ACQUISITION COORDINATE COMPUTATION FOR TRACKING AND SURVEILLANCE SENSORS PROGRAM DOCUMENT

TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-65-160

December 1964

R. G. Schinnerer
D. R. Thompson

496L SYSTEM PROGRAM OFFICE
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

Prepared under Contract No. AF 19(628)-3438 by Aeronutronic,
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FOREWORD

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ACQUISITION COORDINATE COMPUTATION
FOR TRACKING AND SURVEILLANCE SENSORS
PROGRAM DOCUMENT

ABSTRACT

A computer program has been developed to calculate acquisition coordinates of earth satellites for three types of sensors: planar fan, horizontal fan and tracker. The program is equipped to consider the special requirements of phased array trackers, such as the AN/FPS-85. Included in the document are the program description, formulation, operating instructions, flow diagrams, and test cases.

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SECTION 1

INTRODUCTION

The Observing Schedule Program (OBSERV) is programmed for the Philco 2000 computer and is to be part of the B-3 Semi-Automatic Program System (SPS) at the SPADATS Center in Colorado Springs, Colorado. It functions in conjunction with the Executive Program and receives its input from the Schedule, SEAI and FAN input tapes.

OBSERV has been developed to compute sets of acquisition coordinates for stations with fixed beam surveillance devices and sensors that can track satellites. The capability to handle phased array trackers of the AN/FPS-85 type has also been included. For surveillance devices, the program computes the time and coordinates of beam penetration by all satellites requested on the input tape. For tracking devices, the program calculates acquisition coordinates at evenly spaced intervals of time, as specified by the input, during the periods that a satellite is within the tracker coverage.

The primary mode of operation for one specified sensor is the computation of acquisition coordinates of specified satellites in the current satellite population. The results are then presented for each station in chronological order. Data listed for each time point include the identification and the acquisition coordinates of the satellite currently being observed. Satellite positions are computed using the simplified general perturbations technique used in other SPS programs (Hilton, 1963). Flexibility in the program is provided by various input and output control options. The program has been designed for maximum computational efficiency. This will result in a significant reduction in the computer time required for each case.

In addition to the features mentioned above, the program may also be used to simulate sensor-satellite patterns.

SECTION 2

PROGRAM DESCRIPTION

The program OBSERV is designed to calculate acquisition coordinates for sensors of three primary types: planar fan, horizontal fan and tracker. The overall program functions are shown schematically in Figure 1 and are described in the following subsections.

2.1 INITIALIZATION

The initialization consists of two basic parts: (1) initialization for each sensor and (2) initialization for each satellite being processed for the given sensor.

a. Initialization by Sensor

In this section the time limits for acquisition coordinate computation are established, the topocentric coordinate system for this station is computed from the azimuth and elevation angle of the boresight vector (if required), and the sidereal time at the station is computed at the "beginning reference time."

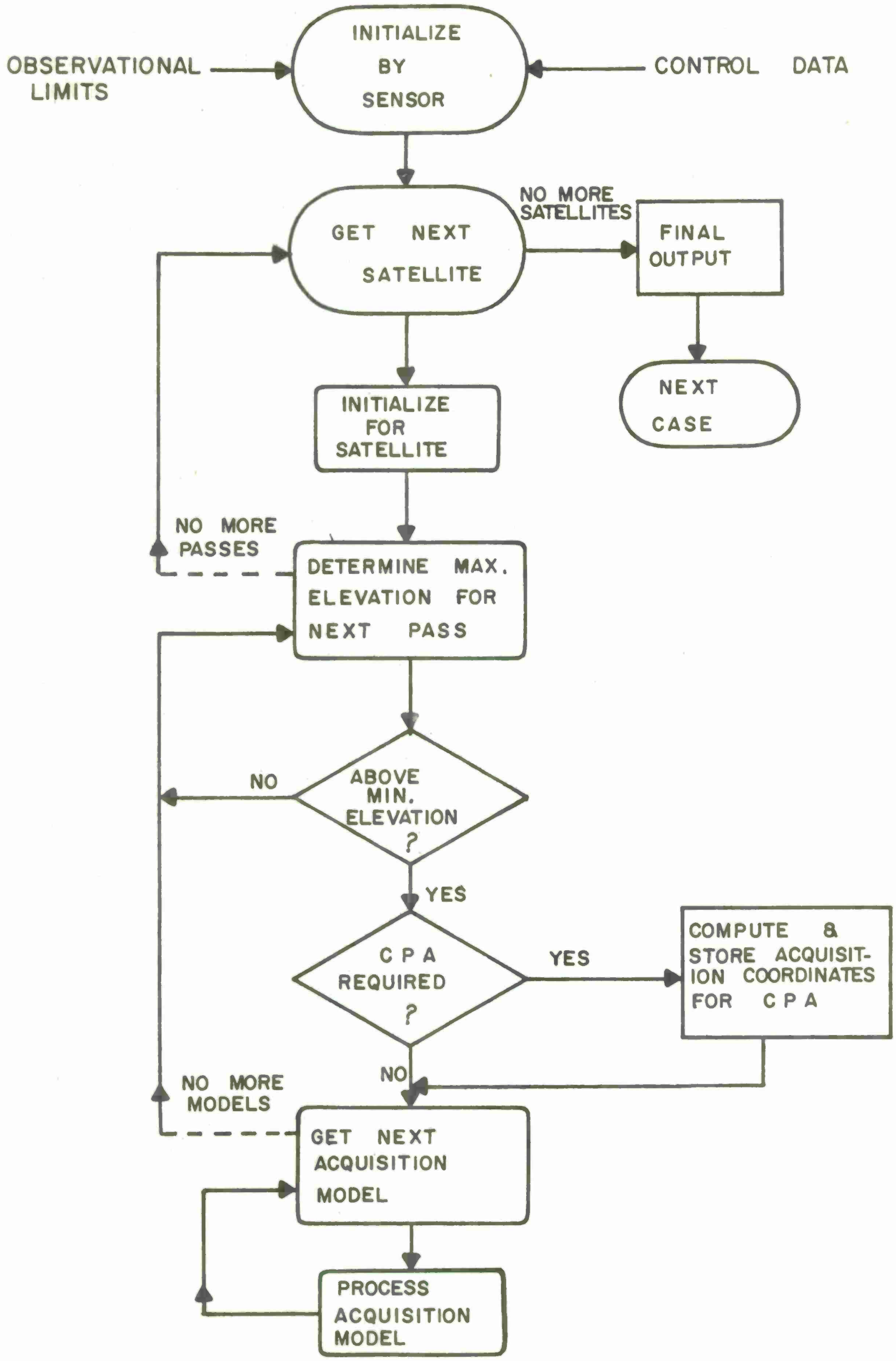


FIGURE 1 OBSERV PROGRAM FUNCTIONS

The time limits and the azimuth and elevation angles of the boresight vector are obtained from the input control card.

b. Initialization by Satellite

The orbital elements for each satellite are obtained from the system subroutine NXTELM. Using these, the calculations shown in Section 3.2 are performed. The minimum elevation angle, h_{min}, is obtained from either the fan card or the tracker card depending on the radar type being processed.

2.2 PRELIMINARY ACQUISITION COMPUTATIONS

This section is entered once for each revolution of the satellite falling within the requested time limits. The formulation given in Section 3.3 is used to obtain the time at which the satellite is at a maximum elevation angle with respect to the sensor. If the point of maximum elevation is below the horizon of the sensor, the calculations are performed again for the next revolution, unless the upper time limit has been passed. If the point of maximum elevation is above the sensor's horizon, a return is made to the main program to test the point against the minimum observable elevation angle. If it is above, the calculation continues to obtain the acquisition points required; if not, a return is made to the beginning of the subroutine to try again on the next revolution.

If acquisition coordinates for the closest point of approach (CPA) are requested, they are computed at the time of maximum elevation.

2.3 ACQUISITION MODELS

The term "Acquisition Model" denotes a mathematical scheme which describes the manner in which a sensor effects satellite acquisition. Four such acquisition models are contained in this program (see Figure 2). They are: (1) the subroutine PACQUI, designed for planar fan radars; (2) the subroutine HACQUI, used for horizontal fan radars; (3) the subroutine TACQUI, a generalized tracker acquisition model; and (4) the subroutine TACQUI1, a specialized subroutine used by TACQUI to obtain acquisition times for phased array trackers. Each acquisition model is successively processed for one pass before the next pass is considered.

Each case may contain as many as thirty acquisition models for one station; however, only one tracker model may be used. The acquisition types need not be ordered.

a. Subroutine PACQUI

This subroutine uses iteration by halving to calculate the topocentric coordinates of the satellite at the time of fan penetration. It then checks to ensure that the satellite is within the observational limits of the fan. If it is, the acquisition coordinates are stored for output.

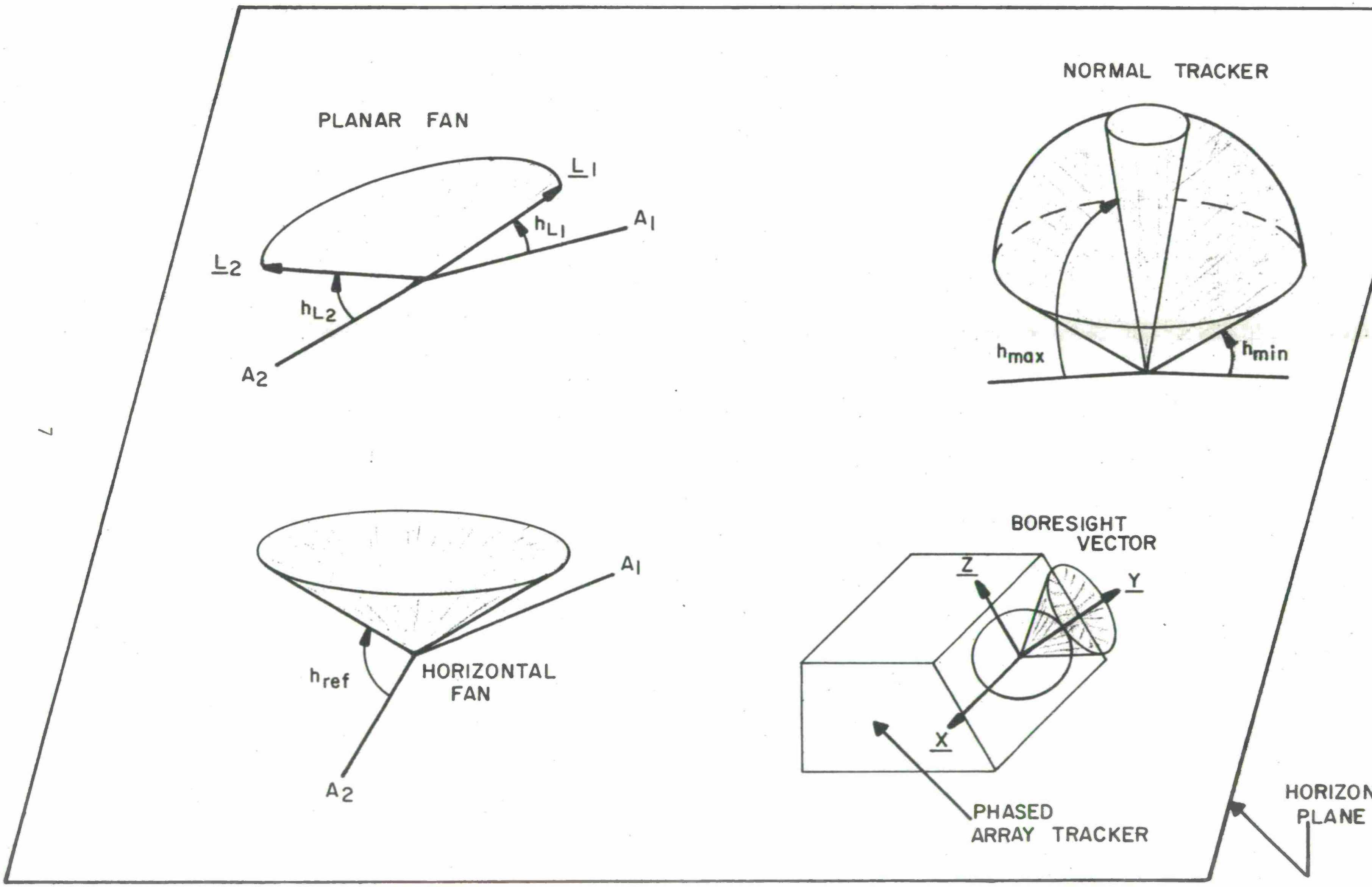


FIGURE 2 RADAR COVERAGE ASSUMED BY THIS PROGRAM

b. Subroutine HACQUI

The horizontal fan acquisition model calculates the points at which the satellite penetrates a cone which forms a constant angle with the horizon. If the points are within the azimuthal and range limits of the fan, they are stored for output. The maximum observable range is assumed to vary linearly between the angular limits of the fan.

c. Subroutine TACQUI

This subroutine makes use of either HACQUI or TACQUI1 (as required) to obtain the time span during which the satellite is observable by the tracker. It then computes the acquisition coordinates specified by the input tracker card: either a specified number of points per pass (ranging from two to eight), or a specified time interval between points.

Tracking limits for a normal tracker are determined by a vertical cone whose side forms an angle with the horizon equal to the minimum elevation angle. If the elevation angle of any point for a normal tracker is greater than the maximum, the point is rejected. No azimuth limits are assumed.

The tracking limits of a phased array tracker are determined by the minimum elevation angle, the limiting values of the direction cosines relative to the reference vectors normal to the boresight, and the maximum off-boresight angle.

d. Subroutine TACQUI1

This subroutine is used by subroutine TACQUI for phased array trackers. It uses iteration by halving to determine the acquisition coordinates and the times when the satellite enters and exits the coverage limits of the radar. Acceptable entry and exit points are stored for output.

2.4 FINAL OUTPUT

After every requested satellite has been processed through the acquisition models for one station, the accepted acquisition points are sorted either by time or by order of satellite appearance and output as shown in Figure 10.

The available output options are:

(1) The fan number may be output.

(2) The units of range and range-rate may be obtained in either nautical or MKS units.

(3) The direction cosines with respect to the topocentric reference system may be obtained.

(4) The point of maximum elevation may be computed as an acquisition point.

(5) The output points may be restricted to the ascending half of each pass.

SECTION 3

FORMULATION

The acquisition coordinate computation program employs a simplified General Perturbations theory to calculate positions and velocities of the satellite. The formulation for this theory is given in the reference: Hilton, 1963. The remaining program formulation is detailed in the following subsections.

3.1 INITIALIZATION FOR EACH SENSOR

The following calculations are performed once for each station requiring acquisition coordinates:

(1) Compute the topocentric reference triad from the boresight azimuth and elevation:

$$\underline{x} \begin{cases} x_{xh} = \sin A_B \\ x_{yh} = \cos A_B \\ x_{zh} = 0 \end{cases} \qquad (1)$$

$$\underline{y}\begin{cases} y_{xh} = -\cos h_B \cos A_B \\ y_{yh} = \cos h_B \sin A_B \\ y_{zh} = \sin h_B \end{cases} \quad (2)$$

$$\underline{z}\begin{cases} z_{xh} = \sin h_B \cos A_B \\ z_{yh} = -\sin h_B \sin A_B \\ z_{zh} = \cos h_B \end{cases} \quad (3)$$

(2) Compute the sidereal time at the station at the "beginning reference time"

$$\theta_i = (\dot{\theta} - 360)\ D + \dot{\theta} F + \theta_{gr_o} + \lambda_E \quad (4)$$

where D and F are, respectively, the days and fraction of a day of the "beginning time" into the reference year; θ_{gr_o} is the Greenwich sidereal time at the start of the year, λ_E is the east longitude of the observing station and $\dot{\theta}$ is the rotation rate of the earth.

3.2 INITIALIZATION FOR EACH SATELLITE

The following calculations are performed once for each satellite.

(1) Enter the XYZI subroutine to compute the time independent initial parameters required for the ephemeris subroutine, XYZSB.

(2) Calculate the epoch Greenwich sidereal time, θ_o:

$$\theta_o = \theta_i + \dot{\theta}\ (t_o - t_B) \quad (5)$$

where θ_i is from equation (4) and $(t_o - t_B)$ is the difference between the epoch time, t_o, and the input "beginning time" t_B.

(3) Compute sin and cos :

$$\sin \quad = \sin \left\{ (\dot{\Omega} - \dot{\theta}) \ \Delta t_1 \right\} \qquad (6)$$

$$\cos \quad = \cos \left\{ (\dot{\Omega} - \dot{\theta}) \ \Delta t_1 \right\} \qquad (7)$$

$$\text{where } \dot{\Omega} = - \frac{3}{2} J_2 \frac{a_e^2}{p^2} n \cos i \qquad (8)$$

is the rotation rate of the earth and

Δt_1 is 5 minutes

(4) Compute K_1 the critical value for $\underline{Z} \cdot \underline{W}$, above which visibility of this satellite is not possible for this station (see Figure 3).

$$K_1 = q_2^{-1} \cos h_{min} \left\{ (q_2^2 - \cos^2 h_{min})^{1/2} - \sin h_{min} \right\} \qquad (9)$$

where q_2, the geocentric apogee distance, is given by:

$$q_2 = a(1 + e) \qquad (10)$$

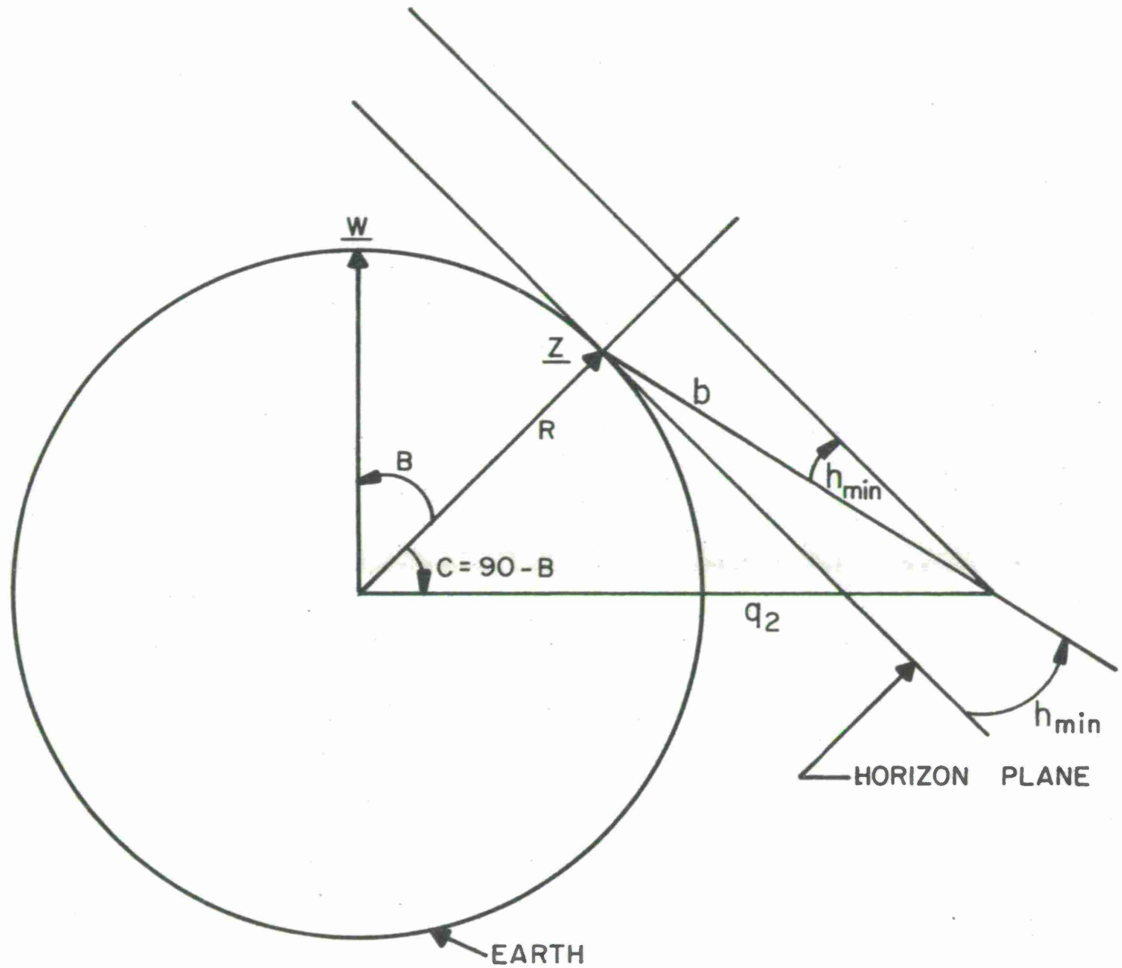
(5) Compute the revolution number at the "beginning time":

$$N_B = N_o + I \left\{ \frac{n_o}{2\pi} \cdot (t_B - t_o) \right\} \qquad (11)$$

where N_o is the epoch revolution number and $I\{\}$ represents the integral part of the bracketed quantity

(6) The quantity t_L , used in later calculations, is set equal to zero at this point.

(7) The quantity ϵ, also used in later calculations, is set equal to 1/2 of the beamwidth of the sensor.



$\underline{Z} \cdot \underline{W} = \sin C$

$q_2 \sin C = b \cos h_{min}$

$q_2 \cos C = R + b \sin h_{min}$

ELIMINATING b TO SOLVE FOR sin C FROM THESE TWO EQUATIONS GIVES THE CRITICAL VALUE OF $\underline{Z} \cdot \underline{W}$ GIVEN BY EQUATION(9). THE ASSUMPTION IS MADE THAT THE EARTH IS SPHERICAL AND THEREFORE THAT R = 1.

$\underline{Z}$ IS A UNIT VECTOR DIRECTED TOWARD THE OBSERVERS ZENITH

$\underline{W}$ IS A UNIT VECTOR IN THE DIRECTION OF ORBITAL ANGULAR MOMENTUM

FIGURE 3 DERIVATION OF CRITICAL VALUE FOR $\underline{Z} \cdot \underline{W}$

3.3 COMPUTATION OF t AND $L_{zh_{max}}$ FOR EACH PASS

This calculation is used to determine the point of maximum elevation angle of the satellite with respect to the sensor.

(1) Set t_i equal to t_L and initialize for $\underline{Z} \cdot \underline{W}$ computation as follows:

$$\theta_t = \theta_o + \dot{\theta}(t_i + t_B - t_o) \qquad (12)$$

$$\Omega = \Omega_o + \dot{\Omega}(t_i + t_B - t_o) \qquad (13)$$

Compute the sine and cosine of $\Omega - \theta_t$

(2) Iterate on $\underline{Z} \cdot \underline{W}$ as follows: if $t_i + t_B > t_F$ return to main program; otherwise,

$$t_{i+1} = t_i + \Delta t_1 \qquad (14)$$

$$\sin(\Omega - \theta_t)_{i+1} = \sin(\Omega - \theta_t)_i \cos\Delta + \cos(\Omega - \theta_t)_i \sin\Delta \qquad (15)$$

$$\cos(\Omega - \theta_t)_{i+1} = \cos(\Omega - \theta_t)_i \cos\Delta - \sin(\Omega - \theta_t)_i \sin\Delta \qquad (16)$$

$$\underline{Z} \cdot \underline{W}_{i+1} = \sin(\Omega - \theta_t)_{i+1} \cos\phi \sin i + \sin\phi \cos i \qquad (17)$$

where t_F is the final time for which look angles are required and ϕ is the station latitude.

if $|\underline{Z} \cdot \underline{W}_{i+1}| \geq K_1$ continue the iteration; otherwise,

(3) Set t_i equal to $t_{i+1} - \Delta t_1$ and iterate on $\dot{L}_{zh}$ as follows:

(a) Enter the XYZSB subroutine to obtain the position and velocity of the satellite at time $t_i + t_B$

(b) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(4) Compute $\dot{\rho}_{zh}$, the zenithal component of the range velocity and $\dot{L}_{zh}$, the zenithal components of $\underline{\dot{L}}$.

$$\dot{\rho}_{zh} = (\dot{x} + \dot{\theta} y) \cos \phi \cos \theta + (\dot{y} - \dot{\theta} x) \cos \phi \sin \theta + \dot{z} \sin \phi \qquad (18)$$

$$\dot{L}_{zh} = \frac{1}{\rho} (\dot{\rho}_{zh} - \frac{\dot{\rho}}{\rho} \rho_{zh})$$

$$\text{where } \theta = \theta_o + \dot{\theta} (t_i + t_B - t_o) \qquad (19)$$

if $\dot{L}_{zh} \leq 0$ add Δt_2 to t_i (Δt_2 = 25 min. at present) and continue the iteration; otherwise, enter the following iteration on $\dot{L}_{zh}$:

add Δt_2 to t_i

(5) Enter the XYZSB subroutine to obtain the position and velocity of the satellite at time $t_i + t_B$

(6) Compute $\dot{L}_{zh}$ as above

if $\dot{L}_{zh} > 0$ continue the iteration; otherwise, set

Δt_{i-1} = 25 minutes and N = 0 and enter the following iteration on $\dot{L}_{zh}$:

(7) Iterate to obtain the point of maximum elevation:

$$\text{set } \Delta t_i = - \frac{1}{2} | \Delta t_{i-1} | \qquad (20)$$

$$t_{i+1} = t_i + \Delta t_i \qquad (21)$$

$$N = N + 1 \qquad (22)$$

Enter the XYZSB subroutine and compute $\dot{L}_{zh}$ as above.

If N is less than 7 test $\dot{L}_{zh}$: 0; if $>$ set Δt_{i+1} = $\frac{1}{2} | \Delta t_i |$ and continue iteration; if $\leq$ set $\Delta t_{i+1} = - \frac{1}{2} | \Delta t_i |$ and continue iteration.

(8) If N = 7 compute $\ddot{L}_{zh}$ as follows:

$$\ddot{L}_{zh} = (\dot{L}_{zh_i} - \dot{L}_{zh_{i-1}}) / \Delta t \tag{23}$$

(9) Test the quantity $\frac{\dot{L}_{zh}}{\ddot{L}_{zh}}$: if

$$\left| \frac{\dot{L}_{zh}}{\ddot{L}_{zh}} \right| < \left| \frac{\Delta t}{2} \right| \text{ set } t_{i+1} = t_i - \frac{\dot{L}_{zh}}{\ddot{L}_{zh}} \text{; otherwise, set} \tag{24}$$

$$t_{i+1} = t_i + \frac{\dot{L}_{zh}}{|\dot{L}_{zh}|} \left| \frac{\Delta t_i}{2} \right| \text{ ; then compute } \underline{\rho}_h \text{ and } \dot{\rho} \tag{25}$$

as follows:

$$\theta = \theta_o + \dot{\theta}(t_{i+1} + t_B - t_o) \tag{26}$$

$$X = (X/\cos\theta) \cos\theta \tag{27}$$

$$Y = (X/\cos\theta) \sin\theta \tag{28}$$

where $X/\cos\theta$ is a station coordinate function obtained as input.

$$\underline{\rho}_h \begin{cases} \rho_{xh} = (x + X) \sin\phi \cos\theta + (y + Y) \sin\phi \sin\theta - (z + Z) \cos\phi \\ \rho_{yh} = -(x + X) \sin\theta + (y + Y) \cos\theta \\ \rho_{zh} = (x + X) \cos\phi \cos\theta + (y + Y) \cos\phi \sin\theta + (z + Z) \sin\phi \end{cases} \tag{29}$$

$$\rho = (\rho_{xh}^2 + \rho_{yh}^2 + \rho_{zh}^2)^{1/2} \tag{30}$$

$$\dot{\rho} = \frac{1}{\rho} \left\{ (x + X)(\dot{x} + y\dot{\theta}) + (y + Y)(\dot{y} - x\theta) + (z + Z)\dot{z} \right\} \tag{31}$$

$$\text{Set } t_L = t_{i+1} + \Delta t_1 + \Delta t_2 \tag{32}$$

(10) Test ρ_{zh}: if $\rho_{zh} > 0$, exit to next computation; otherwise return to the beginning of this section 3.3.(1) with the new t_L. If $\rho_{zh} \leq \rho(\sin h_{min} - \epsilon)$, also return to the beginning of this section with the new t_L.

3.4 COMPUTATION OF THE MAXIMUM ELEVATION

If the point of maximum elevation (CPA) is required, compute A and h as follows:

$$A = \tan^{-1} \frac{\rho_{yh}}{-\rho_{xh}} ; \quad 0 \leq A < 2\pi \tag{33}$$

$$h = \sin^{-1} \frac{\rho_{zh}}{\rho} \tag{34}$$

where ρ and $\underline{\rho}_h$ are available from the previous section at the time of closest approach.

3.5 DETERMINATION OF THE REQUIRED ACQUISITION MODEL

Test the radar type to determine which acquisition model is required:

Planar fans use PACQUI formulation.

Horizontal fans use HACQUI formulation.

Trackers use TACQUI formulation.

3.6 PACQUI FORMULATION

Acquisition model for planar fans

(1) Compute $\underline{\rho} \cdot \underline{N}$, where $\underline{N}$ is a unit vector normal to and above the plane of the fan.

$$\rho_{N_1} = \underline{\rho} \cdot \underline{N} \tag{35}$$

Set Δt = -10 minutes and $t_2 = t_i$

(2) Start iteration to make $\underline{\rho} \cdot \underline{N}$ change sign:

(a) If $\rho_{zh} \geq 0$ continue the iteration with (c); otherwise,

(b) If this is the first time through, set $t_i = t_2$ and exit, if this is not the first time through, set $\underline{\rho} \cdot \underline{N}$ equal to ρ_{N_1}, $\Delta t = +10$ and $t_i = t_2$; then go to step (d) to obtain the descending observation time.

(c) If $|\underline{\rho} \cdot \underline{N}| \leq \rho\epsilon$ go to the next subsection; otherwise,

(d) $t_{i+1} = t_i + \Delta t$ (36)

$\rho_{N_3} = \underline{\rho} \cdot \underline{N}$ (37)

(e) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(f) Compute $\underline{\rho} \cdot \underline{N}$ and test $\rho_{N_1} (\underline{\rho} \cdot \underline{N})$; if ≥ 0 continue the iteration with (a) above; otherwise, go to the next subsection.

(3) Iterate, by halving, to determine the time when the satellite passes within the observational limits of the fan.

(a) $$\Delta t_{i+1} = \frac{\rho_{N_3} (\underline{\rho} \cdot \underline{N})}{|\rho_{N_3} (\underline{\rho} \cdot \underline{N})|} \quad \frac{\Delta t_i}{2} \tag{38}$$

(b) $$t_{i+1} = t_i + \Delta t_{i+1} \tag{39}$$

$$\rho_{N_3} = (\underline{\rho} \cdot \underline{N}) \tag{40}$$

(c) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31). (41)

(d) Compute $\underline{\rho} \cdot \underline{N}$ and test: if $|\underline{\rho} \cdot \underline{N}| \leq \rho\epsilon$ go to the next subsection; otherwise return to (a) above to continue the iteration.

(4) Test the observation with respect to the angular limits of the fan: if $(\underline{L} \cdot \underline{L}_1)\ (\underline{L} \cdot \underline{L}_2) \geq (\underline{L} \cdot \underline{L}_2)$, the observation is within the angular limits of the fan; otherwise, return to 3.6(2)(a). (42)

$\underline{L} = \frac{\underline{\rho}}{\rho}$; $\underline{L}_1$ and $\underline{L}_2$ are unit topocentric vectors defining the angular limits of the fan. (43)

(5) If range limits are specified perform the following test: if $\rho \leq \rho_{max1} + \rho'_{max} \cos^{-1} (\underline{L} \cdot \underline{L}_1)$ the range is observable. (44)

ρ_{max1} is the maximum observable range along $\underline{L}_1$

ρ'_{max} is the derivative of maximum observable range with respect to the angle $\cos^{-1} (\underline{L} \cdot \underline{L}_1)$. It is assumed linear for this program and is given by:

$$\rho'_{max} = \frac{\rho_{max2} - \rho_{max1}}{\cos^{-1} (\underline{L}_1 \cdot \underline{L}_2)} \qquad (45)$$

(6) If the satellite is observable and the time of observation falls within the requested time limits, then perform the following calculations if illumination information is required.

(a) Compute the sun's true longitude, $\ell_\odot$, at time

$$\frac{(t_B + t_i)}{1440} = T: \qquad (46)$$

$$\ell_\odot = L_\odot + n_\odot T + 1.91 \sin (n_\odot T - M_{\odot_o}) \qquad (47)$$

where $n_\odot$ is the mean notion of the sun in degrees per day

$L_\odot$ is the mean longitude of the sun at time T, given by

$L_\odot = L_{\odot_o} + n_\odot T$; $L_{\odot_o}$ is the mean longitude of the sun at the beginning of the epoch year. (48)

$M_{\odot} = L_{\odot_0} + n_{\odot} T - \pi_{\odot}$; $\pi_{\odot}$ is the sun's longitude of perifocus (49)

(b) Calculate the geocentric unit vector toward the sun, $\underline{L}_{\odot}$:

$$\underline{L}_{\odot} \begin{cases} L_{x_{\odot}} = \cos \delta_{\odot} \cos\alpha_{\odot} \\ L_{y_{\odot}} = \cos \delta_{\odot} \sin\alpha_{\odot} \\ L_{z_{\odot}} = \sin \delta_{\odot} \end{cases} \quad (50)$$

where $\alpha_{\odot} = \ell_{\odot} - 2.47 \sin 2 \ell_{\odot}$ (51)

$$\delta_{\odot} = \tan^{-1} (0.4336635 \sin\alpha_{\odot}) \quad (52)$$

(c) Calculate and test the elevation angle of the sun, $h_{\odot}$

$$h_{\odot} = \sin^{-1} \left(-\underline{L}_{\odot} \cdot \frac{\underline{R}}{R}\right) \quad (53)$$

where $\frac{\underline{R}}{R}$ is a unit vector from the station to the geocenter.

If $h_{\odot} > -5^{\circ}$, no visual points may be calculated.

If $h_{\odot} < -5^{\circ}$ the calculation continues to determine if the satellite is illuminated.

(d) It has already been established that the satellite is above the sensor's horizon. The Earth's shadow is assumed cylindrical. See Figure 4.

$$\cos \psi = \frac{1}{r} (\underline{L}_{\odot} \cdot \underline{r}) \quad (54)$$

(e) If $\cos \psi$ is positive, the satellite is illuminated. If $\cos \psi$ is negative, the satellite may still be illuminated. This is determined from γ and η as follows.

$$\gamma = \psi - 90^{\circ} \quad (55)$$

$$\eta = \sin^{-1} \left(\frac{R}{r}\right) \quad (56)$$

If $\gamma + \eta > 90^{\circ}$, the satellite is not visible, if $\gamma + \eta \leq 90^{\circ}$, the satellite is illuminated.

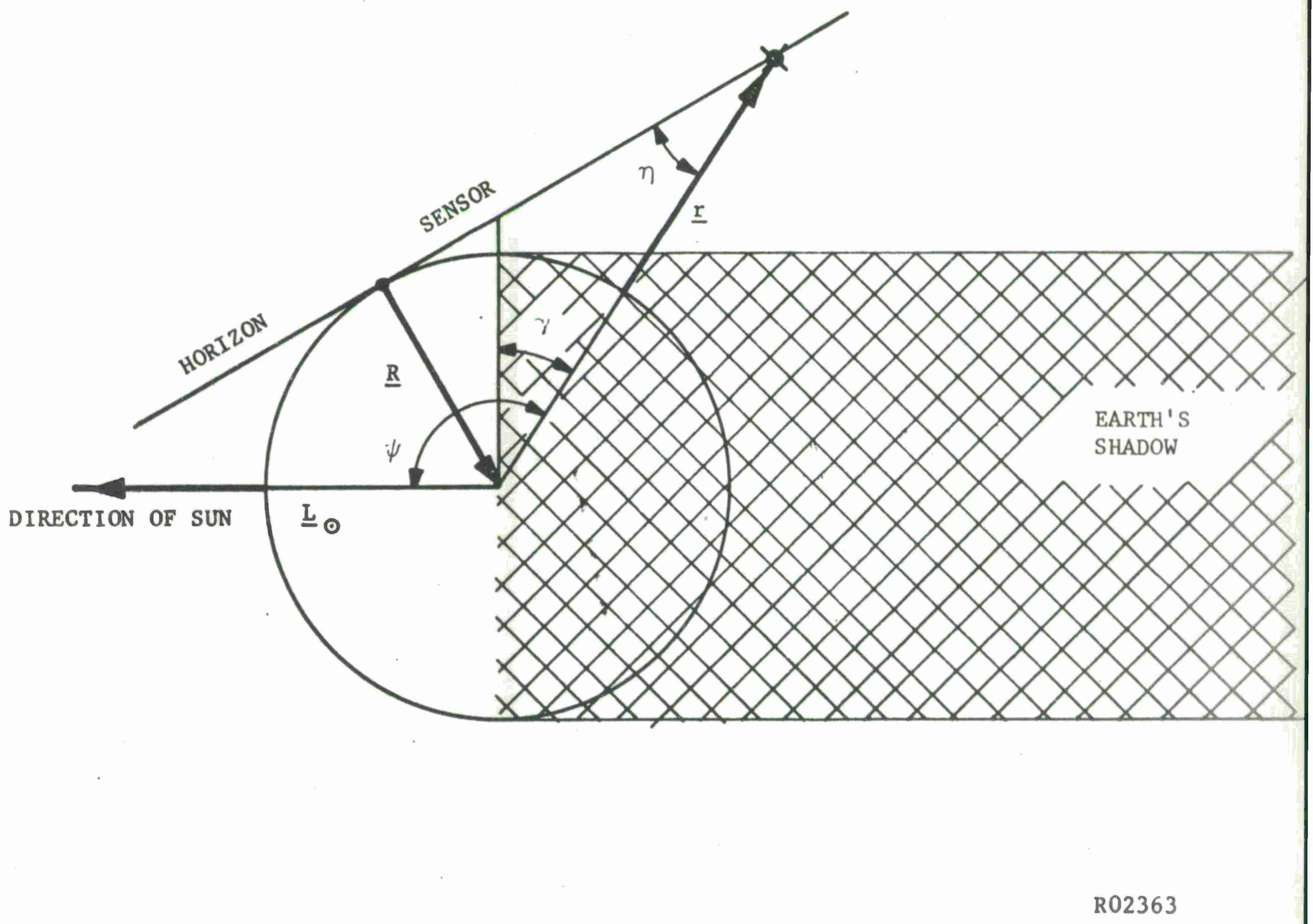


FIGURE 4. POSITION OF SATELLITE WITH RESPECT TO THE EARTH'S SHADOW

(7) If either the satellite is not observable or this is the first time through, and $t_i < t_2$; then set

$$\underline{\rho} \cdot \underline{N} = \rho_{N_1} \quad (57)$$

$$t_i = t_2 \quad (58)$$

$$\Delta t = 10 \text{ min} \quad (59)$$

and return to 3.6(3)(b). Otherwise, continue with the next subsection after storing the acquisition coordinates for output.

3.7 HACQUI FORMULATION

Acquisition model for horizontal fans

(1) Set $t_2 = t_i$ and $\Delta t = -10$ min.

(2) Iterate to make ρ_{zh} approach $\rho \sin h_{ref}$. $\cos h_{ref}$ and $\sin h_{ref}$ are available from the acquisition buffer (input quantities)

(a) If $|\rho_{zh} - \rho \sin h_{ref}| \leq \rho \epsilon \cos h_{ref}$ go to (60)

(4) below; otherwise, continue with (b)

(b) Set $K_3 = 1$ and $t_{i+1} = t_i + \Delta t$ (61)

(c) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(d) If $\rho_{zh} > \rho \sin h_{ref}$ return to (a) above; otherwise, continue with (3). (62)

(3) Iterate to obtain the time of fan penetration

(a)

$$\Delta t_{i+1} = \frac{K_3 (\rho_{zh} - \rho \sin h_{ref})}{|K_3 (\rho_{zh} - \rho \sin h_{ref})|} \cdot \frac{\Delta t_i}{2} \quad (63)$$

(b)

$$K_3 = \rho_{zh} - \rho \sin h_{ref} \quad (64)$$

$$t_{i+1} = t_i + \Delta t_{i+1} \quad (65)$$

(c) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(d) If $|\rho_{zh} - \rho \sin h_{ref}| > \rho \epsilon \cos h_{ref}$ return to (a); otherwise, continue with (4). (66)

(4) Compute A and h from ρ and $\underline{\rho}_h$:

$$A = \tan^{-1} \frac{\rho_{yh}}{-\rho_{xh}} \tag{67}$$

$$h = \sin^{-1} \frac{\rho_{zh}}{\rho} \tag{68}$$

(5) If this is a tracker to to (8); otherwise, continue with (6).

(6) If $(A_2 - A_1)(A - A_1)(A_2 - A) \geq 0$ the observation is within the angular limits of the fan so continue with (7). A_1 and A_2 are the azimuthal limits of the fan.

If < 0 and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, then return to 3.7(2)(b); otherwise exit.

(7) If $\rho \leq \rho_{max1} + \rho'_{max} (A - A_1)$ the range is observable so continue with (8).

ρ_{max1} is the maximum observable range in the A_1 direction

ρ'_{max} is the derivative of maximum range with respect to $(A - A_1)$. It is assumed linear and is given by:

$$\rho'_{max} = \frac{\rho_{max2} - \rho_{max1}}{A_2 - A_1} \tag{69}$$

If $\rho > \rho_{max1} + \rho'_{max} (A - A_1)$ and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, the return to 3.7(2)(b); otherwise exit.

(8) If the satellite is observable and the time of observation is within the requested time limits; then, if required, test for solar illumination using equations (46) through (56). If this is the first time through and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, then return to 3.7(2)(b); otherwise, set $T_2 = t_i$ and $t_i = t_2$ and exit to the next subsection. In either case, store the acquisition coordinates for output.

3.8 TACQUI FORMULATION

Acquisition model for trackers

(1) If a maximum range is specified test ρ, if $\rho > \rho_{max}$ exit, otherwise continue with (2).

(2) If this is a phased array tracker, go to TACQUI1 (3.9). Otherwise, set $A_1 = 0$, $A_2 = 2\pi$ and go to HACQUI (3.7).

(3) If only the ascending half of the pass is required, set $T_2 = t_2$.

(4) Test the points per pass integer, P:

If P = 9, an output interval, Δt, is specified, so go to (5); otherwise set

$$\Delta t = \frac{T_2 - T_1}{P - 1} \tag{70}$$

$$t_i = T_1 \tag{71}$$

and go to (6).

(5) Set N = integral part of $(T_2 - T_1)/2\Delta t$ and (72)

$$t_i = \frac{1}{2}(T_2 + T_1) - (N + 1)\Delta t \tag{73}$$

(6) If this is a phased array, go to (8).

(7) If ascending points only are required, set

$$T_2 = T_2 + \Delta t \tag{74}$$

(8) Compute ρ, A, h and $\dot{\rho}$, for output, at each time point between T_1 and T_2 required by (4) or (5) above.

3.9 TACQUI1 FORMULATION

Acquisition model for phased array trackers

(1) Set $K_1 = 1$ and go to AFILT3 (3.10)

(a) if this observation passes the tests in AFILT3 or is marginal and visible, go to (4).

(b) if this observation fails the tests in AFILT3 or is marginal but not visible as described by equations 98-100, go to (2).

(2) Set $K_1 = -1$, $t_2 = t_i$, $K_3 = -1$ and $\Delta t = -0.2$ min (75)

(3) Iterate to check for visible points on this pass

(a) Set $t_{i+1} = t_i + \Delta t$ (76)

(b) Compute ρ, $\dot{\rho}$ and ρ_h from equations (29) through (31).

(c) If $\rho_{zh} > 0$ go to (d); if ≤ 0 and $t_i < t_2$, set

$t_i = t_2$, $\Delta t = 0.2$ and $K_1 = +1$ and go to (a). (77)

(d) Go to AFILT3

If the satellite fails the tests in AFILT3, return to (a).
If it passes the tests, set $t_2 = t_i$ and go to (e).
If it is marginal, set $t_2 = t_i$ and go to (8).

(e) Set $\Delta t_{i+1} = \frac{1}{2} K_3 \ \Delta t_i$ and go to (7). (78)

(4) Set $t_2 = t_i$, $K_3 = +1$ and $\Delta t = -10$ min (79)

(5) Set $t_{i+1} = t_i + \Delta t$. (80)

Compute ρ, $\dot{\rho}$ and ρ_h from equations (29) through (31).
Go to AFILT3

If the satellite passes the tests in AFILT3, return to the beginning of 3.9(5).
If it fails the tests, go to 3.9(6).
If it is marginal, go to 3.9(8).

(6) Set $\Delta t_{i+1} = -\frac{1}{2} K_3 \Delta t_i$ and $K_3 = -1$ (81)

(7) Iterate to obtain the times of marginal visibility

(a) Set $t_{i+1} = t_i + \Delta t_{i+1}$

(b) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(c) Go to AFILT3

If the satellite passes the tests in AFILT3 go to 3.9(3)(e).
If it fails the tests go to 3.9(6).
If it is marginal go to 3.9(8).

(8) Compute A and h from equations (67) and (68) and:

If this is the first time through set

$$T_1 = t_i \quad (83)$$

$$t_i = t_2 \quad (84)$$

$$\Delta t = 10K_1 \quad (85)$$

$$K_3 = 1 \quad (86)$$

and go to 3.9(5); otherwise, if $t_i > T_1$ set $T_2 = t_i$; if $< T_1$ set (87)

$$T_2 = T_1 \quad (88)$$

$$T_1 = t_i \quad (89)$$

and exit.

3.10 AFILT3 FORMULATION

Determine whether the satellite is visible, invisible or marginally visible to the sensor at this time.

(1) Test against minimum elevation angle

(a) Set $\delta = \rho_{zh} - \rho \sin h_{min}$ and (90)

$$E = \rho \epsilon \cos h_{min} \quad (91)$$

U_{max}, V_{max}, $\cos \psi_{max}$, $\sin h_{min}$, and $\cos h_{min}$ are stored from input into the FANTAB buffer.

(b) Go to AFILT31 (3.11)

(2) Test against maximum off boresight angle

(a) Set $\delta = \underline{\rho} \cdot \underline{y} - \rho \cos \psi_{max}$ (92)

$E = \rho \epsilon \sin \psi_{max}$ (93)

(b) Go to AFILT31

(3) Test against minimum angle from $\underline{z}$ axis

(a) Set $\delta = \rho U_{max} - |\underline{\rho} \cdot \underline{z}|$ (94)

$E = \rho \epsilon (1 - U^2_{max})^{1/2}$ (95)

(b) Go to AFILT31

(4) Test against minimum angle from $\underline{x}$ axis

(a) Set $\delta = \rho V_{max} - |\underline{\rho} \cdot \underline{x}|$ (96)

$E = \rho \epsilon (1 - V^2_{max})^{1/2}$ (97)

(b) Go to AFILT31

3.11 AFILT31 FORMULATION

Subroutine used by AFILT3

(1) If $\delta \geq 0$ the satellite is visible (98)

(2) If $\delta < 0$ the satellite is invisible (99)

(3) If $|\delta| < E$ the satellite is marginally visible (100)

SECTION 4

OPERATING INSTRUCTIONS AND COMPUTER REQUIREMENTS

The OBSERV module is programmed for the Philco 2000 computer. This section describes the tape setup, deck setup, input options and output formats.

4.1 GENERAL

This program has two modes of execution: (1) in conjunction with the Semi-Automatic System job-schedule mode of operation, where the normal operating procedures required for this mode are described in Section 2 of reference 3; and (2) the manual mode of operation which obtains input from the console typewriter instead of the SCHEDULE TAPE.

Input quantities are to specify which sensor is to be provided acquisition coordinates, which satellites are to be observed and the time period which calculations are to cover. The data are calculated and stored in core and on magnetic tape for one satellite at a time. Note that any or all types of acquisition models can be combined in the same case.

For one satellite, output data for the visual passes only and all the predictions for one pass may be printed in chronological order without being mixed with predictions for other satellites.

Due to changes in system operating procedures, OBSERV has become somewhat like a main sequence program, which reverses the original design specifications. Therefore, the program has been modified so that it may be run in the manual mode. In this mode the program may be called big using the console typewriter. The input is the same as for option 0 in the schedule tape mode except that the base day and base message numbers are typed in. Most of the changes are primarily concerned with input data processing.

4.2 TAPE SETUP

Tape assignments are displayed in Figure 5. When OBSERV is run in the manual mode of operation the SCHEDULE TAPE (logical 2) is not used.

4.3 DECK SETUP

For both modes of operation (schedule and manual), the FAN TAPE (logical 0) is generated from punched cards on the Philco 1000 in read-code mode with sense option on. Nine types of cards are used (see Figure 6):

CARD TYPE		CONTENT
1		"FANCARDS" Card
2	case data cards	Control Card
3		Fan/Tracker Card
4		"FROM" Address Card
5		"INFO" Address Card
6		"TO" Address Card
7		"ALL", "ALL BUT", or "ONLY" Card
8		ENDCASE Card
9		ENDSCHED Card

Explanation of card types:

TYPE	DESCRIPTION
1	Used as the Tape Identifier. See Figure II-1
2	Must always be used and specifies data about the sensor, the calculations and the output. Fields 11 and 12 are used in the headings of the printed output. See Figure II-2

Logical Unit		Tape Identification	Description
0		FANCARDS	FAN TAPE - Input
1		70 BINMST	SPS B-2 Master
2		70△ SCHTP	SCHEDULE TAPE - Input (Not required in manual mode)
4		70△ SEAI1	Sensor, Element Acquisition Information Communication Files
7	(write ring in)	SCRATCH	SCRATCH
8	(write ring in)	SCRATCH	SCRATCH
9	(write ring in)	SCRATCH	SCRATCH
11	(write ring in)	70 ØUTPUT	OUTPUT

FIGURE 5. TAPE SETUP FOR OBSERV

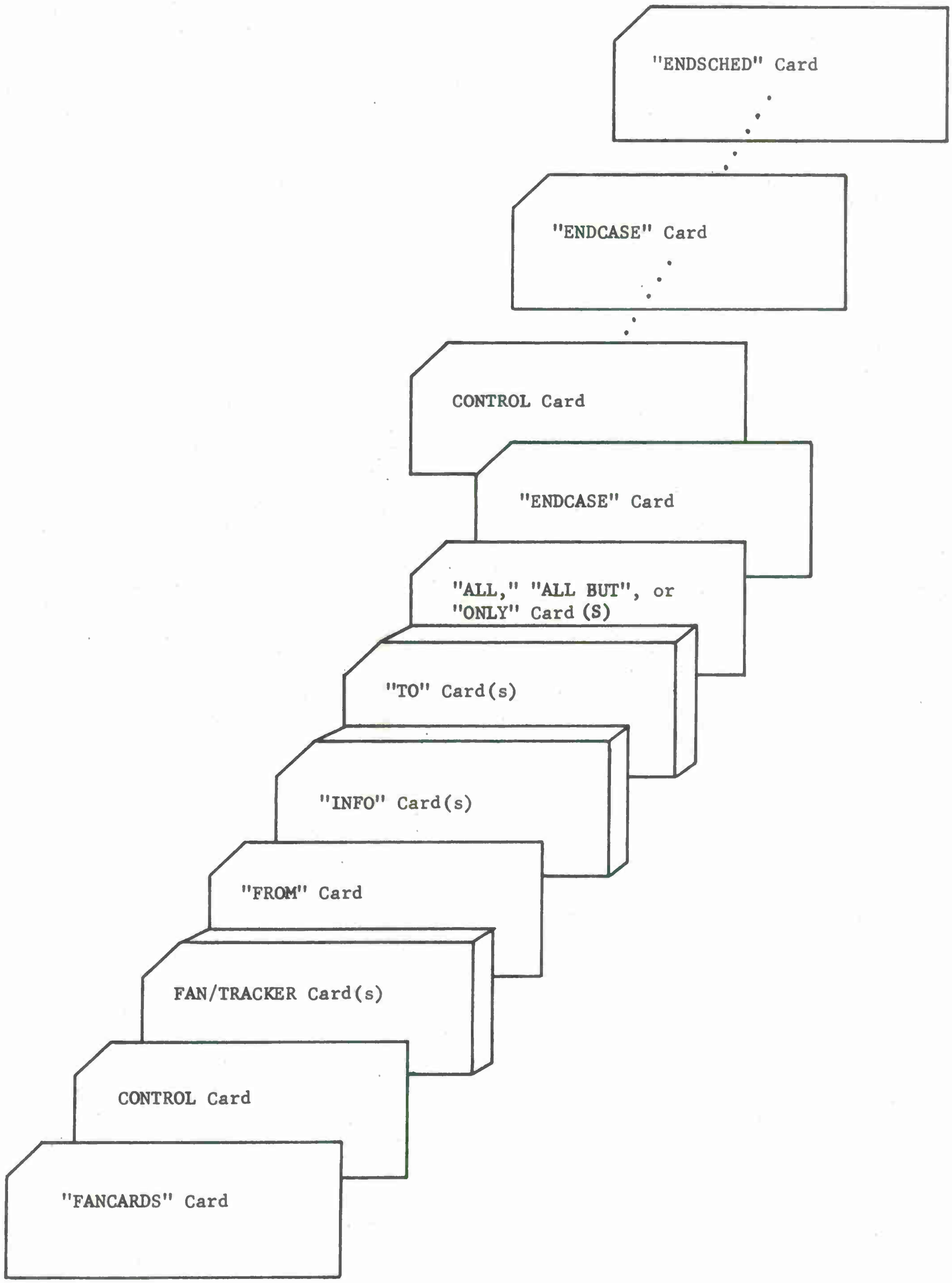


FIGURE 6. DECK SETUP FOR FAN TAPE - (LOGICAL 0)

Type	Description
3	FAN Card - used to specify data for fixed beam surveillance sensors. As many as two fixed beams or fans may be specified on one card. A maximum of fifteen cards, specifying no more than 30 beams can be used. See Figure II-3.
	TRACKER Card - used to specify data for a sensor with tracking capability. This card, one per sensor, must have a " Δ-99.0" punched in the first field. Any number 2 thru 8 points may be specified per satellite pass. If 9 is indicated-points are spaced Δt apart. See Figure II-4.
4,5,6	The FROM card indicates the address of the sending agency. There is one of these cards per case. The first TO card shows the address of the sensor to which the teletype message will be sent. This station has primary interest and maintains control over the message received. Other stations or persons may also be sent this message. They are indicated on a TO card if they have a secondary interest in the message. If the message is sent for information only then an INFO card is used. The total of INFO and TO cards cannot exceed nine per case. Columns 1-64 of the Address card are positioned on the DE line of the output, while those for the TO and INFO cards are positioned on the preceding line of the message in the format required by the automatic routing equipment. See Figure II-5.

Type	Description
7	Specifies the satellites to be used. The ALL card indicates all satellites are to be used in the run. The ALL BUT card indicates all but the satellites specified in the variable field beginning in Column 9 are to be run. The ONLY card indicates only the ones specified in the variable field are to be run. The satellite numbers are specified by five digit numerics separated by commas. A range of satellites may also be specified. For example, assume satellites 00004, 00005, 00006, 00007, are to be run. This may be specified on an ONLY card in one of two ways: ONLY 00004, 00005, 00006, 00007, ONLY 00004 - 00007 Data can continue on subsequent cards, the data beginning in Column 1. See Figure II-6.
8,9	Both cards have 11-8-2 punch in Column 9 for END BLOCK Control and both are the same as those used on Schedule Tape jobs. END CASE - separates each group of Case Data Cards. ENDSCHED - the last card in the deck.

The required order of cards to be used for the FAN Input Data Tape is as follows:

TYPE	CONTENT
1	"FANCARDS" Card
2-7	Case Data Cards

Type	Content
8	END CASE Card
2-7	Case Data Cards
8	END CASE Card
.	.
.	.
.	.
9	ENDSCHED Card

The Case Data Cards are arranged in the following order:

TYPE	CONTENT	COMMENT
2	Control Card	One per case
3	Fan/Tracker Cards	One Tracker card and/or any number of fan cards the total not to exceed 30 fans.
4	"FROM" Card	One per case
5	"TO" Card	Up to nine per case with limitation that the sum of "TO" and "INFO" Cards cannot exceed nine.
6	Either "ALL", "ALL BUT" or "ONLY"	One per case; additional satellite specifiers can follow "ALL BUT" and "ONLY" Cards.

For schedule mode of operation the SCHEDULE TAPE (logical 2) is generated from punched cards in the same manner as the FAN TAPE is generated (see Figure 7). The cards are as follows:

ID Card
JOB Card
REM Card (optional)
SPS JOB Card
Parameter (Base-Time) Card
Data Cards (for options 1, 2, 3, 4, and 5 only) -
    Element, Sensor, etc.
ENDOFJOB Card

The ID, JOB, REM, ENDOFJOB, ENDSCHED and the END CASE Cards are described in Section 5.4 of reference 3.

The parameter (Base-Time) Card is depicted in Figure II-7

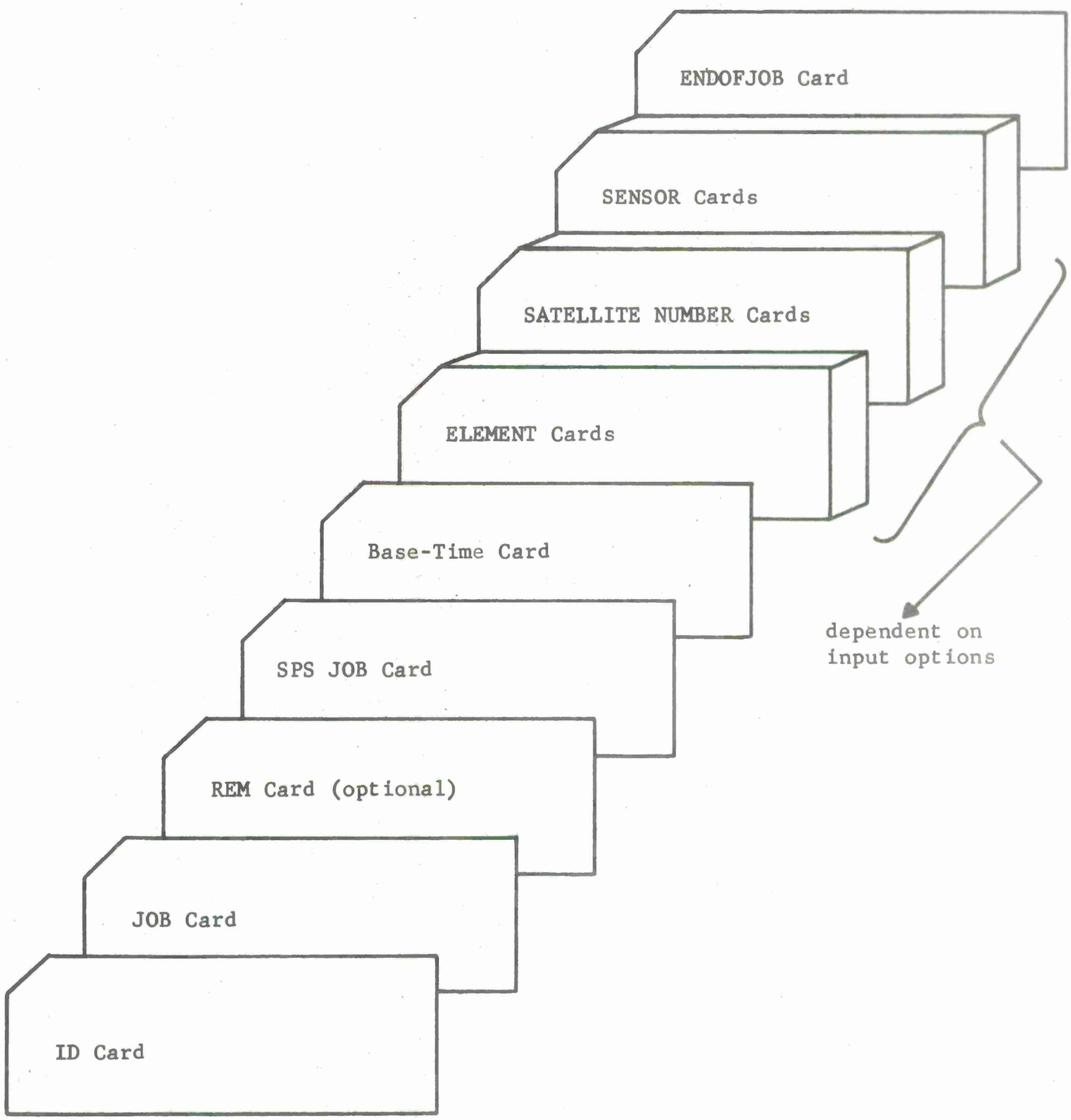


FIGURE 7. DECK SETUP FOR SCHEDULE TAPE - (LOGICAL 2)

4.4 INPUT OPTIONS

The program allows six input options while in the schedule tape mode of operation. The input option designates whether required data will come from the input tape or from standard system files.

TABLE I INPUT OPTIONS

	Tape 4 (SEAI)		Tape 2 (SCHEDULE)			
INPUT OPTION	E-FILE	S-FILE	PARAMETER CARDS	ELEMENT CARDS	SATELLITE NUMBER CARDS	SENSOR CARDS
0	*	*	Yes	No	No	No
1		*	Yes	Yes	No	No
2	*	*	Yes	No	Yes	No
3			Yes	Yes	No	Yes
4	*		Yes	No	Yes	Yes
5	*		Yes	No	No	Yes

*Use of these files is implied with this option.

Notes: (1) Parameter card - This card specifies the base day and base message number.

(2) E-File - This file on the SEAI tape contains the elements of all satellite orbits.

(3) S-File - File on the SEAI tape which contains the coordinates of all the sensors.

(4) Element Cards - Each set of six cards contains the elements of any given satellite orbit.

(5) Satellite Number Cards - These cards contain the numbers of satellites whose elements are to be obtained from the E-File.

(6) Sensor Cards - These cards contain the coordinates of any one sensor.

Descriptions of the cards and tape files mentioned above can be found in Sections 5.4 and 5.5 respectively, of reference 3.

A description of each option follows:

0 - The elements of those satellite orbits on the E-File which are specified on the ALL, ALLBUT or ONLY card will be used in calculations. The coordinates of the sensor specified on the Control Card will be obtained from the S-File.

1 - The elements introduced by the Element Cards will be used in calculations. All other operations are the same as option 0.

2 - Those elements specified on the Satellite Number Cards will be read from the E-File and used for calculations. All other operations are the same as option 0.

3 - Operations are similar to option 1 except that the sensor coordinates are obtained from the Sensor Card.

4 - Operations are similar to option 2 except that the sensor coordinates are obtained from the Sensor Card.

5 - The elements of those satellite orbits on the E-File which are specified on the ALL, ALLBUT or ONLY card will be used in calculations. The sensor coordinates are obtained from the Sensor Card.

4.5 OUTPUT

a. Options

(1) -0- Specifies the generation of the output on printed copy and teletype tape.

(2) -1- Output is produced on printed copy only. Note that the information on the printed copy and the teletype tape are in the same order; however, the direction cosine printout is optional on hard copy but is not available for the teletype tape. When run in manual mode, option 0 is automatically specified. In the schedule mode, column 18 of the SPSJOB card specifies the option (0 or 1).

b. Format

Figure 8 shows the general format of the output with heading information. FAN number is optional on both hard copy and teletype tape; also, when requested for a tracker, FAN number prints "T" and for point of maximum elevation "**". Every

```
SAT. SUMMARY FOR STA - XXX
NNNNN, . . . . . . . . .
DECAYING
NNNNN, . . . . . .
100 DAYS PAST EPOCH
NNNNN, . . . . . . .
SAT.NO./SET NO.
NNNNN/SSSS. . . .

ΔΔΔ
PP  SSS TTTT VVVV . . . . . . . . . (up to 9 addresses
DE  RRRR MMMM  C
CCCk
P DD/HHMMZ
FM  SENDING STATION ADDRESS
TO  STATION ADDRESS
INFO STATION ADDRESS
CLASSIFICATION (see below)     DDD  HHMM.FF
LOOK ANGLE SCHEDULE FOR   STATION ADDRESS
SAT  XXXX      TIME  ELEV  AZMTH  RANGE   R-RATE  FAN  DIRECTION COSINES
                                                  No.     U     V     W
    DAY  DDD  DD/MM/YY               (XX)
NNN   NNNNN  HHMM.FF  ±EE.E  AAA.A  RRRRR ±RR.R   NN  ±.UUU ±.VVV ±.WWW
 :      :      :        :      :      :     :      :    :     :     :
 :      :      :        :      :      :     :      :    :     :     :
NO MORE DATA
DD/HHMMZ  MMM    RRRRR
Classification Format
UNCLAS 1SPADATLAS
CONFIDENTIAL 1SPADATLAS
SECRET 1SPADATLAS
SECRETNOFORN 1SPADATLAS
SECRET RELEASABLE OUTSIDE SSO CHANNELS 1SPADATLAS
```

XXX = Station ID Number
NNNNN = Satellite Number
NNNNN = 000 if no Satellites qualify for these two categories
SSSS = Element Set Number
} Hard Copy Only

ΔΔΔ = TTY Heading for each message or after every 100 lines if TTY is requested with addressing
Priority and To and INFO Station Route Addresses
RRRRR = Sending Station Route Address; MMMM = Message Number; C = A or D
CCC = ZNR if unclassified
Current Time

Route Addresses may also be included

Current Time

XXXX = ELEM or REV
XX = KM or NM
Data Within Period
} Hard Copy and TTY output

Current Time; Month; Sending Station Route Address } TTY Wrapup

NOTES: Underlined quantities are of fixed format and are printed as shown.

This Format is subject to change without notice in order to comply with Military Network changes.

FIGURE 8 OBSERVING SCHEDULE PROGRAM OUTPUT FORMAT effort has been made to ensure that teletype headings conform with the procedure presently established for use within the military networks. The RANGE may print "0" kilometers - this indicates that the actual range was greater than 16,383 km. and could not be contained in the internal packed format.

c. Satellite Summary

The satellite summary output routine has been retained which lists the satellites being used and their corresponding element set numbers. This is printed on the hardcopy only. Special comments are printed if the predictions are more than one hundred days from epoch or if the satellite has reached decay conditions during the prediction.

d. Diagnostic Error Comments

The program may print any one of a number of diagnostic error comments some of which indicate an error in the input and others which indicate a malfunction of the program or the machine. They are nearly all self-explanatory and are intended to aid the user in the full utilization of the program. The comments which might appear are as follows:

(1) "CASE REJECTED - BASE TIME CARD MISSING OR IN ERROR". The entire job is rejected because of a faulty card or because the base time or message number was typed incorrectly.

(2) "CASE REJ-INP ERR - STA XXX" The current case only is rejected for one of the following stated reasons:

"ERROR ON ALL BUT OR ONLY CARDS".

"FAN PARAMETER (REQUEST) CARD MISSING (NO R IN COLUMN 79)."

"CHECK INPUT DATA FOR ILLEGAL CHARACTERS IN FIELDS."

"STA. NO. ON R AND F CARDS DIFFER."

"FAN CARDS MISSING (NO F IN COLUMN 79)."

"ADDRESS CARD MISSING"

"PRIORITY NOT PUNCHED IN PARAMETER (REQUEST) CARD."

"MORE THAN THIRTY RECORDS IN F TYPE CARDS"

"ALL, ALL BUT, OR ONLY CARDS MISSING"

"ROUTING DATA MISSING"

"TOO MANY ROUTE CARDS"

(3) "ERROR ON TRACKER CARD. CARD REJECTED" A tracker card is rejected for one of the following reasons:

"ONLY 1 TRACKER CARD ALLOWED"

"LIMITS ON BORESIGHT ANGLES WRONG"

"POINTS PER PASS WRONG"

"DELTA T IS ZERO"

"MAX, RANGE IS WRONG"

"MIN. ELEV. GREATER THAN 90"

(4) "ERROR IN FAN RECORD. RECORD REJECTED" A single fan record is rejected for one of the following reasons:

"FAN TYPE NOT H OR P"

"FAN ENDS TOO CLOSE TO COLINEAR"

"ELEVATION GREATER THAN 89 DEG"

"AZIMUTH LIMITS ARE EQUAL"

"MAX. RANGE IS WRONG"

(5) "SUBROUTINE ERROR FROM LOCATION XXXXX"

(6) "EXPONENT OVERFLOW FROM LOCATION XXXXX"

After printing either of the above two comments, the program continues processing at the next logical point.

4.6 PROGRAM NOTES

a. Case Bypass Option

Toggle 47 in the on position causes the program to type the sensor about to be processed and wait for a "STOP" or a "GO" type-in from the operator. A "STOP" will cause the case to be bypassed. A "GO" will cause the case to be run.

b. Point of Maximum Elevation

The point of maximum elevation is the first point calculated. If the range at the point of maximum elevation exceeds the maximum range of the tracker, the entire pass is rejected. If this point falls within the maximum range, the entire pass is retained.

c. Use of the ALL, ALL BUT, and ONLY cards.

One of these cards must be present in every set of Case Data Cards that is used to generate the Fan Input Data Tape. The content of this card is important only for input options of zero and five, because Element and Satellite Number Cards are not used. Therefore, it becomes necessary to specify which satellites are desired from the E-File.[1] This is accomplished by using an ALL, ALL BUT or ONLY card as described in Section 4.3a.

For input options 1, 2, 3 and 4, the Schedule Tape contains either Element or Satellite Number Cards to specify which satellites are to be used. Because this tape overrides the Fan Input Data Tape, any one of the ALL, ALL BUT or ONLY cards can be used since it will not be read. Therefore, whichever card is used may either be blank or contain satellite numbers.

1 Refer to Table 1 in Section 4.4

d. Use of the Satellite Summary

The information printed on the Satellite Summary is dependent on the input option. This information is particularly helpful when using input option zero. For this input, the summary lists only those satellites available on the E-File of all those requested on the ALL, ALL BUT or ONLY Cards.

However, for options 1, 2, 3, and 4 the summary prints out all the satellites on the Element or Satellite Number Cards.

e. Acquisition Buffer

Depending on the type of sensor, the acquisition buffer (Figure I-1) holds the respective constants for processing planar fans, horizontal fans, and trackers.

f. Operational Sequence

The B-3 system is initialized by depressing the "load" button on the console. This rewinds the system tape, reads the first block into core and executes a jump to cell 0.

EXECMOD1 and EXECMOD2 are then loaded into core and the tape on logical 4 is checked for proper I.D. "NEXT FUNCTION" is then typed on the console typewriter. The operator can respond to this comment in several ways. He may type "MANUAL", "EXEC", or "WRAPUP". "WRAPUP" will wrap up the output tape and rewind it in lock-out.

(1) Manual Mode

If the operator types "MANUAL" the system will request the program I.D. (OBSERV). After typing in the I.D. the system will execute the object program, which in turn will request the "BASE DAY" and "BASE MESSAGE NO." via the required input console typewriter. The operator must be certain that the data has been prestored onto a tape mounted on logical 0. Upon completion of the program, the system will again type "NEXT FUNCTION".

(2) Schedule Mode

If the operator types "EXEC" and toggle 24 is on, then the schedule tape mounted on logical unit 2 will be processed. A schedule tape program is requested by using an "SPSJOB" card. Such a request causes the system to load EXECMOD3 into core. EXECMOD3 then converts the input data and places it in the proper buffers. It then returns control to EXECMOD2 which loads the object program and executes it. When all the jobs on the schedule tape have been completed, the system again types "NEXT FUNCTION".

SECTION 5

PROGRAM TEST CASE

The test case included in this section illustrates many of the features of the modified program. The input data are shown in Figure 9 and the output in Figure 10.

The satellites which were used exhibit a wide variety of characteristics. Satellite 00001 has a period of approximately 20 hours and a small eccentricity; satellite 00002 has a very high eccentricity (0.7); and satellite 00003 a very low inclination (1.0^o). Satellite 00004 has a very small perigee height; satellite 00005 has a high drag; and satellites 00006 and 00007 have typical direct and retrograde orbits, respectively. The sensor used is located at 30^o north latitude and 90^o west longitude.

The acquisition model is a complex one consisting of a composite of each of the different types. It contains the following:

(1) A phased-array tracker configuration with the boresight oriented at an elevation of 45^o and azimuth of 180^o. The limits imposed are 1^o in elevation, 60^o in α and β, (alpha and beta are respectively, the compliments of the angles between the range vector and the primary and tertiary topocentric reference vectors) and 70^o in off-boresight angle.

(2) A horizontal fan at an elevation of 5° extending only within the tracker limits

(3) A series of five planar fans which form a crude "S" centered about the boresight vector. This figure ranges in azimuth from 140° to 220° and in elevation from 25° to 65°.

PLANAR FANS

Fan #	Beg. Elev.	Beg. Az	End. Elev.	End. Az
1	65°	140°	65°	220°
2	65°	220°	45°	220°
3	45°	140°	45°	220°
4	45°	140°	25°	140°
5	25°	140°	25°	220°

(4) The point of maximum elevation is also requested and is printed regardless of elevation or azimuth.

No range test is requested, nor is a visual only test or up-pass only. It is requested that the passes not be interlaced.

The output shows the acquisition data for all satellites except 00001 and 00003. Satellite 00001 has a large period and was not positioned correctly for acquisition during the period of interest. Satellite 00003 has too low an inclination for the sensor location.

The output data for satellite 00002 shows the advantage of using maximum elevation as opposed to closest approach. One may note from the range-rate values that frequently such a satellite does not have a closest approach point during a complete pass.

The pass which satellite 00007 makes on revolution 994 illustrates well the use of the composite acquisition model. Observe that it rises through the lower tracker boundary, penetrates the horizontal fan, passes through 3 segments of the "S" configuration, reaches maximum elevation, and finally leaves the tracker coverage at one of the "corners".

The pass which satellite 00006 makes on revolution 899 illustrates the program's ability to detect very short passes. (Note that the point of maximum elevation is not within the tracker coverage.) The period of time during which the satellite is within the tracker coverage is only .63 minutes.

```
                  JOB     OBSERV TEST CASE
                  REM     AS IN DOCUMENTATION
SPSJOB  OBSERV  30
    250           25                                                                BP
0333 300000   900000    300             OBSERV TEST SENSOR                          S
1 00001 U     10               0000  166.8     100 4250           000000  0         10E
2 00001 38644.00000000  30.0000 254.9999  59.9999 .0009999   9.9999                 10E
3 00001  1.19841762  .000000000  -.02001   .03912  0000000                          10E
4 00001  0000000000                                                                 10E
5 00001  5.86986988  000000000  000000000                                           10E
6 00001 12015844+4  0000000    31023    200 100 5021921                             10E
1 00002 U     20               0000 0 41.1     200 4245           000000  0         20E
2 00002 38639.00000000 334.9999  40.0000  44.9999 .6999999  40.0000                 20E
3 00002  2.42731506  .000000001  -.31076   .39231 -23567-9                          20E
4 00002  0000000000                                                                 20E
5 00002  3.66666663 -2880464-8  282854-17                                           20E
6 00002 59324807+3 -09999-9       642     200 100 41012 4                           20E
1 00003 U     30               0000 0  6.1     300 4240           000000  0         30E
2 00003 38634.00000000 354.9999  30.0000  35.0000 .0009999    .9999                 30E
3 00003 16.26752414  .000004304 -8.94240 17.88071 -35249-6                          30E
4 00003  0000000000                                                                 30E
5 00003  1.03103103 -3637922-6 -734870-11                                           30E
6 00003 88519923+2 -09999-8       191     300 100 40902 3                           30E
1 00004 U     40 58  ALP   1 0000 0  6.3     400 4235           000000  0           40E
2 00004 38629.00000000 354.9999  30.0000  35.0000 .0009999  40.0000                 40E
3 00004 15.81261142  .000003953 -6.40843  8.09006 -33305-6                          40E
4 00004  0000000000                                                                 40E
5 00004  1.05105104 -3504045-6 -379921-11                                           40E
6 00004 91066551+2 -09999-8       321     400 100 40828 7                           40E
1 00005 U     50 58  BET   2 0000 0  6.5     500 4245           000000  0           50E
2 00005 38639.00000000 325.0000  59.9999 134.9999 .0009999  30.0000                 50E
3 00005 15.15600388  .001740700 -6.56358 10.42109 -15298-3                          50E
4 00005  0000000000                                                                 50E
5 00005  1.08108107 -1655527-3 -5019476-6                                           50E
6 00005 95011852+2 -50000-6       512     500 100 4090714                           50E
1 00006 U     60               0000 0  6.9     600 4230           000000  0         60E
2 00006 38624.00000000 245.0000  74.9999 269.9999 .0200000  79.9999                 60E
3 00006 14.33633205  .000147327 -1.15575 -2.82611 -13427-4                          60E
4 00006  0000000000                                                                 60E
5 00006  1.12244899 -1537982-4 -2945666-8                                           60E
6 00006 10044410+3 -50000-7       658     600 100 4082323                           60E
1 00007 U     70               0000 0  6.9     700 4230           000000  0         70E
2 00007 38624.00000000 245.0000  74.9999 269.9999 .0200000  99.9999                 70E
3 00007 14.33633205  .000147327  1.15575 -2.82611 -13427-4                          70E
4 00007  0000000000                                                                 70E
5 00007  1.12244899 -1537982-4 -2945666-8                                           70E
6 00007 10044410+3 -50000-7       658     700 100 4082323                           70E
ENDOFJOBR
ENDSCHEDR
```

FIGURE 9 Input Data for Test Case (1 of 2)

```
FANCARDSP
 333      0.0      1.0          .08196411 ORR 0 0 1 0 1        1     45       180 0        RP
 -99.0                  1.09 1         2.0 .8662 .8662  70.0                          333   FP
   5.0 120.0                  240.0          HH                                             FP
  65.0 140.0            65.0 220.0          1P   65.0 220.0           45.0 220.0           2PFP
  45.0 140.0            45.0 220.0          3P   45.0 140.0           25.0 140.0           4PFP
  25.0 140.0            25.0 220.0          5P                                              FP
AERONUTRONIC DIV.  PHILCO CORP.                                            PHILCO  FROM333A
SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC                            496LSPO TO  333A
FIRST AEROSPACE CONTROL SQUADRON  ADC                                      ONEAERO INFO333A
ONLY     00001-00007
END CASER
ENDSCHEDR
```

FIGURE 9 (2 of 2)

```
BEGIN SCHED. TAPE
                  JOB       OBSERV TEST CASE
                  REM       AS IN DOCUMENTATION
SPSJOB  OBSERV   30

                                                        START    OBSERV
                                                        01-04-04-04.0

AERONUTRONIC DIV.  PHILCO CORP.                         PHILCO  FROM333A
SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC         496LSPO TO   333A
FIRST AEROSPACE CONTROL SQUADRON  ADC                   ONEAERO INFO333A

SAT. SUMMARY FOR STA-333

00001-00007

DECAYING

00000

100 DAYS PAST EPOCH

00000

SAT.NO./SET NO.

00001/0010  00002/0020  00003/0030  00004/0040  00005/0050  00006/0060  00007/0070


     *0
RR 496LSPO ONEAERO      *0
DE PHILCO 25H 04/0408Z *0
ZNR*
R 040408Z ZEX   *0
FM AERONUTRONIC DIV.  PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON  ADC
AFGRNO*
BT
```

FIGURE 10 Output Data for Test Case (1 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	212	0030.31	21.1	248.2	0	3.2	T	.010	.866	.500
00002	212	0031.48	21.2	247.7	0	3.1	T	.006	.863	.506
00002	212	0033.48	21.3	246.9	0	3.1	T	-.002	.857	.515
00002	212	0035.48	21.4	246.0	0	3.1	T	-.010	.851	.526
00002	212	0037.48	21.5	245.3	0	3.1	T	-.016	.845	.534
00002	212	0039.48	21.5	244.5	0	3.0	T	-.024	.840	.542
00002	212	0041.48	21.6	243.8	0	3.0	T	-.030	.834	.551
00002	212	0042.03	21.6	243.6	0	3.0	**	-.032	.833	.553
00002	212	0043.48	21.6	243.2	0	3.0	T	-.036	.830	.557
00002	212	0045.48	21.5	242.5	0	2.9	T	-.045	.825	.563
00002	212	0047.48	21.5	241.9	0	2.9	T	-.051	.821	.569
00002	212	0049.48	21.4	241.4	0	2.9	T	-.057	.817	.573
00002	212	0051.48	21.4	240.8	0	2.8	T	-.063	.813	.579
00002	212	0053.48	21.3	240.3	0	2.8	T	-.070	.809	.583
00002	212	0055.48	21.2	239.8	0	2.8	T	-.076	.806	.587
00002	212	0057.48	21.1	239.4	0	2.7	T	-.081	.803	.590
00002	212	0059.48	20.9	238.9	0	2.7	T	-.089	.800	.593
00002	212	0101.48	20.8	238.5	0	2.7	T	-.094	.797	.596
00002	212	0103.48	20.7	238.1	0	2.6	T	-.100	.794	.599
00002	212	0105.48	20.5	237.8	0	2.6	T	-.105	.793	.601
00002	212	0107.48	20.4	237.4	0	2.6	T	-.111	.790	.604
00002	212	0109.48	20.2	237.1	0	2.5	T	-.116	.788	.605
00002	212	0111.48	20.0	236.8	0	2.5	T	-.122	.786	.606
00002	212	0113.48	19.9	236.4	0	2.5	T	-.127	.783	.609
00002	212	0115.48	19.7	236.2	0	2.4	T	-.132	.782	.609
00002	212	0117.48	19.5	235.9	0	2.4	T	-.138	.781	.610
00002	212	0119.48	19.3	235.6	0	2.4	T	-.143	.779	.611
00002	212	0121.48	19.1	235.4	0	2.4	T	-.148	.778	.611
00002	212	0123.48	18.9	235.1	0	2.3	T	-.154	.776	.612
00002	212	0125.48	18.7	234.9	0	2.3	T	-.158	.775	.612
00002	212	0127.48	18.5	234.7	0	2.3	T	-.163	.774	.612
00002	212	0129.48	18.3	234.5	0	2.2	T	-.168	.773	.612
00002	212	0131.48	18.1	234.3	0	2.2	T	-.172	.772	.612
00002	212	0133.48	17.9	234.1	0	2.2	T	-.177	.771	.612
00002	212	0135.48	17.7	234.0	0	2.1	T	-.181	.771	.611
00002	212	0137.48	17.4	233.8	0	2.1	T	-.187	.770	.610
00002	212	0139.48	17.2	233.6	0	2.1	T	-.192	.769	.610
00002	212	0141.48	17.0	233.5	0	2.1	T	-.195	.769	.609
00002	212	0143.48	16.8	233.3	0	2.0	T	-.200	.768	.609
00002	212	0145.48	16.5	233.2	0	2.0	T	-.205	.768	.607
00002	212	0147.48	16.3	233.1	0	2.0	T	-.209	.768	.606
00002	212	0149.48	16.1	233.0	0	1.9	T	-.213	.767	.605
00002	212	0151.48	15.9	232.9	0	1.9	T	-.217	.767	.604
00002	212	0153.48	15.6	232.8	0	1.9	T	-.222	.767	.602
00002	212	0155.48	15.4	232.7	0	1.9	T	-.225	.767	.601
00002	212	0157.48	15.1	232.6	0	1.8	T	-.230	.767	.599
00002	212	0159.48	14.9	232.5	0	1.8	T	-.234	.767	.598
00002	212	0201.48	14.7	232.4	0	1.8	T	-.238	.766	.597
00002	212	0203.48	14.4	232.3	0	1.8	T	-.243	.766	.595

FIGURE 10 (2 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY 250		06/09/64			(KM)		NO.	U	V	W
00002	212	0205.48	14.2	232.2	0	1.7	T	-.247	.766	.594
00002	212	0207.48	13.9	232.2	0	1.7	T	-.251	.767	.591
00002	212	0209.48	13.7	232.1	0	1.7	T	-.255	.767	.589
00002	212	0211.48	13.5	232.0	0	1.6	T	-.258	.766	.588
00002	212	0213.48	13.2	232.0	0	1.6	T	-.262	.767	.585
00002	212	0215.48	13.0	231.9	0	1.6	T	-.266	.767	.584
00002	212	0217.48	12.7	231.9	0	1.6	T	-.270	.768	.581
00002	212	0219.48	12.5	231.8	0	1.5	T	-.274	.767	.580
00002	212	0221.48	12.2	231.8	0	1.5	T	-.278	.768	.577
00002	212	0223.48	12.0	231.7	0	1.5	T	-.282	.768	.576
00002	212	0225.48	11.7	231.7	0	1.5	T	-.286	.768	.573
00002	212	0227.48	11.5	231.7	0	1.4	T	-.288	.769	.570
00002	212	0229.48	11.3	231.6	0	1.4	T	-.292	.769	.569
00002	212	0231.48	11.0	231.6	0	1.4	T	-.296	.769	.566
00002	212	0233.48	10.8	231.6	0	1.4	T	-.299	.770	.564
00002	212	0235.48	10.5	231.5	0	1.3	T	-.304	.770	.562
00002	212	0237.48	10.3	231.5	0	1.3	T	-.307	.770	.560
00002	212	0239.48	10.0	231.5	0	1.3	T	-.311	.771	.556
00002	212	0241.48	9.8	231.5	0	1.3	T	-.313	.771	.554
00002	212	0243.48	9.5	231.5	0	1.3	T	-.317	.772	.551
00002	212	0245.48	9.3	231.5	0	1.2	T	-.320	.772	.549
00002	212	0247.48	9.0	231.4	0	1.2	T	-.325	.772	.546
00002	212	0249.48	8.8	231.4	0	1.2	T	-.328	.772	.544
00002	212	0251.48	8.5	231.4	0	1.2	T	-.332	.773	.541
00002	212	0253.48	8.3	231.4	0	1.1	T	-.334	.773	.539
00002	212	0255.48	8.0	231.4	0	1.1	T	-.338	.774	.535
00002	212	0257.48	7.8	231.4	0	1.1	T	-.341	.774	.533
00002	212	0259.48	7.5	231.4	0	1.1	T	-.345	.775	.530
00002	212	0301.48	7.3	231.4	0	1.0	T	-.348	.775	.527
00002	212	0303.48	7.0	231.4	0	1.0	T	-.352	.776	.524
00002	212	0305.48	6.8	231.4	0	1.0	T	-.354	.776	.522
00002	212	0307.48	6.5	231.4	0	1.0	T	-.358	.776	.518
00002	212	0309.48	6.3	231.4	0	1.0	T	-.361	.777	.516
00002	212	0311.48	6.0	231.4	0	.9	T	-.365	.777	.513
00002	212	0313.48	5.8	231.4	0	.9	T	-.367	.778	.510
00002	212	0315.48	5.5	231.4	0	.9	T	-.371	.778	.507
00002	212	0317.48	5.3	231.4	0	.9	T	-.374	.778	.505
00002	212	0319.48	5.0	231.4	0	.8	T	-.378	.779	.501
00002	212	0320.16	5.0	231.4	0	.8	W	-.378	.779	.501
00002	212	0321.48	4.8	231.4	0	.8	T	-.380	.779	.499
00002	212	0323.48	4.5	231.4	0	.8	T	-.384	.779	.495
00002	212	0325.48	4.3	231.4	0	.8	T	-.387	.779	.493
00002	212	0327.48	4.1	231.4	0	.7	T	-.389	.780	.491
00002	212	0329.48	3.8	231.4	0	.7	T	-.393	.780	.487
00002	212	0331.48	3.6	231.4	0	.7	T	-.396	.780	.485

BT

FIGURE 10 (3 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 26H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION	COSINES	
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	212	0333.48	3.3	231.4	0	.7	T	-.400	.780	.481
00002	212	0335.48	3.1	231.4	0	.7	T	-.402	.780	.479
00002	212	0337.48	2.8	231.4	0	.6	T	-.406	.781	.475
00002	212	0339.48	2.6	231.4	0	.6	T	-.409	.781	.473
00002	212	0341.48	2.3	231.5	0	.6	T	-.411	.782	.468
00002	212	0343.48	2.1	231.5	0	.6	T	-.414	.782	.466
00002	212	0345.48	1.8	231.5	0	.6	T	-.418	.782	.462
00002	212	0347.48	1.6	231.5	0	.5	T	-.420	.782	.460
00002	212	0349.48	1.4	231.5	0	.5	T	-.423	.782	.457
00002	212	0351.48	1.1	231.5	0	.5	T	-.427	.782	.454
00002	212	0352.66	1.0	231.5	0	.5	T	-.428	.782	.452
00007	987	0037.00	11.2	93.4	2091	-.3	**	.096	-.979	.178
00007	987	0039.07	8.8	118.8	2232	2.5	T	-.228	-.866	.445
00007	987	0040.51	5.1	133.0	2512	3.9	T	-.417	-.728	.543
00007	987	0040.56	5.0	133.4	2522	3.9	H	-.422	-.724	.546
00007	987	0041.96	1.0	143.8	2894	4.8	T	-.558	-.591	.583
00007	988	0216.22	51.1	298.0	897	-.9	T	.759	.554	.342
00007	988	0216.43	51.5	288.2	890	-.2	**	.691	.591	.416
00007	988	0217.52	42.2	245.9	998	3.3	T	.261	.676	.689
00007	988	0219.52	19.5	218.9	1593	6.0	T	-.283	.592	.755
00007	988	0221.52	6.7	210.9	2360	6.6	T	-.520	.510	.685
00007	988	0221.88	5.0	210.0	2505	6.7	H	-.548	.498	.672
00007	988	0222.82	1.0	208.2	2884	6.8	T	-.611	.472	.635
00004	639	0342.48	1.0	187.1	1963	-5.1	T	-.689	.124	.714
00004	639	0342.70	1.6	185.1	1897	-4.9	T	-.684	.089	.724
00004	639	0343.88	5.0	171.5	1588	-3.6	H	-.635	-.147	.758
00004	639	0344.70	7.0	159.2	1440	-2.3	T	-.570	-.352	.742
00004	639	0345.80	8.1	139.4	1362	.0	**	-.432	-.644	.631
00004	639	0346.70	7.3	123.0	1416	1.9	T	-.292	-.832	.472
00004	639	0346.92	6.9	119.3	1444	2.4	T	-.259	-.866	.428
00007	989	0354.18	2.2	304.0	2929	-.3	**	.422	.828	-.368
00004	640	0516.56	1.0	240.0	1967	-7.0	T	-.341	.866	.366
00004	640	0517.11	3.3	240.0	1736	-7.0	T	-.312	.865	.394
00004	640	0519.11	17.4	240.3	911	-6.6	T	-.123	.829	.546
00004	640	0521.01	84.0	243.0	331	-.7	**	.670	.093	.737
00004	640	0521.11	88.3	51.2	329	.2	T	.720	-.023	.694
00004	640	0521.66	52.1	60.2	411	4.3	T	.774	-.533	.342
00004	641	0656.99	16.6	344.9	940	-.0	**	.856	.250	-.452
00004	642	0833.35	10.7	1.4	1199	-.0	**	.826	-.024	-.563

FIGURE 10 (4 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	213	0851.93	1.0	197.8	8065	-6.2	T	-.661	.306	.685
00002	213	0852.10	1.1	197.6	8000	-6.2	T	-.660	.302	.687
00002	213	0854.10	2.5	194.3	7248	-6.3	T	-.654	.247	.715
00002	213	0856.10	3.9	190.2	6489	-6.3	T	-.646	.177	.742
00002	213	0857.55	5.0	186.6	5941	-6.3	H	-.638	.115	.761
00002	213	0858.10	5.4	185.0	5735	-6.2	T	-.635	.087	.768
00002	213	0900.10	6.7	178.1	5002	-5.9	T	-.619	-.033	.784
00002	213	0902.10	7.6	168.9	4322	-5.3	T	-.594	-.191	.781
00002	213	0903.33	7.9	161.6	3952	-4.7	**	-.567	-.313	.762
00002	213	0904.10	7.8	156.4	3749	-4.1	T	-.546	-.397	.738
00002	213	0906.10	6.2	140.2	3365	-2.1	T	-.464	-.636	.616
00002	213	0906.93	5.0	132.6	3284	-1.1	H	-.415	-.733	.538
00002	213	0908.10	2.5	121.6	3262	.5	T	-.339	-.851	.401
00002	213	0908.27	2.1	119.9	3269	.7	T	-.326	-.866	.378
00006	892	0957.33	1.0	164.7	3389	-6.0	T	-.670	-.264	.694
00006	892	0957.40	1.3	164.5	3363	-6.0	T	-.665	-.267	.697
00006	892	0958.42	5.0	161.7	3001	-5.8	H	-.607	-.313	.730
00006	892	0959.40	9.0	158.2	2663	-5.6	T	-.538	-.367	.759
00006	892	1001.40	18.9	147.1	2027	-4.8	T	-.333	-.514	.791
00006	892	1003.40	30.9	124.6	1551	-2.8	T	.019	-.706	.708
00006	892	1005.03	36.3	92.6	1407	.0	**	.393	-.805	.444
00006	892	1005.40	35.9	84.4	1416	.7	T	.471	-.806	.359
00006	892	1005.48	35.8	82.9	1419	.9	T	.485	-.805	.343
00004	643	1009.67	19.6	17.8	828	-.0	**	.871	-.288	-.397
00005	582	1045.95	1.0	213.7	2496	-5.7	T	-.576	.555	.601
00005	582	1047.14	5.0	206.5	2104	-5.2	H	-.569	.444	.692
00005	582	1047.58	6.6	203.1	1969	-5.0	T	-.565	.390	.727
00005	582	1049.58	14.0	179.8	1482	-2.8	T	-.515	-.003	.857
00005	582	1051.07	16.7	153.5	1351	.0	**	-.403	-.427	.809
00005	582	1051.58	16.4	143.7	1368	1.1	T	-.347	-.568	.746
00005	582	1053.22	11.7	117.8	1616	3.8	T	-.180	-.866	.466
00006	893	1139.13	1.0	220.2	3405	-5.5	T	-.528	.645	.552
00006	893	1139.24	1.3	220.6	3370	-5.5	T	-.521	.651	.553
00006	893	1140.34	5.0	225.0	3011	-5.3	H	-.436	.704	.560
00006	893	1141.24	8.2	229.4	2733	-5.0	T	-.355	.751	.556
00006	893	1143.24	16.1	243.6	2190	-3.9	T	-.106	.861	.498
00006	893	1143.34	16.5	244.6	2165	-3.8	T	-.090	.866	.492
00006	893	1146.49	25.0	285.5	1762	-.0	**	.470	.873	.128
00004	644	1144.51	33.2	274.3	558	-5.2	T	.432	.834	.343
00004	644	1145.19	52.3	240.4	400	-2.1	T	.346	.532	.773
00004	644	1145.38	55.7	220.1	384	-.6	2	.279	.363	.889
00004	644	1145.47	55.9	210.1	383	.1	**	.243	.281	.928
00004	644	1145.71	52.5	183.8	399	2.0	3	.131	.040	.990
00004	644	1146.74	25.8	142.6	672	5.9	5	-.198	-.547	.814
00004	644	1147.19	19.0	137.6	839	6.4	T	-.264	-.638	.724
00004	644	1148.97	5.0	129.9	1560	6.9	H	-.390	-.764	.513
00004	644	1149.19	3.9	129.4	1649	6.9	T	-.400	-.771	.496
00004	644	1149.86	1.0	128.4	1931	7.0	T	-.427	-.784	.451
00007	993	1147.56	15.9	63.6	2209	.0	**	.496	-.861	-.109

FIGURE 10 (5 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00005	583	1227.26	9.5	241.4	1759	-6.4	T	-.217	.866	.451
00005	583	1228.14	15.2	238.0	1427	-6.1	T	-.176	.818	.547
00005	583	1230.14	38.6	214.6	779	-4.0	T	-.014	.444	.896
00005	583	1231.15	52.0	168.9	636	-.3	3	.130	-.119	.984
00005	583	1231.22	52.1	164.5	635	-.0	**	.139	-.164	.977
00005	583	1232.14	41.5	119.2	740	3.5	T	.210	-.654	.727

BT

FIGURE 10 (6 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 27H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRMC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION	COSINES	
DAY	250	06/09/64			(KM)		NO.	U	V	W
00005	583	1233.02	27.9	101.3	979	5.2	T	.208	-.867	.453
00007	994	1318.05	1.0	173.1	3391	-6.4	T	-.690	-.120	.714
00007	994	1318.52	2.7	173.7	3211	-6.4	T	-.669	-.110	.735
00007	994	1319.08	5.0	174.4	2993	-6.4	W	-.639	-.097	.763
00007	994	1320.52	11.8	176.8	2451	-6.2	T	-.546	-.055	.836
00007	994	1322.52	25.4	183.1	1736	-5.6	T	-.335	.049	.941
00007	994	1323.13	31.2	186.6	1539	-5.2	5	-.235	.098	.967
00007	994	1324.52	48.6	202.8	1170	-3.4	T	.099	.256	.961
00007	994	1324.60	49.9	204.6	1153	-3.3	3	.127	.268	.955
00007	994	1325.15	57.6	219.9	1064	-2.1	2	.306	.344	.888
00007	994	1325.90	63.3	255.6	1015	-.0	**	.553	.435	.711
00007	994	1326.52	59.8	287.0	1045	1.6	T	.715	.481	.507
00007	994	1326.99	53.7	303.1	1107	2.7	T	.798	.496	.341
00004	645	1319.45	3.4	240.2	1702	-2.1	T	-.309	.866	.393
00004	645	1320.63	4.2	222.3	1623	-.0	**	-.470	.671	.573
00004	645	1321.27	4.0	212.4	1645	1.1	T	-.546	.534	.645
00004	646	1323.09	1.0	188.2	1929	3.8	T	-.687	.143	.712
00005	584	1409.81	29.9	267.9	934	-5.7	T	.330	.866	.375
00005	584	1411.63	87.1	286.6	514	-.3	T	.716	.048	.696
00005	584	1411.71	88.6	43.8	513	.1	**	.719	-.017	.694
00005	584	1413.46	31.8	87.1	894	5.6	T	.403	-.849	.342
00007	995	1505.63	4.2	269.2	3109	.0	**	.042	.997	.062
00005	585	1550.38	29.9	268.0	932	-5.6	T	.331	.866	.374
00005	585	1550.52	32.1	267.0	887	-5.5	T	.344	.846	.407
00005	585	1552.21	70.6	191.0	541	-.0	**	.436	.063	.898
00005	585	1552.28	70.4	181.7	541	.3	1	.429	.010	.903
00005	585	1552.52	66.4	155.0	555	1.5	T	.391	-.169	.905
00005	585	1554.52	23.5	111.4	1096	6.0	T	.045	-.854	.519
00005	585	1554.65	22.0	110.9	1145	6.1	T	.031	-.866	.499
00005	586	1730.54	17.8	245.5	1302	-4.3	T	-.063	.866	.495
00005	586	1732.27	26.0	208.8	1024	-.6	T	-.247	.433	.867
00005	586	1732.49	26.2	202.8	1020	-.0	**	-.273	.348	.897
00005	586	1734.27	18.9	162.9	1257	4.0	T	-.410	-.278	.868
00005	586	1736.27	7.9	142.0	1863	5.7	T	-.455	-.610	.649
00005	586	1736.94	5.0	138.0	2101	6.0	W	-.462	-.667	.585
00005	586	1738.00	1.0	133.5	2487	6.2	T	-.474	-.725	.499
00005	587	1909.89	2.8	240.2	2308	-3.0	T	-.316	.867	.386
00005	587	1910.88	4.4	230.0	2156	-2.0	T	-.399	.764	.507
00005	587	1911.46	5.0	223.5	2099	-1.3	W	-.449	.686	.573

FIGURE 10 (7 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY 250		06/09/64			(KM)		NO.	U	V	W
00005	587	1912.39	5.5	212.4	2059	-.1	**	-.527	.533	.662
00005	587	1912.88	5.4	206.5	2067	.6	T	-.563	.444	.697
00005	587	1913.49	5.0	199.4	2102	1.3	W	-.603	.331	.726
00005	587	1914.88	3.0	184.5	2284	2.9	T	-.667	.078	.741
00005	587	1915.87	1.0	175.7	2484	3.8	T	-.693	-.075	.717
00002	214	1926.27	43.9	286.9	4394	.6	T	.638	.689	.342
00002	214	1926.49	45.1	286.3	4404	.8	T	.641	.677	.361
00002	214	1928.49	55.5	280.3	4566	1.9	T	.654	.557	.511
00002	214	1930.49	64.2	271.2	4844	2.7	T	.643	.435	.630
00002	214	1932.49	70.8	257.3	5210	3.3	T	.617	.321	.719
00002	214	1934.49	74.8	237.2	5640	3.8	T	.582	.220	.783
00002	214	1936.47	76.0	214.1	6107	4.1	**	.544	.136	.828
00002	214	1936.49	76.0	213.9	6112	4.1	T	.544	.135	.828
00002	214	1938.49	75.1	194.0	6613	4.2	T	.507	.062	.860
00002	214	1940.49	73.0	180.2	7131	4.4	T	.469	.001	.883
00002	214	1942.49	70.7	171.2	7659	4.4	T	.436	-.051	.898
00002	214	1943.03	70.0	169.4	7803	4.4	1	.427	-.063	.902
00002	214	1944.49	68.3	165.3	8192	4.4	T	.404	-.094	.910
00002	214	1946.49	66.1	161.2	8724	4.4	T	.375	-.131	.918
00002	214	1948.49	64.0	158.3	9255	4.4	T	.348	-.162	.924
00002	214	1950.49	62.1	156.1	9782	4.4	T	.322	-.190	.927
00002	214	1952.49	60.4	154.5	10303	4.3	T	.300	-.213	.930
00002	214	1954.49	58.8	153.3	10818	4.3	T	.278	-.233	.932
00002	214	1956.49	57.3	152.4	11326	4.2	T	.257	-.250	.934
00002	214	1958.49	56.0	151.6	11827	4.1	T	.238	-.266	.934
00002	214	2000.49	54.8	151.1	12321	4.1	T	.221	-.279	.935
00002	214	2002.49	53.6	150.7	12806	4.0	T	.203	-.290	.935
00002	214	2004.49	52.6	150.3	13284	3.9	T	.189	-.301	.935
00002	214	2006.49	51.6	150.1	13754	3.9	T	.173	-.310	.935
00002	214	2008.49	50.6	149.9	14216	3.8	T	.158	-.318	.935
00002	214	2010.49	49.8	149.8	14671	3.7	T	.146	-.325	.935
00002	214	2012.49	49.0	149.8	15118	3.7	T	.133	-.330	.935
00002	214	2013.97	48.4	149.7	15443	3.6	3	.123	-.335	.934
00002	214	2014.49	48.2	149.7	15557	3.6	T	.120	-.336	.934
00002	214	2016.49	47.5	149.8	15989	3.6	T	.108	-.340	.934
00002	214	2018.49	46.8	149.8	0	3.5	T	.097	-.344	.934
00002	214	2020.49	46.2	149.9	0	3.4	T	.087	-.347	.934
00002	214	2022.49	45.6	150.0	0	3.4	T	.077	-.350	.934
00002	214	2024.49	45.0	150.1	0	3.3	T	.067	-.352	.933
00002	214	2026.49	44.5	150.2	0	3.3	T	.058	-.354	.933
00002	214	2028.49	44.0	150.4	0	3.2	T	.049	-.355	.933
00002	214	2030.49	43.5	150.5	0	3.2	T	.040	-.357	.933
00002	214	2032.49	43.0	150.7	0	3.1	T	.031	-.358	.933
00002	214	2034.49	42.5	150.9	0	3.1	T	.022	-.359	.933
00002	214	2036.49	42.1	151.1	0	3.0	T	.015	-.359	.933
00002	214	2038.49	41.7	151.3	0	3.0	T	.007	-.359	.933
00002	214	2040.49	41.3	151.5	0	2.9	T	.000	-.358	.934
00002	214	2042.49	40.9	151.8	0	2.9	T	-.008	-.357	.934
00002	214	2044.49	40.6	152.0	0	2.8	T	-.014	-.356	.934

FIGURE 10 (8 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	214	2046.49	40.2	152.2	0	2.8	T	-.021	-.356	.934
00002	214	2048.49	39.9	152.5	0	2.7	T	-.028	-.354	.935
00002	214	2050.49	39.6	152.7	0	2.7	T	-.033	-.353	.935
00002	214	2052.49	39.2	153.0	0	2.6	T	-.041	-.352	.935
00002	214	2054.49	38.9	153.2	0	2.6	T	-.047	-.351	.935
00002	214	2056.49	38.6	153.5	0	2.6	T	-.053	-.349	.936

BT

FIGURE 10 (9 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 28H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	214	2058.49	38.4	153.7	0	2.5	T	-.058	-.347	.936
00002	214	2100.49	38.1	154.0	0	2.5	T	-.064	-.345	.936
00002	214	2102.49	37.8	154.3	0	2.4	T	-.070	-.343	.937
00002	214	2104.49	37.6	154.6	0	2.4	T	-.075	-.340	.938
00002	214	2106.49	37.3	154.8	0	2.4	T	-.080	-.339	.937
00002	214	2108.49	37.1	155.1	0	2.3	T	-.085	-.336	.938
00002	214	2110.49	36.8	155.4	0	2.3	T	-.091	-.333	.938
00002	214	2112.49	36.6	155.7	0	2.3	T	-.096	-.330	.939
00002	214	2114.49	36.4	155.9	0	2.2	T	-.100	-.329	.939
00002	214	2116.49	36.1	156.2	0	2.2	T	-.106	-.326	.939
00002	214	2118.49	35.9	156.5	0	2.1	T	-.111	-.323	.940
00002	214	2120.49	35.7	156.8	0	2.1	T	-.115	-.320	.940
00002	214	2122.49	35.5	157.1	0	2.1	T	-.120	-.317	.941
00002	214	2124.49	35.3	157.4	0	2.0	T	-.124	-.314	.941
00002	214	2126.49	35.1	157.7	0	2.0	T	-.129	-.310	.942
00002	214	2128.49	34.9	158.0	0	2.0	T	-.133	-.307	.942
00002	214	2130.49	34.7	158.3	0	1.9	T	-.138	-.304	.943
00002	214	2132.49	34.5	158.6	0	1.9	T	-.142	-.301	.943
00002	214	2134.49	34.4	158.9	0	1.9	T	-.145	-.297	.944
00002	214	2136.49	34.2	159.1	0	1.9	T	-.149	-.295	.944
00002	214	2138.49	34.0	159.4	0	1.8	T	-.153	-.292	.944
00002	214	2140.49	33.8	159.7	0	1.8	T	-.158	-.288	.944
00002	214	2142.49	33.7	160.0	0	1.8	T	-.160	-.285	.945
00002	214	2144.49	33.5	160.3	0	1.7	T	-.165	-.281	.945
00002	214	2146.49	33.3	160.6	0	1.7	T	-.169	-.278	.946
00002	214	2148.49	33.2	160.9	0	1.7	T	-.172	-.274	.946
00002	214	2150.49	33.0	161.2	0	1.6	T	-.176	-.270	.947
00002	214	2152.49	32.8	161.5	0	1.6	T	-.181	-.267	.947
00002	214	2154.49	32.7	161.8	0	1.6	T	-.183	-.263	.947
00002	214	2156.49	32.5	162.1	0	1.6	T	-.188	-.259	.947
00002	214	2158.49	32.4	162.4	0	1.5	T	-.190	-.255	.948
00002	214	2200.49	32.2	162.7	0	1.5	T	-.194	-.252	.948
00002	214	2202.49	32.1	163.0	0	1.5	T	-.197	-.248	.949
00002	214	2204.49	31.9	163.3	0	1.5	T	-.201	-.244	.949
00002	214	2206.49	31.8	163.6	0	1.4	T	-.204	-.240	.949
00002	214	2208.49	31.6	163.9	0	1.4	T	-.208	-.236	.949
00002	214	2210.49	31.5	164.2	0	1.4	T	-.211	-.232	.950
00002	214	2212.49	31.3	164.5	0	1.3	T	-.215	-.228	.950
00002	214	2214.49	31.2	164.8	0	1.3	T	-.217	-.224	.950

FIGURE 10 (10 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	214	2216.49	31.0	165.1	0	1.3	T	-.222	-.220	.950
00002	214	2218.49	30.9	165.3	0	1.3	T	-.224	-.218	.950
00002	214	2220.49	30.7	165.6	0	1.2	T	-.228	-.214	.950
00002	214	2222.49	30.6	165.9	0	1.2	T	-.230	-.210	.950
00002	214	2222.72	30.6	166.0	0	1.2	5	-.231	-.208	.951
00002	214	2224.49	30.4	166.2	0	1.2	T	-.234	-.206	.950
00002	214	2226.49	30.3	166.5	0	1.2	T	-.237	-.202	.950
00002	214	2228.49	30.2	166.8	0	1.1	T	-.239	-.197	.951
00002	214	2230.49	30.0	167.1	0	1.1	T	-.243	-.193	.950
00002	214	2232.49	29.9	167.4	0	1.1	T	-.246	-.189	.951
00002	214	2234.49	29.7	167.7	0	1.1	T	-.250	-.185	.950
00002	214	2236.49	29.6	167.9	0	1.1	T	-.252	-.182	.950
00002	214	2238.49	29.5	168.2	0	1.0	T	-.254	-.178	.951
00002	214	2240.49	29.3	168.5	0	1.0	T	-.258	-.174	.950
00002	214	2242.49	29.2	168.8	0	1.0	T	-.261	-.170	.950
00002	214	2244.49	29.0	169.1	0	1.0	T	-.264	-.165	.950
00002	214	2246.49	28.9	169.3	0	.9	T	-.267	-.163	.950
00002	214	2248.49	28.8	169.6	0	.9	T	-.269	-.158	.950
00002	214	2250.49	28.6	169.9	0	.9	T	-.273	-.154	.950
00002	214	2252.49	28.5	170.2	0	.9	T	-.275	-.150	.950
00002	214	2254.49	28.3	170.5	0	.8	T	-.279	-.145	.949
00002	214	2256.49	28.2	170.7	0	.8	T	-.281	-.142	.949
00002	214	2258.49	28.1	171.0	0	.8	T	-.283	-.138	.949
00002	214	2300.49	27.9	171.3	0	.8	T	-.287	-.134	.949
00002	214	2302.49	27.8	171.5	0	.8	T	-.289	-.131	.948
00002	214	2304.49	27.6	171.8	0	.7	T	-.293	-.126	.948
00002	214	2306.49	27.5	172.1	0	.7	T	-.295	-.122	.948
00002	214	2308.49	27.4	172.3	0	.7	T	-.297	-.119	.948
00002	214	2310.49	27.2	172.6	0	.7	T	-.300	-.115	.947
00002	214	2312.49	27.1	172.9	0	.6	T	-.303	-.110	.947
00002	214	2314.49	26.9	173.1	0	.6	T	-.306	-.107	.946
00002	214	2316.49	26.8	173.4	0	.6	T	-.308	-.103	.946
00002	214	2318.49	26.6	173.6	0	.6	T	-.312	-.100	.945
00002	214	2320.49	26.5	173.9	0	.6	T	-.314	-.095	.945
00002	214	2322.49	26.4	174.2	0	.5	T	-.316	-.091	.945
00002	214	2324.49	26.2	174.4	0	.5	T	-.319	-.088	.944
00002	214	2326.49	26.1	174.7	0	.5	T	-.321	-.083	.943
00002	214	2328.49	25.9	174.9	0	.5	T	-.325	-.080	.942
00002	214	2330.49	25.8	175.2	0	.5	T	-.327	-.075	.942
00002	214	2332.49	25.6	175.4	0	.4	T	-.330	-.072	.941
00002	214	2334.49	25.5	175.7	0	.4	T	-.332	-.068	.941
00002	214	2336.49	25.3	175.9	0	.4	T	-.335	-.065	.940
00002	214	2338.49	25.2	176.1	0	.4	T	-.337	-.062	.939
00002	214	2340.49	25.0	176.4	0	.4	T	-.341	-.057	.938
00002	214	2342.49	24.9	176.6	0	.3	T	-.343	-.054	.938
00002	214	2344.49	24.7	176.9	0	.3	T	-.346	-.049	.937
00002	214	2346.49	24.6	177.1	0	.3	T	-.348	-.046	.936
00002	214	2348.49	24.4	177.3	0	.3	T	-.351	-.043	.935
00002	214	2350.49	24.3	177.6	0	.2	T	-.353	-.038	.935

FIGURE 10 (11 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION	COSINES	
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	214	2352.49	24.1	177.8	0	.2	T	-.356	-.035	.934
00002	214	2354.49	24.0	178.0	0	.2	T	-.358	-.032	.933
00002	214	2356.49	23.8	178.2	0	.2	T	-.361	-.029	.932
00002	214	2358.49	23.7	178.5	0	.2	T	-.363	-.024	.931
00006	899	2040.63	13.3	69.9	1979	-.2	**	.399	-.914	-.074
00006	899	2045.37	2.9	119.8	2726	4.7	T	-.315	-.867	.387

BT

FIGURE 10 (12 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 29H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00006	899	2045.68	1.9	121.9	2817	4.9	T	-.350	-.849	.397
00006	899	2046.00	1.0	123.8	2910	5.0	T	-.381	-.831	.406
00006	900	2221.88	42.1	284.7	1005	-1.8	T	.607	.718	.341
00006	900	2222.41	43.8	266.1	973	-.2	**	.455	.720	.524
00006	900	2223.37	38.7	234.4	1045	2.6	T	.121	.635	.763
00006	900	2224.51	27.3	212.2	1302	4.7	5	-.207	.474	.856
00006	900	2225.37	19.7	203.2	1570	5.5	T	-.374	.371	.850
00006	900	2227.37	7.3	192.6	2295	6.4	T	-.595	.216	.774
00006	900	2227.88	5.0	191.0	2492	6.4	W	-.630	.190	.753
00006	900	2228.86	1.0	188.6	2874	6.6	T	-.687	.150	.711

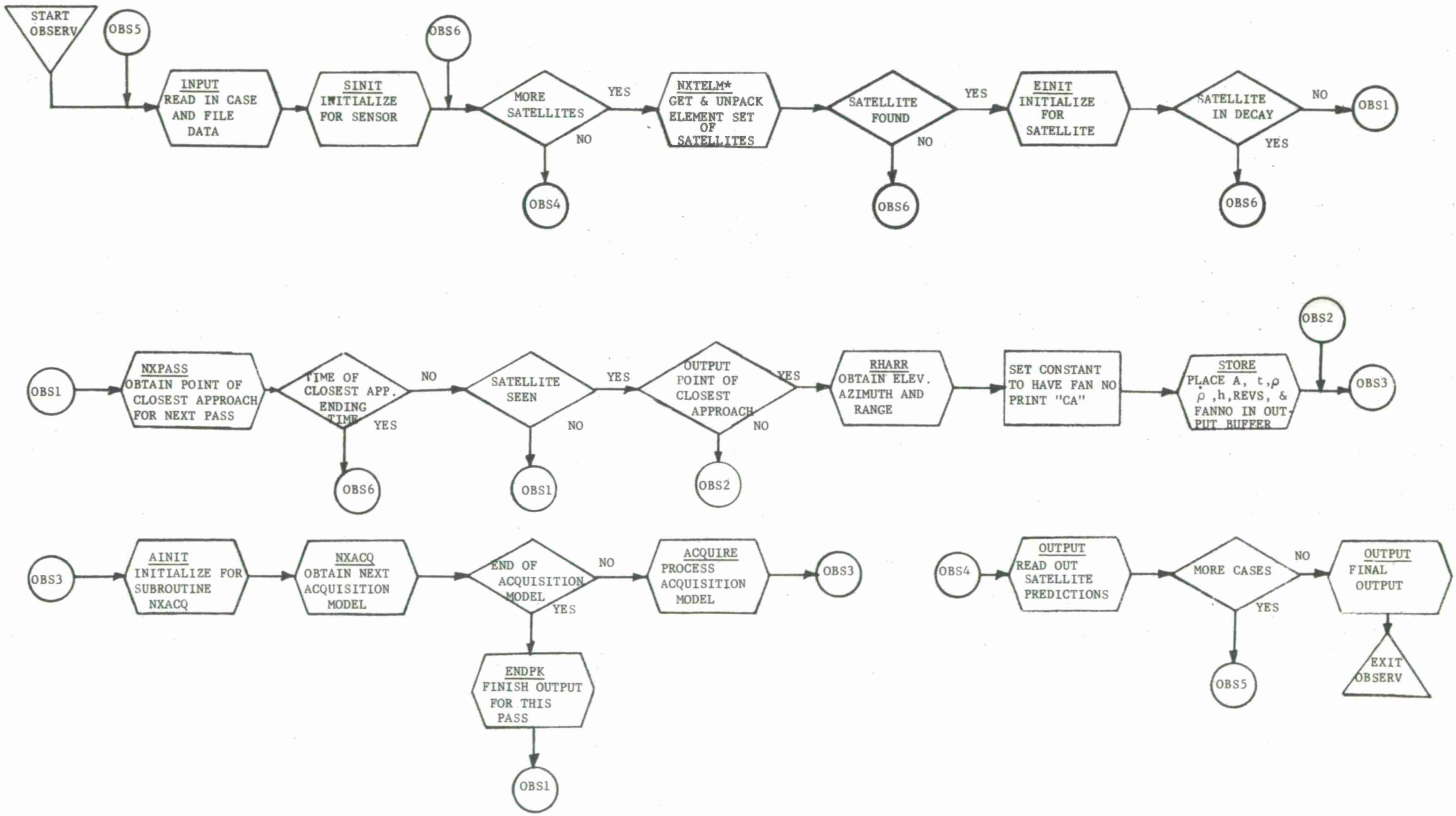
NO MORE DATA
BT

FIGURE 10 (13 of 13)

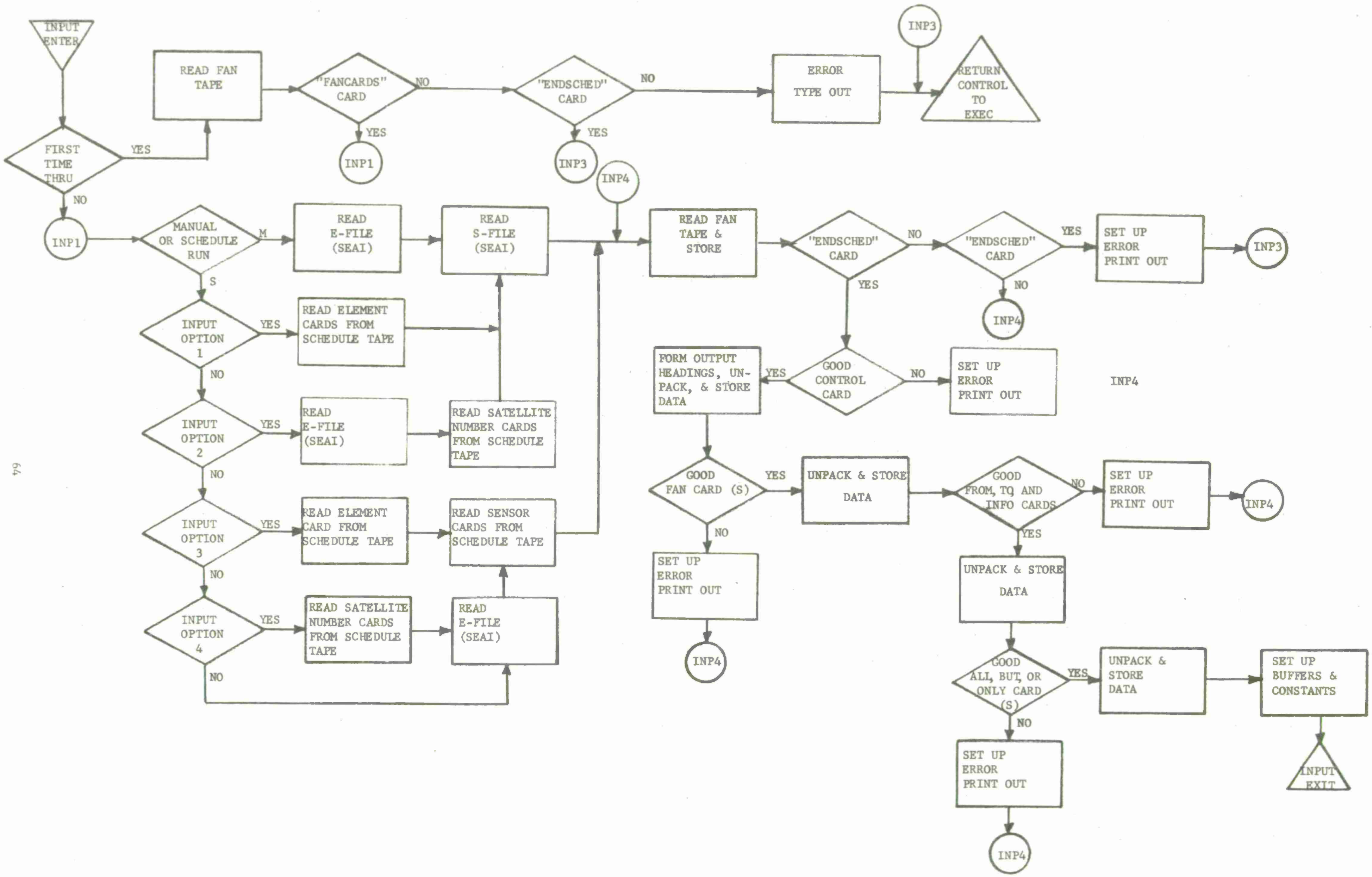
SECTION 6

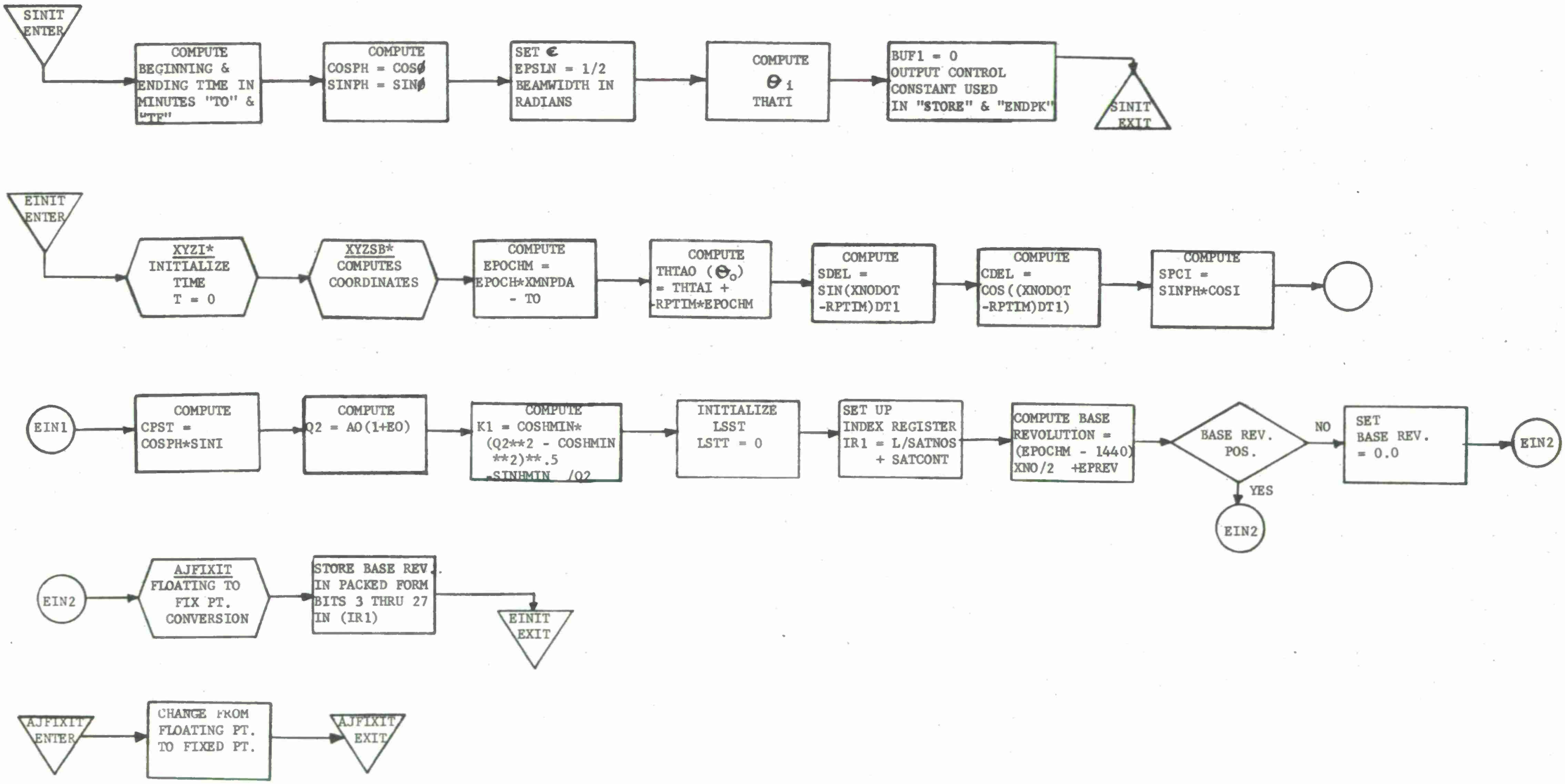
FLOW DIAGRAMS

The following flow diagram displays the logical flow and computational procedures used in the program. Standard symbols are maintained throughout.

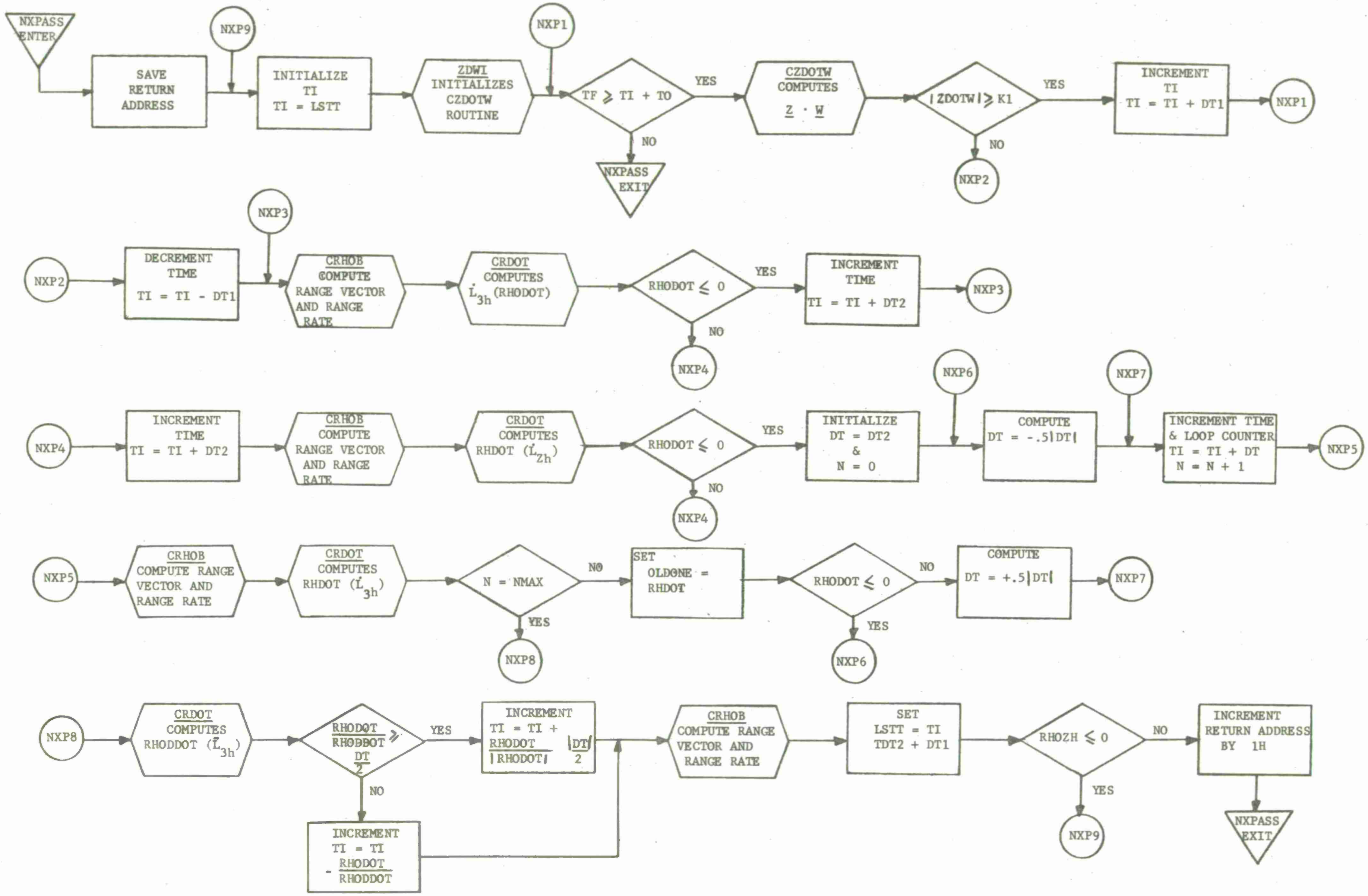


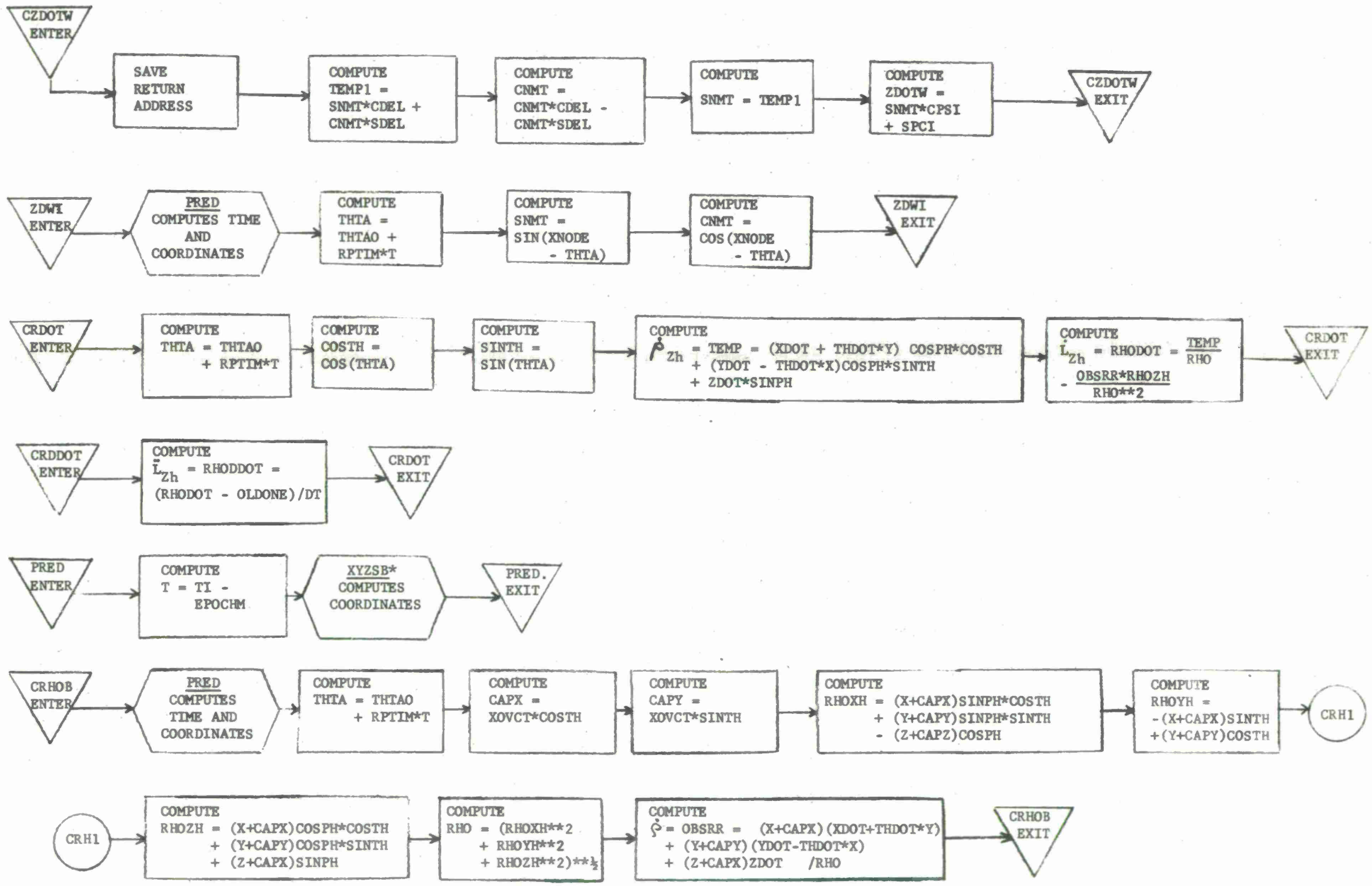
*B-2 SYSTEM SUBROUTINE


INPUT ENTER
FIRST TIME THRU
YES
NO
READ FAN TAPE
"FANCARDS" CARD
NO
YES
INP1
"ENDSCHED" CARD
NO
YES
INP3
ERROR TYPE OUT
INP3
RETURN CONTROL TO EXEC
INP4
INP1
MANUAL OR SCHEDULE RUN
M
S
READ E-FILE (SEAI)
READ S-FILE (SEAI)
INPUT OPTION 1
YES
NO
READ ELEMENT CARDS FROM SCHEDULE TAPE
INPUT OPTION 2
YES
NO
READ E-FILE (SEAI)
READ SATELLITE NUMBER CARDS FROM SCHEDULE TAPE
INPUT OPTION 3
YES
NO
READ ELEMENT CARD FROM SCHEDULE TAPE
READ SENSOR CARDS FROM SCHEDULE TAPE
INPUT OPTION 4
YES
NO
READ SATELLITE NUMBER CARDS FROM SCHEDULE TAPE
READ E-FILE (SEAI)
READ FAN TAPE & STORE
"ENDSCHED" CARD
NO
YES
"ENDSCHED" CARD
YES
NO
SET UP ERROR PRINT OUT
INP3
INP4
GOOD CONTROL CARD
YES
NO
FORM OUTPUT HEADINGS, UN-PACK, & STORE DATA
SET UP ERROR PRINT OUT
INP4
GOOD FAN CARD (S)
YES
NO
UNPACK & STORE DATA
SET UP ERROR PRINT OUT
INP4
GOOD FROM, TO, AND INFO CARDS
NO
YES
SET UP ERROR PRINT OUT
INP4
UNPACK & STORE DATA
GOOD ALL, BUT, OR ONLY CARD (S)
YES
NO
UNPACK & STORE DATA
SET UP BUFFERS & CONSTANTS
INPUT EXIT
SET UP ERROR PRINT OUT
INP4

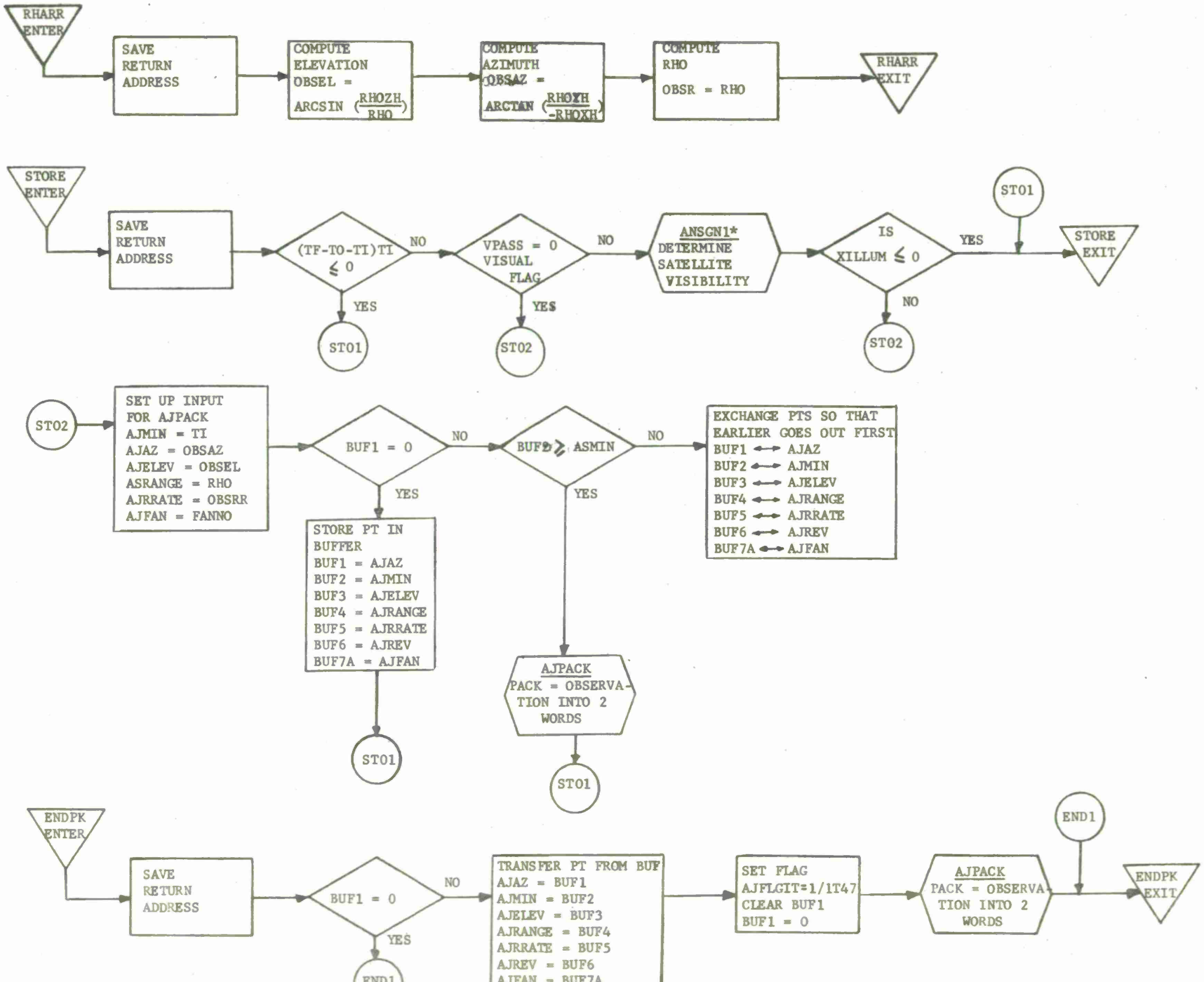


*B-2 System Subroutine

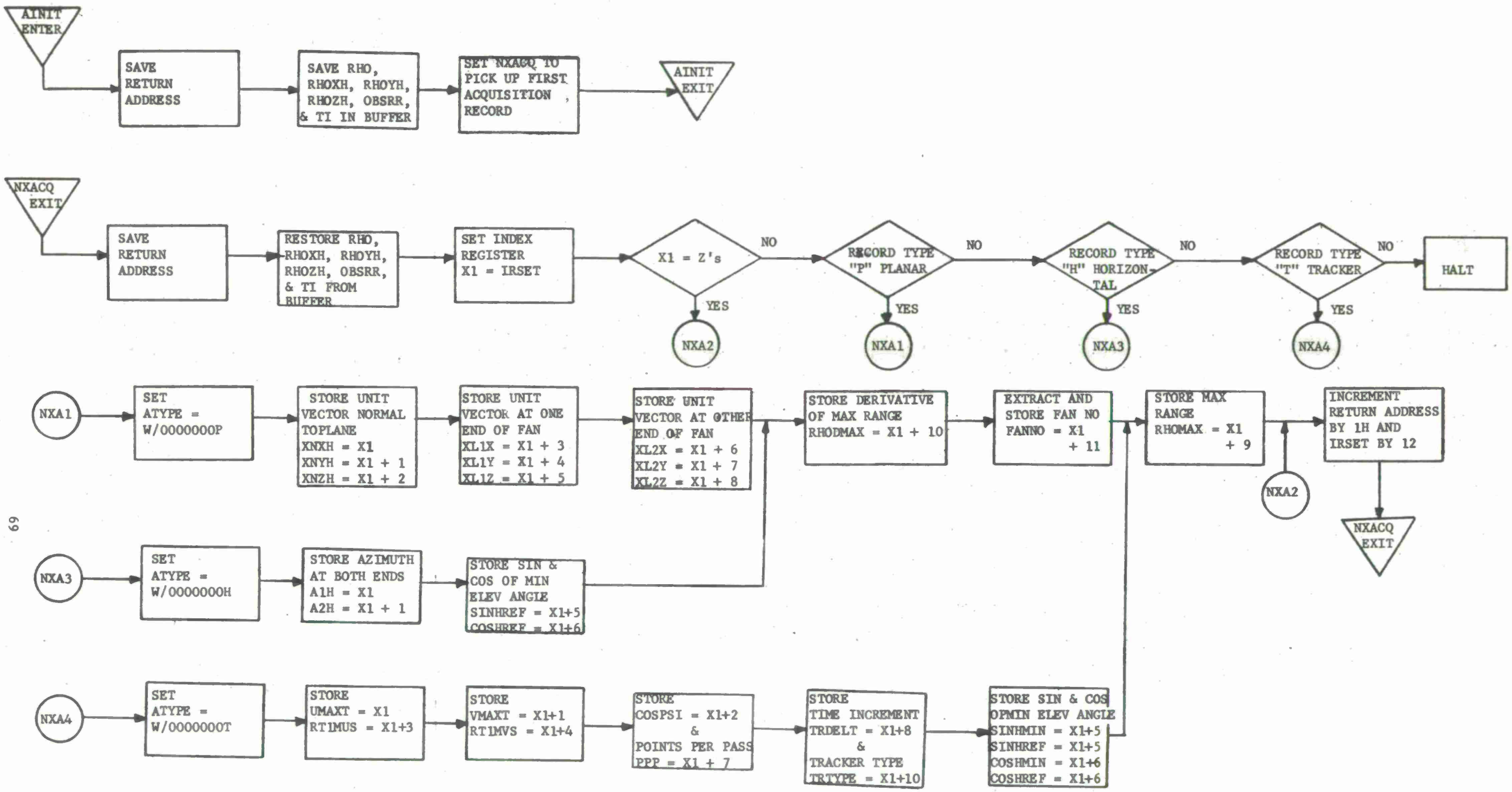

NXPASS ENTER
SAVE RETURN ADDRESS
NXP9
INITIALIZE TI TI = LSTT
ZDWI INITIALIZES CZDOTW ROUTINE
NXP1
TF ≥ TI + TO
YES
NO
NXPASS EXIT
CZDOTW COMPUTES Z · W
\|ZDOTW\| ≥ K1
YES
NO
NXP2
INCREMENT TI TI = TI + DT1
NXP1
NXP2
DECREMENT TIME TI = TI - DT1
NXP3
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES L3h (RHODOT)
RHODOT ≤ 0
YES
NO
NXP4
INCREMENT TIME TI = TI + DT2
NXP3
NXP4
INCREMENT TIME TI = TI + DT2
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES RHDOT (LZh)
RHODOT ≤ 0
YES
NO
NXP4
INITIALIZE DT = DT2 & N = 0
NXP6
COMPUTE DT = -.5\|DT\|
NXP7
INCREMENT TIME & LOOP COUNTER TI = TI + DT N = N + 1
NXP5
NXP5
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES RHDOT (L3h)
N = NMAX
NO
YES
NXP8
SET OLDONE = RHDOT
RHODOT ≤ 0
NO
YES
NXP6
COMPUTE DT = +.5\|DT\|
NXP7
NXP8
CRDOT COMPUTES RHODDOT (L3h)
RHODOT / RHODDOT ≥ DT / 2
YES
NO
INCREMENT TI = TI + RHODOT / \|RHODOT\| · \|DT\| / 2
INCREMENT TI = TI - RHODOT / RHODDOT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
SET LSTT = TI TDT2 + DT1
RHOZH ≤ 0
NO
YES
NXP9
INCREMENT RETURN ADDRESS BY 1H
NXPASS EXIT

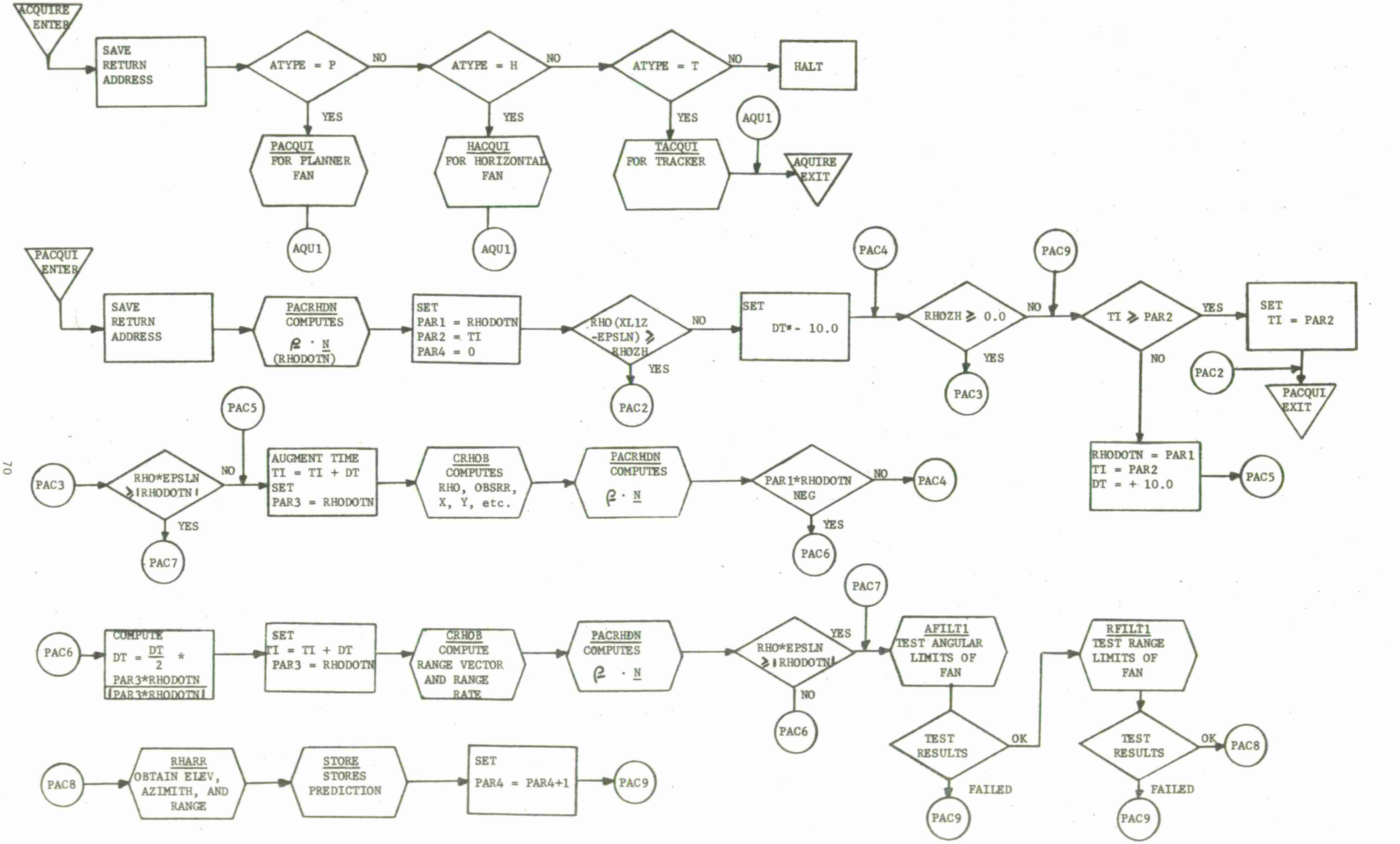


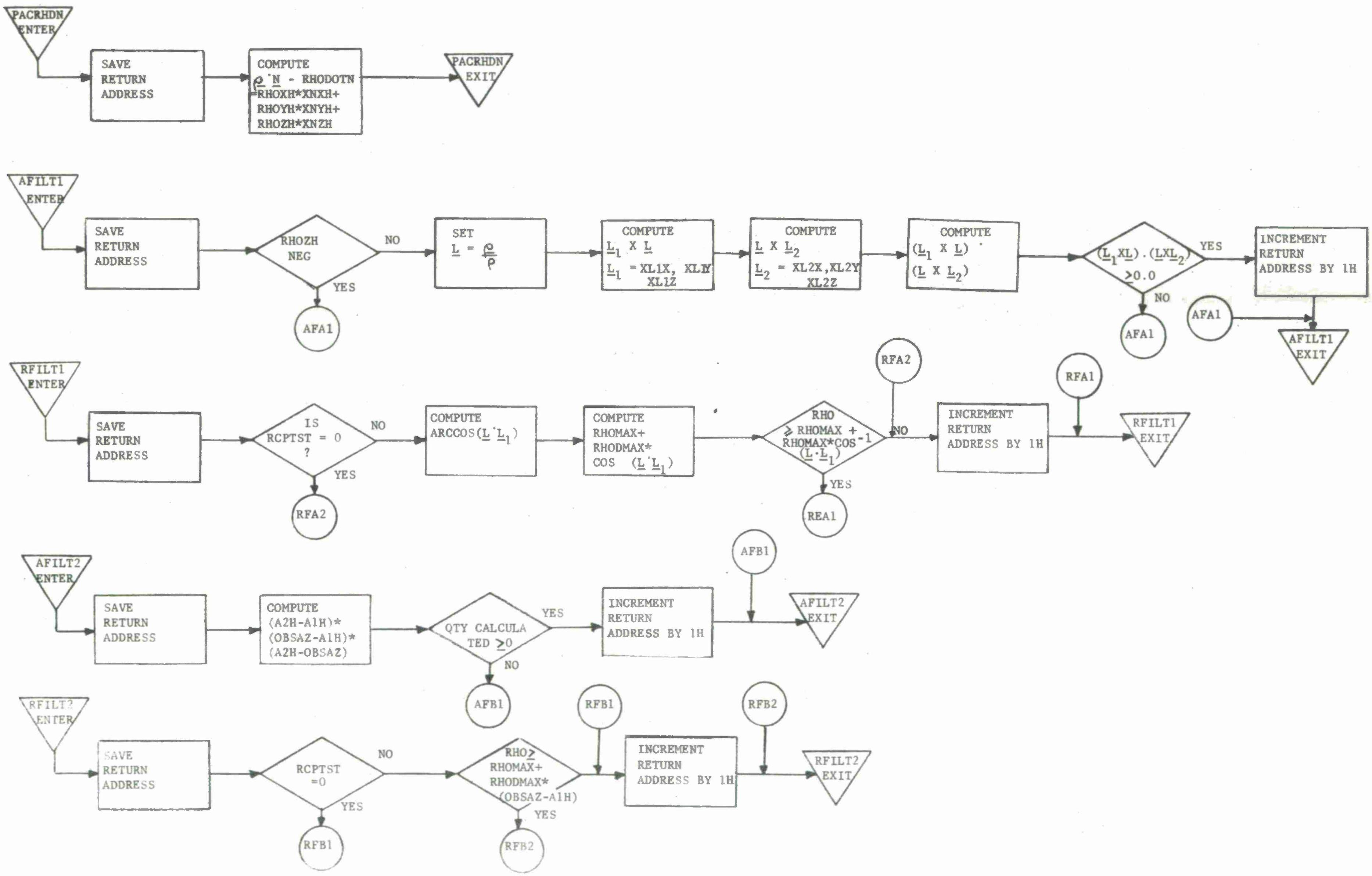
* B-2 System Subroutine

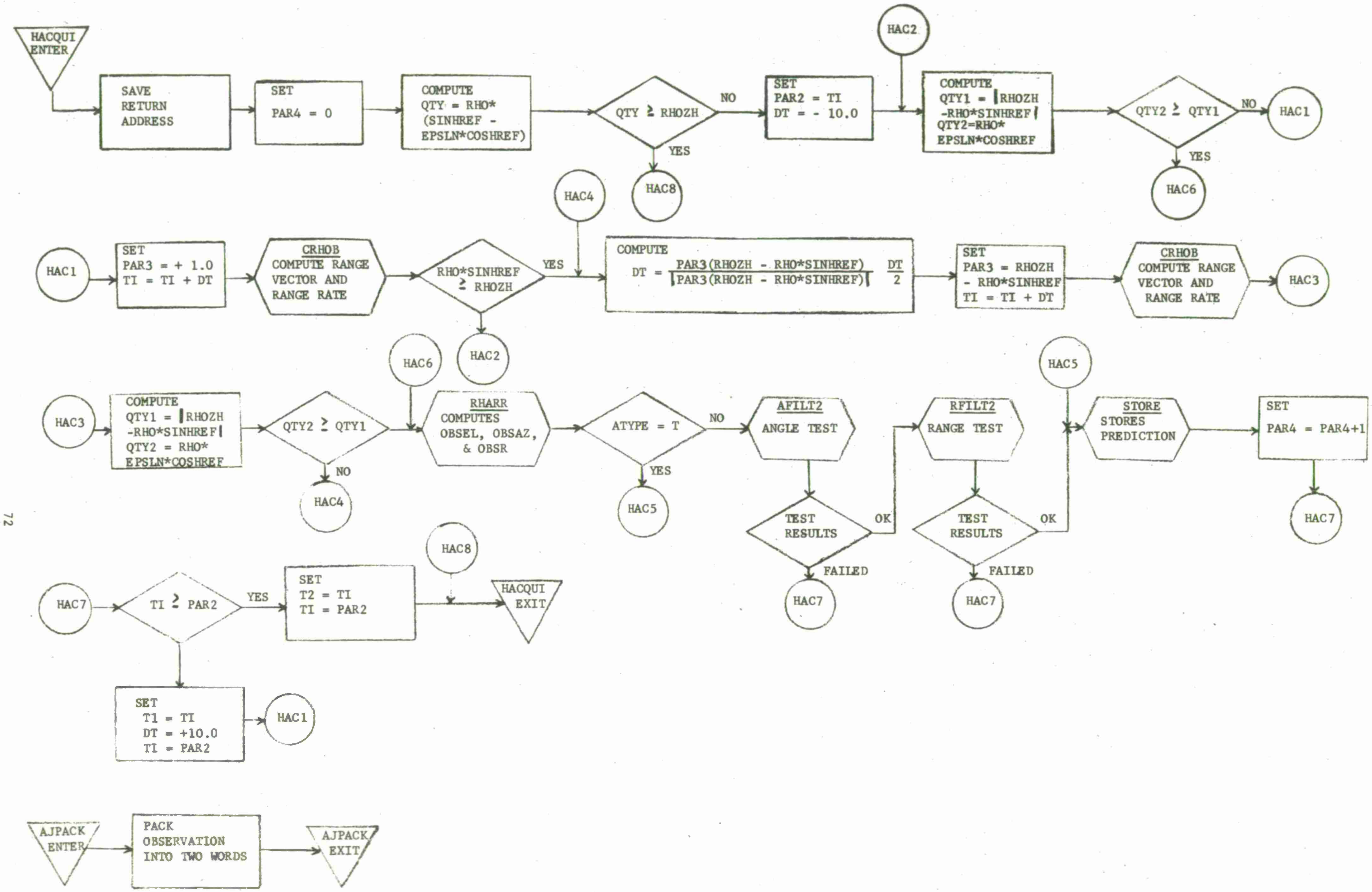


*B-2 System Subroutine

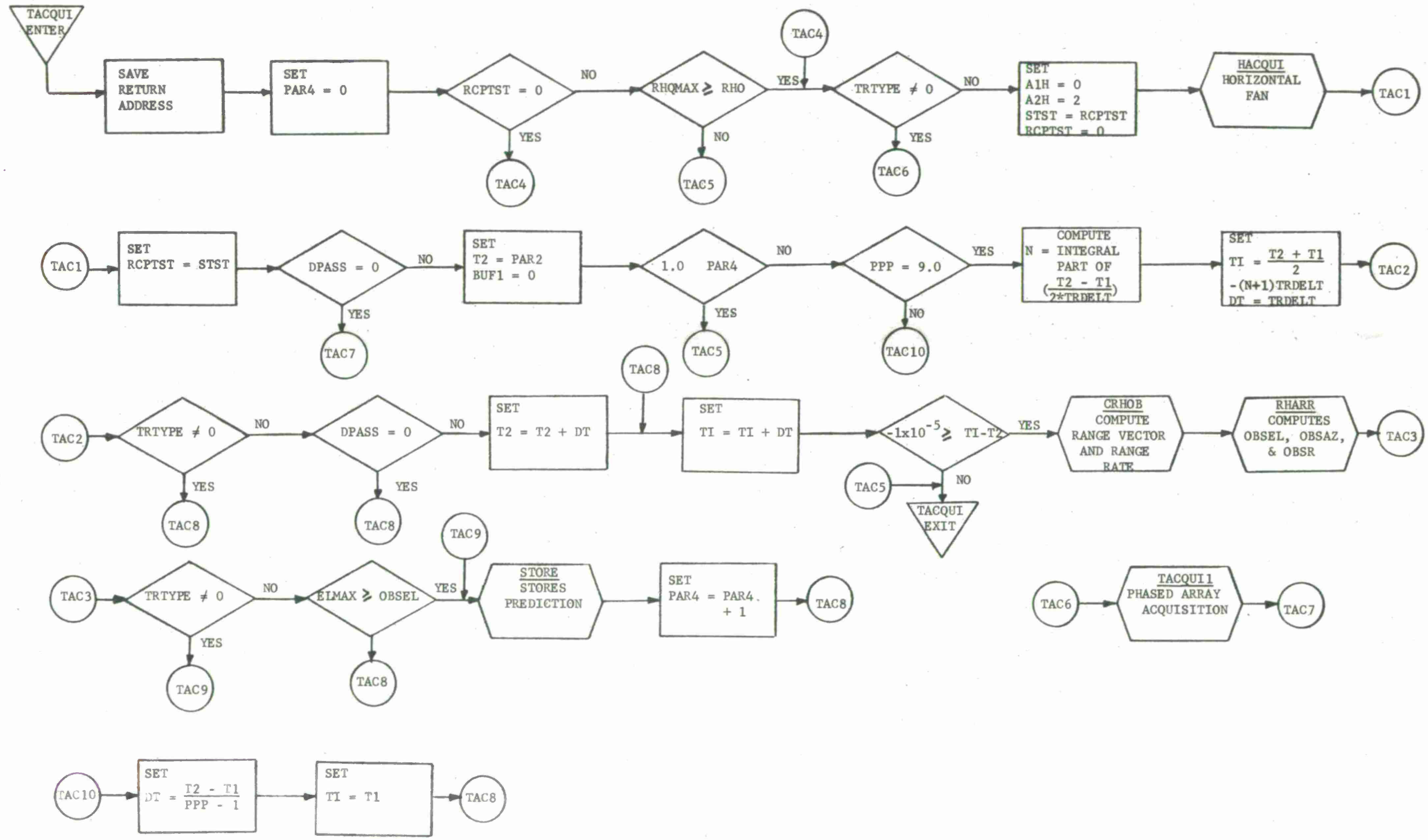

AINIT ENTER
SAVE RETURN ADDRESS
SAVE RHO, RHOXH, RHOYH, RHOZH, OBSRR, & TI IN BUFFER
SET NXACQ TO PICK UP FIRST ACQUISITION RECORD
AINIT EXIT
NXACQ EXIT
SAVE RETURN ADDRESS
RESTORE RHO, RHOXH, RHOYH, RHOZH, OBSRR, & TI FROM BUFFER
SET INDEX REGISTER X1 = IRSET
X1 = Z's
NO
YES
NXA2
RECORD TYPE "P" PLANAR
NO
YES
NXA1
RECORD TYPE "H" HORIZONTAL
NO
YES
NXA3
RECORD TYPE "T" TRACKER
NO
YES
NXA4
HALT
NXA1
SET ATYPE = W/0000000P
STORE UNIT VECTOR NORMAL TOPLANE XNXH = X1 XNYH = X1 + 1 XNZH = X1 + 2
STORE UNIT VECTOR AT ONE END OF FAN XL1X = X1 + 3 XL1Y = X1 + 4 XL1Z = X1 + 5
STORE UNIT VECTOR AT OTHER END OF FAN XL2X = X1 + 6 XL2Y = X1 + 7 XL2Z = X1 + 8
STORE DERIVATIVE OF MAX RANGE RHODMAX = X1 + 10
EXTRACT AND STORE FAN NO FANNO = X1 + 11
STORE MAX RANGE RHOMAX = X1 + 9
NXA2
INCREMENT RETURN ADDRESS BY 1H AND IRSET BY 12
NXACQ EXIT
NXA3
SET ATYPE = W/0000000H
STORE AZIMUTH AT BOTH ENDS A1H = X1 A2H = X1 + 1
STORE SIN & COS OF MIN ELEV ANGLE SINHREF = X1+5 COSHREF = X1+6
NXA4
SET ATYPE = W/0000000T
STORE UMAXT = X1 RTIMUS = X1+3
STORE VMAXT = X1+1 RTIMVS = X1+4
STORE COSPSI = X1+2 & POINTS PER PASS PPP = X1 + 7
STORE TIME INCREMENT TRDELT = X1+8 & TRACKER TYPE TRTYPE = X1+10
STORE SIN & COS OPMIN ELEV ANGLE SINHMIN = X1+5 SINHREF = X1+5 COSHMIN = X1+6 COSHREF = X1+6

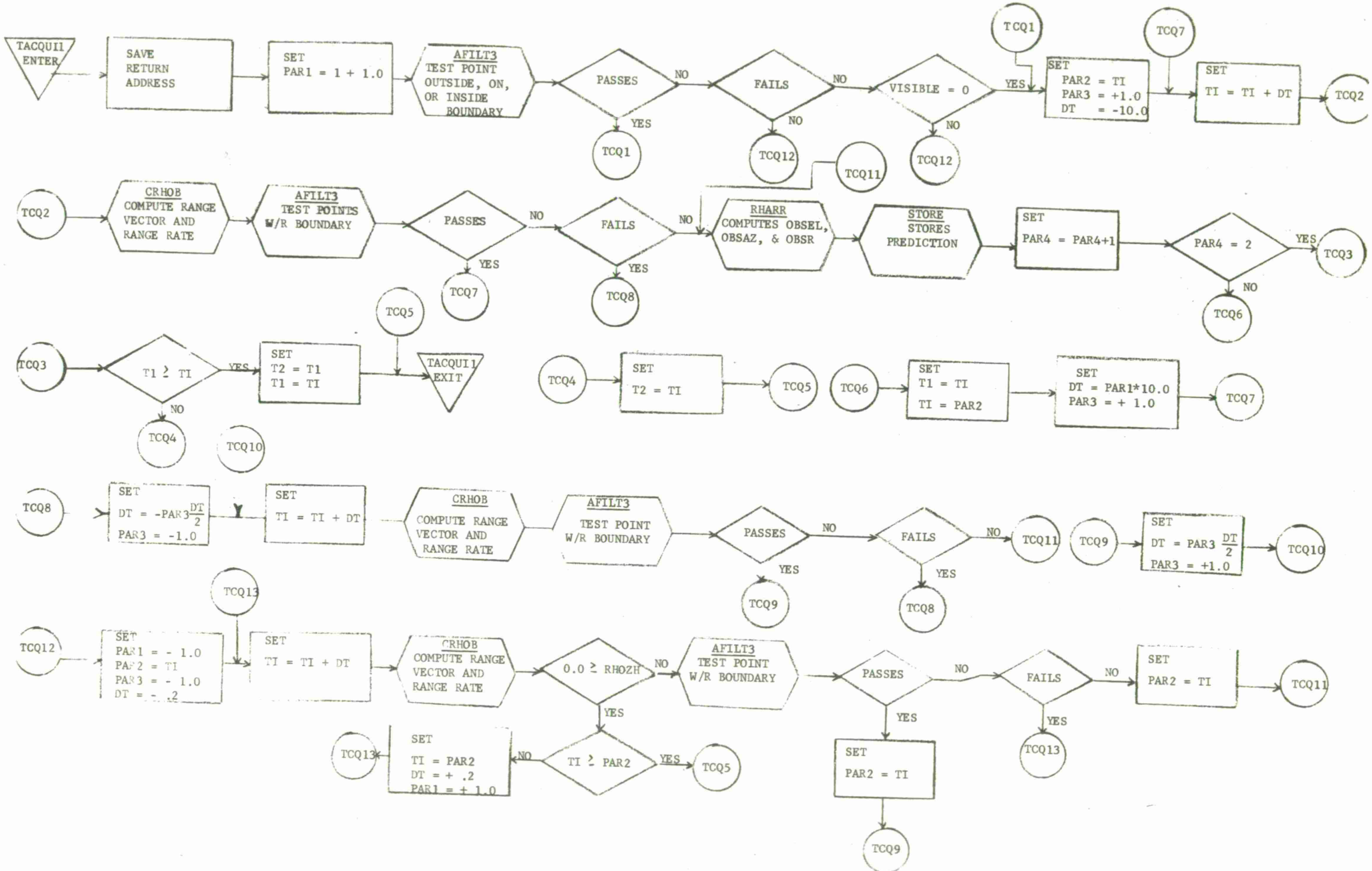

ACQUIRE ENTER
SAVE RETURN ADDRESS
ATYPE = P
NO
YES
PACQUI FOR PLANNER FAN
AQU1
ATYPE = H
NO
YES
HACQUI FOR HORIZONTAL FAN
AQU1
ATYPE = T
NO
YES
HALT
TACQUI FOR TRACKER
AQU1
AQUIRE EXIT
PACQUI ENTER
SAVE RETURN ADDRESS
PACRHDN COMPUTES ρ · N (RHODOTN)
SET PAR1 = RHODOTN PAR2 = TI PAR4 = 0
RHO(XL1Z -EPSLN) ≥ RHOZH
NO
YES
PAC2
SET DT = - 10.0
PAC4
RHOZH ≥ 0.0
NO
YES
PAC3
PAC9
TI ≥ PAR2
YES
NO
SET TI = PAR2
PAC2
PACQUI EXIT
RHODOTN = PAR1 TI = PAR2 DT = + 10.0
PAC5
PAC3
RHO*EPSLN ≥ |RHODOTN|
NO
YES
PAC7
PAC5
AUGMENT TIME TI = TI + DT SET PAR3 = RHODOTN
CRHOB COMPUTES RHO, OBSRR, X, Y, etc.
PACRHDN COMPUTES ρ · N
PAR1*RHODOTN NEG
NO
PAC4
YES
PAC6
PAC6
COMPUTE DT = DT/2 * PAR3*RHODOTN / |PAR3*RHODOTN|
SET TI = TI + DT PAR3 = RHODOTN
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
PACRHDN COMPUTES ρ · N
RHO*EPSLN ≥ |RHODOTN|
YES
NO
PAC6
PAC7
AFILT1 TEST ANGULAR LIMITS OF FAN
TEST RESULTS
OK
FAILED
PAC9
RFILT1 TEST RANGE LIMITS OF FAN
TEST RESULTS
OK
PAC8
FAILED
PAC9
PAC8
RHARR OBTAIN ELEV, AZIMITH, AND RANGE
STORE STORES PREDICTION
SET PAR4 = PAR4+1
PAC9


PACRHDN ENTER
SAVE RETURN ADDRESS
COMPUTE ρ·N - RHODOTN RHOXH*XNXH+ RHOYH*XNYH+ RHOZH*XNZH
PACRHDN EXIT
AFILT1 ENTER
SAVE RETURN ADDRESS
RHOZH NEG
NO
YES
AFA1
SET L = ρ/ρ
COMPUTE L1 X L
L1 = XL1X, XL1Y XL1Z
COMPUTE L X L2
L2 = XL2X,XL2Y XL2Z
COMPUTE (L1 X L) · (L X L2)
(L1XL)·(LXL2) >0.0
YES
NO
AFA1
INCREMENT RETURN ADDRESS BY 1H
AFA1
AFILT1 EXIT
RFILT1 ENTER
SAVE RETURN ADDRESS
IS RCPTST = 0 ?
NO
YES
RFA2
COMPUTE ARCCOS(L·L1)
COMPUTE RHOMAX+ RHODMAX* COS (L·L1)
RFA2
RHO ≥ RHOMAX + RHOMAX*COS-1 (L·L1)
NO
YES
REA1
RFA1
INCREMENT RETURN ADDRESS BY 1H
RFILT1 EXIT
AFILT2 ENTER
SAVE RETURN ADDRESS
COMPUTE (A2H-A1H)* (OBSAZ-A1H)* (A2H-OBSAZ)
QTY CALCULA TED ≥0
YES
NO
AFB1
INCREMENT RETURN ADDRESS BY 1H
AFB1
AFILT2 EXIT
RFILT2 ENTER
SAVE RETURN ADDRESS
RCPTST =0
NO
YES
RFB1
RHO ≥ RHOMAX+ RHODMAX* (OBSAZ-A1H)
YES
RFB2
RFB1
INCREMENT RETURN ADDRESS BY 1H
RFB2
RFILT2 EXIT

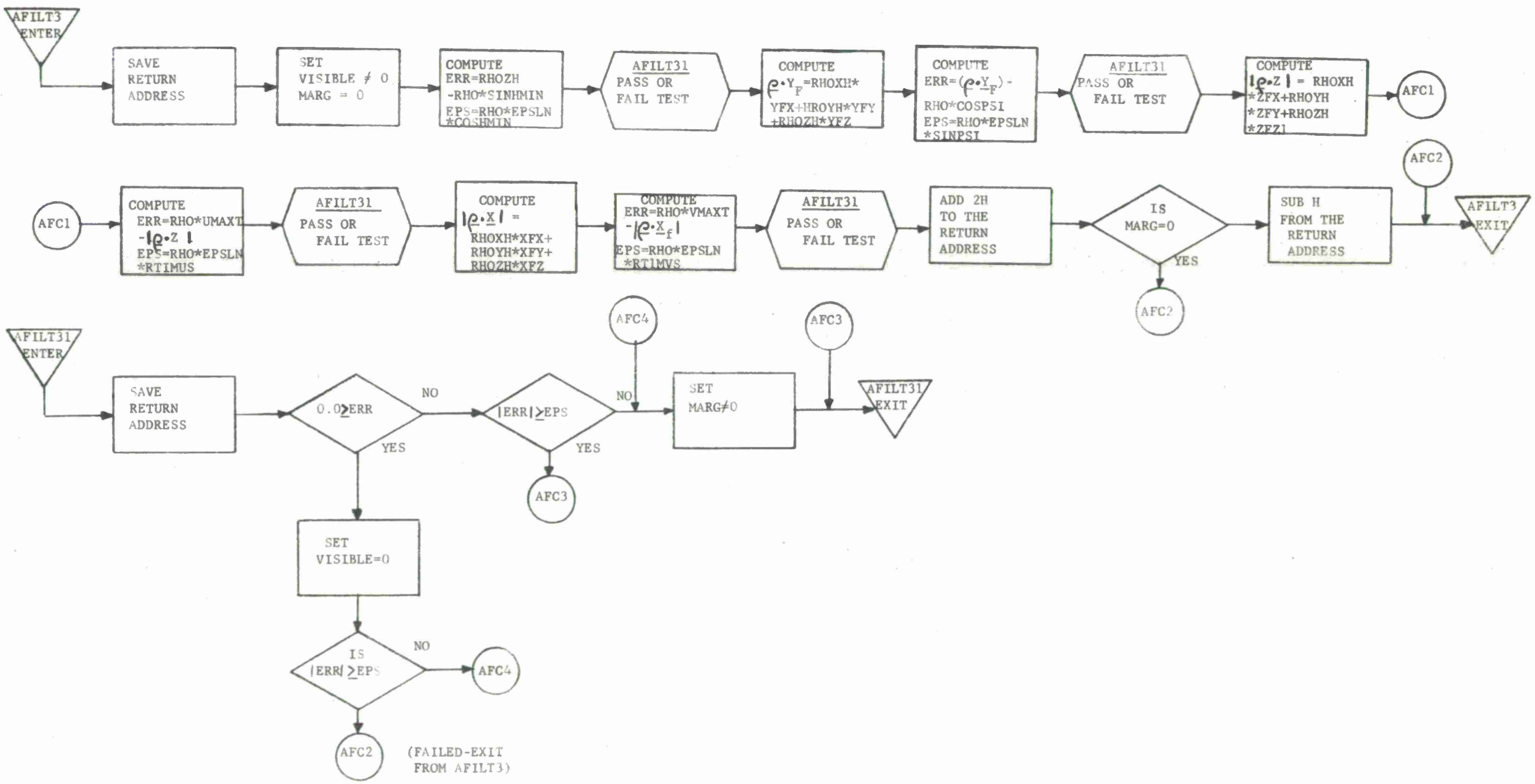


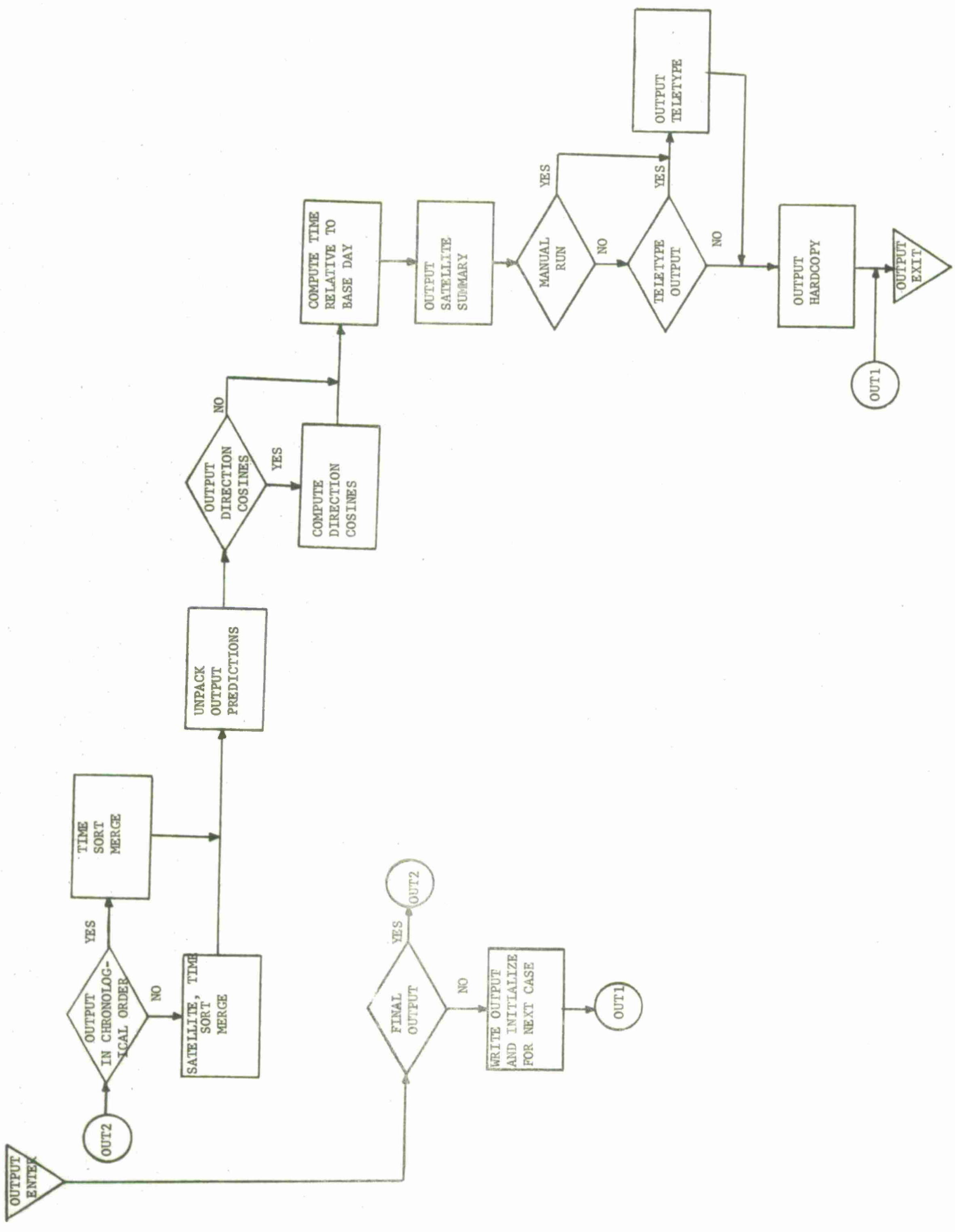
HACQUI ENTER
SAVE RETURN ADDRESS
SET PAR4 = 0
COMPUTE QTY = RHO* (SINHREF - EPSLN*COSHREF)
QTY ≥ RHOZH
NO
YES
HAC8
SET PAR2 = TI DT = - 10.0
HAC2
COMPUTE QTY1 = |RHOZH -RHO*SINHREF| QTY2=RHO* EPSLN*COSHREF
QTY2 ≥ QTY1
NO
HAC1
YES
HAC6
HAC1
SET PAR3 = + 1.0 TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
RHO*SINHREF ≥ RHOZH
YES
HAC2
HAC4
COMPUTE DT = PAR3(RHOZH - RHO*SINHREF) / |PAR3(RHOZH - RHO*SINHREF)| DT/2
SET PAR3 = RHOZH - RHO*SINHREF TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
HAC3
HAC3
COMPUTE QTY1 = |RHOZH -RHO*SINHREF| QTY2 = RHO* EPSLN*COSHREF
QTY2 ≥ QTY1
NO
HAC4
HAC6
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
ATYPE = T
NO
YES
HAC5
AFILT2 ANGLE TEST
TEST RESULTS
OK
FAILED
HAC7
RFILT2 RANGE TEST
TEST RESULTS
OK
FAILED
HAC7
HAC5
STORE STORES PREDICTION
SET PAR4 = PAR4+1
HAC7
HAC7
TI ≥ PAR2
YES
SET T2 = TI TI = PAR2
HAC8
HACQUI EXIT
SET T1 = TI DT = +10.0 TI = PAR2
HAC1
AJPACK ENTER
PACK OBSERVATION INTO TWO WORDS
AJPACK EXIT


TACQUI ENTER
SAVE RETURN ADDRESS
SET PAR4 = 0
RCPTST = 0
NO
YES
TAC4
RHOMAX ≥ RHO
YES
NO
TAC5
TAC4
TRTYPE ≠ 0
NO
YES
TAC6
SET A1H = 0 A2H = 2 STST = RCPTST RCPTST = 0
HACQUI HORIZONTAL FAN
TAC1
TAC1
SET RCPTST = STST
DPASS = 0
NO
YES
TAC7
SET T2 = PAR2 BUF1 = 0
1.0 PAR4
NO
YES
TAC5
PPP = 9.0
YES
NO
TAC10
COMPUTE N = INTEGRAL PART OF (T2 - T1 / 2*TRDELT)
SET TI = T2 + T1 / 2 - (N+1)TRDELT DT = TRDELT
TAC2
TAC2
TRTYPE ≠ 0
NO
YES
TAC8
DPASS = 0
NO
YES
TAC8
SET T2 = T2 + DT
TAC8
SET TI = TI + DT
-1x10^-5 ≥ TI-T2
YES
NO
TAC5
TACQUI EXIT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
TAC3
TAC3
TRTYPE ≠ 0
NO
YES
TAC9
ELMAX ≥ OBSEL
YES
TAC8
TAC9
STORE STORES PREDICTION
SET PAR4 = PAR4 + 1
TAC8
TAC6
TACQUI1 PHASED ARRAY ACQUISITION
TAC7
TAC10
SET DT = T2 - T1 / PPP - 1
SET TI = T1
TAC8



TACQUI1 ENTER
SAVE RETURN ADDRESS
SET PAR1 = 1 + 1.0
AFILT3 TEST POINT OUTSIDE, ON, OR INSIDE BOUNDARY
PASSES
NO
YES
TCQ1
FAILS
NO
TCQ12
VISIBLE = 0
YES
NO
TCQ12
TCQ1
SET PAR2 = TI PAR3 = +1.0 DT = -10.0
TCQ7
SET TI = TI + DT
TCQ2
TCQ2
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
AFILT3 TEST POINTS W/R BOUNDARY
PASSES
NO
YES
TCQ7
FAILS
NO
YES
TCQ8
TCQ11
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
STORE STORES PREDICTION
SET PAR4 = PAR4+1
PAR4 = 2
YES
TCQ3
NO
TCQ6
TCQ3
T1 ≥ TI
YES
NO
TCQ4
SET T2 = T1 T1 = TI
TCQ5
TACQUI1 EXIT
TCQ10
TCQ4
SET T2 = TI
TCQ5
TCQ6
SET T1 = TI TI = PAR2
SET DT = PAR1*10.0 PAR3 = + 1.0
TCQ7
TCQ8
SET DT = -PAR3 DT/2 PAR3 = -1.0
SET TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
AFILT3 TEST POINT W/R BOUNDARY
PASSES
NO
YES
TCQ9
FAILS
NO
TCQ11
YES
TCQ8
TCQ9
SET DT = PAR3 DT/2 PAR3 = +1.0
TCQ10
TCQ13
TCQ12
SET PAR1 = - 1.0 PAR2 = TI PAR3 = - 1.0 DT = - .2
SET TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
0.0 ≥ RHOZH
NO
YES
AFILT3 TEST POINT W/R BOUNDARY
PASSES
NO
YES
FAILS
NO
YES
SET PAR2 = TI
TCQ11
TCQ13
TI ≥ PAR2
NO
YES
TCQ5
SET TI = PAR2 DT = + .2 PAR1 = + 1.0
TCQ13
SET PAR2 = TI
TCQ9


AFILT3 ENTER
SAVE RETURN ADDRESS
SET VISIBLE ≠ 0 MARG = 0
COMPUTE ERR=RHOZH -RHO*SINHMIN EPS=RHO*EPSLN *COSHMIN
AFILT31 PASS OR FAIL TEST
COMPUTE ρ•Y_F=RHOXH* YFX+HROYH*YFY +RHOZH*YFZ
COMPUTE ERR=(ρ•Y_F)- RHO*COSPSI EPS=RHO*EPSLN *SINPSI
AFILT31 PASS OR FAIL TEST
COMPUTE |ρ•Z| = RHOXH *ZFX+RHOYH *ZFY+RHOZH *ZFZ|
AFC1
AFC1
COMPUTE ERR=RHO*UMAXT -|ρ•Z| EPS=RHO*EPSLN *RTIMUS
AFILT31 PASS OR FAIL TEST
COMPUTE |ρ•X| = RHOXH*XFX+ RHOYH*XFY+ RHOZH*XFZ
COMPUTE ERR=RHO*VMAXT -|ρ•X_f| EPS=RHO*EPSLN *RTIMVS
AFILT31 PASS OR FAIL TEST
ADD 2H TO THE RETURN ADDRESS
IS MARG=0
YES
AFC2
SUB H FROM THE RETURN ADDRESS
AFC2
AFILT3 EXIT
AFILT31 ENTER
SAVE RETURN ADDRESS
0.0≥ERR
NO
YES
|ERR|≥EPS
NO
YES
AFC3
AFC4
SET MARG≠0
AFC3
AFILT31 EXIT
SET VISIBLE=0
IS |ERR|≥EPS
NO
AFC4
AFC2
(FAILED-EXIT FROM AFILT3)


OUTPUT ENTER
OUT2
OUTPUT IN CHRONOLOG-ICAL ORDER
YES
NO
TIME SORT MERGE
SATELLITE, TIME SORT MERGE
UNPACK OUTPUT PREDICTIONS
OUTPUT DIRECTION COSINES
YES
NO
COMPUTE DIRECTION COSINES
COMPUTE TIME RELATIVE TO BASE DAY
OUTPUT SATELLITE SUMMARY
MANUAL RUN
YES
NO
TELETYPE OUTPUT
YES
NO
OUTPUT TELETYPE
OUTPUT HARDCOPY
OUTPUT EXIT
OUT1
FINAL OUTPUT
YES
NO
OUT2
WRITE OUTPUT AND INITIALIZE FOR NEXT CASE
OUT1

APPENDIX I

FILE FORMATS

Word	Format	Field	Description
1	48 bit floating point	XNX	Unit vector normal to plane
2	48 bit floating point	XNY	
3	48 bit floating point	XNZ	
4	48 bit floating point	XL1X	Unit vector at one end of fan
5	48 bit floating point	XL1Y	
6	48 bit floating point	XL1Z	
7	48 bit floating point	XL2X	Unit vector at other end of fan (note: XL1Z $\leq$ XL2Z)
8	48 bit floating point	XL2Y	
9	48 bit floating point	XL2Z	
10	48 bit floating point	RHOMAX	Maximum range at first end of fan
11	48 bit floating point	RHODMAX	Derivative of maximum range
12	N △ △ △ △ △ △ P	N	Fan Number (BCD); P - identification

a. FANTAB - Planar Fan

FIGURE I-1. FORMAT FOR ACQUISITION BUFFER

Word	Format	Name	Description
1	48 bit floating point	A1H	Azimuth (coverage goes from A1H clockwise to A2H)
2	48 bit floating point	A2H	
3			
4			
5			
6	48 bit floating point	SINHREF	sine at constant elevation
7	48 bit floating point	COSHREF	cosine of constant elevation
8			
9			
10	48 bit floating point	RHOMAX - Maximum range at first end of fan	
11	48 bit floating point	RHODMAX - Derivative at maximum range	
12	N △ △ △ △ △ △ H	N - Fan Number (BCD) H - identification	

b. FANTAB - Horizontal Fan

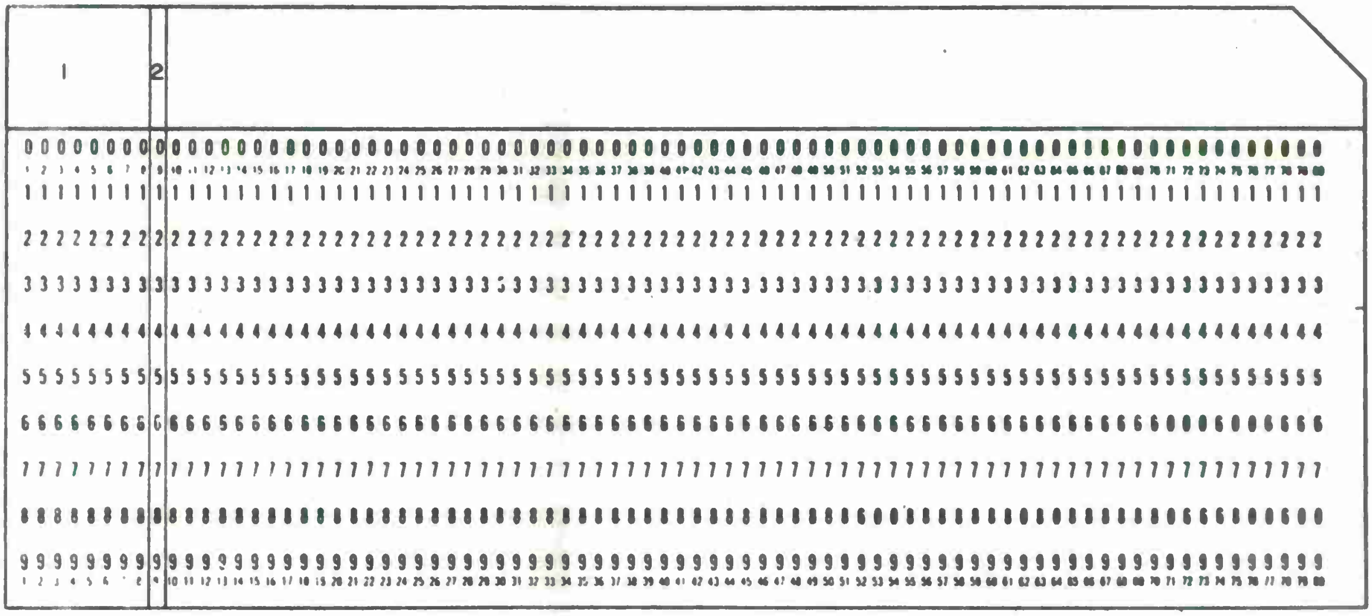
Word	Format	Name	Description
1	48 bit floating point	UMAXT	Not used for normal trackers
2	48 bit floating point	VMAXT	
3	48 bit floating point	COSPSI	
4	48 bit floating point	RT1MUS	
5	48 bit floating point	RT1MVS	
6	48 bit floating point	SINHMIN	sine of minimum elevation
7	48 bit floating point	COSHMIN	cosine of minimum elevation
8	48 bit floating point	PPP	points per pass
9	48 bit floating point	TRDELT	Δt (minutes)
10	48 bit floating point	RHOMAX	Maximum range
11	48 bit fixed point	TRTYPE	Tracker type 1 = Phased array 0 = normal
12	△ △ △ △ △ △ △ T		T = identification

c. FANTAB - Tracker

FIGURE I-1. FORMAT FOR ACQUISITION BUFFER (continued)

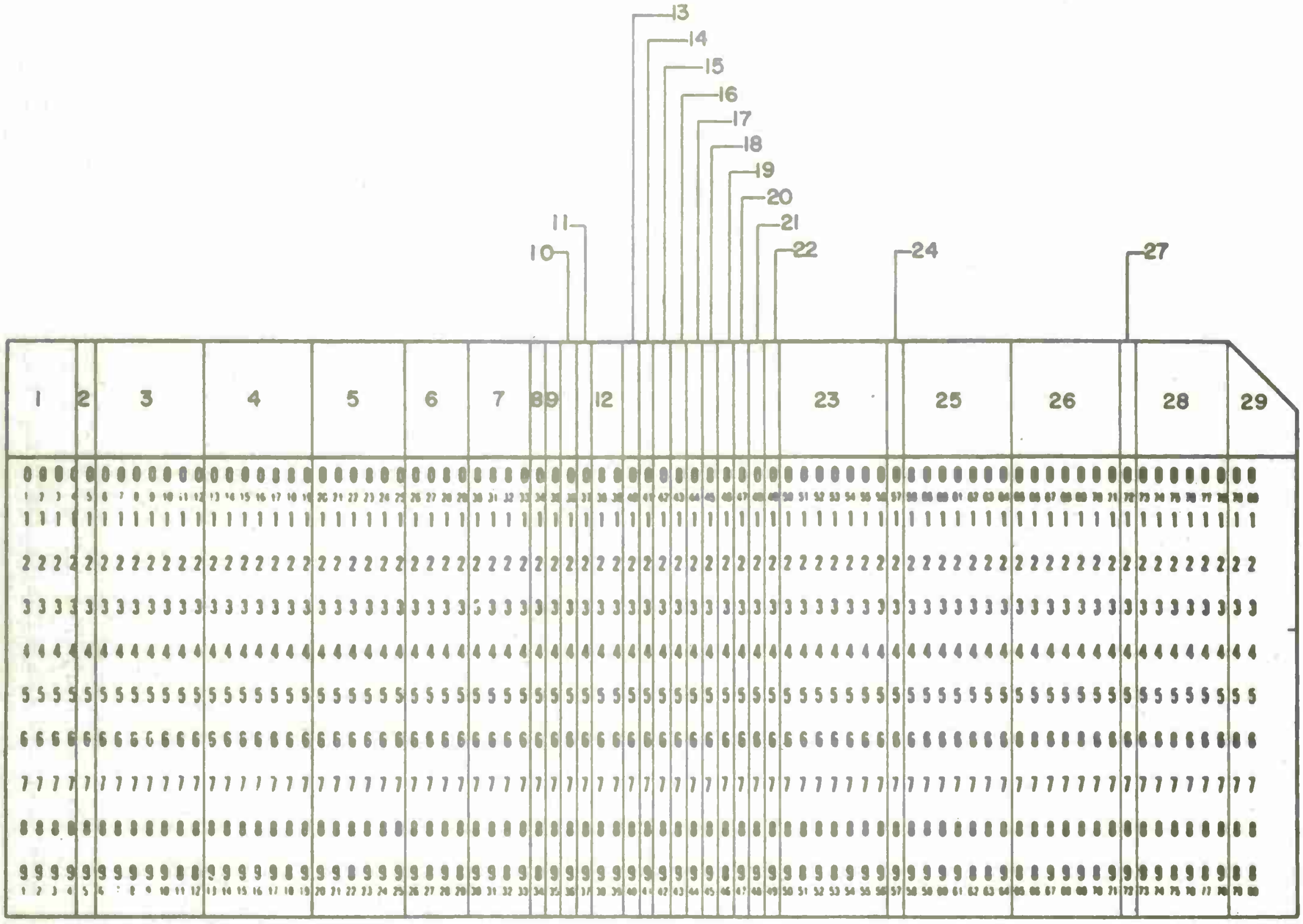
APPENDIX II

CARD FORMATS



Field	Column	Contents
1	1-8	"FANCARDS"
2	9	End of block character: 11-8-2 punch

FIGURE II-1. FAN INPUT DATA TAPE IDENTIFIER



Field	Column	Contents
1	1-4	Sensor number right adjusted
2	5	Not used
3	6-12	Beginning time - days since base time
4	13-19	End time - days since base time
5	20-25	Not used
6	26-29	Beamwidth - degrees
7	30-33	Year
8	34	Output indicator for fan number column on output. 0: No fan number 1: Fan number
9	35	Output indicator for units of range and range rate. 0: Nautical units 1: MKS Units

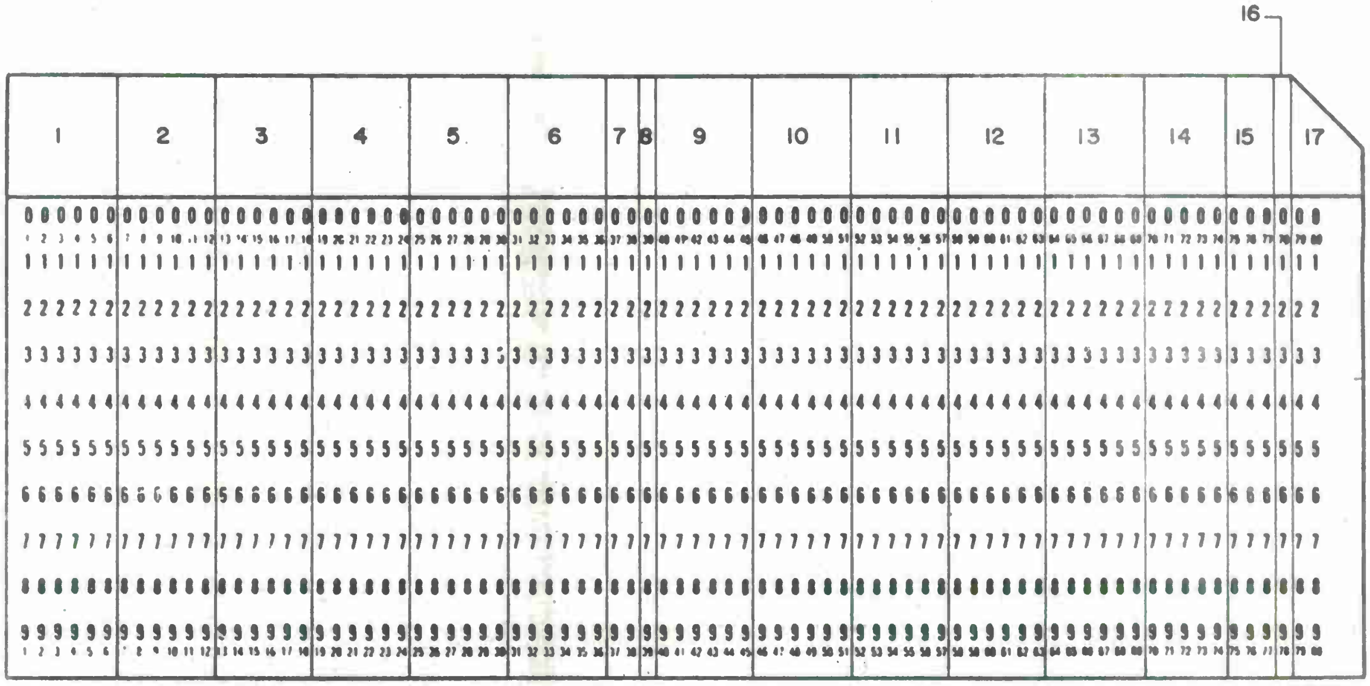
FIGURE II-2. CONTROL CARD

Field	Column	Contents
10	36	Not used
11	37	Classification indicator 0: Unclassified 1: Confidential 2: Secret 3: Secret/No form 4: Secret/Releasable outside SSO channels
12	38-39	Priority - printed on output message
13	40	Not used
14	41	Visual pass indicator 0: All passes 1: Visual passes only
15	42	Not used
16	43	Down pass indicator[1] 0: Complete pass computed 1: No points after closest point of approach
17	44	Not used
18	45	Point of maximum elevation 0: No 1: Yes
19	46	Not used
20	47	Maximum range test for point of closest approach 0: No test 1: Test
21	48	Not used
22	49	Interlace inhibit 0: Interlace predictions[2] 1: No mixture of predictions[3]
23	50-56	Not used
24	57	Direction cosines print out 0: No print out 1: Print out
25	58-64	Elevation angle of the boresight in degrees[4]
26	65-71	Boresight azimuth in degrees[4]
27	72	Element number option 0: Print revolution number 1: Print element number

1 For trackers only
2 Output in strictly chronological order
3 Same as (2) but satellite passes are not mixed
4 These fields are needed only if the tracker card indicates an FPS type tracker and/ or it is desired to print direction cosines

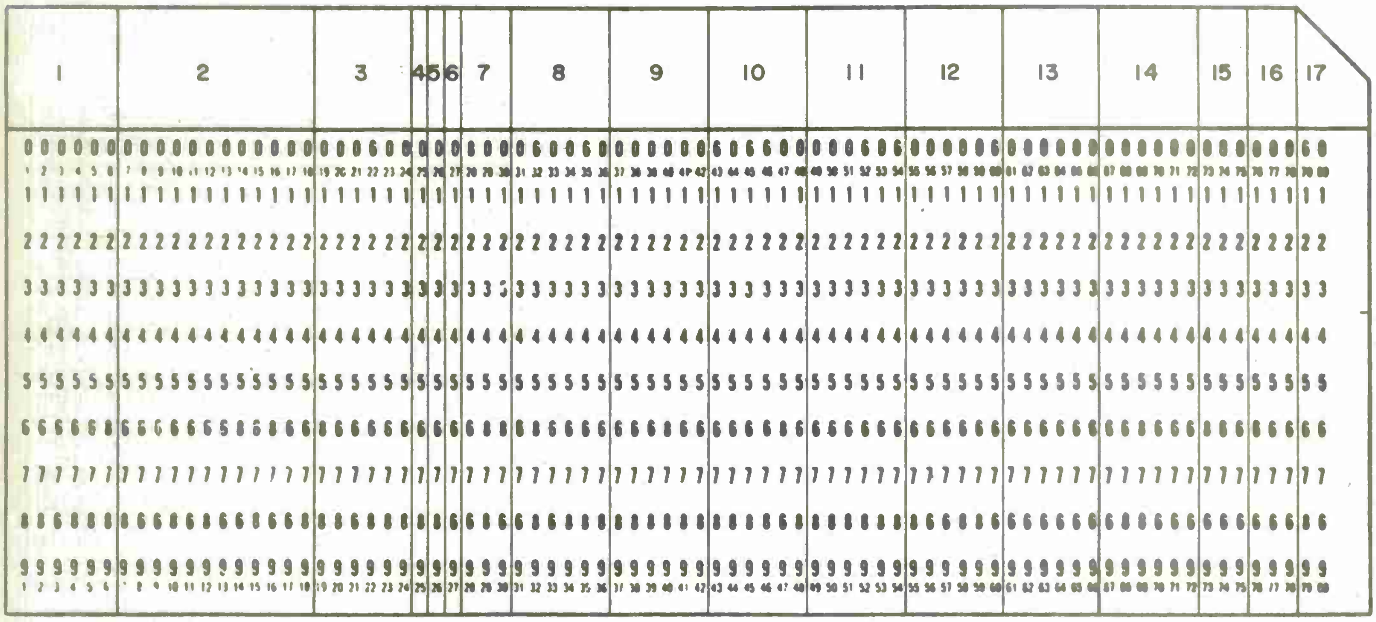
FIGURE II-2. CONTROL CARD (Continued)

Field	Column	Contents
28	73-78	Not used
29	79-80	"RP" - must contain these two letters as ID



Field	Column	Contents
1, 9	1-6, 40-45	Elevation angle at start of fan (h_1)-in degrees
2, 10	7-12, 46-51	Azimuth at start of fan (A_1) - in degrees
3, 11	13-18, 52-57	Maximum range at start of fan (ρ_{1max}) - in kilometers
4, 12	19-24, 58-63	Elevation angle at end of fan (h_2) - in degrees
5, 13	25-30, 64-69	Azimuth at end of fan (A_2) - in degrees
6, 14	31-36, 70-75	Maximum range at end of fan (ρ_{2max}) - in kilometers
7, 15	37-38, 76-77	Fan number (BCD)
8, 16	39, 78	Fan type "H" - Constant elevation azimuth scan "P" - Planar fan
17	79-80	"FP" - must contain these two letters as ID.

FIGURE II-3. FAN CARD

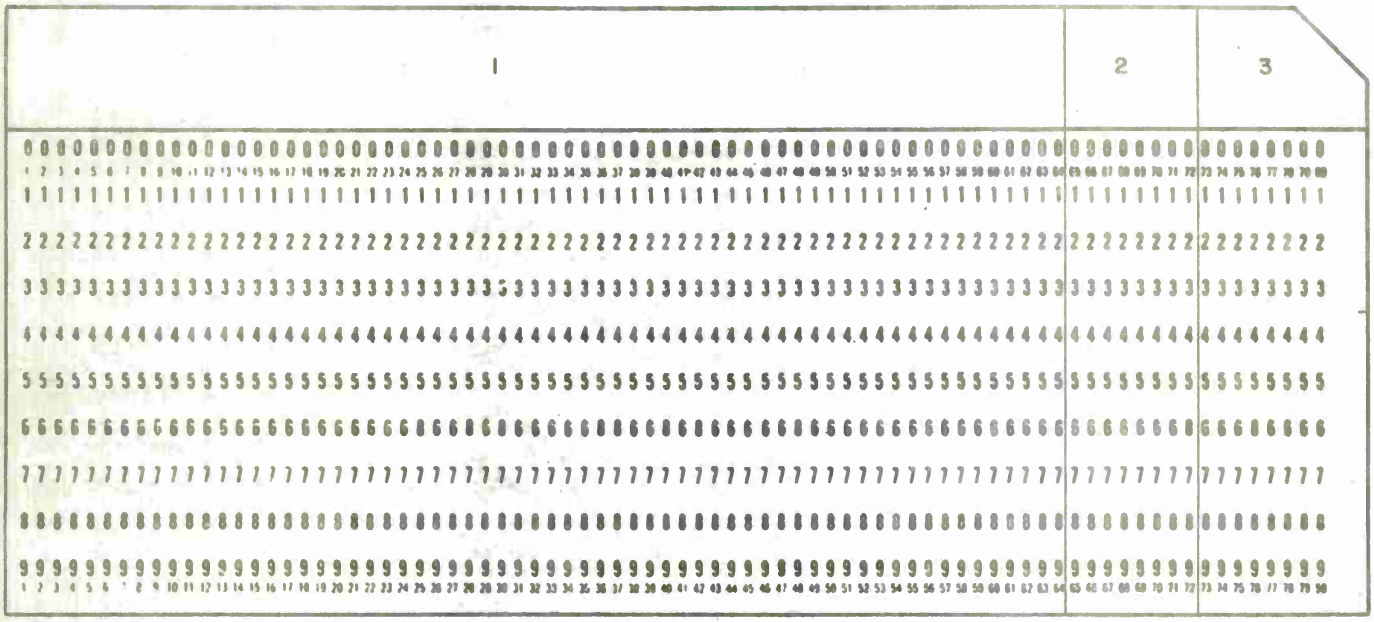


Field	Column	Contents
1	1-6	"Δ-99.0" An elevation of -99° signifies a request for acquisition coordinates for a tracking device
2	7-18	Not used
3	19-24	Minimum elevation - degrees - floating point
4	25	Points per pass 2-8: 2-8 points per pass 9: points every delta T (field 8)
5	26	Not used
6	27	Tracker type Δ or 0: Normal tracker 1: FPS-85 tracker
7	28-30	Not used
8	31-36	Time increment in minutes - (needed only if points per pass = 9)
9	37-42	Limiting value of the SIN of the boresight oriented angle α - sin α - floating point boresight oriented
10	43-48	Limiting value of the SIN of the angle β - sin β - floating point
11	49-54	Limiting value of the off-boresight angle, ψ, in degrees

FIGURE II-4. TRACKER CARD

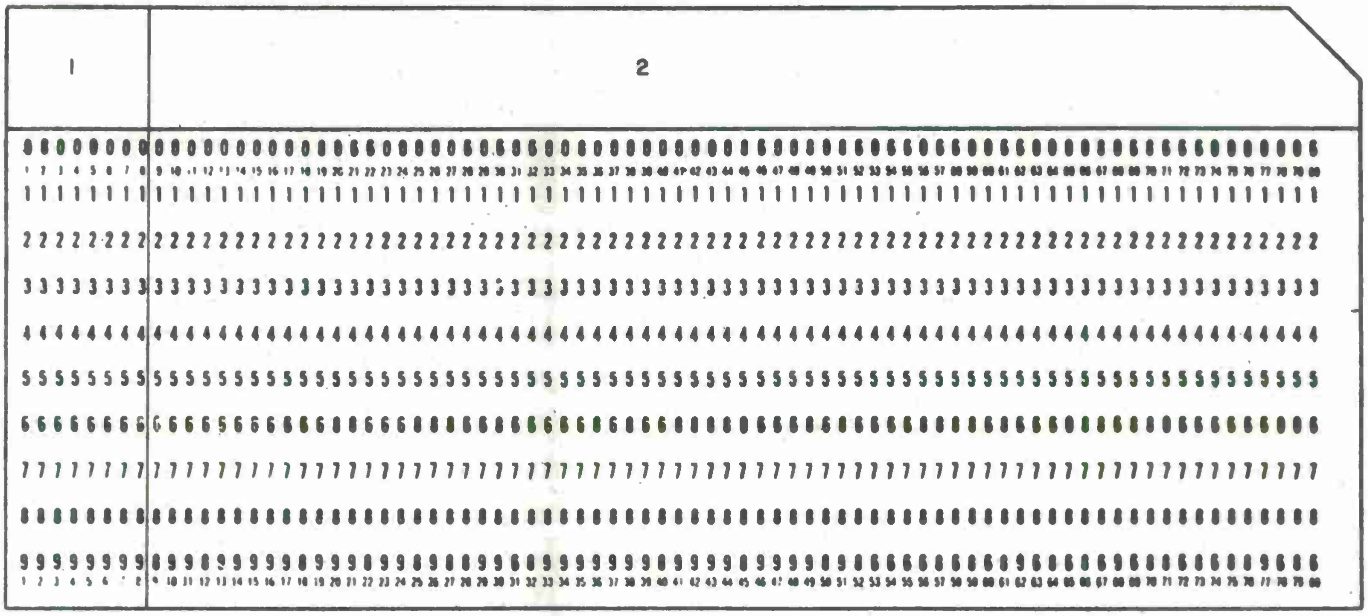
Field	Columns	Contents
12	55-60	Maximum observable range - floating point kilometers
13	61-66	Maximum elevation angle to be used for normal tracker only - if blank, 90° is assumed
14	67-72	Not used
15	73-75	Sensor number
16	76-78	Not used
17	79-80	"FP" - must contain these two letters as ID.

FIGURE II-4. TRACKER CARD (Continued)



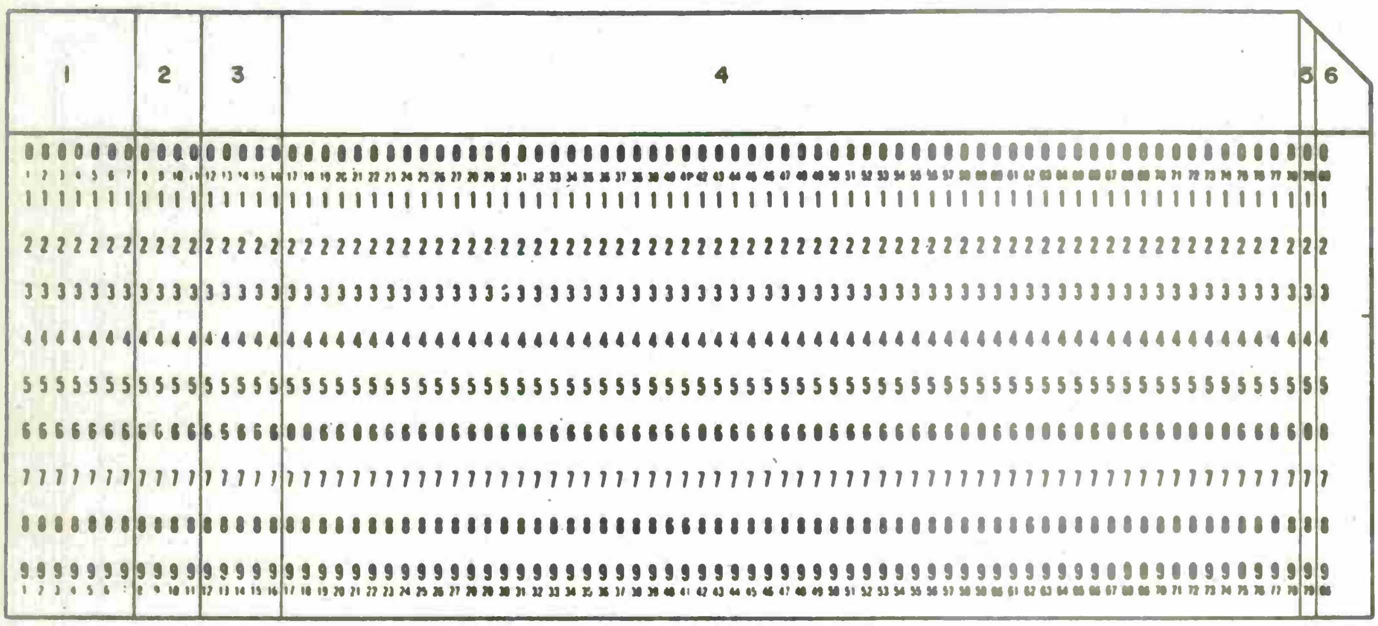
Field	Column	Contents
1	1-64	Station address - 64 BCD characters (can also include the routing address, even though this will be repeated in Columns 65-72)
2	65-72	Routing address - 6 or 7 BCD characters
3	73-80	Card identifier, one of the following: FROMXXXA, TO△△XXXA, or INFOXXXA; XXX is sensor number

FIGURE II-5. ADDRESS CARD



Field	Column	Contents
1	1-8	ALL ΔΔΔΔ ALLΔBUTΔ ONLY ΔΔΔΔ
2	9-80	1. Not used for ALL Cards 2. For "ALL BUT" and "ONLY" Cards - This field contains five -digit satellite identifiers, separated by commas and/or two five -digit satellite identifiers separated by a minus.

FIGURE II-6. ALL, ALL BUT, or ONLY CARD



Field	Column	Contents
1	1-7	Base Time - day number in year and fraction, decimal punched in Column 4
2	8-11	Not used
3	12-16	Message number, right adjusted
4	17-78	Not used
5	79	B
6	80	P

FIGURE II-7. BASE TIME CARD

```
        SET     39              $
        JMP     START           $
        SET     M/52500                   $

        SAME    ORIGIN,START              $
START   JMP     (P)+2                     $
        NOP                               $
        HLT                               $
        HLT                               $
        TMD     W/FANCARDS                $
          TDM   SYSNAME
          TMA   P/SYSTAB.T39
          JMP   TAPCK
          TMA   P/SYSTAB+7,T39
          JMP   TAPCK
          TMA   P/SYSTAB+8,T39
          JMP   TAPCK
          TMA   P/SYSTAB+9,T39
          JMP   TAPCK
            TMA N/11T15;P/SYSTAB,T39
          JMP   PANT.PINT
        CM      PHAIN                     $
        TMD     C/TJML,EREX;C/JMP,ER10  $
        TDM     0       $
        TDM     3       $
        TMD     C/HLTL,E8LOC$
        TDM     ILOCE$
        CM      NOELM$
        CM      AJDNCNT  $
        TMA     EXLOD                     $
        JAZ     (P)+2H                    $
        JMP     GO ON                     $
        TMD     1/1T6                     $
        TDM     CARDTYP                   $
        CM      NOTTY                     $
        TMD     W/        BP              $
        TDM     CONBUF+9                  $
TAG1    TMA     C/HLT,18;C/HLT,TAG6       $
        JMP     FLEX                      $
        TMQ     W/        0               $
TAG3    CD                                $
        JMP     TCMR                      $
        TDA                               $
        TMD     0/72T47                   $
        JAED    TAG1                      $
        TMD     0/32T47                   $
        JAED    TAG2                      $
        AQ                                $
        SLA     6                         $
        TAQ                               $
        JMP     TAG3                      $
TAG2    TQM     CONBUF                    $
        TMA     C/HLT,18;C/HLT,TAG7       $
        JMP     FLEX                      $
        TMQ     W/        0               $
TAG4    CD                                $
        JMP     TCMR                      $
        TDA                               $
        TMD     0/72T47                   $
```

```
        JAED    TAG2+1H                   $
        TMD     0/32T47                   $
        JAED    TAG5                      $
        AQ                                $
        SLA     6                         $
        TAQ                               $
        JMP     TAG4                      $
TAG5    SRQ     6                         $
        TQM     CONBUF+1                  $
        JMP     GO ON                     $
TAG6    0/32;A/BASE DAS                   $
        A/YS                              $
        A/ ;0/52T11$                      $
TAG7    0/32;A/BASE MES                   $
        A/SSAGE NO$                       $
        A/,;0/52T11$                      $
GO ON   TMD     L/CONBUF                  $
          TDXLC ,3
          TMA   9,3
          TMD   W/        BP
          JAED  (P)+2H
          JMP   CASE REJ
          TMA   0,3
          TMD   W/
          JAED  CASE REJ
          TMQ   0/0000001717171717
          ETA   1,3
        JAZ     CASEREJ
          TAM   AJMSGNO

L         TMA   (P)+2
          JMP   XSRCH
          JAZ   CASE REJ
          JMP   LOAD
          HLT
          TIJL  (P)+1H
          ICOZ  7+128+7
          CAM   BASE
        A/CASE REJECTED-BAS

        A/SE TIME CARD MISS

        A/SING OR IN ERRORS 48

CASEREJTMA      N/6T15;P/(P)-6,T39$
        JMP     PANT
        TMA     N/48T15;P/(P)-7,T39
        JMP     FLEX
        TMA     N/10T15;P/CONBUF,T39
        JMP     PANT
        JMP     PANT.FINISH
        JMP     MANEXIT                   $
L BUFA  SET     (P)+128$
  BUFB  SET     (P)+128$
  START6 TJM    READX$
```

```
         JMP     BUF022$
  RD6A   TJM     READX$
         TMD     TIO$
         TDXLC   0,3$
         TMD     C/HLT,0;C/HLT,SYSTAB$
         JMP     SYSIO$
         TMD     C/HLT,BUFA;C/HLT,BUF01$
         AIXJ    0,3$
  BUF022 TIJ     BUFB$
         TJM     TIO$

L READ   TMA     1/110010001T47$
R        JMP     SYS$
  TIO    TIO     $
         JMP     SYSNO$
  READX  JMP     (P)$
  BUF01  TIJ     BUFA$
         TJM     TIO$
         JMP     READ$
  LOAD   TMQ     1/1T3$
         ETA     CARDTYP$
         JAZ     LOADE$
         JMP     LOADSNO                        $
*                                               $
  LOADE  TMQ     1/1T7$
         ETA     CARDTYP$
         JAZ     LOADO$
*                                               $
         TMQ     1/1T0$
         JMP     ELMLOD$
  LOADSNOJMP     CASATTB                        $
         TMA     NUMELM$
         SLA     24$
         TAM     NOELM$
*                                               $
  TESTSNSTMQ     1/1T8$
         ETA     CARDTYP$
         JAZ     LOADE7$
  LSNCD  TMD     C/HLTL,SBLOC;C/HLT;STYPE$
         TDXLC   ,3$
         TDXRC   ,4$
         TMD     ,3$
         TDM     ,4$
         TMD     C/HLTL,STYPE+9$
         AIXO    1,3$
         AIXOL   1,4$
         JNO     (P)-5H$
         CA      $
         TMQ     STYPE$
         SLQ     12$
         SLAQ    18$
         TAM     STYPE$
         TMA     MASKBL$
         SLAQ    18$
         TAM     STAID$
```



```
  LOADE7 TMA     C/HLT,SATNOS            $
         AM      NOELM                   $
         AM      N/1T15                  $
         TAM     IEEND                   $
         SRA     24$
         TAM     TEMP1$
         TMA     NOELM$
         TMQ     4/1;12/0;32/1$
         EIS     4S1 B$
         SRA     24$
         TMQ     28/1;12/0;8/1$
         EIS     4A 10D1$
         TMA     C/HLT,0;C/HLT,ORIGIN-1 $               K;25
         SM      TEMP1$
         SLA     17$
         TMQ     16/0;32/1$
         EI      D/0$
         TAM     AJNMBLK$
         TMA     IEEND$
         TAM     4LMAX$
         SCD     24$
         TDM     4RMAX$
         SM      N/2T15$
         TAM     4LMAX2$
         JMP     START6$
         JMP     NXTCASE$
  CASATTBTJM     CASXX$
         TMD     C/HLT,SATTB;C/HLT,SATNOS$
         TDXLC   ,3$
         TDXRC   ,4$
  CASPP  TMQ     MASKSAT$
         ETA     ,3$
         ETD     MASKBL$
         JAED    ELEND$
         TMQ     1/1T0$
         EA      MASK1$
         TAM     ,4$
         AIXO    1,3$
         AIXO    1,4$
         JMP     CASPP$
  ELEND  CA      $
         TAM     ,4$
  CASXX  JMP     (P)$
  LOADO  TIJ     LOAD A3$
         TJM     LOAD A4+1H$
         TIJ     4A10$
         TJM     LOADA7-1H$
  OPTIONOTMD     C/HLT,EBLOC;C/HLT,SATNOS$
         TDXLC   ,3$
         TDXRC   ,4$
         CQ      $
         JMP     ELMLOD$
         TMA     NUMELM$
         TMQ     18/1T29                 $
         TMD     D/400B39$
```

```
         JAGD     ECYCLE$
 NOCYCLEETA       ,3$
         ETD      MASKZ$
         JAED     NOMORE$
         SRA      18                          $
         TAM      ,4$
         AIXO     16,3$
         AIXO     1,4$
         JMP      NOCYCLE                     $
         ASGN     PASSONE,M/3754$                      CN K-160
 NOMORE  TMQ      24/1T47                     $
         ETA      ,3                          $
         ETD      MASKZ                       $
         JAED     (P)+4H                      $
         TMQ      18/1T29                     $
         ETA      ,3                          $
         JMP      NOMORE-5H                   $
         CM       ,4                          $
         TMA      NUMELM$
         SLA      24$
         AMS      NOELM$
*                                             $
         JMP      TESTSNS$
 ECYCLE  DRANA*   400                         $

         ETD      16,3$
         SRD      18                          $
         TDM      1,4$
         TMA      D/400B15$
         AMS      NOELM$
         TMD      C/HLT,EBLOC$
         TDXLC    ,3$
         JMP      OPTION0+3H$

L  4S1     TJM    4S1 B+2H
           TMA    1/1
           JMP    (P)+3H
   4S1 A   TJM    4S1 B+2H
           CA
           TMQ    12/0;36/1
         TMD      C/HLT,SATNOS$
           TDXLC  ,1
L 4S1 B  RPTA     1000$
         EIS      1,1$
           JMP
   4S2     TJM    (P)-1H
         TMD      C/HLT,BUFA+120;C/HLT,BUFB+120$
           AIXOL  ,3
           JOF    (P)+3H
           AIXOR  ,3
           JNO    (P)+2H
         JMP      RD6A$
            TMA   ,3
           TMD    W/END CASE
           JAED   4S2-1H
```



```
             TMD    W/ENDSCHED
             JAED   (P)+4H
             TMA    N/1T16
             AMS    4S2-1H
             JMP    4S2-1H
             TIJ    4S3 A
             TJM    NXTCASE
             JMP    4S2-1H
R  4S3       TJM    (P)+4H
             TMA    W/END CASE
R            RPTAN  12
             TMD    10,3
             JAED
             TMA    W/ENDSCHED
R            RPTSN  13
             TMD    10,3
             JAED   4S3 A
           JMP      RD6A$
             JMP    4S3+1H
           A/END FAN INPUT$

   4S3 A     TMA    N/13T15;P/(P)-2,T39
             JMP    FLEX
             JMP    PANT.ALLFIN
           TIJ      NXTCAS1+1H$
           TJM      NXTCAS1$
             JMP    NXTCASE+1H
   4S4       TJM    4S4 A-1H $ BIT 47=1,ERROR
             CD              $     46=1,COMMA
             SIXO   1,0      $     45=1,DASH
             JOF    4S4 A    $     44=1, ENDCASE
             TMQ    4T11
             CA
             SLAQ   6
             TQM    4T11
             TMD    0/60T47
             JAED   4S4+1
             TMD    W/0000000,
           JAED     (P)+2$
             TMD    W/0000000-
           JAED     (P)+2$
             JMP    4S4 A-1
             TMD    1/1T46
             JMP    (P)+2
             TMD    1/1T45
             JMP    (P)+1
             TMD    1/1T47
             DORMS  4T9
             SRAQ   6
             JMP
   4S4 A     AIXO   1,3
             SIXO   1,1
             JNO    (P)+2
             JMP    4S2
             JMP    (P)+3
```

```
          TIXZ   10,1
          TIXZ   9,0
          TMD    ,3
          TDM    4T11
          JMP    4S4+1H
          TMD    1/1T44
          JMP    4S4 A-3H
4S4 B     TJM    4S4 B3+5H
          CM     4T9
          CM     4T6
         TIXZ    5,2                              $
          JMP    4S4
          TMA    4T6
          SLAQ   6
          TAM    4T6
          TMA    4T9
          JAZ    4S4 B3
4S4 B1    TMD    N/10T15
          AIXO   0,1
          JOF    4S4 B2
          SIXO   1,3
          AIXO   1,1
          JOF    (P)+2H
          JMP    (P)-3H
4S4 B2    TMQ    30/1;18/0
          TMA    STAN
          EIS    4S4 B3-1
         TMA     N/16T15;P/4S4 B3-3,T39$
          JMP    FLEX
         JMP     PANT.SPACE
          TMA    N/3T15;P/4S4 B3-3,T39
          JMP    PANT
          TMQ    4T9
          SRQ    3
          JQO    NXTCASE
          AIXO   10,3
          JMP    4S2
          JMP    NXTCASE
          JMP    (P)-3H

         W/ERROR ON
         W/ ALL BUT
         W/ OR ONLY
         W/ CARDS
         W/CASE REJ
         W/-INP ERR
         W/-STA XXX
4S4 B3    SIXO   1,2
          JNO    4S4 B+4H
          JMP    4S4
         TMA     4T9
         JAZ     (P)+2H
          JMP
         TMA     N/4T15;P/4S4 B3-7,T39
         JMP     PANT
```



```
           JMP      4S4 B1
  4BCDADD    TJM    (P)+6H
             AM     W/000WWWWX
             TAQ
             ES     W/
             SRD    3
             SD
             JMP
*
           0/7777777777777777
           0/6060606060603254
           JMP
  4HEAD    TJM      (P)-1H
           TIJ      PANT.TPANTAS
           TJM      4OUT1+2H $
           TMA      N/2T15;P/(P)-8H,T39$
           JMP      4OUT 1              $ LINE 1
           TMD      L/STADR+20          $ LINE 2
           TDXLC    ,7
           JMP      4HEAD 4
           TMD      C/HLT,STADR+30;C/HLT,8
           TDM      4SAVE 02
           TMQ      W/DE
           TQM      DUM
           TIXZ     18,1
           JMP      4OUT 5
           TMQ      STADR+1
           JMP      4OUT 5D
           JMP      4OUT 5B
           TIXZ     48,1                $ LINE 3
           TMQ      AJMSGNO
           CA
           SLAQ     6
           JAZ      (P)+2H
           JMP      (P)+3H
           SIXO     6,1
           JMP      (P)-5H
           SRAQ     6
           TQM      DUM
           JMP      4OUT 5
           TIXZ     12,1$
           TMQ      W/H
           TQM      DUM
           JMP      4OUT 5
           TIXZ     48,1$
           TMQ      STADR+10$
           TQM      DUM$
           JMP      4OUT 5$
           JMP      4OUT 5C
           JMP      4HEAD 4
           TMA      AJMSGNO
           JMP      4BCDADD
           TAM      AJMSGNO

R          TMA      CLSFY               $ LINE 4 IF UNCLAS
```

```
        JAZ      (P)+4H
        JMP      (P)+5H
        A/ZNR;0/3232323254
        TMA      N/1T15;P/(P)-2H,T39
        JMP      4OUT 1
        TMD      L/STADR+40
        TDXLC    ,7
        JMP      4HEAD 4              $ LINE 5(4)
        JMP      4HEAD 4              $ FM LINE
        JMP      4HEAD 4              $ TO LINE
        TMA      ,7
        TMD      W/
        JAED     (P)+2H
        JMP      (P)-4H
        TMA      C/HLT,1;C/HLT,AFGRNCS
        JMP      4OUT 1
        JMP      4HEAD-1H
 AFGRNC A/AFGRNC;0/3254
 4HEAD 4 TJM     4OUT 1+5H
        TMD      N/9T15
        TXDRC    ,7
        TDA
        AIXO     10,7
        JMP      4OUT 1+1H
*
 4OUT 1   TJM    (P)+5H
          TAD
          JMP    PANT.TPANTA
          TAD
          JMP    PANT
          JMP
L          JMP
 4OUT 2    TJM   (P)-1H $ INSERT 0/32 IF HALF WORD BLANK
        TXDLC    ,4
        TDXLC    ,0
        SIXO     10,0
           TXDLC,0
           TDXLC,2
           TIXZ 1,1
           TMQ  24/1;24/0
           ETA  ,2
           ETD  W/
        JAED     4OUT 2A-2H $
           SRQ  24
           ETA  ,2
           ETD  W/
           JAED  4OUT 2B
           AIXO 1,2
        TMD      N/10T15
           AIXO 1,1
        JNO      4OUT 2+7H
           TMD  0/32
           TDM  ,2
 4OUT 2A SIXO    1,2
        JMP      4OUT 2C
```



```
            CD
            TXDLC,1
            TXDRC,0
            TDA
         TDM      9,0
            JMP   4OUT 2-1H
 4OUT 2B JMP      4OUT 2C
         JMP      4OUT 2A+2H
*
 4OUT 2C TJM      (P)+5H
         TMQ      6/1T47
         ETA      W/
         ETD      ,2
         JAED     (P)+2H
         JMP
         TMA      ,2
         EI       8/011010
         TAM      ,2
         JQN      (P)-4H
         JQO      (P)+1H
         SLQ      6
         JMP      4OUT 2C+2H

 4C1     W/SAT, SUM
         W/MARY FOR
         W/ STA-XXX
 4C2     W/DECAYING
 4C3     W/100 DAYS
         A/ PAST EPOCH    $

 4C4     W/SAT,NO./
         W/SET NO.
         $
*
 4SAVE02S
         TMD      4SAVE 02
         TXDLC    ,2
         TXDRC    ,0
         TDM      4SAVE 02
         JMP
 4OUT 5  TJM      (P)-1H
         TMD      4SAVE 02
         TDXLC    ,2
         TDXRC    ,0
         TDM      4SAVE  02
         TMQ      DUM
         SLAQ     6
         TQM      DUM
         JMP      (P)+5H
 4OUT 5A CD
         SIXO     6,1
         JNO      (P)-6H
         JMP      4OUT 5-5H
         TMQ      42/1;6/0
         EIS      ,2
```

```
          CD
          SIXO    1,0
          JNO     (P)+4H
          AIXO    1,2
          TIXZ    8,0
          JMP     4OUT 5A
          SLA     6
          TAM     ,2
          JMP     4OUT 5A
4OUT 5B   TJM     4OUT 5-1H
          TIXZ    6,1
          TMD     W/
          JMP     (P)+4H
4OUT 5C   TJM     4OUT 5-1H
          TIXZ    48,1
          TMD     7/011010;1/101100
          TDM     DUM
          JMP     4OUT 5+1H
4OUT5D    TJM     4OUT5-1H $
          TQA     $
          TIXZ    0,1 $
          TIXZ    M/60,0$
          SRAQ    6$
          TQD     $
          SRD     10 $
          SIXO    ,0$
          JOF     (P)+3H $
          AIXO    6,1$
          JMP     (P)+2H $
          SLQ     6 $
          JAZ     (P)+2H $
          JMP     (P)-9H $
          TQM     DUM $
          JMP     4OUT5+1H$

          $
4SMRYX    $
          TMD     4SMRYX$
          TDXLC   ,6$
          JMP     (P)$
4SUMMRY   TJM     (P)-1H$
          TXDLC   ,6$
          TDM     4SMRYX$
          TIJ     4OUT1+3H
          TJM     4OUT1+2H
          JMP     PANT.PAGE
          JMP     4CLEAR
          TMA     STAN
          TMQ     30/1;18/0
          EIS     4C1+2
          TMA     N/3T15;P/4C1,T39
          JMP     4OUT1
          JMP     PANT.SPACE
          TIJR
          TJM     4NXTEL+6H$
```

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```
          JMP     4SET
          JMP     PANT.SPACE
          JMP     PANT.SPACE
          JMP     4CLEAR
          TMA     N/1T15;P/4C2,T39
          JMP     4OUT1
          JMP     PANT.SPACE
          TIJR    47
          TJM     4NXTEL+6H$
          JMP     4SET
          JMP     PANT.SPACE
          JMP     PANT.SPACE
          JMP     4CLEAR
          TMA     N/3T15;P/4C3,T39
          JMP     4OUT1
          JMP     PANT.SPACE
          TIJR    46
          TJM     4NXTEL+6H$
          JMP     4SET
          JMP     PANT.SPACE
          JMP     PANT.SPACE
          JMP     4CLEAR
          TMA     N/2T15;P/4C4,T39
          JMP     4OUT1
          JMP     PANT.SPACE
          TMD     C/HLT,SATNOS                $
          TDXLC   ,1$
          TMD     L/48FR$
          TDXLC   ,0$
          CSM     D/1847$
          TAM     4T13$
          CM      4T14$
NXTSET    TMQ     18/1T47$
          ETA     ,1$
          JAZ     NONXSET$        END OF SATNOS TABLE
          TMQ     ,1$
          JQN     (P)+3H$         CHECK  THIS SATELLITE
          AIXO    1,1$
          J       NXTSET$
          TAM     SATN$
          JMP     NXTELM$         GET.EL. SET NO.
          NOP     $
          TMQ     18/1T47                     $
          ETA     SATN                        $
          JMP     BINBCD$         CONVERT TO BCD
          TMD     BCDSAT$
          TDM     4T7$
          TMA     ELNO$
          JMP     BINBCD$
          TMD     BCDSAT$
          TDM     4T8$            EL SET NO. IN BCD
          TMA     D/1847$
          AMS     4T13$
          JAZ     SATONE$
          J       SATTWO$
```

```
*       THERE WILL BE 4 GROUPS OF THE FOLLOWING PER LINE OF
*       OUTPUT FOR SATNO./ELNO. EACH GROUP CONTAINS 3 WORDS
*      (SSSSS/EE) ,(EE  SSSS) ,(S/EEEE  )

*        FIRST SAT. IN GROUP
 SATONE TMA     4T7$            (000SSSSS)
        TMQ     0/61T5$         SLASH
        SLAQ    6$              (00SSSSS/)
        TMQ     4T8$            (0000EEEE)
        SLQ     24$             (EEEE0000)
        SLAQ    12$             (EE000000)=Q
        TAM     0,0$            (SSSSS/EE)=A
        SLAQ    12$              (000000EE) =A
        TMQ     MASKBL$
        SLAQ    12$
        TAM     1,0$             (0000EE  ) =A
        AIXO    1,0$
        AIXO    1,1$
        J       NXTSET$

*        SECOND SAT. IN GROUP
 SATTWO TMA     0,0$            (0000EE  )
        TMQ     4T7$            (000SSSSS) =Q
        SLQ     18$             (SSSSS000) =Q
        SLAQ    24$             (EE  SSSS) =A
        TAM     0,0$
        SLAQ    6$
        TMQ     0/61T5$           SLASH
        SLAQ    6$
        TMQ     4T8$
        SLQ     24$
        SLAQ    24$               (S/EEEE00)
        TMQ     MASKBL$
        SLAQ    12$               (S/EEEE  )
        TAM     1,0$            (S/EEEE  )
        AIXO    2,0$
        AIXO    1,1$
        CSM     D/1847$
        TAM     4T13$
        TMA     D/1847$
        AMS     4T14$
        TMD     D/4847$
        JAED    (P)+2H$
        J       NXTSET$
        CM      4T14$
        TMA     N/12T15;P/4BFR,T39$
        JMP     4OUT1$
        JMP     4CLEAR$
        TMD     L/4BFR$
        TDXLC   0,0$
        J       NXTSET$
```



```
*        END OF SATNOS TABLE
 NONXSETCD      $
        TXDLC   0,0$
        TDA     $
        SM      C/HLT,4BFR;C/HLT,0$
        TAM     4T7$
        JAZ     4SUMMRY-3H$
        TMA     4T13$
        JAZ     SET00$
        J       SET11$

*        FIRST SAT. IN GROUP
 SET00  TMA     0,0$            (0000EE  )
        TMQ     MASKBL$
        SLAQ    24$             (EE      )
        TAM     0,0$
        J       SETEND$

*        SECOND SAT. IN GROUP
 SET11  TMA     4T7$
        AM      P/4BFR,T39$
        J       SETEND+1$
 SETEND TMA     4T7$
        AM      C/HLT,1;C/HLT,4BFR$
        JMP     4OUT1$
        JMP     4SUMMRY-3H$
 BINBCD TJM     BINDONE$        BIN.SAT. NO. IN (A)
        CM      BCDSAT$
        TAQ     $
        TIXZ    0,2                     $
 NXTCHARCA      $
 BINDONEJAEQ    (P)$            BIN.NO. NOW CONVERTED TO BCD
        DAQ     D/10$
        SLA     0,2                     $
        AMS     BCDSAT$
        AIXO    6,2                     $
        JMP     NXTCHAR$

L 4CLEAR   TJM     (P)+7H
           TMD     L/4BFR
           TDXRC   ,3
           TMD     W/
L       RPTA    11
           TDM     1,3
        SIXO    11,3
           JMP
L          TAQ
           TMA     1/1T16
           AMS     (P)+1
           TQA
           JMP
```

```
4NXTEL   TJM     (P)-1H
         TMQ     18/1T47$
         ETA     ,1
         JAZ     4NXTEL-1H$
         TMD     ,1
         AIXO    1,1$
         SCD
         JDP     (P)-6H
         JMP     4NXTEL-5H
4SET     TJM     4SET3-1H
         TMD     C/HLT,SATNOS                    $
         TDXLC   ,1$
         TMD     L/4BFR
         TDM     4T6
         CSM     D/1B47$
         TAM     4T13$
         CM      4T14$
         JMP     4NXTEL
         NOP
         TAM     4T7
4SET 1   JMP     4NXTEL
         JMP     4SET 2
         TAM     4T8
         TMA     4T7
         AM      D/1B47$
         TMD     4T8$              SAT.NOS. CONSECUTIVE ?
         JAED    4SET 3$           YES
         TMA     4T7$
         JMP     BINBCD$
         JMP     4COMMA
         JMP     4SET1
4SET2    TMA     4T7$
         JMP     BINBCD$
         JMP     4BLANK$
         TMA     4T6$                    4BFR+2 IN BOTH HALVES
         TDXLC   ,0$
         SM      C/HLT,4BFR$
         TAM     4T7$
         TMD     C/HLT;C/HLT,4BFR$   BUFFER EMPTY ?
         JAED    (P)+2H$             MAYBE
         J       GROUPCK$            NO
         TMA     4T13$
         JAN     4SET3-1H$           BUFFER IS EMPTY
         J       GROUPCK$            AT LEAST 1 SATNO. TO PRINT
         TMA     D/12B15$
INSERT   TMQ     1/1;15/0;32/1$
         EIS     SLAQ$
         J       ASBL$
GROUPCK  TMQ     4T13$
         JQO     AS2OR4$           2ND OR 4TH SATNO. IN GROUP
AS0OR2   JQO     AS3$              3RD
         J       AS1$              IST
AS2OR4   JQO     SLAQ+2H$          4TH
         J       AS2$              2ND
AS1      TMA     D/12B15$         FIRST SAT. IN GROUP
```



```
         J       INSERT$
AS2      TMA     D/24B15$          SECOND SAT.IN GROUP
         J       INSERT$
AS3      TMA     D/36B15$          THIRD SAT. IN GROUP
         J       INSERT$
ASBL     TMA     ,0$
         TMQ     MASKBL$

L SLAQ   SLAQ    0$
         TAM     ,0
         TMQ     15/1T15$
         ETA     4T7$                NO. WORDS TO PRINT IN LEFT
         AM      C/HLT,1;C/HLT,4BFR$ HALF OF A REG. STARTING
*                                    ADDRESS IN RIGHT HALF
         JMP     4OUT 1
         JMP
4SET 3   TMA     4T7$
         JMP     BINBCD$
         JMP     4DASH$
         JMP     4NXTEL
         JMP     4SET 2
         TAM     4T8
         TMA     4T7
         TDM     4T9
         AM      D/1B47$
         TAM     4T7
         TMD     4T8
         JAED    4SET3+3H                  $
         TMD     4T9
         TDM     4T7
         JMP     4SET2-4H                  $
4SLASH   TMQ     W//
         TJM     4DONE$
         JMP     INSERTA$
4BLANK   TMQ     W/
         TJM     4DONE$
         JMP     INSERTA$
4COMMA   TMQ     W/,
         TJM     4DONE$
         JMP     INSERTA$
4DASH    TMQ     W/-
         TJM     4DONE$
INSERTA  TMA     BCDSAT$           SAT.NO. IN BCD AT T47
         SLAQ    6$
         TAM     4T7$
         JMP     4HALF
4RESET   TMD     4T8$
         TDM     4T7
4DONE    JMP     (P)$
4HALF    TMD     4T6$              4BFR TO
         TDXLC   ,0$               0X
         TMA     4T14$             GROUP COUNT
         TMD     D/3B47$
         JAED    SAT13$            LAST SAT. ON THE LINE-13TH.
         TMA     D/1B47$
```

```
         AMS     4T13S           COUNTS NO. IN GROUP
         TAQ     S
         JQO     SAT2OR4S
SAT002   JQO     SAT3S
         J       SAT1S
SAT2OR4  JQO     SAT4S
         J       SAT2S
SAT1     TMD     4T7S            FIRST SAT. IN GROUP
         TDM     ,0S             (0011111,)
         J       4RESETS        X0 NOT INCREMENTED HERE
SAT2     TMA     ,0S             (0011111,)
         TMQ     4T7S            SECOND SAT. IN GROUP
         TDM     1,0S            (0022222,)
         SLQ     12S             (22222,00)
         SLAQ    12S             (11111,22)
         TAM     ,0S            (11111,22)
         AIXO    1,0S
         J       ASENDS
SAT3     TMA     ,0S             (0022222,) =A
         TMQ     4T7S            THIRD SAT IN GROUP
         TDM     1,0S            (0033333,)
         SLQ     12S             (33333,00) =Q
         SLAQ    24S             (222,3333) =A
         TAM     ,0S            (222,3333) =ABUF+1 IST TIME
         AIXO    1,0S
         J       ASENDS
         TAM     ,0S             (11111,22)
SAT4     TMA     ,0S             (0033333,)
         TMQ     4T7S           4TH AND LAST SAT IN GROUP
         SLQ     12S
         SLAQ    36S             (3,44444,) =A
         TAM     ,0S
         AIXO    1,0S
         TMA     D/1847S
         AMS     4T14S
         CSM     D/1847S
         TAM     4T13S
         J       ASENDS
SAT13    TMA     4T7S            LAST=13TH. SAT. ON LINE
         TMQ     MASKBLS
         SLAQ    12S
         TAM     ,0S             XXXXX,  **
         CM      4T14S
         TMA     N/10T15;P/4BFR,T39S
         JMP     4OUT1S
         JMP     4CLEARS
         TMD     L/4BFRS
SETBFFR  TDM     4T6S
         JMP     4HALF+3HS
ASEND    CD      S
         TXDLC   ,0S
         JMP     SETBFFRS
BCDSAT   S
4T13     S
4T14     S
```



```
REWIND   TJM     (P)+4H
         JMP     SYS
         TIO     ABUF
         JMP     SYSNO
         JMP
NXTCASE  JMP     PANT.FINISH                 S OR 4S3 A
         CM      PHAIN                       S
         TMA     N/7T23;H/8AT47
         JMP     REWIND
         TMA     N/8T23;H/8AT47
         JMP     REWIND
         TMA     N/9T23;H/8AT47
         JMP     REWIND
NXTCAS1  JMP     (P)+3HS
         JMP     SATLODS
         JMP     MANEXIT                     S
*
* RESET
*
         CM      PASSONES                                CN K-160
         CQ      S                                       CN K-160
         JMP     ELMLODS                                 CN K-161
         CM      AJDNCNT S
         TMD     W/   MORE S
         TDM     AJMRDTAS
         TIJ     AJINSMR+1H S
         TJM     AJINSMR    S
*                                            S
         TMD     W/ SAT   R
         TDM     AJLN12
         TMD     W/EV    TI
         TDM     AJLN12+1
         TMD     C/JMP,SYS;C/TIO,AJBFFX
         TDM     AJWT89+1
         TIJ     AJPKITA+3H
         TJM     AJPKITA-1H
         TIJ     AJDYCK
         TJM     AJDLOOP
         TIJ     GLOP.TGLOP
         TJM     AJCLU+3H
         TIJ     GLOP.GLOP
         TJM     AJHDU+3H
         TMD     C/ICOZ,27*128+1;C/TMA,AJELEV
         TDM     AJFWL6
         TMD     C/ICOZ,34*128+1;C/TMA,AJAZ
         TDM     AJFWL7
         TIJ     AJDAYSS                     S
         TJM     AJ1OUT                      S
         TMD     C/HLT,17*128+17;C/TMA,AJUNS
         TDM     AJFCL
         TMD     C/HLT,34*128+34;C/TMA,AJCONS
         TDM     AJFCF
         TMD     C/HLT,22*128+22;C/TMA,AJSCS
         TDM     AJFSC
         TMD     C/HLT,34*128+34;C/TMA,AJNFS
```

```
         TDM      AJFNF
         TMD      C/HLT,54*128+54;C/TMA,AJACN2$
         TDM      AJACN1
         TMD      W/                          $
         TDM      AJBFFR                      $
         JMP      PANT.PAGE          $
*
* READ SENSOR FILE
  READSNSJMP      SNSGET$
         TMD      C/HLT,SBLOC$
         TDXLC    ,3$
         TMD      IEEND$
         TDXLC    ,4$

R        RPTAA    9$
         TMD      1,3$
         TDM      1,4$
         SIXO     9,3$
         TMA      ,3$
         TMD      MASKBL$
         JAED     (P)+3H$
         AIXO     9,3$
         JMP      (P)-8H$
*
* CASE BY PASS OPTION
*
  4A 1   JMP      RD6A$
           TMA    ,3
           TMD    W/ENDSCHED
           JAED   4S3 A
           TMD    W/END CASE
           JAED   4A 1
           TAM    4A3-1
           TMA    N/12T15;P/4A3-2,T39
           JMP    FLEX
           TTD
           SCD    1
           JDP    4A 4
           JMP    4A 2
  4A 1A    JMP    4S3
         JMP      RD6A$
           TMA    ,3
         JMP      4A 1+6H
  4A2    JMP      STOPGO$
         JMP      4A 4$
         JMP      4A 1A$
         A/STATION XXXX$

  4A3    A/JAN$
         A/FEB$
         A/MAR$
         A/APR$
         A/MAY$
         A/JUN$
         A/JUL$
```



```
         A/AUG$
         A/SEP$
         A/OCT$
         A/NOV$
         A/DEC$
*                                             $
*
* ERROR OUTPUT
*
  AJERRORNOP
         TMA      N/6T15;P/AJERR7,T39
           JMP    PANT
           TMA    N/10T15
           TXDRC  ,3
           JMP    PANT
         TMD      4S4 B3-2
         TDM      4T9
         JMP      4S2
           JMP    4S4 B2
         AIXO     10,3
         JMP      (P)-3H
*
* DETERMINE TIME
*
  4A 4     JMP    AKLOK
           TQM    ZULUT
           SLQ    12
           TQM    TFN
           TMD    L/4A3-1
           TDXLC  ,0
           SRAQ   7
           CA
           SLAQ   7
           TMD    D/64
           JAGD   (P)+7H
           SLA    8
           TAD
           ADXR   0,0
           TMD    0,0
           TDM    MONTH
           JMP    (P)+3H
           SM     D/54
           JMP    (P)-7H
           JMP    FKLOK
           JMP    FYKLOK
           JMP    AJFIXIT
           TAM    DFN
*
* PROCESS CONTROL CARD
*
         TIJ      4S2
         TJM      AJERROR+8H
           TMQ    12/1T47
           ETA    9,3
            TMD   W/000000RP
```

```
         JAED   (P)+3H
         TMA    N/7T15;P/AJERR1,T39
          JMP   AJERROR+1S
         TMA    C/HLT;C/TIJL,AJSRFWR
         JMP    XSRCH
         JAZ    AJERROR
*
       TMA      8,3
       SLA      35
       JAP      4A 4AA
       TMD      C/HLT,17*128+17;C/TMA,AJUN1S
       TDM      AJFCL
       TMD      C/HLT,34*128+34;C/TMA,AJCON1S
       TDM      AJFCF
       TMD      C/HLT,22*128+22;C/TMA,AJSC1S
       TDM      AJFSC
       TMD      C/HLT,34*128+34;C/TMA,AJNF1S
       TDM      AJFNF
       TMD      C/HLT,54*128+54;C/TMA,AJACN3S
       TDM      AJACN1
 4A 4AA TMA     BASE
         FAM    BEGT
         TMQ    YEAR
         JMP    BKLOK
         TAM    BEGT
         TDM    FDAY
         TMA    BASE
         FAM    ENDT
         JMP    BKLOK
         TAM    ENDT
       FSM      BEGT                           S
       TMQ      F/29                           S
       JAGQF    TIME OUT                       S
*
       CM       RSU                            S
       CM       RSV                            S
       CM       RSW                            S
       TMD      0/32;7/110000                  S
       TDM      AJUNITS+1                      S
       TMQ      W/     (NM)                    S
       TMA      RNGFLAG                        S
       JAZ      (P)+2H                         S
       TMQ      W/     (KM)                    S
       TQM      AJUNITS                        S
       TMD      A/E;0/32;6/110000              S
       TDM      AJLN12+6                       S
       TMQ      W/                             S
       TMA      ELFLAG                         S
       JAZ      (P)+5H                         S
       TMD      A/E  FAN;0/3260                S
       TDM      AJLN12+6                       S
       TQM      AJUNITS+1                      S
       TMQ      A/  NO.;0/32;A/  S             S
       TQM      AJUNITS+2                      S
       TMD      W/                             S
```



```
           TDM     AJUNITS+3                   S
           TDM     AJUNITS+4                   S
           TDM     AJUNITS+5                   S
           TDM     AJLN12+7                    S
           TDM     AJLN12+8                    S
           TDM     AJLN12+9                    S
           TMA     DRCOSFL                     S
           JAZ     BYPASS2                     S
           TMD     W/   U                      S
           TDM     AJUNITS+3                   S
           TMD     W/    V                     S
           TDM     AJUNITS+4                   S
           TMD     W/    W                     S
           TDM     AJUNITS+5                   S
           TMD     W/     DIRE                 S
           TDM     AJLN12+7                    S
           TMD     W/CTION CO                  S
           TDM     AJLN12+8                    S
           TMD     W/SINES                     S
           TDM     AJLN12+9                    S
*
  BYPASS2  TMA     PRIO                        S
           TMD     W/
           JAED    AJERROR
             CM    AJ1STF
             TMA   CLSFY
             SLA   8
             TAM   CLSFY
             TMD   N/5T39
             JAGD  AJERROR
*
           TMA     ZFX                         S
           TMQ     ZFY                         S
           JMP     COMPL                       S
           TDM     YFX                         S
           TQM     YFY                         S
           TAM     YFZ                         S
           TMQ     DE2RA                       S
           FMMRS   ZFX                         S
           FMMRS   ZFY                         S
S          FSIN                                S

           TAM     XFX                         S
S          FCOS    ZFY                         S


           TAM     XFY                         S
           TMD     F/0                         S
           TDM     XFZ                         S
S          FCOS    ZFX                         S

           TAM     ZFZ                         S
           TMQ     YFZ                         S
           FMMR    XFY                         S
```

```
         TAM     ZFX                                  $
         FCSM    XFX                                  $
         FMARS   ZFY                                  $
         TMA     4C4+2
         JMP     (P)+5H                               $
*                                                     $
*                                                     $
         TMD     W/ SAT  EL
         TDM     AJLN12
         TMD     W/EM    TI
         TDM     AJLN12+1
*
*  UNPACK SENSOR RECORD
*
         CSM     D/1815$
         TAM     SATCONTS
         TMQ     1/1T8      $
         ETA     CARDTYP
         JAZ     (P)+9H
         TMQ     18/1T47
         ETA     STAN
         ETD     STAID
         JAED    LOAD S0
         TMD     W/N S AND
         TDM     AJERR9+1
         TMA     N/4T15;P/AJERR9,T39
         JMP     AJERROR+1S
         TMD     IEENDS
         TDXLC   ,4S
         TMQ     18/1T47
         ETA     ,4
         ETD     STAN
         JAED    LOAD S
         ETD     MASKBLS
         JAED    (P)+3H
         AIXO    9,4
         JMP     (P)-6H
         TMQ     24/0;24/1
         TMA     STAN
         SLA     24
         EIS     LOAD S-2
         TMA     N/3T15;P/LOAD S-3,T39
         JMP     AJERROR+5H

         A/STATION XXXX NOT ON SEAI$3

LOAD S   TMD     C/HLT,STYPES
         TDXLC   ,0
         CA
R        RPTAA   9
         TMD     1,4
         TDM     1,0
         TMQ     STYPE
         SLQ     12
```

100


```
         SLAQ    18
         TAM     STYPE
         TMA     W/
         SLAQ    18
         TAM     STAID
LOAD S0  SLA     6
         TMQ     24/1;18/0;6/1
         EIS     LOAD S1-3H
         EIS     LOAD S1-5H
         EIS     LOAD S1-7H
         JMP     LOAD S1

         W/FROMXXXA
         W/TO  XXXA
         W/INFOXXXA
*
*  STORE  FAN AND ADDRESS DATA
L        HLT     IREC
LOAD S1  TMD     (P)
         TDXLC   ,0
         TMD     W/
L        RPTA    256
         TDM     1,0
         TMD     LOAD A$
         TDXRC   ,0$
         AIXO    10,3$
LOAD F   JMP     4S2
         JMP     LOAD A1                              $
         TMQ     12/1T47
         ETA     9,3
         ETD     W/000000FP
         JAED    (P)+7H
         SRQ     6
         ETA     9,3
         ETD     LOAD S1-3H
         JAED    LOAD A
LOAD F1  TMA     N/5T15;P/AJERR6,T39                  $
         JMP     AJERROR+5H
         TMD     C/HLT,AJBFFR+150;C/HLT,(P)+4H$
         AIXJ    0,0
         TMA     N/5T15;P/AJERR5,T39                  $
         JMP     AJERROR+5H
R        RPTAA   10
         TMD     1,3
         TDM     1,0
         TMD     W/                                   $
         TDM     1,0                                  $
         JMP     LOAD F
R LOAD F2 TJM    (P)+7H
         NOP     STADR+50
R        RPTAA   9
         TMD     1,3
         TDM     1,4
         AIXO    1,3
         AIXO    1,4
```

```
         JMP

L LOAD A TMA      W/
         TMD      AJBFFR
         JAED     CHKMEL                    $
         TAM      ,0
         TMA      9,3
         TMD      LOAD S1-7H
         JAED     (P)+3H
 LOAD A1 TMA      N/3T15;P/AJERR3,T39
         JMP      AJERROR+5H
         TMD      LOAD F2+1H
         TDXLC    ,4
*
         TMD      C/HLT,STADR+9;C/HLT,STADR-1
         TDM      STADR+9
         JMP      LOAD A7
         TIXZ     18,2
         TIXZ     30,1
         TMA      W/00000FM
         JMP      LOAD A9
         JMP      4S2
         JMP      LOAD A1
         TMA      9,3
         TMD      LOAD S1-5H
         JAED     (P)+2H
         JMP      LOAD A1
         JMP      LOAD A7
         TIXZ     18,2
         TIXZ     30,1
         TMA      W/00000TO
         JMP      LOAD A9
         JMP      4S2
         JMP      LOAD A1
         TMA      9,3
         TMD      LOAD S1-5H
         JAED     (P)+2H
         JMP      (P)+6H
         JMP      LOAD A7
         JMP      4OUT 2
         JMP      (P)-8H
 LOAD A3 TMA      N/5T15;P/AJERR10,T39
         JMP      AJERROR+5H
*
 LOAD A4 JMP      4S2
         JMP      LOAD A5
         TMA      9,3
         TMD      LOAD S1-3H
         JAED     (P)+2H
         JMP      LOAD A5
         JMP      LOAD A7
         TIXZ     30,2
         TIXZ     18,1
         TMA      W/000INFO
         TIJ      LOAD A6+1H
```



```
         TJM      LOAD A6
         JMP      LOAD A9
         JMP      4S2
         JMP      LOAD A5
         TMA      9,3
         TMD      LOAD S1-3H
         JAED     (P)+2H
         JMP      LOAD A5
         JMP      LOAD A7
         JMP      4OUT 2
         JMP      (P)-8H
*
         JMP      4S2
         JMP      4A20
         AIXO     10,3
         JMP      (P)-3H
 LOAD A5 TMD      C/HLT,STADR+20;C/HLT,8
         TDM      4SAVE 02
         TMA      PRIO
         SRAQ     12
         TQM      DUM
         TIXZ     12,1
         JMP      4OUT 5
         JMP      4OUT 5B
         TMD      L/STADR $
         TDXLC    ,7
         TMQ      0,7
         TDM      SAVE
         JMP      LDA5
 LDA5A   TMA      0,7
         TMD      W/
         JAED     LDA5B
         TMD      SAVE
         JAED     LDA5B
         TAM      SAVE
         JMP      4OUT5B
         TMQ      0,7
 LDA5    JMP      4OUT 5D
 LDA5B   TMD      STADR+9
         AIXOR    1,7
         JNO      LDA5A
         JMP      4OUT 5C
*
         TMD      C/HLT,STADR+40;C/HLT,8
         TDM      4SAVE 02
         TMA      PRIO
         SRAQ     12
         TQM      DUM
         TIXZ     6,1
         ETA      12/1T11
         ETD      W/YY
         JAED     (P)+5H
         ETD      W/00
         JAED     (P)+3H
         TIJ      LOAD A6+7H
```

```
         TJM      LOAD A6
         JMP      4OUT 5
         JMP      4OUT 5B
 LOAD A6 JMP      (P)+7H
         TIJ      (P)+6H
         TJM      (P)-2H
         TMQ      W/P
         TQM      DUM
         TIXZ     12,1
         JMP      4OUT 5
         TMA      ZULUT
         TMQ      W/Z
         SRA      12
         SRAQ     36
         TQM      DUM
         TIXZ     42,1
         JMP      4OUT 5
         TMD      W/ ZEX
         TDM      DUM
         TIXZ     24,1
         JMP      4OUT 5
         JMP      4OUT 5C
*
         TMQ      ZULUT
         SLAQ     12
         SLA      6
         SLAQ     24
         SLA      6
         AM       0/61T17;0/71T47
         TAM      DUM
         TMD      C/HLT,STADR+10;C/HLT,8
         TDM      4SAVE 02
         TIXZ     48,1
         JMP      4OUT 5
         JMP      4OUT 5B
         TMD      MONTH
         TDM      DUM
         TIXZ     18,1
         JMP      4OUT 5
         JMP      4OUT 5B
         TMQ      STADR+1
         JMP      4OUT 5D
         JMP      4OUT 5C
         JMP      LOADA5-4H $
*
 LOAD A7 TJM      LOAD F2+7H
         TMA      N/10T15
         TXDRC    ,3
         JMP      PANT
         TMA      W/
         TMQ      8,3
         JAED     LOAD A8
         TAM      8,3
         TMA      N/1T39
         AMS      STADR+9
```



```
         TDXRC    ,0
         SIXO     1,0
         JOF      LOAD A8+1
         TQM      0,0
         JMP      LOAD F2+1H
 LOAD A8 TMA      N/3T15;P/AJERR11,T39
         JMP      AJERROR+5H
         TMA      N/3T15;P/AJERR12,T39
         JMP      AJERROR+5H
         $
 LOAD A9 TJM      4OUT 2-1H
         TMD      LOAD A9-1
         TXDLC    ,4
         TDXLC    ,0
         SIXO     1,0
         TXDLC    ,0
         SIXO     9,0
         TXDRC    ,0
         TDM      LOAD A9-1
         TMQ      ,0
         SRAQ     ,2
         TMA      ,0
         TQM      ,0
         NOP      $
         TMD      LOAD A9-1
         AIXOL    1,0
         JNO      (P)-7H
         JMP      4OUT 2+1H
*
*
*  EDIT  ALL,ALL BUT, OR ONLY CARDS
*
 4A 10      JMP   4S1
            TMA   ,3
            TMD   W/ALL
            JAED  4A 10A
            TMD   W/ALL BUT
            JAED  4A 10A+2
            TMD   W/ONLY
            JAED  4A 10A+3
            JMP   LOAD A3
*
 4A 10A     JMP   4S2
            JMP   4A20
            AIXO  10,3
            JMP   (P)-3H
            CD
            JMP   (P)+3H
            JMP   4S1 A
            TMD   1/1
            TDM   4T3
         AIXO     1,3
         TIXZ     9,1
            TIXZ   9,0
            TMD   ,3
```

```
            TDM    4T 11
*
  4A 10B    JMP    4S4 B
            TMD    4T6
            TDM    4T5
            TMQ    4T9
            JQO    4S4 B1
            JQO    4A 10C+3H
            JQO    4A 10C+6H
*
  4A 10C    TIJ    4A 10F+1H
            TJM    4A 10F
            JMP    4A 10D-4H
            JQO    (P)+1H
            JQO    4A 10C
            JMP    4A 10D-4H
            JQO    4A 10C
            JMP    4S4 B
*
            TMQ    4T9
            JQO    4S4 B1
          JQO      (P)+3H $
            JQO    4S4 B1
          JMP      4A10C $
            TMA    4T5
            TMD    4T6
            JAED   (P)+2H
            JAGD   4S4 B1
*
  4A 10D  TAQ                                          $
          CA                                           $
          JMP      FXINT                               $
          TAQ                                          $
          TMA      FXERCL                              $
          JAZ      4BCDADD-3H                          $
          TQA                                          $
          TMD      C/HLT,SATNOS                        $
          TDXLC    ,4$
          TMQ      18/1T47$
R 4A 10D1RPTAN     1000$
          ETD      1,4$
            JAED   (P)+2H
            JMP    4A 10E
          SIXO     1,4$
            TMQ    1/0;47/1
            TMA    4T3
            EIS    ,4
*
  4A 10E    TMA    4T5
            JMP    4BCDADD
            TAM    4T5
            TMD    4T6
            JAED   4A 10D
            JAGD   (P)+2H
            JMP    4A 10D
```



```
*
  4A 10F    JMP    4A 10B
            TIJ    4A 10B
            TJM    (P)-2H
*
  4A 20     TMD    P/AJBFFR,T15;P/FANTAB,T39
            TDXLC ,3
            TDXRC ,6
            TIXZ   ,5
*                                                      $
          CM       TRFLG                               $
          CM       FNCONT                              $
          TIJ      FNOTAB                              $
          TJM      STIKFN                              $
            TMD    W/N R AND
            TDM    AJERR9+1
  4A 21     TMA    ,3
            TMD    W/
            JAED   (P)+2H
            JMP    AJFCARD
            TMD    W/ZZZZZZZZ
            TDM    ,6
          CM       PHAIN                               $
          TMQ      W/ZZZZZZZZ                          $
          TMA      FANTAB                              $
          JAEQ     AJNORMX                             $
          TMA      FANTAB+12                           $
          JAEQ     AJNORMX                             $
          TMD      P/FANTAB,T15                        $
          TDM      TEMP2                               $
          TDXLC    ,4                                  $
          TMD      5,4                                 $
          TDM      TEMP1                               $
  SRT1    AIXO     12,4                                $
          TMA      0,4                                 $
          TMD      W/ZZZZZZZZ                          $
          JAED     SRT2                                $
          TMA      5,4                                 $
          TMQ      TEMP1                               $
          JAGQF    SRT1                                $
          TAM      TEMP1                               $
          CD                                           $
          TXDLC    ,4                                  $
          TDM      TEMP2                               $
          JMP      SRT1                                $
  SRT2    TMD      TEMP2                               $
          TDXLC    ,4                                  $
          TMD      P/FANTAB,T15                        $
          TDXLC    ,6                                  $

R         DRNNAA   12                                  $
          TMA      0,4                                 $
          TMD      0,6                                 $
          TDM      1,4                                 $
          TAM      1,6                                 $
```

```
AJNORMX  TMD    P/AJBFFR,T15
         TDM    AJCOL79
         TMQ    BEGT                      $        DETERMINE
         JMP    AJFIXIT                   $        NUMBER
         SLA    17                        $        OF
         TMQ    F/1073741824.             $        MINUTES
         FMARS  AJHOLD                    $        EXPIRED
         TMA    BEGT                      $        IN
         FSM    AJHOLD                    $        BEGINNING
         TMQ    F/1440.                   $        DAY
         FMARS  AJHOLD                    $        REQUEST.
         TMA    RNGFLAG                   $        NM
         JAZ    (P)+2                     $        OR
         TMA    XKMPER                    $        KM
         TMQ    ERK2KMS                   $        CONVERSION
         JMP    (P)+2                     $        FACTORS
         TMA    ERK2KMS                   $        FOR
         FDA    F/1.852$                  $        RANGE CNT260
         TMA    XNMPER                    $        AND
         TAM    AJCNV1                    $        RANGE
         TQM    AJCNV2                    $        RATE.
         JMP    START1                    $
AJFCARDTMA      C/HLT,0;C/TIJL,AJSRFWE    $ SET UP FANTAB FROM F CARDS
         JMP    XSRCH                     $ AND CHECK INPUT.
         JAZ    AJERROR                   $
         TMA    AJFNTAB                   $
         FAM    F/90.0                    $
         JAP    AJREGFN                   $
         TMA    TRFLG                     $ INTERPRET TRACKER CARD
         JAZ    (P)+3H                    $
         TIXZ   1,4                       $
         JMP    TRERR                     $
         TMD    F/5                       $
         TDM    PHAIN                     $
         TIXZ   0,4
         TMA    C/HLT,0;C/TIJL,AJSRFWF    $
         JMP    XSRCH                     $
         JAZ    THERR
         TMD    L/TEMP0                   $
         TDXLC  ,4                        $

R        RPTAA  11                        $
         TMD    1,4                       $
         TDM    1,6                       $
         SIXO   11,6                      $
         TMA    10,6                      $
         JAZ    AJFC1                     $
         TIXZ   2,4                       $
         TMQ    0,6                       $
         FMMR   0,6                       $
         FSM    F/1                       $
         JAP    TRERR                     $
         TAQ                              $
         FCSQ                             $
         TMQ    F/1                       $
```



```
         JAEQ   TRERR                     $
S        FSQRT                            $

         TAM    3,6                       $
         TMQ    1,6                       $
         FMMR   1,6                       $
         FSM    F/1                       $
         JAP    TRERR                     $
         TAQ                              $
         FCSQ                             $
         TMQ    F/1                       $
         JAEQ   TRERR                     $
S        FSQRT                            $

         TAM    4,6                       $
         TMQ    DE2RA                     $
         FMMRS  AJFNTAB+2                 $
         TMD    F/0                       $
         JAED   TRERR                     $
S        FCOS                             $

         TAM    2,6                       $
S        FSIN   AJFNTAB+2                 $


         TAM    SINPSI                    $
AJFC1    TIXZ   3,4                       $
         TMA    7,6                       $
         TMQ    F/2                       $
         JAGQF  (P)+2H                    $
         JMP    TRERR                     $
         TIXZ   4,4                       $
         TMD    F/9                       $
         JAED   (P)+2H                    $
         JMP    AJFC2                     $
         FCAMAS 8,6                       $
         TMD    F/0                       $
         JAED   TRERR                     $
AJFC2    TMA    RCPTST                    $
         JAZ    AJFC3                     $
         TIXZ   5,4                       $
         TMA    F/0                       $
         TMQ    9,6                       $
         JAGQF  TRERR                     $
         FMMR   ERPKM                     $
         TAM    9,6                       $
AJFC3    TMA    AJFNTAB+1                 $
         TMQ    F/90                      $
         TIXZ   6,4                       $
         JAGQF  TRERR                     $
         TMQ    DE2RA                     $
         FMARS  AJFNTAB+1                 $
S        FSIN                             $

         TAM    5,6                       $
```

```
S        FCOS    AJFNTAB+1              $

         TAM     6,6                    $
         TMD     0/37:0/63T47           $
         TDM     11,6                   $
         TMA     ELMAX                  $
         TMD     F/0                    $
         JAED    (P)+4H                 $
         TMQ     DE2RA                  $
         FMARS   ELMAX                  $
         JMP     (P)+3H                 $
         TMD     F/2                    $
         TDM     ELMAX                  $
         TJM     TRFLG                  $
         AIXO    1,5                    $
         AIXO    10,3                   $
         AIXO    12,6                   $
         JMP     4A21                   $
  TRERR  TMA     C/HLT,5:C/HLT,TRCOM7   $
         JMP     PANT                   $
         TMA     N/10T15                $
         TXDRC   ,3                     $
         JMP     PANT                   $
         TMD     P/TRCOM-1,T39          $
         ADXR    ,4                     $
         TMA     ,4                     $
         JMP     PANT                   $
         AIXO    10,3                   $
         JMP     PANT.SPACE             $
         JMP     4A21                   $

L        HLT     7                      $
         HLT     AJERR7
L TRCOM  HLT     4                      $
         HLT     TRCOM1                 $
         HLT     4                      $
         HLT     TRCOM2                 $
         HLT     3                      $
         HLT     TRCOM3                 $
         HLT     2                      $
         HLT     TRCOM4                 $
         HLT     3                      $
         HLT     TRCOM5                 $
         HLT     4                      $
         HLT     TRCOM6                 $
  TRCOM1 A/ONLY 1 TRACKER CARD ALLOWED$


  TRCOM2 A/LIMITS ON BORESIGHT ANGLES WRONG$


  TRCOM3 A/POINTS PER PASS WRONG$
```



```
  TRCOM4 A/DELTA T IS ZERO$

  TRCOM5 A/MAX. RANGE IS WRONG$


  TRCOM6 A/MIN. ELEV. GREATER THAN 90$


  TRCOM7 A/ERROR ON TRACKER CARD. CARD REJECTED$



L AJSRFWFICOZ    6*128+6                $
         TMA     AJFNTAB                $
         ICOZ    24*128+6               $
         TMA     AJFNTAB+1              $
         ICOZ    25*128+1               $
         TMA     TEMP7                  $
         JBT     27*128+1               $
         TMA     TEMP10                 $
         ICOZ    36*128+6               $
         TMA     TEMP8                  $
         ICOZ    42*128+6               $
         TMA     TEMP0                  $
         ICOZ    48*128+6               $
         TMA     TEMP1                  $
         ICOZ    54*128+6               $
         TMA     AJFNTAB+2              $
         ICOZ    66*128+6               $
         TMA     ELMAX                  $
         ICOZ    60*128+6               $
         CAM     TEMP9                  $
L RSTSTWDHLT     0                      $
         HLT     AJREG1                 $


  AJREGFNAIXO    3,3                    $
         TMD     RSTSTWD                $
         TXDLC   ,3                     $
         TDM     RSTSTWD                $
         AIXO    5,3                    $
         TMQ     1,3                    $
         TMD     F/6                    $
         TDM     PHAIN                  $
  AJREG1 TMA     0,3                    $
         SRAQ    6                      $
         TQM     1,3                    $
         SRAQ    42                     $
```

```
        TMD    RSTSTWD                    $
        SIXJ   1,3                        $
        SIXO   3,3                        $
        TMA    0/60T47                    $
        TMQ    42/1T41                    $
        EIS    4,3                        $
        EIS    9,3
        TJM    FNFLG                      $
AJREG2  TMA    0,3                        $
        TMD    W/                         $
        JAED   AJREG4                     $
        TIXZ   0,4
        TMA    C/HLT,0:C/TIJL,AJSRFWD     $
        JMP    XSRCH                      $
        JAZ    FNERR
        TMQ    AJFNTAB+6                  $
        SLAQ   42                         $
        SLA    30                         $
        SLAQ   6                          $
        TAM    11,6                       $
        TIXZ   1,4                        $
        TMQ    6/1T47                     $
        ETA    11,6                       $
        TMD    0/47T47                    $
        JAED   CONVP                      $
        TMD    0/30T47                    $
        JAED   CONVH                      $
        JMP    FNERR                      $
CONVP   TMA    AJFNTAB+3                  $
        TMQ    AJFNTAB                    $
        JAGQF  AJREG3                     $
        TQM    AJFNTAB+3                  $
        TAM    AJFNTAB                    $
        TMA    AJFNTAB+1                  $
        TMD    AJFNTAB+4                  $
        TDM    AJFNTAB+1                  $
        TAM    AJFNTAB+4                  $
        TMA    AJFNTAB+2                  $
        TMD    AJFNTAB+5                  $
        TDM    AJFNTAB+2                  $
        TAM    AJFNTAB+5                  $
AJREG3  TMA    AJFNTAB                    $
        TMQ    AJFNTAB+1                  $
        JMP    COMPL                      $
        TDM    3,6                        $
        TQM    4,6                        $
        TAM    5,6                        $
        TMA    AJFNTAB+3                  $
        TMQ    AJFNTAB+4                  $
        JMP    COMPL                      $
        TDM    6,6                        $
        TQM    7,6                        $
        TAM    8,6                        $
        TMQ    3,6                        $
        FMMR   6,6                        $
```



```
        TMQ    4,6                        $
        FMAD   7,6                        $
        TMQ    5,6                        $
        FMAD   8,6                        $
        TAM    LDOTL                      $
        FCAMA  LDOTL                      $
        FSM    F/.9998477                 $
        TIXZ   2,4                        $
        JAP    FNERR                      $
S       FACOS  LDOTL                      $

        TAM    10,6                       $
        TMQ    LDOTL                      $
        FMMR   LDOTL                      $
        TMQ    F/1                        $
        FMSU   F/1                        $
S       FSQRT                             $

        TAM    2,6                        $
        TMQ    5,6                        $
        FMMR   7,6                        $
        TMQ    4,6                        $
        FMSU   8,6                        $
        FDA    2,6                        $
        TQM    0,6                        $
        TMQ    3,6                        $
        FMMR   8,6                        $
        TMQ    5,6                        $
        FMSU   6,6                        $
        FDA    2,6                        $
        TQM    1,6                        $
        TMQ    4,6                        $
        FMMR   6,6                        $
        TMQ    3,6                        $
        FMSU   7,6                        $
        FDAS   2,6                        $
        JMP    CONVOUT                    $
CONVH   TIXZ   4,4                        $
        TMQ    AJFNTAB                    $
        TMA    F/89                       $
        JAGQF  (P)+2H                     $
        JMP    FNERR                      $
        FMMR   DE2RA                      $
        TAM    AJFNTAB                    $
S       FSIN                              $

        TAM    5,6                        $
S       FCOS   AJFNTAB                    $

        TAM    6,6                        $
        TIXZ   5,4                        $
        TMA    AJFNTAB+1                  $
        TMQ    AJFNTAB+4                  $
```

```
         JAEQ     FNERR                          $
         TQM      1,6                            $
         TMQ      DE2RA                          $
         FMARS    0,6                            $
         FMMRS    1,6                            $
         FSM      0,6                            $
         JAP      (P)+2H                         $
         FAM      TWOPI                          $
         TAM      10,6                           $
  CONVOUTTMA      AJFNTAB+2                      $
         TIXZ     3,4                            $
         TMQ      F/0                            $
         JAEG     FNERR                          $
         TAM      9,6                            $
         TMA      AJFNTAB+5                      $
         JAEQ     FNERR                          $
         FSM      9,6                            $
         FDAS     10,6                           $
         TMQ      ERPKM                          $
         FMMRS    9,6                            $
         FMMRS    10,6                           $
*                                                $
         TMD      11,6                           $
  STIKFN TDM      (P)                            $
         TMA      FNCONT                         $
         SLA      10                             $
         TMQ      42/1T47                        $
         EIS      11,6                           $
         INCA     STIKFN                         $
         INCA     FNCONT                         $
         AIXO     12,6                           $
         AIXO     1,5                            $
  AJREG4 AIXO     5,3                            $
         TMA      FNFLG                          $
         JAZ      4A21                           $
         CM       FNFLG                          $
         JMP      AJREG2                         $
  COMPL  TJM      COMPLX                         $
         TQM      TEMP2                          $
         TMQ      DE2RA                          $
         FMARS    TEMP1                          $
         FMMRS    TEMP2                          $
S        FCOS                                    $

         TAM      TEMP3                          $
S        FSIN     TEMP2                          $


         TAM      TEMP2                          $
S        FCOS     TEMP1                          $


         TAQ                                     $
         FMMR     TEMP2                          $
         TAM      TEMP2                          $
```



```
         FCSM     TEMP3                          $
         FMARS    TEMP3                          $
S        FSIN     TEMP1                          $


         TMQ      TEMP2                          $
         TMD      TEMP3                          $
  COMPLX JMP      (P)                            $
  DOTPR  TDM      TEMP6                          $
         TJM      DOTPRX                         $
         TAM      TEMP4                          $
         FMMR     TEMP2                          $
         TMQ      TEMP4                          $
         FMAD     TEMP1                          $
         TMQ      TEMP6                          $
         FMAD     TEMP3                          $
  DOTPRX JMP      (P)                            $
  FNERR  TJM      FNERRX                         $
         TAM      TEMP1                          $
         TMA      0/3T15                         $
         CD                                      $
         TXDLC    ,4                             $
         JAED     (P)+2H                         $
         JMP      (P)+3H                         $
         TMA      RCPTST                         $
         JAZ      FNERRX-1H                      $
         TMA      C/HLT,5;C/HLT,FNCOM6           $
         JMP      PANT                           $
         TMA      N/5T15                         $
         TXDRC    ,3                             $
         JMP      PANT                           $
         TMD      P/FNCOM-1,T39                  $
         ADXR     ,4                             $
         TMA      ,4                             $
         JMP      PANT                           $
         JMP      PANT.SPACE                     $
         JMP      AJREG4                         $
         TMA      TEMP1                          $
  FNERRX JMP      (P)                            $

L        HLT      7                              $
         HLT      AJERR7
L FNCOM  HLT      3                              $
         HLT      FNCOM1                         $
         HLT      4                              $
         HLT      FNCOM2                         $
         HLT      3                              $
         HLT      TRCOM5                         $
         HLT      4                              $
         HLT      FNCOM4                         $
         HLT      3                              $
         HLT      FNCOM5                         $
  FNCOM1 A/FAN TYPE NOT H OR P$                  $
```

```
  FNCOM2 A/FAN ENDS TOO CLOSE TO COLINEARS $

  FNCOM4 A/ELEVATION GREATER THAN 89 DEGS  $

  FNCOM5 A/AZIMUTH LIMITS ARE EQUALS       $

  FNCOM6 A/ERROR IN FAN RECORD, RECORD REJECTEDS

L AJSRFWDICOZ      6*128+6                    $
         TMA      AJFNTAB                     $
         ICOZ     12*128+6                    $
         TMA      AJFNTAB+1                   $
         ICOZ     18*128+6                    $
         TMA      AJFNTAB+2                   $
         ICOZ     24*128+6                    $
         TMA      AJFNTAB+3                   $
         ICOZ     30*128+6                    $
         TMA      AJFNTAB+4                   $
         ICOZ     36*128+6                    $
         TMA      AJFNTAB+5                   $
         HLT      39*128+3                    $
         CAM      AJFNTAB+6                   $
  AJ79F  W/         FS
  AJERR1 A/FAN PARAMETER (REQUEST) CARD MISSING (NO R IN COS

         A/L 79).S
  AJERR2 A/NO FAN CARDS AND NO MAX. ELEV. REQUESTS

  AJERR3 A/ADDRESS CARD MISSINGS 3

  AJERR4 A/PRIORITY NOT PUNCHED IN PARAMETER (REQUEST) CARD.S

  AJERR5 A/MORE THAN THIRTY RECORDS IN F TYPE CARDSS
```



```
  AJERR6 A/ILLEGAL CARD EXISTS AFTER F CARDS.S

  AJERR7 A/CHECK INPUT DATA FOR ILLEGAL CHARACTERS IN FIELDS.S

  AJERR9 A/STA.NO.ON R AND F CARDS DIFFER.S

  AJERR10A/ALL, ALL BUT, OR ONLY CARDS MISSINGS5

  AJERR11A/ROUTING DATA MISSINGS 3

  AJERR12A/TOO MANY ROUTE CARDS $ 3

  AJSRFWRHLT      4*128+4                     $
         TMA      STAN                        $
         ICOZ     12*128+7                    $
         TMA      BEGT                        $
         ICOZ     19*128+7                    $
         TMA      ENDT                        $
         ICOZ     29*128+4                    $
         TMA      BEAMW                       $
         HLT      33*128+4                    $
         TMA      YEAR                        $
         JBT      34*128+1                    $
         TMA      ELFLAG                      $
         JBT      35*128+1                    $
         TMA      RNGFLAG                     $
         JBT      37*128+1                    $
         TMA      CLSFY                       $
         HLT      39*128+2                    $
         TMA      PRIO                        $
         JBT      41*128+1                    $
         TMA      VPASS                       $
         JBT      43*128+1                    $
         TMA      DPASS                       $
         JBT      45*128+1                    $
         TMA      FNCPA                        $
         JBT      47*128+1                    $
```

```
         TMA      RCPTST                  $
         JBT      49*128+1                $
         TMA      CONTG                   $
         JBT      57*128+1                 $
         TMA      DRCOSFL                  $
         ICOZ     64*128+7                 $
         TMA      ZFX                      $
         ICOZ     71*128+7                 $
         TMA      ZFY                      $
             JBT  72*128+1   $
         TMA      4C4+2    $
   AJSRFWLHLT     79*128+1                $
         CAM      AJCOL79                 $
   AJSRFWEICOZ    6*128+6                  $
         CAM      AJFNTAB                  $
   TIMEOUTTJM     TIMEX                    $
         TMA      F/29                     $
         FAM      BEGT                     $
         TAM      ENDT                     $
         JMP      FYKLOK                   $
         TJM      TEMP0                    $
         TMA      C/HLT,0;C/TIJL,TIMO1     $
         JMP      GLOP.GLOP                $
   TIMEX JMP      (P)                      $

L  TIMO1 HLT      69*128+51                $
         TMA      TIMO2                    $
         ICOZ     77*128+3                 $
         CAM      TEMP0                    $
   TIMO2 A/REQUESTED TIME EXCEEDS 29 DAYS. END TIME CHANGED TOS



   CHKMEL TMA     FNCPA                    $
          JAZ     (P)+4H                   $
          TMD     F/0                      $
          TDM     FANTAB+5                 $
          JMP     LOAD A1-3H               $
          TMA     C/HLT,5;C/HLT,AJERR2     $
          JMP     AJERROR+5H               $

   MASKBL W/                               $
   MASKSATO/777777T47                      $
   MASK1  1/1T0                            $
   MASKZ  W/0000ZZZZ                       $
 *                                         $
   AJFNTABASTOR    7                       $
   AJBFFR W/                               $
          SET     (P)+150                  $
   FNOTAB SET     (P)+30                   $
          W/**                             $
          W/T                              $
```



```
OCTALA SET     (P)+50                      $
TEMP0   $                                  $
TEMP1   $                                  $
TEMP2   $                                  $
TEMP3   $                                  $
TEMP4   $                                  $
TEMP5   $                                  $
TEMP6   $                                  $
TEMP7   $                                  $
TEMP8   $                                  $
TEMP9   $                                  $
TEMP10  $                                  $
BUF1                                       $
BUF2                                       $
BUF3                                       $
BUF4                                       $
BUF5                                       $
BUF6                                       $
BUF7                                       $
BUF8                                       $
XLSUNT                                     $
ALSUN                                      $
CSALS                                      $
SNALS                                      $
DLSUN                                      $
CPT                                        $
SNDLS                                      $
CSDLS                                      $
SUNLX                                      $
SUNLY                                      $
SUNLZ                                      $
SNHSN                                      $
CSHSN                                      $
CSAN                                       $
HSUN                                       $
CSPST                                      $
SAVE    $
STYPE   $
STNM    $
STNM2   $
PHIRD   $
XLAMBA  $
OALT    $
XOVCT   $
CAPZ    $
STGAR   $
STAID   $
AJFNFLD$
AJCAPRQ$
RMAX    $
BEAMW   $
XINTRV  $
AJSVXR1$
AJSV34  $
AJSV56  $
```

```
AJSV7   $
AJPAGES$
AJTYSW  $
AJSMDAY$
AJHR    $
AJMIN   $
AJFRMIN$
AJSAT   $
AJAZ    $
AJREV   $
AJRANGE$
AJRRATE$
AJELEV  $
AJDEPRE$
AJDAY   $
AJDDD   $
AJDATE  $
AJTM17  $
AJMSGNO$
ZULUT   $
TFN     $
MONTH   $
DFN     $
AJCOL79$
YEAR    $
FDAY    $
BEGT    $
ENDT    $
PRIO    $
AJ1STF  $
CLSFY   $
CLAS    $
AJSSAVE$
AJSTAID$
AJFLGIT$
AJSVSV  $
AJCKEND$
BASE    $
VPASS   $
DPASS   $
FCAP    $
RCPTST  $
CONTG   $
STAN    $
AJSTAN  $
AJKPXR3$
ELFLAG  $
RNFLAG  $
AJHOLD  $
AJCNV1  $
AJCNV2  $
AJNMBLK$
AJSTBK  $
AJCMNBK$
AJDNCNT$
```



```
AJMRGSW$
4LMAX        $        $
4LMAX2       $        $
4RMAX        $        $
IEEND        $        $
ILOCE        $        $
IRSET        $        $
NOELM        $        $
PHAIN        $        $
PSATN        $        $
AJFAN        $        $
AJSAT1       $        $
ATYPE        $        $
SINHMIN      $        $
COSHMIN      $        $
TRDELT       $        $
TRFLG        $        $
PPP          $        $
TRTYPE       $        $
XL1X         $        $
XL1Y         $        $
XL1Z         $        $
XL2X         $        $
XL2Y         $        $
XL2Z         $        $
A1H          $        $
A2H          $        $
SINHREF      $        $
COSHREF      $        $
RHOMAX       $        $
RHODMAX      $        $
DRCOSFL      $        $
FANNO        $        $
FNCONT       $        $
FNFLG        $        $
UMAXT        $        $
RT1MUS       $        $
VMAXT        $        $
RT1MVS       $        $
CCPHTH       $        $
CDEL         $        $
CNMT         $        $
COSPSI       $        $
CPSI         $        $
CSPHTH       $        $
DT           $        $
EPOCHM       $        $
EPS          $        $
EPSLN        $        $
ERR          $        $
FNCPA        $        $
K1           $        $
LDOTL        $        $
LSTT         $        $
MARG         $        $
```

```
N                                  $                    $
OBSAZ                              $                    $
OBSEL                              $                    $
OBSRR                              $                    $
OLD ONE                            $                    $
PAR1                               $                    $
PAR2                               $                    $
PAR3                               $                    $
PAR4                               $                    $
Q2                                 $                    $
RHO                                $                    $
RHODDOT                            $                    $
RHODOT                             $                    $
RHODOTN                            $                    $
RHOSQRO                            $                    $
RHOXH                              $                    $
RHOYH                              $                    $
RHOZH                              $                    $
RSU                                $                    $
RSV                                $                    $
RSW                                $                    $
SDEL                               $                    $
SINPSI                             $                    $
SNMT                               $                    $
SPCI                               $                    $
STST                               $                    $
T1                                 $                    $
T2                                 $                    $
TEM1                               $                    $
TF                                 $                    $
THTAO                              $                    $
THTAI                              $                    $
TI                                 $                    $
VISIBLE                            $                    $
XFX                                $                    $
XFY                                $                    $
XFZ                                $                    $
YFX                                $                    $
YFY                                $                    $
YFZ                                $                    $
ZFX                                $                    $
ZFY                                $                    $
ZFZ                                $                    $
XILLUM                             $                    $
XNXH                               $                    $
XNYH                               $                    $
XNZH                               $                    $
ZDOTW                              $                    $
SATCONT                            $                    $
```



```
* * * * * MAIN PROGRAM STARTS HERE * * * * *
START1  CM      PHAIN              $ ERROR EXIT RETURNS TO NXCASE
        JMP     INITEL             $
        JMP     SINIT              $
NXTEL   THD     F/1                $ SET ERROR EXIT TO RETURN
        TDM     PHAIN              $ TO NXTEL.
        TMA     C/HLT,SATNOS       $ GET NEXT SATELLITE TO BE
        AM      SATCONT            $ PROCESSED FROM SATNOS TABLE.
        TAD                        $
        TDXLC   ,0                 $
NXTEL1  TMA     0/1T15             $
        AMS     SATCONT            $
        AIXO    1,0                $
        TMQ     1/1T0              $
        ETA     0,0                $
        JAN     NXTEL2             $
        TMA     0,0                $
        JAZ     AJENDPK            $ ALL SATELLITES DONE
        JMP     NXTEL1             $
NXTEL2  TMQ     MASKSAT            $
        ETA     0,0                $
        JAZ     AJENDPK            $ ALL SATELLITES DONE
        TAM     SATN               $
        JMP     NXTELM             $ UNPACK ELEMENT SET
        JMP     NXTEL1             $ IF SATELLITE NOT FOUND
        JMP     EINIT              $ INITIALIZE FOR SATELLITE
        TMQ     XNO                $
        TMA     F/.072220521       $
        JAGQF   (P)+4H             $ SATELLITE NOT IN DECAY
        TMD     1/1T1              $
        DORMS   0,0                $ IR5 MUST BE PRESERVED
        JMP     NXTEL1             $ SATELLITE IN DECAY
        TMA     EPOCH              $
        FSM     ENDT               $
        TMQ     F/-100             $
        JAGQF   (P)+3H             $
        TMD     1/1T2              $
        DORMS   0,0                $
START2  THD     F/3                $
        TDM     PHAIN              $
        JMP     NXPASS             $
        JMP     NXTEL              $ NO MORE PASSES
        TMQ     RHO                $
        FMMR    EPSLN              $
        FMSU    FANTAB+5           $
        TMQ     RHOZH              $
        JAGQF   START2             $ SATELLITE CANNOT BE SEEN.
        TMA     FNCPA              $
        JAZ     (P)+5H             $
        JMP     RHARR              $ FIXED FANS BEING PROCESSED
        TMD     0/36 T5
        TDM     FANNO
        JMP     STORE              $ AND CPA REQUESTED.
        JMP     AINIT              $ INITIALIZE NXACQ ROUTINE
START3  TMD     F/2                $ SET ERROR EXIT TO RETURN
```

```
        TDM     PHAIN                   $ TO START3.
        JMP     NXACQ                   $ GET NEXT ACQUISITION MODEL
        JMP     (P)+2H                  $ NO MORE ACQ. MODELS
        JMP     START4                  $ NORMAL RETURN FROM NXACQ
        JMP     ENDPK                   $ FINISH UP THIS PASS
        TMD     F/1                     $ SET ERROR EXIT TO RETURN
        TDM     PHAIN                   $ TO NXTEL.
        JMP     START2                  $ GO BACK AND GET NEXT PASS.
*
 START4 JMP     AQUIRE                  $ PROCESS ACQ. MODEL
        JMP     START3                  $ GO BACK AND GET NEXT ONE.
*
*  * * * *  MAIN PROGRAM ENDS HERE  * * * *  *
```



```
        AFEND   42S
HACQUI  TJM     HACQUIX
        CM      PAR4              SET PAR4=0
        FCSM    EPSLN             TEST IS RHO(SIN(HREF)-EPSLN*
        TMQ     COSHREF                   COS(HREF)) GREATER THAN OR
        FMAR                              EQUAL TO RHOZH
        FAM     SINHREF
        TMQ     RHO
        FMAR
        TMQ     RHOZH
        JAGQF   HACQUIX
        TMD     TI                 SET PAR 2=TI
        TDM     PAR2
        TMD     F/-10.0            SET  DT=-10
        TDM     DT
HACQ3   TMQ     RHO               TEST IS RHO*EPSLN*COSHREG  GREATER
        FMMR    SINHREF              THAN OR = ABS( RHOZH-RHO* SINHREF)
        FSM     RHOZH
        TAQ
        FCAQAS  TEMP1               TEMP1=ABS(RHOZH-RHO*SINHREF)
        TMQ     RHO
        FMMR    EPSLN
        TMQ     COSHREF
        FMAR
        TMQ     TEMP1
        JAGQF   HACQ1
HACQ8   TMA     F/1.0S
        TAM     PAR3
        TMA     DT                 SET TI=TI+DT
        FAMS    TI
        JMP     CRHOB              SUBROUTINE
        TMQ     RHO                TEST IF  RHO*SINHREF  IS GREATER
        FMMR    SINHREF               THAN OR =  RHOXH
        TMQ     RHOZH
        JAGQF   HACQ2
        JMP     HACQ3
HACQ2   TMQ     DT                DT = SIGN OF PAR3(RHOZH-RHO*SINHREF)
        TMA     F/.5
        FMARS   TEMP1                TEMP1= DT*.5
        TMQ     RHO
        FMMR    SINHREF
        FSM     RHOZH
        TAM     TEMP2                TEMP2= RHO*SINHREF - RHOZH
        TMQ     PAR3
        FMAR
        TMQ     TEMP1
        JAN     HACQ4
        FCSQ
        TAQ
HACQ4   TQM     DT                DT
        FCSM    TEMP2              SET PAR3= RHOZH- RHO*SINHREF
        TAM     PAR3
        TQA                        SET  TI=TI+DT
        FAMS    TI
        JMP     CRHOB
```

```
         TMQ     RHO                    TEST IF RHO*EPSLN*COSHREF > OR =
         FMMR    SINHREF                  ABS(RHOZH-RHO*SINHREF)
         FSM     RHOZH
         TAQ
         FCAQAS  TEMP1                  TEMP1=ABS(RHOZH-RHO*SINHREF)
         TMQ     RHO
         FMMR    EPSLN
         TMQ     COSHREF
         FMAR
         TMQ     TEMP1
         JAGQF   HACQ1
         JMP     HACQ2
HACQ1    JMP     RHARR                 SUBROUTINE
         TMA     ATYPES  TEST FOR TRACKER TYPE
         TMD     W/0000000TS
         JAED    HACQ1KS
         JMP     AFILT2                 SUBROUTINE
         JMP     HACQ6                    EXIT -FAILED ANGLE TESTS
         JMP     RFILT2                SUBROUTINE
         JMP     HACQ6                      EXIT -FAILED RANGE TEST
HACQ1K   JMP     STORES
         TMA     F/1.0
         FAMS    PAR4
HACQ6    TMA     TI                    TEST IF  TI >OR= PAR2
         TMQ     PAR2
         JAGQF   HACQ7
         TAM     T1                     SET T1=TI
         TMD     F/10.0                 SET DT=10
         TDM     DT
         TQM     TI                     SET  TI=PAR2
         JMP     HACQ8
HACQ7    TAM     T2                     SET T2=TI
         TMD     PAR2
         TDM     TI
HACQUIXJMP       0                     EXIT



AFILT2   TJM     AFILT2X
         TMA     A2H                    TEST IF (A2H-A1H)(OBSAZ-A1H)
         FSM     A1H                            (A2H-OBSAZ) 7 OR=  0
         TAM     TEMP1
         TMA     OBSAZ
         FSM     A1H
         TAQ
         TMA     A2H
         FSM     OBSAZ
         FMAR
         TMQ     TEMP1
         FMAR
         JAN     AFILT2X
         TMA     D/1B16                 INCREMENT RETURN ADDRESS FOR
         AMS     AFILT2X                   NORMAL RETURN
```



```
L AFILT2XJMP      0                     EXIT



  RFILT2 TJM      RFILT2X
         TMA      RCPTST                TEST IS RCPTST=0
         JAZ      RFB1
         TMA      OBSAZ                TEST IF RHO > OR= RHOMAX+
         FSM      A1H                      RHODMAX*(OBSAZ-A1H)
         TMQ      RHODMAX
         FMAR
         FAM      RHOMAX
         TAQ
         TMA      RHO
         JAGQF    RFILT2X
  RFB1   TMA      D/1 B16               INCREMENT BY  1H
         AMS      RFILT2X
L RFILT2XJMP      0                     EXIT



  AQUIRE TJM      ACQUIRX              SAVE RETURN ADDRESS
         TMA      ATYPE                TEST IF ATYPE IS P(PLANAR FAN),
         TMD      A/0000000PS          H(HORIZONTAL FAN),OR T(TRACKER)
         JAED     ACQUI1                 PLANAR FAN
         TMD      A/0000000HS
         JAED     ACQUI2                HORIZONTAL FAN
         TMD      A/0000000TS
         JAED     ACQUI3
         HLT                           ERROR
  ACQUI3 JMP      TACQUI                 TRACKER  SUBROUTINE
  ACQUIRXJMP                           EXIT
  ACQUI1 JMP      PACQUI                 PLANAR SUBROUITNE
         JMP      ACQUIRX
  ACQUI2 JMP      HACQUI                 HORIZONTAL SUBROUTINE
         JMP      ACQUIRX



  PACQUI TJM      PACQUIX
         JMP      PACRHDN              SUBROUTINE COMPUTES RHO DOT N
         TAM      PAR1
         TMD      TI                    PAR2=TI
         TDM      PAR2
         CM       PAR4                  PAR4=0
         TMA      XL1Z                 TEST IS RHO(XL1Z-EPSLN) GRRATER
         FSM      EPSLN                    THAN OR EQUAL TO RHOZH
         TMQ      RHO
         FMAR
```

```
         TMQ     RHOZH
         JAGQF   PACQUIX
         TMD     F/-10.0          SET DT= -10
         TDM     DT
PACQ2    TMA     RHOZH            TEST IF RHOZH IS POSITIVE
         JAP     PACQ1
PACQ6    TMA     TI               TEST IF TI IS GREATER THAN OR EQUAL
         TMQ     PAR2                 TO PAR2
         JAGQF   PACQ13
         TMD     PAR1S
         TDM     RHODOTNS
         TQM     TI               SET  TI= PAR2
         TMD     F/10.0           SET  DT=+10
         TDM     DT
PACQ8    TMA     DT               SET TI= TI+DT
         FAMS    TI
         TMD     RHODOTN          SET  PAR3= RHODOTN
         TDM     PAR3
         JMP     CRHOB            SUBROUTINE
         JMP     PACRHDN          SUBROUTINE COMPUTES RHO DOT N
         TMQ     PAR1             TEST IF PAR1* RHODOTN IS POSITIVE
         FMAR
         JAP     PACQ2
PACQ5    TMQ     DT               COMPUTE DT= SIGN(PAR3,RHODOTN)*DT/2
         FMMR    F/.5
         TAM     TEMP1            TEMP1= DT/2
         TMQ     PAR3
         FMMR    RHODOTN
         TMQ     TEMP1
         JAP     PACQ3
         FCSQ
         TAQ
PACQ3    TQM     DT
         TQA                      SET TI= TI+DT
         FAMS    TI
         TMD     RHODOTN          SET  PAR3= RHODOTN
         TDM     PAR3
         JMP     CRHOB            SUBROUTINE
         JMP     PACRHDN          SUBROUTINE COMPUTES RHO DOTN
         TAQ                      TEST IF RHO*EPSLN IS GREATER THAN OR
         FCAQAS  TEMP1              EQUAL TOABS(RHODOTN) = TEMP1
         TMQ     RHO
         FMMR    EPSLN
         TMQ     TEMP1              TEMP= ABS(RHODOTN)
         JAGQF   PACQ4
         JMP     PACQ5
PACQ4    JMP     AFILT1           SUBR. TEST ANGULAR LIMITS OF FAN
         JMP     PACQ6                TEST FAILED
         JMP     RFILT1           SUBR.  TEST RANGE LIMITS OF FAN
         JMP     PACQ6                 TEST FAILED
         JMP     RHARR            SUBR. COMPUTES RHO,H,A,S RHODOT
         JMP     STORE            SUBR. STORE PT FOR OUTPUT AFTER TESTIN
         TMA     F/1.0
         FAMS    PAR4
         JMP     PACQ6
```



```
PACQ1    FCAMA   RHODOTN          TEST IF RHO*EPSLN IS GREATER THAN OR
         TAM     TEMP1               EQUAL TO ABS(RHODOTN)
         TMQ     RHO
         FMMR    EPSLN
         TMQ     TEMP1               TEMP1= ABS(RHODOTN)
         JAGQF   PACQ4
         JMP     PACQ8
PACQ13   TMD     PAR2
         TDM     TI
PACQUIXJMP       0                EXIT
PACRHDNTJM       PACRHDX          COMPUTE RHO DOT N
         TMQ     RHOXH
         FMMR    XNXH
         TMQ     RHOYH
         FMAD    XNYH
         TMQ     RHOZH
         FMAD    XNZH
         TAM     RHODOTN
PACRHDXJMP       0

AFILT1   TJM     AFILT1X
         TMA     RHOZH
         JAN     AFILT1X
         TMQ     RHOZH            TEST IF (L1 CROSSL) DOT(L CROSSL2)
         FMMR    XL2Y                IS POSITIVE
         TMQ     RHOYH              QTY  TO BE TESTED =((XL2Z*RHOYH-
         FMSU    XL2Z                XL2Y*RHOZH)*(XL1Y*RHOZH-XL1Z*RHOYH)
         TAM     TEMP1               +(XL2Z*RHOXH-XL2X*RHOZH)*(XL1X*
         FMMR    XL1Z                RHOZH-ZL1Z*RHOXH)+(XL2Y*RHOXH
         TMQ     RHOZH               -XL2X*RHOYH)*(XL1X*RHOYH
         FMSU    XL1Y                -XL1Y*RHOXH))/RHO**2
         TAM     TEMP2
         FMMR    XL2X
         TMQ     RHOXH
         FMSU    XL2Z
         TAM     TEMP3
         FMMR    XL1Z
         TMQ     XL1X
         FMSU    RHOZH
         TAM     TEMP4
         FMMR    RHOYH
         TMQ     RHOXH
         FMSU    XL1Y
         TAM     TEMP5
         FMMR    XL2Y
         TMQ     XL2X
         FMSU    RHOYH
         TMQ     TEMP5
         FMAR
         TMQ     TEMP4
         FMAD    TEMP3
```

```
         TMQ     TEMP2
         FMAD    TEMP1
         JAN     AFILT1X
         TMA     D/1816
         AMS     AFILT1X
L AFILT1XJMP     0


  RFILT1 TJM     RFILT1X
         TMA     RCPTST          TEST IF RCPTST=0
         JAZ     RFA1
         TMQ     RHOXH           TEST IF RHO IS GREATER THAN OR EQUAL T
         FMMR    XL1X               RHOMAX+RHODMAX*ARCOS(L DOT L1)
         TMQ     RHOYH
         FMAD    XL1Y
         TMQ     RHOZH
         FMAD    XL1Z
         FDA     RHO
         TQA
S        FACOS
         TMQ     RHODMAX
         FMAR                          $
         FAM     RHOMAX                $
         TAQ
         TMA     RHO                   $
         JAGQF   RFILT1X
  RFA1   TMA     D/1816
         AMS     RFILT1X
L RFILT1XJMP     0               EXIT


  AINIT  TJM     AINITX
         TMD     RHO              SAVE RHO,RHOXH,RHOYH,RHOZH,
         TDM     BUFFER                + OBSRR
         TMD     RHOXH
         TDM     BUFFER+1
         TMD     RHOYH
         TDM     BUFFER+2
         TMD     RHOZH
         TDM     BUFFER+3
         TMD     OBSRR
         TDM     BUFFER+4
         TMD     TI                    $
         TDM     BUFFER+5              $
         TIJ     FANTAB
         TJM     IRSET
  AINITX JMP     0
```



```
  BUFFER ASTOR   6                         $


  NXACQ  TJM     NXACQX
         TMD     BUFFER            RESTORE  RHO, RHOXH, RHOYH, RHOZH,
         TDM     RHO                  + OBSRR
         TMD     BUFFER+1
         TDM     RHOXH
         TMD     BUFFER+2
         TDM     RHOYH
         TMD     BUFFER+3
         TDM     RHOZH
         TMD     BUFFER+4
         TDM     OBSRR
         TMD     BUFFER+5                  $
         TDM     TI                        $
         TMD     IRSET
         TDXLC   ,1                 X1=L/FANTAB   STORED IN IRSET
         TMA     A/ZZZZZZZZ$
         TMD     ,1
         JAED    NXACQX
         TMQ     0/77T47            TEST FOR RECORD TYPE
         ETA     11,1
         TMD     A/0000000P$
         JAED    NXAP1
         TMD     A/0000000H$
         JAED    NXAH1
         TMD     A/0000000T$
         JAED    NXAT1
         HLT     0
  NXAP1  TDM     ATYPE
         TMD     ,1
         TDM     XNXH
         TMD     1,1
         TDM     XNYH
         TMD     2,1
         TDM     XNZH
         TMD     3,1
         TDM     XL1X
         TMD     4,1
         TDM     XL1Y
         TMD     5,1
         TDM     XL1Z
         TMD     6,1
         TDM     XL2X
         TMD     7,1
         TDM     XL2Y
         TMD     8,1
         TDM     XL2Z
  NXAH2  TMD     10,1
         TDM     RHODMAX
  NXAT2  TMQ     0/77T5                    $
```

```
         ETA      11,1S
         TAM      FANNO
         TMD      9,1                    S
         TDM      RHOMAX
         TMA      D/1816
         AMS      NXACOX
         TMA      N/12T15
         AMS      IRSET
L NXACOX JMP      0
  NXAH1  TDM      ATYPE
         TMD      ,1
         TDM      A1H
         TMD      1,1
         TDM      A2H
         TMD      5,1
         TDM      SINHREF
         TMD      6,1
         TDM      COSHREF
         JMP      NXAH2
  NXAT1  TDM      ATYPE
         TMD      ,1
         TDM      UMAXT
         TMD      1,1
         TDM      VMAXT
         TMD      2,1
         TDM      COSPSI
         TMD      3,1
         TDM      RT1MUS
         TMD      4,1
         TDM      RT1MVS
         TMD      5,1
         TDM      SINHMIN
         TDM      SINHREFS
         TMD      6,1
         TDM      COSHMIN
         TDM      COSHREFS
         TMD      7,1
         TDM      PPP
         TMD      8,1
         TDM      TRDELT
         TMD      10,1
         TDM      TRTYPE
         JMP      NXAT2



 TACOJI1TJM       TCQUIX
         TMD      F/1.0             SET PAR1= 1.0
         TDM      PAR1
         JMP      AFILT3            SUBROUTINE
         JMP      TCQ1                FAILED EXIT
         JMP      TCQ2                MARGINAL EXIT
 TCQ6    TMD      TI                  NORMAL OR PASS EXIT     SET PAR2=TI
```



```
         TDM      PAR2
         TMD      F/1.0             SET PAR3=1.0
         TDM      PAR3
         TMD      F/-10,0           SET DT=-10.0
         TDM      DT
 TCQ3    TMA      DT                 SET TI=TI+DT
         FAMS     TI
         JMP      CRHOB             SUBROUTINE
         JMP      AFILT3            SUBROUTINE
         JMP      TCQ4                FAILED EXIT
         JMP      TCQ5                MARGINAL EXIT
         JMP      TCQ3                PASSED EXIT
 TCQ2    TMA      VISIBLE           TEST FOR VISIBILITY YES =X NO=0
         JAZ      TCQ1                 FAILS
         JMP      TCQ6                 OK
 TCQ1    TMD      F/-1.0            SET PAR1=-1.0
         TDM      PAR1
         TDM      PAR3              SET PAR3=-1.0
         TMD      TI                SET PAR2=TI
         TDM      PAR2
         TMD      F/-.2              SET DT=-.2
         TDM      DT
 TCQ7    TMA      DT                SET TI=TI+DT
         FAMS     TI
         JMP      CRHOB             SUBROUTINE
         TMA      F/0.0             TEST IS /> OR=RHOZH
         TMQ      RHOZH
         JAGQF    TCQ8
         JMP      AFILT3            SUBROUTINE
         JMP      TCQ7                 FAILED EXIT
         JMP      TCQ9                MARGINAL EXIT
         TMD      TI                SET PAR2=TI
         TDM      PAR2
 TCQ10   TMQ      PAR3              SET DT=PAR3*DT*.5
         FMMR     DT
         TMQ      F/.5
         FMARS    DT
         TMD      F/1.0             SET PAR3=1.0
         TDM      PAR3
 TCQ11   TMA      DT                SET TI=IT+DT
         FAMS     TI
         JMP      CRHOB             SUBROUTINE
         JMP      AFILT3            SUBROUTINE
         JMP      TCQ4                FAILED EXIT
         JMP      TCQ5                MARGINAL EXIT
         JMP      TCQ10                PASSED EXIT
 TCQ5    JMP      RHARR             SUBROUTINE
         JMP      STORE             SUBROUTINE
         TMA      F/1.0             SET PAR4=PAR4+1.0
         FAMS     PAR4
         TMD      F/2.0             TEST IF PAR4=2.0
         JAED     TCQ12
         TMD      TI                SET T1=TI
         TDM      T1
         TMD      F/1.0              SET PAR3=1.0
```

```
         TDM      PAR3
         TMA      PAR1           SET DT=PAR1*10
         TMQ      F/10.0
         FMARS    DT
         TMD      PAR2           SET TI=PAR2
         TDM      TI
         JMP      TCQ3
TCQ12    TMA      T1             TEST IS T1 > OR = TI
         TMQ      TI
         JAGQF    TCQ13
         TMD      TI             SET T2=TI
         TDM      T2
TCQUIX   JMP      0              EXIT
TCQ13    TMD      T1             SET T2,T1
         TDM      T2
         TMD      TI             SET T1=TI
         TDM      T1
         JMP      TCQUIX
TCQ4     TMQ      PAR3           SET DT=-PAR3*DT*.5
         FMMR     DT
         TMQ      F/-.5
         FMARS    DT
         TMD      F/-1.0          SET PAR3=-1.0
         TDM      PAR3
         JMP      TCQ11
TCQ9     TMD      TI             SET PAR2=TI
         TDM      PAR2
         JMP      TCQ5
TCQ8     TMA      TI             TEST IS TI > OR = PAR2
         TMQ      PAR2
         JAGQF    TCQUIX
         TQM      TI             SET TI=PAR2
         TMD      F/.2           SET DT=.2
         TDM      DT
         TMD      F/1.0          SET PAR1=1.0
         TDM      PAR1
         JMP      TCQ7


TACQUI   TJM      TACQUIX
         CM       PAR4           SET PAR4=0
         TMA      RCPTST         TEST TS RCPTST=ZERO
         JAZ      TACQ1
         TMA      RHOMAX         TEST IS RHOMAX >OR= RHO
         TMQ      RHO
         JAGQF    TACQ1
TACQUIXJMP        0
TACQ1    TMA      TRTYPE         TEST PHASED ARRAY TRTYPE=0 NO =1 YES
         JAZ      TACQ2
         JMP      TACQUI1        SUBROUTINE
TACQ3    TMA      F/1.0
         TMQ      PAR4
```



```
         JAGQF    TACQUIX
         TMA      PPP            TEST IF PPP=9.0
         TMD      F/9.0
         JAED     TACQ4
         JMP      TACQ6
TACQ4    TMA      TRDELT         N=INTERGRAL PART OF (T2-T1)/(2TRDELT)
         FAD
         TAM      TEMP1
         TMA      T2
         FSM      T1
         FDA      TEMP1
         TQA
         JMP      SEPSUB         SUBROUTINE FINDS INTEPGRAL PART OF ACC
         TMQ      TRDELT
         FMARS    TI
         TMA      T2
         FAM      T1
         TMQ      F/.5
         FMAR
         FSMS     TI
         TMD      TRDELT         SET DT=TRDELT
         TDM      DT
         FCSM     DT                   $
         FAMS     TI                   $
TACQ4A   TMA      DPASS                $
         JAZ      TACQ7                $
         TMA      TRTYPE               $
         JAZ      (P)+2H               $
         JMP      TACQ7                $
         TMA      DT                   $
         FAMS     T2                   $
TACQ7    TMA      DT             SET TI=TI+DT
         FAMS     TI
         FSM      T2             TEST IF -1E-4 >OR = TI-T2
         TAQ
         TMA      F/-.00001
         JAGQF    TACQ8
         JMP      TACQUIX
TACQ8    JMP      CRHOB          SUBROUTINE
         JMP      RHARR          SUBROUTINE
         TMA      TRTYPE         TEST FOR PHASED ARRAY TRTYPE=0 NO 1YES
         JAZ      TACQ9
TACQ10   JMP      STORE          SUBROUTINE
         TMA      F/1.0
         FAMS     PAR4
         JMP      TACQ7
TACQ9    TMA      ELMAX          TEST IF ELMAX > OR = OBSEL
         TMQ      OBSEL
         JAGQF    TACQ10
         JMP      TACQ7
TACQ6    TMA      PPP            COMPUTE DT=(T2-T1)/(PPP-1)
         FSM      F/1.0
         TAM      DT
         TMA      T2
         FSM      T1
```

```
        FDAS    DT
        TMD     T1
        TDM     TI
        JMP     TACQ4A                            $
TACQ2   TMD     F/0.0               SET A14=0
        TDM     A1H
        TMD     TWOPI               SET A2H=TWOPI
        TDM     A2H
        TMD     RCPTST              SET STST=RCPTST
        TDM     STST
        CM      RCPTST              SET RCPTST=0
        JMP     HACQUI              SUBROUTINE
        TMD     STST                      $
        TDM     RCPTST                    $
        TMA     DPASS               TEST UPASS ONLY DPASS=1  NO DPASS =0
        JAZ     TACQ3
        TMD     PAR2                SET T2=PAR2
        TDM     T2
        CM      BUF1                      $
        JMP     TACQ3



AFILT3  TJM     AFILT3X
        TJM     VISIBLE
        CM      MARG
        FCSM    RHO                 SET ERR= RHO7H-RHO*SINHMIN
        TMQ     SINHMIN
        FMAR
        FAM     RHOZH
        TAM     ERR                 ERR
        TMQ     RHO                 SET EPS=RHO*EPSLN*COSHMIN
        FMMR    EPSLN
        TAM     TEMP1                 TEMP1=RHO*EPSLN
        TMQ     COSHMIN
        FMARS   EPS                 EPS
        JMP     AFILT31             SUBROUTINE
        TMQ     RHO                 SET ERR= (RHO DOT YF)-RHO*COSPSI
        TMA     COSPSI
        FMARS   ERR                    ERR= RHO*COSPSI
        TMQ     RHOXH
        FMMR    YFX
        TMQ     RHOYH
        FMAD    YFY
        TMQ     RHOZH
        FMAD    YFZ                    RHO DOT  YF  COMPLETE
        FSMS    ERR                 ERR
        TMA     TEMP1               SET EPS= RHO*EPSLN*SINPSI
        TMQ     SINPSI                  TEMP1= RHO*EPSLN
        FMARS   EPS
        JMP     AFILT31             SUBROUTINE
        TMQ     RHOXH               SET ERR= RHO*UMAXT-ABS(RHO DOT ZF)
        FMMR    ZFX
```

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```
        TMQ     RHOYH
        FMAD    ZFY
        TMQ     RHOZH
        FMAD    ZFZ
        TAQ
        FCAQAS  ERR                    ERR=ABS (RHO DOT ZF)
        TMQ     RHO
        FMMR    UMAXT
        FSMS    ERR                 ERR
        TMA     TEMP1               SET EPS=RHO*EPSLN*(1-UMAXT**2)**1/2
        TMQ     RT1MUS
        FMARS   EPS                 EPS
        JMP     AFILT31             SUBROUTINE
        TMQ     RHOXH               SET ERR=RHO*VMAXT-ABS(RHO DOT XF)
        FMMR    XFX
        TMQ     RHOYH
        FMAD    XFY
        TMQ     RHOZH
        FMAD    XFZ
        TAQ
        FCAQAS  ERR                    ERR=ABS(RHO DOT XF)
        TMQ     RHO
        FMMR    VMAXT
        FSMS    ERR                 ERR
        TMQ     TEMP1               SET EPS=RHO*EPSLN*(1-VMAX**2)**1/2
        TMA     RT1MVS                    $
        FMARS   EPS
        JMP     AFILT31             SUBROUTINE
        TMA     0/2 T16
        AMS     AFILT3X
        TMA     MARG
        JAZ     AFILT3X
        CSM     0/1T16                    $
        AMS     AFILT3X
L AFILT3XJMP    0                   EXIT



AFILT31TJM      AFILX
        TMA     F/0.0               TEST IS ZERO >OR= ERR
        TMQ     ERR
        JAGQF   AFD1
        FCAQA                       TEST IF ABS(ERR) > OR = EPS
        TMQ     EPS
        JAGQF   AFILX
AFD2    TAM     MARG                SET MARG NOT ZERO
AFILX   JMP     0                   EXIT
AFD1    CM      VISIBLE             SET VISIBLE = 0
        TMQ     EPS                 TEST IF ABS(ERR) > OR =  EPS
        FCAMA   ERR
        JAGQF   AFILT3X             EXIT FROM AFILT3  ROUTINE
        JMP     AFD2
```

```
RHARR  TJM     RHARRX          $
       TMA     RHOZH           $  COMPUTE OBSEL =ARCSIN(RHOZH/RHO)
       FDA     RHO             $
       TQA                     $
S      FASIN                   $
       TAM     OBSEL           $ OBSEL
       TMQ     RHOYH           $ COMPUTE OBSAZ=ARCTAN(RHOYH/
       FCSM    RHOXH           $          =RHOXH)
       JMP     ARCTAN          $ SUBROUTINE
       TAM     OBSAZ           $ S
       TMD     RHO             $ SET OBSR = RHO
       TDM     OBSR            $
RHARRX JMP     0               $


STORE  TJM      STOREX         $
       TMA     TF              $ TEST IS ZERO > OR= TI(TF=TO-TI)
       FSM     TO              $
       TMQ     TI              $
       FSQ                     $
       FMAR                    $
       TAQ                     $
       TMA     F/0.0           $
       JAGQF   STOREX          $
       TMA     VPASS           $  TEST IF VPASS=0
       JAZ     STO1R           $
       JMP     ANGSN1          $ SUBROUTINE
       TMQ     XILLUM          $
       TMA     F/0.0           $
       JAGQF   STOREX          $
STO1R  TMD     TI              $  SET UP INPUT FOR AJPACK
       TDM     AJMIN           $  AJMIN=TI
       TMD     OBSAZ           $
       TDM     AJAZ            $  AJAZ=OBSAZ
       TMD     OBSEL           $
       TDM     AJELEV          $ AFELEV=OBSEL
       TMD     RHO             $
       TDM     AJRANGE         $ AJRANE=RHO
       TMD     OBSRR           $
       TDM     AJRRATE         $ AJRRATE=OBSRR
       TMD     FANNO                   $
       TDM     AJFAN                   $
       TMQ     T               $
       FMMR    XNO             $
       FDA     TWOPI           $
       TMA     EPREV           $
       FAQS    AJREV           $ AJREV=EPREV+T*XNO/TWOPI
```



```
       TMA     BUF1            $ TEST  IS  BUF1=0
       JAZ     STO2R           $
       TMA     BUF2            $ TEST BUF2> OR= AJMIN
       TMQ     AJMIN           $
       JAGQF   STO3R           $
       TQM     BUF2            $  EXCHANGE
       TAM     AJMIN           $   BUF2=AJMIN  + AJMIN=BUF2
       TMA     BUF1            $
       TMD     AJAZ            $
       TDM     BUF1            $
       TAM     AJAZ            $  AJAZ=BUF1  $  BUF1=AJAZ
       TMA     BUF3            $
       TMD     AJELEV          $
       TDM     BUF3            $
       TAM     AJELEV          $ AJELEV=BUF3  $  BUF3=AJELEV
       TMA     BUF4            $
       TMD     AJRANGE         $
       TDM     BUF4            $
       TAM     AJRANGE         $ AJRANGE=BUF4  +  BUF4=AJRANGE
       TMA     BUF5            $
       TMD     AJRRATE         $
       TDM     BUF5            $
       TAM     AJRRATE         $ AJRRATE=BUF5  +  BUF5=AJRRATE
       TMA     BUF6            $
       TMD     AJREV           $
       TDM     BUF6            $
       TAM     AJREV           $ AJREV=BUF6  +  BUF6=AJREV
       TMA     BUF7S
       TMD     AJFAN                   $
       TDM     BUF7S
       TAM     AJFAN                   $
STO3R  JMP     AJPACK          $  SUBROUTINE
STOREX JMP     0               $ EXIT
STO2R  TMD     AJAZ            $
       TDM     BUF1            $ BUF1=AJAZ
       TMD     AJMIN           $
       TDM     BUF2            $  BUF2=AJMIN
       TMD     AJELEV          $
       TDM     BUF3            $   BUF3=AJELEV
       TMD     AJRANGE         $
       TDM     BUF4            $   BUF4= AJRANGE
       TMD     AJRRATE         $
       TDM     BUF5            $   BUF5=AJRRATE
       TMD     AJREV           $
       TDM     BUF6            $    BUF6=AJREV
       TMD     AJFAN                   $
       TDM     BUF7S
       JMP     STOREX          $


ENDPK  TJM     ENDPK X         $
       TMA     BUF1            $  TEST IS BUF1=0
```

```
         JAZ     ENDPKX         $
         TMD     BUF1           $  TRANSFER DATA FROM BUF TO AJ;S
         TDM     AJAZ           $
         TMD     BUF2           $
         TDM     AJMIN          $
         TMD     BUF3           $
         TDM     AJELEV         $
         TMD     BUF4           $
         TDM     AJRANGE        $
         TMD     BUF5           $
         TDM     AJRRATE        $
         TMD     BUF6           $
         TDM     AJREV          $
         TMD     0/1T47         $  SET FLAG AJFLGIT
         TDM     AJFLGIT        $
         CM      BUF1           $
         TMD     BUF7$
         TDM     AJFAN                   $
         JMP     AJPACK         $
ENDPKX   JMP     0              $



CRHO9    TJM     CRHOBX         $
         JMP     PRED           $  SUBROUTINE
         TMA     THTAO          $  COMPUTE THTA = THTAO + RPTIM * T
         TMQ     RPTIM          $
         FMAD    T              $
         TAM     THTA           $   THTA
S        FSIN                   $        $

         TAM     SINTH          $        $
S        FCOS    THTA           $        $

         TAM     COSTH          $        $
         TMQ     XOVCT          $ COMPUTE CAPX = CAPX = XOVCT*COSTH
         TMA     COSTH          $
         FMARS   CAPX           $  CAPX
         TMA     SINTH          $ COMPUTE  CAPY= XOVCT*SINTH
         FMARS   CAPY           $  CAPY    QREG=XOVCT
         FAM     Y              $ COMPUTE  RHOXH= (X+CAPX)SINPH*COSTH
         TAM     TEMP1          $      +(Y+CAPY)SINPH*SINTH -
         TMQ     SINTH          $       (Z+CAPZ)COSPH
         FMARS   TEMP2          $  TEMP1= Y+CAPY  TEMP2= (Y+CAPY)SINTH
         TMA     X              $
         FAM     CAPX           $
         TAM     TEMP3          $  TEMP3=X+CAPX
         TMQ     COSTH          $
         FMARS   TEMP4          $   TEMP4=(X+CAPX)COSTH
         TMA     Z              $
         FAM     CAPZ           $
         TAM     TEMP5          $   TEMP5= Z+CAPZ
```



```
         TMQ     COSPH          $
         FMAR                   $
         TMQ     SINPH          $
         FMSU    TEMP2          $
         FMAD    TEMP4          $    TEMP4= (X+CAPX)COSTH
         TAM     RHOXH          $ RHOXH
         TMQ     SINTH          $ COMPUTE  RHOYH=(Y+CAPY)COSTH
         FMMR    TEMP3          $                -(X+CAPX)SINTH
         TMQ     COSTH          $   TEMP3=(X+CAPX)
         FMSU    TEMP1          $   TEMP1=(Y+CAPY)
         TAM     RHOYH          $ RHOYH
         TMQ     SINPH                $
         FMMR    TEMP5          $   (Y+CAPZ)COSPH*XSINTH+(Z+CAPZ)SINTH
         TMQ     COSPH          $    TEMP5=Z+CAPZ
         FMAD    TEMP2          $    TEMP2=(Y+CAPY)SINTH
         FMAD    TEMP4          $     TEMP4=(X+CAPX) COSTH
         TAM     RHOZH          $ RHOZH
         TAQ                    $ COMPUTE RHO =(RHOXH**2+RHOYH**2
         FMAR                   $              +RHOZH**2)**1/2
         TMQ     RHOXH          $
         FMAD    RHOXH          $
         TMQ     RHOYH          $
         FMAD    RHOYH          $
         TAM     RHOSQRD        $
S        FSQRT                  $

         TAM     RHO            $ RHO
         TMA     XDOT           $ COMPUTE OBSRR=(1/P)(X+CAPX)(XDOT+THDOT
         TMQ     THDOT          $    +(Y+CAPY)(YDOT-THDOT*X)+(Z+CAPZ)
         FMAD    Y              $    *ZDOT
         TAM     TEMP2          $  TEMP2= XDOT+THDOT*Y
         FMMR    X              $
         FSM     YDOT           $
         TMQ     TEMP1          $  TEMP1= Y+CAPY
         FMAR                   $
         TMQ     ZDOT           $
         FMSU    TEMP5          $  TEMP5= Z+CAPZ
         TMQ     TEMP2          $   TEMP2= XDOT+ THDOT*Y
         FMAD    TEMP3          $   TEMP3= X+CAPY
         FDA     RHO            $
         TQM     OBSRR          $ OBSRR
CRHO9X   JMP     0              $ EXIT



PRED     TJM     PREDX          $
         TMA     TI             $ COMPUTE T= TI-EPOCHM
         FSM     EPOCHM         $
         TAM     T              $  T
         JMP     XYZSB          $  SUBROUTINE
PREDX    JMP     0              $ EXIT
```

```
 CRDOT  TJM      CRDOTX           $
        TMQ      T                $ COMPUTE RHODOT= (XDOT+THDOT*Y)*COSPH
        FMMR     RPTIM                      $
        FAM      THTAO            $    +ZDOT*SINPH
        TAM      THTA             $   THTA=THTAO+THDOT*T
S       FCOS                      $

        TAM      COSTH            $
        TMQ      COSPH            $
        FMARS    CCPHTH           $  CCPHTH = COSPH*COSTH
        TMA      THTA             $
S       FSIN                      $

        TAM      SINTH            $
        TMQ      COSPH            $
        FMARS    CSPHTH           $   CSPHTH = COSPH*SINTH
        TMQ      X                $
        FMMR     THDOT            $
        FSM      YDOT             $
        TMQ      CSPHTH           $
        FMARS    RHODOT           $  USED AS TEMP
        TMQ      Y                $
        FMMR     THDOT            $
        FAM      XDOT             $
        TMQ      CCPHTH           $
        FMAR                      $
        TMQ      ZDOT             $
        FMAD     SINPH            $
        FSMS     RHODOT           $ RHODOT
        TMA      OBSRR                      $
        FDA      RHO                        $
        FMMR     RHOZH                      $
        FSM      RHODOT                     $
        FDA      RHO                        $
        FCSQS    RHODOT                     $
 CRDOTX JMP      0                $ EXIT



 CRDDOT TJM      CRDDOTX          $
        TMA      RHODOT                     $
        FSM      OLD ONE                    $
        FDA      DT                         $
        TJM      RHODDOT                    $
 CRDDOTXJMP      0                $ EXIT
```



```
  NXPASS TJM     NXPASSX          $
  NXPAS12TMD     LSTT             $ SET TI=LSTT
         TDM     TI               $
         JMP     ZDWI             $  SUBROUTINE
  NXPAS7 TMA     TI               $ TEST IF TF IS GREATER THAN OR EQUAL TO
         FAM     TO               $
         TAQ                      $
         TMA     TF               $  TI-IF YES JMP-IF NO EXIT
         JAGQF   NXPAS1           $
L NXPASSXJMP     0                $ EXIT
  NXPAS1 JMP     CZDOTW           $ SUBROUTINE
         FCAMA   ZDOTW            $ TEST IF ABS(ZDOTW) IS GREATER THAN OR
         TMQ     K1               $     EQUAL TO K1 -IF YES JMP
         JAGQF   NXPAS2           $
         FCSM    DT1              $ COMPUTE TI=TI-DT1
         FAMS    TI               $
  NXPAS6 JMP     CRHOB                      $
         JMP     CRDOT            $ SUBROUTINE
         TMA     F/0.0            $ TEST IF RHODOT IS GREATER THAN ZERO
         TMQ     RHODOT           $
         JAGQF   NXPAS3           $
  NXPAS5 TMA     DT2              $ SET  TI=TI+DT2
         FAMS    TI               $
         JMP     CRHOB                      $
         JMP     CRDOT            $ SUBROUTINE
         TMA     F/0.0            $ TEST IF ZERO IS GREATER THAN OR EQUAL
         TMQ     RHODOT           $     TO RHODOT - IF YES JMP
         JAGQF   NXPAS4           $
         JMP     NXPAS5           $
  NXPAS3 TMA     DT2              $ SET TI=TI+DT2
         FAMS    TI               $
         JMP     NXPAS6           $
  NXPAS2 TMA     DT1              $ SET TI=TI+DT1
         FAMS    TI               $
         JMP     NXPAS7           $
  NXPAS4 TMD     DT2              $ SET DT=DT2
         TDM     DT               $
         CM      N                $  N=0
  NXPAS9 FCSMA   DT               $ COMPUTE DT= -.5*ABS(DT)
         TMQ     F/.5             $
         FMARS   DT               $
  NXPAS10FAMS    TI               $ SET TI=TI+DT
         TMA     D/1B15           $ SET N=N+1    FIX PT B15
         AMS     N                $
         JMP     CRHOB                      $
         JMP     CRDOT            $ SUBROUTINE
         TMA     N                $ TEST IF N=NMAX  NMAX=7  FOR 1ST CUT
         TMD     NMAX             $
         JAED    NXPAS8           $
         TMA     F/0.0            $ TEST IF ZERO IS GREATER THAN OR EQUAL
         TMQ     RHODOT           $      RHODOT
         TQM     OLD ONE                    $
         JAGQF   NXPAS9           $
         FCAMA   DT               $ SET DT= +.5*ABS(DT)
         TMQ     F/.5             $
```

```
        FMARS   DT              $
        JMP     NXPAS10         $
NXPAS8  JMP     CRDDOT          $ SUBROUTINE
        TMA     RHODOT          $ TEST IF ABS(RHODOT/RHODOT) IS
        FDA     RHODDOT         $     GREATER THAN OR EQUAL TO
        TQM     TEMP1           $     ABS(DT/2)
        TMA     DT              $   TEMP1=RHODOT/RHODDOT
        FDA     F/2.0           $
        FCAQAS  TEMP2           $  TEMP2=ABS(DT/2)
        FCAMA   TEMP1           $
        TMQ     TEMP2           $
        JAGQF   NXPAS11         $
        FCSM    TEMP1           $ SET  TI=TI-RHODOT/RHODDOT
        FAMS    TI              $
NXPAS14JMP      CRHOB           $ SUBROUTINE
        TMA     DT1             $ COMPUTE LSTT=TI+DT2+DT1
        FAM     DT2             $
        FAM     TI              $
        TAM     LSTT            $ LSTT
        TMA     F/0.0           $ TEST IF ZERO IS GREATER THAN RHOZH
        TMQ     RHOZH           $
        JAGQF   NXPAS12         $
        TMA     D/1B16          $ INCREMENT RETURN ADDRESS BY 1 INSTOR1H
        AMS     NXPASSX         $
        JMP     NXPASSX         $ EXIT
NXPAS11TMA      RHODOT          $ COMPUTE TI=TI+(RHODOT/ABS(RHODOT))*
        TMQ     TEMP2           $       ABS(DT/2)
        JAP     NXPAS13         $
        FCSQ                    $
        TAQ                     $
NXPAS13FCAQ                     $
        FAMS    TI              $ TI
        JMP     NXPAS14         $

DT1     F/5                                   $
DT2     F/25                                  $
NMAX    0/7 T15                 $ CONSTANT



EINIT   TJM     EINITX          $
        JMP     XYZI            $ SUBROUTINE
        CM      T               $  SET T=0
        JMP     XYZSB           $  SUBROUTINE
        TMQ     EPOCH           $  COMPUTE EPOCHM= EPOCH*XMNPDA- TO
        FMMR    XMNPDA          $
        FSM     TO              $
        TAM     EPOCHM          $  EPOCHM
        TMO     RPTIM           $  COMPUTE THTAO= THTAI+RPTIM*EPOCHM
        FMAR                    $
        FAM     THTAI           $
        TAM     THTAO           $ THTAO
        TMA     XNODOT          $          $
```



```
        FSM     RPTIM           $                 *DT1)
        TMQ     DT1             $
        FMARS   TEMP1           $  TEMP1=(XNODOT-THDOT)*DT1
S       FSIN                    $

        TAM     SDEL            $
        TMA     TEMP1           $ COMPUTE CDEL = SIN(TEMP1)
S       FCOS                    $

        TAM     CDEL            $
        TMQ     SINPH           $ COMPUTE  SPCI= SIN PH*COSI
        TMA     COSI            $
        FMARS   SPCI            $
        TMQ     SINI            $ COMPUTE  CPSI = COSPH*SINI
        TMA     COSPH           $
        FMARS   CPSI            $
        TMA     EO              $ COMPUTE  Q2 =AO(1+EO)
        FAM     F/1.0           $
        TMQ     AO              $
        FMARS   Q2              $
        FCSM    FANTAB+5        $        $
        TMQ     FANTAB+5        $        $
        FMAR                    $
        FAM     F/1.0           $
        TAM     TEMP1           $  TEMP1= COSHMIN**2
S       FSQRT                   $

        TAM     TEMP2           $  TEMP2= COSHMIN
        TMQ     Q2              $
        FMMR    Q2              $
        FSM     TEMP1           $
S       FSQRT                   $

        FSM     SINHMIN         $
        FDA     Q2              $
        FMMR    TEMP2           $
        TAM     K1              $ K1
        CM      LSTT            $  SET LSTT=0
        TMD     C/HLT,SATNOS    $ COMPUTE REV.NO) AT START TIME,FIX,IT,
        TDXLC   ,1              $     AND PUT INTO SATNOS TABLE
        TMD     SATCONT         $
        ADXL    ,1              $
        FCSM    EPOCHM                   $
        FSM     F/1440.0        $
        FDA     TWOPI           $
        FMMR    XNO             $
        FAM     EPREV           $
        JAP     (P)+2H          $
        TMA     F/0.0           $
        TAQ                     $
        JMP     AJFIXIT         $
        SLA     30              $  STORE
        TMQ     3/1T2;30/1T47   $
        EIS     0,1             $
EINITX  JMP     0               $  EXIT
```

```
SINIT   TJM     SINITX          $
        TMA     BEGT            $  COMPUTE TO=BEGT*XMNPDA
        TMQ     XMNPDA          $
        FMARS   TO              $
        TMA     ENDT            $ COMPUTE  TF=ENDT*XMNPDA
        FMARS   TF              $
        TMA     PHIRD           $  COMPUTE  COSPH =COS(PHIRD)
S       FCOS                    $

        TAM     COSPH           $
        TMA     PHIRD           $  COMPUTE  SINPH= SIN(PHIRD)
S       FSIN                    $

        TAM     SINPH           $
        TMQ     BEAMW           $  COMPUTE EPSLN=.5*BEAMW*D2R
        FMMR    F/.5            $
        TMQ     DE2RA           $     D2R= DEGREES TO RADIANS CONSTANT
        FMARS   EPSLN           $
        CM      BUF1            $  BUF1=0
        TMA     BEGT            $  COMPUTE  THTAI
        JMP     FYKLOK          $  SUBROUTINE
        TAM     TOY             $
        TQA                     $
        JMP     SEPSUB          $   SUBROUTINE
        TAM     ORGDA           $
        TQM     ORGTM           $
        TMQ     TOY             $
        JMP     TLC             $   SUBROUTINE
        TMQ     ORGDA           $
        FMMR    SIDRT           $
        TMQ     ORGTM           $
        FMAD    SIDRT+1         $
        FAM     THGRO           $
        TMQ     DE2RA                     $
        FMAR                              $
        FAM     XLAMBA          $
        TAM     THTAI                     $
SINITX  JMP     0               $ EXIT



ZDWI    TJM     ZDWIX           $
        FCSM    DT1                       $
        FAMS    TI                        $
        JMP     PRED            $ SUBROUTINE
        TMA     THTAO           $ COMPUTE  THTA=THTAO+THDOT* T
        TMQ     RPTIM                     $
        FMAD    T               $
```



```
        TAM     THTA            $ THTA
        TAQ                     $ COMPUTE SNMT =SIN(XNODE-THTA)
        TMA     XNODE           $
        FSQS    CNMT            $    CNMT USED AS TEMP = XNODE-THTA
S       FSIN                    $

        TAM     SNMT            $ SNMT
        TMA     CNMT            $ COMPUTE CNMT=COS(XNODE-THTA)
S       FCOS                    $

        TAM     CNMT            $ CNMT
        TMA     DT1                       $
        FAMS    TI                        $
ZDWIX   JMP     0               $



CZDOTW  TJM     CZDOTWX         $
        TMQ     SNMT            $ TEMP1=SNMT*CDEL+CNMT*SDEL   TO COMPUTE
        FMMR    CDEL            $
        TMQ     SDEL            $
        FMAD    CNMT            $
        TAM     TEMP1           $ TEMP1
        FMMR    SNMT            $ COMPUTE CNMT=CNMT*CDEL-SNMT*SDEL
        TMQ     CDEL            $
        FMSU    CNMT            $
        TAM     CNMT            $ CNMT
        TMQ     TEMP1           $ SET SNMT= TEMP1
        TQM     SNMT            $
        TMA     SPCI            $ COMPUTE ZDOTW=SNMT*CPSI+SPCI
        FMAD    CPSI            $
        TAM     ZDOTW           $
CZDOTWXJMP      0               $ EXIT
```

```
        SAME    XYZSB,XYZ3      $
        ASGN    DTERM,    M/3752$
        SAME    BJTLCE,M/3 $
XYZI    TJM     (P)+3H          $
        JMP     BEGIN           $
        JMP     NTHCN           $  XYZ+1
        JMP     (P)             $
XYZ1    TJM     XYZSWT1          $
        JMP     XYZK25+1H       $
XYZ2    TJM     XYZSWT2          $
        JMP     (P)+4H          $
XYZ3    TJM     XYZSBX      $
        TIJ     XYZSB3$
        TJM     XYZSWT2          $
        TIJ     XYZSWT1+1H       $
        TJM     XYZSWT1          $
        JMP     XYZK25+1H       $
XYZSBG  TJM     XYZSBX          $
        TIJ     XYZSB3          $
        TJM     XYZSWT2          $
        JMP     XYZSB2          $
```



```
  BEGIN  TJM     BEGINX$
         TMQ     HXO$
         FMMR    HXO$
         TMQ     HYO$
         FMAD    HYO$
         TMQ     HZO$
         FMAD    HZO$
         TAM     P$
            TDM  PO          $
S        FSQRT   $

         TAM     RTP$
         TMA     F/1$
         FDA     RTP$
         FMMR    HXO$
         TAM     WX$
         FMMR    HYO$
         TAM     WY$
         FMMR    HZO$
         TAM     WZ$
         TDM     COSI$
         TDQ     $
         FCSQ    $
         FMAR    $
         FAM     F/1$
S        FSQRT   $

         TAM     SINI$
         TDM     XMZ$
         TDQ     $
         TMA     COSI$
         JMP     ARCTAN$
         TAM     XINCL$
         TMA     F/1$
         FDA     SINI$
         FMMR    WX$
         TAM     SINO$
         FMMR    WY$
         TAQ     $
         FCSQS   COSO$
         TMQ     SINO$
         JMP     ARCTAN$
         TAM     XNODEO$
         TMQ     AXNO$
         FMMR    AXNO$
         TMQ     AYNO$
         FMAD    AYNO$
         TAM     ESQ$
S        FSORT   $

         TAM     EO$
         TMA     F/1$
         FSM     ESQ$
         TAM     AO$
S        FSQRT   $
```

```
         TAM      RTESQS
         THA      PS
         FDAS     AOS
         TQA      S
S        FSQRT    S
         TAM      RTAS
         THA      XNODEOS
         TMQ      WZS
         JQN      (P)+2HS
         FCSM     XNODEOS
         FAM      XLOS
         TAM      UOS
         TMQ      SINIS
         FMMR     SINIS
         FDA      F/.666666667S
         FCSQ     S
         FAM      F/1S
         FDA      PS
         FMMR     RTESQS
         FDA      PS
         FMMR     P3JA02S
         FDA      F/2S
         THA      F/1S
         FSQ      S
         TAM      XNOREVS
         FDA      AOS
         FMMR     XKERTMS
         FDA      RTAS
         TQM      XNOS
         FMMR     XNOS
         FDA      PIO36S
         FMMR     COS
         TAM      CS
  BEGINX JMP      OS

  DELTPI S
  XNOREV S
  NTHCN  TJM      NTHCNXS
         TMQ      AOS
         THA      F/1S
         FSM      EOS
         FMARS    QOS
         THA      SINIS
         FDA      F/-.4S
         FMMR     SINIS
         FAM      F/2S
         FSMA     COSIS
         FDA      PS
         FMMR     P3JA02S
         FDA      PS
         TQM      DELTPIS
         TMQ      XM403S
         FMMR     CS
```



```
         TAM      XM4C03S
  NTHCNX JMP      OS
```

```
 XYZS9X    JMP     (P)                 $
 XYZK25 TJM       XYZS8X               $
        TMA       F/.06     $
        TMQ       EO        $
        JAGQF     (P)+3H    $ COMPUTE D IF E LESS THAN .06
        TMA       F/0       $
        JMP       NODTERM   $ SET D = 0
        TMA       XYZND                  $
        FSM       XNO       $
        TMQ       F/0.20061256E-2$                      K-66
        JAGQF     (P)+3H    $
        TMQ       F/13.0    $                           K-66
        JMP       (P)+5H    $
        TMQ       F/3       $
        FMARS     A         $
        FAM       XYZND                  $
        FDA       A         $
        FMMR      C         $
        FDA       1OVA      $                           K-66
        FMMR      C         $
 NODTERMTAM       DTERM     $ END COMPUTING D
        TMQ       F/1.5     $ START COMPUTING A
        FMMR      DTERM     $
        TMQ       T         $
        FMAR                $
        FAM       C         $
        FMAR                $
        TMQ       F/2       $
        FMAR                $
        FAM       F/1       $
S       FLOG2X    $

        TMQ       F/-.6666666667$
        FMAR                $
S       F2X       $

        TMQ       AO        $
        FMARS     A         $ END COMPUTING A
S       FSQRT     $

        TAM       RTA$
        TMQ       A$
        FMARS     XN$
        TMA       XKE$
        FDAS      XN$
        TMA       F/1E-10   $                           K-66
        TMQ       EO        $                           K-66
        JAGQF     (P)+4H    $                           K-66
        TMA       A$
        TMQ       QO$
        JAGQF     (P)+7H    $                           K-66
        TMD       F/0$
        TDM       E$
        TDM       ESQ       $                           K-66
        TMA       A         $                           K-66
```



```
          TDM       P         $                                   K-66
          JMP       TAGRS     $                                   K-66
          TQA       $
          FDA       A$
          TMA       F/1$
          FSQS      E$
          TDQ       $
          FMMR      E$
          TAM       ESQ$
          TMA       F/1$
          FAM       E$
          TMQ       QO$
          FMARS     P$
S TAGRS   FSQRT     $                                             K-66

          TAM       RTP$
             TMA    P3JA02      $
             FDA    PO          $
             FMMR   XNO         $
             FDA    PO          $
             TQM    OMGDT       $
             FCSM   COSI        $
             FMARSXNODOT        $
          TDQ       $
          TMA       XNODEO$
          FMAD      T$
          TAM       XNODE$
  XYZSWT1JMP        (P)                 $
  XYZS82  TMA       F/1$
          FSM       ESQ$
S         FSQRT     $

          TAM       RTESQ$
             FCSM   SINI        $
             TMQ    SINI        $
             FMAR               $
             TMQ    FLO 5       $
             FMAR               $
             FAM    FLO 4       $
             FDA    FLO 2       $
             FMMRSOMGDT         $
          TMQ       T$
          FMARS     OMGAS$
S         FCOS      $

          TAM       U$
             TMA    OMGAS               $
S         FSIN      $

          TAM       XL$
          TMA       F/0$
          TMD       EO$
          JAED      XYZSB7$
          FCSM      AYNO$
          TMQ       XL$
```

```
         FMAR     $
         TMQ      U$
         FMAD     AXNO$
         FDA      EO$
         FMMR     E$
         TAM      AXN$
         TMQ      U$
         FMMR     AYNO$
         TMQ      XL$
         FMAD     AXNO$
         FDA      EO$
         FMMR     E$
         TAM      AYN  $
XYZSB10  TMA      SINI$
         FDA      P$
         FMMR     MJ3AOJ2$
         FDA      F/2$
         TQM      L3$
         TQA      $
         FAMS     AYN$
XYZSB9   TMQ      T          $
         FMMR     DTERM      $
         FAM      C          $
         FMAR                $
         FAM      F/1        $
         FAM      DELTPI     $
         FMAR                $
         TAQ                 $
         FMMR     XNO        $
         FAM      XLO        $
         TAM      XL         $
         TMA      F/1$
         FAMA     COSI$
         TAM      DENOM$
         TAQ      $
         FMMR     F/5$
         FSM      F/2$
         FDA      DENOM$
         FMMR     AXN$
         FDA      F/2$
         FMMRS    L3$
         FAMS     XL$
         TMQ      F/0$
         TMA      WZ$
         JAGQF    XYZSB21$
         TMA      XL$
         FAM      XNODE$
XYZSB22  FDA      TWOPI$
         TQA      $
         JMP      SEPSUB$
         FMMR     TWOPI$
         TAM      U$
XYZSWT2  JMP      (P)                 $
XYZSB21  FCSM     XNODE$
         FAM      XL$
```



```
         JMP      XYZSB22$
XYZSB3      TMA   XNODE          $
S        FSIN     $

         TAM      XNY$
         TDM      SINO$
            TMA   XNODE          $
S        FCOS     $

         TAM      XNX$
         TDM      COSO$
         TMQ      SINI$
         FMMR     XNY$
         TAM      WX$
         FCSM     XNX$
         FMARS    WY$
         TMQ      COSI$
         FCSM     XNY$
         FMARS    XMX$
         FMMR     XNX$
         TAM      XMY$
         TMA      RTESQ$
         FAM      F/1$
         TAQ      $
         FMAR     $
         TMQ      RTESQ$
         FMARS    DENM$
         TMD      U$
         TDM      E01$
XYLP        CM    XYZSBZ         $
            TMA   E01            $
S        FSIN     $

         TAM      SINEO$
            TMA   E01            $
S        FCOS     $

         TAM      COSEO$
         TDQ      $
         TMA      AYN$
         FMAR     $
         TMQ      AXN$
         FMSU     SINEO$
         TAM      ESINE$
         FAM      U$
         TAM      E02$
         FSM      E01$
         TAQ      $
         FCAQA    $
         TMQ      TENM6$
         JAGQF    XYLP1$
         JMP      XYZLP2$
XYLP1    TMD      E02$
         TDM      E01$
            TMA   N/30T15        $
```

```
         INCA XYZSBZ        $
         JAED (P)+2H        $
         JMP  XYLP+1H       $
XYZLP2 TMQ    SINEOS
       FMMR   AYNS
       TMQ    COSEOS
       FMAD   AXNS
       TAM    ECOSES
       TDQ    S
       TMA    F/1S
       FSQ    S
       TMQ    AS
       FMARS  RS
       TQA    S
       FDA    RS
       TQM    ARS
       TMA    RTAS
       FDA    RS
       FMMR   ESINES
       TAM    RDOTS
       FMMR   RTESQS
       TAM    RVDOTS
       TMA    RTESQS
       FAM    F/1S
       TAM    SINUS
       TMA    ESINES
       FDAS   SINUS
       FCSM   AXNS
       TMQ    SINUS
       FMAD   AYNS
       FAM    COSEOS
       TMQ    ARS
       FMARS  COSUS
       FCSM   AXNS
       TAQ    S
       FCSM   AYNS
       FMAD   SINUS
       FAM    SINEOS
       TMQ    ARS
       FMARS  SINUS
       TMQ    COSUS
       FMMR   XNXS
       TMQ    SINUS
       FMAD   XMXS
       TAM    UXS
       FMMR   XNXS
       TMQ    COSUS
       FMSU   XMXS
       TAM    VXS
       FMMR   XNYS
       TMQ    SINUS
       FMAD   XMYS
       TAM    UYS
       FMMR   XNYS
       TMQ    COSUS
```



```
         FMSU   XMYS
         TAM    VYS
         FMMR   XMZS
         TAM    VZS
         TMQ    SINUS
         FMMR   XMZS
         TAM    UZS
         TMQ    RS
         FMMR   UXS
         TAM    XS
         FMMR   UYS
         TAM    YS
         FMMR   UZS
         TAM    ZS
         TMQ    RDOTS
         FMMR   UXS
         TMQ    RVDOTS
         FMAD   VXS
         TAM    XDOTS
         FMMR   VYS
         TMQ    RDOTS
         FMAD   UYS
         TAM    YDOTS
         FMMR   UZS
         TMQ    RVDOTS
         FMAD   VZS
         TAM    ZDOTS
         JMP    XYZSBXS
 XYZSB7  TDM    AYNS
         TMD    ES
         TDM    AXNS
         JMP    XYZSB10S
C ARCTAN TJM    ONODE8S
         TAM    ONODE10S
         TQM    ONODE10+1S
         TMA    F/0S           NODE ACCORDING TO
         TMD    ONODE10S
         JAED   ONODE5S
         JDP    ONODE1S        USED. THE A,Q,D REGISTERS .
         TMA    PIS
         JMP    ONODE3S        ENTRY
 ONODE1  TMD    ONODE10+1S
         JAED   ONODE8S
         JDP    ONODE3S        THE RESULT IS STORED IN
         TMA    TWOPIS
 ONODE3  TAM    ONODE10+2S
         JMP    ONODE7S        10TH. SIGNIFICANT DECIMAL DIGIT
 ONODE5  TMD    ONODE10+1S
         JAED   ONODE8S
         JDP    ONODE6S        SUBROUTINE.....
         TMA    X3PIO2S
         JMP    ONODE8S
 ONODE6  TMA    PIOV2S
         JMP    ONODE8S
 ONODE7  TMA    ONODE10+1S
```

```
         FDA      ONODE10$
         TQA      $
S        FATAN    $

         FAM      ONODE10+2$
  ONODE8 JMP      0$
L ONODE10SET      (P)+3$



* GENERALIZED SUBROUTINE TO CONVERT ANY FLOATING
*   POINT NUMBER TO ITS FRACTIONAL AND INTEGRAL
*   PARTS. NUMBER IN ACC. AT ENTRY. INTEGER IN ACC.,
*   FRACTION IN Q REG. ON EXIT.
C SEPSUB TJM      SEPSUBX$
         TAM      SEPSUB3$
         FCAMA    SEPSUB3$
         TMQ      1/1T1;0/43T47$
         JAGQF    SEPSUB1$
         TAQ      $
         ETA      1/1T36$
         JAZ      (P)+4H$
         TMA      F/0$
         TMQ      SEPSUB3$
         JMP      SEPSUBX$
         ETA      11/1T47$
         SLA      8$
         AM       C/CA;C/SLAQN,12$
         TAM      SEPSUB2$
         SRQ      12$
L SEPSUB2  CA     $
           SLAQN  12+0$
         SLA      12$
         AM       D/35$
         TAM      SEPSUB2$
         TMD      SEPSUB3$
         JDP      (P)+5H$
         FCSQ     $
         TAQ      $
         FCSM     SEPSUB2$
         JMP      (P)+4H$
         FCAQ     $
         TAQ      $
         FCAM     SEPSUB2$
  SEPSUBXJMP      0$
  SEPSUB1TMQ      F/0$
         TMA      SEPSUB3$
         JMP      SEPSUBX$
  SEPSUB3$
```



```
  TLC     TJM      TLC4$
          TXDLC    ,1$
          TDM      TL2$
          TMD      TL1$
          TDXLC    ,1$
          ETD      6/1T47$          TLC
          TDQ      $
          TMA      D/9$
          JAGQ     (P)+2H$
          JMP      BJTLCE  $
          MM       TL3$
          TQA      $
          SLA      8$
          TMQ      TL4$
          EIS      TLC1$
          EIS      TLC2$
          EIS      TLC3$
R TLC1    TMD      ,1$
          TDM      THGRO$
R TLC2    TMD      ,1$
          TDM      XLSUNO$
R TLC3    TMD      ,1$
          TDM      C3$
          TMD      TL2$
          TDXLC    ,1$
  TLC4    JMP      $
  TL1     C/HLTR,YCONS$
  TL2     $
          1/1$ CONSTANTS MUST FOLLOW THIS WORD
  CGP     $
  MJ3AOJ2F/2.1251E-3$                                CN T-266
  10VA    F/0.25         $                              K-66
  DENOM   $
  L3      $
  XY1     $
  TL3     D/3$
  TL4     28/1;12/0;8/1$
*  A-1 HLT REMOVED
  XYZSBZ  $
  XYZNO   F/.072722052$                                 CN T-29
  YCONS   F/98.67401$
          F/278.6797$
          F/-3.5728$
          F/99.42094$
          F/279.4267$
          F/-2.8431$
          F/99.18222$
          F/279.1879$
          F/-3.0990$
          F/98.94349$
          F/278.9491$
          F/-3.3549$
          F/98.70477$
          F/278.7104$
```

```
F/-3,6108$
F/99,45170$
F/279,4573$
F/-2,8811$
F/99,21297$
F/279,2186$
F/-3,1370$
F/99,39017$
F/279,3958$
F/-2,8050$
F/99,15144$
F/279,1571$
F/-3,0610$
F/98,91273$
F/278,9184$
F/-3,3169$
```



```
  ER10    TJMR     EREX$
          TMQ      EREX$
          ETA      O/4T39$
          JAZ      EREXP$
          TIJ      PRERS$
          TJM      E3FWR1$
          TQD      $
          TDXLC    ,1$
          SIXOL    1,1$
          TMA      ,1$
  ER11    SM       D/1816$
          SRA      32$

R         RPTNN    5$
          SRAQ     3$
          SRQ      3$
          TQM      PRERL$
          TMA      E3WOR$
          JMP      GLOP.GLOP$
  ER12    TMA      PHAIN$
          JAZ      NXTCASE                   $
          TMD      F/1.0$
          JAED     NXTEL$
          TMD      F/2.0$
          JAED     START3                    $
          TMD      F/3.0$
          JAED     START2                    $
          TMQ      F/5                       $
          JAGQF    (P)+2H                    $
          JMP      NXTCASE                   $
          TIXZ     0,4                       $
          JAEQ     TRERR                     $
          JMP      FNERR                     $
  EREXP   TIJ      PRERE$
          TJM      E3FWR1$
          ETA      O/77777T15$
          JMP      ER11$

  PRERS   A/SUBROUTINE ERROR $


  PRERE   A/EXPONENT OVERFLOWS


  PRERC   A/FROM LOCATIONS

  PRERL   $
L E3WOR   HLT      $
          TIJL     E3FWOR$
  E3FWOR  HLT      17+128+17$
  E3FWR1  TMA      $
          HLT      31+128+13$
          TMA      PRERC$
          HLT      37+128+5$
          CAM      PRERL$
```

```
L EREX   HLT      $
         HLT      $
  TLCE   TMD      SATN$
         SCD      18$
         TDM      PSATN$
         TMA      TWOR1$
         JMP      GLOP.GLOP$
         JMP      NXTEL$
L TWOR1  HLT      $
         TIJL     TFWOR$
L TFWOR  HLT      15+128+11$
         TMA      PRELM$
         HLT      23+128+3$
         TMA      PSATN$
         HLT      37+128+16$
         CAM      PRTLC$
  PRTLC  W/ILLEGAL $
         W/YEAR    $
  PRELM  A/ELEMENT NO.$

  ANGSN1 TJM      ANGSNX$
         TMA      TI                         $
         FDA      XMNPDA$
         TMA      ORGDA                      $
         FAM      ORGTM                      $
         FAQ      $
         TMQ      C1$
         FMARS    TEM$
         FAM      C3$
         TMQ      DE2RA$
         FMAR     $
A        FSIN     $

         TAQ      $
         FMMR     C2$
         FAM      TEM$
         FAM      XLSUNO$
         TAM      XLSUNT$
         FDA      RADYN$
         FMMR     F/2.0$
A        FSIN     $

         TMQ      C4$
         FMAR     $
         FSM      XLSUNT$
         TAQ      $
         FCSM     DE2RA$
         FMARS    ALSUN$
A        FCOS     $

         TAM      CSALS$
A        FSIN     ALSUN$

         TAM      SNALS$
```



```
         TDQ      $
         FMMR     C5$
A        FATAN    $

         TAM      DLSUN$
A        FSIN     $

         TAM      SNDLS$
         TDM      SUNLZ$
A        FCOS     DLSUN$


         TAM      CSDLS$
         TMQ      CSALS$
         FMARS    SUNLX$
         TMQ      CSDLS$
         FMMR     SNALS$
         TAM      SUNLY$
         TMQ      CAPX$
         FMMR     CAPX$
         TMQ      CAPY$
         FMAD     CAPY$
         TMQ      CAPZ$
         FMAD     CAPZ$
A        FSQRT    $

         TAM      CAPR$
         TMQ      CAPX$
         FMMR     SUNLX$
         TMQ      CAPY$
         FMAD     SUNLY$
         TMQ      CAPZ$
         FMAD     SUNLZ$
         FDA      CAPR$
         FCSQS    SNHSN$
         FAM      F/.0871557              $ SINE 5 DEGREES
         JAN      ANGSN2$
  ANGSN3 TMD      F/-1.0$
         TDM      XILLUM$
  ANGSNX JMP      (P)$
  ANGSN2 TMQ      SUNLX                   $
         FMMR     X$
         TMQ      SUNLY$
         FMAD     Y$
         TMQ      SUNLZ$
         FMAD     Z$
         TAQ                              $
         FMAR                             $
         TMQ      R                       $
         FMSU     R                       $
         TMQ      F/1                     $
         JAGQF    CALIL2                  $
         JMP      ANGSN3                  $
  CALIL2 TMD      F/1.0$
         TDM      XILLUM$
```

```
       JMP      ANGSNXS
```



```
AJPACK TJM    AJPKXX             $
       CD                        $
       TXDLC  0,3X               $
       TXDRC  0,4X               $
       TDM    AJSV34             $
       TMD    AJCOL79            $      BUFFER AND BL
       TDXLC  0,4X               $
       TMA    AJHOLD             $
       FAM    AJMIN              $
       TAQ                       $
       FMMR   F/100,             $
       FAM    F/.4               $      100 X MINUTES
       TAQ                       $
       JMP    AJFIXIT            $
       SLA    25                 $
       TAM    0,4X               $
       TMA    SATCONTS
       SRA    19                 $
       AMS    0,4S
       TMQ    AJAZ               $      10 X AZ AT T4
       FMMR   F/572,957795       $
       FAM    F/.4               $
       TAQ                       $
       JMP    AJFIXIT            $
       SLA    1                  $
       AM     AJFLGIT            $
       CM     AJFLGIT            $
       AMS    0,4X               $
       TMA    4C4+2              $
       JAZ    (P)+4H             $
       TMA    ELNO               $
       SLA    32                 $
       JMP    4ELNO3             $
       TMQ    AJREV              $      REV No. AT T1
       JMP    AJFIXIT            $
       SLA    30                 $
       TMD    C/HLT,SATNOS       $
       TDXLC  ,1                 $
       TMD    SATCONT            $
       ADXL   ,1                 $
       TMQ    15/1T17            $
       ES     0,1                $
       SLA    2                  $
4ELNO 3TMQ    6/1T5;32/1T47      $
       EIS    1,4                $
       TMQ    42/1T47            $
       TMA    AJFAN              $
       EIS    1,4                $
       TMQ    AJRANGE            $      RANGE AT T29
       FMMR   AJCNV1             $      IN KM OR NM
       FAM    F/.4               $
       TAQ                       $
       JMP    AJFIXIT            $
       SLA    18                 $
       TMQ    16/1T15            $
```

```
        TMD     14/1T29                    $
        JAGD    (P)+1                      $
        JMP     (P)+1                      $
        CA                                  $
        EIS     1,4X                       $
        TMQ     AJCNV2                     $
        FMMA    AJRRATE                    $         10 X RRATE AT
        TAQ                                $
        FMMR    F/10.                      $         IN KM/SEC OR
        FAM     F/.4                       $
        TAQ                                $
        JMP     AJFIXIT                    $
        SLA     11                         $
        TMQ     30/1T29                    $
        TMD     7/1T36                     $
        JAGD    (P)+1                      $
        JMP     (P)+1                      $
        TDA                                $
        EIS     1,4X                       $
        TMD     AJRRATE                    $
        JDP     (P)+3H                     $
        TMD     1/1T37                     $         RR SIGN AT T3
        DORMS   1,4X                       $
        TMQ     F/572.957795               $
        FMMAR   AJELEV                     $         10 X ELEV AT
        FAM     F/.4                       $
        TAQ                                $
        JMP     AJFIXIT                    $
        TMQ     38/1T37                    $
        TMD     10/1T47                    $
        JAGD    (P)+1                      $
        JMP     (P)+1                      $
        TDA                                $
        EIS     1,4X                       $
        TMD     AJELEV                     $         ELEV SIGN
        JDP     (P)+3H                     $         AT T0
        TMD     1/1T0                      $         OF
        DORMS   1,4                         $
        TMD     C/HLT,AJBFFR+128;C/HLT,AJPKITA    $
        AIXJ    2,4X                       $
        SIXOL   128,4X                     $         OUTPUT
        TMD     AJCOL79                    $         ONTO
        TXDLC   0,4X                       $         TAPE
        TDA                                $         (A BLOCK AT A
        AM      D/1                        $         PACKED
        TAM     AJCOL79                    $         PAIRS OF
AJPKFINTMA      N/7T23;N/1T39;H/19T47      $         DATA READY
        JMP     SYS                        $         FOR
        TIO     AJBFFR                     $         TIME
        JMP     SYSNO                      $
        TMD     C/HLT,0;C/HLT,SYSTAB+7     $         ORDERING.

        JMP     SYSIO                      $
        JMP     (P)+2                      $
AJPKITATMD      AJCOL79                    $
```



```
        TXDLC   0,4X                       $         EXIT FOR MORE
        TDM     AJCOL79                    $         DATA.
        TMD     AJSV34                     $
        TDXLC   0,3X                       $
        TDXRC   0,4X                       $
AJPKXX  JMP     (P)                        $
AJNODTA  TIJ    AJND1  $
         TJM    AJDLOOPS
         TIJ    AJADREXS
         TJM    AJCLU+3HS
         TIJ    AJHEDEXS
         TJM    AJHDU+3HS
        JMP     AJDAYSS+1H                 $
AJND1   JMP     PANT.SPACE                 $
        TMD     AJTYSW                     $
        JDP     (P)+1                      $
        JMP     PANT.TSPACE                $
        TMA     AJNDCW                     $
        JMP     GLOP.GLOP                  $
        TMD     AJTYSW                     $
        JDP     (P)+3H                     $
        JMP     PANT.TPANT                 $
        JMP     AJTYEND                    $
        JMP     PANT.ALLFIN                $
        JMP     NXTCASE                     $
AJNDCW  C/HLT,0;C/TIJL,AJNDFW              $
AJNDFW  C/HLT,9+128+8;C/CAM,AJNDAA         $
AJNDAA  A/NO DATAS
*
AJENDPK    JMP  4SUMMRY $
        TIJ     PANT.TPANTA
        TJM     4OUT 1+2H
        JMP     PANT.PAGE
*
          TMA   AJCOL79 $
        TDXLC   0,4X                       $
        TMD     C/HLT,AJBFFR;C/HLT;0       $
        JAED    AJNODTA                    $
        TMD     C/HLT,AJBFFR+128;C/HLT,AJPKITB    $
        AIXJ    0,4X                       $
        JMP     (P)+3                      $
AJPKITBTMD      47/1T47                    $
        TDM     0,4X                       $         WORDS OF
        TDM     1,4X                       $
        AIXOL   2,4X                       $         47 ONES
        JMP     AJPKITB-3H $
        SIXOL   128,4X                     $         FOR
        TMA     AJCOL79                    $         REMAINDER
        AM      D/1                        $
        TAM     AJCOL79                    $         OF BLOCK.
         TIJ    AJPKITCS
         TJM    AJPKITA-1HS
        JMP     AJPKFIN                    $
AJPKITC  TMA    N/7T23;H/8AT47S
         JMP    REWIND $
```

```
         JMP      AJSRTITS
         AFEND    50$
 XSRCH   TJM      XSRCHX
         CM       XSRCH9
         TJM      XSRCH11S
         TXDLC    ,1
         TXDRC    ,2
         TDM      XSRCH1
         TXDLC    ,3
         TXDRC    ,4
         TDM      XSRCH2
         TXDLC    ,5$
         TXDRC    ,6$
         TDM      XSRCH3
         TAD
         TDXRC    ,6
 XSRCHA  TMD      XSRCH2
         TDXLC    ,3
         TMQ      ,6
         TDXRC    ,5
         TMD      XSRCH4
         TDXLC    ,1
         TDXRC    ,4
         ETD      0/177T15$
         SDXL     ,4
         ETD      0/177T8
         TDM      CARD.T4
         ETA      0/7T8
         SRD      7
         JAZ      XSRCHB
 XSRCHC  TDXLC    ,2
         SDXL     ,1
         SDXR     ,3
         ETD      0/17T5
         SRD      10
         ADXL     ,3
         ETA      0/1T41
         JAZ      (P)+2H
         TJM      XSRCH9
         ETA      0/3T23
         SLA      8
         AM       XSRCH10
         TAM      XSRCHF

L XSRCHF HLT
         HLT
         SIXO     2,3
         TMQ      2,3
         TMA      1,3

L        RPTN     6
         SRAQ     ,1
         TQM      XSRCHHS

L        RPTN     6
```



```
         SRAQ     ,2
         TMA      ,3

L        RPTN     6
         SRAQ     ,1
         TQM      XSRCHYS
         TMA      XSRCH4S
         TXDLC    ,4S
         JAGD     XSRCHGS
 XSRCHJ  TMQ      XSRCHWS
         SIXOL    8,4S
         JMP      XSRCHHS
         AIXOL    8,4S
         TMA      XSRCHZS

L XSRCHE JMP      0S
         JMP      XSRCHDS
         TXDLC    ,4S
         JAED     (P)+2H          S
         JAGD     (P)+3HS
         TQA      S
         JMP      XSRCHDS
         TQM      1,5S
         TMA      XSRCHWS
 XSRCHD  TAM      ,5S
         TMA      FXERCLS
         JAZ      XSRCHKS
         TMA      XSRCH9S
         JAZ      (P)+2HS
         JMP      (P)+3HS
         AIXO     1,6S
         JMP      XSRCHAS
         TMD      XSRCH1S
         TDXLC    ,1S
         TDXRC    ,2S
         TMD      XSRCH2S
         TDXLC    ,3S
         TDXRC    ,4S
         TMD      XSRCH3S
         TDXLC    ,5S
         TDXRC    ,6S
         TMA      XSRCH11S
 XSRCHX  JMP      0S
 XSRCHG  JAED     XSRCHJS
         JMP      XSRCHHS
         TQA      S
         TMQ      XSRCHWS
         JMP      XSRCHES
 XSRCHH  TJM      XSRCHIS
         TMA      XSRCHZS

L        RPTN     6S
         SLQ      ,4S
L        RPTN     6S
         SRAQ     ,4S
```

```
  XSRCHI JMP      0$
  XSRCHK CM       XSRCH11$
         JMP      XSRCHD+3H$

  XSRCH1 $
  XSRCH2 $
  XSRCH3 $
  XSRCH4 C/HLT,8;C/HLT,16$
  XSRCH5 C/HLT,8;C/HLT,1$
  XSRCH6 C/TAM,XSRCHW;C/TMA,XSRCH4$
  XSRCH7 C/JMP,FXINT;C/JMP,XSRCHD$
  XSRCH8 C/JMP,FXFLT;C/JMP,XSRCHD$
  XSRCH9 $
  XSRCH10C/TMD,XSRCH6;C/TDM,XSRCHE$
  XSRCH11$
  XSRCHB TMD      XSRCH5$
         JMP      XSRCHC$
  XSRCHW $
  XSRCHY $
  XSRCHZ W/           $
E        AFEND    $
  AJSRTIT  TMA    AJCOL79         $
         TDM      AJCNV1$
         SLA      32                        $
         TIXZ     1,1X                      $          DETERMINE
         SM       AJNMBLK                   $          NUMBER
         JAZ      (P)+4H                    $          OF TAPE
         JAN      (P)+3H                    $          READS
         AIXOL    1,1X                      $          REQUIRED.
         JMP      (P)-2                     $
         AM       AJNMBLK                   $          XR1= N TIMES
         TAM      AJLSTBK                   $          AJNMBLK=MAX,C
         CD                                 $          AJLSTBK=LAST
         TXDLC    0,1X                      $
         TDM      AJSVXR1                   $
         SCD      33                        $
         JDP      (P)+1                     $
         JMP      (P)+1                     $
         CSMS     AJCNV1                    $          TAPE ALTERNAT
         TMD      C/HLT,1;C/HLT,AJSRTA      $
         AIXJ     0,1X                      $
         TMD      AJLSTBK                   $
         JMP      (P)+1                     $
  AJSRTA TMD      AJNMBLK                   $
         TDM      AJCMNBK                   $
         TMD      C/HLT,AJBFFR;C/HLT,AJBFFX$          SET UP
         TDXLC    0,5X                      $          INPUT AND
         TDXRC    0,6X                      $          OUTPUT BUFFER
           TMA    N/8T23;H/8AT47  $
           JMP    REWIND          $
           TMA    N/9T23;H/8AT47  $
           JMP    REWIND          $
  AJSRTB JMP      AJRD7                     $          READ AND
         JMP      AJMERGE                   $          MERGE,IF REQ.
         TMD      C/HLT,0;C/HLT,AJSRTC      $
```



```
            SIXJ     1,1X                    $          IS MERGE ALL
              TMA    N/7T23;H/8AT47 $
              JMP    REWIND         $
            JMP      AJCNGTM-3H               $
   AJSRTC   TMD      C/HLT,1;C/HLT,AJSRTB    $          NO,IS IT ONE
            SIXJ     0,1X                    $          NO,CONTINUE
            TMD      AJLSTBK                 $          YES,SET UP FO
            TDM      AJCMNBK                 $          PARTIAL CORE,
            JMP      AJSRTB                  $
            TMD      AJSVXR1                 $
            TDXLC    0,3X                    $
            CM       AJMRGSW                  $
   AJCNGTMTMD        C/HLT,1;C/HLT,AJSRTD    $          PROCESS TAPE
            AIXJ     0,3X                    $          FOR PROPER
            CSM      AJLSTBK                 $          TIME FORMAT,
            TAM      AJMRGSW                 $          AJMRGSW=
            TMD      AJLSTBK                 $          -,PARTIAL COR
            JMP      (P)+1                   $          +,FULL AND/OR
   AJSRTD   TMD      AJNMBLK                 $            CORE.
            TDM      AJCMNBK                 $
            TDXLC    0,4X                    $
              TMD    4LMAX          $
            TDXLC    0,5X                    $          IN
            TMA      N/8T23;N/1T39;H/91T47   $          TAPE
            JMP      SYS                     $
            TIO      0,5X                    $          8.
            JMP      SYSNO                   $
            TMD      C/HLT,0;C/HLT,SYSTAB+8  $
            JMP      SYSIO                   $
            AIXOL    128,5X                  $
            TMD      C/HLT,0;C/HLT,AJSRTD+5H $
            SIXJ     1,4X                    $
            TMD      AJMRGSW                 $          IF PARTIAL

L           JDP      (P)+8H                   $
            SIXOL    128,5X                  $          LENGTH BY
            TMA      47/1T47                 $          SENTINEL SEAR
R           RPTAN    64                      $
            TMD      2,5X                    $
            JAED     (P)+2H                   $
            AIXOL    2,5                      $
            SIXOL    2,5X                    $
            CD                               $
            TXDRC    0,5X                    $
            TDA                              $
              SM     4RMAX          $
            SRA      1                       $          COMMAND WORD
              AM     4LMAX          $
L  AJLEAP   TAM      AJSVSV                  $          ADDR.(T15);NO
            SIXOL    2,5X                    $
   AJINSMRJMP        (P)+1H  $
            TMQ      23/1T22                  $
            ETA      0,5X                    $          EXTRACT FROM
            TAQ                              $          EACH PAIR (IN
            CA                               $                     OR
```

```
          SRG     25                            $
          DAQ     D/144000                      $        CONVERT TO
          SLQ     42                            $
          TQM     AJSV34                        $        DAYS ELAPSED.
          TAQ                                   $
          CA                                    $
          DAQ     D/6000                        $
          SLQ     37                            $
          TQM     AJHR                          $        HOURS;
          TAQ                                   $
          CA                                    $
          DAQ     D/100                         $
          SLQ     31                            $
          TQM     AJMIN                         $        MINUTES.
          SLA     24                            $        FRACMIN.
          TMQ     6/1T16                        $
          EI      AJMIN                         $        REINSERT
          SLQ     6                             $        IN FORM.
          EI      AJHR                          $        DAYS ELAPSED
          SLQ     5                             $        HOURS AT T10
          EI      AJSV34                        $        MIN   AT T16
          SLA     1                             $
          TMQ     25/1T47                       $
          EIS     0,5X                          $
            TMD   4LMAX2              $
            SIXO  2,5                 $
            JNO   AJINSMR             $
AJLEAPDTMD        AJSVSV                        $        JUMP TO FINAL
          TDXLC   0,4X                          $        OUTPUT PHASE
          TDXRC   0,5X                          $        PUT OUT HARDC
          TMA     CONTG                         $
          JAZ     (P)+1                         $
          JMP     AJSATST                       $
          JMP     AJOUTPT                       $        AND TTY(IF RE
AJCTAGNTMD        C/HLT,0;C/HLT,AJCNGTM         $        CONTINUE
          SIXJ    1,3X                          $        OR
          TMA     CONTG                         $
          JAZ     (P)+1                         $
          JMP     AJGHPIT                       $
          JMP     PANT.FINISH$                         FINISH    AJJ K=1
            JMP   NXTCASE             $
L AJT8CD  N/8T23;N/1T39;H/91T47                 $        READ T8
          C/HLT,0;C/HLT,SYSTAB+8                $        AND
          N/9T23;N/1T39;H/19T47                 $        WRITE 9
          C/HLT,0;C/HLT,SYSTAB+9                $
  AJT9CD  N/9T23;N/1T39;H/91T47                 $        READ 9
          C/HLT,0;C/HLT,SYSTAB+9                $        AND
          N/8T23;N/1T39;H/19T47                 $        WRITE T8.
          C/HLT,0;C/HLT,SYSTAB+8                $
AJMRCW1$                                                 READ
AJMRCW2$                                                 AND
AJMRCW3$                                                 WRITE
AJMRCW4$                                                 COMMANDS.
AJMERGETJM        AJMRGX                        $
          TMA     AJCNV1                        $        MERGE
```



```
          TMD     C/HLT,AJT8CD;C/HLT,AJMRCW1          $TAPE
          JAN     (P)+1                       $        ALTERNATOR.
          TMD     C/HLT,AJT9CD;C/HLT,AJMRCW1          $
          TDXLC   0,2X                        $
          TDXRC   0,3X                        $
R         RPTAA   4                           $        SET
          TMD     1,2X                        $        UP
          TDM     1,3X                        $        MERGE
            TMD   4LMAX             $
          TDXLC   0,2X                        $        EBLOC;
          TMD     AJCMNBK                     $        LENGTH OF
          SCD     41                          $        USABLE
          TDXLC   0,3X                        $        CORE,
          TMD     AJDNCNT                     $        AND
          TDXLC   0,4X                        $        BLOCKS ON TAP
          TMD     C/HLT,0;C/HLT,AJMRGIT-1H    $
          AIXJ    0,4X                        $
          JMP     AJCORTT                     $
          JMP     AJRD89                      $
AJMRGITTMQ        47/1T47                     $
          ETA     0,5X                        $        COMPARE
          ETD     0,2X                        $        TAPE AND
          JAGD    AJMRGA+1                    $        CORE.
          TMD     0,5X                        $        XR2=CORE ADDR
          TDM     0,6X                        $        XR3=CORE WORD
          TMD     1,5X                        $        XR4=NO.BLOCK
          TDM     1,6X                        $        XR5=OLD TAPE
          TMD     C/HLT,AJBFFR+128;C/HLT,AJCK6X       $XR6=NEW TAPE
          AIXJ    2,5X                        $
          SIXOL   128,5X$
          TMD     C/HLT,0;C/HLT,AJMRGA        $
          SIXJ    1,4X                        $
          TDM     AJMRGSW                     $        AJMRGSW
          JMP     AJCK6X                      $        =0 ,CONTINUE
  AJMRGA  JMP     AJRD89                      $        =+ ,OLD TAPE
          JMP     AJCK6X                      $        =- ,CORE DONE
          TMD     0,2X                        $
          TDM     0,6X                        $
          TMD     1,2X                        $
          TDM     1,6X                        $        EMPTY NEW TAP
          AIXOL   2,2X                        $        BUFFER AS REQ
          TMD     C/HLT,0;C/HLT,AJCK6X        $        ONTO TAPE.
          SIXJ    2,3X                        $
          TMD     30/1T29                     $
          TDM     AJMRGSW                     $
  AJCK6X  TMD     C/HLT,AJBFFX+128;C/HLT,AJMRGB       $
          AIXJ    2,6X                        $
          SIXOL   128,6X                      $
          JMP     AJWT89                      $
  AJMRGB  TMA     AJMRGSW                     $
          JAZ     AJMRGIT                     $
          JAN     AJDOTPE                     $

R AJDOCORRPTAA    2                           $        IF OLD TAPE D
          TMD     1,2X                        $        PROCESS
```

```
        TDM     1,6X                        $       REMAINDER OF
        SIXOL   2,3X                        $
        TMD     C/HLT,AJBFFX+128;C/HLT,AJDOCOR     SCORE DATA
        AIXJ    0,6X                        $       ONTO
        SIXOL   128,6X                      $       NEW TAPE.
        JMP     AJWT89                      $
        TMD     C/HLT,0;C/HLT,AJCORTT       $
        SIXJ    0,3X                        $
        JMP     AJREWTP                     $
 AJCORTTTMD     C/JMP,SYS;C/TIO,0,2X        $
        TDM     AJWT89+1                    $
        CD                                  $
        TXDLC   0,3X                        $
        SRD     7                           $
        TDXLC   0,3X                        $
 AJMRGC JMP     AJWT89                      $
        AIXOL   128,2X                      $
        TMD     C/HLT,0;C/HLT,AJMRGC        $
        SIXJ    1,3X                        $
        TMD     C/JMP,SYS;C/TIO,AJBFFX$
        TDM     AJWT89+1                    $
        JMP     AJREWTP                     $       IF CORE DONE.
R AJDOTPERPTAA  2$
        TMD     1,5X                        $       REMAINDER
        TDM     1,6X                        $       OF TAPE DATA
        TMD     C/HLT,AJBFFX+128;C/HLT,AJDOTPE     $ONTO
        AIXJ    0,6X                        $       NEW TAPE.
        SIXOL   128,6X                      $
        SIXOL   128,5X                      $
        JMP     AJWT89                      $
        TMD     C/HLT,0;C/HLT,AJTAPTT       $
        SIXJ    1,4X                        $
        JMP     AJREWTP                     $
 AJTAPTTTMD     C/JMP,SYS;C/TIO,AJBFFX      $
        TDM     AJRD89+1                    $
        JMP     AJRD89                      $
        JMP     AJWT89                      $
        TMD     C/HLT,0;C/HLT,AJTAPTT+1     $
        SIXJ    1,4X                        $
        TMD     C/JMP,SYS;C/TIO,AJBFFR      $       REWIND
        TDM     AJRD89+1                    $       OLD AND
 AJREWTPTMA     C/HLT,0;C/HLT,SYSTAB+8      $       NEW TAPE.
          TMA   N/8T23;H/8AT47 $
          JMP   REWIND         $
          TMA   N/9T23;H/8AT47 $
          JMP   REWIND         $
        TMA     AJCMNBK                     $
        AMS     AJDNCNT                     $       UPDATF BLOCK
        CSMS    AJCNV1                      $       SWITCH ALTERN
        CM      AJMRGSW                     $       CLEAR MERGE S
 AJMRGX JMP     (P)                         $
L AJRD89 TJM    AJRDINX                     $
        TMA     AJMRCW1                     $       TAPE
        JMP     SYS                         $       READ.
        TIO     AJBFFR                      $
```



```
        JMP     SYSNO                       $
        TMD     AJMRCW2                     $
        JMP     SYSIO                       $
 AJRDINXJMP     (P)                         $
L AJWT89 TJM    AJWTX                       $
        TMA     AJMRCW3                     $       TAPE
        JMP     SYS                         $       WRITE.
        TIO     AJBFFX                      $
        JMP     SYSNO                       $
        TMD     AJMRCW4                     $
        JMP     SYSIO                       $
 AJWTX  JMP     (P)                         $
 AJRD7  TJM     AJRD7X                      $
          TMD   4LMAX          $
        TDXLC   0,2X                        $       IN
        TMD     AJCMNBK                     $       RAW
        TDXLC   0,3X                        $       DATA
 AJRD7A TMA     N/7T23;N/1T39;H/91T47       $       FROM
        JMP     SYS                         $       TAPE 7.
        TIO     0,2X                        $       FILLING
        JMP     SYSNO                       $       UP AS
        TMD     C/HLT,0;C/HLT,SYSTAB+7      $       MUCH CORE
        JMP     SYSIO                       $       AS
        AIXOL   128,2X                      $       REQUIRED
        TMD     C/HLT,0;C/HLT,AJRD7A        $       OR
        SIXJ    1,3X                        $       POSSIBLE.
        TMA     AJCMNBK                     $       SORT
        SLA     7                            $
        AM      4LMAX                        $
        SRA     24                           $
        AM      4LMAX                        $
        JMP     SORT.SORT                    $
*                                            $
 AJRD7X JMP     (P)                         $
 AJOUTPTTJM     AJFINAL                     $
        CD      $
        TXDLC   0,3X                        $
        TDM     AJSV34                      $
 AJ1OUT JMP     AJDAYSS                      $
L AJDAYSSJMP    AJDAYEL                     $
        TMD     D/1                         $
        TDM     AJPAGES                     $       INITIALIZE
        TMA     CLSFY                       $       PAGE COUNT.
        AM      L/AJACN                     $       FETCH PROPER
        TAD                                 $       CLASSIFICATIO
        TDXRC   0,6X                        $       AND
        TMD     0,6X                        $       STORE
        TDM     AJHDCY                      $       FOR
        TDM     AJTYCL                      $       OUTPUT.
        TMA     NOTTY                       $
        JAZ     AJTTY                       $
        CM      AJTYSW                      $       AJTYSW=+,NO T
        JMP     (P)+3H                      $              =-,TTY.
 AJTTY  CSM     N/1T47                      $
        TAM     AJTYSW                      $
```

```
          CD                                    $
          TDXLC    0,6X                         $
          TDXRC    0,7X                         $
          TIJ      AJCONT                        $
          TJM      AJ1OUT                        $
          TMD      AJTYSW                       $
          JDP      (P)+1                        $        IF REQUESTED,
          JMP      AJADR                        $        TTY HEADING,
          JMP      AJHEAD                       $        HD COPY HDG,

L AJDLOOPJMP       AJDYCK                       $        CHECK
          TMD      AJSMDAY                      $        DAY ELAPSED
          JDP      AJGO1                        $
          TMA      AJCWJ                        $        IF NEW,
          JMP      GLOP.GLOP                    $        OUTPUT
          TMD      AJTYSW                       $        TTY AND/OR
          JDP      AJGO                         $        HD COPY,
          JMP      PANT.TPANT                   $
  AJLOOP  TMD      C/HLT,99;C/HLT,AJGO          $        CHECK
          AIXJ     1,7X                         $        TTY LINE COUN
          JMP      AJTYEND                      $        CONTINUE OR
          SIXOL    99,7X                        $        RESET
          AFEND    80                            $
          JMP      PANT.PAGE
          TMA      AJPAGE
          JMP      GLOP.GLOP
          TMA      D/1$
          AMS      AJPAGES
          JMP      AJADR
          TIXZ     10,6
          TIJ      AJGOA
          TJM      AJHEDEX
          JMP      AJHDCY
  AJGO    TMD      C/HLT,54;C/HLT,AJGOA         $        CHECK
          AIXJ     1,6X                         $        HD COPY LINE
          SIXOL    54,6X                        $        CONTINUE OR
          JMP      AJHEAD                       $        RESET.
  AJGOA   JMP      AJDLOOP                      $
  AJGO1   TMQ      5/1T9                         $
          ETA      0,4X                         $        EXTRACT
          SRA      1                             $
          TAM      AJHR                         $        HOURS.
          TMD      N/10T10                      $
          JAGD     (P)+3                        $
          TMD      C/HLT,15*128+ 2;C/TMA,AJHR        $
          TDM      AJFWL2                       $
          SRA      1                            $
          TAM      AJHR                         $
          JMP      (P)+3H                       $
          TMD      C/TCM,15*128+37;C/TMA,AJHR        $
          TDM      AJFWL2                       $
          TMQ      6/1T15                        $
          ETA      0,4X                         $
          SRA      1                             $
          TAM      AJMIN                        $        MINUTES,
```



```
          TMD      N/10T16                      $
          JAGD     (P)+3                        $
          TMD      C/HLT,17*128+ 2;C/TMA,AJMIN      $
          TDM      AJFWL3                       $
          SLA      5                            $
          TAM      AJMIN                        $
          JMP      (P)+3H                       $
          TMD      C/TCM,17*128+31;C/TMA,AJMIN      $
          TDM      AJFWL3                       $
          TMQ      7/1T22                         $
          ETA      0,4X                         $
          SRA      1                              $
          TAM      AJFRMIN                      $
          TMD      N/10T23                      $
          JAGD     (P)+3                        $
          TMD      C/HLT,20*128+ 2;C/TMA,AJFRMIN $
          TDM      AJFWL5                       $
          SLA      12                           $
          TAM      AJFRMIN                        $
          JMP      (P)+3H                       $
          TMD      C/TCM,20*128+24;C/TMA,AJFRMIN $
          TDM      AJFWL5                       $
          TMQ      12/1T34                        $
          ETD      0,4                            $
          SRD      5                              $
          TDA      $
          AM       C/HLT,0;C/HLT,SATNOS$
          TMQ      24/1;16/0;8/1$
          EIS      SATRT$
          EIS      SATRT1                         $
L SATRT1  TMQ      15/1T17                        $
          ETA      (P)                            $
          SLA      2                              $
          TMQ      10/1T15                        $
          EA       1,4                            $
          TAM      AJREV                          $
          TMA      4C4+2                          $
          JAZ      (P)+3H                         $
          ETD      1,4                            $
          TDM      AJREV                          $
L SATRT   TMQ      18/1T47$
          ETA      (P)                            $
          TDM      AJSAT$                                   XXX00000
          JMP      BINBCD                         $
          TMD      BCDSAT                         $
          SCD      30                             $
          TDM      AJSAT1$
          TMQ      12/1T46                        $
          ETA      0,4X                         $
          SLA      16                           $
          TMQ      F/107374182.4                $
          FMAR                                  $
          FAM      F/.04                        $
          TAM      AJAZ                         $           FL.PT.AZ,
          TMQ      5/1T5                          $
```

```
          ETA     1,4                         $
          SRA     10                          $
          AM      C/TMD,FNOTAB;C/TDM,FANNO    $
          TAM     (P)+1                       $

L         NOP                                 $
          NOP                                 $
          TMQ     ELFLAG                      $
          JQO     (P)+3H                      $
          TMD     W/                          $
          TDM     FANNO                       $
          TMQ     14/1T29                     $
          ETD     1,4X                        $
          TDM     AJRANGE                     $       RANGE:
          TMQ     7/1T36                      $
          ETA     1,4X                        $
          SLA     6                           $
          TMQ     F/107374182.4               $
          FMAR                                $
          FAM     F/.04                       $
          TAM     AJRRATE                     $       FL.PT.R-RATE.
          TMQ     1/1T37                      $
          ETA     1,4X                        $       (CHECK
          JAZ     (P)+1                       $        POS. OR
          FCSMS   AJRRATE                     $        NEG.)
          TMQ     10/1T47                     $
          ETA     1,4X                        $        OR
          SLA     17                          $
          TMQ     F/107374182.4               $
          FMAR                                $
          FAM     F/.04                       $
          TAM     AJELEV                      $       FL.PT.ELEV.
          TMD     1,4                         $
          JDP     (P)+1                       $
          FCSMS   AJELEV                      $
          TMA     DRCOSFL                     $
          JAZ     BYPASS1                     $
          TMA     AJAZ                        $
          FSM     F/.04                       $
          TAQ                                 $
          TMA     AJELEV                      $
          JAP     (P)+3H                      $
          FAM     F/.04                       $
          JMP     (P)+2H                      $
          FSM     F/.04                       $
          JMP     COMPL                       $
          TDM     TEMP1                       $
          TJM     TEMP2                       $
          TAM     TEMP3                       $
          TMA     XFX                         $
          TMQ     XFY                         $
          TMD     XFZ                         $
          JMP     DOTPR                       $
          FAM     F/.0005                     $
          JAP     (P)+2H                      $
```



```
          FSM     F/.0010                     $
          TAM     RSV                         $
          TMA     ZFX                         $
          TMQ     ZFY                         $
          TMD     ZFZ                         $
          JMP     DOTPR                       $
          FAM     F/.0005                     $
          JAP     (P)+2H                      $
          FSM     F/.0010                     $
          TAM     RSU                         $
          TMA     YFX                         $
          TMQ     YFY                         $
          TMD     YFZ                         $
          JMP     DOTPR                       $
          FAM     F/.0005                     $
          JAP     (P)+2H                      $
          FSM     F/.0010                     $
          TAM     RSW                         $
BYPASS1   TMA     AJCHL                       $
          JMP     GLOP.GLOP                   $
          TMD     AJTYSW                      $
          JDP     (P)+10H                     $
          TMA     0/32;42/1                   $
          TMQ     42/1T47                     $
          TMD     ELFLAG                      $
          SCD     1                           $
          JDP     (P)+2H                      $
          SRAQ    36                          $
          TMD     LOCGB                       $
          TDXLC   ,1                          $
          EIS     6,1                         $
          JMP     PANT.TPANT                  $
          AIXOL   2,4X                        $
          TMD     C/HLT,0;C/HLT,AJCONT        $       DECREMENT AND
          SIXJ    1,5X                        $       CHECK COUNT.
          TMD     AJMRGSW                     $
          JDP     LOAD3X                      $
          TMD     A/NO MORE $
          TDM     AJMRDTA                     $
          TMA     AJCHMR                      $
          JMP     GLOP.GLOP                   $
          TMA     CLSFY                       $             CN-T350
          JAZ     (P)+3H                      $             CN-T350
          TMA     JSGP                        $             CN-T350
          JMP     GLOP.GLOP                   $             CN-T350
          TMD     AJTYSW                      $       IF DONE
          JDP     (P)+1                       $       FINISH
          JMP     AJTYEND                     $       UP AND
LOAD3X    TMD     AJSV34                      $
          TDXLC   0,3X                        $
AJFINAL   JMP     (P)                         $       EXIT.
AJCONT    TMD     AJTYSW                      $       OR
          JDP     (P)+1                       $       RETURN FOR
          JMP     AJLOOP                      $       NEXT
          JMP     AJGO                        $       DATA.
```

```
AJDAYELTJM    AJDEXS                                  INITIAL ENTRY
      TMQ     5/1T4                        $
      ETA     0,4XS                                   EXTRACT
      SRA     1                            $
AJPRO TAM     AJDEPRES                                DAYS
      SRA     10S                                     ELAPSED,
      TAQ     S                                       ADD
      FMMR    F/32768S                                TO
      FAM     FDAYS                                   FDAY
      TAM     AJDAYS                                  AND
      JMP     FYKLOKS                                 ENTER
      CSM     D/1S
      TAM     AJSMDAYS
      JMP     AJFIXIT                     $
      TAM     AJDDDS                                  SET
      TMA     AJDAYS                                  AJSMDAY
      JMP     DKLOKS                                  SWITCH
      TAM     AJDATES                                 NEGATIVE.
      TAQ                                  $          ALSO
      SRA     12                           $          SAVE
      SLQ     6                            $          IN
      SRAQ    12                           $          AJDEPRE
      TMA     AJDATE                       $          CURRENT
      SLA     6                            $          DAYS
      SLAQ    30                           $          ELAPSED.
      AM      0/61T17;0/01T35              $
      TAM     AJDATE                       $
AJDEX JMP     (P)S                                    EXIT.
AJDYCK TJM    AJDEXS                                  NEW DATA ENTR
      TMQ     5/1T4                        $
      ETA     0,4XS                                   NEW AND OLD
      SRA     1                            $
      TMD     AJDEPRES                                DAY ELAPSED.
      JAED    (P)+1S                                  IF DIFFERENT,
      JMP     AJPROS                                  AJPRO TO COMP
      CM      AJSMDAYS                                IF SAME, CLEA
      JMP     AJDEXS                                  AJSMDAY SWITC
AJHEAD TJM    AJHEDEX                      $          HARDCOPY HEAD
      JMP     PANT.PAGE                    $
      TMA     AJPAGE                       $          PAGE NUMBER
      JMP     GLOP.GLOP                    $
      TMA     AJPAGES                      $          CLASSIFICATIO
      AM      D/1                          $
      TAM     AJPAGES                      $          LOOK ANGLE...

L AJHDCY NOP                               $

L     JMP     GLOP.GLOP                    $          DAY
      TMA     AJCWI                        $
      JMP     GLOP.GLOP                    $          SAT.........R-
      JMP     PANT.SPACE                   $
      TMA     C/HLT,10;C/HLT,AJLN12         $
      JMP     PANT                          $
L AJHDJ TMD   C/HLT,77*128+44;C/CAM,AJUNITSS
      TDM     AJFWJ3                       $
```



```
         TMA     AJCWJ                       $
         JMP     GLOP.GLOP                   $        AND
         TMD     C/HLT,24*128+1;C/CAM,AJCRLF        $
         TDM     AJFWJ3                      $
         AIXOL   5,6X                        $        SPACE;
AJHEDEXJMP       (P)                         $
*
*
         S
         S
AJADR    TJM     AJADREX S
         TMD     AJADR-1 S
         TXDLC   ,0  S
         TXDLC   ,1  S
         TDM     AJADR-1 S
         TXDLC   ,2
         TDM     AJADR-2 S
         JMP     4HEAD     S
         TMD     AJADR-1 S
         TDXLC   ,0 S
         TDXRC   ,1 S
         TMD     AJADR-2 S
         TDXLC   ,2
*
*
AJNOADRTMA       AJCWH                       $
         JMP     GLOP.GLOPS                             AJJ   T-205
         JMP     PANT.TPANTS                            AJJ   T-205
L AJTYCL NOP                                 $        AND

L        JMP     GLOP.TGLOP                  $
         TMA     AJCWI                       $        A
         JMP     GLOP.TGLOP                  $
         JMP     PANT.TSPACE                 $
         TMA     C/HLT,10;C/HLT,AJLN12          $
         JMP     PANT.TPANTA                    $
L AJCLU  TMD     C/HLT,77*128+44;C/CAM,AJUNITSS
         TDM     AJFWJ3                      $
         TMA     AJCWJ                       $        LINE
         JMP     GLOP.TGLOP                  $
         TMD     C/HLT,24*128+1;C/CAM,AJCRLF        $
         TDM     AJFWJ3                      $
         TIXZ    5,7
AJADREXJMP       (P)                         $
AJTYENDTJM       AJTNEX                      $        WRAP-UP
         TMA     AJCWMR                      $
         JMP     GLOP.TGLOP                  $
         TMA     CLSFY
         JAZ     JSTYEND
         TMA     JSGP
         JMP     GLOP.TGLOP
JSTYENDTMA       AJCWH
         JMP     GLOP.GLOPS                             AJJ   T-205
         JMP     PANT.TPANTS                            AJJ   T-205
*
```

```
*
*
        TMA      C/HLT,7;C/NOP,0            S        AND
        JMP      PANT.TSPACER               S
        TMA      AJCHNN                     S        12 INCHES
        JMP      GLOP.TGLOP                 S           OF
        TMA      AJCHLC                     S        LETTER CHARAC
        JMP      GLOP.TGLOP                 S           AJ.I K-135
        JMP      PANT.TTYCSS
 AJTNEX JMP      (P)                        S
 AJFIXITTJM      AJFXEXT                    S        FIX FLT.PT.
        ETD      12/1T47                      S
        CA                                    S
        SCD      12                           S
        JDP      (P)+2H                       S
        JMP      AJFXEXT                      S
        SRD      4                            S
        TDXLC    .2                           S
        SLAQ     1,2                          S
*                                             S
 AJFXEXTJMP      (P)                        S        EXIT.
 AJGRPIT  TMA    N/7T23;H/8AT47  S
           JMP   REWIND          S
           TMA   N/8T23;H/8AT47  S
           JMP   REWIND          S
        TMD      AJSVXR1                    S
        TDXLC    0,3X                       S
        TMD      C/HLT,AJBFFR               S
        TDXLC    0,4X                       S
 AJGRPA TMD      C/HLT,1;C/HLT,AJGRPB       S              INITI
        AIXJ     0,3X                       S
        TMA      AJLSTBK                    S              AND
        JMP      (P)+1                      S
 AJGRPB TMA      AJNMBLK                    S              READ
        TDXLC    0,7X                       S
        SLA      7S
         AM      4LMAX           S
        TDXLC    0,6X                       S              INTO
        TAM      AJCKEND                    S
 AJGRPC TMA      N/7T23;N/1T39;H/91T47      S
        JMP      SYS                        S              EBLOC
        TIO      0,6X                       S
        JMP      SYSNO                      S
        TMD      C/HLT,0;C/HLT,SYSTAB+7     S
        JMP      SYSIO                      S
        AIXOL    128,6X                     S
        TMD      C/HLT,0;C/HLT,AJGRPC       S
        SIXJ     1,7X                       S
        TMD      4LMAX           S
        TDXLC    0,6X                       S
        TIXZ     0,7X                       S
 AJGRPD TMA      0,6X                       S
        TMD      47/1T47                    S              IF SE
        JAED     AJGFIN                     S              FINIS
        CD                                  S
```



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        JAED     AJCLRLC                    S              SKIP
        TMQ      1/1T47                     S              LOC.
        ETA      0,6X                       S
        JAEQ     (P)+1                      S              IF LA
        JMP      (P)+3H                     S              FOR T
        JMP      AJWTBF8                    S              AND S
        JMP      AJCLRLC                    S              AND G
        TMQ      12/1T34                      S
        ETD      0,6                          S
        SRD      5                            S
        TDA      S
        AM       C/HLT,0;C/HLT,SATNOSS
        TMQ      24/1;16/0;8/1S
        EIS      FJAMSS
 L FJAMS TMQ     18/1T47S
        ETD      (P)S
        TDM      AJSATS                          XXX00000
        TXDLC    0,6X                       S              REMAI
        TDM      AJSV56                     S              POINT
        JMP      AJWTBF8                    S
 AJGRPE AIXOL    2,6X                       S
        TMA      AJCKEND                    S              IF AT
        TXDLC    0,6X                       S              OF EB
        JAED     AJSCHBF                    S              ON TA
        TMA      0,6
        JAZ      AJGRPE
        TMQ      12/1T34                      S
        ETD      0,6                          S
        SRD      5                            S
        TDA      S
        AM       C/HLT,0;C/HLT,SATNOSS
        TMQ      24/1;16/0;8/1S
        EIS      AMFJSS
 L AMFJS TMQ     18/1T47S
        ETA      (P)S
        ETD      AJSATS
        JAED     (P)+1                      S              EBLOC
        JMP      AJGRPE                     S              SEARC
        TMQ      1/1T47                     S
        ETA      0,6X                       S
        JAEQ     (P)+1                      S
        JMP      (P)+3H                     S
        JMP      AJWTBF8                    S
        JMP      AJGRPX                     S
        JMP      AJWTBF8                    S
        JMP      AJGRPE                     S
 AJGRPX TMD      AJSV56                     S
        TDXLC    0,6X                       S
 AJCLRLCAIXOL    2,6X                       S              CHECK
        TMA      AJCKEND                    S              END O
        TXDLC    0,6X                       S              EBLOC
        JAED     (P)+1                      S
        JMP      AJGRPD                     S
        SIXOL    1,3X                       S
```

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         JMP     AJGRPA                     $             
AJGFIN   TMD     47/1T47                    $             FINIS
         TDM     0,4X                       $             TRANS
         TDM     1,4X                       $             INFO
         TMD     C/HLT,AJBFFR+128;C/HLT,AJGFIN$
         AIXJ    2,4X                       $             AND
         SIXOL   128,4X                     $             CLEAR
         JMP     AJWTBUF                    $             NON-I
         CM      CONTG                      $             SWITC
           TMA   N/8T23;H/8AT47 $
           JMP   REWIND            $
         TIJ     AJLEAPD $
         TJM     AJINSMR $
         JMP     AJCNGTM-3H                  $
AJSCHBFTMA       N/7T23;N/1T39;H/91T47      $             TAPE
         JMP     AJTP7                      $             SEARC
         AIXOL   1,7X                       $             FOR
         TMA     N/1T15;N/7T23;H/D1T47      $             DATA
         JMP     AJTP7                      $             OF
         TMD     C/HLT,AJBFFX               $             REMAI
AJSCHBGTDXLC     0,6X                       $             POINT
         TMQ     12/1T34                     $
         ETD     0,6                         $
         SRD     5                           $
         TDA     $
         AM      C/HLT,0;C/HLT,SATNOS$
         TMQ     24/1;16/0;8/1$
         EIS     FJAMS1$

L FJAMS1 TMQ     18/1T47$
         ETA     (P)$
         ETD     AJSATS$
         JAED    AJSCHBH                    $             AND
AJSCHBDTMD       C/HLT,AJBFFX+128;C/HLT,AJSCHBG+1H$      REV
         AIXJ    2,6X                       $
         SIXOL   128,6X                     $
         TMA     N/7T23;N/1T39;H/19T47      $
         JMP     AJTP7                      $
         JMP     AJSCHBF                    $
AJSCHBHTMQ       1/1T47                     $
         ETA     0,6X                       $
.
         JAEQ    (P)+1                      $
         JMP     AJSCHBK                    $
         JMP     AJWTBF8                    $
         TMA     N/7T23;N/1T39;H/19T47      $
         JMP     AJTP7                      $
AJSCHBITMD       C/HLT,0;C/HLT,AJSCHBJ      $             RESTO
         SIXJ    0,7X                       $             7 TO
         JMP     AJGRPX                     $             POSIT
AJSCHBJTMA       N/1T15;N/7T23;H/D1T47      $             PRIOR
         JMP     AJTP7                      $             TO
         SIXOL   1,7X                       $             SEARC
         JMP     AJSCHBI                    $
AJSCHBKJMP       AJWTBF8                    $
```



```
         JMP     AJSCHBD                    $             
AJTP7    TJM     AJTP7XX                    $             TAPE
         JMP     SYS                        $             READ
         TIO     AJBFFX                     $             OR
         JMP     SYSNO                      $             WRITE
         TMD     C/HLT,0;C/HLT,SYSTAB+7     $             OR
         JMP     SYSIO                      $             SPACE
AJTP7XXJMP       (P)                        $
AJWTBF8TJM       AJBF8XX                    $             TRANS
         TMD     0,6X                       $             BUFFE
         TDM     0,4X                       $             OF
         TMD     1,6X                       $             INFO
         TDM     1,4X                       $             FROM
         CM      0,6X                       $             EBLOC
         TMD     C/HLT,AJBFFR+128;C/HLT,AJBF8XX   $       TO
         AIXJ    2,4X                       $             TAPE
         JMP     AJWTBUF                    $
         SIXOL   128,4X                     $
AJBF8XXJMP       (P)                        $
AJWTBUFTJM       AJWBXX                     $             ROUTI
         TMA     N/8T23;N/1T39;H/19T47      $             TO
         JMP     SYS                        $             COPY
         TIO     AJBFFR                     $             ONTO
         JMP     SYSNO                      $             TAPE
         TMD     C/HLT,0;C/HLT,SYSTAB+8     $
         JMP     SYSIO                      $
AJWBXX   JMP     (P)                        $
AJSATSTTMD       AJCMNBK                    $             NO
         TDXLC   0,4X                       $             SATEL
           TMD   4LMAX           $
         TDXLC   0,5X                       $
         TMA     N/7T23;N/1T39;H/19T47      $             THERE
         JMP     SYS                        $             RATHE
         TIO     0,5X                       $             THAN
         JMP     SYSNO                      $             OUTPU
         TMD     C/HLT,0;C/HLT,SYSTAB+7     $             STORE
         JMP     SYSIO                      $             INFO
         AIXOL   128,5X                     $             ON
         TMD     C/HLT,0;C/HLT,AJSATST+2    $             SCRAT
         SIXJ    1,4X                       $             TAPE.
         JMP     AJCTAGN                    $
JSGP     C/HLT,0;C/TIJL,JSGP1
JSGP1    C/HLT,5+128+5;C/CAM,JSGP2
E        AFEND                              $
JSGP2    A/GP-3;0/32323232$
AJCWH    C/HLT,     0;C/TIJL,AJFWH  $              LINE 8
AJUNC    C/HLT,     0;C/TIJL,AJFCL          $     LINE 9 UNCLAS
AJCONF   C/HLT,     0;C/TIJL,AJFCF          $            CONF.
AJSEC    C/HLT,     0;C/TIJL,AJFSC          $            SECRET
AJSNF    C/HLT,     0;C/TIJL,AJFNF          $            NO FOR
AJCWI    C/HLT,     0;C/TIJL,AJFWI          $     LINE 10
AJCWJ    C/HLT,     0;C/TIJL,AJFWJ          $     LINE 11
AJCWLC   C/HLT,     0;C/TIJL,AJFWLC $
AJCWNN   C/HLT,     0;C/TIJL,AJFWNN $
AJPAGE   C/HLT,     0;C/TIJL,AJPGF          $
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AJCWMR C/HLT,     0;C/TIJL,AJFWMR $
AJCWL  C/HLT,     0;C/TIJL,AJFWL           $
AJINERCC/HLT,0;C/TIJL,AJINERF              $
AJFWH  C/HLT, 3*128+ 3;C/CAM,AJLN8         $        LINE 8
AJFCL  C/HLT,17*128+17;C/TMA,AJUN          $        LINE 9
AJFCL1 C/TCM,21*128+ 0;C/TMA,DFN           $
AJFCL2 C/HLT,29*128+ 7;C/TMA,TFN           $         OR
AJFCL3 C/HLT,30*128+ 1;C/CAM,AJCRLF        $
AJFCF  C/HLT,34*128+34;C/TMA,AJCON         $        LINE 9
AJFCF1 C/TCM,38*128+ 0;C/TMA,DFN           $
AJFCF2 C/HLT,46*128+ 7;C/TMA,TFN           $         OR
AJFCF3 C/HLT,47*128+ 1;C/CAM,AJCRLF        $
AJFSC  C/HLT,22*128+22;C/TMA,AJSC          $        LINE 9
AJFSC1 C/TCM,26*128+ 0;C/TMA,DFN           $
AJFSC2 C/HLT,34*128+ 7;C/TMA,TFN           $         OR
AJFSC3 C/HLT,35*128+ 1;C/CAM,AJCRLF        $
AJFNF  C/HLT,34*128+34;C/TMA,AJNF          $        LINE 9
AJFNF1 C/TCM,38*128+ 0;C/TMA,DFN           $
AJFNF2 C/HLT,46*128+ 7;C/TMA,TFN           $
AJFNF3 C/HLT,47*128+ 1;C/CAM,AJCRLF        $
AJFWI  C/HLT,24*128+24;C/TMA,AJLN10        $        LINE 10
AJFWI1 C/HLT,41*128+16;C/TMA,STNM          $
AJFWI2 C/HLT,42*128+ 1;C/CAM,AJCRLF        $
AJFWJ  C/HLT, 7*128+ 3;C/TMA,AJLN13        $       LINE 13
AJFWJ1 C/TCM,11*128+ 0;C/TMA,AJDDD         $
AJFWJ2 C/HLT,23*128+ 8;C/TMA,AJDATE        $
AJFWJ3 C/HLT,24*128+ 1;C/CAM,AJCRLF        $
AJFWNN C/HLT,17*128+17;C/CAM,AJNNNN        $        NNNN+12LTR S
AJPGF  C/HLT,60*128+ 4;C/TMA,AJPG          $
AJPGF1 C/TCM,64*128+ 0;C/CAM,AJPAGES       $
AJFWLC C/HLT,120*128+120;C/CAM,AJLTRCH     $
AJFWMR C/HLT,14*128+13;C/CAM,AJMRDTA       $
AJFWL  C/HLT,5*128+5;C/TMA,AJSAT1           $
AJFWL1 C/TCM,11*128+32;C/TMA,AJREV         $
AJFWL2 C/TCM,15*128+37;C/TMA,AJHR          $
AJFWL3 C/TCM,17*128+31;C/TMA,AJMIN         $
AJFWL4 C/HLT,18*128+ 1;C/TMA,AJDOT         $
AJFWL5 C/TCM,20*128+24;C/TMA,AJFRMIN       $
AJFWL6 C/ICOZ,27*128+1;C/TMA,AJELEV        $
AJFWL7 C/ICOZ,34*128+1;C/TMA,AJAZ          $
AJFWL8 C/TCM,41*128+18;C/TMA,AJRANGE       $
AJFWL9 C/ICOZ,48*128+1;C/TMA,AJRRATE       $
       HLT      54*128+2                    $
       TMA      FANNO                       $
       ICOZ     61*128+3                    $
       TMA      RSU                         $
       ICOZ     69*128+3                    $
       TMA      RSV                         $
       ICOZ     77*128+3                    $
       CAM      RSW                         $
AJINERFC/HLT,81*128+80;C/CAM,0,6X          $
AJNNNN A/NNNN;0/77777777$
       8/111111$
AJCRLF 0/32$
AJLN8  A/BT;0/32$
```



```
AJLN10 A/ LOOK ANGLE SCHEDULE FOR$


AJLN12 A/ SAT    REV     TIME      ELEV  AZMTH  RANGE  R*RAT$



       SET      (P)+4                          $
AJLN13 A/DAYS
AJLN17 A/1AERO;0/32$
AJUN   A/UNCLAS SPACETRACKS


AJCON  A/C O N F I D E N T I A L SPACETRACKS


AJSC   A/S E C R E T SPACETRACKS


AJNF   A/S E C R E T N O F O R N SPACETRACKS



AJDOT  0/33$
AJPG   A/PAGES
AJMRDTAA/    MORE $
       A/DATA;0/32$
AJUNITS  SET    (P)+6                          $
L AJACN  C/TMA,AJUNC;C/NOP,0                   $
       C/TMA,AJCONF;C/NOP,0                    $
       C/TMA,AJSEC;C/NOP,0                     $
       C/TMA,AJSNF;C/NOP,0                     $
       C/TMA,(P)+1;C/NOP$
       C/HLT;C/TIJL,(P)+1$
AJACN1 C/HLT,54*128+54;C/TMA,AJACN2$
       C/TCM,58*128+0;C/TMA,DFN$
       C/HLT,66*128+7;C/TMA,TFN$
       C/HLT,67*128+1;C/CAM,AJCRLF$
AJACN2 A/S E C R E T RELEASABLE OUTSIDE SSO CHANN$



       A/ELS SPACETRACKS

AJLTRCH48/1                                    $
       48/1                                    $
       48/1                                    $
       48/1                                    $
       48/1                                    $
```

```
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        48/1                                    $
        42/1;0/32                               $
AJUN1   A/UNCLAS NOCC-SD    $

AJCON1  A/C O N F I D E N T I A L NOCC-SD    $

AJSC1   A/S E C R E T NOCC-SD    $

AJNF1   A/S E C R E T N O F O R N NOCC-SD    $

AJACN3  A/S E C R E T RELEASABLE OUTSIDE SSO CHANN$

        A/ELS NOCC-SD    $
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```
*          SPECIALIZED SORT ROUTINE          $
           NAME     SORT                     $
   SORT    TJM      SORTX                    $
           CD                                $
           TXDLC    ,3                       $
           TXDRC    ,5                       $
           TDM      RSSV35                   $
           TAD                               $
           TDXLC    ,2                       $
           SLA      24                       $
           TMQ      1/1;15/0;32/1T47         $
           EIS      SORT3                    $
           SM       N/2T15                   $
           EIS      SORT4                    $
   SORT0   TXDLC    ,2                       $
           TDXLC    ,5                       $
           TMA      48/1T47                  $
           TMQ      22/1T22;1/1T47           $
   SORT1   ETD      0,5                      $
           JAGD     (P)+2H                   $
           JMP      SORT2                    $
           JAED     SORT2                    $
           TDA                               $
           TXDLC    ,5                       $
           TDXLC    ,3                       $
   SORT2   TMD      SORT3                    $
           AIXJ     2,5                      $
           TMA      ,2                       $
           TMD      ,3                       $
           TDM      ,2                       $
           TAM      ,3                       $
           TMA      1,2                      $
           TMD      1,3                      $
           TDM      1,2                      $
           TAM      1,3                      $
           TMD      SORT4                    $
           AIXJ     2,2                      $
           TMD      RSSV35                   $
           TDXLC    ,3                       $
           TDXRC    ,5                       $
   SORTX   JMP      (P)                      $

   SORT3   C/HLT,0;C/HLT,SORT1               $
   SORT4   C/HLT,0;C/HLT,SORT0               $
   RSSV 35                                   $
           END      $
```

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