	4531.						10
	190701111	CY VS BETA MACH POWER OFF								
	-30.	-15.	-6.	0.	0.	15.	30.			1
6.	.435	.225	.09	0.	-.09	-.225	-.435			2
	200503111	CY VS BETA THETA 60. VJ/V0#5.4								
60.	-20.	-10.	0.	10.	20.					1
0.	.4	.22	0.	-.24	-.4					2
10.	.35	.18	0.	-.18	-.32					3
20.	.3	.15	0.	-.15	-.3					4
	210503111	CY VS BETA ALPHA THETA 75. VJ/V0#5.4								
75.	-20.	-10.	0.	10.	20.					1
0.	.37	.21	0.	-.25	-.44					2

10.	.35	.21	0.	-.16	-.3							3
20.	.31	.15	0.	-.15	-.31							4
	220503111		CY VS BETA ALPHA, THETJ#60., VJ/VO#11.9									
60.	-20.	-10.	0.	10.	20.							1
0.	.3	.17	0.	-.2	-.4							2
5.	.36	.14	0.	-.18	-.36							3
10.	.36	.18	0.	-.16	-.32							4
	230503111		CY VS BETA ALPHA, THETJ#90., VJ/VO#11.9									
90.	-20.	-10.	0.	10.	20.							1
0.	.4	.23	0.	-.14	-.35							2
10.	.38	.17	0.	-.18	-.31							3
20.	.27	.135	0.	-.135	-.27							4
	240504211		CROLL VS BETA, ALPHA, THETJ#0., VJ/VO#0., M#0.4									
0.	-2.	0.	2.	4.	6.							1
0.	.002	0.	-.0004	-.0007	-.0013							2
4.	.002	0.	-.001	-.002	-.0035							3
M.	.0015	0.	-.0001	-.0015	-.0024							4
12.	.0014	0.	-.0018	-.0038	-.0059							5
	250407111		CROLL VS BETA ALPHA, THETJ#60., VJ/VO#5.4									
60.	-40.	-30.	-20.	-10.	0.	10.	20.	30.	40.			1
-10.	-.005	-.003	-.002	-.001	0.	.001	.002	.003	.004			2
-5.	.026	.02	.013	.006	0.	-.006	-.012	-.02	-.026			3
0.	.044	.074	.052	.031	0.	-.012	-.022	-.054	-.074			4
5.	.114	.084	.056	.034	0.	-.024	-.055	-.084	-.11			5
10.	.12	.094	.072	.04	0.	-.046	-.09	-.138	-.172			6
15.	.13	.102	.074	.042	0.	-.054	-.102	-.142	-.178			7
20.	.13	.098	.066	.034	0.	-.034	-.074	-.116	-.164			8
	260407111		CROLL CS BETA ALPHA, THETJ#75., VJ/VO#5.4									
75.	-40.	-30.	-20.	-10.	0.	10.	20.	30.	40.			1
-10.	.014	.021	.015	.008	0.	-.009	-.019	-.028	-.034			2
-5.	.027	.02	.014	.007	0.	-.007	-.014	-.02	-.024			3
0.	.065	.052	.034	.02	0.	-.026	-.056	-.086	-.114			4
5.	.1	.094	.064	.04	0.	-.036	-.056	-.08	-.094			5
10.	.144	.114	.08	.04	0.	-.05	-.1	-.14	-.178			6
15.	.129	.107	.063	.047	0.	-.075	-.127	-.155	-.175			7
20.	.12	.094	.06	.03	0.	-.043	-.064	-.12	-.152			8
	270407111		CROLL VS ALPHA, BETA, THETJ#60., VJ/VO#11.9									
60.	-40.	-30.	-20.	-10.	0.	10.	20.	30.	40.			1
-10.	-.033	-.025	-.019	-.01	0.	.005	.01	.015	.02			2
-5.	-.01	-.004	-.004	-.003	0.	.002	.004	.008	.01			3
0.	.021	.024	.022	.014	0.	-.014	-.037	-.054	-.064			4
5.	.048	.045	.04	.024	0.	-.05	-.084	-.102	-.12			5
10.	.112	.109	.082	.042	0.	-.056	-.076	-.114	-.144			6
15.	.134	.114	.08	.046	0.	-.064	-.12	-.156	-.204			7
20.	.17	.13	.087	.04	0.	-.04	-.07	-.118	-.15			8
	280406111		CROLL VS ALPHA, BETA, THETJ#90., VJ/VO#11.9									
90.	-40.	-30.	-20.	-10.	0.	10.	20.	30.	40.			1
-10.	0.											2
-5.	.07	.015	.01	.005	0.	-.006	-.01	-.018	-.024			3
0.	.033	.025	.016	.008	0.	-.009	-.015	-.024	-.032			4
5.	.042	.032	.022	.012	0.	-.01	-.022	-.032	-.042			5
10.	.111	.083	.057	.029	0.	-.029	-.058	-.085	-.112			6
15.	.107	.094	.079	.052	0.	-.03	-.12	-.168	-.204			7
	240504211		CN VS BETA ALPHA, THETJ#0., VJ/VO#0.									
0.	-2.	0.	2.	4.	6.							1

0.	-.0087	0.	.0075	.0155	.024					2
4.	-.0088	0.	.0065	.015	.024					3
8.	-.007	0.	.0055	.0125	.022					4
12.	-.005	0.	.005	.011	.0205					5
300507111 CN VS ALPHA,BETA,THTJ#60.,VJ/VOM5.4										
40.	-20.	-10.	0.	10.	20.					1
-10.	-.044	-.048	0.	.046	.093					2
-5.	-.12	-.064	0.	.06	.12					3
0.	-.07	-.052	0.	.116	.154					4
5.	-.085	-.06	0.	.086	.15					5
10.	-.102	-.054	0.	.082	.112					6
15.	-.084	-.046	0.	.046	.084					7
20.	-.064	-.03	0.	.022	.044					8
310507111 CN VS ALPHA,BETA,THTJ#75.VJ/VOM5.4										
75.	-20.	-10.	0.	10.	20.					1
-10.	-.152	-.086	0.	.084	.134					2
-5.	-.104	-.058	0.	.082	.134					3
0.	-.115	-.045	0.	.07	.12					4
5.	-.04	-.065	0.	.087	.145					5
10.	-.084	-.046	0.	.052	.091					6
15.	-.085	-.044	0.	.04	.08					7
20.	-.054	-.026	0.	.022	.038					8
320507111 CN VS ALPHA,BETA,THTJ#75.VJ/VOM11.9										
40.	-20.	-10.	0.	10.	20.					1
-10.	-.075	-.044	0.	.062	.124					2
-5.	-.09	-.06	0.	.12	.138					3
0.	-.044	-.052	0.	.06	.112					4
5.	-.057	-.046	0.	.106	.142					5
10.	-.076	-.044	0.	.05	.09					6
15.	-.06	-.032	0.	.036	.07					7
20.	-.032	-.016	0.	.016	.03					8
330507111 CN VS ALPHA,BETA,THTJ#90.VJ/VOM11.9										
90.	-20.	-10.	0.	10.	20.					1
-10.	-.106	-.066	0.	.07	.12					2
-5.	-.046	-.07	0.	.17	.21					3
0.	-.083	-.05	0.	.14	.2					4
5.	-.078	-.056	0.	.072	.122					5
10.	-.042	-.054	0.	.046	.086					6
15.	-.05	-.032	0.	.058	.118					7
20.	-.042	-.02	0.	.018	.034					8
340501111 CLORVS SPED IN KNOTS										
40.	40.	120.	160.	200.						1
	.00016	.00017	.00014	.00012	.0001					2
350201111 CNDA VS ALPHA										
2.	12.									1
	.00025	-.00035								2
360201111 CLR VS ALPHA										
6.	12.									1
	.143	.212								2
370702121 CL VS ALPHA,UM,VJ#0.THTJ#0										
-5.	0.	5.	10.	12.	15.	20.				1
0.	.004	.3	.53	.83	.94	1.05	1.1			2
6.	.05	.35	.62	.89	.99	1.09	1.13			3
380602121 CL VS ALPHA,UM,VJ/VOM5.4.THTJ30.										
30.	-5.	0.	5.	8.	10.	12.	15.	20.		1

6.	-.12	.12	.37	.53	.63	.74	.87	.95	2
12.	-.04	.21	.46	.61	.71	.82	.94	1.01	3
	390802121 CL VS ALPHA,DM,VJ#5.4,THTJ#45								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.22	.04	.29	.44	.54	.64	.77	.975	2
12.	-.15	.1	.35	.5	.6	.7	.83	1.03	3
	400802121 CL VS ALPHA,DM,VJ/VO#5.4,THTJ#60								
40.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.3	-.05	.21	.36	.46	.55	.67	.88	2
12.	-.26	0.	.26	.4	.5	.59	.72	.94	3
	410802121 CL VS ALPHA,DM,VJ/VO#5.4,THTJ#75								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.43	-.18	.07	.21	.31	.41	.55	.79	2
12.	-.35	-.11	.13	.28	.38	.47	.62	.86	3
	420802121 CL VS ALPHA,DM,VJ/VO#5.4,THTJ#90								
90.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.62	-.25	.01	.16	.26	.36	.51	.7	2
12.	-.43	-.2	.06	.21	.31	.42	.56	.81	3
	430802121 CL VS ALPHA,DM,VJ/VO#11,THTJ#45								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.55	-.3	-.03	.12	.23	.33	.46	.6	2
12.	-.5	-.22	.04	.14	.3	.4	.54	.74	3
	440802121 CL VS ALPHA,DM,VJ/VO#11,THTJ#60								
60.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.66	-.36	-.1	.04	.14	.23	.33	.45	2
12.	-.54	-.3	-.05	.1	.2	.3	.42	.54	3
	450802121 CL VS ALPHA,DM,VJ/VO#11,THTJ#75								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.8	-.59	-.29	-.14	-.05	.04	.16	.36	2
12.	-.74	-.46	-.21	-.08	0.	.08	.17	.36	3
	460702121 CD VS ALPHA,DM,VJ/VO#5.4,THTJ#0								
0.	-5.	0.	5.	10.	12.	15.	20.		1
0.	.106	.122	.146	.207	.262	.332	.528		2
6.	.12	.173	.153	.217	.263	.36	.556		3
	470801111 CD VS ALPHA,DM,VJ/VO#5.4,THTJ#30								
30.	-5.	0.	5.	8.	10.	12.	15.	20.	1
12.	.147	.159	.182	.214	.242	.28	.34	.41	2
	480802121 CD ALPHA,DM,VJ/VO#5.,THTJ#45.								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.161	.151	.18	.196	.233	.268	.338	.505	2
12.	.144	.16	.197	.224	.252	.294	.368	.526	3
	490802121 CD VS ALPHA,DM,VJ/VO#5.4,THTJ#60.								
60.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.142	.156	.183	.208	.235	.262	.32	.42	2
12.	.141	.155	.193	.213	.24	.272	.33	.45	3
	500802121 CD VS ALPHA,DM,VJ/VO#5,THTJ#75								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.156	.14	.158	.18	.207	.232	.288	.4	2
12.	.14	.15	.172	.20	.226	.25	.3	.408	3
	510802121 CD VS ALPHA,DM,VH VJ/VO#5,THTJ#90								
90.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.161	.148	.166	.188	.21	.232	.272	.372	2
12.	.168	.156	.179	.206	.222	.254	.296	.368	3
	520802121 CD VS ALPHA,DM,VJ/VO#11,THTJ#45								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1

6.	.192	.145	.12	.144	.165	.19	.228	.273	2
12.	.195	.13	.126	.157	.183	.213	.252	.31	3
	530802121 CD VS ALPHA,DM,VJ/VO=11,THTJ=60								
60.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.192	.12	.117	.137	.16	.186	.226	.346	2
12.	.148	.134	.134	.159	.176	.198	.236	.294	3
	540802121 CD VS ALPHA,DM,VJ/VO=11,THTJ=75								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.216	.1	.064	.072	.088	.108	.12	.178	2
12.	.246	.105	.074	.08	.095	.11	.134	.174	3
	550702121 CM VS ALPHA,DM,THTJ=0,VJ/VO=5.4								
0.	-5.	0.	5.	10.	12.	15.	20.		1
0.	-.055	-.072	-.102	-.145	-.17	-.22	-.3		2
6.	-.14	-.165	-.19	-.24	-.27	-.32	-.39		3
	560802121 CM VXS ALPHA,DM,THTJ=30,VJ/VO=5.4								
30.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	-.055	-.024	-.03	-.034	-.038	-.042	-.036	-.018	2
12.	-.143	-.14	-.14	-.156	-.168	-.166	-.158	-.152	3
	570802121 CMVS,ALPHA,DM,THTJ=45,VJ/VO=5.4								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.007	-.005	.001	.003	.004	.004	.008	.018	2
12.	-.122	-.118	-.12	-.118	-.117	-.12	-.116	-.093	3
	580802121 CMVS ALPHA,DM,THTJ=60,VJ/VO=5.4								
60.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.04	.038	.04	.037	.035	.034	.039	.076	2
12.	-.053	-.076	-.08	-.082	-.084	-.086	-.082	-.053	3
	590802121 CM VS ALPHA,DM,THTJ=75,VJ/VO=5.4								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.08	.079	.06	.045	.036	.026	.021	.02	2
12.	-.042	-.046	-.055	-.074	-.088	-.096	-.102	-.108	3
	600802121 CM VS ALPHA,DM,THTJ=90,VJ/VO=5.4								
90.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.088	.08	.06	.04	.03	.024	.022	.018	2
12.	-.022	-.03	-.04	-.066	-.08	-.088	-.092	-.094	3
	610802121 CM VS ALPHA,DM,THTJ=45,VJ/VO=11.9								
45.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.065	.059	.046	.048	.054	.064	.067	.04	2
12.	-.028	-.058	-.058	-.06	-.06	-.058	-.054	-.044	3
	620802121 CM VS ALPHA,DM,THTJ=60,VJ/VO=11.9								
60.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.102	.057	.058	.062	.062	.059	.034	.018	2
12.	-.024	-.047	-.049	-.048	-.046	-.047	-.053	-.058	3
	630802121 CM VS ALPHA,DM,THTJ=75,VJ/VO=11.9								
75.	-5.	0.	5.	8.	10.	12.	15.	20.	1
6.	.145	.085	.069	.066	.064	.06	.058	.05	2
12.	.044	-.02	-.032	-.032	-.036	-.04	-.053	-.06	3
	641101222 NOSE GEAR FORCE VS GEAR COMPRESSION								
-1.75	-1.14	-1.	-.83	-.77	-.513	-.33	-.17	0.	1
-32000.	-27000.	-17600.	-11200.	-7000.	-6347.	-5000.	-3000.	0.	2
.01	1.								3
0.									4
	650601222 MAIN FORCE VERSUS GEAR COMPRESSION								
-1.04	-1.	-.833	-.67	-.5833	-.0				1
-27000.	-16000.	-8000.	-4300.	0.	0.				2
660201111	CNP VS ALPHA								

6.	12.									1
-1.240	-0.974									2
672201111	PITCH TIME HISTORY FDR# 38 AV-8A									
0.	1.25	1.75	2.	8.	8.5	9.	9.25	9.5		1
5.5	5.	6.5	7.	7.	6.5	7.	6.5	6.4		2
9.75	10.	10.25	10.5	11.	11.5	12.	12.5	12.75		3
7.5	8.7	9.25	9.5	9.5	9.7	10.	9.5	9.2		4
13.	13.25	15.	16.							5
9.5	10.	10.	10.							6
601201111	STEADY WUMBLE VERSUS RANGE									
-1430.	-1800.	-1700.	-1600.	-1400.	-1200.	-850.	-660.	-460.		1
0.	-0.04	-0.06	-0.056	-0.03	-0.04	-0.097	-0.12	-0.14		2
-300.	0.	100.								3
										4
6913 1111	STEADY WUMBLE VS RANGE									
-2700.	-2500.	-2250.	-2000.	-1500.	-1100.	-1000.	-800.	-300.		1
0.	.065	.07	.065	.035	0.	-.005	-.0175	0.		2
400.	430.	510.	550.							3
0.	.256	0.	0.							4
700901111	DOWN WASH WITH ILAURB=1									
-2700.	-2500.	-2250.	-2000.	-1500.	-1100.	-1000.	-800.	-600.		1
0.	.065	.07	.065	.035	0.	-.005	-.0175	0.		2
71 4 1111	SIGMA RANDOM BUMBLE									
-2540.	-1400.	-1200.	-1100.	-1000.	-800.	-600.	-440.	0.		1
0.	.024	.035	.0355	.036	.0335	.021	0.	0.		2
72 4 1111	TAU RANDOM WUMBLE									
-2540.	-1400.	-1200.	-1100.	-1000.	-800.	-600.	-440.	0.		1
1.02	1.02	1.05	.95	.82	.5	.325	.25	.11		2
73 7 5111	DCL 120 G. TANK MUD 4 ESTIMATE									
0.	.05	.1	.15	.2	.25	.3				1
0.										2
30.	-.42	-.354	-.288	-.223	-.1356	-.108	-.05			3
50.	-.405	-.344	-.284	-.223	-.158	-.134	-.089			4
60.	-.4	-.341	-.282	-.223	-.175	-.167	-.14			5
98.	-.4	-.341	-.282	-.223	-.175	-.167	-.14			6
743401111	STABILIZER VS TIME FDR#38									
0.	1.	1.25	1.5	1.75	2.	2.25	3.	4.		1
6.6	6.5	6.5	7.	7.3	7.	6.5	6.5	6.1		2
7.	7.05	7.2	7.4	7.6	7.75	9.	9.4	10.		3
6.	6.5	5.	5.	6.5	6.	5.5	4.5	7.		4
10.25	10.5	10.75	11.	11.5	11.75	12.	12.75	13.		5
9.5	7.	6.7	7.1	7.	7.5	7.7	6.2	6.2		6
14.	15.	16.	17.	18.	18.25	20.				7
6.5	7.	6.	5.7	5.7	5.	5.				8
751301111	STICK VS STABILIZER GEARING									
-10.	-8.	-6.	-4.	-2.	-.5	0.	2.	4.		1
-7.5	-6.6	-5.55	-4.35	-3.1	-2.05	-1.7	-.5	.6		2
6.	8.	10.	11.3							3
1.6	2.5	3.3	3.7							4
760505111	VX MFAN VSS=20 KNOT PSIS=0 Z=14.50									
14.5M	0.	37.	90.	125.	250.					1
-18.75	17.702	17.414	21.578	23.11	25.38					2
0.	15.354	17.308	21.199	23.34	25.23					3
14.75	14.324	18.102	23.174	25.23	23.69					4
54.	27.522	27.433	30.82	31.44	30.402					5

104.	24.108	28.04	31.1	30.84	30.05		6
	770505111		VXBAR	VSS=20	PSI=0	Z=25	
25.	0.	37.	90.	125.	250.		1
-1A.75	23.67	24.11	25.748	26.71	28.534		2
0.	19.729	19.932	23.777	25.29	26.06		3
1A.75	21.274	21.646	25.486	26.29	25.11		4
54.	27.332	26.447	29.61	30.01	29.45		5
104.	30.46	30.44	30.46	30.19	30.03		6
	780505111		VXBAR	VSS=20	PSI=0	Z=44.5	
44.50	0.	37.	90.	125.	250.		1
-1A.75	27.40	24.32	29.29	24.81	29.0		2
0.	24.4	23.95	25.02	26.21	26.34		3
1A.75	27.13	18.39	25.29	25.51	22.209		4
54.	30.20	24.95	29.65	30.11	24.46		5
104.	29.44	24.77	30.115	30.11	29.64		6
	790505111		VZBAR	VXS=20	KNUTS	PSI=0. Z=14	
14.5A	0.	37.	90.	125.	250.		1
-1A.75	-1.028	-1.34	-.656	-.824	-.709		2
0.	-1.220	-.6518	.2158	-.0588	-1.33		3
1A.75	1.3136	1.2182	1.443	1.544	.333		4
54.	1.762	1.6173	1.153	2.17	1.407		5
104.	.174	.1488	-.853	-.1512	-.45238		6
	800505111		VYBAR	VSS=20	PSI=0	Z=25	
25.	0.	37.	90.	125.	250.		1
-1A.75	-2.002	-1.701	-1.604	-1.625	-.803		2
0.	-.7	-1.024	.3087	1.156	.118		3
1A.75	1.4654	1.317	1.5036	1.287	.0797		4
54.	.48914	.8048	.821	2.039	1.		5
104.	.2	.15	.4736	1.307	.4506		6
	810505111		VYBAR	VSS=20	PSI=0	Z=44.5	
44.50	0.	37.	90.	125.	250.		1
-1A.75	-1.2212	-1.512	-1.548	-1.615	-.737		2
0.	2.024	.3314	.4089	.205	.374		3
1A.75	1.448	6.7234	.1465	-.1	1.301		4
54.	-.268	1.0115	-1.225	-.1629	-.204		5
104.	-.4384	.0154	-1.574	-.534	-.856		6
	820505111		VZBAR	VSS=20	PSI=0	Z=14.58	
14.50	0.	37.	90.	125.	250.		1
-1A.75	-1.2	-.7144	-1.744	-.3345	.742		2
0.	-3.142	-1.405	-1.21	-1.018	.25512		3
1A.75	-.1458	.05174	1.541	1.194	1.4689		4
54.	1.2408	1.144	.2479	-.004	1.3		5
104.	.2201	.21714	.132	.4034	.778		6
	830505111		VZBAR	VSS=20	PSI=0	Z=25	
24.	0.	37.	90.	125.	250.		1
-1A.75	-.4612	-.475	-.965	.1313	.6674		2
0.	-1.83	-.437	.2029	-.222	.7146		3
1A.75	-.3546	-.0664	-.1612	-1.149	1.061		4
54.	.5471	.6448	-.133	.365	.143		5
104.	0.	0.	.01215	-.0703	.633		6
	840505111		VZPAR	VSS=20	PSI=0	Z=44	
44.50	0.	37.	90.	125.	250.		1
-1A.75	-.6105	-.014	-.1246	.9025	1.011		2
0.	1.4	1.507	1.354	1.859	1.447		3
1A.75	.4357	-.4.792	.4027	1.256	-2.123		4

54.	2.664	1.307	3.044	1.092	2.1748	5
104.	2.207	2.064	1.6819	2.141	2.1758	6
	M50505111		SIGX VSS=20 PSI=0 Z=14.58			
14.58	0.	37.	90.	125.	250.	1
-18.75	6.444	5.5144	4.719	4.549	3.8833	2
0.	4.5334	3.495	4.609	4.04	2.443	3
18.75	3.494	4.3837	4.257	3.468	3.026	4
54.	1.3287	1.3053	.9439	.6644	1.18	5
104.	.2948	.2999	.422	.3844	.2444	6
	M60505111		SIGX VSS=20 SPI=0 Z=25.			
25.	0.	37.	90.	125.	250.	1
-18.75	4.0513	4.274	3.204	3.529	2.863	2
0.	3.828	3.97	4.46	2.88	2.409	3
18.75	4.339	3.436	4.25	3.464	2.703	4
54.	1.55	1.674	1.395	.9143	.74	5
104.	1.2	1.2	.9914	.64214	.3424	6
	M70505111		SIGX VSS=20 PSI=0 Z=44			
44.58	0.	37.	90.	125.	250.	1
-18.75	2.779	3.196	1.44	1.5	1.57	2
0.	3.17	2.004	2.787	2.722	2.53	3
18.75	3.203	4.2835	3.545	3.411	6.015	4
54.	1.055	1.104	1.355	1.382	1.509	5
104.	.4958	.4877	.7277	.367	.515	6
	M80505111		SIGY VSS=20 PSI=0 Z=14.58			
14.58	0.	37.	90.	125.	250.	1
-18.75	4.4404	4.2153	3.4148	3.72	3.024	2
0.	4.3348	4.7034	4.4203	4.45	3.279	3
18.75	3.3622	2.931	3.1038	3.47	2.9516	4
54.	1.4748	1.406	1.1226	.833	1.331	5
104.	.41318	.4135	.701	.7368	.2444	6
	M90505111		SIGY VSS=20 PSI=0 Z=25			
25.	0.	37.	90.	125.	250.	1
-18.75	3.511	3.184	3.794	3.727	2.8142	2
0.	3.806	3.915	4.075	3.588	2.567	3
18.75	3.254	3.272	3.1415	3.277	2.5414	4
54.	1.3143	1.3384	1.741	1.286	.7404	5
104.	.413	.413	1.459	1.1274	.3424	6
	900505111		SIGY VSS=20 PSI=0 Z=44			
44.58	0.	37.	90.	125.	250.	1
-18.75	4.131	2.764	2.974	2.416	2.27	2
0.	4.444	3.8723	3.35	3.182	2.526	3
18.75	3.36	4.079	3.06	3.488	5.087	4
54.	1.748	1.5304	1.429	1.601	2.107	5
104.	.4545	.7434	1.259	.563	.7324	6
	910505111		SIG7 VSS=20 PSI=0 Z=14			
14.58	0.	37.	90.	125.	250.	1
-18.75	4.144	4.385	4.194	3.471	3.144	2
0.	3.47	3.193	3.376	3.156	2.7823	3
18.75	3.442	3.144	3.5457	2.848	2.373	4
54.	1.625	1.515	1.181	1.088	1.0456	5
104.	.43614	.36	.634	.558	.4174	6
	420505111		SIG7 VSS=20 PSI=0 Z=25			
25.	0.	37.	90.	125.	250.	1
-18.75	3.	3.254	3.1438	2.756	2.868	2
0.	3.037	2.866	3.356	2.667	2.226	3

1A.75	3.394	2.61	2.7307	3.824	2.0169	4
54.	1.559	1.7179	2.0738	1.4359	.8047	5
104.	1.559	1.01	.4663	.6445	.44424	6
	930905111		SIGZ		VSS=20 PSI=0 Z=44	
44.58	0.	37.	90.	125.	250.	1
-1A.75	3.425	2.623	2.296	2.115	1.719	2
0.	3.511	2.8529	2.757	2.737	2.136	3
1A.75	4.202	11.04	2.718	3.138	8.5137	4
54.	1.803	1.742	2.168	1.716	2.006	5
104.	.6198	.595	.8391	.544	.6321	6

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APPENDIX B  
PLOTS OF NON LINEAR TABLES

APPENDIX B  
STATE OF NEW JERSEY

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TABLE NO.1

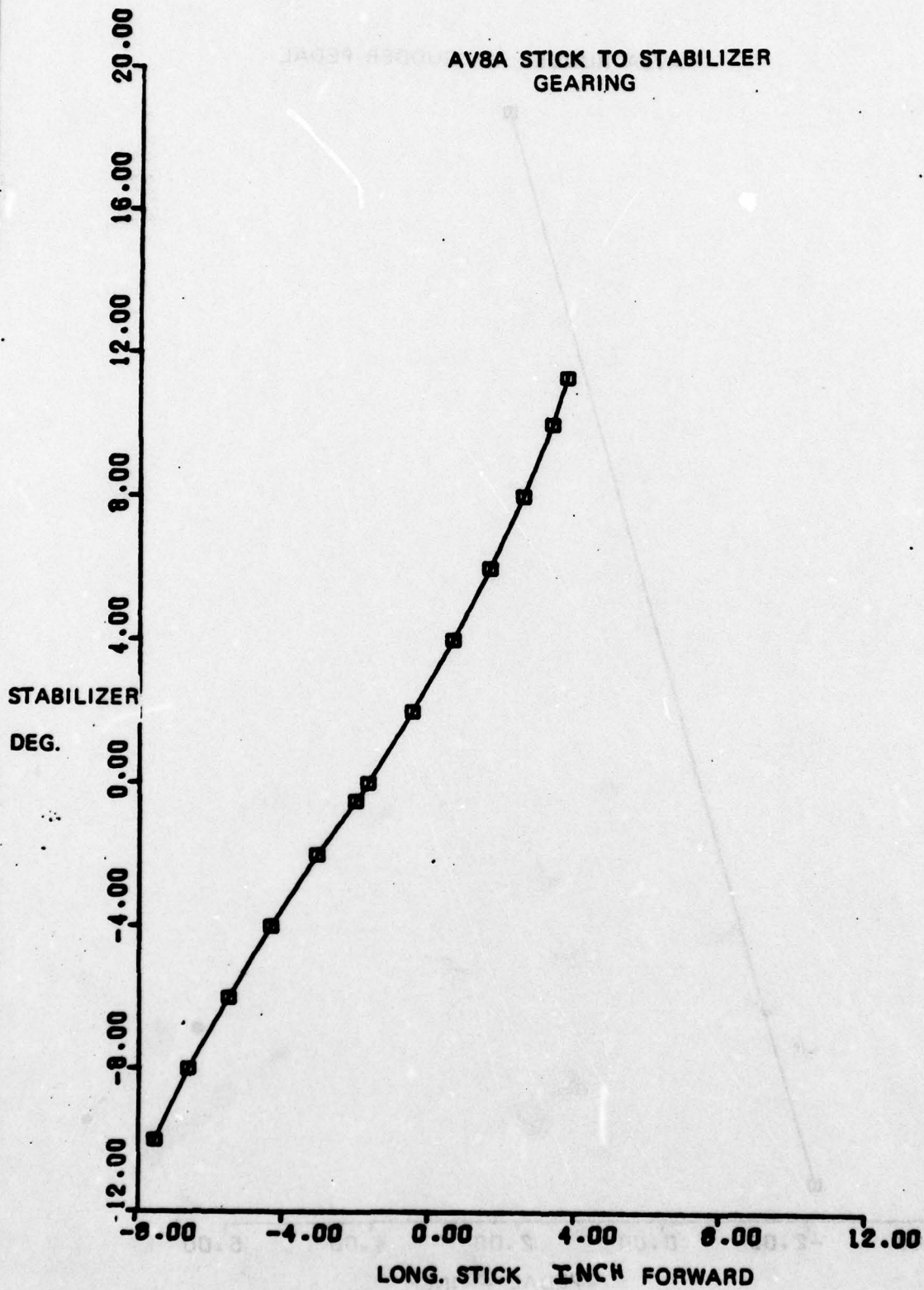


TABLE NO. 2

AV8A RUDDER VS. RUDDER PEDAL

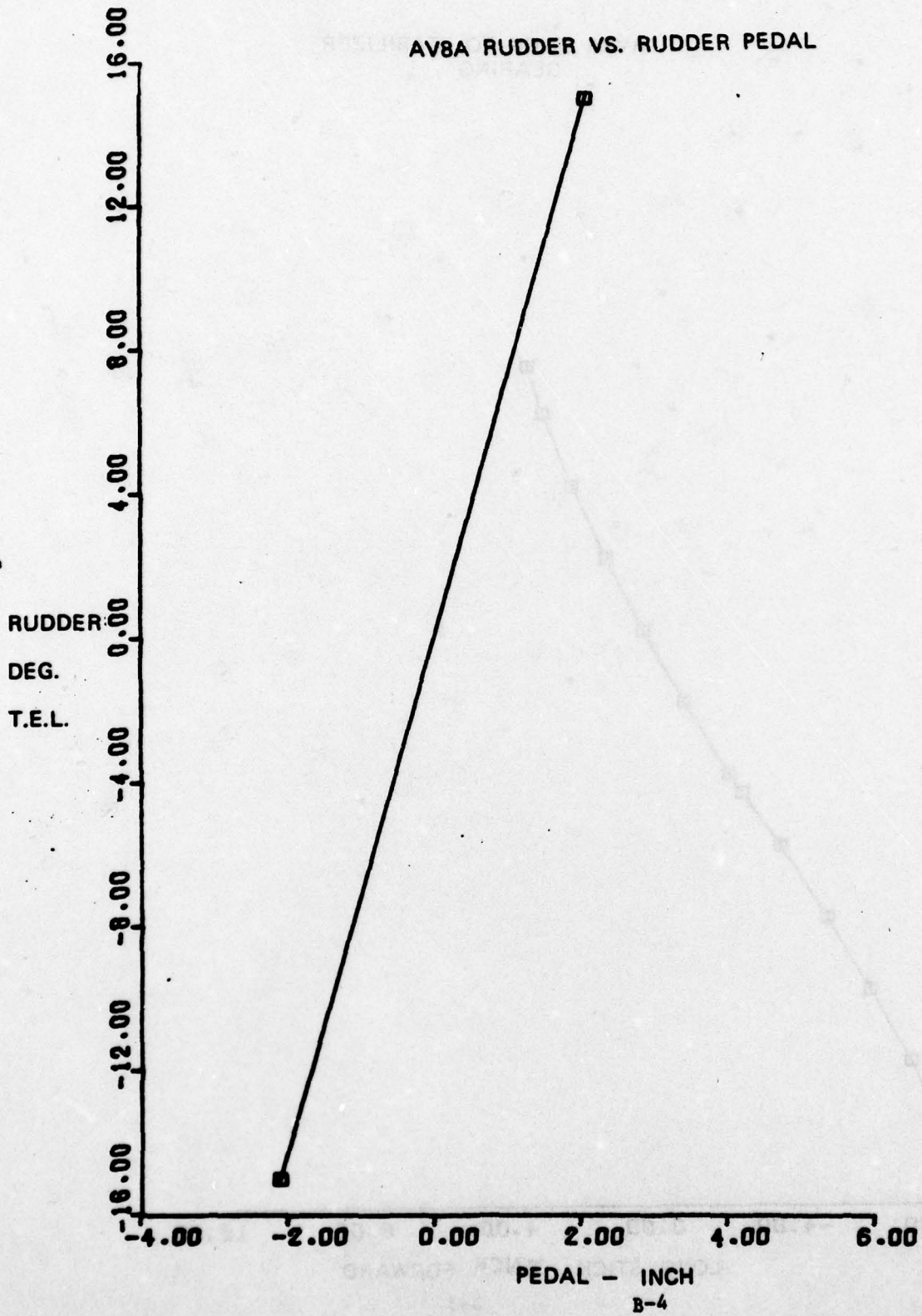


TABLE NO. 3

AV8A LATERAL STICK GEARING

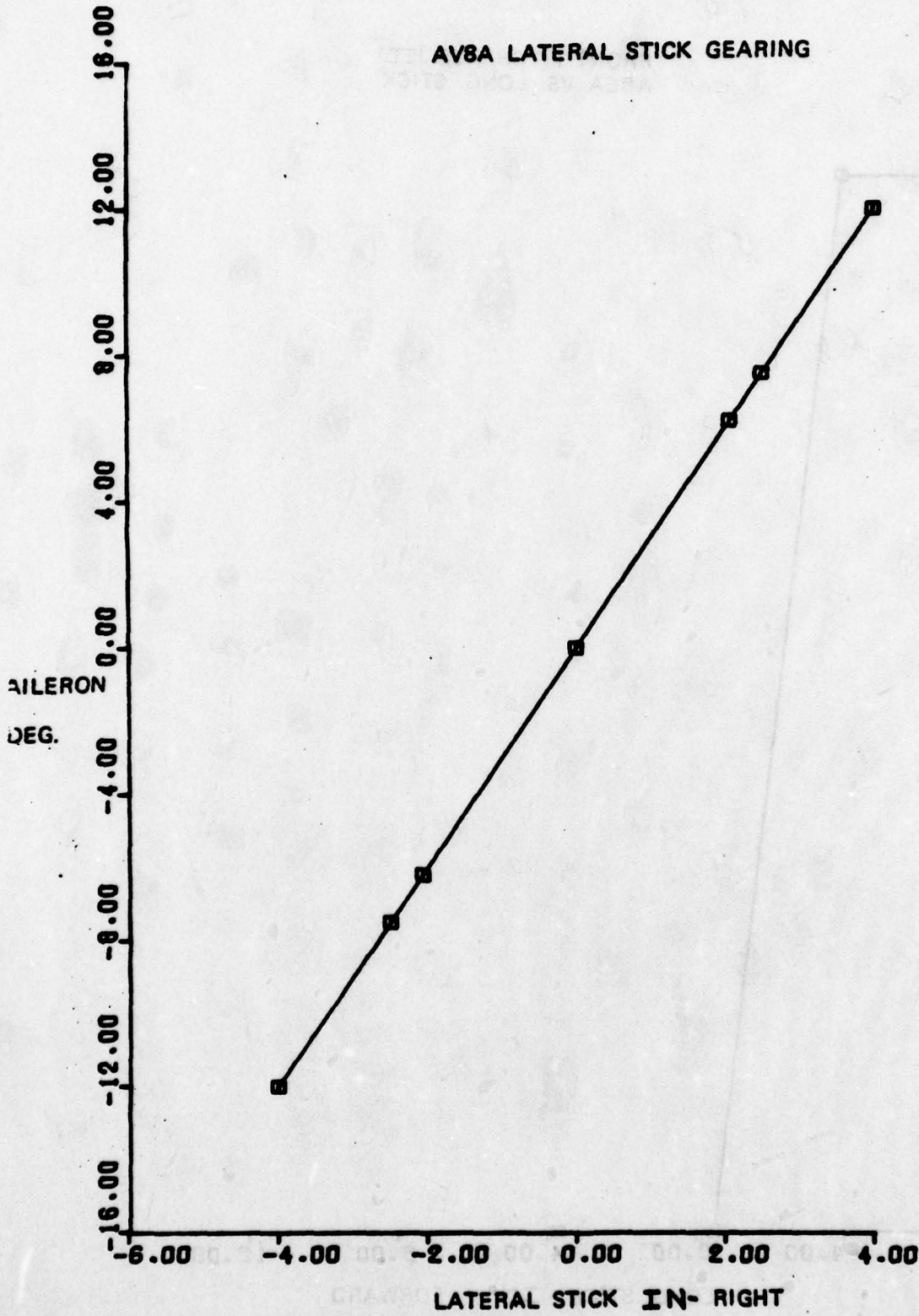
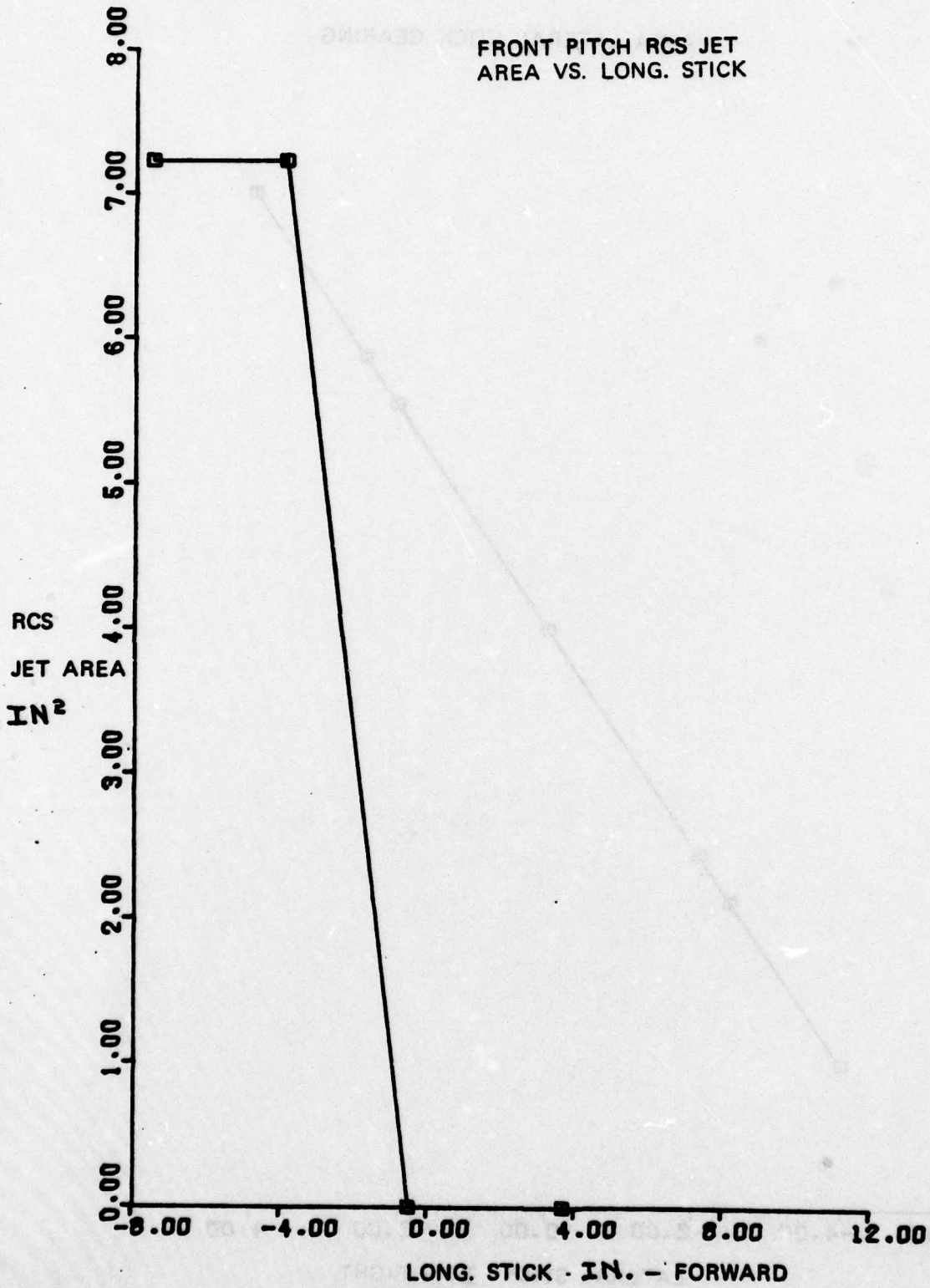
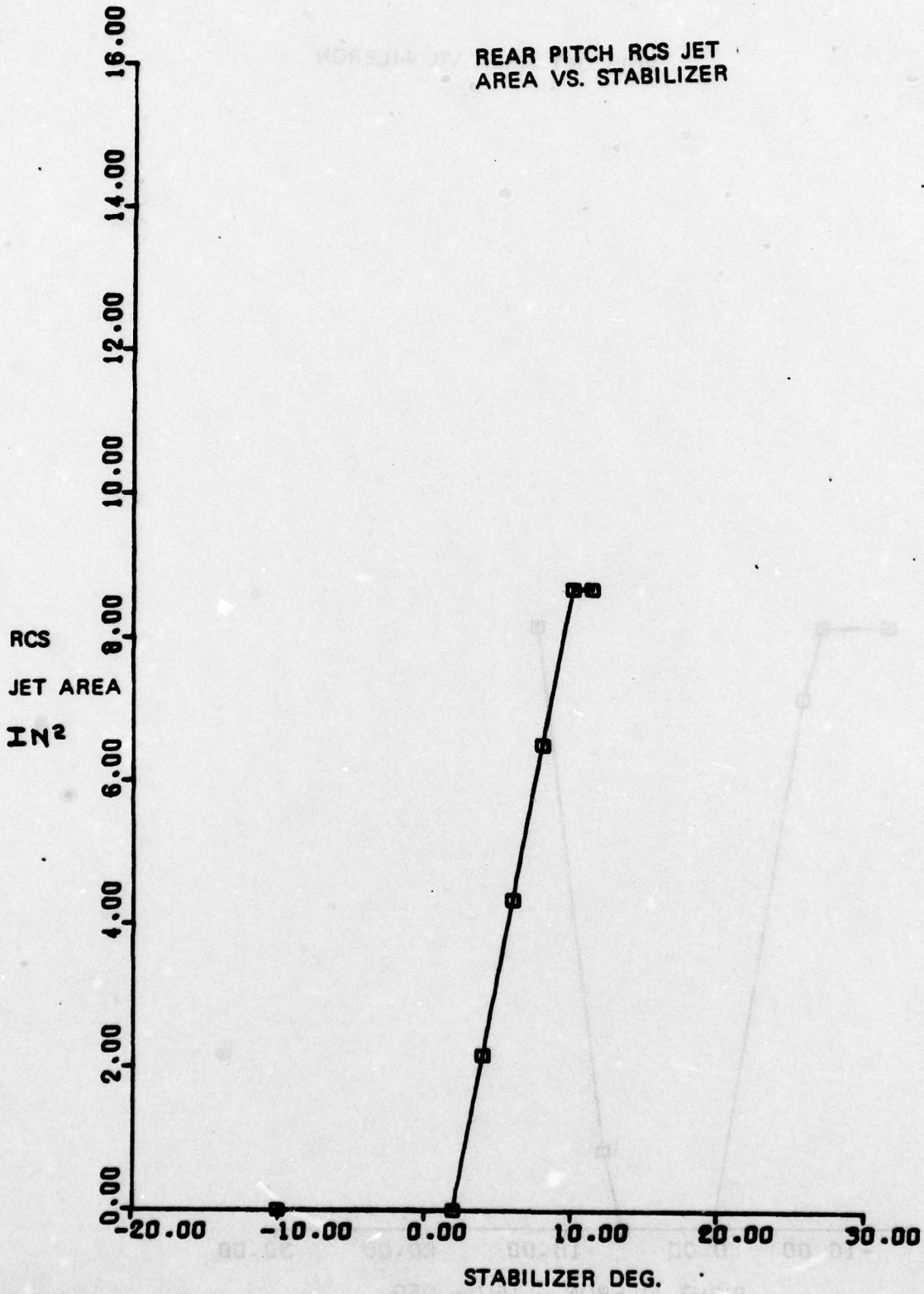


TABLE NO.4



# TABLE NO.5

REAR PITCH RCS JET  
AREA VS. STABILIZER



# TABLE NO. 6

## ROLL JET AREA VS. AILERON

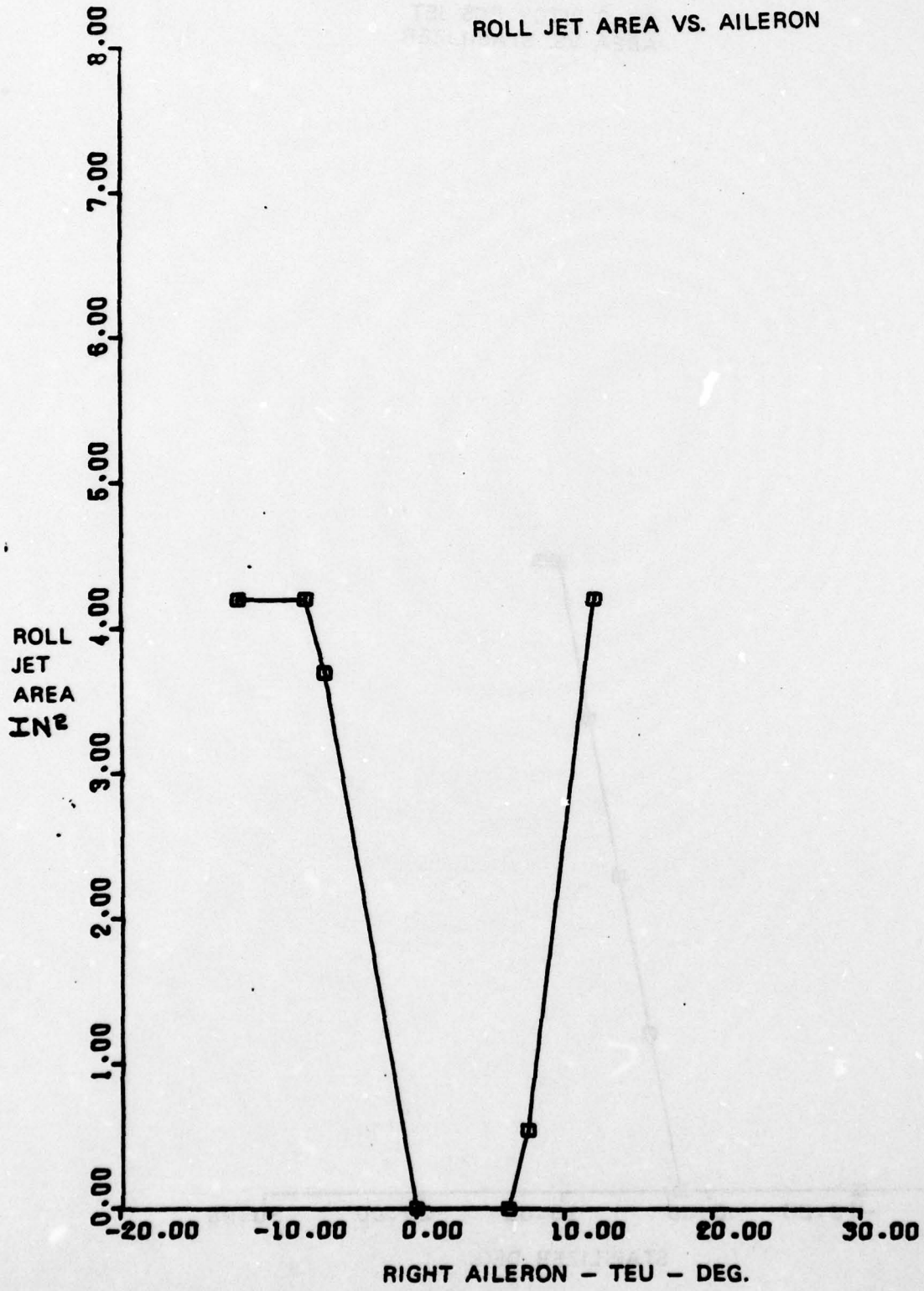
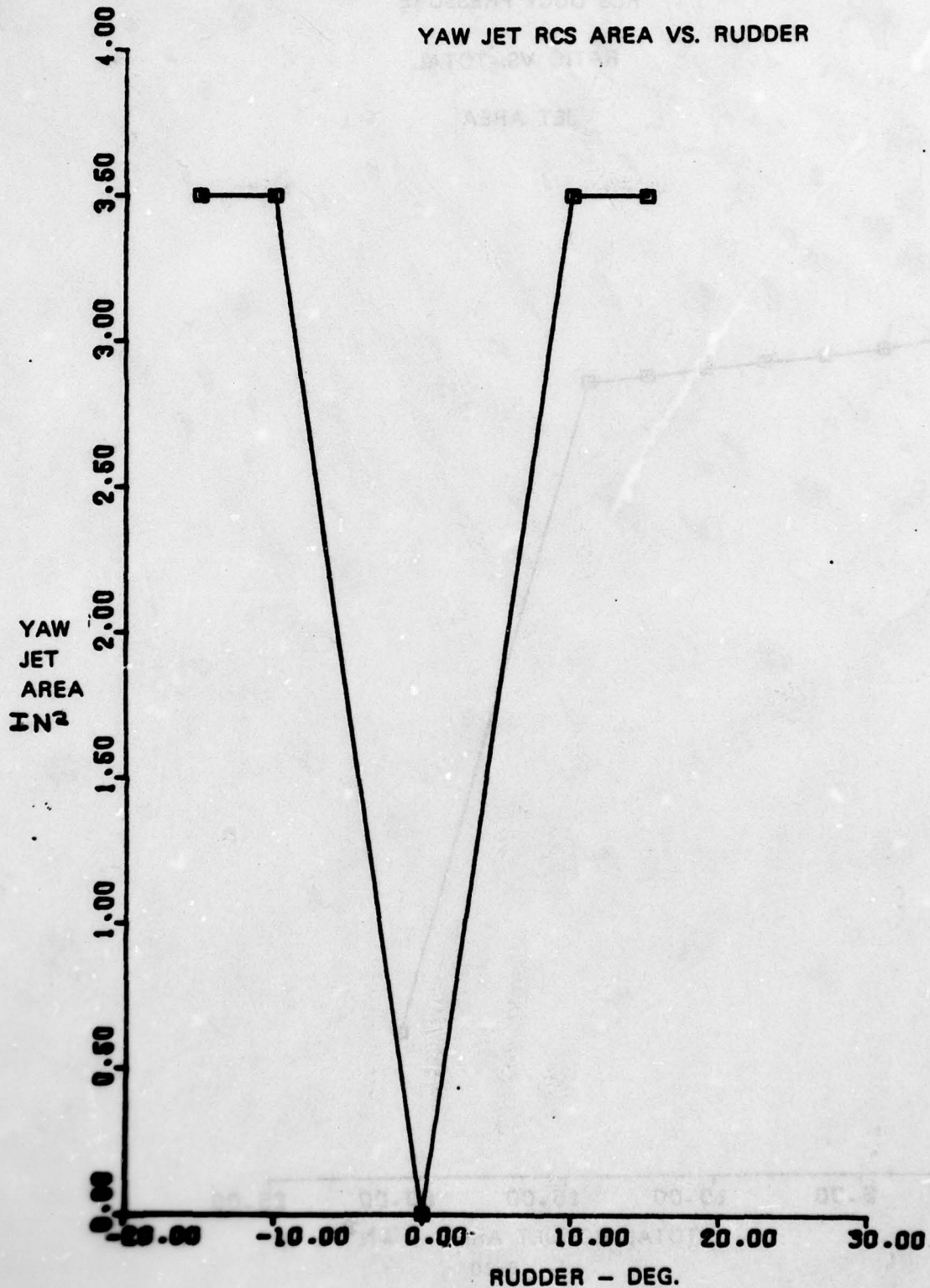


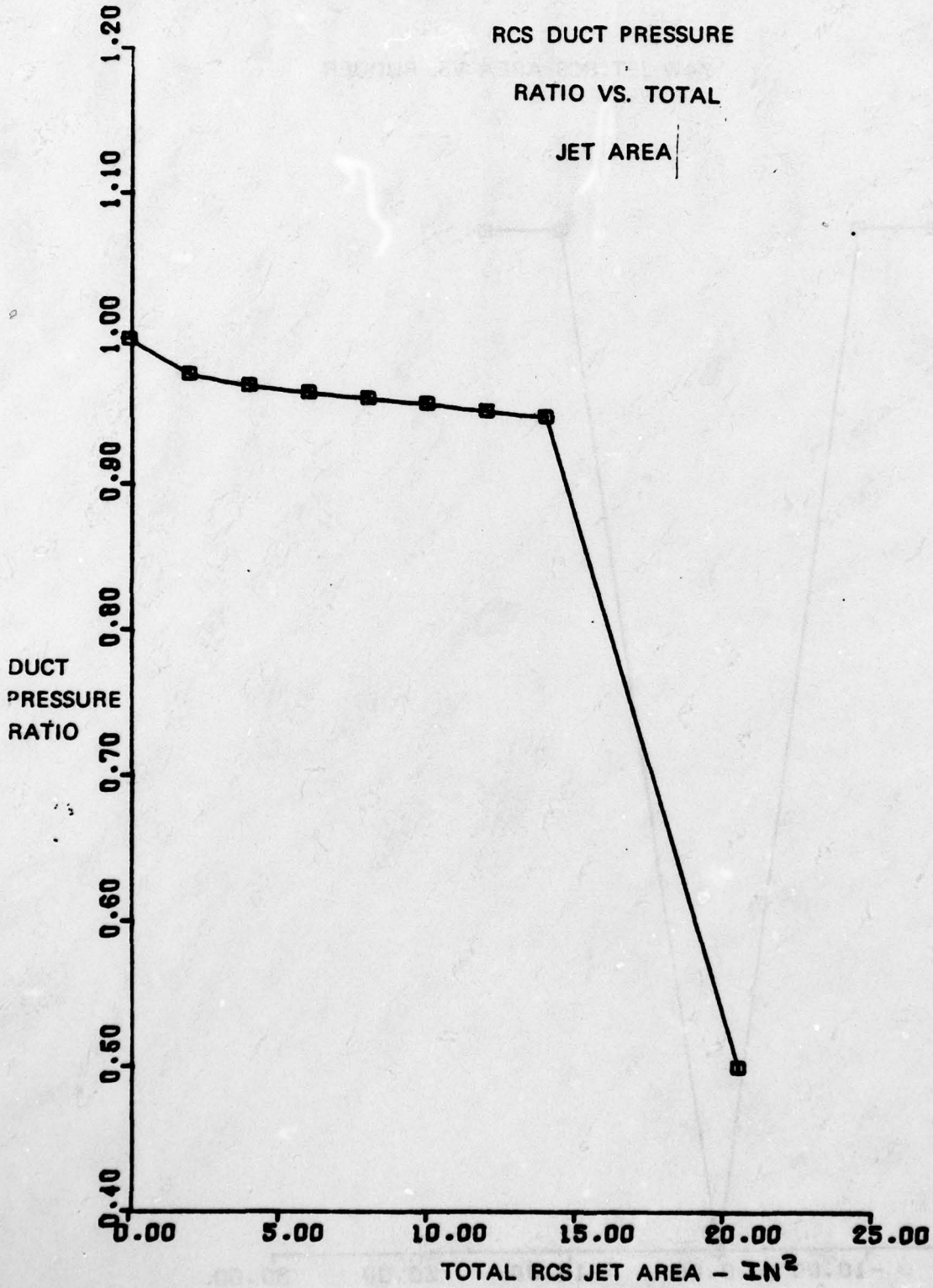
TABLE NO.7

YAW JET RCS AREA VS. RUDDER



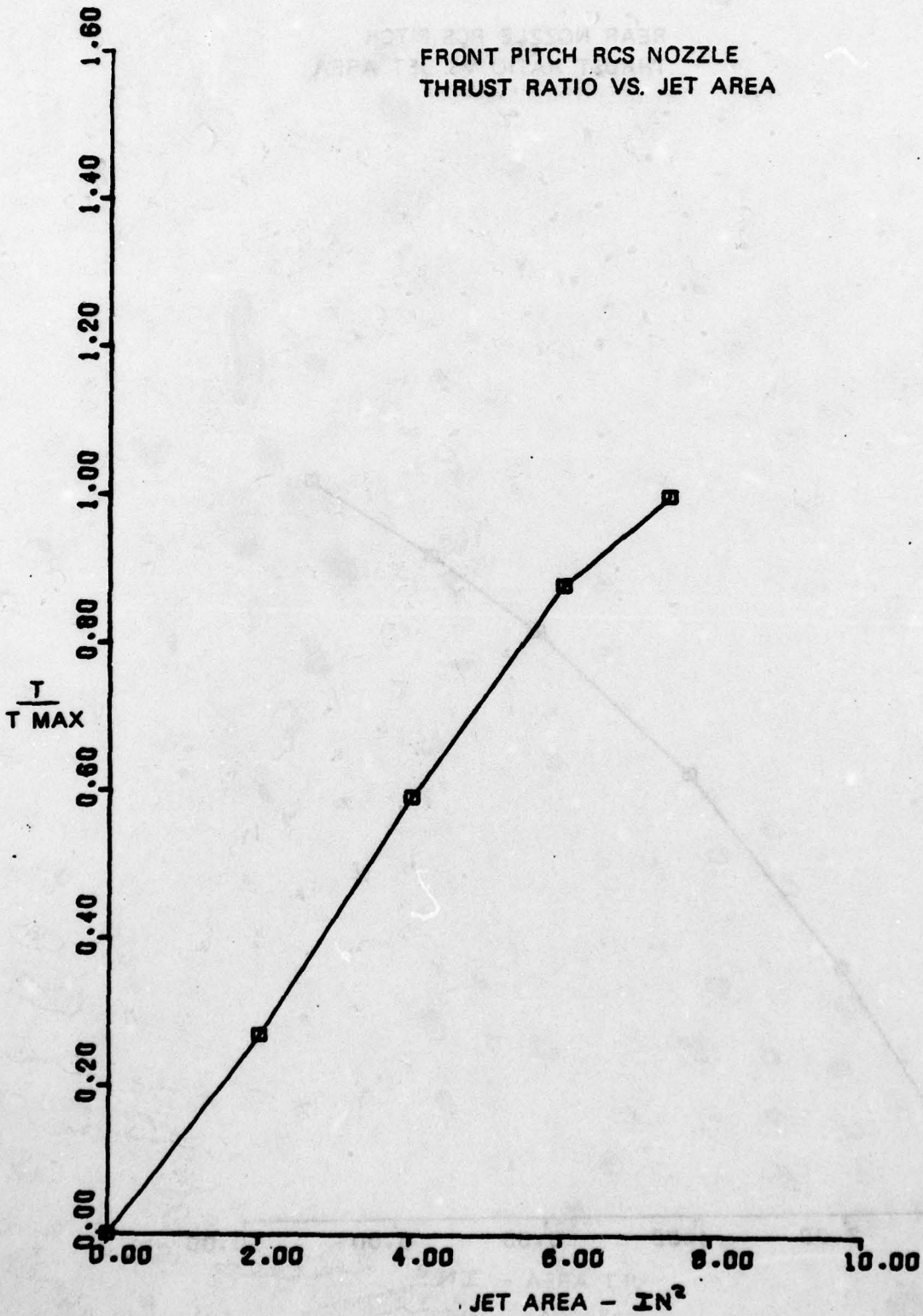
### TABLE NO. 8

RCS DUCT PRESSURE  
RATIO VS. TOTAL  
JET AREA



# TABLE NO. 9

FRONT PITCH RCS NOZZLE  
THRUST RATIO VS. JET AREA



# TABLE NO.10

REAR NOZZLE RCS PITCH  
THRUST RATIO VS. JET AREA

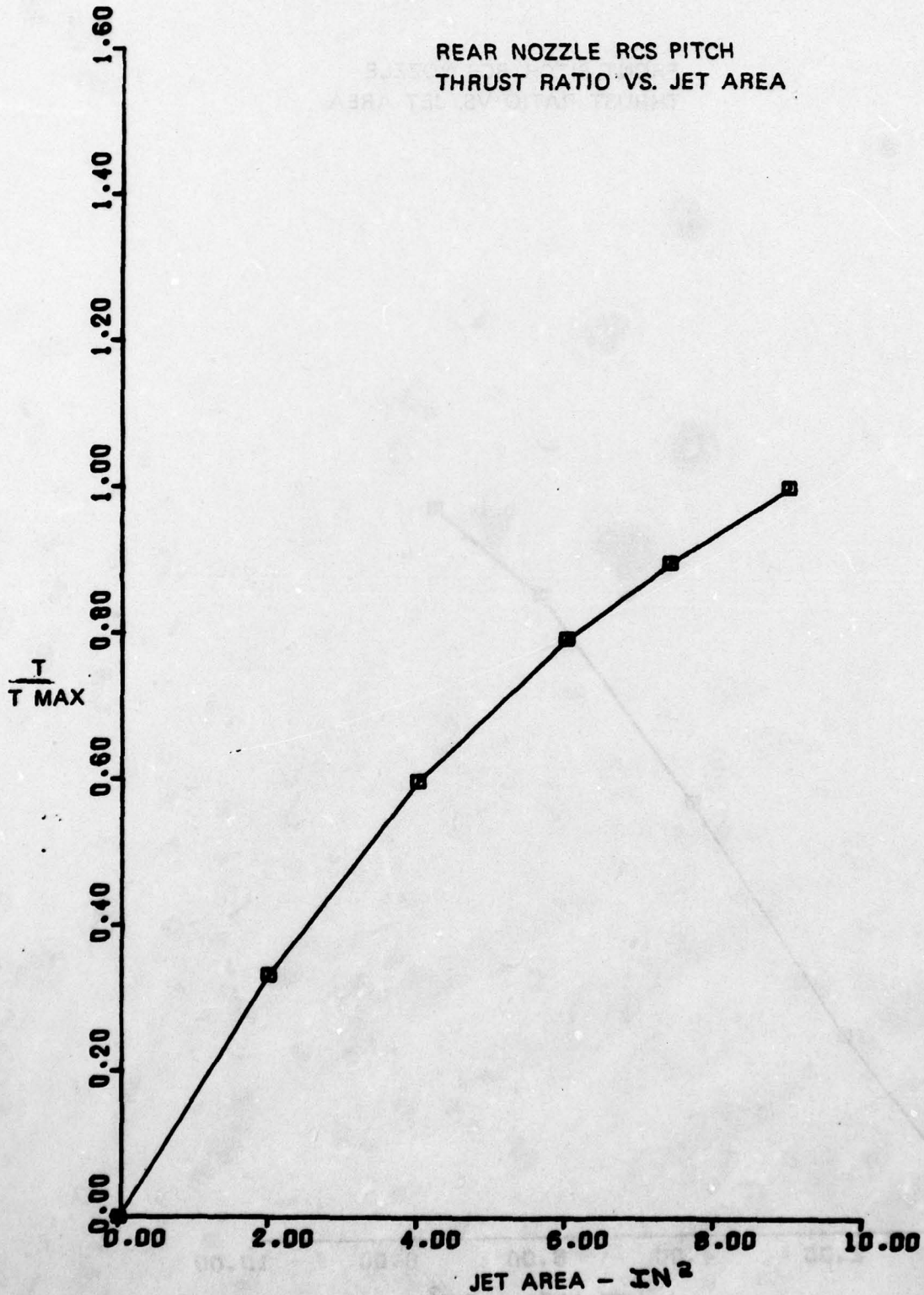
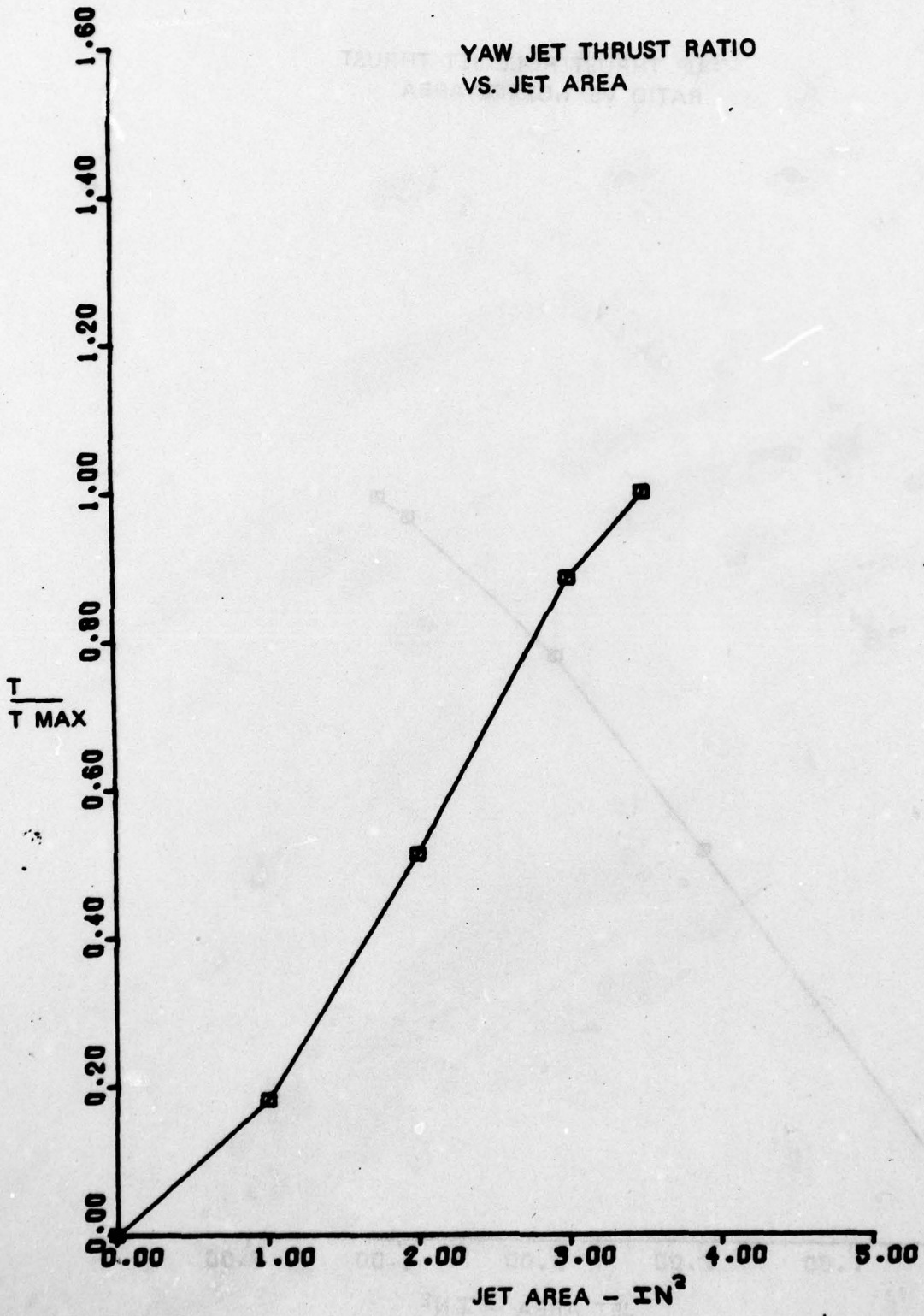
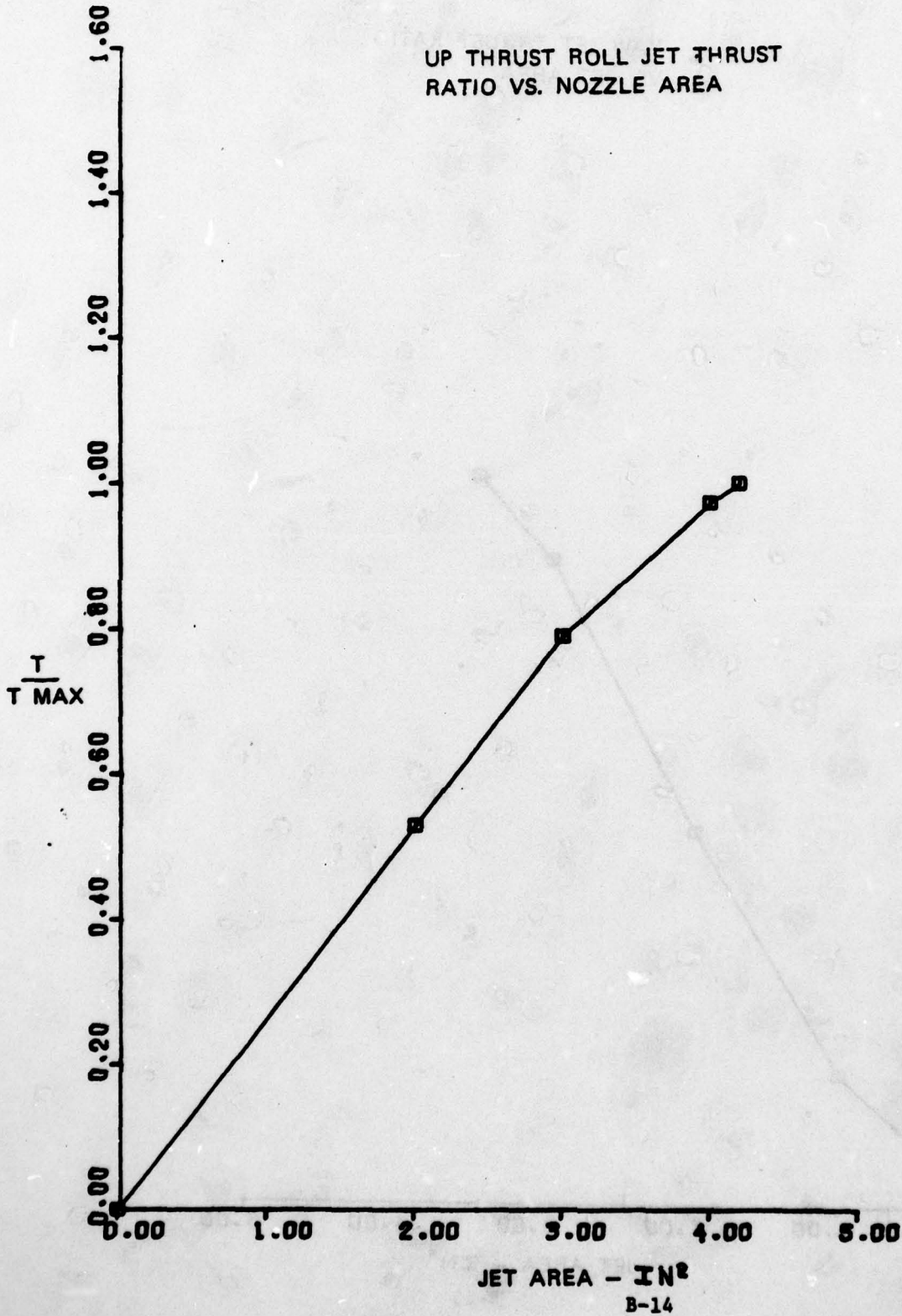


TABLE NO.11



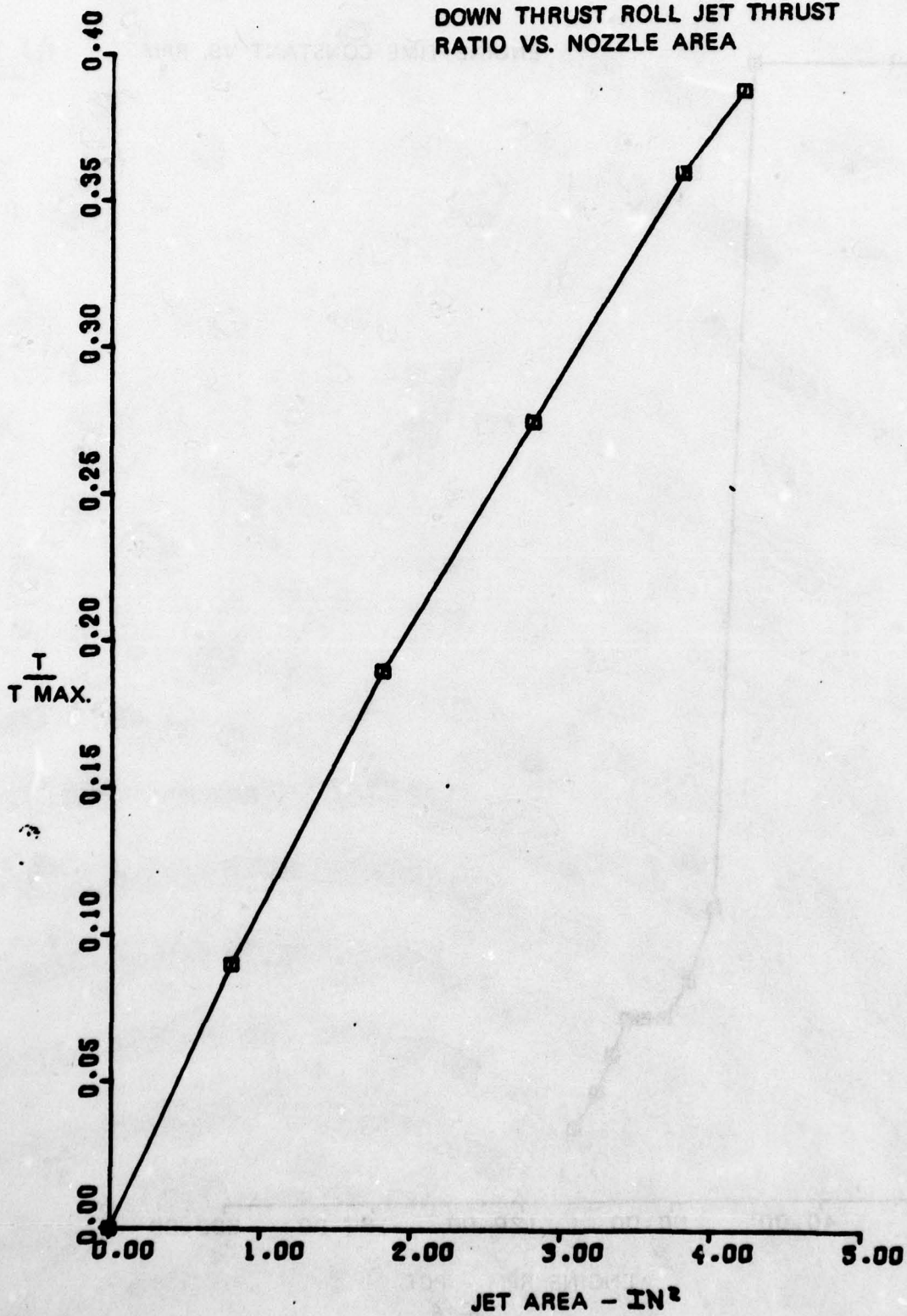
# TABLE NO.12

UP THRUST ROLL JET THRUST  
RATIO VS. NOZZLE AREA



# TABLE NO.13

DOWN THRUST ROLL JET THRUST  
RATIO VS. NOZZLE AREA



# TABLE NO.14

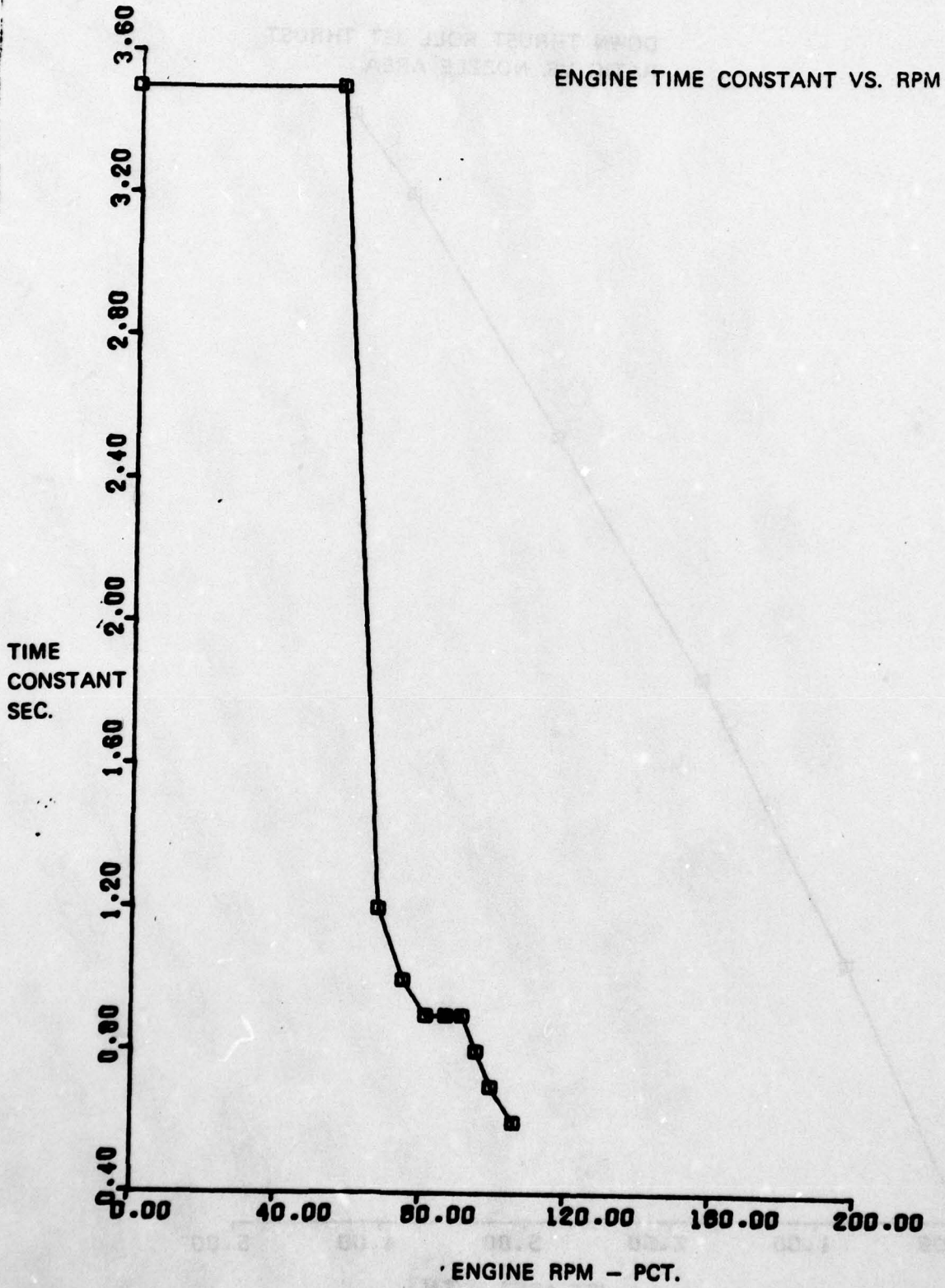


TABLE NO.15

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

MACH NUMBER

- 0.00000
- 0.10000
- ▲ 0.20000
- + 0.30000

INCREASE IN GROSS  
THRUST VS. FORWARD  
SPEED AND MACH NO.

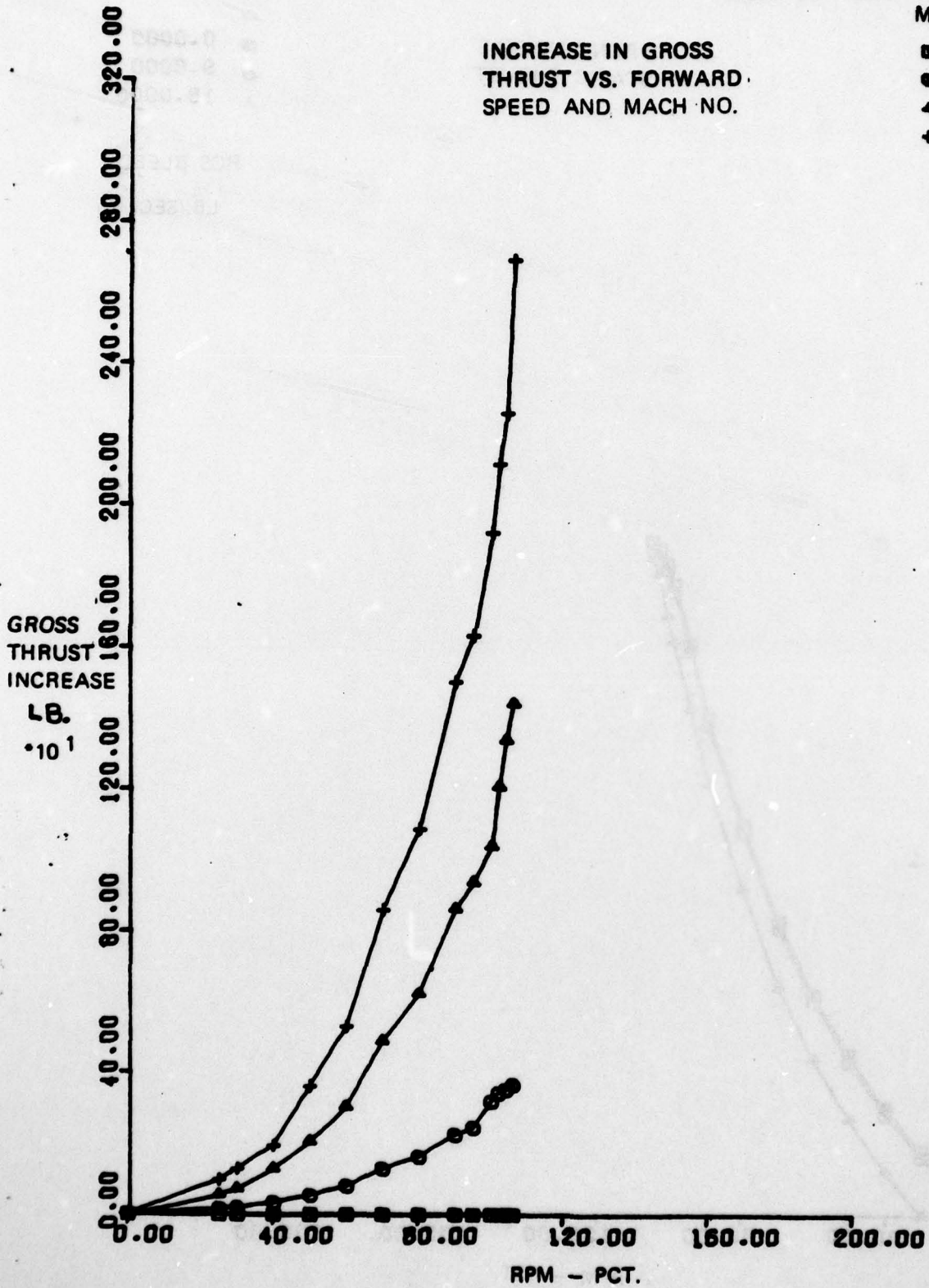


TABLE NO.16

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

FRONT NOZZLE  
STATIC THRUST

- 0.0000
- 9.0000
- ▲ 18.0000

RCS BLEED  
LB./SEC.

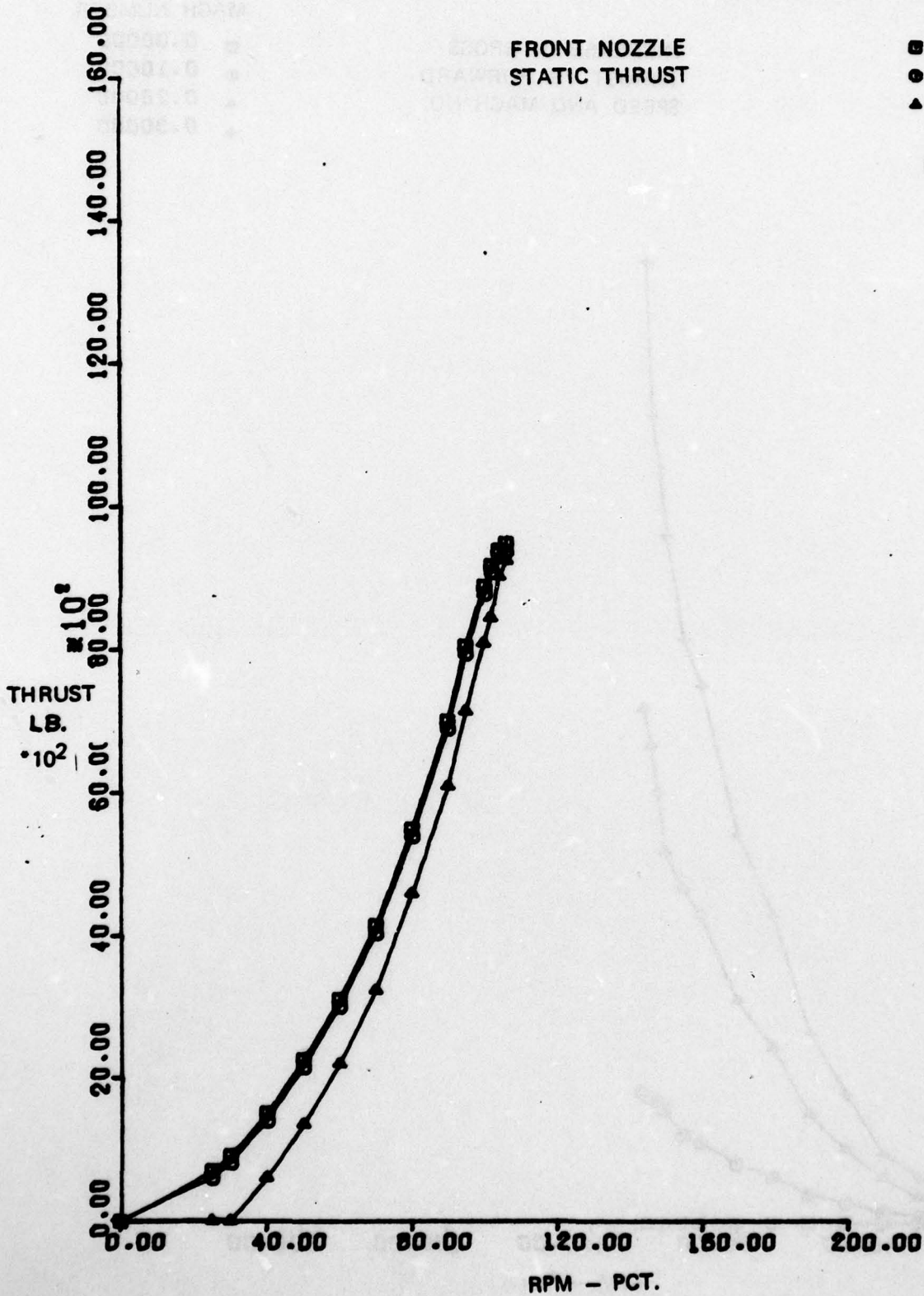


TABLE NO.17

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

REAR NOZZLE  
STATIC THRUST

- 0.0000
  - 9.0000
  - ▲ 18.0000
- RCS BLEED -  
LB./SEC.

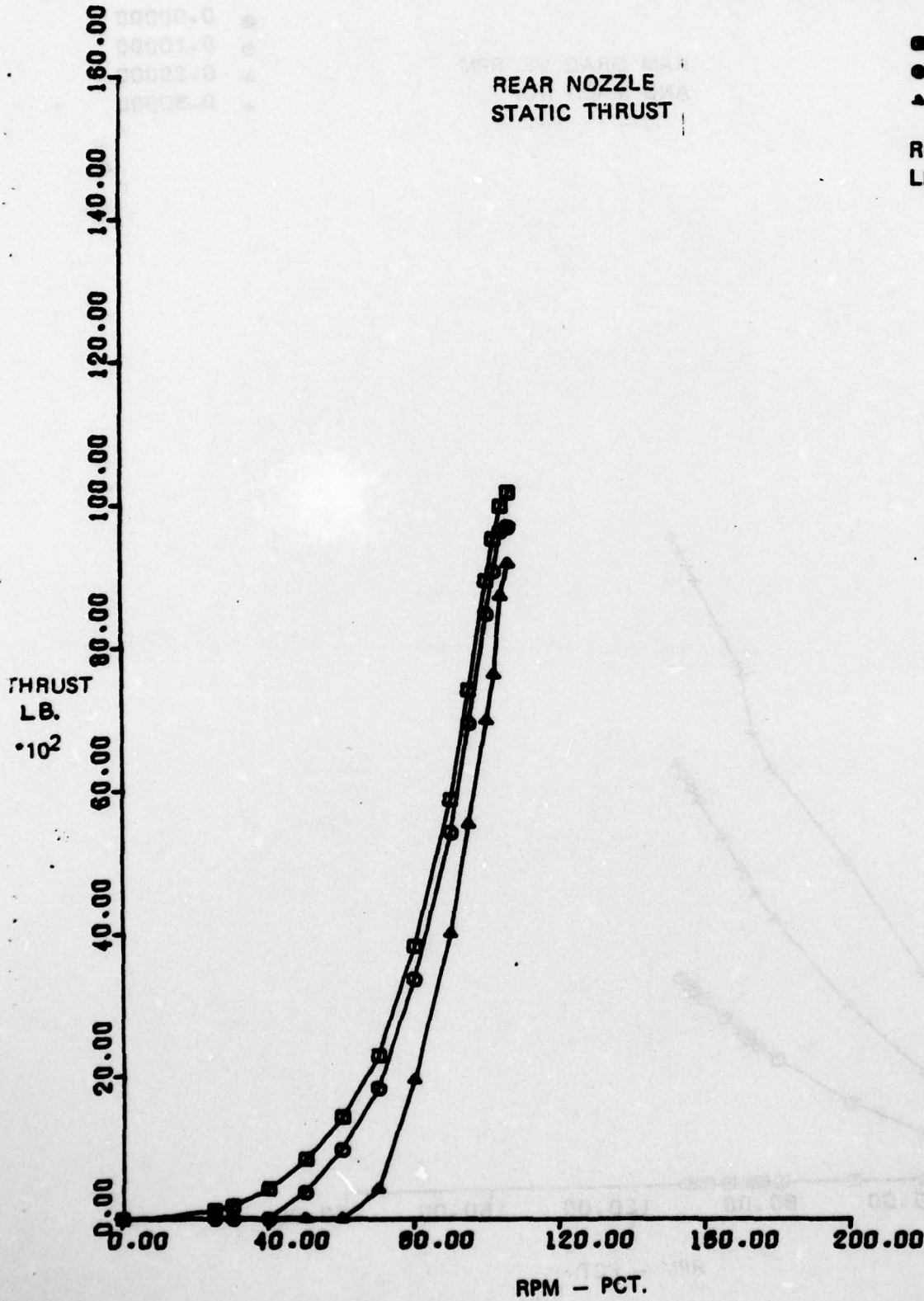
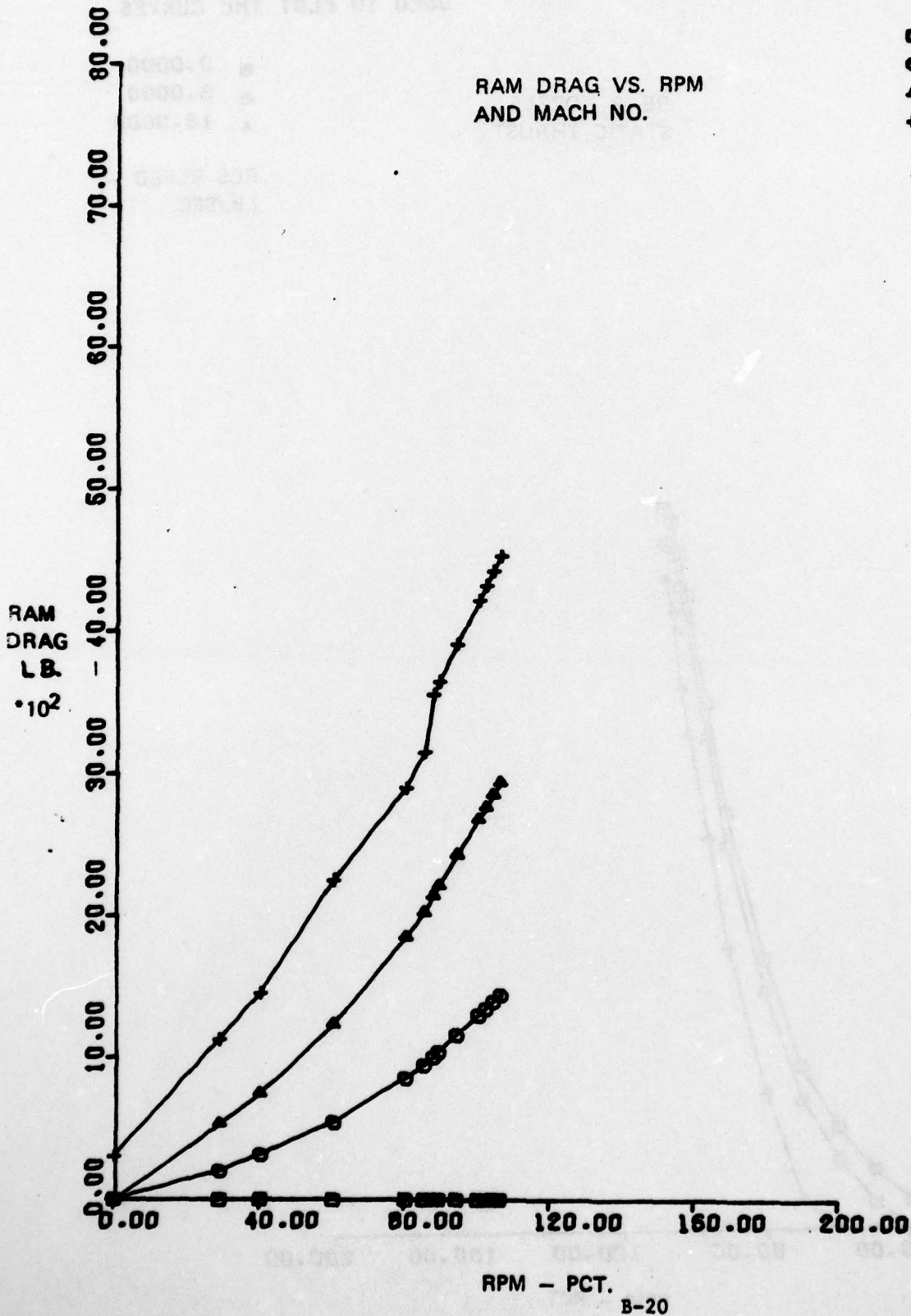


TABLE NO.18

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

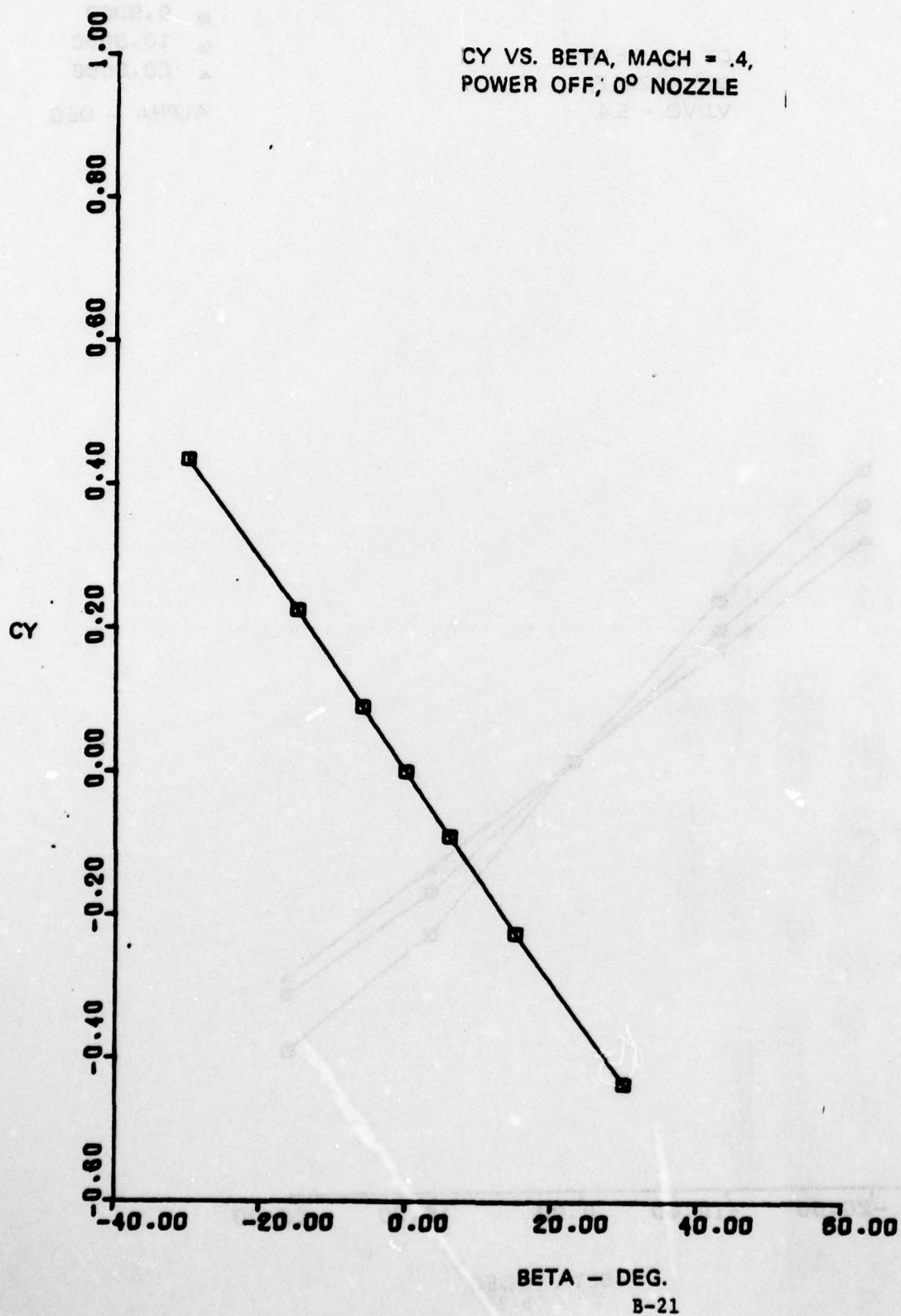
RAM DRAG VS. RPM  
AND MACH NO.

- 0.00000
- 0.10000
- ▲ 0.20000
- + 0.30000



### TABLE NO.19

CY VS. BETA, MACH = .4,  
POWER OFF, 0° NOZZLE



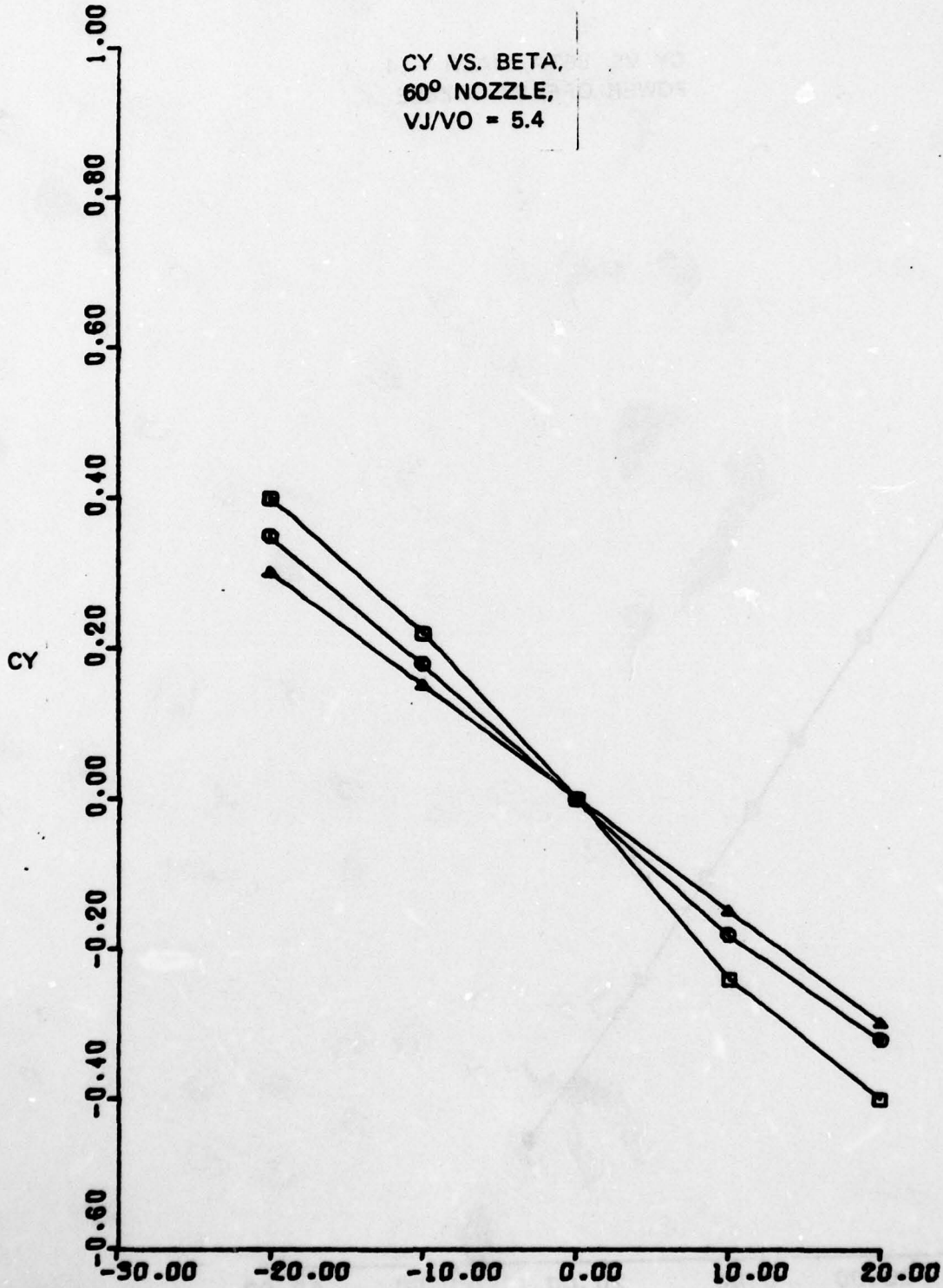
### TABLE NO 20

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- 0.0000
- 10.0000
- ▲ 20.0000

ALPHA - DEG.

CY VS. BETA,  
60° NOZZLE,  
VJ/VO = 5.4



AD-A073 587

NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AIR VEHICL--ETC F/G 1/2  
A COMPUTERIZED VSTOL/SMALL PLATFORM LANDING DYNAMICS INVESTIGAT--ETC(U)  
SEP 77 R L NAVE

UNCLASSIFIED

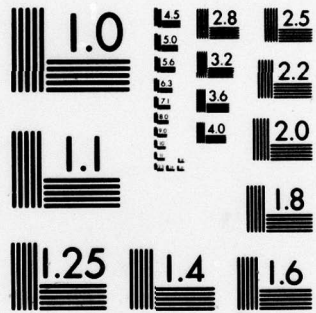
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MM

3 OF 4

AD  
A073587





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

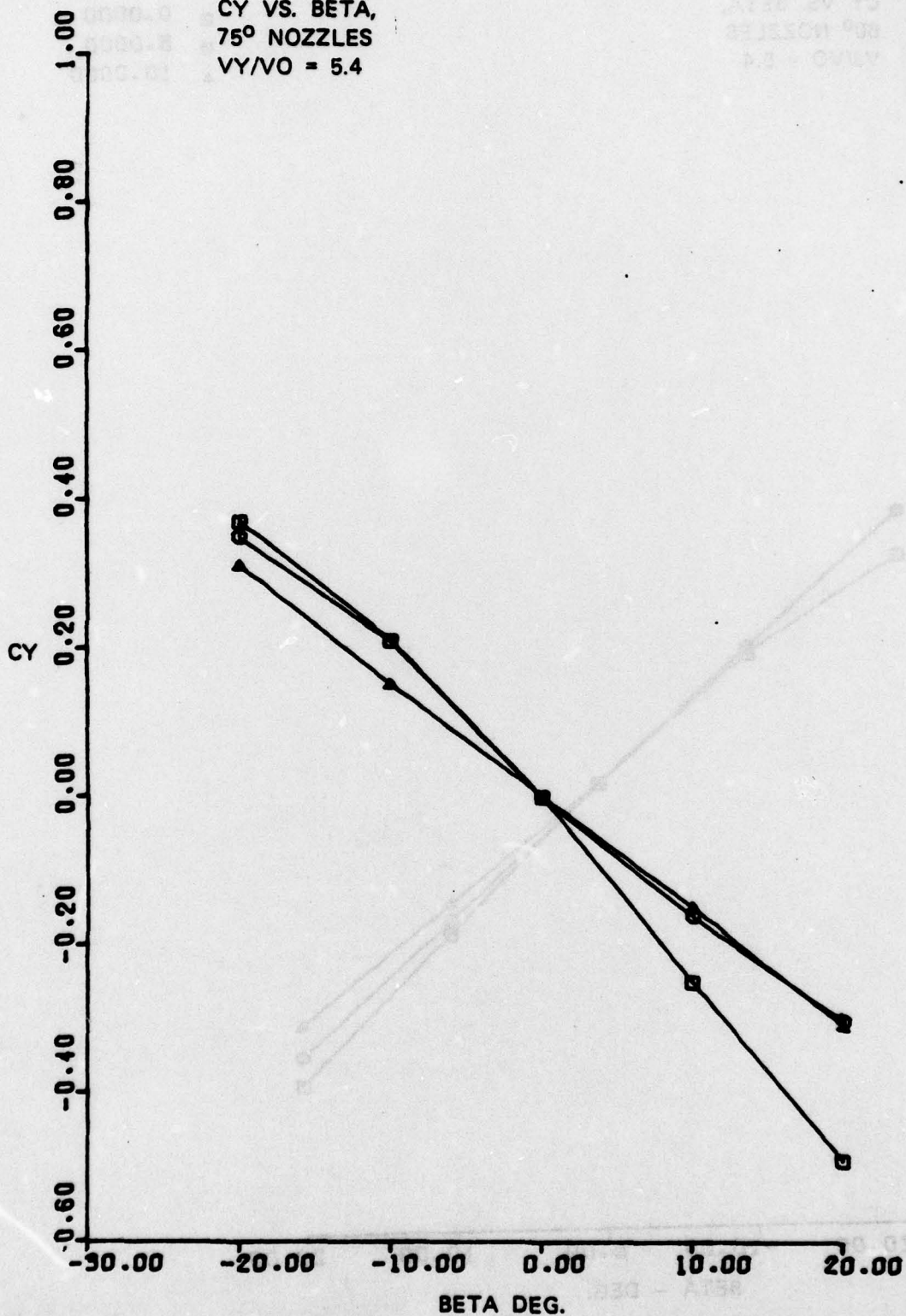
### TABLE NO. 21

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

ALPHA - DEG.

- 0.0000
- 10.0000
- ▲ 20.0000

CY VS. BETA,  
75° NOZZLES  
VY/VO = 5.4

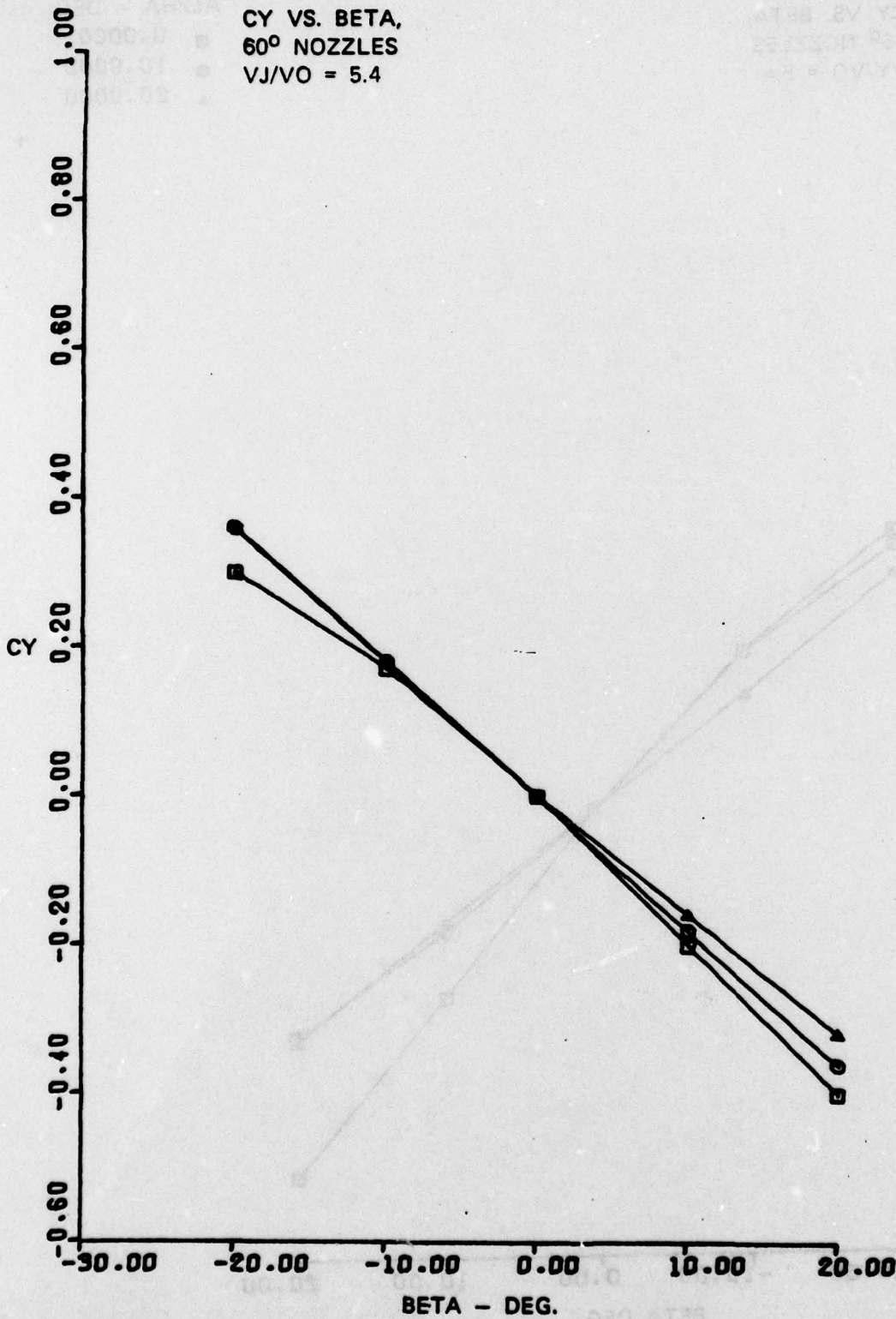


### TABLE NO 22

THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

- ALPHA
- 0.0000
  - 5.0000
  - ▲ 10.0000

CY VS. BETA,  
60° NOZZLES  
VJ/VO = 5.4



### TABLE NO 23

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

ALPHA - DEG.

- 0.0000
- 10.0000
- ▲ 20.0000

CY VS. BETA  
90° NOZZLES  
VJ/VO = 11.9

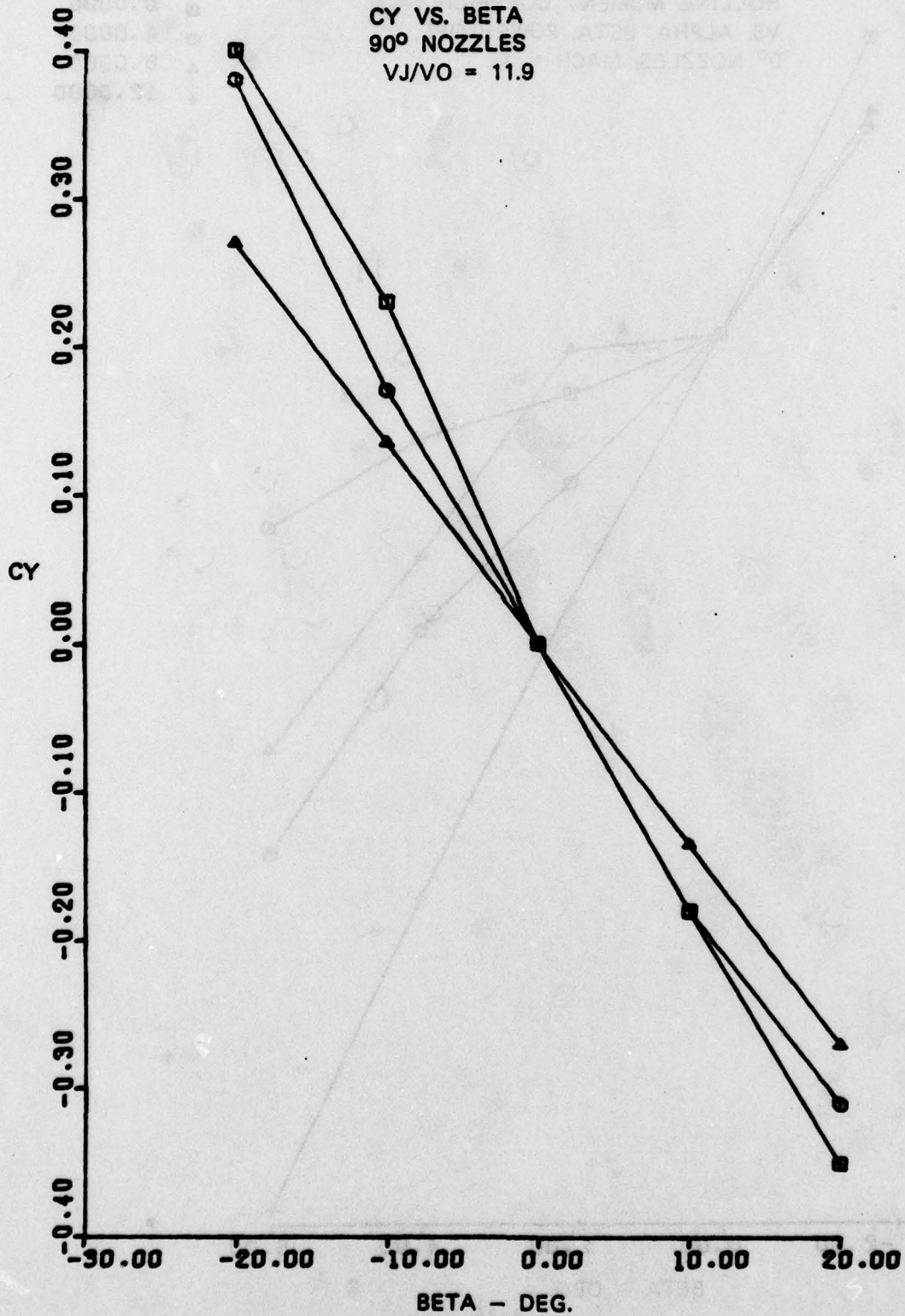


TABLE NO. 24

THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

ALPHA - DEG.

- 0.0000
- 4.0000
- ▲ 8.0000
- + 12.0000

ROLLING MOMENT COEFFICIENT VS. ALPHA, BETA, POWER OFF, 0° NOZZLES, MACH = .4

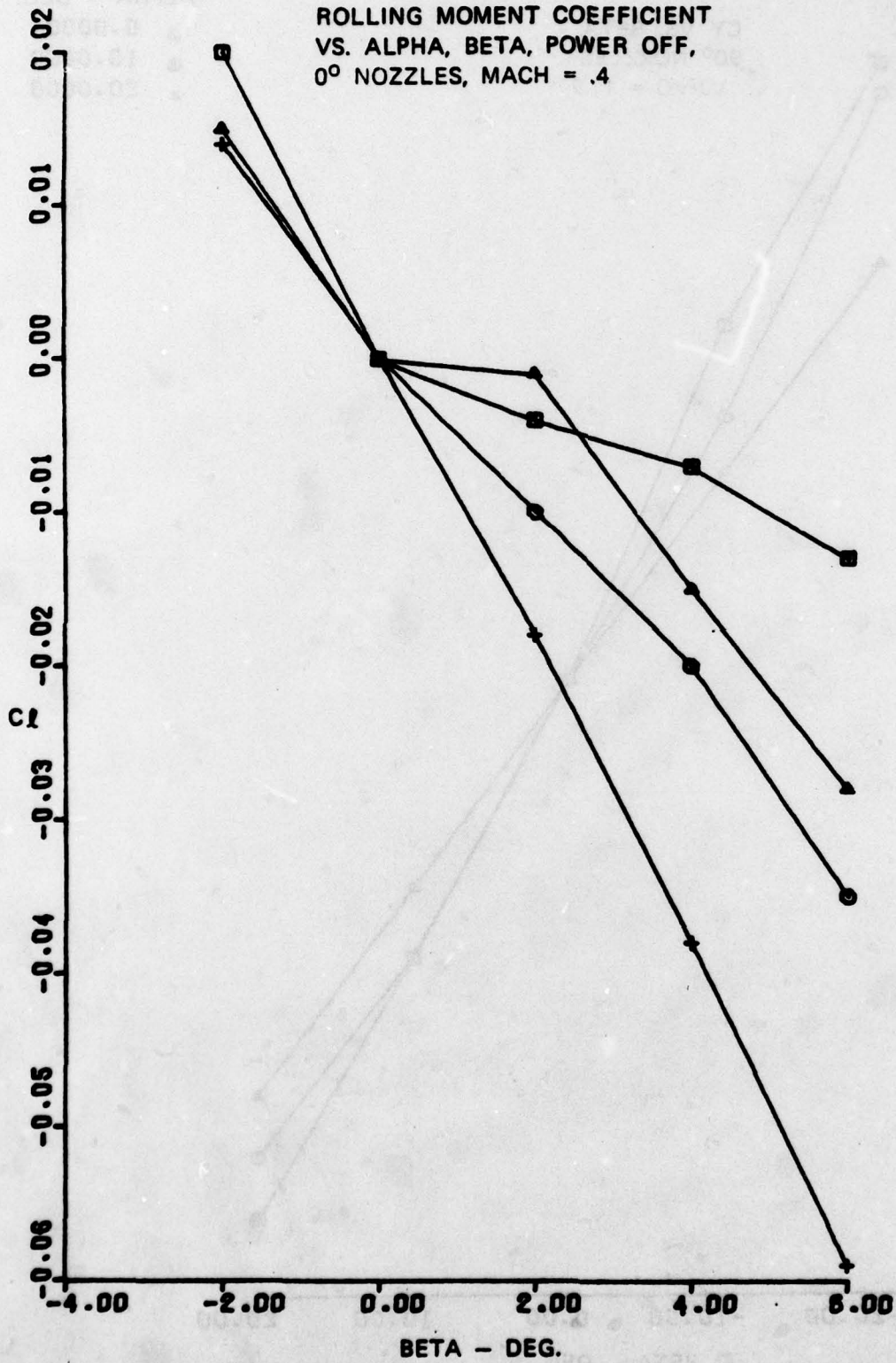


TABLE NO. 25

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

ROLLING MOMENT COEFFICIENT  
VS. ALPHA, BETA, 60° NOZZLE,  
VJ/VO = 5.4

ALPHA - DEG.

- -10.0000
- -5.0000
- ▲ 0.0000
- + 5.0000
- x 10.0000
- ◆ 15.0000
- ♦ 20.0000

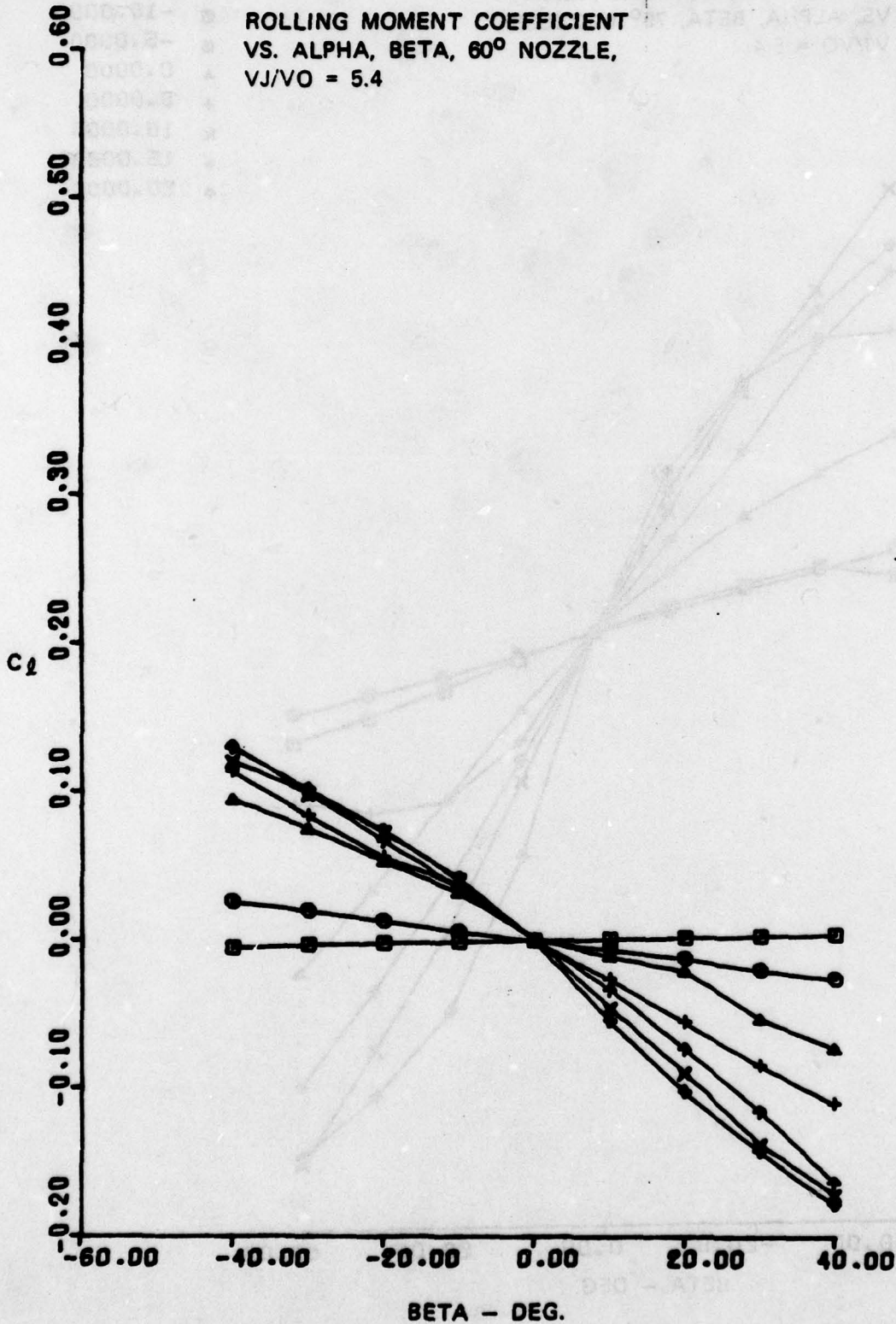


TABLE NO. 26

THE FOLLOWING VALUES OF  $\alpha$  WERE USED TO PLOT THE CURVES

ROLLING MOMENT COEFFICIENT  
VS. ALPHA, BETA, 75° NOZZLES,  
VJ/VO = 5.4

- -10.0000
- -5.0000
- ▲ 0.0000
- + 5.0000
- x 10.0000
- ◆ 15.0000
- ⬥ 20.0000

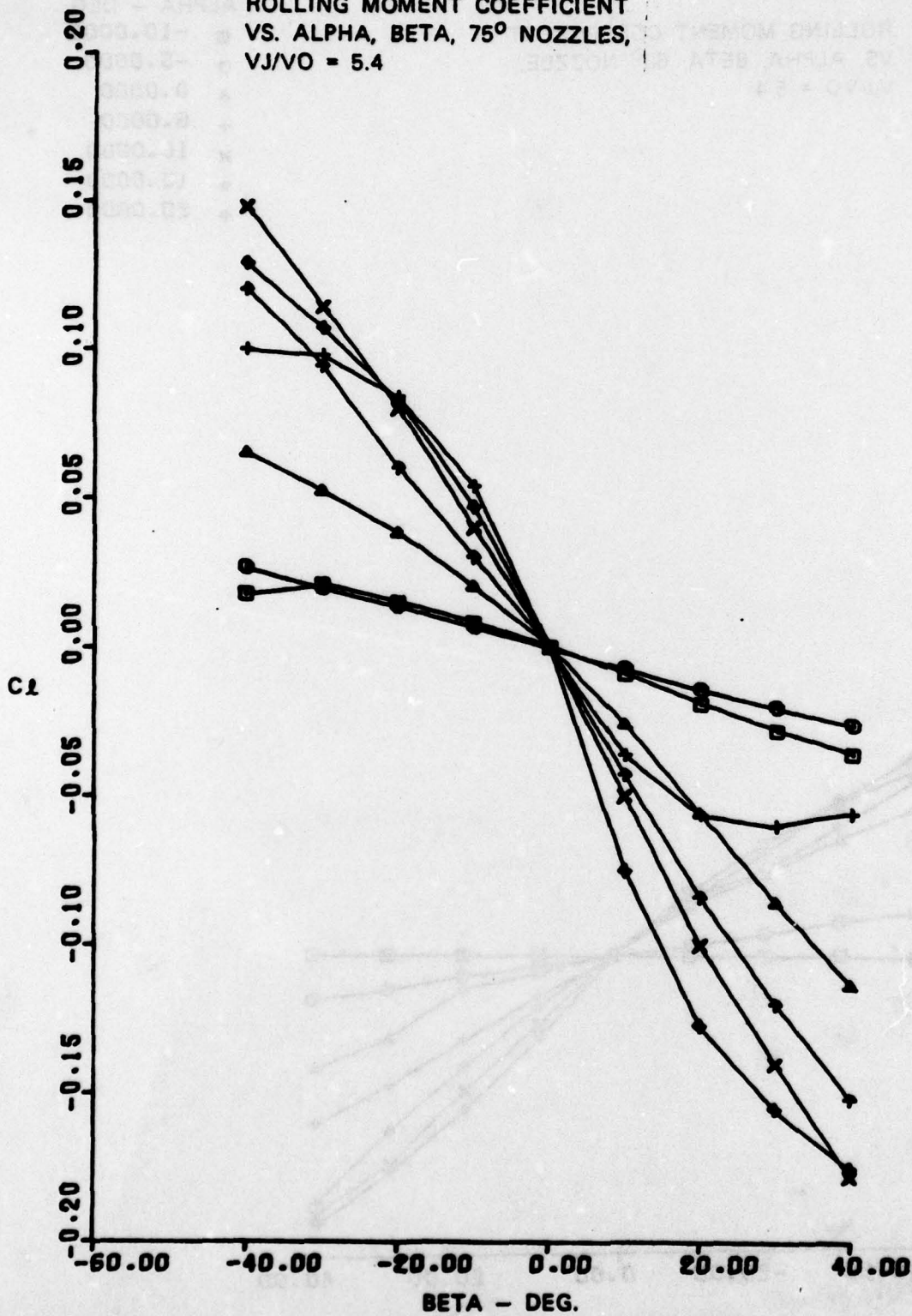


TABLE NO. 27

THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

- ALPHA - DEG.
- -10.0000
  - -5.0000
  - ▲ 0.0000
  - + 5.0000
  - x 10.0000
  - ◆ 15.0000
  - ♣ 20.0000

ROLLING MOMENT COEFFICIENT  
VS. ALPHA, BETA, 60° NOZZLES,  
VJ/VO = 11.9

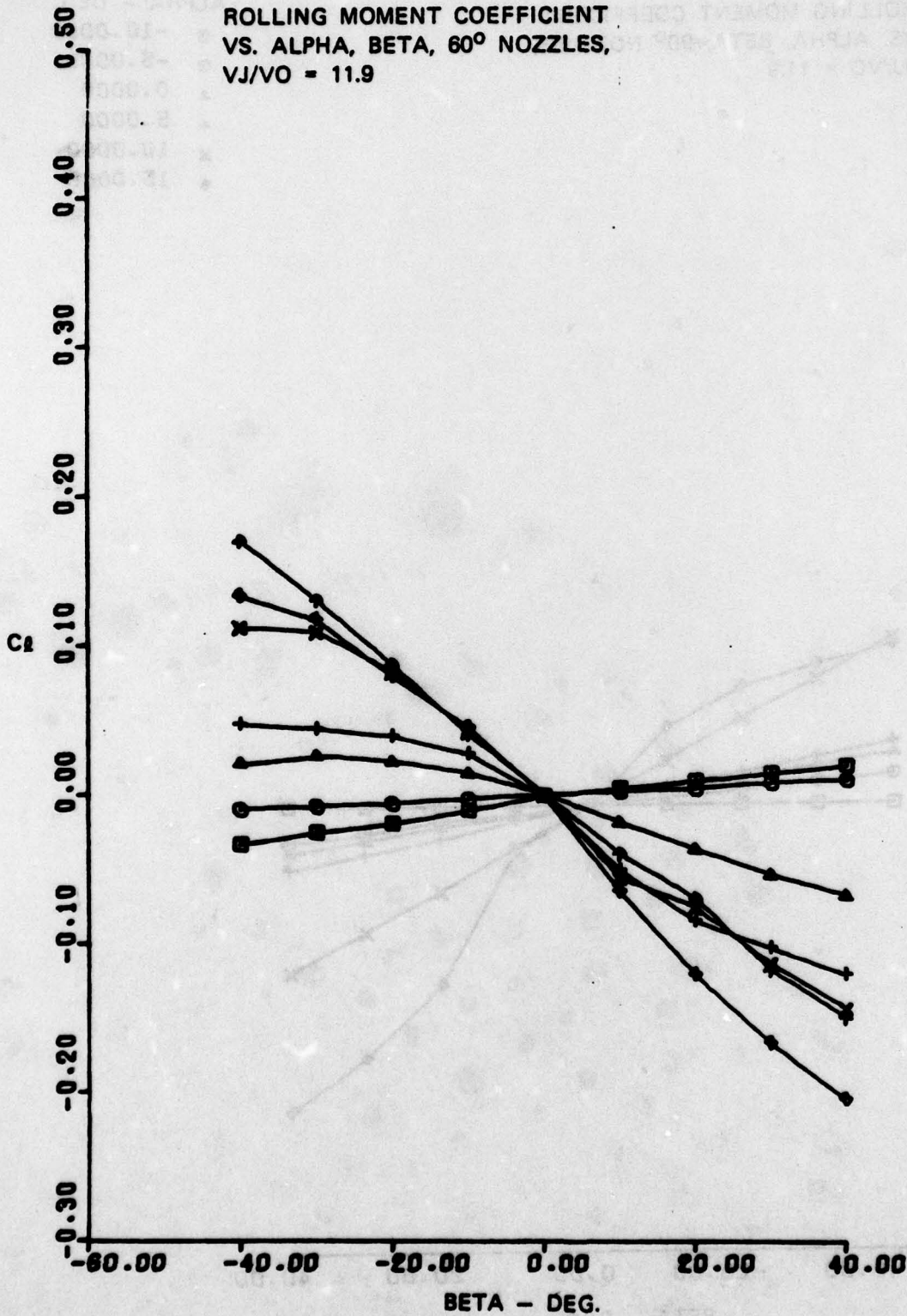


TABLE NO. 28

THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

ROLLING MOMENT COEFFICIENT  
VS. ALPHA, BETA, 90° NOZZLES,  
 $VJ/V_0 = 11.9$

- ALPHA - DEG.
- -10.0000
  - -5.0000
  - ▲ 0.0000
  - + 5.0000
  - x 10.0000
  - ◆ 15.0000

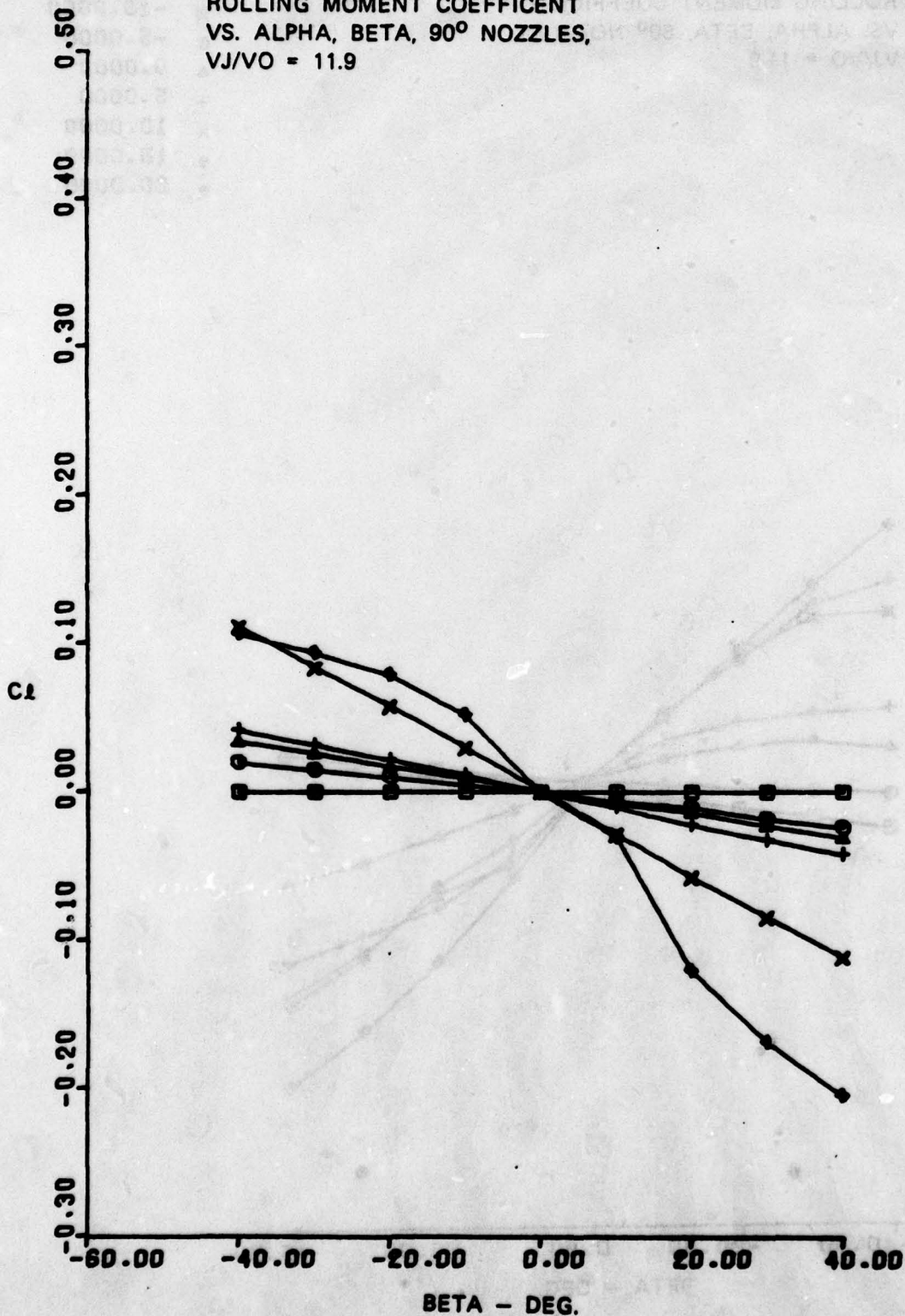


TABLE NO.29

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

ALPHA

- 0.0000
- 4.0000
- ▲ 8.0000
- + 12.0000

YAWING MOMENT VS.  
BETA, ALPHA, 0° NOZZLES,  
VJ/VO = 0

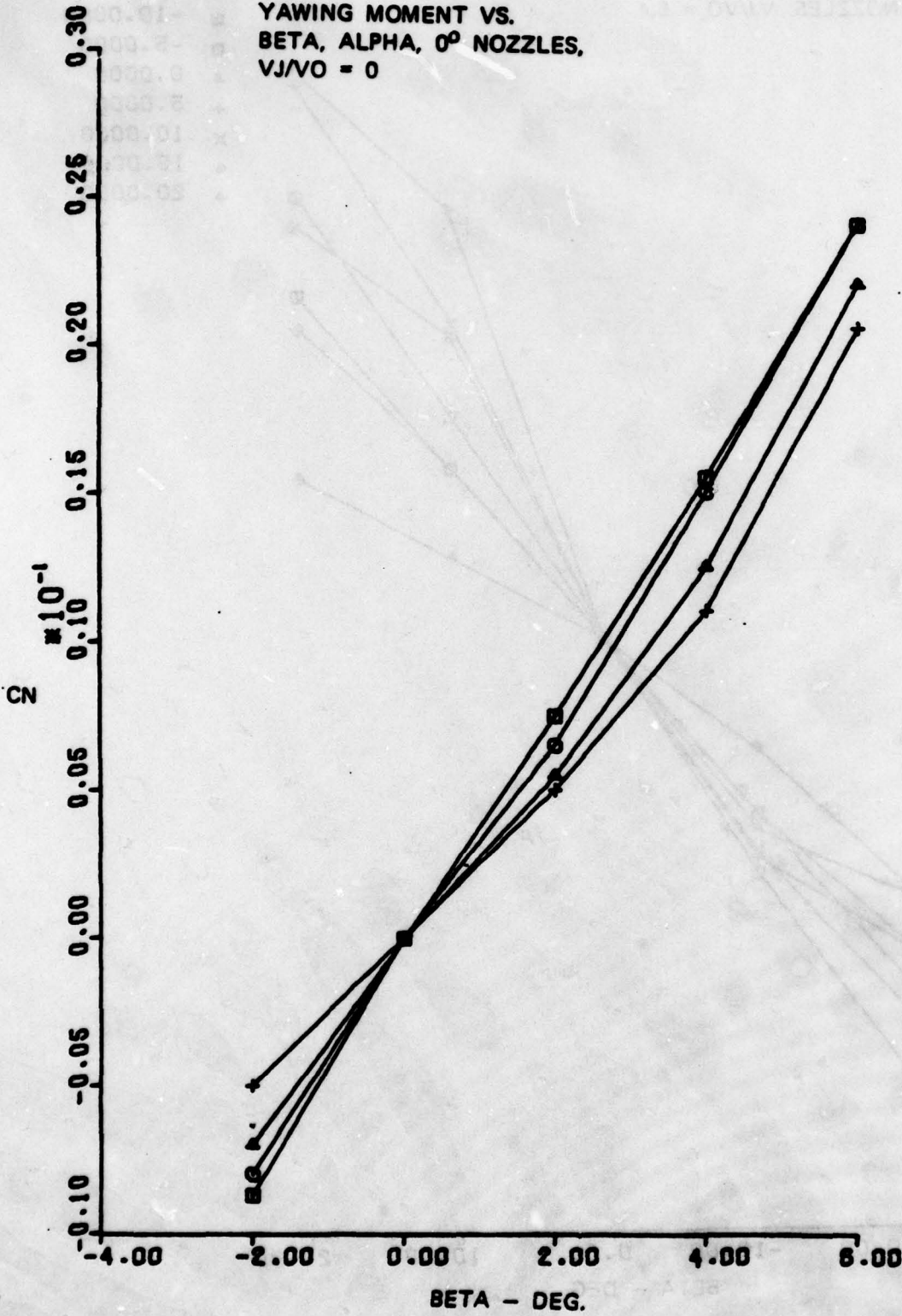


TABLE NO.30

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

CN VS. ALPHA, BETA,  
60° NOZZLES, VJ/VO = 5.4

- ALPHA DEG.
- -10.0000
  - -5.0000
  - ▲ 0.0000
  - + 5.0000
  - x 10.0000
  - ◆ 15.0000
  - ⋄ 20.0000

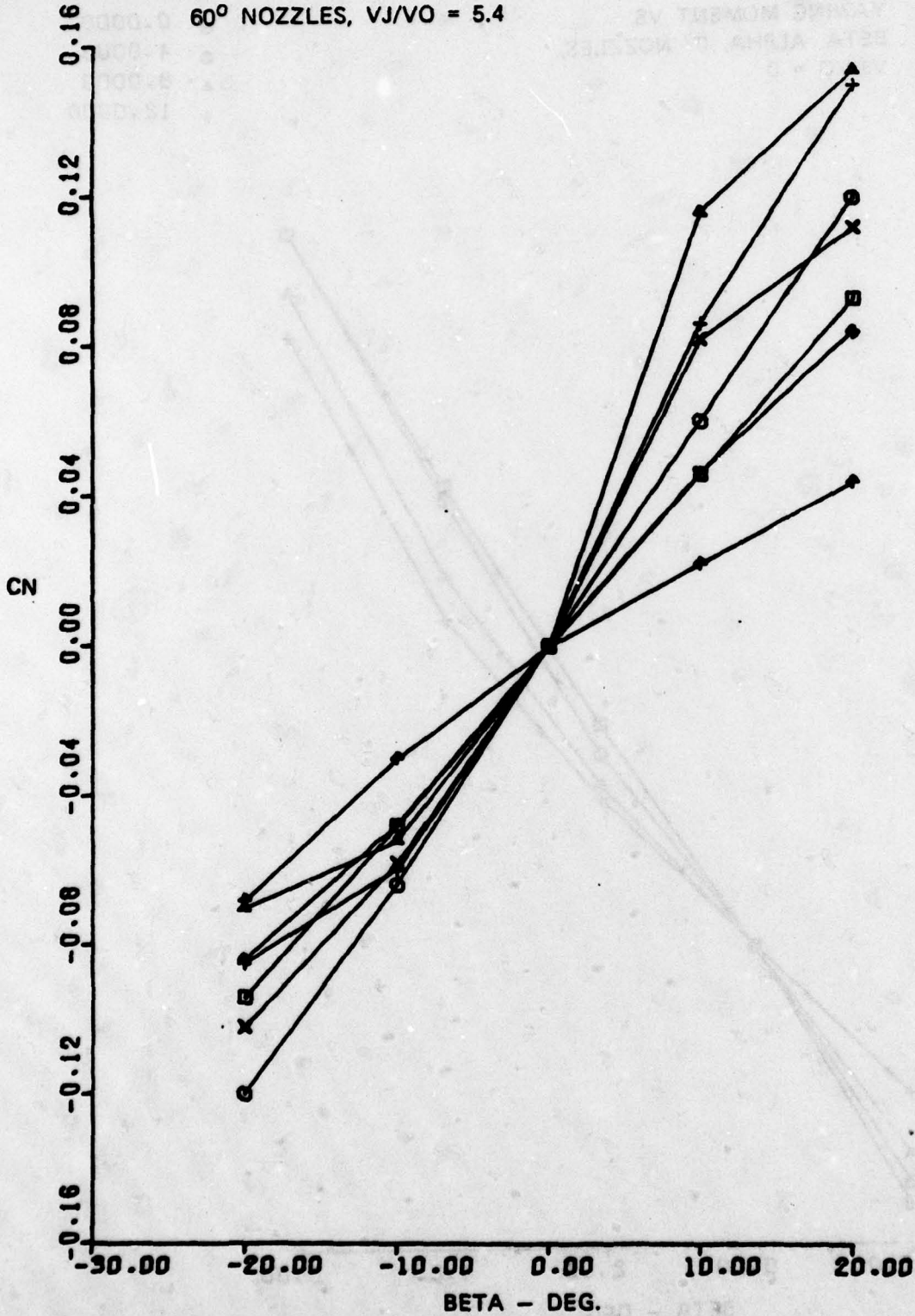


TABLE NO.31

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

ALPHA DEG.

- -10.0000
- -5.0000
- ▲ 0.0000
- + 5.0000
- x 10.0000
- ◆ 15.0000
- ⋄ 20.0000

CN VS. ALPHA, BETA, 75°  
NOZZLES, VJ/VO = 5.4

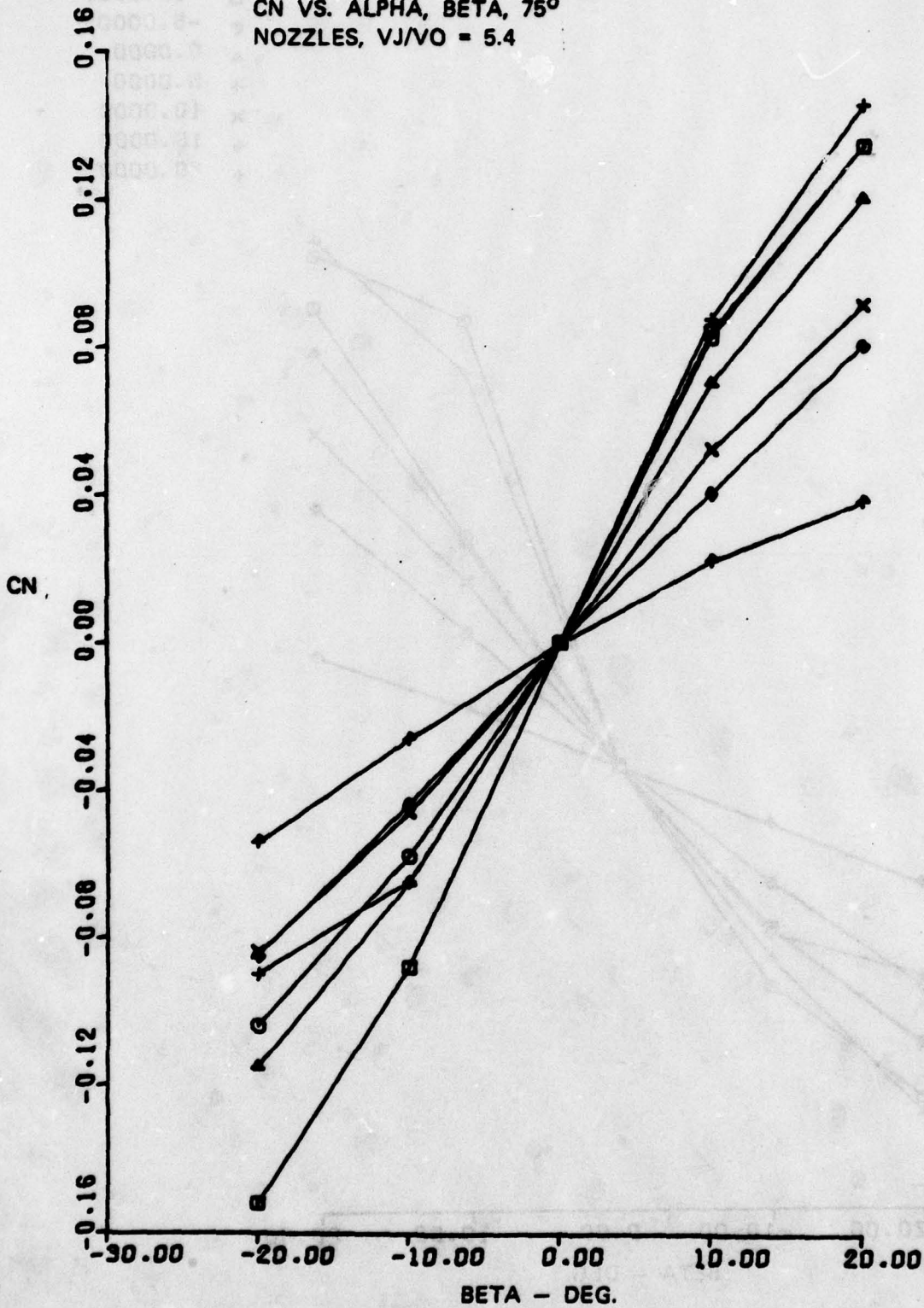


TABLE NO. 32

THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

CN VS. ALPHA, BETA,  $75^\circ$   
NOZZLES,  $VJ/V_0 = 11.9$

ALPHA DEG.

- -10.0000
- -5.0000
- ▲ 0.0000
- + 5.0000
- x 10.0000
- ◆ 15.0000
- ♦ 20.0000

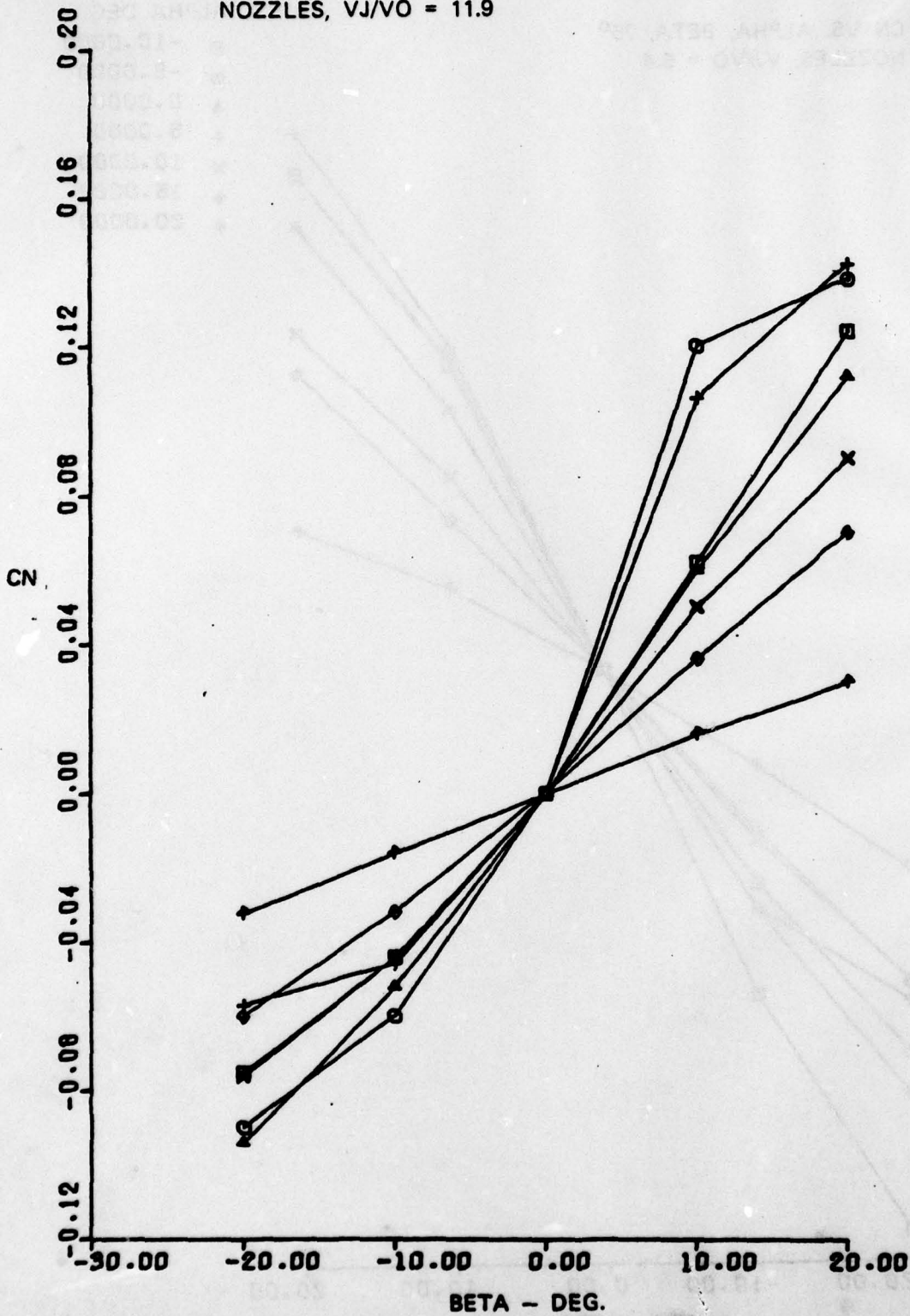


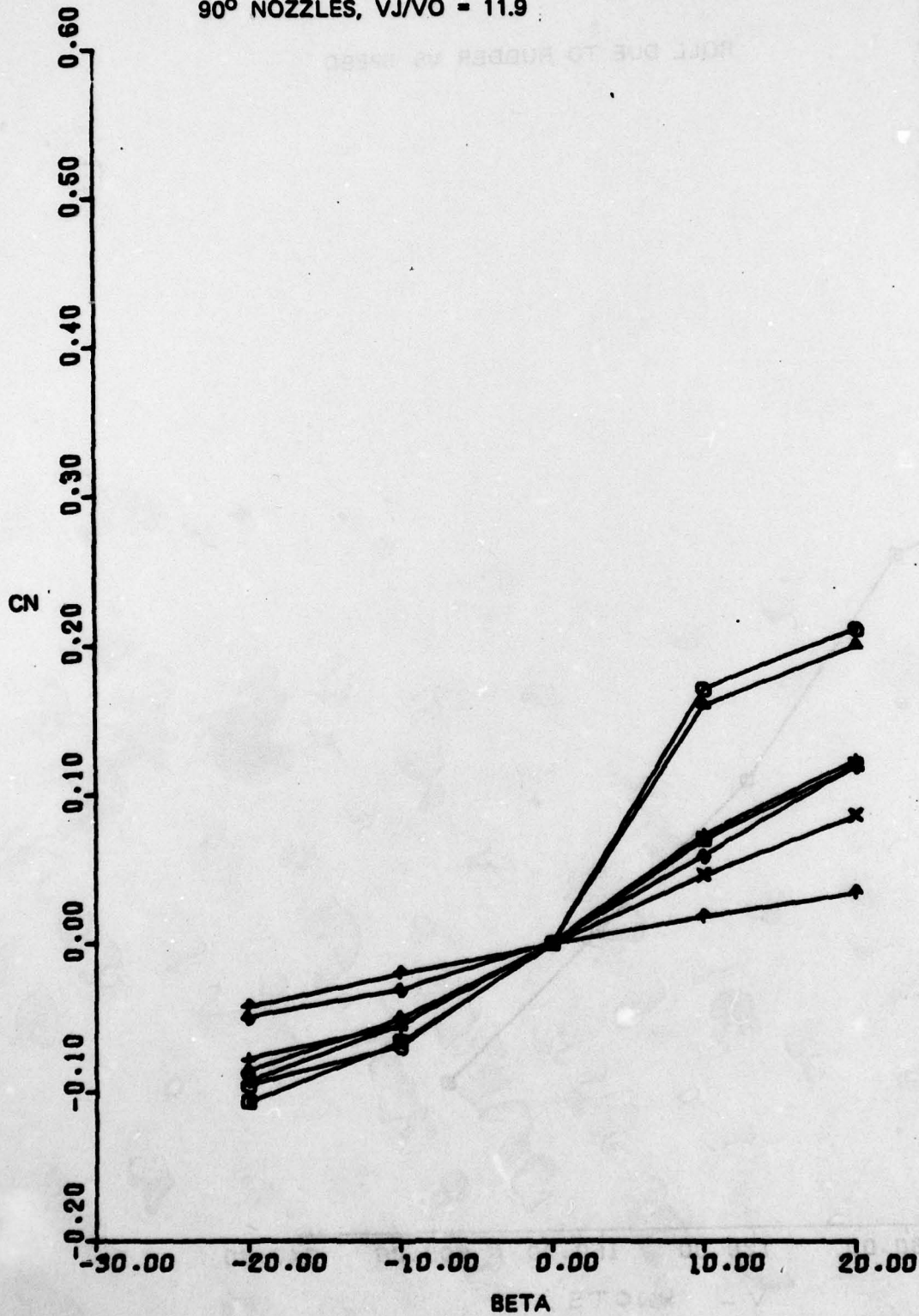
TABLE NO.33

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

CN VS. ALPHA, BETA,  
90° NOZZLES, VJ/VO = 11.9

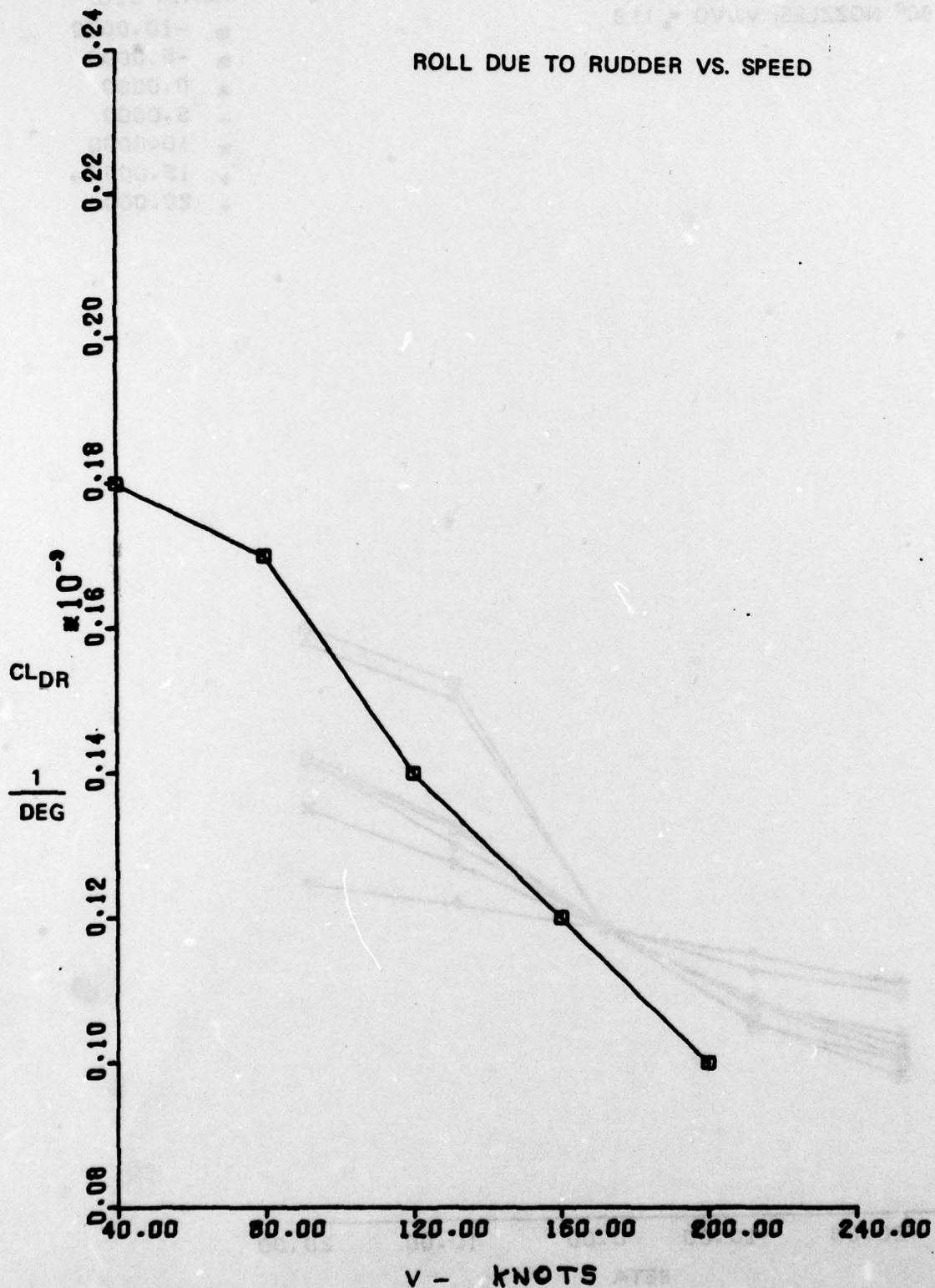
ALPHA DEG.

- -10.0000
- -5.0000
- ▲ 0.0000
- + 5.0000
- x 10.0000
- ◆ 15.0000
- ♦ 20.0000



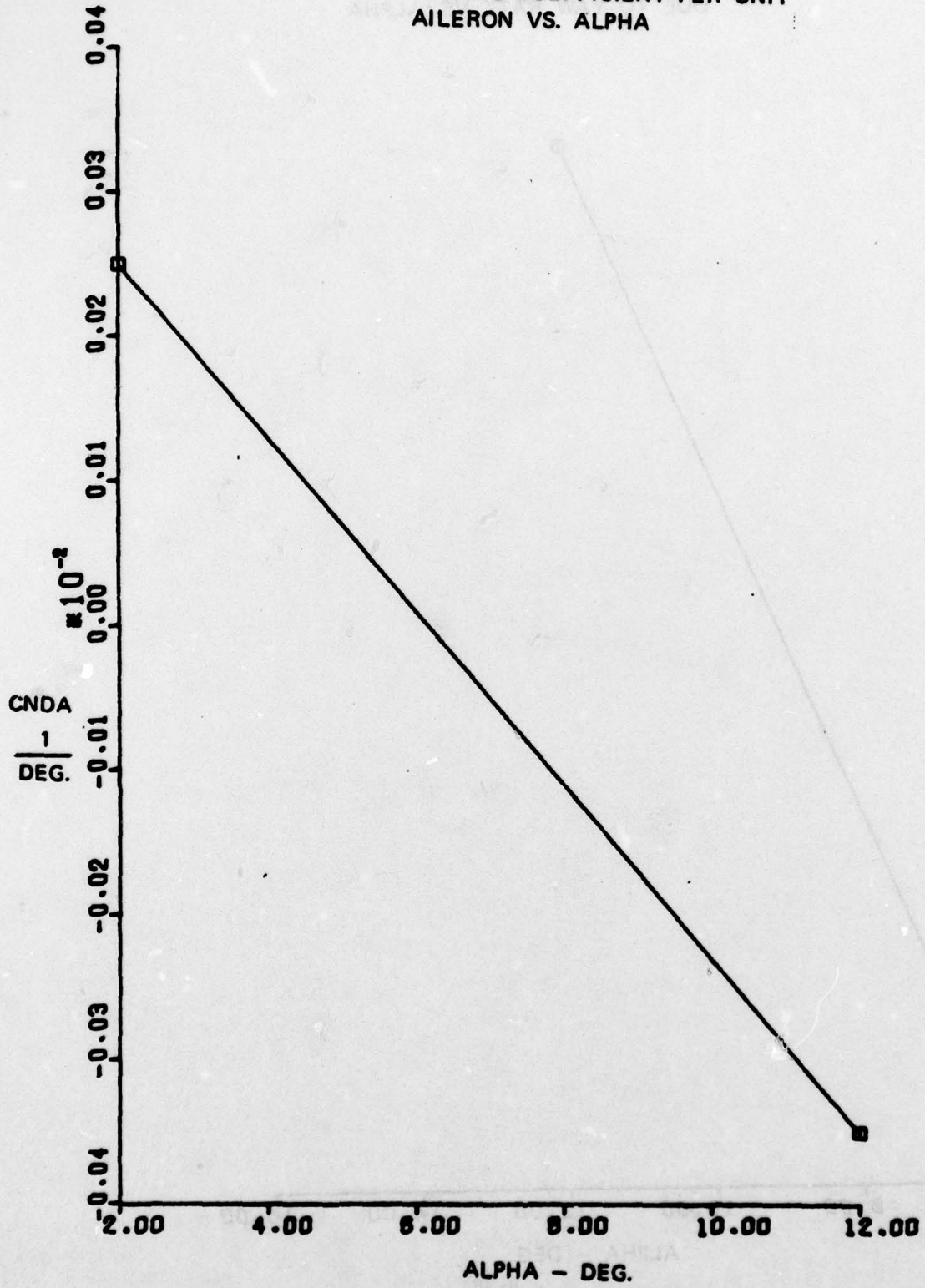
# TABLE NO. 34

ROLL DUE TO RUDDER VS. SPEED



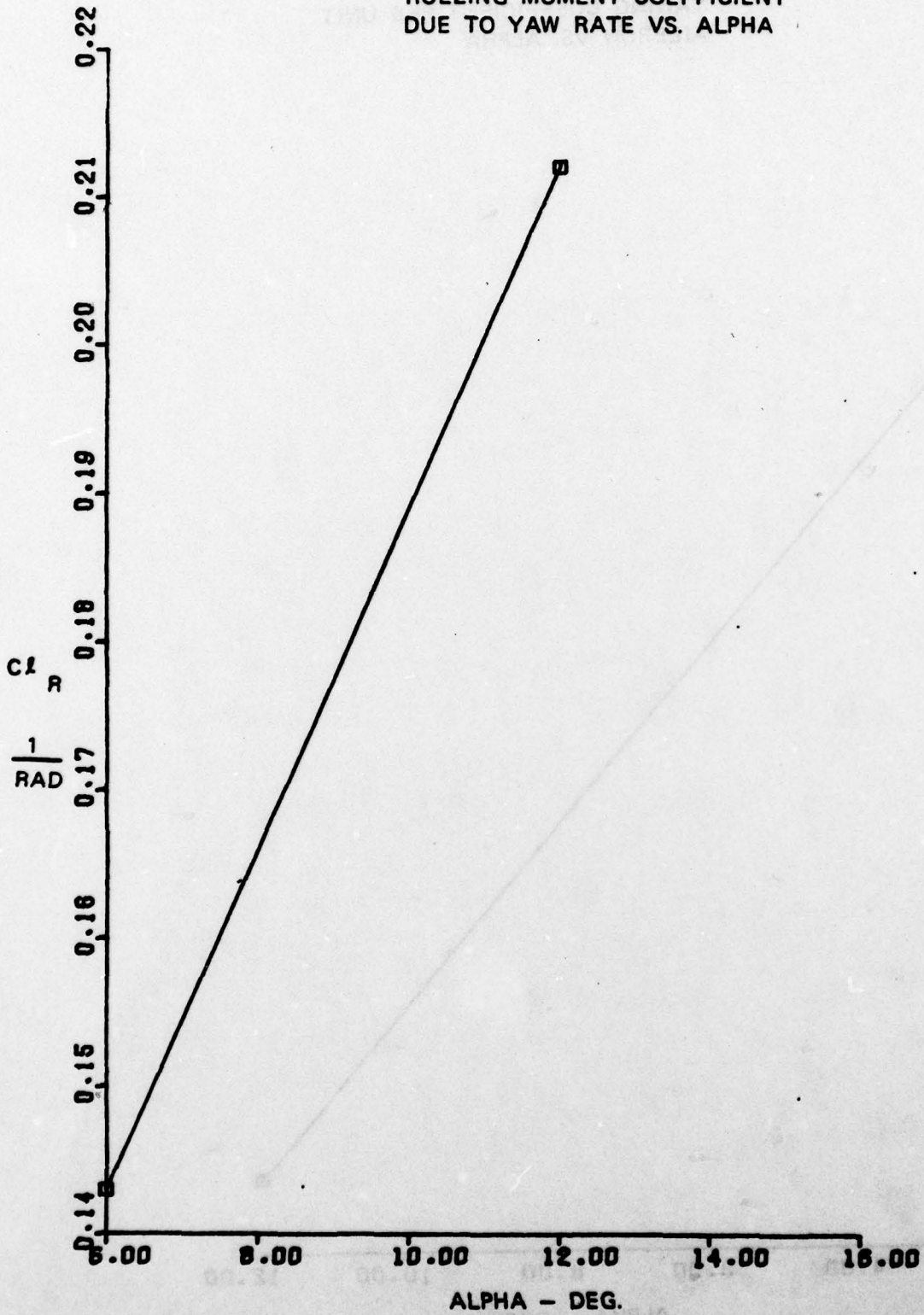
# TABLE NO 35

YAWING COEFFICIENT PER UNIT  
AILERON VS. ALPHA



### TABLE NO.36

ROLLING MOMENT COEFFICIENT  
DUE TO YAW RATE VS. ALPHA



### TABLE NO 37

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 0.00000

● 6.00000

LIFT COEFFICIENT VS. ALPHA,  
DH, VJ = 0, 0° NOZZLES

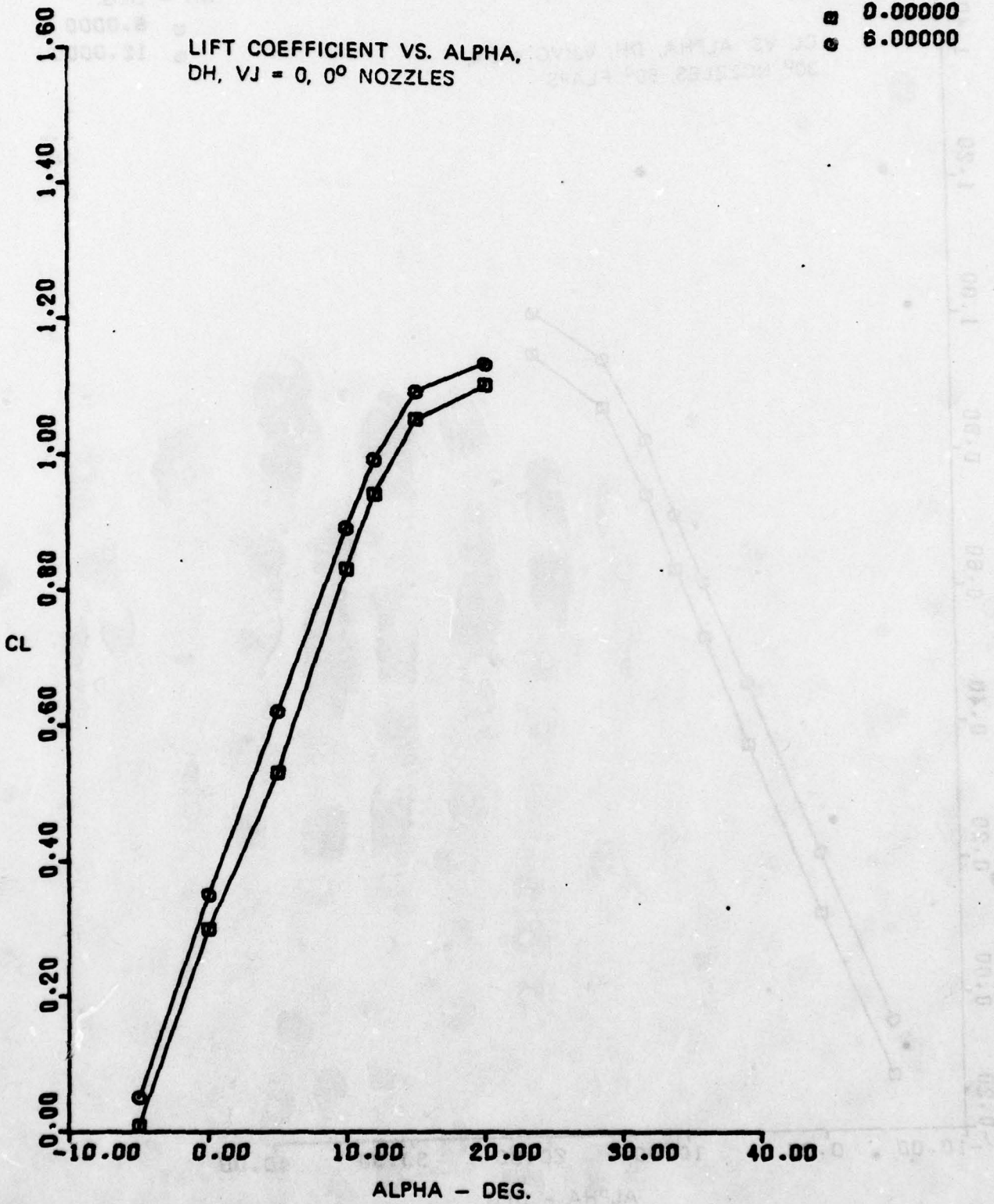


TABLE NO. 38

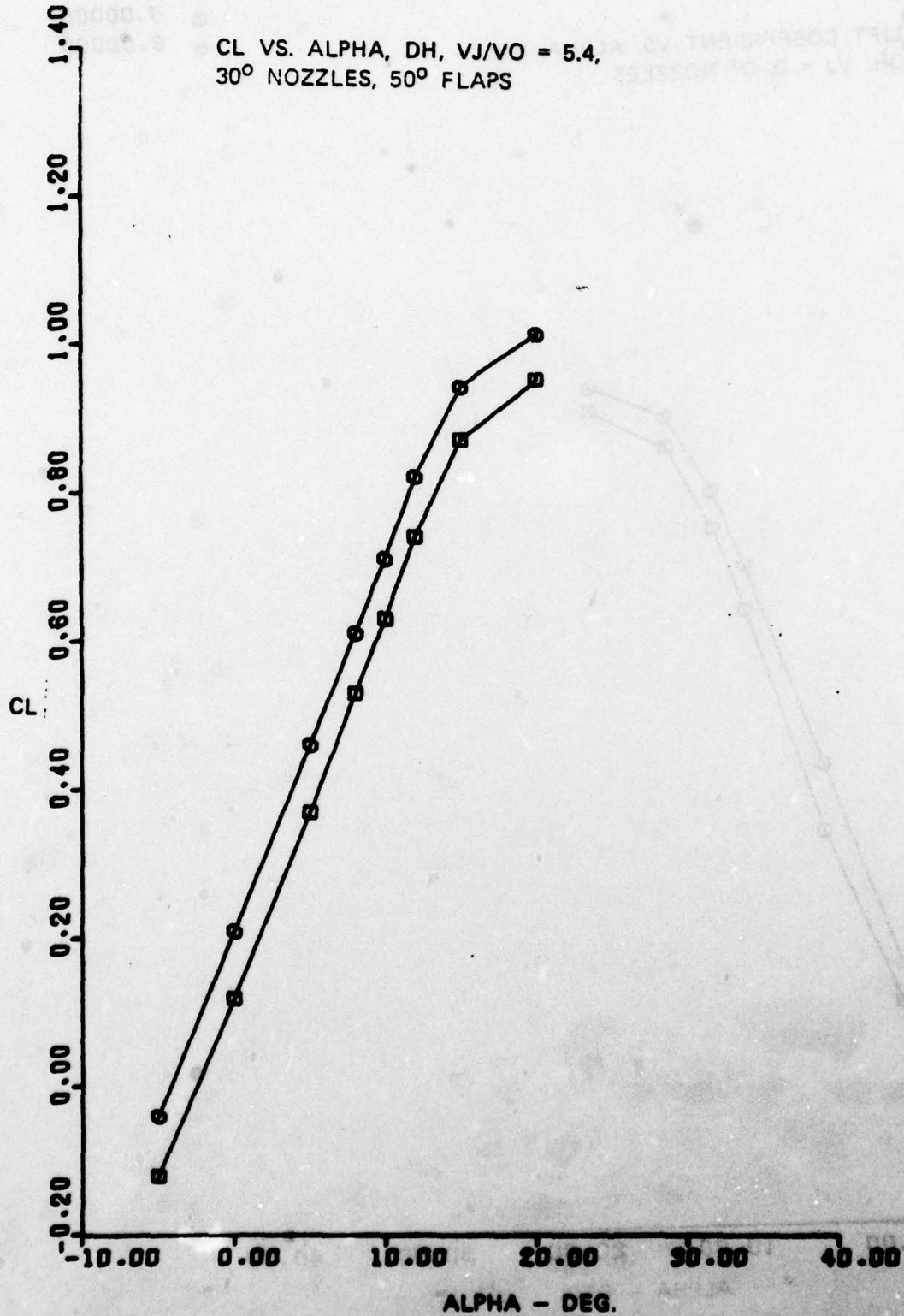
THE FOLLOWING VALUES OF  $\gamma$  WERE USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

● 12.0000

CL VS. ALPHA, DH, VJ/VO = 5.4,  
30° NOZZLES, 50° FLAPS



# TABLE NO.39

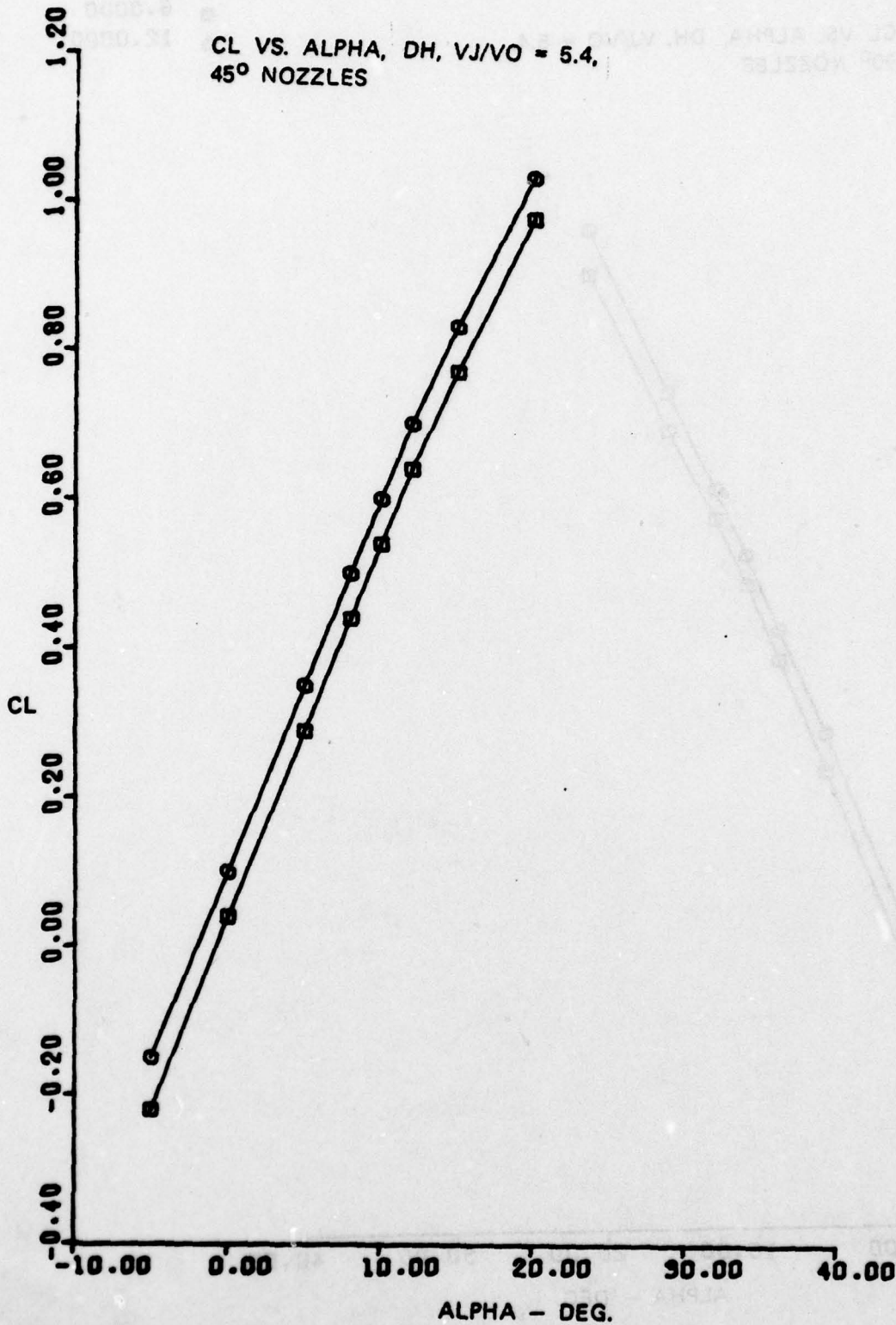
THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

● 12.0000

CL VS. ALPHA, DH, VJ/VO = 5.4,  
45° NOZZLES



### TABLE NO.40

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

● 12.0000

CL VS. ALPHA, DH, VJ/VO = 5.4,  
60° NOZZLES

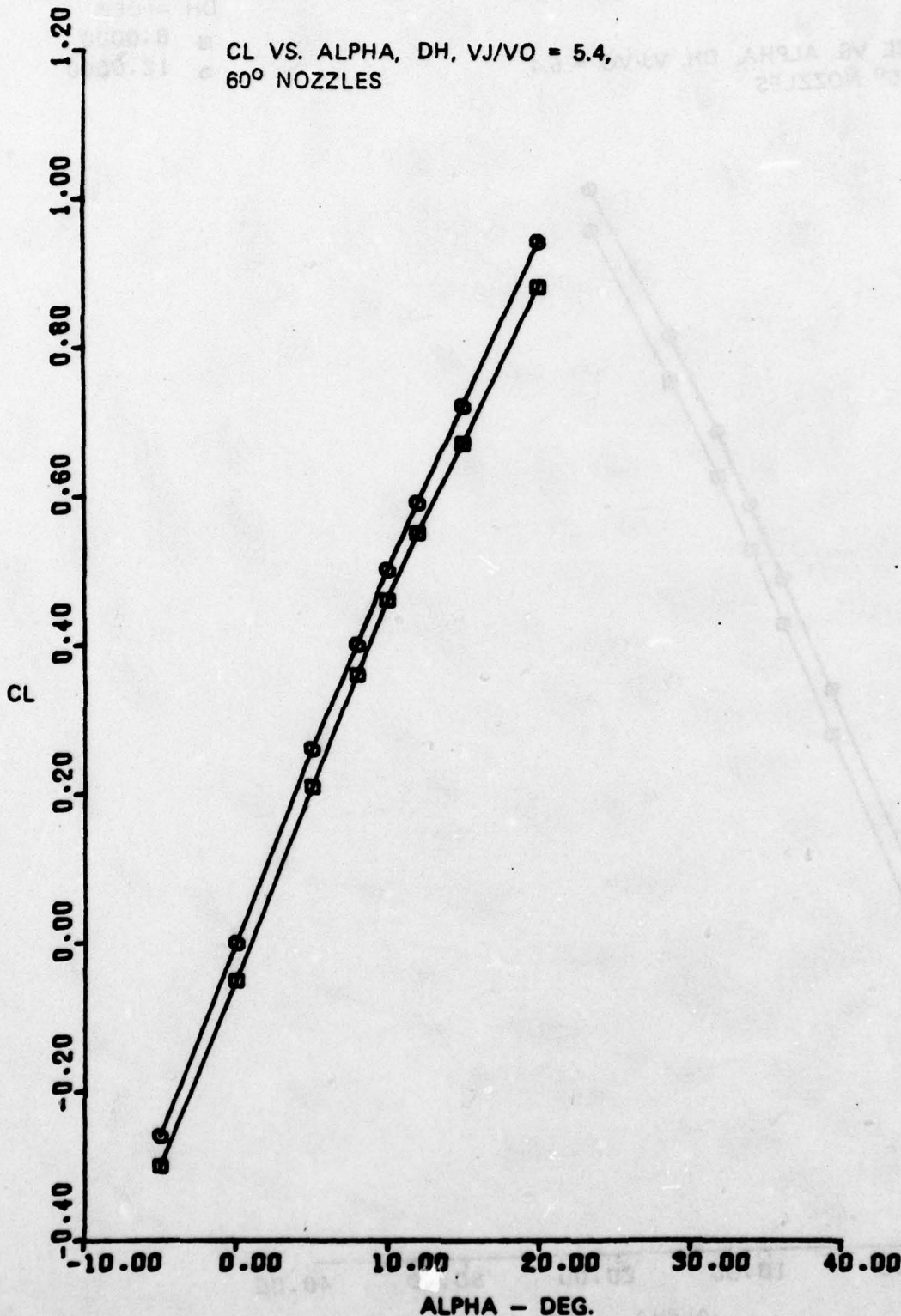


TABLE NO.41

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

● 12.0000

CL VS. ALPHA, DH, VJ/VO = 5.4,  
75° NOZZLES

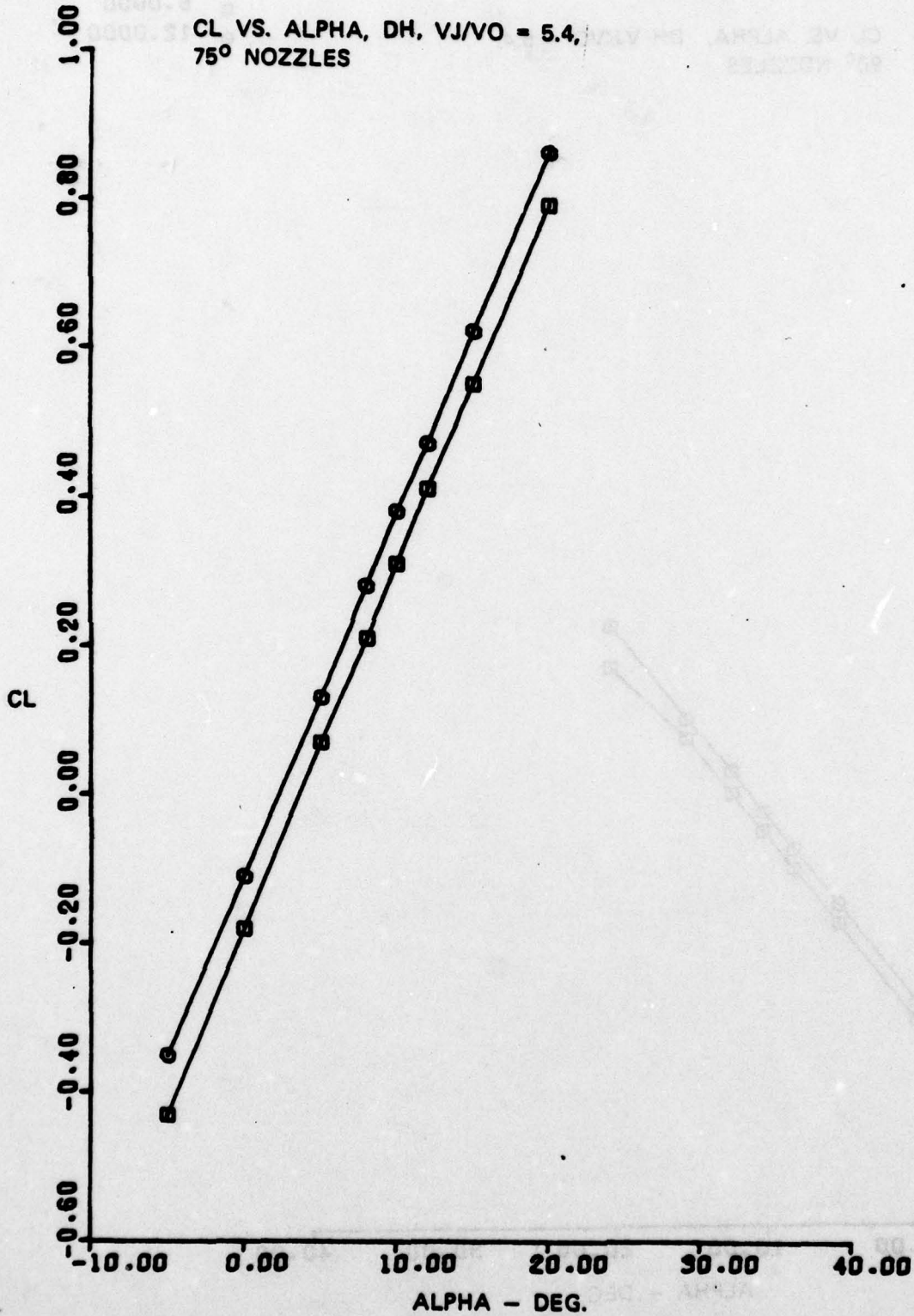


TABLE NO.42

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

● 12.0000

CL VS. ALPHA, DH VJ/VO = 5.4,  
90° NOZZLES

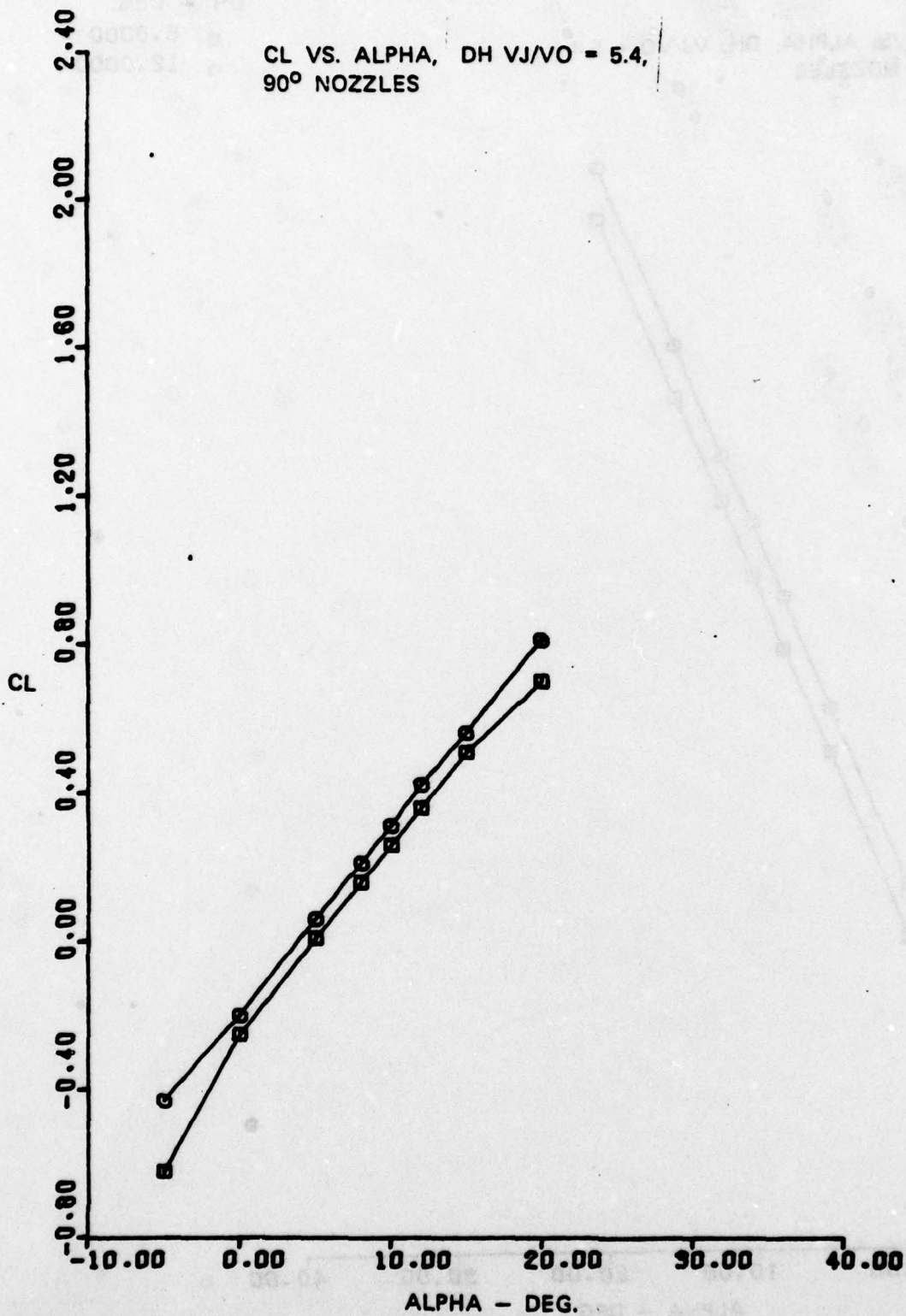
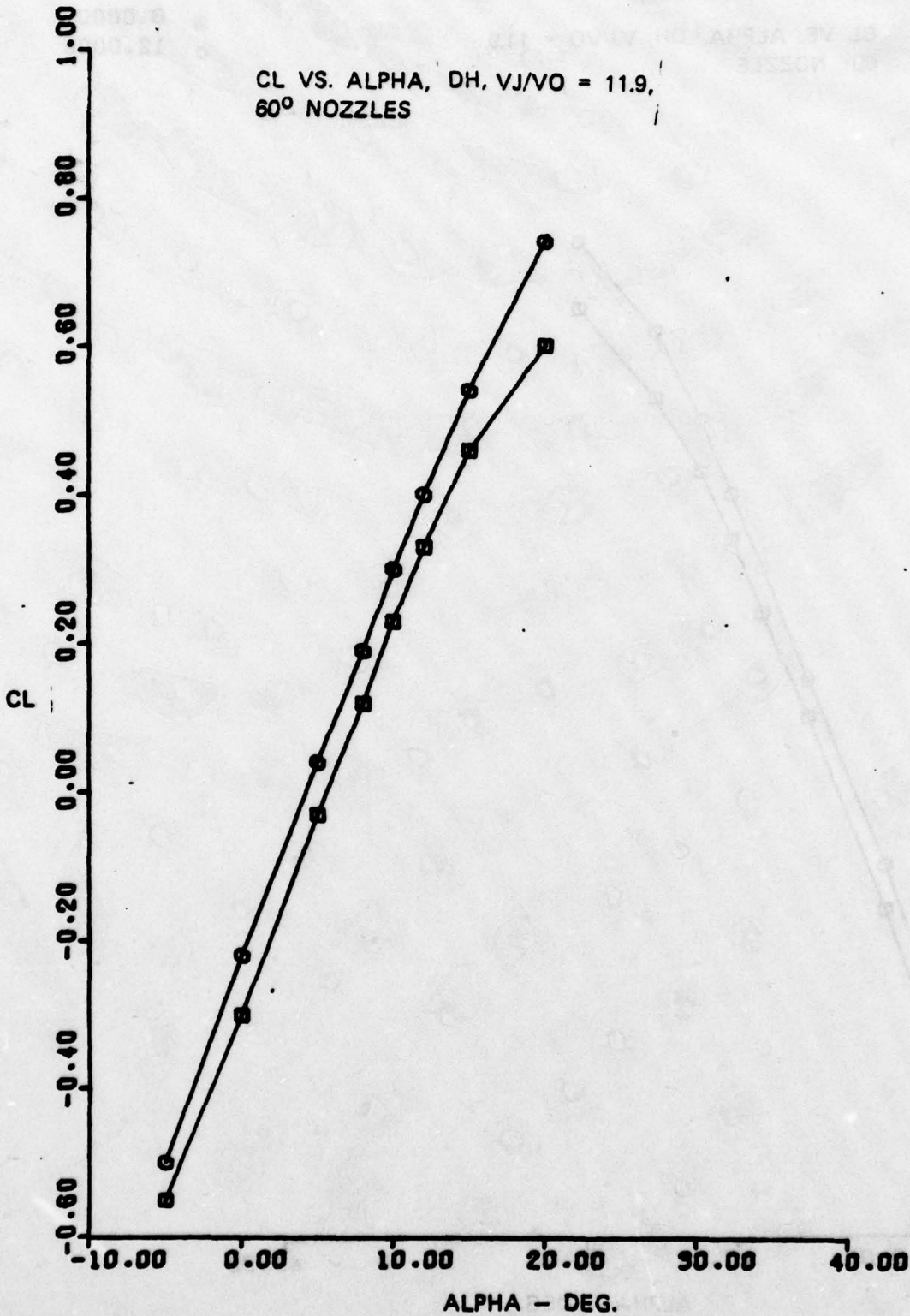


TABLE NO.43

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- DH - DEG.
- 6.0000
- 12.0000

CL VS. ALPHA, DH, VJ/VO = 11.9,  
60° NOZZLES



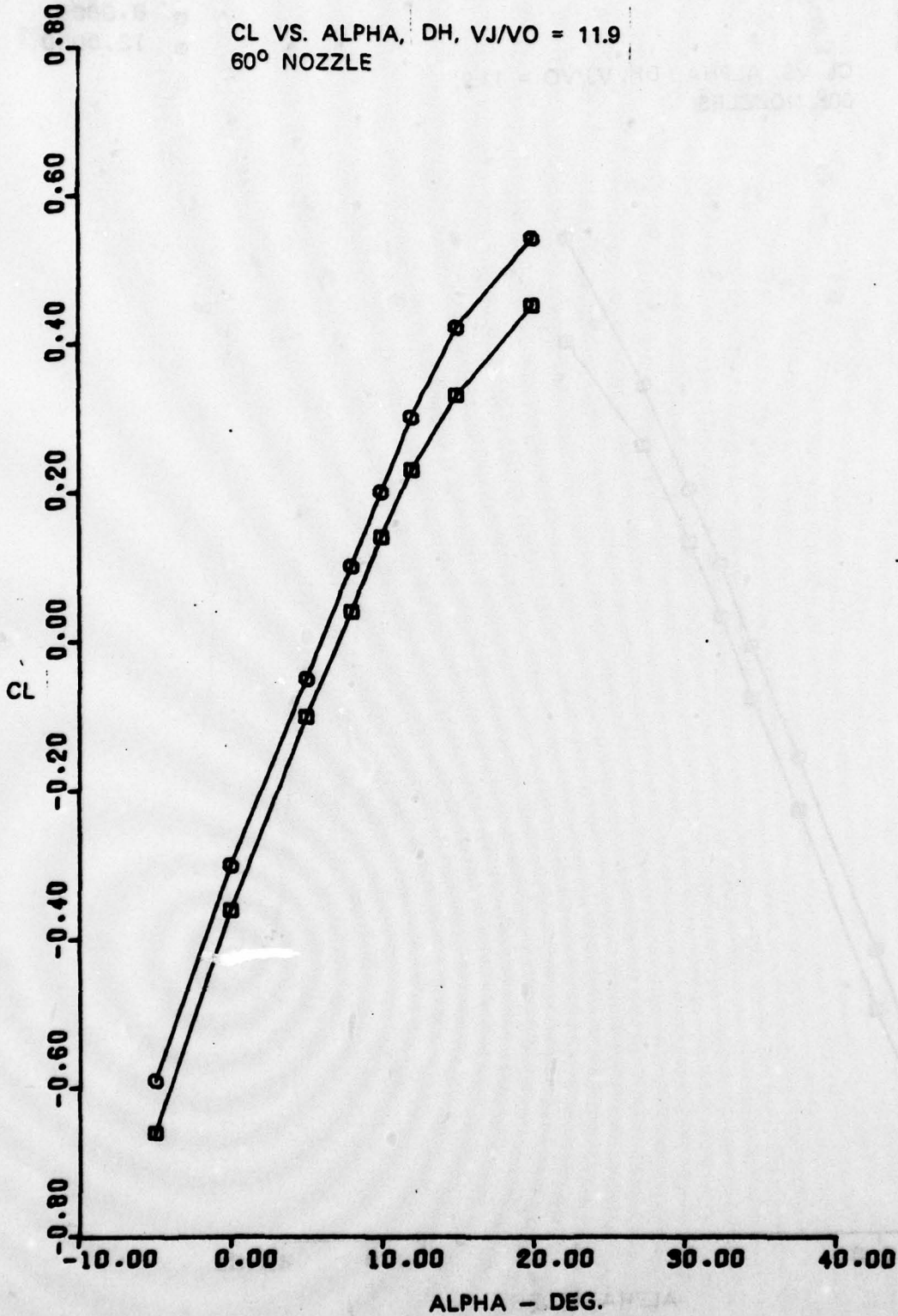
### TABLE NO.44

THE FOLLOWING VALUES OF  $\gamma$  WERE  
USED TO PLOT THE CURVES

DH - DEG.

- 6.0000
- 12.0000

CL VS. ALPHA, DH, VJ/VO = 11.9  
60° NOZZLE

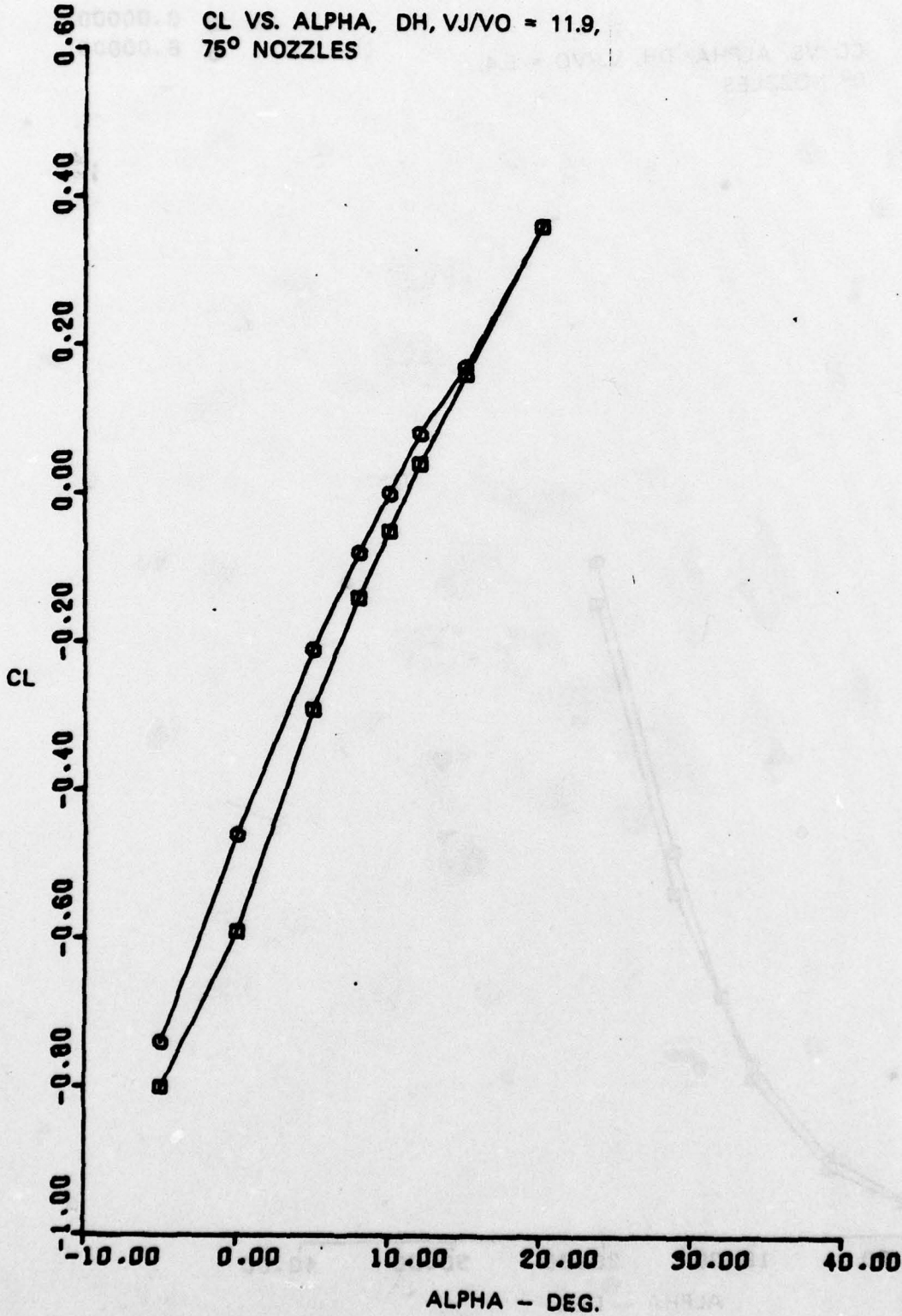


### TABLE NO.45

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- DH - DEG.
- 6.0000
- 12.0000

CL VS. ALPHA, DH, VJ/VO = 11.9,  
75° NOZZLES

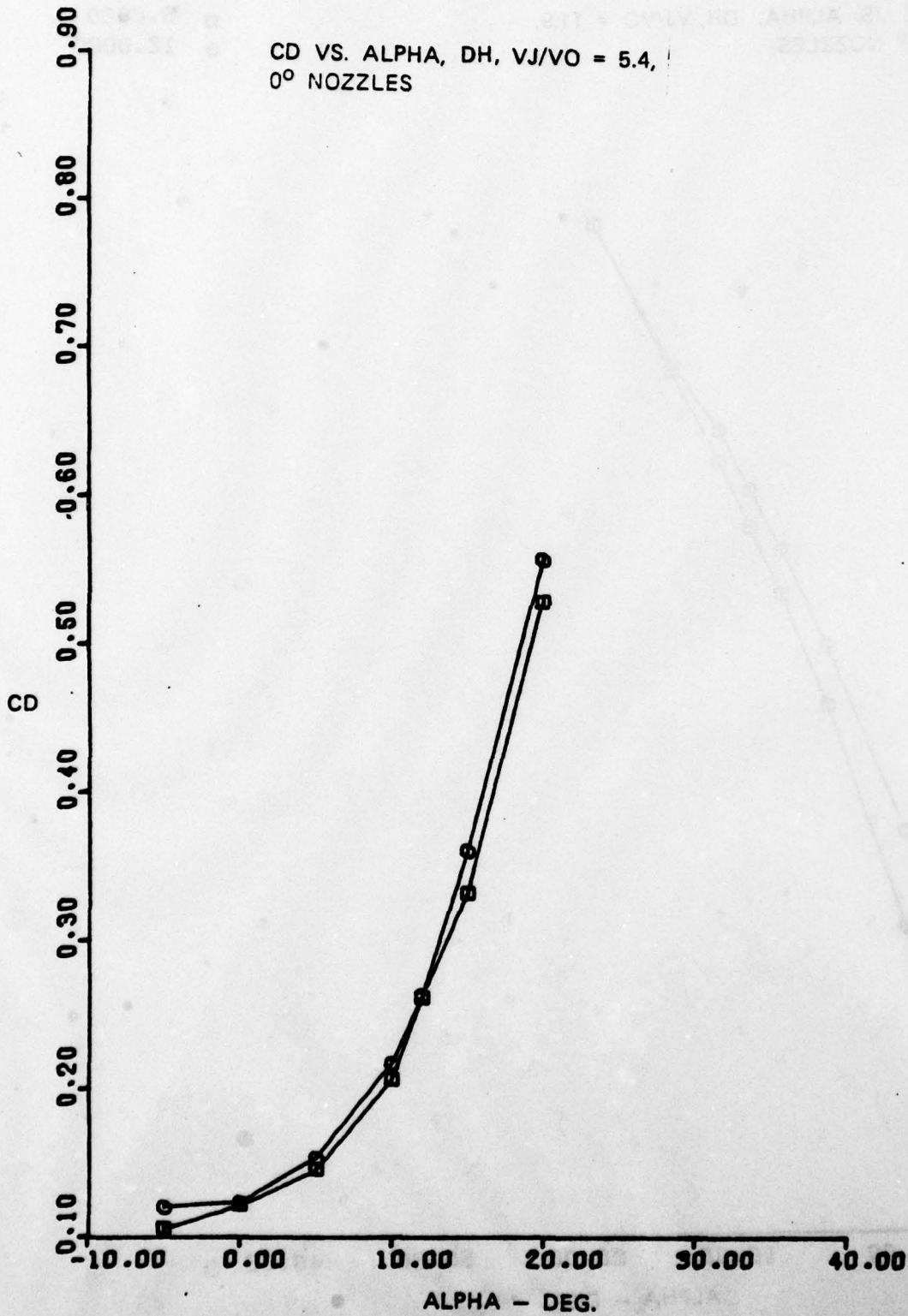


### TABLE NO.46

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.  
■ 0.00000  
● 6.00000

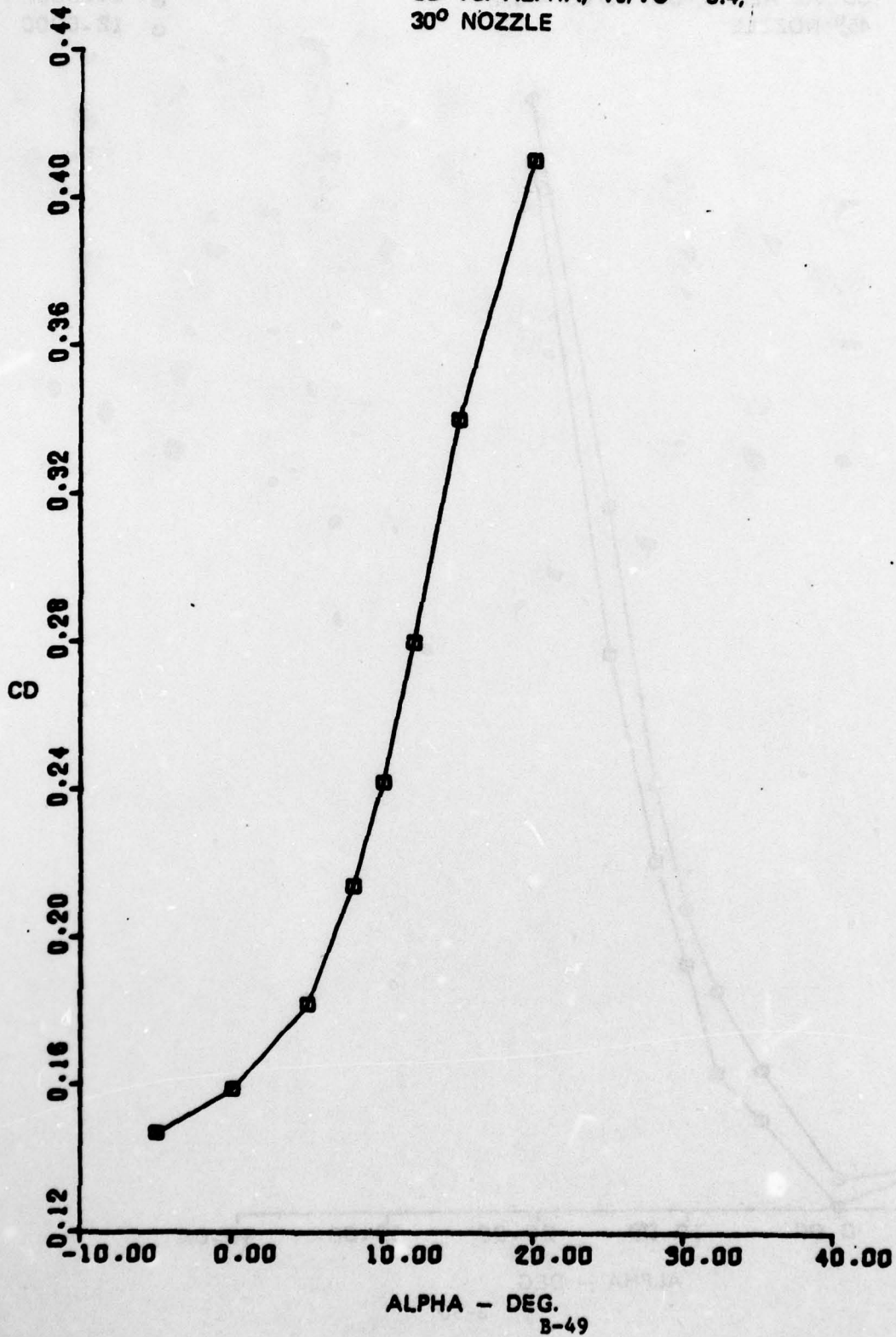
CD VS. ALPHA, DH, VJ/VO = 5.4,  
0° NOZZLES



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# TABLE NO.47

CD VS. ALPHA, VJ/VO = 5.4,  
30° NOZZLE



### TABLE NO.48

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

○ 12.0000

CD VS. ALPHA, DH, VJ/VO = 5.4,  
45° NOZZLE



TABLE NO.49

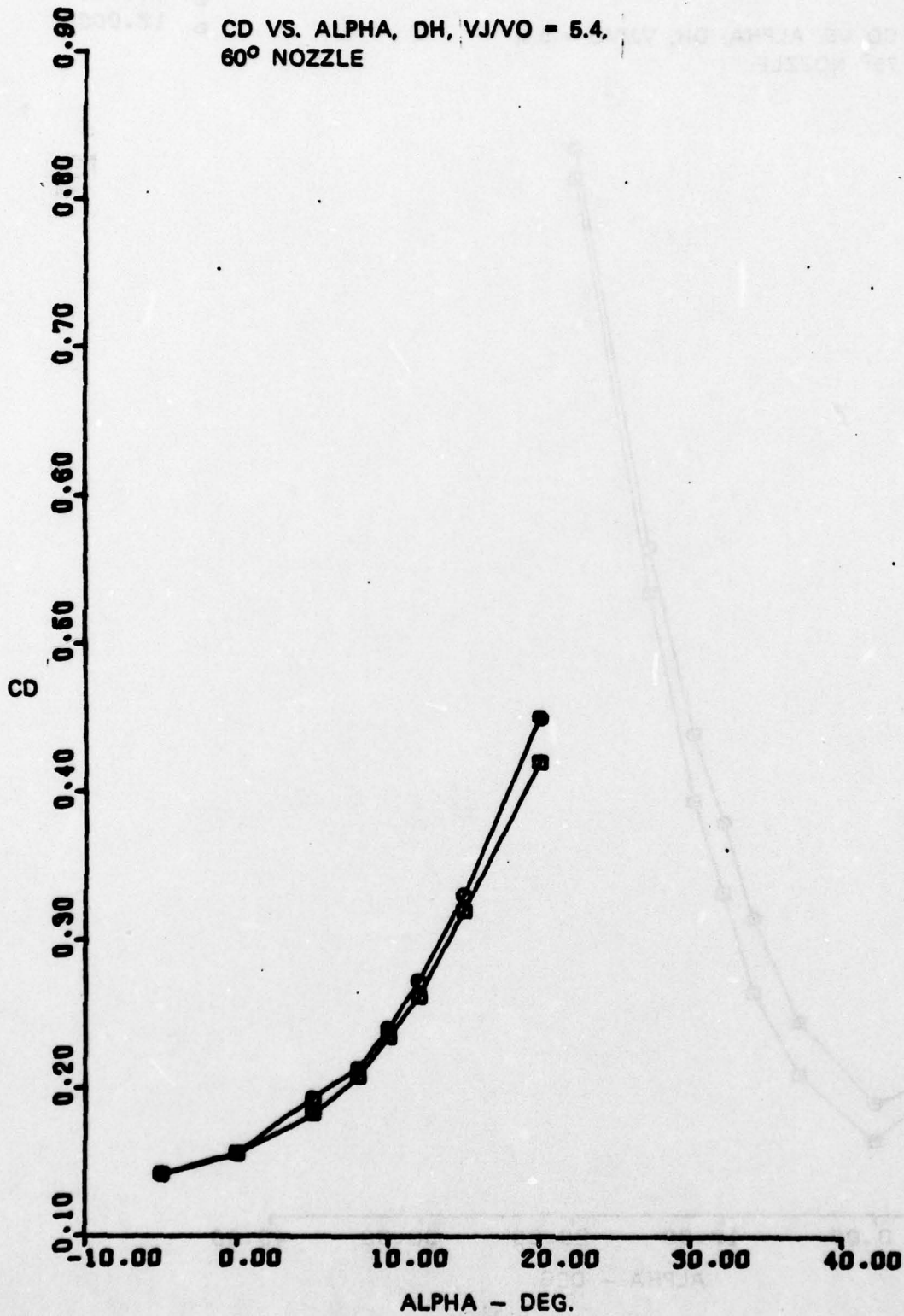
THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

● 12.0000

CD VS. ALPHA, DH, VJ/VO = 5.4,  
60° NOZZLE



# TABLE NO. 50

THE FOLLOWING VALUES OF  $\gamma$  WERE  
USED TO PLOT THE CURVES

DH - DEG.

■ 6.0000

○ 12.0000

CD VS. ALPHA, DH, VJ/VO = 5.4,  
75° NOZZLE

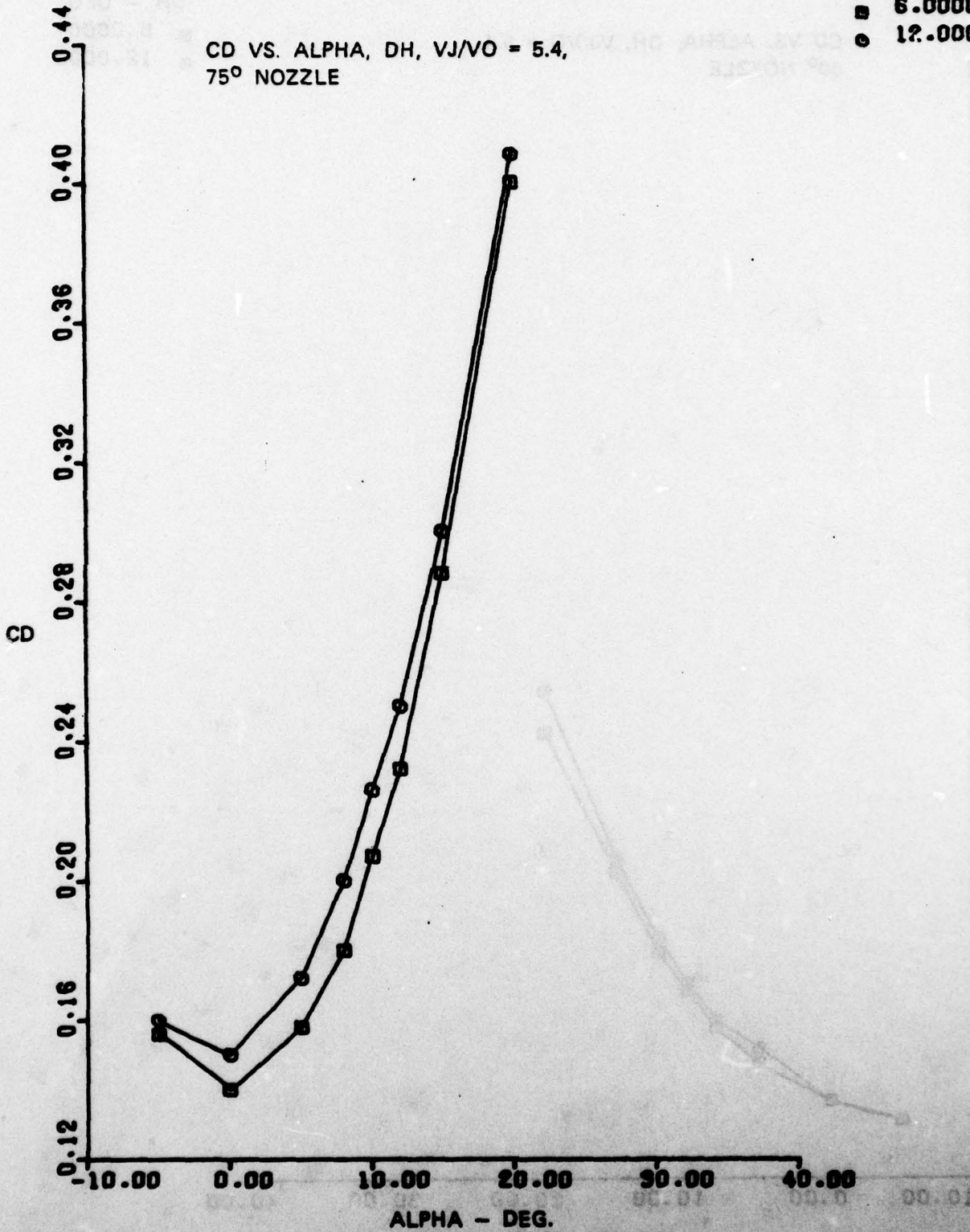


TABLE NO. 51

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- DH, - DEG.  
□ 6.0000  
● 12.0000

CD VS. ALPHA, DH, VJ/VO = 5.4,  
90° NOZZLE

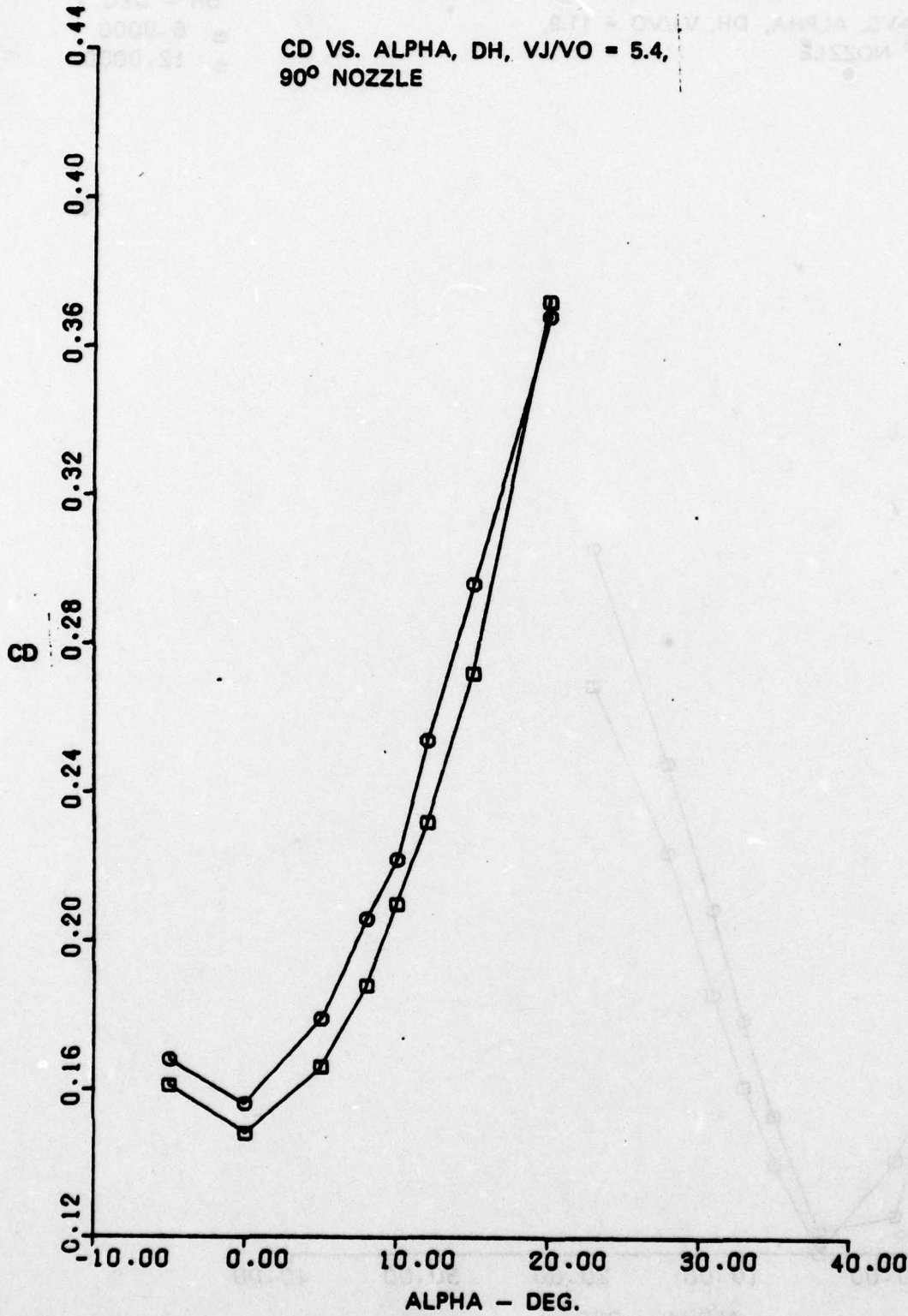


TABLE NO. 52

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

○ 12.0000

CD VS. ALPHA, DH, VJ/VO = 11.9,  
45° NOZZLE

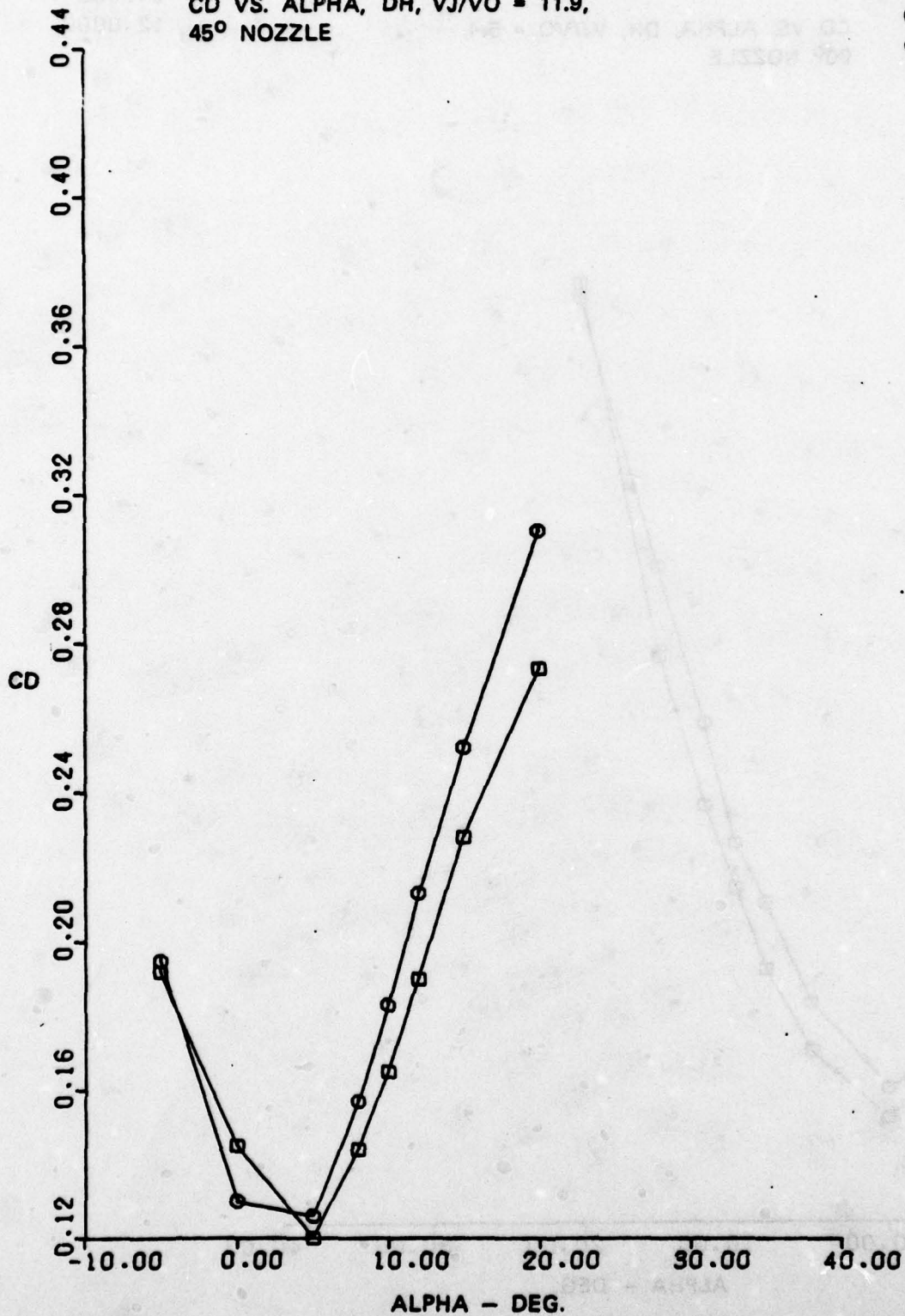


TABLE NO.53

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- DH - DEG.
- 6.0000
- 12.0000

CD VS. ALPHA, DH, VJ/VO = 11.9,  
60° NOZZLES

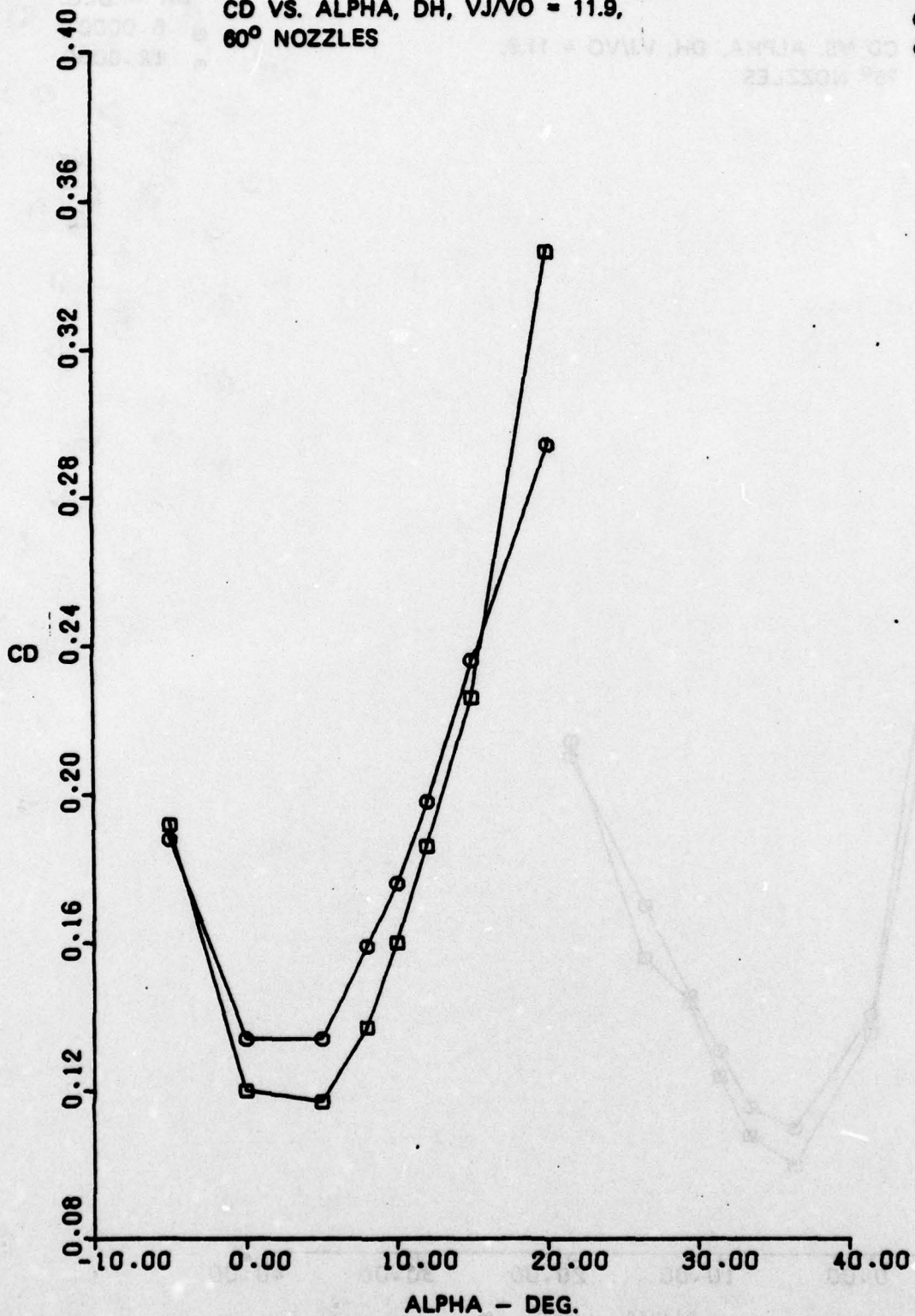


TABLE NO.54

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

○ 12.0000

CD VS. ALPHA, DH, VJ/VO = 11.9,  
75° NOZZLES

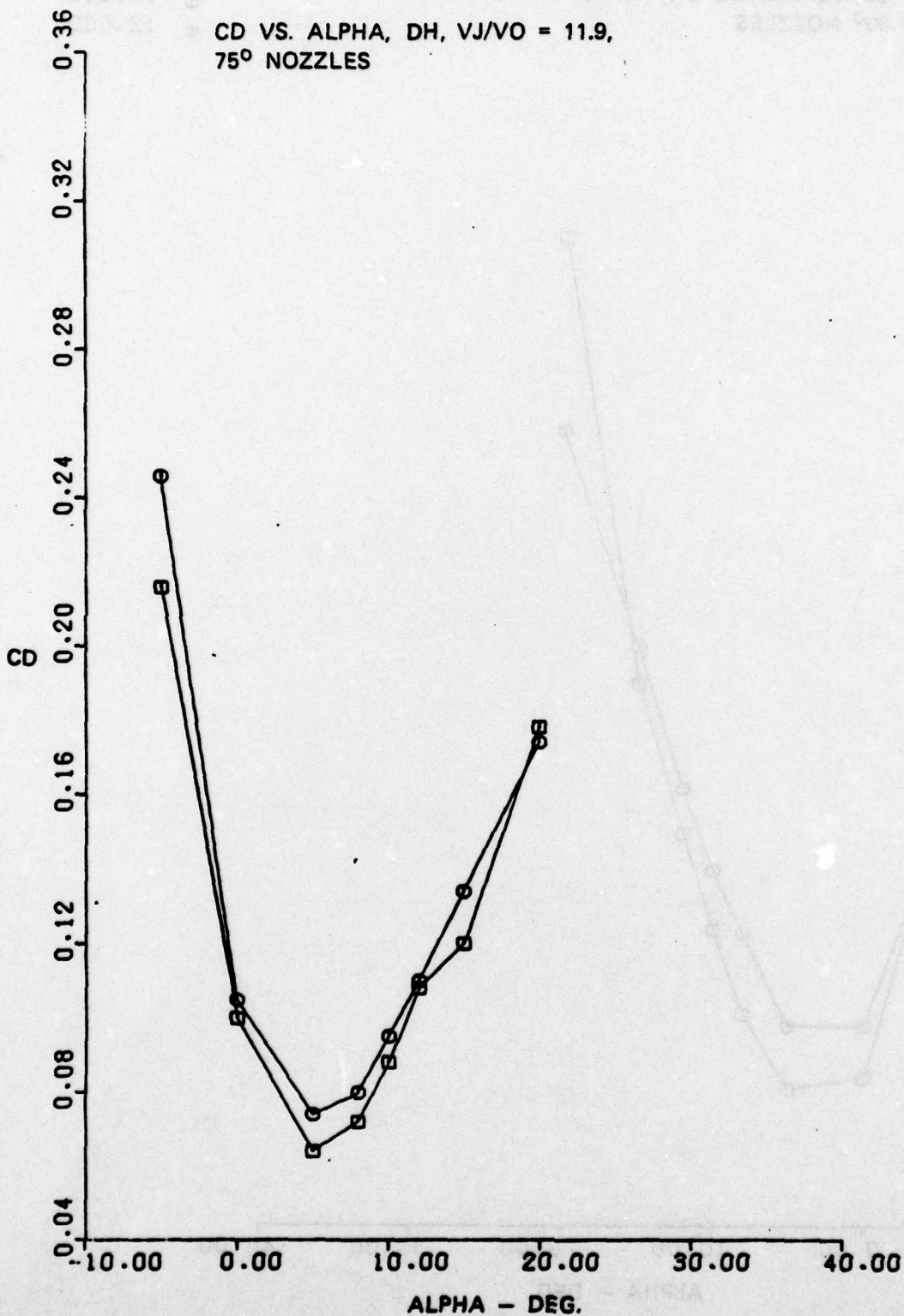


TABLE NO. 55

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

- DH - STAB.
- 0.00000
- 6.00000

CM VS. ALPHA, DH, 0° NOZZLE,  
VJ/VO = 5.4

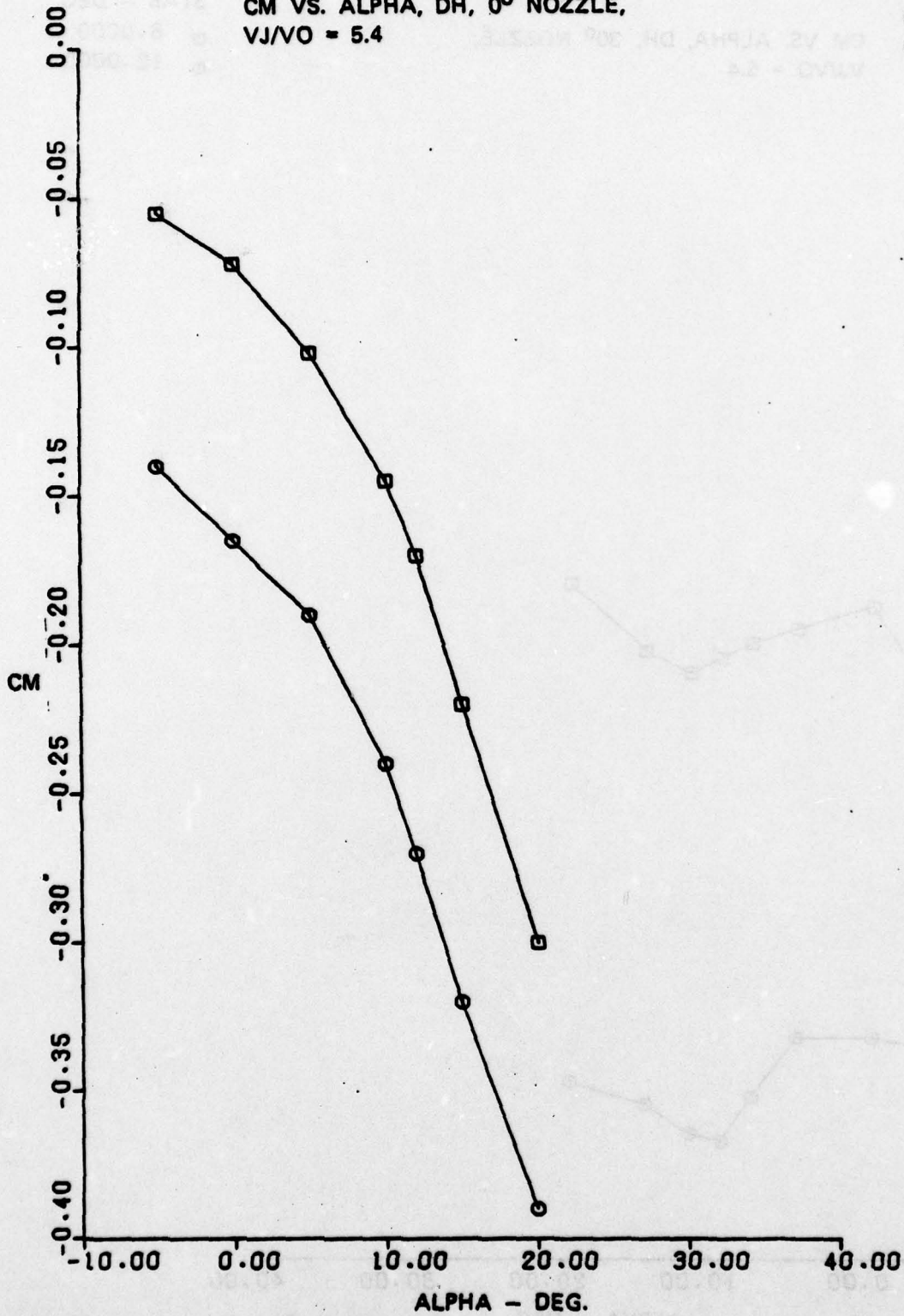


TABLE NO.56

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

STAB - DEG.

□ 6.0000

○ 12.0000

CM VS. ALPHA, DH, 30° NOZZLE,  
VJ/VO = 5.4

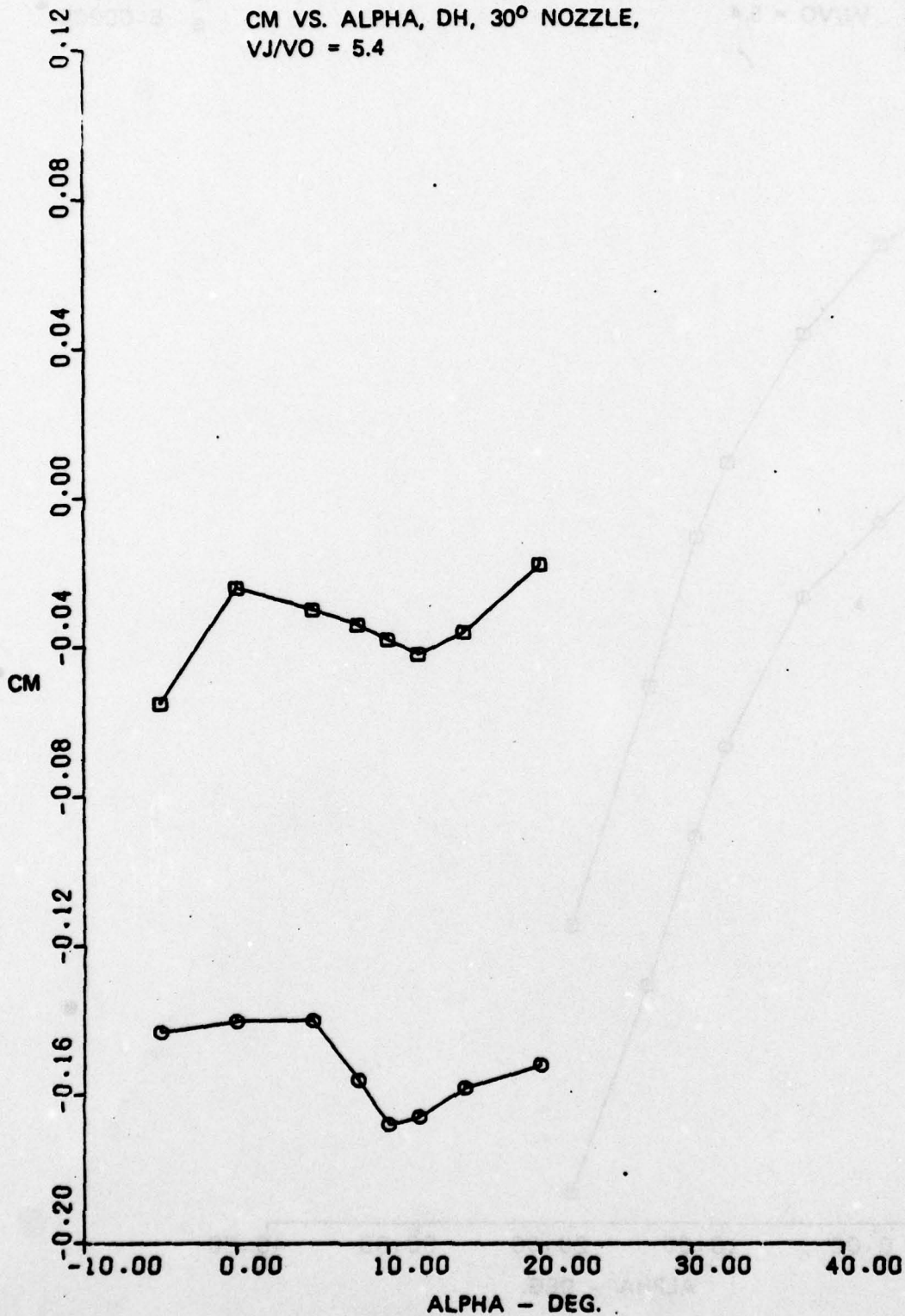


TABLE NO.57

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

DH - DEG.

- 6.0000
- 12.0000

CM VS. ALPHA,  
45° NOZZLE,  
VJ/VO = 5.4

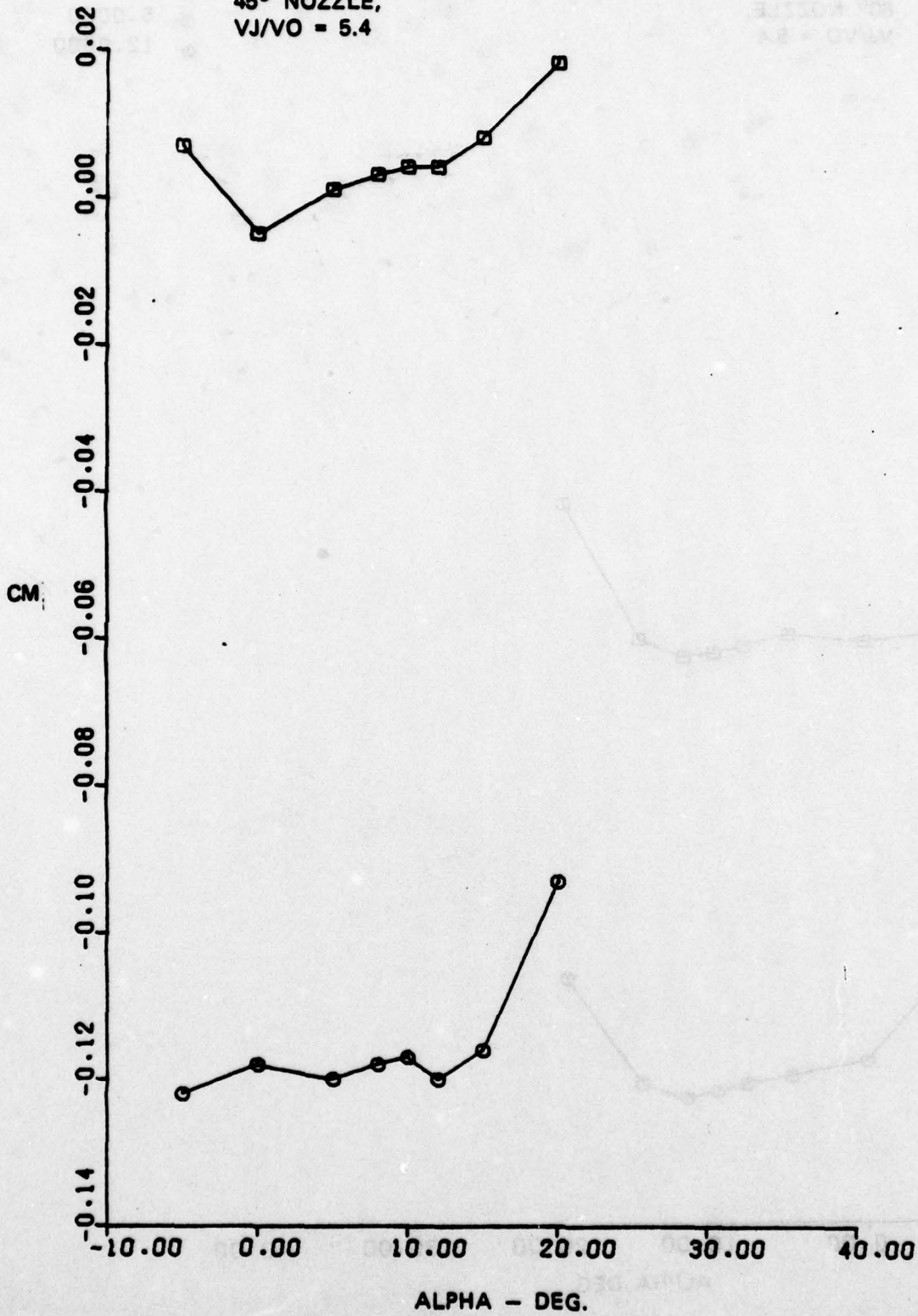


TABLE NO.58

CM VS. ALPHA, DH,  
60° NOZZLE,  
VJ/VO = 5.4

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES  
DH - DEG.  
□ 6.0000  
○ 12.0000

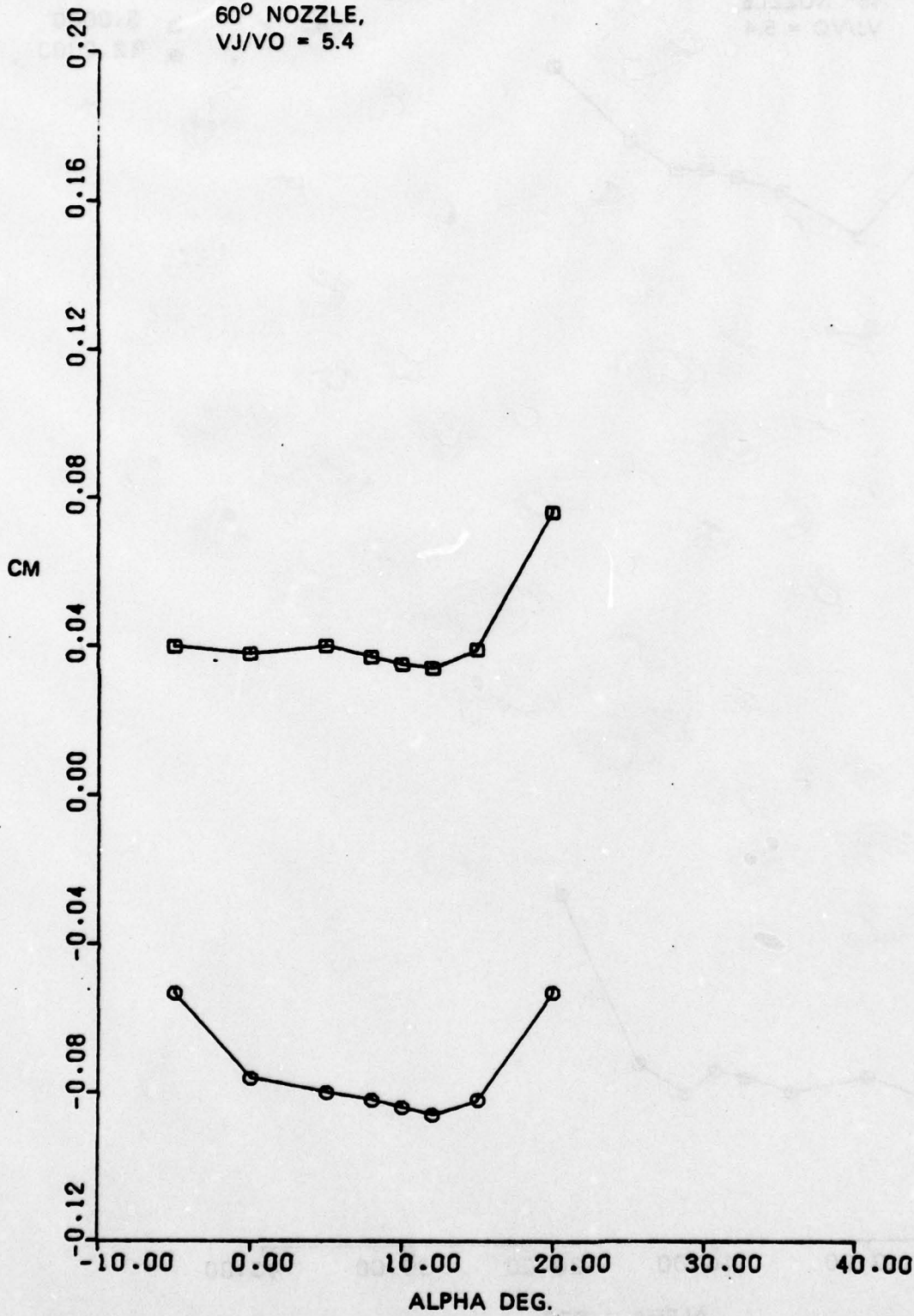


TABLE NO.59

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

○ 12.0000

CM VS. ALPHA, DH, 75° NOZZLE,  
VJ/VO = 5.4

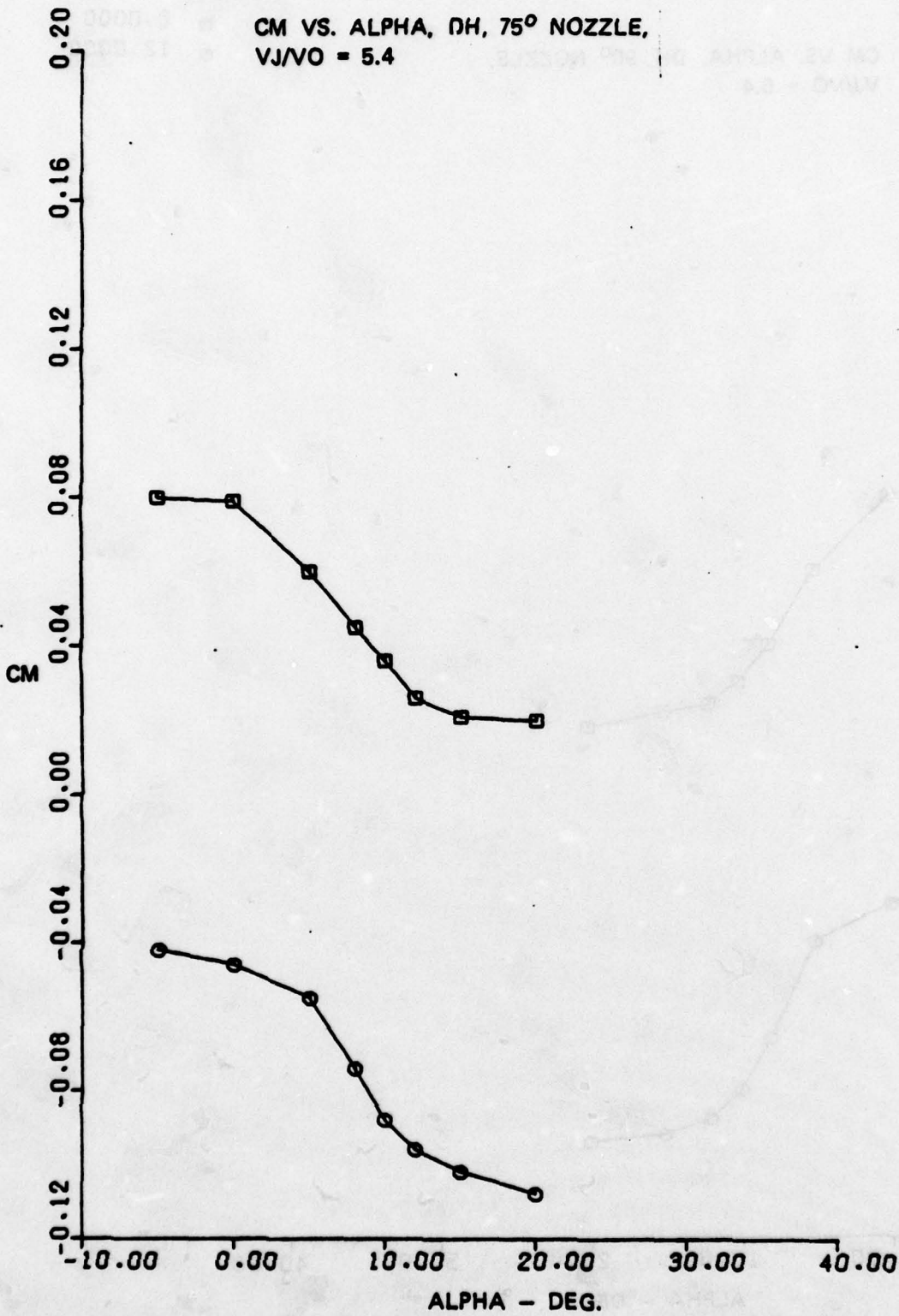


TABLE NO.60

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

○ 12.0000

CM VS. ALPHA, DH, 90° NOZZLE,  
VJ/VO = 5.4

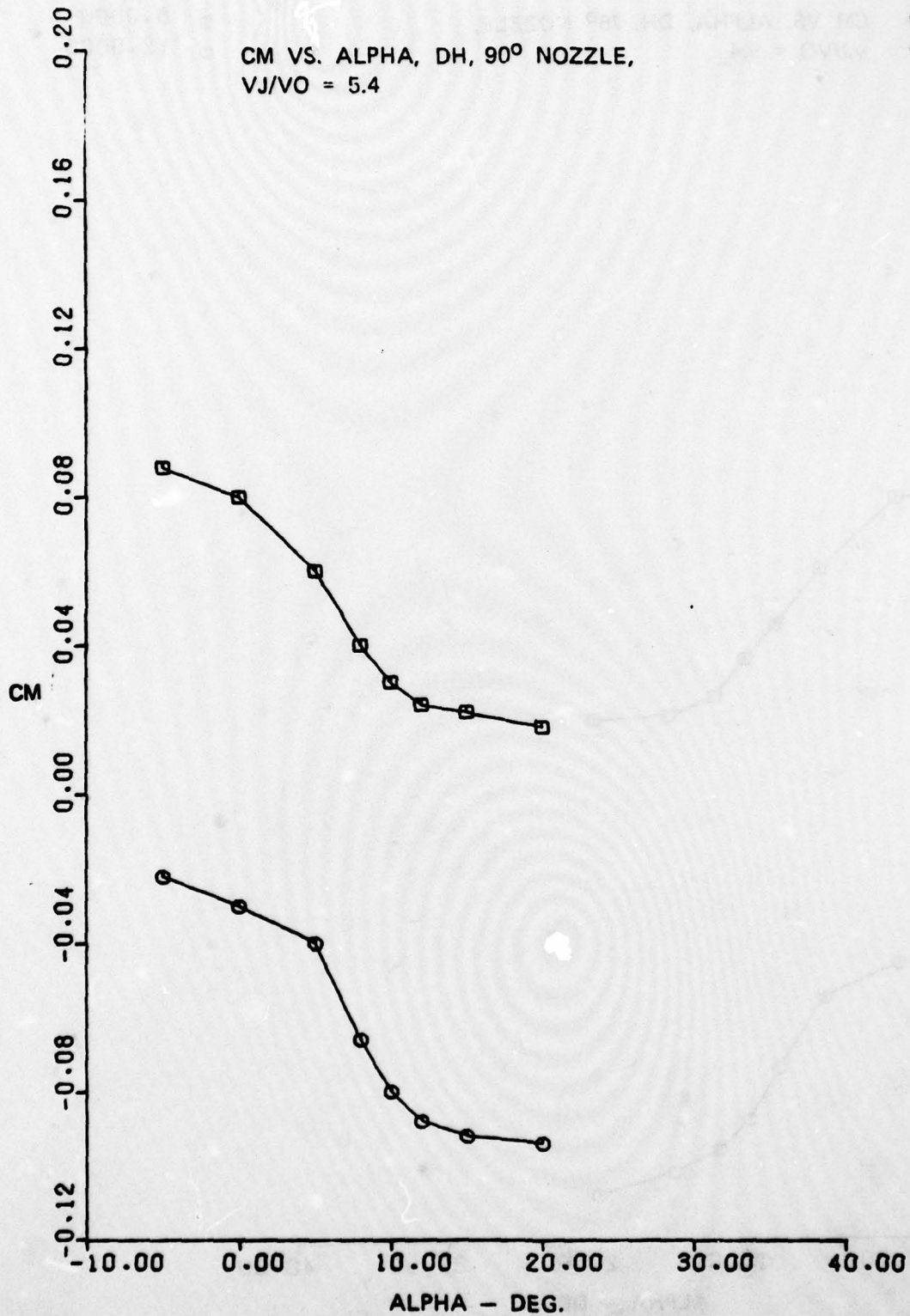


TABLE NO. 61

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES

DH - DEG.  
 □ 6.0000  
 ○ 12.0000

CM VS. ALPHA, DH,  
 45° NOZZLE, VJ/VO = 11.9

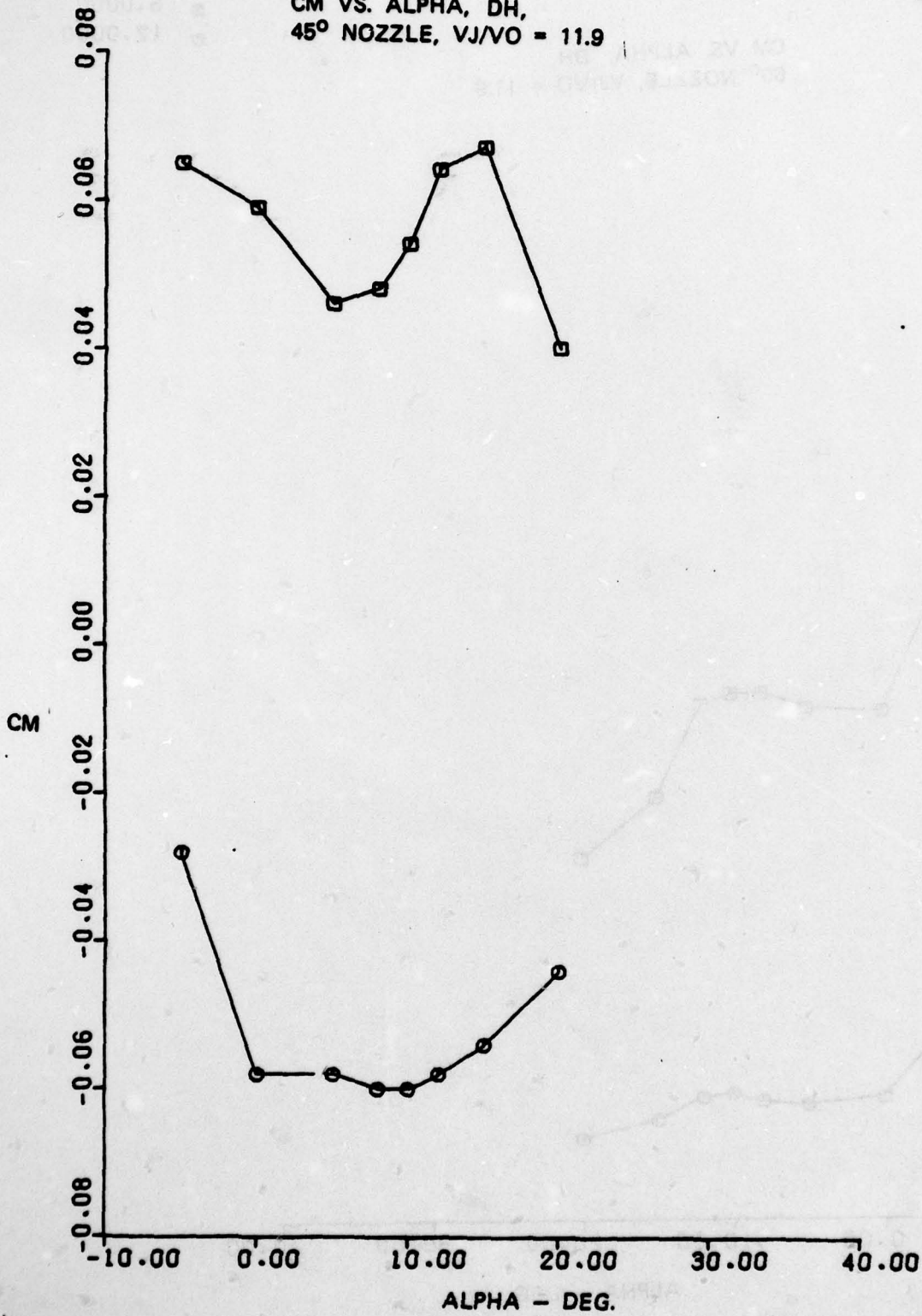


TABLE NO.62

THE FOLLOWING VALUES OF Y WERE USED TO PLOT THE CURVES

DH - DEG.

□ 6.0000

○ 12.0000

CM VS. ALPHA, DH,  
60° NOZZLE, VJ/VO = 11.9

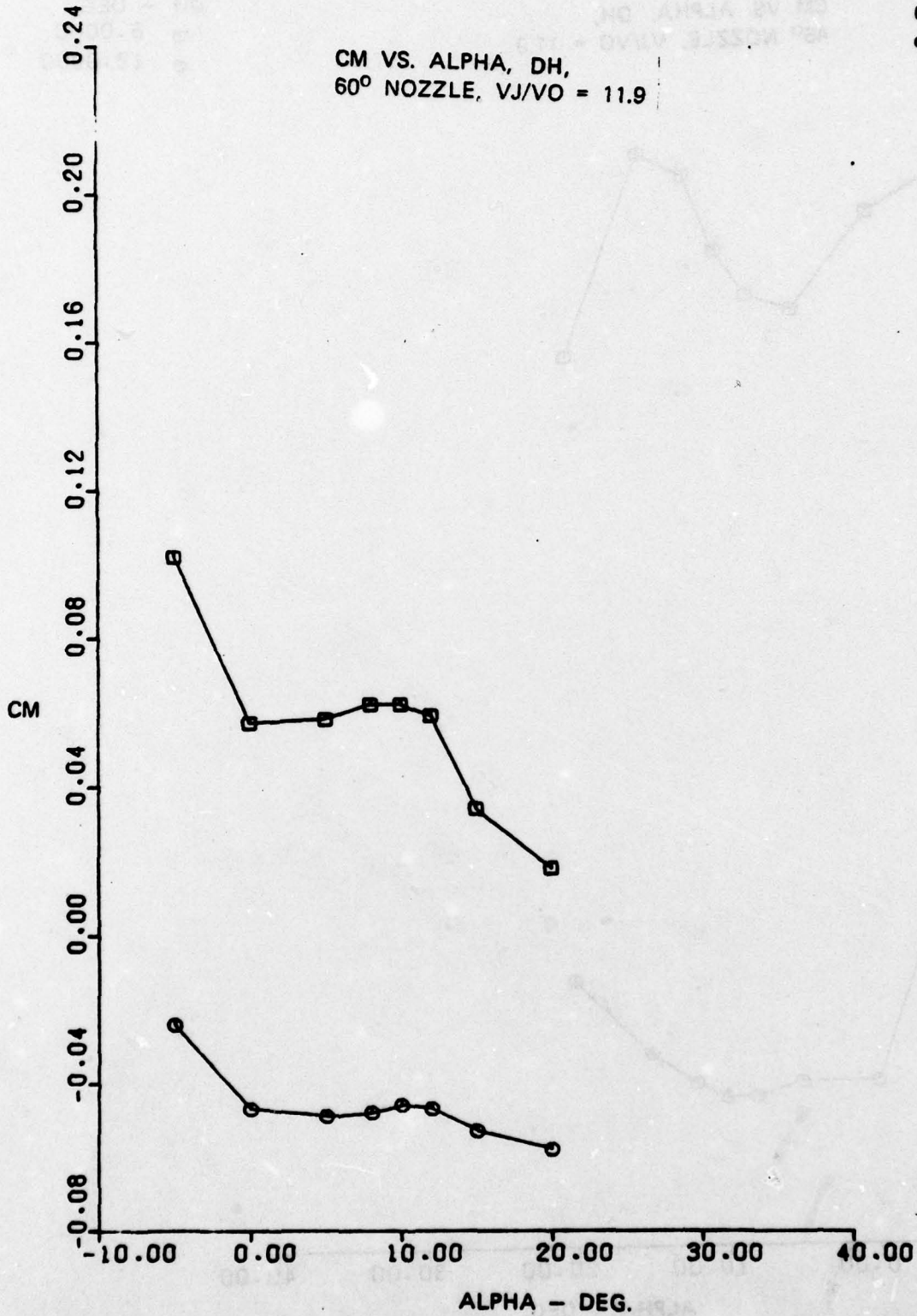


TABLE NO.63

THE FOLLOWING VALUES OF Y WERE  
USED TO PLOT THE CURVES  
DH - DEG.

CM VS. ALPHA, DH,  
75° NOZZLE, VJ/VO = 11.9

- 6.0000
- 12.0000

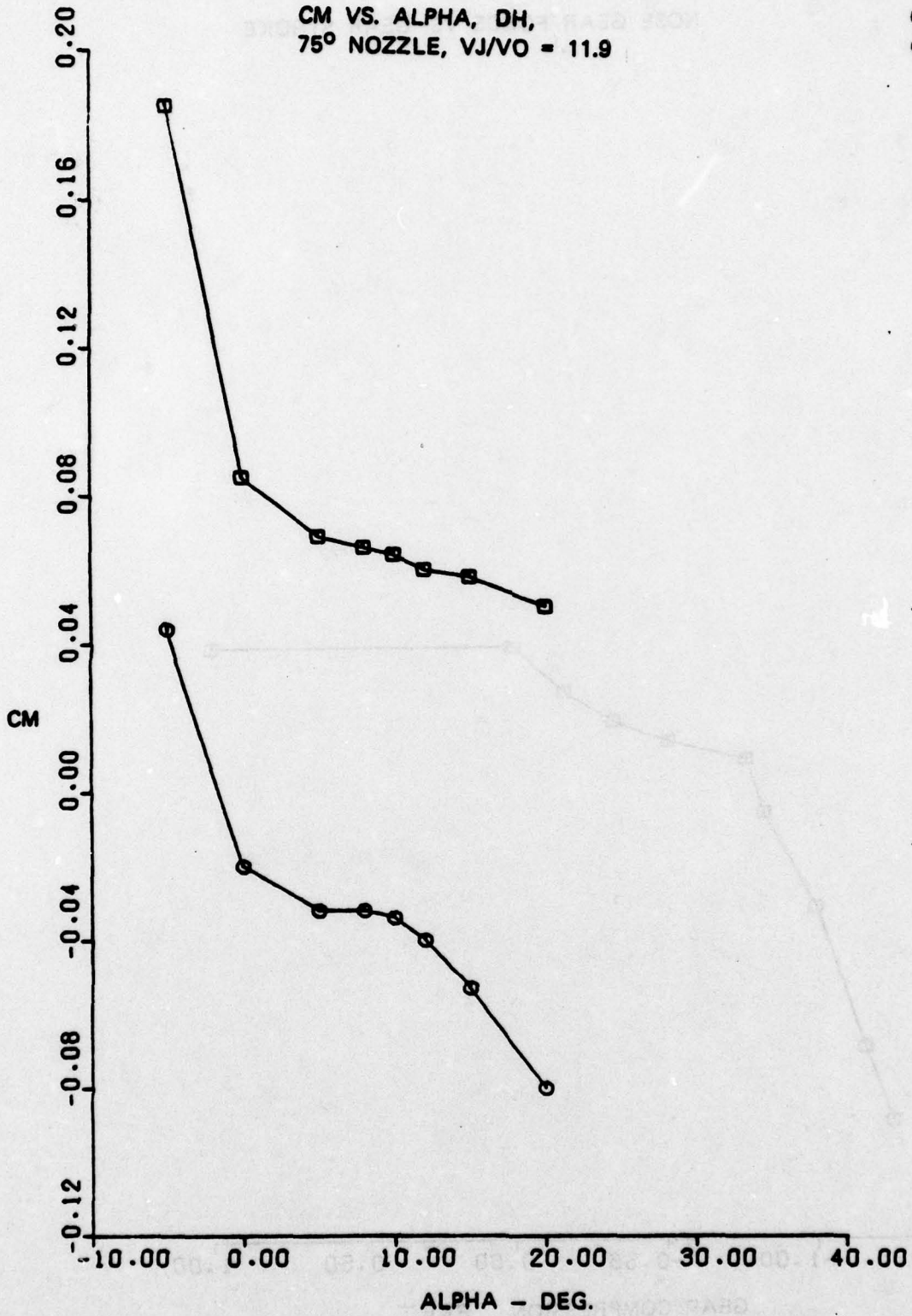


TABLE NO.64

NOSE GEAR FORCE VS. GEAR STROKE

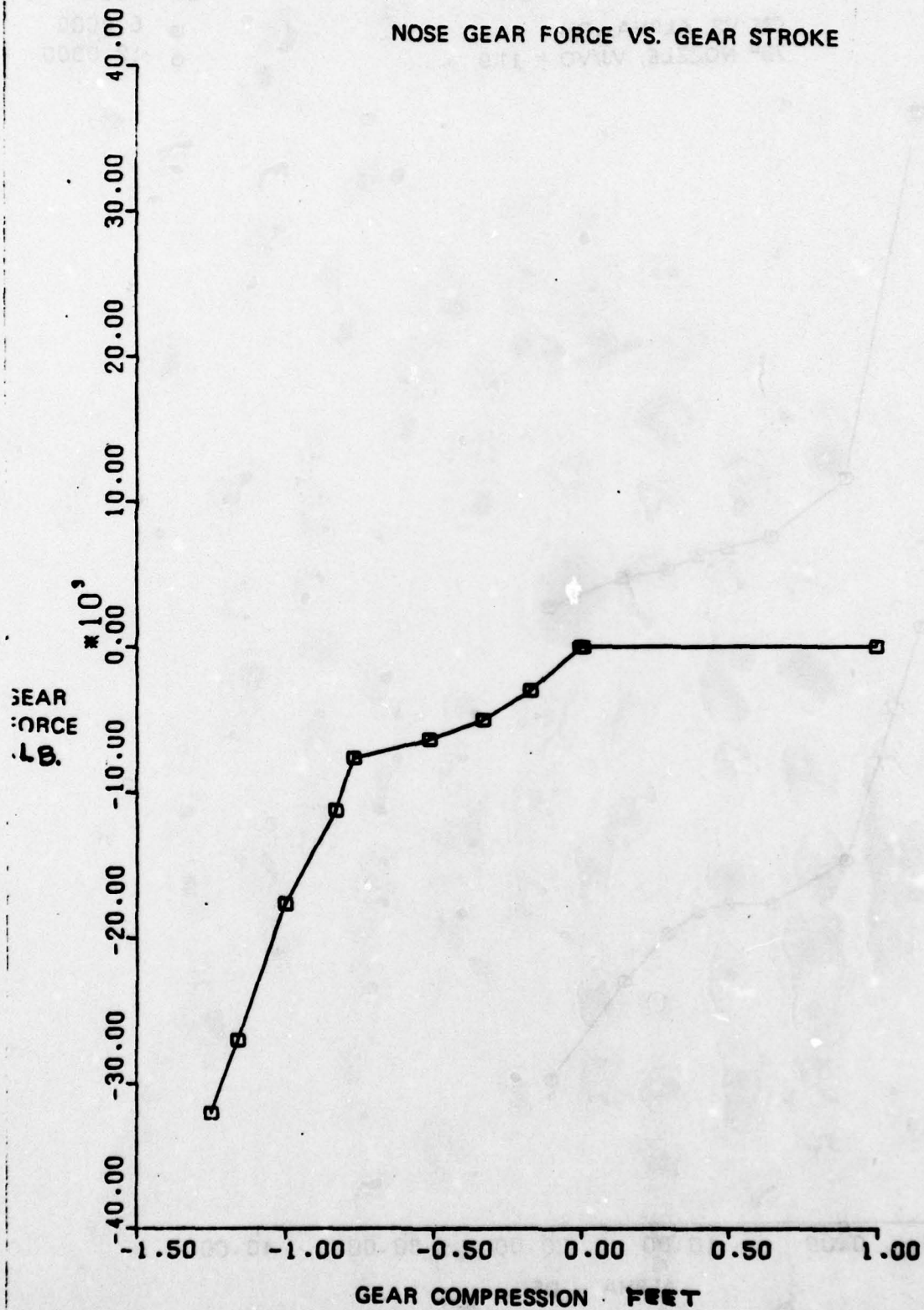


TABLE NO.65

MAIN GEAR FORCE VS. GEAR COMPRESSION

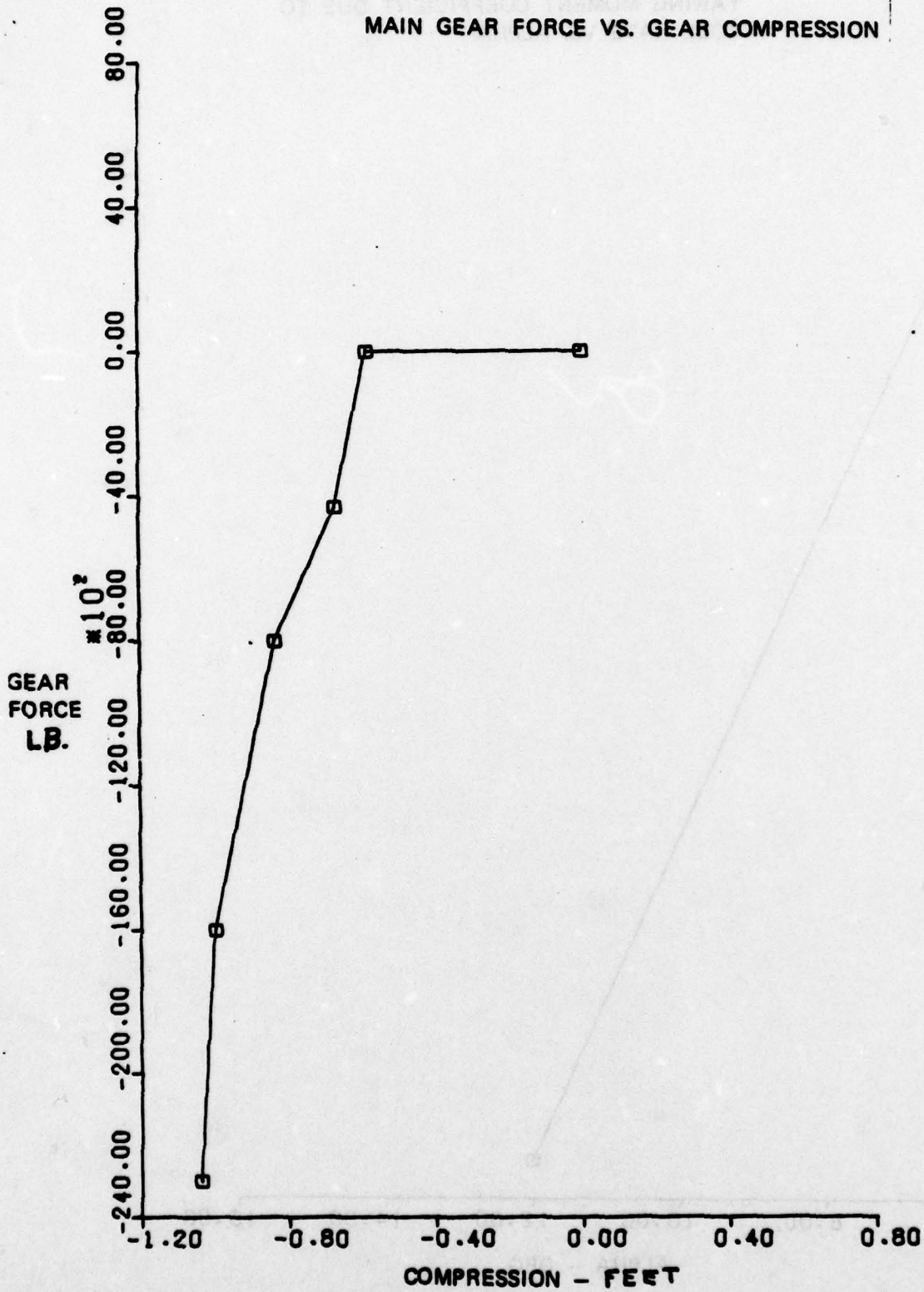


TABLE NO.66

YAWING MOMENT COEFFICIENT DUE TO ROLL RATE VS. ALPHA

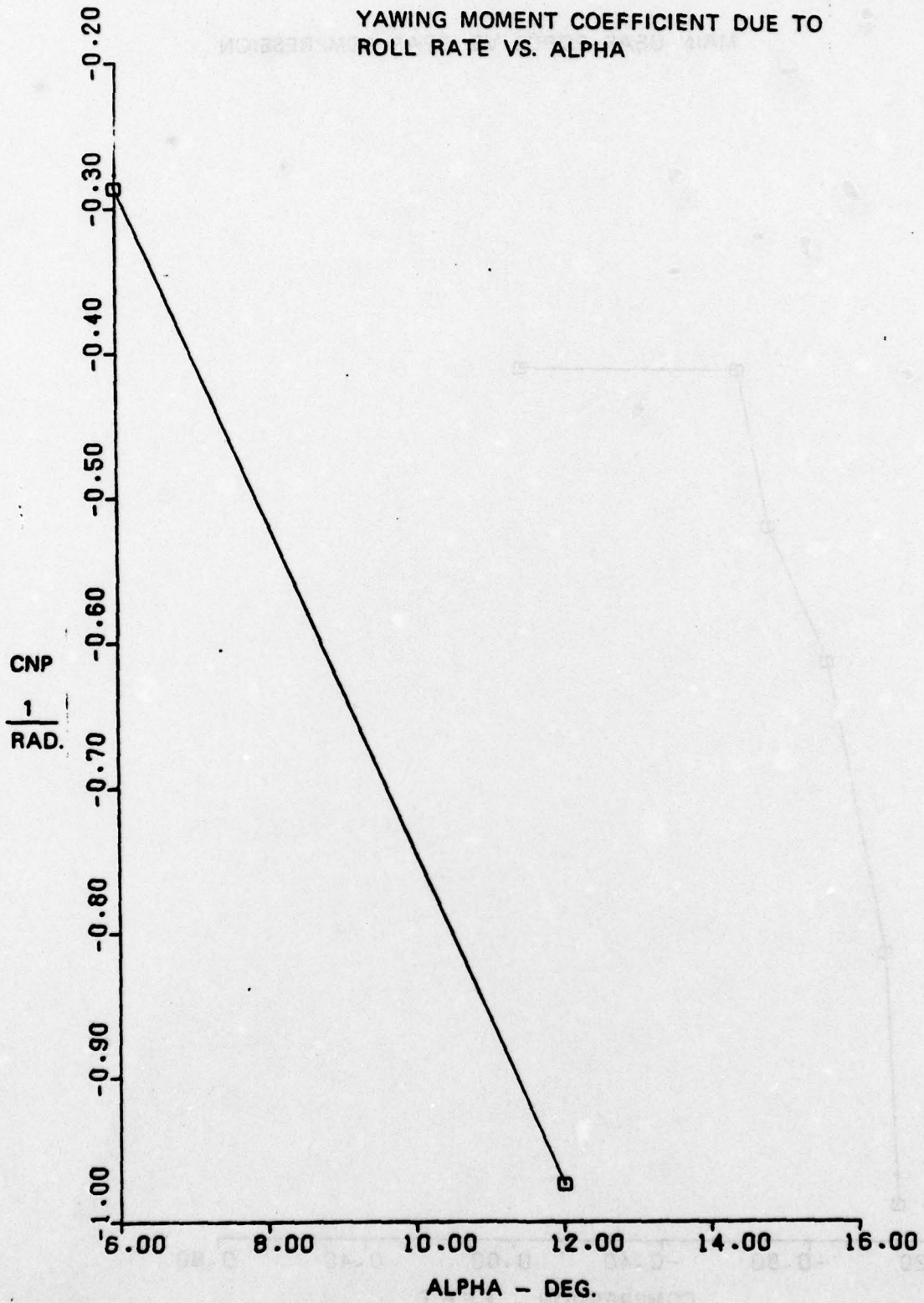


TABLE NO 57

PITCH TIME HISTORY

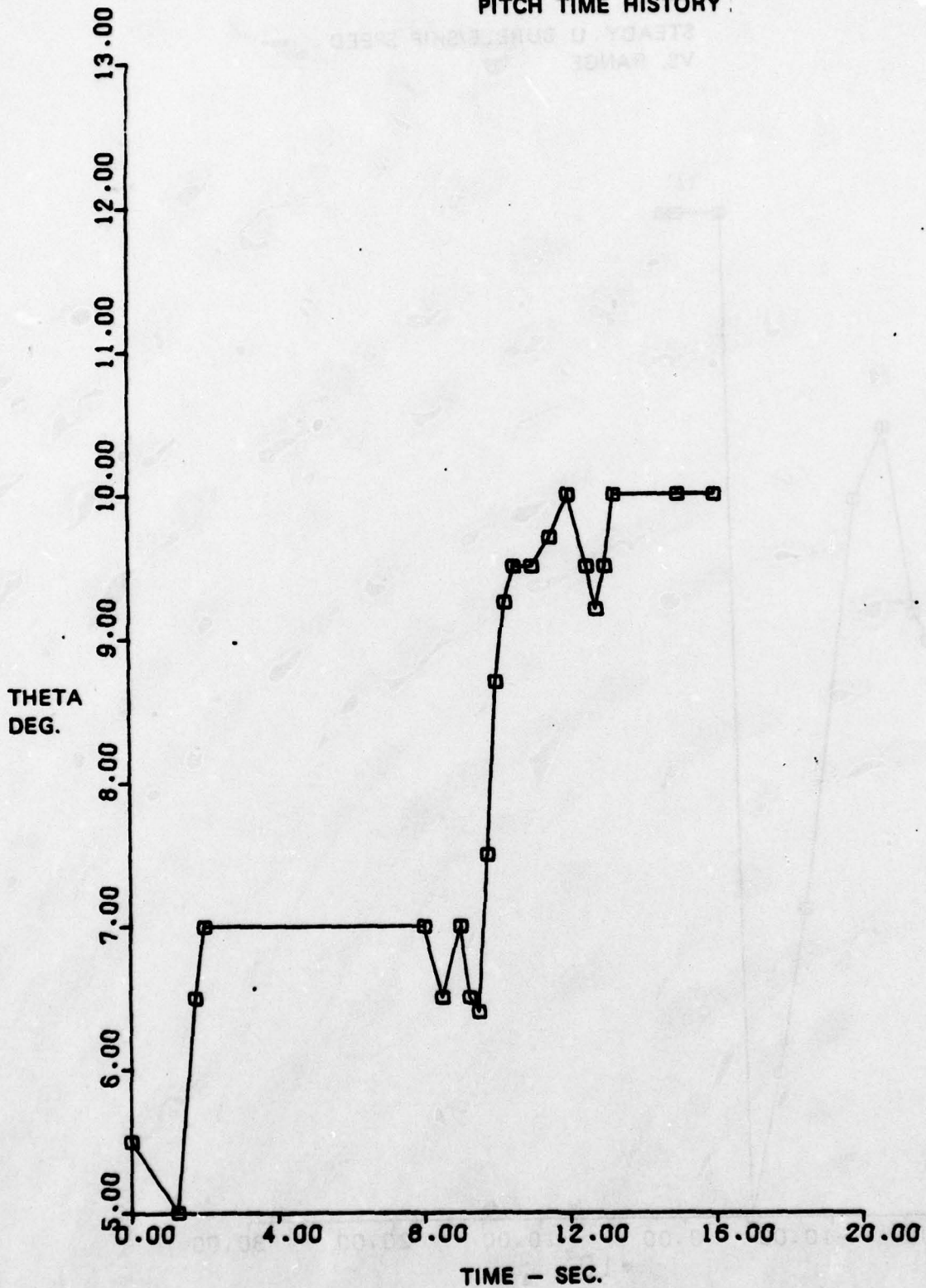


TABLE NO.68

STEADY U BURBLE/SHIP SPEED  
VS. RANGE

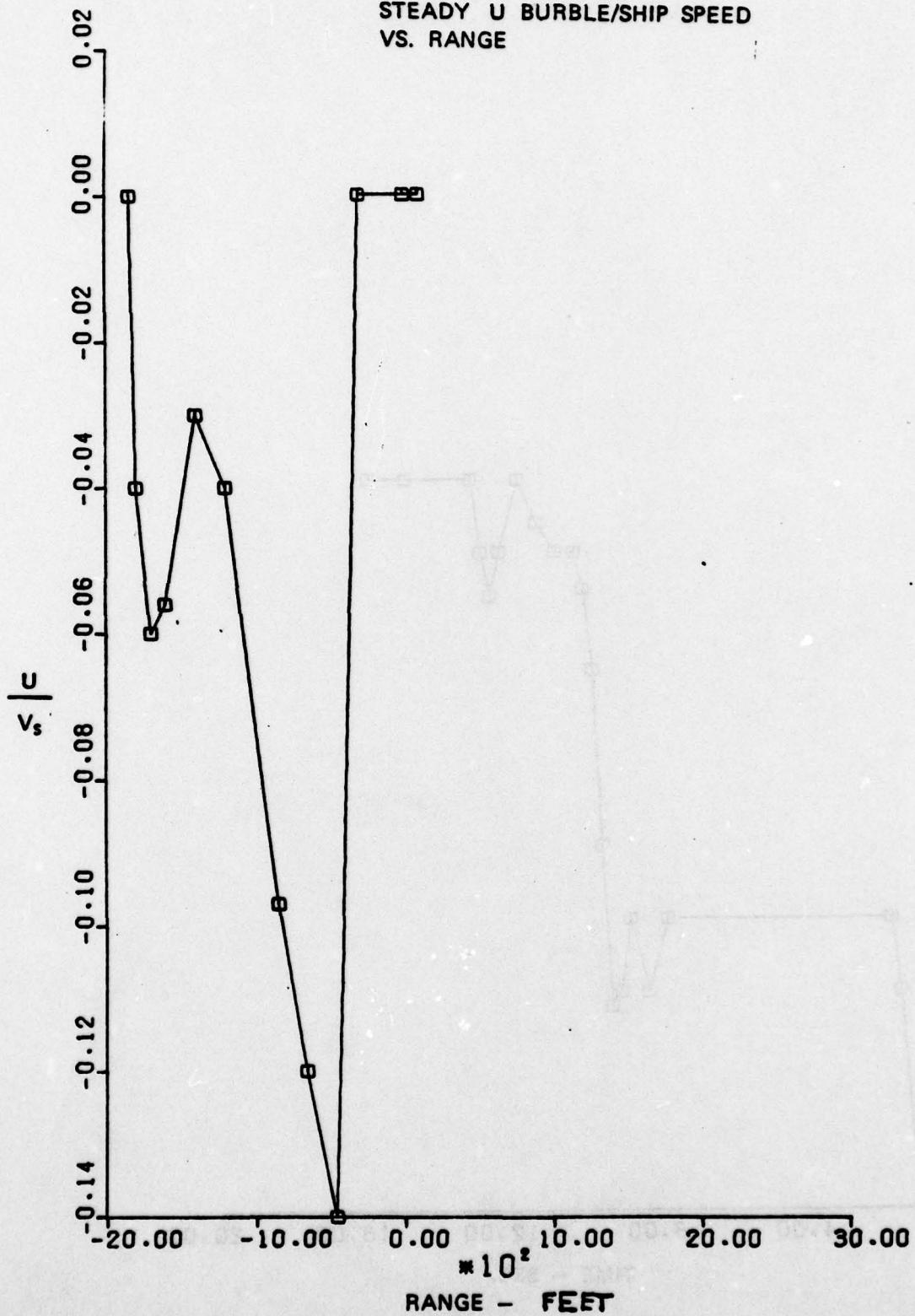


TABLE NO. 69

STEADY W BURBLE/SHIP SPEED  
VS. RANGE

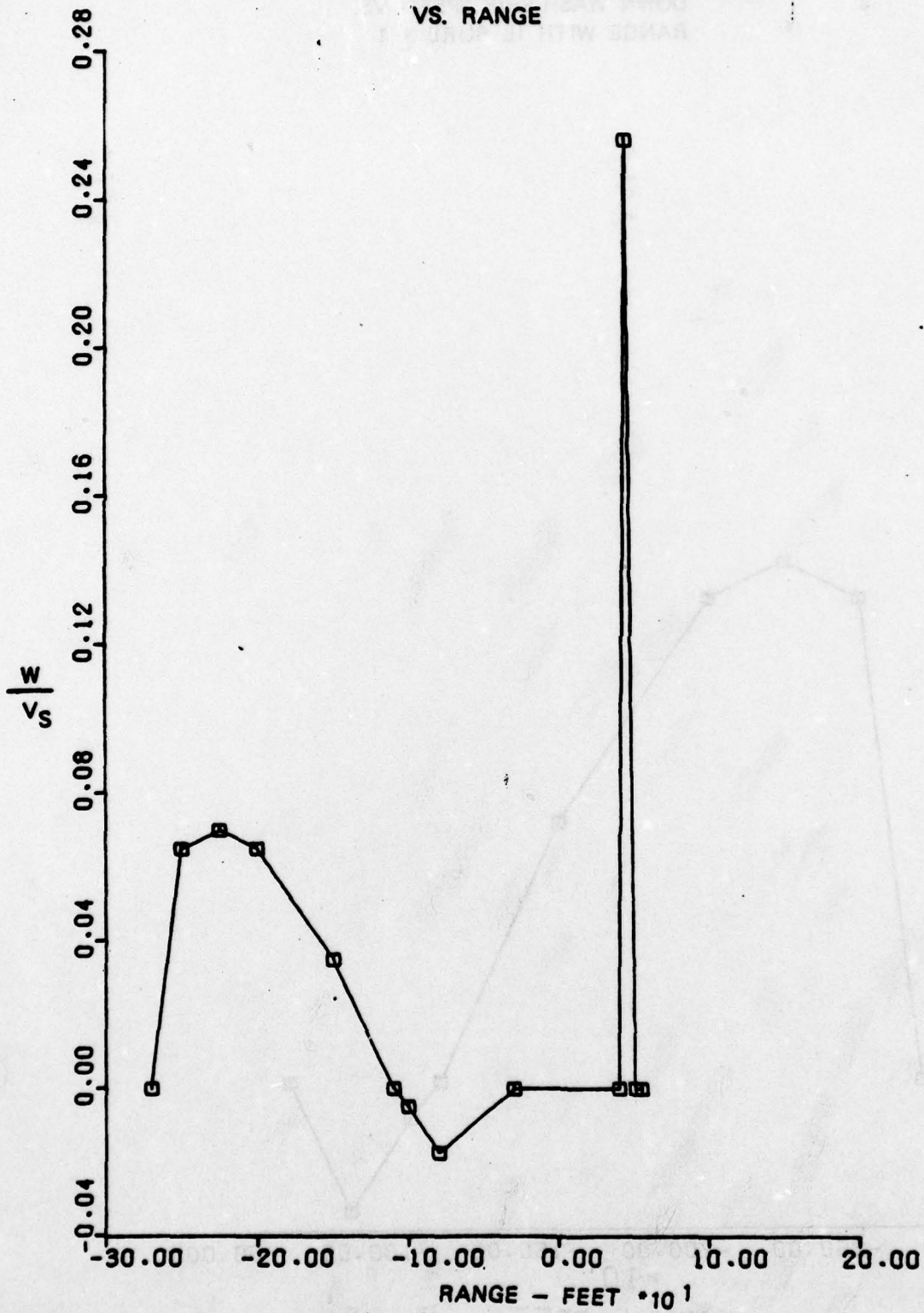
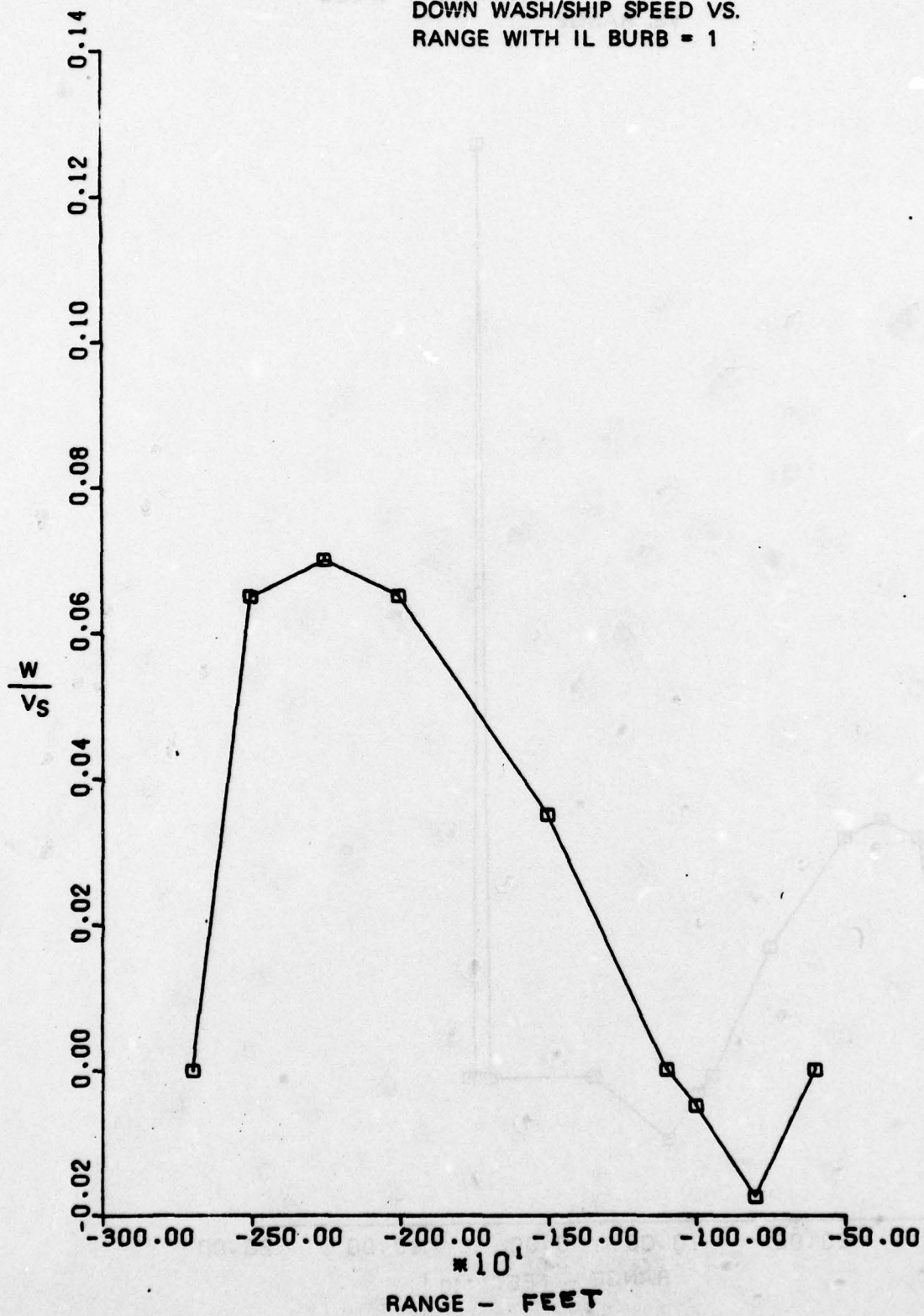


TABLE NO.70

DOWN WASH/SHIP SPEED VS.  
RANGE WITH IL BURB = 1



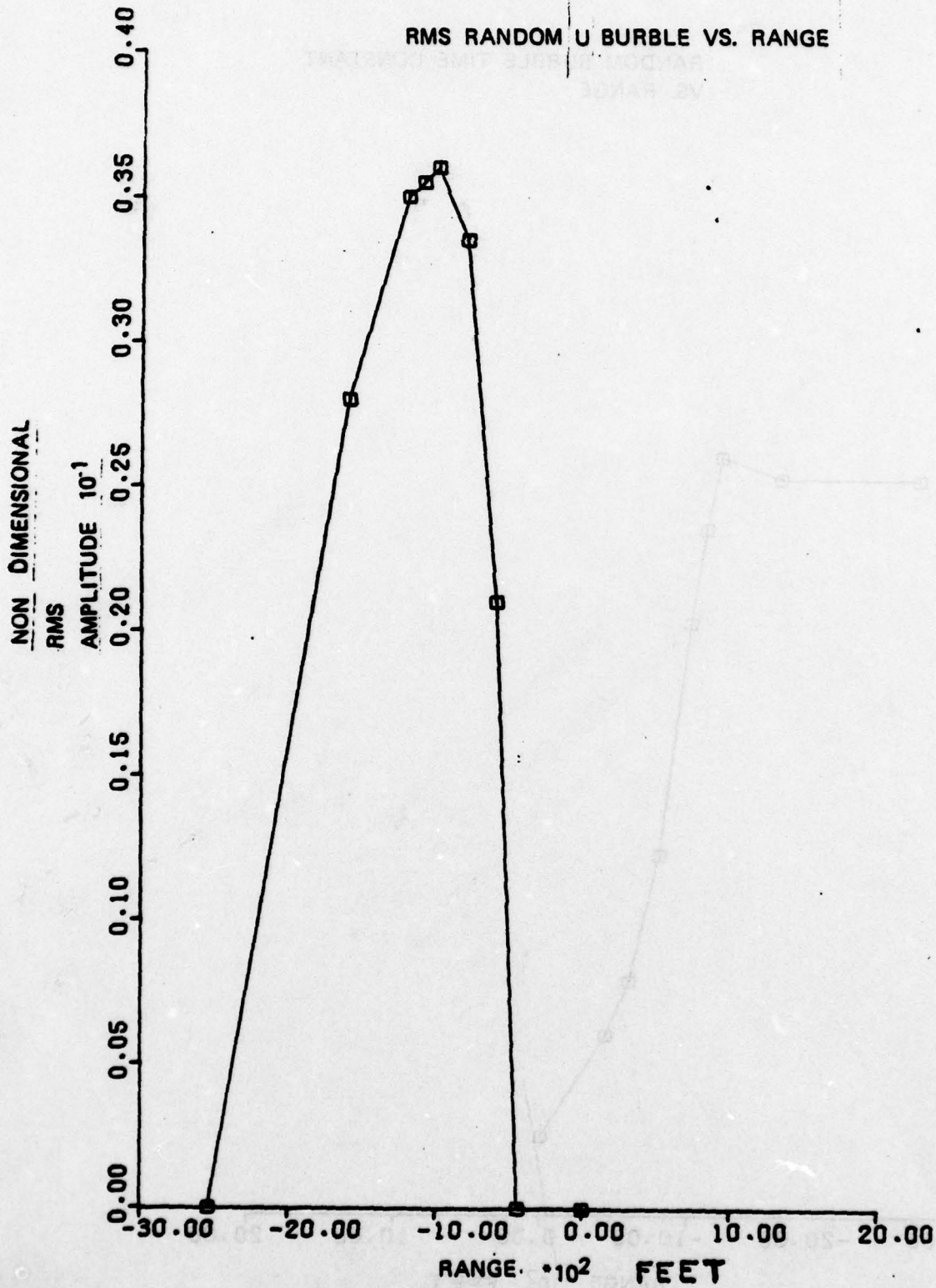


TABLE NO.72

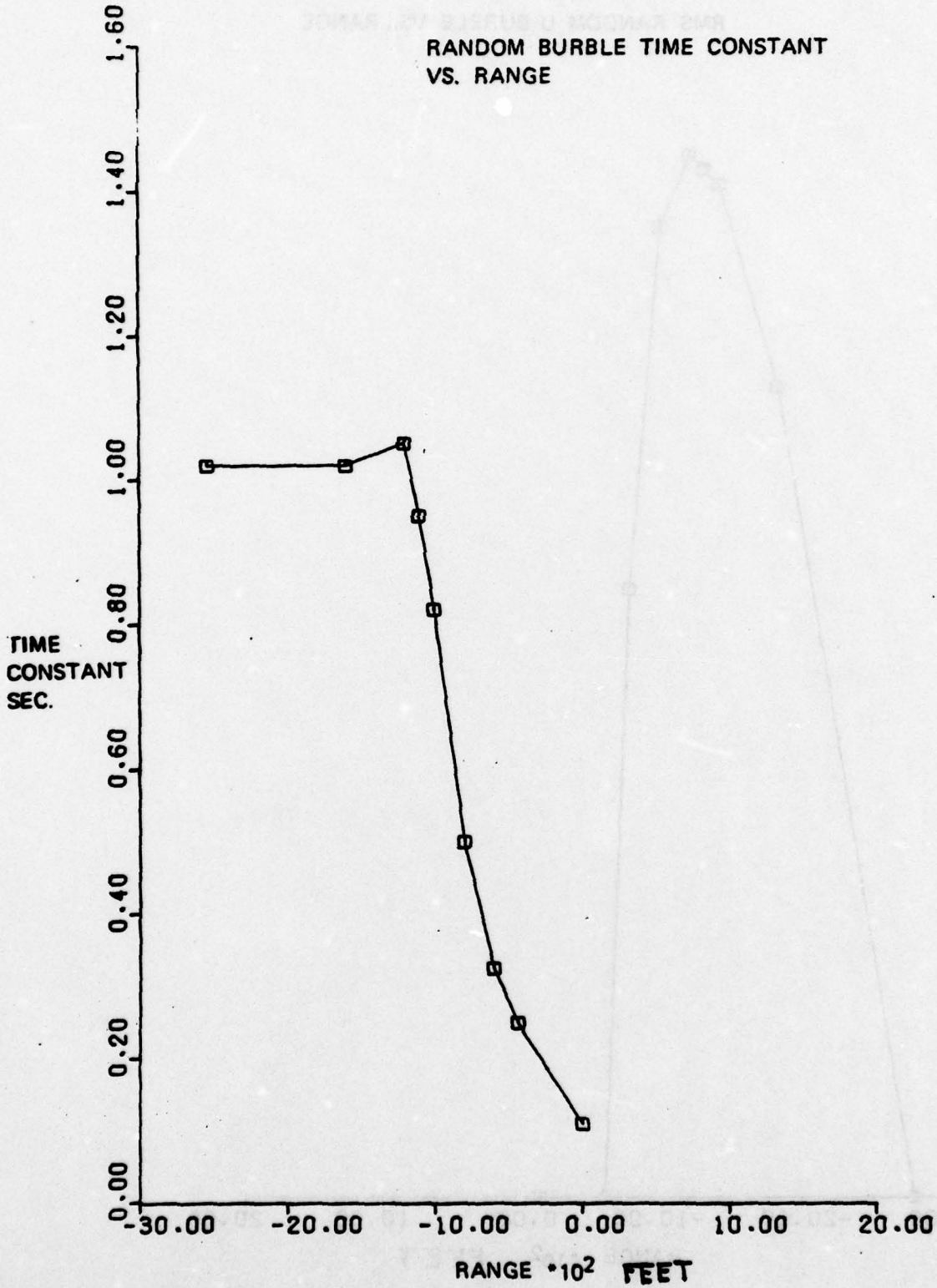


TABLE NO.73

THE FOLLOWING VALUES OF  $\theta$  WERE USED TO PLOT THE CURVES

- $\theta$  J - DEG.
- 0.0000
  - 30.0000
  - ▲ 50.0000
  - + 60.0000
  - x 98.0000

LIFT COEFFICIENT LOSS DUE TO INBOARD  
120 GALLON TANKS VS. NOZZLE ANGLE AND  
FORWARD SPEED RATIO

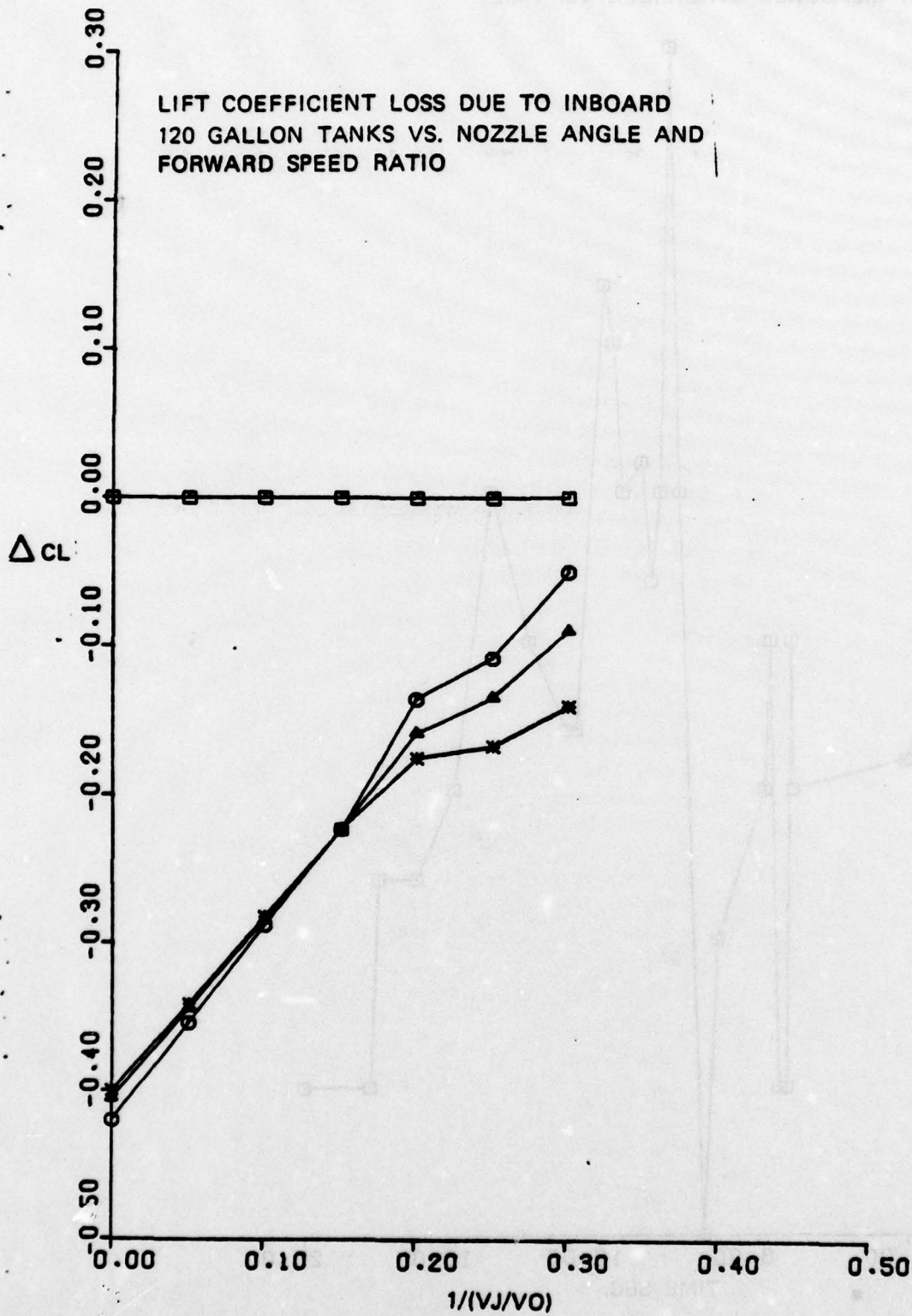


TABLE NO.74

FLIGHT MEASURED STABILIZER VS. TIME

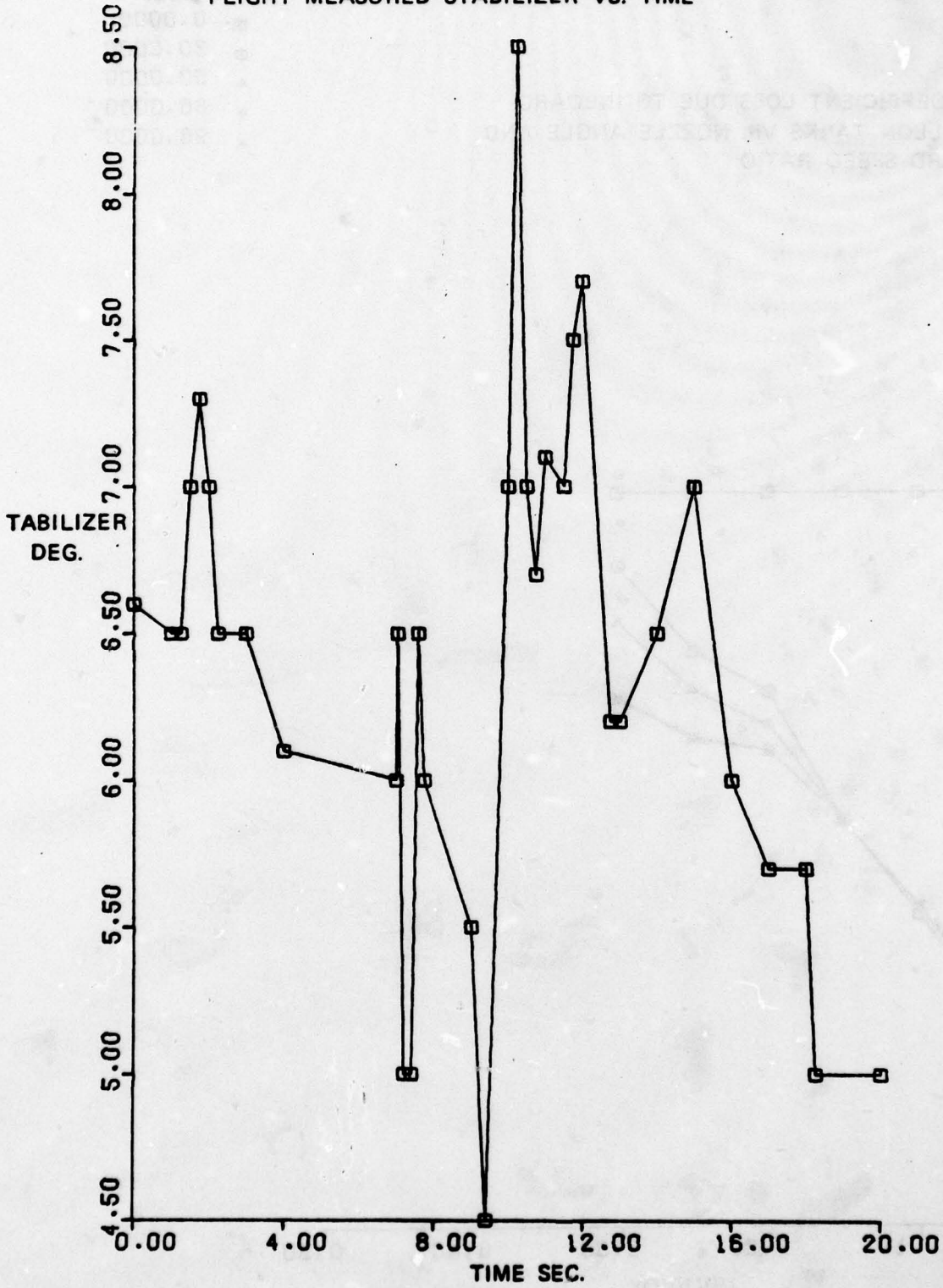
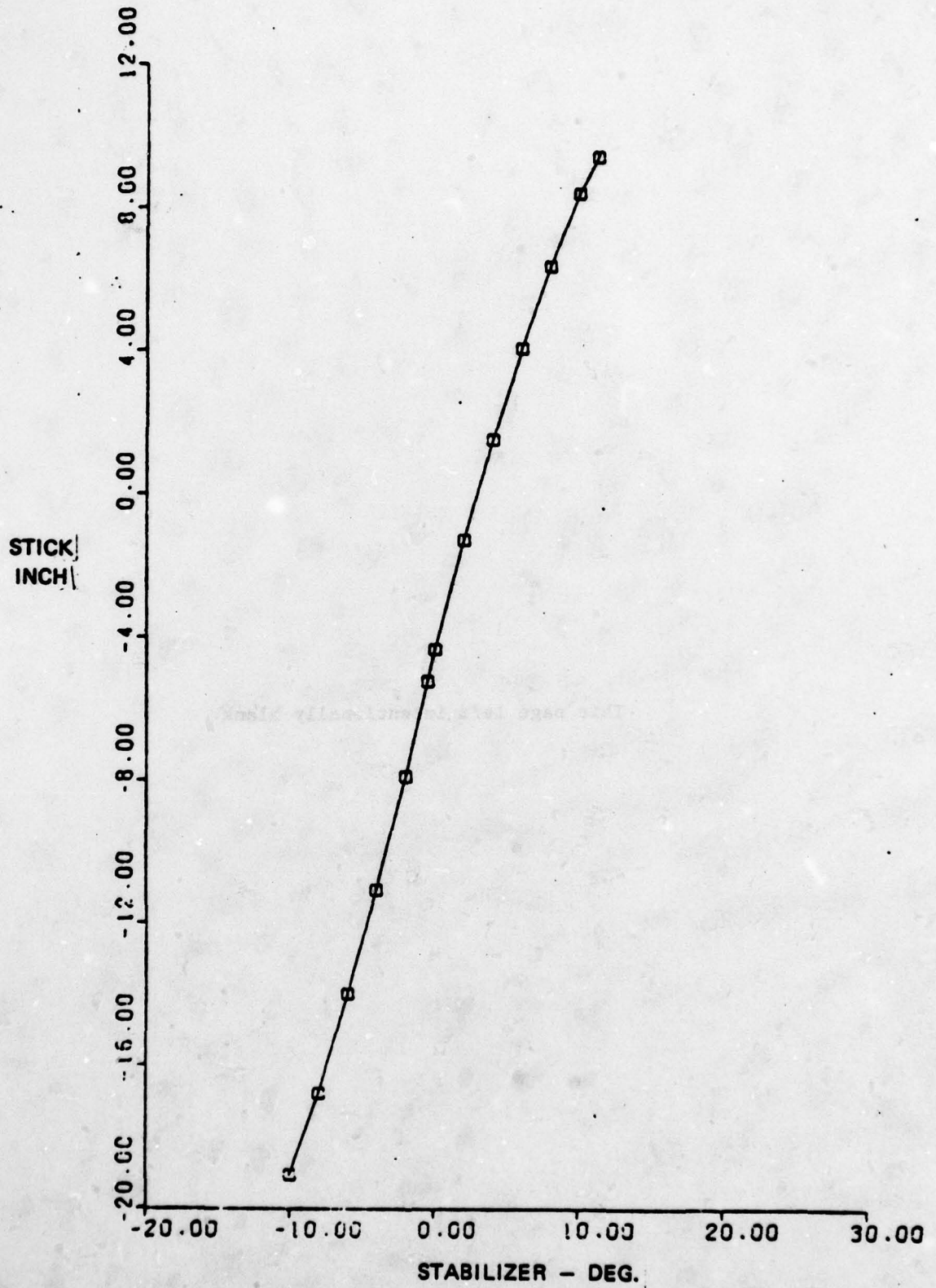


TABLE NO.75

LONGITUDINAL STICK VS. STABILIZER



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APPENDIX C

USER'S GUIDE TO THE VSTOL MODEL PROGRAM

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ALPHABETICALLY  
HERE'S GUIDE TO THE WESTERN WORLD

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APPENDIX C  
USER'S GUIDE TO THE VSTOL MODEL PROGRAM

The following description explains the procedures for loading data required for the simulation. The principal program variables reside in labeled common blocks to facilitate access between various subroutines. Initial values of common variables may be defined by using the block data subroutine. This method is used to define basic or reference values of program variables. In addition local variables may be defined by using data statements in individual subroutines. Figure 22 shows the subroutine arrangement.

Common variables may be changed from run to run by specifying appropriate data cards located after the control card and program deck.

The common variables are divided into seven main common groups. These are as follows:

A(1-500)	Basic real program variables
IA(1-200)	Basic integer program variables
B(1-200)	User floating point variables
IB(1-50)	User fixed point variables
GA(1-100)	User control system gain parameters
SCALE(1-28)	Plotting program scale values
NPLOT(1-14)	Plot selection switch values

The format for data input is specified below:

<u>CARD NO.</u>	<u>COLUMN</u>	<u>FORMAT</u>	<u>QUANTITY</u>
1	1-2	(I2)	NRUN - number of runs 1 = single run >1 = multiple runs 0 = terminate program
2	2-5	(1X, A4)	Name - input option switch = data for common variable input
3-11	1	A1	Blank
	2	I1	Common variable type indicator 1 = A common 2 = IA common 3 = GA common 4 = Scale common 5 = NPLOT(I) 6 = CHTSP 7 = B common 8 = IB common

CARD NO.	COLUMN	FORMAT	QUANTITY
3-11	8-10	I3	Common location = 1 → 500
3-11	11-20	G10.0	Value of common variable
3-1i	21-80	15A4	Variable description title
12	1	A1	/ - A slash in column 1 indicates the end of common input data
13	1-5	IX,A4	Name = UDAT, indicates table data input
14-32	The format for loading table lookup data is described separately in Appendix D. A blank card at the end of the last set of data causes the computer to stop reading table data.		
33	2-5	A4	Name = OPRN, indicates the operation of the simulation run.
33	11-19	G9.0	RTIME - specifies simulation run time in seconds
34	1-6	3I2	I1READ, I2READ, ISCALE I1READ = 0 - continue I1READ = 1 - read IPLOT(I) I2READ = 0 - continue I2READ = 1 - read IPRNT(I) ISCALE = 0 - use SCALE(I) values for data plots ISCALE = 1 - calculate plot scales
35-36	1-80	8I10	IPLOT(I), I = 1, 14 or IPRNT(I), I = 1, 11 specifies print and plot variables
37	1-2	I2	NRUN - specify number of repetitions for next run, terminate program if NRUN = 0.
38	2-5	A4	Name = END terminates program



30	10.	30	.17	0.	-.18	12016	52011	11001	11008
31	20.	27	.135	0.	-.135	91021	11021	11001	11008
32	OPRN	15.				52140	11025	11002	11008
33	01 0001								
34	12001	132009	51015	122011	03015				
35	51010	51013		51010					
36	END								
37	71719								
38	6171719								





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APPENDIX D

USER'S GUIDE FOR LINEAR TABLE DATA LOOKUP ROUTINE

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APPENDIX D  
USER'S GUIDE FOR LINEAR TABLE DATA LOOKUP ROUTINE

Three FORTRAN subroutines, TABRD, LOOKUP, and TABI provide a capability for linear interpolation and extrapolation of table data expressed as a function of as many as three independent variables.

For arguments outside the range of the input data, three options are available:

- (1) stop lookup procedure and return error code with function value equal to zero
- (2) set function value to data value corresponding to the independent variable value within the input data range which is nearest in value to the desired argument
- (3) linearly extrapolate from last available table values to approximate function value at desired argument

The table lookup package consists of one FUNCTION subprogram and two SUBROUTINE subprograms. Four COMMON blocks are required in the calling program to provide for convenient data transfer. The procedures for involving the proper routines and initializing the COMMON blocks are described in the following.

COMMON Block Initialization

COMMON/TABLE/NUMPTS(m) - provides storage for the input table data. NUMPTS is the array where the data are stored and must be dimensioned large enough to hold all tables. An approximation to this dimension may be made as follows:

$$m = \sum_{i=1}^N ((X_i + 1) (Y_i + 1) + 3)$$

where N is the total number of tables  
 $X_i$  is the number of first argument values in table i  
 $Y_i$  is the number of second argument values in table i

Note: a separate table is required for each value of z (third argument) as will be explained later.

COMMON/XTRAP/METH, IACT (3, n) - contains information concerning type of search to be used and action to be taken when argument is outside the range of the table. METH must be initialized in the calling program.

METH = 1: standard order search each time lookup is required

METH = 2: memory search; i.e., search begins at point in table where last search was completed

METH = 3: binary search (can be more efficient)

The second dimension of IACT, n, must be greater than or equal to the number of tables being used.

COMMON/FIND/IPREV (3, n) - stores array data used during interpolation. Here again, n is greater than or equal to the number of tables being used.

COMMON/TABOUT/NTBL, ISEQ - provides information in the event of a data error.

NTBL is the number of the table currently being read.

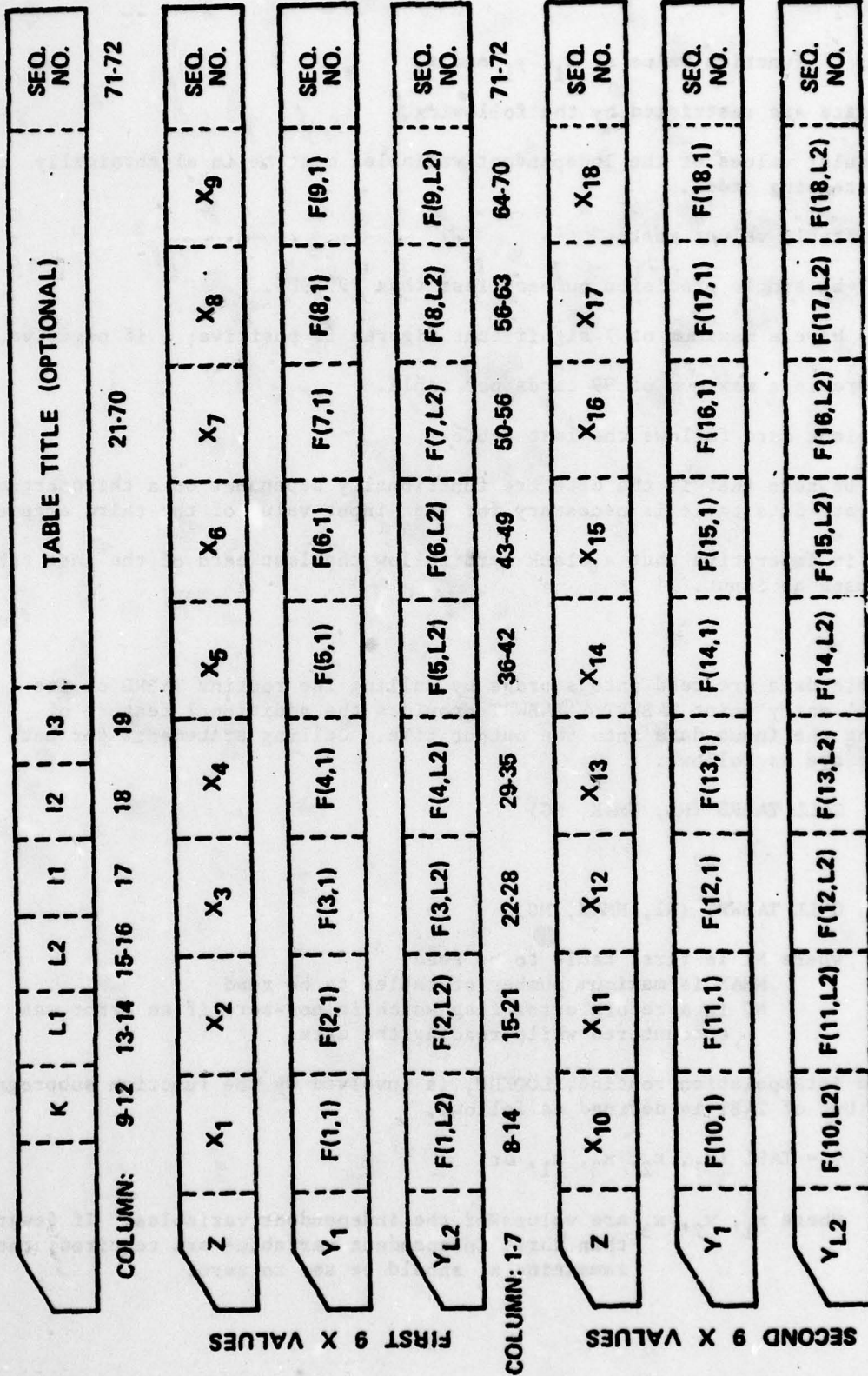
ISEQ is the sequence number of the card being read.

Data Input

The input data is read from punched cards which have been prepared using the format of Figure 23. Nomenclature pertaining to Figure 23 and certain table data restrictions are given below.

Nomenclature and Restrictions

- K            table number (positive integer starting at 1 and increasing by 1 for each successive table)
- L1           number of tabular values of the first independent variable (x)
- L2           number of tabular values of the second independent variable (y) (= 1 for function of one variable)
- Seq. No.    sequence number of card within a table beginning with 0 for the first card, 1 for the second, etc.
- z            value of the third independent variable (if used). A separate table is necessary for each value of z.
- I1           integer signifying the type of action desired if argument #1(x) goes off table during interpolation
  - = 0: stop lookup procedure and return error code
  - = 1: hold end value of argument #1
  - = 2: linearly extrapolate on argument #1
- I2           same as above but for argument #2
- I3           same as above but for argument #3



ADDITIONAL X VALUES UP TO AND INCLUDING X<sub>L1</sub> ARE HANDLED SIMILARLY

FIGURE 23. TABLE CARD FORMAT

$f(i, j)$  function value at  $x_i$ ,  $y_i$  and  $z$

Table data are restricted by the following.

- (1) Tabular values of the independent variables must be in algebraically increasing order.
- (2) All table values must:
  - (a) be single precision numbers less than 99999E9.
  - (b) have a maximum of 7 significant figures if positive; 6 if negative.
- (3) There is a maximum of 99 cards per table.
- (4) A blank card follows the last table.

It can be seen that if the data are functionally dependent on a third argument, a separate data table is necessary for each input value of the third argument.

It is imperative that a blank card follow the last card of the last table being used as input.

#### Usage

Table data are read into storage by calling the routine TABRD or its optional entry point TABWRT. TABWRT provides the additional feature of printing the input data onto the output file. Calling statements for both options are as follows.

```
CALL TABRD (N1, NMAX, NG)
```

or

```
CALL TABWRT (N1, NMAX, NG)
```

where N1 is first table to be read

NMAX is maximum number of tables to be read

NG is a return error flag which is non-zero if an error was encountered while reading the data.

The interpolation routine, LOOKUP, is involved by the function subprogram TAB1. Use of TAB1 is defined as follows.

$$y = \text{TAB1}(x_1, x_2, x_3, n_1, \Delta n)$$

where  $x_1, x_2, x_3$  are values of the independent variables. If fewer than three independent variables are required, the remaining  $x_i$  should be set to zero.

$n$  is the number of the table required for the lookup. If a three argument interpolation is being performed,  $n$  is the number of the first required table

$\Delta n$  is the total number of tables required in the case of a triple argument lookup

$y$  is the resulting function value

If one or more of the arguments is outside the range of the table data, the previously indicated action is taken and an informative message is printed on the output file.

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APPENDIX E

COMMON VARIABLE DEFINITIONS

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APPENDIX E  
COMMON VARIABLE DEFINITIONS

A Common

NUMBER	NAME	COMPUTED UNITS	DEFINITION
1	PHI	deg	aircraft bank angle
2	THET	deg	aircraft pitch angle
3	PSI	deg	aircraft heading from north
4	PHIR	rad	aircraft bank angle
5	THETR	rad	aircraft pitch angle
6	PSIR	rad	aircraft heading
7	PHID	rad/sec	rate of change of bank
8	THED	rad/sec	rate of change of pitch
9	PSID	rad/sec	rate of change of heading
10	SPHI	-	sine of PHIR
11	CPHI	-	cosine of PHIR
12	STHI	-	sine of THETR
13	CTHT	-	cosine of THETR
14	SPSI	-	sine of PSIR
15	CPSI	-	cosine of PSIR
16	T11	-	euler transformation
17	T21	-	matrix elements
18	T31	-	matrix elements
19	T12	-	matrix elements
20	T22	-	matrix elements
21	T32	-	matrix elements
22	T13	-	matrix elements
23	T23	-	matrix elements
24	T33	-	euler transform coefficient
25	ALFA	deg	aircraft angle of attack
26	BETA	deg	aircraft sideslip angle
27	ALFAR	rad	aircraft angle of attack
28	BETAR	rad	aircraft sideslip angle
29	ALFD	rad/sec	rate of change of ALFAR
30	BETD	rad/sec	rate of change of BETAR
31	SALPH	-	sine of ALFAR
32	CALPH	-	cosine of ALFAR
33	SBETA	-	sine of BETAR
34	CBETA	-	cosine of BETAR
35	GAMV	rad	vertical flight path angle
36	GAMH	rad	horizontal flight path angle
37	PB	rad/sec	aircraft roll rate, body axes
38	QB	rad/sec	aircraft pitch rate, body axes
39	RB	rad/sec	aircraft yaw rate, body axes
40	PL	rad/sec	inertial roll rate due to earth curvature
41	QL	rad/sec	inertial pitch rate due to earth curvature
42	RL	rad/sec	inertial yaw rate due to earth curvature

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
43	PLB	rad/sec	body axis roll rate due to curvature
44	QLB	rad/sec	body axis pitch rate due to curvature
45	RLB	rad/sec	body axis yaw rate due to curvature
46	PT	rad/sec	total roll rate
47	QT	rad/sec	total pitch rate
48	RT	rad/sec	total yaw rate
49	PBWN	rad/sec	total roll rate WRT wind
50	QBWN	rad/sec	pitch rate WRT wind
51	RBWN	rad/sec	yaw rate WRT wind
52	PTURB	rad/sec	apparent roll rate due to turbulence
53	QTURB	rad/sec	apparent pitch rate due to turbulence
54	RTURB	rad/sec	apparent yaw rate due to turbulence
55	PBD	rad/sec <sup>2</sup>	roll acceleration
56	QBD	rad/sec <sup>2</sup>	pitch acceleration
57	RBD	rad/sec <sup>2</sup>	yaw acceleration
58	UB	ft/sec	body axis - x component of airspeed
59	VB	ft/sec	body axis - y component of airspeed
60	WB	ft/sec	body axis - z component of airspeed
61	UTURB	ft/sec	x - body axis turbulence
62	VTURB	ft/sec	y - body axis turbulence
63	WTURB	ft/sec	z - body axis turbulence
64	VN	ft/sec	aircraft north inertial velocity
65	VE	ft/sec	aircraft east inertial velocity
66	VD	ft/sec	aircraft inertial down velocity
67	VEE	ft/sec	aircraft east velocity relative to ground
68	VT	ft/sec	aircraft total velocity
69	VG	ft/sec	ground velocity
70	VRW	ft/sec	airspeed
71	RMACH	-	Mach number
	XMACH		
72	VNR	ft/sec	relative wind north
73	VER	ft/sec	relative wind east
74	VDR	ft/sec	relative wind down
75	VEQ	kts	equivalent airspeed
76	VNW	ft/sec	north wind component
77	VEW	ft/sec	east wind component
78	VDW	ft/sec	vertical wind component
79	-	-	-
80	ALTD	ft/sec	aircraft sink/climb rate, + up
81	XLOND	rad/sec	rate of change of aircraft longitude
82	XLATD	rad/sec	rate of change of aircraft latitude
83	ALT	ft	aircraft altitude above sea level
84	XLON	rad	aircraft longitude
85	XLAT	rad	aircraft latitude
86	SLAT	-	sine of latitude
87	CLAT	-	cosine of latitude

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
88	VND	ft/sec <sup>2</sup>	aircraft north acceleration
89	VED	ft/sec <sup>2</sup>	aircraft east acceleration
90	VDD	ft/sec <sup>2</sup>	aircraft vertical acceleration
91	AX	ft/sec <sup>2</sup>	x - body axis acceleration at cg
92	AY	ft/sec <sup>2</sup>	y - body axis acceleration at cg
93	AZ	ft/sec <sup>2</sup>	z - body axis acceleration at cg
94	AXP	ft/sec <sup>2</sup>	body axis x acceleration at pilot station
95	AYP	ft/sec <sup>2</sup>	body axis y acceleration at pilot station
96	AZP	ft/sec <sup>2</sup>	body axis z acceleration at pilot station
97	G	ft/sec <sup>2</sup>	acceleration of gravity
98	-	-	-
99	-	-	-
100	-	-	-
101	VCAL	kts	calibrated airspeed
102	-	-	-
103	XPR	ft	ship axis pilot x position
104	YPR	ft	ship axis pilot y position
105	HPR	ft	pilot eye altitude above sea level
106	DNR	ft	relative position of aircraft cg north of reference
107	DER	ft	relative position of aircraft cg east of reference
108	RR	ft	height of runway above center of earth
109	RTV	ft	height of aircraft above center of earth
110	COURSE	rad	ship heading
111	XLATR	rad	latitude of reference point
112	XLONR	rad	longitude of reference point
113	CLATR	-	cosine of latitude
114	STHETR	-	sine of aircraft attitude
115	CTHETR	-	cosine of aircraft attitude
116	XIXX	slug-ft <sup>2</sup>	aircraft roll inertia in body axes
117	XIYY	slug-ft <sup>2</sup>	aircraft pitch inertia
118	XIZZ	slug-ft <sup>2</sup>	aircraft yaw inertia
119	XIXZ	slug-ft <sup>2</sup>	aircraft cross inertia
120	XMC(1)	-	inertial coefficient
121	XMC(2)	-	inertial coefficient
122	XMC(3)	1/slug-ft <sup>2</sup>	inertial coefficient
123	XMC(4)	1/slug-ft <sup>2</sup>	inertial coefficient
124	XMC(5)	-	inertial coefficient
125	XMC(6)	-	inertial coefficient
126	XMC(7)	1/slug-ft <sup>2</sup>	inertial coefficient
127	XMC(8)	-	inertial coefficient
128	XMC(9)	-	inertial coefficient
129	XMC(10)	1/slug-ft <sup>2</sup>	inertial coefficient
130	XMASS	slug	aircraft mass
131	CL	-	lift coefficient
132	CD	-	drag coefficient

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
133	CX	-	aircraft x axis aero force coefficient
134	CY	-	y axis aero force coefficient
135	CZ	-	z axis aero force coefficient
136	FAX	lb	aero x axis force
137	FAY	lb	y axis aero force
138	FAZ	lb	z axis aero force
139	FEX	lb	x axis engine force
140	FEY	lb	y axis engine force
141	FEZ	lb	z axis engine force
142	FGX	lb	x axis landing gear force
143	FGY	lb	y axis landing gear force
144	FGZ	lb	z axis landing gear force
145	FTX	lb	x axis total force
146	FTY	lb	y axis total force
147	FTZ	lb	z axis total force
148	FN	lb	total aircraft force north
149	FE	lb	total aircraft force east
150	FD	lb	total aircraft force down
151	FG	lb	gravity force
152	CLL	-	rolling moment coefficient
153	CLM	-	pitching moment coefficient
154	CLN	-	yawing moment coefficient
155	TAL	ft-lb	aerodynamic rolling moment
156	TAM	ft-lb	aerodynamic pitching moment
157	TAN	ft-lb	aerodynamic yawing moment
158	TEL	ft-lb	engine rolling moment
159	TEM	ft-lb	engine pitching moment
160	TEN	ft-lb	engine yawing moment
161	TGL	ft-lb	landing gear rolling moment
162	TGM	ft-lb	gear pitching moment
163	TGN	ft-lb	gear yawing moment
164	TTL	ft-lb	total rolling moment
165	TTM	ft-lb	total pitching moment
166	TTN	ft-lb	total yawing moment
167	DT1	sec	loop1 frame time
168	DT2	sec	loop2 frame time
169	DT3	sec	loop3 frame time
170	HR	ft	runway height above sea level
171	-	-	
172	-	-	
173	-	-	
174	XCC	ft	aircraft x location in ship coordinates
175	YCC	ft	aircraft y location
176	HCC	ft	aircraft height above runway
177	WAIT	lb	aircraft weight
178	QBAR	lb/ft <sup>2</sup>	dynamic pressure

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
179	QBARC	lb/ft <sup>2</sup>	stagnation - static pressure
180	AREA	ft <sup>2</sup>	wing area
181	SPAN	ft	wing span
182	CHORD	ft	mean aerodynamic chord
183	RHO	slug/ft <sup>3</sup>	air density
184	DXPA (1)	ft	nose gear x station
185	DXPA (2)	ft	main gear x station
186	DXPA (3)	ft	right wing gear x station
187	DXPA (4)	ft	left wing gear x station
188	DXPA (5)	ft	pilot x station
189	DXPA (6)	ft	tail x station
190	DXPA (7)	ft	ram drag x station
191	DXPA (8)	ft	front nozzle x station
192	DXPA (9)	ft	rear nozzle x location
193	DXPA (10)	ft	front pitch jet x station
194	DXPA (11)	ft	rear pitch jet x station
195	DXPA (12)	ft	yaw jet x station
196	DXPA (13)	ft	right wing jet x station
197	DXPA (14)	ft	left wing jet x station
198	DXCG	ft	cg reference x station
199			
200	VX	ft/sec	aircraft x axis inertial velocity
201	VY	ft/sec	aircraft y axis inertial velocity
202			
203			
204			
205			
206			
207			
208			
209	SOUND	ft/sec	speed of sound
210	DYPA (1)	ft	nose gear y station
211	DYPA (2)	ft	main gear y station
212	DYPA (3)	ft	right wing gear y station
213	DYPA (4)	ft	left wing gear y position
214	DYPA (5)	ft	pilot y station
215	DYPA (6)	ft	tail y station
216	DYPA (7)	ft	ram drag y station
217	DYPA (8)	ft	front nozzle y station
218	DYPA (9)	ft	rear nozzle y location
219	DYPA (10)	ft	front pitch jet y station
220	DYPA (11)	ft	rear pitch jet y station
221	DYPA (12)	ft	yaw jet y station
222	DYPA (13)	ft	right wing jet y location
223	DYPA (14)	ft	left wing jet y location
224	DYPA (15)	ft	aircraft lateral cg position

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
225	XP	ft	pilot x position WRT cg
226	YP	ft	pilot y position WRT cg
227	ZP	ft	pilot z position WRT cg
228	-	-	-
229	VDIC	ft/sec	trim vertical velocity
230	PHIIC	deg	trim bank angle
231	THETIC	deg	trim pitch attitude
232	PSIIC	deg	trim heading angle
233	GAMVIC	deg	initial vertical path angle
234	GAMHIC	deg	horizontal path angle
235	PBIC	rad/sec	initial roll rate
236	QBIC	rad/sec	initial pitch rate
237	RBIC	rad/sec	initial yaw rate
238	VEQIC	kts	trim equivalent airspeed
239	XIC	ft	initial aircraft x location
240	YIC	ft	initial aircraft y location
241	HIC	ft	initial altitude
242	WAITIC	lb	initial aircraft weight
243	XIXXIC	slug-ft <sup>2</sup>	initial roll inertia
244	XIYYIC	slug-ft <sup>2</sup>	initial pitch inertia
245	XIZZIC	slug-ft <sup>2</sup>	initial yaw inertia
246	XIXZIC	slug-ft <sup>2</sup>	initial cross-product inertia
247	WFUELIC	lb	initial fuel weight
248	WWATIC	lb	initial water weight
249	WFUEL	lb	fuel weight
250	WWAT	lb	water weight
251	WAITO	lb	initial empty weight
252	WSTORE	lb	store weight
253	-	-	-
254	DXCGO	ft	x location of mac leading edge
255	DZCGO	ft	z location of aero data reference chord
256	CG	percent	aircraft center of gravity WRT mac
257	DZPA (1)	ft	nose gear z location
258	DZPA (2)	ft	main gear z station
259	DZPA (3)	ft	right wing gear z station
260	DZPA (4)	ft	left wing gear z station
261	DZPA (5)	ft	pilot z position
262	DZPA (6)	ft	tail z position
263	DZPA (7)	ft	ram drag z position
264	DZPA (8)	ft	front nozzle z position
265	DZPA (9)	ft	rear nozzle z position
266	DZPA (10)	ft	front nozzle pitch jet z position
267	DZPA (11)	ft	rear pitch jet z position
268	DZPA (12)	ft	yaw jet z position
269	DZPA (13)	ft	right wing jet z position
270	DZPA (14)	ft	left wing jet z position

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
271	DZPA (15)	ft	cg - cg reference z position
272	HDECK (1)	ft	deck height beneath nose gear
273	HDECK (2)	ft	deck height beneath main gear
274	HDECK (3)	ft	deck height beneath right wing gear
275	HDECK (4)	ft	deck height beneath left wing gear
276	HDECK (5)	ft	deck height beneath tail
277	-		
278	-		
279	XIG (1)	ft	inertial x location of nose gear
280	XIG (2)	ft	inertial x location of main gear
281	XIG (3)	ft	
282	XIG (4)	ft	
283	XIG (5)	ft	
284	XIG (6)	ft	
285	YIG (1)	ft	inertial y position of landing gear
286	YIG (2)	ft	
287	YIG (3)	ft	
288	YIG (4)	ft	
289	YIG (5)	-	
290	YIG (6)	-	
291	HIG (1)	ft	altitude of nose gear above sea level
292	HIG (2)	ft	altitude of main gear
293	HIG (3)	ft	altitude of right wing gear
294	HIG (4)	ft	altitude of left wing gear
295	HIG (5)	ft	-
296	HIG (6)	ft	-
297	-		
298	-		
299	-		
300	-		
301	-		
302	-		
303	TIME	sec	run time
304	RTIME	sec	maximum run time
305-331	-	-	-
332	TR	-	total temperature ratio
333	PR	-	total pressure ratio
334	-	-	-
335	DTIM1	sec	print time increment
336	TI	sec	print time interval switch point
337-357	-	-	-
358	D2R	rad/deg	converts radians to degrees
359	R2D	deg/rad	converts degrees to radians
360-363	-	-	-
364	RHOZ	slug/ft <sup>3</sup>	reference air density
365	HRHOZ	ft	reference altitude

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
366	TAMB	°k	ambient temperature
367	PAMB	lb/ft <sup>2</sup>	ambient pressure
368	TTOT	°k	total temperature
369	PTOT	lb/ft <sup>2</sup>	total pressure
370	DELAT	°k	temperature variation from standard at sea level
371	SQTEMPR	-	square root of temperature ratio
372-374	-	-	-
375	XMCC1	1/sec	inertial coefficient
376	XMCC2	1/sec	inertial coefficient
377	XMCC3	1/sec	inertial coefficient
378	XMCC4	1/sec	inertial coefficient
379	XMCC5	1/sec	inertial coefficient
380	XMCC6	1/sec	inertial coefficient
381	XMCC7	1/sec	inertial coefficient
382	EXMX	ft-lb-sec	rotor angular momentum
383	EXMY	ft-lb-sec	rotor angular momentum
384	EXMZ	ft-lb-sec	rotor angular momentum
385-390	-	-	-
391	STATE (1)	-	trim state variable
392	STATE (2)	-	trim state variable
393	STATE (3)	-	trim state variable
394	STATE (4)	-	trim state variable
395	STATE (5)	-	trim state variable
396	STATE (6)	-	trim state variable
397	CONT (1)	-	trim control variable
398	CONT (2)	-	trim control variable
399	CONT (3)	-	trim control variable
400	CONT (4)	-	trim control variable
401	CONT (5)	-	trim control variable
402	CONT (6)	-	trim control variable
403-405	-	-	-
406	UBIC	ft/sec	trim u velocity
407	VBIC	ft/sec	trim v velocity
408	WBIC	ft/sec	trim w velocity
409-412	-	-	-
413	UBD	ft/sec <sup>2</sup>	rate of change of UB
414	VBD	ft/sec <sup>2</sup>	rate of change of VB
415	WBD	ft/sec <sup>2</sup>	rate of change of WB
416	VTWN	ft/sec	total north wind
417	VTWE	ft/sec	total east wind
418	VTWD	ft/sec	total vertical wind
419	VNTURB	ft/sec	north component of turbulence
420	VETURB	ft/sec	east component of turbulence
421	VDTURB	ft/sec	vertical turbulence
422-432	-	-	-

## A Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
433	VDKN(1)	ft/sec	deck north velocity at nose gear location
434	VDKN(1)	ft/sec	deck north velocity at main gear
435	VDKN(1)	ft/sec	deck north velocity at right wing gear
436	VDKN(1)	ft/sec	deck north velocity at left wing gear
437	-	-	-
438	-	-	-
439	-	-	-
440	VDKE(1)	ft/sec	deck east velocity at nose gear location
441	VDKE(2)	ft/sec	deck east velocity at main gear
442	VDKE(3)	ft/sec	deck east velocity at right wing gear
443	VDKE(4)	ft/sec	deck east velocity at left wing gear
444	VDKE(5)	-	-
445	-	-	-
446	-	-	-
447	HDTDKE(1)	ft/sec	deck vertical velocity at cg
448	HDTDKE(2)	ft/sec	deck vertical velocity at nose gear
449	HDTDKE(3)	ft/sec	deck vertical velocity at main gear
450	HDTDKE(4)	ft/sec	deck vertical velocity at right wing gear
451	HDTDKE(5)	ft/sec	deck vertical velocity at left wing gear
452-453	-	-	-
454	VR	ft/sec	relative aircraft deck velocity
455	FGQM	lb	maximum braking force
456-500	-	-	-

## B Common

NUMBER	NAME	COMPUTED UNITS	DEFINITION
1	STAB	deg	stabilizer deflection
2	AIL	deg	aileron deflection
3	RUD	deg	rudder deflection
4	-	-	-
5	STAB1	deg	pilot commanded stabilizer
6	PSAS	deg	pitch SAS command
7	RLONSTK	in	longitudinal stick
8	RLNSTKO	in	trim longitudinal stick
9	RLATSTK	in	lateral stick
10	RLTSTKO	in	trim lateral stick
11	RUDPED	in	rudder pedal
12	YSAS	deg	yaw SAS position
13	RSAS	deg	roll SAS command
14	THROT	deg	throttle position
15	THROTIC	deg	trim throttle
16	THTNC	deg	engine nozzle angle command
17	THTN	deg	engine nozzle angle
18	THTNIC	deg	trim nozzle angle
19	RNI	percent	engine RPM
20	TOUT	lb	engine gross thrust
21	RPEDO	in	trim rudder pedal
22	THRTMN	-	minimum trim throttle
23	THRTMX	-	maximum trim throttle
24	THTMN	deg	minimum trim attitude
25	THTMX	deg	maximum trim attitude
26	PHIMN	deg	minimum trim bank angle
27	PHIMX	deg	maximum trim bank angle
28	PEDMN	in	minimum trim pedal
29	PEDMX	in	maximum trim pedal
30	VS	ft/sec	ship speed
31-32	-	-	-
33	THTNMN	deg	minimum trim nozzle angle
34	THTNMX	deg	maximum trim nozzle angle
35	VNWBIC	ft/sec	north component of wind
36	VEWBIC	ft/sec	east component of wind
37	BETAIC	deg	trim sideslip
38	STKMIN	in	minimum trim longitudinal stick
39	STKMAX	in	maximum trim longitudinal stick
40	RLSMIN	in	minimum lateral trim stick
41	RLSMAX	in	maximum lateral stick
42	ALFAIC	deg	trim angle of attack
43	-	-	-
44	TFPJ	lb	front pitch jet thrust
45	TRPJ	lb	rear pitch jet thrust
46	TYAWJ	lb	yaw jet thrust
47	TRRJ	lb	right roll jet thrust

## B Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
48	TLRJ	lb	left roll jet thrust
49	TFPJ1	lb	maximum front pitch jet thrust
50	TRPJ1	lb	rear pitch jet reference thrust
51	TRJ1	lb	roll jet reference thrust
52	TYAWJ1	lb	yaw jet reference thrust
53	WWDOT1	lb/sec	engine water flow rate
54	-	-	-
55	-	-	-
56	TAUENG	sec	engine time constant
57	RDRAG	lb	ram drag
58	TFN	lb	front nozzle gross thrust
59	TRN	lb	rear nozzle gross thrust
60	VJRCS	ft/sec	RCS jet velocity
61	DGE	-	% thrust loss due to suckdown
62	ALT1	ft	ground effect altitude limit
63	GEF1	-	suckdown coefficient
64	GEF2	1/ft	suckdown coefficient
65	ALTGE	ft	suckdown coefficient
66	FCR	lb/sec/%	fuel consumption rate
67	ALRJ	in <sup>2</sup>	left roll jet area
68	AFPJ	in <sup>2</sup>	front pitch jet area
69	ARPJ	in <sup>2</sup>	rear pitch jet area
70	ARRJ	in <sup>2</sup>	right roll jet area
71	AYAWJ	in <sup>2</sup>	yaw jet area
72	CSPLAYF	-	cosine of front nozzle splay angle
73	CSPLAYR	-	cosine of rear nozzle splay angle
74	CRJ	-	cosine of roll jet angle
75	CFPJA	-	cosine of front pitch jet angle
76	CRPJA	-	cosine of rear pitch jet angle
77	SFPJA	-	sine of front pitch jet angle
78	SRPJA	-	sine of rear pitch jet angle
79	SRJ	-	sine roll jet angle
80	RLAM1	rad	component of deck tilt along aircraft x axis
81	RLAM2	rad	component of deck tilt along aircraft y axis
82	PHIS	rad	ship roll angle
83	THETS	rad	ship pitch angle
84	PSIS	rad	ship yaw angle
85	THETSD	rad/sec	ship pitch rate
86	PHISD	rad/sec	ship roll rate
87	PSISD	rad/sec	ship yaw rate
88	HEAVE	ft	ship heave at cg
89	HEAVED	ft/sec	ship heave velocity at cg
90	SURGE	ft	ship fore-aft motion
91	SURGED	ft/sec	ship fore-aft transient velocity

## B Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
92	SWAY	ft	ship transient lateral motion
93	SWAYD	ft/sec	ship lateral velocity
94	XIS	ft	aft deck limit
95	X2S	ft	forward deck limit
96	Y1S	ft	port deck limit
97	Y2S	ft	starboard deck limit
98	X3S	ft	bow location
99	H3S	ft	superstructure height
100	H1S	ft	deck mean height
101	XTD	ft	longitudinal ideal touchdown point
102	YTD	ft	lateral ideal touchdown point
103	HIPS	ft	ship roll/pitch height
104	HMAG	ft	ship heave magnitude
105	PHIROL	rad	phase of ship roll
106	PHIHV	rad	phase of ship roll
107	OMEGH	rad/sec	frequency of heave motion
108	OMEGR	rad/sec	frequency of ship roll
109	ROLLM	rad	magnitude of ship roll
110	PITCHM	rad	ship pitch magnitude
111	OMEGP	rad/sec	ship pitch frequency
112	PHIP	rad	ship pitch phase
113	YAWM	rad	ship yaw magnitude
114	OMEGY	rad/sec	frequency of ship yaw
115	PHIY	rad	phase of ship yaw
116	SURGM	ft	magnitude of ship surge
117	OMEGSRG	rad/sec	frequency of ship surge
118	PHISRG	rad	phase of ship surge
119	SWAYM	ft	maximum ship sway
120	OMEGSWY	rad/sec	frequency of ship sway
121	PHISWY	rad	phase of ship roll
122	VJR	-	jet nozzle velocity ratio
123	CDQ	1/rad	drag coefficient due to pitch rate
124	CLADOT	1/rad	lift coefficient due to rate of change of angle of attack
125	CLP	1/rad	roll moment coefficient due to roll rate
126	CMQ	1/rad	pitching moment coefficient due to pitch rate
127	CYDR	1/deg	sideforce coefficient due to rudder
128	CYR	1/rad	sideforce coefficient due to yaw rate
129	CLDA	1/deg	roll moment coefficient due to aileron
130	CLQ	1/rad	lift coefficient due to pitch rate
131	CMADT	1/rad	pitching moment coefficient due to rate of change of alfa
132	CNDR	1/deg	yawing moment coefficient due to rudder
133	CNR	1/rad	yaw moment coefficient due to yaw rate
134	CYDA	1/deg	sideforce coefficient due to aileron

## B Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
135	CYP	1/rad	sideforce coefficient due to roll rate
136-139	-	-	-
140	HE	ft	height of landing gear above touchdown point
141	XE	ft	x distance from aircraft to touchdown point
142	YE	ft	y distance from aircraft to touchdown point
143	ALTCOM	ft	commanded altitude
144	ALTDCOM	ft/sec	commanded climb rate
145	YCOM	ft	commanded lateral position
146	XCOM	ft	commanded x position
147	THETCOM	deg	pitch command
148	PHICOM	deg	bank command
149	VXCOM	ft/sec	commanded airspeed
150	PSICOM	deg	heading command
151	CMSTR1	-	store pitch coefficient
152	CLSTR3	-	store lift increment
153	UGST	(ft/sec) <sup>2</sup>	rms u gust
154	VGST	(ft/sec) <sup>2</sup>	mean square v gust
155	WGST	(ft/sec) <sup>2</sup>	mean square w gust
156	XFRZ	ft	burble freeze range
157	SWBSW	-	w burble scale factor
158	SUBSW	-	u burble scale factor
159	-	-	-
160	RKQ	deg/rad/sec	SAS pitch rate gain
161	TLEADP	sec	pitch SAS lead time constant
162	PSAS1	deg/sec	pitch SAS feedback term
164	-	-	-
165	RBWSHI	deg/sec	yaw SAS coefficient
166	RBWSH	deg	output of yaw rate washout filter
167	RKDRRB	deg/rad/sec	yaw rate to rudder gain
168	TLAGRB	sec	yaw rate lag constant
169	RKDRA Y	deg/ft/sec	yaw SAS gain
170	TLEADAY	sec	yaw SAS time constant
171	TLAGAY	sec	yaw SAS time constant
172	AYFILTI	deg	lateral acceleration filter term
173	AYFILT	deg	lateral acceleration filter output
174	YSAS2	deg	lateral SAS output
175	RINCNT	deg	rudder command due to aileron
176	RKDRDA	deg/deg	rudder interconnect gain
177	YSAS1	deg	SAS input to rudder
178	YSASLIM	deg	SAS rudder limit
179	RPEDA	deg/rad/sec	roll SAS gain
180	TLEADDA	sec	roll SAS time constant
181	TLAGDA	sec	roll SAS time constant

B Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
182	PBWSH	deg	output of roll rate washout
183	FWSHI	deg	roll SAS term
184	PSASLIM	deg	pitch SAS limit
185	AIRC	deg	aileron command
186	TAUACDA	sec	aileron time constant
187	TAUACHS	sec	elevator time constant
188	RUD2	deg	total RCS yaw command
189	XTDI	ft	inertial x location of touchdown point
190	YTDI	ft	y location of touchdown point
191	TAUALPH	sec	pilot model time constant
192-200	-	-	-

## IB Common

NUMBER	NAME	DEFINITION
1	IHOV	hover configuration flag
2	ICON	conventional flight flag
3	ILAND	deck landing switch
4	IZERO	statistical array zero flag
5	IHNDOFF	hands off takeoff switch
6	ITRANS	transition flight flag
7	ISWAT	water injection switch
8	IFUEL	fuel exhaustion flag
9	ICRASH	crash flag
10	-	-
11	ICOPY	statistics print control
12	ISET	brake application switch
13	-	-
14	ITD	touchdown flag
15	IDA	deck edge crossing flag
16	IONCE	turbulence sequence control
17	IHOLD	altitude hold switch
18	IPITCH	ship pitch induced wind switch
19	IHIT	ground trim flag
20	IWIND	turbulence switch
21	ILTURB	turbulence switch
22	NCHK	control input selector
23	MCHK	input type selector
24	IBFRZ	burble freeze control
25	ILBURB	burble control switch
26	IPDAMP	roll damper switch
27	IQDAMP	pitch damper switch
28	IRDAMP	yaw damper switch
29	IBRAK	brake application switch
30	ITASK	control task switch
31	IGRAD	trim gradient evaluation switch
32-35	-	-
36	NCNT	calcomp plot point count
37	ISTOR2	outboard store flag
39	-	-
40	ITHIS	time response print switch
41	IUPLOT	calcomp plot switch
42	ISTAT	statistics printout switch
43-44	-	-
45	IPITCH	ship pitch induced wind
46-48	-	-
49	J2	trim iteration limit
50	JLAND	landing switch

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I HTRUCK

Pilot Modik - hover Control  
Switch

## IA Common

NUMBER	NAME	DEFINITION
1	IMODE	mode switch
2-5	-	-
6	IFLAT	flat earth switch
7	IFFCI	constant position switch
8-9	-	-
10	ITOUCH(1)	nose gear contact flag
11	ITOUCH(2)	main gear contact flag
12	ITOUCH(3)	right wing gear contact flag
13	ITOUCH(4)	left wing gear contact flag
14	ITOUCH(5)	-
15	IOVDK	over deck switch
16	I2DOF	2 degree of freedom pitch following mode
17-20	-	-
21	IEVAL	trim gradient evaluation flag
22	-	-
23	ITPROG	trim switch
24-60	-	-
61	IDT1	first loop time increment milli-sec
62	IDT2	second loop time increment milli-sec
63	IDT3	third loop time increment milli-sec
64	ICG	trim altitude flag
65	ID	trim flag
66-89	-	-
90-101	ICHNBF(I,J)	printout title number
102	ITRIM	trim switch
103	ITRMP	past value of trim switch
104	IGEAR	landing gear switch
105	NRUN	number of runs
106-109	-	-
110	INDEXT	trim mode switch
111	ITRMCM	trim command switch
112-113	-	-
114	IMACH	airspeed trim switch
115-117	-	-
118	J1	trim iteration count
119-123	-	-
124	ICPRNT	initial condition print switch
125-140	-	-
141	ICOND	constant density flag
142-166	-	-
167	IM	trim state counter
168-178	-	-
179	IREVAL	gradient flag
180	NUSED	loop 3/loop 2 frame time
181-183	-	-
184	IEULR	trim velocity flag
185	IETURB	turbulence coordinate flag

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I In REF

Deck

IA Common (Cont'd)

NUMBER	NAME	DEFINITION
186	-	-
187	ITOMTR	alfa, beta rate flag
188-198	-	-
199	N2	run counter
200	-	-
24	ITape	Ship input Flag
25	ISTART	Ship input Flag
26	IFILE	Ship input Flag
27	K1	"
28	JFILM*	"
29	JSTART	"
30-50	Nlag	pilot model Lag index

## GA Common

NUMBER	NAME	COMPUTED UNITS	DEFINITION
1	FAC	-	plot scale factor
2-17	-	-	-
18	FREQCK	rad/sec	sinusoidal input frequency
19	T0	sec	input switch time
20	T1	sec	input switch time
21	T2	sec	input switch time
22	RMAG	-	input magnitude
23	DTIM2	sec	printout time interval
24-29	-	-	-
30-35	GA (I)	ft/sec	turbulence scale
36	VERI1	ft	throttle integral feedback limit
37	ALT1	ft	control switch altitude
38	RK1V	deg/ft/sec	throttle gain
39	RK2V	deg/ft	throttle gain
40	-	-	-
41	RKRUD1	in/rad/sec	yaw rate to rudder gain
42	RKRUD2	in/rad	sideslip to rudder gain
43	ALT2	ft	switch altitude
44	RKTHT1	rad/ft/sec <sup>2</sup>	pitch command gain
45	RKALPH	rad/rad	angle of attack to pitch command gain
46	THET1	rad	minimum pitch attitude command
47	ALT3	ft	altitude command
48	RKALTD	1/sec	altitude rate command gain
49	THETCO	rad	pitch attitude command
50	RKTHT2	rad/ft	pitch command gain
51	RKTHT3	rad/ft/sec	pitch command gain
52	RKTHT4	rad/ft/sec	pitch command gain
53	RKYE	rad/ft	roll command gain
54	RKVE	rad/ft/sec	roll command gain
55	RKPSI	rad/rad	roll command gain
56	RKPHILT	in/rad	lateral stick gain
57	RKPLT	in/rad/sec	lateral stick gain
58	RKTHLN	in/rad	longitudinal stick gain
59	RKQLN	in/rad/sec	longitudinal stick gain
60	RKNOZLN	in/deg	longitudinal stick/nozzle angle gain
61	VRW1	ft/sec	switching speed
62	ALT4	ft	switching altitude
63	THTNC1	deg	nozzle angle command
64	XCG1	ft	switching range
65	VRW2	ft/sec	switching speed
66	VRW3	ft/sec	switching speed
67	VRW4	ft/sec	switching speed
68	ALT5	ft	switching altitude
69	RKTHT5	rad/ft	pitch command gain
70	RKVY1	-	bank command gain
71	RKVX1	rad/ft/sec	pitch command gain

## GA Common (Cont'd)

NUMBER	NAME	COMPUTED UNITS	DEFINITION
72	RKVY2	-	bank command gain
73	RKVX2	rad/ft/sec	pitch command gain
74	RKYPHI	rad/ft	bank command gain
75	RKPHIVY	rad/ft/sec	bank command gain
76	RLNTH2	in/rad	longitudinal stick gain
77	RLNQB2	in/rad/sec	longitudinal stick gain
78	RLTPHI2	in/rad	lateral stick gain
79	RLTPB2	in/rad/sec	lateral stick gain
80	RPR1	in/rad/sec	rudder gain
81	RPPS11	in/rad	rudder gain
82	RTHROT	deg/ft	throttle gain
83	RTHROT1	deg/ft/sec	throttle gain
84	RTHROT2	deg/ft/sec	throttle gain
85	ALFTRM1	deg	reference angle of attack
86	XCG2	ft	switch range
87	TPITCH	sec	pitch command time limit
88	THET2	rad	pitch command limit
89	RPM <del>MAX</del>	RPM	maximum engine speed
90	THCOR	-	engine thrust correction factor
91	RTHROT3	deg/ft/sec <sup>2</sup>	throttle gain



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APPENDIX F  
GUST CHARACTERISTICS

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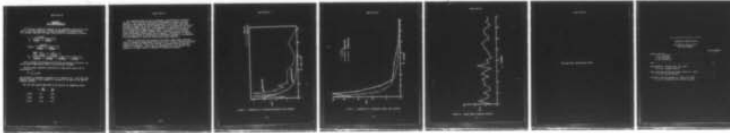
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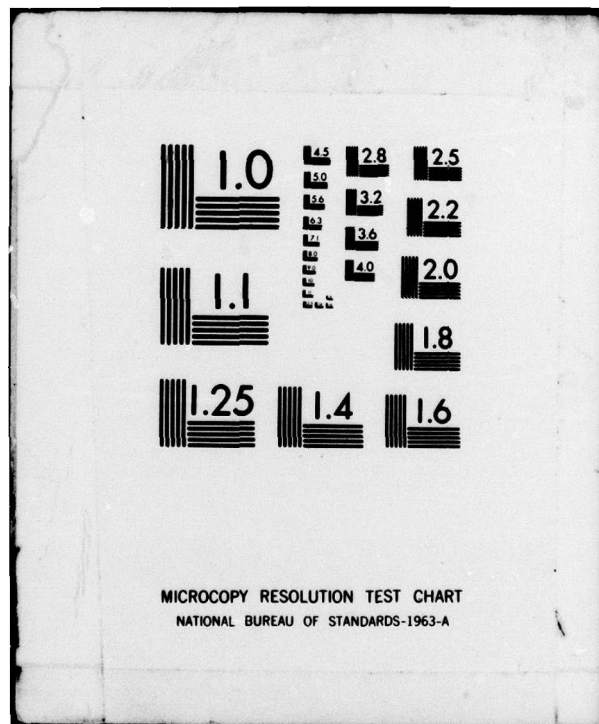
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APPENDIX F  
GUST CHARACTERISTICS

The free air turbulence component of the atmospheric disturbance model used in the VSTOL simulation is based on Appendix B of MILSPEC AR-40. This document specifies the power spectrum for air turbulence as follows:

$$\phi_{v_s} = \frac{71.6/V_0^3}{\left(\frac{s}{V_0/100} + 1\right) \left(\frac{-s}{V_0/100} + 1\right)}$$

$$\phi_{\Delta u_g/u_0} = \frac{200/V_0^3}{\left(\frac{s}{V_0/100} + 1\right) \left(\frac{-s}{V_0/100} + 1\right)}$$

$$\phi_{s_g} = \frac{\left(\frac{940}{V_0^3}\right) \left(\frac{-s}{V_0/400} + 1\right) \left(\frac{-s}{V_0/400} + 1\right)}{\left(\frac{-s}{3V_0/400} + 1\right) \left(\frac{s}{3V_0/400} + 1\right) \left(\frac{-s}{V_0/1000} + 1\right) \left(\frac{s}{V_0/1000} + 1\right)}$$

These represent the frequency distribution of vertical, horizontal, and lateral gusts respectively, and  $V_0$  is the aircraft airspeed.

The mean square amplitude represented by these power spectra may be calculated as

$$G^2 = \int_{-\infty}^{\infty} s(\omega) d\omega$$

This integral is tabulated in Appendix IV of reference (f). The factor  $1/2\pi$  normally included in this integral is contained in the gain of the spectral transfer function.

The root mean square amplitudes of the spectra are summarized below:

	$G - \frac{ft}{sec}$	$\frac{ft}{sec}$
U gust	2.5	.762
V gust	2.39	.728
W gust	1.50	.457

The simulation model was used to generate a representative turbulence sequence. Then these data were fourier transformed to compute the power spectrum of the simulated turbulence generated by the digital algorithms. As shown in Figures 24 and 25, the general shape of the theoretical and actual distribution agree rather well. The comparison is complicated by the fact that the finite data sample length results in a cutoff of the DC portion of the signal and a rather irregular curve. Therefore, only the general shape and frequency distribution can be compared. Nevertheless, it appears that the model should be satisfactory for simulation purposes if the magnitude is scaled properly to yield the desired mean square amplitude.

Figure 26 illustrates the spectrum of the basic random number generator which is intended to approximate white noise with a constant spectral amplitude. Although the spectrum is not truly uniform, it does not show any definite trends with frequency. Thus, it may be considered flat in an average sense. Therefore, the model should be adequate for simulation purposes.

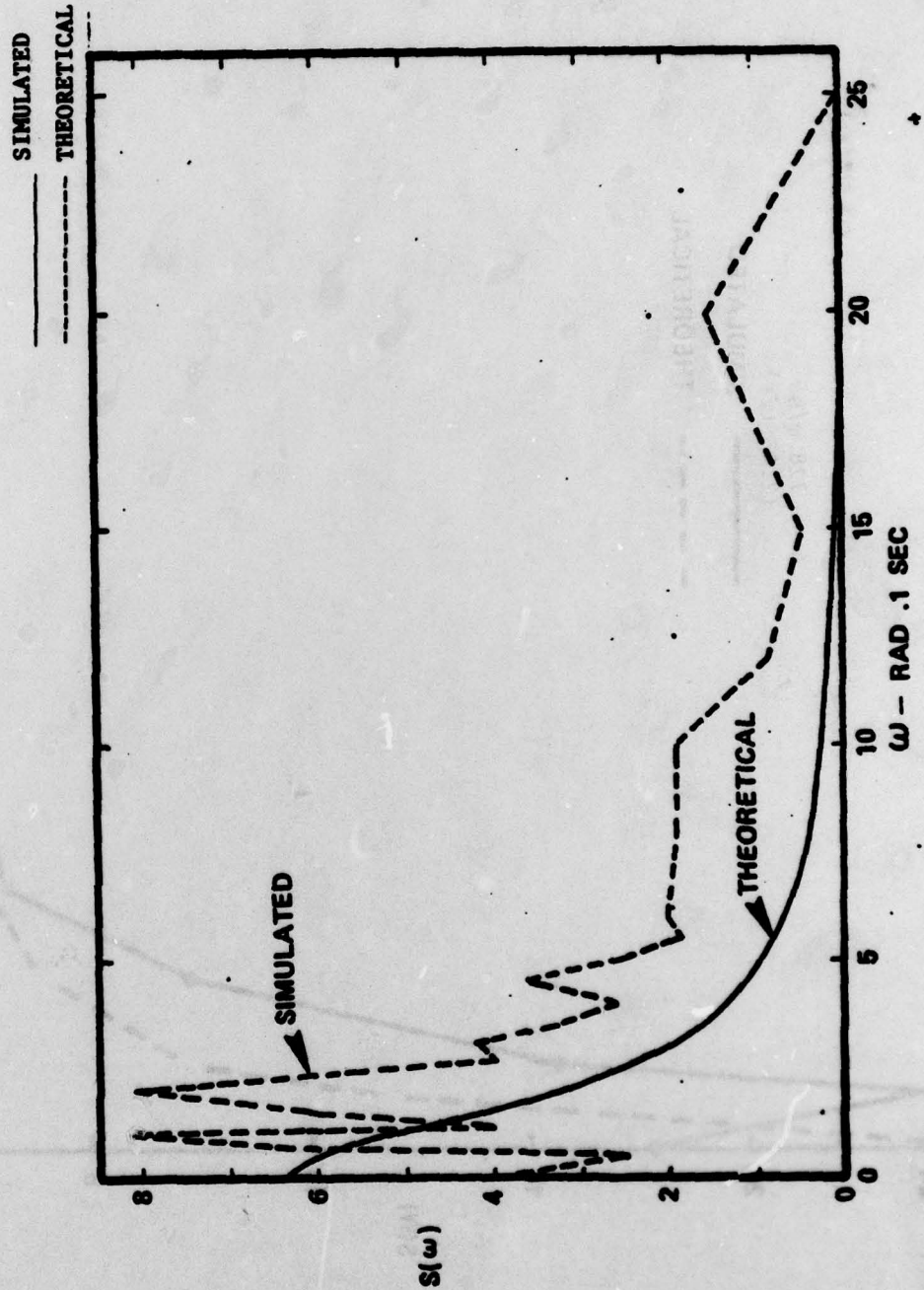


FIGURE 24. THEORETICAL VS. SIMULATED HORIZONTAL GUST SPECTRUM

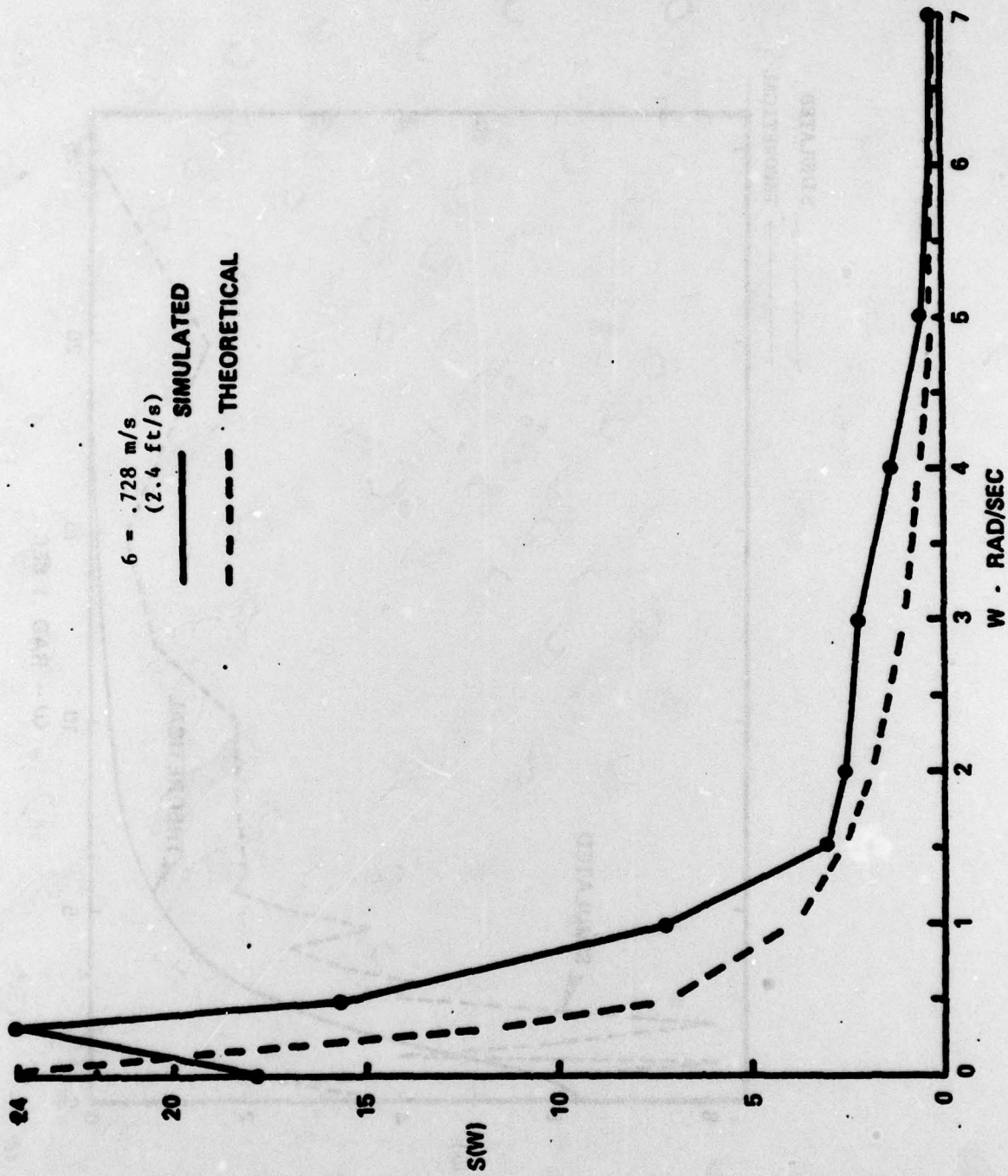


FIGURE 25. THEORETICAL VS. SIMULATED LATERAL GUST SPECTRUM

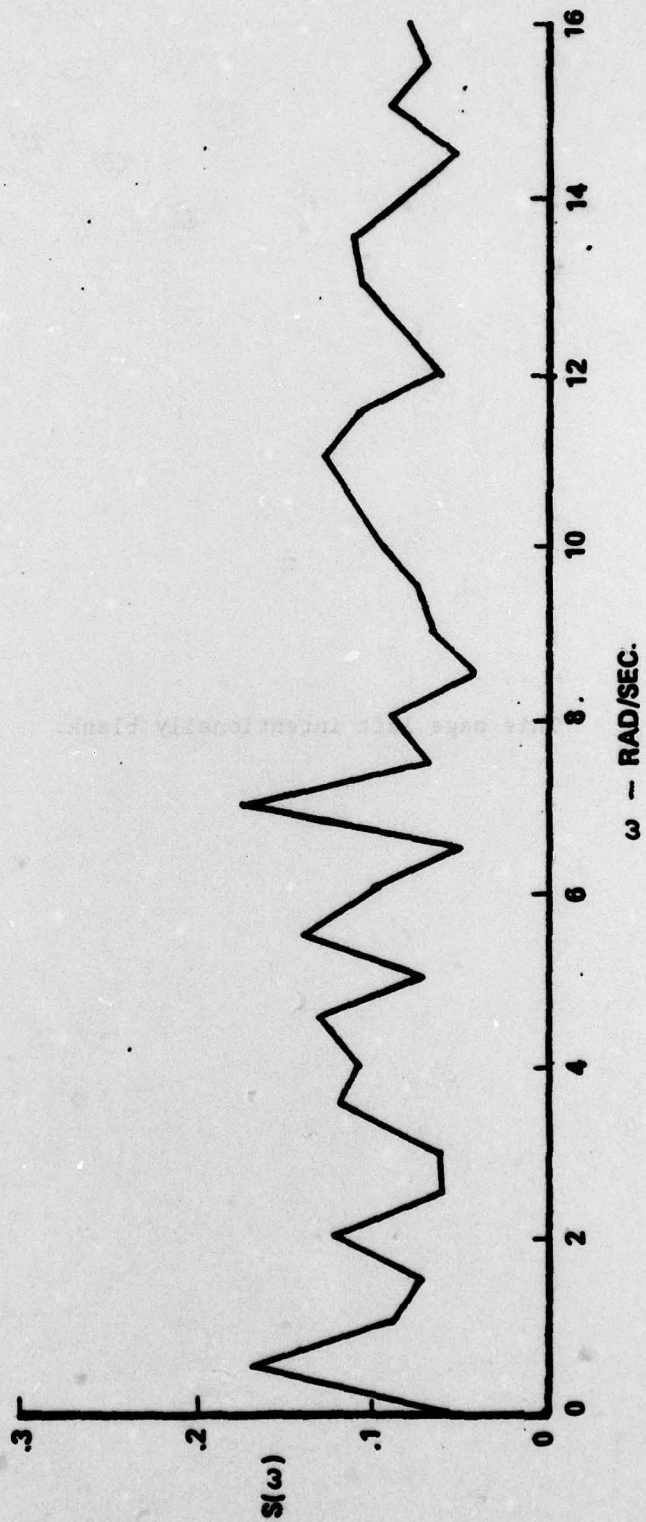
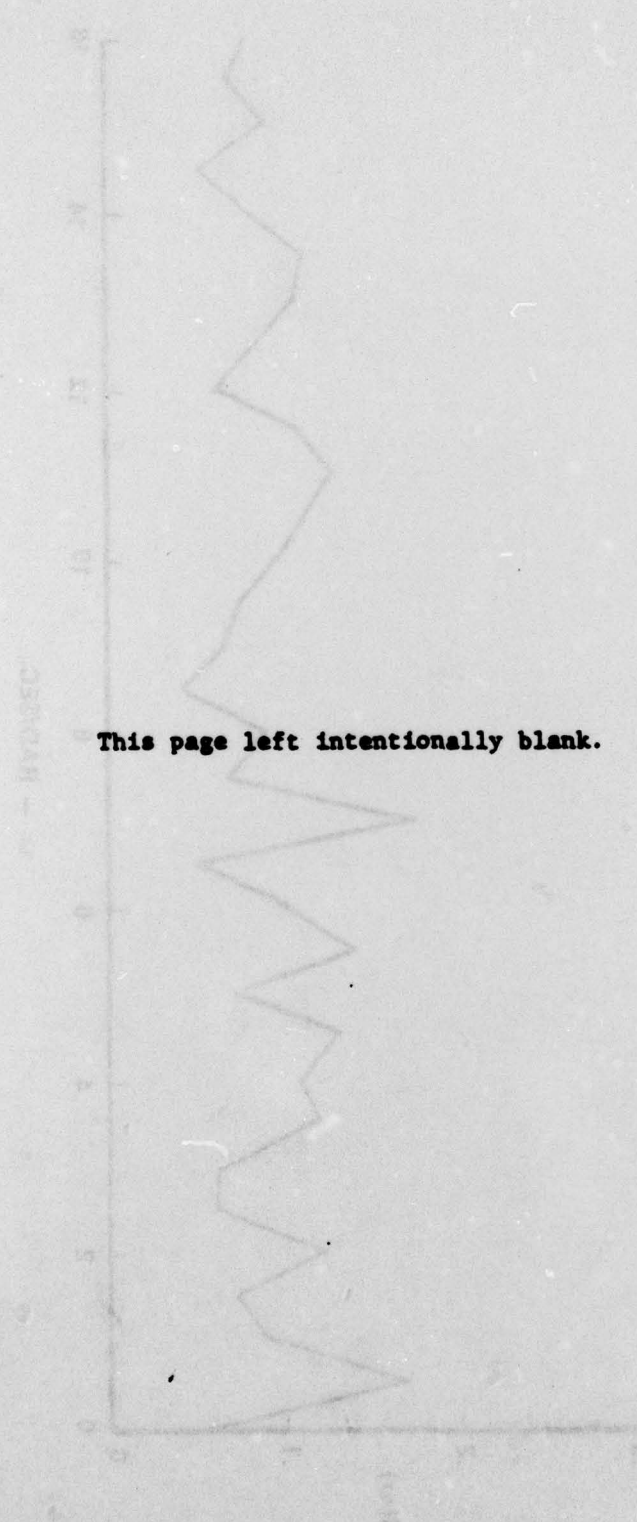


FIGURE 26. RANDOM NUMBER GENERATOR SPECTRUM

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FIGURE 12. TYPICAL WIND SPEED RECORD FOR 10 MINUTES

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