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USER'S GUIDE FOR AN OPTICAL CONSTRAST SEEKER MONTE CARLO TERMINAL HOMING SIMULATION

S. L. O'Hanian, et al

Army Missile Research, Development and Engineering Laboratory
Redstone Arsenal, Alabama

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USER'S GUIDE FOR AN OPTICAL CONTRAST SEEKER MONTE CARLO TERMINAL HOMING SIMULATION

S. L. O'Hanian, A. W. Lee, Jr., and C. L. Lewis
Guidance and Control Directorate
US Army Missile Research, Development and Engineering Laboratory
US Army Missile Command
Redstone Arsenal, Alabama 35809

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This report documents the development and incorporation of a stochastic Optical Contrast Seeker Model into the existent Monte Carlo point target terminal homing 6-DOF simulation program. In addition the basic pitch and yaw seeker platform dynamics, parameter target size, seeker breaklock, seeker blind range, transport log, and helicopter induced launch transients are included. Platform imperfections such as mass unbalance and rate gyro drifts were modeled. Each data point generated by the simulation is obtained from the statistical reduction of approximately 25 individual runs (depending on number of breaklocks),

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20. ABSTRACT (continued)

each of which has new random starting and within run variations. The runs are reduced by parametric or nonparametric means, depending on the normality of the miss distance points, to yield the miss bias (mean) and the circular error probability (GEP).

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1.0 INTRODUCTION

A stochastic simulation model of an Optical Contrast Seeker (OCS) was developed and incorporated into the existent Monte Carlo point target, laser guided, terminal homing 6-DOF simulation program described in reference 2. Two OCS simulation subroutines were developed: (1) a subroutine consisting of high and low frequency poles, and (2) a simplification of the first consisting of only low frequency poles. The non-essential high frequency poles of the OCS model were eliminated to reduce computer run time. This simplified subroutine is, in general, sufficient; however, either subroutine may be used by setting the appropriate flag.

The 6-DOF simulation program was modified to include a two-dimensional target and helicopter vibrations. The target dimensions are required for study of the OCS breaklock and blind-range phenomena. The helicopter vibrations were added to describe the missile launch transients.

The updated 6-DOF simulation program may continue to be run as either a stochastic or deterministic program. In the stochastic mode, the program executes a specified number of runs*, computes miss distance coordinates from each run, and then determines the CEP and other statistical parameters from the set of miss distances. Each run of the run set is made based on both initialization error conditions (mass unbalance, etc.) and time varying error conditions (wind, etc.) that are randomly generated from input error probability distributions. In the absence of statistical input data, the operation of the 6-DOF program reverts to that of the deterministic version of the program.

Because of the addition of the two OCS subroutines and associated 6-DOF program modifications, the computer program listing contained in this document supersedes the listings found in references 1 and 2. However, the deterministic program model description and input/output formats found in reference 1 and the stochastic program description and input/output formats found in reference 2 are still valid.

---

*A run is defined as the numerical integration of a missile trajectory from launch to target plane intercept.

2.0 FUNCTIONAL DESCRIPTION

Figures 2.1 and 2.2 are the block diagram representations of the OCS simulation model, Model S2. Figure 2.1 represents the pitch channel and Figure 2.2 represents the yaw channel. The transfer functions given in these block diagrams were transformed by use of the M-method into state variable format for solution by numerical integration. A new seeker subroutine (S2) was developed to control the integration of these state variables and to perform other calculations pertinent to the OCS.

Because of the modular concept of the 6-DOF simulation program, interfacing the new subroutine required minimal effort, particularly since the input and output variables of this seeker subroutine were identical to those of the laser seeker subroutine, S1. The one exception to this was the missile-body-to-seeker-gimbal coordinate transformation matrix, since the OCS seeker mounting has been rotated 90 degrees from that of the laser seeker. This necessitated a new matrix for transformation of the line-of-sight vector (LOS) from missile body coordinates (the basic program coordinate system) to the seeker gimbal coordinate system.

Figures 2.3 and 2.4 are the block diagrams of the simplified model, Model S3, containing only the low frequency components with the high frequency blocks replaced by their appropriate gains. This simplification, in effect, neglects the small amplitude high frequency oscillations of the system which are superimposed on the more significant, lower frequency dynamics. The simplification evolved as a consequence of the very long computation time required when running Model S2. The high frequencies of 314 and 1000 rad/sec of Model S2 require a numerical integration step size of .5 millisec, while Model S3 is integrated accurately at a step size of 12.5 millisec. This translates directly into a factor of 25 difference in run time, and there is no significant loss of accuracy when using Model S3. In comparison runs that were made, less than three percent differences in miss distance and CEP were observed.

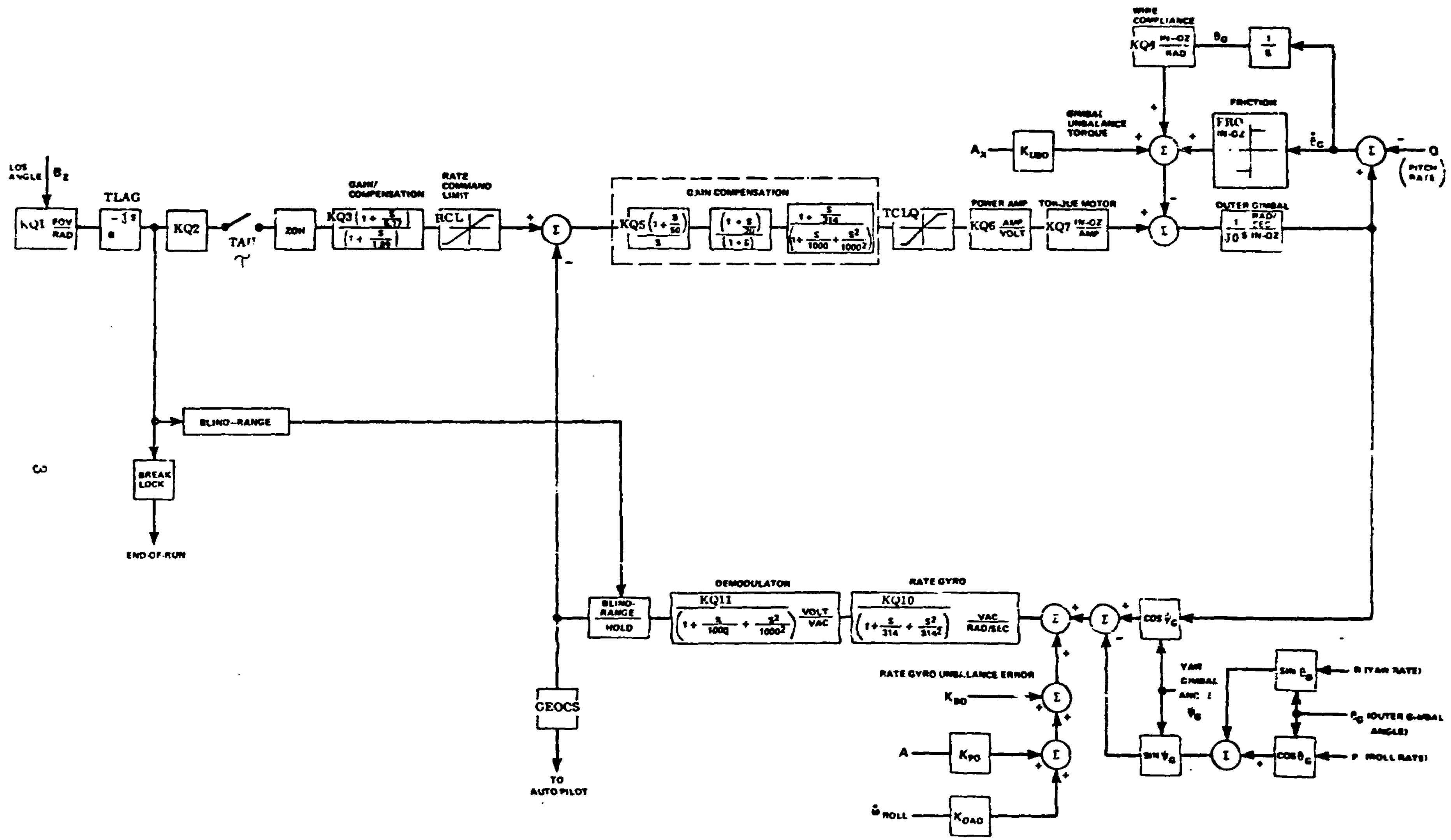


FIGURE 2.1. OCS Simulation Model (S2) - Pitch Channel

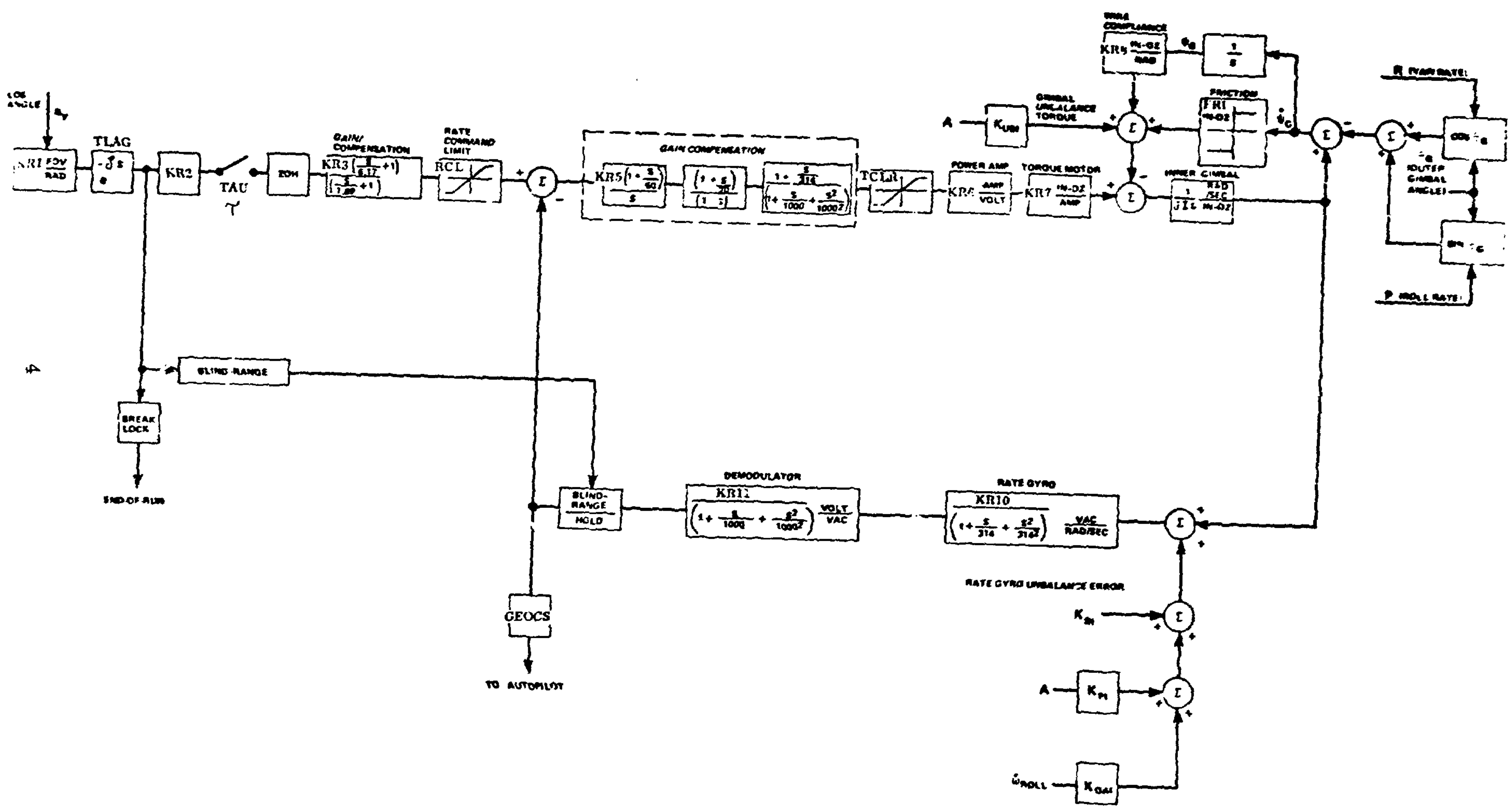


FIGURE 2.2. OCS Simulation Model (S2) - Yaw Channel

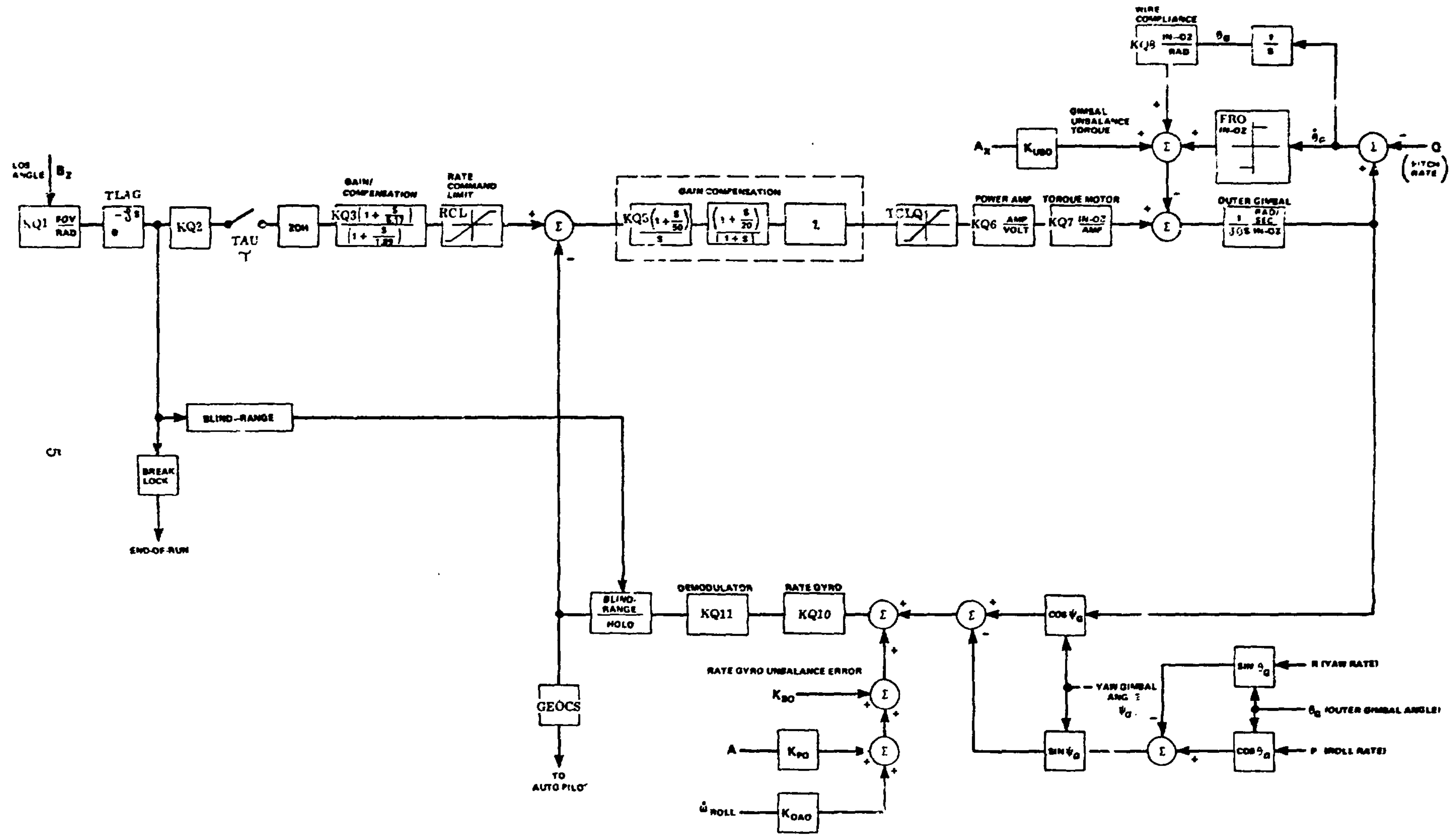


FIGURE 2.3. Simplified OCS Model (S3) - Pitch Channel

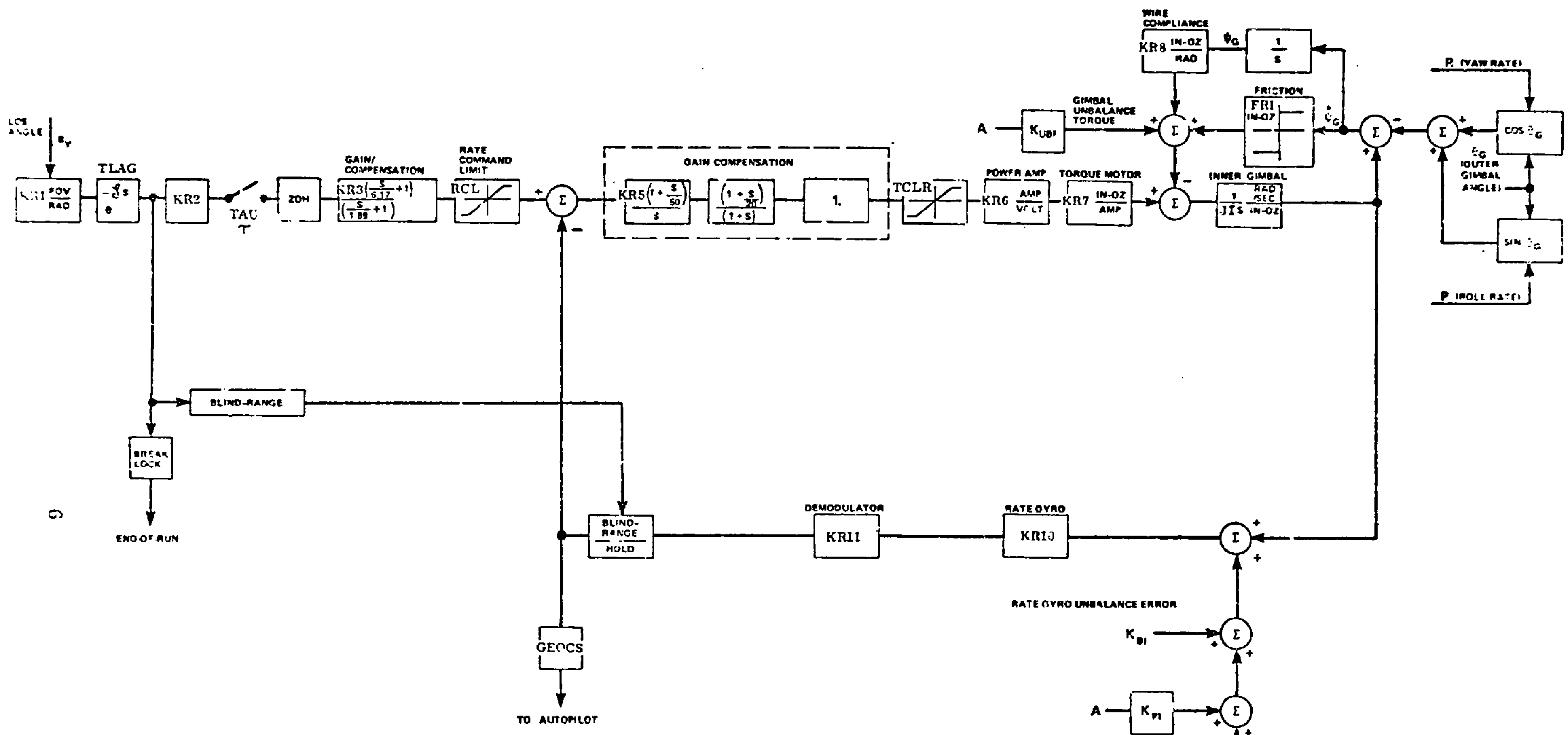


FIGURE 2.4. Simplified OCS Model (S3) - Yaw Channel

2.1 Transformation Matrix

The seeker gimbal coordinate system (X_G, Y_G, Z_G) is given in Figure 2.5 with respect to the missile body coordinate system (X_B, Y_B, Z_B). The order of rotation is (1) a rotation about Y_B through the outer gimbal angle θ_G, then (2) a rotation about Z_G through the inner gimbal angle Ψ_G.

The missile body-to-seeker gimbal coordinate system transformation matrix for this rotation sequence is:

$$[M]_G = \begin{bmatrix} (\cos\theta_G \cos\psi_G) & \sin\psi_G & (-\cos\psi_G \sin\theta_G) \\ (-\cos\theta_G \sin\psi_G) & \cos\psi_G & (\sin\psi_G \sin\theta_G) \\ \sin\theta_G & 0 & \cos\theta_G \end{bmatrix} \qquad \text{Eq. 2.1}$$

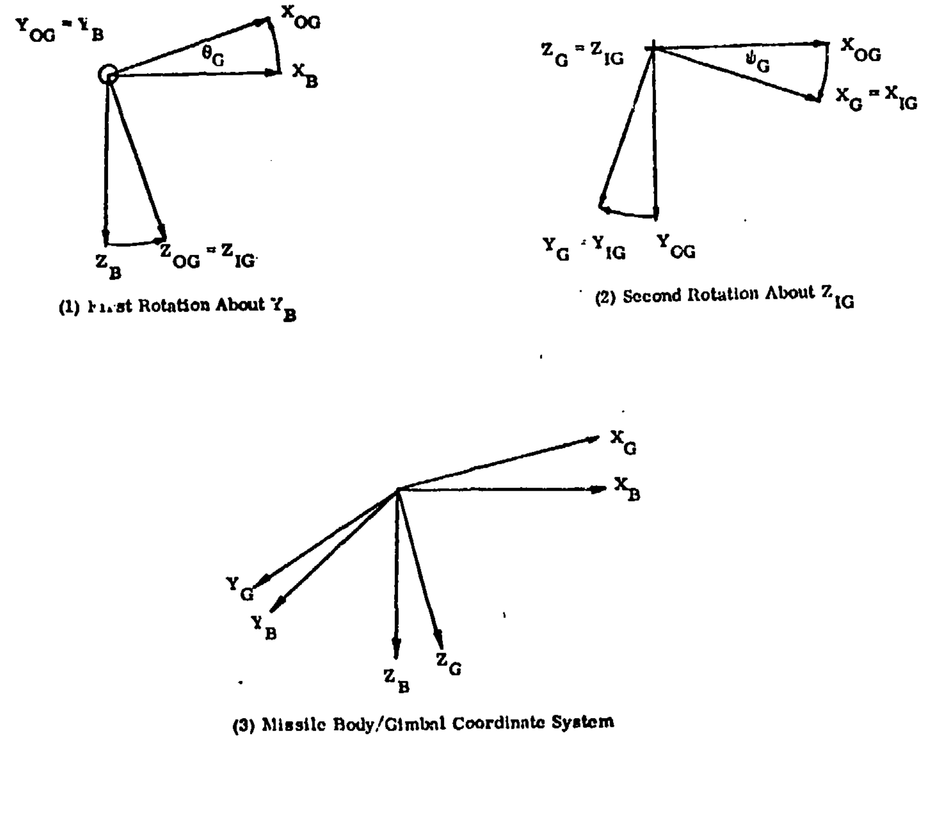


FIGURE 2.5. Coordinate Rotation

2.2 OCS Support Models

In addition to incorporation of the pitch and yaw axis OCS models into the 6-DOF program, other critical parameter models unique to the OCS were added. These parameter models are listed below and described in the following sections:

- Gimbal friction
- Target size
- Seeker breaklock
- Seeker blind range
- Transport lag
- Helicopter induced launch transients

2.2.1 Gimbal Friction Model

Gimbal friction couples the missile angular rates to the OCS platform and may cause system degradation. Gimbal bearing pre-load and the gimbal torque motor are the main contributors of this friction which is primarily stiction (static) and coulomb. Coulomb friction is defined as a constant frictional drag which opposes motion but has a magnitude that is independent of velocity. A slight distinction must be made between stiction and coulomb friction because, in general, the force required to initiate motion (overcome stiction) is somewhat greater than the coulomb friction. When the stiction level is identical to the coulomb friction and the system starts at rest, any applied force to the gimbal less than this value must be identically opposed so that no motion is initiated. Thus, the idealized coulomb friction model, $T_F = T_C \, \mathrm{sgn}(\dot{\theta}_G)$, can create a physically impossible situation where the friction model supplies energy to the system. As mentioned previously, the missile rates (actually, accelerations or torques) are directly coupled to the platform through the effects of friction, although the coupling is limited in magnitude by the friction level.

Figure 2.6 is a block diagram representation of the pitch gimbal friction model. The opposing friction, T_F, is a function of the coulomb friction, T_C; the net torque, T_N; and the relative gimbal rate, $\dot{\theta}_G$. (Stiction is assumed identical to the coulomb magnitude.) The missile angular acceleration, $\dot{Q}$, is coupled to the platform through the function f_2 which is magnitude limited. The complete mathematical description is:

For $|\dot{\theta}_G| \leq \Delta$, where Δ is a computational dead zone and the system is considered at rest,

$$T_F = T_N \, \mathrm{Sat}(T_C) \qquad \text{Eq. 2.2}$$

$$\dot{Q}_A = \dot{Q} \, \mathrm{Sat} \, \frac{T_F + T_C \, \mathrm{Sgn}(\dot{Q})}{J}, \text{ where J is gimbal inertia.} \qquad \text{Eq. 2.3}$$

For $|\dot{\theta}_G| > \Delta$

$$T_F = T_C \, \mathrm{Sgn}(\dot{\theta}_G) \qquad \text{Eq. 2.4}$$

$$\dot{Q}_A = 0 \quad \text{where } \dot{Q}_A \triangleq f_2 (T_C, T_N, \dot{Q}, \dot{\theta}_G) \, \dot{Q} \qquad \text{Eq. 2.5}$$

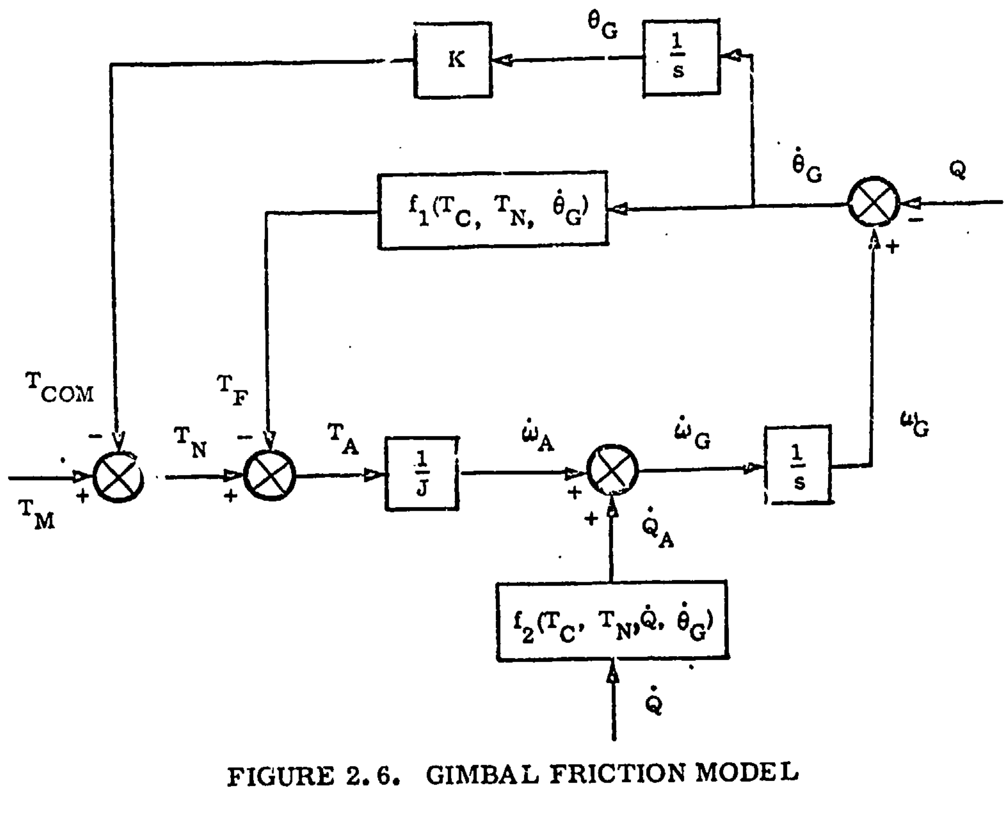


FIGURE 2.6. GIMBAL FRICTION MODEL

Figure 2.7 is a time history of the torque motor output. For this illustration, $\dot{\theta}_G$ is initially zero and θ_G is positive. To initiate motion, the torque motor had to exceed the coulomb friction level and the wire compliance torque. Figure 2.8 shows the missile acceleration, $\dot{Q}$, and the gimbal acceleration, $\dot{\omega}_G$. Observe that the gimbal angular acceleration tracks the missile angular acceleration until the torque motor exceeded the breakaway torque level.

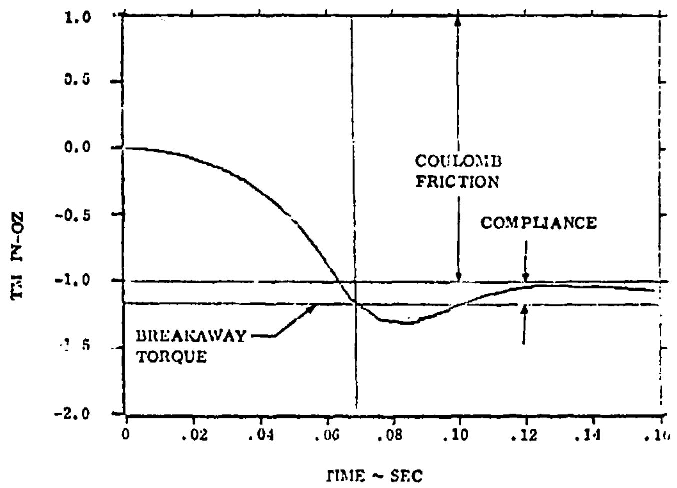


Figure 2.7. Pitch Channel Torque Motor Output

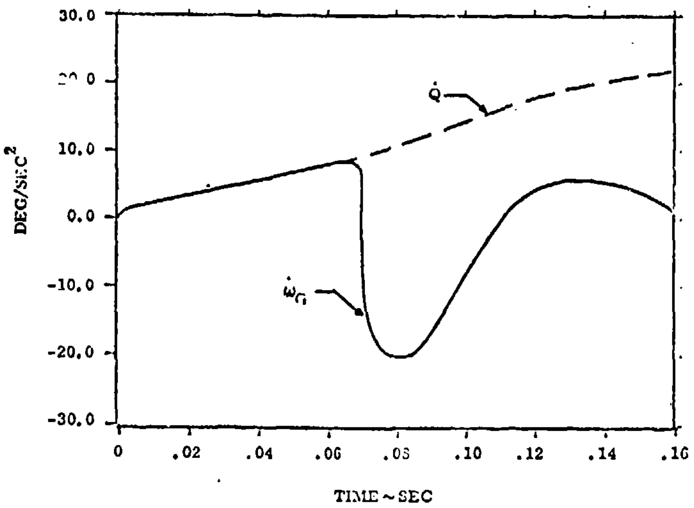


Figure 2.8. Missile Pitch and OCS Outer Gimbal Inertial Angular Acceleration

2.2.2 Target Model

A two dimensional target model was incorporated into the program for the purpose of computing seeker breaklock (Section 2.2.3) and blind range (Section 2.2.4). The dimensionality of the target does not affect any other missile or seeker parameter.

The target model is defined by the shaded area in Figure 2.9 and due to the dimensionality is restricted to be normal to the line-of-sight of the missile. The outer rectangle represents the seeker field-of-view (FOV) and the intersection of the dashed lines the instantaneous seeker aimpoint. The top and bottom of the target are always parallel to the raster lines of the vidicon screen of the seeker. Thus, for this elementary model, if the seeker rolls, the target rolls. The line-of-sight vector intersects the target at its geometric center.

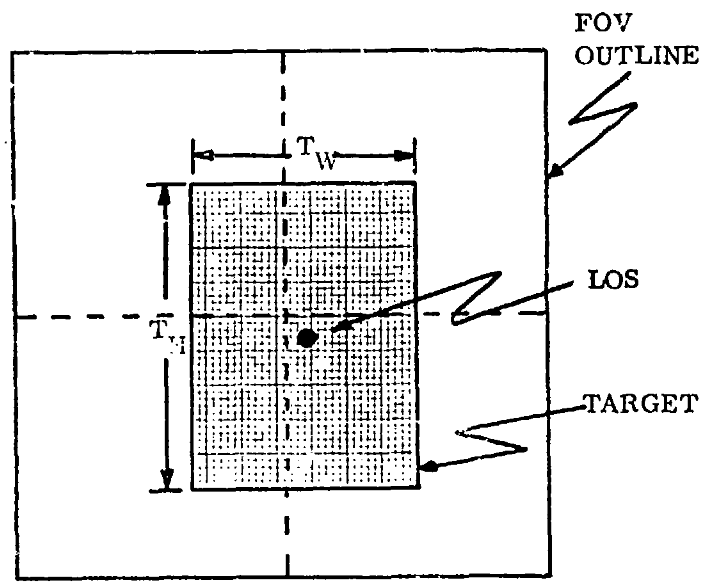


FIGURE 2.9. Target Model

2.2.3 Seeker Breaklock

Seeker breaklock (loss of target image) is assumed* to occur when seeker aimpoint shifts more than 50 percent of target height or width during one sample period, τ. Seeker aimpoint is defined as the projection of seeker boresight onto the target plane. Figure 2.10 illustrates the geometry of the breaklock parameter, aimpoint shift.

S_T is the total amount of seeker aimpoint shift over the sample period τ. S_H and S_W are the components of S_T that parallel target height T_H and width T_W, respectively. If S_H becomes greater than .5 T_H or if S_W becomes greater than .5 T_W, it is assumed that breaklock has occurred. When breaklock does occur, the simulation run is terminated because breaklock causes loss of the missile as far as homing in on the target is concerned.

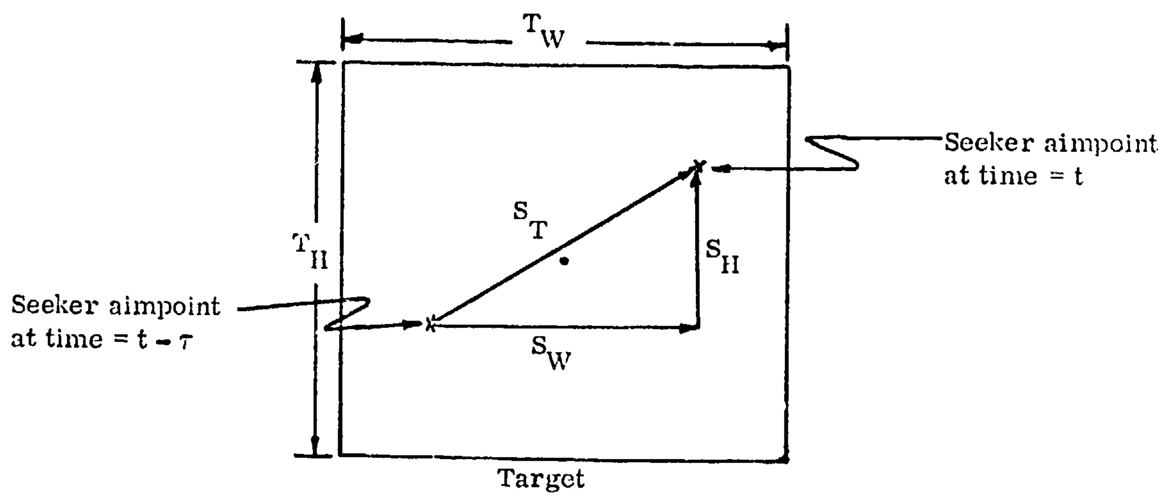


FIGURE 2.10. Seeker Aimpoint Shift

*This assumption is valid for a target-to-range ratio as low as .001.

In the simulation program, breaklock is determined from the angles subtended by the target sides/slant range and aimpoint shift/slant range. Thus, for pitch, the angle*

$$\theta_{TH} = \tan^{-1}[(T_H/2)/R] \qquad \text{Eq. 2.6}$$

and the angle

$$\Delta_Z = (\beta_{Z_t} - \beta_{Z_{t-\tau}}) \qquad \text{Eq. 2.7}$$

are compared at the end of each sample period, τ. If Δ_Z becomes greater than θ_{TH}, breaklock conditions are met.

The variables in the above equation are defined as:

- R – slant range
- θ_{TH} – angle subtended by slant range and one half the target height
- $\beta_{Z_{t-\tau}}$ – angle subtended by pitch plane component of LOS (S_H) and seeker boresight, one sample period back in time
- β_{Z_t} – angle subtended by pitch plane component of LOS (S_H) and seeker boresight, at the current time
- Δ_Z – angular shift of aimpoint over one sample period

When breaklock is encountered, the message below is printed out and the run is terminated. The time (seconds), range (feet from target), and the channel in which breaklock occurs is output.

```
**************************************************************************
BREAK LOCK CONDITION AT TIME =     .73 RANGE =    9715.04 IN PITCH  .
**************************************************************************
```

An example of seeker aimpoint shift is given in Figure 2.11. This figure contains a time history of seeker aimpoint shift for a 1 kilometer deterministic trajectory. No errors (such as gimbal mass unbalance, launch transients, rate gyro drift, etc.) were present when this run was made. The sample period was 16.7 millisec. The breaklock point (50 percent of

*Comparable calculations are made in the yaw plane to determine if breaklock occurs there.

target) currently in use in the simulation program is illustrated in the figure. If any of the spikes on the curve had reached the 50 percent point, the trajectory would have been terminated. As noted for this particular example, the maximum boresight shift was about ten percent.

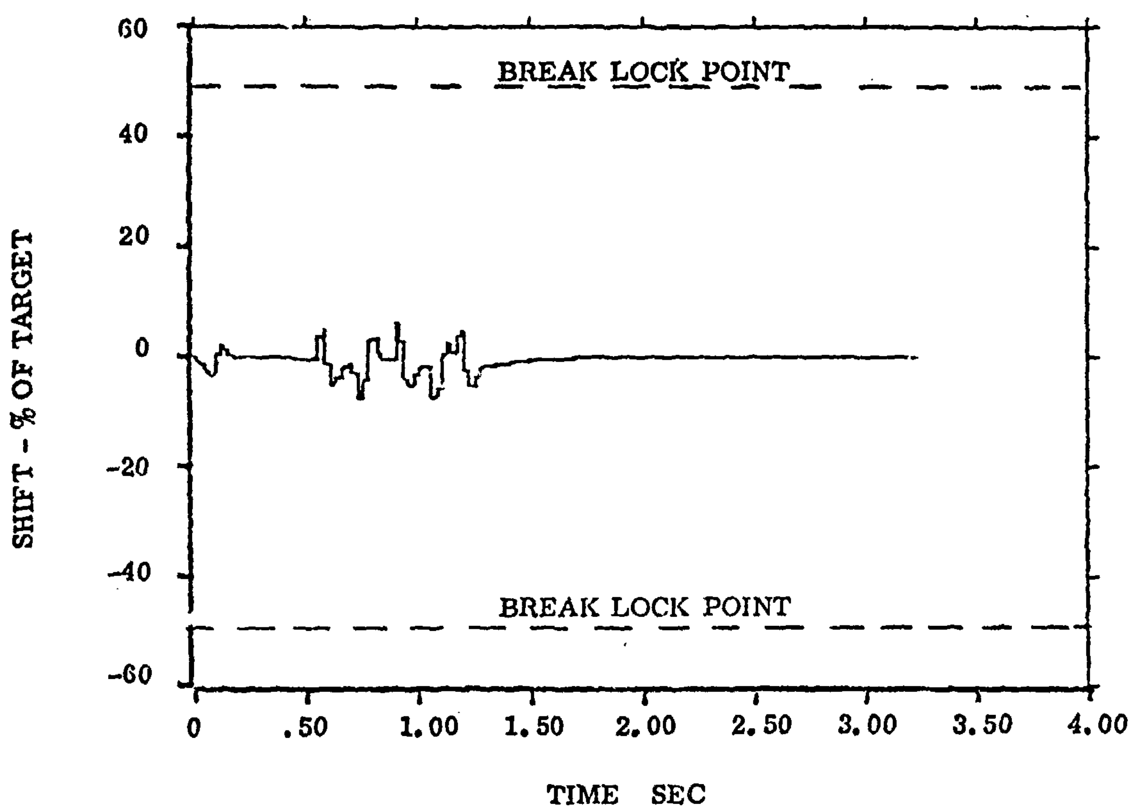


FIGURE 2.11. Seeker Breaklock Time History

2.2.4 Seeker Blind Range

Seeker blind-range is defined as the distance from the target when the target image occupies 70-80 percent of the tracker vidicon field-of-view (FOV). The actual blind-range limit is adjustable and is currently preset for 70 percent FOV.

To determine if a blind-range condition occurs, gating functions are established to check the target edges with respect to the 70 percent FOV lines as shown in Figure 2.12. However, with this implementation, blind-range is a function of the LOS angle, as well as target growth. Figure 2.13 is a time history of target edge in one axis with respect to the vidicon FOV. The general shape of the curve is due to target growth while the perturbations are caused by the LOS angle variations. The program monitors all four edges at each integration step to determine if any one edge has reached the blind-range limit. Nominally, this limit is set at 70 percent FOV, but is a program variable that may be input at any desired value. When the blind-range limit has been reached, the seeker rate gyro's output signals to the autopilot are held at their present value. Thus, the missile no longer responds to commands generated by the seeker, but instead, flies into the target with the autopilot signals set at the blind-range value. In Figure 2.13, blind-range occurred at 3.01 seconds. When blind-range occurs, the following message is printed out:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
CCS BLIND RANGE SIGNAL HOLD AT TIME  =   3.01  RANGE =        225.00
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Time is in seconds of flight and range is in feet from target.

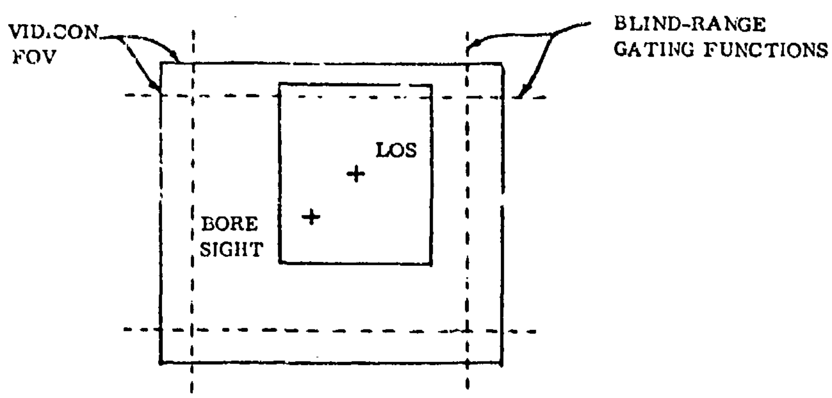


FIGURE 2.12. Blind-Range Due to LOS and Target Growth

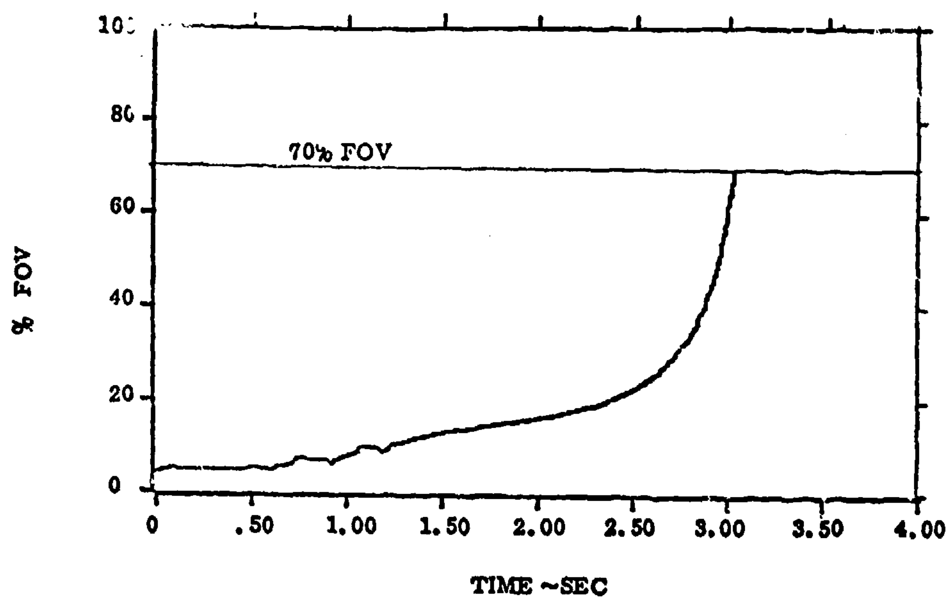


FIGURE 2.13. Target Image Growth in Seeker FOV

2.2.5 Transport Lag Implementation

The exponential, $e^{-\zeta s}$, in the second block of each of the block diagrams of Figures 2.1, 2.2, 2.3, and 2.4 represents a transport lag in the camera of the OCS. The actual phenomena that this term models is unknown at the present; however, it closely approximates the effects required to match OCS subsystem test data. Implementation of this lag was accomplished as follows:

- The last six time points of the LOS angle (BZ and BY) are stored in a storage array.
- A table look up function interpolates linearly within the stored values to return the values of BZ and BY at the lag time (TIME - TLAG).
- The interpolated values of the LOS angles are then used by the OCS model as the target position for guidance calculations.

2.2.6 Launch Transients

Missile pitch, yaw, and roll launch transients caused by helicopter vibration and launcher rail/missile shoe interaction were modeled because these transients could severely affect the condition of seeker breaklock. Typical launch transient data from which the models were developed are given in reference 3. Examination of this data reveals that pitch and yaw characteristics are similar. Thus, pitch and yaw perturbations are simulated from similar transient models. Roll transients are presented as plots of roll angle versus time. Roll transients appear to exhibit different characteristics from those of pitch and yaw, thus roll is modeled separately. An example of the plots as presented in reference 3 is given in Figure 2.14.

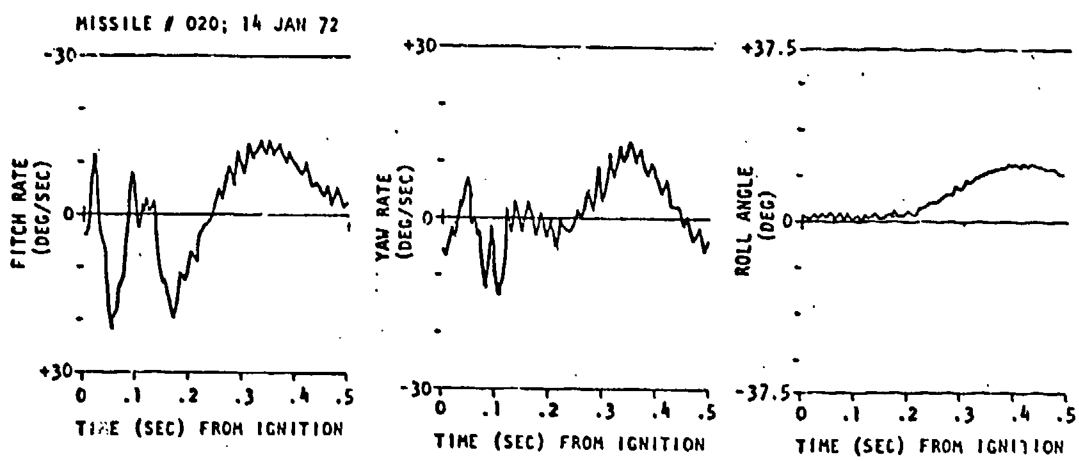


FIGURE 2.14. Typical Launch Transients

In addition to the data of reference 3, telemetry data relating to pitch and yaw, in the form of undocumented strip charts for pitch and yaw rates and a power spectral density (PSD) plot of rate-gyro output in pitch, were available to aid in model development. These telemetry data were taken from a captive flight test of the anti-tank missile mounted on a helicopter launcher. A reproduction of the PSD is shown in Figure 2.15.

2.2.6.1 Pitch, Yaw, and Roll Models

2.2.6.1.1 Pitch Model

In modeling the pitch launch transients, the helicopter vibration was assumed to be a pitching moment applied to the launch rail and coupled to the missile through the rail shoes. Since the power spectral density (PSD) of the pitch rate gyro output, Figure 2.15, has distinct frequencies; the pitching moment was modeled as a harmonic forcing function and is applied until the rear shoe exits the launch rail (tip-off point). The forcing function is defined as:

$$F(t) = A_m \cdot \epsilon^{A_e t} \cdot \sum_{i=1}^{n} A_i \sin(\omega_i t + \Phi_i) \qquad \text{Eq. 2.8}$$

where

- ω_i - frequency ($2\pi f_i$)
- Φ_i - phase angles initialized randomly from a 0 to 2π uniform distribution
- A_i - peak amplitudes
- A_e - time constant which spreads the PSD about the discrete frequencies
- A_m - scale factor

The relationships between the peak amplitudes, A_i, were determined by comparing the peak amplitudes of the PSD at the desired frequencies. However, these values are the pitch rate densities in $(\text{rad/sec})^2/\text{hz}$ and need to be related to the equivalent autocorrelation values. Since the autocorrelation function, R(0) is related to the PSD by

$$R(0) = \int_{-\infty}^{\infty} \text{PSD}(f)\, df$$

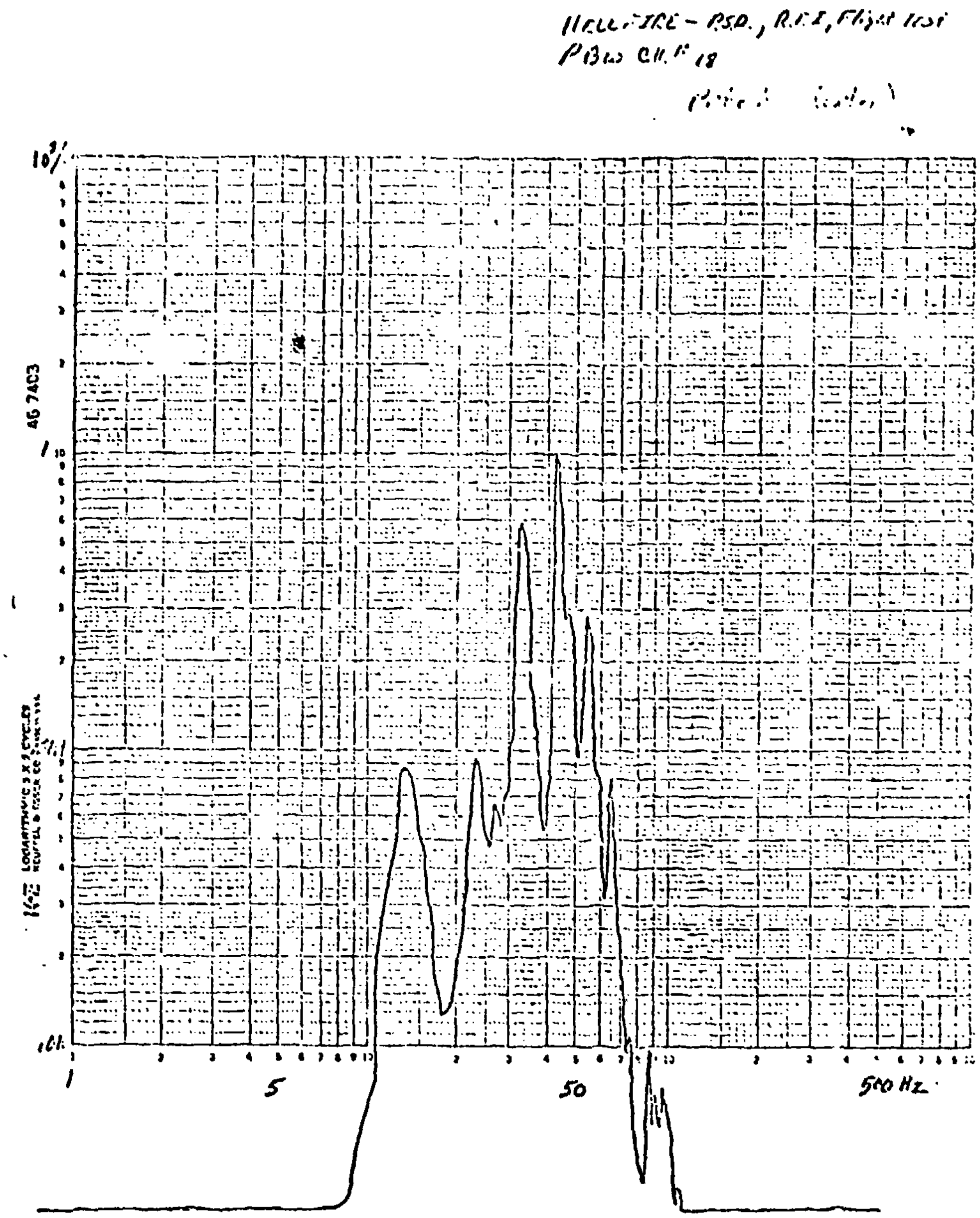


FIGURE 2.15. Power Spectral Density of Rate Gyro Output-Helicopter Mounted Captive Flight Test

It can be shown that with an ideal bandpass filter of bandwidth, BW, we can relate the autocorrelation values, A_i, to the PSD values, B_i, by

$$A_i^2 = BW \cdot B_i$$

Using the first four (n = 4) predominant frequencies of the PSD given in Figure 2.15

$$f_i = \{11, 22, 33, 44\}$$

and their peak values

$$B_i = \{.085, 0.10, 0.56, 1.0\}$$

the autocorrelation values are calculated with BW = 500 hz as

$$A_i = \{6.5, 6.7, 16.7, 22.4\}$$

Using the time constant, $A_e = -1$, to spread the spectral densities about each frequency, the scale factor, A_m, was determined by calculating* the autocorrelation function, Figure 2.16, of the simulation rate gyro output signal and comparing it to the telemetry PSD, Figure 2.15. A reasonable match was obtained with all the telemetry data with

$$A_m(\text{pitch}) = 10 \text{ FT-LBS}$$

and

$$A_i = \{1, 4, 12, 26\}.$$

Example time histories of F(t), the pitch rate, and the rate gyro output are shown in Figure 2.17, 2.18, and 2.19, respectively. The missile was constrained to the launch rail for these runs.

An example of a pitch rate time history of the missile (not constrained to the rail) for the first one-half second of flight is given in Figure 2.20. Front shoe exit time is .086 seconds and rear shoe exit time (tip-off time) is .112 seconds.

2.2.6.1.2. Yaw Model

The pitching moment forcing function and coefficients were assumed applicable for yaw. The peak amplitude, A_m, of yaw moment was determined in similar manner as pitch. A_m (yaw) was adjusted to give a reasonable match between the peak-to-peak yaw rates of the simulation program and the peak-to-peak rates given in reference 3. An example of a yaw rate time

---

* The autocorrelation function was calculated with the Time Series Analysis Program (TSAP), Reference 4.

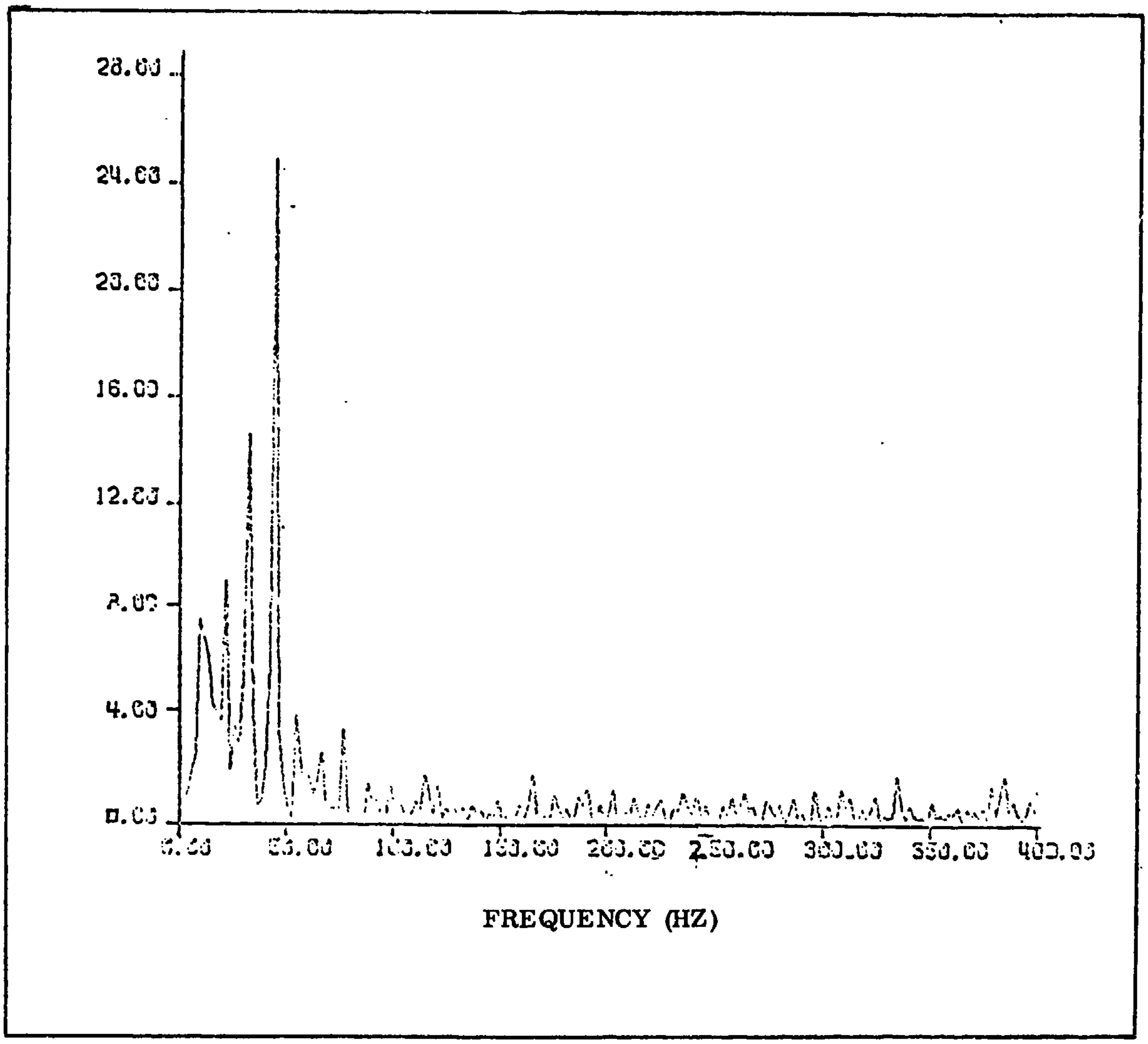


Figure 2.16. Autocorrelation Function of Rate Gyro Output - Simulation Model

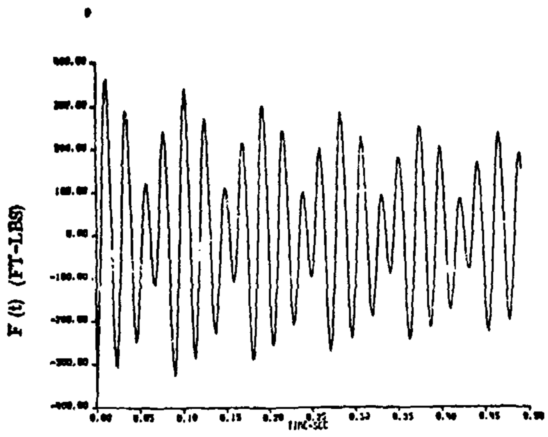


FIGURE 2. 17. Moment Forcing Function Time History

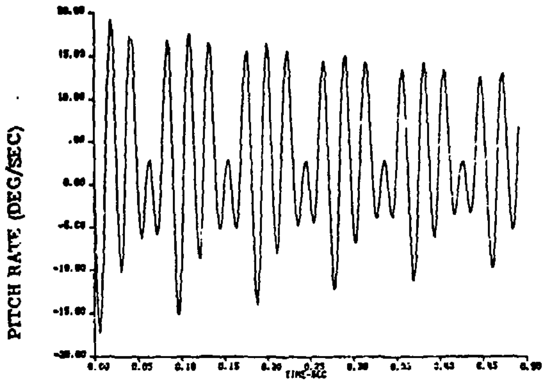


FIGURE 2.18. Pitch Rate Time History

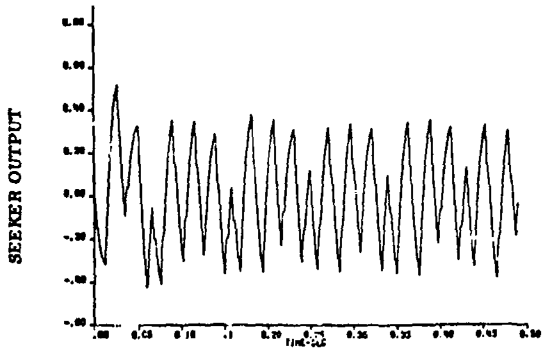


FIGURE 2.19. Output to Autopilot Time History

history is given in Figure 2.21. The best value obtained for the yaw rate amplitude coefficient was:

$$A_m \text{ (yaw)} = 4 \text{ FT-LBS.}$$

2.2.6.1.3. Pitch and Yaw Rate Initialization

As long as the missile is on the launch rail and the pitch and yaw moments are being applied, the pitch and yaw rates are directly proportional to the integral of F(t). Integrating F(t) results in the following equation, H(t).

$$H(t) = A_m \cdot \epsilon^{A_e t} \cdot \sum_{i=1}^{n} \left\{ \frac{A_i}{A_e^2 + \omega_i^2} \cdot [A_e \sin(\omega_i t + \Phi_i) - \omega_i \cos(\omega_i t + \Phi_i)] \right\} \qquad \text{Eq. 2.9}$$

The proportionality constants for pitch and yaw are the moments of inertia about the appropriate rotational axes. Thus,

$$\omega_Q = \frac{H(t)_Q}{I_Y} \qquad \text{Eq. 2.10}$$

$$\omega_R = \frac{H(t)_R}{I_Z} . \qquad \text{Eq. 2.11}$$

where

$H(t)_Q$ - refers to the pitch rate equation
$H(t)_R$ - refers to the yaw rate equation
I_Y - moment of inertia about Y axis
I_Z - moment of inertia about Z axis

Equations 2.10 and 2.11 are solved at time = 0 to determine the correct initial values of pitch and yaw rate so that the time functions of pitch and yaw are in phase with the moment time function F(t). (This is equivalent to solving for the constant of integration of a differential equation.) Pitch and yaw rates are not determined by Eq. 2.10 and 2.11 except for initialization. Instead, the forcing function F(t) is numerically integrated along with all other differential equations in the program.

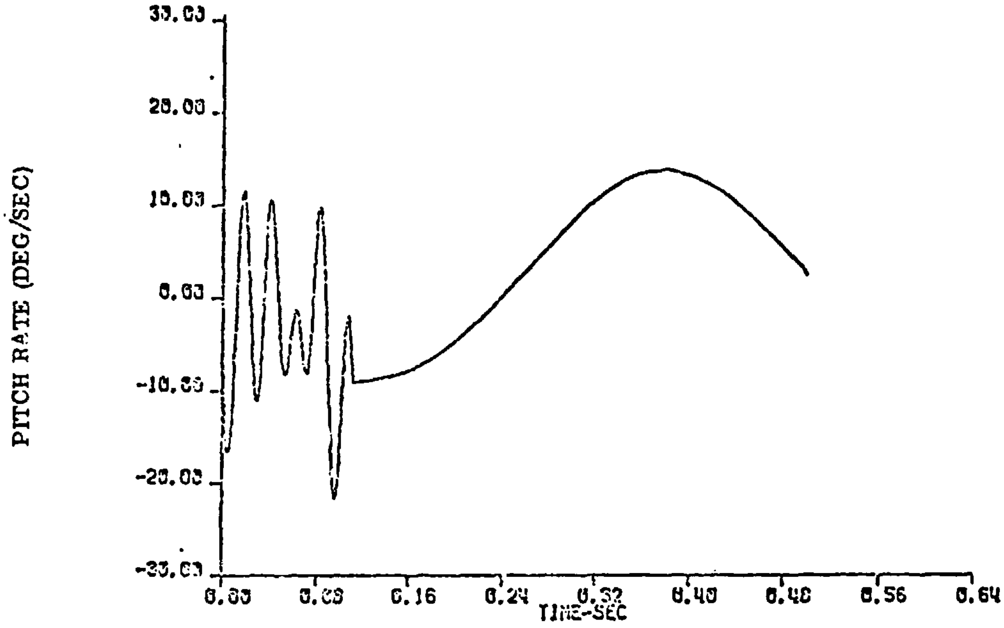


FIGURE 2.20. Simulation Model Pitch Launch Transient

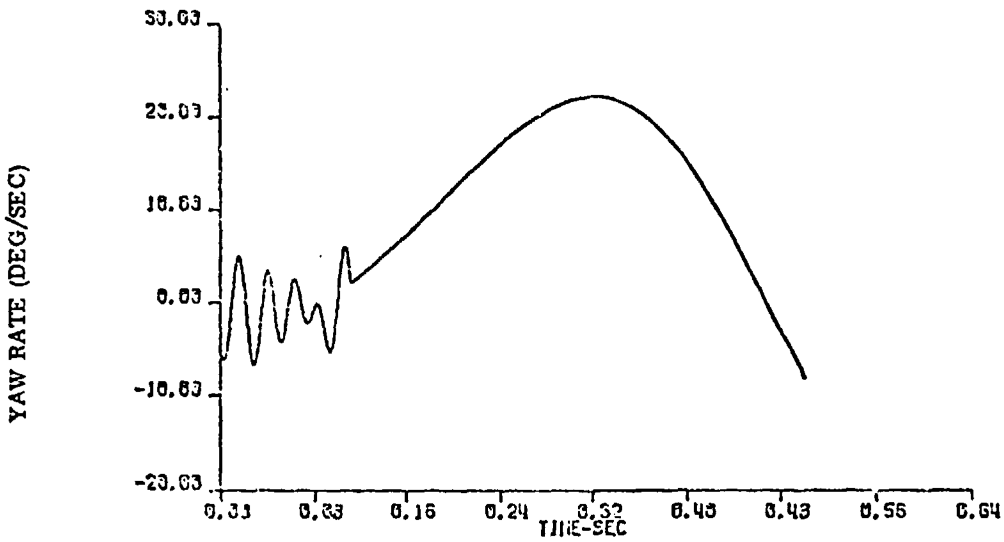


FIGURE 2.21. Simulation Model Yaw Launch Transient

2.2.6.1.4 Roll Model

Roll transients were modeled based solely on the data given in reference 3. No additional data on roll was available. All roll data plotted in reference 3 is given in roll angle; however, as with pitch and yaw, the roll transient was modeled as a roll moment. A roll moment model was developed that produced roll angles that matched typical roll angle characteristics as given in the reference.*

Examination of the slopes of the plots of reference 3 reveal that for all practical purposes, roll rate is zero until the front shoe exits the launch rail. Roll rate then begins to build up until a maximum roll angle is reached between .3 and .4 seconds. Once off the rail, roll angle varies about a mean value established when the autopilot gyros were uncaged. The oscillation about this mean is caused by the roll stabilization system.

The roll transient model developed assumes a zero roll rate and a zero roll acceleration (zero) moment applied) until front shoe exits the launch rail, as shown in Figure 2.22. Following front shoe exit, a roll moment (F_{MX}) is computed based on the difference between front and rear shoe exit times (Δt) and the desired rear shoe exit roll rate (tip-off roll rate, ω_{PTO}), or:

$$F_{MX} = (\omega_{PTO} \cdot I_X)/\Delta t \qquad \text{Eq. 2.12}$$

where I_X is the moment of inertia about the longitudinal axis and ω_{PTO} is specified by the user. The exit time difference (Δt) is .026 sec for this missile simulation.

The roll moment (F_{MX}) is applied to the missile from the time of front shoe exit to the time of rear shoe exit. Integration of the roll acceleration due to F_{MX} results in the tip-off roll rate ω_{PTO}. Immediately following rear shoe exit, all transient models are zeroed out and the simulation reverts to 6-DOF guided flight. An example roll angle time history resulting from this model is shown in Figure 2.23.

* Modeling of roll transients is critical because of the interaction between seeker breaklock and roll acceleration. Seeker breaklock is influenced by roll acceleration through the roll coupling term of the seeker rate gyro output axis. This output axis is directed along the roll axis of the missile.

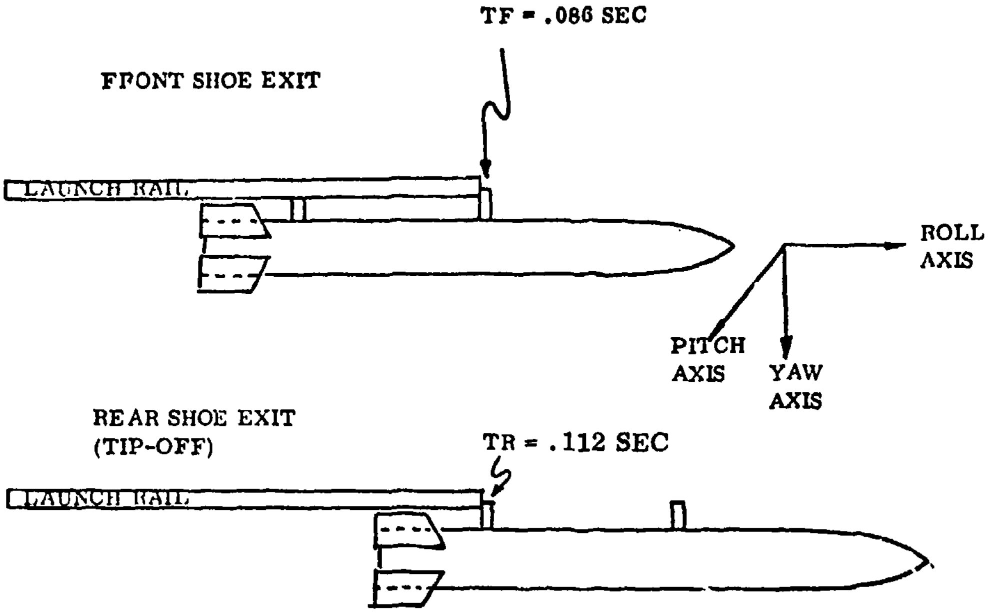


FIGURE 2.22. Launcher/Missile Configuration

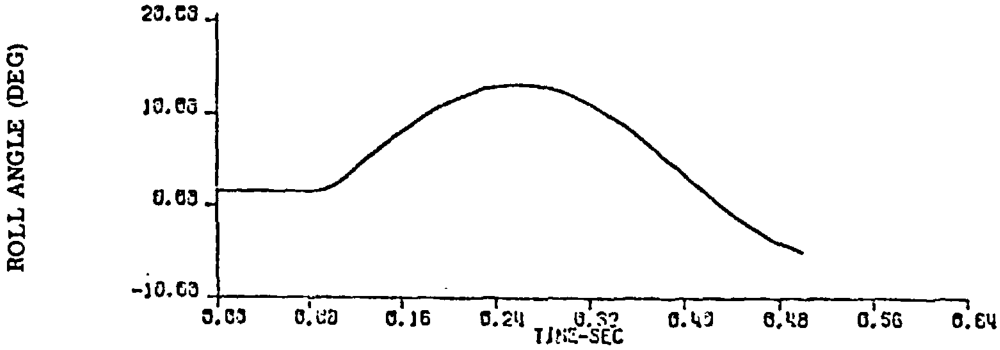


FIGURE 2.23. Simulation Model Roll Launch Transient

2.3 Input Variable Description

2.3.1 OCS Input Variable Description

The following list identifies all variables of the OCS seeker subroutines (S2 and S3) that can be input by 3-cards.* Variable names beginning with K are the gains shown in the block diagrams of Figures 2.1 and 2.2. Variable names beginning with W are the frequency components given in Figures 2.1 and 2.2. The frequency variable names themselves do not appear in the figures. Instead, actual frequency values are shown. However, these variables may still be input by 3-cards. The variable name and its position in the block diagram can be correlated by the frequency values tabulated below in the second column.

FORTRAN SYMBOL	SYMBOL USED IN TEXT	C INDEX	DEFINITION
KQ1	KQ1	545	
KQ2	KQ2	547	
KQ3	KQ3	549	
KQ5	KQ5	551	
KQ6	KQ6	553	PITCH CHANNEL GAINS
KQ7	KQ7	555	
KQ8	KQ8	557	
KQ10	KQ10	559	
KQ11	KQ11	561	
KQ12	KQ12	563	
KR1	KR1	546	
KR2	KR2	548	
KR3	KR3	550	
KR5	KR5	552	
KR6	KR6	554	YAW CHANNEL GAINS
KR7	KR7	556	
KR8	KR8	558	
KR10	KR10	560	
KR11	KR11	562	
KR12	KR12	564	

Input description continued on next page.

* See reference 1 for definition and use of 3-cards.

FORTRAN SYMBOL	SYMBOL USED IN TEXT	C INDEX	DEFINITION
WTQ1	6.17	573	
WTQ2	1.89	575	
WGQ1	50.	577	
WGQ3	20.	581	
WGQ4	1.	583	PITCH CHANNEL FREQUENCIES
WGQ5	314.	585	
WGQ6	1000.	587	
WRQ2	314.	591	
WRQ4	1000.	595	
WTR1	6.17	574	
WTR2	1.89	576	
WGR1	50.	578	
WGR3	20.	582	
WGR4	1.	584	YAW CHANNEL FREQUENCIES
WGR5	314.	586	
WGR6	1000.	588	
WRR2	314.	592	
WRR4	1000.	596	
RCL	RCL	597	Rate command limit in pitch and yaw
TCLQ	TCLQ	598	Torque command limit in pitch
TCLR	TCLR	599	Torque command limit in yaw
JI	JI	565	Moment of inertia of inner gimbal
JO	JO	566	Moment inertia of outer gimbal
GEOCS	GEOCS	497	Rate gyro gain to autopilot, pitch and yaw
FRI	FRI	567	Inner gimbal friction coefficient (in-oz)
FRO	FRO	568	Outer gimbal friction coefficient (in-oz)
FFOV	FFOV	604	Blind range decimal percent field of view
TARHT	T_H	601	Target height (ft)
TARWD	T_W	602	Target width (ft)
TAU	τ	600	Seeker sample period (sec)
TLAG	ζ	606	OCS transport lag (sec)

2.3.2 Launch Transient Input Variable Description

A new subroutine, LTRAN, was added that contains the pitch and yaw moment forcing function, F(t), and the pitch and yaw initialization function, H(t). This subroutine is called by subroutine A3I for initialization of the rates and by subroutine A2 to compute the time varying rates.

The roll transient model is also initialized in subroutine A3I. Subroutine A2 contains the logic for integration of the roll acceleration computed in A3I.

The following list identifies all variables of the launch transient models that are input by 3-cards.

FORTRAN SYMBOL	SYMBOL USED IN TEXT	C INDEX	DEFINITION
WPTO	ω_{PTO}	1738	Tip-off roll rate (deg/sec)
AMP2	A_m	1742	Peak amplitude of pitch moment forcing function (ft/lbs)
AMP1	A_m	1746	Peak amplitude of yaw moment forcing function (ft/lbs)
VIB		626	Launch transient vibration flag (pitch and yaw only) 0 - no vibration 1 - run with vibration

3.0 RANDOM ERROR SOURCES

Initial condition random error sources specified as probability distributions unique to the OCS or impacting the operation of the OCS are listed below and described in the following sections.

1. Seeker Platform Mass Unbalance
   - Outer gimbal
   - Inner gimbal
2. Seeker Rate Gyro Errors
   - Drift
   - Mass Unbalance
   - Output axis/missile roll coupling
3. Launch Transient-Rate Distributions
   - Pitch and yaw rate
   - Roll rate

3.1 Error Source Distribution

3.1.1 Seeker Platform Mass Unbalance

Error randomization of seeker platform mass unbalance was added to the simulation program for both inner and outer gimbals of the seeker head. Missile acceleration normal to the gimbal plane acts on this mass unbalance to create a torque that attempts to rotate the seeker head, thus generating an error signal. The seeker torque motor must then compensate for this error.

Figure 3.24 illustrates the mass unbalance geometry of the outer gimbal ring. The centroid of mass unbalance is assumed to have an equal likelihood of lying at any point in the gimbal plane, while the mass unbalance magnitude (K_{UBO}) distribution must be specified by the user. Since mass unbalance magnitude includes the moment arm as well as the normalized force acting on the moment arm, the actual radius on which the mass unbalance lies is unimportant, except as to whether the resulting torque causes a clockwise or counter-clockwise rotation about the gimbal axis. Thus, following the selection of the mass unbalance magnitude from a specified distribution, the sign of the mass unbalance is selected from the uniform distribution shown in Figure 3.25. The torque acting about the outer gimbal axis is then:

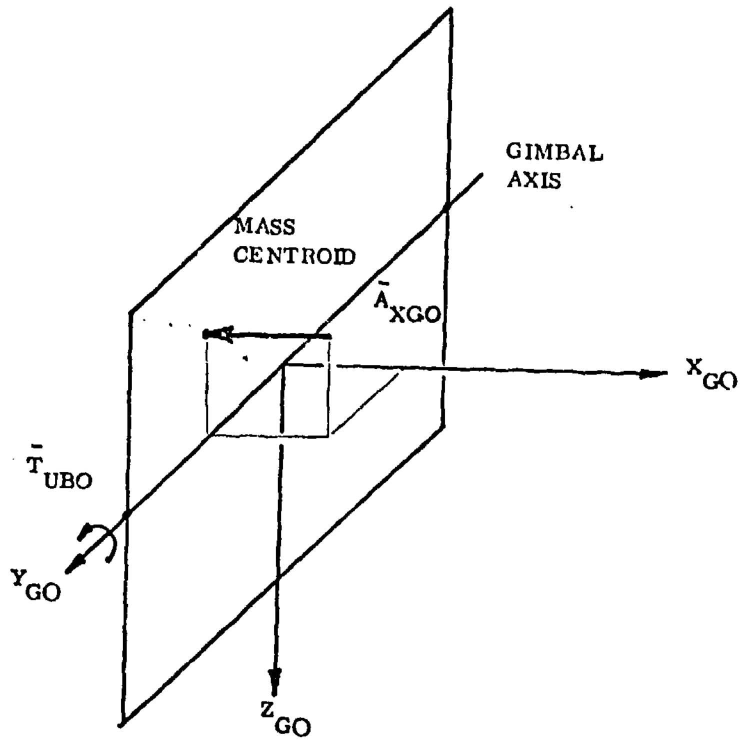


FIGURE 3.24. Seeker Outer Gimbal Mass Unbalance

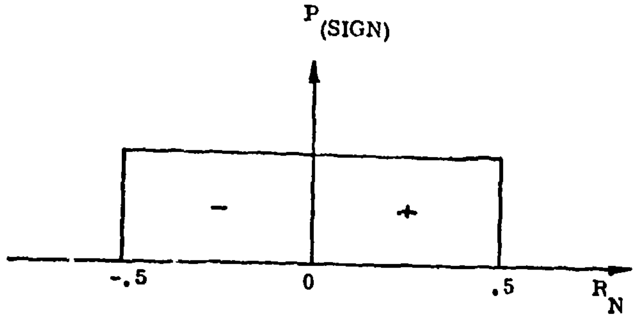


FIGURE 3.25. Probability Distribution of Mass Unbalance Sign

$$\bar{T}_{UBO} = A_{XGO} \cdot K_{UBO} \cdot SGN(RN) \qquad \text{Eq. 2.13}$$

The total acceleration,

$$\bar{A}_T = [A_{XB}, A_{YB}, A_{ZB}] \qquad \text{Eq. 2.14}$$

acting on the missile is resolved through the outer gimbal angle (θ_G) to get the acceleration component (A_{XGO}) normal to the gimbal plane. Thus, from Figure 3.26,

$$A_{XGO} = A_{XB} \cos \theta_G - A_{ZB} \sin \theta_G. \qquad \text{Eq. 2.15}$$

Since the outer gimbal rotates about the y-axis (Y_B) of the missile, only the acceleration components along missile x-axis (X_B) and z-axis (Z_B) act on the gimbal plane.

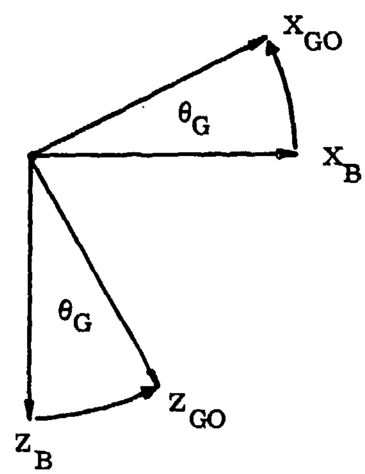


FIGURE 3.26. Gimbal Rotation About Missile Y-Axis

The inner gimbal mass unbalance centroid is somewhat more complex to locate because the inner gimbal mass is more complex in shape as shown in Figure 3.27.

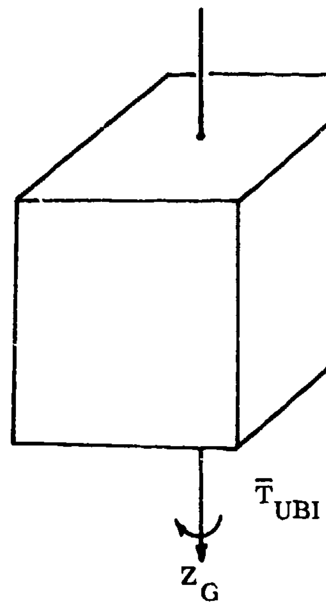


FIGURE 3.27. Inner Gimbal Mass

As with the outer gimbal, the distribution of the mass unbalance magnitude (K_{UBI}) is user specified, while the plane in which the centroid lies is assumed to have an equal likelihood of being oriented at any angle (χ), as shown in Figure 3.28. The angle χ is selected from the uniform distribution shown in Figure 3.29. The resulting torque acting about the inner gimbal axis is then,

$$\overline{T}_{UBI} = K_{UBI} (A_{YG} \cos \chi - A_{XG} \sin \chi) \qquad \text{Eq. 2.16}$$

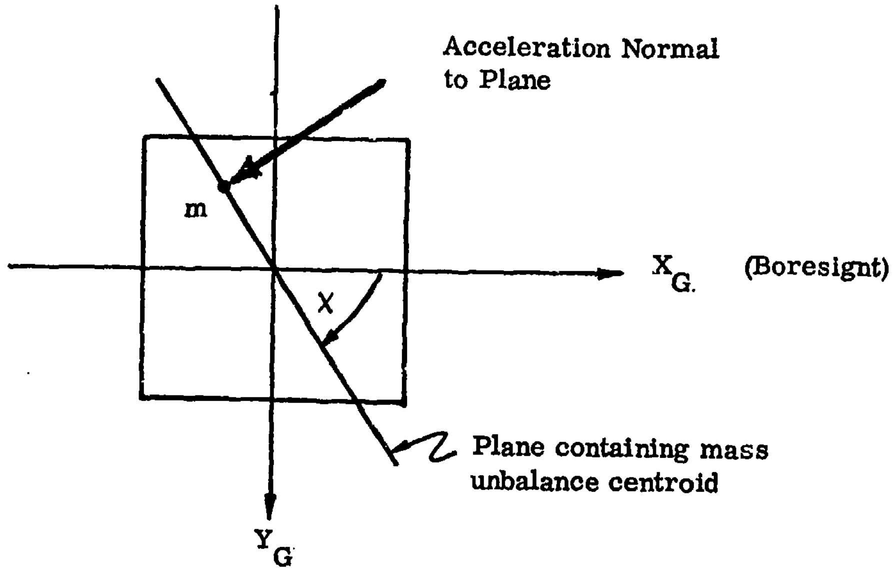


FIGURE 3.28. Inner Gimbal View Looking Down the Z-Axis

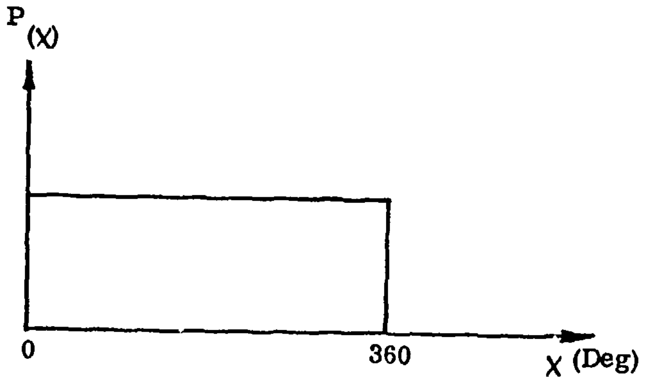


FIGURE 3. 29. Probability Distribution of Mass Unbalance Radial Position

The acceleration components (A_{YG} and A_{XG}) in the inner gimbal coordinate system are determined by transforming the total acceleration ($\bar{A}_T$) through the gimbal angles (θ_G and Ψ_G), thus

$$\begin{bmatrix} A_{XG} \\ A_{YG} \\ A_{ZG} \end{bmatrix} = [M]_G \begin{bmatrix} A_{XB} \\ A_{YB} \\ A_{ZB} \end{bmatrix} \qquad \text{Eq. 2.17}$$

The transformation matrix $[M]_G$ is derived in Section 2.1.

Mass unbalance magnitude distributions are normalized with respect to acceleration. Thus, mass unbalance has the units of IN-OZ per g of acceleration. All acceleration components seen in the proceeding equations are also normalized.

3.1.2 Seeker Rate Gyro Errors

The seeker rate gyros can produce errors that perturb and bias the tracker rate loops and degrade the performance of the OCS seeker. Therefore, the primary errors sources of these rate gyros were included in the simulation program for study. Gyro errors (or more correctly, gyro error torques) can arise from a variety of different sources and are usually expressed as equivalent gyro drift rates.

Constant gyro drift rates result from uncompensated bias torques, L_ϵ, and their magnitude is usually a measure of the gyro quality. Acceleration sensitivity is primarily a function of the mass unbalance about the gyro output axis, i.e., the center of mass not coincident with the output axis. Linear accelerations, A, normal to the output axis produce gyro drift rates proportional to the acceleration.

The last gyro error source to be considered is a characteristic due to the inertia of the gyro float assembly. Angular accelerations about the output axis, $\dot{\omega}_{OA}$, cause gyro pick-off angle errors, which in turn torque the gyro through the electronic caging loop resulting in a gyro drift rate. Thus, the total gyro error rate is

$$\omega_\epsilon = \frac{L_\epsilon}{H} + \frac{P}{H} A + \frac{J_{OA}}{H} \dot{\omega}_{OA} \qquad \text{Eq. 2.19}$$

where H is the angular momentum of the rotor, P is the pendulosity, and J_{OA} is the moment of inertia of the floated assembly about its output axis.

The OCS platform has two stabilizing rate gyros mounted to sense inertial rates in the pitch and yaw axes. These rate gyros are so mounted that their output axes are aligned with the platform roll axis. Therefore, from Eq. 2.19, the error rate for the pitch gyro is

$$\omega_{\epsilon O} = K_{BO} + K_{PO} A + K_{OAO} \dot{\omega}_{ROLL} \qquad \text{Eq. 2.20}$$

and for the yaw gyro

$$\omega_{\epsilon I} = K_{BI} + K_{PI} A + K_{OAI} \dot{\omega}_{ROLL} \, . \qquad \text{Eq. 2.21}$$

The coefficients in Eqs. 2.20 and 2.21 are user specified by their distribution functions. Since the gyro pendulosity, K_P, has an equal likelihood of occurring anywhere about the gyro output axis, its location is picked from a uniform distribution prior to each run.

3.2 Probability Distribution Input Description

3.2.1 OCS Monte Carlo Input Variables

The variables associated with the Monte Carlo seeker models are given below. The mean values of these variables are input by 3-cards and the probability distributions are input by 8-cards.**

Program Variable Name of Error Source	C Index of Error Source	Program Module Calling MCARLO	MCARLO Flag*		Definition
			Name	Index	
KUO	611	S2I		611	Outer gimbal mass unbalance (in-oz/g)
KUI	612	S2I		612	Inner gimbal mass unbalance (in-oz/g)
KBO	613	S2I		613	Outer gimbal drift rate (deg/sec)
KBI	614	S2I		614	Inner gimbal drift rate (deg/sec)
KPO	615	S2I		615	Outer gimbal pendulosity coefficient (deg/sec/g)
KPI	616	S2I		616	Inner gimbal drift rate (deg/sec/g)
KOAO	617	S2I		617	Outer gimbal output axis/ roll coupling coefficient (sec)
KOAI	618	S2I		618	Inner gimbal output axis/ roll coupling coefficient (sec)

*MCARLO is flagged by the C-Index of this variable in the calling module.

When MCARLO is flagged by this C-Index, a random number will be returned from MCARLO for the error source in the first column.

** See reference 2 for definition of 8-cards.

3.2.2 Launch Transient Monte Carlo Input Variables

The variables associated with the Monte Carlo launch transient models are given below. An 8-card is used to select any one of these models (roll, pitch or yaw) as a Monte Carlo variable. Roll is the only one of the three that requires specification of a probability distribution on the 8-card. The pitch and yaw models do require 8-cards; however, the probability distribution input fields are left blank because pitch and yaw are randomized indirectly, as explained in Section 2.2.6.

A mean value of roll rate (WPTO) is input by 3-card. Mean values of pitch and yaw rate are not input, because the mean and distribution of these two variables are determined from solution of the forcing function, F(t), Eq. 2.8. However, the peak amplitude of pitch (AMP2) and yaw (AMP1) moment (due to helicopter vibration) must be input by 3-card. In addition, the flag, VIB, defined in Section 2.3.2 must be input equal to 1.

Program Variable Name of Error Source	C Index of Error Source	Program Module Calling MCARLO	MCARLO Flag*		Definition
			Name	Index	
WPTO	1738	A3I, A2		1738	Mean tip-off roll rate (deg/sec)
AMP2	1742	A3I, A2		1742	Peak amplitude of pitching moment forcing function (ft/lbs)
AMP1	1746	A3I, A2		1746	Peak amplitude of yawing moment forcing function (ft/lbs)

*MCARLO is flagged by the C-Index of this variable in the calling module.

When MCARLO is flagged by this C-Index, a random number will be returned from MCARLO for the error source in the first column.

3.2.3 Pitch and Yaw Randomization Independent of Launch Transient Model

Pitch and yaw tip-off rates may be randomized from an input probability distribution by inputting the C-indices of pitch and yaw rate on an 8-card. This capability was added as an option to directly randomize as opposed to indirectly randomizing pitch and yaw rates as mentioned above. Use of this option will generate instantaneous changes in pitch and yaw rate at time of rear shoe rail exit. This option was added primarily to allow randomization of pitch and yaw rates for launch from a tower or ground vehicle in which there are no launcher vibrations. However, this option can be exercised simultaneously with the vibration model above. Roll rate randomization described above applies equally to helicopter or ground launchers.

Program Variable Name of Error Source	C Index of Error Source	Program Module Calling MCARLO	MCARLO Flag*		Definition
			Name	Index	
WQ	1743	A2		1743	Pitch rate (deg/sec)
WR	1747	A2		1747	Yaw rate (deg/sec)

*MCARLO is flagged by the C-Index of this variable in the calling module.

When MCARLO is flagged by this C-Index, a random number will be returned from MCARLO for the error source in the first column.

4.0 COMPUTER PROGRAM DESCRIPTIONS

4.1 New Subroutines

The basic structure of the 6-DOF Monte Carlo program remains unchanged. Modifications and minor alterations were made to incorporate the OSC subroutines and all related models. Four new subroutines were created and minor changes in other subroutines were made to interface the new subroutines with existing program structure. The new subroutines added are:

1. LTRAN - pitch and yaw helicopter vibration subroutine containing Eq. 2.8, the moment forcing function, and Eq. 2.9, the rate initialization function.
2. S2I - OCS initialization subroutine. This subroutine initializes values for both OCS models, S2 and S3. (S2I contains an entry point, S3I, that initializes variables pertinent to S3.)
3. S2 - The derived OCS model subroutine, which contains both high and low frequency components.
4. S3 - The simplified OCS model subroutine, consisting of only the low frequency components.

Input variables for the OCS model and all related models are defined following the sections that describe those particular models.

Seeker subroutine selection is made by use of the 2-cards* Care must be exercised when changing 2-cards, because, as explained in reference 1, the order in which 2-cards are input determines the order in which all missile and environment subroutines are called.

4.2 Monte Carlo Runs With Breaklock

Flights that breaklock are terminated when breaklock occurs. This, of course, impacts the Monte Carlo operation of the simulation program. Dropping the run from the run set reduces the number of miss distance values that will be used to compute statistical information such as mean, standard deviation and CEP; and this in turn reduces the confidence level of the statistical data. To alleviate this degradation in confidence level, additional runs are

*See reference 1 for definition of 2-cards.

automatically added to a run set to make up for runs terminated due to breaklock. However, a limit of five additional runs is built into the program to avoid ad infinitum runs (or until computer run time limit is reached) due to the occurrence of a very large percentage of breaklock flights.

At the completion of a run set, and prior to printing out CEP data, the number of breaklock flights occurring, the total number of run attempts made, and the ratio of these two is printed out in the format shown below.

```
*BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK*
*BREAKLOCK*                                                                                         *BREAKLOCK*
*BREAKLOCK*   ------------------------------------------------------------------------------------   *BREAKLOCK*
*BREAKLOCK*   THIS RUN SET HAD   17 BREAKLOCK FLIGHTS OUT OF   30 GIVING A PROPORTION OF  .5667      *BREAKLOCK*
*BREAKLOCK*   ------------------------------------------------------------------------------------   *BREAKLOCK*
*BREAKLOCK*                                                                                         *BREAKLOCK*
*BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK**BREAKLOCK*
```

4.3 Sample Run

An example of a Monte Carlo run set and a CEP circle utilizing the OCS model is given in the following pages. The example consists of four runs out of a 25 run set that went into the CEP calculation.

INPUT DATA

1	OUFT 2,3	3-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
1	STOL 2,3	4-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	G2-WINDS	23-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	G3-HE	24-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	G5-HE	25-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	A1-HE	2-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	A3-HE	4-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	A2-HE	3-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	D1-HE	17-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	D2-HE	19-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	G3	30-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	C1-HE(LO-FQ)	7-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
2	C4-HE	10-0	-0.00	-0.	-0.		-0.0000	-0-0.0000
3	T	2100-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	TF	2101-0	-0.00	.1500000E+02	-0.		-0.0000	-0-0.0000
3	PPP	2103-0	-0.00	.3250000E-01	-0.		-0.0000	-0-0.0000
3	REPPLT	2105-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	PTLESS	2107-0	-0.00	.4000000E+01	-0.		-0.0000	-0-0.0000
3	PLOTNO	2108-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	DDC	2113-0	-0.00	.6000000E+01	-0.		-0.0000	-0-0.0000
3	DPP	2115-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	UPP	2115-0	-0.00	.4000000E+01	-0.		-0.0000	-0-0.0000
3	HMIN	2562-0	-0.00	.2500000E-02	-0.		-0.0000	-0-0.0000
3	DER(1)	2564-0	-0.00	.5000000E-02	-0.		-0.0000	-0-0.0000
3	HMAX	2563-0	-0.00	.5000000E-02	-0.		-0.0000	-0-0.0000
3	OPTN2	3502-0	-0.00	.2000000E+01	-0.		-0.0000	-0-0.0000
3	OPTN4	3504-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	OPTN6	3505-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	VHXE	100-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	VHYE	101-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	VHZE	102-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	VMACH	204-0	-0.00	.1000000E+00		.1000000E+01	-0.0000	-0-0.0000
3	RHZRO	209-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	BALPHA	367-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	BALPHY	368-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	RTHTG	427-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	SPSIG	431-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	RF	442-0	-0.00	.4000000E+03	-0.		-0.0000	-0-0.0000
3	DF	443-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	HDB	444-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	RLOCK	445-0	-0.00	.3281000E+05	-0.		-0.0000	-0-0.0000
3	DT	446-0	-0.00	.5000000E-01	-0.		-0.0000	-0-0.0000
3	DDB	447-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	CFOVZ	448-0	-0.00	.2000000E+02	-0.		-0.0000	-0-0.0000
3	CFOVY	449-0	-0.00	.2000000E+02	-0.		-0.0000	-0-0.0000
3	SSX	450-0	-0.00	.1000000E+02	-0.		-0.0000	-0-0.0000
3	SEPS	451-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	SAM	452-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	RBK	453-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	SED	454-0	-0.00	.1000000E+02	-0.		-0.0000	-0-0.0000
3	OPTNSK	455-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	GS	456-0	-0.00	.5000000E+01	-0.		-0.0000	-0-0.0000
3	WSL	457-0	-0.00	.5000000E+01	-0.		-0.0000	-0-0.0000
3	WSN	458-0	-0.00	.1000000E+03	-0.		-0.0000	-0-0.0000
3	WSN	458-0	-0.00	.5000000E+02	-0.		-0.0000	-0-0.0000
3	HL2	459-0	-0.00	.3000000E+02	-0.		-0.0000	-0-0.0000
3	HL2	459-0	-0.00	.1500000E+02	-0.		-0.0000	-0-0.0000
3	TDY	160-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	SBIAS	161-0	-0.00	.1000050E+01	-0.		-0.0000	-0-0.0000
3	SH	162-0	-0.00	.4000000E+01	-0.		-0.0000	-0-0.0000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

3	WN1	364-0	-0.00	.1500000E+02	-0.		-0.0000	-0-0.0000
3	WL	365-0	-0.00	.1500000E+01	-0.		-0.0000	-0-0.0000
3	WLXX1	366-0	-0.00	.3500000E+02	-0.		-0.0000	-0-0.0000
3	WLXX2	367-0	-0.00	.3500000E+02	-0.		-0.0000	-0-0.0000
3	WLJK1	368-0	-0.00	.3000000E+02	-0.		-0.0000	-0-0.0000
3	WLJK2	369-0	-0.00	.3000000E+02	-0.		-0.0000	-0-0.0000
3	HJK	370-0	-0.00	.1300000E+02	-0.		-0.0000	-0-0.0000
3	WXX	371-0	-0.00	.1750000E+03	-0.		-0.0000	-0-0.0000
3	DXX	372-0	-0.00	.6500000E+00	-0.		-0.0000	-0-0.0000
3	WJK	73-0	-0.00	.1750000E+03	-0.		-0.0000	-0-0.0000
3	DJK	74-0	-0.00	.6500000E+00	-0.		-0.0000	-0-0.0000
3	GXX	375-0	-0.00	.3700000E+00	-0.		-0.0000	-0-0.0000
3	GJK	375-0	-0.00	.2500000E+01	-0.		-0.0000	-0-0.0000
3	RES	377-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	QBIAS	378-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	RBIAS	379-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	HXX	390-0	-0.00	.1800000E+02	-0.		-0.0000	-0-0.0000
3	OPTACT	1140-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	DR	1145-0	-0.00	.1000000E+02	-0.		-0.0000	-0-0.0000
3	HDCL	1147-0	-0.00	.2400000E+03	-0.		-0.0000	-0-0.0000
3	W1	1148-0	-0.00	.6000000E+01	-0.		-0.0000	-0-0.0000
3	ZN	1149-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	G1	1151-0	-0.00	.7200000E+03	-0.		-0.0000	-0-0.0000
3	BH	1152-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	WN	1153-0	-0.00	.1600000E+03	-0.		-0.0000	-0-0.0000
3	G2	1154-0	-0.00	.1000000E+01	-0.		-0.0000	-0-0.0000
3	BOP	1231-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	BOQ	1232-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	BOR	1233-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	RFAREA	1305-0	-0.00	.1963000E+00	-0.		-0.0000	-0-0.0000
3	RFLGTH	1307-0	-0.00	.5000000E+00	-0.		-0.0000	-0-0.0000
3	RLUG	1315-0	-0.00	.2320000E+01	-0.		-0.0000	-0-0.0000
3	RAIL	1317-0	-0.00	.3500000E+01	-0.		-0.0000	-0-0.0000
3	AGV	1330-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	QNALGN	1403-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	QBURN	1405-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	CISP	1414-0	-0.00	.1965000E+03	-0.		-0.0000	-0-0.0000
3	DWT	1415-0	-0.00	.5760000E+02	-0.		-0.0000	-0-0.0000
3	DWP	1416-0	-0.00	.1500000E+02	-0.		-0.0000	-0-0.0000
3	RDCGO	1417-0	-0.00	-.7500000E-01	-0.		-0.0000	-0-0.0000
3	RDCGF	1418-0	-0.00	.2670000E+00	-0.		-0.0000	-0-0.0000
3	FMIXF	1419-0	-0.00	.5700000E-01	-0.		-0.0000	-0-0.0000
3	FMIYF	1420-0	-0.00	.4600000E+01	-0.		-0.0000	-0-0.0000
3	RLCGO	1421-0	-0.00	.1430000E+01	-0.		-0.0000	-0-0.0000
3	AGRAV	1627-0	-0.00	.3217400E+02	-0.		-0.0000	-0-0.0000
3	XE	1515-0	-0.00	-.6560000E+04		.1000000E+01	-0.0000	-0-0.0000
3	ZE	1523-0	-0.00	-.1000000E+03		.1000000E+01	-0.0000	-0-0.0000
3	OPTARG	1539-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	P	1739-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	Q	1743-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	R	1747-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	BTHTO	1753-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	BPSIO	1754-0	-0.00	0.	-0.		-0.0000	-0-0.0000
3	STEP	2110-0	-0.00	.2000000E+01	-0.		-0.0000	-0-0.0000
3	ST	460-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3	PPP	2105-0	-0.00	.1000000E-01	-0.		-0.0000	-0-0.0000
3	PPNT	2104-0	-0.00	0.		.1000000E+01	-0.0000	-0-0.0000
3		2664-0	-0.00	.1250000E-01		.1000000E+01	-0.0000	-0-0.0000
3	TF	2101-0	-0.00	.2500000E+02	-0.		-0.0000	-0-0.0000
3	WSL	457-0	-0.00	.3000000E+01	-0.		-0.0000	-0-0.0000
3	WSL	457-0	-0.00	.1000000E+02	-0.		-0.0000	-0-0.0000
3	XE	1515-0	-0.00	-.6560000E+04		.1000000E+01	-0.0000	-0-0.0000
3	XL	1513-0	-0.00	-.3280000E+04		.1000000E+01	-0.0000	-0-0.0000
3	KD1	545-0	-0.00	.1430000E+02	-0.		-0.0000	-0-0.0000
3	KR1	546-0	-0.00	.1430000E+02	-0.		-0.0000	-0-0.0000

3	KR2	549-0	-0.00	.5100000E+01	-0.	-0.0000	-0-0.0000
3	KQ3	549-0	-0.00	.3330000E+01	-0.	-0.0000	-0-0.0000
3	KR3	550-0	-0.00	.3330000E+01	-0.	-0.0000	-0-0.0000
3	KQ5	551-0	-0.00	.9980000E+03	-0.	-0.0000	-0-0.0000
3	KR5	552-0	-0.00	.5240000E+03	-0.	-0.0000	-0-0.0000
3	KQ6	553-0	-0.00	.3020000E+00	-0.	-0.0000	-0-0.0000
3	KP6	554-0	-0.00	.3020000E+00	-0.	-0.0000	-0-0.0000
3	KQ7	555-0	-0.00	.8700000E+01	-0.	-0.0000	-0-0.0000
3	KR7	556-0	-0.00	.8700000E+01	-0.	-0.0000	-0-0.0000
3	KQ8	557-0	-0.00	.4900000E+01	-0.	-0.0000	-0-0.0000
3	KR8	558-0	-0.00	.4400000E+01	-0.	-0.0000	-0-0.0000
3	KQ10	559-0	-0.00	.2680000E+01	-0.	-0.0000	-0-0.0000
3	KR10	560-0	-0.00	.2680000E+01	-0.	-0.0000	-0-0.0000
3	KQ11	561-0	-0.00	.9500000E+01	-0.	-0.0000	-0-0.0000
3	KR11	562-0	-0.00	.9300000E+01	-0.	-0.0000	-0-0.0000
3	KQ12	563-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
3	KR12	564-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
3	WTQ1	573-0	-0.00	.6170000E+01	-0.	-0.0000	-0-0.0000
3	WTR1	574-0	-0.00	.6170000E+01	-0.	-0.0000	-0-0.0000
3	WTQ2	575-0	-0.00	.1890000E+01	-0.	-0.0000	-0-0.0000
3	WTR2	576-0	-0.00	.1890000E+01	-0.	-0.0000	-0-0.0000
3	WGQ1	577-0	-0.00	.5000000E+02	-0.	-0.0000	-0-0.0000
3	WGR1	578-0	-0.00	.5000000E+02	-0.	-0.0000	-0-0.0000
3	WGQ3	581-0	-0.00	.2000000E+02	-0.	-0.0000	-0-0.0000
3	WGR3	582-0	-0.00	.2000000E+02	-0.	-0.0000	-0-0.0000
3	WGQ4	583-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
3	WGR4	584-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
3	WGQ5	585-0	-0.00	.3140000E+03	-0.	-0.0000	-0-0.0000
3	WGR5	586-0	-0.00	.3140000E+03	-0.	-0.0000	-0-0.0000
3	WGQ6	587-0	-0.00	.1000000E+04	-0.	-0.0000	-0-0.0000
3	WGR6	588-0	-0.00	.1000000E+04	-0.	-0.0000	-0-0.0000
3	WRQ2	591-0	-0.00	.3140000E+03	-0.	-0.0000	-0-0.0000
3	WRR2	592-0	-0.00	.3140000E+03	-0.	-0.0000	-0-0.0000
3	WRQ4	595-0	-0.00	.1000000E+04	-0.	-0.0000	-0-0.0000
3	WRR4	595-0	-0.00	.1000000E+04	-0.	-0.0000	-0-0.0000
3	RCL	597-0	-0.00	.1500000E+01	-0.	-0.0000	-0-0.0000
3	TCLQ	598-0	-0.00	.4970000E+01	-0.	-0.0000	-0-0.0000
3	TCLR	599-0	-0.00	.3100000E+01	-0.	-0.0000	-0-0.0000
3	JI	565-0	-0.00	.3500000E+00	-0.	-0.0000	-0-0.0000
3	JO	566-0	-0.00	.6580000E+00	-0.	-0.0000	-0-0.0000
3	GEOCS	497-0	-0.00	.1500000E+01	-0.	-0.0000	-0-0.0000
3	FRI	567-0	-0.00	.7000000E+00	-0.	-0.0000	-0-0.0000
3	FRO	569-0	-0.00	.1500000E+01	-0.	-0.0000	-0-0.0000
3	FFOV (ODS)	564-0	-0.00	.7300000E+00	-0.	-0.0000	-0-0.0000
3	TARHT	501-0	-0.00	.1350000E+02	-0.	-0.0000	-0-0.0000
3	TARWD	502-0	-0.00	.1050000E+02	-0.	-0.0000	-0-0.0000
3	DER1	2164-0	-0.00	.6350000E-02	.1000000E+01	-0.0000	-0-0.0000
3	TAU	500-0	-0.00	.1670000E-01	-0.	-0.0000	-0-0.0000
3	RNSTRT	3511-0	-0.00	.7700000E+02	-0.	-0.0000	-0-0.0000
8	GYRO DRIFT P1	1764-0	-0.00	.1525000E+00	-.3000000E+01	3.0000	-0-0.0000
8	GYRO DRIFT Q1	1765-0	-0.00	.5350000E-01	-.3000000E+01	3.0000	-0-0.0000
8	GYRO DRIFT P2	1766-0	-0.00	.1525000E+00	-.3000000E+01	3.0000	-0-0.0000
8	GYRO DRIFT R2	1767-0	-0.00	.5350000E-01	-.3000000E+01	3.0000	-0-0.0000
3	BPSIW	51-0	-0.00	0.	.1000000E+01	-0.0000	-0-0.0000
3	VWTE	52-0	-0.00	0.	.1000000E+01	-0.0000	-0-0.0000
8	STEADY WND VWTE	52-0	-0.00	.2800000E+02	-.3000000E+01	3.0000	-0-0.0000
8	STEADY WND BPSIW	51 1	-0.00	.1000000E+01	0.	360.0000	-0-0.0000
8	FIN ELECB	1247 1	-0.00	.5700000E+00	-.1000000E+01	1.0000	-0-0.0000
8	FIN ELECQB	1248 1	-0.00	.5700000E+00	-.1000000E+01	1.0000	-0-0.0000
8	FIN ELECRB	1249 1	-0.00	.5700000E+00	-.1000000E+01	1.0000	-0-0.0000
8	FIN MECHB	1250 1	-0.00	.3800000E+00	-.1000000E+01	1.0000	-0-0.0000
8	FIN MECHQB	1251 1	-0.00	.3800000E+00	-.1000000E+01	1.0000	-0-0.0000
8	FIN MECHRB	1252 1	-0.00	.3800000E+00	-.1000000E+01	1.0000	-0-0.0000
3	QNALGN	1403-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
8	THRST X-OFFSET	1113 1	-0.00	.4200000E-02	-.1000000E+01	1.0000	-0-0.0000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]							
8	THRST Z-OFFSET	1315 1	-0.00	.4200000E-02	-.1000000E+01	1.0000	-0-0.0000
8	THRST BALPHT	1401 1	-0.00	.2500000E+00	-.1000000E+01	1.0000	-0-0.0000
8	THRST BPHIT	1402 1	-0.00	.2500000E+00	-.1000000E+01	1.0000	-0-0.0000
8	AUTOPILOT GYRO	360 1	-0.00	.3000000E+01	-.1000000E+01	1.0000	-0-0.0000
8	AUTOPILOT GYRO	361 1	-0.00	.3000000E+01	-.1000000E+01	1.0000	-0-0.0000
8	AUTOPILOT GYRO	362 1	-0.00	.3000000E+01	-.1000000E+01	1.0000	-0-0.0000
8	EULER ANG BPSIO	1754 1	-0.00	.1000000E+01	-.3000000E+01	3.0000	-0-0.0000
8	EULER ANG BTHTO	1753 1	-0.00	.1000000E+01	-.3000000E+01	3.0000	-0-0.0000
8	EULER ANG BPHIO	1752 1	-0.00	.1000000E+01	-.3500000E+01	3.0000	-0-0.0000
8	OUTER UNBAL	611-0	-0.00	.1570000E-01	-.3000000E+01	3.0000	-0-0.0000
8	INNER UNBAL	612-0	-0.00	.1670000E-01	-.3000000E+01	3.0000	-0-0.0000
3	TIPOFF HP MEAN	1738-0	-0.00	.2000000E+02	.1000000E+01	-0.0000	-0-0.0000
3	ZE	1523-0	-0.00	-.6000000E+03	.1000000E+01	-0.0000	-0-0.0000
3	VMHTE	1574-0	-0.00	.1360000E+03	.1000000E+01	-0.0000	-0-0.0000
3	TLAG	603-0	-0.00	.1000000E-01	-0.	-0.0000	-0-0.0000
3	TLAG	606-0	-0.00	0.	-0.	-0.0000	-0-0.0000
8	TIP OFF ROLL RATE	1733-0	-0.00	.2000000E+02	-.3000000E+01	3.0000	-0-0.0000
8	FMZ AMPL(LAUNCH)	1745-0	-0.00	.1400000E+01	-.3000000E+01	3.0000	-0-0.0000
8	FMY AMPL(LAUNCH)	1742-0	-0.00	.1000000E+01	-.3000000E+01	3.0000	-0-0.0000
3	FMZ MEAN (LAUNCH)	1745-0	-0.00	.8000000E+02	.1000000E+01	-0.0000	-0-0.0000
3	FMY MEAN (LAUNCH)	1742-0	-0.00	.2000000E+03	.1000000E+01	-0.0000	-0-0.0000
3	KOAO	617-0	-0.00	.8700000E-03	.1000000E+01	-0.0000	-0-0.0000
3	KOAI	613-0	-0.00	.8700000E-03	.1000000E+01	-0.0000	-0-0.0000
8	KOAO	617-0	-0.00	.3000000E-04	-.3000000E+01	3.0000	-0-0.0000
8	KOAI	613-0	-0.00	.3000000E-04	-.3000000E+01	3.0000	-0-0.0000
3	KUI	612-0	-0.00	.5000000E-01	.1000000E+01	-0.0000	-0-0.0000
3	KUO	611-0	-0.00	.5000000E-01	.1000000E+01	-0.0000	-0-0.0000
3	XE	1515-0	-0.00	-.1000000E+05	.1000000E+01	-0.0000	-0-0.0000
3	BTHTO	1753-0	-0.00	-.2000000E+01	.1000000E+01	-0.0000	-0-0.0000
3	BTHTO	1753-0	-0.00	-.8530000E+01	.1000000E+01	-0.0000	-0-0.0000
3	XE	1515-0	-0.00	-.4000000E+04	.1000000E+01	-0.0000	-0-0.0000
3	BTHTO	1753-0	-0.00	-.4900000E+01	.1000000E+01	-0.0000	-0-0.0000
3	XE	1515-0	-0.00	-.7000000E+04	.1000000E+01	-0.0000	-0-0.0000
3	HELICOPTER VIB	525-0	-0.00	.1000000E+01	-0.	-0.0000	-0-0.0000
6		-0-0	-0.00	-0.	-0.	-0.0000	-0-0.0000

MONTE CARLO INITIAL CONDITIONS

C-INDEX	MC-VALUE	MEAN	DISTRIBUTION	LOWER BOUND	UPPER BOUND
52	8.1288072	0.0000000	NORMAL	-3.000	3.000
51	236.561	0.000	UNIFORM	0.000	350.000
1247	-.180	0.000	UNIFORM	-1.000	1.000
1248	.378	0.000	UNIFORM	-1.000	1.000
1249	-.329	0.000	UNIFORM	-1.000	1.000
1250	-.174	0.000	UNIFORM	-1.000	1.000
1251	-.377	0.000	UNIFORM	-1.000	1.000
1252	.281	0.000	UNIFORM	-1.000	1.000
1313	-.004	0.000	UNIFORM	-1.000	1.000
1314	-.004	0.000	UNIFORM	-1.000	1.000
1315	-.003	0.000	UNIFORM	-1.000	1.000
1401	.071	0.000	UNIFORM	-1.000	1.000
1402	-.230	0.000	UNIFORM	-1.000	1.000
1733	8.1197569	20.0000000	NORMAL	-3.000	3.000
1764	.0045006	0.0000000	NORMAL	-3.000	3.000
1765	-.0691272	0.0000000	NORMAL	-3.000	3.000
1766	.0805035	0.0000000	NORMAL	-3.000	3.000
1767	.0445368	0.0000000	NORMAL	-3.000	3.000
360	1.775	0.000	UNIFORM	-1.000	1.000
361	-.597	0.000	UNIFORM	-1.000	1.000
362	-.924	0.000	UNIFORM	-1.000	1.000
1754	.858	0.000	UNIFORM	-3.000	3.000
1753	-4.706	-4.900	UNIFORM	-3.000	3.000
1752	1.380	0.000	UNIFORM	-3.000	3.000
611	.0885407	.0500000	NORMAL	-3.000	3.000
612	.0379133	.0500000	NORMAL	-3.000	3.000
617	.0008617	.0008700	NORMAL	-3.000	3.000

```
TIME=      .002:00C   STEP SIZE=      2.0000C00E-03

    FRONT LUG CLEARS RAIL      T =  8.60E-02     REL VEL =  2.11E+02     PITCH MOMENT = -5.45E+01
                                   RANGO  = 3.5848
                                                          TIPOFF RATES--ROLL =    8.1 PITCH =   -4.0 YAW =   -3.1

        REAR LUG CLEARS RAIL    T =    .1120REL VEL =  232.929   RAIL FORCE =   -40.63
                                   RANGO  = 5.9739
TIME=      .112:000   STEP SIZE=      8.3500L00E-03

BURNOUT TIME=  3.0011 SEC.

***************************************************************************************************
OCS BLIND RANGE SIGNAL HOLD AT TIME =  6.21  RANGE =     329.79
***************************************************************************************************

                                                          +++MAX BREAKLOCK VALUE =    .28337  IN  PITCH

                                                          +++MAX BREAKLOCK VALUE =    .27224  IN  YAW

RUN NUMBER =  1

 MISS DISTANCE =    4.7314125E+00

 FLIGHT  TIME  =    6.5360395E+00

      ROELX =  -6.7331478E-01       ROELY =   4.5156575E-01       ROELZ =   4.6795396E+00

                                    RYFP   =   4.5454347E-01       RZFP   =   4.7296209E+00
   BZ       *************
   BY       *************
```

INPUT DATA

6 -0-0 -0.00 -0. -0. -0.0000 -0-0.0000

MONTE CARLO INITIAL CONDITIONS

C-INDEX	MC-VALUE	MEAN	DISTRIBUTION	LOWER BOUND	UPPER BOUND
52	2.9129063	0.0000000	NORMAL	-3.000	3.000
51	163.976	0.000	UNIFORM	0.000	360.000
1247	-.074	0.000	UNIFORM	-1.000	1.000
1248	-.020	0.000	UNIFORM	-1.000	1.000
1249	-.403	0.000	UNIFORM	-1.000	1.000
1250	-.315	0.000	UNIFORM	-1.000	1.000
1251	-.180	0.000	UNIFORM	-1.000	1.000
1252	-.229	0.000	UNIFORM	-1.000	1.000
1313	-.003	0.000	UNIFORM	-1.000	1.000
1314	-.001	0.000	UNIFORM	-1.000	1.000
1315	.502	0.000	UNIFORM	-1.000	1.000
1401	-.152	0.000	UNIFORM	-1.000	1.000
1402	.004	0.000	UNIFORM	-1.000	1.000
1733	38.2631228	20.0000000	NORMAL	-3.000	3.000
1764	.0383014	0.0000000	NORMAL	-3.000	3.000
1765	.0738540	0.0000000	NORMAL	-3.000	3.000
1766	--.0695206	0.0000000	NORMAL	-3.000	3.000
1767	-.1013949	0.0000000	NORMAL	-3.000	3.000
360	-2.606	0.000	UNIFORM	-1.000	1.000
361	1.096	0.000	UNIFORM	-1.000	1.000
362	.713	0.000	UNIFORM	-1.000	1.000
1754	.389	0.000	UNIFORM	-3.000	3.000
1753	-3.681	-4.900	UNIFORM	-3.000	3.000
1752	1.190	0.000	UNIFORM	-3.000	3.000
611	.0418523	.0500000	NORMAL	-3.000	3.000
612	.0615168	.0500000	NORMAL	-3.000	3.000
617	.0003060	.0003700	NORMAL	-3.000	3.000
618	.0008466	.0008700	NORMAL	-3.000	3.000

TIME= .0020000 STEP SIZE= 2.0000000E-03

FRONT LUG CLEARS RAIL T = 8.60E-02 REL VEL = 2.11E+02 PITCH MOMENT = -5.43E+01
RANGO = 3.5829
TIPOFF RATES--ROLL = 38.3 PITCH = -21.5 YAW = -1.9

REAR LUG CLEARS RAIL T = .1120REL VEL = 232.875 RAIL FORCE = -41.32
RANGO = 5.9769
TIME= .1120000 STEP SIZE= 8.3500000E-03

BURNOUT TIME= 3.0011 SEC.

****
OCS BLIND RANGE SIGNAL HOLD AT TIME = 6.24 RANGE = 305.73
****

+++MAX BREAKLOCK VALUE = .38339 IN PITCH

+++MAX BREAKLOCK VALUE = -.34518 IN YAW

RUN NUMBER = 2

MISS DISTANCE = 3.8427765E+00

FLIGHT TIME = 6.5467267E+00

RDELX = -5.7209481E-01 RDELY = 5.4297058E-01 RDELZ = 3.7595870E+00

RYFP = 5.3245114E-01 RZFP = 3.8057098E+00

INPUT DATA

6 -0-0 -0.00 -0. -0. -0.0000 -0-0.0000

MONTE CARLO INITIAL CONDITIONS

D-INDEX	MC-VALUE	MEAN	DISTRIBUTION	LOWER BOUND	UPPER BOUND
52	50.1629962	0.0000000	NORMAL	-3.000	3.000
51	248.545	0.000	UNIFORM	0.000	350.000
1247	.193	0.000	UNIFORM	-1.000	1.000
1248	.066	0.000	UNIFORM	-1.000	1.000
1249	-.118	0.000	UNIFORM	-1.000	1.000
1250	-.261	0.000	UNIFORM	-1.000	1.000
1251	-.089	0.000	UNIFORM	-1.000	1.000
1252	.163	0.000	UNIFORM	-1.000	1.000
1313	.003	0.000	UNIFORM	-1.000	1.000
1314	.003	0.000	UNIFORM	-1.000	1.000
1315	.003	0.000	UNIFORM	-1.000	1.000
1401	.105	0.000	UNIFORM	-1.000	1.000
1402	-.156	0.000	UNIFORM	-1.000	1.000
1733	43.3415734	20.0000000	NORMAL	-3.000	3.000
1764	.0046708	0.0000000	NORMAL	-3.000	3.000
1765	-.0206029	0.0000000	NORMAL	-3.000	3.000
1766	-.0677724	0.0000000	NORMAL	-3.000	3.000
1767	.0243741	0.0000000	NORMAL	-3.000	3.000
360	.538	0.000	UNIFORM	-1.000	1.000
361	2.257	0.000	UNIFORM	-1.000	1.000
362	.675	0.000	UNIFORM	-1.000	1.000
1754	.855	0.000	UNIFORM	-3.000	3.000
1753	-3.641	-4.900	UNIFORM	-3.000	3.000
1752	-2.797	0.000	UNIFORM	-3.000	3.000
611	.0685639	.0500000	NORMAL	-3.000	3.000
612	.0585906	.0500000	NORMAL	-3.000	3.000
617	.0003758	.0008700	NORMAL	-3.000	3.000
618	.0008565	.0008700	NORMAL	-3.000	3.000

TIME= .002000 STEP SIZE= 2.0000000E-03

FRONT LUG CLEARS RAIL T = 8.60E-02 REL VEL = 2.11E+02 PITCH MOMENT = -6.40E+01
RANGO = 3.5828
TIPOFF RATES--ROLL = 43.4 PITCH = -22.0 YAW = 4.2

REAR LUG CLEARS RAIL T = .1120REL VEL = 232.375 RAIL FORCE = -49.56
RANGO = 5.9768
TIME= .112000 STEP SIZE= 8.3500000E-03

BURNOUT TIME= 3.0011 SEC.

****
OCS BLIND RANGE SIGNAL HOLD AT TIME = 6.16 RANGE = 305.94
****

+++MAX BREAKLOCK VALUE = .36408 IN PITCH

+++MAX BREAKLOCK VALUE = .22631 IN YAW

RUN NUMBER = 3

MISS DISTANCE = 3.9798668E+00

FLIGHT TIME = 6.0084555E+00

RDELX = -6.5284602E-01 RDELY = 5.2700033E-01 RDELZ = 3.8901170E+00

RYFP = 4.9703574E-01 RZFP = 3.9487081E+00

INPUT DATA

6 -0-0 -0.00 -0. -0. -0.0000 -0-0.0000

MONTE CARLO INITIAL CONDITIONS

C-INDEX	MC-VALUE	MEAN	DISTRIBUTION	LOWER BOUND	UPPER BOUND
52	-30.7594857	0.0000000	NORMAL	-3.000	3.000
51	20.578	0.000	UNIFORM	0.000	360.000
1247	.352	0.000	UNIFORM	-1.000	1.000
1248	-.510	0.000	UNIFORM	-1.000	1.000
1249	-.195	0.000	UNIFORM	-1.000	1.000
1250	.223	0.000	UNIFORM	-1.000	1.000
1251	-.073	0.000	UNIFORM	-1.000	1.000
1252	-.150	0.000	UNIFORM	-1.000	1.000
1313	-.002	0.000	UNIFORM	-1.000	1.000
1314	.001	0.000	UNIFORM	-1.000	1.000
1315	.003	0.000	UNIFORM	-1.000	1.000
1401	-.120	0.000	UNIFORM	-1.000	1.000
1402	-.048	0.000	UNIFORM	-1.000	1.000
1738	42.4128024	20.0000000	NORMAL	-3.000	3.000
1764	.1296747	0.0000000	NORMAL	-3.000	3.000
1765	.0250585	0.0000000	NORMAL	-3.000	3.000
1766	-.0722943	0.0000000	NORMAL	-3.000	3.000
1767	-.0855807	0.0000000	NORMAL	-3.000	3.000
360	.311	0.000	UNIFORM	-1.000	1.000
361	-2.630	0.000	UNIFORM	-1.000	1.000
362	2.884	0.000	UNIFORM	-1.000	1.000
1754	.386	0.000	UNIFORM	-3.000	3.000
1753	-2.857	-4.900	UNIFORM	-3.000	3.000
1752	-2.346	0.000	UNIFORM	-3.000	3.000
611	.0693596	.0500000	NORMAL	-3.000	3.000
612	.0739063	.0500000	NORMAL	-3.000	3.000
617	.0003564	.0003700	NORMAL	-3.000	3.000
610	.0008411	.0008700	NORMAL	-3.000	3.000

TIME= .0020000 STEP SIZE= 2.0000000E-03

FRONT LUG CLEARS RAIL T = 8.60E-02 REL VEL = 2.11E+02 PITCH MOMENT = -5.02E+01
RANGO = 3.5812
TIPOFF RATES--ROLL = 42.3 PITCH = -16.8 YAW = 1.6

REAR LUG CLEARS RAIL T = .1120REL VEL = 232.525 RAIL FORCE = -35.63
RANGO = 5.9740
TIME= .1120000 STEP SIZE= 8.3500000E-03

BURNOUT TIME= 3.0011 SEC.

****
OCS BLIND RANGE SIGNAL HOLD AT TIME = 6.44 RANGE = 318.98
****

+++MAX BREAKLOCK VALUE = .35363 IN PITCH

+++MAX BREAKLOCK VALUE = .27758 IN YAW

RUN NUMBER = 4

MISS DISTANCE = 4.4172301E+00

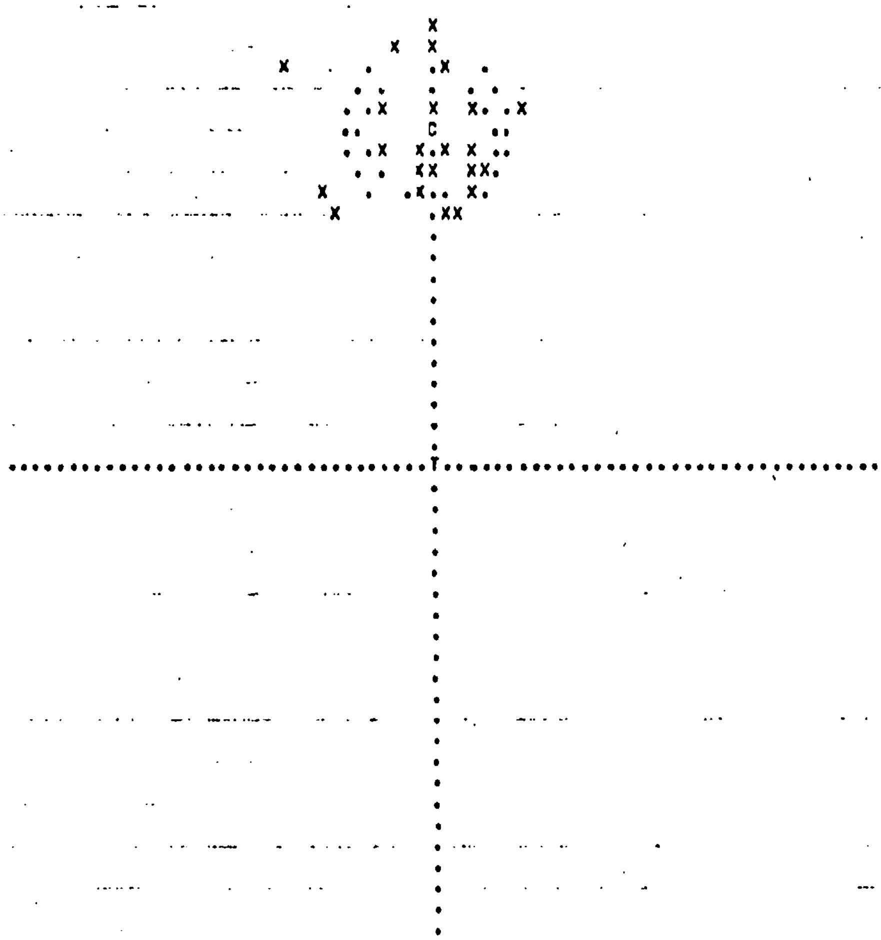
FLIGHT TIME = 6.7754873E+00

RDELX = -5.1198689E-01 RDELY = -6.1444841E-01 RDELZ = 4.3329670E+00

CEP CENTROID AT (-.069,4.449)   DISTANCE FROM TARGET CENTER= 4.450

CEP CONFIDENCE CIRCLE FOR LAMBDA = 0.00

POINTS   X
CEP CIRCLE   ......
CIRCLE CENTROID   C
TGT CENTER   T
99 PER CENT CONFIDENCE CIRCLE   ......



CEP CENTROID=(-.069, 4.449)   DIST. FROM TGT CENTER= 4.450   CEP= .857
THE 99 PER CENT CONFIDENCE CIRCLE RADIUS IS 1.118

5.0 COMMENTS

5.1 Integration Synchronization With Sample Period

Numerical integration must be synchronized with sample period* (τ @ ZOH) in order to insure accurate integration. Logic is built into the seeker subroutines to insure that integration and sample period are synchronized. This is accomplished by:

$$\Delta t = \tau / [\mathrm{AINT}(\tau / \Delta t_{INPUT})]$$

where

τ	– sample period (SEC).
Δt_{INPUT}	– input integration stepsize (SEC).
AINT(X)	– computer center library function that integerizes the argument (X).
Δt	– computer integration stepsize that the program will use.

The above function will always compute an integration stepsize that is equal to or greater than the input stepsize. Since there is an upper bound on the stepsize that can be used to integrate the differential equations in this simulation program, there is the possibility that a stepsize larger than the upper bound will be computed. (Upper bound is approximately 12.5 millisec, with the exception of the OCS seeker model S2 which has an upper bound of approximately .5 millisec). Therefore, one should insure that a reasonable stepsize is input and verify that a reasonable stepsize is computed. For example, if the sample period is 16.7 millisecs, then a stepsize of 8.35 millisecs or less must be input to insure that the computed stepsize is 12.5 millisecs or less.

* A discussion of errors caused by numerical integration of sample data is given in Reference 5.

REFERENCES

1. "An Engineering and Programming Guide For a Six Degree of Freedom, Terminal Homing Simulation Program," TR RG-73-22, dated 10 October 1973.

2. "User's Guide For a Monte Carlo Point Target Terminal Homing Simulation Program," TR RG-74-37, dated 20 May 1974.

3. "Terminal Homing Engineering Flight Test T7 and MT7 Missile Launch Transients Data Reduction and Summary," TR RG-75-12, dated 29 August 1974.

4. "TSAP (Time Series Analysis Program): A Monte Carlo Support Module," Computer Sciences Corporation, dated 19 April 1974.

5. "Laser Guided Close Air Support Weapons Systems Effectiveness Measures," Computer Sciences Corporation, dated 28 September 1973.

APPENDIX

Monte Carlo 6-DOF Program Listing

A FORTRAN IV listing of the Monte Carlo 6-DOF Program that is operational on the MICOM CDC 6600 computer, SCOPE 3.4 operating system, is given in the following pages.

```
      PROGRAM MAIN(INPUT,OUTPUT,FILE,TAPE14,TAPE5=FILE,TAPE6=OUTPUT)      MCSIX   2
C                                                                        MCSIX   3
C*****DIMODS TO BE USED WITH FORTRAN AMRK INTEGRATION ROUTINE             MCSIX   4
C                                                                        MCSIX   5
      COMMON C(3830),GRAPH                                               MCSIX   6
      COMMON/CEPASS/X(100),Y(100)                                        MCSIX   7
      EQUIVALENCE (C(2561),HMIN  ), (C(2663),HMAX  ), (C(2664),DER   ),  MCSIX   8
     C            (C(2561),N     ), (C(2562),IPL   ), (C(2965),VAR   ),  MCSIX   9
     C            (C(2000),T     ), (C(2011),KSTEP ), (C(2010),STEP  ),  MCSIX  10
     C            (C(2012),LSTEP ), (C(2008),PLOTNO), (C(2009),NOPLOT),  MCSIX  11
     C            (C(2023),OPOINT), (C(2025),TIME  ), (C(2325),VLABLE),  MCSIX  12
     C            (C(1167),NODUT ), (C(2022),OPTN10), (C(2006),REPPLT),  MCSIX  13
     C            (C(2865),EU    ), (C(2765),EL    ), (C(2007),PTLESS)   MCSIX  14
      EQUIVALENCE             (C(1971),RITE  ), (C(1972),RKUTTA)         MCSIX  15
      EQUIVALENCE (C(1973),KASE  ), (C(1974),NJ    ), (C(1975),NPT   )   MCSIX  16
      EQUIVALENCE (C(3512),ISGCT),(C(3721),ITCT),(C(3511),RNSTRT)        MCSIX  17
      EQUIVALENCE (C( 21),IBVNSW)                                        MCSIX  18
      EQUIVALENCE (C( 22), IPLOT)                                        MCSIX  19
      EQUIVALENCE (C( 23),KLAMBD)                                        MCSIX  20
      EQUIVALENCE (C( 24), KSSIG)                                        MCSIX  21
      EQUIVALENCE (C( 25),CEPSIG)                                        MCSIX  22
      EQUIVALENCE (C(300),RMISS)                                         MCSIX  23
      DIMENSION RMISST(100)                                              MCSIX  24
      EQUIVALENCE (C(1000),RMISST)                                       MCSIX  25
      EQUIVALENCE (C(301),     L)                                        MCSIX  26
      EQUIVALENCE (C(302),   RYF)                                        MCSIX  27
      EQUIVALENCE(C(19),PSIZE)                                           MCSIX  28
      EQUIVALENCE (C(303),   RZF)                                        MCSIX  29
      EQUIVALENCE (C( 31), CEP)                                          MCSIX  30
      EQUIVALENCE (C(3525), NCASE), (C( 625),     IBL)                   MCSIX  31
      EQUIVALENCE (C( 623),   DERSV)                                     LAG     1
      REAL KSSIG                                                         MCSIX  32
      INTEGER CEPSIG                                                     MCSIX  33
      DIMENSION CEPSIG(5)                                                MCSIX  34
      DIMENSION GRAPH(1,1),TIME(300)                                     MCSIX  35
      DIMENSION   VLABLE(2,15)     , IPL(100)        , DER(101)          MCSIX  36
      DIMENSION   VAR(101)         , EL(100)         , EU(100)           MCSIX  37
      EQUIVALENCE (C(1980),RN    )                                       MCSIX  38
      EQUIVALENCE (C(1981),RNT   )                                       MCSIX  39
      EQUIVALENCE (C(1382),PLOTN4)                                       MCSIX  40
      EQUIVALENCE (C(1383),PLOTN2)                                       MCSIX  41
      EQUIVALENCE (C(1384),NPLOT )                                       MCSIX  42
      INTEGER OPOINT                                                     MCSIX  43
      INTEGER OPT                                                        MCSIX  44
      EXTERNAL AUXSUB                                                    MCSIX  45
      ISGCT=0                                                            MCSIX  46
      ITCT=0                                                             MCSIX  47
      MODE=-1                                                            MCSIX  48
      ITSNGX=0                                                           MCSIX  49
C                                                                        MCSIX  50
C                                                                        MCSIX  51
C                  THIS CALL TO SUBROUTINE RANNUM IS TO PERMIT USE OF    MCSIX  52
C                  DIFFERENT RANDOM NUMBER GENERATOR STARTERS (IRNST).   MCSIX  53
C                  IF SUBROUTINE NORMAL IS CALLED WITHOUT FIRST CALLING  MCSIX  54
C                  RANNUM, THE RANDOM NUMBER SEQUENCE WILL ALWAYS        MCSIX  55
C                  BE STARTED WITH THE SAME NUMBER (ENTERED AS A DATA    MCSIX  56
C                  STATEMENT IN SUBROUTINE NORMAL), WHICH WILL RESULT    MCSIX  57
```

```
C                  IN THE SAME SEQUENCE ALWAYS BEING GENERATED.     MCSIX    58
            L = 1                                                   MCSIX    59
            NP = 0                                                  MCSIX    60
            CALL COUNTV                                             MCSIX    61
       1000 CALL ZERO                                               MCSIX    62
       1001 IF(PLOTN3.LE.0.)GOTO7                                   MCSIX    63
            IF(REPPLT.GT.0.)GOTO7                                   MCSIX    64
C                                                                   MCSIX    65
C                          REPPLT = 0.  USE NEW NO.4,7 (DISCARD OLD) MCSIX   66
C                                   1.  USE OLD PLUS THOSE ADDED    MCSIX    67
C                                  -1.  USE NEW NO. 7 (DISCARD OLD) MCSIX    68
            IF (REPPLT.GT.-1.0) NOOUT = 0                           MCSIX    69
            NPLOT=0                                                 MCSIX    70
          7 CALL OINPT1                                             MCSIX    71
          8 CONTINUE                                                MCSIX    72
            CALL RANNUM(1.,RNSTRT,DUM)                              MCSIX    73
            IF(ISGCT.GT.0) CALL MCARLO (DUM, -1, IDUM)              MCSIX    74
            C(1976) = 1.                                            MCSIX    75
            KASE=0                                                  MCSIX    76
            LSTEP = STEP                                            MCSIX    77
            NPLOT4=PLOTN4                                           MCSIX    78
            NPLOT2=PLOTN2                                           MCSIX    79
            NGPLOT=PLOTNO                                           MCSIX    80
       1002 CALL  SUBL1                                             MCSIX    81
       1003 CALL  AUXI                                              MCSIX    82
       1004 CALL  SUBL2                                             MCSIX    83
       1005 CONTINUE                                                MCSIX    84
            DER(101)=DER(1)                                         MCSIX    85
            IF(DER(1).GT.DERSV) DER(1)=DERSV                        LAG       2
            C(1976)=1.                                              MCSIX    87
       1006 CALL   AUXSUB                                           MCSIX    88
       1007 NJ=N-1                                                  MCSIX    89
            CALL AMRK(AUXSUB)                                       MCSIX    90
       1008 CONTINUE                                                MCSIX    91
       1009 CALL  SUBL3                                             MCSIX    92
            IF ( KSTEP .EQ. 1 ) GO TO 1007                          MCSIX    93
C                                                                   MCSIX    94
C                                                                   MCSIX    95
C                                                                   MCSIX    96
C                                                                   MCSIX    97
C                                                                   MCSIX    98
C                                                                   MCSIX    99
C*****************SAVE MISS DISTANCE FOR EACH RUN OF THE MONTE CARLO MCSIX  100
C                  RUN SET******************************************** MCSIX 101
C                                                                   MCSIX   102
C                                                                   MCSIX   103
C                                                                   MCSIX   104
            IF(LCEP.NE.1) GO TO 20                                  MCSIX   105
            LCEP=0                                                  MCSIX   106
            NP = NP + 1                                             MCSIX   107
            X(NP) = RYF                                             MCSIX   108
            Y(NP) = RZF                                             MCSIX   109
            RMISST(NP) = RMISS                                      MCSIX   110
            GO TO 21                                                MCSIX   111
         20 CONTINUE                                                MCSIX   112
            WRITE(6,805)                                            MCSIX   113
        805 FORMAT(1H0,///)                                         MCSIX   114
```

```
      WRITE(6,22) L
   22 FORMAT(1H0,11X,26H*$*$*$ WARNING RUN NUMBER ,I3,
     2      37H DID NOT INTERSECT TARGET PLANE*$*$*$,/,
     3      //,26X,38H$*$*THIS RUN DROPPED FROM DATA SET*$*$)
      WRITE(6,805)
   21 CONTINUE
      L = L + 1
C
C
C
C
C
      CALL S8
      CALL PROCES
      IF (OPTN10 .GT. 0.) CALL DUMPO
      CALL RESET
      IF(LSTEP.EQ.5.OR.LSTEP.EQ.7.OR.NOPLOT.EQ.0)GOTO5
      CALL TIMEV(DELT)
      WRITE(6,96)DELT
   96 FORMAT(1H ,17HSTART PLOTTING ATF14.7)
      LESSPT=PTLESS
      OPOINT=OPOINT-LESSPT
      CALL PLOT4(GRAPH,OPOINT,VLABLE,TIME,NPLOT4,NPLOT2,NOPLOT)
      CALL PLOT2(GRAPH,OPOINT,VLABLE,TIME,NPLOT4,NPLOT2,NOPLOT)
      CALL FLOTN(GRAPH,OPOINT,VLABLE,TIME,NPLOT4,NPLOT2,NOPLOT)
      CALL TIMEV(DELT)
      WRITE(6,97)DELT
   97 FORMAT(1H ,18HPLOTTING ENDED AT F14.7)
    5 GO TO (1000,1001,1002,1003,1004,1005,1006,1007,1008,1009,1010),
     1 LSTEP
 1010 CONTINUE
C
C
C
C
C
C************MONTE CARLO AND CEP LOGIC FOLLOWS*************************
C
C
C
      IF(NP.LT.NCASE.AND.L.LE.(NCASE+5))WRITE(6,807)
      IF(NP.LT.NCASE.AND.L.LE.(NCASE+5))GO TO 8
  807 FORMAT(1H1,3(/),*     THIS RUN ADDED DUE TO BREAKLOCK*,3(/))
      J =0
      WRITE(6,800)
  800 FORMAT(1H1, 96X,10HY-MISS    ,10HZ-MISS    ,10HMISS DIST /,
     1   6X,123H--------------------------------------------------------
     2--------------------------------------------------------------------
     3--)
      DO 801 I=1,NP
      J = J +1
      WRITE(6,802) X(I),Y(I),RMISST(I)
  802 FORMAT( 6X,10H1          ,10H1          ,10H1          ,10H1
     1,10H1          ,10H1          ,10H1          ,10H1          ,10H1
     2    ,1H1,F9.5,2H 1,F9.5,2H 1,F8.5,2H 1)
      WRITE(6,803)
  803 FORMAT( 6X,123H-------------------------------------------------------
```

```
     2------------------------------------------------------------------
     3------)
      IF(J.GT.30) WRITE (6,800)
      IF(J.GT.30) J = 0
  861 CONTINUE
      IF(IBL.LE.0) GO TO 804
      L=L-1
      XIBL=IBL
      XL=L
      RATIO=XIBL/XL
      WRITE(6,806)IBL,L,RATIO
  806 FORMAT(1H1,15(/,1X,10(11H*BREAKLOCK*),
     .       /,1X,11H*BREAKLOCK*,88X,11H*BREAKLOCK*,
     .       /,1X,11H*BREAKLOCK*,88X,11H*BREAKLOCK*,
     .       /,1X,11H*BREAKLOCK*,3X,*THIS RUN SET HAD *I4,* BREAKLOCK FL
     .IGHTS OUT OF *I4,* GIVING A PROPORTION OF *F6.4,4X,11H*BREAKLOCK*,
     .       /,1X,11H*BREAKLOCK*,88X,11H*BREAKLOCK*,
     .       /,1X,11H*BREAKLOCK*,88X,11H*BREAKLOCK*,
     .       /1X,10(11H*BREAKLOCK*))
  804 CONTINUE
      CALL CEPAS(NP,ISVNSW,IPLOT,XLAMBD,KSSIG,CEPSIG,PSIZE)
 4668 CONTINUE
      CALL EXIT
      STOP
      END
```

```
        PROGRAM MAIN      74/74  OPT=1                       FTN 4.2+75067    05/05/75  16.16.28.     PAGE    5

        SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
 10214  MAIN          1

VARIABLES     SN  TYPE             RELOCATION
    0   C         REAL      ARRAY   / /          REFS       5     21*7    2*14    3*15    3*16     17     18
                                                           19       20       21      22      24      25     26     27
                                                           28       29     2*30      31      38      39     40     41
                                                           42  DEFINED       75      97
   30   CEPSIG    INTEGER   ARRAY   / /          REFS      21       33       34     192
10752   DELI      REAL                           REFS     132      133      140     141
 5147   DER       REAL      ARRAY   / /          REFS       7       36       85      86  DEFINED     85     86
 1156   DERSV     REAL              / /          REFS      31     2*86
10746   DUM       REAL                           REFS      73       74
 5314   EL        REAL      ARRAY   / /          REFS       7       37
 5460   EU        REAL      ARRAY   / /          REFS       7       37
 7366   GRAPH     REAL      ARRAY   / /          REFS       5       35      137     138     139
 5146   HMAX      REAL              / /          REFS       7
 5145   HMIN      REAL              / /          REFS       7
10755   I         INTEGER                        REFS   3*166  DEFINED      154
 1160   IBL       INTEGER           / /          REFS      30      177      179     182
   24   IBVNSW    INTEGER           / /          REFS      17      192
10747   IDUM    * INTEGER                        REFS      74
 5001   IPL       INTEGER   ARRAY   / /          REFS       7       36
   25   IPLOT     INTEGER           / /          REFS      18      132
 6667   ISGCT     INTEGER           / /          REFS      16       74  DEFINED      46
 7210   ITCT      INTEGER           / /          REFS      16  DEFINED       47
10744   ITSNUX  * INTEGER                     DEFINED      49
10754   J         INTEGER                        REFS     165      174      175  DEFINED     158    135    175
 3664   KASE      INTEGER           / /          REFS      15  DEFINED       76
   27   KSSIG     REAL              / /          REFS      20       32      192
 3732   KSTEP     INTEGER           / /          REFS       7       33
  454   L         INTEGER           / /          REFS      25      115      121     155     156    178    188
                                                          182  DEFINED       59     121     178
   36   LCEP      INTEGER           / /          REFS      29      105  DEFINED     106
10753   LESSPT    INTEGER                        REFS     136  DEFINED      135
 3733   LSTEP     INTEGER           / /          REFS       7    2*131      143  DEFINED      77
10743   MODE    * INTEGER                     DEFINED      48
 5000   N         INTEGER           / /          REFS       7       89
 7360   NCASE     INTEGER           / /          REFS      30    2*155    2*156
 3665   NJ        INTEGER           / /          REFS      15  DEFINED       89
 6136   NOOUT     INTEGER           / /          REFS       7  DEFINED       69
 3730   NOPLOT    INTEGER           / /          REFS       7      131      137     138     139
                                              DEFINED      80
10745   NP        INTEGER                        REFS     107      108      109     110     155    156    164
                                                          192  DEFINED       60     107
 3677   NPLOT     INTEGER           / /          REFS      42  DEFINED       70
10751   NPLOT2    INTEGER                        REFS     137      138      139  DEFINED      79
10750   NPLOT4    INTEGER                        REFS     137      138      139  DEFINED      78
 3666   NPT       INTEGER           / /          REFS      15
 3746   OPOINT    INTEGER           / /          REFS       7       43      136     137     138    139
                                              DEFINED     136
10742   OPT     * INTEGER  *UNDEF                REFS      44
 3745   OPTN10    REAL              / /          REFS       7      129
 3727   PLOTNO    REAL              / /          REFS       7       53       80
 3676   PLOTN2    REAL              / /          REFS      41       79
```

```
 VARIABLES      SN  TYPE                 RELOCATION
   3675  PLOTN4     REAL                  / /         REFS      40     78
     22  PSIZE      REAL                  / /         REFS      27    192
   3726  PTLESS     REAL                  / /         REFS       7    135
  10760  RATIO      REAL                              REFS     152  DEFINED    181
   3725  REPPLT     REAL                  / /         REFS       7     64     69
   3662  RITE       REAL                  / /         REFS      14
   3663  RKUTTA     REAL                  / /         REFS      14
    453  RMISS      REAL                  / /         REFS      22    110
   1747  RMISST     REAL       ARRAY      / /         REFS      23     24    156   DEFINED    118
   3673  RN         REAL                  / /         REFS      38
   6666  RNSTRT     REAL                  / /         REFS      16     73
   3674  RNT        REAL                  / /         REFS      39
    455  RYF        REAL                  / /         REFS      26    108
    456  RZF        REAL                  / /         REFS      28    109
   3731  STEP       REAL                  / /         REFS       7     77
   3717  T          REAL                  / /         REFS       7
   3750  TIME       REAL       ARRAY      / /         REFS       7     35    137    138    139
   5624  VAR        REAL       ARRAY      / /         REFS       7     37
   4424  VLABLE     REAL       ARRAY      / /         REFS       7     36    137    138    139
      0  X          REAL       ARRAY      CEPASS      REFS       6    166  DEFINED    108
  10756  XIBL       REAL                              REFS     151  DEFINED    179
  10757  XL         REAL                              REFS     151  DEFINED    180
     26  XLAMBD     REAL                  / /         REFS      19    192
    144  Y          REAL       ARRAY      CEPASS      REFS       6    166  DEFINED    109

 FILE NAMES         MODE
   4102  FILE
      0  INPUT
   2641  OUTPUT
   6143  TAPE14
   4102  TAPE5
   2041  TAPE6      FMT                   WRITES     113    115    119    133    141    155    159    166
                                             173     174    192

 EXTERNALS          TYPE   ARGS          REFERENCES
             AMRK            1               90
             AUXI            6               82
             AUXSUB          0               45     88     90
             CEPAS           7              192
             COUNTV          0               61
             DUMPO           0              123
             EXIT            0              194
             MCARLO          3               74
             OINPI1          0               71
             PLOTN           7              133
             PLOT2           7              133
             PLOT4           7              137
             PROCES          6              128
             RANNUM          3               73
             RESET           0              130
             SUBL1           6               81
             SUBL2           0               83
             SUBL3           0               92
             S8              6              127
             TIMEV           1              132    140
             ZERO            0               62
```

```
PROGRAM MAIN          74/74  OPT=1                          FTN 4.2+73867       05/05/75  16.16.28.     PAGE    7

STATEMENT LABELS                    DEF LINE   REFERENCES
 10347   5                             143        131
 10233   7                              71         63        64
 10234   8                              72        155
 10303  20                             112        105
 10311  21                             120        111
 10512  22        FMT                  115        115
 10537  96        FMT                  134        133
 10547  97        FMT                  142        141
 10571 800        FMT                  160        153       174
     0 801                             176        164
 10622 802        FMT                  167        165
 10646 803        FMT                  171        171
 10437 804                             191        177
 10564 805        FMT                  114        113       119
 10676 806        FMT                  183        182
 10557 807        FMT                  157        155
 10223 1000                             62        143
 10224 1001                             63        143
 10253 1002                             81        143
 10254 1003                             82        143
 10255 1004                             83        143
 10256 1005                             84        143
 10264 1006                             88        143
 10265 1007                             89         93       143
 10270 1008                             91        143
 10270 1009                             92        143
 10366 1010                            145        143
     0 4668         INACTIVE           193

 LOOPS  LABEL    INDEX     FROM-TO     LENGTH     PROPERTIES
 10404  801     * I        164 176       248                      EXT REFS

 COMMON BLOCKS   LENGTH      MEMBERS - BIAS NAME(LENGTH)
        //         3831                0 C      (3830)              3830 GRAPH  (1)
       CEPASS       200                0 X      (100)                100 Y      (100)

 EQUIV CLASSES   LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C       C         3831              18 PSIZE   (1)                  20 IBVNSN  (1)            21 IPLOT   (1)
                                     22 XLAMBD  (1)                  23 KSSIG   (1)            24 CEPSIG  (6)
                                     30 LCEP    (1)                 239 RMISS   (1)           300 L       (1)
                                    301 RYF     (1)                 302 RZF     (1)           622 DERSV   (1)
                                    524 IBL     (1)                 999 RMISST  (100)        1970 RITE    (1)
                                   1971 RKUTTA  (1)                1972 KASE    (1)          1973 NJ      (1)
                                   1974 NPT     (1)                1973 RN      (1)          1980 RNT     (1)
                                   1981 PLOTN4  (1)                1982 PLOTN2  (1)          1983 NPLOT   (1)
                                   1999 T       (1)                2005 REPPLT  (1)          2006 PTLESS  (1)
                                   2007 PLOTNO  (1)                2008 NOPLOT  (1)          2009 STEP    (1)
                                   2010 KSTEP   (1)                2011 LSTEP   (1)          2021 OPTN10  (1)
                                   2022 OPOINT  (1)                2024 TIME    (303)        2324 VLABLE  (30)
                                   2560 N       (1)                2561 IPL     (100)        2661 HMIN    (1)
                                   2662 HMAX    (1)                2663 DER     (101)        2764 EL      (100)
                                   2864 EU      (100)              2964 VAR     (101)        3166 NODOUT  (1)
                                   3510 KNSTRT  (1)                3511 ISSCT   (1)          3720 ITCT    (1)
                                   3824 NCASE   (1)
```

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PROGRAM MAIN        74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.16.20.     PAGE    8

STATISTICS
  PROGRAM LENGTH                555B     365
  BUFFER LENGTH               10204B    4228
  CM LABELED COMMON LENGTH      310B     200
  CM BLANK COMMON LENGTH       7367B    3831
```

```
      BLOCK DATA                                                        MCSIX   197
      COMMON                                                            MCSIX   198
     */NC1/NC1(2)      /NC2/NC2(4)      /NC3/NC3(4)      /NC5/NC5(4)    MCSIX   199
     */CA1/VM1(6)      /CA2/BA2(6),VM2(6)                               MCSIX   200
     */CA3/BA3(7),VM3(3)      /CA5/BA5(7),VM5(3)                        MCSIX   201
      COMMON  /CMDF/CMO (6)   /CA4/VM4(6)                               MCSIX   202
     */CZPF/CZP(35)    /CZ2F/CZ2(35)    /CMPF/CMP(35)    /CM2F/CM2(35)  MCSIX   203
     */CY4F/CY4(35)    /CN4F/CN4(35)    /CL4F/CL4(21)    /CL2F/CL2(21)  MCSIX   204
     */CZDF/CZ01(35)                    /CMDF/CMD1(35)                  MCSIX   205
     */CM3F/CM3(35)    /CLPF/CLP(35)    /CLDF/CLD1(21)                  MCSIX   206
     */CX0F/CX0(6)                                                      MCSIX   207
      DATA NC1/5,0/                                                     MCSIX   208
      DATA NC2/6,6,0,0/                                                 MCSIX   209
      DATA NC3/7,5,0,0/                                                 MCSIX   210
      DATA NC5/7,3,0,0/                                                 MCSIX   211
      DATA VM1/0.3,0.8,0.9,1.1,1.4,2.0/                                 MCSIX   212
      DATA VM2/0.3,0.7,0.9,1.1,1.4,2.0/                                 MCSIX   213
      DATA VM3/.5,.85,.95,1.05,1.25/                                    MCSIX   214
      DATA VM4/ .5, .85, .95,1.05,1.25,2./                              MCSIX   215
      DATA VM5/.5,.95, 1.25/                                            MCSIX   216
      DATA BA2/ 0., 4., 8.,12.,16.,20./                                 MCSIX   217
      DATA BA3/ 0., 2., 4., 8.,12.,16.,20./                             MCSIX   218
      DATA BA5/ 0., 2., 4., 8., 12.,16.,20./                            MCSIX   219
      DATA CX0/.33,.30,.38,.71,.84,.87/                                 MCSIX   220
      DATA CMO /                                                        MCSIX   221
     *                                                                  MCSIX   222
      DATA CZP/                                                         MCSIX   223
     *                                                                  MCSIX   224
     *                                                                  MCSIX   225
     *                                                                  MCSIX   226
     *                                                                  MCSIX   227
     *                                                                  MCSIX   228
      DATA CMP/                                                         MCSIX   229
     *                                                                  MCSIX   230
     *                                                                  MCSIX   231
     *                                                                  MCSIX   232
     *                                                                  MCSIX   233
     *                                                                  MCSIX   234
      DATA CZ01/                                                        MCSIX   235
     *                                                                  MCSIX   236
     *                                                                  MCSIX   237
     *                                                                  MCSIX   238
     *                                                                  MCSIX   239
     *                                                                  MCSIX   240
      DATA CM01/                                                        MCSIX   241
     *                                                                  MCSIX   242
     *                                                                  MCSIX   243
     *                                                                  MCSIX   244
     *                                                                  MCSIX   245
     *                                                                  MCSIX   246
      DATA CLD1/                                                        MCSIX   247
     *                                                                  MCSIX   248
     *                                                                  MCSIX   249
     *                                                                  MCSIX   250
      DATA CY4/                                                         MCSIX   251
     *                                                                  MCSIX   252
     *                                                                  MCSIX   253
```

```
     *                                                                  MCSIX    254
     *                                                                  MCSIX    255
     *                                                                  MCSIX    256
     *                                                                  MCSIX    257
      DATA CN4/                                                         MCSIX    258
     *                                                                  MCSIX    259
     *                                                                  MCSIX    260
     *                                                                  MCSIX    261
     *                                                                  MCSIX    262
     *                                                                  MCSIX    263
     *                                                                  MCSIX    264
      DATA CL4/                                                         MCSIX    265
     *                                                                  MCSIX    266
     *                                                                  MCSIX    267
     *                                                                  MCSIX    268
      DATA CL2/                                                         MCSIX    269
     *                                                                  MCSIX    270
     *                                                                  MCSIX    271
     *                                                                  MCSIX    272
      DATA CZ2/                                                         MCSIX    273
     *                                                                  MCSIX    274
     *                                                                  MCSIX    275
     *                                                                  MCSIX    276
     *                                                                  MCSIX    277
     *                                                                  MCSIX    278
      DATA CM2/                                                         MCSIX    279
     *                                                                  MCSIX    280
     *                                                                  MCSIX    281
     *                                                                  MCSIX    282
     *                                                                  MCSIX    283
     *                                                                  MCSIX    284
      DATA CMQ/                                                         MCSIX    285
     *                                                                  MCSIX    286
     *                                                                  MCSIX    287
     *                                                                  MCSIX    288
     *                                                                  MCSIX    289
     *                                                                  MCSIX    290
     *                                                                  MCSIX    291
      DATA CLP/                                                         MCSIX    292
     *                                                                  MCSIX    293
     *                                                                  MCSIX    294
     *                                                                  MCSIX    295
     *                                                                  MCSIX    296
     *                                                                  MCSIX    297
     *                                                                  MCSIX    298
                                                                        MCSIX    299
```

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BLOCK DATA            74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.16.23.      PAGE    3

      SYMBOLIC REFERENCE MAP (R=3)

VARIABLES        SN  TYPE            RELOCATION
      0  BA2         REAL      ARRAY    CA2          REFS        2  DEFINED     21
      0  BA3         REAL      ARRAY    CA3          REFS        2  DEFINED     22
      0  BA5         REAL      ARRAY    CA5          REFS        2  DEFINED     23
      0  CLD1        REAL      ARRAY    CLDF         REFS        6  DEFINED     51
      0  CLP         REAL      ARRAY    CLPF         REFS        6  DEFINED     36
      0  CL2         REAL      ARRAY    CL2F         REFS        6  DEFINED     73
      0  CL4         REAL      ARRAY    CL4F         REFS        6  DEFINED     69
      0  CMD1        REAL      ARRAY    CMDF         REFS        6  DEFINED     45
      0  CMO         REAL      ARRAY    CMOF         REFS        6  DEFINED     25
      0  CMP         REAL      ARRAY    CMPF         REFS        6  DEFINED     33
      0  CMQ         REAL      ARRAY    CMQF         REFS        6  DEFINED     89
      0  CM2         REAL      ARRAY    CM2F         REFS        6  DEFINED     83
      0  CN4         REAL      ARRAY    CN4F         REFS        6  DEFINED     52
      0  CXO         REAL      ARRAY    CXOF         REFS        6  DEFINED     24
      0  CY4         REAL      ARRAY    CY4F         REFS        6  DEFINED     55
      0  CZD1        REAL      ARRAY    CZDF         REFS        6  DEFINED     39
      0  CZP         REAL      ARRAY    CZPF         REFS        6  DEFINED     27
      0  CZ2         REAL      ARRAY    CZ2F         REFS        6  DEFINED     77
      0  NC1         INTEGER   ARRAY    NC1          REFS        2  DEFINED     12
      0  NC2         INTEGER   ARRAY    NC2          REFS        2  DEFINED     13
      0  NC3         INTEGER   ARRAY    NC3          REFS        2  DEFINED     14
      0  NC5         INTEGER   ARRAY    NC5          REFS        2  DEFINED     15
      0  VM1         REAL      ARRAY    CA1          REFS        2  DEFINED     16
      6  VM2         REAL      ARRAY    CA2          REFS        2  DEFINED     17
      7  VM3         REAL      ARRAY    CA3          REFS        2  DEFINED     18
      0  VM4         REAL      ARRAY    CA4          REFS        6  DEFINED     19
      7  VM5         REAL      ARRAY    CA5          REFS        2  DEFINED     20

COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
         NC1        2                0 NC1    (2)
         NC2        4                0 NC2    (4)
         NC3        4                0 NC3    (4)
         NC5        4                0 NC5    (4)
         CA1        6                0 VM1    (6)
         CA2       12                0 BA2    (6)                 6 VM2     (5)
         CA3       12                0 BA3    (7)                 7 VM3     (5)
         CA5       10                0 BA5    (7)                 7 VM5     (3)
         CMOF       6                0 CMO    (6)
         CA4        6                0 VM4    (6)
         CZPF      35                0 CZP    (35)
         CZ2F      35                0 CZ2    (35)
         CMPF      35                0 CMP    (35)
         CM2F      35                0 CM2    (35)
         CY4F      36                0 CY4    (36)
         CN4F      36                0 CN4    (36)
         CL4F      21                0 CL4    (21)
         CL2F      21                0 CL2    (21)
         CZDF      35                0 CZD1   (35)
         CMDF      35                0 CMD1   (35)
         CMQF      36                0 CMQ    (36)
         CLPF      36                0 CLP    (36)
         CLDF      21                0 CLD1   (21)
         CXOF       6                0 CXO    (6)
```

```
      BLOCK DATA             74/74   OPT=1                      FTN 4.2+75067     05/05/75  16.16.23.      PAGE    6

 STATISTICS
   PROGRAM LENGTH              03       0
   CM LABELED COMMON LENGTH  7510     489
```

```
      SUBROUTINE MCARLO(RNSTRT,MODE,ITSNDX)
      COMMON C(3830)
      EQUIVALENCE (C(  60),    RLW)
      EQUIVALENCE (C(1551),     RX)
      EQUIVALENCE (C(1571),     RY)
      EQUIVALENCE (C(2000),      T)
      EQUIVALENCE (C(1564),YMC)
      EQUIVALENCE (C(1565),YMC2)
      EQUIVALENCE (C(1574),ZMC)
      EQUIVALENCE (C(1575),ZMC2)
      EQUIVALENCE (C(2564),     DT)
      EQUIVALENCE (C(2765),    NTM)
      EQUIVALENCE (C(2775),     TM)
      EQUIVALENCE (C(2785),  TRMS2)
      EQUIVALENCE (C(2795),   TRMS)
      EQUIVALENCE (C(2805),    TMU)
      EQUIVALENCE (C(2815),    TVM)
      EQUIVALENCE (C(2825),   TSIG)
      EQUIVALENCE (C(3510),  ISGCT)
      EQUIVALENCE (C(3514),  SIGMA)
      EQUIVALENCE (C(3554),  SIGLB)
      EQUIVALENCE (C(3594),  SIGUB)
      EQUIVALENCE (C(3634),  ISNDX)
      EQUIVALENCE (C(3674),  IDIST)
      EQUIVALENCE (C(3511),RANSTT)
      EQUIVALENCE (C(3721),   ITCT)
      EQUIVALENCE (C(3723),  TSGMA)
      EQUIVALENCE (C(3733),    TLB)
      EQUIVALENCE (C(3743),    TUB)
      EQUIVALENCE (C(3753),ITNDX)
      EQUIVALENCE (C(3763),ITDIST)
      EQUIVALENCE (C(3773),  TSPER)
      EQUIVALENCE (C(3783),TYPPER)
      EQUIVALENCE (C(3793), TPSIG)
      EQUIVALENCE (C(3813),ITNDX2)
      EQUIVALENCE (C(3803),  TNXST)
      DIMENSION SIGMA(40),SIGLB(40),SIGUB(40),ISNDX(40),IDIST(40)
      DIMENSION TSGMA(10),TLB(10),TUB(10),ITNDX(10),ITDIST(10),
     *TSPER(10),TYPPER(10),TPSIG(10),ITNDX2(10),TNXST(10)
      DIMENSION SVC(40),SVCT(40),IDISTT(7)
      DIMENSION INIT(40)
      DIMENSION NTM(10), TM(10), TRMS2(10), TRMS(10), TMU(10), TVM(10),
     1 TSIG(10)
      DATA CFERTY/10HR         /
      DATA INIT/40*0/
      DATA COEF1/13.0537351/
      DATA COEF2/165.4366343/
      DATA COEF3/23.10344032/
      DATA LTCT/0/
      DATA (IDISTT(IA),IA=1,7)/6HNORMAL,7HUNIFORM,7H2-ORDER,7H2-ORDER,7H
     *1-ORDER,7H2-ORDER,7H2-ORDER/
      RNSTRT = RANSTT
      I = ITSNDX
      IF(MODE.GE.2) GO TO 300
      IF(MODE.NE.-1) GO TO 81
      WRITE(6,2100)
      WRITE(6,2103)
```

```
          GO TO 1000                                                     MCARLO    59
       81 CONTINUE                                                       MCARLO    60
C                                                                        MCARLO    61
C                   MONTE-CARLO INITIAL CONDITIONS.  USE UNIFORM         MCARLO    62
C                   DISTRIBUTION FOR I TH  CONDITION IF IDIST(I)=1,      MCARLO    63
C                   AND USE NORMAL DISTRIBUTION IF IDIST(I)=0.           MCARLO    64
C                                                                        MCARLO    65
C                                                                        MCARLO    66
C                   SAVE MEAN VALUES OF INITIAL CONDITIONS TO BE MONTE   MCARLO    67
C                   CARLO D.  IN SVC(I), AND SAVE TIME SERIES MEAN       MCARLO    68
C                   VALUES (FOR CONSTANT MEANS) IN SVCT(I).              MCARLO    69
C                                                                        MCARLO    70
C                                                                        MCARLO    71
          IF(MODE.EQ.INIT(I)) GO TO 80                                   MCARLO    72
          JU = ISNDX(I)                                                  MCARLO    73
          SVC(I) = C(JU)                                                 MCARLO    74
          INIT(I) = 1                                                    MCARLO    75
       80 CONTINUE                                                       MCARLO    76
          IF(IDIST(I).NE.1) GO TO 100                                    MCARLO    77
          CALL RANNUM (1., RNSTRT, RX)                                   MCARLO    78
          JU = ISNDX(I)                                                  MCARLO    79
          C(JU) = SVC(I) + (RX*(SIGUB(I) - SIGLB(I)) + SIGLB(I))*SIGMA(I) MCARLO    80
          GO TO 1                                                        MCARLO    81
      100 IF(IDIST(I).NE.0) GO TO 101                                    MCARLO    82
          XL = SIG  (I)                                                  MCARLO    83
          SGMA=SIGMA(I)                                                  MCARLO    84
          XU = SIGUB(I)                                                  MCARLO    85
          JU = ISNDX(I)                                                  MCARLO    86
          XMU=SVC(I)                                                     MCARLO    87
          CALL NORM(RX,XL,XU,XMU,SGMA,RNSTRT)                            MCARLO    88
          C(JU)=RX                                                       MCARLO    89
          GO TO 1                                                        MCARLO    90
      101 JU= ISNDX(I)                                                   MCARLO    91
          WRITE(6,5000)JU,IDIST(I)                                       MCARLO    92
        1 CONTINUE                                                       MCARLO    93
          IF(IDIST(I).NE.1) GO TO 737                                    MCARLO    94
          WRITE(6,2101) JU, C(JU), SVC(I), SIGLB(I), SIGUB(I)            MCARLO    95
          GO TO 13                                                       MCARLO    96
      737 WRITE(6,2105) JU, C(JU), SVC(I), SIGLB(I), SIGUB(I)            MCARLO    97
       13 CONTINUE                                                       MCARLO    98
     5000 FORMAT(1X,61HTHE INITIAL CONDITION MONTE CARLO DIST. PARAMETER FOR MCARLO    99
         * C-INDEX,1X,I5,1X,12HWAS INPUT AS,1X,I5,1X,30H...ONLY 0 AND 1 ARE MCARLO   100
         *RECOGNIZED)                                                    MCARLO   101
C                                                                        MCARLO   102
C                                                                        MCARLO   103
C                   WRITE OUT MONTE CARLO INITIAL CONDITIONS.            MCARLO   104
C                                                                        MCARLO   105
C                                                                        MCARLO   106
     2100 FORMAT(30X,30HMONTE CARLO INITIAL CONDITIONS/)                 MCARLO   107
     2103 FORMAT(25X,7HC-INDEX,5X,8HMC-VALUE,5X,4HMEAN,5X,12HDISTRIBUTION,5X MCARLO   108
         *,11HLOWER BOUND,5X,11HUPPER BOUND)                             MCARLO   109
     2101 FORMAT(25X,I5,8X,F8.3,3X,F8.3,6X,7HUNIFORM,9X,F8.3,7X,F8.3)    MCARLO   110
     2105 FORMAT(25X,I5,8X,F11.7,1X,F11.7,1X,7H NORMAL,10X,F8.3,7X,F8.3) DLAY       1
C                                                                        MCARLO   112
          GO TO 1000                                                     MCARLO   113
C                                                                        MCARLO   114
C                                                                        MCARLO   115
```

```
      GO TO 1000                                                         MCARLO    59
   81 CONTINUE                                                           MCARLO    60
C                                                                        MCARLO    61
C                   MONTE CARLO INITIAL CONDITIONS.  USE UNIFORM         MCARLO    62
C                   DISTRIBUTION FOR I TH  CONDITION IF IDIST(I)=1,      MCARLO    63
C                   AND USE NORMAL DISTRIBUTION IF IDIST(I)=0.           MCARLO    64
C                                                                        MCARLO    65
C                                                                        MCARLO    66
C                   SAVE MEAN VALUES OF INITIAL CONDITIONS TO BE MONTE   MCARLO    67
C                   CARLO D    IN SVC(I), AND SAVE TIME SERIES MEAN      MCARLO    68
C                   VALUES (FOR CONSTANT MEANS) IN SVCT(I).              MCARLO    69
C                                                                        MCARLO    70
C                                                                        MCARLO    71
      IF(MODE.EQ.INIT(I)) GO TO 80                                       MCARLO    72
      JU = ISNDX(I)                                                      MCARLO    73
      SVC(I) = C(JU)                                                     MCARLO    74
      INIT(I) = 1                                                        MCARLO    75
   80 CONTINUE                                                           MCARLO    76
      IF(IDIST(I).NE.1) GO TO 100                                        MCARLO    77
      CALL RANNUM (1.,-RNSTRT, RX)                                       MCARLO    78
      JU = ISNDX(I)                                                      MCARLO    79
      C(JU) = SVC(I) + (RX*(SIGUB(I) - SIGLB(I)) + SIGLB(I))*SIGMA(I)    MCARLO    80
      GO TO 1                                                            MCARLO    81
  100 IF(IDIST(I).NE.0) GO TO 101                                        MCARLO    82
      XL = SIGLB(I)                                                      MCARLO    83
      SGMA=SIGMA(I)                                                      MCARLO    84
      XU = SIGUB(I)                                                      MCARLO    85
      JU = ISNDX(I)                                                      MCARLO    86
      XMU=SVC(I)                                                         MCARLO    87
      CALL NOR4(RX,XL,XU,XMU,SGMA,RNSTRT)                                MCARLO    88
      C(JU)=RX                                                           MCARLO    89
      GO TO 1                                                            MCARLO    90
  101 JU= ISNDX(I)                                                       MCARLO    91
      WRITE(6,5000)JU,IDIST(I)                                           MCARLO    92
    1 CONTINUE                                                           MCARLO    93
      IF(IDI  (I).NE.1) GO TO 737                                        MCARLO    94
      WRITE(6,2101) JU, C(JU), SVC(I), SIGLB(I), SIGUB(I)                MCARLO    95
      GO TO 13                                                           MCARLO    96
  737 WRITE(6,2105) JU, C(JU), SVC(I), SIGLB(I), SIGUB(I)                MCARLO    97
   13 CONTINUE                                                           MCARLO    98
 5000 FORMAT(1X,61HTHE INITIAL CONDITION MONTE CARLO DIST. PARAMETER FOR MCARLO    99
     * C-INDEX,1X,I5,1X,12HWAS INPUT AS,1X,I6,1X,30H...ONLY 0 AND 1 ARE  MCARLO   100
     *RECOGNIZED)                                                        MCARLO   101
C                                                                        MCARLO   102
C                                                                        MCARLO   103
C                   WRITE-OUT MONTE CARLO INITIAL CONDITIONS.            MCARLO   104
C                                                                        MCARLO   105
C                                                                        MCARLO   106
 2100 FORMAT(30X,30HMONTE CARLO INITIAL CONDITIONS/)                     MCARLO   107
 2103 FORMAT(25X,7HC-INDEX,5X,8HMC-VALUE,5X,4HMEAN,5X,12HDISTRIBUTION,5X MCARLO   108
     *,11HLOWER BOUND,5X,11HUPPER BOUND)                                 MCARLO   109
 2101 FORMAT(25X,I5,8X,F8.3,3X,F8.3,6X,7HUNIFORM,9X,F3.3,7X,F5.3)        MCARLO   110
 2105 FORMAT(25X,I5,8X,F11.7,1X,F11.7,1X,74 NORMAL,10X,F8.3,7X,F8.3)     DLAY       1
C                                                                        MCARLO   112
      GO TO 1000                                                         MCARLO   113
C                                                                        MCARLO   114
C                                                                        MCARLO   115
```

```
      C
      C              TEST FLIGHT TIME AGAINST NEXT SAMPLE TIME FOR
      C              EACH TIME SERIES ERROR SOURCE.  FOR THOSE TIME
      C              SERIES ERROR SOURCES HAVING A NEXT SAMPLING TIME,
      C              TNXST(I), LESS THAN OR EQUAL TO THE SIMULATION
      C              TIME, I, DETERMINE THE TIME SERIES ERROR SOURCE
      C              MONTE CARLO VALUE.
      C
      C
  304 IF(LICI.LE.3) GO TO 1000
      IF(MODE.EQ.4) TNKST(I) = 0.
      IF(C(1976).LE.0.) GO TO 1000
      IF(C(2000).LT.TNXST(ITSNDX)) GO TO 1000
      IB= ITSNDX
      ITT=ITDIST(IB) +1
      C
      C
      C              DETERMINE IF THE TIME SERIES PERIOD IS DETERMINISTIC
      C              (TYPPER(IB).GT.0) OR STOCHASTIC (TYPPER(IB).EQ.0).
      C
      C
      IF(TYPPER(IB).GT.0.) GO TO 311
      C
      C
      C              INCREMENT THE IB TH  TIME SERIES ERROR SOURCE BY
      C              THE VALUE OF THE DETERMINISTIC PERIOD, TSPER(IB)
      C
      C
      TNXST(IB)=C(2000)+ TSPER(IB)
      GO TO 312
  311 XMU=TNXST(IB)+ TSPER(IB)
      XL=TNXST(IB)
      XU=XMU+TSPER(IB)
      SGMA=TESIG(IB)
      CALL NORM(RX,XL,XU,XMU,SGMA,RNSTRT)
      C
      C
      C              INCREMENT THE IB TH   TIME SERIES ERROR SOURCE BY
      C              A NORMALLY DISTRIBUTED RANDOM VALUE, WHERE THE
      C              RANDOM VALUEIS BOUNDED TO  LIE BETWEEN ZERO AND
      C              TWICE THE PERIOD MEAN VALUE, TSPER(IB).
      C
      C
      TNXST(IB)=RX
  312 CONTINUE
      JU=ITNDX(IB)
      JW=ITNDX2(IB)
      IF(MODE.EQ.4) SVCT(I) = C(JJ)
      XMU=SVCT(IB)
      IF(JU.NE.JW) XMU=C(JJ)
      XL=TLB(IB)
      XU=TUB(IB)
      SGMA=TSGMA(IB)
 1306 IF(ITDIST(IB).LE.0) GO TO 1307
      GO TO (304,305,340,350,380,380),ITDIST(IB)
      C
 1307 CONTINUE
```

```
C
C                 DETERMINE THE NORMALLY DISTRIBUTED IB TH  ERRROR
C                 SOURCE MONTE CARLO VALUE.
C
C
      CALL NORM(RX,XL,XU,XMU,SGMA,RNSTRT)
      C(JH)=RX
      GO TO 309
C
  304 CONTINUE
C
C                 DETERMINE THE UNIFORMALY DISTRIBUTED IB TH  ERROR
C                 SOURCE MONTE CARLO VALUE.
C
C
      CALL RANNUM (1., RNSTRT, RX)
      ZMU=SVCT(IB)
      IF(JU.NE.JH) ZMU=C(JJ)
      C(JH) = SVCT(IB) + (RX*(TJB(IB) - TLB(IB)) + TLB(IB)) *TSGMA(IB)
      GO TO 309
C
C
C                 DETERMINE THE CORRELATED NORMAL IB TH   ERROR SOURCE
C                 MONTE CALRLO VALUE.
C
C
  305 IF(MODE.NE.4) GO TO 330
      GO TO 1000
  330 CALL NORM(RX,-3.,3.,0.,1.,RNSTRT)
      YMC = TMU(IB)
      YMC2 = TRMS(IB)
      GO TO 303
  340 IF(MODE.NE.4) GO TO 341
      GO TO 1000
  341 CALL NORM(RY,-3.,3.,0.,1.,RNSTRT)
      ZMC = TMU(IB)
      ZMC2 = TRMS(IB)
      GO TO 309
  350 IF(MODE.NE.4) GO TO 351
      NTM(IB) = 0
      TM(IB) = 0.
      TRMS2(IB) = 0.
      GO TO 1000
  351 CALL NORM (RL4,-3.,3.,0.,1.,RNSTRT)
  309 CONTINUE
      NTM(IB) = NTM(IB) + 1
      TM(IB) = TM(IB) + C(JU)
      TRMS2(IB) = (TRMS2(IB) + C(JU)*C(JU))
C
C     CALCULATE TIME SERIES ROOT MEAN SQUARE
C
      TRMS(IB) = SQRT(TRMS2(IB)/NTM(IB))
C
C     CALCULATE TIME SERIES MEAN VALUES
C
      TMU(IB) = TM(IB)/NTM(IB)
      GO TO 1000
```

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      SUBROUTINE MCARLO       74/74    OPT=1                       FTN 4.2+75067       05/05/75  16.16.27.      PAGE     5

                         ENTRY MCARLX                                                      MCARLO    230
   230                   WRITE(6,7443)                                                     MCARLO    231
                         DO 1001 I3=1,ITCT                                                 MCARLO    232
                C                                                                          MCARLO    233
                C        CALCULATE TIME SERIES VARIANCE                                    MCARLO    234
                C                                                                          MCARLO    235
   235                   TVM(IB) = TRMS(IB)*TRMS(IB) - TMU(IB)*TMU(IB)                     MCARLO    236
                C                                                                          MCARLO    237
                C        CALCULATE TIME SERIES STANDARD DEVIATION                          MCARLO    238
                C                                                                          MCARLO    239
                         TSIG(IB) = SQRT(TVM(IB))                                          MCARLO    240
   240          C                                                                          MCARLO    241
                         WRITE(6,7443) ITNDX(IB),TMU(IB),TVM(IB),TSIG(IB),TRMS(I3)         MCARLO    242
                    1001 CONTINUE                                                          MCARLO    243
                    7440 FORMAT(30X,30HMONTE CARLO TIME SERIES VALUES//,                   MCARLO    244
                       1 26X,7HC-INDEX,5X,4HMEAN,8X,8HVARIANCE,4X,7HSTD DEV,5X,3HRMS/)     MCARLO    245
   245              7443 FORMAT(25X,I5,8X,F8.3,4X,F8.3,4X,F8.3,4X,F8.3)                    MCARLO    246
                         GO TO 1000                                                        MCARLO    247
                     380 WRITE(6,8821)ITDIST(IB)                                           MCARLO    248
                    8821 FORMAT(1X,23HUNRECOGNIZED DISTRIBUTION NO.,1X,I6,1X,7HENTERED)    MCARLO    249
                    1000 RETURN                                                            MCARLO    250
   250                   END                                                               MCARLO    251

      SUBROUTINE MCARLO       74/74    OPT=1                       FTN 4.2+75057       05/05/75  16.16.27.      PAGE     6

CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

   235      I      ITCT       THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
   239      I      ITCT       THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
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        SUBROUTINE MCARLO      74/74   OPT=1                    FTN 4.2+75067      05/05/75  16.16.27.     PAGE    7

        SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    3   MCARLO          1
  306   MCARLX        229         249

VARIABLES          SN  TYPE                RELOCATION
    0   C              REAL          ARRAY     / /          REFS          2         3         4         5         6         7         8
                                                              9          10        11        12        13        14        15        16
                                                             17          18        19        20        21        22        23        24
                                                             25          26        27        28        29        30        31        32
                                                             33          34        35        36        73        94        96       126
                                                            127         143       152       164       189       218      2*219
                                                        DEFINED          79        88       178       190
  410   COEF1       *  REAL                             DEFINED          46
  411   COEF2       *  REAL                             DEFINED          47
  412   COEF3       *  REAL                             DEFINED          48
  407   CPERTY      *  REAL                             DEFINED          44
 5147   DT             REAL                    / /      REFS             11
  573   I              INTEGER                          REFS             71        72        73        74        76        78      5*79
                                                             81          82        83        84        85        86        90        91
                                                             93        3*94      3*96       125       162   DEFINED        53
  601   IB             INTEGER                          REFS            129       136     2*143     2*145       146       147       148
                                                            158         160       161       163       165       166       157       168
                                                            169         198     5*190       201       202       207       208       211
                                                            212         213     2*217     2*218     2*219     3*223     3*227     5*235
                                                          2*239       5*241       247   DEFINED       128       231
 7131   IDIST          INTEGER       ARRAY     / /      REFS             24        37        76        81        91        93
  725   IDISTT         INTEGER       ARRAY              REFS             40   DEFINED        50
  734   INIT           INTEGER       ARRAY              REFS             41        71   DEFINED        45        74
 6667   ISGCT          INTEGER                 / /      REFS             19
 7661   ISNDX          INTEGER       ARRAY     / /      REFS             23        37        72        78        85        90
 7210   ITCT           INTEGER                 / /      REFS             26       124       231
 7262   ITDIST         INTEGER       ARRAY     / /      REFS             31        38       129       168       159       247
 7250   ITNDX          INTEGER       ARRAY     / /      REFS             30        34       160       241
 7344   ITNDX2         INTEGER       ARRAY     / /      REFS             35        38       151
    0   ITSNDX         INTEGER                 F.P.     REFS             53       127       128   DEFINED         1
  602   ITT         *  INTEGER                          DEFINED         129
  574   JU             INTEGER                          REFS             73        79        88        91      2*94      2*96       162
                                                          2*164       2*189       218     2*219   DEFINED        72        78        85
                                                             90         150
  603   JW             INTEGER                          REFS            154       178       189       190   DEFINED       161
  413   LTCT        *  INTEGER                          DEFINED          49
    0   MODE           INTEGER                 F.P.     REFS             54        55        71       125       162       198       284
                                                            210     DEFINED         1
 5314   NIM            INTEGER       ARRAY     / /      REFS             12        42       217       223       227
                                                        DEFINED         211       217
 6666   RANSTI         REAL                    / /      REFS             25        52
   73   RLW            REAL                    / /      REFS              3       215
    0   RNSTRT         REAL                    F.P.     REFS             77        87       149       177       187       208       286
                                                            215     DEFINED         1        52
 3030   RX             REAL                    / /      REFS              4        77        79        87        88       149       158
                                                            177         178       187       198       208
 3042   RY             REAL                    / /      REFS              5       206
  576   SGMA           REAL                             REFS             57       149       177   DEFINED        83       148       167
 6741   SIGLB          REAL          ARRAY     / /      REFS             21        37      2*79        82        94        96
 6671   SIGMA          REAL          ARRAY     / /      REFS             20        37        79        83
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        SUBROUTINE MCARLO     74/74    OPT=1                         FTN 4.2+75067      05/05/75  16.16.27.     PAGE    8

VARIABLES      SN   TYPE          RELOCATION
   7011  SIGUB      REAL      ARRAY    / /       REFS       22       37       79       84       94       96
    605  SVC        REAL      ARRAY              REFS       40       79       56       94       96
                                                 DEFINED    73
    655  SVCT       REAL      ARRAY              REFS       40      163      188      190    DEFINED    162
   3717  T          REAL               / /       REFS        6
   7224  TLB        REAL      ARRAY    / /       REFS       28       38      165     2*198
   5326  TM         REAL      ARRAY    / /       REFS       13       42      218      227    DEFINED    212      218
   5364  TMU        REAL      ARRAY    / /       REFS       16       42      201      207     2*235     241
                                                 DEFINED   227
   7332  TNXST      REAL      ARRAY    / /       REFS       36       38      127      145      146
                                                 DEFINED   125      143      158
   7320  TPSIG      REAL      ARRAY    / /       REFS       34       38      146
   5352  TRMS       REAL      ARRAY    / /       REFS       15       42      202      208     2*235     241
                                                 DEFINED   223
   5340  TRMS2      REAL      ARRAY    / /       REFS       14       42      219      223    DEFINED    213      219
   7212  TSGMA      REAL      ARRAY    / /       REFS       27       38      157      190
   5410  TSIG       REAL      ARRAY    / /       REFS       18       42      241    DEFINED    239
   7274  TSPER      REAL      ARRAY    / /       REFS       32       38      143      145      147
   7236  TUB        REAL      ARRAY    / /       REFS       29       38      156      190
   5376  TVM        REAL      ARRAY    / /       REFS       17       42      239      241    DEFINED    235
   7306  TYPPER     REAL      ARRAY    / /       REFS       33       38      136
    575  XL         REAL                         REFS       87      149      177    DEFINED     82      146      165
    600  XMU        REAL                         REFS       87      147      149      177    DEFINED     86      145
                                                  163      164
    577  XU         REAL                         REFS       87      149      177    DEFINED     94      147      166
   3033  YMC        REAL               / /       REFS        7    DEFINED    201
   3034  YMC2       REAL               / /       REFS        8    DEFINED    202
   3045  ZMC        REAL               / /       REFS        9    DEFINED    207
   3C46  ZMC2       REAL               / /       REFS       10    DEFINED    208
    604  ZMU        REAL                         DEFINED   188      189

FILE NAMES      MODE
        TAPE6   FMT                    WRITES     56       57       91       94       96    .  238      241      247

EXTERNALS          TYPE   ARGS      REFERENCES
        NORM               6           87      149      177      200      236      215
        RANNUM             3           77      187
        SQRT       REAL    1 LIBRARY  223      239

STATEMENT LABELS               DEF LINE   REFERENCES
     71  1                        92        51       89
    116  13                       97        95
     30  60                       75        71
     21  81                       59        55
     45  100                      81        75
     63  101                      90        81
    117  300                     124        54
    215  304                     181       163
    234  305                     198       163
    270  309                     216       173      191      233      289
    137  311                     145       136
    152  312                     159       144
    237  330                     200       193
    246  340                     204       169
    251  341                     235       204
    260  350                     210       169
    265  351                     215       213
```

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STATEMENT LABELS                   DEF LINE   REFERENCES
  342  380                          247       2*169
  105  737                           95         93
  346  1000                         249         55     112     124     126     127     199     205     214     228
                                               245
    0  1001                         242        231
    0  1306        INACTIVE         168
  207  1307                         171        165
  465  2100      FMT                105         55
  504  2101      FMT                109         94
  472  2103      FMT                107         57
  512  2105      FMT                110         95
  447  5000      FMT                 38         91
  534  7440      FMT                243        233
  547  7443      FMT                245        241
  560  8821      FMT                248        247

 LOOPS  LABEL    INDEX     FROM-TO    LENGTH     PROPERTIES
   320  1001   * IB        231 242      228                   EXT REFS

 COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
   / /           3830              0 C       (3830)

 EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
 C      C         3830            53 RLH     (1)          1553 RX      (1)          1563 YMC     (1)
                                1564 YMC2    (1)          1573 RY      (1)          1573 ZMC     (1)
                                1574 ZMC2    (1)          1933 T       (1)          2663 DT      (1)
                                2764 NTM     (10)         2774 TM      (10)         2784 TRMS2   (10)
                                2794 TRMS    (10)         2804 TMJ     (10)         2814 TVM     (10)
                                2824 ISIG    (10)         3510 RANSTT  (1)          3511 ISGCT   (1)
                                3513 SIGMA   (40)         3553 SIGLB   (40)         3593 SIGUB   (40)
                                3633 ISNDX   (40)         3673 IDIST   (40)         3720 ITCT    (1)
                                3722 ISGMA   (10)         3732 TLB     (10)         3742 TUB     (10)
                                3752 ITNDX   (10)         3762 ITDIST  (10)         3772 TSPER   (10)
                                3782 TYPPER  (10)         3792 TPSIG   (10)         3802 TNXST   (10)
                                3812 ITNDX2  (10)

 STATISTICS
   PROGRAM LENGTH                10148     516
   CM BLANK COMMON LENGTH        73663    3830
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      SUBROUTINE CEPAS(NP,IBVNSW,IPLOT,XLAMBD,KSSIG,CEPSIG,PSIZE)       MCARLO   252
      COMMON/CEPASS/X(100),Y(100)                                       MCARLO   253
      DIMENSION                   CEPSIG(6)                             MCARLO   254
      DIMENSION CRIT(100)                                               MCARLO   255
      REAL KSSIG                                                        MCARLO   256
      INTEGER CEPSIG                                                    MCARLO   257
      WRITE(6,2003)                                                     SOMETH     9
 2003 FORMAT(1H1,39HCEPAS PARAMETER CONTROL CARD INPUT DATA  )          SOMETH    10
      WRITE(6,2004)NP,IBVNSW,IPLOT,XLAMBD,KSSIG,(CEPSIG(JJ),JJ=1,5)     MCARLO   258
      WRITE(6,2005)                                                     SOMETH    11
 2005 FORMAT(1X,31HINPUT MISS DISTANCE COORDINATES///)                  SOMETH    12
 2004 FORMAT(1X,3I6,2(1X,F10.3),5I6)                                    MCARLO   259
      DO 5 I=1,5                                                        MCARLO   260
      IF(CEPSIG(I).GT.0) GO TO 5                                        MCARLO   261
      CEPSIG(I)= -1                                                     MCARLO   262
    5 CONTINUE                                                          MCARLO   263
      NUC=(NP - 1) / 15                                                 MCARLO   264
      NUC=NUC+1                                                         MCARLO   265
      WRITE(6,2000)                                                     MCARLO   266
 2000 FORMAT(1X,2HX=)                                                   MCARLO   267
      WRITE(6,2001)(X(I),I=1,NP)                                        MCARLO   268
 2001 FORMAT(10(2X,F7.3))                                               MCARLO   269
      WRITE(6,2002)                                                     MCARLO   270
 2002 FORMAT(1X,2HY=)                                                   MCARLO   271
      WRITE(6,2001)(Y(I),I=1,NP)                                        MCARLO   272
      CALL CEPP (X,Y,NP,KSSIG,XLAMBD,IBVNSW,CEPSIG,IPLOT,PSIZE)         MCARLO   273
      RETURN                                                            MCARLO   274
      END                                                               MCARLO   275
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SUBROUTINE CEPAS          74/74   OPT=1                           FTN 4.2+75057     05/05/75  16.16.32.     PAGE   2

      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    3  CEPAS          1             27

VARIABLES      SN   TYPE              RELOCATION
    0  CEPSIG      INTEGER    ARRAY    F.P.       REFS        3      6       9       14      26
  161  CRIT        REAL       *UNDEF              DEFINED     1     15
  157  I           INTEGER                        REFS        4
                                                  REFS       14     15      21      25   DEFINED   13    21
                                                  23
    3  IBVNSW      INTEGER             F.P.       REFS        9     26   DEFINED      1
    0  IPLOT       INTEGER             F.P.       REFS        9     26   DEFINED      1
  156  JJ          INTEGER                        REFS        9   DEFINED      9
    0  KSSIG       REAL                F.P.       REFS        5      9      26   DEFINED    1
    0  NP          INTEGER             F.P.       REFS        9     17      21      25      26
                                                  DEFINED     1
  160  NUG         INTEGER                        REFS       18   DEFINED   17      18
    0  PSIZE       REAL                F.P.       REFS       26   DEFINED    1
    0  X           REAL       ARRAY    CEPASS     REFS        2     21      26
    0  XLAMBD      REAL                F.P.       REFS        9     26   DEFINED    1
  144  Y           REAL       ARRAY    CEPASS     REFS        2     25      26

FILE NAMES         MODE
    TAPE6          FMT                 WRITES     7       9     10      19      21      23      25

EXTERNALS              TYPE    ARGS        REFERENCES
    CEPP                        9            26

STATEMENT LABELS                DEF LINE    REFERENCES
   17   5                          16          13        14
  134   2000     FMT               20          13
  142   2001     FMT               22          21        25
  150   2002     FMT               24          23
   75   2003     FMT                8           7
  125   2004     FMT               12           3
  117   2005     FMT               11          13

LOOPS   LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
   15   5           I         13 16        38B       INSTACK

COMMON BLOCKS    LENGTH     MEMBERS - BIAS NAME(LENGTH)
    CEPASS        200              0 X      (100)          100 Y      (100)

STATISTICS
  PROGRAM LENGTH                    3253     213
  CM LABELED COMMON LENGTH          310B     200
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 SUBROUTINE CEPP      74/74  OPT=1                    FTN 4.2+75067    05/05/75  16.16.33.     PAGE   1

      SUBROUTINE CEPP(X,Y,NP,KSSIG,XLAMBD,IBVNSW,CEPSIG,IPLOT,PSIZE)     MCARLO   276
      REAL KSSIG                                                        MCARLO   277
      INTEGER CEPSIG                                                    MCARLO   278
      DIMENSION ZXX(100),ZYY(100)                                       MCARLO   279
      DIMENSION TITLE1(5),TITLE2(5)                                     MCARLO   280
      DIMENSION ICHI(6)                                                 MCARLO   281
      DIMENSION CHI2(6,50)                                              MCARLO   282
      DIMENSION X(100),Y(100),SORTX(100),DIST(100),CEPSIG(6),ICONREF(6), MCARLO   283
     * RCONF1(5),RCONF2(5)                                              MCARLO   284
      DATA ISKSW/0/                                                     MCARLO   285
      DATA (CHI2(1,I),I=1,50)/0.0201,0.297,0.872,1.65,2.56,3.57,4.66,   MCARLO   286
     *5.81,7.01,8.26,9.54,10.9,12.2,13.6,15.0,16.4,17.8,19.2,20.7,22.2, MCARLO   287
     *23.7,25.1,26.7,28.2,29.7,31.2,32.8,34.3,35.9,37.5,39.1,40.6,42.2, MCARLO   288
     *43.8,45.4,47.1,48.7,50.3,51.9,53.5,55.2,56.8,58.5,60.1,61.8,63.4, MCARLO   289
     *65.1,66.7,68.4,70.1/                                              MCARLO   290
      DATA (CHI2(2,I),I=1,50)/0.103,0.711,1.64,2.73,3.94,5.23,6.57,     MCARLO   291
     *7.96,9.39,10.9,12.3,13.8,15.4,16.9,18.5,20.1,21.7,23.3,24.9,26.5, MCARLO   292
     *28.1,29.8,31.4,33.1,34.8,36.4,38.1,39.8,41.5,43.2,44.9,46.6,48.3, MCARLO   293
     *50.0,51.7,53.5,55.2,56.9,58.7,60.4,62.1,63.9,65.6,67.4,69.1,70.9, MCARLO   294
     *72.6,74.4,76.2,77.9/                                              MCARLO   295
      DATA (CHI2(3,I),I=1,50)/0.211,1.06,2.20,3.49,4.87,6.3,7.79,9.31,  MCARLO   296
     *10.9,12.4,14.0,15.7,17.3,18.9,20.6,22.3,24.0,25.6,27.3,29.1,      MCARLO   297
     *30.8,32.5,34.2,35.9,37.7,39.4,41.2,42.9,44.7,46.5,48.2,50.0,51.8, MCARLO   298
     *53.5,55.3,57.1,58.9,60.7,62.5,64.3,66.1,67.9,69.7,71.5,73.3,75.1, MCARLO   299
     *76.9,78.7,80.5,82.4/                                              MCARLO   300
      DATA (CHI2(4,I),I=1,50)/0.446,1.65,3.07,4.59,6.18,7.81,9.47,11.2, MCARLO   301
     *12.9,14.6,16.3,18.1,19.8,21.6,23.4,25.1,26.9,28.7,30.5,32.3,34.2, MCARLO   302
     *36.0,37.8,39.6,41.4,43.3,45.1,47.0,48.8,50.6,52.5,54.3,56.2,58.0, MCARLO   303
     *59.9,61.8,63.6,65.5,67.3,69.2,71.1,72.9,74.8,76.7,78.6,80.4,82.3, MCARLO   304
     *84.2,86.1,87.9/                                                   MCARLO   305
      DATA (CHI2(5,I),I=1,50)/0.713,2.19,3.83,5.53,7.27,9.03,10.8,12.6, MCARLO   306
     *14.4,16.3,18.1,19.9,21.8,23.6,25.5,27.4,29.2,31.1,33.0,34.9,36.8, MCARLO   307
     *38.6,40.5,42.4,44.3,46.2,48.1,50.0,51.9,53.8,55.7,57.6,59.5,61.4, MCARLO   308
     *63.3,65.3,67.2,69.1,71.0,72.9,74.8,76.8,78.7,80.6,82.5,84.4,86.4, MCARLO   309
     *88.3,90.2,92.1/                                                   MCARLO   310
      DATA (TITLE1(I),I=1,5)/6HCEP CO,6HNFIDEN,6HCE CIR,6HCLE FO,       MCARLO   311
     1       6HR LAMB,6HDA =  /                                         MCARLO   312
      DATA (TITLE2(I),I=1,5)/6HCEP CO,6HNFIDEN,6HCE CIR,6HCLE FO,       MCARLO   313
     1       5HR LAMB,6HDA =  /                                         MCARLO   314
      DATA ICONREF/99,95,90,80,70/                                      MCARLO   315
      DATA SORTX/100*(0.)/                                              MCARLO   316
C                                                                       MCARLO   317
C   * * *   X= ARRAY OF X-COMPONENT OF MISS DISTANCES                   MCARLO   318
C   * * *   Y= ARRAY OF Y-COMPONENT OF MISS DISTANCES                   MCARLO   319
C   * * *   NP= NUMBER OF POINTS                                        MCARLO   320
C   * * *   KSSIG= SIGNIFICANCE LEVEL FOR K-S TEST DESIRED -- SET       MCARLO   321
C           NEGATIVE IF NO K-S TEST DESIRED                             MCARLO   322
C   * * *   XLAMBD= (PROGRAM   ) / (MISSILE CEP) --                     MCARLO   323
C           SET TO ZERO IF NO ESTIMATE OF PROGRAM CEP IS MADE           MCARLO   324
C   * * *   IBVNSW=1 IF DESIRE TO USE BIVARIATE NORMAL ASSUMPTION       MCARLO   325
C           REGARDLESS OF OUTCOME OF K-S TEST ---  SET NOT = 1 TO USE   MCARLO   326
C           BIVARIATE NORMAL ONLY IF K-S TEST DOES NOT REJECT           MCARLO   327
C           ASSUMPTION OF NORMALITY.  IF NOT =1, AND DATA FAILS K-S TEST MCARLO   328
C           FOR NORMALITY, CEP WILL BE                                  MCARLO   329
C           CALCULATED AS THE RADIUS, R, OF A CIRCLE CONTAINING         MCARLO   330
C           ONE-HALF OF THE SAMPLE POINTS.                              MCARLO   331
C   * * *   CEPSIG= SIGNIFICANCE LEVELS AT WHICH CEP CONFIDENCE         MCARLO   332
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C          INTERVAL(S) PRINT IS DESIRED.   PRELOAD TO NEGATIVE NUMBERS  MCARLO   333
C          IN CALLING PROGRAM BEFORE ENTERING DESIRED CONFIDENCE LEVELS MCARLO   334
C          ENTER AS AN INTEGER (IN PERCENT) -- EG., IF DESIRE           MCARLO   335
C           R(0.99), R(0.90), AND R(0.70), ENTER (FOR EXAMPLE)          MCARLO   336
C          CEPSIG(1=90, CEPSIG(2)=99, AND CEP(3)=70.  NO ORDER          MCARLO   337
C          NEEDS TO BE OBSERVED.                                        MCARLO   338
C    * * * IPLOT= 1 FOR PLOTS OF CEP(S) AND POINTS, NOT =1 OTHERWISE    MCARLO   339
C                                                                       MCARLO   340
      KSSIG=0.05                                                        MCARLO   341
      NCONF=0                                                           MCARLO   342
      EPSLN=.00001                                                      MCARLO   343
 8950 CONTINUE                                                          MCARLO   344
      WRITE(6,1019)                                                     MCARLO   345
 1019 FORMAT(1H1)                                                       MCARLO   346
      IF(NP.LE.0) GO TO 300                                             MCARLO   347
C                                                                       MCARLO   348
C    * * *  CALCULATE SAMPLE SIGMA-X, SIGMA-Y, X-MEAN, AND Y-MEAN       MCARLO   349
C                                                                       MCARLO   350
      SUMX2=0.                                                          MCARLO   351
      SUMY2=0.                                                          MCARLO   352
      XBAR=0.                                                           MCARLO   353
      YBAR=0.                                                           MCARLO   354
      DO 1 I=1,NP                                                       MCARLO   355
      SUMX2=SUMX2 + X(I)**2                                             MCARLO   356
      SUMY2=SUMY2 + Y(I)**2                                             MCARLO   357
      XBAR=XBAR + X(I)                                                  MCARLO   358
    1 YBAR = YBAR + Y(I)                                                MCARLO   359
      XBAR = XBAR / NP                                                  MCARLO   360
      YBAR = YBAR / NP                                                  MCARLO   361
      SXHAT2=(SUMX2 - (XBAR**2)*NP)/(NP - 1)                            MCARLO   362
      SYHAT2 = (SUMY2 - (YBAR**2)*NP)/(NP-1)                            MCARLO   363
      SXHAT= SQRT(SXHAT2)                                               MCARLO   364
      SYHAT = SQRT(SYHAT2)                                              MCARLO   365
C                                                                       MCARLO   366
C                                                                       MCARLO   367
C    * * *  KOLOMOGOROV-SMIRNOV TEST FOR NORMALITY                      MCARLO   368
C                                                                       MCARLO   369
C    * * *  CHECK X                                                     MCARLO   370
C                                                                       MCARLO   371
C                                                                       MCARLO   372
      NI=0                                                              MCARLO   373
      CALL KSTEST(X,NP,KSSIG,XBAR,SXHAT,NI)                             MCARLO   374
      NIX=NI                                                            MCARLO   375
C                                                                       MCARLO   376
C    * * *  CHECK Y                                                     MCARLO   377
C                                                                       MCARLO   378
      CALL KSTEST(Y,NP,KSSIG,YBAR,SYHAT,NI)                             MCARLO   379
      NIY=NI                                                            MCARLO   380
      IF(NIX.GT.0) WRITE(6,1001)KSSIG                                   MCARLO   381
 1001 FORMAT(1X,53HX-COMPONENT OF MISS DISTANCE FAIL K-S TEST FOR NORMAL MCARLO   382
     *ITY AT ,F10.5,2X,18HSIGNIFICANCE LEVEL)                           MCARLO   383
      WRITE(6,1073)                                                     MCARLO   384
      WRITE(6,1078)                                                     MCARLO   385
      IF(NIY.GT.0) WRITE(6,1002)KSSIG                                   MCARLO   386
 1002 FORMAT(1X,53HY-COMPONENT OF MISS DISTANCE FAIL K-S TEST FOR NORMAL MCARLO   387
     *ITY AT ,F10.5,2X,18HSIGNIFICANCE LEVEL)                           MCARLO   388
      IF(IBVNSW.EQ.1) GO TO 450                                         MCARLO   389
```

```
      IF(NIX.GT.0.OR.NIY.GT.0) GO TO 400
C
C  * * *   DETERMINE CONSTANT XK FOR ELLIPTICAL TO CEP CONVERSION
C
  450 SSMIN=AMIN1(SXHAT,SYHAT)
      SSMAX= AMAX1(SXHAT,SYHAT)
      RATIOX=SSMIN/SSMAX
      IF(RATIOX.GE.0.3) GO TO 102
      XK=0.9938*RATIOX**2 - 0.0495*RATIOX + 0.675
  103 CEP=XK*SSMAX
      GO TO 121
  102 CEP=0.615*SSMIN + 0.562*SSMAX
C
C  * * *   CALCULATE CONFIDENCE INTERVALS
C
      IF(NP.GT.1) GO TO 545
      WRITE(6,1073)
      WRITE(6,1078)
      WRITE(6,1112)NP
 1112 FORMAT(1X,64HNO CONFIDENCE INTERVALS CALCULATED BECAUSE NUMBER OF
     *POINTS, NP=,I6,14HIS LESS THAN 2)
      GO TO 528
  545 CONTINUE
  121 NCONF=0
      IF(CEPSIG(1).LE.0) GO TO 528
      DO 4 I=1,5
      ICHI(I)=-1
      IF(CEPSIG(I).LE.0) GO TO 4
      NCONF=NCONF + 1
      IF(CEPSIG(I).EQ.99) ICHI(I)=1
      IF(CEPSIG(I).EQ.95) ICHI(I)=2
      IF(CEPSIG(I).EQ.90) ICHI(I)=3
      IF(CEPSIG(I).EQ.80) ICHI(I)=4
      IF(CEPSIG(I).EQ.70) ICHI(I)=5
      IF(ICHI(I).GT.0) GO TO 44
      WRITE(6,1007)CEPSIG(I)
      NCONF=NCONF - 1
   44 IF(CEPSIG(I+1).LE.0) GO TO 526
    4 CONTINUE
 1007 FORMAT(1X,23HCONFIDENCE LEVEL OF ,I4,2X,28HENTERED WHICH IS NOT TA
     *BLED,2X,31HNO CONFIDENCE INTERVAL COMPUTED)
  526 CEPS=CEP
      NU=2*(NP - 1)
      NUS=NU
      NU=NU/2
      IF(NCONF.LE.0) GO TO 528
      DO 5 I=1,NCONF
      J=ICHI(I)
    5 RCONF1(I)=CEP*SQRT(NUS/CHI2(J,NU))
      IF(XLAMBD.LT.EPS_N) GO TO 528
  257 CEPS=CEP/SQRT(1+XLAMBD**2)
      IF(NCONF.LE.0) GO TO 528
      DO 6 I=1,NCONF
      J=ICHI(I)
    6 RCONF2(I)=RCONF1(I)/SQRT(1+(XLAMBD**2)*(1 - CHI2(J,NU)/NUS))
      WRITE(6,1073)
  528 WRITE(6,1013)CEP,NP
```

```
      1010 FORMAT(1X,10HJOINT CEP=,F7.3,2X,18HFOR THE FOLLOWING ,I4,1X,6HPOIN
          *TS)
           DO 8 I=1,NP
           DX=SQRT((X(I) - XBAR)**2 + (Y(I) - YBAR)**2)
         8 WRITE(6,1011)X(I),Y(I),DX
      1011 FORMAT(10X,1H(,F5.2,1H,,F5.2,1H),5X,10HMISS DIST=,F5.2)
           IF(NCONF.LE.0) GO TO 529
C
C
C
           WRITE(6,1078)
           WRITE(6,1078)
           WRITE(6,1012)
      1012 FORMAT(1X,33HCONFIDENCE INTERVAL(S) FOR JOINT CEP/)
           WRITE(6,1499)
      1499 FORMAT(42X,10H(PER CENT))
           WRITE(6,1013)(ICONREF(JJ),JJ=1,NCONF)
      1013 FORMAT(1X,21HCONFIDENCE LEVELS --,5(5X,I6))
           WRITE(6,1014)
      1014 FORMAT(21X,5(5X,6H------))
           WRITE(6,1015)(RCONF1(JJ),JJ=1,NCONF)
      1015 FORMAT(21X,5(5X,F5.2))
           WRITE(6,1500)
      1500 FORMAT(40X,4H(FT))
       529 IF(XLAMBD.LT.EPSLN) GO TO 500
           WRITE(6,1078)
           WRITE(6,1078)
      1078 FORMAT(130X)
           WRITE(6,1016)CEPS,XLAMBD
      1016 FORMAT(1X,12HMISSILE CEP=,F7.3,26H ASSUMING  SIMULATION CEP=,F6.2,
          *1X,21HTIMES THE MISSILE CEP)
       539 CONTINUE
           IF(NCONF.LE.0) GO TO 500
           WRITE(6,1078)
           WRITE(6,1078)
           WRITE(6,1017)
      1017 FORMAT(1X,35HCONFIDENCE INTERVAL(S) FOR MISSILE CEP/)
           WRITE(6,1499)
           WRITE(6,1013)(ICONREF(JJ),JJ=1,NCONF)
           WRITE(6,1014)
           WRITE(6,1015)(RCONF2(JJ),JJ=1,NCONF)
           WRITE(6,1500)
           GO TO 500
C
C
C
C
       530 CONTINUE
C
C
C    * * *   K-S TEST FOR NORMALITY WAS NEGATIVE, CALCULATE CEP AS THE
C            RADIUS OF A CIRCLE CONTAINING 50 PERCENT OF THE SAMPLE POINT
C
C
C
       400 DO 2 I=1,NP
         2 DIST(I)=SQRT((X(I)-XBAR)**2+(Y(I)-YBAR)**2)
```

```
      C
      C   * * *    SORT DISTANCES IN INCREASING ORDER
      C
            ND=NP
            ISV=0
            NS=0
        402 COMPR = 10**6
            DO 3 I=1,ND
            IF(DIST(I).GE.COMPR) GO TO 3
            ISV=I
            COMPR=DIST(I)
          3 CONTINUE
            NS=NS+1
            SORTX(NS)=COMPR
            DIST(ISV)=DIST(ND)
            ND=ND-1
            IF(ND.GT.1) GO TO 402
            NS=NS+1
            SORTX(NS)=DIST(1)
      C
      C   * * *    DETERMINE IF NUMBER OF POINTS,NP, IS EVEN OR ODD
      C
            ND=NP/2
            NS=NP-2*ND
            IF(NS.EQ.0) GO TO 403
      C
      C   * * *    NUMBER OF POINTS IS EVEN.  SET CEP TO A DISTANCE WHICH IS
      C
      C            HALFWAY BETWEEN THE INTERIOR POINT CLOSEST TO THE 50 PER-
      C            CENT CIRCLE AND THE EXTERIOR POINT CLOSEST TO THE 50 PER-
      C            CENT CIRCLE.
      C
            CEP=(SORTX(ND)+SORTX(ND+1))/2.
            GO TO 404
      C
      C   * * *    NUMBER OF POINTS IS ODD.  SET CEP TO THE MEDIAN DISTANCE.
      C
        403 CEP=SORTX(ND+1)
        404 WRITE(6,1004)CEP
       1004 FORMAT(1X,4HCEP=,F10.5,2X,67HDATA FAILED K-S NORMALITY TEST -- NO
           *CONFIDENCE INTERVAL CALCULATED)
            GO TO 500
        300 WRITE(6,1000)
       1000 FORMAT(1X,42HSUBROUTINE CEP ENTERED WITH NO. POINTS = 0)
            GO TO 520
      C
      C   * * *    PLOT CEP(S), CONFIDENCE INTERVALS, AND POINTS
      C
        500 DX=SQRT(XBAR**2 + YBAR**2)
            WRITE(6,1078)
            WRITE(6,1073)
            WRITE(6,1113)XBAR,YBAR,DX
       1113 FORMAT(1X,17HCEP CENTROID AT (,F5.3,1H,,F5.3,1H),10X,28HDISTANCE F
           *ROM TARGET CENTER=,F5.3)
            IF(IPLOT.EQ.0) GO TO 520
            IF(NCONF.LE.0) GO TO 501
            DO 27 KOCH=1,NCONF
```

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      SUBROUTINE CEPP        74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.16.33.        PAGE    6

      JU=ICHI(KOCH)                                                               MCARLO   561
      DO 558 KMN=1,NP                                                             MCARLO   562
      ZXX(KMN)=X(KMN)                                                             MCARLO   563
  558 ZYY(KMN)=Y(KMN)                                                             MCARLO   564
      CALL FPLOT(ZXX,ZYY,NP,CEP,ICONREF(JU),RCONF1(KOCH),TITLE1,XBAR,             MCARLO   565
     *YBAR,0.,PSIZE)                                                              MCARLO   566
      IF(XLAMBD.LT.EPS_N) GO TO 27                                                MCARLO   567
      DO 557 KMN=1,NP                                                             MCARLO   568
      ZXX(KMN)=X(KMN)                                                             MCARLO   569
  557 ZYY(KMN)=Y(KMN)                                                             MCARLO   570
      CALL FPLOT(ZXX,ZYY,NP,CEPS,ICONREF(JU),RCONF2(KOCH),TITLE2,XBAR,            MCARLO   571
     *YBAR,XLAMBD,PSIZE)                                                          MCARLO   572
   27 CONTINUE                                                                    MCARLO   573
      GO TO 520                                                                   MCARLO   574
  501 CALL FPLOT(X,Y,NP,CEP,0,0.,TITLE1,XBAR,YBAR,0.,PSIZE)                       MCARLO   575
  520 CONTINUE                                                                    MCARLO   576
      RETURN                                                                      MCARLO   577
      END                                                                         MCARLO   578

      SUBROUTINE CEPP        74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.16.33.        PAGE    7

CARD NR. SEVERITY  DETAILS   DIAGNOSIS OF PROBLEM

   40     I                  DATA VARIABLE LIST EXCEEDS ITEM LIST, EXCESS VARIABLES NOT INITIALIZED.
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SUBROUTINE CEPP        74/74   OPT=1                        FTN 4.2-75067      05/05/75  16.16.33.      PAGE    8

        SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
    3  CEPP          1           302

VARIABLES       SN  TYPE               RELOCATION
  1317  CEP         REAL                                REFS      156      163      165      171      257      298      308
                                                     DEFINED      124      126      251      266
  1320  CEPS        REAL                                REFS      200      296  DEFINED      156      165
     0  CEPSIG      INTEGER      ARRAY      F.P.        REFS        3        8      139      142      144      145      146
                                                         147      148      150      152  DEFINED        1
  1667  CHI2        REAL         ARRAY                  REFS        7      153      159  DEFINED       11       16       21
                                                          26       31
  1331  COMPR       REAL                                REFS      237      242  DEFINED      235      239
  2507  DIST        REAL         ARRAY                  REFS        8      237      239      243      247
                                                     DEFINED      228      243
  1324  DX          REAL                                REFS      176      280  DEFINED      175      277
  1275  EPSLN       REAL                                REFS      154      136      232  DEFINED       68
  1302  I           INTEGER                             REFS       51       82       83       84      141      142    2*144
                                                       2*145    2*146    2*147    2*148      149      150      152      162
                                                         163      158    2*159    2*175    2*176    3*228      237      238
                                                         239  DEFINED       80      140      161      167      174      227
                                                         236
     0  IBVNSM      INTEGER                 F.P.        REFS      114  DEFINED        1
  1661  ICHI        INTEGER      ARRAY                  REFS        6      149      152      168      286
                                                     DEFINED      141      144      145      146      147      148
  2653  ICONREF     INTEGER      ARRAY                  REFS        8      188      210      296      296
                                                     DEFINED       40
     0  IPLOT       INTEGER                 F.P.        REFS      283  DEFINED        1
   663  ISKSM     * INTEGER                          DEFINED       10
  1327  ISV         INTEGER                             REFS      243  DEFINED      233      238
  1323  J           INTEGER                             REFS      153      169  DEFINED      162      168
  1325  JJ          INTEGER                             REFS      188      192      210      212  DEFINED      188      192
                                                         210      212
  1333  JU          INTEGER                             REFS      230      296  DEFINED      286
  1334  KMN         INTEGER                             REFS    2*288    2*289    2*294    2*295  DEFINED      287      293
  1332  KOCH        INTEGER                             REFS      296      290      296  DEFINED      285
     0  KSSIG       REAL                    F.P.        REFS        2       99      104      106      111
                                                     DEFINED        1       66
  1274  NCONF       INTEGER                             REFS      143      151      160      161      166      157      178
                                                         188      192      204      210      212      284      285
                                                     DEFINED       57      138      143      151
  1326  ND          INTEGER                             REFS      236      243      244      245      252    2*261      260
                                                     DEFINED      232      244      251
  1307  NI          INTEGER                             REFS       99      100      104      105  DEFINED       98
  1311  NIX         INTEGER                             REFS      106      115  DEFINED      100
  1312  NIY         INTEGER                             REFS      111      115  DEFINED      105
     0  NP          INTEGER                 F.P.        REFS       72       80       85       86     2*87     2*88       99
                                                         104      130      133      157      171      174      227      232
                                                         251      252      287      238      293      296      308
                                                     DEFINED        1
  1330  NS          INTEGER                             REFS      241      242      246      247      253
                                                     DEFINED      234      241      246      252
  1321  NU          INTEGER                             REFS      158      159      153      169  DEFINED      157      159
  1322  NUS         INTEGER                             REFS      153      169  DEFINED      158
     0  PSIZE       REAL                    F.P.        REFS      230      296      330  DEFINED        1
  1315  RATIOX      REAL                                REFS      122    2*123  DEFINED      121
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      SUBROUTINE CEPP        74/74   OPT=1                                FTN 4.2+75067        05/05/75  16.16.33.       PAGE    9

 VARIABLES      SN   TYPE              RELOCATION
  2661  RCONF1       REAL      ARRAY                        REFS       8      169      132      290    DEFINED    153
  2667  RCONF2       REAL      ARRAY                        REFS       8      212      296   DEFINED      169
  1310  SBAR      *  REAL                                   REFS      99
  2343  SORTX        REAL      ARRAY                        REFS       8    2*261      256   DEFINED       41      242      247
  1314  SSMAX        REAL                                   REFS     121      124      126   DEFINED      120
  1313  SSMIN        REAL                                   REFS     121      126  DEFINED      119
  1276  SUMX2        REAL                                   REFS      81       87  DEFINED       76       81
  1277  SUMY2        REAL                                   REFS      82       88  DEFINED       77       82
  1305  SXHAT        REAL                                   REFS      99      119      120   DEFINED       89
  1303  SXHAT2       REAL                                   REFS      89  DEFINED       87
  1306  SYHAT        REAL                                   REFS     104      119      120   DEFINED       98
  1304  SYHAT2       REAL                                   REFS      90  DEFINED       88
  1645  TITLE1       REAL      ARRAY                        REFS       5      290      300   DEFINED       36
  1653  TITLE2       REAL      ARRAY                        REFS       5      296  DEFINED       38
     0  X            REAL      ARRAY      F.P.              REFS       8       81       83       99      175      175      228
                                                             288     234      300  DEFINED        1
  1300  XBAR         REAL                                   REFS      83       85       87      175      228      277      280
                                                             296     236      300  DEFINED       78       83       85
  1316  XK .         REAL                                   REFS     124  DEFINED      123
     0  XLAMBD       REAL                 F.P.              REFS     154      165      169      196      200      292      298
                                                         DEFINED       1
     0  Y            REAL      ARRAY      F.P.              REF.       5       82       84      104      175      176      228
                                                             289     235      300  DEFINED        1
  1301  YBAR         REAL                                   REFS      84       86       88      104      175      228      277
                                                             280     230      296      300   DEFINED       79       84       86
  1335  ZXX          REAL      ARRAY                        REFS       4      290      236   DEFINED      288      234
  1501  ZYY          REAL      ARRAY                        REFS       4      230      236   DEFINED      289      295

 FILE NAMES         MODE
        TAPE6       FMT                           WRITES       70      136      109      110      111      131      132      133
                                                    153       175      171      176      182      183      184      186      188
                                                    193       192      194      197      198      200      205      206      207
                                                    203       210      211      212      213      267      271      278      279
                                                    280

 EXTERNALS          TYPE   ARGS         REFERENCES
        KSTEST               6              93      104
        PPLOT               11             293      296      300
        SQRT        REAL     1 LIBRARY      83       90      163      155      169      175      228      277

 INLINE FUNCTIONS   TYPE   ARGS        DEF LINE  REFERENCES
        AMAX1       REAL     6  INTRIN             120
        AMIN1       REAL     C  INTRIN             119

 STATEMENT LABELS               DEF LINE   REFERENCES
     0  1                          84        83
     0  2                         228       227
   454  3                         243       235      237
   222  4                         153       141      142
     0  5                         163       161
     0  6                         169       167
     0  8                         176       174
   565  27                        298       285      292
   217  44                        152       143
   132  102                       126       122
     0  103         INACTIVE      124
   146  121                       138       125
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STATEMENT LABELS               DEF LINE   REFERENCES
    0  257        INACTIVE       165
  502  300                       271        72
  423  400                       227       115
  442  402                       235       245
  475  403                       266       253
  477  404                       267       262
  116  450                       119       114
  505  500                       277       196       204       214       278
  570  501                       300       284
  577  520                       301       273       283       239
  225  526                       156       152
  277  528                       171       135       139       150       164       156
  357  529                       195       178
    0  530        INACTIVE       213
    0  539        INACTIVE       203
  146  545                       137       133
    0  557                       295       233
    0  558                       289       287
 1225 1000    FMT                272       271
  675 1001    FMT                107       106
  722 1002    FMT                112       111
 1210 1004    FMT                268       267
  766 1007    FMT                154       153
 1611 1010    FMT                172       171
 1626 1011    FMT                177       175
 1645 1012    FMT                185       184
 1665 1013    FMT                189       183       210
 1675 1014    FMT                191       191       211
 1104 1015    FMT                193       192       212
 1132 1016    FMT                201       201
 1155 1017    FMT                209       207
  667 1019    FMT                 71        71
 1123 1078    FMT                193       103       110       131       132       170       182       183       137       198
                                           205       206       278       279
  747 1112    FMT                134       133
 1247 1113    FMT                231       231
 1056 1499    FMT                187       185       209
 1112 1500    FMT                195       194       213
    0 8950        INACTIVE        69

LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
   34   1         I        80  84      7B      INSTACK
  152   4       * I       140 153     53B                EXT REFS    EXITS
  235   5       * I       161 163     12B                EXT REFS
  260   6       * I       167 169     15B                EXT REFS
  302   8       * I       174 176     22B                EXT REFS
  424   2       * I       227 228     13B                EXT REFS
  451   3       * I       236 240      5B      INSTACK
  522  27       * KOCH    285 298     46B                EXT REFS  NOT INNER
  530 558         KMN     287 283      3B      INSTACK
  551 557         KMN     293 295      3B      INSTACK

STATISTICS
  PROGRAM LENGTH          27243    1492
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STATEMENT LABELS              DEF LINE   REFERENCES
    0  257          INACTIVE    165
  502  300                      271        72
  423  400                      227       115
  442  402                      235       245
  475  403                      266       253
  477  404                      267       262
  116  450                      113       114
  505  500                      277       196      204      214      270
  570  501                      300       284
  577  520                      301       273      283      239
  225  526                      156       152
  277  528                      171       135      139      150      164      156
  357  529                      195       178
    0  530          INACTIVE    219
    0  539          INACTIVE    203
  146  545                      137       133
    0  557                      235       233
    0  558                      283       287
 1225  1000   FMT               272       271
  675  1001   FMT               107       106
  722  1002   FMT               112       111
 1210  1004   FMT               268       267
  766  1007   FMT               154       151
 1011  1010   FMT               172       171
 1026  1011   FMT               177       175
 1045  1012   FMT               185       184
 1065  1013   FMT               189       183      210
 1075  1014   FMT               191       193      211
 1104  1015   FMT               193       192      212
 1132  1016   FMT               231       203
 1155  1017   FMT               208       207
  667  1019   FMT                71        73
 1123  1078   FMT               193       103      110      131      132      170      182      183      137      198
                                          205      206      278      279
  747  1112   FMT               134       133
 1247  1113   FMT               281       293
 1056  1499   FMT               187       185      209
 1112  1500   FMT               195       194      213
    0  8950         INACTIVE     69

LOOPS  LABEL    INDEX     FROM-TO    LENGTH   PROPERTIES
   34  1        I         80  84       73     INSTACK
  152  4      * I        146 153      538               EXT REFS   EXITS
  235  5      * I        161 163      128               EXT REFS
  260  6      * I        167 169      158               EXT REFS
  302  8      * I        174 176      228               EXT REFS
  424  2      * I        227 228      138               EXT REFS
  451  3      * I        236 246       53     INSTACK
  522  27     * KOCH     285 298      468               EXT REFS  NOT INNER
  530  558      KMN      287 289       38     INSTACK
  551  557      KMK      293 295       38     INSTACK

STATISTICS
  PROGRAM LENGTH                 27243   1492
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SUBROUTINE NORM          74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.16.49.       PAGE    1

                         SUBROUTINE NORM(RX,XL,XU,XMU,SGMA,RNSTRT)                               MCARLO    579
                         XLL=XMU+SGMA*XL                                                         MCARLO    580
                         XUU=XMU +SGMA*XU                                                        MCARLO    581
                         CALL NORMAL(RX,XLL,XUU,XMU,SGMA,RNSTRT)                                 MCARLO    582
      5                  RETURN                                                                  MCARLO    583
                         END                                                                     MCARLO    584


SUBROUTINE NORM          74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.16.49.       PAGE    2

      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    3  NORM           1             5

VARIABLES        SN   TYPE             RELOCATION
     0  RNSTRT        REAL                     F.P.        REFS       4   DEFINED      1
     0  RX            REAL                     F.P.        REFS       4   DEFINED      1
     0  SGMA          REAL                     F.P.        REFS       2       3        4   DEFINED      1
     0  XL            REAL                     F.P.        REFS       2   DEFINED      1
    30  XLL           REAL                                 REFS       4   DEFINED      2
     0  XMU           REAL                     F.P.        REFS       2       3        4   DEFINED      1
     0  XU            REAL                     F.P.        REFS       3   DEFINED      1
    31  XUU           REAL                                 REFS       4   DEFINED      3

EXTERNALS             TYPE   ARGS         REFERENCES
    NORMAL                     6              4

STATISTICS
  PROGRAM LENGTH                  32B     26
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```
      SUBROUTINE KSTEST(Y,NP,KSSIG,XBAR,SXBAT,NI)                        MCARLO  585
      DIMENSION Y(100),CRIT(100),ISNIGF(100)                             MCARLO  586
      REAL KSSIG                                                         MCARLO  587
      DATA NZT/3/                                                        MCARLO  588
      DATA NUM/0/                                                        MCARLO  589
      DATA CRIT /375.,542.,708.,624.,565.,521.,485.,457.,432.,410.,391., MCARLO  590
     A           375.,361.,349.,338.,328.,318.,303.,301.,294.,289.,284., MCARLO  591
     B           280.,275.,270.,264.,258.,252.,248.,242.,238.,236.,234., MCARLO  592
     C           232.,230.,227.,224.,221.,218.,215.,212.,210.,207.,205., MCARLO  593
     D           203.,200.,198.,196.,194.,192.,50*192./                  MCARLO  594
      NV=NP                                                              MCARLO  595
      NI=0                                                               MCARLO  596
      RSNIG=KSSIG                                                        MCARLO  597
      NZT=5                                                              MCARLO  598
 3011 CONTINUE                                                           MCARLO  599
      NSG=0                                                              MCARLO  600
  500 FORMAT(I2)                                                         MCARLO  601
      NUM=NUM+1                                                          MCARLO  602
  527 RNV=NV                                                             MCARLO  603
      YMAX=Y(1)                                                          MCARLO  604
      YS2=Y(1)**2                                                        MCARLO  605
      YMIN=Y(1)                                                          MCARLO  606
      YSUM=Y(1)                                                          MCARLO  607
      DO 1 I=2,NV                                                        MCARLO  608
      IF(YMAX-Y(I))100,100,101                                           MCARLO  609
  100 YMAX=Y(I)                                                          MCARLO  610
  101 IF(YMIN-Y(I))106,105,102                                           MCARLO  611
  102 YMIN=Y(I)                                                          MCARLO  612
  106 YSUM=YSUM+Y(I)                                                     MCARLO  613
    1 YS2=YS2+Y(I)**2                                                    MCARLO  614
      RNV1=RNV-1                                                         MCARLO  615
      S2=(YS2-(YSUM**2)/RNV)/RNV1                                        MCARLO  616
      S=SQRT(S2)                                                         MCARLO  617
      YMEAN=YSUM/RNV                                                     MCARLO  618
      WRITE(6,563)NUM                                                    MCARLO  619
  563 FORMAT(1X,9HCASE NO.=,I4/)                                         MCARLO  620
      WRITE(6,517)YMEAN,S                                                MCARLO  621
  517 FORMAT(11X,5HMEAN=,F10.4,8HSTD DEV=,F10.4)                         MCARLO  622
      NSTEPS = NV/5                                                      MCARLO  623
      SSTEP=(YMAX-YMIN)/NSTEPS                                           MCARLO  624
      B1=YMIN-SSTEP                                                      MCARLO  625
      NCUM=0                                                             MCARLO  626
      UMAX=0.                                                            MCARLO  627
      WRITE(6,4331)NSTEPS,YMIN,YMAX                                      MCARLO  628
 4331 FORMAT(1X,7HNSTEPS=,I6,2X,5HYMIN=,F6.3,1X,5HYMAX=,F6.3)            MCARLO  629
      DO 2 I=1,NSTEPS                                                    MCARLO  630
      B1=B1+SSTEP                                                        MCARLO  631
  124 OBS=B1+SSTEP/0.5                                                   MCARLO  632
  125 B2=B1+SSTEP                                                        MCARLO  633
      IF(I.EQ.NSTEPS) B2=B2+0.00001                                      MCARLO  634
      NN=0                                                               MCARLO  635
      DO 2 J=1,NV                                                        MCARLO  636
      IF(Y(J)-B1)3,103,103                                               MCARLO  637
  103 IF(Y(J)-B2)104,3,3                                                 MCARLO  638
  104 NN=NN+1                                                            MCARLO  639
      NCUM=NCUM+1                                                        MCARLO  640
    3 CONTINUE                                                           MCARLO  641
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      RNCJM=NCUM                                              MCARLO     642
      RELCUM=RNCJM/RNV                                        MCARLO     643
      YMINUSM=OBS-YMEAN                                       MCARLO     644
      Z=YMINUSM/S                                             MCARLO     645
      CALL ZTABLE(Z,FREQ,NZT)                                 MCARLO     646
      D=ABS(FREQ-RELCUM)                                      MCARLO     647
      IF(D-DMAX)120,120,121                                   MCARLO     648
  121 DMAX=D                                                  MCARLO     649
  120 CONTINUE                                                MCARLO     650
    2 CONTINUE                                                MCARLO     651
      CRITTT = CRIT(NV)/1000.                                 MCARLO     652
      WRITE(6,5123)DMAX,CRITTT                                MCARLO     653
 5123 FORMAT(1X,5HDMAX=,F10.7,2X,13HCRITICAL VAL=,F10.7)      MCARLO     654
      IF(DMAX-CRITTT)566,568,568                              MCARLO     655
  568 NSG=NSG+1                                               MCARLO     656
  516 CONTINUE                                                MCARLO     657
      NI=1                                                    MCARLO     658
  566 CONTINUE                                                MCARLO     659
      RETURN                                                  MCARLO     660
      END                                                     MCARLO     661
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SUBROUTINE KSTEST     74/74   OPT=1                  FTN 4.2+75057     05/05/75  16.16.58.     PAGE    3

     SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
      3   KSTEST       1           75

VARIABLES        SN   TYPE           RELOCATION
   250   B1           REAL                             REFS        47       48        49       53    DEFINED      41      47
   254   B2           REAL                             REFS        50       54   DEFINED       49       58
   266   CRIT         REAL         ARRAY               REFS         2       68   DEFINED        6
   265   CRITTT       REAL                             REFS        69       71   DEFINED       68
   264   D            REAL                             REFS        54       65   DEFINED       63
   252   DMAX         REAL                             REFS        64       59        71  DEFINED       43      65
   263   FREQ         REAL                             REFS        62       63
   241   I            INTEGER                          REFS        25       26        27       28       29      30      50
                                                    DEFINED        24       46
   432   ISNIGF       INTEGER    *UNDEF                REFS         2
   256   J            INTEGER                          REFS        53       54   DEFINED       52
     0   KSSIG        REAL                  F.P.       REFS         3       13   DEFINED        1
   251   NCUM         INTEGER                          REFS        56       58   DEFINED       42       56
     0   NI           INTEGER               F.P.    DEFINED         1       12        74
   255   NN           INTEGER                          REFS        55  DEFINED        51       55
     0   NO           INTEGER               F.P.       REFS        11  DEFINED         1
   233   NSG          INTEGER                          REFS        72  DEFINED        16       72
   246   NSTEPS       INTEGER                          REFS        40       44        46       50   DEFINED      39
   153   NUM          INTEGER                          REFS        18       35   DEFINED        5       18
   231   NV           INTEGER                          REFS        19       24        39       52       68
                                                    DEFINED        11
   152   NZT          INTEGER                          REFS        62  DEFINED         4       14
   253   OBS          REAL                             REFS        50  DEFINED        48
   260   RELCUM       REAL                             REFS        63  DEFINED        59
   257   RNCUM        REAL                             REFS        59  DEFINED        58
   234   RNV          REAL                             REFS        31       32        34       59   DEFINED      19
   242   RNV1         REAL                             REFS        32  DEFINED        31
   232   RSMIG     *  REAL                          DEFINED        13
   244   S            REAL                             REFS        37       51   DEFINED       33
   247   SSTEP        REAL                             REFS        41       47        48       49   DEFINED      40
     0   SXHAT        REAL       *UNUSED    F.P     DEFINED         1
   243   S2           REAL                             REFS        33  DEFINED        32
     0   XBAR         REAL       *UNUSED    F.P.    DEFINED         1
     0   Y            REAL         ARRAY    F.P.       REFS         2       20        21       22       23      25      26
                                                         27        28       29        30       53       54
                                                    DEFINED         1
   235   YMAX         REAL                             REFS        25       40        44  DEFINED       20      26
   245   YMEAN        REAL                             REFS        37       50   DEFINED       34
   237   YMIN         REAL                             REFS        27       40        41       44   DEFINED      22      28
   261   YMINUSN      REAL                             REFS        51  DEFINED        60
   240   YSUM         REAL                             REFS        29       32        34  DEFINED       23      29
   236   YS2          REAL                             REFS        30       32   DEFINED       21       30
   262   Z            REAL                             REFS        62  DEFINED        51

 FILE NAMES         MODE
       TAPE6        FMT                     WRITES      35        37       44        59

EXTERNALS           TYPE    ARGS        REFERENCES
       SQRT         REAL      1 LIBRARY      33
       ZTABLE                 3              62
```

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SUBROUTINE KSTEST       74/74   OPT=1                              FTN 4.2+75057     05/05/75  16.16.50.      PAGE    4

INLINE FUNCTIONS   TYPE   ARGS          DEF LINE  REFERENCES
    ABS            REAL     1  INTRIN                  63

STATEMENT LABELS                 DEF LINE   REFERENCES
       0  1                          30         24
       0  2                          67         45        52
     111  3                          57         53      2*54
       0  100          INACTIVE      26       2*25
      30  101                        27         25
       0  102          INACTIVE      28         27
       0  103          INACTIVE      54       2*53
       0  104          INACTIVE      55         54
      33  106                        29       2*27
     127  120                        65       2*54
       0  121          INACTIVE      65         64
       0  124          INACTIVE      48
       0  125          INACTIVE      43
     154  500      FMT  NO REFS      17
       0  516          INACTIVE      73
     172  517      FMT               38         37
       0  527          INACTIVE      13
     162  563      FMT               36         35
     145  566                        75         71
       0  568          INACTIVE      72       2*71
       0  3011         INACTIVE      15
     205  4331     FMT               45         44
     220  6123     FMT               70         63

LOOPS  LABEL    INDEX     FROM-TO   LENGTH   PROPERTIES
   25  1          I        24 30      128      OPT
   66  2        * I        46 67      463               EXT REFS  NOT INNER
  101  2        * J        52 67      318               EXT REFS

STATISTICS
  PROGRAM LENGTH                5753    382
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      SUBROUTINE ZTABLE(Z,FREQ,NZT)                                    MCARLO   662
      DIMENSION ZCUM(385)                                              MCARLO   663
      DATA (ZCUM(I),I=1,108)                                           MCARLO   664
     1         /0000.,0040.,0080.,0120.,0160.,0199.,0239.,0279.,0319.,  MCARLO   665
     A          0359.,0398.,0438.,0478.,0517.,0557.,0596.,0636.,0675.,  MCARLO   666
     B          0714.,0753.,0793.,0832.,0871.,0910.,0948.,0987.,1026.,  MCARLO   667
     C          1064.,1103.,1141.,1179.,1217.,1255.,1293.,1331.,1368.,  MCARLO   668
     D          1406.,1443.,1480.,1517.,1554.,1591.,1682.,1664.,1700.,  MCARLO   669
     E          1736.,1772.,1808.,1844.,1879.,1915.,1950.,1985.,2019.,  MCARLO   670
     F          2054.,2088.,2123.,2157.,2190.,2224.,2257.,2291.,2324.,  MCARLO   671
     G          2357.,2389.,2422.,2452.,2486.,2517.,2549.,2580.,2611.,  MCARLO   672
     H          2642.,2673.,2704.,2734.,2764.,2794.,2823.,2852.,2881.,  MCARLO   673
     I          2910.,2939.,2967.,2995.,3023.,3051.,3078.,3106.,3133.,  MCARLO   674
     J          3159.,3186.,3212.,3238.,3264.,3289.,3315.,3340.,3365.,  MCARLO   675
     K          3389.,3413.,3138.,3461.,3485.,3508.,3531.,3554.,3577./  MCARLO   676
      DATA (ZCUM(I),I=109,216)                                         MCARLO   677
     2         /3599.,3621.,3643.,3665.,3686.,3708.,3729.,3749.,3770.,  MCARLO   678
     A          3790.,3810.,3830.,3849.,3869.,3888.,3907.,3925.,3944.,  MCARLO   679
     B          3962.,3980.,3997.,4015.,4032.,4049.,4066.,4082.,4099.,  MCARLO   680
     C          4115.,4131.,4147.,4162.,4177.,4192.,4207.,4222.,4236.,  MCARLO   681
     D          4251.,4265.,4279.,4292.,4306.,4319.,4332.,4345.,4357.,  MCARLO   682
     E          4370.,4382.,4394.,4406.,4418.,4429.,4441.,4452.,4463.,  MCARLO   683
     F          4474.,4484.,4495.,4505.,4515.,4525.,4535.,4545.,4554.,  MCARLO   684
     G          4564.,4573.,4582.,4591.,4599.,4608.,4616.,4625.,4633.,  MCARLO   685
     H          4641.,4649.,4656.,4664.,4671.,4678.,4686.,4693.,4699.,  MCARLO   686
     I          4706.,4713.,4719.,4726.,4732.,4738.,4744.,4750.,4756.,  MCARLO   687
     J          4761.,4767.,4772.,4778.,4783.,4788.,4793.,4798.,4803.,  MCARLO   688
     K          4808.,4812.,4817.,4821.,4826.,4830.,4834.,4838.,4842./  MCARLO   689
      DATA (ZCUM(I),I=217,385)                                         MCARLO   690
     3         /4846.,4850.,4854.,4857.,4861.,4864.,4868.,4871.,4875.,  MCARLO   691
     A          4878.,4881.,4884.,4887.,4890.,4893.,4896.,4898.,4901.,  MCARLO   692
     B          4904.,4906.,4909.,4911.,4913.,4916.,4918.,4920.,4922.,  MCARLO   693
     C          4925.,4927.,4929.,4931.,4932.,4934.,4936.,4938.,4940.,  MCARLO   694
     D          4941.,4943.,4945.,4946.,4948.,4949.,4951.,4952.,4953.,  MCARLO   695
     E          4955.,4956.,4957.,4959.,4960.,4961.,4962.,4963.,4964.,  MCARLO   696
     F          4965.,4966.,4967.,4968.,4969.,4970.,4971.,4972.,4973.,  MCARLO   697
     G          4974.,4974.,4975.,4976.,4977.,4977.,4978.,4979.,4979.,  MCARLO   698
     H          4980.,4981.,4981.,4982.,4982.,4983.,4984.,4984.,4985.,  MCARLO   699
     I          4985.,4985.,4986.,4987.,4987.,4987.,4988.,4988.,4989.,  MCARLO   700
     J          4989.,4989.,4990.,4990.,75*4990./                       MCARLO   701
  107 ABSZ=ABS(Z)                                                      MCARLO   702
      EPSLN1=-0.005                                                    MCARLO   703
      EPSLN2=0.005                                                     MCARLO   704
      IF(Z-EPSLN1)110,111,111                                          MCARLO   705
  111 IF(Z-EPSLN2)112,112,110                                          MCARLO   706
  112 FREQ=0.5                                                         MCARLO   707
      GO TO 200                                                        MCARLO   708
  110 ABSZ=100.*ABSZ                                                   MCARLO   709
      IZ=ABSZ                                                          MCARLO   710
      RZ=IZ                                                            MCARLO   711
      RZ=RZ+0.5                                                        MCARLO   712
      IF(ABSZ-RZ)101,101,102                                           MCARLO   713
  102 IZ=IZ+1                                                          MCARLO   714
  101 IF(IZ-310)103,104,104                                            MCARLO   715
  104 FREQ=1.                                                          MCARLO   716
      GO TO 203                                                        MCARLO   717
  103 IZ=IZ+1                                                          MCARLO   718
```

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          SUBROUTINE ZTABLE      74/74  OPT=1                       FTN 4.2+75067    05/05/75  16.16.54.     PAGE    2

                    FREQ = ZCUM(IZ)/10000.                                                      MCARLO    719
                    IF(Z-C.)105,105,106                                                         MCARLO    720
  60            105 FREQ=0.5-FREQ                                                               MCARLO    721
                    GO TO 200                                                                   MCARLO    722
                106 FREQ=FREQ+0.5                                                               MCARLO    723
                200 RETURN                                                                      MCARLO    724
                    END                                                                         MCARLO    725


          SUBROUTINE ZTABLE      74/74  OPT=1                       FTN 4.2+75067    05/05/75  16.16.54.     PAGE    3

          SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE      REFERENCES
        3  ZTABLE          1          63

  VARIABLES        SN  TYPE            RELOCATION
       55  ABSZ        REAL                          REFS      48      49      52   DEFINED     41     48
       56  EPSLN1      REAL                          REFS      44  DEFINED      42
       57  EPSLN2      REAL                          REFS      45  DEFINED      43
        0  FREQ        REAL               F.P.       REFS      60      62  DEFINED      1     46     55     58
                                                     60        62
       60  IZ          INTEGER                       REFS      50      53      54      57     58
                                                   DEFINED     49      53      57
        0  NZT         INTEGER  *UNUSED   F.P.     DEFINED      1
       61  RZ          REAL                          REFS      51      52  DEFINED     50     51
        0  Z           REAL               F.P.       REFS      41      44      45      59  DEFINED      1
       62  ZCUM        REAL        ARRAY             REFS       2      58  DEFINED      3     16     29

  INLINE FUNCTIONS    TYPE   ARGS       DEF LINE  REFERENCES
           ABS        REAL     1  INTRIN              41

  STATEMENT LABELS               DEF LINE    REFERENCES
       26  101                      54        2*52
        0  102        INACTIVE      53          52
       33  103                      57          54
        0  104        INACTIVE      55        2*54
        0  105        INACTIVE      60        2*59
       43  106                      62          59
        0  107        INACTIVE      41
       16  110                      48          44      45
        0  111        INACTIVE      45        2*44
        0  112        INACTIVE      46        2*45
       46  200                      63          47      56      51

  STATISTICS
    PROGRAM LENGTH              663B      435
```

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SUBROUTINE PPLOT       74/74    OPT=1                      FTN 4.2+75067      05/05/75  16.16.56.       PAGE    1

      SUBROUTINE PPLOT(X,Y,NP,CEP,ICHI,RCONF,TITLE,XBAR,YBAR,XLAMBD,          MCARLO   726
     1                 PSIZE)                                                 MCARLO   727
      DIMENSION X(100),Y(100),TITLE(6),SORTY(100),SORTX(100),PLINE(22)        MCARLO   728
      DIMENSION MSKK(2))                                                      MCARLO   729
      DATA POINTS/7HX      /                                                  MCARLO   730
      DATA CEPX/7H......./                                                    MCARLO   731
      DATA CONFC/7H......./                                                   MCARLO   732
      DATA EPSLN/0.00001/                                                     MCARLO   733
      DATA (PLINE(I),I=1,22)/22*(7H       )/                                  MCARLO   734
      DATA FF/7HXXXXXXX/                                                      MCARLO   735
      DATA CPR/7H......./                                                     MCARLO   736
      DATA RCR/7H......./                                                     MCARLO   737
      DATA TGT/7HTTTTTTT/                                                     MCARLO   738
      DATA CPCEN/7HCCCCCCC/                                                   MCARLO   739
      DATA BLNKK/7H      /                                                    MCARLO   740
      DATA (MSKK(I),I=1,10)/77000000000000000003,00770000000000000008,        MCARLO   741
     *00007700000000000003,00000077000000000008,00000000770000000008,         MCARLO   742
     *00000000007700000003,00000000000077000008,00000000000000770000002,      MCARLO   743
     *00000000000000007703,00000000000000000778/                              MCARLO   744
      ICIRSW=0                                                                MCARLO   745
      ITGTSW=0                                                                MCARLO   746
      YCEP=CEP                                                                MCARLO   747
      YRCNF=RCONF                                                             MCARLO   748
      WRITE(6,1000)                                                           MCARLO   749
 1000 FORMAT(1H1)                                                             MCARLO   750
      WRITE(6,1001) (TITLE(I),I=1,6),XLAMBD                                   MCARLO   751
 1001 FORMAT(45X,6A5,F4.2)                                                    MCARLO   752
      WRITE(6,1003)                                                           MCARLO   753
      WRITE(6,1002)POINTS                                                     MCARLO   754
      WRITE(6,1072)CEPX                                                       MCARLO   755
      CPCCC=CPCEN.A.MSKK(4).O.BLNKK.A..N.MSKK(4)                              MCARLO   756
      WRITE(6,1492)CPCCC                                                      MCARLO   757
 1492 FORMAT(6X,16HCIRCLE CENTROID ,A7)                                       MCARLO   758
      CPCCC=TGT.A.MSKK(4).O.BLNKK.A..N.MSKK(4)                                MCARLO   759
      WRITE(6,1493)CPCCC                                                      MCARLO   760
 1493 FORMAT(6X,11HTGT CENTER,A7)                                             MCARLO   761
 1002 FORMAT(6X,9HPOINTS    ,A6)                                              MCARLO   762
 1003 FORMAT(130X)                                                            MCARLO   763
 1072 FORMAT(6X,10HCEP CIRCLE,3X,A6)                                          MCARLO   764
      IF(ICHI.LE.0) GO TO 100                                                 MCARLO   765
      WRITE(6,1073)ICHI,CONFC                                                 MCARLO   766
  100 CONTINUE                                                                MCARLO   767
      DO 1 I=1,3                                                              MCARLO   768
    1 WRITE(6,1003)                                                           MCARLO   769
 1073 FORMAT(1X,I4,1X,26HPER CENT CONFIDENCE CIRCLE,3X,A6)                    MCARLO   770
      ND=NP                                                                   MCARLO   771
      NS=0                                                                    MCARLO   772
      XMIN=1.*(10**6)                                                         MCARLO   773
      XMAX=1.*(-10**6)                                                        MCARLO   774
  103 YMAX=1.*(-10**6)                                                        MCARLO   775
      DO 2 I=1,ND                                                             MCARLO   776
      IF(Y(I).LE.YMAX) GO TO 101                                              MCARLO   777
      YMAX = Y(I)                                                             MCARLO   778
      IY=I                                                                    MCARLO   779
  101 IF(ND.NE.NP) GO TO 2                                                    MCARLO   780
      IF(X(I).GT.XMAX) XMAX=X(I)                                              MCARLO   781
      IF(X(I).LT.XMIN) XMIN=X(I)                                              MCARLO   782
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SUBROUTINE PPLOT        74/74    OPT=1                          FTN 4.2+75067        05/05/75  16.16.36        PAGE    2

              2 CONTINUE                                                  MCARLO     783
                NS=NS+1                                                   MCARLO     784
                SORTY(NS)=Y(IY)                                           MCARLO     785
                Y(IY)=Y(ND)                                               MCARLO     786
                SORTX(NS)=X(IY)                                           MCARLO     787
                X(IY)=X(ND)                                               MCARLO     788
                ND=ND-1                                                   MCARLO     789
                IF(ND.GT.1) GO TO 103                                     MCARLO     790
                NS=NS+1                                                   MCARLO     791
                SORTY(NS)=Y(1)                                            MCARLO     792
                SORTX(NS)=X(1)                                            MCARLO     793
                XMAXA = ABS(XMAX)                                         MCARLO     794
                XMINA=ABS(XMIN)                                           MCARLO     795
                XDEVM=AMAX1(XMAXA,XMINA)                                  MCARLO     796
                YMAXA=ABS(SORTY(1))                                       MCARLO     797
                YMINA=ABS(SORTY(NP))                                      MCARLO     798
                YDEVM=AMAX1(YMAXA,YMINA)                                  MCARLO     799
            106 XCIR=ABS(XBAR) + AMAX1(CEP,RCONF)                         MCARLO     800
                YCIR=ABS(YBAR)  + AMAX1(CEP,RCONF)                        MCARLO     801
            110 TSPRD=AMAX1(XDEVM,YDEVM,XCIR,YCIR)                        MCARLO     802
                IF(PSIZE.GT.0.) TSPRD=PSIZE/2.                            MCARLO     803
                SCAL=TSPRD/21.                                            MCARLO     804
                SCAL2=SCAL/2.                                             MCARLO     805
                HSPRD=TSPRD                                               MCARLO     806
                HSCAL=HSPRD/35.                                           MCARLO     807
                CCIRTP=YBAR + CEP                                         MCARLO     808
                CCIRBT=YBAR - CEP                                         MCARLO     809
                RCIRTP=YBAR + RCONF                                       MCARLO     810
                RCIRBT=YBAR - RCONF                                       MCARLO     811
                IF(RCONF.LT.CEP)RCIRTP=-100000.                           MCARLO     812
                YCEP = CCIRTP + SCAL                                      MCARLO     813
                YRCNF = RCIRTP + SCAL                                     MCARLO     814
                ICSW = 0                                                  MCARLO     815
                TU = TSPRD + SCAL                                         MCARLO     816
                NJ=1                                                      MCARLO     817
                CALL XLOC(0.,HSPRD,IWD,INDX)                              MCARLO     818
                IXWD=IWD                                                  MCARLO     819
                IXNDX = INDX                                              MCARLO     820
                DO 15 I=1,44                                              MCARLO     821
                TU=TU - SCAL                                              MCARLO     822
                PLINE(IXWD)= RCR.A.MSKK(IXNDX).O.PLINE(IXWD).A..N.MSKK(IXNDX) MCARLO 823
                IF(0..LT.TU.OR.ITGTSW.GT.0) GO TO 2222                    MCARLO     824
                DO 2223 IOP=7,16                                          MCARLO     825
           2223 PLINE(IOP)=RCR                                            MCARLO     826
           2222 CONTINUE                                                  MCARLO     827
                IF(CCIRTP.LT.TU.OR.TU.LT.CCIRBT) GO TO 5180               MCARLO     828
                YCEP=YCEP - SCAL                                          MCARLO     829
                ARGG=CEP**2 - YCEP**2 + 2*YCEP*YBAR - YBAR**2             MCARLO     830
                IF(ARGG.LT.0) GO TO 5180                                  MCARLO     831
                RAD=SQRT(ARGG)                                            MCARLO     832
                GO TO 5181                                                MCARLO     833
           5180 CONTINUE                                                  MCARLO     834
                IF(CCIRTP.LT.TU) GO TO 205                                MCARLO     835
                IF(ABS(TU - CCIRBT).GT.SCAL2) GO TO 205                   MCARLO     836
                RAD=0.                                                    MCARLO     837
           5181 CONTINUE                                                  MCARLO     838
                XXL=XBAR - RAD                                            MCARLO     839
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```
            CALL XLOC(XXL,HSPRD IWD,INDX)                                    MCARLO  840
            PLINE(IWD)=CPR.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)         MCARLO  841
            XXU=XBAR + RAD                                                   MCARLO  842
            CALL XLOC(XXU,HSPRD,IWD,INDX)                                    MCARLO  843
            PLINE(IWD)=CPR.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)         MCARLO  844
      205   IF(RCIRTP.LT.TU.OR.TU.LT.RCIRBT) GO TO 5190                      MCARLO  845
            YRCNF=YRCNF - SCAL                                               MCARLO  846
            ARRCNF=RCONF**2 - YRCNF**2 + 2*YRCNF*YBAR - YBAR**2              MCARLO  847
            IF(ARRCNF.LT.0) GO TO 5190                                       MCARLO  848
            RAD=SQRT(ARRCNF)                                                 MCARLO  849
            GO TO 5191                                                       MCARLO  850
     5190   CONTINUE                                                         MCARLO  851
            IF(RCIRTP.LT.TU) GO TO 207                                       MCARLO  852
            IF(ABS(TU - RCIRBT).GT.SCAL2) GO TO 207                          MCARLO  853
            RAD=0.                                                           MCARLO  854
     5191   CONTINUE                                                         MCARLO  855
            XXL=XBAR - RAD                                                   MCARLO  856
            CALL XLOC(XXL,HSPRD,IWD,INDX)                                    MCARLO  857
            PLINE(IWD)=RCR.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)         MCARLO  858
            XXU=XBAR + RAD                                                   MCARLO  859
            CALL XLOC(XXU,HSPRD,IWD,INDX)                                    MCARLO  860
            PLINE(IWD)=RCR.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)         MCARLO  861
      207   IF(ICSW.GT.0) GO TO 210                                          MCARLO  862
            IF(YBAR.LT.TU) GO TO 210                                         MCARLO  863
            ICSW=1                                                           MCARLO  864
            CALL XLOC(XBAR,HSPRD,IWD,INDX)                                   MCARLO  865
            PLINE(IWD)=CPCEN.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)       MCARLO  866
      210   IF(0..LT.TU.OR.ITGTSW.GT.0) GO TO 213                            MCARLO  867
            ITGTSW=1                                                         MCARLO  868
            CALL XLOC(0.,HSPRD,IWD,INDX)                                     MCARLO  869
            PLINE(IWD)=TGT.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)         MCARLO  870
      213   JQ=0                                                             MCARLO  871
            IF(NJ.GT.NP) GO TO 202                                           MCARLO  872
            DO 16 K=NJ,NP                                                    MCARLO  873
            IF(SORTY(K).LT.TU) GO TO 201                                     MCARLO  874
            JQ=JQ+1                                                          MCARLO  875
            CALL XLOC(SORTX(K),HSPRD,IWD,INDX)                               MCARLO  876
            PLINE(IWD)=PP.A.MSKK(INDX).O.PLINE(IWD).A..N.MSKK(INDX)          MCARLO  877
       16   CONTINUE                                                         MCARLO  878
      201   NJ=NJ+JQ                                                         MCARLO  879
      202   WRITE(6,1022)(PLINE(KUG),KUG=3,19)                               MCARLO  880
     1022   FORMAT(1X,16A7,A5)                                               MCARLO  881
            DO 33 KUG=1,19                                                   MCARLO  882
       33   PLINE(KUG)=BLNKK                                                 MCARLO  883
       15   CONTINUE                                                         MCARLO  884
            WRITE(6,1003)                                                    MCARLO  885
            DX=SQRT(XBAR**2+YBAR**2)                                         MCARLO  886
            WRITE(6,1021)XBAR,YBAR,DX,CEP                                    MCARLO  887
     1021   FORMAT(1X,14HCEP CENTROID=(,F6.3,1H,,F6.3,1H),10X,22HDIST. FROM TG MCARLO  888
           *T CENTER=,F6.3,10X,4HCEP=,F6.3)                                  MCARLO  889
            WRITE(6,1175)ICHI,RCONF                                          MCARLO  890
     1175   FORMAT(1X,4HTHE ,I4,1X,37HPER CENT CONFIDENCE CIRCLE RADIUS IS ,F6 MCARLO  891
           *.3)                                                              MCARLO  892
            RETURN                                                           MCARLO  893
            END                                                              MCARLO  894
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SUBROUTINE PPLOT      74/74   OPT=1                    FTN 4.2+75057     05/05/75  16.16.36.      PAGE   4

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    3   PPLOT          1          160

VARIABLES     SN   TYPE          RELOCATION
  722  ARGG        REAL                            REFS      106      107    DEFINED     105
  726  ARRCNF      REAL                            REFS      123      124    DEFINED     122
  477  BLNKK       REAL                            REFS       31       34        158   DEFINED     15
  707  CCIRBT      REAL                            REFS      103      111    DEFINED      84
  766  CCIRTP      REAL                            REFS       88      103        110   DEFINED     83
    0  CEP         REAL               F.P.         REFS       22       75         76       83      84      87     105
                                                    162  DEFINED        1
  467  CEPX        REAL                            REFS       30  DEFINED          6
  470  CONFC       REAL                            REFS       41  DEFINED          7
  662  CPCCC       REAL                            REFS       32       35    DEFINED      31      34
  476  CPCEN       REAL                            REFS       31      141    DEFINED      14
  473  CPR         REAL                            REFS      116      119    DEFINED      11
  732  DX          REAL                            REFS      152  DEFINED        151
  471  EPSLN    *  REAL                            DEFINED     8
  705  HSCAL    *  REAL                            DEFINED    92
  704  HSPRD       REAL                            REFS       82       93        115      118     132     135     148
                                                    144      131  DEFINED         81
  661  I           INTEGER                         REFS       26       52         53       54    2*56    2*57
                                                   DEFINED    26       43         51       96
    0  ICHA        INTEGER            F.P.         REFS       40       41        155   DEFINED      1
  655  ICIRSN   *  INTEGER                         DEFINED    20
  712  ICSM        INTEGER                         REFS      137  DEFINED         90      139
  716  INDX        INTEGER                         REFS       33       95        115    2*116     118   2*119     132
                                                   2*133     135    2*136        140    2*141     144   2*145     151
                                                   2*152
  721  IOP         INTEGER                         REFS      131  DEFINED        100
  656  ITGTSN      INTEGER                         REFS       39      142    DEFINED      21     143
  715  IND         INTEGER                         REFS       93       94        115    2*116     118   2*119     132
                                                   2*133     135    2*136        140    2*141     144   2*143     151
                                                   2*152
  720  IXNDX       INTEGER                         REFS     2*98  DEFINED         95
  717  IXND        INTEGER                         REFS     2*98  DEFINED         94
  670  IY          INTEGER                         REFS       50       61         52       63  DEFINED     54
  727  JQ          INTEGER                         REFS      150      154    DEFINED     146     150
  730  K           INTEGER                         REFS      149      151    DEFINED     148
  731  KUG         INTEGER                         REFS      155      158    DEFINED     155     157
 1271  MSKK        INTEGER   ARRAY                 REFS        4     2*31       2*34     2*98   2*115   2*119   2*133
                                                   2*136   2*141    2*145      2*152  DEFINED      16
  663  ND          INTEGER                         REFS       51       55         51       63      64      65
                                                   DEFINED    46       64
  714  NJ          INTEGER                         REFS      147      148        154  DEFINED      92     154
    0  NP          INTEGER            F.P.         REFS       46       55         73      147     148
                                                   DEFINED     1
  664  NS          INTEGER                         REFS       59       60         52       66      57      58
                                                   DEFINED    47       59         56
 1243  PLINE       REAL      ARRAY                 REFS        3       98        116      119     133     136     141
                                                    145      152      155    DEFINED        9      98     1[illegible]     110
                                                    119      133      136        141      145     152     158
  466  POINTS      REAL                            REFS       29  DEFINED          5
  472  PP          REAL                            REFS      152  DEFINED         10
    0  PSIZE       REAL               F.P.         REFS     2*78  DEFINED          1
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        SUBROUTINE PPLOT      74/74    OPT=1                              FTN 4.2+75067    05/05/75  15.16.56.      PAGE    5

VARIABLES      SN   TYPE             RELOCATION
   723  RAD         REAL                               REFS       114      117      131      134   DEFINED      107      112
                                                         124      129
   711  RCIRBT      REAL                               REFS       120      120  DEFINED       86
   710  RCIRTP      REAL                               REFS        59      120      127  DEFINED       85       97
     0  RCONF       REAL                   F.P.        REFS        23       75       76       85       86       87      122
                                                         165  DEFINED        1
   474  RCR         REAL                               REFS        98      101      133      136   DEFINED       12
   702  SCAL        REAL                               REFS        80       88       89       91       97      104      121
                                                     DEFINED       79
   703  SCAL2       REAL                               REFS       111      128  DEFINED       80
  1077  SORTX       REAL       ARRAY                   REFS         3      151  DEFINED       62       68
   733  SORTY       REAL       ARRAY                   REFS         3       72       73      149  DEFINED       58       67
   ...  TGT         REAL                               REFS        34      145  DEFINED       13
     0  TITLE       REAL       ARRAY       F.P.        REFS         3       26  DEFINED        1
   701  TSPRD       REAL                               REFS        79       81       91  DEFINED       77       78
   713  TU          REAL                               REFS        97       99    2*103      110      111    2*120      127
                                                         128      138      142      149  DEFINED       91       97
     0  X           REAL       ARRAY       F.P.        REFS         3     2*56     2*57       62       63       68
                                                     DEFINED        1       63
     0  XBAR        REAL                   F.P.        REFS        75      114      117      131      134      148      161
                                                         162  DEFINED        1
   677  XCIR        REAL                               REFS        77  DEFINED       75
   673  XDEVM       REAL                               REFS        77  DEFINED       71
     0  XLAMBD      REAL                   F.P.        REFS        26  DEFINED        1
   666  XMAX        REAL                               REFS        56       59  DEFINED       49       56
   671  XMAXA       REAL                               REFS        71  DEFINED       59
   665  XMIN        REAL                               REFS        57       70  DEFINED       48       57
   672  XMINA       REAL                               REFS        71  DEFINED       70
   724  XXL         REAL                               REFS       115      132  DEFINED      114      131
   725  XXU         REAL                               REFS       118      135  DEFINED      117      134
     0  Y           REAL       ARRAY       F.P.        REFS         3       52       53       60       61       67
                                                     DEFINED        1       51
     0  YBAR        REAL                   F.P.        REFS        76       83       84       85       86    2*105    2*122
                                                         138      151      152  DEFINED        1
   657  YCEP        REAL                               REFS       104    2*105  DEFINED       22       58      104
   700  YCIR        REAL                               REFS        77  DEFINED       76
   676  YDEVM       REAL                               REFS        77  DEFINED       74
   667  YMAX        REAL                               REFS        52  DEFINED       50       53
   674  YMAXA       REAL                               REFS        74  DEFINED       72
   675  YMINA       REAL                               REFS        74  DEFINED       73
   660  YRCNF       REAL                               REFS       121    2*122  DEFINED       23       89      121

FILE NAMES         MODE
        TAPE6      FMT                    WRITES        24       26       28       29       30       32       35       41
                                            44         155      150      162      165

EXTERNALS             TYPE   ARGS       REFERENCES
        SQRT          REAL     1 LIBRARY    107      124      151
        XLOC                   4             93      115      118      132      135      140      144      131

INLINE FUNCTIONS      TYPE   ARGS      DEF LINE  REFERENCES
        ABS           REAL     1  INTRIN          69       70       72       73       75       76      111      128
        AMAX1         REAL     6  INTRIN          71       74       75       76       77

STATEMENT LABELS               DEF LINE    REFERENCES
     0  1                         44           43
   102  2                                      51       55
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SUBROUTINE PPLOT        74/74    OPT=1                    FTN 4.2+73867      05/15/75  16.16.56.       PAGE    6

STATEMENT LABELS                     DEF LINE   REFERENCES
      0  15                             159        95
      0  16                             153       149
      0  33                             158       157
     41  100                             42        48
     74  101                             55        52
     56  103                             30        63
      0  106           INACTIVE          75
      0  110           INACTIVE          77
    416  201                            134       143
    423  202                            155       147
    300  205                            120       113       111
    345  207                            137       127       128
    361  210                            142       137       138
    373  213                            145       142
    583  1000       FMT                  25        24
    512  1001       FMT                  27        25
    547  1002       FMT                  37        23
    552  1003       FMT                  38        23        46        150
    617  1021       FMT                 163       162
    602  1022       FMT                 156       153
    554  1072       FMT                  39        38
    570  1073       FMT                  43        41
    636  1175       FMT                 165       165
    534  1492       FMT                  33        32
    544  1493       FMT                  36        35
    233  2222                           102        93
      0  2223                           101       103
    251  5180                           109       103       106
    260  5181                           113       108
    316  5190                           126       123       123
    325  5191                           130       125

LOOPS  LABEL    INDEX      FROM-TO    LENGTH    PROPERTIES
   42  1       * I          43 44        58           EXT REFS
   70  2       * I          51 56       153        OPT
  217  15      * I          96 159     2110            EXT REFS  NOT INNER
  231  2223      IOP       100 101       28      INSTACK
  400  16      * K         148 153      160            EXT REFS   EXITS
  424  33        KUG       157 158       23      INSTACK

STATISTICS
  PROGRAM LENGTH                  13153       717
```

```
      SUBROUTINE XLOC        74/74    OPT=1                    FTN 4.2+75057     05/05/75  16.17.04.      PAGE    1

            SUBROUTINE XLOC(XVAL,HSPRO,IND,INDX)                                              MCARLO    895
            XD=ABS(-HSPRO + XVAL)                                                             MCARLO    896
            XR=XD/(2.*HSPRO)                                                                  MCARLO    897
            RK=XR*70.                                                                         MCARLO    898
  5         KK=RK                                                                             MCARLO    899
            RKK=KK                                                                            MCARLO    900
            RMDR=RK-RKK                                                                       MCARLO    901
            IF(RMDR.GE.1.5) KK=KK+1                                                           MCARLO    902
            KK1=KK - 1                                                                        MCARLO    903
 10         IND=KK1/7                                                                         MCARLO    904
            INDX=KK - 7*IND                                                                   MCARLO    905
            IND=IND + 7                                                                       MCARLO    906
            RETURN                                                                            MCARLO    907
            END                                                                               MCARLO    908

      SUBROUTINE XLOC        74/74    OPT=1                    FTN 4.2+75067     05/05/75  16.17.04.      PAGE    2

      SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     3  XLOC           1           13

 VARIABLES      SN   TYPE              RELOCATION
     0  HSPRO        REAL                 F.P.      REFS        2       3   DEFINED      1
     0  INDX         INTEGER              F.P.      DEFINED     1      11
     0  IND          INTEGER              F.P.      REFS       11      12   DEFINED      1       10       12
    37  KK           INTEGER                        REFS        6       8         9     11   DEFINED        5      8
    42  KK1          INTEGER                        REFS       10   DEFINED       9
    36  RK           REAL                           REFS        5       7   DEFINED      4
    40  RKK          REAL                           REFS        7   DEFINED       6
    41  RMDR         REAL                           REFS        8   DEFINED       7
    34  XD           REAL                           REFS        3   DEFINED       2
    35  XR           REAL                           REFS        4   DEFINED       3
     0  XVAL         REAL                 F.P.      REFS        2   DEFINED       1

 INLINE FUNCTIONS     TYPE    ARGS          DEF LINE    REFERENCES
      ABS             REAL      1  INTRIN                  2

 STATISTICS
   PROGRAM LENGTH                 433      35
```

```
SUBROUTINE G2          74/74    OPT=1                         FTN 4.2+75067       05/05/75  16.17.35.      PAGE    1

      SUBROUTINE G2
C ** MONTE CARLO WINDS **
      COMMON C(3830)
      EQUIVALENCE (C(3753), ITNDX)
      EQUIVALENCE (C(3721),ITCT)
      EQUIVALENCE (C(  52),  VNTE)
      EQUIVALENCE (C(  54),  SIGU)
      EQUIVALENCE (C(  56),   BLU)
      EQUIVALENCE (C(  58), WNDWO)
      EQUIVALENCE (C(  59),  SLWD)
      EQUIVALENCE (C(  60),   RLW)
      EQUIVALENCE (C(  62),   SLW)
      EQUIVALENCE (C(  63),CBPSIW)
      EQUIVALENCE (C(  65),SBPSIW)
      EQUIVALENCE (C(  69), GSIGU)
      EQUIVALENCE (C(  70), GVWTE)
      EQUIVALENCE (C( 100),  VWXE)
      EQUIVALENCE (C( 101),  VWYE)
      EQUIVALENCE (C( 102),  VWZE)
      EQUIVALENCE (C(1503),   VXE)
      EQUIVALENCE (C(1507),   VYE)
      EQUIVALENCE (C(1511),   VZE)
      DIMENSION ITNDX(10)
      DATA RNSTRT /0./
      ICK = 0
      DO 500 IOL = 1,ITCT
      ITSNDX = IOL
C
C  MONTE CARLO WIND GUSTS TIME SERIES
      IF(ITNDX(IOL).NE.78) GO TO 502
      UBAR = 0.
      IF(VWTE.NE.0.) UBAR = ABS((VXE*VWXE + VYE*VWYE + VZE*VWZE)/VWTE)
      CALL MCARLO(DUM, 2, ITSNDX)
      WNDW02 = UBAR/BLU + WNDWO
      GLW = GSIGU*SQRT(WNDW02)
      SLWD = RLW - WNDW02*SLW
      GVWTE = VWTE + GLW*SLW
      ICK = 1
  502 CONTINUE
  500 CONTINUE
      IF(ICK.EQ.0) GO TO 503
      VWXE = - GVWTE*CBPSIW
      VWYE = - GVWTE*SBPSIW
  503 CONTINUE
C
      RETURN
      END
```

```
        SUBROUTINE G2          74/74    OPT=1                      FTN 4.2+75067      05/05/75  16.17.05.     PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS        DEF LINE      REFERENCES
      1   G2              1             46

 VARIABLES      SN   TYPE              RELOCATION
     67   BLU        REAL                 / /        REFS          8        34
      0   C          REAL        ARRAY    / /        REFS          3         4         5         6         7         8         9
                                                       10         11        12        13        14        15        16        17
                                                       18         19        20        21        22
    100   CBPSIN     REAL                 / /        REFS         13        42
     60   DUM      * REAL                            REFS         33
     62   GLN        REAL                            REFS         37    DEFINED        35
    104   GSIGU      REAL                 / /        REFS         15        35
    105   SVHTC      REAL                 / /        REFS         16        42        43    DEFINED        37
     54   ICP        INTEGER                         REFS         41    DEFINED        25        38
     55   IOL        INTEGER                         REFS         27        30   DEFINED        26
   7210   ITCT       INTEGER              / /        REFS          5        26
   7250   ITNDX      INTEGER     ARRAY    / /        REFS          4        23        30
     56   ITSNDX     INTEGER                         REFS         33    DEFINED        27
     73   RLW        REAL                 / /        REFS         11        36
     52   RNSTRT   * REAL                         DEFINED         24
    101   SBPSIN     REAL                 / /        REFS         14        43
     65   SIGU       REAL                 / /        REFS          7
     75   SLW        REAL                 / /        REFS         12        36        37
     72   SLWO       REAL                 / /        REFS         10    DEFINED        36
     57   UBAR       REAL                            REFS         34    DEFINED        31        32
     63   VHTE       REAL                 / /        REFS          6      2*32        37
    143   VWXE       REAL                 / /        REFS         17        32   DEFINED        42
    144   VWYE       REAL                 / /        REFS         18        32   DEFINED        43
    145   VWZE       REAL                 / /        REFS         19        32
   3102   VXE        REAL                 / /        REFS         20        32
   3106   VYE        REAL                 / /        REFS         21        32
   3112   VZE        REAL                 / /        REFS         22        32
     71   WNDWO      REAL                 / /        REFS          9        34
     61   WNDWO2     REAL                            REFS         35        36   DEFINED        34

 EXTERNALS             TYPE    ARGS         REFERENCES
        MCARLO                   3                33
        SQRT           REAL      1 LIBRARY        35

 INLINE FUNCTIONS      TYPE    ARGS          DEF LINE   REFERENCES
        ABS            REAL      1  INTRIN                  32

 STATEMENT LABELS                DEF LINE   REFERENCES
      0   500                       40          25
     36   502                       39          31
     45   503                       44          41

 LOOPS   LABEL    INDEX      FROM-TO    LENGTH     PROPERTIES
     4   500    * IOL        26  40      35B                   EXT REFS

 COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
       / /          3836               0  C        (3830)
```

```
     SUBROUTINE G2         74/74   OPT=1                    FTN 4.2+75067      05/05/75  16.17.05.        PAGE    3

  EQUIV CLASSES    LENGTH       MEMBERS - BIAS NAME(LENGTH)
 C        C         383C                51 VWTE    (1)                53 SIGU    (1)                55 BLU     (1)
                                        57 WHDW0   (1)                58 SLWO    (1)                59 RLW     (1)
                                        61 S_W     (1)                64 CBPSIN  (1)                65 SBPSIN  (1)
                                        68 GSIGU   (1)                69 GVWTE   (1)                99 VWXE    (1)
                                       100 VWYE    (1)               101 VWZE    (1)              1602 VXE     (1)
                                      1506 VYE     (1)              1613 VZE     (1)              3720 ITCT    (1)
                                      3752 ITNDX   (10)

 STATISTICS
   PROGRAM LENGTH                 633       51
   CM BLANK COMMON LENGTH       73663     3830
```

```
      SUBROUTINE G21
C**WIND AND GUSTS MODULE
      COMMON C(3630)
C**INPUT DATA
      EQUIVALENCE(C(2000),I)
      EQUIVALENCE (C(  50),OPTNW )
      EQUIVALENCE (C(  51),BPSIN )
      EQUIVALENCE (C(  52),VWTE  )
C**OUTPUT DATA
      EQUIVALENCE (C( 100),VWXE  )
      EQUIVALENCE (C( 101),VWYE  )
      EQUIVALENCE (C( 102),VWZE  )
C**INPUTS FROM OTHER MODULES
      EQUIVALENCE (C(  54),  SIGU)
      EQUIVALENCE (C(  55),   BLU)
      EQUIVALENCE (C(  58), WNDWD)
      EQUIVALENCE (C(  59),  SLWD)
      EQUIVALENCE (C(  60),   RLW)
      EQUIVALENCE (C(  62),   SLW)
      EQUIVALENCE (C(  55),CBPSIN)
      EQUIVALENCE (C(  66),SBPSIN)
      EQUIVALENCE (C(  58), VWTEM)
      EQUIVALENCE (C(  59), GSIGU)
      EQUIVALENCE (C(2561),     N)
      EQUIVALENCE (C(2562),   IPL)
      EQUIVALENCE (C(3634), ISNDX)
      EQUIVALENCE (C(3512), I3512)
      EQUIVALENCE (C(3753), ITNDX)
      EQUIVALENCE (C(3771),  ITCT)
      DIMENSION IPL(100), ISNDX(40), ITNDX(10)
C
      VWTEM=VWTE
C MONTE CARLO STEADY STATE WIND COMPONENT
      DO 500 I = 1, I3512
      IDO = 1
      IF(ISNDX(I).EQ.51) CALL MCARLO (DUM, 1, IDO)
      IF(ISNDX(I).EQ.52) CALL MCARLO (DUM, 1, IDO)
  500 CONTINUE
C
      VWTE = ABS(VWTE)
      SLW = 0.
C
C MONTE CARLO  INITIAL VALUE OF TIME SERIES WIND GUSTS
      DO 501 I = 1,ITCT
      IDO = 1
      IF(ITNDX(I).NE.70) GO TO 501
      CALL MCARLO ( DUM,4,IDO)
      WNDWD = 1.
      IF(VWTE.EQ.0.) GO TO 505
      SIGU = VWTE/2.9
      GO TO 506
  505 CONTINUE
      VWTE = 2.9 * SIGU
  506 CONTINUE
      GSIGU = SIGU*SQRT(1.89/C(2654))
      BLU = -12.1*SIGU + 475.
      IF(VWTEM/VWTE.GT..1) WNDWD = VWTE/VWTEM
```

```
      SUBROUTINE G2I          74/74    OPT=1                    FTN 4.2+75067     05/05/75  16.17.06.      PAGE    2

                IPL(N) = 59                                         G2       106
                N = N + 1                                           G2       107
          501 CONTINUE                                              G2       108
      C                                                             G2       109
                CBPSIW = COSD(BPSIW)                                G2       110
                SBPSIW = SIND(BPSIW)                                G2       111
                VWXE = - VWTE*CBPSIW                                G2       112
                VWYE = - VWTE*SBPSIW                                G2       113
                VWZE = 0.                                           G2       114
                RETURN                                              G2       115
                END                                                 G2       116

      SUBROUTINE G2I          74/74    OPT=1                    FTN 4.2+75067     05/05/75  16.17.06.      PAGE    3

CARD NR. SEVERITY  DETAILS   DIAGNOSIS OF PROBLEM

     58      I      ITCT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
```

```
      SUBROUTINE G2I          74/74   OPT=1                         FTN 4.2+75057     05/15/75  15.17.36.     PAGE    4

      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS          DEF LINE     REFERENCES
    1  G2I               1            67

VARIABLES      SN  TYPE           RELOCATION
   67  BLU         REAL                     REFS        15  DEFINED      56
   62  BPSIN       REAL                     REFS         7       52      53
    0  C           REAL      ARRAY          REFS         3        5       6       7       8      10      11
                                              12        14       15      16      17      18      19      20
                                              21        22       23      24      25      26      27      28
                                              29        55
  100  CBPSIN      REAL                     REFS        20       64  DEFINED     62
  115  DUM         REAL                     REFS        36       37      47
  104  GSIGU       REAL                     REFS        23  DEFINED      55
  113  I           INTEGER                  REFS        35       36      37      45      45
                                           DEFINED      34       44
  114  IDO         INTEGER                  REFS        36       37      47  DEFINED     35      35
 5001  IPL         INTEGER   ARRAY          REFS        25       30  DEFINED     58
 7061  ISNDX       INTEGER   ARRAY          REFS        26       30      36      37
 7210  ITCT        INTEGER                  REFS        29       44
 7250  ITNDX       INTEGER   ARRAY          REFS        28       30      46
 6667  I3512       INTEGER                  REFS        27       34
 5000  N           INTEGER                  REFS        24       38      59  DEFINED     59
   61  OPTNN       REAL                     REFS         6
   73  RLN         REAL                     REFS        18
  101  SBPSIN      REAL                     REFS        21       65  DEFINED     63
   65  SIGU        REAL                     REFS        14       53      55      56  DEFINED     50
   75  SLN         REAL                     REFS        19  DEFINED      41
   72  SLNG        REAL                     REFS        17
 3717  T           REAL                     REFS         5
   63  VNTE        REAL                     REFS         8       32      40      49      50     2*57      64
                                              65   DEFINED       40      53
  103  VNTEM       REAL                     REFS        22     2*57  DEFINED     32
  143  VNXE        REAL                     REFS        10  DEFINED      64
  144  VNYE        REAL                     REFS        11  DEFINED      65
  145  VNZE        REAL                     REFS        12  DEFINED      66
   71  WNDNO       REAL                     REFS        16  DEFINED      48      57

EXTERNALS        TYPE    ARGS         REFERENCES
     COSD        REAL      1              62
     MCARLO                3              35         37       47
     SIND        REAL      1              63
     SQRT        REAL      1 LIBRARY      55

INLINE FUNCTIONS   TYPE    ARGS       DEF LINE   REFERENCES
     ABS           REAL      1  INTRIN                40

STATEMENT LABELS                  DEF LINE   REFERENCES
     0  500                          38          34
    55  501                          60          44         46
    36  565                          52          43
    40  506                          54          51

LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
    5   500      * I       34 38      14B                EXT REFS
   24   501      * I       44 60      34B                EXT REFS
```

```
SUBROUTINE G2I        74/74   OPT=1                          FTN 4.2+75087     05/05/75  16.17.06.      PAGE   5

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
    / /            383C              0 C      (3830)

EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
C        C          3836            49 OPTNW   (1)          50 BPSIN  (1)           51 VWTE   (1)
                                    53 SIGJ    (1)          55 BLJ    (1)           57 WNDWD  (1)
                                    59 SLWD    (1)          59 RLW    (1)           61 SLW    (1)
                                    64 CBPSIN  (1)          65 SBPSIN (1)           67 VWTEM  (1)
                                    68 GSIGU   (1)          99 VWXE   (1)          100 VWYE   (1)
                                   101 VWZE    (1)        1939 T      (1)         2560 N      (1)
                                  2561 IPL     (100)      3511 I3512  (1)         3633 ISNDX  (40)
                                  3720 ITST    (1)        3752 ITNDX  (10)

STATISTICS
  PROGRAM LENGTH                  1163      78
  CM BLANK COMMON LENGTH         73663    3830
```

```
SUBROUTINE G3          74/74   OPT=1                FTN 4.2+75057    05/05/75  16.17.08.    PAGE   1

      SUBROUTINE G3                                                  G3       2
C**AIR DATA MODULE G3                                                G3       3
      COMMON C(3030)                                                 G3       4
C**INPUT DATA                                                        G3       5
      EQUIVALENCE (C(1208),RHZRO )                                   G3       6
C**INPUTS FROM OTHER MODULES                                         G3       7
      EQUIVALENCE (C(0100),VWXE  )                                   G3       8
      EQUIVALENCE (C(0101),VWYE  )                                   G3       9
      EQUIVALENCE (C(0102),VWZE  )                                   G3      10
      EQUIVALENCE (C(1603),VXE   )                                   G3      11
      EQUIVALENCE (C(1607),VYE   )                                   G3      12
      EQUIVALENCE (C(1611),VZE   )                                   G3      13
      EQUIVALENCE (C(1623),RZE   )                                   G3      14
C**INPUTS FROM MAIN PROGRAM                                          G3      15
C**STATE VARIABLE OUTPUTS                                            G3      16
C**NONE                                                              G3      17
C**OTHER OUTPUTS                                                     G3      18
      EQUIVALENCE (C(0200),VMWXE )                                   G3      19
      EQUIVALENCE (C(0201),VMWYE )                                   G3      20
      EQUIVALENCE (C(0202),VMWZE )                                   G3      21
      EQUIVALENCE (C(0203),PDYNMC)                                   G3      22
      EQUIVALENCE (C(0204),VMACH )                                   G3      23
      EQUIVALENCE (C(0205),DRHO  )                                   G3      24
      EQUIVALENCE (C(0206),VSOUND)                                   G3      25
      EQUIVALENCE (C(0207),VAIRSP)                                   G3      26
      EQUIVALENCE (C(0209),RH    )                                   G3      27
C**CALCULATE PRESENT ALTITUDE                                        G3      28
      RH= -RZE+RHZRO                                                 G3      29
C**CALCULATE MISSILE VELOCITY WRT AIR MASS IN EARTH AXES             G3      30
      VMWXE = VXE-VWXE                                               G3      31
      VMWYE = VYE-VWYE                                               G3      32
      VMWZE = VZE-VWZE                                               G3      33
      VAIRSP = SQRT(VMWXE*VMWXE+VMWYE*VMWYE+VMWZE*VMWZE)             G3      34
C**AIR DENSITY, SPEED OF SOUND, DYNAMIC PRESSURE, AND MACH           G3      35
      DRHO=(.076475)/(1.+.3325E-04*RH+RH*RH*RH*.02315E-12)           G3      36
      VSOUND = -.00392*RH+1117.3                                     G3      37
      PDYNMC = (DRHO*VAIRSP*VAIRSP)/64.344                           G3      38
      VMACH = VAIRSP/VSOUND                                          G3      39
      RETURN                                                         G3      40
      END                                                            G3      41
```

```
SUBROUTINE G3          74/74  OPT=1                        FTN 4.2+75057      05/05/75  16.17.08.      PAGE    2

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    1  G3              1           39

VARIABLES        SN  TYPE          RELOCATION
   0  C              REAL     ARRAY    / /          REFS      3       5       7       8       9      10      11
                                                     12      13      18      19      20      21      22      23
                                                     24      25      26
   314  DRHO         REAL              / /          REFS     23      37   DEFINED    35
   312  PDYNMC       REAL              / /          REFS     21   DEFINED    37
   320  RH           REAL              / /          REFS     26     4*35     36   DEFINED    28
   317  RHZRO        REAL              / /          REFS      5      28
  3126  RZE          REAL              / /          REFS     13      28
   316  VAIRSP       REAL              / /          REFS     25     2*37     38   DEFINED    33
   313  VMACH        REAL              / /          REFS     22   DEFINED    38
   307  VMWXE        REAL              / /          REFS     18     2*33  DEFINED    30
   310  VMWYE        REAL              / /          REFS     19     2*33  DEFINED    31
   311  VMWZE        REAL              / /          REFS     20     2*33  DEFINED    32
   315  VSOUND       REAL              / /          REFS     24      38   DEFINED    36
   143  VWXE         REAL              / /          REFS      7      30
   144  VWYE         REAL              / /          REFS      8      31
   145  VWZE         REAL              / /          REFS      9      32
  3102  VXE          REAL              / /          REFS     10      30
  3106  VYE          REAL              / /          REFS     11      31
  3112  VZE          REAL              / /          REFS     12      32

EXTERNALS           TYPE    ARGS       REFERENCES
     SQRT           REAL     1 LIBRARY    33

COMMON BLOCKS    LENGTH    MEMBERS - BIAS NAME(LENGTH)
    / /           3830                0     (3830)

EQUIV CLASSES    LENGTH    MEMBERS - BIAS NAME(LENGTH)
C        C        3830          99 VWXE    (1)          100 VWYE    (1)          101 VWZE    (1)
                               199 VMWXE   (1)          200 VMWYE   (1)          201 VMWZE   (1)
                               202 PDYNMC  (1)          203 VMACH   (1)          204 DRHO    (1)
                               205 VSOUND  (1)          206 VAIRSP  (1)          207 RHZRO   (1)
                               208 RH      (1)         1602 VXE     (1)         1606 VYE     (1)
                              1610 VZE     (1)         1622 RZE     (1)

STATISTICS
  PROGRAM LENGTH                 403       32
  CM BLANK COMMON LENGTH       73663     3830
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```
SUBROUTINE G5          74/74    OPT=1                      FTN 4.2+75057     05/05/75  16.17.10.      PAGE    1

                SUBROUTINE G5                                              G5       2
          C**COORDINATE CONVERSION MODULE                                  G5       3
                COMMON C(3830)                                             G5       4
          C                                                                G5       5
          C**INPUTS FROM OTHER MODULES                                     G5       6
                EQUIVALENCE (C(0200),VMHXE )                               G5       7
                EQUIVALENCE (C(0201),VMHYE )                               G5       8
                EQUIVALENCE (C(0202),VMHZE )                               G5       9
                EQUIVALENCE (C(0207),VAIRSP)                               G5      10
                EQUIVALENCE (C(1317),RAIL  )                               G5      11
                EQUIVALENCE (C(1405),QBURN )                               G5      12
                EQUIVALENCE (C(1603),VXE   )                               G5      13
                EQUIVALENCE (C(1607),VYE   )                               G5      14
                EQUIVALENCE (C(1611),VZE   )                               G5      15
                EQUIVALENCE (C(1615),RXE   )                               G5      16
                EQUIVALENCE (C(1619),RYE   )                               G5      17
                EQUIVALENCE (C(1623),RZE   )                               G5      18
                EQUIVALENCE (C(1635),RDELX )                               G5      19
                EQUIVALENCE (C(1636),RDELY )                               G5      20
                EQUIVALENCE (C(1637),RDELZ )                               G5      21
                EQUIVALENCE (C(1651),RTXE  )                               G5      22
                EQUIVALENCE (C(1655),RTYE  )                               G5      23
                EQUIVALENCE (C(1659),RTZE  )                               G5      24
                EQUIVALENCE (C(1668),RXO   )                               G5      25
                EQUIVALENCE (C(1669),RYO   )                               G5      26
                EQUIVALENCE (C(1670),RZO   )                               G5      27
                EQUIVALENCE (C(1671),VXO   )                               G5      28
                EQUIVALENCE (C(1672),VYO   )                               G5      29
                EQUIVALENCE (C(1673),VZO   )                               G5      30
                EQUIVALENCE (C(1580),RSJYMC)                               G5      31
                EQUIVALENCE (C(1581),RSJZMC)                               G5      32
                EQUIVALENCE (C(1582),RSPOTX)                               G5      33
                EQUIVALENCE (C(1583),RSPOTY)                               G5      34
                EQUIVALENCE (C(1584),RSPOTZ)                               G5      35
                EQUIVALENCE (C(3753), ITNDX)                               G5      36
                EQUIVALENCE (C(3721),  ITCT)                               G5      37
                EQUIVALENCE (C(1560), SXPDD)                               G5      38
                EQUIVALENCE (C(1561),    RX)                               G5      39
                EQUIVALENCE (C(1562),GSPOTY)                               G5      40
                EQUIVALENCE (C(1563),  SXPD)                               G5      41
                EQUIVALENCE (C(1566),   SXP)                               G5      42
                EQUIVALENCE (C(1570), SYPDD)                               G5      43
                EQUIVALENCE (C(1571),    RY)                               G5      44
                EQUIVALENCE (C(1572),GSPOTZ)                               G5      45
                EQUIVALENCE (C(1573),  SYPD)                               G5      46
                EQUIVALENCE (C(1576),   SYP)                               G5      47
                EQUIVALENCE (C(1579),  ZETA)                               G5      48
                EQUIVALENCE (C(1580),    WJ)                               G5      49
                DIMENSION ITNDX(10)                                        G5      50
                EQUIVALENCE (C(1703),CFA11 )                               G5      51
                EQUIVALENCE (C(1707),CFA12 )                               G5      52
                EQUIVALENCE (C(1711),CFA13 )                               G5      53
                EQUIVALENCE (C(1715),CFA21 )                               G5      54
                EQUIVALENCE (C(1719),CFA22 )                               G5      55
                EQUIVALENCE (C(1723),CFA23 )                               G5      56
                EQUIVALENCE (C(1727),CFA31 )                               G5      57
                EQUIVALENCE (C(1731),CFA32 )                               G5      58
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      EQUIVALENCE (C(1735),CFA33 )                                    G5    59
      EQUIVALENCE (C(1751),CRAD  )                                    G5    60
      EQUIVALENCE (C(1768),  XB01)                                    G5    61
      EQUIVALENCE (C(1769),  YB01)                                    G5    62
      EQUIVALENCE (C(1770),  ZB01)                                    G5    63
      EQUIVALENCE (C(1771),  XB02)                                    G5    64
      EQUIVALENCE (C(1772),  YB02)                                    G5    65
      EQUIVALENCE (C(1773),  ZB02)                                    G5    66
      EQUIVALENCE (C(1764),   P1)                                     G5    67
      EQUIVALENCE (C(1765),   Q1)                                     G5    68
      EQUIVALENCE (C(1755),   P2)                                     G5    69
      EQUIVALENCE (C(1767),   R2)                                     G5    70
      EQUIVALENCE (C(1751),  A011)                                    G5    71
      EQUIVALENCE (C(1752),  A012)                                    G5    72
      EQUIVALENCE (C(1763),  A013)                                    G5    73
      EQUIVALENCE (C(1755),A021  )                                    G5    74
      EQUIVALENCE (C(1756),A022  )                                    G5    75
      EQUIVALENCE (C(1757),A023  )                                    G5    76
      EQUIVALENCE (C(1758),A031  )                                    G5    77
      EQUIVALENCE (C(1759),A032  )                                    G5    78
      EQUIVALENCE (C(1760),A033  )                                    G5    79
      EQUIVALENCE (C(2000),T     )                                    G5    80
C                                                                     G5    81
C**OTHER OUTPUTS                                                      G5    82
      EQUIVALENCE (C(0350),BTHT  )                                    G5    83
      EQUIVALENCE (C(0351),BPSI  )                                    G5    84
      EQUIVALENCE (C(0352),BPHI  )                                    G5    85
      EQUIVALENCE (C(0353),BPH1  )                                    G5    86
      EQUIVALENCE (C(0354),BTH2  )                                    G5    87
      EQUIVALENCE (C(0355),BPSI  )                                    G5    88
      EQUIVALENCE (C(0356),VTOTE )                                    G5    89
      EQUIVALENCE (C(0357),BGAMH )                                    G5    90
      EQUIVALENCE (C(0358),BGAMV )                                    G5    91
      EQUIVALENCE (C(0363),ETHLV )                                    G5    92
      EQUIVALENCE (C(0364),BFSLV )                                    G5    93
      EQUIVALENCE (C(0365),BLAMV )                                    G5    94
      EQUIVALENCE (C(0366),BLAMH )                                    G5    95
      EQUIVALENCE (C(0367),BALPHA)                                    G5    96
      EQUIVALENCE (C(0368),BALPHY)                                    G5    97
      EQUIVALENCE (C(0369),BALPHP)                                    G5    98
      EQUIVALENCE (C(0370),BPHIP )                                    G5    99
      EQUIVALENCE (C(0371),RANGE )                                    G5   100
      EQUIVALENCE (C(0372),RXBA  )                                    G5   101
      EQUIVALENCE (C(0373),RYBA  )                                    G5   102
      EQUIVALENCE (C(0374),RZBA  )                                    G5   103
      EQUIVALENCE (C(0380),RANGO )                                    G5   104
      EQUIVALENCE (C(0390),RXL   )                                    G5   105
      EQUIVALENCE (C(0391),RYL   )                                    G5   106
      EQUIVALENCE (C(0392),RZL   )                                    G5   107
      EQUIVALENCE (C(0393),BPH2  )                                    G5   108
C                                                                     G5   109
C**CALCULATION OF HEADING, PITCH, ROLL EULER ANGLES IN DEGREES         G5   110
      BPHI = ATAND(CFA23,CFA33)                                       G5   111
      BTHT = ATAND(-CFA13,SQRT(CFA11*CFA11+CFA12*CFA12))              G5   112
      BPSI = ATAND(CFA12,CFA11)                                       G5   113
C                                                                     G5   114
C**FREE GYRO MODELS (INITIAL GIMBAL ANGLES ARE ZERO)                  G5   115
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      C
      C** AUTO-PILOT-DRIFT-RATES
            DXB01 = -Q1*YB01/CRAD
            DYB01 = (Q1*XB01 - P1*ZB01)/CRAD
            DZB01 = P1*YB01/CRAD
            DXB02 = -R2*ZB02/CRAD
            DYB02 = -P2*ZB02/CRAD
            DZB02 = (P2*YB02 - R2*XB02)/CRAD
      C
            XB01 = DXB01*T
            YB01 = 1. + DYB01*T
            ZB01 = DZB01*T
            XB02 = DXB02*T
            YB02 = DYB02*T
            ZB02 = 1. + DZB02*T
            B11 = A011*CFA11 + A012*CFA12 + A013*CFA13
            B12 = A011*CFA21 + A012*CFA22 + A013*CFA23
            B13 = A011*CFA31 + A012*CFA32 + A013*CFA33
            B21 = A021*CFA11 + A022*CFA12 + A023*CFA13
            B22 = A021*CFA21 + A022*CFA22 + A023*CFA23
            B23 = A021*CFA31 + A022*CFA32 + A023*CFA33
            B31 = A031*CFA11 + A032*CFA12 + A033*CFA13
            B32 = A031*CFA21 + A032*CFA22 + A033*CFA23
            B33 = A031*CFA31 + A032*CFA32 + A033*CFA33
            XB1 = B11*XB01 + B21*YB01 + B31*ZB01
            YB1 = B12*XB01 + B22*YB01 + B32*ZB01
            ZB1 = B13*XB01 + B23*YB01 + B33*ZB01
            XB2 = B11*XB02 + B21*YB02 + B31*ZB02
            YB2 = B12*XB02 + B22*YB02 + B32*ZB02
            ZB2 = B13*XB02 + B23*YB02 + B33*ZB02
            BPH1 = ATAND (ZB1,YB1)
            BPS1 = ATAND (-XB1,YB1/COSD(BPH1))
            BTH2 = ATAND (XB2,ZB2)
            BPH2 = ATAND (-YB2,ZB2/COSD(BTH2))
      C
      C**CALCULATION OF TOTAL VELOCITY
            VTOTE = SQRT(VXE*VXE+VYE*VYE+VZE*VZE)
            RDELX = RTXE-RXE
            RDELY = RTYE-RYE
            RDELZ = RTZE-RZE
      C
            IF(C(1976).LE.0.) GO TO 20
            RXL = RXE - RXO - VXO*T
            RYL = RYE - RYO - VYO*T
            RZL = RZE - RZO - VZO*T
            RANGO = SQRT(RXL**2 + RYL**2 + RZL**2)
            VXL = VXE - VXO
            VYL = VYE - VYO
            VZL = VZE - VZO
         20 CONTINUE
      C
      C**TRANSFORM MISSILE LOS FROM EARTH TO BODY AXES
      C
      C LINE OF SIGHT OF LASER SPOT WITH MONTE CARLO SPOT JITTER INCLUDED
      C
            DO 500 I = 1, XTST
            IDO = I
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      SUBROUTINE G5           74/74   OPT=1                       FTN 4.2+75067     05/05/75  16.17.18.      PAGE

      IF(ITNDX(I).NE.1580) GO TO 581                                  G5     173
      RSJYMC =-GSPOTY*SXP                                              G5     174
      CALL MCARLO (DUM,2,IDO)                                          G5     175
      SXPDD = W0*W0*(RX-2.*ZETA*SXPD/W0 - SXP)                         G5     176
  581 IF(ITNDX(I).NE.1581) GO TO 580                                   G5     177
      RSJZMC = GSPOTZ*SYP                                              G5     178
      CALL MCARLO (DUM,2,IDO)                                          G5     179
      SYPDD =-W0*W0*(RY -2.*ZETA*SYPD/W0 - SYP)                        G5     180
  580 CONTINUE                                                         G5     181
      RSPOTX = RDELX                                                   G5     182
      RSPOTY = RDELY + RSJYMC                                          G5     183
      RSPOTZ = RDELZ + RSJZMC                                          G5     184
      RXBA = RSPOTX*CFA11 + RSPOTY*CFA12 + RSPOTZ*CFA13                G5     185
      RYBA = RSPOTX*CFA21 + RSPOTY*CFA22 + RSPOTZ*CFA23                G5     186
      RZBA = RSPOTX*CFA31 + RSPOTY*CFA32 + RSPOTZ*CFA33                G5     187
C                                                                      G5     188
      UVP1 =  VXE*RDELX+VYE*RDELY                                      G5     189
      UVP2 = RDELX*RDELX+RDELY*RDELY                                   G5     190
      UVP3 = VZE*RDELZ                                                 G5     191
      UVP4 = SQRT(UVP2)                                                G5     192
      RANGE = SQRT(UVP2+RDELZ**2)                                      G5     193
C**VERTICAL AND HORIZONTAL LINE-OF-SIGHT ANGLES (EARTH AXES)            G5     194
C                                                                      G5     195
      BLAMH = ATAND(-RDELY,RDELX)                                      G5     196
      BLAMV = ATAND(-RDELZ,UVP4)                                       G5     197
C                                                                      G5     198
C**VERTICAL AND HORIZONTAL PROPORTIONAL NAVIGATION ANGLES               G5     199
      IF(VTOTE.LE.10.) GO TO 30                                        G5     200
      VXP=(UVP1+UVP3)/RANGE                                            G5     201
      VYP = ( VYE*RDELX-VXE*RDELY)/UVP4                                G5     202
      VZP = (VZE*UVP2-RDELZ*UVP1)/(RANGE*UVP4)                         G5     203
      BTHLV  = ATAND(VZP,VXP)                                          G5     204
      BPSLV  = ATAND(VYP,VXP)                                          G5     205
C                                                                      G5     206
      BGAMV = ATAND(-VZE,SQRT(VXE*VXE+VYE*VYE))                        G5     207
      BGAMH = ATAND(VYE,VXE)                                           G5     208
C                                                                      G5     209
C**VELOCITY WRT AIR IN BODY AXES                                        G5     210
      VMHU = CFA11*VMHXE+CFA12*VMHYE+CFA13*VMHZE                       G5     211
      VMHV = CFA21*VMHXE+CFA22*VMHYE+CFA23*VMHZE                       G5     212
      VMHW = CFA31*VMHXE+CFA32*VMHYE+CFA33*VMHZE                       G5     213
C                                                                      G5     214
C**VERTICAL AND HORIZONTAL ANGLES OF ATTACK                             G5     215
      IF (QBURN.LE.0. .AND. RANGO.LE.RAIL) GO TO 30                    G5     216
      BALPHA = ATAND(VMHW,VMHU)                                        G5     217
      BALPHY = ATAND(VMHV,VMHU)                                        G5     218
C                                                                      G5     219
C**ALPHA PRIME AND PHI PRIME (WIND TUNNEL AXES)                         G5     220
      IF ((BALPHA-BALPHY).EQ.0.) GO TO 30                              G5     221
      BPHIP = ATAND(BALPHY,BALPHA)                                     G5     222
   30 BALPHP=SQRT(BALPHA**2+BALPHY**2)                                 G5     223
      RETURN                                                           G5     224
      END                                                              G5     225
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      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
   1   G5              1        223

VARIABLES      SN   TYPE            RELOCATION
  3340  A011        REAL                / /      REFS      70      130      131      132
  3341  A012        REAL                / /      REFS      71      130      131      132
  3342  A013        REAL                / /      REFS      72      130      131      132
  3332  A021        REAL                / /      REFS      73      133      134      135
  3333  A022        REAL                / /      REFS      74      133      134      135
  3334  A023        REAL                / /      REFS      75      133      134      135
  3335  A031        REAL                / /      REFS      76      136      137      138
  3336  A032        REAL                / /      REFS      77      136      137      138
  3337  A033        REAL                / /      REFS      78      136      137      138
   556  BALPHA      REAL                / /      REFS      95      220      221      222   DEFINED    216
   560  BALPHP      REAL                / /      REFS      97    DEFINED    222
   557  BALPHY      REAL                / /      REFS      96      220      221      222   DEFINED    217
   544  BGAMH       REAL                / /      REFS      89    DEFINED    207
   545  BGAMV       REAL                / /      REFS      90    DEFINED    206
   555  BLAMH       REAL                / /      REFS      94    DEFINED    195
   554  BLAMV       REAL                / /      REFS      93    DEFINED    136
   537  BPHI        REAL                / /      REFS      84    DEFINED    110
   561  BPHIP       REAL                / /      REFS      98    DEFINED    221
   540  BPH1        REAL                / /      REFS      85      146    DEFINED    145
   610  BPH2        REAL                / /      REFS     117    DEFINED    148
   536  BPSI        REAL                / /      REFS      83    DEFINED    112
   553  BPSLV       REAL                / /      REFS      92    DEFINED    204
   542  BPS1        REAL                / /      REFS      87    DEFINED    146
   552  BTHLV       REAL                / /      REFS      91    DEFINED    203
   535  BTHT        REAL                / /      REFS      82    DEFINED    111
   541  BTH2        REAL                / /      REFS      86      148    DEFINED    147
   534  B11         REAL                         REFS     139      142    DEFINED    130
   535  B12         REAL                         REFS     140      143    DEFINED    131
   536  B13         REAL                         REFS     141      144    DEFINED    132
   537  B21         REAL                         REFS     139      142    DEFINED    133
   540  B22         REAL                         REFS     140      143    DEFINED    134
   541  B23         REAL                         REFS     141      144    DEFINED    135
   542  B31         REAL                         REFS     139      142    DEFINED    136
   543  B32         REAL                         REFS     140      143    DEFINED    137
   544  B33         REAL                         REFS     141      144    DEFINED    138
     0  C           REAL     ARRAY      / /      REFS       3        6        7        8        9       10       11
                                                           12       13       14       15       16       17       18       19
                                                           20       21       22       23       24       25       26       27
                                                           28       29       30       31       32       33       34       35
                                                           36       37       38       39       40       41       42       43
                                                           44       45       46       47       48       50       51       52
                                                           53       54       55       56       57       58       59       60
                                                           61       62       63       64       65       66       67       68
                                                           69       70       71       72       73       74       75       76
                                                           77       78       79       82       83       84       85       86
                                                           87       88       89       90       91       92       93       94
                                                           95       96       97       98       99      100      101      102
                                                          103      104      105      106      107      156
  3246  CFA11       REAL                / /      REFS      50    2*111      112      130      133      136      184
                                                          216
  3252  CFA12       REAL                / /      REFS      51    2*111      112      130      133      136      184
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       SUBROUTINE 65        74/74   OPT=1                                FTN 4.2+75067     05/05/75  16.17.10.      PAGE      6

VARIABLES      SN  TYPE              RELOCATION
                                                210
  3256    CFA13     REAL             / /       REFS     52     111      130      133      136      184      210
  3262    CFA21     REAL             / /       REFS     53     131      134      137      185      211
  3266    CFA22     REAL             / /       REFS     54     131      134      137      185      211
  3272    CFA23     REAL             / /       REFS     55     110      131      134      137      185      211
  3276    CFA31     REAL             / /       REFS     56     132      135      138      186      212
  3302    CFA32     REAL             / /       REFS     57     132      135      138      186      212
  3306    CFA33     REAL             / /       REFS     58     110      132      135      138      186      212
  3326    CRAD      REAL             / /       REFS     59     117      118      119      120      121      122
   560    DUM       REAL                       REFS    174     178
   526    DXB01     REAL                       REFS    124     DEFINED  117
   531    DXB02     REAL                       REFS    127     DEFINED  120
   527    DYB01     REAL                       REFS    125     DEFINED  118
   532    DYB02     REAL                       REFS    128     DEFINED  121
   530    DZB01     REAL                       REFS    126     DEFINED  119
   533    DZB02     REAL                       REFS    129     DEFINED  122
  3031    GSPOTY    REAL             / /       REFS     39     173
  3043    GSPOTZ    REAL             / /       REFS     44     177
   556    I         INTEGER                    REFS    171     172      176      DEFINED  170
   557    IDO       INTEGER                    REFS    174     178      DEFINED  171
  7210    ITCT      INTEGER          / /       REFS     36     170
  7250    ITNDX     INTEGER   ARRAY  / /       REFS     35     49       172      176
  3343    P1        REAL             / /       REFS     56     118      119
  3345    P2        REAL             / /       REFS     58     121      122
  2574    QBURN     REAL             / /       REFS     11     215
  3344    Q1        REAL             / /       REFS     67     117      118
  2444    RAIL      REAL             / /       REFS     10     215
   562    RANGE     REAL             / /       REFS     99     200      202      DEFINED  192
   573    RANGO     REAL             / /       REFS    133     215      DEFINED  160
  3142    RDELX     REAL             / /       REFS     18     181      188      2*189    195      201
                                           DEFINED    152
  3143    RDELY     REAL             / /       REFS     19     182      190      2*189    195      201
                                           DEFINED    153
  3144    RDELZ     REAL             / /       REFS     20     183      190      192      196      202
                                           DEFINED    154
  3217    RSJYMC    REAL             / /       REFS     30     182      DEFINED  173
  3220    RSJZMC    REAL             / /       REFS     31     183      DEFINED  177
  3221    RSPOTX    REAL             / /       REFS     32     184      185      186      DEFINED  181
  3222    RSPOTY    REAL             / /       REFS     33     184      185      186      DEFINED  182
  3223    RSPOTZ    REAL             / /       REFS     34     184      185      186      DEFINED  183
  3162    RTXE      REAL             / /       REFS     21     152
  3166    RTYE      REAL             / /       REFS     22     153
  3172    RTZE      REAL             / /       REFS     23     154
  3030    RX        REAL             / /       REFS     38     175
   563    RXBA      REAL             / /       REFS    100     DEFINED  184
  3116    RXE       REAL             / /       REFS     15     152      157
   605    RXL       REAL             / /       REFS    104     160      DEFINED  157
  3203    RXO       REAL             / /       REFS     24     157
  3042    RY        REAL             / /       REFS     43     179
   564    RYBA      REAL             / /       REFS    101     DEFINED  185
  3122    RYE       REAL             / /       REFS     16     153      158
   606    RYL       REAL             / /       REFS    105     160      DEFINED  158
  3204    RYO       REAL             / /       REFS     25     158
   565    RZBA      REAL             / /       REFS    102     DEFINED  186
  3126    RZE       REAL             / /       REFS     17     154      159
   607    RZL       REAL             / /       REFS    106     160      DEFINED  159
  3205    RZO       REAL             / /       REFS     26     159
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VARIABLES      SN  TYPE          RELOCATION
 3346  R2          REAL             / /       REFS       59      120      122
 3035  SXP         REAL             / /       REFS       41      173      175
 3032  SXPD        REAL             / /       REFS       40      175
 3027  SXPDD       REAL             / /       REFS       37   DEFINED     175
 3047  SYP         REAL             / /       REFS       46      177      179
 3044  SYPD        REAL             / /       REFS       45      179
 3041  SYPDD       REAL             / /       REFS       42   DEFINED     179
 3717  T           REAL             / /       REFS       79      124      125      126      127      128      129
                                               157      158      159
  561  UVP1        REAL                       REFS      200      202   DEFINED      188
  562  UVP2        REAL                       REFS      131      192      202   DEFINED      189
  563  UVP3        REAL                       REFS      230   DEFINED     130
  564  UVP4        REAL                       REFS      136      201      202   DEFINED      191
  316  VAIRSP      REAL             / /       REFS        9
  570  VMWU        REAL                       REFS      216      217   DEFINED      210
  571  VMWV        REAL                       REFS      217   DEFINED     211
  572  VMWW        REAL                       REFS      216   DEFINED     212
  307  VMWXE       REAL             / /       REFS        6      210      211      212
  310  VMWYE       REAL             / /       REFS        7      210      211      212
  311  VMWZE       REAL             / /       REFS        8      210      211      212
  543  VTOTE       REAL             / /       REFS       88      199   DEFINED      151
 3102  VXE         REAL             / /       REFS       12    2*151      151      188      201    2*206      207
  553  VXL      *  REAL                    DEFINED      161
 3206  VXO         REAL             / /       REFS       27      157      151
  565  VXP         REAL                       REFS      203      204   DEFINED      200
 3106  VYE         REAL             / /       REFS       13    2*151      152      188      201    2*206      207
  554  VYL      *  REAL                    DEFINED      152
 3207  VYO         REAL             / /       REFS       28      158      152
  566  VYP         REAL                       REFS      204   DEFINED     201
 3112  VZE         REAL             / /       REFS       14    2*151      153      190      202      206
  555  VZL      *  REAL                    DEFINED      153
 3210  VZO         REAL             / /       REFS       29      159      153
  567  VZP         REAL                       REFS      203   DEFINED     202
 3053  WO          REAL             / /       REFS       48    3*175    3*179
 3347  XB01        REAL             / /       REFS       50      118      139      140      141
                                           DEFINED      124
 3352  XB02        REAL             / /       REFS       53      122      142      143      144
                                           DEFINED      127
  545  XB1         REAL                       REFS      146   DEFINED     139
  550  XB2         REAL                       REFS      147   DEFINED     142
 3350  YB01        REAL             / /       REFS       51      117      119      139      140      141
                                           DEFINED      125
 3353  YB02        REAL             / /       REFS       54      122      142      143      144
                                           DEFINED      128
  546  YB1         REAL                       REFS      145      146   DEFINED      140
  551  YB2         REAL                       REFS      148   DEFINED     143
 3351  ZB01        REAL             / /       REFS       52      118      139      140      141
                                           DEFINED      126
 3354  ZB02        REAL             / /       REFS       55      120      121      142      143      144
                                           DEFINED      129
  547  ZB1         REAL                       REFS      145   DEFINED     141
  552  ZB2         REAL                       REFS      147      148   DEFINED      144
 3052  ZETA        REAL             / /       REFS       47      175      179

EXTERNALS         TYPE   ARGS        REFERENCES
      ATAND       REAL     2            113      111      112      145      146      147      148      195      198
                                        203      204      206      207      216      217      221
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SUBROUTINE GS          74/74   OPT=1                          FTN 4.2+75067      05/05/75  16.17.10.      PAGE    8

EXTERNALS        TYPE   ARGS       REFERENCES
   COSD          REAL   1          146       148
   MCARLO               3          174       178
   SQRT          REAL   1 LIBRARY  111       151       160       191       192       206       222

STATEMENT LABELS              DEF LINE   REFERENCES
   243   20                      164     155
   435   30                      222     193       215       220
   275   500                     190     170       176
   261   501                     176     172

LOOPS   LABEL   INDEX   FROM-TO   LENGTH   PROPERTIES
 244    500     I       170 180   34B                  EXT REFS

COMMON BLOCKS   LENGTH   MEMBERS - BIAS NAME(LENGTH)
   / /          3830          0 C      (3830)

EQUIV CLASSES   LENGTH   MEMBERS - BIAS NAME(LENGTH)
 C        C     3830          199 VMMXE   (1)        200 VMAYE   (1)        201 VMMZE   (1)
                              205 VAIRSP  (1)        349 BTHT    (1)        350 BPSI    (1)
                              351 BPHI    (1)        352 BPH1    (1)        353 BTH2    (1)
                              354 BPS1    (1)        355 VTOTE   (1)        356 BGAMH   (1)
                              357 BGAMV   (1)        362 BTHLV   (1)        363 BPSLV   (1)
                              364 BLAMV   (1)        365 BLAMH   (1)        366 BALPHA  (1)
                              367 BALPHY  (1)        368 BALPHP  (1)        369 BPHIP   (1)
                              370 RANGE   (1)        371 RX3A    (1)        372 RYBA    (1)
                              373 RZBA    (1)        373 RANGO   (1)        389 RXL     (1)
                              390 RYL     (1)        391 RZL     (1)        392 BPH2    (1)
                             1315 RAIL    (1)       1404 GBURN   (1)       1559 SXPDD   (1)
                             1560 RX      (1)       1551 GSPDTY  (1)       1562 SXPD    (1)
                             1565 SXP     (1)       1569 SYPDD   (1)       1570 RY      (1)
                             1571 GSPOTZ  (1)       1572 SYPD    (1)       1575 SYP     (1)
                             1578 ZETA    (1)       1579 HO      (1)       1602 VXE     (1)
                             1505 VYE     (1)       1610 VZE     (1)       1614 RXE     (1)
                             1618 RYE     (1)       1622 RZE     (1)       1634 RDELX   (1)
                             1635 RDELY   (1)       1636 RDELZ   (1)       1650 RTXE    (1)
                             1654 RTYE    (1)       1658 RTZE    (1)       1667 RXO     (1)
                             1668 RYO     (1)       1653 RZO     (1)       1670 VXO     (1)
                             1671 VYO     (1)       1672 VZO     (1)       1679 RSJYMC  (1)
                             1680 RSJZMC  (1)       1681 RSPOTX  (1)       1682 RSPOTY  (1)
                             1683 RSPOTZ  (1)       1702 CFA11   (1)       1706 CFA12   (1)
                             1710 CFA13   (1)       1714 CFA21   (1)       1718 CFA22   (1)
                             1722 CFA23   (1)       1725 CFA31   (1)       1730 CFA32   (1)
                             1734 CFA33   (1)       1750 CRAD    (1)       1754 A021    (1)
                             1755 A022    (1)       1756 A023    (1)       1757 A031    (1)
                             1758 A032    (1)       1759 A033    (1)       1760 A011    (1)
                             1761 A012    (1)       1762 A013    (1)       1763 P1      (1)
                             1764 Q1      (1)       1765 P2      (1)       1766 R2      (1)
                             1767 X301    (1)       1768 Y301    (1)       1769 Z801    (1)
                             1770 X302    (1)       1771 Y802    (1)       1772 Z802    (1)
                             1993 F.      (1)       3720 ITCT    (1)       3752 ITNOX   (10)

STATISTICS
   PROGRAM LENGTH                 5733     379
   CM BLANK COMMON LENGTH        73653    3830
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      SUBROUTINE A1                                                   A1       2
      COMMON C(3800)                                                  A1       3
C                                                                     A1       4
C**TABLE LOOKUP FOR AERO COEF                                         A1       5
      COMMON                                                          A1       6
     */NC1/NC1(2)     /NC2/NC2(4)     /NC3/NC3(4)     /NC5/NC5(4)     A1       7
     */CA1/CA1(6)     /CA2/CA2(12)    /CA3/CA3(12)    /CA5/CA5(10)    A1       8
     */CZPF/CZPF(35)  /CZ2F/CZ2F(35)  /CMPF/CMPF(35)  /CM2F/CM2F(35)  A1       9
     */CY4F/CY4F(36)  /CN4F/CN4F(36)  /CL4F/CL4F(21)  /CL2F/CL2F(21)  A1      10
     */CZOF/CZOF(35)                  /CMOF/CMOF(35)                  A1      11
     */CMQF/CMQF(36)  /CLPF/CLPF(36)  /CLOF/CLOF(21)                  A1      12
     */CXOF/CXOF(5)                                                   A1      13
      COMMON /CMOF/CMOF(6)  /CA4/CA4(6)                               A1      14
C                                                                     A1      15
C**INPUTS FROM OTHER MODULES                                          A1      16
      EQUIVALENCE (C(0204),VMACH )                                    A1      17
      EQUIVALENCE (C(0367),BALPHA)                                    A1      18
      EQUIVALENCE (C(0368),BALPHY)                                    A1      19
      EQUIVALENCE (C(0369),BALPHP)                                    A1      20
      EQUIVALENCE (C(0370),BPHIP )                                    A1      21
      EQUIVALENCE (C(1103),BDELT1)                                    A1      22
      EQUIVALENCE (C(1107),BDELT2)                                    A1      23
      EQUIVALENCE (C(1111),BDELT3)                                    A1      24
      EQUIVALENCE (C(1113),BDELT4)                                    A1      25
      EQUIVALENCE (C(1551),OPTM  )                                    A1      26
      EQUIVALENCE (C(1555),UDL1  )                                    A1      27
      EQUIVALENCE (C(1556),UDL2  )                                    A1      28
      EQUIVALENCE (C(1557),UDL3  )                                    A1      29
      EQUIVALENCE (C(1558),UDL4  )                                    A1      30
C                                                                     A1      31
C**INPUTS FROM MAIN PROGRAM                                           A1      32
      EQUIVALENCE (C(2000),T     )                                    A1      33
      EQUIVALENCE (C(2020),LCONV)                                     A1      34
C                                                                     A1      35
C**OUTPUT TO MODULES                                                  A1      36
      EQUIVALENCE (C(1200),OPTHNG)                                    A1      37
      EQUIVALENCE (C(1203),CX    )                                    A1      38
      EQUIVALENCE (C(1204),CY    )                                    A1      39
      EQUIVALENCE (C(1205),CZ    )                                    A1      40
      EQUIVALENCE (C(1206),CLP   )                                    A1      41
      EQUIVALENCE (C(1207),CMQ   )                                    A1      42
      EQUIVALENCE (C(1208),CNR   )                                    A1      43
      EQUIVALENCE (C(1209),CL    )                                    A1      44
      EQUIVALENCE (C(1210),CM    )                                    A1      45
      EQUIVALENCE (C(1211),CN    )                                    A1      46
C                                                                     A1      47
C**OTHER OUTPUTS                                                      A1      48
      EQUIVALENCE (C(1212),CXO   )                                    A1      49
      EQUIVALENCE (C(1213),CZO   )                                    A1      50
      EQUIVALENCE (C(1214),DCZ2  )                                    A1      51
      EQUIVALENCE (C(1215),CZOQ  )                                    A1      52
      EQUIVALENCE (C(1216),CZOR  )                                    A1      53
      EQUIVALENCE (C(1217),DCY4  )                                    A1      54
      EQUIVALENCE (C(1218),CMO   )                                    A1      55
      EQUIVALENCE (C(1219),DCM2  )                                    A1      56
      EQUIVALENCE (C(1220),CMOQ  )                                    A1      57
      EQUIVALENCE (C(1221),CMOR  )                                    A1      58
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      EQUIVALENCE (C(1222),DCN4  )                                      A1      59
      EQUIVALENCE (C(1223),DCL1  )                                      A1      60
      EQUIVALENCE (C(1224),DCL4  )                                      A1      61
      EQUIVALENCE (C(1225),CLOP  )                                      A1      62
      EQUIVALENCE (C(1226),VM    )                                      A1      63
      EQUIVALENCE (C(1227),BAP   )                                      A1      64
      EQUIVALENCE (C(1228),BDL   )                                      A1      65
      EQUIVALENCE (C(1229),BDM   )                                      A1      66
      EQUIVALENCE (C(1230),BDN   )                                      A1      67
      EQUIVALENCE (C(1231),BDP   )                                      A1      68
      EQUIVALENCE (C(1232),BDQ   )                                      A1      69
      EQUIVALENCE (C(1233),BDR   )                                      A1      70
      EQUIVALENCE (C(1236),CH1   )                                      A1      71
      EQUIVALENCE (C(1237),CH2   )                                      A1      72
      EQUIVALENCE (C(1238),CH3   )                                      A1      73
      EQUIVALENCE (C(1239),CH4   )                                      A1      74
      EQUIVALENCE (C(1240),CH11  )                                      A1      75
      EQUIVALENCE (C(1241),CH21  )                                      A1      76
      EQUIVALENCE (C(1242),CH31  )                                      A1      77
      EQUIVALENCE (C(1243),CH41  )                                      A1      78
      DIMENSION NOCLD(2), DCLDVM(3), DCLDOF(3), DCLDAF(3)               A1      79
      EQUIVALENCE (C(1234), DCLDO)                                      A1      80
      EQUIVALENCE (C(1235), DCLDA)                                      A1      81
      DATA NOCLD /3,3 /                                                 A1      82
      DATA DCLDVM / .500,.350, 1.250/                                   A1      83
      DATA DCLDOF /.000,-.0013,.0010/                                   A1      84
      DATA DCLDAF /.0015,.0023,.0010/                                   A1      85
C                                                                       A1      86
      DATA IA,IB,IC,ID,IE,IF /7,6,8,5,8,3/                              A1      87
C  MULTIPLE ANGLE FORMULAE AND ABSOLUTE VALUES OF ANGLE OF ATTACK       A1      88
      USPHI = SIND(BPHIP)                                               A1      89
      UCPHI = COSD(BPHIP)                                               A1      90
      US2PHI = SIND(2.*BPHIP)                                           A1      91
      US4PHI = SIND(4.*BPHIP)                                           A1      92
      US2PH2 = US2PHI**2                                                A1      93
C                                                                       A1      94
C**LIMIT TABLE ARGUMENTS                                                A1      95
      BDP = (-BDELT1-BDELT2+BDELT3+BDELT4)/4.                           A1      96
      BDQ = ( BDELT1+BDELT2+BDELT3+BDELT4)/4.                           A1      97
      BDR = (-BDELT1+BDELT2-BDELT3+BDELT4)/4.                           A1      98
      IF (OPTM .LE. 0.) GO TO 15                                        A1      99
      BDP = (-UDL1-UDL2+UDL3+UDL4)/4.                                   A1     100
      BDQ = (+UDL1+UDL2+UDL3+UDL4)/4.                                   A1     101
      BDR = (-UDL1+UDL2-UDL3+UDL4)/4.                                   A1     102
   15 CONTINUE                                                          A1     103
      BDL = AMAX1(10.,ABS(BDP))                                         A1     104
      BDM = AMAX1(10.,ABS(BDQ))                                         A1     105
      BDN = AMAX1(10.,ABS(BDR))                                         A1     106
      BAP = BALPHP                                                      A1     107
      UAL = ABS(BALPHA)                                                 A1     108
      UBT = ABS(BALPHY)                                                 A1     109
      VM = VMACH                                                        A1     110
      IF (BAP.GT.20.)BAP=20.                                            A1     111
      IF (UAL.GT.20.)UAL=20.                                            A1     112
      IF (UBT.GT.20.)UBT=20.                                            A1     113
      IF (VM.GT.1.25) VM = 1.25                                         A1     114
      IF (VM.LT.0.5) VM = .5                                            A1     115
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      C
      C**TABLE LOOKUP FOR AERO COEF
         IF (T.GT.0. .AND. T.LE.UT) GO TO 1000
         UT = T
         CALL TABLE(    VM,CA1,CXOF,NC1,XF,4HCXO ,CXO )
         CALL TABLE(    VM,CA4,CMOF,NC1,XF,4HCMO ,CMO )
         XF=0.
         CALL TABL2(BAP,VM,CA3,CZPF,NC3,XF,4HCZO ,CZO )
         CALL TABL2(BAP,VM,CA3,CMPF,NC3,XF,4HCMO ,CMO )
         CALL TABL2(BAP,VM,CA3,CM2F,NC3,XF,4HDCM2,DCM2)
         CALL TABL2(BAP,VM,CA3,CZOF,NC3,XF,4HCZOQ,CZOQ)
         CZOR = CZOQ
         CALL TABL2(BAP,VM,CA3,CMOF,NC3,XF,4HCMOQ,CMOQ)
         CMOR = CMOQ
         CALL TABL2(BAP,VM,CA3,CZ2F,NC3,XF,4HDCZ2,DCZ2)
         XF=0.
         CALL TABL2(BAP,VM,CA2,CY4F,NC2,XF,4HDCY4,DCY4)
         CALL TABL2(BAP,VM,CA2,CN4F,NC2,XF,4HDCN4,DCN4)
         CALL TABL2(BAP,VM,CA2,CLPF,NC2,XF,4HCLP ,CLP )
         XF=0.
         CALL TABL2(UAL,VM,CA2,CMQF,NC2,XF,4HCMQ ,CMQ )
         XF=0.
         CALL TABL2(UBT,VM,CA2,CMQF,NC2,XF,4HCNR ,CNR )
         XF=0.
         CALL TABL2(BAP,VM,CA5,CLOF,NC5,XF,4HCLOP,CLOP)
         CALL TABL2(BAP,VM,CA5,CL4F,NC5,XF,4HDCL4,DCL4)
         CALL TABL2(BAP,VM,CA5,CL2F,NC5,XF,4HDCL2,DCL2)
         CALL TABLE(    VM,DCLDVM,DCLDOF,NDCLD,XF,4H     ,DCLDO)
         CALL TABLE(    VM,DCLDVM,DCLDAF,NDCLD,XF,4H     ,DCLDA)
         CMO = CMO - CMO
 1000    CONTINUE
      C
      C**AERO COEF WIND AXIS
         CZP = CZO + DCZ2*US2PH2 + CZOQ*UCPHI*BDQ - CZOR*USPHI*BDR
         CMP = CMO + DCM2*US2PH2 + CMOQ*UCPHI*BDQ - CMOR*USPHI*BDR
         CNP =       DCN4*US4PHI + CMOQ*USPHI*BDQ + CMOR*UCPHI*BDR
         CYP =       DCY4*US4PHI + CZOQ*USPHI*BDQ + CZOR*UCPHI*BDR
      C
      C** TRANSFORMATION FROM WIND TO BODY AXIS
         CX = CXO
         CL = DCL2*US2PHI+ DCL4*US4PHI + CLOP*BDP
         CY =  CYP*UCPHI - CZP*USPHI
         CZ = -CYP*USPHI - CZP*UCPHI
         CN =  CNP*UCPHI - CMP*USPHI
         CM =  CNP*USPHI + CMP*UCPHI + CMO
         DUM = SIN(.31416*34LPHP)
         DCLDR = DCLDO - DCLDA*DUM*COSD(BPHIP)
         DCLDQ =       -DCLDA*DUM*SIND(BPHIP)
         CL = CL + DCLDR*BDR + DCLDQ*BDQ
         RETURN
         END
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SUBROUTINE A1         74/74   OPT=1                         FTN 4.2+75067     05/05/75  16.17.17.      PAGE    4

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE    REFERENCES
    1   A1            1          164

 VARIABLES      SN   TYPE          RELOCATION
   556  BALPHA       REAL                / /        REFS       17      107
   560  BALPHP       REAL                / /        REFS       19      106      160
   557  BALPHY       REAL                / /        REFS       18      108
  2312  BAP          REAL                / /        REFS       53      110      122      123      124      125      127
                                                     129      131      132      133      139      140      141
                                                   DEFINED    106      110
  2116  BDELT1       REAL                / /        REFS       21       95       96       97
  2122  BDELT2       REAL                / /        REFS       22       95       96       97
  2126  BDELT3       REAL                / /        REFS       23       95       96       97
  2132  BDELT4       REAL                / /        REFS       24       95       96       97
  2313  BOL          REAL                / /        REFS       64   DEFINED     103
  2314  BOM          REAL                / /        REFS       65   DEFINED     104
  2315  BON          REAL                / /        REFS       66   DEFINED     105
  2316  BOP          REAL                / /        REFS       67      103      155  DEFINED       95       99
  2317  BOQ          REAL                / /        REFS       68      104      148      149      150      151      163
                                                   DEFINED     96      100
  2320  BOR          REAL                / /        REFS       59      105      148      149      150      151      163
                                                   DEFINED     97      101
   561  BPHIP        REAL                / /        REFS       20       88       89       90       91      151      162
     0  C            REAL      ARRAY     / /        REFS        2       16       17       18       19       20       21
                                                      22       23       24       25       26       27       28       29
                                                      32       33       36       37       38       39       40       41
                                                      42       43       44       45       48       49       50       51
                                                      52       53       54       55       56       57       58       59
                                                      60       61       62       63       64       65       66       67
                                                      68       69       70       71       72       73       74       75
                                                      75       77       79       80
     0  CA1          REAL      ARRAY     CA1        REFS        5      119
     0  CA2          REAL      ARRAY     CA2        REFS        5      131      132      133      135      137
     0  CA3          REAL      ARRAY     CA3        REFS        5      122      123      124      125      127      129
     0  CA4          REAL      ARRAY     CA4        REFS       13      120
     0  CA5          REAL      ARRAY     CA5        REFS        5      139      140      141
  2323  CH1          REAL                / /        REFS       70
  2327  CH11         REAL                / /        REFS       74
  2324  CH2          REAL                / /        REFS       71
  2330  CH21         REAL                / /        REFS       75
  2325  CH3          REAL                / /        REFS       72
  2331  CH31         REAL                / /        REFS       76
  2326  CH4          REAL                / /        REFS       73
  2332  CH41         REAL                / /        REFS       77
  2270  CL           REAL                / /        REFS       43      163  DEFINED      155      153
     0  CLOF         REAL      ARRAY     CLOF       REFS        5      139
  2310  CLOP         REAL                / /        REFS       51      139      155
  2265  CLP          REAL                / /        REFS       40      133
     0  CLPF         REAL      ARRAY     CLPF       REFS        5      133
     0  CL2F         REAL      ARRAY     CL2F       REFS        5      141
     0  CL4F         REAL      ARRAY     CL4F       REFS        5      140
  2271  CM           REAL                / /        REFS       44  DEFINED      159
     0  CMOF         REAL      ARRAY     CMOF       REFS        5      127
  2303  CMOQ         REAL                / /        REFS       56      127      128      149      150
  2304  CMOR         REAL                / /        REFS       57      149      150  DEFINED      128
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SUBROUTINE A1          74/74  OPT=1                                FTN 4.2+75067     05/15/75  16.17.17.    PAGE   5

VARIABLES   SN  TYPE             RELOCATION
  2301  CMO     REAL                  / /        REFS     54    123     144     149  DEFINED   144
     0  CMOF    REAL       ARRAY      CMOF       REFS     13    120
   560  CMP     REAL                             REFS    158    159  DEFINED   149
     0  CMPF    REAL       ARRAY      CMPF       REFS      5    123
  2266  CMQ     REAL                  / /        REFS     41    135
     0  CMQF    REAL       ARRAY      CMQF       REFS      5    135     137
   555  CMD     REAL                             REFS    120    144     159
     0  CM2F    REAL       ARRAY      CM2F       REFS      5    124
  2272  CN      REAL                  / /        REFS     45  DEFINED   158
   561  CNP     REAL                             REFS    158    159  DEFINED   150
  2267  CNR     REAL                  / /        REFS     42    137
     3  CN4F    REAL       ARRAY      CN4F       REFS      5    132
  2262  CX      REAL                  / /        REFS     37  DEFINED   154
  2273  CXO     REAL                  / /        REFS     48    119     154
     0  CXOF    REAL       ARRAY      CXOF       REFS      5    119
  2263  CY      REAL                  / /        REFS     38  DEFINED   156
   562  CYP     REAL                             REFS    156    157  DEFINED   151
     0  CY4F    REAL       ARRAY      CY4F       REFS      5    131
  2264  CZ      REAL                  / /        REFS     39  DEFINED   157
     0  CZOF    REAL       ARRAY      CZOF       REFS      5    125
  2276  CZDQ    REAL                  / /        REFS     51    125     126     148     151
  2277  CZOR    REAL                  / /        REFS     52    148     151  DEFINED   126
  2274  CZO     REAL                  / /        REFS     49    122     145
   557  CZP     REAL                             REFS    156    157  DEFINED   148
     0  CZPF    REAL       ARRAY      CZPF       REFS      5    122
     0  CZ2F    REAL       ARRAY      CZ2F       REFS      5    129
  2322  DCLOA   REAL                  / /        REFS     90    143     151     162
   576  DCLOAF  REAL       ARRAY                 REFS     78    143  DEFINED    84
  2321  DCLOO   REAL                  / /        REFS     79    142     161
   573  DCLOOF  REAL       ARRAY                 REFS     78    142  DEFINED    83
   565  DCLOQ   REAL                             REFS    163  DEFINED   162
   564  DCLOR   REAL                             REFS    153  DEFINED   151
   570  DCLOVH  REAL       ARRAY                 REFS     78    142     143  DEFINED    82
  2306  DCL1    REAL                  / /        REFS     59
   556  DCL2    REAL                             REFS    141    155
  2307  DCL4    REAL                  / /        REFS     50    140     155
  2302  DCM2    REAL                  / /        REFS     55    124     149
  2305  DCN4    REAL                  / /        REFS     58    132     150
  2300  DCY4    REAL                  / /        REFS     53    131     151
  2275  DCZ2    REAL                  / /        REFS     50    129     148
   563  DUM     REAL                             REFS    161    162  DEFINED   160
   526  IA    * INTEGER                       DEFINED     86
   527  IB    * INTEGER                       DEFINED     86
   530  IC    * INTEGER                       DEFINED     86
   531  ID    * INTEGER                       DEFINED     86
   532  IE    * INTEGER                       DEFINED     86
   533  IF    * INTEGER                       DEFINED     86
  3743  LCONV   INTEGER               / /        REFS     33
     0  NC1     INTEGER    ARRAY      NC1        REFS      5    119     120
     0  NC2     INTEGER    ARRAY      NC2        REFS      5    131     132     133     135     137
     0  NC3     INTEGER    ARRAY      NC3        REFS      5    122     123     124     125     127     129
     0  NC5     INTEGER    ARRAY      NC5        REFS      5    139     140     141
   566  NOCLD   INTEGER    ARRAY                 REFS     78    142     143  DEFINED    81
  2257  OPTHNG  REAL                  / /        REFS     36
  3616  OPTM    REAL                  / /        REFS     25     98
  3717  T       REAL                  / /        REFS     32    117     118
   551  UAL     REAL                             REFS    111    135  DEFINED   137   ...
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VARIABLES      SN   TYPE          RELOCATION
   552  UBT         REAL                            REFS      112      137   DEFINED     108     112
   545  UCPHI       REAL                            REFS      148      149     150       151     156     157     158
                                                            DEFINED    89
  3022  UDL1        REAL           / /              REFS                99     100       101
  3023  UDL2        REAL           / /              REFS        3       99     100       101
  3024  UDL3        REAL           / /              REFS       28       99     100       101
  3025  UDL4        REAL           / /              REFS       29       99     100       101
   544  USPHI       REAL                            REFS      148      149     150       151     156     157     158
                                                     159    DEFINED    88
   546  US2PHI      REAL                            REFS       92      155   DEFINED      90
   550  US2PH2      REAL                            REFS      148      149   DEFINED      92
   547  US4PHI      REAL                            REFS      150      151     155     DEFINED    91
   553  UT          REAL                            REFS      117   DEFINED    118
  2311  VM          REAL           / /              REFS       52      113     114       119     120     122     123
                                                     124      125      127     129       131     132     133     135
                                                     137      139      140     141       142     143
                                                  DEFINED     139      113     114
   313  VMACH       REAL           / /              REFS       16      109
   554  XF          REAL                            REFS      119      120     122       123     124     125     127
                                                     129      131      132     133       135     137     139     140
                                                     141      142      143   DEFINED     121     130     134     136
                                                     136

EXTERNALS         TYPE   ARGS      REFERENCES
        COSO      REAL     1           89      161
        SIN       REAL     1 LIBRARY  161
        SINO      REAL     1           83       90       91      162
        TABLE              7          113      120      142      143
        TABL2              8          122      123      124      125     127     129     131     132     133
                                      135      137      139      140     141

INLINE FUNCTIONS  TYPE   ARGS      DEF LINE  REFERENCES
        ABS       REAL     1 INTRIN           103      104      105     107     108
        AMAX1     REAL     2 INTRIN           103      104      105

STATEMENT LABELS               DEF LINE   REFERENCES
    45  15                       102        99
   165  1000                     145       117

COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
        / /       3830               0 C      (3830)
        NC1          2               0 NC1    (2)
        NC2          4               0 NC2    (4)
        NC3          4               0 NC3    (4)
        NC5          4               0 NC5    (4)
        CA1          6               0 CA1    (6)
        CA2         12               0 CA2    (12)
        CA3         12               0 CA3    (12)
        CA5         10               0 CA5    (10)
        CZPF        35               0 CZPF   (35)
        CZ2F        35               0 CZ2F   (35)
        CMPF        35               0 CMPF   (35)
        CM2F        35               0 CM2F   (35)
        CY4F        36               0 CY4F   (36)
        CN4F        36               0 CN4F   (36)
        CL4F        21               0 CL4F   (21)
        CL2F        21               0 CL2F   (21)
```

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SUBROUTINE A1          74/74   OPT=1                          FTN 4.2+75067     05/05/75  16.17.17.      PAGE    7

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
     CZDF           35                  0 CZDF    (35)
     CMDF           35                  0 CMDF    (35)
     CMQF           36                  0 CMQF    (36)
     CLPF           36                  0 CLPF    (36)
     CLDF           21                  0 CLDF    (21)
     CXDF            6                  0 CXDF    (6)
     CMOF            6                  0 CMOF    (6)
     CA4             6                  0 CA4     (6)

EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C       C         3830             203 VMACH   (1)            365 BALPHA (1)            367 BALPHY (1)
                                    368 BALPHP  (1)            369 BPHIP  (1)           1102 BDELT1 (1)
                                   1105 BDELT2  (1)           1110 BDELT3 (1)           1114 BDELT4 (1)
                                   1199 UPTHNG  (1)           1202 CX     (1)           1203 CY     (1)
                                   1204 CZ      (1)           1205 CLP    (1)           1206 CMQ    (1)
                                   1207 CNR     (1)           1208 CL     (1)           1209 CM     (1)
                                   1210 CN      (1)           1211 CXO    (1)           1212 CZO    (1)
                                   1213 DCZ2    (1)           1214 CZDQ   (1)           1215 CZDR   (1)
                                   1216 DCY4    (1)           1217 CMO    (1)           1218 DCM2   (1)
                                   1219 CMDQ    (1)           1220 CMDR   (1)           1221 DCN4   (1)
                                   1222 DCL1    (1)           1223 DCL4   (1)           1224 CLOP   (1)
                                   1225 VA      (1)           1226 BAP    (1)           1227 BOL    (1)
                                   1228 BOM     (1)           1229 BDN    (1)           1230 BDP    (1)
                                   1231 BDQ     (1)           1232 BDR    (1)           1233 DCLDO  (1)
                                   1234 DCLDA   (1)           1235 CH1    (1)           1236 CH2    (1)
                                   1237 CH3     (1)           1238 CH4    (1)           1239 CH11   (1)
                                   1240 CH21    (1)           1241 CH31   (1)           1242 CH41   (1)
                                   1553 UPTH    (1)           1554 UDL1   (1)           1555 UDL2   (1)
                                   1556 UDL3    (1)           1557 UDL4   (1)           1933 T      (1)
                                   2319 LCONV   (1)

STATISTICS
  PROGRAM LENGTH                6453     421
  CM LABELED COMMON LENGTH      7311     489
  CM BLANK COMMON LENGTH       73660    3830
```

```
      SUBROUTINE A3I
C***INITIALIZATION FOR ENGINE MODULE
      COMMON C(3830)
      DIMENSION IPL(100), ISNDX(43)
      EQUIVALENCE (C(3634), ISNDX), (C(3512), I3512)
      EQUIVALENCE (C( 357),BALPHA)
      EQUIVALENCE (C( 358),BALPHY)
      EQUIVALENCE (C( 370),BPHIP )
      EQUIVALENCE (C(1303),RDELCG)
      EQUIVALENCE (C(1320),FMXTH )
      EQUIVALENCE (C(1321),FMYTH )
      EQUIVALENCE (C(1322),FMZTH )
      EQUIVALENCE (C(1405),QBURN )
      EQUIVALENCE (C(1411),FTHX  )
      EQUIVALENCE (C(1412),FTHY  )
      EQUIVALENCE (C(1413),FTHZ  )
      EQUIVALENCE (C(1415),DWT   )
      EQUIVALENCE (C(1418),RDCGF )
      EQUIVALENCE (C(1419),FMIXF )
      EQUIVALENCE (C(1420),FMIYF )
      EQUIVALENCE (C(1528),DMASS )
      EQUIVALENCE (C(1739),WP    )
      EQUIVALENCE (C(1743),WQ    )
      EQUIVALENCE (C(1747),WR    )
      EQUIVALENCE (C(1748),FMIX  )
      EQUIVALENCE (C(1749),FMIY  )
      EQUIVALENCE (C(1750),FMIZ  )
      EQUIVALENCE (C(2000),     T)
      EQUIVALENCE (C(2551),N     )
      EQUIVALENCE (C(2552),IPL   )
      EQUIVALENCE (C(1751),    CRAD)
      EQUIVALENCE (C( 525),     VI3)
      EQUIVALENCE (C(1737),     FMX), (C(1741),    FMY), (C(1745), FMZ)
      DATA IFL31,IFL32/0,0/
      IPL(N  ) = 1496
      N = N+1
      C(1499) = 0.
C
      IF (QBURN .GT. 0.) GO TO 10
      CRAD=57.295778
      FMX=0.        $ FMY=0.        $ FMZ=0.
      WP = 0.
      WQ = 0.
      WR = 0.
      BALPHA = 0.
      BALPHY = 0.
      BPHIP = 0.
C
C MONTECARLO THRUST DIRECTION ERRORS
C
      DO 5 I = 1, I3512
      IDO = I
      IF(ISNDX(I).EQ.1313) CALL MCARLO (DUM, 1, IDO)
      IF(ISNDX(I).EQ.1314) CALL MCARLO (DUM, 1, IDO)
      IF(ISNDX(I).EQ.1315) CALL MCARLO (DUM, 1, IDO)
      IF(ISNDX(I).EQ.1401) CALL MCARLO (DUM, 1, IDO)
      IF(ISNDX(I).EQ.1402) CALL MCARLO (DUM, 1, IDO)
```

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      C**MONTE CARLO TIPOFF ROLL,PITCH AND YAW RATES                          A3      59
               IF(ISNDX(I).EQ.1738)CALL MCARLO(DUM,1,IDO)                      A3      60
               IF(ISNDX(I).EQ.1745)IFLG2=0                                     A3      61
               IF(ISNDX(I).EQ.1742)IFLG1=0                                     A3      62
      5        CONTINUE                                                        A3      63
      C                                                                        A3      64
               IF(VIB.LE.0.)GO TO 6                                            A3      65
               CALL LTRAN(T,DELT,D(1746),DUM,WR0,IFLG2,1)                      A3      66
               CALL LTRAN(T,DELT,D(1742),DUM,WQ0,IFLG1,2)                      A3      67
               WQ=WQ0/FMIYF       *CRAD                                        A3      68
               WR=WR0/FMIYF       *CRAD                                        A3      69
      6        CONTINUE                                                        A3      70
               IFLG1=1        $ IFLG2=1                                        A3      71
      C                                                                        A3      72
               RETURN                                                          A3      73
         10    CONTINUE                                                        A3      74
               FTHRST=0.                                                       A3      75
               FTHX=0.                                                         A3      76
               FTHY=0.                                                         A3      77
               FTHZ=0.                                                         A3      78
               FMXTH=0.                                                        A3      79
               FMYTH=0.                                                        A3      80
               FMZTH=0.                                                        A3      81
               DMASS = DWT/32.174                                              A3      82
               RDELCG = RDCGF                                                  A3      83
               FMIX = FMIXF                                                    A3      84
               FMIY = FMIYF                                                    A3      85
               FMIZ = FMIYF                                                    A3      86
               RETURN                                                          A3      87
               END                                                             A3      88
```

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 SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS    DEF LINE    REFERENCES
     1  A3I          1          72       85

 VARIABLES     SN   TYPE          RELOCATION
    556  BALPHA     REAL                   / /          REFS      6   DEFINED    45
    557  BALPHY     REAL                   / /          REFS      7   DEFINED    46
    561  BPHIP      REAL                   / /          REFS      8   DEFINED    47
      0  C          REAL        ARRAY      / /          REFS      3       2*5     6      7      8      9     10
                                                          11     12      13    14     15     16     17     18
                                                          19     20      21    22     23     24     25     28
                                                          27     28      29    30     31     32    3*33    65
                                                          65  DEFINED    37
   3326  CRAD       REAL                   / /          REFS     31      57    58  DEFINED   48
    146  DELT       REAL                                REFS     55      56
   3133  DMASS      REAL                   / /          REFS     21   DEFINED    81
    145  DUM        REAL                                REFS     53      54    55     56     57     59     65
                                                          65
   2606  DMT        REAL                   / /          REFS     17      81
   3323  FMIX       REAL                   / /          REFS     25   DEFINED    83
   2612  FMIXF      REAL                   / /          REFS     19      83
   3324  FMIY       REAL                   / /          REFS     26   DEFINED    84
   2613  FMIYF      REAL                   / /          REFS     20      57    58     84     85
   3325  FMIZ       REAL                   / /          REFS     27   DEFINED    85
   3310  FMX        REAL                   / /          REFS     33   DEFINED    41
   2447  FMXTH      REAL                   / /          REFS     10   DEFINED    78
   3314  FMY        REAL                   / /          REFS     33   DEFINED    41
   2450  FMYTH      REAL                   / /          REFS     11   DEFINED    79
   3320  FMZ        REAL                   / /          REFS     33   DEFINED    41
   2451  FMZTH      REAL                   / /          REFS     12   DEFINED    80
    151  FTHRST  *  REAL                              DEFINED    74
   2602  FTHX       REAL                   / /          REFS     14   DEFINED    75
   2603  FTHY       REAL                   / /          REFS     15   DEFINED    76
   2604  FTHZ       REAL                   / /          REFS     16   DEFINED    77
    143  I          INTEGER                             REFS     52      53    54     55     56     57     59
                                                          60     51   DEFINED    51
    144  IDO        INTEGER                             REFS     53      54    55     56     57     59
                                                      DEFINED    52
    135  IFLG1      INTEGER                             REFS     66   DEFINED    34     61     70
    136  IFLG2      INTEGER                             REFS     65   DEFINED    34     66     70
   5601  IPL        INTEGER     ARRAY      / /          REFS      4      30  DEFINED   35
   7061  ISNOX      INTEGER     ARRAY      / /          REFS      4       5    53     54     55     56     57
                                                          59     50      61
   6667  I3512      INTEGER                / /          REFS      5      51
   5663  N          INTEGER                / /          REFS     27      35    36  DEFINED   36
   2574  QBURN      REAL                   / /          REFS     13      39
   2611  RDCGF      REAL                   / /          REFS     18      82
   2433  RDELCG     REAL                   / /          REFS      9   DEFINED    82
   3717  T          REAL                   / /          REFS     28      65    66
   1161  VIB        REAL                   / /          REFS     32      56
   3312  WP         REAL                   / /          REFS     22   DEFINED    42
   3316  WQ         REAL                   / /          REFS     23   DEFINED    43     67
    150  WQ0        REAL                                REFS     56      57
   3322  WR         REAL                   / /          REFS     24   DEFINED    44     68
    147  WR0        REAL                                REFS     55      58
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SUBROUTINE A3I        74/74   OPT=1                          FTN 4.2+75067     05/35/75  16.17.22.      PAGE    4

EXTERNALS            TYPE   ARGS      REFERENCES
   LTRAN                      7           55      66
   MCARLO                     3           53      54      55      56      57      59

STATEMENT LABELS           DEF LINE   REFERENCES
    0  5                     62           51
   74  6                     69           64
   76  10                    73           33

LOOPS  LABEL   INDEX     FROM-TO    LENGTH    PROPERTIES
   16  5         I        51 62       44B             EXT REFS

COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
   //            3830              0 C       (3830)

EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
 C      C        3830        366 BALPHA  (1)        357 BALPHY  (1)        369 BPHIP   (1)
                             625 VIB     (1)       1307 RDELCG  (1)       1319 FMXTH   (1)
                            1320 FMYTH   (1)       1321 FMZTH   (1)       1404 QBURN   (1)
                            1410 FTHX    (1)       1411 FTHY    (1)       1412 FTHZ    (1)
                            1414 UNT     (1)       1417 RDCGF   (1)       1418 FMIXF   (1)
                            1413 FMIYF   (1)       1627 DMASS   (1)       1736 FMX     (1)
                            1738 WP      (1)       1740 FMY     (1)       1742 WQ      (1)
                            1744 FMZ     (1)       1745 WR      (1)       1747 FMIX    (1)
                            1748 FMIY    (1)       1749 FMIZ    (1)       1750 CRAD    (1)
                            1393 T       (1)       2560 N       (1)       2561 IPL     (100)
                            3511 13512   (1)       3533 ISNDX   (40)

STATISTICS
   PROGRAM LENGTH                1523     106
   CM BLANK COMMON LENGTH       73663    3830
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      SUBROUTINE A3                                                     A3      89
C**ENGINE MODULE                                                        A3      90
      COMMON C(3830)                                                    A3      91
C                                                                       A3      92
C                                                                       A3      93
C**-INPUT DATA                                                          A3      94
      EQUIVALENCE (C(1313),RFXCG )                                      A3      95
      EQUIVALENCE (C(1314),RFYCG )                                      A3      96
      EQUIVALENCE (C(1315),RFZCG )                                      A3      97
      EQUIVALENCE (C(1401),BALPHT)                                      A3      98
      EQUIVALENCE (C(1402),BPHIT )                                      A3      99
      EQUIVALENCE (C(1403),QNALGN)                                      A3     100
      EQUIVALENCE (C(1404),PCFTH )                                      A3     101
      EQUIVALENCE (C(1405),QBURN )                                      A3     102
      EQUIVALENCE (C(1414),CISP  )                                      A3     103
      EQUIVALENCE (C(1415),DWT   )                                      A3     104
      EQUIVALENCE (C(1416),DWP   )                                      A3     105
      EQUIVALENCE (C(1417),RDCGO )                                      A3     106
      EQUIVALENCE (C(1418),RDCGF )                                      A3     107
      EQUIVALENCE (C(1419),FMIXF )                                      A3     108
      EQUIVALENCE (C(1420),FMIYF )                                      A3     109
      EQUIVALENCE (C(1421),RLCGO )                                      A3     110
C                                                                       A3     111
C** INPUTS FROM OTHER MODULES                                           A3     112
      EQUIVALENCE (C(2000),T     )                                      A3     113
C                                                                       A3     114
C** OUTPUTS                                                             A3     115
      EQUIVALENCE (C(1308),RDELCG)                                      A3     116
      EQUIVALENCE (C(1320),FMXTH )                                      A3     117
      EQUIVALENCE (C(1321),FMYTH )                                      A3     118
      EQUIVALENCE (C(1322),FMZTH )                                      A3     119
      EQUIVALENCE (C(1409),UDWP  )                                      A3     120
      EQUIVALENCE (C(1410),FTHRST)                                      A3     121
      EQUIVALENCE (C(1411),FTHX  )                                      A3     122
      EQUIVALENCE (C(1412),FTHY  )                                      A3     123
      EQUIVALENCE (C(1413),FTHZ  )                                      A3     124
      EQUIVALENCE (C(1422),RLCG  )                                      A3     125
      EQUIVALENCE (C(1628),DMASS )                                      A3     126
      EQUIVALENCE (C(1748),FMIX  )                                      A3     127
      EQUIVALENCE (C(1749),FMIY  )                                      A3     128
      EQUIVALENCE (C(1750),FMIZ  )                                      A3     129
C                                                                       A3     130
C**STATE VARIABLES AND THEIR DERIVATIVES                                A3     131
      EQUIVALENCE (C(1496),UIMPD )                                      A3     132
      EQUIVALENCE (C(1499),UIMP  )                                      A3     133
C**LOOK UP TABLE FOR THRUST                                             A3     134
      DIMENSION NTH(2), THA(10), THF(10)                                A3     135
      DATA NTH/10,0/                                                    A3     136
      DATA THA/   0., .125, .250, .750,1.500,1.625,1.750, 2.00, 3.,100./ A3     137
      DATA THF/2300.,1750.,1650.,1600.,1400.,1250., 600., 300., 0., 0./ A3     138
C                                                                       A3     139
      IF (QBURN.GT.0.) RETURN                                           A3     140
      CALL TABLE(T,THA,THF,NTH,XF,6HFTHRST,FTHRST)                      A3     141
C                                                                       A3     142
      IF (QNALGN) 20,20,10                                              A3     143
   10 USINA=SIND(BALPHT)                                                A3     144
      FTHX=FTHRST*COSD(BALPHT)                                          A3     145
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                  FTHY=-FTHRST*USINA*SIND(BPHIT)                               A3        146
                  FTHZ=FTHRST*USINA*COSD(BPHIT)                                A3        147
                  FMXTH = -FTHY*RFZCG + FTHZ*RFYCG                             A3        148
                  FMYTH = -FTHX*RFZCG + FTHZ*RFXCG                             A3        149
                  FMZTH = -FTHX*RFYCG - FTHY*RFXCG                             A3        150
                  GO TO 30                                                     A3        151
               20 FTHX=FTHRST                                                  A3        152
                  FTHY=0.                                                      A3        153
                  FTHZ=0.                                                      A3        154
                  FMXTH=0.                                                     A3        155
                  FMYTH=0.                                                     A3        156
                  FMZTH=0.                                                     A3        157
               30 CONTINUE                                                     A3        158
            C                                                                  A3        159
                  UIMPD = FTHRST                                               A3        160
                  UDWP = UIMP/CISP                                             A3        161
            C                                                                  A3        162
                  DMASS = (DWT+DWP-UDWP)/32.174                                A3        163
                  RDELCG = RDCGO - (RDCGO - RDCGF)*UDWP/DWP                    A3        164
            C                                                                  A3        165
                  FMIX=FMIXF*(DWT+DWP-UDWP)/DWT                                A3        166
                  FMIY=FMIYF*(DWT+DWP-UDWP)/DWT                                A3        167
                  FMIZ = FMIY                                                  A3        168
                  RLCG = RLCGO + RDELCG                                        A3        169
                  IF (FTHRST .GT. 0.) RETURN                                   A3        170
            C                                                                  A3        171
                  WRITE (6,100) T                                              A3        172
              100 FORMAT (//14H BURNOUT TIME=,F8.4,5H SEC.)                    A3        173
                  QBURN=1.0                                                    A3        174
                  RETURN                                                       A3        175
                  END                                                          A3        176
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SUBROUTINE A3        74/74  OPT=1                      FTN 4.2+75067     05/05/75  16.17.23.     PAGE   3

     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
   1  A3              1            52      82      87

VARIABLES    SN  TYPE                RELOCATION
  2570  BALPHT     REAL                  / /        REFS       10      56      57
  2571  BPHIT      REAL                  / /        REFS       11      58      59
     0  C          REAL        ARRAY     / /        REFS        3       7       8       9      10      11      12
                                                              13      14      15      16      17      18      19      20
                                                              21      22      25      28      29      30      31      32
                                                              33      34      35      36      37      38      39      40
                                                              41      44      45
  2605  CISP       REAL                  / /        REFS       15      73
  3133  DMASS      REAL                  / /        REFS       38  DEFINED      75
  2607  DMP        REAL                  / /        REFS       17      75      76      78      79
  2606  DMT        REAL                  / /        REFS       16      75    2*78    2*79
  3323  FMIX       REAL                  / /        REFS       39  DEFINED      78
  2612  FMIXF      REAL                  / /        REFS       20      78
  3324  FMIY       REAL                  / /        REFS       40      80  DEFINED      79
  2613  FMIYF      REAL                  / /        REFS       21      79
  3325  FMIZ       REAL                  / /        REFS       41  DEFINED      80
  2447  FMXTH      REAL                  / /        REFS       29  DEFINED      60      67
  2450  FMYTH      REAL                  / /        REFS       30  DEFINED      61      68
  2451  FMZTH      REAL                  / /        REFS       31  DEFINED      62      69
  2601  FTHRST     REAL                  / /        REFS       33      53      57      58      59      54      72
                                                              82
  2602  FTHX       REAL                  / /        REFS       34      61      62  DEFINED      57      54
  2603  FTHY       REAL                  / /        REFS       35      60      62  DEFINED      58      65
  2604  FTHZ       REAL                  / /        REFS       36      60      61  DEFINED      59      66
   114  NTH        INTEGER     ARRAY                REFS       47      53  DEFINED      48
  2573  PCFTH      REAL                  / /        REFS       13
  2574  QBURN      REAL                  / /        REFS       14      52  DEFINED      86
  2572  QNALGN     REAL                  / /        REFS       12      55
  2611  ROCGF      REAL                  / /        REFS       19      76
  2610  ROCGO      REAL                  / /        REFS       18    2*76
  2433  ROELCG     REAL                  / /        REFS       28      81  DEFINED      76
  2440  RFXCG      REAL                  / /        REFS        7      61      62
  2441  RFYCG      REAL                  / /        REFS        8      60      62
  2442  RFZCG      REAL                  / /        REFS        9      60      61
  2615  RLCG       REAL                  / /        REFS       37  DEFINED      81
  2614  RLCGO      REAL                  / /        REFS       22      81
  3717  T          REAL                  / /        REFS       25      53      84
   116  THA        REAL        ARRAY                REFS       47      53  DEFINED      49
   130  THF        REAL        ARRAY                REFS       47      53  DEFINED      50
  2600  UDWP       REAL                  / /        REFS       32      75      76      78      79
                                                 DEFINED       73
  2732  UIMP       REAL                  / /        REFS       45      73
  2727  UIMPD      REAL                  / /        REFS       44  DEFINED      72
   113  USINA      REAL                             REFS       58      59  DEFINED      56
   112  XF       * REAL                             REFS       53

FILE NAMES       MODE
     TAPE6       FMT                  WRITES       84
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SUBROUTINE A3          74/74  OPT=1                    FTN 4.2+75067     05/05/75  16.17.23.      PAGE    4

EXTERNALS          TYPE   ARGS        REFERENCES
      COSD         REAL     1             57        59
      SIND         REAL     1             55        58
      TABLE                 7             53

STATEMENT LABELS                DEF LINE    REFERENCES
    0  10          INACTIVE       56          53
   33  20                         64          2*55
   37  30                         70          63
  103 100       FMT               85          84

COMMON BLOCKS    LENGTH     MEMBERS - BIAS NAME(LENGTH)
     //           3830                 0 C     (3830)

EQUIV CLASSES    LENGTH     MEMBERS - BIAS NAME(LENGTH)
C       C         3830          1307 RDELCG  (1)          1312 RFXCG   (1)          1313 RFYCG   (1)
                                1314 RFZCG   (1)          1319 FMXTH   (1)          1320 FMYTH   (1)
                                1321 FMZTH   (1)          1400 BALPHT  (1)          1401 BPHIT   (1)
                                1402 QNALGV  (1)          1403 PCFTH   (1)          1404 QBURN   (1)
                                1408 UDWP    (1)          1409 FTHRST  (1)          1410 FTHX    (1)
                                1411 FTHY    (1)          1412 FTHZ    (1)          1413 CISP    (1)
                                1414 UWT     (1)          1415 DWP     (1)          1416 RDCGD   (1)
                                1417 RDCGF   (1)          1418 FMIXF   (1)          1419 FMIYF   (1)
                                1420 RLCGD   (1)          1421 RLCG    (1)          1495 UIMPD   (1)
                                1498 UIMP    (1)          1627 DMASS   (1)          1747 FMIX    (1)
                                1748 FMIY    (1)          1749 FMIZ    (1)          1999 T       (1)

STATISTICS
  PROGRAM LENGTH                 1443     100
  CM BLANK COMMON LENGTH        73663    3830
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```
      SUBROUTINE A2                                                     A2        2
C**AERO FORCE AND MOMENT MODULE   BODY AXES                             A2        3
      COMMON C(3830)                                                    A2        4
  101 FORMAT(1H0,4X,21HFRONT LUG CLEARS RAIL,5X,3HT =,1PE10.2,5X,       A2        5
     *        9HREL VEL =,1PE10.2,5X,14HPITCH MOMENT =,1PE10.2)         A2        6
C                                                                       A2        7
C**INPUT DATA                                                           A2        8
      EQUIVALENCE (C(1306),RFAREA)                                      A2        9
      EQUIVALENCE (C(1307),RFLGTH)                                      A2       10
      EQUIVALENCE (C(1316),RLUG  )                                      A2       11
      EQUIVALENCE (C(1317),RAIL  )                                      A2       12
      EQUIVALENCE (C(1742),   AMP2),  (C(1746),   AMP1)                 A2       13
      EQUIVALENCE (C(1332),CPHAS )                                      A2       14
      EQUIVALENCE (C(1405),QBURN )                                      A2       15
      EQUIVALENCE (C(1627),AGRAV )                                      A2       16
C                                                                       A2       17
C**INPUTS FROM OTHER MODULES                                            A2       18
      DIMENSION ISNDX(40)                                               A2       19
      EQUIVALENCE (C(3534),   ISNDX),  (C(3512),   I3512)               A2       20
      EQUIVALENCE (C(0203),PDYNMC)                                      A2       21
      EQUIVALENCE (C( 204),VMACH )                                      A2       22
      EQUIVALENCE (C(0207),VAIRSP)                                      A2       23
      EQUIVALENCE (C( 350),BTHT  )                                      A2       24
      EQUIVALENCE (C( 380),RANGO )                                      A2       25
      EQUIVALENCE (C(1203),CX    )                                      A2       26
      EQUIVALENCE (C(1204),CY    )                                      A2       27
      EQUIVALENCE (C(1205),CZ    )                                      A2       28
      EQUIVALENCE (C(1206),CLP   )                                      A2       29
      EQUIVALENCE (C(1207),CMQ   )                                      A2       30
      EQUIVALENCE (C(1208),CNR   )                                      A2       31
      EQUIVALENCE (C(1209),CL    )                                      A2       32
      EQUIVALENCE (C(1210),CM    )                                      A2       33
      EQUIVALENCE (C(1211),CN    )                                      A2       34
      EQUIVALENCE (C(1236),CH1   )                                      A2       35
      EQUIVALENCE (C(1237),CH2   )                                      A2       36
      EQUIVALENCE (C(1238),CH3   )                                      A2       37
      EQUIVALENCE (C(1239),CH4   )                                      A2       38
      EQUIVALENCE (C(1320),FMXTH )                                      A2       39
      EQUIVALENCE (C(1321),FMYTH )                                      A2       40
      EQUIVALENCE (C(1322),FMZTH )                                      A2       41
      EQUIVALENCE (C(1411),FTHX  )                                      A2       42
      EQUIVALENCE (C(1412),FTHY  )                                      A2       43
      EQUIVALENCE (C(1413),FTHZ  )                                      A2       44
      EQUIVALENCE (C(1422),RLCG  )                                      A2       45
      EQUIVALENCE (C(1723),CFA23 )                                      A2       46
      EQUIVALENCE (C(1735),CFA33 )                                      A2       47
      EQUIVALENCE (C(1739),WP    )                                      A2       48
      EQUIVALENCE (C(1743),WQ    )                                      A2       49
      EQUIVALENCE (C(1737),      FMX),  (C(1741),     FMY), (C(1745), FMZ)  A2   50
      EQUIVALENCE (C(1747),WR    )                                      A2       51
      EQUIVALENCE (C(1749),   FMI()                                     A2       52
      EQUIVALENCE (C(1738),   WPT))                                     A2       53
      EQUIVALENCE (C(1751),   CRA))                                     A2       54
      EQUIVALENCE (C( 525),    VI3))                                    A2       55
      EQUIVALENCE (C(2000),T     )                                      A2       56
      EQUIVALENCE  (C(1972),RKUTTA)                                     A2       57
      EQUIVALENCE (C(1975),NPT)                                         A2       58
```

```
C
C**OUTPUTS
      EQUIVALENCE (C(1300),FXBA  )
      EQUIVALENCE (C(1301),FYBA  )
      EQUIVALENCE (C(1302),FZBA  )
      EQUIVALENCE (C(1303),FMXBA )
      EQUIVALENCE (C(1304),FMYBA )
      EQUIVALENCE (C(1305),FMZBA )
      EQUIVALENCE (C(1308),ROELCG)
      EQUIVALENCE (C(1628),DMASS )
      EQUIVALENCE (C(1748),FMIX  )
      EQUIVALENCE (C(1749),FMIY  )
      EQUIVALENCE (C(1750),FMIZ  )
C
C**OTHER OUTPUTS
      EQUIVALENCE (C(1309),FMH1  )
      EQUIVALENCE (C(1310),FMH2  )
      EQUIVALENCE (C(1311),FMH3  )
      EQUIVALENCE (C(1312),FMH4  )
      EQUIVALENCE (C(1323),FMXLUG)
      EQUIVALENCE (C(1324),FMYLUG)
      EQUIVALENCE (C(1325),FMZLUG)
      EQUIVALENCE (C(5504),OPTN4)
C
C**FORCE VECTOR COMPONENTS
      UQS = PDYNMC*RFAREA
      UQSL = UQS*RFLGTH
C
      FXBA=UQS*(-CX)+FTHX
      FYBA=UQS*CY+FTHY
      FZBA=UQS*CZ+FTHZ
C
C** AERO MOMENTS   (NOTE FACTOR OF 2.0 IN DAMPING COEFFICIENT)
      UL2V =.0
      IF (VAIRSP .GT. 0.) UL2V = RFLGTH/(2.*VAIRSP)
      FMXBA = (CL + CLP*UL2V*WP) * UQSL              + FMXTH
      FMYBA = (CM + CMQ*UL2V*WQ) * UQSL + FZBA*ROELCG + FMYTH
      FMZBA = (CN + CNR*UL2V*WR) * UQSL - FYBA*ROELCG + FMZTH
C
C** CALCULATE HINGE MOMENTS
      FMH1 = CH1*UQSL
      FMH2 = CH2*UQSL
      FMH3 = CH3*UQSL
      FMH4 = CH4*UQSL
C
C**MOMENTS AND FORCES DUE TO LUGS
      IF ( (OPTN4 .GT. 0.).AND.(RANGO .LE. RAIL+RLUG) ) GO TO 70
      UFZL2=FZLUG
      FYLUG = 0.
      FZLUG = 0.
      FMXLUG = 0.
      FMYLUG = 0.
      FMZLUG = 0.
      IF (FLG2 .GT.0.) GO TO 74
      FMX=0.       $      FMY=0.        $      FMZ=0.
      DO 6 I=1,I3512
      IDO=I
```

```
      IF(ISNDX(I).EQ.1743)CALL MCARLO(DUM,1,IDO)
      IF(ISNDX(I).EQ.1747)CALL MCARLO(DUM,1,IDO)
    6 CONTINUE
      C(13) = 1.
      WRITE(6,104)WP,WQ,WR
  104 FORMAT(1H ,30X,*TIPOFF RATES--ROLL = *F6.1,* PITCH = *F6.1,
     . * YAW = *F6.1)
      FLG2 = 1.
      WRITE(6,102) T,VAIRSP,UFZL2
      WRITE(6,103) RANGO
  103 FORMAT(32X,9HRANGO  = ,F6.4)
  102 FORMAT (1H0,36H          REAR LUG CLEARS RAIL    T = ,F8.4,
     *  10HREL VEL = ,F8.3,16H    RAIL FORCE = ,F8.2)
      GO TO 74
   70 IF (RANGO .LE. RAIL) GO TO 72
      RZDD=0.
      FYLUG = -(FYBA + DMASS*AGRA/*CFA23 +  FMZBA*
     *       RLCG*DMASS/FMIZ)/(1. + DMASS*RLCG*RLCG/FMIZ)
      FZLUG = -(FZBA + DMASS*AGRA/*(CFA33-RZDD) +  FMYBA*
     *       RLCG*DMASS/FMIY)/(1. + DMASS*RLCG*RLCG/FMIY)
      FMXLUG = - FMXBA
      FMYLUG = -FZLUG*RLCG
      FMZLUG = FYLUG*RLCG
      IF (FLG1 .GT. 0.) GO TO 74
      FLG1 = 1.
      WRITE(6,101) T, VAIRSP, FMYLUG
      WRITE(6,103) RANGO
C
C
C
C
C
C                  WPTO--MONTE CARLO VALUE OF TIPOFF ROLL RATE
C                  DTLUG---TIME INCREMENT BETWEEN FIRST LUG AND
C                          LAST LUG DROP OFF TIME(TIPOFF ROLL RATE
C                          OCCURS AT LAST LUG)
C                  FMX---ROLL MOMENT THAT GENERATES  TIPOFF ROLL RATE
      DTLUG=.026
      FMX=WPTO*FMIX/CRAD/DTLUG
    5 CONTINUE
C
C
C
C
      GO TO 74
   72 CONTINUE
      RZDD=0.
      FYLUG = -(FYBA + DMASS*AGRA/*CFA23)
      FZLUG = -(FZBA + DMASS*AGRA/*(CFA33-RZDD))
      FMXLUG = - FMXBA
      FMYLUG = - FMYBA
      FMZLUG = - FMZBA
      FLG1 = 0.
      FLG2=0.
   74 CONTINUE
C**TOTAL FORCE AND MOMENTS
      FYBA = FYBA + FYLUG
```

```
      SUBROUTINE A2          74/74    OPT=1                FTN 4.2+75067     05/05/75  16.17.26.     PAGE    4

      FZBA = FZBA + FZLUG
      FMXBA = FMXBA + FMXLUG                                            A2      173
      FMYBA = FMYBA + FMYLUG                                            A2      174
      FMZBA = FMZBA + FMZLUG                                            A2      175
C                                                                       A2      175
C**LAUNCH TRANSIENTS MOMENTS (1-YAW,2-PITCH,3-ROLL MOMENTS)              A2      177
C                                                                       A2      178
      IF(FLG2.GT.0.)GO TO 75                                            A2      179
      IF(VIB.LE.0.)GO TO 75                                             A2      180
      CALL LTRAN(T,DELT,AMP2,FMY,4Q0,1,2)                               A2      181
      CALL LTRAN(T,DELT,AMP1,FMZ,4R0,1,1)                               A2      182
   75 CONTINUE                                                          A2      183
      FMXBA=FMXBA+FMX                                                   A2      184
      FMYBA=FMYBA+FMY                                                   A2      185
      FMZBA=FMZBA+FMZ                                                   A2      185
C                                                                       A2      187
      RETURN                                                            A2      188
      END                                                               A2      189
                                                                        A2      190
```

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      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
   1  A2             1           168

VARIABLES     SN   TYPE            RELOCATION
  3132 AGRAV       REAL               / /        REFS      15     131     133     162     163
  3321 AMP1        REAL               / /        REFS      12     182
  3315 AMP2        REAL               / /        REFS      12     181
   535 BTHT        REAL               / /        REFS      23
     0 C           REAL    ARRAY      / /        REFS       3       8       9      10      11    2*12      13
                                                           14      15    2*19      20      21      22      23      24
                                                           25      26      27      28      29      30      31      32
                                                           33      34      35      36      37      38      39      40
                                                           41      42      43      44      45      46      47      48
                                                         3*49      50      51      52      53      54      55      56
                                                           57      50      51      52      63      64      65      66
                                                           67      68      69      70      73      74      75      78
                                                           77      78      79      80 DEFINED     118
  327. ?3          REAL               / /        REFS      45     131     152
  3306 33          REAL               / /        REFS      46     133     163
  2323 CH1         REAL               / /        REFS      34      98
  2324 CH2         REAL               / /        REFS      35      99
  2325 CH3         REAL               / /        REFS      36     100
  2326 CH4         REAL               / /        REFS      37     101
  2270 CL          REAL               / /        REFS      31      93
  2265 CLP         REAL               / /        REFS      28      93
  2271 CM          REAL               / /        REFS      32      94
  2266 CMQ         REAL               / /        REFS      29      94
  2272 CN          REAL               / /        REFS      33      95
  2267 CNR         REAL               / /        REFS      30      95
  2463 CPHAS       REAL               / /        REFS      13
  3326 CRAD        REAL               / /        REFS      53     153
  2262 CX          REAL               / /        REFS      25      86
  2263 CY          REAL               / /        REFS      26      87
  2264 CZ          REAL               / /        REFS      27      88
   363 DELT        REAL                          REFS     131     182
  3133 DMASS       REAL               / /        REFS      57   3*131   3*133     162     163
   362 DTLUG       REAL                          REFS     153 DEFINED     152
   357 DUM         REAL                          REFS     115     116
   361 FLG1        REAL                          REFS     138 DEFINED     139     167
   354 FLG2        REAL                          REFS     111     179 DEFINED     122     158
  2434 FMH1        REAL               / /        REFS      73 DEFINED      98
  2435 FMH2        REAL               / /        REFS      74 DEFINED      99
  2436 FMH3        REAL               / /        REFS      75 DEFINED     100
  2437 FMH4        REAL               / /        REFS      76 DEFINED     101
  3323 FMIX        REAL               / /        REFS      51      58     153
  3324 FMIY        REAL               / /        REFS      59   2*133
  3325 FMIZ        REAL               / /        REFS      70   2*131
  3310 FMX         REAL               / /        REFS      49     184 DEFINED     112     153
  2426 FMXBA       REAL               / /        REFS      53     135     154     173     184
                                              DEFINED      93     173     184
  2452 FMXLUG      REAL               / /        REFS      77     173 DEFINED     108     135     164
  2447 FMXTH       REAL               / /        REFS      38      93
  3314 FMY         REAL               / /        REFS      49     181     185 DEFINED     112
  2427 FMYBA       REAL               / /        REFS      64     133     165     174     185
                                              DEFINED      94     174     185
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          SUBROUTINE A2          74/74   OPT=1                            FTN 4.2+75057      05/05/75  16.17.26.      PAGE    6

 VARIABLES     SN  TYPE             RELOCATION
   2453  FMYLUG    REAL                   / /         REFS       78     140     174   DEFINED     109     136     165
   2450  FMYTH     REAL                   / /         REFS       39      94
   3320  FMZ       REAL                   / /         REFS       49     182     156   DEFINED     112
   2430  FMZBA     REAL                   / /         REFS       65     131     166     175     186
                                                   DEFINED       95     175     186
   2454  FMZLUG    REAL                   / /         REFS       79     175   DEFINED     110     137     136
   2451  FMZTH     REAL                   / /         REFS       40      95
   2602  FTHX      REAL                   / /         REFS       41      86
   2603  FTHY      REAL                   / /         REFS       42      87
   2604  FTHZ      REAL                   / /         REFS       43      88
   2423  FXBA      REAL                   / /         REFS       60   DEFINED      86
   2424  FYBA      REAL                   / /         REFS       51      95     131     162     171
                                                   DEFINED       87     171
    353  FYLUG     REAL                               REFS      137     171   DEFINED     106     131     162
   2425  FZBA      REAL                   / /         REFS       52      94     133     163     172
                                                   DEFINED       88     172
    352  FZLUG     REAL                               REFS      105     136     172   DEFINED     107     133     163
    355  I         INTEGER                            REFS      114     115     116   DEFINED     113
    356  IDO       INTEGER                            REFS      115     116   DEFINED     114
   7661  ISNDX     INTEGER     ARRAY      / /         REFS       18      19     115     116
   6667  I3512     INTEGER                / /         REFS       19     113
   3666  NPT       INTEGER                / /         REFS       57
   6657  OPTN4     REAL                   / /         REFS       50     104
    312  POYNMC    REAL                   / /         REFS       20      83
   2574  QBURN     REAL                   / /         REFS       14
   2444  RAIL      REAL                   / /         REFS       11     104     129
    573  RANGO     REAL                   / /         REFS       24     104     124     129     141
   2433  RUELCG    REAL                   / /         REFS       66      94      95
   2431  RFAREA    REAL                   / /         REFS        8      83
   2432  RFLGTH    REAL                   / /         REFS        9      94      32
   3663  RKUTTA    REAL                   / /         REFS       56
   2615  RLCG      REAL                   / /         REFS       44   3*131   3*133     136     137
   2443  RLUG      REAL                   / /         REFS       10     104
    360  RZDO      REAL                               REFS      133     153   DEFINED     130     151
   3717  T         REAL                   / /         REFS       55     123     140     181     182
    351  UFZL2     REAL                               REFS      123   DEFINED     105
    350  UL2V      REAL                               REFS       93      94      95   DEFINED      91      92
    346  UQS       REAL                               REFS       84      86      87      88   DEFINED      93
    347  UQSL      REAL                               REFS       93      94      95      98      99     108     181
                                                   DEFINED       84
    316  VAIRSP    REAL                   / /         REFS       22    2*92     123     140
   1161  VIB       REAL                   / /         REFS       54     150
    313  VMACH     REAL                   / /         REFS       21
   3312  WP        REAL                   / /         REFS       47      93     119
   3311  WPTO      REAL                   / /         REFS       52     153
   3316  WQ        REAL                   / /         REFS       48      94     119
    364  WQ0     * REAL                               REFS      151
   3322  WR        REAL                   / /         REFS       50      95     119
    365  WR0     * REAL                               REFS      152

 FILE NAMES        MODE
      TAPE6        FMT                      WRITES      119     123     124     140     141

 EXTERNALS          TYPE    ARGS        REFERENCES
        LTRAN                  7            181     182
        MCARLO                 3            115     116
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        SUBROUTINE A2          74/74   OPT=1                          FTN 4.2+75067       05/05/75  16.17.26.        PAGE     7

 STATEMENT LABELS                    DEF LINE   REFERENCES
      0  5           INACTIVE         154
      0  6                            117       113
    113  70                           129       104
    156  72                           160       123
    174  74                           159       111       128       138       159
    214  75                           183       173       180
    246  101      FMT                   4       143
    315  102      FMT                 125       123
    312  103      FMT                 125       124       141
    267  104      FMT                 120       113

 LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
    66   6        * I      113 117      14B               EXT REFS

  COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
       / /          3830                   0 C        (3830)

 EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C        C        3830          202 POYNMD (1)            203 VMACH  (1)           206 VAIRSP (1)
                                 349 STAT   (1)            379 RANGO  (1)           625 VIB    (1)
                                1202 CX     (1)           1203 CY     (1)          1204 CZ     (1)
                                1205 CLP    (1)           1206 CM1    (1)          1207 CNR    (1)
                                1208 CL     (1)           1209 CM     (1)          1210 CN     (1)
                                1235 CM1    (1)           1236 CM2    (1)          1237 CM3    (1)
                                1238 CM4    (1)           1299 FX3A   (1)          1300 FYBA   (1)
                                1301 FZBA   (1)           1302 FMXBA  (1)          1303 FMYBA  (1)
                                1304 FMZBA  (1)           1305 RFAREA (1)          1306 RFLGTH (1)
                                1307 RDELCS (1)           1308 FMM1   (1)          1309 FMM2   (1)
                                1310 FMM3   (1)           1311 FMM4   (1)          1315 RLUG   (1)
                                1316 RAIL   (1)           1313 FMXTH  (1)          1320 FMYTH  (1)
                                1321 FMZTH  (1)           1322 FMXLUG (1)          1323 FMYLUG (1)
                                1324 FMZLUG (1)           1331 CPHAS  (1)          1404 QBURN  (1)
                                1410 FTHX   (1)           1411 FTHY   (1)          1412 FTHZ   (1)
                                1421 RLCG   (1)           1625 AGRAV  (1)          1627 DMASS  (1)
                                1722 CFA23  (1)           1734 CFA33  (1)          1736 FMX    (1)
                                1737 WPTO   (1)           1738 HP     (1)          1740 FMY    (1)
                                1741 AMP2   (1)           1742 H1     (1)          1744 FMZ    (1)
                                1745 AMP1   (1)           1743 WR     (1)          1747 FMIX   (1)
                                1749 FMIY   (1)           1743 FMIZ   (1)          1750 CRAG   (1)
                                1371 RKUTTA (1)           1974 NPT    (1)          1999 T      (1)
                                3503 OPTN4  (1)           3511 I3512  (1)          3633 ISNDX  (48)

  STATISTICS
    PROGRAM LENGTH                3663       246
    CM BLANK COMMON LENGTH       73663      3830
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SUBROUTINE LTRAN        74/74    OPT=1                    FTN 4.2+75067      05/15/75  16.17.38.       PAGE    1

      SUBROUTINE LTRAN(T,DELT,AMP,Y,YC,IFLG,K)
      DIMENSION A(5,3),PHI(5,3),W(5,3)
      DATA IMAX,AE/4,-1./
      DATA (A(I,1),I=1,5)/1.,4.,12.,26.,0./
      DATA (A(I,2),I=1,5)/1.,4.,12.,26.,0./
      DATA (A(I,3),I=1,5)/1.,4.,12.,26.,0./
      IF(IFLG.GT.0)GO TO 17
      ZC=0.
      W1=5.28E11.
      DO 1 I=1,IMAX
      CALL RANNUM(0.,RNSTRT,RN)
      PHI(I,K)=3.14*RN
      W(I,K)=I*W1
C ZC IS INTEGRATION CONSTANT FOR Z
      B=W(I,K)*T+PHI(I,K)
      ZC=ZC+ A(I,K)*(AE*SIN(B)-W(I,K)*COS(B))/(AE**2+W(I,K)**2)
    1 CONTINUE
      YC=AMP*EXP(AE*T)*ZC
   17 CONTINUE
      Z=0.
      DO 2 I=1,IMAX
      Z=Z+A(I,K)*SIN(W(I,K)*T+PHI(I,K))
    2 CONTINUE
      Y=AMP*EXP(AE*T)*Z
      RETURN
      END
```

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SUBROUTINE LTRAN      74/74    OPT=1                  FTN 4.2+75057     05/05/75  16.17.30.      PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE      REFERENCES
      3   LTRAN          1          25

  VARIABLES     SN   TYPE              RELOCATION
     116  A          REAL       ARRAY               REFS         2       16       22   DEFINED      4       5       6
     101  AE         REAL                           REFS      2*16       18       24   DEFINED      3
       0  AMP        REAL                 F.P.      REFS        18       24  DEFINED         1
     114  B          REAL                           REFS      2*16  DEFINED       15
       0  DELT       REAL       *UNUSED   F.P.     DEFINED       1
     111  I          INTEGER                        REFS        12     2*13     2*15     3*16    3*22
                                                   DEFINED      10       21
       0  IFLG       INTEGER              F.P.      REFS         7  DEFINED        1
     100  IMAX       INTEGER                        REFS        10       21  DEFINED         3
       0  K          INTEGER              F.P.      REFS        12       13     2*15     3*16    3*22
                                                   DEFINED       1
     135  PHI        REAL       ARRAY               REFS         2       15       22   DEFINED     12
     113  RN         REAL                           REFS        11       12
     112  RNSTRT  *  REAL                           REFS        11
       0  T          REAL                 F.P.      REFS        15       18       22       24   DEFINED     1
     154  W          REAL       ARRAY               REFS         2       15     2*16       22   DEFINED    13
     110  W1         REAL                           REFS        13  DEFINED        9
       0  Y          REAL                 F.P.     DEFINED       1       24
       0  YC         REAL                 F.P.     DEFINED       1       18
     115  Z          REAL                           REFS        22       24  DEFINED        20      22
     107  ZC         REAL                           REFS        16       18  DEFINED         8      16

  EXTERNALS          TYPE    ARGS        REFERENCES
          COS        REAL      1 LIBRARY     15
          EXP        REAL      1 LIBRARY     15        24
          RANNUM               3             11
          SIN        REAL      1 LIBRARY     15        22

  STATEMENT LABELS                DEF LINE   REFERENCES
       0  1                          17          13
       0  2                          23          21
      47  17                         19           7

  LOOPS   LABEL    INDEX     FROM-TO     LENGTH    PROPERTIES
     12   1        * I        16 17        30B               EXT REFS
     51   2        * I        21 23        15B               EXT REFS

  STATISTICS
    PROGRAM LENGTH              173B      123
```

```
      SUBROUTINE D1I                                                    D1       2
C**   TRANSLATIONAL DYNAMICS INITIALIZATION MODULE FOR D1               D1       3
      COMMON C(3830)                                                    D1       4
      EQUIVALENCE (C(2551),N      )                                     D1       5
      EQUIVALENCE (C(2562),IPL    )                                     D1       6
      DIMENSION IPL(100), ISNDX(4)), ITNDX(10)                          D1       7
      EQUIVALENCE (C(3634), ISNDX), (C(3512), I3512)                    D1       8
C                                                                       D1       9
C**   INPUT DATA                                                        D1      10
      EQUIVALENCE (C( 100),VMXE   )                                     D1      11
      EQUIVALENCE (C( 101),VMYE   )                                     D1      12
      EQUIVALENCE (C( 102),VMZE   )                                     D1      13
      EQUIVALENCE (C( 204),VMACH  )                                     D1      14
      EQUIVALENCE (C( 357),BALPHA)                                      D1      15
      EQUIVALENCE (C( 368),BALPHY)                                      D1      16
      EQUIVALENCE (C( 427),BTHTG )                                      D1      17
      EQUIVALENCE (C( 431),BPSIG )                                      D1      18
      EQUIVALENCE (C(1633),OPTARG)                                      D1      19
      EQUIVALENCE (C(1665),BLOSV )                                      D1      20
      EQUIVALENCE (C(1657),RSLANT)                                      D1      21
      EQUIVALENCE (C(1574),VMHTE )                                      D1      22
      EQUIVALENCE (C(1751),CRAD   )                                     D1      23
      EQUIVALENCE (C(3502),OPTN2 )                                      D1      24
      EQUIVALENCE (C(3504),OPTN4 )                                      D1      25
      EQUIVALENCE (C(3535),OPTN6 )                                      D1      26
C                                                                       D1      27
C**   OUTPUT TO MODULES                                                 D1      28
      EQUIVALENCE (C(1615),RXE    )                                     D1      29
      EQUIVALENCE (C(1619),RYE    )                                     D1      30
      EQUIVALENCE (C(1623),RZE    )                                     D1      31
      EQUIVALENCE (C(1603),VXE    )                                     D1      32
      EQUIVALENCE (C(1607),VYE    )                                     D1      33
      EQUIVALENCE (C(1611),VZE    )                                     D1      34
      EQUIVALENCE (C(1651),RTXE   )                                     D1      35
      EQUIVALENCE (C(1655),RTYE   )                                     D1      36
      EQUIVALENCE (C(1659),RTZE   )                                     D1      37
      EQUIVALENCE (C(1558),RXO    )                                     D1      38
      EQUIVALENCE (C(1653),RYO    )                                     D1      39
      EQUIVALENCE (C(1570),RZO    )                                     D1      40
      EQUIVALENCE (C(1571),VXO    )                                     D1      41
      EQUIVALENCE (C(1572),VYO    )                                     D1      42
      EQUIVALENCE (C(1573),VZO    )                                     D1      43
      EQUIVALENCE (C(1752),BPHIO )                                      D1      44
      EQUIVALENCE (C(1753),BTHTO )                                      D1      45
      EQUIVALENCE (C(1754),BPSIO )                                      D1      46
      EQUIVALENCE (C(1555),RHZRO  )                                     D1      47
      EQUIVALENCE (C(1635), ROELX)                                      D1      48
      EQUIVALENCE (C(1536), ROELY)                                      D1      49
      EQUIVALENCE (C(1537), ROELZ)                                      D1      50
      EQUIVALENCE (C(1580),RSJYMC)                                      D1      51
      EQUIVALENCE (C(1581),RSJZMC)                                      D1      52
      EQUIVALENCE (C(3753),ITNDX), (C(3721),ITGT)                       D1      53
      EQUIVALENCE (C(1751),   A011)                                     D1      54
      EQUIVALENCE (C(1762),   A012)                                     D1      55
      EQUIVALENCE (C(1763),   A013)                                     D1      56
      EQUIVALENCE (C(1755),   A021)                                     D1      57
      EQUIVALENCE (C(1756),   A022)                                     D1      58
```

```
      EQUIVALENCE (C(1757),  A023)
      EQUIVALENCE (C(1758),  A031)
      EQUIVALENCE (C(1759),  A032)
      EQUIVALENCE (C(1750),  A033)
      EQUIVALENCE (C(1764),    P1)
      EQUIVALENCE (C(1765),    Q1)
      EQUIVALENCE (C(1766),    P2)
      EQUIVALENCE (C(1767),    R2)
      EQUIVALENCE (C(1768),  X801)
      EQUIVALENCE (C(1769),  Y801)
      EQUIVALENCE (C(1770),  Z801)
      EQUIVALENCE (C(1771),  X802)
      EQUIVALENCE (C(1772),  Y802)
      EQUIVALENCE (C(1773),  Z802)
      EQUIVALENCE (C( 350),BPH1ER)
      EQUIVALENCE (C( 351),BTH2ER)
      EQUIVALENCE (C( 362),BPS1ER)
      EQUIVALENCE (C(1562),GSPOTY)
      EQUIVALENCE (C(1572),GSPOTZ)
      EQUIVALENCE (C(1581),SIGSPOT)
      EQUIVALENCE (C(1579),   ZETA)
      EQUIVALENCE (C(1580),     W0)
C
C
C* ZERO OUT SPOT JITTER MAX/MIN STORAGE LOCATIONS THAT ARE SAVED IN OUTP
      C(1567) = 0.
      C(1568) = 0.
      C(1577) = 0.
      C(1578) = 0.
C  PRINTED FROM MODULE-34
      W0 = 3.94
      ZETA = .745
C
C SPOT JITTER MONTE CARLO INITIAL VALUES
C
      RSJYMC = 0.
      RSJZMC = 0.
      DO 500 IOL=1,ITCT
      ITSNDX = IOL
      IF(ITNDX(IOL).NE.1580) GO TO 502
      IPL(N)=1560
      IPL(N+1)=1563
      N=N+2
      IF(SIGSPOT.NE.0.)
     1  GSPOTY = .707*SIGSPOT/SQRT(W0/4./ZETA * C(2664))
      CALL MCARLO(RNSTRT,4,ITSNDX)
  502 IF(ITNDX(IOL).NE.1581) GO TO 500
      IPL(N)=1570
      IPL(N+1)=1573
      N=N+2
      IF(SIGSPOT.NE.0.)
     1  GSPOTZ = .707*SIGSPOT/SQRT(W0/4./ZETA * C(2664))
      CALL MCARLO(RNSTRT,4,ITSNDX)
  500 CONTINUE
C
      IPL(N) = 1630
      IPL(N+1) = 1634
```

```
      IPL(N+2) = 1608
      IPL(N+3) = 1612
      IPL(N+4) = 1616
      IPL(N+5) = 1620
      IPL(N+6) = 1640
      IPL(N+7) = 1644
      IPL(N+8) = 1648
      IPL(N+9) = 1652
      IPL(N+10) = 1656
      N = N+11
      C( 363) = 0.
      C( 364) = 0.
      CRAD = 57.295778
C
      IF (OPTN2.LE.0.) RETURN
      IF (OPTARG.LE. 0.) N = N-5
C
C**CALCULATE MISSILE PARAMETER INITIAL CONDITIONS
      RYE=0.
      RTZE = 0.
      RTYE = 0.
      RTXE = 0.
      BPHIO = 0.
      XB01 = 0.
      YB01 = 1.
      ZB01 = 0.
      XB02 = 0.
      YB02 = 0.
      ZB02 = 1.
C
C***  MONTE CARLO AUTOPILOT GYRO DRIFT RATES
      P1 = 0.
      Q1 = 0.
      P2 = 0.
      R2 = 0.
      DO 503 I = 1,I3512
      IDD = I
      IF(ISNDX(I).EQ.1764) CALL MCARLO (DUM, 1, IDD)
      IF(ISNDX(I).EQ.1765) CALL MCARLO (DUM, 1, IDD)
      IF(ISNDX(I).EQ.1766) CALL MCARLO (DUM, 1, IDD)
      IF(ISNDX(I).EQ.1767) CALL MCARLO (DUM, 1, IDD)
  503 CONTINUE
C
C
C*** AUTOPILOT GYRO BIAS ERRORS
C
      BPHIER = 0.
      BTHZER = 0.
      BPSIER = 0.
      DO 11 I = 1, I3512
      IDD = I
      IF(ISNDX(I).EQ.550) CALL MCARLO (DUM, 1, IDD)
      IF(ISNDX(I).EQ.561) CALL MCARLO (DUM, 1, IDD)
      IF(ISNDX(I).EQ.552) CALL MCARLO (DUM, 1, IDD)
   11 CONTINUE
C
C** INITIALIZE MATRIX COEF FOR AUTOPILOT GYRO MODELS
```

```
      C
            USPHI1 = SIND(BPHIO + BPH1ER)
            UCPHI1 = COSD(BPHIO + BPH1ER)
            USTHT2 = SIND(BTHTO + BTH2ER)
            UCTHT2 = COSD(BTHTO + BTH2ER)
            USPSI1 = SIND(BPSIO + BPS1ER)
            UCPSI1 = COSD(BPSIO + BPS1ER)
            A011 = UCPSI1*UCTHT2
            A012 = USPSI1*UCTHT2
            A013 = -USTHT2
            A021 = -USPSI1*UCPHI1 + UCPSI1*USTHT2*USPHI1
            A022 = UCPSI1*UCPHI1 + USPSI1*USTHT2*USPHI1
            A023 = UCTHT2*USPHI1
            A031 = UCPSI1*USTHT2*UCPHI1 + USPSI1*USPHI1
            A032 = USPSI1*USTHT2*UCPHI1 - UCPSI1*USPHI1
            A033 = UCTHT2*UCPHI1
      C
      C
      C MISSILE INITIAL ATTITUDE ERRORS
      C
            DO 5 I = 1, I3512
            IDO = -I
            IF(ISNDX(I).EQ.1752) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1753) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1754) CALL MCARLO (DUM, 1, IDO)
          5 CONTINUE
      C
            IF (OPTN2.GT.1.0) GO TO 10
            RXE=-RSLANT*COSD(BLOSV)
            RZE=RSLANT*SIND(BLOSV)
            GO TO 20
         10 RSLANT = SQRT(RZE**2 + RXE**2)
         20 RH = RHZRO - RZE
      C
            IF (OPTN4 .GT. 0.) GO TO 30
            BPSIO = CRAD*ASIN(SIND(BPSIG)*RSLANT/RXE)
            CPSIO  = COSD(BPSIO)
            TTHTG = SIND(BTHTG)/COSD(BTHTG)
            BTHTO = ATAND((-RZE/RXE - TTHTG*CPSIO),(CPSIO - TTHTG*RZE/RXE))
            GO TO 40
         30 CONTINUE
            IF (OPTN4 .GT. 1.) GO TO 40
            UST = SIND(BTHTO)
            USP = SIND(BPSIO)
            UCP = COSD(BPSIO)
            UCT = COSD(BTHTO)
            UCPH = COSD(BPHIO)
            USPH = SIND(BPHIO)
            RXBA = -RXE*UCP*UCT + RZE*UST
            RYBA = -RXE*(UCP*UST*USPH - USP*UCPH) - RZE*UCT*USPH
            RZBA = -RXE*(UCP*UST*UCPH + USP*USPH) - RZE*UCT*UCPH
            BTHTG = ATAND(-RZBA,RXBA)
            BPSIG = ATAND( RYBA,(RXBA*COSD(BTHTG)-RZBA*SIND(BTHTG)))
         40 CONTINUE
      C
         24 VSOUND = 1117.3 - .00392*RH
            IF (OPTN5 .LE. 0.) VMHTE = /MACH*VSOUND
```

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      SUBROUTINE D1I          74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.17.31.     PAGE    5

                    VMNXY = VMNTE*COSD(BALPHA - BTHTO)                                01      230
230       C                                                                            01      231
                    VXE = VMXE + VMNXY*COSD(BALPHY + BPSIO)                           01      232
                    VYE = VMYE + VMNXY*SIND(BALPHY + BPSIO)                           01      233
                    VZE = VMZE + VMNTE*SIND(BALPHA - BTHTO)                           01      234
          C                                                                            01      235
235                 RXO = RXE                                                          01      236
                    RYO = RYE                                                          01      237
                    RZO = RZE                                                          01      238
                    VXO = VXE                                                          01      239
                    VYO = VYE                                                          01      240
240                 VZO = VZE                                                          01      241
                    RDELX = RTXE - RXE                                                 01      242
                    RDELY = RTYE - RYE                                                 01      243
                    RDELZ = RTZE - RZE                                                 01      244
                    RETURN                                                             01      245
245                 END                                                                01      246


      SUBROUTINE D1I          74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.17.31.     PAGE    6

CARD NR. SEVERITY  DETAILS   DIAGNOSIS OF PROBLEM

    98      I       ITCT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
    99      I       ITCT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
   105      I       ITCT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
   106      I       ITCT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
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SUBROUTINE D1I        74/74   OPT=1                      FTN 4.2+75067      05/05/75  16.17.31.      PAGE    7

          SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE      REFERENCES
    1   D1I            1         129       244

 VARIABLES      SN  TYPE          RELOCATION
   3340  A011       REAL                  / /      REFS       53   DEFINED     179
   3341  A012       REAL                  / /      REFS       54   DEFINED     180
   3342  A013       REAL                  / /      REFS       55   DEFINED     181
   3332  A021       REAL                  / /      REFS       56   DEFINED     182
   3333  A022       REAL                  / /      REFS       57   DEFINED     183
   3334  A023       REAL                  / /      REFS       58   DEFINED     184
   3335  A031       REAL                  / /      REFS       59   DEFINED     185
   3336  A032       REAL                  / /      REFS       60   DEFINED     186
   3337  A033       REAL                  / /      REFS       61   DEFINED     187
    556  BALPHA     REAL                  / /      REFS       14        229     233
    557  BALPHY     REAL                  / /      REFS       15        231     232
   3201  BLOSV      REAL                  / /      REFS       19        200     201
   3327  BPHIO      REAL                  / /      REFS       43        173     174     218     219
                                                DEFINED      137
    547  BPHIER     REAL                  / /      REFS       72        173     174  DEFINED     161
    656  BPSIG      REAL                  / /      REFS       17        207  DEFINED     224
   3331  BPSIO      REAL                  / /      REFS       45        177     178     208     215     216     231
                                                      232   DEFINED     207
    551  BPSIER     REAL                  / /      REFS       74        177     178  DEFINED     153
    652  BTHTG      REAL                  / /      REFS       16      2*209   2*224  DEFINED     223
   3330  BTHTO      REAL                  / /      REFS       44        175     176     214     217     229     233
                                                DEFINED      210
    550  BTH2ER     REAL                  / /      REFS       73        175     176  DEFINED     152
      0  C          REAL        ARRAY     / /      REFS        3          4       5     2*7      10      11      12
                                                       13       14         15      16      17      18      19      20
                                                       21       22         23      24      25      28      29      30
                                                       31       32         33      34      35      36      37      38
                                                       39       40         41      42      43      44      45      46
                                                       47       48         49      50      51    2*52      53      54
                                                       55       56         57      58      59      60      61      62
                                                       63       64         65      66      67      68      69      70
                                                       71       72         73      74      75      76      77      78
                                                       79      101        108  DEFINED      83      84      85      88
                                                      125      126
    537  CPSIC      REAL                           REFS    2*210   DEFINED     208
   3326  CRAD       REAL                  / /      REFS       22        207  DEFINED     127
    527  DJN        REAL                           REFS      152        153     154     155     166     157     168
                                                      194      195        196
   3031  GSPOTY     REAL                  / /      REFS       75   DEFINED     101
   3043  GSPOTZ     REAL                  / /      REFS       76   DEFINED     108
    525  I          INTEGER                        REFS      151        152     153     154     155     165     168
                                                      167      158        193     134     195     196
                                                DEFINED      150        154     192
    526  IDO        INTEGER                        REFS      152        153     154     155     166     157     168
                                                      194      195        196  DEFINED     151     165     193
    522  IOL        INTEGER                        REFS       96         97     10'  DEFINED      95
   5601  IPL        INTEGER     ARRAY     / /      REFS        5          6  DEFINED      98      99     105     106
                                                      113      114        115     116     117     118     119     120
                                                      121      122        1??
   7061  ISNOX      INTEGER     ARRAY     / /      REFS        6          ?     152     153     154     155     166
                                                      167      158        194     195     196
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         SUBROUTINE OII        74/74   OPT=1                               FTN 4.2+75067     05/05/75  16.17.31.     PAGE    8

VARIABLES      SN   TYPE              RELOCATION
  7210  ITCT      INTEGER               / /            REFS        52       95
  7250  ITNDX     INTEGER      ARRAY    / /            REFS         6       52       97      104
   523  ITSNDX    INTEGER                              REFS       183      110  DEFINED       96
  6667  I3512     INTEGER               / /            REFS         7      150      154      192
  5600  N         INTEGER               / /            REFS         4       98       99      100      105      106      107
                                                        113       114      115      116      117      118      119      120
                                                        121       122      123      124      130  DEFINED      100      107
                                                        124       130
  3146  OPTARG    REAL                  / /            REFS        18      130
  6655  OPTN2     REAL                  / /            REFS        23      129      139
  6657  OPTN4     REAL                  / /            REFS        24      206      213
  6661  OPTN6     REAL                  / /            REFS        25      228
  3343  P1        REAL                  / /            REFS        62  DEFINED      146
  3345  P2        REAL                  / /            REFS        64  DEFINED      148
  3344  Q1        REAL                  / /            REFS        63  DEFINED      147
  3142  RDELX     REAL                  / /            REFS        47  DEFINED      241
  3143  RDELY     REAL                  / /            REFS        48  DEFINED      242
  3144  RDELZ     REAL                  / /            REFS        49  DEFINED      243
   536  RH        REAL                                 REFS       227  DEFINED      204
  3200  RHZRO     REAL                  / /            REFS        46      204
   524  RNSTRT    REAL                                 REFS       103      110
  3217  RSJYMC    REAL                  / /            REFS        50  DEFINED       93
  3220  RSJZMC    REAL                  / /            REFS        51  DEFINED       94
  3262  RSLANT    REAL                  / /            REFS        20      200      201      207  DEFINED      203
  3162  RTXE      REAL                  / /            REFS        34      241  DEFINED      136
  3166  RTYE      REAL                  / /            REFS        35      242  DEFINED      135
  3172  RTZE      REAL                  / /            REFS        36      243  DEFINED      134
   547  RXBA      REAL                                 REFS       223      224  DEFINED      220
  3116  RXE       REAL                  / /            REFS        28      203      207    2*210      220      221      222
                                                        235       241  DEFINED      200
  3203  RXO       REAL                  / /            REFS        37  DEFINED      235
   550  RYBA      REAL                                 REFS       224  DEFINED      221
  3122  RYE       REAL                  / /            REFS        29      236      242  DEFINED      133
  3204  RYO       REAL                  / /            REFS        38  DEFINED      236
   551  RZBA      REAL                                 REFS       223      224  DEFINED      222
  3126  RZE       REAL                  / /            REFS        30      203      204    2*210      220      221      222
                                                        237       243  DEFINED      201
  3205  RZO       REAL                  / /            REFS        39  DEFINED      237
  3346  R2        REAL                  / /            REFS        65  DEFINED      149
  3054  SIGSPOT   REAL                  / /            REFS        77    2*101    2*108
   540  TTHTG     REAL                                 REFS     2*210  DEFINED      209
   543  UCP       REAL                                 REFS       220      221      222  DEFINED      216
   545  UCPH      REAL                                 REFS       221    2*222  DEFINED      218
   531  UCPHI1    REAL                                 REFS       182      183      185      186      187
                                                    DEFINED       174
   535  UCPSI1    REAL                                 REFS       179      182      183      185      186
                                                    DEFINED       178
   544  UCT       REAL                                 REFS       220      221      222  DEFINED      217
   533  UCTHT2    REAL                                 REFS       179      180      184      187  DEFINED      176
   542  USP       REAL                                 REFS       221      222  DEFINED      215
   546  USPH      REAL                                 REFS     2*221      222  DEFINED      219
   530  USPHI1    REAL                                 REFS       182      183      184      185      185
                                                    DEFINED       173
   534  USPSI1    REAL                                 REFS       180      182      183      185      186
                                                    DEFINED       177
   541  UST       REAL                                 REFS       220      221      222  DEFINED      214
   532  USTHT2    REAL                                 REFS       181      182      183      185      196
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SUBROUTINE D1I          74/74   OPT=1                                  FTN 4.2+75067     05/05/75  16.17.31.      PAGE    9

VARIABLES    SN   TYPE               RELOCATION
                                                    DEFINED    175
     313   VMACH     REAL                   / /     REFS        13      228
    3211   VMWTE     REAL                   / /     REFS        21      229      233     DEFINED    228
     553   VMWXY     REAL                           REFS       231      232   DEFINED     22?
     552   VSOUND    REAL                           REFS       228   DEFINED     227
     143   VMXE      REAL                   / /     REFS        10      231
     144   VMYE      REAL                   / /     REFS        11      232
     145   VMZE      REAL                   / /     REFS        12      233
    3102   VXE       REAL                   / /     REFS        31      238   DEFINED     231
    3206   VXO       REAL                   / /     REFS        40   DEFINED     238
    3106   VYE       REAL                   / /     REFS        32      239   DEFINED     232
    3207   VYO       REAL                   / /     REFS        41   DEFINED     239
    3112   VZE       REAL                   / /     REFS        33      240   DEFINED     233
    3210   VZO       REAL                   / /     REFS        42   DEFINED     240
    3053   WO        REAL                   / /     REFS        79      101      108     DEFINED    88
    3347   XB01      REAL                   / /     REFS        66   DEFINED     138
    3352   XB02      REAL                   / /     REFS        69   DEFINED     141
    3350   YB01      REAL                   / /     REFS        67   DEFINED     139
    3353   YB02      REAL                   / /     REFS        70   DEFINED     142
    3351   ZB01      REAL                   / /     REFS        68   DEFINED     140
    3354   ZB02      REAL                   / /     REFS        71   DEFINED     143
    3052   ZETA      REAL                   / /     REFS        78      101      138     DEFINED    89

EXTERNALS          TYPE    ARGS        REFERENCES
        ASIN       REAL    1 LIBRARY    207
        ATAND      REAL    2            213     223     224
        COSD       REAL    1            174     176     178     200     208     209     216     217     218
                                        224     229     231
        MCARLO             3            103     110     152     153     154     155     166     157     168
                                        194     195     196
        SIND       REAL    1            173     175     177     201     207     209     214     215     219
                                        224     232     233
        SQRT       REAL    1 LIBRARY    101     108     203

STATEMENT LABELS              DEF LINE    REFERENCES
      0   5                     197         192
    267   10                    203         199
      0   11                    159         164
    273   20                    204         202
      0   24        INACTIVE    227
    322   30                    212         205
    375   40                    225         211      213
     51   500                   111          95      104
     31   502                   104          97
      0   503                   156         153

LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
   11  500     * IOL      95 111      438            EXT REFS
  117  503     * I       150 156      24B            EXT REFS
  146  11      * I       164 169      20B            EXT REFS
  237  5       * I       192 137      20B            EXT REFS

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
      //          3830              0 C        (3830)
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SUBROUTINE DII            74/74   OPT=1                         FTN 4.2+75067    05/05/75  16.17.31.     PAGE   18

EQUIV-CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
C        C        3830         99 VMXE    (1)         100 VMYE    (1)         101 VMZE    (1)
                              203 VMACH   (1)         359 BPH1ER  (1)         360 BTH2ER  (1)
                              361 BPS1ER  (1)         365 BALPHA  (1)         367 BALPHY  (1)
                              426 BTHTG   (1)         430 BPSIG   (1)        1561 GSPOTY  (1)
                             1571 GSPOTZ  (1)        1578 ZETA    (1)        1579 W0      (1)
                             1580 SIGSPOT (1)        1602 VXE     (1)        1606 VYE     (1)
                             1610 VZE     (1)        1614 RXE     (1)        1618 RYE     (1)
                             1622 RZE     (1)        1634 RDELX   (1)        1635 RDELY   (1)
                             1636 RDELZ   (1)        1635 OPTARG  (1)        1650 RTXE    (1)
                             1654 RTYE    (1)        1658 RTZE    (1)        1664 RHZRD   (1)
                             1665 DLOSV   (1)        1666 RS_ANT  (1)        1667 RX0     (1)
                             1668 RY0     (1)        1669 RZ0     (1)        1670 VX0     (1)
                             1671 VY0     (1)        1672 VZ0     (1)        1673 VMNTE   (1)
                             1679 RSJYMC  (1)        1680 RSJZMC  (1)        1750 CRAD    (1)
                             1751 BPHIO   (1)        1752 BTHTO   (1)        1753 BPSIO   (1)
                             1754 A021    (1)        1755 A022    (1)        1756 A023    (1)
                             1757 A031    (1)        1758 A032    (1)        1759 A033    (1)
                             1760 A011    (1)        1761 A012    (1)        1762 A013    (1)
                             1763 P1      (1)        1764 Q1      (1)        1765 P2      (1)
                             1766 Q2      (1)        1767 X801    (1)        1768 Y801    (1)
                             1769 Z301    (1)        1770 X802    (1)        1771 Y802    (1)
                             1772 Z302    (1)        2553 N       (1)        2561 IPL     (100)
                             3501 OPTN2   (1)        3503 OPTN4   (1)        3505 OPTN5   (1)
                             3511 ISZIP2  (1)        3633 ISNDX   (40)       3720 ITCT    (1)
                             3752 ITNDX   (10)

STATISTICS
  PROGRAM LENGTH                 5543B     364
  CM BLANK COMMON LENGTH        73653B    3830
```

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      SUBROUTINE D1                                                       D1     247
C**TRANSLATIONAL DYNAMICS MODULE                                          D1     248
      COMMON C(3830)                                                      D1     249
C                                                                         D1     250
C**INPUT DATA                                                             D1     251
      EQUIVALENCE (C(1527),AGRAV )                                        D1     252
      EQUIVALENCE (C(1528),DMASS )                                        D1     253
      EQUIVALENCE (C(1529),ATHRST)                                        D1     254
      EQUIVALENCE (C(1530),ATURNT)                                        D1     255
      EQUIVALENCE (C(1531),BGAMT )                                        D1     256
      EQUIVALENCE (C(1539),OPTARG)                                        D1     257
      EQUIVALENCE (C(1581),ADIVE )                                        D1     258
      EQUIVALENCE (C(1751),CRAD  )                                        D1     259
C                                                                         D1     260
C**INPUTS FROM OTHER MODULES                                              D1     261
      EQUIVALENCE (C(1300),FXBA  )                                        D1     262
      EQUIVALENCE (C(1301),FYBA  )                                        D1     263
      EQUIVALENCE (C(1302),FZBA  )                                        D1     264
      EQUIVALENCE (C(1703),CFA11 )                                        D1     265
      EQUIVALENCE (C(1707),CFA12 )                                        D1     266
      EQUIVALENCE (C(1711),CFA13 )                                        D1     267
      EQUIVALENCE (C(1715),CFA21 )                                        D1     268
      EQUIVALENCE (C(1719),CFA22 )                                        D1     269
      EQUIVALENCE (C(1723),CFA23 )                                        D1     270
      EQUIVALENCE (C(1727),CFA31 )                                        D1     271
      EQUIVALENCE (C(1731),CFA32 )                                        D1     272
      EQUIVALENCE (C(1735),CFA33 )                                        D1     273
      EQUIVALENCE (C(2000),T     )                                        D1     274
C                                                                         D1     275
C**STATE VARIABLE OUTPUTS                                                 D1     276
      EQUIVALENCE (C(1600),VXED  )                                        D1     277
      EQUIVALENCE (C(1603),VXE   )                                        D1     278
      EQUIVALENCE (C(1604),VYED  )                                        D1     279
      EQUIVALENCE (C(1607),VYE   )                                        D1     280
      EQUIVALENCE (C(1608),VZED  )                                        D1     281
      EQUIVALENCE (C(1611),VZE   )                                        D1     282
      EQUIVALENCE (C(1612),RXED  )                                        D1     283
      EQUIVALENCE (C(1615),RXE   )                                        D1     284
      EQUIVALENCE (C(1616),RYED  )                                        D1     285
      EQUIVALENCE (C(1619),RYE   )                                        D1     286
      EQUIVALENCE (C(1620),RZED  )                                        D1     287
      EQUIVALENCE (C(1623),RZE   )                                        D1     288
      EQUIVALENCE (C(1640),VTARGD)                                        D1     289
      EQUIVALENCE (C(1643),VTARG )                                        D1     290
      EQUIVALENCE (C(1644),BPSITD)                                        D1     291
      EQUIVALENCE (C(1647),BPSIT )                                        D1     292
      EQUIVALENCE (C(1648),RTXED )                                        D1     293
      EQUIVALENCE (C(1651),RTXE  )                                        D1     294
      EQUIVALENCE (C(1652),RTYED )                                        D1     295
      EQUIVALENCE (C(1655),RTYE  )                                        D1     296
      EQUIVALENCE (C(1656),RTZED )                                        D1     297
      EQUIVALENCE (C(1659),RTZE  )                                        D1     298
C                                                                         D1     299
C**OTHER OUTPUTS                                                          D1     300
      EQUIVALENCE (C(1624),AXBA  )                                        D1     301
      EQUIVALENCE (C(1625),AYBA  )                                        D1     302
      EQUIVALENCE (C(1626),AZBA  )                                        D1     303
```

```
      EQUIVALENCE (C(1532),VDELX )
      EQUIVALENCE (C(1533),VDELY )
      EQUIVALENCE (C(1534),VDELZ )
      EQUIVALENCE (C(1535),RDELX )
      EQUIVALENCE (C(1536),RDELY )
      EQUIVALENCE (C(1537),RDELZ )
      EQUIVALENCE (C(1538),VCLSNG)
      EQUIVALENCE (C(1660),VTXE  )
      EQUIVALENCE (C(1661),VTYE  )
      EQUIVALENCE (C(1662),VTZE  )
      EQUIVALENCE (C(1663),VDXB  )
      EQUIVALENCE (C(1664),VDYB  )
      EQUIVALENCE (C(1665),VDZB  )
      EQUIVALENCE (C(1575),ANGX  )
      EQUIVALENCE (C(1577),ANGY  )
      EQUIVALENCE (C(1578),ANGZ  )
      EQUIVALENCE (C( 371),RANGE  )
C
C**ADD AERO AND THRUST FORCES TO GET TOTAL ACCELERATION IN BODY AXES
      AXBA = FXBA/DMASS
      AYBA = FYBA/DMASS
      AZBA = FZBA/DMASS
C
C**RESOLVE FROM BODY TO EARTH AXES
      AXE = CFA11*AXBA+CFA21*AYBA+CFA31*AZBA
      AYE = CFA12*AXBA+CFA22*AYBA+CFA32*AZBA
      AZE = CFA13*AXBA+CFA23*AYBA+CFA33*AZBA
C
C**INTEGRATE ACCELERATIONS
      VXED = AXE
      VYED = AYE
      VZED = AZE + AGRAV
C
C**CALCULATE TOTAL MISSILE ACCELERATION IN BODY AXES
      VDXB = CFA11*VXED + CFA12*VYED + CFA13*VZED
      VDYB = CFA21*VXED + CFA22*VYED + CFA23*VZED
      VDZB = CFA31*VXED + CFA32*VYED + CFA33*VZED
      ANGX = VDXB/32.174
      ANGY = VDYB/32.174
      ANGZ = VDZB/32.174
C
C**INTEGRATE VELOCITIES TO EARTH AXES  POSITION
   10 RXED = VXE
      RYED = VYE
      RZED = VZE
C
C**TARGET MOTION
      IF (OPTARG .LE. 0.) RETURN
      VTARGD = ATHRST*AGRAV
      BPSITD= 0.
      IF (VTARG.GT.0.) BPSITD= ATURNT*AGRAV*CRAD/VTARG
C
      VTXE = VTARG*COSD(BGAMT)*COSD(BPSIT)
      VTYE = VTARG*COSD(BGAMT)*SIND(BPSIT)
      VTZE = VTARG*SIND(BGAMT)
C
      RTXED = VTXE
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  115                 RTYED = VTYE                                          D1       361
                      RTZED = VTZE                                          D1       362
             C                                                              D1       363
                      VDELX = VTXE-VXE                                      D1       364
                      VDELY = VTYE-VYE                                      D1       365
  120                 VDELZ = VTZE-VZE                                      D1       366
             C                                                              D1       367
                      VCLSNG = (RDELX*VDELX+RDELY*VDELY+RDELZ*VDELZ)/RANGE  D1       368
                      RETURN                                                D1       369
                      END                                                   D1       370
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SUBROUTINE D1          74/74  OPT=1                          FTN 4.2+75067     05/05/75  16.17.37.     PAGE    4

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     1  D1            1        105     123

 VARIABLES     SN   TYPE          RELOCATION
   3220  ADIVE      REAL                / /          REFS       12
   3132  AGRAV      REAL                / /          REFS        6        89      106     108
   3213  ANGX       REAL                / /          REFS       71   DEFINED       95
   3214  ANGY       REAL                / /          REFS       72   DEFINED       96
   3215  ANGZ       REAL                / /          REFS       73   DEFINED       97
   3134  ATHRST     REAL                / /          REFS        8       106
   3135  ATURNT     REAL                / /          REFS        9       108
   3127  AXBA       REAL                / /          REFS       55        82       83      84  DEFINED     77
    130  AXE        REAL                             REFS       37   DEFINED       82
   3130  AYBA       REAL                / /          REFS       56        82       83      34  DEFINED     78
    131  AYE        REAL                             REFS       58   DEFINED       83
   3131  AZBA       REAL                / /          REFS       57        82       83      84  DEFINED     79
    132  AZE        REAL                             REFS       59   DEFINED       84
   3136  BGAMT      REAL                / /          REFS       10       110      111     112
   3156  BPSIT      REAL                / /          REFS       46       110      111
   3153  BPSITD     REAL                / /          REFS       45   DEFINED      107     108
      0  C          REAL      ARRAY     / /          REFS        3         6        7       8       9      10      11
                                                       12       13        16       17      18      19      20      21
                                                       22       23        24       25      26      27      28      31
                                                       32       33        34       35      36      37      38      39
                                                       40       41        42       43      44      45      46      47
                                                       48       49        50       51      52      55      56      57
                                                       58       59        60       61      62      63      64      65
                                                       66       67        68       69      70      71      72      73
                                                       74
   3246  CFA11      REAL                / /          REFS       19        82       92
   3252  CFA12      REAL                / /          REFS       20        83       92
   3256  CFA13      REAL                / /          REFS       21        84       92
   3262  CFA21      REAL                / /          REFS       22        82       93
   3266  CFA22      REAL                / /          REFS       23        83       93
   3272  CFA23      REAL                / /          REFS       24        84       93
   3276  CFA31      REAL                / /          REFS       25        82       94
   3302  CFA32      REAL                / /          REFS       26        83       94
   3306  CFA33      REAL                / /          REFS       27        84       94
   3326  CRAD       REAL                / /          REFS       13       108
   3133  DMASS      REAL                / /          REFS        7        77       78      79
   2423  FXBA       REAL                / /          REFS       16        77
   2424  FYBA       REAL                / /          REFS       17        78
   2425  FZBA       REAL                / /          REFS       18        79
   3146  OPTARG     REAL                / /          REFS       11       105
    562  RANGE      REAL                / /          REFS       74       122
   3142  RDELX      REAL                / /          REFS       51       122
   3143  RDELY      REAL                / /          REFS       62       122
   3144  RDELZ      REAL                / /          REFS       53       122
   3162  RTXE       REAL                / /          REFS       48
   3157  RTXED      REAL                / /          REFS       47   DEFINED      114
   3166  RTYE       REAL                / /          REFS       50
   3163  RTYED      REAL                / /          REFS       49   DEFINED      115
   3172  RTZE       REAL                / /          REFS       52
   3167  RTZED      REAL                / /          REFS       51   DEFINED      116
   3116  RXE        REAL                / /          REFS       38
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VARIABLES     SN   TYPE            RELOCATION
  3113  RXED       REAL               / /       REFS      37   DEFINED     100
  3122  RYE        REAL               / /       REFS      40
  3117  RYED       REAL               / /       REFS      39   DEFINED     101
  3126  RZE        REAL               / /       REFS      42
  3123  RZED       REAL               / /       REFS      41   DEFINED     102
  3717  T          REAL               / /       REFS      28
  3145  VCLSNG     REAL               / /       REFS      64   DEFINED     122
  3137  VDELX      REAL               / /       REFS      58       122  DEFINED    118
  3140  VDELY      REAL               / /       REFS      59       122  DEFINED    119
  3141  VDELZ      REAL               / /       REFS      60       122  DEFINED    120
  3176  VDXB       REAL               / /       REFS      68        95  DEFINED     92
  3177  VDYB       REAL               / /       REFS      69        96  DEFINED     93
  3200  VDZB       REAL               / /       REFS      70        97  DEFINED     94
  3152  VTARG      REAL               / /       REFS      44     2*108      110    111    112
  3147  VTARGD     REAL               / /       REFS      43   DEFINED      106
  3173  VTXE       REAL               / /       REFS      55       114      118  DEFINED    110
  3174  VTYE       REAL               / /       REFS      56       115      119  DEFINED    111
  3175  VTZE       REAL               / /       REFS      57       116      120  DEFINED    112
  3102  VXE        REAL               / /       REFS      32       100      118
  3077  VXED       REAL               / /       REFS      31        92       93     94  DEFINED   87
  3106  VYE        REAL               / /       REFS      34       101      119
  3103  VYED       REAL               / /       REFS      33        92       93     94  DEFINED   88
  3112  VZE        REAL               / /       REFS      36       102      120
  3107  VZED       REAL               / /       REFS      35        92       93     94  DEFINED   89

 EXTERNALS        TYPE   ARGS       REFERENCES
        COSD      REAL     1          2*110      111
        SIND      REAL     1            111      112

 STATEMENT LABELS               DEF LINE    REFERENCES
     0  10            INACTIVE     100

 COMMON BLOCKS    LENGTH     MEMBERS - BIAS NAME(LENGTH)
      / /          3830                  0 C      (3830)

 EQUIV CLASSES    LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C       C         3830          370 RANGE  (1)        1299 FX3A   (1)          1300 FYBA   (1)
                                1301 FZ3A   (1)        1599 VXED   (1)          1602 VXE    (1)
                                1603 VYED   (1)        1605 VYE    (1)          1507 VZED   (1)
                                1610 VZE    (1)        1611 RXED   (1)          1614 RXE    (1)
                                1615 RYED   (1)        1618 RYE    (1)          1619 RZED   (1)
                                1622 RZE    (1)        1623 AX3A   (1)          1624 AYBA   (1)
                                1625 AZ3A   (1)        1625 AGRAV  (1)          1527 DMASS  (1)
                                1620 ATHRST (1)        1629 ATJRNT (1)          1630 BGAMT  (1)
                                1631 VDELX  (1)        1632 VDELY  (1)          1633 VDELZ  (1)
                                1634 RDELX  (1)        1635 RDELY  (1)          1636 RDELZ  (1)
                                1637 VCLSNG (1)        1638 OPTARG (1)          1639 VTARGD (1)
                                1642 VTARG  (1)        1643 BPSITD (1)          1646 BPSIT  (1)
                                1647 RTXED  (1)        1650 RTXE   (1)          1651 RTYED  (1)
                                1654 RTYE   (1)        1655 RTZED  (1)          1658 RTZE   (1)
                                1659 VTXE   (1)        1660 VTYE   (1)          1661 VTZE   (1)
                                1662 VDXB   (1)        1663 VDYB   (1)          1664 VDZB   (1)
                                1675 ANGX   (1)        1676 ANGY   (1)          1677 ANGZ   (1)
                                1680 ADIVE  (1)        1702 CFA11  (1)          1706 CFA12  (1)
                                1710 CFA13  (1)        1714 CFA21  (1)          1718 CFA22  (1)
                                1722 CFA23  (1)        1726 CFA31  (1)          1730 CFA32  (1)
                                1734 CFA33  (1)        1750 CRAD   (1)          1999 T      (1)
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SUBROUTINE D1          74/74   OPT=1                    FTN 4.2+75067     05/15/75  16.17.37.     PAGE   5

STATISTICS
  PROGRAM LENGTH                1333     31
  CM BLANK COMMON LENGTH       73663   3830
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      SUBROUTINE O2I                                              01   371
C**ROTATIONAL DYNAMICS INITIALIZATION MODULE O2IEUL               01   372
      COMMON C(3530)                                              01   373
      DIMENSION IPL (100)                                         01   374
C**INPUT DATA                                                     01   375
      EQUIVALENCE (C(1752),BPHIO )                                01   376
      EQUIVALENCE (C(1753),BTHTO )                                01   377
      EQUIVALENCE (C(1754),BPSIO )                                01   378
C**INPUTS FROM MAIN PROGRAM                                        01   379
      EQUIVALENCE (C(2561),N     )                                01   380
      EQUIVALENCE (C(2562),IPL   )                                01   381
C**STATE VARIABLE OUTPUTS                                          01   382
      EQUIVALENCE (C(1703),CFA11 )                                01   383
      EQUIVALENCE (C(1707),CFA12 )                                01   384
      EQUIVALENCE (C(1711),CFA13 )                                01   385
      EQUIVALENCE (C(1715),CFA21 )                                01   386
      EQUIVALENCE (C(1719),CFA22 )                                01   387
      EQUIVALENCE (C(1723),CFA23 )                                01   388
      EQUIVALENCE (C(1727),CFA31 )                                01   389
      EQUIVALENCE (C(1731),CFA32 )                                01   390
      EQUIVALENCE (C(1735),CFA33 )                                01   391
C**OTHER OUTPUTS                                                  01   392
      EQUIVALENCE (C(1755),A021  )                                01   393
      EQUIVALENCE (C(1756),A022  )                                01   394
      EQUIVALENCE (C(1757),A023  )                                01   395
      EQUIVALENCE (C(1758),A031  )                                01   396
      EQUIVALENCE (C(1759),A032  )                                01   397
      EQUIVALENCE (C(1760),A033  )                                01   398
C**INITIAL CALCULATION OF EULER ANGLE MATRIX OF DIRECTION COSINES (CFA) 01   399
      USPHI = SIND(BPHIO)                                         01   400
      UCPHI = COSD(BPHIO)                                         01   401
      USTHT = SIND(BTHTO)                                         01   402
      UCTHT = COSD(BTHTO)                                         01   403
      USPSI = SIND(BPSIO)                                         01   404
      UCPSI = COSD(BPSIO)                                         01   405
      CFA11 = UCPSI*UCTHT                                         01   406
      CFA12 = USPSI*UCTHT                                         01   407
      CFA13 = -USTHT                                              01   408
      CFA21 = -USPSI*UCPHI+UCPSI*USTHT*USPHI                      01   409
      CFA22 = UCPSI*UCPHI+USPSI*USTHT*USPHI                       01   410
      CFA23 = UCTHT*USPHI                                         01   411
      CFA31 = UCPSI*USTHT*UCPHI+USPSI*USPHI                       01   412
      CFA32 = USPSI*USTHT*UCPHI-UCPSI*USPHI                       01   413
      CFA33 = UCTHT*UCPHI                                         01   414
C                                                                 01   415
C**INITIALIZE MATRIX COEF FOR FREE GYRO MODEL(S)                   01   416
C                                                                 01   417
C**INTEGRATED PARAMATER LIST (IPL) FOR WPO,WQO,WRO,AND CFAO        01   418
      IPL(N) = 1700                                               01   419
      IPL(N+1) = 1704                                             01   420
      IPL(N+2) = 1708                                             01   421
      IPL(N+3) = 1712                                             01   422
      IPL(N+4) = 1716                                             01   423
      IPL(N+5) = 1720                                             01   424
      IPL(N+6) = 1724                                             01   425
      IPL(N+7) = 1728                                             01   426
      IPL(N+8) = 1732                                             01   427
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      SUBROUTINE D2I          74/74   OPT=1                     FTN 4.2+75067     05/05/75  16.17.40.      PAGE    2

                  IPL(N+9)  = 1736
                  IPL(N+10) = 1740                                          01       428
   60             IPL(N+11) = 1744                                          01       429
                  N = N+12                                                  01       430
                  RETURN                                                    01       431
                  END                                                       01       432
                                                                            01       433
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        SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE     REFERENCES
     1   D2I               1         62

  VARIABLES     SN   TYPE              RELOCATION
     3332   A021     REAL                    / /      REFS      23
     3333   A022     REAL                    / /      REFS      24
     3334   A023     REAL                    / /      REFS      25
     3335   A031     REAL                    / /      REFS      26
     3336   A032     REAL                    / /      REFS      27
     3337   A033     REAL                    / /      REFS      28
     3327   BPHIO    REAL                    / /      REFS       6      30      31
     3331   BPSIO    REAL                    / /      REFS       8      34      35
     3330   BTHIO    REAL                    / /      REFS       7      32      33
        0   C        REAL        ARRAY       / /      REFS       3       6       7       8      10      11      13
                                                            14      15      16      17      18      19      20      21
                                                            23      24      25      26      27      28
     3246   CFA11    REAL                    / /      REFS      13  DEFINED     36
     3252   CFA12    REAL                    / /      REFS      14  DEFINED     37
     3256   CFA13    REAL                    / /      REFS      15  DEFINED     38
     3262   CFA21    REAL                    / /      REFS      16  DEFINED     39
     3266   CFA22    REAL                    / /      REFS      17  DEFINED     40
     3272   CFA23    REAL                    / /      REFS      18  DEFINED     41
     3276   CFA31    REAL                    / /      REFS      19  DEFINED     42
     3302   CFA32    REAL                    / /      REFS      20  DEFINED     43
     3306   CFA33    REAL                    / /      REFS      21  DEFINED     44
     5001   IFL      INTEGER     ARRAY       / /      REFS       4      11  DEFINED     49      50      51      52
                                                            53      54      55      56      57      58      59      60
     5000   N        INTEGER                 / /      REFS      10      49      50      51      52      53      54
                                                            55      56      57      58      59      60      61
                                                       DEFINED      51
       73   UCPHI    REAL                             REFS      39      40      42      43      44
                                                       DEFINED      31
       77   UCPSI    REAL                             REFS      36      39      40      42      43
                                                       DEFINED      35
       75   UCTHT    REAL                             REFS      36      37      41      44  DEFINED     33
       72   USPHI    REAL                             REFS      39      40      41      42      43
                                                       DEFINED      30
       76   USPSI    REAL                             REFS      37      39      40      42      43
                                                       DEFINED      34
       74   USTHT    REAL                             REFS      38      39      40      42      43
                                                       DEFINED      32

  EXTERNALS         TYPE    ARGS       REFERENCES
            COSD    REAL       1             31      33      35
            SIND    REAL       1             33      32      34

  COMMON BLOCKS   LENGTH      MEMBERS - BIAS NAME(LENGTH)
        //          3830                   0 C    (3830)

  EQUIV-CLASSES   LENGTH      MEMBERS - BIAS NAME(LENGTH)
  C        C        3830         1702 CFA11  (1)          1706 CFA12  (1)          1710 CFA13  (1)
                                 1714 CFA21  (1)          1718 CFA22  (1)          1722 CFA23  (1)
                                 1726 CFA31  (1)          1730 CFA32  (1)          1734 CFA33  (1)
                                 1751 BPHIO  (1)          1752 BTHIO  (1)          1753 BPSIO  (1)
                                 1754 A021   (1)          1755 A022   (1)          1756 A023   (1)
```

```
SUBROUTINE D2I          74/74   OPT=1                       FTN 4.2+75067     05/15/75  16.17.40.     PAGE    4

EQUIV CLASSES   LENGTH   MEMBERS - BIAS NAME(LENGTH)
                           1757 A031    (1)          1758 A032   (1)          1759 A033   (1)
                           2550 N       (1)          2551 IPL    (100)

STATISTICS
  PROGRAM LENGTH             1003      64
  CM BLANK COMMON LENGTH    73653    3930
```

```
      SUBROUTINE D2                                              D2   2
C**   ROTATIONAL DYNAMICS MODULE                                 D2   3
      COMMON C(3530)                                             D2   4
C                                                                D2   5
C**DATA INPUTS                                                   D2   6
      EQUIVALENCE (C(1748),FMIX )                                D2   7
      EQUIVALENCE (C(1749),FMIY )                                D2   8
      EQUIVALENCE (C(1750),FMIZ )                                D2   9
      EQUIVALENCE (C(1751),CRAD )                                D2  10
      EQUIVALENCE (C(4503),OPTN3)                                D2  11
C                                                                D2  12
C**INPUTS FROM OTHER MODULES                                     D2  13
      EQUIVALENCE (C(1303),FMXBA )                               D2  14
      EQUIVALENCE (C(1304),FMYBA )                               D2  15
      EQUIVALENCE (C(1305),FMZBA )                               D2  16
C                                                                D2  17
C**STATE VARIABLE OUTPUTS                                        D2  18
      EQUIVALENCE (C(1700),CFA11D)                               D2  19
      EQUIVALENCE (C(1703),CFA11 )                               D2  20
      EQUIVALENCE (C(1704),CFA12D)                               D2  21
      EQUIVALENCE (C(1707),CFA12 )                               D2  22
      EQUIVALENCE (C(1708),CFA13D)                               D2  23
      EQUIVALENCE (C(1711),CFA13 )                               D2  24
      EQUIVALENCE (C(1712),CFA21D)                               D2  25
      EQUIVALENCE (C(1715),CFA21 )                               D2  26
      EQUIVALENCE (C(1716),CFA22D)                               D2  27
      EQUIVALENCE (C(1719),CFA22 )                               D2  28
      EQUIVALENCE (C(1720),CFA23D)                               D2  29
      EQUIVALENCE (C(1723),CFA23 )                               D2  30
      EQUIVALENCE (C(1724),CFA31D)                               D2  31
      EQUIVALENCE (C(1727),CFA31 )                               D2  32
      EQUIVALENCE (C(1728),CFA32D)                               D2  33
      EQUIVALENCE (C(1731),CFA32 )                               D2  34
      EQUIVALENCE (C(1732),CFA33D)                               D2  35
      EQUIVALENCE (C(1735),CFA33 )                               D2  36
      EQUIVALENCE (C(1736),WPD   )                               D2  37
      EQUIVALENCE (C(1739),WP    )                               D2  38
      EQUIVALENCE (C(1740),WQD   )                               D2  39
      EQUIVALENCE (C(1743),WQ    )                               D2  40
      EQUIVALENCE (C(1744),WRD   )                               D2  41
      EQUIVALENCE (C(1747),WR    )                               D2  42
C                                                                D2  43
C**INTEGRATE BODY ANGULAR RATES                                  D2  44
      IF (OPTN3.GT.0.) GO TO 55                                  D2  45
      WPD = CRAD*FMXBA/FMIX                                      D2  46
   55 WQD = (CRAD*FMYBA+(FMIZ-FMIX)*WP*WR/CRAD)/FMIY             D2  47
   65 WRD = (CRAD*FMZBA+(FMIX-FMIY)*WP*WQ/CRAD)/FMIZ             D2  48
C                                                                D2  49
C**INTEGRATE ATTITUDE DIRECTION COSINES                          D2  50
   49 CFA11D=(CFA21*WR-CFA31*WQ)/CRAD                            D2  51
      CFA12D=(CFA22*WR-CFA32*WQ)/CRAD                            D2  52
      CFA13D=(CFA23*WR-CFA33*WQ)/CRAD                            D2  53
      CFA21D = (CFA31*WP-CFA11*WR)/CRAD                          D2  54
      CFA22D = (CFA32*WP-CFA12*WR)/CRAD                          D2  55
      CFA23D = (CFA33*WP-CFA13*WR)/CRAD                          D2  56
      CFA31D = (CFA11*WQ-CFA21*WP)/CRAD                          D2  57
      CFA32D = (CFA12*WQ-CFA22*WP)/CRAD                          D2  58
```

```
      CFA33D = (CFA13*W2-CFA23*WP)/CRAD                                D2      59
      RETURN                                                           D2      60
   60 END                                                              D2      61
```

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      SUBROUTINE D2          74/74    OPT=1                      FTN 4.2+75067      05/35/75  16.17.42.        PAGE     3

          SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS        DEF LINE     REFERENCES
      1   D2               1          59

  VARIABLES        SN   TYPE              RELOCATION
     0   C              REAL          ARRAY     / /        REFS        3        6        7        8        9       10       13
                                                           14         15       18       19       20       21       22       23
                                                           24         25       26       27       28       29       30       31
                                                           32         33       34       35       36       37       38       39
                                                           40         41
    3246   CFA11        REAL                    / /        REFS       19       53       56
    3243   CFA11D       REAL                    / /        REFS       18    DEFINED     50
    3252   CFA12        REAL                    / /        REFS       21       54       57
    3247   CFA12D       REAL                    / /        REFS       20    DEFINED     51
    3256   CFA13        REAL                    / /        REFS       23       55       58
    3253   CFA13D       REAL                    / /        REFS       22    DEFINED     52
    3262   CFA21        REAL                    / /        REFS       25       50       56
    3257   CFA21D       REAL                    / /        REFS       24    DEFINED     53
    3266   CFA22        REAL                    / /        REFS       27       51       57
    3263   CFA22D       REAL                    / /        REFS       26    DEFINED     54
    3272   CFA23        REAL                    / /        REFS       29       52       58
    3267   CFA23D       REAL                    / /        REFS       28    DEFINED     55
    3276   CFA31        REAL                    / /        REFS       31       50       53
    3273   CFA31D       REAL                    / /        REFS       30    DEFINED     56
    3302   CFA32        REAL                    / /        REFS       33       51       54
    3277   CFA32D       REAL                    / /        REFS       32    DEFINED     57
    3306   CFA33        REAL                    / /        REFS       35       52       55
    3303   CFA33D       REAL                    / /        REFS       34    DEFINED     58
    3326   CRAD         REAL                    / /        REFS        9       45      2*45     2*47      50       51       52
                                                           53         54       55       56       57       58
    3323   FMIX         REAL                    / /        REFS        6       45       46       47
    3324   FMIY         REAL                    / /        REFS        7       46       47
    3325   FMIZ         REAL                    / /        REFS        8       46       47
    2426   FMXBA        REAL                    / /        REFS       13       45
    2427   FMYBA        REAL                    / /        REFS       14       46
    2430   FMZBA        REAL                    / /        REFS       15       47
    6656   OPTN3        REAL                    / /        REFS       10       44
    3312   WP           REAL                    / /        REFS       37       46       47       53       54       55       56
                                                           57         58
    3307   WPD          REAL                    / /        REFS       36    DEFINED     45
    3316   WQ           REAL                    / /        REFS       39       47       50       51       52       56       57
                                                           58
    3313   WQD          REAL                    / /        REFS       38    DEFINED     46
    3322   WR           REAL                    / /        REFS       41       46       50       51       52       53       54
                                                           55
    3317   WRD          REAL                    / /        REFS       40    DEFINED     47

  STATEMENT LABELS              DEF LINE   REFERENCES
     0  49        INACTIVE         50
     6  55                         46         44
     0  65        INACTIVE         47

  COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
    / /           3836             0 C      (3830)
```

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SUBROUTINE D2        74/74    OPT=1                    FTN 4.2+75057      05/15/75  16.17.42.     PAGE    4

EQUIV CLASSES   LENGTH   MEMBERS - BIAS NAME(LENGTH)
C       C        3830       1302 FMXBA   (1)        1303 FMYBA   (1)        1304 FMZBA   (1)
                            1699 CFA11D  (1)        1702 CFA11   (1)        1703 CFA12D  (1)
                            1706 CFA12   (1)        1707 CFA13D  (1)        1710 CFA13   (1)
                            1711 CFA21D  (1)        1714 CFA21   (1)        1715 CFA22D  (1)
                            1718 CFA22   (1)        1719 CFA23D  (1)        1722 CFA23   (1)
                            1723 CFA31D  (1)        1726 CFA31   (1)        1727 CFA32D  (1)
                            1730 CFA32   (1)        1731 CFA33D  (1)        1734 CFA33   (1)
                            1735 WPD     (1)        1738 WP      (1)        1739 WQD     (1)
                            1742 WQ      (1)        1743 WRD     (1)        1746 WR      (1)
                            1747 FMIX    (1)        1748 FMIY    (1)        1749 FMIZ    (1)
                            1750 GRAD    (1)        3502 OPTN3   (1)

STATISTICS
  PROGRAM LENGTH             643      52
  CM BLANK COMMON LENGTH   73663    3830
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```
      SUBROUTINE S1I                                                S1        2
C**SEEKER INIT. MODULE                                              S1        3
      COMMON C(3830)                                                S1        4
      DIMENSION IZ(50), IY(50), ISNDX(40)                           S1        5
      EQUIVALENCE (C(3634), ISNDX), (C(3512), I3512)                S1        6
      EQUIVALENCE (C( 470), BTGERR)                                 S1        7
      EQUIVALENCE (C( 471), BPGERR)                                 S1        8
      EQUIVALENCE (C( 465), SOY)                                    S1        9
      EQUIVALENCE (C( 466), SOZ)                                    S1       10
    1 FORMAT(5X,2HBZ,6X,4(I13,I11)/(13X,4(I13,I11)))                S1       11
    2 FORMAT(5X,2HBY,6X,4(I13,I11)/(13X,4(I13,I11)))                S1       12
      EQUIVALENCE (C(11),BY)                                        S1       13
      EQUIVALENCE (C(12),BZ)                                        S1       14
      EQUIVALENCE(C(2011),KSTEP)                                    S1       15
      EQUIVALENCE(C(500),IZ)                                        S1       16
      EQUIVALENCE(C(550),IY)                                        S1       17
      DIMENSION IPL(100)                                            S1       18
      EQUIVALENCE (C(452),SWP)                                      S1       19
      EQUIVALENCE(C(0411),WLQ)                                      S1       20
      EQUIVALENCE(C(0415),WLR)                                      S1       21
      EQUIVALENCE (C(0419),WLQS)                                    S1       22
      EQUIVALENCE (C(0423),WLRS)                                    S1       23
      EQUIVALENCE (C(0427),BTHTG)                                   S1       24
      EQUIVALENCE (C(0431),BPSIG)                                   S1       25
      EQUIVALENCE (C(2561),N)                                       S1       26
      EQUIVALENCE (C(2562),IPL)                                     S1       27
      EQUIVALENCE (C(4504),OPIN4)                                   S1       28
      EQUIVALENCE (C( 523),    DERIV)                               LAG       3
      IPL(N)=424                                                    S1       29
      IPL(N+1)=423                                                  S1       30
      IPL(N+2)=403                                                  S1       31
      IPL(N+3)=412                                                  S1       32
      IPL(N+4)=415                                                  S1       33
      IPL(N+5)=423                                                  S1       34
      N=N+6                                                         S1       35
      C(411)=0.                                                     S1       36
      C(415)=0.                                                     S1       37
      C(419)=0.                                                     S1       38
      C(423)=0.                                                     S1       39
      BY=0.                                                         S1       40
      BZ=0.                                                         S1       41
      SOY = 0.                                                      S1       42
      SOZ = 0.                                                      S1       43
      DO 10 I = 1, I3512                                            S1       44
      IDO = I                                                       S1       45
C                                                                   S1       46
C MONTE CARLO SEEKER OUTPUT STARTING VALUES                         S1       47
C                                                                   S1       48
      IF(ISNDX(I).EQ.11) CALL MCARLO (DUM, 1, IDO)                  S1       49
      IF(ISNDX(I).EQ.12) CALL MCARLO (DUM, 1, IDO)                  S1       50
      IF(ISNDX(I).EQ.450) CALL MCARLO (DUM, 1, IDO)                 S1       51
      IF(ABS(BY).GT.0. ) BY = SIGN(1.,BY)                           S1       52
      IF(ABS(BZ).GT.0. ) BZ = SIGN(1.,BZ)                           S1       53
C                                                                   S1       54
C  MONTE CARLO SEEKER POINTING ERROR                                S1       55
C                                                                   S1       56
      IF(ISNDX(I).EQ.470) CALL MCARLO (DUM, 1, IDO)                 S1       57
```

```
      IF(ISNDX(I).EQ.471) CALL MCARLO (DUM, 1, IDO)                S1    58
C                                                                  S1    59
C ** MONTECARLO SEEKER DRIFT                                       S1    60
      IF(ISNDX(I).EQ.465) CALL MCARLO (DUM, 1, IDO)                S1    61
      IF(ISNDX(I).EQ.466) CALL MCARLO (DUM, 1, IDO)                S1    62
C                                                                  S1    63
   10 CONTINUE                                                     S1    64
      BTHTG = BTHTG + BTGERR                                       S1    65
      BPSIG = BPSIG + BPGERR                                       S1    66
C                                                                  S1    67
      WLQS=SWP*(BTHTG-BPSIG)                                       S1    68
      WLQ=SWP*(BTHTG-BPSIG)                                        S1    69
      WLR=SWP*(BTHTG+BPSIG)                                        S1    70
      WLRS=SWP*(BTHTG+BPSIG)                                       S1    71
      C(13) = -1.                                                  S1    72
      DERSV=.002                                                   LAG    4
      C(461)=0.                                                    S1    73
      C(462)=0.                                                    S1    74
      C(463)=0.                                                    S1    75
      C(464)=0.                                                    S1    76
      IF(OPTN4.GT.1.) GO TO 30                                     S1    77
      C(461)=1.                                                    S1    78
      C(462)=1.                                                    S1    79
      C(463)=1.                                                    S1    80
      C(464)=1.                                                    S1    81
   30 CONTINUE                                                     S1    82
      NI=1                                                         S1    83
      MI=1                                                         S1    84
      SET=0.                                                       S1    85
      DO 200 I=1,50                                                S1    86
      IZ(I)=0                                                      S1    87
  200 IY(I)=0                                                      S1    88
      RETURN                                                       S1    89
      ENTRY QD                                                     S1    90
      IF(SET.GT.0.) RETURN                                         S1    91
      IF(NI.GT.50) RETURN                                          S1    92
      IF(MI.LE.10) GO TO 100                                       S1    93
      NI=NI+1                                                      S1    94
      MI=1                                                         S1    95
  100 IZ(NI)=IZ(NI)+INT(BZ+2.)*10**(10-MI)                         S1    96
      IY(NI)=IY(NI)+INT(BY+2.)*10**(10-MI)                         S1    97
      MI=MI+1                                                      S1    98
      RETURN                                                       S1    99
      ENTRY SB                                                     S1   100
      IF(SET.GT.0..OR.KSTEP.NE.2) RETURN                           S1   101
      SET=1.                                                       S1   102
      WRITE(6,1) (IZ(I),I=1,NI)                                    S1   103
      WRITE(6,2) (IY(I),I=1,NI)                                    S1   104
      RETURN                                                       S1   105
      END                                                          S1   106
```

```
SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
  126  QU             31        92      93     106
    1  S1I             1        30
  160  S8            101       102     105

VARIABLES      SN  TYPE          RELOCATION
  726  BPGERR      REAL                 / /     REFS       7      56
  656  BPSIG       REAL                 / /     REFS      24      66      58      69      70      71
                                             DEFINED      56
  725  BTGERR      REAL                 / /     REFS       6      65
  652  BTHTG       REAL                 / /     REFS      23      65      58      69      70      71
                                             DEFINED      65
   12  BY          REAL                 / /     REFS      12    2*52      98 DEFINED      40      52
   13  BZ          REAL                 / /     REFS      13    2*53      37 DEFINED      41      53
    0  C           REAL        ARRAY    / /     REFS       3     2*5       6       7       8       9      12
                                                  13      14      15      16      18      19      20      21
                                                  22      23      24      25      26      27      28
                                             DEFINED      36      37      38      39      72      74      75
                                                  76      77      79      80      81      82
 1156  DERSV       REAL                 / /     REFS      28 DEFINED      73
  244  DUM         REAL                         REFS      49      50      51      57      58      51      62
  242  I           INTEGER                      REFS      45      49      50      51      57      58      61
                                                  62      88      89     104     105 DEFINED      44      87
                                                 104     105
  243  IDO         INTEGER                      REFS      49      50      51      57      58      51      62
                                             DEFINED      45
 5001  IPL         INTEGER     ARRAY    / /     REFS      17      26 DEFINED      29      30      31      32
                                                  33      34
 7061  ISNDX       INTEGER     ARRAY    / /     REFS       4       5      49      50      51      57      58
                                                  61      62
 1211  IY          INTEGER     ARRAY    / /     REFS       4      15      98     105 DEFINED      89      98
 1127  IZ          INTEGER     ARRAY    / /     REFS       4      15      97     104 DEFINED      88      97
 6667  I3512       INTEGER              / /     REFS       5      44
 3732  KSTEP       INTEGER              / /     REFS      14     102
  246  MI          INTEGER                      REFS      34      97      99      99 DEFINED      85      96
                                                  99
 5000  N           INTEGER              / /     REFS      25      29      30      31      32      33      34
                                                  35 DEFINED      35
  245  NI          INTEGER                      REFS      33      95    2*97    2*98     104     105
                                             DEFINED      94      95
 6657  OPTN4       REAL                 / /     REFS      27      78
  720  SDY         REAL                 / /     REFS       8 DEFINED      42
  721  SDZ         REAL                 / /     REFS       9 DEFINED      43
  247  SET         REAL                         REFS      32     102 DEFINED      86     103
  703  SWP         REAL                 / /     REFS      18      58      59      70      71
  632  WLQ         REAL                 / /     REFS      19 DEFINED      69
  642  WLQS        REAL                 / /     REFS      21 DEFINED      58
  636  WLR         REAL                 / /     REFS      20 DEFINED      70
  646  WLRS        REAL                 / /     REFS      22 DEFINED      71

FILE NAMES          MODE
      TAPE6         FMT                       WRITES     104     105
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SUBROUTINE S1I        74/74   OPT=1                    FTN 4.2+75067    05/05/75  16.17.45.    PAGE   4

EXTERNALS        TYPE   ARGS       REFERENCES
    MCARLO                3          49        50      51      57      58      61      62

INLINE FUNCTIONS    TYPE     ARGS        DEF LINE  REFERENCES
    ABS             REAL       1  INTRIN              52      53
    INT             INTEGER    1  INTRIN              97      98
    SIGN            REAL       2  INTRIN              52      53

STATEMENT LABELS             DEF LINE   REFERENCES
    213  1        FMT             10       104
    220  2        FMT             11       105
      0  10                       64        44
    116  30                       83        78
    140  100                      97        94
      0  200                      89        87

LOOPS  LABEL     INDEX      FROM-TO    LENGTH    PROPERTIES
   22  10       * I          44 64       523                 EXT REFS
  123  200        I          87 89        28     INSTACK

COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
    / /          3830                  0 C      (3830)

EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
  G      C        3836              10 BY     (1)            11 BZ     (1)           410 WLQ     (1)
                                   414 WLR    (1)           416 WLAS   (1)           422 WLRS    (1)
                                   425 BTHTG  (1)           430 BPSIG  (1)           451 SWP     (1)
                                   464 SDY    (1)           465 SDZ    (1)           469 BTGERR  (1)
                                   473 BPSERR (1)           599 IZ     (50)          622 DERSV   (1)
                                   649 IY     (50)         2010 KSTCP  (1)          2550 N       (1)
                                  2561 IPL    (100)        3503 OPTN4  (1)          3511 I3512   (1)
                                  3633 ISNDX  (40)

STATISTICS
  PROGRAM LENGTH                   2503     168
  CM BLANK COMMON LENGTH          73663    3830
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      SUBROUTINE S1                                          S1     107
C**SEEKER MODULE                                             S1     108
C                                                            S1     109
      COMMON C(3330)                                         S1     110
      EQUIVALENCE (C(2000),T     )                           S1     111
  101 FORMAT (30H    TARGET ACQUISITION    T = ,F8.4,        S1     112
     *       10H   EPS Z = ,1PE11.3,10H   EPS Y = ,1PE11.3)  S1     113
  102 FORMAT (30H    PITCH PLANE TRACK     T = ,F8.4,        S1     114
     *       10H   EPS Z = ,1PE11.3,10H   EPS Y = ,1PE11.3)  S1     115
  103 FORMAT (30H      YAW   PLANE TRACK   T = ,F8.4,        S1     116
     *       10H   EPS Z = ,1PE11.3,10H   EPS Y = ,1PE11.3)  S1     117
C                                                            S1     118
C**INPUT DATA                                                S1     119
      EQUIVALENCE (C( 443),RLOCK )                           S1     120
      EQUIVALENCE (C( 445),DT    )                           S1     121
      EQUIVALENCE (C( 447),BOB   )                           S1     122
      EQUIVALENCE (C( 448),CFOVZ )                           S1     123
      EQUIVALENCE (C( 449),CFOVY )                           S1     124
      EQUIVALENCE (C( 450),GSX   )                           S1     125
      EQUIVALENCE (C( 451),SEPS  )                           S1     126
      EQUIVALENCE (C( 452),SHP   )                           S1     127
      EQUIVALENCE (C( 453),RBK   )                           S1     128
      EQUIVALENCE (C( 454),GEO   )                           S1     129
      EQUIVALENCE (C( 455),OPTNSK)                           S1     130
      EQUIVALENCE (C(0456),GS    )                           S1     131
      EQUIVALENCE (C(0457),WSL   )                           S1     132
      EQUIVALENCE (C(0458),WSN   )                           S1     133
      EQUIVALENCE (C(0459),WL2   )                           S1     134
C                                                            S1     135
      EQUIVALENCE (C( 460),ST    )                           S1     136
      EQUIVALENCE (C( 461),CAGE  )                           S1     137
      EQUIVALENCE (C( 462),TKRZ  )                           S1     138
      EQUIVALENCE (C( 463),TKRY  )                           S1     139
      EQUIVALENCE (C( 464),TRKZY )                           S1     140
C                                                            S1     141
C**INPUTS FROM OTHER MODULES                                 S1     142
      EQUIVALENCE (C(0371),RANGE )                           S1     143
      EQUIVALENCE (C(0372),RXBA  )                           S1     144
      EQUIVALENCE (C(0373),RYBA  )                           S1     145
      EQUIVALENCE (C(0374),RZBA  )                           S1     146
      EQUIVALENCE (C(1739),WP    )                           S1     147
      EQUIVALENCE (C(1743),WQ    )                           S1     148
      EQUIVALENCE (C(1747),WR    )                           S1     149
C                                                            S1     150
C**STATE VARIABLE OUTPUTS                                    S1     151
      EQUIVALENCE (C(0408),WLQD  )                           S1     152
      EQUIVALENCE (C(0411),WLQ   )                           S1     153
      EQUIVALENCE (C(0412),WLRD  )                           S1     154
      EQUIVALENCE (C(0415),WLR   )                           S1     155
      EQUIVALENCE (C(0416),WLQSD )                           S1     156
      EQUIVALENCE (C(0419),WLQS  )                           S1     157
      EQUIVALENCE (C(0420),WLRSD )                           S1     158
      EQUIVALENCE (C(0423),WLRS  )                           S1     159
      EQUIVALENCE (C(0424),BTHTGD)                           S1     160
      EQUIVALENCE (C(0427),BTHTG )                           S1     161
      EQUIVALENCE (C(0428),BPSIGD)                           S1     162
      EQUIVALENCE (C(0431),BPSIG )
```

```
C
C**OTHER-OUTPUTS
      EQUIVALENCE (C(11),BY)
      EQUIVALENCE (C(12),BZ)
      EQUIVALENCE (C(0403),WLAMQ )
      EQUIVALENCE (C(0407),WLAMR )
      EQUIVALENCE (C(0435),BEPSZ )
      EQUIVALENCE (C(0436),BEPSY )
      EQUIVALENCE (C(0437),WZ    )
      EQUIVALENCE (C(0438),WY    )
      EQUIVALENCE (C(0439),BGDEFL)
      EQUIVALENCE (C( 465),   SDY)
      EQUIVALENCE (C( 465),   SDZ)
C
C**DIRECTION COSINES FOR BODY TO PLATFORM TRANSFORMATION
      BTACT = BTHTG
      BPACT = BPSIG
      UCT=COSD(BTACT)
      UST=SIND(BTACT)
      UCP=COSD(BPACT)
      USP=SIND(BPACT)
      UB11 = UCT*UCP
      UB12 = UCT*USP
      UB13 =-UST
      UB21 =-USP
      UB22 = UCP
      UB23 = 0.
      UB31 = UST*UCP
      UB32 = UST*USP
      UB33 = UCT
C
C** CALCULATE TOTAL DEFLECTION OF GIMBALS
      BGDEFL=SQRT(BTHTG**2+BPSIG**2)
C
C**TRANSFORM LOS FROM BODY TO GIMBAL AXES
      RXG = UB11*RXBA+UB12*RYBA+UB13*RZBA
      RYG = UB21*RXBA+UB22*RYBA+UB23*RZBA
      RZG = UB31*RXBA+UB32*RYBA+UB33*RZBA
C
C**LOS ERRORS IN PLATFORM COORDINATES
      BEPSZ = ATAND(-RZG,RXG)
      BEPSY = ATAND( RYG,RXG)
C
C**SEEKER OUTPUT SIGNALS
      IF (OPTNSK.LE.0.) GO TO 80
C
C**VIDICON TRACKER
      IF (RANGE .LT. R3K) RETURN
      WLAMQ = GEO*BEPSZ
      WLAMR = GEO*BEPSY
      GO TO 30
C
C**QUADRENT TRACKER
   80 CONTINUE
      IF(C(1975).LE.0.) GO TO 82
      IF(T.LT.(ST-.000001)) GO TO 82
      IF(C(13).LE.0.) GO TO 820
```

```
      C(13) = -1.
      ST = T
      C(2664) = DT / AINT(DT / C(2764))
  820 CONTINUE
      ST = ST + DT
      IF (RANGE .GT. RLOCK) GO TO 81
      CZ = 2.*BEPSZ/DFOVZ
      CY = 2.*BEPSY/DFOVY
      IF (CZ**2 .GT. 1.-CY**2) GO TO 81
      BZ = SIGN(1.,BEPSZ)
      BY = SIGN(1.,BEPSY)
      TKDB = BDB/2.*(RANGE/32810.)**2
      IF (ABS(BEPSZ).LT.TKDB) BZ = 0.
      IF (ABS(BEPSY).LT.TKDB) BY = 0.
      CALL GD
      IF (CAGE .GT. 0.) GO TO 82
      UZ = BZ
      UY = BY
      CAGE = 1.
      WRITE(6,101) T, BEPSZ, BEPSY
      GO TO 82
   81 BZ = 0.
      BY = 0.
C**SEEKER COMPENSATION
   82 WLAMQ = BZ*GS
      WLAMR = BY*GS
      WQP = WLAMQ
      WRP = WLAMR
      IF (WSL .LE. 0.) GO TO 83
      WLQD = WLAMQ
      WLRD = WLAMR
      WLQD = WLQD + SEPS
      WLRD = WLRD + SEPS
      WQP = WLQD/WSL + WLQ
      WRP = WLRD/WSL + WLR
      WLAMQ = WQP
      WLAMR = WRP
      IF (WSN .LE. 0.) GO TO 83
      WLQSD = WSN*(WQP - WLQS)
      WLRSD = WSN*(WRP - WLRS)
      WQP = WLQSD/WL2 + WLQS
      WRP = WLRSD/WL2 + WLRS
C**SEEKER SWITCHING LOGIC
   83 IF (CAGE .LE. 0.) GO TO 30
C  PITCH PLANE
   10 IF (TKRZ .GT. 0.) GO TO 20
      IF (BZ*UZ .GE. 0.) GO TO 12
      TKRZ = 1.
      WRITE(6,102) T, BEPSZ, BEPSY
      GO TO 20
   12 WLAMQ = BZ*GSX
      WQP = WLAMQ
      WLQD = 0.
      WLQSD = 0.
      UZ = BZ
C  YAW PLANE
   20 IF (TKRY .GT. 0.) GO TO 30
```

```
      IF (BY*UY .GE. 0.) GO TO 22                                       S1   278
      IKRY = 1                                                          S1   279
      WRITE(5,103) T, BEPSZ, BEPSY                                      S1   280
      GO TO 30                                                          S1   281
   22 WLAMR = BY*GSX                                                    S1   282
      WRP = WLAMR                                                       S1   283
      WLRD = 0.                                                         S1   284
      WLRSD = 0.                                                        S1   285
      UY = BY                                                           S1   286
   30 CONTINUE                                                          S1   287
C                                                                       S1   288
C**MISSILE BODY RATES IN GIMBAL AXES                                    S1   289
      WZ = UB31*WP+UB32*WQ+UB33*WR                                      S1   290
      WY = UB21*WP+UB22*WQ+UB23*WR                                      S1   291
C                                                                       S1   292
C**GIMBAL COUPLING                                                      S1   293
      UZK = SKP*(-BTHIG + .1*BPSIG)                                     S1   294
      UYK = SKP*(-BPSIG - .1*BTHIG)                                     S1   295
      UZK = UZK + SDZ                                                   S1   296
      UYK = UYK + SDY                                                   S1   297
C                                                                       S1   298
C**GIMBAL ANGLE DERIVATIVES                                             S1   299
      BTHIGD = WQP + UZK - WY                                           S1   300
      BPSIGD = WRP + UYK - WZ/UB33                                      S1   301
C                                                                       S1   302
      IF (CAGE .GT. 0.) RETURN                                          S1   303
      WLAMQ = 0.                                                        S1   304
      WLAMR = 0.                                                        S1   305
      WLQD = 0.                                                         S1   306
      WLRD = 0.                                                         S1   307
      WLQSD = 0.                                                        S1   308
      WLRSD = 0.                                                        S1   309
      BTHIGD = 0.                                                       S1   310
      BPSIGD = 0.                                                       S1   311
      RETURN                                                            S1   312
      END                                                               S1   313
C**HELFIRE AUTOPILOT INITIATION MODULE                                  S1   314
C**HIGH FREQ. MODEL                                                     S1   315
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 SUBROUTINE S1        74/74  OPT=1                 FTN 4.2+75067     05/05/75  16.17.47.     PAGE   5

     SYMBOLIC REFERENCE MAP (R=2)

 ENTRY POINTS     DEF LINE     REFERENCES
    1  S1              1         105     137     206

 VARIABLES     SN   TYPE           RELOCATION
   676  BOB         REAL                  / /     REFS       16      126
   663  BEPSY       REAL                  / /     REFS       65      107      122      125      128      134      163
                                                  174   DEFINED       99
   662  BEPSZ       REAL                  / /     REFS       64      106      121      124      127      134      163
                                                  174   DEFINED       98
   666  BGDEFL      REAL                  / /     REFS       58   DEFINED      90
   364  BPACT       REAL                          REFS       77       78   DEFINED      74
   656  BPSIG       REAL                  / /     REFS       57       74       90      188      189
   653  BPSIGD      REAL                  / /     REFS       56   DEFINED     195      205
   363  BTACT       REAL                          REFS       75       76   DEFINED      73
   652  BTHTG       REAL                  / /     REFS       55       73       90      188      189
   647  BTHTGD      REAL                  / /     REFS        4   DEFINED     194      204
    12  BY          REAL                  / /     REFS       60      132      140      172      176      180
                                               DEFINED      125      128      137
    13  BZ          REAL                  / /     REFS       61      131      139      161      165      159
                                               DEFINED      124      127      136
     0  C           REAL        ARRAY     / /     REFS        4        5       14       15       16       17       18
                                                   19        20       21       22       23       24       25       26
                                                   27        28       30       31       32       33       34       37
                                                   38        39       40       41       42       43       46       47
                                                   48        49       50       51       52       53       54       55
                                                   55        57       60       61       62       63       64       65
                                                   66        67       68       59       70      112      114      116
                                               DEFINED      115      117
   714  CAGE        REAL                  / /     REFS       31      130      158      197   DEFINED      133
   700  CFOVY       REAL                  / /     REFS       18      122
   677  CFOVZ       REAL                  / /     REFS       17      121
   406  CY          REAL                          REFS      123   DEFINED      122
   405  CZ          REAL                          REFS      123   DEFINED      121
   675  DT          REAL                  / /     REFS       15    2*117      119
   705  GEO         REAL                  / /     REFS       23      106      107
   707  GS          REAL                  / /     REFS       25      139      140
   701  GSX         REAL                  / /     REFS       19      165      176
   706  OPTNSK      REAL                  / /     REFS       24      102
   562  RANGE       REAL                  / /     REFS       37      105      120      126
   704  RBK         REAL                  / /     REFS       22      105
   674  RLOCK       REAL                  / /     REFS       14      120
   563  RXBA        REAL                  / /     REFS       38       93       94       95
   402  RXG         REAL                          REFS       98       99   DEFINED       93
   564  RYBA        REAL                  / /     REFS       39       93       94       95
   403  RYG         REAL                          REFS       39   DEFINED       94
   565  RZBA        REAL                  / /     REFS       40       93       34       95
   404  RZG         REAL                          REFS       38   DEFINED       95
   720  SDY         REAL                  / /     REFS       69      191
   721  SDZ         REAL                  / /     REFS       70      190
   702  SEPS        REAL                  / /     REFS       20      146      147
   713  ST          REAL                  / /     REFS       30      113      119   DEFINED      116      119
   703  SWP         REAL                  / /     REFS       21      186      189
  3717  T           REAL                  / /     REFS        5      113      116      134      163      174
   407  TKDB        REAL                          REFS      127      128   DEFINED      126
   716  TKRY        REAL                  / /     REFS       33      171   DEFINED      173
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      SUBROUTINE S1          74/74   OPT=1                          FTN 4.2+75067      05/05/75  16.17.47.        PAGE    6

--VARIABLES      SN   TYPE            RELOCATION
    715   TKRZ        REAL                 / /        REFS        32      160    DEFINED      162
    717   TRKZY       REAL                 / /        REFS        34
    371   UB11        REAL                            REFS        33   DEFINED       79
    372   UB12        REAL                            REFS        33   DEFINED       80
    373   UB13        REAL                            REFS        33   DEFINED       81
    374   UB21        REAL                            REFS        34      185    DEFINED       82
    375   UB22        REAL                            REFS        34      185    DEFINED       83
    376   UB23        REAL                            REFS        34      185    DEFINED       84
    377   UB31        REAL                            REFS        35      184    DEFINED       85
    400   UB32        REAL                            REFS        35      184    DEFINED       86
    401   UB33        REAL                            REFS        35      184       195    DEFINED      87
    367   UCP         REAL                            REFS        79       83        85    DEFINED      77
    365   UCT         REAL                            REFS        79       80        87    DEFINED      75
    370   USP         REAL                            REFS        50       82        86    DEFINED      78
    366   UST         REAL                            REFS        51       85        86    DEFINED      76
    411   UY          REAL                            REFS       172   DEFINED      132       180
    415   UYK         REAL                            REFS       131      195    DEFINED      189       191
    410   UZ          REAL                            REFS       151   DEFINED      131       169
    414   UZK         REAL                            REFS       130      194    DEFINED      188       130
    622   WLANQ       REAL                 / /        REFS        52      141       144       166    DEFINED    186     139
                                                       150       165      198
    626   WLANR       REAL                 / /        REFS        53      142       145       177    DEFINED    187     140
                                                       151       176      139
    632   WLQ         REAL                 / /        REFS        47      148
    627   WLQD        REAL                 / /        REFS        46      146       148    DEFINED      144       146     167
                                                       200
    642   WLQS        REAL                 / /        REFS        51      153       155
    637   WLQSD       REAL                 / /        REFS        50      155    DEFINED      153       158       202
    636   WLR         REAL                 / /        REFS        49      149
    633   WLRD        REAL                 / /        REFS        48      147       149    DEFINED      145       147     178
                                                       201
    646   WLRS        REAL                 / /        REFS        53      154       156
    643   WLRSD       REAL                 / /        REFS        52      156    DEFINED      154       179       203
    712   WL2         REAL                 / /        REFS        28      155       156
   3312   WP          REAL                 / /        REFS        41      184       185
   3316   WQ          REAL                 / /        REFS        42      184       185
    412   WQP         REAL                            REFS       150      153       134    DEFINED      141       148     155
                                                       166
   3322   WR          REAL                 / /        REFS        43      184       185
    413   WRP         REAL                            REFS       151      154       195    DEFINED      142       149     156
                                                       177
    710   WSL         REAL                 / /        REFS        26      143       148       149
    711   WSN         REAL                 / /        REFS        27      152       153       154
    665   WY          REAL                 / /        REFS        67      194    DEFINED      185
    664   WZ          REAL                 / /        REFS        56      195    DEFINED      184

  FILE NAMES          MODE
        TAPE6         FMT                      WRITES    134       153      174

--EXTERNALS           TYPE   ARGS         REFERENCES
        ATAND         REAL     2              93        93
        COSD          REAL     1              73        77
        QU                     6             123
        SIND          REAL     1              73        76
        SQRT          REAL     1 LIBRARY      93
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SUBROUTINE S1          74/74  OPT=1                         FTN 4.2+75067     05/05/75  16.17.47.      PAGE    7

INLINE FUNCTIONS   TYPE   ARGS         DEF LINE  REFERENCES
     ABS           REAL    1  INTRIN              127        128
     AINT          REAL    1  INTRIN              117
     SIGN          REAL    2  INTRIN              124        125

 STATEMENT LABELS                   DEF LINE   REFERENCES
     0   10           INACTIVE        160
   202   12                           165       151
   207   20                           171       151        164
   217   22                           175       172
   224   30                           181       108        158       171       175
    61   80                           111       102
   135   81                           135       121        123
   137   82                           139       112        113       130       135
   171   83                           158       143        152
   274  101         FMT                 5       134
   306  102         FMT                 8       163
   320  103         FMT                10       174
    74  820                           118       114

 COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
     / /          3830                 0 C       (3830)

 EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C        C       3830                10 BY      (1)       11 BZ      (1)       370 RANGE   (1)
                                     371 RX3A    (1)      372 RY3A    (1)       373 RZ3A    (1)
                                     402 W_AMQ   (1)      405 WLAMR   (1)       407 WLQD    (1)
                                     410 WLQ     (1)      411 WLRD    (1)       414 WLR     (1)
                                     415 WLQSD   (1)      418 WLQS    (1)       419 WLRSD   (1)
                                     422 WLRS    (1)      423 BTHTGD  (1)       426 BTHTG   (1)
                                     427 BPSIGD  (1)      430 BPSIG   (1)       434 BEPSZ   (1)
                                     435 BEPSY   (1)      436 WZ      (1)       437 WY      (1)
                                     438 BGDEF   (1)      444 RLOCK   (1)       445 DT      (1)
                                     446 SD3     (1)      447 CFOVZ   (1)       448 CFOVY   (1)
                                     449 GSX     (1)      450 SEPS    (1)       451 SWP     (1)
                                     452 KBK     (1)      453 GEO     (1)       454 OPTNSK  (1)
                                     455 GS      (1)      456 WS      (1)       457 WSN     (1)
                                     458 W_2     (1)      459 ST      (1)       460 CAGE    (1)
                                     461 TKRZ    (1)      462 TKRY    (1)       463 TRKZY   (1)
                                     464 SDY     (1)      465 SDZ     (1)      1738 WP      (1)
                                    1742 WQ      (1)     1746 WR      (1)      1999 T       (1)

 STATISTICS
   PROGRAM LENGTH              4168     270
   CM BLANK COMMON LENGTH    .73668    3830
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      SUBROUTINE C1I                                C1        2
      COMMON C(3830)                                C1        3
      DIMENSION IPL(10))                            C1        4
      EQUIVALENCE (C(2561),N    )                   C1        5
      EQUIVALENCE (C(2562),IPL   )                  C1        6
C                                                   C1        7
      IPL(N  ) = 800                                C1        8
      IPL(N+1) = 804                                C1        9
      IPL(N+2) = 808                                C1       10
      IPL(N+3) = 812                                C1       11
      IPL(N+4) = 815                                C1       12
      IPL(N+5) = 820                                C1       13
      IPL(N+6) = 824                                C1       14
      IPL(N+7) = 828                                C1       15
      IPL(N+8) = 832                                C1       16
      IPL(N+9) = 836                                C1       17
      IPL(N+10) = 840                               C1       18
      IPL(N+11) = 844                               C1       19
      IPL(N+12) = 848                               C1       20
      IPL(N+13) = 852                               C1       21
      N = N+14                                      C1       22
      C(803) = 0.                                   C1       23
      C(807) = 0.                                   C1       24
      C(811) = 0.                                   C1       25
      C(815) = 0.                                   C1       26
      C(819) = 0.                                   C1       27
      C(823) = 0.                                   C1       28
      C(827) = 0.                                   C1       29
      C(831) = 0.                                   C1       30
      C(835) = 0.                                   C1       31
      C(839) = 0.                                   C1       32
      C(843) = 0.                                   C1       33
      C(847) = 0.                                   C1       34
      C(851) = 0.                                   C1       35
      C(855) = 0.                                   C1       36
      C( 811) = C( 878) + C (851)                   C1       37
      C( 823) = C( 879)                             C1       38
      C( 831) =-C(1233)                             C1       39
      C( 847) =-C( 831)                             C1       40
      C( 839) = C( 831)                             C1       41
      IF (C(877) .LE. 0.) RETURN                    C1       42
      IPL(N  ) = 901                                C1       43
      IPL(N+1) = 905                                C1       44
      IPL(N+2) = 909                                C1       45
      C( 904) = 0.                                  C1       46
      C( 908) = 0.                                  C1       47
      C( 912) = 0.                                  C1       48
      RETURN                                        C1       49
      END                                           C1       50
C**HELFIRE AUTOPILOT MODULE                         C1       51
C**HIGH FREQ MODEL (USE DER = .0025)                C1       52
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SUBROUTINE C1I          74/74   OPT=1                                    FTN 4.2+75057       05/05/75  16.17.52.        PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE      REFERENCES
    1  C1I             1            41       43

 VARIABLES      SN   TYPE           RELOCATION
     0  C             REAL        ARRAY    / /          REFS        2        4        5      2*36      37       38       39
                                                                   40       41   DEFINED     22       23       24       25       26
                                                                   27       28       29       30       31       32       33       34
                                                                   35       36       37       38       39       40       45       46
                                                                   47
  5001  IPL           INTEGER     ARRAY    / /          REFS        3        5   DEFINED      7        8        9       10
                                                                   11       12       13       14       15       16       17       18
                                                                   19       20       42       43       44
  5003  N             INTEGER              / /          REFS        4        7        8        9       10       11       12
                                                                   13       14       15       16       17       18       19       20
                                                                   21       42       43       44   DEFINED      21

 COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
   / /             3830                   0 C       (3830)

 EQUIV-CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C        C         3830           2560 N       (1)                 2551 IPL       (103)

 STATISTICS
   PROGRAM LENGTH                  553      45
   CM BLANK COMMON LENGTH        73663    3830
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      SUBROUTINE C1                                              C1     53
      COMMON C(3830)                                             C1     54
      DIMENSION BDELTC(4),VAR(101)                               C1     55
C                                                                C1     56
C**INPUT DATA                                                     C1     57
      EQUIVALENCE (C( 850),TOY    )                              C1     58
      EQUIVALENCE (C( 851),GBIAS )                               C1     59
      EQUIVALENCE (C( 852),GN    )                               C1     60
      EQUIVALENCE (C( 853),WN2   )                               C1     61
      EQUIVALENCE (C( 854),WN1   )                               C1     62
      EQUIVALENCE (C( 865),WL    )                               C1     63
      EQUIVALENCE (C( 855),WLXX1 )                               C1     64
      EQUIVALENCE (C( 857),WLXX2 )                               C1     65
      EQUIVALENCE (C( 858),WLJK1 )                               C1     66
      EQUIVALENCE (C( 859),WLJK2 )                               C1     67
      EQUIVALENCE (C( 870),WJK   )                               C1     68
      EQUIVALENCE (C( 871),WXX   )                               C1     69
      EQUIVALENCE (C( 872),DXX   )                               C1     70
      EQUIVALENCE (C( 873),WJK   )                               C1     71
      EQUIVALENCE (C( 874),DJK   )                               C1     72
      EQUIVALENCE (C( 875),GXX   )                               C1     73
      EQUIVALENCE (C( 875),GJK   )                               C1     74
      EQUIVALENCE (C( 877),RES   )                               C1     75
      EQUIVALENCE (C( 878),QBIAS )                               C1     76
      EQUIVALENCE (C( 879),RBIAS )                               C1     77
      EQUIVALENCE (C( 880),HXX   )                               C1     78
C                                                                C1     79
C**INPUTS FROM OTHER MODULES                                      C1     80
      EQUIVALENCE (C(  77),SPHI   )                              C1     81
      EQUIVALENCE (C(  87),STHT   )                              C1     82
      EQUIVALENCE (C(  97),SPSI   )                              C1     83
      EQUIVALENCE (C( 353),BPHI  )                               C1     84
      EQUIVALENCE (C( 354),BTHZ  )                               C1     85
      EQUIVALENCE (C( 355),BPSI  )                               C1     86
      EQUIVALENCE (C( 403),WLAMQ )                               C1     87
      EQUIVALENCE (C( 407),WLAMR )                               C1     88
      EQUIVALENCE (C( 451),CAGE  )                               C1     89
      EQUIVALENCE (C( 452),TKRZ  )                               C1     90
      EQUIVALENCE (C( 453),TKRY  )                               C1     91
      EQUIVALENCE (C(1551),O TH  )                               C1     92
      EQUIVALENCE (C(1552),UPHI  )                               C1     93
      EQUIVALENCE (C(1553),UPSI  )                               C1     94
      EQUIVALENCE (C(1554),UTHT  )                               C1     95
C                                                                C1     96
C**INPUTS FROM MAIN PROGRAM                                       C1     97
      EQUIVALENCE (C(2000),T     )                               C1     98
C                                                                C1     99
C** STATE VARIABLE OUTPUTS                                        C1    100
      EQUIVALENCE (C( 800),WLQSDD)                               C1    101
      EQUIVALENCE (C( 803),WLQSP )                               C1    102
      EQUIVALENCE (C( 804),WLQSD )                               C1    103
      EQUIVALENCE (C( 807),WLQS  )                               C1    104
      EQUIVALENCE (C( 808),WLQSSD)                               C1    105
      EQUIVALENCE (C( 811),WLQSS )                               C1    106
      EQUIVALENCE (C( 812),WLRSDD)                               C1    107
      EQUIVALENCE (C( 815),WLRSP )                               C1    108
      EQUIVALENCE (C( 816),WLRSD )                               C1    109
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```
      EQUIVALENCE (C( 819),WLRS   )
      EQUIVALENCE (C( 820),WLRSSD)
      EQUIVALENCE (C( 823),WLRSS )
      EQUIVALENCE (C( 824),BLQSSD)
      EQUIVALENCE (C( 827),BLQSS )
      EQUIVALENCE (C( 828),BLRSSD)
      EQUIVALENCE (C( 831),BLRSS )
      EQUIVALENCE (C( 832),BJJSDD)
      EQUIVALENCE (C( 835),BJJSP )
      EQUIVALENCE (C( 836),BJJSD )
      EQUIVALENCE (C( 839),BJJS  )
      EQUIVALENCE (C( 840),BKKSDD)
      EQUIVALENCE (C( 843),BKKSP )
      EQUIVALENCE (C( 844),BKKSD )
      EQUIVALENCE (C( 847),BKKS  )
      EQUIVALENCE (C( 848),BXXSDD)
      EQUIVALENCE (C( 851),BXXSP )
      EQUIVALENCE (C( 852),BXXSD )
      EQUIVALENCE (C( 855),BXXS  )
      EQUIVALENCE (C( 900),WNS   )
      EQUIVALENCE (C( 901),SNTH  )
      EQUIVALENCE (C( 904),STHP  )
      EQUIVALENCE (C( 905),SNPS  )
      EQUIVALENCE (C( 908),SPSP  )
      EQUIVALENCE (C( 909),SNPH  )
      EQUIVALENCE (C( 912),SPHP  )
C
C**OUTPUTS
      EQUIVALENCE (C( 856),BDELTC)
C
CM*OTHER OUTPUTS
      EQUIVALENCE (C( 880),BXX   )
      EQUIVALENCE (C( 881),BJJ   )
      EQUIVALENCE (C( 882),BKK   )
      EQUIVALENCE (C( 883),BXXSS )
      EQUIVALENCE (C( 884),BJJSS )
      EQUIVALENCE (C( 885),BKKSS )
      EQUIVALENCE (C( 886),BTHTS )
      EQUIVALENCE (C( 887),BPSIS )
C
C**GUIDANCE SIGNAL SHAPING
C**GUIDANCE SWITCHING
      WLQSD = WLQSP
      WLRSD = WLRSP
      WLQSDD = WN2*(WN2*(WLAMQ - WLQS) - 2.*WLQSD)
      WLRSDD = WN2*(WN2*(WLAMR - WLRS) - 2.*WLRSD)
      WQC = GN*(WLQSD/WL+WLQS) + QBIAS
      WRC = GN*(WLRSD/WL+WLRS) + RBIAS
      IF (TKRZ.GT.0. .AND. T.GT.TDY) GO TO 4
      WLQSDD = 0.
      WQC = QBIAS + GBIAS
      IF (CAGE.GT.0. .AND. T.GT.TDY) WQC = WLAMQ + GBIAS
    4 IF (TKRY .GT. 0.) GO TO 5
      WLRSDD = 0.
      WRC = RBIAS
      IF (CAGE .GT. 0.) WRC = WLAMR
    5 CONTINUE
```

```
      WLQSSD = WN1*(WQC - WLQSS)
      WLRSSD = WN1*(WRC - WLRSS)
      BLQSSD = WLQSS
      BLRSSD = WLRSS
C
C**RATE GYRO DYNAMICS AND LIMITING
      BTHTS = -BTH2
      BPSIS = -BPSI
      BXX   = -BPHI
      IF (RES .LE. 0.) GO TO 10
      SNTH = WNS*(STHT - STHP)
      SNPS = WNS*(SPSI - SPSP)
      SNPH = WNS*(SPHI - SPHP)
      BTHTS = -RES*AINT(BTH2/RES) + SNTH
      BPSIS = -RES*AINT(BPSI/RES) + SNPS
      BXX   = -RES*AINT(BPHI/RES) + SNPH
   10 CONTINUE
      IF (OPTN .LE. 0.) GO TO 15
      BTHTS = UTHT
      BPSIS = UPSI
      BXX   = UPHI
      BTH2 = -BTH2
      BPSI = -BPSI
      BPHI = -BPHI
   15 CONTINUE
C
C**SUMMATION OF RATE DAMPING AND GUIDANCE SIGNALS AND THEIR DERIVATIVES
      BJJ =-(BLRSS-BPSIS) - (BLQSS-BTHTS)
      BKK =-(BLRSS-BPSIS) - (BLQSS-BTHTS)
C
C**GUIDANCE SIGNAL SHAPING AND LIMITING
      BXXSD = BXXSP
      BJJSD = BJJSP
      BKKSD = BKKSP
      BXXSDD = WXX*(WXX*(BXX - BXXS) - 2.*DXX*BXXSD)
      BJJSDD = WJK*(WJK*(BJJ - BJJS) - 2.*DJK*BJJSD)
      BKKSDD = WJK*(WJK*(BKK - BKKS) - 2.*DJK*BKKSD)
      BXXSS = GXX*((BXXSDD + (WLXX1+WLXX2)*BXXSD)/(WLXX1*WLXX2) + BXXS)
      BJJSS = GJK*((BJJSDD + (WLJK1+WLJK2)*BJJSD)/(WLJK1*WLJK2) + BJJS)
      BKKSS = GJK*((BKKSDD + (WLJK1+WLJK2)*BKKSD)/(WLJK1*WLJK2) + BKKS)
      IF (ABS(BJJSS) .GT. HJK) BJJSS = SIGN(HJK,BJJSS)
      IF (ABS(BKKSS) .GT. HJK) BKKSS = SIGN(HJK,BKKSS)
      IF (ABS(BXXSS) .GT. HXX) BXXSS = SIGN(HXX,BXXSS)
C
C**COMMANDS TO ACTUATORS
      BDELTC(1) = BJJSS + BXXSS
      BDELTC(2) = BKKSS + BXXSS
      BDELTC(3) = BJJSS - BXXSS
      BDELTC(4) = BKKSS - BXXSS
      RETURN
      END
```

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SUBROUTINE C1          74/74  OPT=1                    FTN 4.2+75057     05/35/75  16.17.53.      PAGE   4

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
    1  C1              1        154

VARIABLES     SN  TYPE              RELOCATION
  1527  BDELTC     REAL      ARRAY    / /          REFS       3        86   DEFINED     160       161       162       163
  1560  BJJ        REAL               / /          REFS      90       150   DEFINED     142
  1566  BJJS       REAL               / /          REFS      58       150       153
  1503  BJJSD      REAL               / /          REFS      67       150       153   DEFINED     147
  1477  BJJSDD     REAL               / /          REFS      65       153   DEFINED     150
  1502  BJJSP      REAL               / /          REFS      66       147
  1563  BJJSS      REAL               / /          REFS      93     2*155       150       162   DEFINED     153       155
  1561  BKK        REAL               / /          REFS      91       151   DEFINED     143
  1516  BKKS       REAL               / /          REFS      72       151       154
  1513  BKKSD      REAL               / /          REFS      71       151       154   DEFINED     148
  1507  BKKSDD     REAL               / /          REFS      69       154   DEFINED     151
  1512  BKKSP      REAL               / /          REFS      70       148
  1564  BKKSS      REAL               / /          REFS      94     2*156       151       163   DEFINED     154       156
  1472  BLQSS      REAL               / /          REFS      62       142       143
  1467  BLQSSD     REAL               / /          REFS      61   DEFINED       117
  1476  BLRSS      REAL               / /          REFS      64       142       143
  1473  BLRSSD     REAL               / /          REFS      63   DEFINED       118
   540  BPH1       REAL               / /          REFS      32       123       130       138   DEFINED     138
  1566  BPSIS      REAL               / /          REFS      36       142       143   DEFINED     122       129       134
   542  BPS1       REAL               / /          REFS      34       122       129       137   DEFINED     137
  1565  BTHTS      REAL               / /          REFS      35       142       143   DEFINED     121       128       133
   541  BTH2       REAL               / /          REFS      33       121       128       136   DEFINED     136
  1557  BXX        REAL               / /          REFS      59       149   DEFINED       123       130       135
  1526  BXXS       REAL               / /          REFS      76       149       152
  1523  BXXSD      REAL               / /          REFS      75       149       152   DEFINED     146
  1517  BXXSDD     REAL               / /          REFS      73       152   DEFINED     149
  1522  BXXSP      REAL               / /          REFS      74       146
  1562  BXXSS      REAL               / /          REFS      92     2*157       160       161       162       163
                                               DEFINED     132       157
     0  C          REAL      ARRAY    / /          REFS       2         6         7         8         9        10        11
                                                     12      13        14        15        16        17        18        19
                                                     20      21        22        23        24        25        26        29
                                                     30      31        32        33        34        35        36        37
                                                     38      39        40        41        42        43        46        49
                                                     50      51        52        53        54        55        56        57
                                                     58      59        60        61        62        63        64        65
                                                     66      67        68        69        70        71        72        73
                                                     74      75        76        77        78        79        80        81
                                                     82      83        86        89        90        91        92        93
                                                     94      35        96
   714  CAGE       REAL               / /          REFS      37       109       113
  1551  DJK        REAL               / /          REFS      20       150       151
  1547  DXX        REAL               / /          REFS      18       149
  1534  GBIAS      REAL               / /          REFS       7       104       108       109
  1553  GJK        REAL               / /          REFS      22       153       154
  1535  GN         REAL               / /          REFS       8       104       105
  1552  GXX        REAL               / /          REFS      21       152
  1545  HJK        REAL               / /          REFS      16     2*155     2*156
  1571  HXX        REAL               / /          REFS      26     2*157
  3616  OPTM       REAL               / /          REFS      48       132
  1555  QBIAS      REAL               / /          REFS      24       108
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VARIABLES       SN  TYPE           RELOCATION
  1556  RBIAS       REAL              / /        REFS      25      105     112
  1554  RES         REAL              / /        REFS      23      124     2*128    2*129    2*130
  1614  SNPH        REAL              / /        REFS      32      130     DEFINED  127
  1610  SNPS        REAL              / /        REFS      80      129     DEFINED  126
  1604  SNTH        REAL              / /        REFS      78      128     DEFINED  125
   114  SPHI        REAL              / /        REFS      29      127
  1617  SPHP        REAL              / /        REFS      53      127
   140  SPSI        REAL              / /        REFS      31      126
  1613  SPSP        REAL              / /        REFS      81      126
  1607  STHP        REAL              / /        REFS      79      125
   126  STHT        REAL              / /        REFS      30      125
  3717  T           REAL              / /        REFS      46      106     139
  1533  TOT         REAL              / /        REFS       6      106     109
   716  TKRY        REAL              / /        REFS      39      110
   715  TKRZ        REAL              / /        REFS      38      106
  3017  UPHI        REAL              / /        REFS      41      135
  3020  UPSI        REAL              / /        REFS      42      134
  3021  UTHT        REAL              / /        REFS      43      133
   211  VAR         REAL     *UNDEF              REFS       3
  1550  WJK         REAL              / /        REFS      19      2*150   2*151
  1540  WL          REAL              / /        REFS      11      104     105
   622  WLAMQ       REAL              / /        REFS      35      102     109
   626  WLAMR       REAL              / /        REFS      36      103     113
  1543  WLJK1       REAL              / /        REFS      14      2*153   2*154
  1544  WLJK2       REAL              / /        REFS      15      2*153   2*154
  1446  WLQS        REAL              / /        REFS      52      102     104
  1443  WLQSD       REAL              / /        REFS      51      102     104      DEFINED  108
  1437  WLQSDD      REAL              / /        REFS      49      DEFINED 102      107
  1442  WLQSP       REAL              / /        REFS      50      100
  1452  WLQSS       REAL              / /        REFS      54      115     117
  1447  WLQSSD      REAL              / /        REFS      53      DEFINED 115
  1462  WLRS        REAL              / /        REFS      58      103     105
  1457  WLRSD       REAL              / /        REFS      57      103     105      DEFINED  101
  1453  WLRSDD      REAL              / /        REFS      55      DEFINED 103      111
  1456  WLRSP       REAL              / /        REFS      56      131
  1466  WLRSS       REAL              / /        REFS      60      116     118
  1463  WLRSSD      REAL              / /        REFS      59      DEFINED 116
  1541  WLXX1       REAL              / /        REFS      12      2*152
  1542  WLXX2       REAL              / /        REFS      13      2*152
  1603  WNS         REAL              / /        REFS      77      125     126      127
  1537  WN1         REAL              / /        REFS      10      115     116
  1536  WN2         REAL              / /        REFS       9      2*102   2*103
   207  WQC         REAL                         REFS     115      DEFINED 104      108      109
   210  WRC         REAL                         REFS     116      DEFINED 105      112      113
  1546  WXX         REAL              / /        REFS      17      2*149

 INLINE FUNCTIONS   TYPE   ARGS        DEF LINE  REFERENCES
        ABS         REAL     1  INTRIN             155      156     157
        AINT        REAL     1  INTRIN             128      129     130
        SIGN        REAL     2  INTRIN             155      156     157

 STATEMENT LABELS              DEF LINE   REFERENCES
    33  4                        110        105
    42  5                        114        113
    77  10                       131        124
   110  15                       139        132
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SUBROUTINE C1          74/74   OPT=1                      FTN 4.2+75087      05/15/75  16.17.53.        PAGE    6

COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
 / /             3830                0 C     (3830)

EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
C       C        3830               75 SPHI     (1)          85 STHT     (1)          96 SPSI     (1)
                                   352 BPH1     (1)         353 BTH2     (1)         354 BPS1     (1)
                                   402 WLAMQ    (1)         405 WLAMR    (1)         460 CAGE     (1)
                                   461 TKRZ*    (1)         462 TKRY     (1)         799 WLQSDD   (1)
                                   802 WLQSP    (1)         803 WLQSD    (1)         806 WLQS     (1)
                                   807 WLQSSD   (1)         810 WLQSS    (1)         811 WLRSDD   (1)
                                   814 WLRSP    (1)         815 WLRSD    (1)         818 WLRS     (1)
                                   819 WLRSSD   (1)         822 WLRSS    (1)         823 BLQSSD   (1)
                                   826 BLQSS    (1)         827 BLRSSD   (1)         830 BLRSS    (1)
                                   831 BJJSDD   (1)         834 BJJSP    (1)         835 BJJSD    (1)
                                   838 BJJS     (1)         839 BKKSDD   (1)         842 BKKSP    (1)
                                   843 BKKSD    (1)         846 BKKS     (1)         847 BXXSDD   (1)
                                   850 BKXSP    (1)         851 BKXSD    (1)         854 BXXS     (1)
                                   855 BDELTC   (4)         859 TDY      (1)         860 GBIAS    (1)
                                   861 GN       (1)         862 WN2      (1)         863 WN1      (1)
                                   864 WL       (1)         865 WLKK1    (1)         866 WLXX2    (1)
                                   867 WLJK1    (1)         868 WLJK2    (1)         869 HJK      (1)
                                   870 WXX      (1)         871 DXX      (1)         872 WJK      (1)
                                   873 DJK      (1)         874 GXX      (1)         875 GJK      (1)
                                   876 RES      (1)         877 QBIAS    (1)         878 RBIAS    (1)
                                   879 BXX      (1)         880 BJJ      (1)         881 BKK      (1)
                                   882 BXXSS    (1)         883 BJJSS    (1)         884 BKKSS    (1)
                                   885 BTHTS    (1)         885 BPSIS    (1)         889 HXX      (1)
                                   899 WNS      (1)         900 SNTH     (1)         903 STHP     (1)
                                   904 SNPS     (1)         937 SPSP     (1)         938 SNPH     (1)
                                   911 SPHP     (1)        1550 OPTH     (1)        1551 UPHI     (1)
                                  1552 UPSI     (1)        1553 UTHT     (1)        1999 T        (1)

STATISTICS
  PROGRAM LENGTH                 3563       238
  CM BLANK COMMON LENGTH        73663      3830
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      SUBROUTINE C2I                                             C2          2
C**HELFIRE AUTOPILOT INITIATION MODULE                           C2          3
C**LOW  FREQ. MODEL                                              C2          4
      COMMON C(3830)                                             C2          5
      DIMENSION IPL(100)                                         C2          6
      EQUIVALENCE (C(2561),N        )                            C2          7
      EQUIVALENCE (C(2552),IPL    )                              C2          8
C                                                                C2          9
      IPL(N  ) = 800                                             C2         10
      IPL(N+1) = 804                                             C2         11
      IPL(N+2) = 808                                             C2         12
      IPL(N+3) = 812                                             C2         13
      IPL(N+4) = 815                                             C2         14
      IPL(N+5) = 823                                             C2         15
      IPL(N+6) = 824                                             C2         16
      IPL(N+7) = 828                                             C2         17
      N = N+8                                                    C2         18
      C(2662) = .105                                             C2         19
      C(2663) = .005                                             C2         20
      C(2664) = .105                                             C2         21
      C(803) = 0.                                                C2         22
      C(807) = 0.                                                C2         23
      C(811) = 0.                                                C2         24
      C(815) = 0.                                                C2         25
      C(819) = 0.                                                C2         26
      C(823) = 0.                                                C2         27
      C(827) = 0.                                                C2         28
      C(831) = 0.                                                C2         29
      C( 811) = C( 861)                                          C2         30
      IF (C( 462) .GT. 0.) RETURN                                C2         31
      C( 811) = C( 978) + C( 861)                                C2         32
      C( 823) = C( 879)                                          C2         33
      RETURN                                                     C2         34
      END                                                        C2         35
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SUBROUTINE C2I          74/74  OPT=1                  FTN 4.2+75067    05/05/75  16.23.42.      PAGE   2

     SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     1  C2I            1          30       33

 VARIABLES      SN  TYPE            RELOCATION
     0  C           REAL       ARRAY   / /         REFS        4      6      7      29     30    2*31     32
                                                   DEFINED    18     19     20      21     22     23      24
                                                     25       26     27     28      29     31     32
  5001  IPL         INTEGER    ARRAY   / /         REFS        5      7   DEFINED    9     10     11      12
                                                     13       14     15     16
  5000  N           INTEGER                / /     REFS        6      9     10      11     12     13      14
                                                     15       16     17   DEFINED   17

 COMMON BLOCKS    LENGTH     MEMBERS - BIAS NAME(LENGTH)
    / /            3830                  0 C      (3830)

 EQUIV CLASSES    LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C       C          3830          2560 N       (1)               2561 IPL     (100)

 STATISTICS
   PROGRAM LENGTH                 368     30
   CM BLANK COMMON LENGTH       73663   3830
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      SUBROUTINE C2                                        C2      35
C**HELLFIRE AUTOPILOT MODULE                               C2      37
C**LOW  FREQ MODEL (USE DER = .005)                        C2      38
      COMMON C(3830)                                       C2      39
      DIMENSION BDELTC(4),VAR(101)                         C2      40
C                                                          C2      41
C**INPUT DATA                                              C2      42
      EQUIVALENCE (C( 860),TOY  )                          C2      43
      EQUIVALENCE (C( 861),GBIAS )                         C2      44
      EQUIVALENCE (C( 862),GN   )                          C2      45
      EQUIVALENCE (C( 863),WN2  )                          C2      46
      EQUIVALENCE (C( 864),WN1  )                          C2      47
      EQUIVALENCE (C( 865),WL   )                          C2      48
      EQUIVALENCE (C( 866),WLXX1 )                         C2      49
      EQUIVALENCE (C( 867),WLXX2 )                         C2      50
      EQUIVALENCE (C( 868),WLJK1 )                         C2      51
      EQUIVALENCE (C( 869),WLJK2 )                         C2      52
      EQUIVALENCE (C( 870),WJK  )                          C2      53
      EQUIVALENCE (C( 875),GXX  )                          C2      54
      EQUIVALENCE (C( 875),GJK  )                          C2      55
      EQUIVALENCE (C( 878),QBIAS )                         C2      56
      EQUIVALENCE (C( 879),RBIAS )                         C2      57
      EQUIVALENCE (C(3504),OPTN4 )                         C2      58
C                                                          C2      59
C**INPUTS FROM OTHER MODULES                               C2      60
      EQUIVALENCE (C( 353),BPH1 )                          C2      61
      EQUIVALENCE (C( 354),BTH2 )                          C2      62
      EQUIVALENCE (C( 355),BPSI )                          C2      63
      EQUIVALENCE (C( 393),BPH2 )                          C2      64
      EQUIVALENCE (C( 403),WLAM2 )                         C2      65
      EQUIVALENCE (C( 407),WLAMR )                         C2      66
      EQUIVALENCE (C( 461), AGE )                          C2      67
      EQUIVALENCE (C( 462),TKRZ )                          C2      68
      EQUIVALENCE (C( 463),TKRY )                          C2      69
      EQUIVALENCE (C(1733),WP   )                          C2      70
      EQUIVALENCE (C(1743),WQ   )                          C2      71
      EQUIVALENCE (C(1747),WR   )                          C2      72
      EQUIVALENCE (C(1735),WPD  )                          C2      73
      EQUIVALENCE (C(1740),WQD  )                          C2      74
      EQUIVALENCE (C(1744),WRD  )                          C2      75
C                                                          C2      76
C**INPUTS FROM MAIN PROGRAM                                C2      77
      EQUIVALENCE (C(2000),T    )                          C2      78
C                                                          C2      79
C** STATE VARIABLE OUTPUTS                                 C2      80
      EQUIVALENCE (C( 800),WLQSDD)                         C2      81
      EQUIVALENCE (C( 803),WLQSP )                         C2      82
      EQUIVALENCE (C( 804),WLQSD )                         C2      83
      EQUIVALENCE (C( 807),WLQS )                          C2      84
      EQUIVALENCE (C( 808),WLQSSD)                         C2      85
      EQUIVALENCE (C( 811),WLQSS )                         C2      86
      EQUIVALENCE (C( 812),WLRSDD)                         C2      87
      EQUIVALENCE (C( 815),WLRSP )                         C2      88
      EQUIVALENCE (C( 816),WLRSD )                         C2      89
      EQUIVALENCE (C( 819),WLRS  )                         C2      90
      EQUIVALENCE (C( 820),WLRSSD)                         C2      91
      EQUIVALENCE (C( 823),WLRSS )                         C2      92
```

```
      EQUIVALENCE (C( 826),BLQSSO)
      EQUIVALENCE (C( 827),BLQSS )
      EQUIVALENCE (C( 828),BLRSSO)
      EQUIVALENCE (C( 831),BLRSS )
C
C**OUTPUTS
      EQUIVALENCE (C( 855),BDELTC)
C
C**OTHER OUTPUTS
      EQUIVALENCE (C( 880),BXXS  )
      EQUIVALENCE (C( 881),BJJS  )
      EQUIVALENCE (C( 882),BKKS  )
      EQUIVALENCE (C( 883),BXXSS )
      EQUIVALENCE (C( 884),BJJSS )
      EQUIVALENCE (C( 885),BKKSS )
      EQUIVALENCE (C(830),WPERR)
      EQUIVALENCE (C(831),WPTIME)
C
      IF(T .LT. WPTIME) WP=WP+WPERR
C**GUIDANCE SIGNAL SHAPING
      WLQSD = WLQSP
      WLRSD = WLRSP
      WLQSDD = WN2*(WN2*(WLAMQ - WLQS) - 2.*WLQSD)
      WLRSDD = WN2*(WN2*(WLAMR - WLRS) - 2.*WLRSD)
      WQC = GN*(WLQSD/WL+WLQS) + QBIAS
      WRC = GN*(WLRSD/WL+WLRS)
C**GUIDANCE SWITCHING
      IF (OPTN4 .LE. 1.) GO TO 5
      IF (TKRZ.GT.0. .AND. T.GT.TDY) GO TO 4
      WLQSDD = 0.
      WQC = QBIAS + SBIAS
      IF (CAGE.GT.0. .AND. T.GT.TDY) WQC = WLAMQ + SBIAS
    4 IF (TKRY .GT. 0.) GO TO 5
      WLRSDD = 0.
      WRC = RBIAS
      IF (CAGE .GT. 0.) WRC = WLAMR
    5 CONTINUE
      WLQSSD = WN1*(WQC - WLQSS)
      WLRSSD = WN1*(WRC - WLRSS)
      BLQSSD = WLQSS
      BLRSSD = WLRSS
C
C**RATE GYRO DYNAMICS AND LIMITING
      CTH2 = COSD(BTH2)
      STH2 = SIND(BTH2)
      SPH1 = SIND(BPH1)
      CPH1 = COSD(BPH1)
      TPH2 = SIND(PH2)/COSD(PH2)
      TPS1 = SIND(PS1)/COSD(PS1)
      BTH    = -BTH2
      BXXS   = -BPH1
      BPS    = -BPS1
      BTHD   = -(-WQ   -(CTH2*WR  + STH2*WP )*TPH2)
      BTHDD  = -(-WQD  -(CTH2*WRD + STH2*WPD)*TPH2)
      BXXSD  = -(-WP   -(SPH1*WR  + CPH1*WP )*TPS1)
      BXXSDD = -(-WPD  -(SPH1*WRD + CPH1*WPD)*TPS1)
      BPSD   = -(      - CPH1*WR  (      *WP )
```

```
      BPSDD = -(      - CPHI*WRD + SPHI*WPD)                           C2     150
C                                                                      C2     151
C**SUMMATION OF RATE DAMPING AND GUIDANCE SIGNALS AND THEIR DERIVATIVES C2    152
      BJJS  =  (BLRSS -BPS  ) - (BLQSS -BTH  )                         C2     153
      BJJSD  =  (WLRSS -BPSD ) - (WLQSS -BTHD )                        C2     154
      BJJSDD =  (WLRSSD-BPSDD) - (WLQSSD-BTHDD)                        C2     155
      BKKS   = -(BLRSS -BPS  ) - (BLQSS -BTH  )                        C2     156
      BKKSD  = -(WLRSS -BPSD ) - (WLQSS -BTHD )                        C2     157
      BKKSDD = -(WLRSSD-BPSDD) - (WLQSSD-BTHDD)                        C2     158
C                                                                      C2     159
C**GUIDANCE SIGNAL SHAPING AND LIMITING                                C2     160
      BXXSS = GXX*((BXXSDD + (WLX(1+WLXX2)*BXXSD)/(WLXX1*WLXX2) + BXXS) C2    161
      BJJSS = GJK*((BJJSDD + (WLJK1+WLJK2)*BJJSD)/(WLJK1*WLJK2) + BJJS) C2    162
      BKKSS = GJK*((BKKSDD + (WLJK1+WLJK2)*BKKSD)/(WLJK1*WLJK2) + BKKS) C2    163
      IF (ABS(BJJSS) .GT. HJK) BJJSS = SIGN(HJK,BJJSS)                 C2     164
      IF (ABS(BKKSS) .GT. HJK) BKKSS = SIGN(HJK,BKKSS)                 C2     165
C                                                                      C2     166
C**COMMANDS TO ACTUATORS                                               C2     167
      BDELTC(1) = BJJSS + BXXSS                                        C2     168
      BDELTC(2) = BKKSS + BXXSS                                        C2     169
      BDELTC(3) = BJJSS - BXXSS                                        C2     170
      BDELTC(4) = BKKSS - BXXSS                                        C2     171
      RETURN                                                           C2     172
      END                                                              C2     173
C** INITIALIZATION MODULE FOR HELFIRE  SIMPLIFIED ACTUATOR              C2     174
C****** NON - LINEAR MODEL ******                                      C2     175
C                                                                      C2     176
```

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SUBROUTINE C2          74/74   OPT=1                          FTN 4.2+73067      05/05/75  16.23.43.     PAGE   4

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    1  C2            1          137

VARIABLES        SN  TYPE          RELOCATION
 1527  BDELTC        REAL     ARRAY   / /     REFS      5       54   DEFINED     133       134       135       136
 1560  BJJS          REAL             / /     REFS     58      127   DEFINED     118
  251  BJJSD         REAL                     REFS    127  DEFINED       119
  252  BJJSDD        REAL                     REFS    127  DEFINED       120
 1563  BJJSS         REAL             / /     REFS     71    2*129       133     135   DEFINED       127       129
 1561  BKKS          REAL             / /     REFS     59      128   DEFINED     121
  253  BKKSD         REAL                     REFS    128  DEFINED       122
  254  BKKSDD        REAL                     REFS    128  DEFINED       123
 1564  BKKSS         REAL             / /     REFS     72    2*130       134     136   DEFINED       128       130
 1472  BLQSS         REAL             / /     REFS     59      118       121
 1467  BLQSSD        REAL             / /     REFS     58  DEFINED        97
 1476  BLRSS         REAL             / /     REFS     51      118       121
 1473  BLRSSD        REAL             / /     REFS     60  DEFINED        98
  540  BPH1          REAL             / /     REFS     26      103       104     108
  610  BPH2          REAL             / /     REFS     29
  242  BPS           REAL                     REFS    118      121   DEFINED     109
  247  BPSD          REAL                     REFS    119      122   DEFINED     114
  250  BPSDD         REAL                     REFS    120      123   DEFINED     115
  542  BPS1          REAL             / /     REFS     28      109
  241  BTH           REAL                     REFS    118      121   DEFINED     107
  243  BTHD          REAL                     REFS    119      122   DEFINED     110
  244  BTHDD         REAL                     REFS    120      123   DEFINED     111
  541  BTH2          REAL             / /     REFS     27      101       102     107
 1557  BXXS          REAL             / /     REFS     67      126   DEFINED     108
  245  BXXSD         REAL                     REFS    126  DEFINED       112
  246  BXXSDD        REAL                     REFS    126  DEFINED       113
 1562  BXXSS         REAL             / /     REFS     70      133       134     135       136
                                           DEFINED    126
    0  C             REAL     ARRAY   / /     REFS      4        8         9      10        11        12        13
                                              14       15       16        17      18        19        20        21
                                              22       23       26        27      28        29        30        31
                                              32       33       34        35      36        37        38        39
                                              40       43       46        47      48        49        50        51
                                              52       53       54        55      56        57        58        59
                                              60       51       54        57      68        59        70        71
                                              72       73       74
  714  CAGE          REAL             / /     REFS     32       89        93
  234  CPH1          REAL                     REFS    112      113       114     115   DEFINED       104
  231  CTH2          REAL                     REFS    110      111   DEFINED     101
 1534  GBIAS         REAL             / /     REFS      9       82        88      89
 1553  GJK           REAL             / /     REFS     20      127       128
 1535  GN            REAL             / /     REFS     10       82        83
 1552  GXX           REAL             / /     REFS     19      126
 1545  HJK           REAL             / /     REFS     18    2*129     2*130
 6657  OPTN4         REAL             / /     REFS     23       85
  236  PH2           REAL                     REFS  2*105
  240  PS1           REAL                     REFS  2*106
 1555  QBIAS         REAL             / /     REFS     21       88
 1556  RBIAS         REAL             / /     REFS     22       92
  233  SPH1          REAL                     REFS    112      113       114     115   DEFINED       133
  232  STH2          REAL                     REFS    110      111   DEFINED     102
```

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 VARIABLES    SN  TYPE          RELOCATION
   3717  T         REAL              / /        REFS      43      76      86      89
   1533  TOY       REAL              / /        REFS       8      86      89
    716  TKRY      REAL              / /        REFS      34      90
    715  TKRZ      REAL              / /        REFS      33      86
    235  TPH2      REAL                         REFS     110     111   DEFINED   105
    237  TPS1      REAL                         REFS     112     113   DEFINED   106
    255  VAR       REAL      *UNDEF             REFS       5
   1540  WL        REAL              / /        REFS      13      82      83
    622  WLAMQ     REAL              / /        REFS      30      80      82
    626  WLAMR     REAL              / /        REFS      31      81      93
   1543  WLJK1     REAL              / /        REFS      16   2*127   2*128
   1544  WLJK2     REAL              / /        REFS      17   2*127   2*128
   1446  WLQS      REAL              / /        REFS      49      50      82
   1443  WLQSD     REAL              / /        REFS      48      80      92   DEFINED    78
   1437  WLQSDD    REAL              / /        REFS      46   DEFINED    90      87
   1442  WLQSP     REAL              / /        REFS      47      78
   1452  WLQSS     REAL              / /        REFS      51      95      97     119     122
   1447  WLQSSD    REAL              / /        REFS      50     120     123   DEFINED    95
   1462  WLRS      REAL              / /        REFS      55      81      83
   1457  WLRSD     REAL              / /        REFS      54      81      83   DEFINED    79
   1453  WLRSDD    REAL              / /        REFS      52   DEFINED    81      91
   1456  WLRSP     REAL              / /        REFS      53      79
   1466  WLRSS     REAL              / /        REFS      57      96      98     119     122
   1463  WLRSSD    REAL              / /        REFS      56     120     123   DEFINED    96
   1541  WLXX1     REAL              / /        REFS      14   2*126
   1542  WLXX2     REAL              / /        REFS      15   2*126
   1537  WN1       REAL              / /        REFS      12      95      96
   1536  WN2       REAL              / /        REFS      11    2*80    2*81
   3312  WP        REAL              / /        REFS      35      76     110   2*112     114
                                             DEFINED      76
   3307  WPO       REAL              / /        REFS      38     111   2*113     115
   1571  WPERR     REAL              / /        REFS      73      76
   1572  WPTIME    REAL              / /        REFS      74      76
   3316  WQ        REAL              / /        REFS      36     110
    227  WQC       REAL                         REFS      95   DEFINED    82      86      89
   3313  WQD       REAL              / /        REFS      39     111
   3322  WR        REAL              / /        REFS      37     110     112     114
    230  WRC       REAL                         REFS      96   DEFINED    83      92      93
   3317  WRD       REAL              / /        REFS      40     111     113     115

 EXTERNALS            TYPE    ARGS       REFERENCES
           COSD       REAL      1           101      104     105     106
           SIND       REAL      1           102      103     105     106

 INLINE FUNCTIONS     TYPE    ARGS       DEF LINE  REFERENCES
           ABS        REAL      1  INTRIN             129     130
           SIGN       REAL      2  INTRIN             129     130

 STATEMENT LABELS              DEF LINE   REFERENCES
     41   4                        90         85
     50   5                        34         85      90

 COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
        / /        3830               0  C      (3830)
```

```
--EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C        C         3830            352 BPH1    (1)         353 BT42    (1)         354 BPS1    (1)
                                    392 BPH2    (1)         402 WLAMQ   (1)         406 WLAMR   (1)
                                    460 UAGE    (1)         451 TKRZ    (1)         462 TKRY    (1)
                                    793 WLQSDO  (1)         802 WLQSP   (1)         803 WLQSD   (1)
                                    805 WLQS    (1)         807 WLQSSD  (1)         810 WLQSS   (1)
                                    811 WLRSDO  (1)         814 WLRSP   (1)         815 WLRSD   (1)
                                    818 WLRS    (1)         819 WLRSSD  (1)         822 WLRSS   (1)
                                    823 BLQSSD  (1)         825 BLQSS   (1)         827 BLRSSD  (1)
                                    830 BLRSS   (1)         855 BDELTC  (4)         859 TDY     (1)
                                    860 WBIAS   (1)         861 GN      (1)         862 WN2     (1)
                                    863 WN1     (1)         864 WL      (1)         865 WLXX1   (1)
                                    865 WLXX2   (1)         867 WLJK1   (1)         868 WLJK2   (1)
                                    869 WJK     (1)         874 GXX     (1)         875 GJK     (1)
                                    877 QBIAS   (1)         878 RBIAS   (1)         879 BXXS    (1)
                                    880 BJJS    (1)         881 BKKS    (1)         882 BXXSS   (1)
                                    883 BJJSS   (1)         884 BKKSS   (1)         889 WPERR   (1)
                                    890 WPTIME  (1)        1735 WPD     (1)        1738 WP      (1)
                                   1739 WQD     (1)        1742 WQ      (1)        1743 WRD     (1)
                                   1746 WR      (1)        1939 T       (1)        3503 OPTN4   (1)

 STATISTICS
   PROGRAM LENGTH                 4223     274
   CM BLANK COMMON LENGTH        73663    3830
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SUBROUTINE C4I   74/74   OPT=1   FTN 4.2+75057   05/05/75 16.23.47.   PAGE 1

```
      SUBROUTINE C4I                                          C4     2
      COMMON C(3830)                                          C4     3
      DIMENSION IPL(103), ISNDX(4))                           C4     4
      EQUIVALENCE (C(3534), ISNDX), (C(3512), I3512)          C4     5
      DIMENSION BDELT(4)                                      C4     6
      EQUIVALENCE (C(1103),BDELT1)                            C4     7
      EQUIVALENCE (C(1107),BDELT2)                            C4     8
      EQUIVALENCE (C(1111),BDELT3)                            C4     9
      EQUIVALENCE (C(1115),BDELT4)                            C4    10
      EQUIVALENCE (C(1247),FELECB )                           C4    11
      EQUIVALENCE (C(1248),FELECQ3)                           C4    12
      EQUIVALENCE (C(1249),FELECR3)                           C4    13
      EQUIVALENCE (C(1250),FMECHB )                           C4    14
      EQUIVALENCE (C(1251),FMECHQ3)                           C4    15
      EQUIVALENCE (C(1252),FMECHR3)                           C4    16
      EQUIVALENCE (C(1254), DELT3)                            C4    17
      EQUIVALENCE (C(1255),DELTQB)                            C4    18
      EQUIVALENCE (C(1255),DELTRB)                            C4    19
      EQUIVALENCE (C(1143),OPTACT)                            C4    20
      EQUIVALENCE (C(1231),BDP   )                            C4    21
      EQUIVALENCE (C(1232),BDQ   )                            C4    22
      EQUIVALENCE (C(1233),BDR   )                            C4    23
      EQUIVALENCE (C(2551),N     )                            C4    24
      EQUIVALENCE (C(2552),IPL   )                            C4    25
      IPL(N) = 1100                                           C4    26
      IPL(N+1) = 1104                                         C4    27
      IPL(N+2) = 1108                                         C4    28
      IPL(N+3) = 1112                                         C4    29
      N = N+4                                                 C4    30
      IF (OPTACT .LE. 0.) RETURN                              C4    31
      IPL(N  ) = 1159                                         C4    32
      IPL(N+1) = 1167                                         C4    33
      IPL(N+2) = 1174                                         C4    34
      IPL(N+3) = 1181                                         C4    35
      IPL(N+4) = 1153                                         C4    36
      IPL(N+5) = 1170                                         C4    37
      IPL(N+6) = 1177                                         C4    38
      IPL(N+7) = 1184                                         C4    39
      N = N+8                                                 C4    40
      C(1163) = 0.                                            C4    41
      C(1170) = 0.                                            C4    42
      C(1177) = 0.                                            C4    43
      C(1184) = 0.                                            C4    44
      C(1166) = 0.                                            C4    45
      C(1173) = 0.                                            C4    46
      C(1180) = 0.                                            C4    47
      C(1187) = 0.                                            C4    48
      IPL(N  ) = 1116                                         C4    49
      IPL(N+1) = 1120                                         C4    50
      IPL(N+2) = 1124                                         C4    51
      IPL(N+3) = 1128                                         C4    52
      N = N+4                                                 C4    53
      C(1119) = 0.                                            C4    54
      C(1123) = 0.                                            C4    55
      C(1127) = 0.                                            C4    56
      C(1131) = 0.                                            C4    57
      RETURN                                                  C4    58
```

SUBROUTINE C4I   74/74   OPT=1   FTN 4.2+75067   05/05/75 16.23.47.   PAGE   2

```
      C
            ENTRY A1I
      C
      C MONTE CARLO FIN MISALIGNMENT ERRORS
      C
            FELECB  = 0.
            FELECQB = 0.
            FELECRB = 0.
            FMECHB  = 0.
            FMECHQB = 0.
            FMECHRB = 0.
            DO 10 I = 1, I3512
            IDO = I
            IF(ISNDX(I).EQ.1250) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1251) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1252) CALL MCARLO (DUM, 1, IDO)
      C MONTE CARLO FIN OFFSET (MODULE C4I AND C4)
            IF(ISNDX(I).EQ.1247) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1248) CALL MCARLO (DUM, 1, IDO)
            IF(ISNDX(I).EQ.1249) CALL MCARLO (DUM, 1, IDO)
            DELTB  = FELECB  + FMECHB
            DELTQB = FELECQB + FMECHQB
            DELTRB = FELECRB + FMECHRB
         10 CONTINUE
            BDELT1 = -BDP + BDQ - BDR
            BDELT2 = -BDP + BDQ + BDR
            BDELT3 =  BDP + BDQ - BDR
            BDELT4 =  BDP + BDQ + BDR
            BDELT1 = BDELT1 - DELTB + DELTQB - DELTRB
            BDELT2 = BDELT2 - DELTB + DELTQB + DELTRB
            BDELT3 = BDELT3 + DELTB + DELTQB - DELTRB
            BDELT4 = BDELT4 + DELTB + DELTQB + DELTRB
            RETURN
            END
      C**   HELFIRE SIMPLIFIED ACTUATOR MODEL
      C****** NON - LINEAR MODEL ******
      C
```

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      SUBROUTINE C4I          74/74   OPT=1                              FTN 4.2+75067      05/05/75  16.23.47.     PAGE   3

           SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE      REFERENCES
     50   A1I            59          30
      1   C4I             1          30         57

  VARIABLES       SN  TYPE            RELOCATION
     150  BDELT        REAL        *UNDEF              REFS        5
    2116  BDELT1       REAL                  / /       REFS        6        86   DEFINED      82       86
    2122  BDELT2       REAL                  / /       REFS        7        87   DEFINED      83       87
    2126  BDELT3       REAL                  / /       REFS        8        88   DEFINED      84       88
    2132  BDELT4       REAL                  / /       REFS        9        89   DEFINED      85       89
    2316  BDP          REAL                  / /       REFS       20        82        83      84       85
    2317  BDQ          REAL                  / /       REFS       21        82        83      84       85
    2320  BDR          REAL                  / /       REFS       22        82        83      84       85
       0  C            REAL        ARRAY     / /       REFS        2       2*4         6       7        8        9       10
                                                         11       12        13        14      15       16       17       18
                                                         19       20        21        22      23       24
                                                    DEFINED       40        41        42      43       44       45       40
                                                         47       53        54        55      56
    2345  DELTB        REAL                  / /       REFS       16        86        87      88       89
                                                    DEFINED       78
    2346  DELTQB       REAL                  / /       REFS       17        86        87      88       89
                                                    DEFINED       79
    2347  DELTRB       REAL                  / /       REFS       18        86        87      88       89
                                                    DEFINED       80
     147  DUM          REAL                            REFS       71        72        73      75       76       77
    2336  FELECB       REAL                  / /       REFS       10        78   DEFINED      63
    2337  FELECQB      REAL                  / /       REFS       11        79   DEFINED      64
    2340  FELECRB      REAL                  / /       REFS       12        80   DEFINED      65
    2341  FMECHB       REAL                  / /       REFS       13        78   DEFINED      66
    2342  FMECHQB      REAL                  / /       REFS       14        79        80  DEFINED      67
    2343  FMECHRB      REAL                  / /       REFS       15   DEFINED        68
     145  I            INTEGER                         REFS       70        71        72      73       75       76       77
                                                    DEFINED       69
     146  IDD          INTEGER                         REFS       71        72        73      75       76       77
                                                    DEFINED       70
    5601  IPL          INTEGER     ARRAY     / /       REFS        3        24   DEFINED      25       26       27       28
                                                         31       32        33        34      35       36       37       38
                                                         48       49        50        51
    7661  ISNDX        INTEGER     ARRAY     / /       REFS        3         4        71      72       73       75       76
                                                         77
    6667  I35.2        INTEGER               / /       REFS        4        59
    5600  N            INTEGER               / /       REFS       23        25        26      27       28       29       31
                                                         32       33        34        35      36       37       38       39
                                                         48       49        50        51      52  DEFINED      29       39
                                                         52
    2163  OPTACT       REAL                  / /       REFS       19        30

  EXTERNALS            TYPE   ARGS       REFERENCES
          MCARLO                3            71          72       73        75        76      77

  STATEMENT LABELS          DEF LINE     REFERENCES
       0  10                   81           53
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SUBROUTINE C4I          74/74   OPT=1                      FTN 4.2+75067     05/05/75  16.23.47.    PAGE    4

LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
  60   10       * I       69 61        42B                EXT REFS

COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
     / /          3830                 0 C      (3830)

EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
C       C         3830          1102 BDELT1  (1)         1106 BDELT2  (1)         1110 BDELT3  (1)
                                1114 BDELT4  (1)         1139 OPTACT  (1)         1230 BOP     (1)
                                1231 BDQ     (1)         1232 BDR     (1)         1246 FELECB  (1)
                                1247 FELECQB(1)          1248 FELECRB(1)          1249 FMECHB  (1)
                                1250 FMECHQB(1)          1251 FMECHRB(1)          1253 DELTB   (1)
                                1254 DELTQB  (1)         1255 DELTRB  (1)         2560 N       (1)
                                2561 IPL     (100)       3511 I3312   (1)         3633 ISNDX   (48)

STATISTICS
  PROGRAM LENGTH                1543   105
  CM BLANK COMMON LENGTH       73663  3830
```

```
      SUBROUTINE C4
C
      COMMON C(3830)
      DIMENSION BDELTO(4),BDELT(4),BDELTC(4),VAR(101)
      DIMENSION WDS(4), WDSD(4),  WDSDD(4), BDS(4), BDSD(4)
      DIMENSION IPL(101)
      DIMENSION NC2(2), CB2(6), CHDF(6)
C
C**INPUT DATA
      EQUIVALENCE (C(1140),OPTACT)
      EQUIVALENCE (C(1145),CR    )
      EQUIVALENCE (C(1146),BDELA )
      EQUIVALENCE (C(1147),HDEL  )
      EQUIVALENCE (C(1148),W1    )
      EQUIVALENCE (C(1149),ZN    )
      EQUIVALENCE (C(1150),FMHD  )
      EQUIVALENCE (C(1151),G1    )
      EQUIVALENCE (C(1152),BH    )
      EQUIVALENCE (C(1153),WN    )
      EQUIVALENCE (C(1154),G2    )
      EQUIVALENCE (C(1155),H1    )
      EQUIVALENCE (C(1156),H2    )
      EQUIVALENCE (C(1305),RFAREA)
      EQUIVALENCE (C(1307),RFLGTH)
C
C**INPUTS FROM OTHER MODULES
      EQUIVALENCE (C(0203),PDYNMC)
      EQUIVALENCE (C( 204),VMACH )
      EQUIVALENCE (C( 855),BDELTC)
      EQUIVALENCE (C(1254), DELTB)
      EQUIVALENCE (C(1255),DELTQB)
      EQUIVALENCE (C(1256),DELTRB)
      EQUIVALENCE (C(1309),FMH1  )
      EQUIVALENCE (C(1310),FMH2  )
      EQUIVALENCE (C(1311),FMH3  )
      EQUIVALENCE (C(1312),FMH4  )
C
C**INPUTS FROM MAIN PROGRAM
      EQUIVALENCE (C(2000),T     )
      EQUIVALENCE (C(2013),DOC   )
      EQUIVALENCE (C(2561),N     )
      EQUIVALENCE (C(2562),IPL   )
C
      DATA NC2/6,0/
      DATA  CB2/  .00,  .40,  .80,  .95, 1.05, 1.40/
      DATA CHDF/.0013,.0014,.0018,.0022,.0032,.0023/
C**STATE VARIABLE OUTPUTS
      BDELTC(1) = BDELTC(1)  - DELTB + DELT2B - DELTRB
      BDELTC(2) = BDELTC(2)  - DELTB + DELT2B + DELTRB
      BDELTC(3) = BDELTC(3)  + DELTB + DELT2B - DELTRB
      BDELTC(4) = BDELTC(4)  + DELTB + DELT2B + DELTRB
      BDELT(1)=C(1103)
      BDELT(2)=C(1107)
      BDELT(3)=C(1111)
      BDELT(4)=C(1115)
      WDSD (1) = C(1163)
      WDSD (2) = C(1170)
```

```
      WDSD (3) = C(1177)
      WDSD (4) = C(1184)
      WDS  (1) = C(1166)
      WDS  (2) = C(1173)
      WDS  (3) = C(1180)
      WDS  (4) = C(1187)
      BDS(1) = C(1119)
      BDS(2) = C(1123)
      BDS(3) = C(1127)
      BDS(4) = C(1131)
C
C**ACTUATOR DYNAMICS
      XF=0.
      CHD=FINTP1(VMACH,CB2,CHDF,NC2,XF,3HCHD)
      DO 30  I=1,4
      UQS = FDYNMC*RFAREA
      UQSL = UQS*RFLGTH
      FMHD = CHD*UQSL*12.
      H1 = HDEL
      H2 = H1*2.
      IF (I.GE.2 .AND. I.LE.3) GO TO 5
      H2 = H1
      H1 = H1*2.
    5 CONTINUE
      A1 =        (BDELTC(I)  - BDELT(I))
      A1S= A1 - SIGN(B4,A1)
      IF(ABS(A1) .LE. B4) A1S= 0.
      A2 = G1/CR*A1S
      IF(A2 .LT. -H2) A2 = -H2
      IF(A2 .GT.  H1) A2 =  H1
      BDSD(I) = W1*(A2 - BDS(I))
      BDE = BDS(I) + G2*FMHD*BDELT(I)
      WDSDD(I) = WN*(WN*(BDE - WDS(I)) - 2.*ZN*WDSD(I))
      BDELTD(I) = WDSD(I)/A1 + WDS(I)
      IF (OFTACT .LE. 1.)
     * BDELTD(I) = (A2 - G2*FMHD*BDELT(I))/(1.+G2*FMHD)/W1)
C** RATE LIMIT
C**SURFACE POSITION LIMITER
      IF((ABS(BDELT(I)).GT.19.).AND.(BDELTD(I)*BDELT(I).GT.0.))BDELTD(I)
     *=0.
   30 CONTINUE
C
      C(1103) = BDELT(1)
      C(1107) = BDELT(2)
      C(1111) = BDELT(3)
      C(1115) = BDELT(4)
C
C**OUTPUT DERIVATIVES OF STATE VARIABLES TO INTEGRATION
      C(1100) = BDELTD(1)
      C(1104) = BDELTD(2)
      C(1108) = BDELTD(3)
      C(1112) = BDELTD(4)
      C(1160) = WDSDD(1)
      C(1167) = WDSDD(2)
      C(1174) = WDSDD(3)
      C(1181) = WDSDD(4)
      C(1116) = BDSD(1)
```

```
  115          C(1120) = BOSD(2)                                     C4     210
               C(1124) = BOSD(3)                                     C4     211
               C(1128) = BOSD(4)                                     C4     212
        C                                                            C4     213
               RETURN                                                C4     214
  120          END                                                   C4     215
```

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      SUBROUTINE C4          74/74    OPT=1                          FTN 4.2+75067      05/05/75  16.23.49.        PAGE     4

         SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS          DEF LINE     REFERENCES
       1   C4                  1        119

 VARIABLES          SN   TYPE            RELOCATION
    211   A1             REAL                               REFS        2*83        84     DEFINED      82
    212   A1S            REAL                               REFS          55   DEFINED        83        84
    213   A2             REAL                               REFS          86        87        86        92   DEFINED      85      88
                                                              87
    214   BDE            REAL                               REFS          90   DEFINED        89
   2171   BDELH          REAL                      / /      REFS          12
    221   BDELT          REAL          ARRAY                REFS           4        82        89        92      2*96     100     101
                                                             102         103   DEFINED        52        53        54      55
   1527   BDELTC         REAL          ARRAY       / /      REFS           4        29        48        49        50      51      82
                                                         DEFINED          48        49        50        51
    215   BDELTD         REAL          ARRAY                REFS           4        96       106       107       108     109
                                                         DEFINED          91        92        96
    406   BDS            REAL          ARRAY                REFS           5        88        89   DEFINED        54      65      66
                                                              67
    412   BDSD           REAL          ARRAY                REFS           5       114       115       116       117
                                                         DEFINED          88
   2177   BH             REAL                      / /      REFS          18        83        84
      0   C              REAL          ARRAY       / /      REFS           3        10        11        12        13      14      15
                                                              16          17        18        19        20        21      22      23
                                                              24          27        28        29        30        31      32      33
                                                              34          35        36        39        40        41      42      52
                                                              53          54        55        56        57        58      59      60
                                                              61          62        63        64        65        66      67
                                                         DEFINED         100       101       102       103       106     107     108
                                                             109         110       111       112       113       114     115     116
                                                             117
    420   CB2            REAL          ARRAY                REFS           7        71   DEFINED        45
    205   CHO            REAL                               REFS          75   DEFINED        71
    426   CHOF           REAL          ARRAY                REFS           7        71   DEFINED        46
   2170   CR             REAL                      / /      REFS          11        85
   2345   DELTB          REAL                      / /      REFS          30        48        49        50        51
   2346   DELTQB         REAL                      / /      REFS          31        48        49        50        51
   2347   DELTRB         REAL                      / /      REFS          32        48        49        50        51
   3734   DOC            REAL                      / /      REFS          40
   2175   FMHO           REAL                      / /      REFS          16        89      2*92   DEFINED        75
   2434   FMH1           REAL                      / /      REFS          33
   2435   FMH2           REAL                      / /      REFS          34
   2436   FMH3           REAL                      / /      REFS          35
   2437   FMH4           REAL                      / /      REFS          36
   2176   G1             REAL                      / /      REFS          17        85
   2201   G2             REAL                      / /      REFS          20        89      2*92
   2172   HDEL           REAL                      / /      REFS          13        76
   2202   H1             REAL                      / /      REFS          21        77        79        80      2*87
                                                         DEFINED          76        80
   2203   H2             REAL                      / /      REFS          22      2*86   DEFINED        77        79
    206   I              INTEGER                            REFS        2*78      2*82      2*88      2*89      3*93    3*91    2*92
                                                             4*95    DEFINED        72
   5001   IPL            INTEGER       ARRAY       / /      REFS           6        42
   5000   N              INTEGER                   / /      REFS          41
    416   NC2            INTEGER       ARRAY                REFS           7        71   DEFINED        44
   2163   OPTACT         REAL                      / /      REFS          10        92
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      SUBROUTINE C4          74/74   OPT=1                                FTN 4.2+75067      05/15/75  16.23.49.        PAGE    5

VARIABLES      SN   TYPE              RELOCATION
    312  POYNMC      REAL                   / /            REFS          27        73
   2431  RFAREA      REAL                   / /            REFS          23        73
   2432  RFLGTH      REAL                   / /            REFS          24        74
   3717  T           REAL                   / /            REFS          39
    207  UQS         REAL                                  REFS          74    DEFINED        73
    210  UQSL        REAL                                  REFS          75    DEFINED        74
    225  VAR         REAL      *UNDEF                      REFS           4
    313  VMACH       REAL                   / /            REFS          28        71
    372  WOS         REAL         ARRAY                    REFS           5        90        91    DEFINED      50       61      62
                                                             63
    376  WOSO        REAL         ARRAY                    REFS           5        90        91    DEFINED      56       57      58
                                                             59
    402  WOSOD       REAL         ARRAY                    REFS           5       110       111       112      113
                                                       DEFINED           90
   2200  WN          REAL                   / /            REFS          19      2*90
   2173  W1          REAL                   / /            REFS          14        88        91        92
    204  XF          REAL                                  REFS          71    DEFINED        70
   2174  ZN          REAL                   / /            REFS          15        90

EXTERNALS          TYPE   ARGS          REFERENCES
       FINTP1      REAL     6              71

INLINE FUNCTIONS   TYPE   ARGS        DEF LINE   REFERENCES
       ABS         REAL     1  INTRIN                84        96
       SIGN        REAL     2  INTRIN                83

STATEMENT LABELS              DEF LINE     REFERENCES
    73  5                        81           78
     0  30                       98           72

LOOPS  LABEL     INDEX       FROM-TO      LENGTH     PROPERTIES
   55   30        * I         72  98        65B          OPT

COMMON BLOCKS    LENGTH       MEMBERS - BIAS NAME(LENGTH)
       / /         3830             0 C        (3830)

EQUIV CLASSES    LENGTH       MEMBERS - BIAS NAME(LENGTH)
  C      C         3830             202 POYNMC  (1)          203 VMACH   (1)          855 BDELTC  (4)
                                   1139 OPTACT  (1)         1144 CP      (1)         1145 BDELH   (1)
                                   1146 HDEL    (1)         1147 W1      (1)         1148 ZN      (1)
                                   1149 FWHD    (1)         1150 GL      (1)         1151 BH      (1)
                                   1152 WN      (1)         1153 G2      (1)         1154 H1      (1)
                                   1155 H2      (1)         1253 DELTB   (1)         1254 DELTQB  (1)
                                   1255 DELTR3  (1)         1305 RFAREA  (1)         1306 RFLGTH  (1)
                                   1308 FMH1    (1)         1309 FMH2    (1)         1310 FMH3    (1)
                                   1311 FMH4    (1)         1939 T       (1)         2012 DOC     (1)
                                   2560 N       (1)         2561 IP      (101)

STATISTICS
  PROGRAM LENGTH               4363     286
  CM BLANK COMMON LENGTH      73663    3830
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```
      SUBROUTINE G4                                                     G4        2
C*****************************************************************      G4        3
C** THIS IS A SUBROUTINE (NOT A MODULE) CALLED BY STAGE 3 **            G4        4
C** STOPS PROGRAM AND COMPUTES MISS DISTANCE                  **        G4        5
C*****************************************************************      G4        6
      COMMON C(3830)                                                    G4        7
  100 FORMAT(1H0,17H MISS DISTANCE = ,1PE15.7/                          G4        8
     *       1H0,17H FLIGHT  TIME  = ,1PE15.7)                          G4        9
  200 FORMAT(1H0, 9X,8HRDELX = ,1PE15.7, 8X,8HRDELY = ,1PE15.7,         G4       10
     *        8X,8HRDELZ = ,1PE15.7)                                    G4       11
  300 FORMAT(1H0,40X,8HRYFP  = ,1PE15.7, 8X,8HRZFP  = ,1PE15.7)         G4       12
      EQUIVALENCE (C( 357),BGAMH )                                      G4       13
     *,           (C( 358),BGAMV )                                      G4       14
     *,           (C( 371),RANGE )                                      G4       15
     *,           (C(1535),RDELX )                                      G4       16
     *,           (C(1536),RDELY )                                      G4       17
     *,           (C(1537),RDELZ )                                      G4       18
      EQUIVALENCE (C(2000),T     )                                      G4       19
      EQUIVALENCE (C(1564),YMC)                                         G4       20
      EQUIVALENCE (C(1565),YMC2)                                        G4       21
      EQUIVALENCE (C(1574),ZMC)                                         G4       22
      EQUIVALENCE (C(1575),ZMC2)                                        G4       23
     *,           (C(2020),LCONV )                                      G4       24
      EQUIVALENCE (C( 300),RMISS )                                      G4       25
     $,           (C(331),              )                               G4       26
     *,           (C( 302),RYF   )                                      G4       27
     *,           (C( 303),RZF   )                                      G4       28
      EQUIVALENCE (C( 31),LCEP)                                         G4       29
      EQUIVALENCE (C(3721),     ITC( )                                  DLAY     24
      LCEP = 0                                                          G4       30
      IF (RANGE .GT. 500.) GO TO 20                                     G4       31
      UC13 =-SIND(BGAMV)                                                G4       32
      UC33 = COSD(BGAMV)                                                G4       33
      UC21 =-SIND(BGAMH)                                                G4       34
      UC22 = COSD(BGAMH)                                                G4       35
      UC11 =  UC22*UC33                                                 G4       36
      UC12 = -UC21*UC33                                                 G4       37
      UC31 = -UC22*UC13                                                 G4       38
      UC32 =  UC21*UC13                                                 G4       39
      RXFP = UC11*RDELX + UC12*RDELY + UC13*RDELZ                       G4       40
      RYFP = UC21*RDELX + UC22*RDELY                                    G4       41
      RZFP = UC31*RDELX + UC32*RDELY + UC33*RDELZ                       G4       42
      IF (RXFP .GT. 0.) GO TO 10                                        G4       43
      PCT = UXFP/(RXFP - UXFP)                                          G4       44
      RDX = UDELX - PCT*(RDELX - UDELX)                                 G4       45
      RDY = UDELY - PCT*(RDELY - UDELY)                                 G4       46
      RDZ = UDELZ - PCT*(RDELZ - UDELZ)                                 G4       47
      RYF = UYFP - PCT*(RYFP - UYFP)                                    G4       48
      RZF = UZFP - PCT*(RZFP - UZFP)                                    G4       49
      TZERO = UT - PCT*(T - UT)                                         G4       50
      RMISS = SQRT(RYF**2 + RZF**2)                                     G4       51
      PITCH=10H PITCH                                                   DLAY     25
      YAW=10H YAW                                                       DLAY     26
      WRITE(6,600)C(630),PITCH                                          DLAY     27
      WRITE(6,600)C(631),YAW                                            DLAY     28
  600 FORMAT(1H0,50X,*+++MAX BREAKLOCK VALUE =*F10.5,*  IN *A10)        DLAY     29
      WRITE(6,400) L                                                    G4       53
```

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  400 FORMAT(1H0,13HRUN NUMBER = ,I2)                              G4        54
      IF(ITOT.LE.3)GO TO 30                                        DLAY      30
      CALL MCARLX(DUM,2,RNSTRT)                                    DLAY      31
      WRITE(6,500) C(1557), C(1561), C(1577), C(1578)              G4        55
      XMCSPOT = SQRT(YMC2*YMC2 + ZMC2*ZMC2)                        G4        56
      WRITE(6,2555)YMC,YMC2                                        G4        57
      WRITE(6,2556)ZMC,ZMC2,XMCSPOT                                G4        58
   30 CONTINUE                                                     DLAY      32
  500 FORMAT(1H0,11X,13HMAX SPOT Y = ,F6.2,14H MIN SPOT Y = , F6.2/ G4       59
     1          12X,13HMAX SPOT Z = ,F6.2,14H MIN SPOT Z = ,F6.2//  G4       60
     2 )                                                           G4        61
 2555 FORMAT(1H0,11X,25HSAMPLE SPOT JITTER Y-MEAN=,F10.5,6X,12HMEAN SQUA G4  62
     1RE=,F10.5)                                                   G4        63
 2556 FORMAT(1H0,11X,25HSAMPLE SPOT JITTER Z-MEAN=,F10.5,6X,12HMEAN SQUA G4  64
     1RE=,F10.5,6X,18HSPOT RADIAL RMS = ,F10.5)                    G4        65
      WRITE(6,100) RMISS, TZERO                                    G4        66
      WRITE(6,200) RDX, ROY, ROZ                                   G4        67
      WRITE(6,300) RYF, RZF                                        G4        68
      LCONV = 2                                                    G4        69
      LCEP = 1                                                     G4        70
      RETURN                                                       G4        71
   16 UT = -T                                                      G4        72
      UDELX = RDELX                                                G4        73
      UDELY = RDELY                                                G4        74
      UDELZ = RDELZ                                                G4        75
      UXFP = -RXFP                                                 G4        76
      UYFP = RYFP                                                  G4        77
      UZFP =-RZFP                                                  G4        78
      RETURN                                                       G4        79
   20 IF (RDELZ .LT. 0.) LCONV = 2                                 G4        80
      RETURN                                                       G4        81
      END                                                          G4        82
```

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SUBROUTINE G4          74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.23.53.      PAGE    3

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     1  G4              1          78       85       88

 VARIABLES        SN  TYPE             RELOCATION
    544  BGAMH         REAL                    / /          REFS        12       34       35
    545  BGAMV         REAL                    / /          REFS        12       32       33
      0  C             REAL          ARRAY     / /          REFS         6      6*12      18       19       20       21      2*22
                                                                    4*24        28       29       54       55     4*61
    371  DUM       *   REAL                                 REFS        60
   7210  IICT          INTEGER                 / /          REFS        29       59
    454  L             INTEGER                 / /          REFS        24       57
     36  LCEP          INTEGER                 / /          REFS        28   DEFINED      30       77
   3743  LCONV         INTEGER                 / /          REFS        22   DEFINED      76       87
    353  PCI           REAL                                 REFS        45       46       47       48       49       50
                                                         DEFINED        44
    367  PITCH         REAL                                 REFS        54   DEFINED      52
    562  RANGE         REAL                    / /          REFS        12       31
   3142  RDELX         REAL                    / /          REFS        12       40       41       42       45       80
   3143  RDELY         REAL                    / /          REFS        12       40       41       42       46       81
   3144  RDELZ         REAL                    / /          REFS        12       40       42       47       82       87
    355  RDX           REAL                                 REFS        74   DEFINED      45
    357  RDY           REAL                                 REFS        74   DEFINED      46
    361  RDZ           REAL                                 REFS        74   DEFINED      47
    453  RMISS         REAL                    / /          REFS        24       73   DEFINED      51
    372  RNSTRT    *   REAL                                 REFS        50
    350  RXFP          REAL                                 REFS        43       44       83   DEFINED      40
    455  RYF           REAL                    / /          REFS        24       51       75   DEFINED      48
    351  RYFP          REAL                                 REFS        48       84   DEFINED      41
    456  RZF           REAL                    / /          REFS        24       51       75   DEFINED      49
    352  RZFP          REAL                                 REFS        49       85   DEFINED      42
   3717  T             REAL                    / /          REFS        18       50       79
    365  TZERO         REAL                                 REFS        73   DEFINED      50
    344  UC11          REAL                                 REFS        40   DEFINED      36
    345  UC12          REAL                                 REFS        40   DEFINED      37
    340  UC13          REAL                                 REFS        38       39       40   DEFINED      32
    342  UC21          REAL                                 REFS        37       39       41   DEFINED      34
    343  UC22          REAL                                 REFS        36       38       41   DEFINED      35
    346  UC31          REAL                                 REFS        42   DEFINED      38
    347  UC32          REAL                                 REFS        42   DEFINED      39
    341  UC33          REAL                                 REFS        36       37       42   DEFINED      33
    356  UDELX         REAL                                 REFS      2*45   DEFINED      80
    360  UDELY         REAL                                 REFS      2*46   DEFINED      81
    362  UDELZ         REAL                                 REFS      2*47   DEFINED      82
    366  UT            REAL                                 REFS      2*50   DEFINED      79
    354  UXFP          REAL                                 REFS      2*44   DEFINED      83
    363  UYFP          REAL                                 REFS      2*48   DEFINED      84
    364  UZFP          REAL                                 REFS      2*49   DEFINED      85
    373  XMCSPOT       REAL                                 REFS        64   DEFINED      52
    370  YAW           REAL                                 REFS        55   DEFINED      53
   3033  YMC           REAL                    / /          REFS        19       63
   3634  YMC2          REAL                    / /          REFS        20     2*62       63
   3645  ZMC           REAL                    / /          REFS        21       54
   3646  ZMC2          REAL                    / /          REFS        22     2*62       64
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SUBROUTINE G4          74/74    OPT=1                    FTN 4.2+75067     05/05/75  16.23.53.     PAGE   3

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     1  G4             1         78      85      88

 VARIABLES      SN  TYPE              RELOCATION
   544  BGAMH       REAL                 / /        REFS     12      34      35
   545  BGAMV       REAL                 / /        REFS     12      32      33
     0  C           REAL        ARRAY    / /        REFS      6    6*12      18      19      20      21    2*22
                                                         4*24      28      29      54      55    4*61
   371  DUM       * REAL                            REFS     60
  7210  ITCT        INTEGER              / /        REFS     29      59
   454  L           INTEGER              / /        REFS     24      57
    36  LCEP        INTEGER              / /        REFS     2P   DEFINED      30      77
  3743  LCONV       INTEGER              / /        REFS     22   DEFINED      76      87
   353  PCT         REAL                            REFS     45      46      47      48      49      50
                                                 DEFINED     44
   367  PITCH       REAL                            REFS     54   DEFINED      52
   562  RANGE       REAL                 / /        REFS     12      31
  3142  RDELX       REAL                 / /        REFS     12      40      41      42      45      80
  3143  RDELY       REAL                 / /        REFS     12      40      41      42      46      81
  3144  RDELZ       REAL                 / /        REFS     12      40      42      47      82      87
   355  RDX         REAL                            REFS     74   DEFINED      45
   357  RDY         REAL                            REFS     74   DEFINED      46
   361  RDZ         REAL                            REFS     74   DEFINED      47
   453  RMISS       REAL                 / /        REFS     24      73   DEFINED      51
   372  RNSTRT    * REAL                            REFS     50
   350  RXFP        REAL                            REFS     43      44      83   DEFINED      40
   455  RYF         REAL                 / /        REFS     24      51      75   DEFINED      48
   351  RYFP        REAL                            REFS     48      64   DEFINED      41
   456  RZF         REAL                 / /        REFS     24      51      75   DEFINED      49
   352  RZFP        REAL                            REFS     49      85   DEFINED      42
  3717  T           REAL                 / /        REFS     18      50      79
   365  TZERO       REAL                            REFS     73   DEFINED      50
   344  UC11        REAL                            REFS     40   DEFINED      36
   345  UC12        REAL                            REFS     40   DEFINED      37
   340  UC13        REAL                            REFS     38      39      40   DEFINED      32
   342  UC21        REAL                            REFS     37      39      41   DEFINED      34
   343  UC22        REAL                            REFS     36      38      41   DEFINED      35
   346  UC31        REAL                            REFS     42   DEFINED      38
   347  UC32        REAL                            REFS     42   DEFINED      39
   341  UC33        REAL                            REFS     36      37      42   DEFINED      33
   356  UDELX       REAL                            REFS   2*45   DEFINED      80
   360  UDELY       REAL                            REFS   2*46   DEFINED      81
   362  UDELZ       REAL                            REFS   2*47   DEFINED      82
   366  UT          REAL                            REFS   2*50   DEFINED      79
   354  UXFP        REAL                            REFS   2*44   DEFINED      83
   363  UYFP        REAL                            REFS   2*48   DEFINED      84
   364  UZFP        REAL                            REFS   2*49   DEFINED      85
   373  XMCSPOT     REAL                            REFS     64   DEFINED      52
   370  YAW         REAL                            REFS     55   DEFINED      53
  3033  YMC         REAL                 / /        REFS     19      63
  3634  YMC2        REAL                 / /        REFS     20    2*62      63
  3645  ZMC         REAL                 / /        REFS     21      64
  3646  ZMC2        REAL                 / /        REFS     22    2*62      64
```

```
        SUBROUTINE G4          74/74    OPT=1                             FTN 4.2+75057     05/05/75  16.23.53.        PAGE     4

 FILE NAMES        MODE
        TAPE6      FMT                  WRITES      54       55        57        61        63        64        73        74
                                            75

 EXTERNALS         TYPE    ARGS         REFERENCES
        COSD       REAL     1               33       35
        MCARLX              3               61
        SIND       REAL     1               32       34
        SQRT       REAL     1 LIBRARY       51       62

 STATEMENT LABELS                DEF LINE    REFERENCES
   127   10                         79          43
   141   20                         87          31
   110   30                         55          59
   155  100        FMT               7          73
   165  200        FMT               9          74
   175  300        FMT              11          75
   230  400        FMT              56          57
   256  500        FMT              66          61
   215  600        FMT              55          54       55
   271 2555        FMT              59          63
   301 2556        FMT              71          64

 COMMON BLOCKS     LENGTH     MEMBERS - BIAS NAME(LENGTH)
     //            3830                 0 C      (3830)

 EQUIV CLASSES     LENGTH     MEMBERS - BIAS NAME(LENGTH)
   C               3830             33 LCEP   (1)       233 RMISS  (1)        300 L      (1)
                                   301 RYF    (1)       302 RZF    (1)        356 BGAMM  (1)
                                   357 BGAMV  (1)       370 RANGE  (1)       1563 YMC    (1)
                                  1564 YMC2   (1)      1573 ZMC    (1)       1574 ZMC2   (1)
                                  1634 RDELX  (1)      1635 RDELY  (1)       1636 RDELZ  (1)
                                  1993 T      (1)      2019 LCONV  (1)       3720 ITCT   (1)

 STATISTICS
   PROGRAM LENGTH               3748       252
   CM BLANK COMMON LENGTH      73663      3830
```

```
      SUBROUTINE AMRK(AUXSUB)                                      AMRK   2
      COMMON C(3830)                                               AMRK   3
      DIMENSION CSAV(100), IPL(100)                                AMRK   4
      REAL K1(100), K2(100), K3(100), K4(100)                      AMRK   5
      EQUIVALENCE (C(2000),   T)                                   AMRK   6
      EQUIVALENCE (C(2664), DELT)                                  AMRK   7
      EQUIVALENCE (C(2561),   NJ)                                  AMRK   8
      EQUIVALENCE (C(2562),  IPL)                                  AMRK   9
      EQUIVALENCE (C(1275), XNORK)                                 AMRK  10
      XNORK = -1.                                                  AMRK  11
      DO 1 I = 1,NJ                                                AMRK  12
      J = IPL(I)                                                   AMRK  13
C                                                                  AMRK  14
C****STORE INITIAL VALUES                                          AMRK  15
      CSAV(I) = C(J+3)                                             AMRK  16
C                                                                  AMRK  17
C*** COMPUTE K1                                                    AMRK  18
      K1(I) = DELT*C(J)                                            AMRK  19
    1 C(J+3) = CSAV(I) + .5*K1(I)                                  AMRK  20
      T = T + .5*DELT                                              AMRK  21
      CALL AUXSUB                                                  AMRK  22
C                                                                  AMRK  23
C*** COMPUTE K2                                                    AMRK  24
      DO 2 I = 1,NJ                                                AMRK  25
      J = IPL(I)                                                   AMRK  26
      K2(I) = DELT*C(J)                                            AMRK  27
    2 C(J+3) = CSAV(I) + .5*K2(I)                                  AMRK  28
      CALL AUXSUB                                                  AMRK  29
C                                                                  AMRK  30
C*** COMPUTE K3                                                    AMRK  31
      DO 3 I = 1,NJ                                                AMRK  32
      J = IPL(I)                                                   AMRK  33
      K3(I) = DELT*C(J)                                            AMRK  34
    3 C(J+3) = CSAV(I) + K3(I)                                     AMRK  35
      T = T + .5*DELT                                              AMRK  36
      CALL AUXSUB                                                  AMRK  37
C                                                                  AMRK  38
C*** COMPUTE K4                                                    AMRK  39
      DO 4 I = 1, NJ                                               AMRK  40
      J = IPL(I)                                                   AMRK  41
      K4(I) = DELT*C(J)                                            AMRK  42
    4 C(J+3) = CSAV(I) +(K1(I) + 2.*(K2(I) + K3(I)) + K4(I))/6.    AMRK  43
      XNORK = 1.                                                   AMRK  44
      CALL AUXSUB                                                  AMRK  45
      RETURN                                                       AMRK  46
      END                                                          AMRK  47
```


CARD NR.	SEVERITY	DETAILS	DIAGNOSIS OF PROBLEM
19	I	NJ	THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
27	I	NJ	THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
34	I	NJ	THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
42	I	NJ	THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.

```
SUBROUTINE AMRK        74/74    OPT=1                              FTN 4.2+75067     05/05/75  16.23.56.     PAGE    3

          SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     3   AMRK           1           43

 VARIABLES      SN   TYPE          RELOCATION
     0   C           REAL        ARRAY    / /         REFS         2        5        6        7          8        9       15
                                                                  18       26       30       41    DEFINED       19       27       34
                                                                  42
   114   CSAV        REAL        ARRAY                REFS         3       19       27       34         42
                                                      DEFINED     15
  5147   DELT        REAL                     / /     REFS         6       18       20       26         33       35       41
   112   I           INTEGER                          REFS        12       15       18     2*19         25       26     2*27
                                                                  32       33     2*34       40         41      5*42
                                                      DEFINED     11       24       31       39
  5001   IPL         INTEGER     ARRAY    / /         REFS         3        8       12       25         32       40
   113   J           INTEGER                          REFS        15       18       19       26         27       33       34
                                                                  41       42  DEFINED       12         25       32       40
   260   K1          REAL        ARRAY                REFS         4       19       42  DEFINED         18
   424   K2          REAL        ARRAY                REFS         4       27       42  DEFINED         26
   570   K3          REAL        ARRAY                REFS         4       34       42  DEFINED         33
   734   K4          REAL        ARRAY                REFS         4       42  DEFINED       41
  5000   NJ          INTEGER                  / /     REFS         7       11       24       31         39
  3717   T           REAL                     / /     REFS         5       20       35  DEFINED         20       35
  3667   XNORK       REAL                     / /     REFS         9  DEFINED       10       43

 EXTERNALS          TYPE     ARGS       REFERENCES
        AUXSUB                 6   F.P.     21       28       36       44

 STATEMENT LABELS                  DEF LINE    REFERENCES
     0   1                            19          11
     0   2                            27          24
     0   3                            34          31
     0   4                            42          33

 LOOPS   LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
    23   1           I          11 19        6B       INSTACK
    41   2           I          24 27        5B       INSTACK
    54   3           I          31 34        5B       INSTACK
    70   4           I          39 42       11B       OPT

 COMMON BLOCKS    LENGTH       MEMBERS - BIAS NAME(LENGTH)
       / /         3830                0 C      (3830)

 EQUIV CLASSES    LENGTH       MEMBERS - BIAS NAME(LENGTH)
 C         C       3830           1375 XNORK   (1)          1939 T      (1)          2560 NJ      (1)
                                  2561 IPL     (100)        2663 DELT   (1)

 STATISTICS
   PROGRAM LENGTH                11053      581
   CM BLANK COMMON LENGTH        73663     3830
```

```
      SUBROUTINE AUXI                                                  AMRK  48
      COMMON C(3830)                                                   AMRK  49
      EQUIVALENCE (C(2361),NOMOD ) , (C(2362),XMODNO), (C(2561),N    ) AMRK  50
      DIMENSION  XMODNO(39)                                            AMRK  51
      N = 1                                                            AMRK  52
      DO 1 I=1,NOMOD                                                   AMRK  53
      L =XMODNO(I)                                                     AMRK  54
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23 AMRK  55
     1      ,24,25,26,27,28,29,30,31,32,33,34,35,36,37),L              AMRK  56
    2 CALL  A1I                                                        AMRK  57
      GO TO 1                                                          AMRK  58
    3 CALL  A2I                                                        AMRK  59
      GO TO 1                                                          AMRK  60
    4 CALL  A3I                                                        AMRK  61
      GO TO 1                                                          AMRK  62
    5 CALL  A4I                                                        AMRK  63
      GO TO 1                                                          AMRK  64
    6 CALL  A5I                                                        AMRK  65
      GO TO 1                                                          AMRK  66
    7 CALL  C1I                                                        AMRK  67
      GO TO 1                                                          AMRK  68
    8 CALL  C2I                                                        AMRK  69
      GO TO 1                                                          AMRK  70
    9 CALL  C3I                                                        AMRK  71
      GO TO 1                                                          AMRK  72
   10 CALL  C4I                                                        AMRK  73
      GO TO 1                                                          AMRK  74
   11 CALL  C5I                                                        AMRK  75
      GO TO 1                                                          AMRK  76
   12 CALL  C6I                                                        AMRK  77
      GO TO 1                                                          AMRK  78
   13 CALL  C7I                                                        AMRK  79
      GO TO 1                                                          AMRK  80
   14 CALL  C8I                                                        AMRK  81
      GO TO 1                                                          AMRK  82
   15 CALL  C9I                                                        AMRK  83
      GO TO 1                                                          AMRK  84
   16 CALL  C10I                                                       AMRK  85
      GO TO 1                                                          AMRK  86
   17 CALL  D1I                                                        AMRK  87
      GO TO 1                                                          AMRK  88
   18 CALL  D2I                                                        AMRK  89
      GO TO 1                                                          AMRK  90
   19 CALL  D3I                                                        AMRK  91
      GO TO 1                                                          AMRK  92
   20 CALL  D4I                                                        AMRK  93
      GO TO 1                                                          AMRK  94
   21 CALL  D5I                                                        AMRK  95
      GO TO 1                                                          AMRK  96
   22 CALL  G1I                                                        AMRK  97
      GO TO 1                                                          AMRK  98
   23 CALL  G2I                                                        AMRK  99
      GO TO 1                                                          AMRK 100
   24 CALL  G3I                                                        AMRK 101
      GO TO 1                                                          AMRK 102
   25 CALL  G4I                                                        AMRK 103
      GO TO 1                                                          AMRK 104
```

```
      26 CALL G5I                                          AMRK  105
         GO TO 1                                           AMRK  106
      27 CALL G6I                                          AMRK  107
         GO TO 1                                           AMRK  108
      28 CALL S1I                                          AMRK  109
         GO TO 1                                           AMRK  110
      29 CALL S2I                                          AMRK  111
         GO TO 1                                           AMRK  112
      30 CALL S3I                                          AMRK  113
         GO TO 1                                           AMRK  114
      31 CALL S4I                                          AMRK  115
         GO TO 1                                           AMRK  116
      32 CALL S5I                                          AMRK  117
         GO TO 1                                           AMRK  118
      33 CALL S6I                                          AMRK  119
         GO TO 1                                           AMRK  120
      34 CALL S7I                                          AMRK  121
         GO TO 1                                           AMRK  122
      35 CALL S8I                                          AMRK  123
         GO TO 1                                           AMRK  124
      36 CALL S9I                                          AMRK  125
         GO TO 1                                           AMRK  126
      37 CALL S10I                                         AMRK  127
       1 CONTINUE                                          AMRK  128
         RETURN                                            AMRK  129
         END                                               AMRK  130
```

```
SUBROUTINE AUXI        74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.23.37.     PAGE    3

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS    DEF LINE    REFERENCES
    1  AUXI           1          82

 VARIABLES      SN  TYPE            RELOCATION
     0  C           REAL        ARRAY   / /         REFS     2      3*3
   171  I           INTEGER                         REFS     7   DEFINED     6
   172  L           INTEGER                         REFS     8   DEFINED     7
  5000  N           INTEGER                 / /     REFS     3   DEFINED     5
  4470  NOMOD       INTEGER                 / /     REFS     3      5
  4471  XMODNO      REAL        ARRAY       / /     REFS     3      4        7

 EXTERNALS            TYPE   ARGS       REFERENCES
        A1I                    0           10
        A2I                    0           12
        A3I                    0           14
        A4I                    0           15
        A5I                    0           13
        C1I                    0           20
        C10I                   0           39
        C2I                    0           22
        C3I                    0           24
        C4I                    0           25
        C5I                    0           23
        C6I                    0           30
        C7I                    0           32
        C8I                    0           34
        C9I                    0           35
        D1I                    0           40
        D2I                    0           42
        D3I                    0           44
        D4I                    0           45
        D5I                    0           43
        G1I                    0           50
        G2I                    0           52
        G3I                    0           54
        G4I                    0           55
        G5I                    0           53
        G6I                    0           60
        S1I                    0           62
        S10I                   0           80
        S2I                    0           64
        S3I                    0           65
        S4I                    0           63
        S5I                    0           70
        S6I                    0           72
        S7I                    0           74
        S8I                    0           75
        S9I                    0           73

 STATEMENT LABELS            DEF LINE   REFERENCES
   166  1                       81         5      8     11     13     15     17     19     21     23
                                          25     27     29     31     33     35     37     39     41
                                          43     45     47     49     51     53     55     57     59
                                          61     63     65     67     69     71     73     75     77
                                          79
```

```
STATEMENT LABELS          DEF LINE  REFERENCES
   57  2                     10        8
   61  3                     12        3
   63  4                     14        5
   65  5                     16        3
   67  6                     18        5
   71  7                     20        5
   73  8                     22        3
   75  9                     24        5
   77  10                    26        3
  101  11                    28        5
  103  12                    30        5
  105  13                    32        3
  107  14                    34        3
  111  15                    36        3
  113  16                    38        5
  115  17                    40        3
  117  18                    42        3
  121  19                    44        3
  123  20                    46        5
  125  21                    48        3
  127  22                    50        3
  131  23                    52        3
  133  24                    54        8
  135  25                    56        3
  137  26                    58        3
  141  27                    60        5
  143  28                    62        5
  145  29                    64        5
  147  30                    66        5
  151  31                    68        3
  153  32                    70        5
  155  33                    72        5
  157  34                    74        5
  161  35                    76        3
  163  36                    78        5
  165  37                    80        5

LOOPS  LABEL   INDEX   FROM-TO   LENGTH   PROPERTIES
  4    1       * I     6 81      165B             EXT REFS

COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
  / /           3830               0 C      (3830)

EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
C       C       3830            2363 NOMOD  (1)          2351 XMODNO (99)          2560 N     (1)

STATISTICS
  PROGRAM LENGTH              1233     123
  CM BLANK COMMON LENGTH     73663    3830
```

```
      SUBROUTINE AUXSUB                                              AMRK   131
      COMMON C(3830)                                                 AMRK   132
      EQUIVALENCE (C(2000),T     ), (C(2361),NOMOD ), (C(2362),XMODNO) AMRK 133
      EQUIVALENCE (C(2561),N     ), (C(2562),IPL   ), (C(2664),DER   ) AMRK 134
      EQUIVALENCE (C(2965),VAR   )                                   AMRK   135
      EQUIVALENCE (C(2320),LCONV)                                    AMRK   136
      DIMENSION   DER(101)        , VAR(101)        , IPL(100)       AMRK   137
      DIMENSION   XMODNO(99)                                         AMRK   138
      EXTERNAL A1                                                    AMRK   139
      EXTERNAL A2                                                    AMRK   140
      EXTERNAL A3                                                    AMRK   141
      DO 1 I=1,NOMOD                                                 AMRK   142
      IF(LCONV.EQ.2)RETURN                                           AMRK   143
      L =XMODNO(I)                                                   AMRK   144
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22, AMRK   145
     123,24,25,26,27,28,29,30,31,32,33,34,35,36,37),L                AMRK   146
    2 CALL A1                                                        AMRK   147
      GO TO 1                                                        AMRK   148
    3 CALL A2                                                        AMRK   149
      GO TO 1                                                        AMRK   150
    4 CALL A3                                                        AMRK   151
      GO TO 1                                                        AMRK   152
    5 CALL A4                                                        AMRK   153
      GO TO 1                                                        AMRK   154
    6 CALL A5                                                        AMRK   155
      GO TO 1                                                        AMRK   156
    7 CALL C1                                                        AMRK   157
      GO TO 1                                                        AMRK   158
    8 CALL C2                                                        AMRK   159
      GO TO 1                                                        AMRK   160
    9 CALL C3                                                        AMRK   161
      GO TO 1                                                        AMRK   162
   10 CALL C4                                                        AMRK   163
      GO TO 1                                                        AMRK   164
   11 CALL C5                                                        AMRK   165
      GO TO 1                                                        AMRK   166
   12 CALL C6                                                        AMRK   167
      GO TO 1                                                        AMRK   168
   13 CALL C7                                                        AMRK   169
      GO TO 1                                                        AMRK   170
   14 CALL C8                                                        AMRK   171
      GO TO 1                                                        AMRK   172
   15 CALL C9                                                        AMRK   173
      GO TO 1                                                        AMRK   174
   16 CALL C10                                                       AMRK   175
      GO TO 1                                                        AMRK   176
   17 CALL D1                                                        AMRK   177
      GO TO 1                                                        AMRK   178
   18 CALL D2                                                        AMRK   179
      GO TO 1                                                        AMRK   180
   19 CALL D3                                                        AMRK   181
      GO TO 1                                                        AMRK   182
   20 CALL D4                                                        AMRK   183
      GO TO 1                                                        AMRK   184
   21 CALL D5                                                        AMRK   185
      GO TO 1                                                        AMRK   186
   22 CALL G1                                                        AMRK   187
```

```
              GO TO 1                                          AMRK    188
           23 CALL G2                                          AMRK    189
              GO TO 1                                          AMRK    190
           24 CALL G3                                          AMRK    191
              GO TO 1                                          AMRK    192
           25 CALL G4                                          AMRK    193
              GO TO 1                                          AMRK    194
           26 CALL G5                                          AMRK    195
              GO TO 1                                          AMRK    196
           27 CALL G6                                          AMRK    197
              GO TO 1                                          AMRK    198
           28 CALL S1                                          AMRK    199
              GO TO 1                                          AMRK    200
           29 CALL S2                                          AMRK    201
              GO TO 1                                          AMRK    202
           30 CALL S3                                          AMRK    203
              GO TO 1                                          AMRK    204
           31 CALL S4                                          AMRK    205
              GO TO 1                                          AMRK    206
           32 CALL S5                                          AMRK    207
              GO TO 1                                          AMRK    208
           33 CALL S6                                          AMRK    209
              GO TO 1                                          AMRK    210
           34 CALL S7                                          AMRK    211
              GO TO 1                                          AMRK    212
           35 CALL S6                                          AMRK    213
              GO TO 1                                          AMRK    214
           36 CALL S9                                          AMRK    215
              GO TO 1                                          AMRK    216
           37 CALL S10                                         AMRK    217
            1 CONTINUE                                         AMRK    218
              RETURN                                           AMRK    219
              END                                              AMRK    220
```

```
      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE     REFERENCES
   1  AUXSUB          1           13       83

VARIABLES      SN   TYPE              RELOCATION
      0  C          REAL          ARRAY   / /          REFS      2      3*3      3*4      5      6
   5147  DER        REAL          ARRAY   / /          REFS      4        7
    172  I          INTEGER                            REFS     14   DEFINED      12
   5061  IPL        INTEGER       ARRAY   / /          REFS      4        7
    173  L          INTEGER                            REFS     15   DEFINED      14
   3743  LCONV      INTEGER               / /          REFS      6       13
   5000  N          INTEGER               / /          REFS      4
   4470  NOMOD      INTEGER               / /          REFS      3       12
   3717  T          REAL                  / /          REFS      3
   5624  VAR        REAL          ARRAY   / /          REFS      5        7
   4471  XMODNO     REAL          ARRAY   / /          REFS      3        8       14

EXTERNALS          TYPE    ARGS         REFERENCES
      A1                     0              9      17
      A2                     0             11      19
      A3                     0             11      21
      A4                     0             23
      A5                     0             25
      C1                     0             27
      C10                    0             45
      C2                     0             29
      C3                     0             31
      C4                     0             33
      C5                     0             35
      C6                     0             37
      C7                     0             39
      C8                     0             41
      C9                     0             43
      D1                     0             47
      D2                     0             49
      D3                     0             51
      D4                     0             53
      D5                     0             55
      G1                     0             57
      G2                     0             59
      G3                     0             61
      G4                     0             63
      G5                     0             65
      G6                     0             67
      S1                     0             69
      S10                    0             87
      S2                     0             71
      S3                     0             73
      S4                     0             75
      S5                     0             77
      S6                     0             79
      S7                     0             81
      S8                     0             83
      S9                     0             85
```

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SUBROUTINE AUXSJ3      74/74   OPT=1                      FTN 4.2+75067      05/05/75  16.23.59.      PAGE    4

STATEMENT LABELS              DEF LINE   REFERENCES
  167  1                        88        12    15    18    20    22    24    26    28    30
                                          32    34    36    38    40    42    44    46    48
                                          50    52    54    56    58    60    62    64    66
                                          68    70    72    74    76    78    80    82    84
                                          86
   60  2                        17        15
   62  3                        19        15
   64  4                        21        15
   66  5                        23        15
   70  6                        25        15
   72  7                        27        15
   74  8                        29        15
   76  9                        31        15
  100 10                        33        15
  102 11                        35        15
  104 12                        37        15
  106 13                        39        15
  110 14                        41        15
  112 15                        43        15
  114 16                        45        15
  116 17                        47        15
  120 18                        49        15
  122 19                        51        15
  124 20                        53        15
  126 21                        55        15
  130 22                        57        15
  132 23                        59        15
  134 24                        61        15
  136 25                        63        15
  140 26                        65        15
  142 27                        67        15
  144 28                        69        15
  146 29                        71        15
  150 30                        73        15
  152 31                        75        15
  154 32                        77        15
  156 33                        79        15
  160 34                        81        15
  162 35                        83        15
  164 36                        85        15
  166 37                        87        15

LOOPS  LABEL    INDEX      FROM-TO     LENGTH      PROPERTIES
  3    1        * I        12 88       1678             EXT REFS   EXITS

COMMON BLOCKS  LENGTH      MEMBERS - BIAS NAME(LENGTH)
 / /           3830            0 C      (3830)

EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C     C        3830         1399 I       (1)          2019 LCONV  (1)      2360 NOMOD  (1)
                             2361 XMODND  (99)         2560 N      (1)      2561 IPL    (100)
                             2663 OER     (131)        2964 VAR    (101)

STATISTICS
  PROGRAM LENGTH                 1743B     124
  CM BLANK COMMON LENGTH        7366B     3830
```

```
SUBROUTINE DUMPJ      74/74   OPT=1                 FTN 4.2+75067     05/05/75  16.24.01.     PAGE    1

                 SUBROUTINE DUMPJ
                 COMMON C(3830)                                          EXEC      2
                 DO 100 I=1, 1500, 7                                     EXEC      3
                 N = 0                                                   EXEC      4
    5            DO 200 J=1, 7                                           EXEC      5
                 K = I + J - 1                                           EXEC      6
             200 IF (ABS(C(K)) .GT. 1.E-10) N = 1                        EXEC      7
             100 IF (N .GT. 0) WRITE(6,300)                              EXEC      8
                *   I,C(I),C(I+1),C(I+2),C(I+3),C(I+4),C(I+5),C(I+6)     EXEC      9
   10        300 FORMAT(1H ,I5,1P7E15.7)                                 EXEC     10
                 RETURN                                                  EXEC     11
                 END                                                     EXEC     12
                                                                         EXEC     13

SUBROUTINE DUMPJ      74/74   OPT=1                 FTN 4.2+75067     05/05/75  16.24.01.     PAGE    2

     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS    DEF LINE    REFERENCES
    1 DUMPO         1          11

VARIABLES     SN   TYPE          RELOCATION
    0  C           REAL          ARRAY   //
   57  I           INTEGER                        REFS     2        7       7*8
   61  J           INTEGER                        REFS     6      8*8   DEFINED     3
   62  K           INTEGER                        REFS     6   DEFINED     5
   60  N           INTEGER                        REFS     7   DEFINED     6
                                                  REFS     8   DEFINED     4      7

FILE NAMES        MODE
     TAPE6        FMT                  WRITES      8

INLINE FUNCTIONS    TYPE    ARGS        DEF LINE  REFERENCES
     ABS            REAL     1  INTRIN                7

STATEMENT LABELS                 DEF LINE    REFERENCES
    0  100                           5           3
    0  200                           7           5
   53  300     FMT                  10           8

LOOPS  LABEL   INDEX    FROM-TO    LENGTH    PROPERTIES
    3  100     * I        3 8       35B                  EXT REFS  NOT INNER
   11  200     * J        5 7        7B      INSTACK

COMMON BLOCKS    LENGTH    MEMBERS - BIAS NAME(LENGTH)
    //            3830                0 C     (3830)

STATISTICS
   PROGRAM LENGTH                 63B       51
   CM BLANK COMMON LENGTH       7366B     3830
```

```
      SUBROUTINE OINPT1                                                EXEC   14
C     BASIC INPUT SUBROUTINE OINPT1                                    EXEC   15
      COMMON C(3830)                                                   EXEC   16
      EQUIVALENCE (C(3219),ONAME1), (C(3268),ONAME2), (C(3318),ONAME3), EXEC  17
C                 (C(3328),ONAME4), (C(2361),NOMOD ), (C(2362),MODNO ), EXEC  18
C                 (C(3440),NORNDM), (C(3441),RNDMNO), (C(3167),NODUT ), EXEC  19
C                 (C(3168),OUTNO ), (C(2461),NOSUB ), (C(2462),SUBNO ), EXEC  20
     *(C(3339),NOSTAT),                                                EXEC   21
C                 (C(3338),LOSTAT), (C(3340),STATNO), (C(3066),NOLIST), EXEC  22
C                 (C(3057),LISTNO), (C(3117),VALUE ), (C(2008),PLOTNO), EXEC  23
C                 (C(2009),NOPLOT), (C(2325),VLABLE), (C,K)            EXEC   24
      EQUIVALENCE (C(2010),  STEP)                                     EXEC   25
      EQUIVALENCE (C(1984),NPLOT )                                     EXEC   26
      EQUIVALENCE (C(1985),OUTPLT)                                     EXEC   27
      EQUIVALENCE (C(3512),ISGCT),(C(3514),SIGMA),(C(3554),SIGLB),     EXEC   28
     *(C(3594),SIGUB),(C(3634),ISNDX),(C(3574),IDIST),(C(3511),RNSTRT) EXEC   29
      EQUIVALENCE(C(3721),ITCT),(C(3723),TSGMA),(C(3733),TLB),         EXEC   30
     *(C(3743),TUB),(C(3753),ITNDX),(C(3763),ITDIST),(C(3773),TSPER),  EXEC   31
     *(C(3783),TYPPER),(C(3793),TPSIG),(C(3803),TNXST),(C(3813),ITNDX2) EXEC  32
      EQUIVALENCE (C( 21),LBVNSW)                                      EXEC   33
      EQUIVALENCE (C( 22), IPLOT)                                      EXEC   34
      EQUIVALENCE (C(19),PSIZE)                                        EXEC   35
      EQUIVALENCE (C( 23),KLAMBD)                                      EXEC   36
      EQUIVALENCE (C( 24), KSSIG)                                      EXEC   37
      EQUIVALENCE (C( 25),CEPSIG)                                      EXEC   38
      EQUIVALENCE (C(3825),  NCASE)                                    BREAK  93
      DIMENSION ONAME3(10),ONAME4(10)                                  EXEC   39
      DIMENSION LISTNO(50), VALUE(50)                                  EXEC   40
      DIMENSION SUBNO(33),IR(4),VR(4)                                  EXEC   41
      DIMENSION RNDMNO(50)                                             EXEC   42
      DIMENSION ALPHA(3),ONAME1(50),ONAME2(50),OUTNO(50) ,MODNO(99)    EXEC   43
      DIMENSION K(3510)                                                EXEC   44
      DIMENSION STATNO (100)                                           EXEC   45
      DIMENSION VLABLE(2,15)                                           EXEC   46
      DIMENSION OUTPLT(15)                                             EXEC   47
      DIMENSION SIGMA(40),SIGLB(4)),SIGUB(40),ISNDX(40),IDIST(40)      EXEC   48
      DIMENSION TSGMA(10),TLB(10),TUB(10),ITNDX(10),ITDIST(10),        EXEC   49
     *TSPER(10),TYPPER(10),TPSIG(10),ITNDX2(10),TNXST(10)              EXEC   50
      DIMENSION CEPSIG(5)                                              EXEC   51
      INTEGER CEPSIG                                                   EXEC   52
      REAL KSSIG                                                       EXEC   53
      REAL MODNO                                                       EXEC   54
      INTEGER OUTNO                                                    EXEC   55
      INTEGER RNDMNO                                                   EXEC   56
      INTEGER STATNO                                                   EXEC   57
      INTEGER OUTPLT                                                   EXEC   58
      DATA CFERTY/10HR        /                                        EXEC   59
      DATA SSS/10HS        /                                           EXEC   60
      JAR = 0                                                          EXEC   61
      WRITE(6,31)                                                      EXEC   62
   31 FORMAT(1H1INPUT DATA/)                                           EXEC   63
    1 READ(5,2)IR(1),(ALPHA(JC),JC=1,3),IR(2),IR(3),TPER,TPSGMA,       EXEC   64
     *VR(1),VR(2),VR(3),IR(4),VR(4)                                    EXEC   65
      IF(EOF(5)) 50,55                                                 EXEC   66
   55 CONTINUE                                                         EXEC   67
      WRITE(6,30)IR(1),(ALPHA(JC),JC=1,3),IR(2),IR(3),TPER,TPSGMA,     EXEC   68
     *VR(1),VR(2),VR(3),                                               EXEC   69
```

```
     *IR(4),VR(4)                                                       EXEC    70
   30 FORMAT(1X,I2,3A6,I5,I2,A1,F3.2,2E15.7,F10.4,I5,F7.4)              EXEC    71
    2 FORMAT(I2,3A6,I5,I1,A1,F3.2,2E15.7,F10.4,I5,F5.2)                 EXEC    72
    7 IF( IR(1) .NE. 1 ) GO TO 3                                        EXEC    73
      NOSUB = NOSUB + 1                                                 EXEC    74
      SUBNO(NOSUB) = IR(2)                                              EXEC    75
      GO TO 1                                                           EXEC    76
    3 IF( IR(1) .NE. 2 ) GO TO 4                                        EXEC    77
      NOMOD = NOMOD + 1                                                 EXEC    78
      MODNO(NOMOD) = IR(2)                                              EXEC    79
      GO TO 1                                                           EXEC    80
    4 IF(IR(1) .NE. 3) GO TO 5                                          EXEC    81
      L = IR(2)                                                         EXEC    82
      G(L) = VR(1)                                                      EXEC    83
      IF (VR(2) .EQ. 0.) GO TO 1                                        EXEC    84
      NOLIST = NOLIST + 1                                               EXEC    85
      LISTNO(NOLIST) = L                                                EXEC    86
      VALUE(NOLIST) = VR(1)                                             EXEC    87
      GO TO 1                                                           EXEC    88
    5 IF(IR(1) .NE. 4) GO TO 6                                          EXEC    89
      NOOUT = NOOUT + 1                                                 EXEC    90
      IF (NOOUT.GT.50) GO TO 1                                          EXEC    91
      ONAME1(NOOUT)=ALPHA(2)                                            EXEC    92
      ONAME2(NOOUT) = ALPHA(3)                                          EXEC    93
      OUTNO(NOOUT) = IR(2)                                              EXEC    94
      GO TO 1                                                           EXEC    95
    6 IF (IR(1) .NE. 5) GO TO 16                                        EXEC    96
      IF (VR(1) .EQ. 0.) GO TO 17                                       EXEC    97
      LOSTAT = LOSTAT + 1                                               EXEC    98
   17 NOSTAT = NOSTAT + 1                                               EXEC    99
      STATNO(NOSTAT) = IR(2)                                            EXEC   100
      ONAME3(NOSTAT)=ALPHA(2)                                           EXEC   101
      ONAME4(NOSTAT)=ALPHA(3)                                           EXEC   102
      GO TO 1                                                           EXEC   103
   16 IF (IR(1).NE.7) GO TO 19                                          EXEC   104
      NPLOT=NPLOT+1                                                     EXEC   105
      IF (NPLOT.GT.15) GO TO 1                                          EXEC   106
      DO 20 I=1,2                                                       EXEC   107
   20 VLABLE (I,NPLOT)=ALPHA(I+1)                                       EXEC   108
      OUTPLT(NPLOT)=IR(2)                                               EXEC   109
      GO TO 1                                                           EXEC   110
   19 IF(IR(1).NE.8) GO TO 18                                           EXEC   111
      IF(TFER.EQ.SSS) GO TO 194                                         EXEC   112
      IF(VR(4).GT.0.) GO TO 192                                         EXEC   113
      IF(IR(3).NE.0.AND.IR(3).NE.1) GO TO 193                           EXEC   114
      ISGCT=ISGCT+1                                                     EXEC   115
      SIGMA(ISGCT)=VR(1)                                                EXEC   116
      SIGLB(ISGCT)=VR(2)                                                EXEC   117
      SIGUB(ISGCT)=VR(3)                                                EXEC   118
      ISNDX(ISGCT)=IR(2)                                                EXEC   119
      IDIST(ISGCT)=IR(3)                                                EXEC   120
      GO TO 1                                                           EXEC   121
   18 IF(IR(1).NE.9) GO TO 191                                          EXEC   122
      STEP = 11.                                                        EXEC   123
      READ(5,8)NP,I3VMSW,IPLOT,XLAMBD,KSSIG,(CEPSIS(I),I=1,5),PSIZE     EXEC   124
    8 FORMAT(3I4,2F10.3,5I2,E15.7)                                      EXEC   125
      GO TO 1                                                           EXEC   126
```

```
  192 IF(IR(3).GT.5) GO TO 193                                          EXEC   127
      ITCT=ITCT+1                                                       EXEC   128
      TSGMA(ITCT)=VR(1)                                                 EXEC   129
      TLB(ITCT)=VR(2)                                                   EXEC   130
      TUB(ITCT)=VR(3)                                                   EXEC   131
      ITNDX2(ITCT)=IR(2)                                                EXEC   132
      IF(IR(4).GT.0) ITNDX2(ITCT)=IR(4)                                 EXEC   133
      ITNDX(ITCT)=IR(2)                                                 EXEC   134
      ITDIST(ITCT)=IR(3)                                                EXEC   135
      TSPER(ITCT)=VR(4)                                                 EXEC   136
      TPSIG(ITCT)=TPSGMA                                                EXEC   137
      TYPPER(ITCT)=0.                                                   EXEC   138
      IF(TPER.EQ.CPER(Y)) TYPPER(ITCT)=1.                               EXEC   139
      GO TO 1                                                           EXEC   140
  194 RNSTRT=VR(1)                                                      EXEC   141
      GO TO 1                                                           EXEC   142
  193 WRITE(6,5518)                                                     EXEC   143
 5518 FORMAT(1X,59HUNDEFINED DISTRIBUTION TYPE NUMBER ENTERED - CARD REJ EXEC   144
     *ECTED)                                                            EXEC   145
      WRITE(6,30)IR(1),(ALPHA(JC),JC=1,3),IR(2),IR(3),TPER,TPSGMA,      EXEC   146
     *VR(1),VR(2),VR(3),                                                EXEC   147
     *IR(4),VR(4)                                                       EXEC   148
      GO TO 1                                                           EXEC   149
  191 CONTINUE                                                          BREAK   94
      NCASE=NCASE+1                                                     BREAK   95
      IF(IR(2).EQ.0)RETURN                                              BREAK   96
      N = IR(2)                                                         EXEC   151
      DO 12 I = 1, N                                                    EXEC   152
      READ (5,13) J,Y,MAND,MIER,SIGNO,BETA                              EXEC   153
      WRITE (6,13) J,Y,MAND,MIER,SIGNO,BETA                             EXEC   154
   13 FORMAT (I5,F5.0,2(3X,O12),2E15.6)                                 EXEC   155
      NORNOM = NORNOM + 1                                               EXEC   156
      RNDMNO(I) = J                                                     EXEC   157
      C(J) = Y                                                          EXEC   158
      K(J+1) = MAND                                                     EXEC   159
      K(J+2) = MIER                                                     EXEC   160
      C(J+3) = SIGNO                                                    EXEC   161
   12 C(J+4) = BETA                                                     EXEC   162
      RETURN                                                            EXEC   163
   50 STOP                                                              EXEC   164
      END                                                               EXEC   165
```


CARD NR.	SEVERITY	DETAILS	DIAGNOSIS OF PROBLEM
60	I	33-CD 60	FIELD WIDTH OF A CONVERSION DESCRIPTOR SHOULD BE AS LARGE AS THE MINIMUM SPECIFIED FOR THAT DESCRIPTOR.

```
     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS     DEF LINE     REFERENCES
    1   OINPT1        1          140       153

VARIABLES     SN   TYPE           RELOCATION
  445   ALPHA      REAL       ARRAY               REFS        31      56      80      81      89      30      96
                                                   134    DEFINED   52
  434   BETA       REAL                           REFS       144     152  DEFINED    143
    0   C          REAL       ARRAY     / /       REFS         3    22*4      12      13      14    7*13  11*17
                                                    20        21      22      23      24      25      26
                                               DEFINED        71    -148     151     152
   30   CEPSIG     INTEGER    ARRAY     / /       REFS        25      39      40  DEFINED    112
  233   CPERTY     REAL                           REFS       127  DEFINED     47
  424   I          INTEGER                        REFS      2*96     112     147  DEFINED     95     112     142
   24   IBVNSW     INTEGER              / /       REFS        20  DEFINED    112
 7131   IDIST      INTEGER    ARRAY     / /       REFS        15      36  DEFINED    108
   25   IPLOT      INTEGER              / /       REFS        21  DEFINED    112
  435   IR         INTEGER    ARRAY               REFS        29    4*56      61      63      65      67      69
                                                    70        77      52      84      88      92      97      99
                                                 2*102       107     108     110     115     120   2*121     122
                                                   123     4*134     140     141  DEFINED   4*52
 6667   ISGCT      INTEGER              / /       REFS        15     103     104     105     106     107     108
                                               DEFINED       103
 7061   ISNOX      INTEGER    ARRAY     / /       REFS        15      36  DEFINED    107
 7210   ITCT       INTEGER              / /       REFS        17     116     117     118     119     120     121
                                                   122       123     124     125     126     127
                                               DEFINED       116
 7262   ITDIST     INTEGER    ARRAY     / /       REFS        17      37  DEFINED    123
 7250   ITNOX      INTEGER    ARRAY     / /       REFS        17      37  DEFINED    122
 7344   ITNOX2     INTEGER    ARRAY     / /       REFS        17      37  DEFINED    120     121
  427   J          INTEGER                        REFS       144     147     148     149     150     151     152
                                               DEFINED       143
  417   JAR      * INTEGER                     DEFINED        49
  420   JC         INTEGER                        REFS        52      56     134  DEFINED     52      56     134
    0   K          INTEGER    ARRAY     / /       REFS         4      32  DEFINED    149     150
   27   KSSIG      REAL                 / /       REFS        24      41  DEFINED    112
  423   L          INTEGER                        REFS        71      74  DEFINED     70
 5772   LISTNO     INTEGER    ARRAY     / /       REFS         4      28  DEFINED     74
 6411   LOSTAT     INTEGER              / /       REFS         4      86  DEFINED     86
  431   MANO       INTEGER                        REFS       144     149  DEFINED    143
  432   MIER       INTEGER                        REFS       144     150  DEFINED    143
 4471   MODNO      REAL       ARRAY     / /       REFS         4      31      42  DEFINED     67
  426   N          INTEGER                        REFS       142  DEFINED    141
 7360   NCASE      INTEGER              / /       REFS        26     139  DEFINED    139
 5771   NOLIST     INTEGER              / /       REFS         4      73      74      75  DEFINED     73
 4470   NOMOD      INTEGER              / /       REFS         4      66      67  DEFINED     66
 6136   NOOUT      INTEGER              / /       REFS         4      78      79      80      81      82
                                               DEFINED        78
 3730   NOPLOT     INTEGER              / /       REFS         4
 6557   NORNOM     INTEGER              / /       REFS         4     146  DEFINED    146
 6412   NOSTAT     INTEGER              / /       REFS         4      87      88      89      90
                                               DEFINED        87
 4634   NOSUB      INTEGER              / /       REFS         4      62      63  DEFINED     62
  425   NP       * INTEGER                     DEFINED       112
 3677   NPLOT      INTEGER              / /       REFS        13      93      94      96      97
                                               DEFINED        93
```

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SUBROUTINE OINPT1      74/74    OPT=1                              FTN 4.2+75067      05/05/75  16.24.82.      PAGE    6

VARIABLES      SN  TYPE           RELOCATION
  6221  ONAME1     REAL       ARRAY   / /       REFS       4      31   DEFINED     80
  6303  ONAME2     REAL       ARRAY   / /       REFS       4      31   DEFINED     81
  6365  ONAME3     REAL       ARRAY   / /       REFS       4      27   DEFINED     89
  6377  ONAME4     REAL       ARRAY   / /       REFS       4      27   DEFINED     90
  6137  OUTNO      INTEGER    ARRAY   / /       REFS       4      31        43   DEFINED     82
  3700  OUTPLT     INTEGER    ARRAY   / /       REFS      14      35        46   DEFINED     97
  3727  PLOTNO     REAL               / /       REFS       4
    22  PSIZE      REAL               / /       REFS      22  DEFINED      112
  6560  RNOMNO     INTEGER    ARRAY   / /       REFS       4      30        44   DEFINED    147
  6666  ONSTRT     REAL               / /       REFS      15  DEFINED      129
  6741  SIGLB      REAL       ARRAY   / /       REFS      15      36   DEFINED    105
  6671  SIGMA      REAL       ARRAY   / /       REFS      15      36   DEFINED    104
   433  SIGNO      REAL                         REFS     144     151   DEFINED    143
  7611  SIGUB      REAL       ARRAY   / /       REFS      15      36   DEFINED    106
   234  SSS        REAL                         REFS     130  DEFINED       48
  6413  STATNO     INTEGER    ARRAY   / /       REFS       4      33        45   DEFINED     88
  3731  STEP       REAL               / /       REFS      12  DEFINED      111
  4635  SUBNO      REAL       ARRAY   / /       REFS       4      29   DEFINED     63
  7224  TLB        REAL       ARRAY   / /       REFS      17      37   DEFINED    118
  7332  TNXST      REAL       ARRAY   / /       REFS      17      37
   421  TPER       REAL                         REFS      56     100       127       134   DEFINED     52
   422  TPSGMA     REAL                         REFS      56     125       134   DEFINED     52
  7320  TPSIG      REAL       ARRAY   / /       REFS      17      37   DEFINED    125
  7212  TSGMA      REAL       ARRAY   / /       REFS      17      37   DEFINED    117
  7274  TSPER      REAL       ARRAY   / /       REFS      17      37   DEFINED    124
  7236  TUB        REAL       ARRAY   / /       REFS      17      37   DEFINED    119
  7306  TYPPER     REAL       ARRAY   / /       REFS      17      37   DEFINED    126       127
  6654  VALUE      REAL       ARRAY   / /       REFS       4      28   DEFINED     75
  4424  VLABLE     REAL       ARRAY   / /       REFS       4      34   DEFINED     96
   441  VR         REAL       ARRAY             REFS      29    4*56        71        72        75        85       101
                                                 104     105     106       117       118       119       124       129
                                               4*134 DEFINED    4*52
    26  XLAMBD     REAL               / /       REFS      23  DEFINED      112
   430  Y          REAL                         REFS     144     148   DEFINED    143

FILE NAMES         MODE
        TAPE5      FMT                    READS       52     112     143
        TAPE6      FMT                    WRITES      50      56     131       134       144

EXTERNALS              TYPE   ARGS        REFERENCES
        EOF            REAL     1             54

STATEMENT LABELS                  DEF LINE   REFERENCES
     5  1                            52        64        68        72        76        79        83        91        94        98
                                              103       114       128       130       137
   306  2          FMT               60        52
    20  3                            65        61
    25  4                            69        65
    42  5                            77        69
    54  6                            84        77
     0  7          INACTIVE          61
   327  8          FMT              113       112
     0  12                          152       142
   407  13         FMT              145       143       144
    70  16                           92        84
    61  17                           87        85
   131  18                          110        93
```

```
SUBROUTINE OINPT1      74/74   OPT=1                                  FTN 4.2+75067          05/05/75  16.24.02.       PAGE    7

STATEMENT LABELS          DEF LINE   REFERENCES
   105  19                     99        32
     0  20                     95        95
   300  30      FMT            59        55        134
   240  31      FMT            51        53
   230  50                    154        54
     0  55          INACTIVE   55        54
   201  191                   138       113
   137  192                   115       101
   174  193                   131       102       115
   172  194                   129       100
   336  5518    FMT           132       131

LOOPS   LABEL   INDEX   FROM-TO    LENGTH    PROPERTIES
  100    20       I      95  96       23      INSTACK
  206    12     * I     142 152      218                    EXT REFS

COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
    / /          3830             0 C       (3830)

EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
C       C        3830             0 K       (3510)
                                            19 PSIZE    (1)          20 IBVNSW   (1)
                                 21 JPLOT    (1)          22 XLAM3D   (1)          23 KSSIG    (1)
                                 24 CEPSIG   (6)        1983 NPLOT    (1)        1984 OUTPLT   (15)
                               2007 PLOTNO   (1)        2008 NOPLOT   (1)        2009 STEP     (1)
                               2324 V.ABLE   (30)       2360 NOMOG    (1)        2361 MODNO    (99)
                               2460 NDSJB    (1)        2461 SUBND    (99)       3065 NOLIST   (1)
                               3065 LISTNO   (50)       3115 VALUE    (50)       3166 NOOUT    (1)
                               3167 OUTNO    (50)       3217 ONAME1   (50)       3267 ONAME2   (50)
                               3317 ONAME3   (10)       3327 ONAME4   (10)       3337 LOSTAT   (1)
                               3338 NOSTAT   (1)        3339 STATNO   (100)      3439 NORNOM   (1)
                               3441 RNDMNO   (50)       3510 RNSTRT   (1)        3511 ISGCT    (1)
                               3513 SIGMA    (40)       3553 SIGLB    (40)       3593 SIGUB    (40)
                               3633 ISNDX    (40)       3673 IDIST    (40)       3720 ITCT     (1)
                               3722 TSGMA    (10)       3732 TLB      (10)       3742 TUB      (10)
                               3752 ITNDX    (10)       3762 ITDIST   (10)       3772 TSPER    (10)
                               3762 TYPPER   (10)       3792 TPSIG    (10)       3802 TNXST    (10)
                               3812 ITNDX2   (10)       3824 NCASE    (1)

STATISTICS
  PROGRAM LENGTH              4503     296
  CM BLANK COMMON LENGTH     73663    3830
```

```
          SUBROUTINE OUPT2                                                      EXEC   165
      C   OUTPUT-INITIALIZITION SUBROUTINE OUPT2                                EXEC   167
          COMMON C(3830),GRAPH                                                  EXEC   168
          EQUIVALENCE (C(2017),DTCNT ), (C(3167),NOOUT ), (C(2016),PGCNT ),     EXEC   169
  5     C             (C(2014),ITCNT ), (C(2003),PCNT  ), (C(2015),OPP   ),     EXEC   170
        C             (C(2018),TAPE  ), (C(2019),TAPEND), (C(2013),DOC   ),     EXEC   171
        C             (C(2000),T     ), (C(2021),KCONV ), (C(2025),TIME  ),     EXEC   172
        C             (C(2005),PLOTNO), (C(2009),NOPLOT), (C(3168),OUTNO ),     EXEC   173
        C             (C(2004),PPNT  ), (C(2023),OPOINT)                        EXEC   174
 10       DIMENSION GRAPH(1,1),TIME(300),OUTNO(50)                              EXEC   175
          INTEGER     PGCNT , DTCNT , OUTNO , OPOINT                            EXEC   176
          EQUIVALENCE (C(1985),OUTPLT)                                          EXEC   177
          INTEGER OUTPLT                                                        EXEC   178
          DIMENSION OUTPLT(15)                                                  EXEC   179
 15       KCONV=0                                                               EXEC   180
          ITCNT = DOC + 1.0                                                     EXEC   181
          PCNT = T-0.000001                                                     EXEC   182
          PGCNT = 1                                                             EXEC   183
          DTCNT = (NOOUT + 4)/5                                                 EXEC   184
 20       IF ( ITCNT .GE. 7) GO TO 2                                            EXEC   185
          ITCNT = ITCNT + 1                                                     EXEC   186
          CALL LUMPO                                                            EXEC   187
      C                                                                         EXEC   188
        2 TIME(1)=T                                                             EXEC   189
 25       OPOINT =1                                                             EXEC   190
          DO 10 J=1,NOPLOT                                                      EXEC   191
          K=OUTPLT(J)                                                           EXEC   192
       10 GRAPH(1,J)=C(K)                                                       EXEC   193
          RETURN                                                                EXEC   194
 30       END                                                                   EXEC   195
```

SUBROUTINE OUPT2   74/74   OPT=1   FTN 4.2+75057   05/05/75 16.24.35.   PAGE 2

CARD NR.	SEVERITY	DETAILS	DIAGNOSIS OF PROBLEM
28	I	NOPLOT	THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.

```
SUBROUTINE OUPT2        74/74    OPT=1                          FTN 4.2+.4057     05/05/75  16.24.05.     PAGE   3

      SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE      REFERENCES
        1  OUPT2         1            29

  VARIABLES     SN  TYPE           RELOCATION
        0  C          REAL      ARRAY    / /        REFS      3     17*4       12        28
     3736  CPP        REAL               / /        REFS      4
     3734  DOC        REAL               / /        REFS      4       16
     3740  DTCNT      INTEGER            / /        REFS      4       11   DEFINED       19
     7366  GRAPH      REAL      ARRAY    / /        REFS      3       10   DEFINED       28
     3735  ITCNT      INTEGER            / /        REFS      4       20       21   DEFINED    16     21
       33  J          INTEGER                       REFS     27       28   DEFINED       26
       34  K          INTEGER                       REFS     28  DEFINED       27
     3744  KCONV      INTEGER            / /        REFS      4  DEFINED       15
     6136  NOOUT      INTEGER            / /        REFS      4       19
     3730  NOPLOT     INTEGER            / /        REFS      4       26
     3746  OPOINT     INTEGER            / /        REFS      4       11   DEFINED       25
     6137  OUTNO      INTEGER   ARRAY    / /        REFS      4       10       11
     3700  OUTPLT     INTEGER   ARRAY    / /        REFS     12       13       14        27
     3722  PCNT       REAL               / /        REFS      4  DEFINED       17
     3737  PGCNT      INTEGER            / /        REFS      4       11   DEFINED       18
     3727  PLOTNO     REAL               / /        REFS      4
     3723  PPNT       REAL               / /        REFS      4
     3717  T          REAL               / /        REFS      4       17       24
     3741  TAPE       REAL               / /        REFS      4
     3742  TAPEND     REAL               / /        REFS      4
     3750  TIME       REAL      ARRAY    / /        REFS      4       10   DEFINED       24

  EXTERNALS           TYPE   ARGS        REFERENCES
        DUMPO                  C             22

  STATEMENT LABELS                 DEF LINE    REFERENCES
       20  2                          24          23
        0  10                         28          25

  LOOPS  LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
     26  10          J         26 28        3B        INSTACK

  COMMON BLOCKS   LENGTH      MEMBERS - BIAS NAME(LENGTH)
        / /         3831                 0 C        (3630)          3630 GRAPH   (1)

  EQUIV CLASSES   LENGTH      MEMBERS - BIAS NAME(LENGTH)
  C        C        3131              1984 OUTPLT  (15)          1999 T        (1)         2002 PCNT    (1)
                                      2003 PPNT    (1)           2007 PLOTNO   (1)         2008 NOPLOT  (1)
                                      2012 DOC     (1)           2013 ITCNT    (1)         2014 CPP     (1)
                                      2015 PGCNT   (1)           2016 DTCNT    (1)         2017 TAPE    (1)
                                      2018 TAPEND  (1)           2020 KCONV    (1)         2022 OPOINT  (1)
                                      2024 TIME    (300)         3166 NOOUT    (1)         3167 OUTNO   (58)

  STATISTICS
    PROGRAM LENGTH                   353       29
    CM BLANK COMMON LENGTH         73673     3831
```

```
      SUBROUTINE OUPT3                                                  EXEC  196
C     OUTPUT-SUBROUTINE-OUPT3                                           EXEC  197
      COMMON C(3830),GRAPH                                              EXEC  198
      EQUIVALENCE (C(3168),OUTNO ), (C(3218),ONAME1), (C(3268),ONAME2), EXEC  199
C                 (C(2017),DTCNT ), (C(3167),NOOUT ), (C(2016),PGCNT ), EXEC  200
C                 (C(2014),ITCNT ), (C(2003),PCNT  ), (C(2015),CPP   ), EXEC  201
C                 (C(2000),T     ), (C(2664),DER   ), (C(2018),TAPE  ), EXEC  202
C                 (C(2019),TAPEND), (C(2008),PLOTNO), (C(2009),NOPLOT), EXEC  203
C                 (C(2005),PPP   ), (C(2004),PPNT  ), (C(2025),TIME  ), EXEC  204
C                 (C(2023),OPOINT)                                      EXEC  205
      EQUIVALENCE (C(1985),OUTPLT)                                      EXEC  206
      DIMENSION B(50),OUTNO(50),ONAME1(50),ONAME2(50)                   EXEC  207
      DIMENSION TIME(300),GRAPH(1,1)                                    EXEC  208
      DIMENSION OUTPLT(15)                                              EXEC  209
      INTEGER DTCNT,PGCNT,OUTNO                                         EXEC  210
      INTEGER OPOINT                                                    EXEC  211
      INTEGER OUTPLT                                                    EXEC  212
C                                                                       EXEC  213
C**   SAVE SPOT JITTER MAX/MIN VALUES                                   EXEC  214
      IF(C(1680).GT.C(1567)) C(1567) = C(1680)                          EXEC  215
      IF(C(1680).LT.C(1568)) C(1568) = C(1680)                          EXEC  216
      IF(C(1681).GT.C(1577)) C(1577) = C(1681)                          EXEC  217
      IF(C(1681).LT.C(1578)) C(1578) = C(1681)                          EXEC  218
C                                                                       EXEC  219
      IF (ITCNT. GT. 6) GO TO 7                                         EXEC  220
      ITCNT = ITCNT + 1                                                 EXEC  221
      CALL DUMPO                                                        EXEC  222
      PGCNT = -1                                                        EXEC  223
C                                                                       EXEC  224
    7 IF (DER. EQ. DER1) GO TO 8                                        EXEC  225
      DER1 = DER                                                        EXEC  226
      WRITE(6,20)T,DER                                                  EXEC  227
   20 FORMAT(1H ,5HTIME=F1+.7,2X,10HSTEP SIZE=1PE19.7)                  EXEC  228
    8 IF (T .LT. PCNT)GOTO15                                            EXEC  229
    9 PCNT = PCNT + CPP                                                 EXEC  230
      IF (PGCNT. NE. 1) GO TO 3                                         EXEC  231
      IF(NOOUT.LE.1) GO TO 3                                            EXEC  232
    1 WRITE(6,2) (ONAME1(I),ONAME2(I), I=1,NOOUT)                       EXEC  233
    2 FORMAT (1H1,3X,4HTIME,5X,5(7X,2A6)//(20X,2A6,7X,2A6,7X,2A6,7X,    EXEC  234
     12A6,7X,2A6)/)                                                     EXEC  235
      PGCNT = 2*DTCNT + 4                                               EXEC  236
    3 IF(PGCNT .GE. 86) GO TO 1                                         EXEC  237
      DO 4 I = 1,NOOUT                                                  EXEC  238
      J = OUTNO(I)                                                      EXEC  239
    4 B(I) = C(J)                                                       EXEC  240
      IF(NOOUT.LE.1) GO TO 15                                           EXEC  241
      WRITE (6,5) T,(B(I), I = 1,NOOUT)                                 EXEC  242
    5 FORMAT (///,F14.7,1P5E19.7/(14X,1P5E19.7))                        EXEC  243
      PGCNT = PGCNT + DTCNT + 4                                         EXEC  244
   15 IF(T.LT.PPNT.OR.NOPLOT.EQ.0) RETURN                               EXEC  245
      PPNT=PPNT+PPP                                                     EXEC  246
      KPOINT =OPOINT +1                                                 EXEC  247
      IF (KPOINT-300) 16,13,18                                          EXEC  248
   13 WRITE (6,14)                                                      EXEC  249
   14 FORMAT (//71H ****  WARNING-PLOTTING ARRAY FILLED-ONLY FIRST 300 P EXEC  250
     1OINTS PLOTTED ****,//)                                            EXEC  251
   16 OPOINT=KPOINT                                                     EXEC  252
```

```
SUBROUTINE OUPT3        74/74   OPT=1                         FT. 4.2+75067     05/05/75  16.24.06.    PAGE   2

                    TIME (OPOINT)=T
                    DO 10 J=1,NJPLOT                              EXEC     253
      60            K=OUTFLT(J)                                   EXEC     254
                 10 GRAPH(OPOINT  ,J)=C(K)                        EXEC     255
                 18 RETURN                                        EXEC     256
                    END                                           EXEC     257
                                                                  EXEC     258

SUBROUTINE OUPT3        74/74   OPT=1                         FTN 4.2+75067     05/05/75  16.24.06.    PAGE   3
CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

   61      I       NOPLOT     THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.
```

```
      SUBROUTINE OUPT3      74/74    OPT=1                    FTN 4.2+75067     05/05/75  16.24.86.    PAGE    4

           SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE      REFERENCES
       1  OUPT3          1            50          62

 VARIABLES        SN   TYPE            RELOCATION
   207  B              REAL         ARRAY             REFS        12        47    DEFINED        45
     0  C              REAL         ARRAY      / /    REFS         3      19*4         11      3*20      3*21      3*22      3*23
                                                        45        51   DEFINED         20        21        22        23
  3736  CPP            REAL                    / /    REFS         4        35
  5147  DER            REAL                    / /    REFS         6        30         31        32
   202  DER1           REAL                           REFS        30   DEFINED         31
  3740  DTCNT          INTEGER                 / /    REFS         4        15         41        49
  7366  GRAPH          REAL         ARRAY      / /    REFS         3        13    DEFINED        61
   203  I              INTEGER                        REFS      2*38        44         45        47   DEFINED        38        43
                                                        47
  3735  ITCNT          INTEGER                 / /    REFS         4        25         26   DEFINED        26
   204  J              INTEGER                        REFS        45        60         51   DEFINED        44        59
   206  K              INTEGER                        REFS        51   DEFINED         60
   205  KPOINT         INTEGER                        REFS        53        57    DEFINED        52
  6136  NODUT          INTEGER                 / /    REFS         4        37         38        43        46        47
  3730  NOPLOT         INTEGER                 / /    REFS         4        50         59
  6221  ONAME1         REAL         ARRAY      / /    REFS         4        12         38
  6303  ONAME2         REAL         ARRAY      / /    REFS         4        12         38
  3746  OPOINT         INTEGER                 / /    REFS         4        16         52        58        61
                                                   DEFINED        57
  6137  OUTNO          INTEGER      ARRAY      / /    REFS         4        12         15        44
  3700  OUTPLT         INTEGER      ARRAY      / /    REFS        11        14         17        60
  3722  PCNT           REAL                    / /    REFS         4        34         35   DEFINED        35
  3737  PGCNT          INTEGER                 / /    REFS         4        15         36        42        49
                                                   DEFINED        28        41         49
  3727  PLOTNO         REAL                    / /    REFS         4
  3723  PPNT           REAL                    / /    REFS         4        50         51   DEFINED        51
  3724  PPP            REAL                    / /    REFS         4        51
  3717  T              REAL                    / /    REFS         4        32         34        47        50        58
  3741  TAPE           REAL                    / /    REFS         4
  3742  TAPEND         REAL                    / /    REFS         4
  3750  TIME           REAL         ARRAY      / /    REFS         4        13    DEFINED        58

 FILE NAMES           MODE
       TAPE6          FMT                     WRITES        32        38        47        54

 EXTERNALS             TYPE    ARGS          REFERENCES
       DUMPO                     6              27

 STATEMENT LABELS               DEF LINE     REFERENCES
    36  1                          38          42
   145  2          FMT             39          38
    54  3                          42          35        37
     0  4                          45          43
   161  5          FMT             48          47
    23  7                          30          25
    27  8                          34          33
     0  9            INACTIVE      35
     0  10                         61          53
     0  13           INACTIVE      54          53
   171  14         FMT             55          54
```

```
STATEMENT LABELS                DEF LINE   REFERENCES
   77  15                          50         34        46
  112  16                          57         53
  123  18                          62         53
  131  20     FMT                  33         32

LOOPS  LABEL   INDEX    FROM-TO    LENGTH    PROPERTIES
  41            * I       38        10B                    EXT REFS
  61    4         I       43-45     3B        INSTACK
 120   10         J       59 61     3B        INSTACK

COMMON BLOCKS   LENGTH      MEMBERS - BIAS NAME(LENGTH)
  //             3831            0 C       (3830)           3830 GRAP4  (1)

EQUIV CLASSES   LENGTH      MEMBERS - BIAS NAME(LENGTH)
C      C         3831           1384 OUTPLT  (15)     1999 T       (1)        2002 PCNT    (1)
                                2303 PPNT    (1)      2004 PPP     (1)        2007 PLOTNO  (1)
                                2308 NOPLOT  (1)      2013 ITCNT   (1)        2014 CPP     (1)
                                2315 PSCNT   (1)      2016 DTCNT   (1)        2017 TAPE    (1)
                                2018 TAPEND  (1)      2022 OPOINT  (1)        2024 TIME    (300)
                                2663 CER     (1)      3165 NOOUT   (1)        3167 OUTNO   (50)
                                3217 ONAME1  (50)     3267 ONAME2  (50)

STATISTICS
  PROGRAM LENGTH              2713      185
  CM BLANK COMMON LENGTH      73673     3831
```

```
SUBROUTINE ZERO          74/74    OPT=1                FTN 4.2+75057      05/05/75  16.24.88.     PAGE   1

                    SUBROUTINE ZERO                                                      EXEC    259
                    COMMON C(3830)                                                       EXEC    260
                    EQUIVALENCE (C(1384),NPLOT )                                         EXEC    261
                    EQUIVALENCE (C(2023),OPOINT)                                         EXEC    262
                    EQUIVALENCE (C(2361),NOMOD )                                         EXEC    263
                    EQUIVALENCE (C(2461),NOSUB )                                         EXEC    264
                    EQUIVALENCE (C(3066),NOLIST)                                         EXEC    265
                    EQUIVALENCE (C(3167),NOOUT )                                         EXEC    266
                    EQUIVALENCE (C(3338),LOSTAT)                                         EXEC    267
                    EQUIVALENCE (C(3339),NOSTAT)                                         EXEC    268
                    EQUIVALENCE (C(3440),NORNDM)                                         EXEC    269
                    INTEGER OPOINT                                                       EXEC    270
                    LOSTAT = 0                                                           EXEC    271
                    NOSTAT = 0                                                           EXEC    272
                    NOSUB = 0                                                            EXEC    273
                    NOMOD = 0                                                            EXEC    274
                    NOOUT = 0                                                            EXEC    275
                    NORNDM = 0                                                           EXEC    276
                    NOLIST = 0                                                           EXEC    277
                    OPOINT=0                                                             EXEC    278
                    NPLOT=0                                                              EXEC    279
                    RETURN                                                               EXEC    280
                    END                                                                  EXEC    281

SUBROUTINE ZERO          74/74    OPT=1                FTN 4.2+75067      05/05/75  16.24.88.     PAGE   2

     SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     1  ZERO             1          22

 VARIABLES    SN   TYPE            RELOCATION
   0  C            REAL        ARRAY   / /       REFS       2        3         4          5        6        7        8
                                                            9       10        11
  6411  LOSTAT     INTEGER             / /       REFS       9    DEFINED      13
  5771  NOLIST     INTEGER             / /       REFS       7    DEFINED      19
  4470  NOMOD      INTEGER             / /       REFS       5    DEFINED      16
  5136  NOOUT      INTEGER             / /       REFS       8    DEFINED      17
  6557  NORNDM     INTEGER             / /       REFS      11    DEFINED      18
  6412  NOSTAT     INTEGER             / /       REFS      10    DEFINED      14
  4634  NOSUB      INTEGER             / /       REFS       6    DEFINED      15
  3677  NPLOT      INTEGER             / /       REFS       3    DEFINED      21
  3746  OPOINT     INTEGER             / /       REFS       4         12   DEFINED     20

 COMMON BLOCKS     LENGTH      MEMBERS - BIAS NAME(LENGTH)
       / /          3830               0 C        (3830)

 EQUIV CLASSES     LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C       C          3830            1383 NPLOT   (1)       2022 OPOINT (1)       2360 NOMOD  (1)
                                    2460 NOSUB   (1)       3065 NOLIST (1)       3166 NOOUT  (1)
                                    3337 LOSTAT  (1)       3338 NOSTAT (1)       3439 NORNDM (1)

 STATISTICS
   PROGRAM LENGTH                103        8
   CM BLANK COMMON LENGTH      73663     3830
```

```
SUBROUTINE SUBL1        74/74   OPT=1                FTN 4.2+75057     05/05/75. 16.24.09.     PAGE    1

      SUBROUTINE   SUBL1                                                EXEC      282
      COMMON C(3330)                                                    EXEC      283
      EQUIVALENCE (C(2461),NOSUB ), (C(2462),SUBNO )                    EXEC      284
      DIMENSION  SUBNO(99)                                              EXEC      285
      DO 1 I = 1, NOSUB                                                 EXEC      286
      J = SUBNO(I)                                                      EXEC      287
      GO TO ( 1, 2, 3, 4, 5, 6, 7, 8, 9 ), J                            EXEC      288
    2 CALL INPT1                                                        EXEC      289
      GO TO 1                                                           EXEC      290
    3 CALL OUPT1                                                        EXEC      291
      GO TO 1                                                           EXEC      292
    4 CALL SIGE1                                                        EXEC      293
      GO TO 1                                                           EXEC      294
    5 CALL CNTR1                                                        EXEC      295
      GO TO 1                                                           EXEC      296
    6 CALL RNG1                                                         EXEC      297
      GO TO 1                                                           EXEC      298
    7 CALL AUXA1                                                        EXEC      299
      GO TO 1                                                           EXEC      300
    8 CALL AUXB1                                                        EXEC      301
      GO TO 1                                                           EXEC      302
    9 CALL AUXC1                                                        EXEC      303
    1 CONTINUE                                                          EXEC      304
      RETURN                                                            EXEC      305
       END                                                              EXEC      306
```

```
      SUBROUTINE SUBL1       74/74   OPT=1                          FTN 4.2+75057     05/05/75  16.24.09.      PAGE    2

          SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS      DEF LINE     REFERENCES
        1  SUBL1          1          24

  VARIABLES      SN   TYPE            RELOCATION
        0  C          REAL        ARRAY    / /          REFS        2         2*3
       44  I          INTEGER                           REFS        6      DEFINED       5
       45  J          INTEGER                           REFS        7      DEFINED       6
     4634  NOSUB      INTEGER                / /        REFS        3          5
     4535  SUBNO      REAL        ARRAY    / /          REFS        3          4         6

  EXTERNALS             TYPE    ARGS        REFERENCES
            AUXA1                 0            18
            AUXB1                 0            20
            AUXC1                 0            22
            CNTR1                 0            14
            INPT1                 0             3
            OUPT1                 0            11
            RNDM1                 0            13
            STGE1                 0            12

  STATEMENT LABELS               DEF LINE    REFERENCES
       41  1                        23           5      7      9     11     13     15     17     19     21
       22  2                         8           7
       24  3                        10           7
       26  4                        12           7
       30  5                        14           7
       32  6                        16           7
       34  7                        18           7
       36  8                        20           7
       40  9                        22           7

  LOOPS  LABEL   INDEX    FROM-TO    LENGTH    PROPERTIES
    3    1       * I       5 23       413              EXT REFS

  COMMON BLOCKS     LENGTH       MEMBERS - BIAS NAME(LENGTH)
        / /          3830                  0 C       (3830)

  EQUIV CLASSES     LENGTH       MEMBERS - BIAS NAME(LENGTH)
 C       C           3830             2460 NOSUB   (1)                 2461 SUBNO   (99)

  STATISTICS
    PROGRAM LENGTH                    463      38
    CM BLANK COMMON LENGTH          73663    3830
```

```
SUBROUTINE SUBL2      74/74   OPT=1                FTN 4.2+75057     05/35/75  16.24.18.     PAGE   1

      SUBROUTINE  SUBL2                                              EXEC    307
                                                                     EXEC    308
      COMMON C(3830)                                                 EXEC    309
      EQUIVALENCE (C(2461),NOSUB ), (C(2462),SUBNO )                 EXEC    310
      DIMENSION   SUBNO(93)                                          EXEC    311
      DO 1 I = 1, NOSUB                                              EXEC    312
      J = SUBNO(I)                                                   EXEC    313
      GO TO ( 1, 2, 3, 4, 5, 6, 7, 8, 9 ), J                         EXEC    314
    2 CALL INPT2                                                     EXEC    315
      GO TO 1                                                        EXEC    316
    3 CALL OUPT2                                                     EXEC    317
      GO TO 1                                                        EXEC    318
    4 CALL STGE2                                                     EXEC    319
      GO TO 1                                                        EXEC    320
    5 CALL CNTR2                                                     EXEC    321
      GO TO 1                                                        EXEC    322
    6 CALL RNDM2                                                     EXEC    323
      GO TO 1                                                        EXEC    324
    7 CALL AUXA2                                                     EXEC    325
      GO TO 1                                                        EXEC    326
    8 CALL AUXB2                                                     EXEC    327
      GO TO 1                                                        EXEC    328
    9 CALL AUXC2                                                     EXEC    329
    1 CONTINUE                                                       EXEC    330
      RETURN                                                         EXEC    331
      END                                                            EXEC    332
```

```
SUBROUTINE SUBL2         74/74    OPT=1                          FTN 4.2+75067     05/05/75  16.24.10.     PAGE     2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE    REFERENCES
     1  SUBL2         1          25

 VARIABLES     SN   TYPE              RELOCATION
     0  C           REAL        ARRAY    / /          REFS       3      2*4
    44  I           INTEGER                           REFS       7   DEFINED       6
    4   J           INTEGER                           REFS       8   DEFINED       7
    4   NOSUB       INTEGER              / /          REFS       4         6
    4   SUBNO       REAL        ARRAY    / /          REFS       4         5       7

 EXTERNALS               TYPE   ARGS         REFERENCES
        AUXA2                     0              19
        AUXB2                     0              21
        AUXC2                     0              23
        CNTR2                     0              15
        INPT2                     0               9
        OUPT2                     0              11
        RNDM2                     0              17
        STGE2                     0              13

 STATEMENT LABELS                  DEF LINE    REFERENCES
    41  1                             24           5       8      10      12      14      16      18      20      22
    22  2                              9           5
    24  3                             11           5
    26  4                             13           5
    30  5                             15           5
    32  6                             17           5
    34  7                             19           3
    36  8                             21           3
    40  9                             23           8

 LOOPS   LABEL     INDEX     FROM-TO    LENGTH    PROPERTIES
    3    1         * I        6 24       41B              EXT REFS

 COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
    / /           3830            0 C        (3830)

 EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C       C        3830           2463 NOSUB  (1)          2461 SUBNO  (99)

  STATISTICS
    PROGRAM LENGTH                 45B      38
    CM BLANK COMMON LENGTH       7366B    3830
```

```
      SUBROUTINE   SUB3                                         EXEC   333
      COMMON C(3830)                                            EXEC   334
      EQUIVALENCE (C(2461),NOSUB ), (C(2462),SUBNO )            EXEC   335
      DIMENSION   SUBNO(99)                                     EXEC   336
      DO 1 I = 1, NOSUB                                         EXEC   337
      J = SUBNO(I)                                              EXEC   338
      GO TO ( 1, 2, 3, 4, 5, 6, 7, 8, 9 ), J                    EXEC   339
    2 CALL INPT3                                                EXEC   340
      GO TO 1                                                   EXEC   341
    3 CALL OUPT3                                                EXEC   342
      GO TO 1                                                   EXEC   343
    4 CALL STGE3                                                EXEC   344
      GO TO 1                                                   EXEC   345
    5 CALL CNTR3                                                EXEC   346
      GO TO 1                                                   EXEC   347
    6 CALL RNDM3                                                EXEC   348
      GO TO 1                                                   EXEC   349
    7 CALL AUXA3                                                EXEC   350
      GO TO 1                                                   EXEC   351
    8 CALL AUXB3                                                EXEC   352
      GO TO 1                                                   EXEC   353
    9 CALL AUXC3                                                EXEC   354
    1 CONTINUE                                                  EXEC   355
      RETURN                                                    EXEC   356
      END                                                       EXEC   357
```

```
        SUBROUTINE SUBL3      74/74   OPT=1                          FTN 4.2+75067      05/05/75  16.24.11.      PAGE     2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS       DEF LINE      REFERENCES
     1  SUBL3            1            24

 VARIABLES       SN   TYPE              RELOCATION
     0  C             REAL         ARRAY      / /        REFS           2     2*3
    44  I             INTEGER                             REFS           6     DEFINED         5
    45  J             INTEGER                             REFS           7     DEFINED         6
  4634  NOSUB         INTEGER                  / /        REFS           3       5
  4635  SUBNO         REAL         ARRAY      / /        REFS           3       4             6

 EXTERNALS              TYPE    ARGS         REFERENCES
        AUXA3                     0              18
        AUXB3                     0              20
        AUXC3                     0              22
        CNTR3                     0              14
        INPT3                     0               5
        OUPT3                     0              13
        RNDM3                     0              15
        STGE3                     0              12

 STATEMENT LABELS                 DEF LINE    REFERENCES
    41  1                            23           5        7        9      11      13      15      17      19      21
    22  2                             8           7
    24  3                            10           7
    26  4                            12           7
    30  5                            14           7
    32  6                            15           7
    34  7                            19           7
    36  8                            20           7
    40  9                            22           7

 LOOPS   LABEL      INDEX      FROM-TO     LENGTH    PROPERTIES
    3  1           * I           5 23        41B              EXT REFS

 COMMON BLOCKS    LENGTH       MEMBERS - BIAS NAME(LENGTH)
      / /          3830               3 C       (3830)

 EQUIV CLASSES    LENGTH       MEMBERS - BIAS NAME(LENGTH)
 C       C         3830           2460 NOSUB   (1)               2461 SUBNO   (99)

 STATISTICS
   PROGRAM LENGTH                   463     38
   CM BLANK COMMON LENGTH         73660   3830
```

```
      SUBROUTINE STGE2        74/74    OPT=1                            FTN 4.2+75067      05/05/75  16.24.12.      PAGE     1

                              SUBROUTINE STGE2
                              COMMON C(3830)                                                              EXEC        358
                              EQUIVALENCE (C(2011),KSTEP ), (C(2020),LCONV ), (C(2021),KCONV )          EXEC        359
                              KCONV = 0                                                                   EXEC        360
         5                    LCONV = 0                                                                   EXEC        361
                              KSTEP = 1                                                                   EXEC        362
                              RETURN                                                                      EXEC        363
                              END                                                                         EXEC        364
                                                                                                          EXEC        365

      SUBROUTINE STGE2        74/74    OPT=1                            FTN 4.2+75067      05/05/75  16.24.12.      PAGE     2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE    REFERENCES
     1  STGE2          1          7

 VARIABLES      SN  TYPE          RELOCATION
     0  C           REAL        ARRAY   / /
  3744  KCONV       INTEGER             / /          REFS      2      3*3
  3732  KSTEP       INTEGER             / /          REFS      3    DEFINED       4
  3743  LCONV       INTEGER             / /          REFS      3    DEFINED       6
                                                     REFS      3    DEFINED       5

 COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
    / /           3830                 0 C      (3830)

 EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
  C     C         3830          2010 KSTEP  (1)            2019 LCONV   (1)           2020 KCONV   (1)

 STATISTICS
   PROGRAM LENGTH                 53         5
   CM BLANK COMMON LENGTH      73668      3830
```

```
          SUBROUTINE STGE3                                                     EXEC    366
          COMMON C(3630)                                                       EXEC    367
          EQUIVALENCE (C(2000),T     ), (C(2001),TF    ), (C(2003),PCNT  )    EXEC    368
          EQUIVALENCE (C(2010),STEP  ), (C(2011),KSTEP ), (C(2020),LCONV )    EXEC    369
          EQUIVALENCE (C(2021),KCONV ), (C(2561),N     ), (C(2662),HMIN  )    EXEC    370
          EQUIVALENCE (C(2663),HMAX  ), (C(2664),DER   ), (C(2765),EL    )    EXEC    371
          EQUIVALENCE (C(2865),EU    ), (C(2965),VAR   )                       EXEC    372
          EQUIVALENCE (C(1973),KASE  ), (C(1974),NJ    ), (C(1975),NPT   )    EXEC    373
          DIMENSION   DER(101)        , VAR(101)       , EL(100)               EXEC    374
          EXTERNAL AUXSUB                                                      EXEC    375
          CALL G4                                                              EXEC    376
          IF (ABS(T-TF) .LE. 0.01 ) GO TO 20                                   EXEC    377
          IF ( (TF-T) .LT. 0.) GO TO 10                                        EXEC    378
          IF (LCONV .EQ. 2) GO TO 20                                           EXEC    379
          IF (LCONV .EQ. 1) GO TO 10                                           EXEC    380
          IF(DER(1) .LT. 0.) DER(1)=-DER(1)*.5                                 EXEC    381
          RETURN                                                               EXEC    382
       10 IF(DER(1) .GT. 0.) DER(1)=-DER(1)*.5                                 EXEC    383
          KCONV = KCONV + 1                                                    EXEC    384
          IF(KCONV .GE. 10) GO TO 20                                           EXEC    385
          RETURN                                                               EXEC    386
       20 PCNT = 1.0                                                           EXEC    387
          IF(STEP .EQ.11.)GOTO 40                                              EXEC    388
          PREDER = DER(1)                                                      EXEC    389
          DER(1) = 0.                                                          EXEC    390
          NJ=N-1                                                               EXEC    391
          NPT=0                                                                EXEC    392
          CALL AMRK(AUXSUB)                                                    EXEC    393
          DER(1) = PREDER                                                      EXEC    394
       40 CALL OUPT3                                                           EXEC    395
          KSTEP = 2                                                            EXEC    396
          RETURN                                                               EXEC    397
          END                                                                  EXEC    398
```

```
SUBROUTINE STGE3        74/74   OPT=1                         FTN 4.2+75067      05/05/75  16.24.13.     PAGE   2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE      REFERENCES
    1  STGE3           1          17      21      32

--VARIABLES    SN   TYPE          RELOCATION
     0  C            REAL         ARRAY
  5147  DER          REAL         ARRAY    / /         REFS        2      3*3      3*4      3*5      3*5      2*7      3*8
                                                       REFS        6        9     2*16     2*18     24
                                                       DEFINED    16       18       25       29
  5314  EL           REAL         ARRAY    / /         REFS        6        9
  5460  EU           REAL                  / /         REFS        7
  5146  HMAX         REAL                  / /         REFS        6
  5145  HMIN         REAL                  / /         REFS        5
  3664  KASE         INTEGER               / /         REFS        8
  3744  KCONV        INTEGER               / /         REFS        5       19       20     DEFINED    19
  3732  KSTEP        INTEGER               / /         REFS        4     DEFINED    31
  3743  LCONV        INTEGER               / /         REFS        4       14       15
  5000  N            INTEGER               / /         REFS        5       26
  3665  NJ           INTEGER               / /         REFS        8     DEFINED    26
  3666  NPT          INTEGER               / /         REFS        8     DEFINED    27
  3722  PCNT         REAL                  / /         REFS        3     DEFINED    22
    52  PREDER       REAL                              REFS       29     DEFINED    24
  3731  STEP         REAL                  / /         REFS        4       23
  3717  T            REAL                  / /         REFS        3       12       13
  3720  TF           REAL                  / /         REFS        3       12       13
  5624  VAR          REAL         ARRAY    / /         REFS        7        9

--EXTERNALS          TYPE    ARGS        REFERENCES
       AMRK                   1           29
       AUXSUB                 0           10       28
       G4                     0           11
       OUPT3                  0           33

--INLINE FUNCTIONS   TYPE    ARGS        DEF LINE   REFERENCES
       ABS           REAL     1  INTRIN                12

  STATEMENT LABELS                  DEF LINE   REFERENCES
    20  10                             18        13         15
    26  20                             22        12         14        20
    41  40                             30        23

  COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
       / /          3830                  0 C        (3830)

  EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
  C        C        3830                1372 KASE      (1)     1973 NJ      (1)      1974 NPT     (1)
                                        1999 T         (1)     2000 TF      (1)      2002 PCNT    (1)
                                        2003 STEP      (1)     2010 KSTEP   (1)      2019 LCONV   (1)
                                        2020 KCONV     (1)     2560 N       (1)      2661 HMIN    (1)
                                        2662 HMAX      (1)     2663 DER     (101)    2764 EL      (100)
                                        2864 EU        (1)     2964 VAR     (101)

  STATISTICS
    PROGRAM LENGTH                   533      43
    CM BLANK COMMON LENGTH         73663    3830
```

```
SUBROUTINE RESET       74/74    OPT=1                          FTN 4.2+75067     05/05/75  16.24.14.        PAGE    1

                       SUBROUTINE RESET                                                     EXEC      399
                       COMMON C(3830)                                                       EXEC      400
                       EQUIVALENCE (C(3066),NOLIST), (C(3067),LISTNO), (C(3117),VALUE )     EXEC      401
                       DIMENSION  LISTNO(5O),   VALUE(50)                                   EXEC      402
        5              IF (NOLIST .EQ. 0) RETURN                                            EXEC      403
                       DO 1 I = 1, NOLIST                                                   EXEC      404
                       J = LISTNO(I)                                                        EXEC      405
                     1 C(J) = VALUE(I)                                                      EXEC      406
                       RETURN                                                               EXEC      407
       10              END                                                                  EXEC      408


SUBROUTINE RESET       74/  .   OPT=1                          FTN 4.2+75067     05/05/75  16.24.14.        PAGE    2

CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

      6      I      NOLIST    THIS STATEMENT MAY REDEFINE A CURRENT LOOP CONTROL VARIABLE OR PARAMETER.


SUBROUTINE RESET       74/74    OPT=1                          FTN 4.2+75067     05/05/75  16.24.14.        PAGE    3

            SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS     DEF LINE     REFERENCES
      1  RESET         1          5       3

  VARIABLES     SN   TYPE              RELOCATION
      0  C           REAL      ARRAY     / /          REFS     2      3*3   DEFINED     8
     11  I           INTEGER                          REFS     7      8     DEFINED     6
     12  J           INTEGER                          REFS     8   DEFINED     7
   5772  LISTNO      INTEGER   ARRAY     / /          REFS     3      4        7
   5771  NOLIST      INTEGER             / /          REFS     3      5        6
   6054  VALUE       REAL      ARRAY     / /          REFS     3      4        8

  STATEMENT LABELS              DEF LINE   REFERENCES
      0  1                          8          5

  LOOPS   LABEL    INDEX     FROM-TO     LENGTH    PROPERTIES
      6    1         I         6  8        3B       INSTACK

  COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
         / /        3830               0 C       (3830)

  EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
  C          C      3830            3065 NOLIST (1)             3066 LISTNO (50)              3116 VALUE  (50)

  STATISTICS
    PROGRAM LENGTH                 133        11
    CM BLANK COMMON LENGTH       73663      3830
```

```
SUBROUTINE TABLE      74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.24.15.      PAGE    1

                  SUBROUTINE TABLE (X,XI,YI,NX,XK,XLABEL,Y)                  EXEC   409
                  DIMENSION XLABEL (2)                                       EXEC   410
                  XK = 0.                                                    EXEC   411
                  Y = FINTP1 (X,XI,YI,NX,XK,XLABEL)                          EXEC   412
     5            RETURN                                                     EXEC   413
                  END                                                        EXEC   414

SUBROUTINE TABLE      74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.24.15.      PAGE    2

      SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     3 TABLE           1            5

 VARIABLES     SN    TYPE             RELOCATION
     0  NX           INTEGER               F.P.     REFS      4   DEFINED     1
     0  X            REAL                  F.P.     REFS      4   DEFINED     1
     0  XI           REAL                  F.P.     REFS      4   DEFINED     1
     0  XK           REAL                  F.P.     REFS      4   DEFINED     1
     0  XLABEL       REAL       ARRAY      F.P.     REFS      4   DEFINED     1       3
     0  Y            REAL                  F.P.     REFS      2        4   DEFINED    1
     0  YI           REAL                  F.P.     DEFINED   1        4
                                                    REFS      4   DEFINED     1

 EXTERNALS           TYPE   ARGS        REFERENCES
     FINTP1          REAL     6              4

 STATISTICS
   PROGRAM LENGTH                30B     24
```

```
      SUBROUTINE TABL2      74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.24.16.       PAGE    1

                          SUBROUTINE TABL2(X,Y,XYI,ZI,NXY,XINTER,XLABEL,Z)                    EXEC    415
                          DIMENSION XLABEL(2)                                                   EXEC    416
                          DIMENSION XYI(2),NXY(2)                                               EXEC    417
                          Z =  FINTP2 (X,Y,XYI,XYI(NXY+1),ZI,NXY,NXY(2),NXY,XINTER,XLABEL)     EXEC    418
      5                   RETURN                                                                EXEC    419
                          END                                                                   EXEC    420


      SUBROUTINE TABL2      74/74   OPT=1                    FTN 4.2+75067     05/05/75  16.24.16.       PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

   ENTRY POINTS     DEF LINE      REFERENCES
        3  TABL2        1             5

   VARIABLES      SN   TYPE              RELOCATION
        0  NXY         INTEGER   ARRAY    F.P.        REFS          3       4*4  DEFINED        1
        0  X           REAL               F.P.        REFS          4   DEFINED        1
        0  XINTER      REAL               F.P.        REFS          4   DEFINED        1
        0  XLABEL      REAL      ARRAY    F.P.        REFS          2         4  DEFINED        1
        0  XYI         REAL      ARRAY    F.P.        REFS          3       2*4  DEFINED        1
        0  Y           REAL               F.P.        REFS          4   DEFINED        1
        0  Z           REAL               F.P.    DEFINED           1         4
        0  ZI          REAL               F.P.        REFS          4   DEFINED        1

   EXTERNALS          TYPE    ARGS       REFERENCES
        FINTP2        REAL     10             4

   STATISTICS
     PROGRAM LENGTH                  40B      32
```

```
SUBROUTINE TABL3        74/74   OPT=1                    FTN 4.2+75067     05/35/75  16.24.17.     PAGE    1

                    SUBROUTINE TABL3(X,Y,Z,XYZI,WI,NXYZ,XINTER,XLABEL,W)              EXEC     421
                    DIMENSION XLABEL(2)                                               EXEC     422
                    DIMENSION XYZI(1),NXYZ(1)                                         EXEC     423
                    NZI= NXYZ(1) + NXYZ(2) + 1                                        EXEC     424
      5             XINTER = 0.                                                       EXEC     425
                    W = FINTP3 (X,Y,Z,XYZI,XYZI(NXYZ+1),XYZI(NZI), WI,NXYZ(3),        EXEC     426
                   C   NXYZ(2),NXYZ,XINTER,XLABEL)                                    EXEC     427
                    RETURN                                                            EXEC     428
                    END                                                               EXEC     429

SUBROUTINE TABL3        74/74   OPT=1                    FTN 4.2+75067     05/35/75  16.24.17.     PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
      3 TABL3          1             8

VARIABLES       SN   TYPE             RELOCATION
      0 NXYZ         INTEGER    ARRAY     F.P.       REFS       3       2*4     4*6   DEFINED      1
     47 NZI          INTEGER                         REFS       6    DEFINED     4
      0 W            REAL                 F.P.    DEFINED       1         6
      0 WI           REAL                 F.P.       REFS       6    DEFINED     1
      0 X            REAL                 F.P.       REFS       6    DEFINED     1
      0 XINTER       REAL                 F.P.       REFS       6    DEFINED     1       5
      0 XLABEL       REAL       ARRAY     F.P.       REFS       2         5   DEFINED       1
      0 XYZI         REAL       ARRAY     F.P.       REFS       3       3*6   DEFINED       1
      0 Y            REAL                 F.P.       REFS       6    DEFINED     1
      0 Z            REAL                 F.P.       REFS       6    DEFINED     1

EXTERNALS            TYPE   ARGS       REFERENCES
      FINTP3         REAL    12             5

STATISTICS
  PROGRAM LENGTH                  50B      40
```

```
FUNCTION FINTP1        74/74    OPT=1                          FTN 4.2+75067      05/05/75  16.24.18.      PAGE    1

                    FUNCTION FINTP1(X,XI,YI,N,F,XL)                              EXEC    430
                    DIMENSION XI(N), YI(N) , XL(2)                               EXEC    431
                    IF(F .GT. 0.)GO TO 30                                        EXEC    432
                    DO 10 I=2, N                                                 EXEC    433
                    IF(X .LE. XI(I)) GO TO 20                                    EXEC    434
                 10 CONTINUE                                                     EXEC    435
                    I = N                                                        EXEC    436
                 20 PCT = (X-XI(I-1))/(XI(I)-XI(I-1))                            EXEC    437
                    F = 1.                                                       EXEC    438
                 30 FINTP1 = YI(I-1) + PCT*(YI(I)-YI(I-1))                       EXEC    439
                    RETURN                                                       EXEC    440
                    END                                                          EXEC    441

FUNCTION FINTP1        74/74    OPT=1                          FTN 4.2+75067      05/05/75  16.24.18.      PAGE    2

     SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     4  FINTP1        1           11

 VARIABLES     SN   TYPE              RELOCATION
     0   F          REAL                    F.P.       REFS       3   DEFINED      1       9
    40   FINTP1     REAL                           DEFINED       10
    41   I          INTEGER                            REFS       5      3*8    3*10   DEFINED     4      7
     0   N          INTEGER                 F.P.       REFS     2*2        4       7   DEFINED     1
    42   PCT        REAL                               REFS      10   DEFINED      8
     0   X          REAL                    F.P.       REFS       5        8   DEFINED     1
     0   XI         REAL         ARRAY      F.P.       REFS       2        5     3*8   DEFINED     1
     0   XL         REAL         ARRAY      F.P.       REFS       2   DEFINED      1
     0   YI         REAL         ARRAY      F.P.       REFS       2     3*10  DEFINED      1

 STATEMENT LABELS              DEF LINE   REFERENCES
     0  10                         5          4
    22  20                         8          5
    31  30                        10          3

 LOOPS  LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
    15  10       * I        4 6        3B        INSTACK     EXITS

 STATISTICS
   PROGRAM LENGTH                 43B        35
```

```
      FUNCTION FINTP2      74/74    OPT=1                    FTN 4.2+75057     05/05/75  16.24.19.     PAGE    1

            FUNCTION FINTP2(X,Y,XI,YI,ZI,NXD,NY,NX,F,XL)                         EXEC     442
            DIMENSION XI(1),YI(1), ZI(NXD,1), T(2), XL(2)                        EXEC     443
            IF(F .GT. 0.) GO TO 30                                               EXEC     444
            DO 10 I=2, NY                                                        EXEC     445
            IF(Y .LE. YI(I)) GO TO 20                                            EXEC     446
         10 CONTINUE                                                             EXEC     447
            I = NY                                                               EXEC     448
         20 PCT = (Y-YI(I-1))/(YI(I)-YI(I-1))                                    EXEC     449
         30 DO 40 J=1,2                                                          EXEC     450
            L = I + J - 2                                                        EXEC     451
         40 T(J) = FINTP1(X,XI,ZI(1,L),NX,F,XL)                                  EXEC     452
            FINTP2 = T(1) + PCT*(T(2)-T(1))                                      EXEC     453
            RETURN                                                               EXEC     454
            END                                                                  EXEC     455

      FUNCTION FINTP2      74/74    OPT=1                    FTN 4.2+75057     05/05/75  16.24.19.     PAGE    2

      SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     4  FINTP2       1            13

 VARIABLES       SN   TYPE           RELOCATION
     0  F            REAL                     F.P.     REFS          3      11     DEFINED     1
    71  FINTP2       REAL                              DEFINED      12
    72  I            INTEGER                           REFS          5     3*8       10     DEFINED     4     7
    74  J            INTEGER                           REFS         10      11     DEFINED     9
    75  L            INTEGER                           REFS         11   DEFINED       10
     0  NX           INTEGER                  F.P.     REFS         11   DEFINED        1
     0  NXD          INTEGER                  F.P.     REFS          2   DEFINED        1
     0  NY           INTEGER                  F.P.     REFS          4       7     DEFINED     1
    73  PCT          REAL                              REFS         12   DEFINED        8
    76  T            REAL         ARRAY                REFS          2    3*12     DEFINED    11
     0  X            REAL                     F.P.     REFS         11   DEFINED        1
     0  XI           REAL         ARRAY       F.P.     REFS          2      11     DEFINED     1
     0  XL           REAL         ARRAY       F.P.     REFS          2      11     DEFINED     1
     0  Y            REAL                     F.P.     REFS          5       8     DEFINED     1
     0  YI           REAL         ARRAY       F.P.     REFS          2       5        3*8    DEFINED     1
     0  ZI           REAL         ARRAY       F.P.     REFS          2      11     DEFINED     1

 EXTERNALS          TYPE   ARGS        REFERENCES
        FINTP1      REAL     6             11

 STATEMENT LABELS                DEF LINE   REFERENCES
     0  10                          6          4
    26  20                          8          5
    33  30                          9          3
     0  40                         11          9

 LOOPS   LABEL    INDEX     FROM-TO     LENGTH     PROPERTIES
    21   10       * I        4 6          38       INSTACK     EXITS
    34   40       * J        9 11        203                   EXT REFS

 STATISTICS
   PROGRAM LENGTH               100B      64
```

```
        FUNCTION FINTP3      74/74   OPT=1                        FTN 4.2+75057     05/05/75  16.24.20.     PAGE   1

                           FUNCTION FINTP3(X,Y,Z,XI,YI,ZI,WI,NZ,NY,NX,F,XL)                   EXEC     456
                           DIMENSION XI(1), YI(1), ZI(1), WI(NX,NY,1), T(2), XL(2)          EXEC     457
                           DO 10 I=2, NZ                                                        EXEC     458
                           IF(Z .LE. ZI(I)) GO TO 20                                            EXEC     459
     5                  10 CONTINUE                                                             EXEC     460
                           I = NZ                                                               EXEC     461
                        20 PCT = (Z-ZI(I-1))/(ZI(I)-ZI(I-1))                                    EXEC     462
                        30 DO 40 J=1,2                                                          EXEC     463
                           L = I + J - 2                                                        EXEC     464
    10                  40 T(J) = FINTP2(X,Y,XI,YI,WI(1,1,L),NX,NY,NX,F,XL)                     EXEC     465
                           FINTP3 = T(1) + PCT*(T(2)-T(1))                                      EXEC     466
                           RETURN                                                               EXEC     467
                           END                                                                  EXEC     468

        FUNCTION FINTP3      74/74   OPT=1                        FTN 4.2+75067     05/05/75  16.24.20.     PAGE   2

            SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS       DEF LINE      REFERENCES
     4  FINTP3         1             12

 VARIABLES      SN   TYPE              RELOCATION
      0  F           REAL                         F.P.    REFS       10    DEFINED       1
    101  FINTP3      REAL                                 DEFINED    11
    102  I           INTEGER                              REFS        4      3*7         9    DEFINED      3      6
    104  J           INTEGER                              REFS        9       10    DEFINED      8
    105  L           INTEGER                              REFS       10    DEFINED       9
      0  NX          INTEGER                      F.P.    REFS        2     2*10    DEFINED      1
      0  NY          INTEGER                      F.P.    REFS        2       10    DEFINED      1
      0  NZ          INTEGER                      F.P.    REFS        3        6    DEFINED      1
    103  PCT         REAL                                 REFS       11    DEFINED       7
    106  T           REAL          ARRAY                  REFS        2     3*11    DEFINED     10
      0  WI          REAL          ARRAY          F.P.    REFS        2       10    DEFINED      1
      0  X           REAL                         F.P.    REFS       10    DEFINED       1
      0  XI          REAL          ARRAY          F.P.    REFS        2       10    DEFINED      1
      0  XL          REAL          ARRAY          F.P.    REFS        2       10    DEFINED      1
      0  Y           REAL                         F.P.    REFS       10    DEFINED       1
      0  YI          REAL          ARRAY          F.P.    REFS        2       10    DEFINED      1
      0  Z           REAL                         F.P.    REFS        4        7    DEFINED      1
      0  ZI          REAL          ARRAY          F.P.    REFS        2        4       3*7    DEFINED      1

 EXTERNALS          TYPE    ARGS        REFERENCES
     FINTP2         REAL     10            10

 STATEMENT LABELS                  DEF LINE     REFERENCES
      0  10                           5            3
     25  20                           7            4
      0  30           INACTIVE        8
      0  40                          10            3

 LOOPS   LABEL    INDEX      FROM-TO     LENGTH     PROPERTIES
    20    10      * I          3  5        3B       INSTACK    EXITS
    33    40      * J          8 10       25B                  EXT REFS

 STATISTICS
   PROGRAM LENGTH                 110B      72
```

SUBROUTINE PLOT4 74/74 OPT=1 FTN 4.2+75067 05/15/75 16.24.21. PAGE 1

```
      SUBROUTINE PLOT4 (GRAPH,NP,YL,T,NPLOT4,NPLOT2,NOPLOT)             EXEC  469
C**PLOT SUBROUTINE                                                      EXEC  470
      DIMENSION GRAPH(1,1),YL(2,4),T(300)                               EXEC  471
      DIMENSION IXP(4),IYP(4),MRKPT(4)                                  EXEC  472
      DATA (MRKPT(I),I=1,4)/42,16,38,63/                                EXEC  473
      DATA IXP/4,29,4,28/                                               EXEC  474
      DATA IYP/776,776,411,411/                                         EXEC  475
      IF (NPLOT4.EQ.0) RETURN                                           EXEC  476
      KK = 1                                                            EXEC  477
      XM1 = GRAPH(1,1)                                                  EXEC  478
      YM1 = GRAPH(1,2)                                                  EXEC  479
      XT1 = GRAPH(1,3)                                                  EXEC  480
      YT1 = GRAPH(1,4)                                                  EXEC  481
      XM2 = XM1                                                         EXEC  482
      YM2 = YM1                                                         EXEC  483
      XT2 = XT1                                                         EXEC  484
      YT2 = YT1                                                         EXEC  485
      DO 1 I=1,NP                                                       EXEC  486
      XM1 = AMIN1(GRAPH(I,1),XM1)                                       EXEC  487
      YM1 = AMIN1(GRAPH(I,2),YM1)                                       EXEC  488
      XT1 = AMIN1(GRAPH(I,3),XT1)                                       EXEC  489
      YT1 = AMIN1(GRAPH(I,4),YT1)                                       EXEC  490
      XM2 = AMAX1(GRAPH(I,1),XM2)                                       EXEC  491
      YM2 = AMAX1(GRAPH(I,2),YM2)                                       EXEC  492
      XT2 = AMAX1(GRAPH(I,3),XT2)                                       EXEC  493
    1 YT2 = AMAX1(GRAPH(I,4),YT2)                                       EXEC  494
      XMIN = AMIN1(XM1,XT1)                                             EXEC  495
      YMIN = AMIN1(YM1,YT1)                                             EXEC  496
      XMAX = AMAX1(XM2,XT2)                                             EXEC  497
      YMAX = AMAX1(YM2,YT2)                                             EXEC  498
      DELX = ABS(XMAX-XMIN)                                             EXEC  499
      DELY = ABS(YMAX-YMIN)                                             EXEC  500
      DEL = AMAX1(DELX,DELY)                                            EXEC  501
      X1 = XMIN                                                         EXEC  502
      Y1 = YMIN-(DEL-DELY)/2.                                           EXEC  503
      X2 = X1+DEL                                                       EXEC  504
      Y2 = Y1+DEL                                                       EXEC  505
      CALL CAMRAV (9)                                                   EXEC  506
      CALL DXDYV(1,X1,X2,DX,N,I,NK,25.,IER2)                            EXEC  507
      CALL DXDYV(2,Y2,Y1,DY,M,J,NK,25.,IER2)                            EXEC  508
      CALL SETMIV (24,0,24,24)                                          EXEC  509
      CALL GRIDIV(KK,X1,X2,Y2,Y1,DX,DY,N,M,I,J,NX,NY)                   EXEC  510
      DO 2 J=1,3,2                                                      EXEC  511
      K = J+1                                                           EXEC  512
      UTIME = 0.                                                        EXEC  513
      IX1 = NXV(GRAPH(1,J) )                                            EXEC  514
      IY1 = NYV(GRAPH(1,K) )                                            EXEC  515
      DO 2 IJ=2,NP                                                      EXEC  516
      IX2 = NXV(GRAPH(IJ,J))                                            EXEC  517
      IY2 = NYV(GRAPH(IJ,K))                                            EXEC  518
      IF(T(IJ)-(.5+UTIME)) 7,3,3                                        EXEC  519
    3 UTIME = T(IJ)                                                     EXEC  520
      CALL POINTV(IX2,IY2,-17,2)                                        EXEC  521
    7 IF(J-2) 4,5,5                                                     EXEC  522
    5 CALL POINTV(IX2,IY2,0,2)                                          EXEC  523
      GO TO 6                                                           EXEC  524
    4 CALL LINEV(IX1,IY1,IX2,IY2)                                       EXEC  525
```

```
    6 IX1 = IX2                                                    EXEC   526
    2 IY1 = IY2                                                    EXEC   527
      CALL PRINTV(12,YL(1,1)    ,524,12)                           EXEC   528
      CALL APRNTV(0,-14,12,YL(1,2)    ,12,524)                     EXEC   529
      RETURN                                                       EXEC   530
C                                                                  EXEC   531
      ENTRY PLOT2                                                  EXEC   532
      IF (NPLOT2.EQ.0) RETURN                                      EXEC   533
      JX= NPLOT4+1                                                 EXEC   534
      JY1= JX+1                                                    EXEC   535
      JYN= NPLOT4+NPLOT2                                           EXEC   536
      X1= GRAPH(1,JX)                                              EXEC   537
      X2= X1                                                       EXEC   538
      DO 110 I=2,NP                                                EXEC   539
      X1= AMIN1 (GRAPH(I,JX),X1)                                   EXEC   540
  110 X2= AMAX1 (GRAPH(I,JX),X2)                                   EXEC   541
      Y1= GRAPH(1,JY1)                                             EXEC   542
      Y2= Y1                                                       EXEC   543
      DO 120 JY=JY1,JYN                                            EXEC   544
      DO 120 I=1,NP                                                EXEC   545
      Y1= AMIN1 (GRAPH(I,JY),Y1)                                   EXEC   546
  120 Y2= AMAX1 (GRAPH(I,JY),Y2)                                   EXEC   547
      CALL CAMRAV (9)                                              EXEC   548
      CALL DXDYV (1,X1,X2,DX,N,I,NX,14.0,IERR)                     EXEC   549
      CALL DXDYV (2,Y1,Y2,DY,M,J,NY,14.0,IERR)                     EXEC   550
      CALL SETMIV (35,24,24,24)                                    EXEC   551
      CALL GRIDIV (1,X1,X2,Y1,Y2,DX,DY,N,M,I,J,-3,-3)              EXEC   552
      IMARK= 1                                                     EXEC   553
      DO 140 JY=JY1,JYN                                            EXEC   554
      IX1= NXV (GRAPH(1,JX))                                       EXEC   555
      IY1= NYV (GRAPH(1,JY))                                       EXEC   556
C                                                                  EXEC   557
      DO 130 IJ=2,NP                                               EXEC   558
      IX2= NXV (GRAPH(IJ,JX))                                      EXEC   559
      IY2= NYV (GRAPH(IJ,JY))                                      EXEC   560
      CALL LINEV (IX1,IY1,IX2,IY2)                                 EXEC   561
      CALL LINEV (IX1,IY1,IX2,IY2)                                 EXEC   562
      IX1= IX2                                                     EXEC   563
  130 IY1= IY2                                                     EXEC   564
      IF (IMARK.GT.4) GO TO 140                                    EXEC   565
      CALL APLOTV (NP,GRAPH(1,JX),GRAPH(1,JY),20,20,1,MRKPT(IMARK),IRR)  EXEC   566
  140 IMARK= IMARK + 1                                             EXEC   567
      CALL PRINTV (12,    YL(1,JX),458,8)                          EXEC   568
      I=1                                                          EXEC   569
      DO 150 JY=JY1,JYN                                            EXEC   570
      IF (I.GT.4) GO TO 150                                        EXEC   571
      IYQ= IYP(I) + 29                                             EXEC   572
      CALL PLOTV (IXP(I),IYQ,MRKPT(I))                             EXEC   573
      CALL APRNTV (0,-14,12,    YL(1,JY),IXP(I),IYP(I))            EXEC   574
  150 I= I+1                                                       EXEC   575
      RETURN                                                       EXEC   576
C                                                                  EXEC   577
      ENTRY PLOTN                                                  EXEC   578
      NPLOT3=NOPLOT-NPLOT2-NPLOT4                                  EXEC   579
      IF (NPLOT3.LE.0) RETURN                                      EXEC   580
      DO 160 NM=1,NPLOT3                                           EXEC   581
      JY=NPLOT4+NPLOT2+NM                                          EXEC   582
```

```
      IX=MOD(NM,3)
      IF(IX .EQ. 0)IX=3                                            EXEC  583
      II=712-344*(IX-1)                                            EXEC  584
      JJ=28+344*(IX-1)                                             EXEC  585
      KK=1                                                         EXEC  586
      IF(IX .GT. 1)KK=2                                            EXEC  587
      X1=T(1)                                                      EXEC  588
      X2=T(NF)                                                     EXEC  589
      Y1=GRAPH(1,JY)                                               EXEC  590
      Y2=Y1                                                        EXEC  591
      DO 50 I=1,NP                                                 EXEC  592
      Y1=AMIN1(GRAPH(I,JY),Y1)                                     EXEC  593
   50 Y2=AMAX1(GRAPH(I,JY),Y2)                                     EXEC  594
      CALL CAMRAV(9)                                               EXEC  595
      CALL DXDYV(1,X1,X2,DX,N,I,NX,14.,IERR)                       EXEC  596
      CALL DXDYV(2,Y1,Y2,DY,M,J,NY,14.,IERR)                       EXEC  597
      CALL SETMIV(24,0,II,JJ)                                      EXEC  598
      CALLGRIDIV(KK,X1,X2,Y1,Y2,DX,DY,N,M,I,J,NX,-3)               EXEC  599
      IX1=NXV(X1)                                                  EXEC  600
      IY1=NYV(GRAPH(1,JY))                                         EXEC  601
      DO 55 IJ=2,NP                                                EXEC  602
      IX2=NXV(T(IJ))                                               EXEC  603
      IY2=NYV(GRAPH(IJ,JY))                                        EXEC  604
      CALL LINEV(IX1,IY1,IX2,IY2)                                  EXEC  605
      IY1=IY2                                                      EXEC  606
   55 IX1=IX2                                                      EXEC  607
      CALL FRINTV (-11,10HTIME (SEC),468,696-344*(IX-1))           EXEC  608
  100 CALL APRNTV (0,-14,12,   Y.(1,JY),4,890-344*(IX-1))          EXEC  609
      RETURN                                                       EXEC  610
      END                                                          EXEC  611
                                                                   EXEC  612
```

```
     SUBROUTINE PLOT4        74/74   OPT=1                    FTN 4.2+75067    05/05/75  16.24.21.      PAGE    4

          SYMBOLIC REFERENCE MAP (R=3)

  ENTRY POINTS     DEF LINE     REFERENCES
    411  PLOTN        110          112        143
    214  PLOT2         64           65        109
      3  PLOT4          1            8         62

  VARIABLES     SN   TYPE              RELOCATION
   1055  DEL         REAL                               REFS     35     36     37  DEFINED     33
   1053  DELX        REAL                               REFS     33  DEFINED   31
   1054  DELY        REAL                               REFS     33     35  DEFINED   32
   1062  DX          REAL                               REFS     39     42     81     84    129    132
   1066  DY          REAL                               REFS     40     42     82     84    130    132
      0  GRAPH       REAL         ARRAY      F.P.       REFS      3     10     11     12     13     19     20
                                                          21     22     23     24     25     26     46     47
                                                          49     50     59     72     73     74     78     79
                                                          87     88     91     92   2*98    123    126    127
                                                         134    137  DEFINED    1
   1046  I           INTEGER                            REFS     19     20     21     22     23     24     25
                                                          26     39     42     72     73     78     79     81
                                                          84    103    104  2*105  2*106    107    126    127
                                                         129    132  DEFINED   18     71     77    101    107
                                                         125
   1065  IERR        INTEGER                            REFS     39     40     81     82    129    130
   1113  II          INTEGER                            REFS    131  DEFINED  117
   1076  IJ          INTEGER                            REFS     49     50     51     52     91     92    138
                                                         137  DEFINED   48     90    135
   1165  IMARK       INTEGER                            REFS     97     98     99  DEFINED   85     99
   1106  IRR      *  INTEGER                            REFS     98
   1112  IX          INTEGER                            REFS    116    117    118    120    141    142
                                                      DEFINED    115    116
   1115  IXP         INTEGER      ARRAY                 REFS      4    105    106  DEFINED    6
   1074  IX1         INTEGER                            REFS     57     93     94    138  DEFINED   46     58
                                                          87     95    133    140
   1077  IX2         INTEGER                            REFS     53     55     57     58     93     94     95
                                                         138    140  DEFINED   49     91    136
   1121  IYP         INTEGER      ARRAY                 REFS      4    104    106  DEFINED    7
   1107  IYQ         INTEGER                            REFS    135  DEFINED  104
   1075  IY1         INTEGER                            REFS     57     93     94    138  DEFINED   47     59
                                                          88     96    134    139
   1100  IY2         INTEGER                            REFS     53     55     57     59     93     94     96
                                                         138    139  DEFINED   50     92    137
   1070  J           INTEGER                            REFS     40     42     44     46     49     54     82
                                                          84    130    132  DEFINED   43
   1114  JJ          INTEGER                            REFS    131  DEFINED  118
   1101  JX          INTEGER                            REFS     57     69     72     73     87     91     98
                                                         100  DEFINED   56
   1104  JY          INTEGER                            REFS     78     79     88     92     98    106    123
                                                         126    127    134    137    142  DEFINED   76     86
                                                         102    114
   1103  JYN         INTEGER                            REFS     76     56    102  DEFINED   68
   1102  JY1         INTEGER                            REFS     74     76     86    102  DEFINED   67
   1072  K           INTEGER                            REFS     47     50  DEFINED   44
   1035  KK          INTEGER                            REFS     42    132  DEFINED    9    119    120
   1067  M           INTEGER                            REFS     40     42     82     84    130    132
   1125  MRKPT       INTEGER      ARRAY                 REFS      4     98    105  DEFINED    5
```

```
VARIABLES   SN  TYPE        RELOCATION
 1111  NM     INTEGER                  REFS     114    115  DEFINED   113
    0  NOPLOT INTEGER           F.P.   REFS     111  DEFINED     1
    0  NP     INTEGER           F.P.   REFS      18     46     71     77     98     98    122
                                       125      135  DEFINED     1
    0  NPLOT2 INTEGER           F.P.   REFS      65     68    111    114  DEFINED      1
 1110  NPLOT3 INTEGER                  REFS     112    113  DEFINED   111
    0  NPLOT4 INTEGER           F.P.   REFS       8     56     68    111    114
                                       DEFINED    1
 1064  NX     INTEGER                  REFS      39     42     81    129    132
 1071  NY     INTEGER                  REFS      40     42     82    130
    0  T      REAL      ARRAY   F.P.   REFS       3     51     52    121    122    136
                                       DEFINED    1
 1073  UTIME  REAL                     REFS      51  DEFINED     45     52
 1051  XMAX   REAL                     REFS      31  DEFINED     29
 1047  XMIN   REAL                     REFS      31     34  DEFINED     27
 1036  XM1    REAL                     REFS      14     19     27  DEFINED     10     19
 1042  XM2    REAL                     REFS      23     29  DEFINED     14     23
 1040  XT1    REAL                     REFS      16     21     27  DEFINED     12     21
 1044  XT2    REAL                     REFS      25     29  DEFINED     16     25
 1056  X1     REAL                     REFS      36     39     42     70     72     81     84
                                       129      132    133  DEFINED     34     59     72    121
 1060  X2     REAL                     REFS      39     42     73     81     84    129    132
                                       DEFINED   36     70     73    122
    0  YL     REAL      ARRAY   F.P.   REFS       3     60     61    100    106    142
                                       DEFINED    1
 1052  YMAX   REAL                     REFS      32  DEFINED     30
 1050  YMIN   REAL                     REFS      32     35  DEFINED     28
 1037  YM1    REAL                     REFS      15     20     28  DEFINED     11     20
 1043  YM2    REAL                     REFS      24     30  DEFINED     15     24
 1041  YT1    REAL                     REFS      17     22     28  DEFINED     13     22
 1045  YT2    REAL                     REFS      26     30  DEFINED     17     26
 1057  Y1     REAL                     REFS      37     40     42     75     78     82     84
                                       124      126    130    132  DEFINED     35     74     78
                                       123      126
 1061  Y2     REAL                     REFS      40     42     79     82     84    127    130
                                       132  DEFINED     37     75     79    124    127

EXTERNALS     TYPE     ARGS     REFERENCES
      APLOTV            8        99
      APRNTV            6        61    106    142
      CAMRAV            1        39     80    128
      DXDYV             9        39     40     81     82    129    130
      GRIDIV           13        42     84    132
      LINEV             4        57     93     94    138
      NXV     INTEGER   1        45     49     57     91    133    136
      NYV     INTEGER   1        47     50     88     92    134    137
      PLOTV             3       105
      POINTV            4        53     55
      PRINTV            4        61    100    141
      SETMIV            4        41     83    131

INLINE FUNCTIONS  TYPE  ARGS       DEF LINE  REFERENCES
      ABS         REAL    1  INTRIN             31     32
      AMAX1       REAL    6  INTRIN             23     24     25     26     29     30     33     73
                                                79    127
      AMIN1       REAL    0  INTRIN             19     20     21     22     27     28     72     78
                                               126
```

```
INLINE FUNCTIONS   TYPE     ARGS          DEF LINE   REFERENCES
     MOD           INTEGER   2  INTRIN                  115

STATEMENT LABELS                  DEF LINE   REFERENCES
      0   1                          26         19
      0   2                          59         43         48
      0   3          INACTIVE        52         2*51
    171   4                          57         54
      0   5          INACTIVE        55         2*54
    173   6                          55         55
    164   7                          54         51
      0   50                        127        125
      0   55                        140        135
      0   100                       142        113
      0   110                        73         71
      0   120                        79         75         77
      0   130                        35         31
    350   140                        99         85         97
    403   150                       107        102        103

LOOPS  LABEL     INDEX      FROM-TO     LENGTH    PROPERTIES
   36   1         I         16 26        23B       OPT
  126   2       * J         43 59        55B                EXT REFS  NOT INNER
  142   2       * IJ        48 59        37B                EXT REFS
  237   110       I         71 73         5B      INSTACK
  250   120     * JY        76 79        13B                NOT INNER
  254   120       I         77 79         5B      INSTACK
  301   140     * JY        86 99        53B                EXT REFS  NOT INNER
  313   130     * IJ        90 95        24B                EXT REFS
  363   150     * JY       102 107       24B                EXT REFS
  426   100     * NM       113 142      117B                EXT REFS  NOT INNER
  455   50        I        125 127        5B      INSTACK
  504   55      * IJ       135 140       21B                EXT REFS

STATISTICS
  PROGRAM LENGTH                  11603      624
```

```
SUBROUTINE DUMMY        74/74   OPT=1                    FTN 4.2+75067      35/05/75  16.24.27.       PAGE    1

            SUBROUTINE DUMMY                                             EXEC    613
        C   DUMMY SUBROUTINE                                             EXEC    614
            ENTRY A2I                                                    EXEC    615
            ENTRY A4                                                     EXEC    616
            ENTRY A4I                                                    EXEC    617
            ENTRY A5                                                     EXEC    618
            ENTRY C3                                                     EXEC    619
            ENTRY C3I                                                    EXEC    620
            ENTRY C5                                                     EXEC    621
            ENTRY C5I                                                    EXEC    622
            ENTRY C6                                                     EXEC    623
            ENTRY C6I                                                    EXEC    624
            ENTRY C7                                                     EXEC    625
            ENTRY C7I                                                    EXEC    626
            ENTRY C8                                                     EXEC    627
            ENTRY C8I                                                    EXEC    628
            ENTRY C9                                                     EXEC    629
            ENTRY C9I                                                    EXEC    630
            ENTRY C10                                                    EXEC    631
            ENTRY C10I                                                   EXEC    632
            ENTRY D3                                                     EXEC    633
            ENTRY D3I                                                    EXEC    634
            ENTRY D4                                                     EXEC    635
            ENTRY D4I                                                    EXEC    636
            ENTRY D5                                                     EXEC    637
            ENTRY D5I                                                    EXEC    638
            ENTRY G1                                                     EXEC    639
            ENTRY G1I                                                    EXEC    640
            ENTRY G3I                                                    EXEC    641
            ENTRY G4I                                                    EXEC    642
            ENTRY G5I                                                    EXEC    643
            ENTRY G6                                                     EXEC    644
            ENTRY G6I                                                    EXEC    645
            ENTRY S4                                                     EXEC    646
            ENTRY S4I                                                    EXEC    647
            ENTRY S5                                                     EXEC    648
            ENTRY S5I                                                    EXEC    649
            ENTRY S6                                                     EXEC    650
            ENTRY S6I                                                    EXEC    651
            ENTRY S7                                                     EXEC    652
            ENTRY S7I                                                    EXEC    653
            ENTRY S8I                                                    EXEC    654
            ENTRY S9                                                     EXEC    655
            ENTRY S9I                                                    EXEC    656
            ENTRY S10                                                    EXEC    657
            ENTRY S10I                                                   EXEC    658
            ENTRY AUXA1                                                  EXEC    659
            ENTRY AUXA2                                                  EXEC    660
            ENTRY AUXA3                                                  EXEC    661
            ENTRY AUXB1                                                  EXEC    662
            ENTRY AUXB2                                                  EXEC    663
            ENTRY AUXB3                                                  EXEC    664
            ENTRY AUXC1                                                  EXEC    665
            ENTRY AUXC2                                                  EXEC    666
```

```
      [illegible]                                                  [illegible]  [illegible]
              ENTRY CNTR1                                          EXEC    668
              ENTRY CNTR2                                          EXEC    669

      SUBROUTINE DUMMY        74/74    OPT=1          FTN 4.2+75067      05/05/75  16.24.27.     PAGE    2

              ENTRY CNTR3                                          EXEC    670
              ENTRY INPT1                                          EXEC    671
 60           ENTRY INPT2                                          EXEC    672
              ENTRY INPT3                                          EXEC    673
              ENTRY OUPT1                                          EXEC    674
              ENTRY PROCES                                         EXEC    675
              ENTRY RNDM1                                          EXEC    675
 65           ENTRY RNDM2                                          EXEC    677
              ENTRY RNDM3                                          EXEC    678
              ENTRY STGE1                                          EXEC    679
              ENTRY KIKSET                                         EXEC    680
              ENTRY COUNTV                                         EXEC    681
 70           ENTRY TIMEV                                          EXEC    682
              ENTRY WRITE                                          EXEC    683
              RETURN                                               EXEC    684
              END                                                  EXEC    685
```

```
SUBROUTINE DUMMY          74/74   OPT=1                    FTN 4 2+75067     05/05/75  16.24.27.     PAGE    3

            SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE     REFERENCES
    1   AUXA1         47
    1   AUXA2         48
    1   AUXA3         49
    1   AUXB1         50
    1   AUXB2         51
    1   AUXB3         52
    1   AUXC1         53
    1   AUXC2         54
    1   AUXC3         55
    1   A2I            3
    1   A4             4
    1   A4I            5
    1   A5             6
    1   CNTR1         56
    1   CNTR2         57
    1   CNTR3         58
    1   COUNTV        69
    1   C10           19
    1   C10I          20
    1   C3             7
    1   C3I            8
    1   C5             9
    1   C5I           10
    1   C6            11
    1   C6I           12
    1   C7            13
    1   C7I           14
    1   C8            15
    1   C8I           16
    1   C9            17
    1   C9I           18
    1   DUMMY          1
    1   D3            21
    1   D3I           22
    1   D4            23
    1   D4I           24
    1   D5            25
    1   D5I           26
    1   G1            27
    1   G1I           28
    1   G3I           29
    1   G4I           30
    1   G5I           31
    1   G6            32
    1   G6I           33
    1   INPT1         59
```

```
      1  INPT2          60
      1  INPT3          61
      1  KIKSET         68
      1  OUPT1          62
      1  PROCES         63
      1  [illegible]    [illegible]
      1  RNDM2          6[illegible]
      1  RNDM3          66

   SUBROUTINE DUMMY      74/74    OPT=1                FTN 4.2+75067     05/05/75  16.24.27.     PAGE    4

 ENTRY POINTS    DEF LINE    REFERENCES
     1  STGE1      67
     1  S10        45
     1  S10I       46
     1  S4         34
     1  S4I        35
     1  S5         36
     1  S5I        37
     1  S6         38
     1  S6I        39
     1  S7         40
     1  S7I        41
     1  S8I        42
     1  S9         43
     1  S9I        44
     1  TIMEV      70
     1  WRITE      71       72

 STATISTICS
   PROGRAM LENGTH            38B      3
```

```
SUBROUTINE TERROR     74/74   OPT=1                         FTN 4.2+75057     05/05/75  16.24.28.       PAGE    1

                      SUBROUTINE TERROR (XLABEL)                                                     EXEC     686
                C**   FOR USE WITH CODIM2, FCN2, FCN3                                                EXEC     687
                C                                                                                    EXEC     688
                      COMMON C(3830)                                                                 EXEC     689
      5               EQUIVALENCE (C(2020),LCONV)                                                    EXEC     690
                      WRITE (6,10) XLABEL                                                            EXEC     691
                 10   FORMAT ( 43H0             NO AERO POINTS SPECIFIED FOR ARG , 5X,               EXEC     692
                C     7HTABLE  ,A6 )                                                                 EXEC     693
                      CALL EXIT                                                                      EXEC     694
     10               END                                                                            EXEC     695

SUBROUTINE TERROR     74/74   OPT=1                         FTN 4.2+75057     05/05/75  16.24.28.       PAGE    2

     SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     3 TERROR          1           10

 VARIABLES      SN  TYPE              RELOCATION
     0  C           REAL        ARRAY      / /            REFS        4        5
  3743  LCONV       INTEGER                / /            REFS        5
     0  XLABEL      REAL                   F.P.           REFS        6    DEFINED        1

 FILE NAMES          MODE
        TAPE6        FMT                          WRITES          5

 EXTERNALS               TYPE   ARGS          REFERENCES
        EXIT                      0               3

 STATEMENT LABELS                  DEF LINE     REFERENCES
    15  10      FMT                    7            5

 COMMON BLOCKS    LENGTH      MEMBERS - BIAS NAME(LENGTH)
      / /          3830                 0 C       (3830)

 EQUIV CLASSES    LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C       C         3830               2019 LCONV    (1)

 STATISTICS
   PROGRAM LENGTH                    253        21
   CM BLANK COMMON LENGTH          73668      3830
```

```
SUBROUTINE AERROR       74/74  OPT=1                                FTN 4.2+75057     05/05/75  16.24.29.     PAGE    1

                  SUBROUTINE AERROR (XLABEL)                                                   EXEC     695
                  COMMON C(3830)                                                               EXEC     697
                  EQUIVALENCE (C(2020),LCONV)                                                  EXEC     698
                  WRITE (6,20) XLABEL                                                          EXEC     699
               20 FORMAT  ( 43H0          OUT OF AERO TABLE ARGUMENT ARRAY , 5X,               EXEC     700
                C    7HTABLE   ,A6 )                                                           EXEC     701
                  DO 40 I=1202,1251,7                                                          EXEC     702
               40 WRITE(6,30) C(I),C(I+1),C(I+2),C(I+3),C(I+4),C(I+5),C(I+6)                   EXEC     703
               30 FORMAT(1H ,7E15.7)                                                           EXEC     704
                  WRITE (6,30) C(2000),C(367),C(368),C(204),C(369),C(370),C(1117),             EXEC     705
                C C(1118),C(1119),C(1120)                                                      EXEC     706
                  LCONV=2                                                                      EXEC     707
                  RETURN                                                                       EXEC     708
                  END                                                                          EXEC     709

SUBROUTINE AERROR       74/74  OPT=1                                FTN 4.2+75057     05/05/75  16.24.29.     PAGE    2

     SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    3   AERROR        1           13

VARIABLES       SN   TYPE             RELOCATION
    0   C            REAL        ARRAY    / /            REFS        2        3         7*8       10*10
  100   I            INTEGER                             REFS      7*8    DEFINED        7
 3743   LCONV        INTEGER             / /             REFS        3    DEFINED       12
    0   XLABEL       REAL                F.P.            REFS        4    DEFINED        1

FILE NAMES          MODE
       TAPE6        FMT                        WRITES          4          8          10

STATEMENT LABELS                  DEF LINE     REFERENCES
   36   20         FMT               5           4
   60   30         FMT               9           3           10
    0   40                           8           7

LOOPS   LABEL    INDEX       FROM-TO      LENGTH     PROPERTIES
  10     40      * I           7 8         17B                       EXT REFS

COMMON BLOCKS    LENGTH       MEMBERS - BIAS NAME(LENGTH)
      / /          3830               0 C      (3830)

EQUIV CLASSES    LENGTH       MEMBERS - BIAS NAME(LENGTH)
C       C          3830          2019 LCONV  (1)

STATISTICS
   PROGRAM LENGTH                 1013        65
   CM BLANK COMMON LENGTH        73668      3830
```

```
FUNCTION SIND          74/74   OPT=1                    FTN 4.2+75057     05/05/75  16.24.38.      PAGE    1

                    FUNCTION SIND (X)
                    SIND=-SIN (X/57.29578)                                           EXEC      710
                    RETURN                                                           EXEC      711
                    END                                                              EXEC      712
                                                                                     EXEC      713


FUNCTION SIND          74/74   OPT=1                    FTN 4.2+75857     05/05/75  16.24.38.      PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS          DEF LINE      REFERENCES
    4  SIND               1              3

VARIABLES          SN  TYPE             RELOCATION
   12  SIND            REAL
    0  X               REAL                      F.P.        DEFINED        2
                                                               REFS          2     DEFINED        1

EXTERNALS                TYPE     ARGS          REFERENCES
     SIN                 REAL        1 LIBRARY       2

STATISTICS
  PROGRAM LENGTH                      13B      11
```

```
      FUNCTION COSD        74/74  OPT=1                    FTN 4.2+75067    05/05/75  16.24.30.      PAGE    1

                          FUNCTION COSD (X)                                                   EXEC     714
                          COSD=-COS-(X/57.29578)                                              EXEC     715
                          RETURN                                                              EXEC     716
                          END                                                                 EXEC     717


      FUNCTION COSD        74/74  OPT=1                    FTN 4.2+75067    05/05/75  16.24.30.      PAGE    2

        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS     DEF LINE     REFERENCES
     4  COSD          1             3

 VARIABLES      SN  TYPE              RELOCATION
    12  COSD        REAL                               DEFINED        2
     0  X           REAL                    F.P.         REFS         2   DEFINED     1

 EXTERNALS            TYPE   ARGS         REFERENCES
        COS           REAL      1 LIBRARY       2

 STATISTICS
   PROGRAM LENGTH                133    11
```

```
FUNCTION ATAND        74/74  OPT=1                    FTN 4.2+75067     05/05/75  15.24.31.     PAGE   1

                     FUNCTION ATAND (Y,X)                                                 EXEC    718
                     ATAND= 57.23578*ATAN2 (Y,X)                                          EXEC    719
                     RETURN                                                               EXEC    720
                     END                                                                  EXEC    721

FUNCTION ATAND        74/74  OPT=1                    FTN 4.2+75057     05/05/75  16.24.31.     PAGE   2

      SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS      DEF LINE      REFERENCES
    4   ATAND         1              3

VARIABLES     SN   TYPE          RELOCATION
   13   ATAND      REAL                           DEFINED      2
    0   X          REAL             F.P.          REFS         2    DEFINED     1
    0   Y          REAL             F.P.          REFS         2    DEFINED     1

EXTERNALS              TYPE    ARGS           REFERENCES
        ATAN2          REAL      2 LIBRARY        2

STATISTICS
  PROGRAM LENGTH                   14B       12
```

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      SUBROUTINE S2I                                                    S2       2
      COMMON C(3830)                                                    S2       3
C                                                                       S2       4
C **OCS SEEKER INITIALIZATION MODULE**                                   S2       5
C                                                                       S2       6
C                                                                       S2       7
C**HIGH FREQUENCY SEEKER                                                S2       8
      REAL KQ1,KQ2,KQ3,KQ4,KQ5,KQ6,KQ7,KQ8,KQ9,KQ10,KQ11,KQ12           S2       9
      REAL KR1,KR2,KR3,KR4,KR5,KR6,KR7,KR8,KR9,KR10,KR11,KR12           S2      10
      REAL KUO,KUI,KBO,KBI,KPO,KPI,KOAO,KOAI                            S2      11
      REAL JI,JO                                                        S2      12
      EQUIVALENCE (C( 545),   KQ1),  (C( 573),   WTQ1)                  S2      13
      EQUIVALENCE (C( 546),   KR1),  (C( 574),   WTR1)                  S2      14
      EQUIVALENCE (C( 547),   KQ2),  (C( 575),   WTQ2)                  S2      15
      EQUIVALENCE (C( 548),   KR2),  (C( 576),   WTR2)                  S2      16
      EQUIVALENCE (C( 549),   KQ3),  (C( 577),   WGQ1)                  S2      17
      EQUIVALENCE (C( 550),   KR3),  (C( 578),   WGR1)                  S2      18
      EQUIVALENCE (C( 551),   KQ5),  (C( 579),   WGQ2)                  S2      19
      EQUIVALENCE (C( 552),   KR5),  (C( 580),   WGR2)                  S2      20
      EQUIVALENCE (C( 553),   KQ6),  (C( 581),   WGQ3)                  S2      21
      EQUIVALENCE (C( 554),   KR6),  (C( 582),   WGR3)                  S2      22
      EQUIVALENCE (C( 555),   KQ7),  (C( 583),   WGQ4)                  S2      23
      EQUIVALENCE (C( 556),   KR7),  (C( 584),   WGR4)                  S2      24
      EQUIVALENCE (C( 557),   KQ8),  (C( 585),   WGQ5)                  S2      25
      EQUIVALENCE (C( 558),   KR8),  (C( 586),   WGR5)                  S2      26
      EQUIVALENCE (C( 559),  KQ10),  (C( 587),   WGQ6)                  S2      27
      EQUIVALENCE (C( 560),  KR10),  (C( 588),   WGR6)                  S2      28
      EQUIVALENCE (C( 561),  KQ11),  (C( 589),   WRQ1)                  S2      29
      EQUIVALENCE (C( 562),  KR11),  (C( 590),   WRR1)                  S2      30
      EQUIVALENCE (C( 563),  KQ12),  (C( 591),   WRQ2)                  S2      31
      EQUIVALENCE (C( 564),  KR12),  (C( 592),   WRR2)                  S2      32
      EQUIVALENCE (C( 565),    JI),  (C( 593),   WRQ3)                  S2      33
      EQUIVALENCE (C( 566),    JO),  (C( 594),   WRR3)                  S2      34
      EQUIVALENCE (C( 567),   FRI),  (C( 595),   WRQ4)                  S2      35
      EQUIVALENCE (C( 568),   FRO),  (C( 596),   WRR4)                  S2      36
      EQUIVALENCE (C( 569),   TUI),  (C( 597),    RCL)                  S2      37
      EQUIVALENCE (C( 570),   TUO),  (C( 598),   TCLQ)                  S2      38
      EQUIVALENCE (C( 571),  QERS),  (C( 599),   TCLR)                  S2      39
      EQUIVALENCE (C( 572),  RERS),  (C( 600),    TAU)                  S2      40
      EQUIVALENCE (C( 480),   GQ1),  (C( 482),    GQ2)                  S2      41
      EQUIVALENCE (C( 481),   GR1),  (C( 483),    GR2)                  S2      42
      EQUIVALENCE (C( 484),   GQ3),  (C( 486),    GQ4)                  S2      43
      EQUIVALENCE (C( 485),   GR3),  (C( 487),    GR4)                  S2      44
      EQUIVALENCE (C( 489),   GQ5),  (C( 491),    GQ6)                  S2      45
      EQUIVALENCE (C( 490),   GR5),  (C( 492),    GR6)                  S2      46
      EQUIVALENCE (C( 601), TARHT),  (C( 602),  TARHD)                  S2      47
C**INPUTS FROM OTHER MODULES**                                          S2      48
      EQUIVALENCE (C(1751),  CRAD)                                      S2      49
      EQUIVALENCE (C( 371), RANGE)                                      S2      50
C                                                                       S2      51
C**STATE VARIABLES                                                      S2      52
                                                                        S2      53
      EQUIVALENCE (C( 424), BTHTGO), (C( 427),  BTHTG)                  S2      54
      EQUIVALENCE (C( 428), BPSIGO), (C( 431),  BPSIG)                  S2      55
      EQUIVALENCE (C( 500),   DQ1),  (C( 503),     Q1)                  S2      56
      EQUIVALENCE (C( 501),   DR1),  (C( 504),     R1)                  S2      57
      EQUIVALENCE (C( 506),   DQ2),  (C( 509),     Q2)                  S2      58
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      EQUIVALENCE (C( 507),    DR2), (C( 510),    R2)
      EQUIVALENCE (C( 512),    DQ3), (C( 515),    Q3)
      EQUIVALENCE (C( 513),    DR3), (C( 516),    R3)
      EQUIVALENCE (C( 514),    DHD), (C( 517),    HD)
      EQUIVALENCE (C( 518),   DDQ4), (C( 521),   DQ4), (C( 524),  Q4)
      EQUIVALENCE (C( 519),   DDR4), (C( 522),   DR4), (C( 525),  R4)
      EQUIVALENCE (C( 520),    DHI), (C( 523),    HI)
      EQUIVALENCE (C( 527),   DDQ5), (C( 530),   DQ5), (C( 533),  Q5)
      EQUIVALENCE (C( 528),   DDR5), (C( 531),   DR5), (C( 534),  R5)
      EQUIVALENCE (C( 536),   DDQ6), (C( 539),   DQ6), (C( 542),  Q6)
      EQUIVALENCE (C( 537),   DDR6), (C( 540),   DR6), (C( 543),  R6)
C
C**OUTPUTS
      EQUIVALENCE (C( 603), RBLOCK), (C( 605),  IOCS)
      EQUIVALENCE (C( 608), TDELAY), (C( 609),  THT2), (C( 510), THTR)
      EQUIVALENCE (C( 525),BEPSYSV)
      EQUIVALENCE (C( 529),BEPSZSV)
      EQUIVALENCE (C( 532), TIMESV)
      EQUIVALENCE (C(2561),      N), (C(2562),    IPL)
      EQUIVALENCE (C( 523),  DERSV)
      EQUIVALENCE (C(3504),  OPTN4)
C
C**MONTE CARLO PARAMETERS
C
      EQUIVALENCE (C(3534),  ISNOK), (C(3512), I3512)
      EQUIVALENCE (C( 511),    KUD), (C( 612),   KJI)
      EQUIVALENCE (C( 613),    KBD), (C( 614),   KBI)
      EQUIVALENCE (C( 615),    KPD), (C( 616),   KPI)
      EQUIVALENCE (C( 617),   KOAD), (C( 618),  KOAI)
      EQUIVALENCE (C( 619),    UCC), (C( 620),   USC)
      EQUIVALENCE (C( 521),   UCCG), (C( 622),  USCG)
      DIMENSION IPL(100)
      DIMENSION ISNOK(40)
      IS3=0
C
C
      IF(C(2564).GT..0005)WRITE(6,112)
  112 FORMAT(1H1,15(/),10X,*INTEGRATION STEPSIZE IS GREATER THAN THE REC
     .OMMENDED VALUE FOR SEEKER MODEL S2.*/,11X,*RECOMMENDED VALUE IS .0
     $005 SEC. CHECK RESULTS FOR VALIDITY.*,10(/))
C
C
      GO TO 10
C
C
      ENTRY S3I
C**LOW FREQUENCY SEEKER
C
      IPL(N)=500
      IS3=1
      IPL(N+1)=501
      IPL(N+2)=505
      IPL(N+3)=507
      IPL(N+4)=512
      IPL(N+5)=513
      IPL(N+6)=514
      IPL(N+7)=520
```

```
      IPL(N+8)=424
      IPL(N+9)=428
      N=N+10
      GO TO 20
   10 CONTINUE
      IPL(N)=500
      IPL(N+1)=501
      IPL(N+2)=506
      IPL(N+3)=507
      IPL(N+4)=512
      IPL(N+5)=513
      IPL(N+6)=514
      IPL(N+7)=513
      IPL(N+8)=513
      IPL(N+9)=520
      IPL(N+10)=521
      IPL(N+11)=522
      IPL(N+12)=527
      IPL(N+13)=528
      IPL(N+14)=530
      IPL(N+15)=531
      IPL(N+16)=536
      IPL(N+17)=537
      IPL(N+18)=539
      IPL(N+19)=540
      IPL(N+20)=424
      IPL(N+21)=428
      N=N+22
   20 CONTINUE
      DO 1 I=500,543
    1 C(I)=0.
C*****FILL TRANSPORT LAG (TLAG) ARRAYS
      C(655)=C(2030)
      DO 7 I=1,6
      C(655-I)=C(655-I)-C(2664)
      C(655+I)=0.
      C(661+I)=0.
    7 CONTINUE
      C(13)=-1.
      C(461)=0.
      C(462)=0.
      C(463)=0.
      C(464)=0.
      IF(OPTN4.GT.1.) GO TO 3
      C(461)=1.
      C(462)=1.
      C(463)=1.
      C(464)=1.
    3 CONTINUE
      TDELAY=0.    $ THTQ=0.    $ THTR=0.
      C(403)=0.    $ C(437)=0.    $ C(424)=0.    $ C(428)=0.
      C(435)=0.    $ C(436)=0.
      C(630)=0.    $ C(631)=0.
      DERSV=.002
      BEPSYSV=0.
      BEPSZSV=0.
      TUI=0.
```

```
      TUO=0.
      GQ1=KQ1*KQ2/CRAD
      GR1=KR1*KR2/CRAD
      GQ2=KQ3*WTQ2/ATQ1
      GR2=KR3*WTR2/ATR1
      GQ3=KQ5*WGQ6*WGQ6*WGQ4/(WGQ1*WGQ3*WGQ5)
      GR3=KR5*WGR6*WGR6*WGR4/(WGR1*WGR3*WGR5)
      GQ4=KQ6*KQ7
      GR4=KR6*KR7
      GQ5=KQ10*WRQ2*WRQ2/CRAD
      GR5=KR10*WRR2*WRR2/CRAD
      GQ6=KQ11*WRQ4*WRQ4
      GR6=KR11*WRR4*WRR4
      RANGE=SQRT(C(1635)*C(1635)+C(1636)*C(1636)+C(1637)*C(1637))
      THTQ=ATAND(TARHT,RANGE)/2.
      THIR=ATAND(TARWD,RANGE)/2.
      IOCS=-10
C
      IF(IS3.EQ.0) GO TO 6
      GQ3=KQ5*WGQ4/WGQ1/WGQ3
      GR3=KR5*WGR4/WGR1/WGR3
      GQ5=KQ10*KQ11/CRAD
      GR5=KR10*KR11/CRAD
    6 CONTINUE
C
      DO 30 I=1,I3512
      IDO=I
C
C**MONTE CARLO MASS UNBALANCE ON SEEKER GYRO
C
      IF(ISNDX(I).EQ.611)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.611)CALL RANNUM(0.,RNSTRT,RN)
      KUO=SIGN(KUO,RN)
      IF(ISNDX(I).EQ.612)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.612)CALL RANNUM(0.,RNSTRT,RN)
      CHI=360.*RN
C
C**MONTE CARLO SEEKER RATE GYRO ERRORS
C
      IF(ISNDX(I).EQ.613)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.614)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.615)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.615)CALL RANNUM(0.,RNSTRT,RN)
      CHIG=360.*RN
      IF(ISNDX(I).EQ.616)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.617)CALL MCARLO(DUM, 1, IDO)
      IF(ISNDX(I).EQ.618)CALL MCARLO(DUM, 1, IDO)
      UCC=COSD(CHI)
      USC=SIND(CHI)
      UCCG=COSD(CHIG)
      USCG=SIND(CHIG)
   30 CONTINUE
      RETURN
      END
```

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        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     1  S2I               1
    11  S3I             133         224

 VARIABLES        SN  TYPE              RELOCATION
   1015  BEPSYSV      REAL                   / /     REFS      73   DEFINED    169
   1020  BEPSZSV      REAL                   / /     REFS      74   DEFINED    170
    656  BPSIG        REAL                   / /     REFS      54
    653  BPSICD       REAL                   / /     REFS      54
    652  BTHTG        REAL                   / /     REFS      53
    647  BTHTGD       REAL                   / /     REFS      53
      0  C            REAL       ARRAY       / /     REFS       2    2*12     2*13     2*14     2*15     2*16     2*17
                                                     2*18    2*19    2*20     2*21     2*22     2*23     2*24     2*25
                                                     2*26    2*27    2*28     2*29     2*30     2*31     2*32     2*33
                                                     2*34    2*35    2*36     2*37     2*38     2*39     2*40     2*41
                                                     2*42    2*43    2*44     2*45     2*46     48       49       2*53
                                                     2*54    2*55    2*56     2*57     2*58     2*59     2*60     2*61
                                                     3*62    3*63    2*64     3*65     3*66     3*67     3*68     2*71
                                                     3*72    73      74       75       2*76     77       78       2*82
                                                     2*83    2*84    2*85     2*86     2*87     2*88     34       167
                                                     2*149   6*185   DEFINED  145      147      149      150      151
                                                     153     154     155      156      157      159      160      161
                                                     162     4*165   2*166    2*167
    430  CHI          REAL                           REFS     219    220      DEFINED  207
    431  CHIG         REAL                           REFS     221    222      DEFINED  215
   3326  CRAD         REAL                   / /     REFS      48    173      174      181      182      193      194
   1005  DDQ4         REAL                   / /     REFS      62
   1016  DDQ5         REAL                   / /     REFS      65
   1027  DDQ6         REAL                   / /     REFS      67
   1006  DDR4         REAL                   / /     REFS      63
   1017  DDR5         REAL                   / /     REFS      66
   1030  DDR6         REAL                   / /     REFS      68
   1156  DERSV        REAL                   / /     REFS      77   DEFINED    168
    763  DQ1          REAL                   / /     REFS      55
    771  DQ2          REAL                   / /     REFS      57
    777  DQ3          REAL                   / /     REFS      59
   1010  DQ4          REAL                   / /     REFS      62
   1021  DQ5          REAL                   / /     REFS      65
   1032  DQ6          REAL                   / /     REFS      67
    764  DR1          REAL                   / /     REFS      56
    772  DR2          REAL                   / /     REFS      58
   1000  DR3          REAL                   / /     REFS      60
   1011  DR4          REAL                   / /     REFS      63
   1022  DR5          REAL                   / /     REFS      66
   1033  DR6          REAL                   / /     REFS      68
    425  DUM          REAL                           REFS     232    205      211      212      213      216      217
                                                     218
   1007  DWI          REAL                   / /     REFS      64
   1001  DWO          REAL                   / /     REFS      61
   1066  FRI          REAL                   / /     REFS      34
   1067  FRO          REAL                   / /     REFS      35
    737  GQ1          REAL                   / /     REFS      40   DEFINED    173
    741  GQ2          REAL                   / /     REFS      40   DEFINED    175
    743  GQ3          REAL                   / /     REFS      42   DEFINED    177      191
    745  GQ4          REAL                   / /     REFS      42   DEFINED    179
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          SUBROUTINE S2I          74/74    OPT=1                            FTN 4.2+75067       05/05/75  16.24.32.      PAGE     6

 VARIABLES    SN  TYPE              RELOCATION
    750  GQ5        REAL                  / /      REFS        44     DEFINED     181       193
    752  GQ6        REAL                  / /      REFS        44     DEFINED     183
    740  GR1        REAL                  / /      REFS        41     DEFINED     174
    742  GR2        REAL                  / /      REFS        41     DEFINED     176
    744  GR3        REAL                  / /      REFS        43     DEFINED     178       192
    746  GR4        REAL                  / /      REFS        43     DEFINED     180
    751  GR5        REAL                  / /      REFS        45     DEFINED     182       194
    753  GR6        REAL                  / /      REFS        45     DEFINED     184
    423  I          INTEGER                        REFS       145       2*149     150       151       198       202       203
                                                    205       206         211     212       213       214       216       217
                                                    218   DEFINED         144     148       197
    424  IDO        INTEGER                        REFS       202         205     211       212       213       216       217
                                                    218   DEFINED         198
   1134  IOCS       INTEGER               / /      REFS        71     DEFINED     188
   5001  IPL        INTEGER     ARRAY     / /      REFS        76          89   DEFINED     106       108       109       110
                                                    111       112         113     114       115       116       120       121
                                                    122       123         124     125       126       127       128       129
                                                    130       131         132     133       134       135       136       137
                                                    138       139         140     141
   7061  ISNDX      INTEGER     ARRAY     / /      REFS        52          90     202       203       205       206       211
                                                    212       213         214     216       217       218
    422  IS3        INTEGER                        REFS       190     DEFINED      91       107
   6667  I3512      INTEGER               / /      REFS        52         197
   1064  JI         REAL                  / /      REFS        11          32
   1065  JO         REAL                  / /      REFS        11          33
   1145  KBI        REAL                  / /      REFS        10          84
   1144  KBO        REAL                  / /      REFS        10          84
   1151  KOAI       REAL                  / /      REFS        10          86
   1150  KOAO       REAL                  / /      REFS        10          86
   1147  KPI        REAL                  / /      REFS        10          85
   1146  KPO        REAL                  / /      REFS        10          85
   1040  KQ1        REAL                  / /      REFS         8          12     173
   1056  KQ10       REAL                  / /      REFS         8          26     181       193
   1060  KQ11       REAL                  / /      REFS         8          28     183       193
   1062  KQ12       REAL                  / /      REFS         8          30
   1042  KQ2        REAL                  / /      REFS         8          14     173
   1044  KQ3        REAL                  / /      REFS         8          16     175
    416  KQ4      * REAL        *UNDEF             REFS         8
   1046  KQ5        REAL                  / /      REFS         8          18     177       191
   1050  KQ6        REAL                  / /      REFS         8          20     179
   1052  KQ7        REAL                  / /      REFS         8          22     179
   1054  KQ8        REAL                  / /      REFS         8          24
    417  KQ9      * REAL        *UNDEF             REFS         8
   1041  KR1        REAL                  / /      REFS         9          13     174
   1057  KR10       REAL                  / /      REFS         9          27     182       194
   1061  KR11       REAL                  / /      REFS         9          29     184       194
   1063  KR12       REAL                  / /      REFS         9          31
   1043  KR2        REAL                  / /      REFS         9          15     174
   1045  KR3        REAL                  / /      REFS         9          17     176
    420  KR4      * REAL        *UNDEF             REFS         9
   1047  KR5        REAL                  / /      REFS         9          19     178       192
   1051  KR6        REAL                  / /      REFS         9          21     180
   1053  KR7        REAL                  / /      REFS         9          23     180
   1055  KR8        REAL                  / /      REFS         9          25
    421  KR9      * REAL        *UNDEF             REFS         9
   1143  KUI        REAL                  / /      REFS        10          83
   1142  KUO        REAL                  / /      REFS        10          83     204   DEFINED       204
```


3

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SUBROUTINE S2I          74/74  OPT=1                        FTN 4.2+75067     05/05/75  16.24.32.     PAGE   7

VARIABLES    SN  TYPE          RELOCATION
  5000  N        INTEGER        / /        REFS     76     106     108     109     110     111     112
                                                    113    114     115     116     117     120     121     122
                                                    123    124     125     126     127     128     129     130
                                                    131    132     133     134     135     136     137     138
                                                    139    140     141     142     DEFINED 117     142
  6657  OPTN4    REAL           / /        REFS     78     158
  1672  QERG     REAL           / /        REFS     38
   766  Q1       REAL           / /        REFS     55
   774  Q2       REAL           / /        REFS     57
  1002  Q3       REAL           / /        REFS     59
  1013  Q4       REAL           / /        REFS     62
  1024  Q5       REAL           / /        REFS     65
  1035  Q6       REAL           / /        REFS     67
   562  RANGE    REAL           / /        REFS     49     186     187     DEFINED 185
  1132  RBLOCK   REAL           / /        REFS     71
  1124  RCL      REAL           / /        REFS     36
  1073  RERG     REAL           / /        REFS     39
   427  RN       REAL                      REFS     203    204     206     207     214     215
   426  RNSTRT   REAL                      REFS     203    206     214
   767  R1       REAL           / /        REFS     56
   775  R2       REAL           / /        REFS     58
  1003  R3       REAL           / /        REFS     60
  1014  R4       REAL           / /        REFS     63
  1025  R5       REAL           / /        REFS     66
  1036  R6       REAL           / /        REFS     68
  1130  TARMT    REAL           / /        REFS     46     186
  1131  TARMD    REAL           / /        REFS     46     187
  1127  TAU      REAL           / /        REFS     39
  1125  TCLQ     REAL           / /        REFS     37
  1126  TCLR     REAL           / /        REFS     38
  1137  TDELAY   REAL           / /        REFS     72     DEFINED 164
  1140  THTQ     REAL           / /        REFS     72     DEFINED 164     186
  1141  THTR     REAL           / /        REFS     72     DEFINED 164     187
  1023  TIMESV   REAL           / /        REFS     75
  1070  TUI      REAL           / /        REFS     36     DEFINED 171
  1071  TUO      REAL           / /        REFS     37     DEFINED 172
  1152  UCC      REAL           / /        REFS     87     DEFINED 219
  1154  UCCG     REAL           / /        REFS     88     DEFINED 221
  1153  USC      REAL           / /        REFS     87     DEFINED 220
  1155  USCG     REAL           / /        REFS     88     DEFINED 222
  1100  WGQ1     REAL           / /        REFS     16     177     191
  1102  WGQ2     REAL           / /        REFS     18
  1104  WGQ3     REAL           / /        REFS     20     177     191
  1106  WGQ4     REAL           / /        REFS     22     177     191
  1110  WGQ5     REAL           / /        REFS     24     177
  1112  WGQ6     REAL           / /        REFS     26     2*177
  1101  WGR1     REAL           / /        REFS     17     178     192
  1103  WGR2     REAL           / /        REFS     19
  1105  WGR3     REAL           / /        REFS     21     178     192
  1107  WGR4     REAL           / /        REFS     23     178     192
  1111  WGR5     REAL           / /        REFS     25     178
  1113  WGR6     REAL           / /        REFS     27     2*178
  1012  WI       REAL           / /        REFS     54
  1004  WO       REAL           / /        REFS     51
  1114  WRQ1     REAL           / /        REFS     28
  1116  WRQ2     REAL           / /        REFS     30     2*181
  1120  WRQ3     REAL           / /        REFS     32
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        SUBROUTINE S2I         74/74   OPT=1                                     FTN 4.2+75067       05/35/75  16.24.32.      PAGE    8

 VARIABLES      SN  TYPE            RELOCATION
   1122  WRQ4       REAL                  / /        REFS     34      2*163
   1115  WRR1       REAL                  / /        REFS     29
   1117  WRR2       REAL                  / /        REFS     31      2*182
   1121  WRR3       REAL                  / /        REFS     33
   1123  WRR4       REAL                  / /        REFS     35      2*184
   1074  WTQ1       REAL                  / /        REFS     12       175
   1076  WTQ2       REAL                  / /        REFS     14       175
   1075  WTR1       REAL                  / /        REFS     13       176
   1077  WTR2       REAL                  / /        REFS     15       176

 FILE NAMES         MODE
        TAPE6       FMT                   WRITES       94

 EXTERNALS          TYPE    ARGS          REFERENCES
        ATAND       REAL     2             185       187
        COSD        REAL     1             219       221
        MCARLC               3             202       205      211      212      213      216      217      218
        RANNUM               3             203       206      214
        SIND        REAL     1             220       222
        SQRT        REAL     1 LIBRARY     185

 INLINE FUNCTIONS   TYPE    ARGS          DEF LINE  REFERENCES
        SIGN        REAL     2  INTRIN               204

 STATEMENT LABELS                  DEF LINE    REFERENCES
      0  1                            145        144
    132  3                            163        155
    236  6                            135        190
      0  7                            152        149
     36  10                           119        100
    101  20                           143        113
      0  30                           223        197
    364  112       FMT                 95         94

 LOOPS  LABEL     INDEX        FROM-TO      LENGTH      PROPERTIES
   103  1          I           144 145        28        INSTACK
   113  7        * I           148 152        7B        INSTACK
   237  30       * I           197 223       77B                     EXT REFS

 COMMON BLOCKS   LENGTH      MEMBERS - BIAS NAME(LENGTH)
    / /           3830                 0 C       (3830)

 EQUIV CLASSES   LENGTH      MEMBERS - BIAS NAME(LENGTH)
 C       C        3830              370 RANGE    (1)          423 BTHTGD  (1)          426 BTHTG   (1)
                                    427 BPSIGD   (1)          430 BPSTG   (1)          479 GQ1     (1)
                                    480 GR1      (1)          481 GQ2     (1)          482 GR2     (1)
                                    483 GQ3      (1)          484 GR3     (1)          485 GQ4     (1)
                                    486 GR4      (1)          488 GQ5     (1)          489 GR5     (1)
                                    490 GQ6      (1)          491 GR6     (1)          499 DQ1     (1)
                                    500 DR1      (1)          502 Q1      (1)          503 R1      (1)
                                    505 DQ2      (1)          505 DR2     (1)          508 Q2      (1)
                                    509 R2       (1)          511 DQ3     (1)          512 DR3     (1)
                                    513 DRO      (1)          514 Q3      (1)          515 R3      (1)
                                    516 WO       (1)          517 DDQ4    (1)          518 DDR4    (1)
                                    519 WI       (1)          520 DQ4     (1)          521 DR4     (1)
                                    522 WI       (1)          523 Q4      (1)          524 R4      (1)
                                    525 BEPSYSV(1)            525 DDQ5    (1)          527 DDR5    (1)
```

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EQUIV CLASSES   LENGTH   MEMBERS - BIAS NAME(LENGTH)
                          528 BEPSZSV(1)      529 DQ5     (1)     530 DR5    (1)
                          531 TIMESV  (1)     532 Q5      (1)     533 R5     (1)
                          535 DDQ6    (1)     536 DDR6    (1)     538 DQ6    (1)
                          539 DR5     (1)     541 Q6      (1)     542 R6     (1)
                          544 KQ1     (1)     545 KR1     (1)     546 KQ2    (1)
                          547 KR2     (1)     548 KQ3     (1)     549 KR3    (1)
                          550 KQ5     (1)     551 KR5     (1)     552 KQ6    (1)
                          553 KR6     (1)     554 KQ7     (1)     555 KR7    (1)
                          556 KQ8     (1)     557 KR8     (1)     558 KQ10   (1)
                          559 KR10    (1)     560 KQ11    (1)     561 KR11   (1)
                          562 KQ12    (1)     563 KR12    (1)     564 JI     (1)
                          565 JJ      (1)     566 FRI     (1)     567 FRO    (1)
                          568 TUI     (1)     569 TJO     (1)     570 QERG   (1)
                          571 RERG    (1)     572 WTQ1    (1)     573 WTR1   (1)
                          574 WTQ2    (1)     575 WTR2    (1)     576 WGQ1   (1)
                          577 WGR1    (1)     578 WGQ2    (1)     579 WGR2   (1)
                          580 WGQ3    (1)     581 WGR3    (1)     582 WGQ4   (1)
                          583 WGR4    (1)     584 WGQ5    (1)     585 WGR5   (1)
                          586 WGQ5    (1)     587 WGR6    (1)     588 WRQ1   (1)
                          589 WRR1    (1)     590 WRQ2    (1)     591 WRR2   (1)
                          592 WRQ3    (1)     593 WRR3    (1)     594 WRQ4   (1)
                          595 WRR4    (1)     596 RCL     (1)     597 TCLQ   (1)
                          598 TCLR    (1)     599 TAU     (1)     600 TARHT  (1)
                          601 TARHO   (1)     602 RBLOCK  (1)     60_ IDCS   (1)
                          607 TDELAY  (1)     608 THTQ    (1)     609 THTR   (1)
                          610 KUD     (1)     611 KUI     (1)     612 KBD    (1)
                          613 KBI     (1)     614 KPD     (1)     615 KPI    (1)
                          616 KOAD    (1)     617 KOAI    (1)     618 UCC    (1)
                          619 USC     (1)     620 UCCG    (1)     621 USCG   (1)
                          622 UERSV   (1)    1750 CRAD    (1)    2560 N      (1)
                         2561 IPL   (100)    3503 OPTN4   (1)    3511 I3512  (1)
                         3633 ISNDX  (40)

STATISTICS
  PROGRAM LENGTH                 4323      282
  CM BLANK COMMON LENGTH        73668     3830
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      SUBROUTINE S2                 74/74    OPT=1                    FTN 4.2+75067      05/05/75  16.29.23.      PAGE    1

      SUBROUTINE S2
C
C ** OCS SEEKER MODULE**
C
C
C**HIGH FREQUENCY SEEKER
C
C
C
C.................USE INTEG STEPSIZE OF .0005 OR LESS WHEN RUNNING WITH
C.................SEEKER MODEL S2.       USE INTEG STEPSIZE OF .0125
C.................OR LESS WHEN RUNNING WITH SEEKER MODEL S3...........
C
C
C
      COMMON C(3830)
      REAL KQ1,KQ2,KQ3,KQ4,KQ5,KQ6,KQ7,KQ8,KQ9,KQ10,KQ11,KQ12
      REAL KR1,KR2,KR3,KR4,KR5,KR6,KR7,KR8,KR9,KR10,KR11,KR12
      REAL KUO,KUI,KBO,KBI,KPO,KPI,KOAO,KOAI
      REAL JI,JO
C**INPUT DATA
      EQUIVALENCE (C( 545),    KQ1),  (C( 573),   WTQ1)
      EQUIVALENCE (C( 546),    KR1),  (C( 574),   WTR1)
      EQUIVALENCE (C( 547),    KQ2),  (C( 575),   WTQ2)
      EQUIVALENCE (C( 548),    KR2),  (C( 576),   WTR2)
      EQUIVALENCE (C( 549),    KQ3),  (C( 577),   WGQ1)
      EQUIVALENCE (C( 550),    KR3),  (C( 578),   WGR1)
      EQUIVALENCE (C( 551),    KQ5),  (C( 579),   WGQ2)
      EQUIVALENCE (C( 552),    KR5),  (C( 580),   WGR2)
      EQUIVALENCE (C( 553),    KQ6),  (C( 581),   WGQ3)
      EQUIVALENCE (C( 554),    KR6),  (C( 582),   WGR3)
      EQUIVALENCE (C( 555),    KQ7),  (C( 583),   WGQ4)
      EQUIVALENCE (C( 556),    KR7),  (C( 584),   WGR4)
      EQUIVALENCE (C( 557),    KQ8),  (C( 585),   WGQ5)
      EQUIVALENCE (C( 558),    KR8),  (C( 586),   WGR5)
      EQUIVALENCE (C( 559),   KQ10),  (C( 587),   WGQ6)
      EQUIVALENCE (C( 560),   KR10),  (C( 588),   WGR6)
      EQUIVALENCE (C( 561),   KQ11),  (C( 589),   WRQ1)
      EQUIVALENCE (C( 562),   KR11),  (C( 590),   WRR1)
      EQUIVALENCE (C( 563),   KQ12),  (C( 591),   WRQ2)
      EQUIVALENCE (C( 564),   KR12),  (C( 592),   WRR2)
      EQUIVALENCE (C( 565),     JI),  (C( 593),   WRQ3)
      EQUIVALENCE (C( 566),     JO),  (C( 594),   WRR3)
      EQUIVALENCE (C( 567),    FRI),  (C( 595),   WRQ4)
      EQUIVALENCE (C( 568),    FRO),  (C( 596),   WRR4)
      EQUIVALENCE (C( 569),    TUI),  (C( 597),    RCL)
      EQUIVALENCE (C( 570),    TUO),  (C( 598),   TCLQ)
      EQUIVALENCE (C( 571),   QERO),  (C( 599),   TCLR)
      EQUIVALENCE (C( 572),   RERO),  (C( 600),    TAU)
      EQUIVALENCE (C( 480),    GQ1),  (C( 482),    GQ2)
      EQUIVALENCE (C( 481),    GR1),  (C( 483),    GR2)
      EQUIVALENCE (C( 484),    GQ3),  (C( 486),    GQ4)
      EQUIVALENCE (C( 485),    GR3),  (C( 487),    GR4)
      EQUIVALENCE (C( 489),    GQ5),  (C( 491),    GQ6)
      EQUIVALENCE (C( 490),    GR5),  (C( 492),    GR6)
      EQUIVALENCE (C( 497),  GEOCS)
      EQUIVALENCE (C( 603), RBLOC4),  (C( 605),   IOCS)
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      EQUIVALENCE (C( 501),  TARHI), (C( 502),  TARHO)
      EQUIVALENCE (C( 604),  FFOV)
      EQUIVALENCE (C( 608), TDELAY), (C( 609),   THTI), (C( 610), THTR)
      EQUIVALENCE (C( 506),   TLAG)
C
C**INPUTS FROM OTHER MODULES**
      EQUIVALENCE (C( 372),   RXBA)
      EQUIVALENCE (C( 373),   RYBA)
      EQUIVALENCE (C( 374),   RZBA)
      EQUIVALENCE (C(1739),     HP)
      EQUIVALENCE (C(1743),     WQ)
      EQUIVALENCE (C(1747),     WR)
      EQUIVALENCE (C(1751),   CRAD)
      EQUIVALENCE (C(2000),   TIME)
      EQUIVALENCE (C( 371),  RANGE)
      EQUIVALENCE (C(1676),   ANGX)
      EQUIVALENCE (C(1577),   ANGY)
      EQUIVALENCE (C(1578),   ANGZ)
      EQUIVALENCE (C(1736),    WPD)
      EQUIVALENCE (C(1740),    WQD)
      EQUIVALENCE (C(1744),    WRD)
      EQUIVALENCE (C( 550),TIMESV)
      EQUIVALENCE (C( 556),   LOSZ)
      EQUIVALENCE (C( 562),   LOSY)
      REAL LOSZ,LOSY
      DIMENSION TIMESV(5),LOSZ(6),LOSY(6),XL(2)
C
C**STATE VARIABLES
      EQUIVALENCE (C( 424), BTHTGD), (C( 427),  BTHTG)
      EQUIVALENCE (C( 428), BPSIGD), (C( 431),  BPSIG)
      EQUIVALENCE (C( 500),    DQ1), (C( 503),     Q1)
      EQUIVALENCE (C( 501),    DR1), (C( 504),     R1)
      EQUIVALENCE (C( 506),    DQ2), (C( 509),     Q2)
      EQUIVALENCE (C( 507),    DR2), (C( 510),     R2)
      EQUIVALENCE (C( 512),    DQ3), (C( 515),     Q3)
      EQUIVALENCE (C( 513),    DR3), (C( 516),     R3)
      EQUIVALENCE (C( 514),    DWO), (C( 517),     WO)
      EQUIVALENCE (C( 518),   DDQ4), (C( 521),    DQ4), (C( 524),   Q4)
      EQUIVALENCE (C( 519),   DDR4), (C( 522),    DR4), (C( 525),   R4)
      EQUIVALENCE (C( 520),    DWI), (C( 523),     WI)
      EQUIVALENCE (C( 527),   DDQ5), (C( 530),    DQ5), (C( 533),   Q5)
      EQUIVALENCE (C( 528),   DDR5), (C( 531),    DR5), (C( 534),   R5)
      EQUIVALENCE (C( 536),   DDQ6), (C( 539),    DQ6), (C( 542),   Q6)
      EQUIVALENCE (C( 537),   DDR6), (C( 540),    DR6), (C( 543),   R6)
C
C**OTHER OUTPUTS
      EQUIVALENCE (C( 435),  BEPSZ)
      EQUIVALENCE (C( 436),  BEPSY)
      EQUIVALENCE (C( 403),  WLAMQ)
      EQUIVALENCE (C( 407),  WLAMR)
      EQUIVALENCE (C( 526),BEPSYSV)
      EQUIVALENCE (C( 529),BEPSZSV)
      EQUIVALENCE (C( 493), DTHCQ), (C( 494),  DTHCR)
      EQUIVALENCE (C( 495), DTHRGQ), (C( 496), DTHRGR)
      EQUIVALENCE (C(2020),  LCONV), (C( 625),    IBL)
      EQUIVALENCE (C( 607),  BRLKQ)
C
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      C**MONTE CARLO PARAMETERS
      C
            EQUIVALENCE (C(3634),  ISNOK), (C(3512),  I3512)
            EQUIVALENCE (C( 611),   KUO), (C( 612),    KUI)
            EQUIVALENCE (C( 513),   KBO), (C( 614),    KBI)
            EQUIVALENCE (C( 615),   KPO), (C( 616),    KPI)
            EQUIVALENCE (C( 517),  KOAO), (C( 618),   KOAI)
            EQUIVALENCE (C( 619),   UCO), (C( 620),    USO)
            EQUIVALENCE (C( 521),  UCCG), (C( 622),   USCG)
            DATA FOV/4./
      C
      C INTEGRATION SWITCHING TEST
      C            SYNCHRONIZE INTEGRATION WITH SAMPLE SIZE
            IF(C(13).LE.0.)GO TO 1
            C(13)=-1.
            C(2664)=TAU/AINT(TAU/C(2764))
    1       CONTINUE
      C
      C**DIRECTION COSINES FOR BODY TO PLATFORM TRANSFORMATION
            UCT=COSD(BTHTG)
            UST=SIND(BTHTG)
            UCP=COSD(BPSIG)
            USP=SIND(BPSIG)
            UB11=UCT*UCP
            UB12=USP
            UB13=-UCP*UST
            UB21=-UCT*USP
            UB22=UCP
            UB23=UST*USP
            UB31=UST
            UB32=0.
            UB33=UCT
      C
      C**TRANSFORM LOS FROM BODY TO GIMBAL AXES
            RXG=UB11*RXBA+UB12*RYBA+UB13*RZBA
            RYG=UB21*RXBA+UB22*RYBA+UB23*RZBA
            RZG=UB31*RXBA+UB32*RYBA+UB33*RZBA
            IF(I3512.LE.0)GO TO 5
      C**GYRO ERRORS
      C
      C**TRANSFORM NORMALIZED ACCELERATIONS FROM BODY TO GIMBAL AXES
            ANGXG=UB11*ANGX+UB12*ANGY+UB13*ANGZ
            ANGYG=UB21*ANGX+UB22*ANGY+UB23*ANGZ
            ANGZG=UB31*ANGX+UB32*ANGY+UB33*ANGZ
            ANG=ANGZG*UCCG-ANGYG*USCG
            QERG=KBO+KPO*ANG+KOAO*WPD
            RERG=KBI+KPI*ANG+KOAI*WPD
            TUO=KUO*(ANGX*UCT-ANGZ*UST)
            TUI=KUI*(ANGYG*UCC-ANGXG*USC)
    5       CONTINUE
      C
      C**LOS ERRORS IN PLATFORM COORDINATES
            IF(C(1976).LE.0.)GO TO 32
            BEPSZ=ATAND(-RZG,RXG)
            BEPSY=ATAND( RYG,RXG)
      C**SAVE EVERY FIFTH  POINT OF BEPSZ AND BEPSY FOR TLAG
            ILAG=ILAG+1
```

```
      IF(ILAG.LT.5)GO TO 4
      ILAG=0
      DO 2 L=2,6
      TIMESV(L-1)=TIMESV(L)
      LOSZ(L-1)=LOSZ(L)
      LOSY(L-1)=LOSY(L)
    2 CONTINUE
    4 CONTINUE
      TIMESV(6)=TIME
      LOSZ(6)=BEPSZ
      LOSY(6)=BEPSY
   32 CONTINUE
C
C        TRACKER LOOP
C
C
C**ZOH (TDELAY..TAU) AND TIME DELAY (TLAG)
      IF(TIME.LT.(TDELAY-.00001).OR.C(1976).LE.0.)GO TO 30
      TDELAY=TIME+TAU
      THTQ=ATAND(TARHT/2.,RANGE)
      THTR=ATAND(TARHW/2.,RANGE)
      BRLKQ=(BEPSZ-BEPSZSV)/(2.*THTQ)
      BRLKR=(BEPSY-BEPSYSV)/(2.*THTR)
      TTLAG=TIME-TLAG   $  N=6  $  F=0.
      BEPSZSV=FINTP1(    TTLAG,TIMESV,LOSZ,N,F,XL)
      BEPSYSV=FINTP1(    TTLAG,TIMESV,LOSY,N,F,XL)
      IF(ABS(BRLKQ) .LT. .5 .AND. ABS(BRLKR) .LT. .5)GO TO 30
C**BREAKLOCK DETERMINATION
      IF(IOCS.NE.-10)GO TO 30
      IOCS=-9
      IBL=IBL+1
      LCONV=2
      WHICH = 1OH IN PITCH
      IF(ABS(BRLKR) .GE. .5)WHICH = 10H IN YAW
      WRITE(6,101)TIME,RANGE,WHICH
  101 FORMAT(1H0,100(1H*)/* BREAK LOCK CONDITION AT TIME = *F5.2,
     + * RANGE = *F10.2,A10,/100(1H*))
   30 CONTINUE
      DELAYQ=GQ1*BEPSZSV
      DELAYR=GR1*BEPSYSV
      DQ1=     DEL1YQ-WTQ2*Q1
      DR1=     DELAYR-WTR2*R1
      DTHCQ=(DQ1+WTQ1*Q1)*GQ2
      DTHCR=(DR1+WTR1*R1)*GR2
C        RATE COMMAND LIMIT
      IF(ABS(DTHCQ).GT.RCL)DTHCQ=SIGN(RCL,DTHCQ)
      IF(ABS(DTHCR).GT.RCL)DTHCR=SIGN(RCL,DTHCR)
C
C        RATE GYRO LOOP
C
      W1Q=WO*UCP-(WP*UST-WR*UST)*JSP
      DDQ5=    (W1Q+QERG)-WRQ2*DQ5-WRQ2*WRQ2*Q5
      DDR5=     (WI+RERG)-WRR2*DR5-WRR2*WRR2*R5
      DDQ6=GG5*Q5-WRQ4*DQ6-WRQ4*WRQ4*Q6
      DDR6=GR5*R5-WRR4*DR6-WRR4*WRR4*R6
      DTHRGQ=KQ12*Q6*GQ6
      DTHRGR=KR12*R6*GR5
```

```
      C
      C
      C** BLIND RANGE DETERMINATION
            THTOAQ=THTQ+ABS(BEPSZ)
            THTOAR=THTR+ABS(BEPSY)
            BLNDQ=THTOAQ*2./FOV
            BLNDR=THTOAR*2./FOV
            TESTFOV=FFOV*FOV/2.
            IF(THTOAQ.LT.TESTFOV.AND.THTOAR.LT.TESTFOV) GO TO 20
            IF(IOCS.LE.1)WRITE(5,100)TIME,RANGE
      100   FORMAT(1H0,100(1H*)/* OCS BLIND RANGE SIGNAL HOLD AT TIME = *F5.2,
           + *  RANGE = *F10.2/100(1H*))
            IOCS=1C
            GO TO 21
      20    CONTINUE
            WLAMQ=Q6*GQ6*GEOCS
            WLAMR=R6*GR6*GEOCS
            IF(ABS(C(630)).LT.ABS(BRLKQ))C(630)=BRLKQ
            IF(ABS(C(631)).LT.ABS(BRLKR))C(631)=BRLKR
      21    CONTINUE
      C
      C        GAIN COMPENSATION
      C
            DTHTEQ=DTHCQ-DTHRGQ
            DTHTER=DTHCR-DTHRGR
            DQ2=     DTHTEQ
            DR2=     DTHTER
            DQ3=DQ2+WGQ1*Q2-WGQ4*Q3
            DR3=DR2+WGR1*R2-WGR4*R3
            DDQ4=DQ3+WGQ3*Q3-WGQ5*DQ4-WGQ6*WGQ6*Q4
            DDR4=DR3+WGR3*R3-WGR5*DR4-WGR6*WGR6*R4
      C
      C        SEEKER TORQUE MOTOR
      C
            TQ=(WGQ5*Q4+DQ4)*GQ3
            TR=(WGR5*R4+DR4)*GR3
            IF(ABS(TQ).GT.TCLQ)TQ=SIGN(TCLQ,TQ)
            IF(ABS(TR).GT.TCLR)TR=SIGN(TCLR,TR)
            TMQ=GQ4*TQ
            TMR=GR4*TR
      C
      C        SEEKER GIMBAL ANGLE RATES
      C
      C**COULOMB FRICTION MODEL
            TCOMQ=KQ8*BTHTG/CRAD
            IF(ABS(BTHTGD).LE.4.E-4)GO TO 70
            TFQ=            SIGN(FRO,BTHTGD)
            TAQ=TMQ-TFQ-TCOMQ-TJJ
            DWQ=TAQ*CRAD/JQ
            GO TO 73
      70    CONTINUE
            TFQ=TMQ-TCOMQ-TUC
            IF(ABS(TFQ).GT.FRO)TFQ=SIGN(FRO,TMQ)
            WCOQ=(TFQ+SIGN(FRO,WQD))*CRAD/JQ
            DWBAQ=WQD
            IF(ABS(WQD).GT.ABS(WCOQ))DWBAQ=WCOQ
            TAQ=TMQ-TFQ-TCOMQ-TJJ
```

```
      DWAQ=TAQ/JO*CRAD                                           S2
      DWO=DWBAQ+DWAQ                                             S2
   73 CONTINUE                                                   S2
      TCOMR=KRB*BPSIG/CRAD                                       S2
      IF(ABS(BPSIGD).LE.4.E-4)GO TO 80                           S2
      TFR=SIGN(FRI,BPSIGD)                                       S2
      TAR=TMR-TFR-TCOMR-TJI                                      S2
      DWI=TAR*CRAD/JI                                            S2
      GO TO 63                                                   S2
   80 CONTINUE                                                   S2
      WRES=UCT*WRD+JST*WP)                                       S2
      TFR=TMR-TCOMR-TJI                                          S2
      IF(ABS(TFR).GT.FRI)TFR=SIGN(FRI,TMR)                       S2
      WCOR=(TFR+SIGN(FRI,WRES))*CRAD/JI                          S2
      DWBAR=WRES                                                 S2
      IF(ABS(WRES).GT.ABS(WCOR))DWBAR=WCOR                       S2
      TAR=TMR-TFR-TCOMR-TUI                                      S2
      DWAR=TAR/JI*CRAD                                           S2
      DWI=DWBAR+DWAR                                             S2
   83 CONTINUE                                                   S2
      BTHTGL=WO-WI                                               S2
      BPSIGD=WI-(WR*JCI+WP*UST)                                  S2
    3 CONTINUE                                                   S2
      RETURN                                                     S2
      END                                                        S2
```

```
        SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE      REFERENCES
      1   S2              1            309

 VARIABLES      SN   TYPE            RELOCATION
    703  ANG          REAL                          REFS       150     161  DEFINED     159
   3213  ANGX         REAL                 / /      REFS        73     156     157      158     162
    700  ANGXG        REAL                          REFS       153  DEFINED    156
   3214  ANGY         REAL                 / /      REFS        74     156     157      158
    701  ANGYG        REAL                          REFS       159     153  DEFINED     157
   3215  ANGZ         REAL                 / /      REFS        75     156     157      158     162
    702  ANGZG        REAL                          REFS       159  DEFINED    158
    663  BEPSY        REAL                 / /      REFS       105     182     194      233  DEFINED     169
   1015  BEPSYSV      REAL                 / /      REFS       138     194     211  DEFINED     197
    662  BEPSZ        REAL                 / /      REFS       134     181     193      232  DEFINED     168
   1020  BEPSZSV      REAL                 / /      REFS       109     193     210  DEFINED     196
    720  BLNDQ     *  REAL                       DEFINED       234
    721  BLNOR     *  REAL                       DEFINED       235
    656  BPSIG        REAL                 / /      REFS        37     136     137      289
    653  BPSIGD       REAL                 / /      REFS        37     290     291  DEFINED     307
   1136  BRLKQ        REAL                 / /      REFS       113     198   2*246  DEFINED     193
    706  BRLKR        REAL                          REFS       198     205   2*247  DEFINED     194
    652  BTHTG        REAL                 / /      REFS        56     134     135      273
    647  BTHTGD       REAL                 / /      REFS        56     274     275  DEFINED     306
      0  C            REAL        ARRAY    / /      REFS        16    2*22    2*23     2*24    2*25    2*26    2*27
                                                  2*28      2*29    2*30    2*31     2*32    2*33    2*34    2*35
                                                  2*36      2*37    2*38    2*39     2*40    2*41    2*42    2*43
                                                  2*44      2*45    2*46    2*47     2*48    2*49    2*50    2*51
                                                  2*52      2*53    2*54    2*55       56    2*57    2*58      59
                                                  3*60        61      64      65       66      67      68      69
                                                    70        71      72      73       74      75      76      77
                                                    78        79      80      81     2*86    2*87    2*88    2*89
                                                  2*90      2*91    2*92    2*93     2*94    3*95    3*96    2*97
                                                  3*98      3*99   3*100   3*101      104     105     106     107
                                                   108       109   2*110   2*111    2*112     113   2*117   2*118
                                                 2*119     2*120   2*121   2*122    2*123     128     130     167
                                                   189       246     247  DEFINED     129     130     246     247
   3326  CRAD         REAL                 / /      REFS        70     273     277      282     286     289     293
                                                   299       303
   1005  DDQ4         REAL                 / /      REFS        95  DEFINED    258
   1016  DDQ5         REAL                 / /      REFS        98  DEFINED    223
   1027  DDQ6         REAL                 / /      REFS       100  DEFINED    225
   1006  DDR4         REAL                 / /      REFS        96  DEFINED    259
   1017  DDR5         REAL                 / /      REFS        99  DEFINED    224
   1030  DDR6         REAL                 / /      REFS       101  DEFINED    226
    713  DELAYQ       REAL                          REFS       212  DEFINED    210
    714  DELAYR       REAL                          REFS       213  DEFINED    211
    763  DQ1          REAL                 / /      REFS        88     214  DEFINED     212
    771  DQ2          REAL                 / /      REFS        90     256  DEFINED     254
    777  DQ3          REAL                 / /      REFS        92     258  DEFINED     256
   1010  DQ4          REAL                 / /      REFS        95     258     263
   1021  DQ5          REAL                 / /      REFS        98     223
   1032  DQ6          REAL                 / /      REFS       100     225
    764  DR1          REAL                 / /      REFS        89     215  DEFINED     213
    772  DR2          REAL                 / /      REFS        91     257  DEFINED     255
   1000  DR3          REAL                 / /      REFS        93     259  DEFINED     257
```

```
VARIABLES    SN  TYPE         RELOCATION
  1011  DR4      REAL            / /       REFS      36      259      264
  1022  DR5      REAL            / /       REFS      39      224
  1033  DR6      REAL            / /       REFS     101      226
   754  DTHCQ    REAL            / /       REFS     110    2*217      252   DEFINED    214     217
   755  DTHCR    REAL            / /       REFS     110    2*218      253   DEFINED    215     218
   756  DTHRGQ   REAL            / /       REFS     111      252   DEFINED       227
   757  DTHRGR   REAL            / /       REFS     111      253   DEFINED       228
   723  DTHTEQ   REAL                      REFS     254  DEFINED      252
   724  DTHTER   REAL                      REFS     255  DEFINED      253
   736  DWAQ     REAL                      REFS     287  DEFINED      286
   745  DWAR     REAL                      REFS     304  DEFINED      303
   735  DWBAQ    REAL                      REFS     287  DEFINED      283       284
   744  DWBAR    REAL                      REFS     304  DEFINED      300       301
  1007  DWI      REAL            / /       REFS      37  DEFINED      293       304
  1001  DWO      REAL            / /       REFS      34  DEFINED      277       287
   711  F        REAL                      REFS     136      197   DEFINED       195
  1133  FFOV     REAL            / /       REFS      59      236
   604  FOV      REAL                      REFS     234      235      236   DEFINED    124
  1066  FRI      REAL            / /       REFS      44      231    2*298       299
  1067  FRO      REAL            / /       REFS      45      275    2*281       282
   760  GEOCS    REAL            / /       REFS      56      244      245
   737  GQ1      REAL            / /       REFS      50      210
   741  GQ2      REAL            / /       REFS      50      214
   743  GQ3      REAL            / /       REFS      52      263
   745  GQ4      REAL            / /       REFS      52      257
   750  GQ5      REAL            / /       REFS      54      225
   752  GQ6      REAL            / /       REFS      54      227      244
   740  GR1      REAL            / /       REFS      51      211
   742  GR2      REAL            / /       REFS      51      215
   744  GR3      REAL            / /       REFS      53      264
   746  GR4      REAL            / /       REFS      53      268
   751  GR5      REAL            / /       REFS      55      226
   753  GR6      REAL            / /       REFS      55      228      245
  1160  IBL      INTEGER         / /       REFS     112      202   DEFINED       202
   704  ILAG     INTEGER                   REFS     171      172   DEFINED       171     173
  1134  IOCS     INTEGER         / /       REFS      57      200      238   DEFINED    281     241
  7661  ISNOX    INTEGER         / /       REFS     117
  6067  I3512    INTEGER         / /       REFS     117      152
  1064  JI       REAL            / /       REFS      20       42      293       299     303
  1065  JO       REAL            / /       REFS      20       43      277       282     286
  1145  KBI      REAL            / /       REFS      19      119      161
  1144  KBO      REAL            / /       REFS      19      119      160
  1151  KOAI     REAL            / /       REFS      19      121      161
  1150  KOAO     REAL            / /       REFS      19      121      160
  1147  KPI      REAL            / /       REFS      19      120      161
  1146  KPO      REAL            / /       REFS      19      120      160
  1040  KQ1      REAL            / /       REFS      17       22
  1056  KQ10     REAL            / /       REFS      17       36
  1060  KQ11     REAL            / /       REFS      17       38
  1062  KQ12     REAL            / /       REFS      17       40      227
  1042  KQ2      REAL            / /       REFS      17       24
  1044  KQ3      REAL            / /       REFS      17       26
   654  KQ4   *  REAL      *UNDEF          REFS      17
  1046  KQ5      REAL            / /       REFS      17       28
  1050  KQ6      REAL            / /       REFS      17       30
  1052  KQ7      REAL            / /       REFS      17       32
  1054  KQ8      REAL            / /       REFS      17       34      273
```

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VARIABLES    SN  TYPE           RELOCATION
  655  KQ9     *  REAL      *UNDEF           REFS      17
 1041  KR1        REAL                / /    REFS      18      23
 1057  KR10       REAL                / /    REFS      18      37
 1061  KR11       REAL                / /    REFS      18      39
 1063  KR12       REAL                / /    REFS      18      41     228
 1043  KR2        REAL                / /    REFS      18      25
 1045  KR3        REAL                / /    REFS      18      27
  656  KR4     *  REAL      *UNDEF           REFS      18
 1047  KR5        REAL                / /    REFS      18      29
 1051  KR6        REAL                / /    REFS      18      31
 1053  KR7        REAL                / /    REFS      18      33
 1055  KR8        REAL                / /    REFS      18      35     289
  657  KR9     *  REAL      *UNDEF           REFS      18
 1143  KUI        REAL                / /    REFS      19     118     163
 1142  KUO        REAL                / /    REFS      19     118     162
  705  L          INTEGER                    REFS   2*175   2*176   2*177   DEFINED   174
 3743  LCONV      INTEGER             / /    REFS     112  DEFINED    203
 1225  LOSY       REAL       ARRAY    / /    REFS      81      82      83     177     197
                                          DEFINED     177     182
 1217  LOSZ       REAL       ARRAY    / /    REFS      80      82      83     176     196
                                          DEFINED     176     181
  710  N          INTEGER                    REFS     136     137  DEFINED    195
 1072  QERG       REAL                / /    REFS      48     223  DEFINED    160
  766  Q1         REAL                / /    REFS      88     212     214
  774  Q2         REAL                / /    REFS      90     256
 1002  Q3         REAL                / /    REFS      92     256     258
 1013  Q4         REAL                / /    REFS      95     258     253
 1024  Q5         REAL                / /    REFS      98     223     225
 1035  Q6         REAL                / /    REFS     100     225     227     244
  562  RANGE      REAL                / /    REFS      72     191     192     206     238
 1132  RBLOCK     REAL                / /    REFS      57
 1124  RCL        REAL                / /    REFS      46   2*217   2*218
 1073  RERG       REAL                / /    REFS      49     224  DEFINED    161
  563  RXBA       REAL                / /    REFS      54     149     150     151
  675  RXG        REAL                       REFS     158     169  DEFINED    149
  564  RYBA       REAL                / /    REFS      65     149     150     151
  676  RYG        REAL                       REFS     169  DEFINED    150
  565  RZBA       REAL                / /    REFS      56     149     150     151
  677  RZG        REAL                       REFS     158  DEFINED    151
  767  R1         REAL                / /    REFS      89     213     215
  775  R2         REAL                / /    REFS      91     257
 1003  R3         REAL                / /    REFS      93     257     259
 1014  R4         REAL                / /    REFS      96     259     264
 1025  R5         REAL                / /    REFS      99     224     226
 1036  R6         REAL                / /    REFS     101     226     228     245
  733  TAQ        REAL                       REFS     277     286  DEFINED    276     285
  741  TAR        REAL                       REFS     293     303  DEFINED    292     302
 1130  TARMT      REAL                / /    REFS      58     191
 1131  TARMO      REAL                / /    REFS      58     192
 1127  TAU        REAL                / /    REFS      49   2*130     190
 1125  TCLQ       REAL                / /    REFS      47   2*265
 1126  TCLR       REAL                / /    REFS      48   2*266
  731  TCOMQ      REAL                       REFS     276     280     285   DEFINED   273
  737  TCOMR      REAL                       REFS     232     297     302   DEFINED   289
 1137  TDELAY     REAL                / /    REFS      50     189  DEFINED    190
  722  TESTFOV    REAL                       REFS   2*237  DEFINED    236
  732  TFQ        REAL                       REFS     276     281     282     285  DEFINED   275   288
```

```
VARIABLES    SN  TYPE          RELOCATION
                                                281
   740  TFR       REAL                           REFS      292     298     239     302   DEFINED    291     292
                                                298
   716  THTOAQ    REAL                           REFS      234     237   DEFINED   232
   717  THTOAR    REAL                           REFS      235     237   DEFINED   233
  1140  THTQ      REAL                 / /       REFS       50     193     232   DEFINED   191
  1141  THTR      REAL                 / /       REFS       50     194     233   DEFINED   192
  3717  TIME      REAL                 / /       REFS       71     180     189     190     195     286     238
  1211  TIMESV    REAL       ARRAY     / /       REFS       79      83     175     196     197
                                              DEFINED      175     180
  1135  TLAG      REAL                 / /       REFS       51     195
   727  THQ       REAL                           REFS      276     280     281     285   DEFINED    257
   730  THR       REAL                           REFS      292     297     298     302   DEFINED    268
   725  TQ        REAL                           REFS    2*265     257   DEFINED   263     265
   726  TR        REAL                           REFS    2*266     268   DEFINED   264     266
   707  TTLAG     REAL                           REFS      136     197   DEFINED   195
  1070  TUI       REAL                 / /       REFS       46     292     297     302   DEFINED    163
  1071  TUO       REAL                 / /       REFS       47     276     280     285   DEFINED    162
   664  UB11      REAL                           REFS      149     156   DEFINED   138
   665  UB12      REAL                           REFS      149     156   DEFINED   139
   666  UB13      REAL                           REFS      149     156   DEFINED   140
   667  UB21      REAL                           REFS      150     157   DEFINED   141
   670  UB22      REAL                           REFS      150     157   DEFINED   142
   671  UB23      REAL                           REFS      150     157   DEFINED   143
   672  UB31      REAL                           REFS      151     158   DEFINED   144
   673  UB32      REAL                           REFS      151     158   DEFINED   145
   674  UB33      REAL                           REFS      151     158   DEFINED   146
  1152  UCC       REAL                 / /       REFS      122     153
  1154  UCCG      REAL                 / /       REFS      123     159
   662  UCP       REAL                           REFS      138     140     142     222   DEFINED    136
   660  UCT       REAL                           REFS      138     141     146     162     222     296     307
                                              DEFINED      134
  1153  USC       REAL                 / /       REFS      122     153
  1155  USCG      REAL                 / /       REFS      123     159
   663  USP       REAL                           REFS      139     141     143     222   DEFINED    137
   661  UST       REAL                           REFS      140     143     144     162     222     296     307
                                              DEFINED      135
   734  WCOQ      REAL                           REFS    2*284   DEFINED   282
   743  WCOR      REAL                           REFS    2*301   DEFINED   299
  1100  WGQ1      REAL                 / /       REFS       26     256
  1102  WGQ2      REAL                 / /       REFS       28
  1104  WGQ3      REAL                 / /       REFS       30     258
  1106  WGQ4      REAL                 / /       REFS       32     256
  1110  WGQ5      REAL                 / /       REFS       34     263
  1112  WGQ6      REAL                 / /       REFS       36   3*258
  1101  WGR1      REAL                 / /       REFS       27     257
  1103  WGR2      REAL                 / /       REFS       29
  1105  WGR3      REAL                 / /       REFS       31     259
  1107  WGR4      REAL                 / /       REFS       33     257
  1111  WGR5      REAL                 / /       REFS       35     264
  1113  WGR6      REAL                 / /       REFS       37   3*259
   712  WHICH     REAL                           REFS      206   DEFINED   204     205
  1012  WI        REAL                 / /       REFS       97     224     307
   622  WLAMQ     REAL                 / /       REFS      106   DEFINED   244
   626  WLAMR     REAL                 / /       REFS      107   DEFINED   245
  1004  WO        REAL                 / /       REFS       94     222     306
  3312  WP        REAL                 / /       REFS       57     222     307
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SUBROUTINE S2          74/74  OPT=1                              FTN 4.2+75067      05/05/75  16.29.23.       PAGE   11

VARIABLES    SN  TYPE           RELOCATION
   3307  WPD      REAL              / /      REFS      76     160     161     296
   3316  WQ       REAL              / /      REFS      68     306
   3313  WQD      REAL              / /      REFS      77     282     283     284
   3322  WR       REAL              / /      REFS      69     222     307
   3317  WRD      REAL              / /      REFS      78     296
    742  WRES     REAL                       REFS     239     300     301   DEFINED   296
   1114  WRQ1     REAL              / /      REFS      38
   1116  WRQ2     REAL              / /      REFS      40    3*223
   1120  WRQ3     REAL              / /      REFS      42
   1122  WRQ4     REAL              / /      REFS      44    3*225
   1115  WRR1     REAL              / /      REFS      39
   1117  WRR2     REAL              / /      REFS      41    3*224
   1121  WRR3     REAL              / /      REFS      43
   1123  WRR4     REAL              / /      REFS      45    3*226
   1074  WTQ1     REAL              / /      REFS      22     214
   1076  WTQ2     REAL              / /      REFS      24     212
   1075  WTR1     REAL              / /      REFS      23     215
   1077  WTR2     REAL              / /      REFS      25     213
    715  W1Q      REAL                       REFS     223   DEFINED   222
    746  XL       REAL      ARRAY            REFS      53     196     197

FILE NAMES       MODE
       TAPE6     FMT                 WRITES      206      238

EXTERNALS         TYPE   ARGS       REFERENCES
       ATAND      REAL     2          168      169      191      192
       COSD       REAL     1          134      136
       FINTP1     REAL     6          195      197
       SIND       REAL     1          135      137

INLINE FUNCTIONS  TYPE   ARGS      DEF LINE  REFERENCES
       ABS        REAL     1  INTRIN         2*198    205     217     218     232     233    2*246   2*247
                                              265     256     274     281    2*284    290     298    2*301
       AINT       REAL     1  INTRIN          130
       SIGN       REAL     2  INTRIN          217     218     265     266     275     281     282     291
                                              298     299

STATEMENT LABELS               DEF LINE   REFERENCES
     10  1                        131        128
      0  2                        178        174
      0  3           INACTIVE     308
    135  4                        179        172
    114  5                        164        152
    325  20                       243        237
    342  21                       248        242
    216  30                       209        183      198      200
    141  32                       193        167
    435  70                       279        274
    467  73                       288        276
    504  80                       295        290
    541  83                       305        294
    632  100     FMT              239        233
    613  101     FMT              207        205

LOOPS  LABEL   INDEX    FROM-TO    LENGTH    PROPERTIES
  132  2       L        174 178       3B     INSTACK
```

```
COMMON BLOCKS   LENGTH    MEMBERS - BIAS NAME(LENGTH)
 / /             3830          0 C      (3830)

EQUIV CLASSES   LENGTH    MEMBERS - BIAS NAME(LENGTH)
 C       C        3830     370 RANGE   (1)     371 RXBA    (1)     372 RYBA    (1)
                           373 RZBA    (1)     402 WLAMQ   (1)     406 WLAMR   (1)
                           423 BTHTGD  (1)     425 BTHTG   (1)     427 BPSIGD  (1)
                           433 BPSIG   (1)     434 BEPSZ   (1)     435 BEPSY   (1)
                           473 GQ1     (1)     480 GR1     (1)     481 GQ2     (1)
                           482 GR2     (1)     483 GQ3     (1)     484 GR3     (1)
                           485 GQ4     (1)     486 GR4     (1)     488 GQ5     (1)
                           489 GR5     (1)     490 GQ6     (1)     491 GR6     (1)
                           492 DTHDQ   (1)     493 DTHDR   (1)     494 DTHRSQ  (1)
                           495 DTHRGR  (1)     496 GEOCS   (1)     499 DQ1     (1)
                           500 DR1     (1)     502 Q1      (1)     503 R1      (1)
                           505 DQ2     (1)     506 DR2     (1)     508 Q2      (1)
                           509 R2      (1)     511 DQ3     (1)     512 DR3     (1)
                           513 DR3     (1)     514 Q3      (1)     515 R3      (1)
                           516 WO      (1)     517 DDQ4    (1)     518 DDR4    (1)
                           519 DWI     (1)     520 DQ4     (1)     521 DR4     (1)
                           522 WI      (1)     523 Q4      (1)     524 R4      (1)
                           525 BEPSYSV (1)     526 DDQ5    (1)     527 DDR5    (1)
                           528 BEPSZSV (1)     529 DQ5     (1)     530 DR5     (1)
                           532 Q5      (1)     533 R5      (1)     535 DDQ6    (1)
                           536 DDR6    (1)     538 DQ6     (1)     539 DR6     (1)
                           541 Q6      (1)     542 R6      (1)     544 KQ1     (1)
                           545 KR1     (1)     546 KQ2     (1)     547 KR2     (1)
                           548 KQ3     (1)     549 KR3     (1)     550 KQ5     (1)
                           551 KR5     (1)     552 KQ6     (1)     553 KR6     (1)
                           554 KQ7     (1)     555 KR7     (1)     556 KQ8     (1)
                           557 KR8     (1)     558 KQ10    (1)     559 KR10    (1)
                           560 KQ11    (1)     561 KR11    (1)     562 KQ12    (1)
                           563 KR12    (1)     564 JI      (1)     565 JO      (1)
                           566 FRI     (1)     567 FRO     (1)     568 TUI     (1)
                           569 TUO     (1)     570 QERG    (1)     571 RERG    (1)
                           572 WTQ1    (1)     573 WTR1    (1)     574 WTQ2    (1)
                           575 WTR2    (1)     576 WGQ1    (1)     577 WGR1    (1)
                           578 WGQ2    (1)     579 WGR2    (1)     580 WGQ3    (1)
                           581 WGR3    (1)     582 WGQ4    (1)     583 WGR4    (1)
                           584 WGQ5    (1)     585 WGR5    (1)     586 WGQ6    (1)
                           587 WGR5    (1)     588 WRQ1    (1)     589 WRR1    (1)
                           590 WRQ2    (1)     591 WRR2    (1)     592 WRQ3    (1)
                           593 WRR3    (1)     594 WRQ4    (1)     595 WRR4    (1)
                           596 RCL     (1)     597 TCLQ    (1)     598 TCLR    (1)
                           599 TAU     (1)     600 TARHT   (1)     601 TARWD   (1)
                           602 RBLOCK  (1)     603 FFOV    (1)     604 IDCS    (1)
                           605 FLAG    (1)     606 BRLKQ   (1)     607 TDELAY  (1)
                           608 THTQ    (1)     609 THTR    (1)     610 KUO     (1)
                           611 KUI     (1)     612 KBO     (1)     613 KBI     (1)
                           614 KPO     (1)     615 KPI     (1)     616 KOAO    (1)
                           617 KOAI    (1)     618 USC     (1)     619 USC     (1)
                           620 USCG    (1)     621 USCG    (1)     624 IBL     (1)
                           649 TIMESV  (6)     655 LOSZ    (6)     661 LOSY    (6)
                          1675 ANGX    (1)    1676 ANGY    (1)    1677 ANGZ    (1)
                          1735 WPD     (1)    1738 WP      (1)    1739 WQD     (1)
                          1742 WL      (1)    1743 WRD     (1)    1746 WR      (1)
                          1750 GRAD    (1)    1933 TIME    (1)    2019 LCONV   (1)
                          3511 13512   (1)    3633 ISNDX   (1)
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      SUBROUTINE S2          74/74  OPT=1                    FTN 4.2+75067     05/05/75  16.29.23.      PAGE   13

 STATISTICS
   PROGRAM LENGTH              7503     488
   CM BLANK COMMON LENGTH     73663    3830
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```
      SUBROUTINE S3
C
C ** OCS SEEKER MODULE**
C
C**LOW FREQUENCE SEEKER
C
      COMMON C(3830)
      REAL KQ1,KQ2,KQ3,KQ4,KQ5,KQ6,KQ7,KQ8,KQ9,KQ10,KQ11,KQ12
      REAL KR1,KR2,KR3,KR4,KR5,KR6,KR7,KR8,KR9,KR10,KR11,KR12
      REAL KU0,KUI,KB0,KBI,KP0,KPI,KOA0,KOAI
      REAL JI,J0
C**INPUT DATA
      EQUIVALENCE (C( 545),    KQ1),  (C( 573),   HTQ1)
      EQUIVALENCE (C( 546),    KR1),  (C( 574),   HTR1)
      EQUIVALENCE (C( 547),    KQ2),  (C( 575),   HTQ2)
      EQUIVALENCE (C( 548),    KR2),  (C( 576),   HTR2)
      EQUIVALENCE (C( 549),    KQ3),  (C( 577),   HGQ1)
      EQUIVALENCE (C( 550),    KR3),  (C( 578),   HGR1)
      EQUIVALENCE (C( 551),    KQ5),  (C( 579),   HGQ2)
      EQUIVALENCE (C( 552),    KR5),  (C( 580),   HGR2)
      EQUIVALENCE (C( 553),    KQ6),  (C( 581),   HGQ3)
      EQUIVALENCE (C( 554),    KR6),  (C( 582),   HGR3)
      EQUIVALENCE (C( 555),    KQ7),  (C( 583),   HGQ4)
      EQUIVALENCE (C( 556),    KR7),  (C( 584),   HGR4)
      EQUIVALENCE (C( 557),    KQ9),  (C( 585),   HGQ5)
      EQUIVALENCE (C( 558),    KR9),  (C( 586),   HGR5)
      EQUIVALENCE (C( 559),   KQ10),  (C( 587),   HGQ6)
      EQUIVALENCE (C( 560),   KR10),  (C( 588),   HGR6)
      EQUIVALENCE (C( 561),   KQ11),  (C( 589),   HRQ1)
      EQUIVALENCE (C( 562),   KR11),  (C( 590),   HRR1)
      EQUIVALENCE (C( 563),   KQ12),  (C( 591),   HRQ2)
      EQUIVALENCE (C( 564),   KR12),  (C( 592),   HRR2)
      EQUIVALENCE (C( 565),     JI),  (C( 593),   HRQ3)
      EQUIVALENCE (C( 566),     J0),  (C( 594),   HRR3)
      EQUIVALENCE (C( 567),    FRI),  (C( 595),   HRQ4)
      EQUIVALENCE (C( 568),    FR0),  (C( 596),   HRR4)
      EQUIVALENCE (C( 569),    TUI),  (C( 597),    RCL)
      EQUIVALENCE (C( 570),    TU0),  (C( 598),   TCLQ)
      EQUIVALENCE (C( 571),   QERS),  (C( 599),   TCLR)
      EQUIVALENCE (C( 572),   RERS),  (C( 600),    TAU)
      EQUIVALENCE (C( 480),    GQ1),  (C( 482),    GQ2)
      EQUIVALENCE (C( 481),    GR1),  (C( 483),    GR2)
      EQUIVALENCE (C( 484),    GQ3),  (C( 486),    GQ4)
      EQUIVALENCE (C( 485),    GR3),  (C( 487),    GR4)
      EQUIVALENCE (C( 489),    GQ5),  (C( 491),    GQ6)
      EQUIVALENCE (C( 490),    GR5),  (C( 492),    GR6)
      EQUIVALENCE (C( 501),  TARHI),  (C( 502),  TARHO)
      EQUIVALENCE (C( 508), TDELAY),  (C( 509),   THTQ),  (C( 510), THTR)
      EQUIVALENCE (C( 504),    FFO)
      EQUIVALENCE (C( 603), RBLOCK),  (C( 605),   IOCS)
      EQUIVALENCE (C( 497),  GEOCS)
      EQUIVALENCE (C( 596),   TLAG)
C
C**INPUTS FROM OTHER MODULES**
      EQUIVALENCE (C( 372),   RXBA)
      EQUIVALENCE (C( 373),   RYBA)
      EQUIVALENCE (C( 374),
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      EQUIVALENCE (C(1739),     WP)
      EQUIVALENCE (C(1743),     WQ)
      EQUIVALENCE (C(1747),     WR)
      EQUIVALENCE (C(1751),   CRAD)
      EQUIVALENCE (C(2000),   TIME)
      EQUIVALENCE (C( 371),  RANGE)
      EQUIVALENCE (C(1676),   ANGX)
      EQUIVALENCE (C(1677),   ANGY)
      EQUIVALENCE (C(1678),   ANGZ)
      EQUIVALENCE (C(1736),    WPD)
      EQUIVALENCE (C(1740),    WQD)
      EQUIVALENCE (C(1744),    WRD)
      EQUIVALENCE (C( 650), TIMESV)
      EQUIVALENCE (C( 656),   LOSZ)
      EQUIVALENCE (C( 662),   LOSY)
      REAL LOSZ,LOSY
      DIMENSION TIMESV(6),LOSZ(6),LOSY(6),XL(2)
C
C**STATE VARIABLES
      EQUIVALENCE (C( 424), BTHTGD),  (C( 427),  BTHTG)
      EQUIVALENCE (C( 428), BPSIGD),  (C( 431),  BPSIG)
      EQUIVALENCE (C( 500),    DQ1),  (C( 503),     Q1)
      EQUIVALENCE (C( 501),    DR1),  (C( 504),     R1)
      EQUIVALENCE (C( 506),    DQ2),  (C( 509),     Q2)
      EQUIVALENCE (C( 507),    DR2),  (C( 510),     R2)
      EQUIVALENCE (C( 512),    DQ3),  (C( 515),     Q3)
      EQUIVALENCE (C( 513),    DR3),  (C( 516),     R3)
      EQUIVALENCE (C( 514),    DWD),  (C( 517),     WD)
      EQUIVALENCE (C( 520),    DWI),  (C( 523),     WI)
C
C**OTHER OUTPUTS
      EQUIVALENCE (C( 435),  BEPSZ)
      EQUIVALENCE (C( 436),  BEPSY)
      EQUIVALENCE (C( 433),  WLAMQ)
      EQUIVALENCE (C( 407),  WLAMR)
      EQUIVALENCE (C( 525),BEPSYSV)
      EQUIVALENCE (C( 529),BEPSZSV)
      EQUIVALENCE (C( 493),  DTHCQ),  (C( 494),  DTHCR)
      EQUIVALENCE (C( 495), DTHRGQ),  (C( 496), DTHRGR)
      EQUIVALENCE (C(2020),  LCONV),  (C( 625),   IBL)
      EQUIVALENCE (C( 507),  BRLKQ)
C
C**MONTE CARLO PARAMETERS
C
      EQUIVALENCE (C(3534),  ISNDC),  (C(3512),  I3512)
      EQUIVALENCE (C( 511),    KUD),  (C( 512),    KJI)
      EQUIVALENCE (C( 513),    KBD),  (C( 514),    KBI)
      EQUIVALENCE (C( 515),    KPD),  (C( 516),    KPI)
      EQUIVALENCE (C( 517),   KOAD),  (C( 518),   KOAI)
      EQUIVALENCE (C( 519),    UCD),  (C( 520),    USC)
      EQUIVALENCE (C( 521),   UCCD),  (C( 622),   USCD)
      DATA FCV/4./
C
C INTEGRATION SWITCHING TEST
C          SYNCHRONIZE INTEGRATION WITH SAMPLE SIZE
      IF(C(13).LE.0.)GO TO 1
      C(13)=-1.
```

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      C(2664)= 9U/AINT(TAU/C(2764))
    1 CONTINUE
C
C**DIRECTION COSINES FOR BODY TO PLATFORM TRANSFORMATION
      UCT=COSD(BTHTG)
      UST=SIND(BTHTG)
      UCP=COSD(BPSIG)
      USP=SIND(BPSIG)
      UB11=UCT*UCP
      UB12=USP
      UB13=-UCP*UST
      UB21=-UCT*USP
      UB22=UCP
      UB23=UST*USP
      UB31=UST
      UB32=0.
      UB33=UCT
C
C** RANSFORM LOS FROM BODY TO GIMBAL AXES
      RXG=UB11*RXBA+UB12*RYBA+UB13*RZBA
      RYG=UB21*RXBA+UB22*RYBA+UB23*RZBA
      RZG=UB31*RXBA+UB32*RYBA+UB33*RZBA
      IF(I3512.LE.0)GO TO 5
C**GYRO ERRORS
C
C**TRANSFORM NORMALIZED ACCELERATIONS FROM BODY TO GIMBAL AXES
      ANGXG=UB11*ANGX+UB12*ANGY+UB13*ANGZ
      ANGYG=UB21*ANGX+UB22*ANGY+UB23*ANGZ
      ANGZG=UB31*ANGX+UB32*ANGY+UB33*ANGZ
      ANG=ANGZG*UCCG-ANGYG*USCG
      QERG=KEO+KPO*ANG+KOAO*WPO
      RERG=KBI+KPI*ANG+KOAI*WPO
      TUO=KUO*(ANGX*UCT-ANGZ*UST)
      TUI=KUI*(ANGYG*UCG-ANGXG*USG)
    5 CONTINUE
C
C**LOS ERRORS IN PLATFORM COORDINATES
      IF(C(1976).LE.0.)GO TO 32
      BEPSZ=ATAND(-RZG,RXG)
      BEPSY=ATAND( RYG,RXG)
C****SAVE THE PREVIOUS FIVE POINTS IN TIME OF BEPSZ AND BEPSY FOR TLAG.
      DO 2 L=2,6
      TIMESV(L-1)=TIMESV(L)
      LOSZ(L-1)=LOSZ(L)
      LOSY(L-1)=LOSY(L)
    2 CONTINUE
      TIMESV(6)=TIME
      LOSZ(6)=BEPSZ
      LOSY(6)=BEPSY
   32 CONTINUE
C
C          TRACKER-LOOP
C
C
C**ZOH (TDELAY..TAU) AND TIME DELAY (TLAG)
      IF(TIME.LT.(TDELAY-.00001).OR.C(1976).LE.0.)GO TO 30
      TDELAY=TIME+TAU
```

```
      THTQ=ATAND(TARHT/2.,RANGE)
      THTR=ATAND(TARWD/2.,RANGE)
      BRLKQ=(BEPSZ-BEPSZSV)/(2.*THTQ)
      BRLKR=(BEPSY-BEPSYSV)/(2.*THTR)
      TTLAG=TIME-TLAG   $  N=6  $  F=1.
      BEPSZSV=FINTP1(    TTLAG,TIMESV,LOSZ,N,F,XL)
      BEPSYSV=FINTP1(    TTLAG,TIMESV,LOSY,N,F,XL)
      IF(ABS(BRLKQ) .LT. .5 .AND. ABS(BRLKR) .LT. .5)GO TO 30
C**BREAKLOCK DETERMINATION
      IF(IOCS.NE.-10)GO TO 30
      IBL=IBL+1
      LCONV=2
      IOCS=-9
      WHICH = 10H IN PITCH
      IF(ABS(BRLKR) .GE. .5)WHICH = 10H IN YAW
      WRITE(6,101)TIME,RANGE,WHICH
  101 FORMAT(1H0,100(1H*)/' BREAK LOCK CONDITION AT TIME =  'F5.2,
     + ' RANGE = 'F10.2,A10,/100(1H*))
   30 CONTINUE
      DELAYQ=GQ1*BEPSZSV
      DELAYR=GR1*BEPSYSV
      DQ1=    DELAYQ-WTQ2*Q1
      DR1=    DELAYR-WTR2*R1
      DTHCQ=(DQ1+WTQ1*Q1)*GQ2
      DTHCR=(DR1+WTR1*R1)*GR2
C       RATE COMMAND LIMIT
      IF(ABS(DTHCQ).GT.RCL)DTHCQ=SIGN(RCL,DTHCQ)
      IF(ABS(DTHCR).GT.RCL)DTHCR=SIGN(RCL,DTHCR)
C
C       RATE GYRO LOOP
C
      W1Q=WQ*USP-(WP*UST-WR*UST)*USP
      RGQ=GG5*(W1Q+QERG)
      RGR=GR5*(WI +RERG)
      DTHRGQ=KQ12*RGQ
      DTHRGR=KR12*RGR
C
C**BLIND RANGE DETERMINATION
      THTOAQ=THTQ+ABS(BEPSZ)
      THTOAR=THTR+ABS(BEPSY)
      BLNDQ=THTOAQ*2./FOV
      BLNDR=THTOAR*2./FOV
      TESTFOV=FFOV*FOV/2.
      IF(THTOAQ.LT.TESTFOV.AND.THTOAR.LT.TESTFOV) GO TO 20
      IF(IOCS.LE.0)WRITE(6,100)TIME,RANGE
  100 FORMAT(1H0,100(1H*)/' OCS BLIND RANGE SIGNAL HOLD AT TIME = 'F5.2,
     + ' RANGE = 'F10.2/100(1H*))
      IOCS=10
      GO TO 21
   20 CONTINUE
C
C**OUTPUT TO AUTOPILOT
      WLAMQ=GEOCS*RGQ
      WLAMR=GEOCS*RGR
      IF(ABS(C(630)).LT.ABS(BRLKQ))C(630)=BRLKQ
      IF(ABS(C(631)).LT.ABS(BRLKR))C(631)=BRLKR
   21 CONTINUE
```

.0167
.01669995
.01669

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C
C     GAIN COMPENSATION
C
      DTHTEQ=DTHCQ-DTHRSQ
      DTHTER=DTHCR-DTHRSR
      DQ2=    DTHTEQ
      DR2=    DTHTER
      DQ3=CQ2+WGQ1*Q2-WGQ4*Q3
      DR3=DR2+WGR1*R2-WGR4*R3
C
C     SEEKER TORQUE MOTOR
C
      TQ=GQ3*(DQ3+WGQ3*Q3)
      TR=GR3*(DR3+WGR3*R3)
      IF(ABS(TQ).GT.TCLQ) TQ=SIGN(TCLQ,TQ)
      IF(ABS(TR).GT.TCLR) TR=SIGN(TCLR,TR)
      TMQ=GQ4*TQ
      TMR=GR4*TR
C
C     SEEKER GIMBAL ANGLE RATES
C
C**COULOMB FRICTION MODEL
      TCOMQ=KQ8*BTHTG/CRAD
      IF(ABS(BTHTGD).LE.4.E-4)GO TO 70
      TFQ=                SIGN(FRQ,BTHTGD)
      TAQ=TMQ-TFQ-TCOMQ-TUQ
      DWQ=TAQ*CRAD/JQ
      GO TO 73
70    CONTINUE
      TFQ=TMQ-TCOMQ-TUQ
      IF(ABS(TFQ).GT.FRQ) TFQ=SIGN(FRQ,TMQ)
      WCOQ=(TFQ+SIGN(FRQ,WQD))*CRAD/JQ
      DWBAQ=WQD
      IF(ABS(WQD).GT.ABS(WCOQ))DWBAQ=WCOQ
      TAQ=TMQ-TFQ-TCOMQ-TUQ
      DWAQ=TAQ/JQ*CRAU
      DWQ=DWBAQ+DWAQ
73    CONTINUE
      TCOMR=KR8*BPSIG/CRAD
      IF(ABS(BPSIGD).LE.4.E-4)GO TO 83
      TFR=SIGN(FRI,BPSIGD)
      TAR=TMR-TFR-TCOMR-TUI
      DWI=TAR*CRAD/JI
      GO TO 83
80    CONTINUE
      WRES=UCT*WRO+UST*WPO
      TFR=TMR-TCOMR-TUI
      IF(ABS(TFR).GT.FRI) TFR=SIGN(FRI,TMR)
      WCOR=(TFR+SIGN(FRI,WRES))*CRAD/JI
      DWBAR=WRES
      IF(ABS(WRES).GT.ABS(WCOR))DWBAR=WCOR
      TAR=TMR-TFR-TCOMR-TUI
      DWAR=TAR/JI*CRAU
      DWI=DWBAR+DWAR
83    CONTINUE
      BTHTGD=WQ-WJ
      BPSIGD=WI-(WR*UCT+WP*UST)
```

```
      3   CONTINUE                                S3       287
          RETURN                                  S3       288
          END                                     S3       289
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      SUBROUTINE S3        74/74   OPT=1                        FTN 4.2+75057      05/05/75  16.29.41.      PAGE    7

          SYMBOLIC REFERENCE MAP (R=3)

 ENTRY POINTS      DEF LINE     REFERENCES
     1  S3             1           287

 VARIABLES    SN  TYPE          RELOCATION
   637  ANG        REAL                         REFS      145     146   DEFINED   144
  3213  ANGX       REAL              / /        REFS       54     141     142     143     147
   634  ANGXG      REAL                         REFS      148  DEFINED    141
  3214  ANGY       REAL              / /        REFS       65     141     142     143
   635  ANGYG      REAL                         REFS      144     148   DEFINED   142
  3215  ANGZ       REAL              / /        REFS       56     141     142     143     147
   636  ANGZG      REAL                         REFS      144  DEFINED    143
   663  BEPSY      REAL              / /        REFS       90     153     175     211   DEFINED   154
  1015  BEPSYSV    REAL              / /        REFS       93     175     192   DEFINED   178
   662  BEPSZ      REAL              / /        REFS       89     152     174     210   DEFINED   153
  1020  BEPSZSV    REAL              / /        REFS       94     174     131   DEFINED   177
   655  BLNDQ   *  REAL                       DEFINED     212
   656  BLNDR   *  REAL                       DEFINED     213
   656  BPSIG      REAL              / /        REFS       78     123     122     267
   653  BPSIGD     REAL              / /        REFS       78     268     259   DEFINED   285
  1136  BRLKQ      REAL              / /        REFS       98     179   2*226   DEFINED   174
   641  BRLKR      REAL                         REFS      179     185   2*227   DEFINED   175
   652  BTHTG      REAL              / /        REFS       77     119     120     251
   647  BTHTGD     REAL              / /        REFS       77     252     253   DEFINED   254
     0  C          REAL     ARRAY    / /        REFS        7    2*13    2*14    2*15    2*16    2*17    2*18
                                               2*19    2*20    2*21    2*22    2*23    2*24    2*25    2*26
                                               2*27    2*28    2*29    2*30    2*31    2*32    2*33    2*34
                                               2*35    2*36    2*37    2*38    2*39    2*40    2*41    2*42
                                               2*43    2*44    2*45    2*46    2*47    3*48      49    2*50
                                                 51      52      55      56      57      58      59      60
                                                 61      62      53      64      65      65      57      63
                                                 69      70      71      72    2*77    2*78    2*79    2*80
                                               2*81    2*82    2*83    2*84    2*85    2*86      89      90
                                                 91      92      93      94    2*95    2*96    2*97      98
                                              2*102   2*103   2*104   2*105   2*106   2*107   2*108     113
                                                115     152     170     226     227   DEFINED   114     115
                                                226     227
  3326  CRAD       REAL              / /        REFS       51     251     255     260     264     257     271
                                                277     281
   646  DELAYQ     REAL                         REFS      133  DEFINED    131
   647  DELAYR     REAL                         REFS      134  DEFINED    192
   763  DQ1        REAL              / /        REFS       79     195   DEFINED   193
   771  DQ2        REAL              / /        REFS       81     236   DEFINED   234
   777  DQ3        REAL              / /        REFS       83     241   DEFINED   236
   764  DR1        REAL              / /        REFS       80     196   DEFINED   194
   772  DR2        REAL              / /        REFS       82     237   DEFINED   235
  1000  DR3        REAL              / /        REFS       84     242   DEFINED   237
   754  DTHCQ      REAL              / /        REFS       95   2*198     232   DEFINED   195     198
   755  DTHCR      REAL              / /        REFS       95   2*199     233   DEFINED   196     199
   756  DTHRGQ     REAL              / /        REFS       96     232   DEFINED   206
   757  DTHRGR     REAL              / /        REFS       96     233   DEFINED   207
   660  DTHTEQ     REAL                         REFS      234  DEFINED    232
   661  DTHTER     REAL                         REFS      235  DEFINED    233
   673  DWAQ       REAL                         REFS      265  DEFINED    264
   702  DWAR       REAL                         REFS      282  DEFINED    281
   672  DWBAQ      REAL                         REFS      265  DEFINED    261     262
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VARIABLES    SN  TYPE          RELOCATION
  701  OWBAR     REAL                           REFS   292   DEFINED   278      279
 1007  OWI       REAL            / /            REFS    56   DEFINED   271      282
 1001  OWO       REAL            / /            REFS    55   DEFINED   255      265
  644  F         REAL                           REFS   177      178   DEFINED    176
 1133  FFOV      REAL            / /            REFS    49      214
  540  FOV       REAL                           REFS   212      213     214   DEFINED   189
 1066  FRI       REAL            / /            REFS    35      269   2*276      277
 1067  FRO       REAL            / /            REFS    36      253   2*259      260
  760  GEOCS     REAL            / /            REFS    51      224     225
  737  GQ1       REAL            / /            REFS    41      191
  741  GQ2       REAL            / /            REFS    41      195
  743  GQ3       REAL            / /            REFS    43      241
  745  GQ4       REAL            / /            REFS    43      245
  750  GQ5       REAL            / /            REFS    45      284
  752  GQ6       REAL            / /            REFS    45
  740  GR1       REAL            / /            REFS    42      192
  742  GR2       REAL            / /            REFS    42      196
  744  GR3       REAL            / /            REFS    44      242
  746  GR4       REAL            / /            REFS    44      246
  751  GR5       REAL            / /            REFS    46      205
  753  GR6       REAL            / /            REFS    46
 1160  IOL       INTEGER         / /            REFS    37      182   DEFINED    182
 1134  IOCS      INTEGER         / /            REFS    50      181     216   DEFINED   184      219
 7061  ISNDX     INTEGER         / /            REFS   102
 6667  I3512     INTEGER         / /            REFS   102      137
 1064  JI        REAL            / /            REFS    11       33     271      277     281
 1065  JO        REAL            / /            REFS    11       34     255      260     264
 1145  KBI       REAL            / /            REFS    10      104     146
 1144  KBO       REAL            / /            REFS    10      104     145
 1151  KOAI      REAL            / /            REFS    10      106     146
 1150  KOAO      REAL            / /            REFS    10      106     145
 1147  KPI       REAL            / /            REFS    10      105     146
 1146  KPO       REAL            / /            REFS    10      105     145
 1040  KQ1       REAL            / /            REFS     8       13
 1056  KQ10      REAL            / /            REFS     8       27
 1060  KQ11      REAL            / /            REFS     8       29
 1062  KQ12      REAL            / /            REFS     8       31     286
 1042  KQ2       REAL            / /            REFS     8       15
 1044  KQ3       REAL            / /            REFS     8       17
  610  KQ4    *  REAL     *UNDEF                REFS     8
 1046  KQ5       REAL            / /            REFS     8       19
 1050  KQ6       REAL            / /            REFS     8       21
 1052  KQ7       REAL            / /            REFS     8       23
 1054  KQ8       REAL            / /            REFS     8       25     251
  611  KQ9    *  REAL     *UNDEF                REFS     8
 1041  KR1       REAL            / /            REFS     9       14
 1057  KR10      REAL            / /            REFS     9       28
 1061  KR11      REAL            / /            REFS     9       30
 1063  KR12      REAL            / /            REFS     9       32     287
 1043  KR2       REAL            / /            REFS     9       16
 1045  KR3       REAL            / /            REFS     9       18
  612  KR4    *  REAL     *UNDEF                REFS     9
 1047  KR5       REAL            / /            REFS     9       20
 1051  KR6       REAL            / /            REFS     9       22
 1053  KR7       REAL            / /            REFS     9       24
 1055  KR8       REAL            / /            REFS     9       25     267
  613  KR9    *  REAL     *UNDEF                REFS     9
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VARIABLES    SN  TYPE           RELOCATION
  1143  KUI       REAL                  / /      REFS      10      103      148
  1142  KUO       REAL                  / /      REFS      10      103      147
   640  L         INTEGER                        REFS   2*157    2*158    2*159   DEFINED    136
  3743  LCONV     INTEGER               / /      REFS      97  DEFINED      183
  1225  LOSY      REAL        ARRAY     / /      REFS      72       73       74      159      178
                                              DEFINED     159      163
  1217  LOSZ      REAL        ARRAY     / /      REFS      71       73       74      158      177
                                              DEFINED     158      152
   643  N         INTEGER                        REFS     177      178  DEFINED      176
  1072  QERG      REAL                  / /      REFS      39      204  DEFINED      145
   766  Q1        REAL                  / /      REFS      79      193      195
   774  Q2        REAL                  / /      REFS      81      236
  1002  Q3        REAL                  / /      REFS      83      236      241
   562  RANGE     REAL                  / /      REFS      63      172      173      187      215
  1132  RBLOCK    REAL                  / /      REFS      50
  1124  RCL       REAL                  / /      REFS      37    2*198    2*199
  1073  RERG      REAL                  / /      REFS      40      205  DEFINED      146
   651  RGQ       REAL                           REFS     206      224  DEFINED      204
   652  RGR       REAL                           REFS     207      225  DEFINED      205
   563  RXBA      REAL                  / /      REFS      55      134      135      136
   631  RXG       REAL                           REFS     153      154  DEFINED      134
   564  RYBA      REAL                  / /      REFS      56      134      135      136
   632  RYG       REAL                           REFS     154  DEFINED      135
   565  RZBA      REAL                  / /      REFS      57      134      135      136
   633  RZG       REAL                           REFS     153  DEFINED      136
   767  R1        REAL                  / /      REFS      80      194      196
   775  R2        REAL                  / /      REFS      82      237
  1003  R3        REAL                  / /      REFS      84      237      242
   670  TAQ       REAL                           REFS     255      264  DEFINED      254      263
   676  TAR       REAL                           REFS     271      281  DEFINED      270      280
  1130  TARHT     REAL                  / /      REFS      47      172
  1131  TARHD     REAL                  / /      REFS      47      173
  1127  TAU       REAL                  / /      REFS      40    2*115      171
  1125  TCLQ      REAL                  / /      REFS      38    2*243
  1126  TCLR      REAL                  / /      REFS      39    2*244
   666  TCOMQ     REAL                           REFS     254      258      263   DEFINED    253
   674  TCOMR     REAL                           REFS     270      275      280   DEFINED    267
  1137  TDELAY    REAL                  / /      REFS      48      170  DEFINED      171
   657  TESTFOV   REAL                           REFS   2*215  DEFINED      214
   667  TFQ       REAL                           REFS     254      259      260      263   DEFINED    253    258
                                                  259
   675  TFR       REAL                           REFS     270      276      277      280   DEFINED    259    275
                                                  276
   653  THTOAQ    REAL                           REFS     212      215  DEFINED      210
   654  THTOAR    REAL                           REFS     213      215  DEFINED      211
  1140  THTQ      REAL                  / /      REFS      48      174      210   DEFINED    172
  1141  THTR      REAL                  / /      REFS      48      175      211   DEFINED    173
  3717  TIME      REAL                  / /      REFS      62      151      170      171      176      187    216
  1211  TIMESV    REAL        ARRAY     / /      REFS      70       74      157      177      178
                                              DEFINED     157      161
  1135  TLAG      REAL                  / /      REFS      52      176
   664  TMQ       REAL                           REFS     254      258      259      263   DEFINED    245
   665  TMR       REAL                           REFS     270      275      276      280   DEFINED    246
   662  TQ        REAL                           REFS   2*243      245  DEFINED      241      243
   663  TR        REAL                           REFS   2*244      246  DEFINED      242      244
   642  TTLAG     REAL                           REFS     177      178  DEFINED      176
  1070  TUI       REAL                  / /      REFS      37      270      275      280   DEFINED    148
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VARIABLES    SN  TYPE         RELOCATION
  1071  TUG       REAL          / /        REFS      38     254     258     263  DEFINED    147
   620  UB11      REAL                     REFS     134     141  DEFINED   123
   621  UB12      REAL                     REFS     134     141  DEFINED   124
   622  UB13      REAL                     REFS     134     141  DEFINED   125
   623  UB21      REAL                     REFS     135     142  DEFINED   126
   624  UB22      REAL                     REFS     135     142  DEFINED   127
   625  UB23      REAL                     REFS     135     142  DEFINED   128
   626  UB31      REAL                     REFS     136     143  DEFINED   129
   627  UB32      REAL                     REFS     136     143  DEFINED   130
   630  UB33      REAL                     REFS     136     143  DEFINED   131
  1152  UCC       REAL          / /        REFS     107     148
  1154  UCCG      REAL          / /        REFS     138     144
   616  UCP       REAL                     REFS     123     125     127     203  DEFINED    121
   614  UCT       REAL                     REFS     123     126     131     147     283    274    285
                                        DEFINED     119
  1153  USC       REAL          / /        REFS     107     148
  1155  USCG      REAL          / /        REFS     138     144
   617  USP       REAL                     REFS     124     126     128     283  DEFINED    122
   615  UST       REAL                     REFS     125     128     129     147     283    274    285
                                        DEFINED     120
   671  WCOQ      REAL                     REFS   2*262  DEFINED    260
   700  WCOR      REAL                     REFS   2*279  DEFINED    277
  1100  WGQ1      REAL          / /        REFS      17     236
  1102  WGQ2      REAL          / /        REFS      19
  1104  WGQ3      REAL          / /        REFS      21     241
  1106  WGQ4      REAL          / /        REFS      23     236
  1110  WGQ5      REAL          / /        REFS      25
  1112  WGQ6      REAL          / /        REFS      27
  1101  WGR1      REAL          / /        REFS      18     237
  1103  WGR2      REAL          / /        REFS      20
  1105  WGR3      REAL          / /        REFS      22     242
  1107  WGR4      REAL          / /        REFS      24     237
  1111  WGR5      REAL          / /        REFS      26
  1113  WGR6      REAL          / /        REFS      28
   645  WHICH     REAL                     REFS     157  DEFINED    185     186
  1012  WI        REAL          / /        REFS      56     205     285
   622  WLAMQ     REAL          / /        REFS      91  DEFINED    224
   626  WLAMR     REAL          / /        REFS      92  DEFINED    225
  1004  WO        REAL          / /        REFS      85     203     284
  3312  WP        REAL          / /        REFS      58     282     285
  3307  WPD       REAL          / /        REFS      67     145     146     274
  3316  WQ        REAL          / /        REFS      59     284
  3313  WQD       REAL          / /        REFS      58     260     251     262
  3322  WR        REAL          / /        REFS      50     203     285
  3317  WRD       REAL          / /        REFS      59     274
   677  WRES      REAL                     REFS     277     278     279  DEFINED    274
  1114  WRQ1      REAL          / /        REFS      29
  1116  WRQ2      REAL          / /        REFS      31
  1120  WRQ3      REAL          / /        REFS      33
  1122  WRQ4      REAL          / /        REFS      35
  1115  WRR1      REAL          / /        REFS      30
  1117  WRR2      REAL          / /        REFS      32
  1121  WRR3      REAL          / /        REFS      34
  1123  WRR4      REAL          / /        REFS      36
  1074  WTQ1      REAL          / /        REFS      13     195
  1076  WTQ2      REAL          / /        REFS      15     193
  1075  WTQ3      REAL          / /        REFS      14     196
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VARIABLES      SN  TYPE          RELOCATION
 1077  WTR2        REAL                 / /        REFS       16     194
  650  W1Q         REAL                            REFS      204   DEFINED     203
  703  XL          REAL       ARRAY                REFS       74     177       178

FILE NAMES          MODE
       TAPE6        FMT                      WRITES      187       216

EXTERNALS           TYPE    ARGS       REFERENCES
       ATAND        REAL     2           153       154       172       173
       COSD         REAL     1           119       121
       FINTP1       REAL     6           177       178
       SIND         REAL     1           120       122

INLINE FUNCTIONS    TYPE    ARGS     DEF LINE  REFERENCES
       ABS          REAL     1  INTRIN          2*179     186     198     199     210     211   2*226   2*227
                                                  243     244     252     259   2*262     258     276   2*279
       AINT         REAL     1  INTRIN            115
       SIGN         REAL     2  INTRIN            199     139     243     244     253     259     250     269
                                                  276     277

STATEMENT LABELS                 DEF LINE  REFERENCES
   10  1                           116       113
    0  2                           160       155
    0  3            INACTIVE       285
  114  5                           149       137
  301  20                          221       215
  314  21                          228       220
  214  30                          190       173       179       181
  136  32                          164       152
  371  70                          257       252
  423  73                          266       255
  440  80                          273       263
  475  83                          283       272
  566  100    FMT                  217       215
  547  101    FMT                  188       187

LOOPS  LABEL   INDEX    FROM-TO    LENGTH    PROPERTIES
 127   2       L        156 160     38       INSTACK

COMMON BLOCKS   LENGTH     MEMBERS - BIAS NAME(LENGTH)
   / /          3930               0 C       (3830)

EQUIV CLASSES   LENGTH     MEMBERS - BIAS NAME(LENGTH)
 C      C       383C         370 RANGE   (1)        371 RXBA    (1)        372 RYBA    (1)
                             373 RZBA    (1)        402 WLAMQ   (1)        406 WLAMR   (1)
                             423 BTHTGD  (1)        425 BTHTS   (1)        427 BPSIGD  (1)
                             430 BPSIG   (1)        434 BEPSZ   (1)        435 BEPSY   (1)
                             479 GQ1     (1)        480 GR1     (1)        481 GQ2     (1)
                             482 GR2     (1)        483 GQ3     (1)        484 GR3     (1)
                             485 GQ4     (1)        486 GR4     (1)        488 GQ5     (1)
                             489 GR5     (1)        490 GQ6     (1)        491 GR6     (1)
                             492 DTHCQ   (1)        493 DTHCR   (1)        494 DTHRGQ  (1)
                             495 DTHRGR  (1)        496 GEOCS   (1)        499 DQ1     (1)
                             500 DR1     (1)        502 Q1      (1)        503 R1      (1)
                             505 DQ2     (1)        506 DR2     (1)        508 Q2      (1)
                             509 R2      (1)        511 DQ3     (1)        512 DR3     (1)
                             513 DWD     (1)        514 Q3      (1)        515 R3      (1)
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      SUBROUTINE S3          74/74    OPT=1                      FTN 4.2+75057      05/05/75  16.29.41.      PAGE   12

  EQUIV CLASSES    LENGTH     MEMBERS - BIAS NAME(LENGTH)
                                    515 WO      (1)          519 DWI     (1)          522 WI      (1)
                                    525 BEPSYSV(1)           528 BEPSZSV(1)           544 KQ1     (1)
                                    545 KR1     (1)          546 KQ2     (1)          547 KR2     (1)
                                    548 KQ3     (1)          549 KR3     (1)          550 KQ5     (1)
                                    551 KR5     (1)          552 KQ6     (1)          553 KR6     (1)
                                    554 KQ7     (1)          555 KR7     (1)          556 KQ8     (1)
                                    557 KR8     (1)          558 KQ10    (1)          559 KR10    (1)
                                    560 KQ11    (1)          561 KR11    (1)          562 KQ12    (1)
                                    563 KR12    (1)          564 JI      (1)          565 JO      (1)
                                    566 FRI     (1)          567 FRO     (1)          568 TUI     (1)
                                    569 TUO     (1)          570 QERG    (1)          571 RERG    (1)
                                    572 WTQ1    (1)          573 WTR1    (1)          574 WTQ2    (1)
                                    575 WTR2    (1)          576 WGQ1    (1)          577 WGR1    (1)
                                    578 WGQ2    (1)          579 WGR2    (1)          580 WGQ3    (1)
                                    581 WGR3    (1)          582 WGQ4    (1)          583 WGR4    (1)
                                    584 WGQ5    (1)          585 WGR5    (1)          586 WGQ6    (1)
                                    587 WGR6    (1)          588 WRQ1    (1)          589 WRR1    (1)
                                    590 WRQ2    (1)          591 WRR2    (1)          592 WRQ3    (1)
                                    593 WRR3    (1)          594 WRQ4    (1)          595 WRR4    (1)
                                    596 KCL     (1)          597 TCLQ    (1)          598 TCLR    (1)
                                    599 TAU     (1)          600 TARHT   (1)          601 TARHD   (1)
                                    602 KBLOCK  (1)          603 FFOV    (1)          604 IOCS    (1)
                                    605 FLAG    (1)          606 BRLKQ   (1)          607 TDELAY  (1)
                                    608 IHTQ    (1)          609 THTR    (1)          610 KUO     (1)
                                    611 KJI     (1)          612 KBO     (1)          613 KBI     (1)
                                    614 KPO     (1)          615 KPI     (1)          616 KOAO    (1)
                                    617 KOAI    (1)          618 UCC     (1)          619 USC     (1)
                                    620 UCCG    (1)          621 USCG    (1)          624 IBL     (1)
                                    649 TIMESV  (6)          655 LOSZ    (6)          661 LOSY    (6)
                                   1675 ANGX    (1)         1676 ANGY    (1)         1677 ANGZ    (1)
                                   1735 WPD     (1)         1738 WP      (1)         1739 WQD     (1)
                                   1742 WQ      (1)         1743 WRD     (1)         1746 W       (1)
                                   1750 CRAD    (1)         1999 TIME    (1)         2019 LCCNV   (1)
                                   3511 I3512   (1)         3633 ISNDX   (1)

  STATISTICS
    PROGRAM LENGTH              7053     453
    CM BLANK COMMON LENGTH     73668    3830
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